APPENDICIES

TABLE OF APPENDICIES

APPENDIX A.....Tutorial

APPENDIX B.....Blast Log

APPENDIX C.....Seismograph Log

APPENDIX D.....Non-Blast Seismograph Log

APPENDIX E.....Full Waveform Data
- Ei.....Entrance Room
- Eii.....Hanging Balcony
- Eiii.....Indian Sleeping Chamber
- Eiv.....Jacob's Room
- Ev.....Helictite Room
- Evi.....Lloyd's Room
- Evii.....Entrance to Lake Room
- Eviii.....Exterior
- Eix.....Non-Blast Triggers

APPENDIX F.....Log-Log Plots

APPENDIX A

TUTORIAL

TUTORIAL

Introduction. This tutorial is included to assist those not familiar with blasting, monitoring, and vibration analysis to become acquainted with both the fundamental concepts and terminology used. It is by no means comprehensive and is deliberately simplified in order that the interested reader can understand this and similar studies.

The Anatomy of an Explosion. Whenever an explosive is detonated, an extremely complicated process is initiated creating zones with characteristic properties. Initially, the explosive is converted into gases whose temperatures are in excess of 3000° C (5432° F) and which exert pressure of 700,000 psi or greater on the surrounding or confining material. These pressures and gases propagate outward as waves traveling at a velocity exceeding that of sound in the medium. Waves with this velocity are designated shock waves. Immediately surrounding the center of the explosion, a hydrodynamic zone is formed in which the material behaves as a fluid. As the waves continue outward, the pressure-temperature combination decreases with distance. This decrease creates in turn: a plastic zone, a crushed or pulverized zone, a zone consisting of large fragments, and finally a region of fractures. All of these are illustrated by Figure A-1. Most of the energy of the explosion is expended in creating these zones, and it is the sum total of their sizes which determines the efficiency of the blasting. Beyond the distance at which fracturing occurs, the material behavior is elastic. This implies that no permanent deformation occurs as a result of the pressure wave, and it is this region which is monitored during blasting operations.

Wave Analysis. Visualize a line of fishing bobbers extending outward from a boat or pier. Whenever a rock is dropped into the water at the beginning of the line, a disturbance (wave) travels outward. The front of the wave then marks the leading edge of the disturbance and logically enough, this is designated the wave front. As the wave travels outward at the velocity of the water, each bobber in turn is agitated but essentially remains in place rather than traveling along with the wave. Assume the distance between any two adjacent peaks or troughs is measured on the outward traveling wave. This distance is designated the wavelength. Now visualize a camcorder focused on one small spot on the water and recording how many times the wave is repeated in one second. This number is called the frequency of the wave. Originally the units were in cycles/second or cps. However the accepted term is now a Hertz or Hz. with one cycle/second equivalent to one Hertz. The time for one cycle to occur is called the period. This is merely the inverse of the number of Hertz. For example, a wave having a frequency of ten Hertz has a period of 0.1 second. One other wave parameter remains to be defined. This is its magnitude or how large it is with reference to the at rest position. A number of choices exist. For example the physical distance or height is acceptable such as four inches above calm water or zero. As the wave is moving up and down as well as outward, another choice would be the velocity (inches/sec) at which the wave crest is moving upward or downward. The associated acceleration (inches/sec^2) is a third option. Regardless of the choice, the value is defined as amplitude.

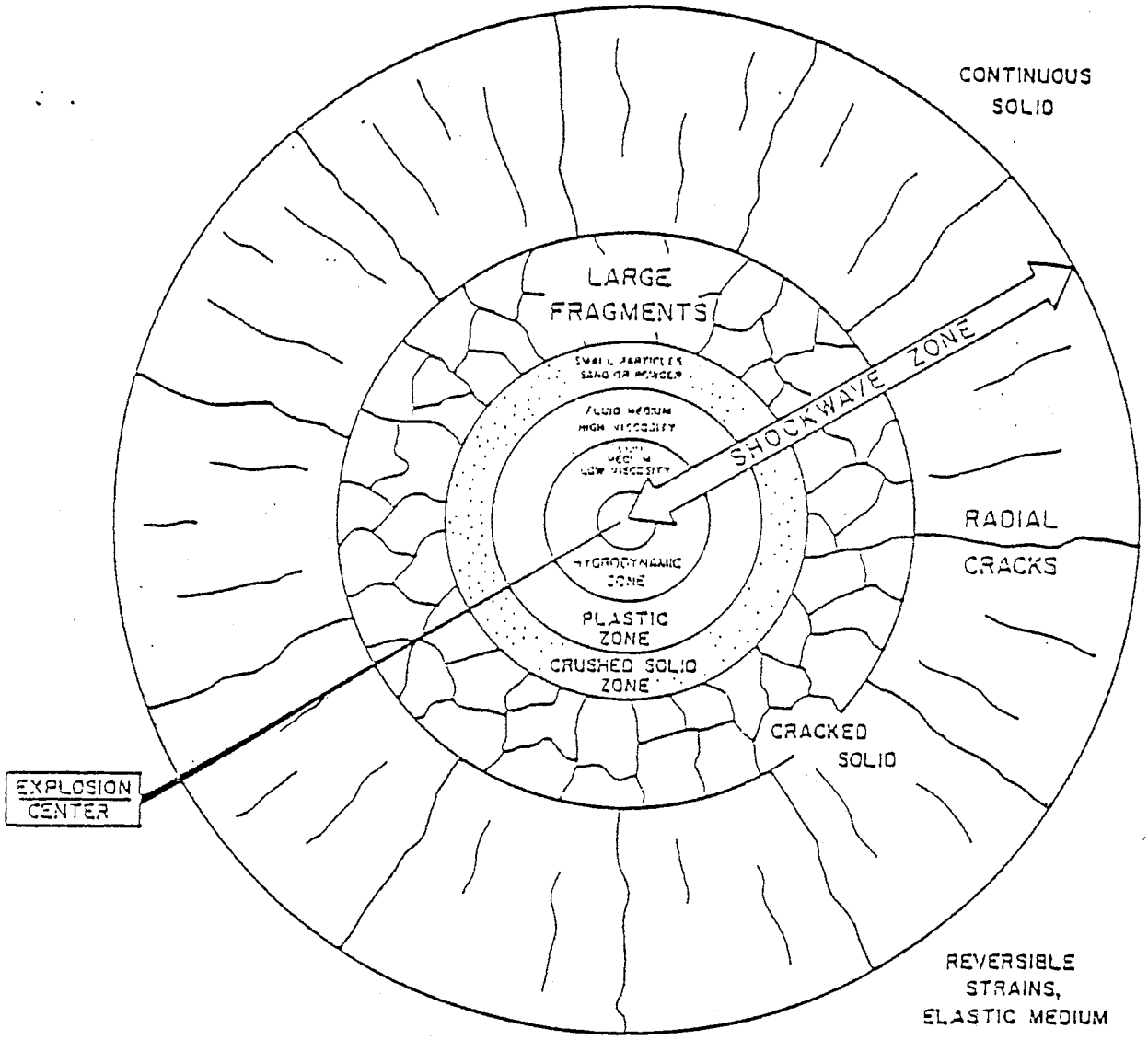


Figure A-1. Zones created by an explosion.

Because blasting instrumentation is generally in a stationary position, it is more convenient to define the behavior of particles adjacent to the instruments. This is analogous to measuring the behavior of the bobber in the water. Thus, the particle displacement is the distance the particle (bobber) moves vertically or horizontally. The particle velocity and particle acceleration are respectively the velocity and rate of change of velocity the particles (bobbers) experience when agitated by a wave. Which of the three values is measured depends upon the instruments used. For most blasting measurements, particle velocity is the measured quantity. One further observation is needed. As the bobber moves up and down, it does so at a certain number of times per second. This number is also designated as so many Hertz.

Unlike the simple wave generated by dropping a rock into the water, those generated by an explosion are a composite consisting of many ones each having a different frequency and unique amplitude. The associated particle parameters in turn are the result of the sum of all the individual contributions. These can be determined by a frequency or Fourier analysis. This procedure was routinely used for this project. As an example refer to Figure A-2. The top display represents the wave shape of particle velocity recorded over a period of time by a vertically oriented instrument. The maximum and minimum values in inches/sec. are 0.48 and -0.35 respectively. Below is the same data after one or more of the frequency components have been removed or modified. This operation is filtering. The envelope is also included. If the envelope and its mirror image were drawn, the recorded wave shape would fit inside with no values extending beyond the boundaries. Envelope values are sometimes considered to be a measure of the theoretical amplitude. The final display is the power density spectrum. This is merely a plot or display of the maximum amplitude squared of each individual frequency component of the composite wave. The term power density spectrum has nothing to do with power, but it is the accepted term for this common type of display. Beneath the spectrum plot in the X column are two numbers. These correspond to the two frequency component values corresponding to the circle and square cursor symbols visible on the horizontal axis. For example, 27.0115 is the frequency in Hz which has a squared amplitude of approximately 1.80E-5 (0.000018) units. No information is given as to whether the amplitude is plus or minus. An amplitude spectrum consisting of plus and/or minus values could also been displayed.

Extensive experimental data has been compiled which relates the values of peak particle velocities to damage criteria. It is widely accepted that the probability of damage to surface structures is essentially negligible provided the peak particle velocity occurring at the structure is less than two inches/second. Little known data is available which pertains to underground structures such as mines, tunnels, and caves.

The importance of frequency analyses can be illustrated by considering two examples. One is the familiar story of a glass breaking whenever an opera singer reaches a certain note, and the second is when an automobile with an out-of-round tire vibrates at a certain speed. A simplified explanation is that all objects (buildings and caves

Channel File processor B#2
Monday, September 28, 1992 11:03 AM

Front Panel

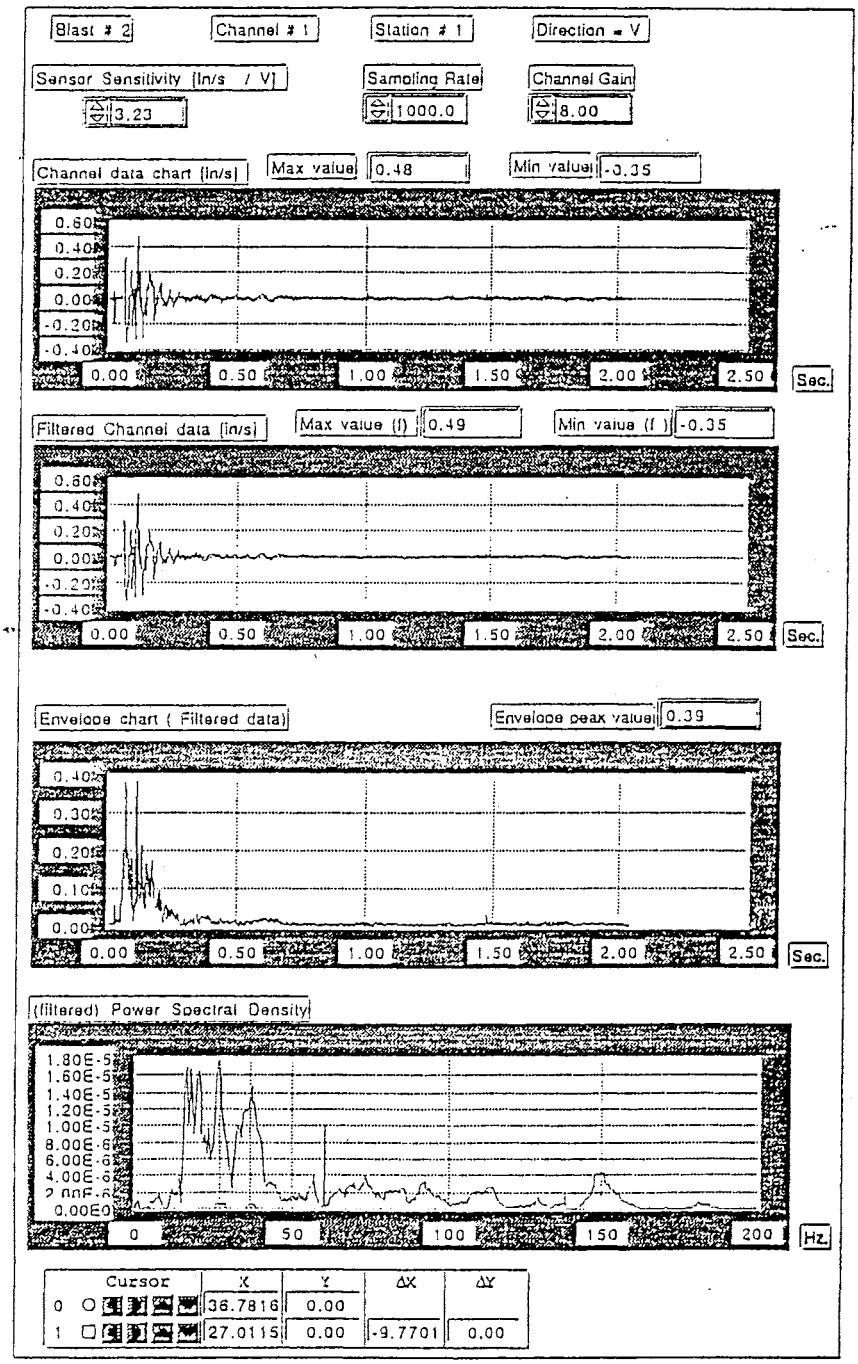


Figure A-2. Example waveform display with terminology.

included) vibrate when subjected to a pressure, and each has a preferred frequency of vibration designated the natural or resonant frequency. In the case of the glass, it is set into motion by the pressure exerted by the sound wave of the singer's voice. Because the sound wave is composed of various frequency components, the one that is identical to the natural frequency of the glass causes an amplification of the vibration of the glass which may lead to breakage. The automobile experiences different vibrations at different speeds. Whenever one corresponds to the natural one of the automobile, amplification again occurs. The same reasoning is also applicable to caves. However, variations in cave geometry and geology make the measurement of the natural frequencies a site specific problem. However, if they can be estimated or measured by experimentation, the blasting program can be designed to minimize the generation of the same by the explosives.

Blasting by Delays. Both frequencies and wavelengths of waves can be minimized or canceled by the use of delay shooting. This is a technique whereby a series of small charges are detonated at different times much the same as a string of fire crackers. The amount detonated at the same time is designated charge weight or size per delay. The assumption is that each charge generates the same wave shape. If the timing can be such that the peaks and troughs of the second wave correspond to the troughs and peaks of the first wave, a cancellation will occur except for the initial portion of the first wave. The timing of the other charges will also contribute to destructive interference. Caution must be exerted as improper delays may cause a constructive interference. To minimize frequencies, charges in the same hole are detonated at pre-determined delays. Multiple holes are detonated at pre-determined delays to minimize wavelengths.

APPENDIX B

BLAST LOG

Cystal Cave Blast Log

Date	Time	Location	Distance	# of holes	Hole Depth	Rock Depth	lbs/delay	lb/hole	Total lbs	Scale Distance	Powder Type	Blaster
5/11/95	16:00	341+25	1492	34	18	10	12.5	5	170	422.001	pre-split	Dewey Wilkins
5/12/95	16:12	340+00	1612	20	27	21	31	31	620	289.524	pre-split	Dewey Wilkins
5/12/95	16:15	339+00	1708	12	27	11	16	16	192	427.000	pre-split	Dewey Wilkins
5/15/95	14:32	327+00	2880	13	15	9	8	8	104	1018.234	ANFO	Jon Drake
5/15/95	16:19	327+00	2880	8	14	5	8.5	8.5	68	987.832	ANFO	Jon Drake
5/15/95	16:31	338+25	1864	12	22	6	16	16	192	466.000	pre-split	Jon Drake
5/16/95	12:16	327+00	2880	17	15	3	17	17	289	698.503	ANFO	Jon Drake
5/16/95	15:21	327+00	2880	18	15	5	16	16	288	720.000	ANFO	Jon Drake
5/16/95	17:01	337+50	1864	30	24	8	17	17	510	452.086	pre-split	Jon Drake
5/17/95	10:15	333+00	2296	26	9	3	6	6	156	937.338	ANFO	Jon Drake
5/17/95	12:05	332+60	2416	12	9	2	6.5	6.5	78	947.633	ANFO	Jon Drake
5/17/95	12:18	336+00	2000	10	20	4	13	13	130	554.700	pre-split	Jon Drake
5/18/95	8:30	332+35	2416	8	9	4	5	5	40	1080.468	ANFO	Jon Drake
5/18/95	10:35	333+10	2296	12	9	3.5	5	5	60	1026.802	ANFO	Jon Drake
5/18/95	15:03	334+50	1425	26	13	3	7	7	182	538.599	pre-split	Jon Drake
5/18/95	16:06	330+00	2584	28	8	2	5	5	140	1155.600	ANFO	Jon Drake
5/18/95	17:15	330+50	2536	16	8	2	5	5	80	1134.134	ANFO	Jon Drake
5/19/95	16:30	330+75	2496	102	8	2	5	5	510	1116.245	ANFO	Jon Drake
5/22/95	14:30	331+00	2475	36	10	6	14	7	504	661.472	ANFO	Jon Drake
5/22/95	14:30	337+50	1900	20	13	9	10	10	200	600.833	ANFO	Jon Drake
5/22/95	19:37	337+50	1900	22	13	8	10	20	220	600.833	ANFO	Jon Drake
5/23/95	16:34	344+50	1425	24	22	22	8.5	25.5	204	488.771	pre-split	Jon Drake
5/23/95	17:25	337+50	1900	55	13-15	13-15	16.67	50	916.85	465.357	ANFO	Jon Drake
5/25/95	15:50	333+75	1740	31	14	8	70	14	434	207.970	ANFO	Jon Drake
5/25/95	16:35	343+50	1535	22	24	22	22.5	7.5	165	323.606	pre-split	Jon Drake
5/30/95	11:45	335+00	2090	22	14	9	10	3.33	73.26	660.916	ANFO	Jon Drake
5/30/95	16:48	344+10	1220	21	22	20	18.857	6.286	132	280.945	pre-split	Jon Drake
5/30/95	17:22	341+75	1535	46	11	7	27	9	414	295.411	ANFO	Jon Drake
5/31/95	14:00	341+75	1535	26	15	9	11	11	286	462.820	ANFO	Jon Drake
5/31/95	17:00	341+75	1535	12	20	15	28	28	336	290.088	ANFO	Jon Drake
6/2/95	17:18	341+50	1000	46	13	8	12	12	552	288.675	ANFO	Jon Drake
6/2/95	17:18	341+50	1000	16	14	10	13	2.6	41.6	277.350	pre-split	Jon Drake
6/2/95	17:32	345+90	640	36	22	20	30	6	216	116.847	pre-split	Jon Drake
6/5/95	13:36	342+00	940	14	24	20	16.98	5.66	79.24	228.118	pre-split	Jon Drake
6/5/95	13:39	346+20	560	12	12	7	4.5	1.5	18	263.987	pre-split	Jon Drake
6/5/95	16:00	342+25	900	32	14	11	12	12	384	259.808	ANFO	Jon Drake
6/6/95	17:34	343+00	833	46	16	10	12	12	552	240.466	ANFO	Jon Drake
6/7/95	17:50	342+65	890	14	24	18	10.5	3.5	49	274.660	pre-split	Jon Drake

Cystal Cave Blast Log

Date	Time	Location	Distance	# of holes	Hole Depth	Rock Depth	lbs/delay	lb/hole	Total lbs	Scale Distance	Powder Type	Blaster
6/7/95	17:55	343+50	775	12	14	10	4.5	1.5	18	365.339	pre-split	Jon Drake
6/9/95	15:07	336+00	1540	32	10	8	36	9	288	256.667	ANFO	Jon Drake
6/9/95	16:15	342+65	840	77	16	16	22	22	1694	179.089	ANFO	Jon Drake
6/12/95	17:25	343+15	735	85	15	15	200	20	1700	51.972	ANFO	Jon Drake
6/14/95	16:30	357+25	710	8	16	16	3.75	3.75	30	366.642	pre-split	Jon Drake
6/14/95	16:30	357+25	710	12	14	14	25	17	204	142.000	ANFO	Jon Drake
6/14/95	16:55	343+50	800	63	18	16	96	24	1512	81.650	ANFO	Jon Drake
6/15/95	13:30	357+25	720	20	13	13	32	16	320	127.279	ANFO	Jon Drake
6/16/95	11:05	357+10	730	11	15	12	32	16	176	129.047	ANFO	Jon Drake
6/16/95	11:05	357+25	720	10	15	13	10.5	3.5	30.5	222.197	pre-split	Jon Drake
6/16/95	17:50	343+35	1335	26	16	14	72	24	624	157.331	ANFO	Jon Drake
6/16/95	17:52	348+50	1067	27	14	12	10.125	3.375	91.125	335.326	pre-split	Jon Drake
6/17/95	9:14	357+00	675	7	13	11	7.875	2.625	18.375	240.535	pre-split	Jon Drake
6/17/95	9:14	357+00	675	21	10	8	30	10	210	123.238	ANFO	Jon Drake
6/17/95	15:15	336+50	1867	101	8	6	5	5	505	834.948	ANFO	Jon Drake
6/19/95	9:40	342+00	1450	9	10	6	5	5	45	648.460	ANFO	Jon Drake
6/19/95	18:30	337+00	1800	111	11	9	12	12	1332	519.615	ANFO	Jon Drake
6/19/95	18:40	344+00	1260	16	16	10	9	3	48	420.000	pre-split	Jon Drake
6/19/95	18:42	351+40	925	13	20	18	16.125	5.375	69.875	230.352	pre-split	Jon Drake
6/20/95	17:45	336+50	1850	60	12	10	16	16	960	462.500	ANFO	Jon Drake
6/21/95	18:10	336+75	1860	94	14	11	80	20	1880	207.954	ANFO	Jon Drake
6/21/95	18:15	349+80	1000	25	20	20	15.75	5.25	131.25	251.976	pre-split	Jon Drake
6/22/95	17:45	337+30	1750	94	15	12	40	20	1880	276.699	ANFO	Jon Drake
6/22/95	17:50	350+70	940	28	20	20	15.75	5.25	147	236.858	pre-split	Jon Drake
6/23/95	17:30	337+50	1775	86	16	14	100	24	2064	177.500	ANFO	Jon Drake
6/23/95	17:35	351+84	880	38	20	20	21	5.25	199.5	192.032	pre-split	Jon Drake
6/24/95	15:00	339+50	1735	4	3	3	0.125	0.125	0.5	4907.321	Trenchrite	Jon Drake
6/24/95	15:15	337+80	1850	16	16	13	24	24	384	377.630	ANFO	Jon Drake
6/24/95	15:30	WW 185+00	2340	40	8	5	9	4.25	170	780.000	ANFO	Jon Drake
6/27/95	15:20	324+00	3270	15	9	9	8	8	120	1156.120	Nitropell and ANFO	Jon Drake
6/27/95	17:55	338+20	1795	60	15	15	84	21	1260	195.851	ANFO	Jon Drake
6/27/95	18:25	WW 184+25	2375	18	8	6	4	4	72	1187.500	Nitropell and ANFO	Jon Drake
6/28/95	17:13	344+25	1265	22	20	17	21	5.25	115.5	276.046	Pre-split	Jon Drake
6/28/95	17:37	338+70	1745	50	15	15	84	21	1050	190.395	ANFO	Jon Drake
6/28/95	17:45	353+00	855	40	20	20	21	5.25	210	186.576	pre-split	Jon Drake
6/29/95	17:25	339+00	1680	60	14	11	64	16	960	210.000	ANFO	Jon Drake
6/29/95	17:35	355+00	800	38	20	20	21	5.25	199.5	174.574	pre-split	Jon Drake
6/30/95	12:45	335+00	1260	36	16	16	66	22	792	155.095	ANFO	Jon Drake

Cystal Cave Blast Log

Date	Time	Location	Distance	# of holes	Hole Depth	Rock Depth	lbs/delay	lb/hole	Total lbs	Scale Distance	Powder Type	Blaster
7/1/95	12:33	356+10	760	45	20	12	15.75	5.25	236.25	191.502	pre-split	Larry Caudill
7/1/95	15:16	340+10	1610	53	13	11	70	14	742	192.432	ANFO	Larry Caudill
7/5/95	17:25	345+00	1305	86	16	13	88	22	1892	139.113	ANFO	Jon Drake
7/5/95	18:10	340+40	1580	81	9	6	28	7	567	298.592	ANFO	Jon Drake
7/6/95	18:10	343+75	1375	52	12	4	27	9	468	264.619	ANFO	Jon Drake
7/6/95	18:22	348+00	1010	97	12	9	48	12	1164	145.781	ANFO	Jon Drake
7/7/95	17:50	348+10	1000	58	14	11	80	16	928	111.803	ANFO	Jon Drake
7/7/95	18:07	WW 185+00	2365	16	8	4	18	6	96	557.436	ANFO	Jon Drake
7/8/95	14:50	7+00	2950	44	9	4	5	5	220	1319.280	ANFO	Jon Drake
7/8/95	15:30	344+80	1195	130	14	14	126	18	2340	106.459	ANFO	Jon Drake
7/10/95	17:21	345+00	1190	134	15	15	168	24	3216	91.810	ANFO	Jon Drake
7/11/95	17:30	346+00	1110	200	14	14	100	20	4000	111.000	ANFO	Jon Drake
7/12/95	16:45	6+00	3035	65	9	9	8	8	520	1073.035	ANFO	Jon Drake
7/12/95	17:40	346+50	1105	48	10	6	32	8	384	195.338	ANFO	Jon Drake
7/13/95	16:40	348+60	1020	130	14	12	100	20	2600	102.000	ANFO	Jon Drake
7/14/95	16:17	349+00	1005	107	14	12	138	23	2461	85.551	ANFO	Jon Drake
7/15/95	14:25	249+50	990	120	14	12	147	21	2520	81.654	ANFO	Jon Drake
7/17/95	16:35	351+10	925	195	14	12	60	20	3900	119.417	ANFO	Jon Drake
7/18/95	16:45	352+00	880	153	14	12	110	22	3366	83.905	ANFO	Jon Drake
7/19/95	16:45	352+80	875	127	14	12	88	22	2794	93.275	ANFO	Jon Drake
7/25/95	16:25	353+50	850	63	14	11	36	18	1134	141.667	ANFO	Jon Drake
7/26/95	16:20	356+50	745	83	11	11	48	12	996	107.531	ANFO	Jon Drake
7/28/95	10:10	356+00	750	106	11	11	48	12	1272	108.253	ANFO	Jon Drake
7/28/95	16:08	353+50	850	36	15	15	110	22	792	81.044	ANFO	Jon Drake
7/31/95	16:45	356+00	765	109	14	14	92.5	18.5	2016.5	79.541	ANFO	Jon Drake
8/1/95	14:15	355+70	750	67	14	14	92.5	18.5	1239.5	77.981	ANFO	Jon Drake

APPENDIX C

SEISMOGRAPH LOG

Crystal Cave Seismograph Log

Date	Time	Unit #	Location	Event #	Blast Location	Distance	lbs/delay	Scale Distance	Type of Blast	Trigger Level	Transverse	Vertical	Radial	Acousitic	Vector Sum
						(ft)		(ft)		(in/s)	(in/s)	(in/s)	(in/s)	(db)	(in/s)
5/22/95	14:19	492	Jacob's Room	3	331+00	2600	14	694.879	Production	0.03	0.02	0.035	0.015	N/A	0.035
5/23/95	16:33	21	Entrance	3	343+50	1525	25.5	301.995	pre-split	0.03	0.02	0.04	0.02	N/A	0.04
5/23/95	16:33	17	INS	2	343+50	1375	25.5	272.291	pre-split	0.03	0.04	0.04	0.03	N/A	0.04
5/23/95	16:32	492	Jacob's Room	4	343+50	1400	25.5	277.241	pre-split	0.03	0.025	0.035	0.025	0.02	0.04
5/23/95	17:24	17	INS	3	337+50	1920	17	465.668	Production	0.03	0.03	0.02	0.02	N/A	0.03
5/23/95	17:23	492	Jacob's Room	5	337+50	1950	17	472.944	Production	0.03	0.02	0.045	0.015	0.02	0.045
5/25/95	15:48	17	INS	4	338+75	1850	70	221.117	ANFO	0.03	0.04	0.02	0.02	N/A	0.04
5/25/95	16:37	17	INS	5	343+50	1535	22.5	323.606	pre-split	0.03	0.03	0.02	0.02	N/A	0.03
5/30/95	16:44	17	INS	6	344+85	1310	18.9	301.329	pre-split	0.03	0.05	0.03	0.03	N/A	0.05
5/30/95	16:44	21	Entrance	4	344+85	1440	18.9	331.231	pre-split	0.03	0.02	0.04	0.02	N/A	0.04
5/30/95	16:44	492	Jacob's Room	7	344+85	1285	18.9	295.578	pre-split	0.03	0.015	0.04	0.015	N/A	0.04
5/31/95	13:54	17	INS	7	341+75	1520	28	287.253	ANFO	0.03	0.04	0.02	0.02	N/A	0.04
5/31/95	17:01	17	INS	8	341+75	1520	28	287.253	ANFO	0.03	0.04	0.03	0.02	N/A	0.04
6/2/95	17:13	17	INS	10	341+50	1545	13	428.506	pre-split	0.03	0.03	0.02	0.02	N/A	0.03
6/2/95	17:29	16	Hanging Balcony	3	345+90	1280	30	233.695	pre-split	0.03	0.01	0.03	0.01	N/A	0.03
6/2/95	17:29	17	INS	11	345+90	1205	30	220.002	pre-split	0.03	0.08	0.06	0.05	0.02	0.1
6/2/95	17:29	18	Exterior	77	345+90	640	30	116.847	pre-split	0.03	0.05	0.05	0.03	0.22	0.05
6/2/95	17:29	20	Lloyd's Room	1	345+90	1240	30	226.392	pre-split	0.03	0.03	0.03	0.02	N/A	0.04
6/2/95	17:29	21	Entrance	5	345+90	1340	30	244.649	pre-split	0.03	0.03	0.05	0.03	N/A	0.05
6/2/95	17:29	491	Helictite	12	345+90	1135	30	207.222	pre-split	0.03	0.01	0.03	0.01	N/A	0.03
6/2/95	17:29	492	Jacob's Room	8	345+90	1220	30	222.741	pre-split	0.03	0.02	0.045	0.02	N/A	0.045
6/5/95	15:48	17	INS	12	342+25	1480	12	427.239	ANFO	0.03	0.03	0.02	0.02	N/A	0.03
6/5/95	15:48	18	Exterior	78	342+25	915	12	264.138	ANFO	0.03	0.03	0.02	0.01	N/A	0.03
6/6/95	17:21	17	INS	13	343+00	1395	12	402.702	ANFO	0.03	0.05	0.03	0.03	N/A	0.05
6/6/95	17:21	18	Exterior	79	343+00	860	12	248.261	ANFO	0.03	0.04	0.04	0.03	N/A	0.04
6/6/95	17:21	21	Entrance	6	343+00	1540	12	444.560	ANFO	0.03	0.03	0.04	0.02	N/A	0.04
6/6/95	17:21	492	Jacob's Room	10	343+00	1415	12	408.475	ANFO	0.03	0.02	0.055	0.02	N/A	0.055
6/7/95	17:54	17	INS	14	342+65	1440	20	321.994	ANFO	0.03	0.06	0.05	0.03	N/A	0.06
6/7/95	17:54	18	Exterior	80	342+65	870	20	194.538	ANFO	0.03	0.03	0.03	0.02	N/A	0.03
6/7/95	17:54	21	Entrance	7	342+65	1620	20	362.243	ANFO	0.03	0.04	0.02	0.02	N/A	0.04
6/7/95	17:54	492	Jacob's Room	11	342+65	1490	20	333.174	ANFO	0.03	0.025	0.04	0.02	N/A	0.045
6/7/95	17:56	17	INS	15	343+50	1360	4.5	641.110	pre-split	0.03	0.04	0.03	0.02	N/A	0.04
6/9/95	16:16	17	INS	19	343+15	1100	22	234.521	ANFO	0.03	0.05	0.04	0.04	N/A	0.05
6/9/95	16:16	18	Exterior	81	343+15	835	22	178.023	ANFO	0.03	0.04	0.03	0.02	N/A	0.04
6/9/95	16:16	21	Entrance	8	343+15	1240	22	264.369	ANFO	0.03	0.03	0.03	0.03	N/A	0.04
6/12/95	17:24	17	INS	20	344+00	1350	200	95.459	ANFO	0.03	0.09	0.04	0.04	N/A	0.09
6/12/95	17:24	18	Exterior	208	344+00	740	200	52.326	ANFO	0.03	0.06	0.1	0.12	N/A	0.14
6/12/95	17:24	20	Lloyd's Room	2	344+00	1400	200	98.995	ANFO	0.03	0.03	0.03	0.02	N/A	0.03
6/12/95	17:24	21	Entrance	11	344+00	1475	200	104.298	ANFO	0.03	0.04	0.05	0.03	N/A	0.06
6/12/95	17:24	492	Jacob's Room	13	344+00	1350	200	95.459	ANFO	0.03	0.035	0.055	0.045	N/A	0.055
6/14/95	16:30	16	Hanging Balcony	6	357+50	935	25	187.000	ANFO	0.03	0.01	0.03	0.01	N/A	0.03

Crystal Cave Seismograph Log

Date	Time	Unit #	Location	Event #	Blast Location	Distance	lbs/delay	Scale Distance	Type of Blast	Trigger Level	Transverse	Vertical	Radial	Acousitic	Vector Sum
						(ft)		(ft)		(in/s)	(in/s)	(in/s)	(in/s)	(db)	(in/s)
6/14/95	16:30	17	INS	21	357+50	990	25	198.000	ANFO	0.03	0.06	0.04	0.03	N/A	0.06
6/14/95	16:30	18	Exterior	209	357+50	735	25	147.000	ANFO	0.03	0.05	0.05	0.02	N/A	0.05
6/14/95	16:30	20	Lloyd's Room	3	357+50	730	25	146.000	ANFO	0.03	0.02	0.03	0.02	N/A	0.03
6/14/95	16:30	21	Entrance	12	357+50	950	25	190.000	ANFO	0.03	0.03	0.04	0.03	N/A	0.04
6/14/95	16:30	492	Jacob's Room	14	357+50	930	25	186.000	ANFO	0.03	0.025	0.04	0.03	N/A	0.045
6/14/95	16:55	17	INS	22	343+50	1420	96	144.928	ANFO	0.03	0.07	0.03	0.03	N/A	0.07
6/14/95	16:55	18	Exterior	210	343+50	800	96	81.650	ANFO	0.03	0.04	0.06	0.02	N/A	0.06
6/14/95	16:55	21	Entrance	13	343+50	1510	96	154.114	ANFO	0.03	0.03	0.03	0.03	N/A	0.03
6/14/95	16:55	492	Jacob's Room	15	343+50	1390	96	141.866	ANFO	0.03	0.035	0.07	0.035	N/A	0.07
6/15/95	13:30	17	INS	23	357+25	950	32	167.938	ANFO	0.03	0.07	0.04	0.04	N/A	0.07
6/15/95	13:30	18	Exterior	211	357+25	735	32	129.931	ANFO	0.03	0.03	0.05	0.04	N/A	0.05
6/15/95	13:30	21	Entrance	14	357+25	950	32	167.938	ANFO	0.03	0.03	0.06	0.03	N/A	0.06
6/15/95	13:30	492	Jacob's Room	16	357+25	925	32	163.518	ANFO	0.03	0.02	0.035	0.025	N/A	0.04
6/16/95	11:05	17	INS	24	357+10	990	32	175.009	ANFO	0.03	0.06	0.03	0.03	N/A	0.06
6/16/95	11:05	21	Entrance	15	357+10	950	32	167.938	ANFO	0.03	0.03	0.03	0.03	N/A	0.04
6/16/95	17:52	17	INS	25	343+35	1430	72	168.527	ANFO	0.03	0.05	0.03	0.02	N/A	0.05
6/16/95	17:52	21	Entrance	16	343+35	1540	72	181.491	ANFO	0.03	0.02	0.03	0.03	N/A	0.04
6/16/95	17:52	492	Jacob's Room	17	343+35	1400	72	164.992	ANFO	0.03	0.02	0.03	0.02	N/A	0.035
6/16/95	17:53	17	INS	26	348+50	1090	10.125	342.554	pre-split	0.03	0.06	0.06	0.04	N/A	0.09
6/16/95	17:53	492	Jacob's Room	18	348+50	1080	10.125	339.411	pre-split	0.03	0.02	0.04	0.03	N/A	0.04
6/17/95	9:13	17	INS	27	357+00	1000	30	182.574	ANFO	0.03	0.04	0.02	0.02	N/A	0.04
6/17/95	9:13	20	Lloyd's Room	4	357+00	750	30	136.931	ANFO	0.03	0.02	0.03	0.02	N/A	0.03
6/17/95	9:13	21	Entrance	17	357+00	960	30	175.271	ANFO	0.03	0.03	0.04	0.02	N/A	0.04
6/17/95	9:13	492	Jacob's Room	19	357+00	935	30	170.707	ANFO	0.03	0.015	0.035	0.015	N/A	0.035
6/19/95	18:39	17	INS	123	351+40	1035	16.125	257.745	pre-split	0.03	0.1	0.06	0.04	N/A	0.1
6/19/95	18:39	18	INS	212	351+40	1035	16.125	257.745	pre-split	0.03	0.02	0.05	0.03	N/A	0.05
6/19/95	18:39	20	Lloyd's Room	5	351+40	935	16.125	232.842	pre-split	0.03	0.02	0.03	0.02	N/A	0.03
6/21/95	18:09	492	Jacob's Room	20	336+75	2075	80	231.992	ANFO	0.03	0.01	0.03	0.015	N/A	0.03
6/21/95	18:18	18	INS	213	349+80	1055	15.75	265.835	pre-split	0.03	0.02	0.04	0.04	N/A	0.04
6/21/95	18:18	20	Lloyd's Room	6	349+80	990	15.75	249.457	pre-split	0.03	0.02	0.03	0.02	N/A	0.03
6/21/95	18:18	21	Entrance	18	349+80	1140	15.75	287.253	pre-split	0.03	0.03	0.03	0.03	N/A	0.03
6/21/95	18:18	492	Jacob's Room	21	349+80	1035	15.75	260.795	pre-split	0.03	0.015	0.03	0.015	N/A	0.03
6/22/95	17:51	19	INS	2	350+70	1030	15.75	259.536	pre-split	0.03	0.01	0.03	0.01	N/A	0.03
6/23/95	17:40	19	INS	4	351+84	1040	21	226.947	pre-split	0.03	0.01	0.04	0.02	N/A	0.04
6/23/95	17:40	21	Entrance	19	351+84	1090	21	237.858	pre-split	0.03	0.03	0.02	0.02	N/A	0.03
6/28/95	17:37	21	Entrance	20	338+70	1985	84	216.581	ANFO	0.03	0.03	0.01	0.02	N/A	0.03
6/28/95	17:47	19	INS	6	353+00	1025	21	223.673	pre-split	0.03	0.02	0.03	0.02	N/A	0.03
6/28/95	17:47	21	Entrance	21	353+00	1075	21	234.584	pre-split	0.03	0.04	0.04	0.03	N/A	0.04
6/29/95	17:33	16	Hanging Balcony	16	355+00	980	21	213.854	pre-split	0.03	0.01	0.03	0.01	N/A	0.03
6/29/95	17:33	19	INS	7	355+00	1020	21	222.582	pre-split	0.03	0.01	0.04	0.02	N/A	0.04
6/29/95	17:33	21	Entrance	22	355+00	1030	21	224.764	pre-split	0.03	0.04	0.05	0.02	N/A	0.05

Crystal Cave Seismograph Log

Date	Time	Unit #	Location	Event #	Blast Location	Distance	lbs/delay	Scale Distance	Type of Blast	Trigger Level	Transverse	Vertical	Radial	Acousitic	Vector Sum
						(ft)		(ft)		(in/s)	(in/s)	(in/s)	(in/s)	(db)	(in/s)
6/29/95	17:33	492	Jacob's Room	23	355+00	975	21	212.762	pre-split	0.03	0.02	0.03	0.015	N/A	0.03
6/30/95	12:41	21	Entrance	23	344+00	1460	66	179.714	ANFO	0.03	0.03	0.03	0.02	N/A	0.03
6/30/95	12:41	492	Jacob's Room	24	344+00	1350	66	166.174	ANFO	0.03	0.01	0.03	0.02	N/A	0.03
7/1/95	12:35	16	Hanging Balcony	17	356+10	965	15.75	243.157	pre-split	0.03	0.02	0.03	0.01	N/A	0.03
7/1/95	12:35	19	INS	8	356+10	1005	15.75	253.236	pre-split	0.03	0.02	0.05	0.03	N/A	0.05
7/1/95	12:35	20	Lloyd's Room	7	356+10	755	15.75	190.242	pre-split	0.03	0.02	0.03	0.02	N/A	0.03
7/1/95	12:35	21	Entrance	24	356+10	995	15.75	250.716	pre-split	0.03	0.04	0.07	0.03	N/A	0.07
7/1/95	12:35	491	Helictite	14	356+10	990	15.75	249.457	pre-split	0.03	0.01	0.03	0.01	N/A	0.03
7/1/95	12:35	492	Jacob's Room	26	356+10	950	15.75	239.377	pre-split	0.03	0.025	0.03	0.02	N/A	0.03
7/5/95	17:25	19	INS	10	345+00	1265	88	134.849	ANFO	0.03	0.02	0.03	0.03	N/A	0.03
7/5/95	17:25	20	Lloyd's Room	8	345+00	1300	88	138.580	ANFO	0.03	0.03	0.03	0.02	N/A	0.04
7/5/95	17:25	21	Entrance	25	345+00	1400	88	149.241	ANFO	0.03	0.04	0.05	0.04	N/A	0.06
7/6/95	18:22	19	INS	11	348+00	1110	48	160.215	ANFO	0.03	0.03	0.03	0.04	N/A	0.05
7/6/95	18:22	20	Lloyd's Room	9	348+00	1110	48	160.215	ANFO	0.03	0.03	0.03	0.02	N/A	0.04
7/6/95	18:22	21	Entrance	26	348+00	1220	48	176.092	ANFO	0.03	0.03	0.05	0.05	N/A	0.07
7/7/95	17:50	16	Hanging Balcony	28	348+10	1150	80	128.574	ANFO	0.03	0.04	0.03	0.04	N/A	0.06
7/7/95	17:50	19	INS	12	348+10	1105	80	123.543	ANFO	0.03	0.02	0.03	0.02	N/A	0.03
7/7/95	17:50	20	Lloyd's Room	10	348+10	1090	80	121.866	ANFO	0.03	0.03	0.03	0.02	N/A	0.03
7/7/95	17:50	21	Entrance	27	348+10	1210	80	135.282	ANFO	0.03	0.03	0.04	0.04	N/A	0.06
7/8/95	15:32	21	Entrance	28	344+80	1440	126	128.285	ANFO	0.03	0.04	0.03	0.04	N/A	0.04
7/10/95	17:23	16	Hanging Balcony	34	345+00	1335	168	102.997	ANFO	0.03	0.02	0.03	0.02	N/A	0.03
7/10/95	17:23	19	INS	13	345+00	1265	168	97.597	ANFO	0.03	0.03	0.04	0.05	N/A	0.05
7/10/95	17:23	20	Lloyd's Room	11	345+00	1300	168	100.297	ANFO	0.03	0.03	0.03	0.03	N/A	0.03
7/10/95	17:23	21	Entrance	29	345+00	1400	168	108.012	ANFO	0.03	0.06	0.07	0.04	N/A	0.09
7/11/95	17:31	19	INS	14	346+00	1210	100	121.000	ANFO	0.03	0.04	0.05	0.05	N/A	0.06
7/11/95	17:31	20	Lloyd's Room	12	346+00	1230	100	123.000	ANFO	0.03	0.02	0.04	0.02	N/A	0.04
7/11/95	17:31	21	Entrance	30	346+00	1340	100	134.000	ANFO	0.03	0.03	0.04	0.03	N/A	0.05
7/12/95	17:42	19	INS	15	346+50	1185	32	209.480	ANFO	0.03	0.01	0.04	0.02	N/A	0.04
7/12/95	17:42	21	Entrance	31	346+50	1320	32	233.345	ANFO	0.03	0.04	0.02	0.03	N/A	0.04
7/13/95	16:39	16	Hanging Balcony	37	348+60	1125	100	112.500	ANFO	0.03	0.03	0.04	0.03	N/A	0.05
7/13/95	16:39	19	INS	16	348+60	1090	100	109.000	ANFO	0.03	0.04	0.07	0.05	N/A	0.08
7/13/95	16:39	20	Lloyd's Room	13	348+60	1055	100	105.500	ANFO	0.03	0.07	0.05	0.04	N/A	0.08
7/13/95	16:39	21	Entrance	32	348+60	1200	100	120.000	ANFO	0.03	0.06	0.06	0.05	N/A	0.08
7/13/95	16:39	491	Helictite	15	348+60	1010	100	101.000	ANFO	0.03	0.03	0.03	0.03	N/A	0.04
7/14/95	16:17	16	Hanging Balcony	40	349+00	1120	138	95.341	ANFO	0.03	0.03	0.05	0.03	N/A	0.05
7/14/95	16:17	19	INS	17	349+00	1080	138	91.936	ANFO	0.03	0.04	0.08	0.03	N/A	0.08
7/14/95	16:17	20	Lloyd's Room	14	349+00	1040	138	88.531	ANFO	0.03	0.09	0.06	0.05	N/A	0.09
7/14/95	16:17	21	Entrance	33	349+00	1165	138	99.171	ANFO	0.03	0.04	0.05	0.04	N/A	0.06
7/14/95	16:17	491	Helictite	16	349+00	1010	138	85.977	ANFO	0.03	0.03	0.03	0.02	N/A	0.035
7/15/95	14:29	16	Hanging Balcony	41	349+50	1100	147	90.726	ANFO	0.03	0.02	0.04	0.03	N/A	0.04
7/15/95	14:29	19	INS	18	349+50	1075	147	88.665	ANFO	0.03	0.03	0.07	0.04	N/A	0.07

Crystal Cave Seismograph Log

Date	Time	Unit #	Location	Event #	Blast Location	Distance	lbs/delay	Scale Distance	Type of Blast	Trigger Level	Transverse	Vertical	Radial	Acousitic	Vector Sum
						(ft)		(ft)		(in/s)	(in/s)	(in/s)	(in/s)	(db)	(in/s)
7/15/95	14:29	20	Lloyd's Room	15	349+50	1000	147	82.479	ANFO	0.03	0.08	0.06	0.04	N/A	0.08
7/15/95	14:29	21	Entrance	35	349+50	1135	147	93.613	ANFO	0.03	0.03	0.06	0.04	N/A	0.07
7/15/95	14:29	491	Helictite	17	349+50	1000	147	82.479	ANFO	0.03	0.03	0.03	0.03	N/A	0.035
7/17/95	16:35	16	Hanging Balcony	43	351+10	1050	60	135.554	ANFO	0.03	0.02	0.04	0.02	N/A	0.04
7/17/95	16:35	19	INS	19	351+10	1035	60	133.618	ANFO	0.03	0.03	0.05	0.03	N/A	0.05
7/17/95	16:35	20	Lloyd's Room	16	351+10	925	60	119.417	ANFO	0.03	0.04	0.04	0.03	N/A	0.04
7/17/95	16:35	21	Entrance	36	351+10	1100	60	142.009	ANFO	0.03	0.04	0.05	0.03	N/A	0.06
7/17/95	16:35	491	Helictite	18	351+10	980	60	126.517	ANFO	0.03	0.01	0.03	0.02	N/A	0.03
7/18/95	16:52	16	Hanging Balcony	44	352+00	1020	110	97.253	ANFO	0.03	0.02	0.04	0.02	N/A	0.04
7/18/95	16:52	17	INS	103	352+00	1020	110	97.253	ANFO	0.03	0.04	0.05	0.06	N/A	0.06
7/18/95	16:52	18	Jacob's Room	216	352+00	990	110	94.393	ANFO	0.03	0.08	0.1	0.04	N/A	0.1
7/18/95	16:52	20	Lloyd's Room	17	352+00	890	110	84.858	ANFO	0.03	0.03	0.05	0.02	N/A	0.05
7/18/95	16:52	21	Entrance	37	352+00	1080	110	102.974	ANFO	0.03	0.05	0.04	0.03	N/A	0.05
7/19/95	16:49	16	Hanging Balcony	45	352+80	1005	88	107.133	ANFO	0.03	0.02	0.03	0.02	N/A	0.03
7/19/95	16:49	17	INS	104	352+80	1020	88	108.732	ANFO	0.03	0.04	0.08	0.09	N/A	0.09
7/19/95	16:49	18	Jacob's Room	217	352+80	990	88	105.534	ANFO	0.03	0.05	0.08	0.07	N/A	0.09
7/19/95	16:49	20	Lloyd's Room	18	352+80	860	88	91.676	ANFO	0.03	0.05	0.05	0.03	N/A	0.07
7/19/95	16:49	21	Entrance	39	352+80	1060	88	112.996	ANFO	0.03	0.04	0.06	0.03	N/A	0.07
7/25/95	16:27	16	Hanging Balcony	48	353+50	1005	36	167.500	ANFO	0.03	0.02	0.04	0.02	N/A	0.04
7/25/95	16:27	17	INS	105	353+50	1015	36	169.167	ANFO	0.03	0.03	0.05	0.05	N/A	0.06
7/25/95	16:27	18	Jacob's Room	213	353+50	990	36	165.000	ANFO	0.03	0.04	0.06	0.04	N/A	0.07
7/25/95	16:27	20	Lloyd's Room	19	353+50	850	36	141.667	ANFO	0.03	0.03	0.03	0.02	N/A	0.04
7/25/95	16:27	21	Entrance	40	353+50	1050	36	175.000	ANFO	0.03	0.04	0.04	0.02	N/A	0.05
7/26/95	16:20	16	Hanging Balcony	50	356+50	950	48	137.121	ANFO	0.03	0.02	0.04	0.03	N/A	0.04
7/26/95	16:20	17	INS	106	356+50	990	48	142.894	ANFO	0.03	0.03	0.04	0.05	N/A	0.05
7/26/95	16:20	18	Jacob's Room	219	356+50	935	48	134.956	ANFO	0.03	0.07	0.06	0.06	N/A	0.08
7/26/95	16:20	20	Lloyd's Room	20	356+50	750	48	108.253	ANFO	0.03	0.04	0.05	0.04	N/A	0.05
7/26/95	16:20	21	Entrance	41	356+50	980	48	141.451	ANFO	0.03	0.04	0.06	0.03	N/A	0.07
7/28/95	10:10	16	Hanging Balcony	51	356+00	960	48	138.564	ANFO	0.03	0.03	0.04	0.02	N/A	0.04
7/28/95	10:10	17	INS	107	356+00	1000	48	144.338	ANFO	0.03	0.03	0.06	0.03	N/A	0.06
7/28/95	10:10	18	Jacob's Room	220	356+00	940	48	135.677	ANFO	0.03	0.05	0.13	0.05	N/A	0.13
7/28/95	10:10	20	Lloyd's Room	21	356+00	760	48	109.697	ANFO	0.03	0.05	0.04	0.04	N/A	0.06
7/28/95	10:10	21	Entrance	42	356+00	1000	48	144.338	ANFO	0.03	0.04	0.07	0.03	N/A	0.08
7/28/95	16:10	17	INS	108	353+50	1010	110	96.300	ANFO	0.03	0.04	0.05	0.05	N/A	0.06
7/28/95	16:10	18	Jacob's Room	221	353+50	990	110	94.393	ANFO	0.03	0.03	0.04	0.02	N/A	0.04
7/28/95	16:10	20	Lloyd's Room	22	353+50	850	110	81.044	ANFO	0.03	0.03	0.04	0.03	N/A	0.04
7/28/95	16:10	21	Entrance	43	353+50	1050	110	100.114	ANFO	0.03	0.04	0.07	0.04	N/A	0.07
7/31/95	16:48	17	INS	109	356+00	1000	92.5	103.975	ANFO	0.03	0.04	0.04	0.04	N/A	0.05
7/31/95	16:48	18	Jacob's Room	222	356+00	940	92.5	97.737	ANFO	0.03	0.04	0.05	0.04	N/A	0.05
7/31/95	16:48	20	Lloyd's Room	23	356+00	760	92.5	79.021	ANFO	0.03	0.04	0.05	0.03	N/A	0.06
7/31/95	16:48	21	Entrance	45	356+00	1000	92.5	103.975	ANFO	0.03	0.05	0.06	0.03	N/A	0.07

Crystal Cave Seismograph Log

Date	Time	Unit #	Location	Event #	Blast Location	Distance	lbs/delay	Scale Distance	Type of Blast	Trigger Level	Transverse	Vertical	Radial	Acousitic	Vector Sum
						(ft)		(ft)		(in/s)	(in/s)	(in/s)	(in/s)	(db)	(in/s)
8/1/95	14:19	16	Hanging Balcony	56	355+70	975	92.5	101.376	ANFO	0.03	0.02	0.04	0.02	N/A	0.04
8/1/95	14:19	17	INS	110	355+70	1005	92.5	104.495	ANFO	0.03	0.04	0.06	0.03	N/A	0.06
8/1/95	14:19	18	Jacob's Room	223	355+70	950	92.5	98.776	ANFO	0.03	0.07	0.05	0.05	N/A	0.07
8/1/95	14:19	20	Lloyd's Room	24	355+70	775	92.5	80.581	ANFO	0.03	0.04	0.05	0.02	N/A	0.05
8/1/95	14:19	21	Entrance	46	355+70	990	92.5	102.935	ANFO	0.03	0.05	0.06	0.03	N/A	0.07

APPENDIX D

NON-BLAST

SEISMOGRAPH LOG

Non-Blast Seismographs

Date	Time	Unit #	Location	Event #	Trig Lev	Tangent	Vertical	Radial	Air Blast	Vector Sum	Cause
5/14/95	8:32	16	Hanging Balcony	1	0.03	0.01	0.05	0.02	N/A	0.050	Unknown; probable tour traffic
5/15/95	4:24	492	Jacob's Room	1	0.03	0.495	0.5	0.49	N/A	0.000	Self-Calibration
5/16/95	8:11	21	Entrance	1	0.03	0.04	0.06	0.03	N/A	0.060	Unknown; probable tour traffic
5/16/95	8:12	21	Entrance	2	0.03	0.01	0.05	0.01	N/A	0.050	Unknown; probable tour traffic
5/16/95	17:32	17	INS	1	0.03	0.16	0.08	0.08	N/A	0.180	Uknown; probable downloading
5/19/95	23:57	492	Jacob's Room	2	0.03	0.495	0.495	0.495	N/A	0.000	Self-Calibration
5/29/95	5:21	492	Jacob's Room	6	0.03	0.495	0.495	0.495	N/A	0.000	Self-Calibration
6/1/95	16:25	16	Hanging Balcony	2	0.03	0.01	0.01	0.05	N/A	0.050	Unknown
6/1/95	16:29	17	INS	9	0.03	0.03	0.01	0.01	N/A	0.030	Unknown
6/6/95	6:47	492	Jacob's Room	9	0.03	0.495	0.495	0.495	N/A	0.000	Self-Calibration
6/7/95	14:16	16	Grand	4	0.03	0.02	0.03	0.01	N/A	0.030	Unknown; probable tour
6/8/95	15:17	17	INS	16	0.03	0.04	0.01	0.01	N/A	0.040	Unknown; possible thunder
6/8/95	15:18	17	INS	17	0.03	0.07	0.03	0.04	N/A	0.070	Unknown; possible thunder
6/8/95	15:19	17	INS	18	0.03	0.03	0.01	0.01	N/A	0.030	Unknown; possible thunder
6/9/95	18:01	21	Entrance	9	0.03	0.06	0.05	0.05	N/A	0.090	Downloading
6/12/95	10:47	21	Entrance	10	0.03	0.09	0.06	0.07	N/A	0.010	Changing Batteries
6/12/95	17:45	16	Hanging Balcony	5	0.03	0.02	0.04	0.02	N/A	0.040	Downloading
6/16/95	10:11	16	Hanging Balcony	7	0.03	0.03	0.05	0.06	N/A	0.060	Tour in Cave
6/16/95	10:14	16	Hanging Balcony	8	0.03	0.02	0.07	0.03	N/A	0.070	Tour in Cave
6/16/95	13:01	16	Hanging Balcony	9	0.03	0.02	0.05	0.02	N/A	0.050	Tour in Cave
6/17/95	10:30-13:43	17	INS	28-122	0.03	N/A	N/A	N/A	N/A	N/A	Instrument Malfunction
6/19/95	13:40	16	Hanging Balcony	10	0.03	0.03	0.02	0.04	N/A	0.050	Tour in Cave
6/19/95	19:31	491	Helictite	13	0.03	0.5	0.49	0.49	N/A	0.000	Manual Calibration
6/20/95	13:51	19	INS	1	0.08	0.02	0.32	0.02	N/A	0.320	Before Installation
6/23/95	11:30	19	INS	3	0.03	0.01	0.03	0.01	N/A	0.030	Unknown
6/26/95	23:06	492	Jacob's Room	22	0.03	0.495	0.495	0.495	N/A	0.000	Self-Calibration
6/28/95	1:49	19	INS	5	0.03	0.52	0.53	0.51	N/A	0.000	Self-Calibration
6/29/95	11:57	16	Hanging Balcony	11	0.03	0.01	0.03	0.01	N/A	0.030	Tour in Cave
6/29/95	11:57	16	Hanging Balcony	12	0.03	0.03	0.03	0.02	N/A	0.030	Tour in Cave
6/29/95	12:14	16	Hanging Balcony	13	0.03	0.04	0.05	0.11	N/A	0.110	Tour in Cave
6/29/95	12:35	16	Hanging Balcony	14	0.03	0.01	0.04	0.01	N/A	0.040	Tour in Cave
6/29/95	13:07	16	Hanging Balcony	15	0.03	0.03	0.07	0.02	N/A	0.070	Tour in Cave
7/1/95	18:04	492	Jacob's Room	28	0.03	0.025	0.035	0.02	N/A	0.040	Downloading (No physical contact with instrument)
7/4/95	12:23	16	Hanging Balcony	18	0.03	0.06	0.02	0.07	N/A	0.090	Tour in Cave
7/4/95	12:53	16	Hanging Balcony	19	0.03	0.01	0.01	0.05	N/A	0.050	Tour in Cave
7/4/95	12:53	16	Hanging Balcony	20	0.03	0.01	0.02	0.03	N/A	0.030	Tour in Cave
7/4/95	12:53	16	Hanging Balcony	21	0.03	0.02	0.03	0.04	N/A	0.040	Tour in Cave
7/4/95	14:34	16	Hanging Balcony	22	0.03	0.01	0.03	0.02	N/A	0.030	Tour in Cave
7/5/95	6:03	19	INS	9	0.03	0.53	0.52	0.52	N/A	0.000	Self-Calibration
7/5/95	6:08	492	Jacob's Room	29	0.03	0.5	0.5	0.495	N/A	0.000	Self-Calibration
7/5/95	10:38	16	Hanging Balcony	23	0.03	0.01	0.04	0.02	N/A	0.040	Tour in Cave
7/5/95	12:55	16	Hanging Balcony	24	0.03	0.02	0.03	0.04	N/A	0.040	Tour in Cave

Non-Blast Seismographs

Date	Time	Unit #	Location	Event #	Trig Lev	Tangent	Vertical	Radial	Air Blast	Vector Sum	Cause
7/7/95	10:34	16	Hanging Balcony	26	0.03	0.01	0.03	0.01	N/A	0.030	Tour in Cave
7/7/95	10:34	16	Hanging Balcony	27	0.03	0.01	0.03	0.01	N/A	0.030	Tour in Cave
7/7/95	17:52	16	Hanging Balcony	29	0.03	0.03	0.02	0.02	N/A	0.040	2 Min after blast
7/8/95	8:42	16	Hanging Balcony	30	0.03	0.03	0.02	0.02	N/A	0.040	Tour in Cave
7/8/95	9:15	16	Hanging Balcony	31	0.03	0.03	0.02	0.02	N/A	0.040	Tour in Cave
7/8/95	9:20	16	Hanging Balcony	32	0.03	0.03	0.02	0.02	N/A	0.040	Tour in Cave
7/8/95	9:21	16	Hanging Balcony	33	0.03	0.03	0.01	0.02	N/A	0.030	Tour in Cave
7/12/95	9:45	16	Hanging Balcony	35	0.03	0.01	0.03	0.02	N/A	0.030	Tour in Cave
7/12/95	4:26	492	Jacob's Room	30	0.03	0.495	0.5	0.495	N/A	0.000	Self-Calibration
7/13/95	11:43	16	Hanging Balcony	36	0.03	0.01	0.03	0.01	N/A	0.030	Tour in Cave
7/14/95	9:55	16	Hanging Balcony	38	0.03	0.01	0.03	0.01	N/A	0.030	Tour in Cave
7/14/95	13:49	16	Hanging Balcony	39	0.03	0.02	0.02	0.04	N/A	0.040	Tour in Cave
7/14/95	16:20	21	Entrance	34	0.03	0.03	0.02	0.02	N/A	0.040	3 Minutes after blast/ Unknown
7/17/95	11:30	16	Hanging Balcony	42	0.03	0.01	0.01	0.04	N/A	0.040	Tour in Cave
7/21/95	12:58	16	Hanging Balcony	46	0.03	0.03	0.07	0.04	N/A	0.070	Tour in Cave
7/21/95	14:49	16	Hanging Balcony	47	0.03	0.02	0.03	0.02	N/A	0.030	Tour in Cave
7/24/95	12:58	21	Entrance	39	0.03	0.03	0.02	0.02	N/A	0.040	Unknown
7/26/95	12:32	16	Hanging Balcony	49	0.03	0.02	0.07	0.02	N/A	0.070	Tour in Cave
7/29/95	13:44	16	Hanging Balcony	52	0.03	0.01	0.03	0.01	N/A	0.030	Tour in Cave
7/31/95	8:02	21	Entrance	44	0.03	0.03	0.02	0.02	N/A	0.040	Unknown
8/1/95	11:33	16	Hanging Balcony	53	0.03	0.06	0.07	0.08	N/A	0.090	Tour in Cave
8/1/95	11:33	16	Hanging Balcony	54	0.03	0.04	0.05	0.03	N/A	0.050	Tour in Cave
8/1/95	11:33	16	Hanging Balcony	55	0.03	0.02	0.05	0.03	N/A	0.050	Tour in Cave
8/3/95	10:24	16	Hanging Balcony	57	0.03	0.01	0.03	0.01	N/A	0.030	Tour in Cave
8/4/95	10:46	492	Helictite	134	0.03	0.505	0.51	0.5	N/A	0.000	Self-Calibration
8/5/95	12:49	16	Hanging Balcony	58	0.03	0.02	0.03	0.02	N/A	0.030	Tour in Cave
8/5/95	12:49	16	Hanging Balcony	59	0.03	0.01	0.05	0.01	N/A	0.050	Tour in Cave
8/5/95	12:49	16	Hanging Balcony	60	0.03	0.01	0.04	0.01	N/A	0.040	Tour in Cave
8/6/95	14:40	16	Hanging Balcony	61	0.03	0.01	0.03	0.01	N/A	0.030	Tour in Cave
8/7/95	22:47	492	Helictite	135	0.03	0.5	0.5	0.49	N/A	0.000	Self-Calibration
8/11/95	10:48	492	Helictite	136	0.03	0.5	0.495	0.495	N/A	0.000	Self-Calibration
8/12/95	14:22	16	Hanging Balcony	62	0.03	0.03	0.03	0.06	N/A	0.060	Tour in Cave
8/12/95	14:45	16	Hanging Balcony	63	0.03	0.28	0.52	0.27	N/A	0.570	Downloading
8/12/95	14:45	16	Hanging Balcony	64	0.03	0.82	0.08	0.5	N/A	0.920	Downloading
8/15/95	13:46	18	Jacob's Room	224	0.03	0.02	0.04	0.02	N/A	0.040	Unknown
8/18/95	11:11	16	Hanging Balcony	65	0.03	0.01	0.03	0.02	N/A	0.030	Tour in Cave
8/19/95	12:32	16	Hanging Balcony	66	0.03	0.07	0.07	0.07	N/A	0.090	Tour in Cave
8/19/95	12:32	16	Hanging Balcony	67	0.03	0.1	0.13	0.21	N/A	0.210	Tour in Cave
8/19/95	14:19	16	Hanging Balcony	68	0.03	0.01	0.03	0.01	N/A	0.030	Tour in Cave
8/20/95	15:07	16	Hanging Balcony	69	0.03	0.05	0.06	0.1	N/A	0.110	Tour in Cave
8/24/95	11:30	16	Hanging Balcony	70	0.03	0.47	0.22	0.26	N/A	0.580	Tour in Cave
8/26/95	12:05	16	Hanging Balcony	71	0.03	0.27	0.15	0.18	N/A	0.350	Downloading

Non-Blast Seismographs

Date	Time	Unit #	Location	Event #	Trig Lev	Tangent	Vertical	Radial	Air Blast	Vector Sum	Cause
8/26/95	12:05	16	Hanging Balcony	72	0.03	0.14	0.08	0.09	N/A	0.180	Downloading
8/26/95	12:05	16	Hanging Balcony	73	0.03	0.26	0.14	0.17	N/A	0.340	Downloading
8/26/95	12:26	20	Lloyd's Room	25	0.03	0.08	0.1	0.07	N/A	0.100	Downloading
9/12/95	15:49	17	INS	15:49	0.03	0.02	0.06	0.06	N/A	0.070	Downloading

APPENDIX E

FULL WAVEFORM DATA

APPENDIX Ei

FULL WAVEFORM DATA

ENTRANCE ROOM

University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

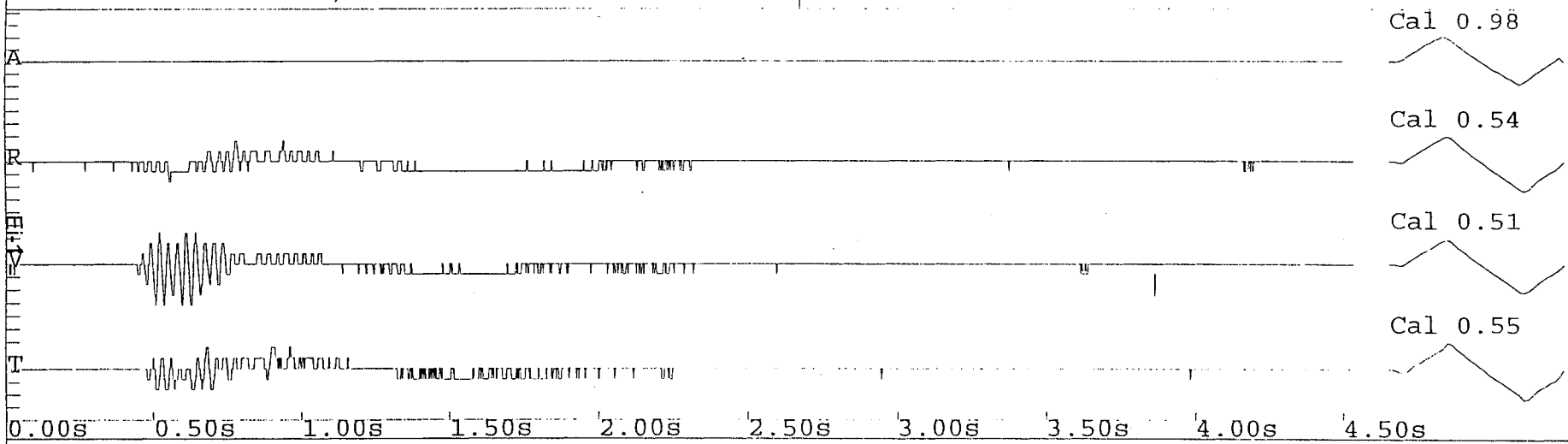
Event: 003 Date: 5/23/95 Time: 16:33
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

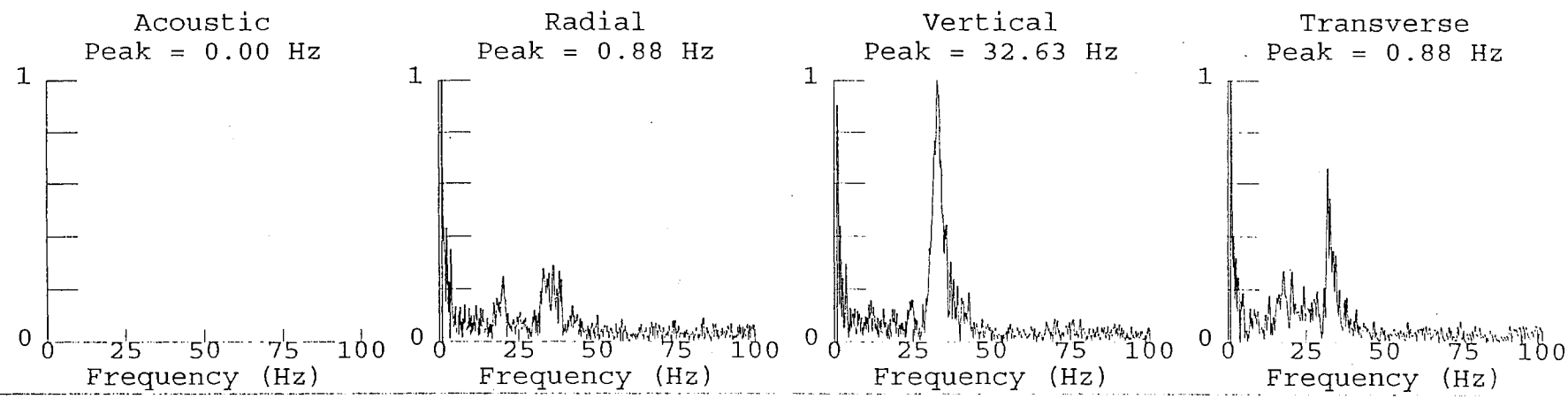
Acoustic: 0 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.04 in/s 39.3 Hz.
Transverse: 0.02 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

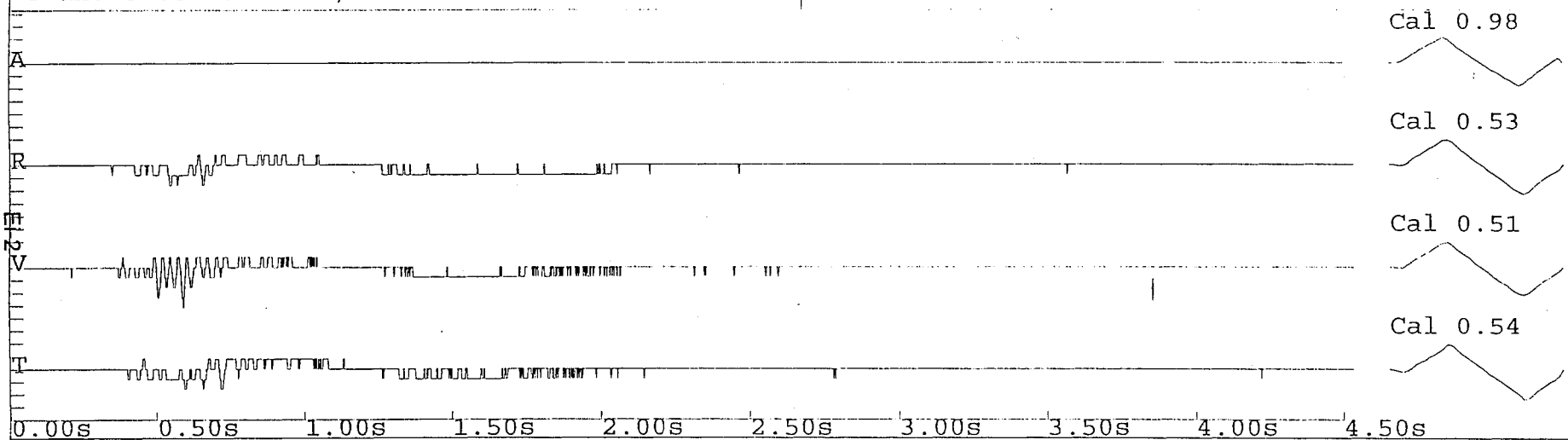
Event: 004 Date: 5/30/95 Time: 16:44
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

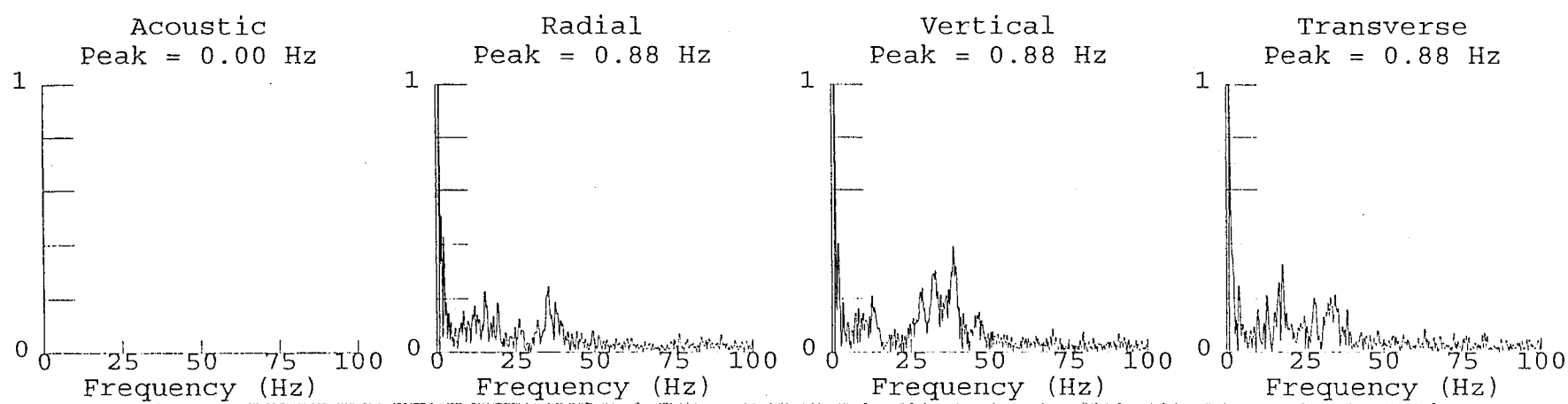
Acoustic: 0 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.04 in/s 34.1 Hz.
Transverse: 0.02 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



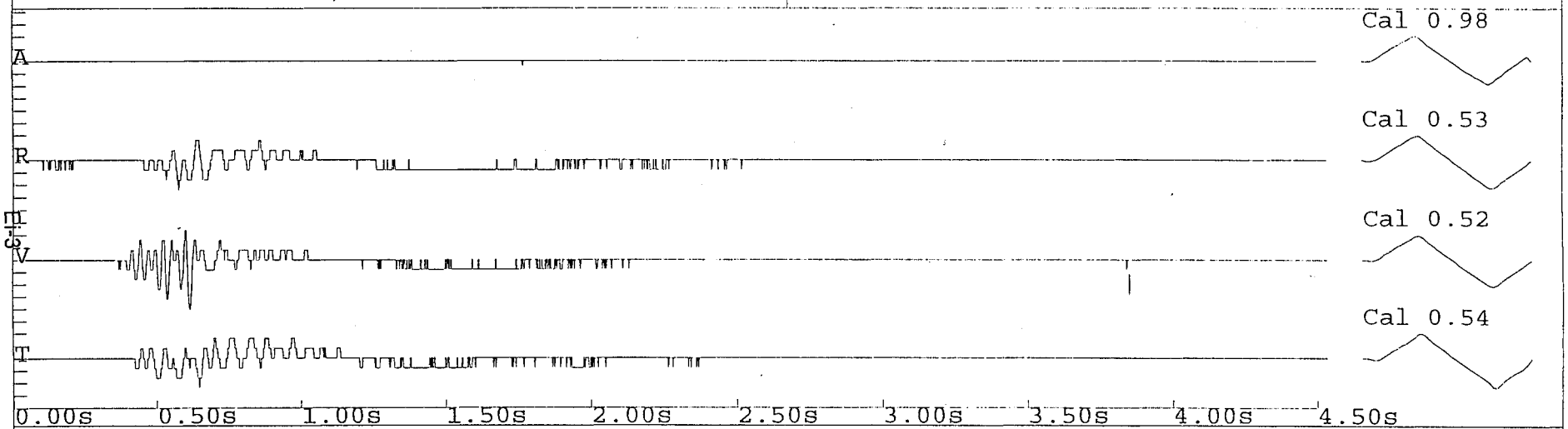
Fourier Analysis (Amplitude Spectrum)



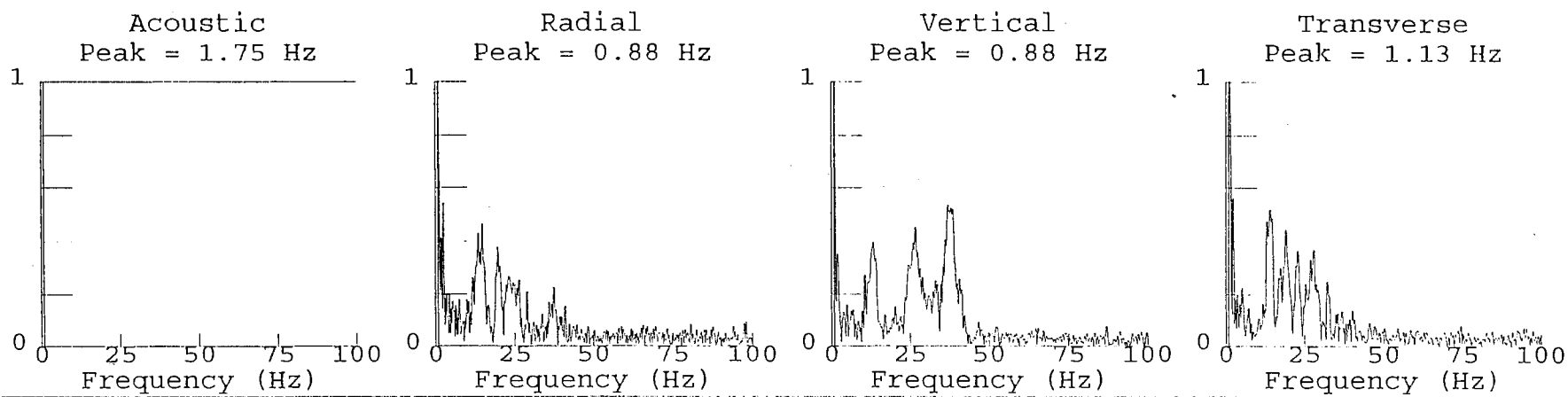
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

Event: 005 Date: 6/ 2/95 Time: 17:29
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 30.1 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

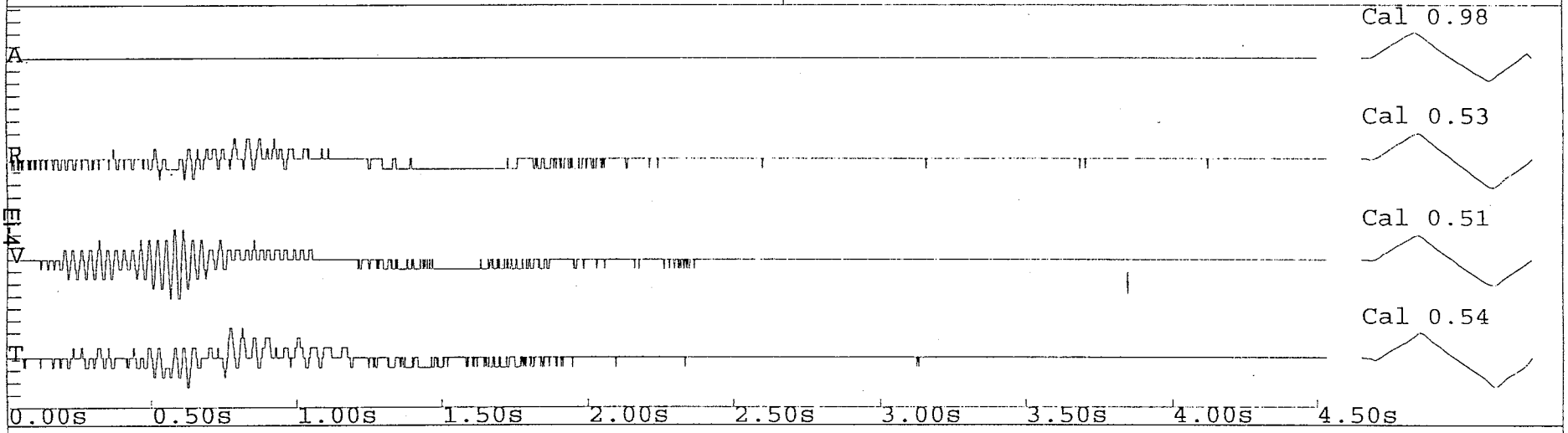
Event: 006 Date: 6/ 6/95 Time: 17:21
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

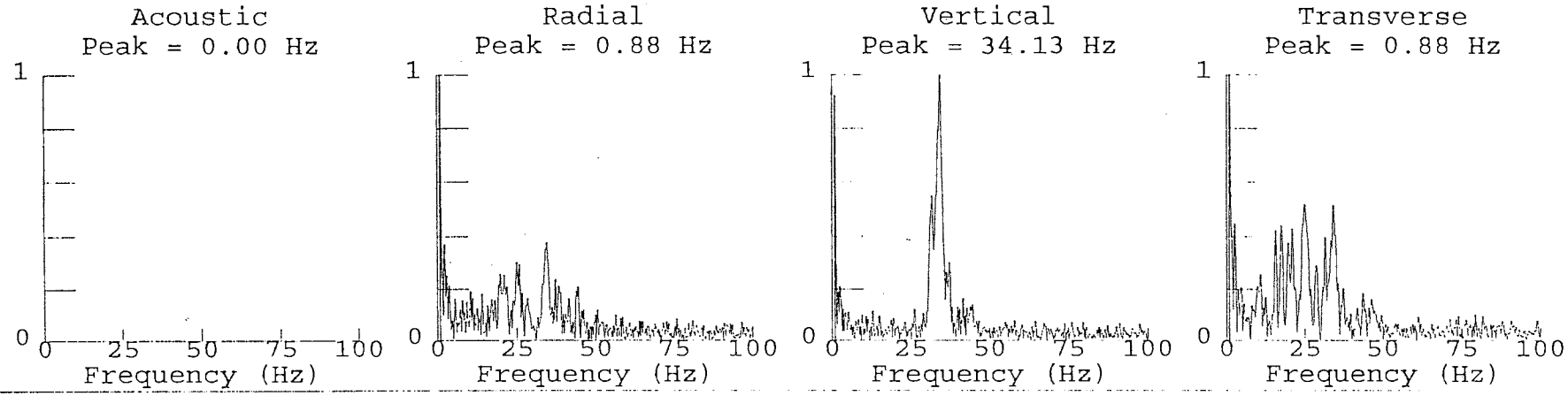
Acoustic: 0 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.04 in/s 34.1 Hz.
Transverse: 0.03 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

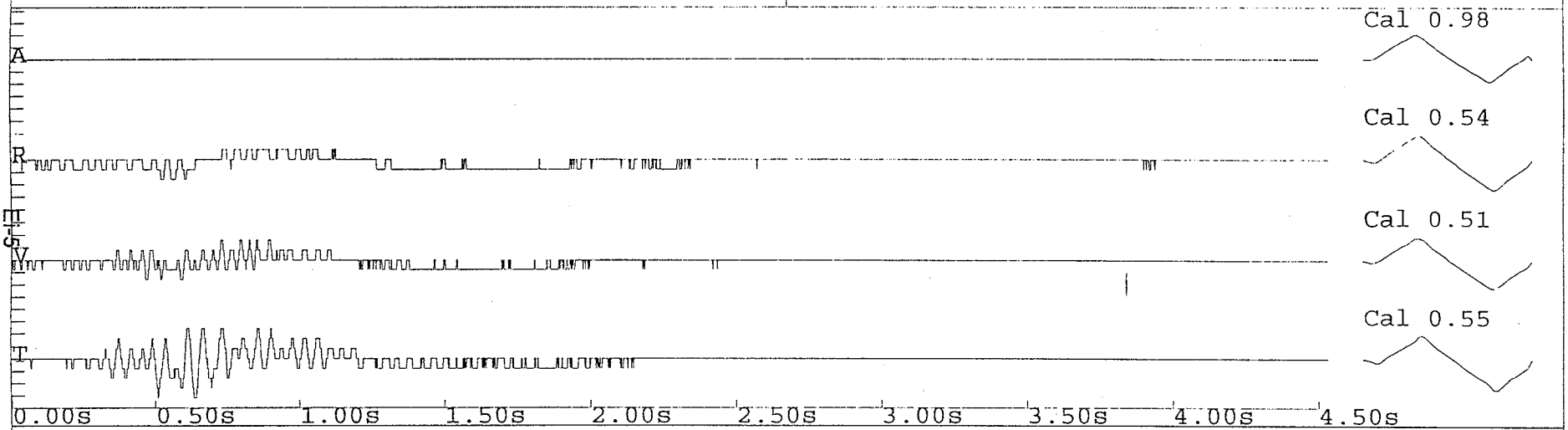
Event: 007 Date: 6/ 7/95 Time: 17:55
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

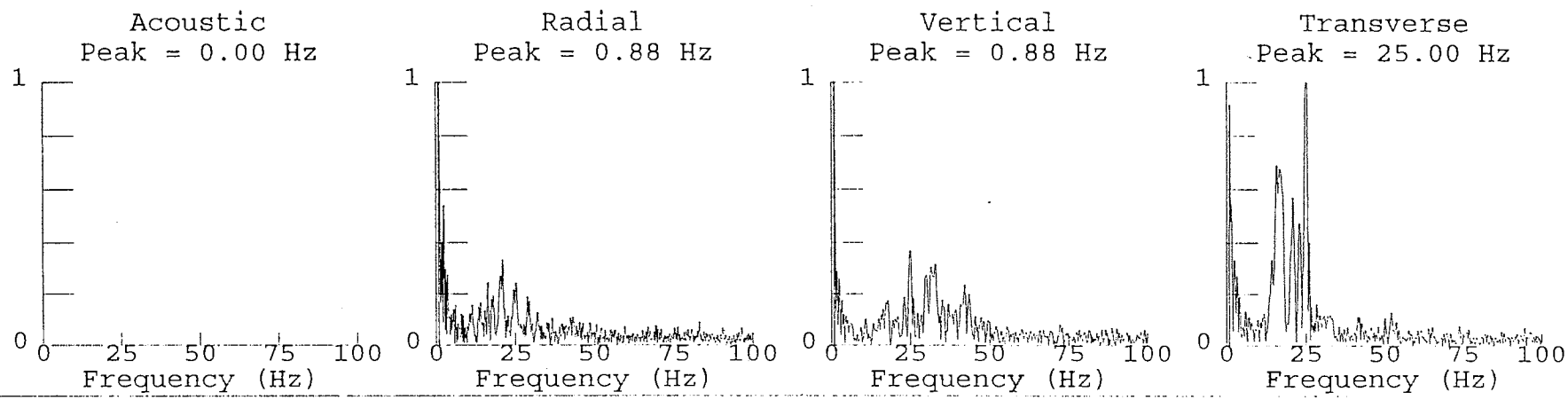
Acoustic: 0 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 21.3 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



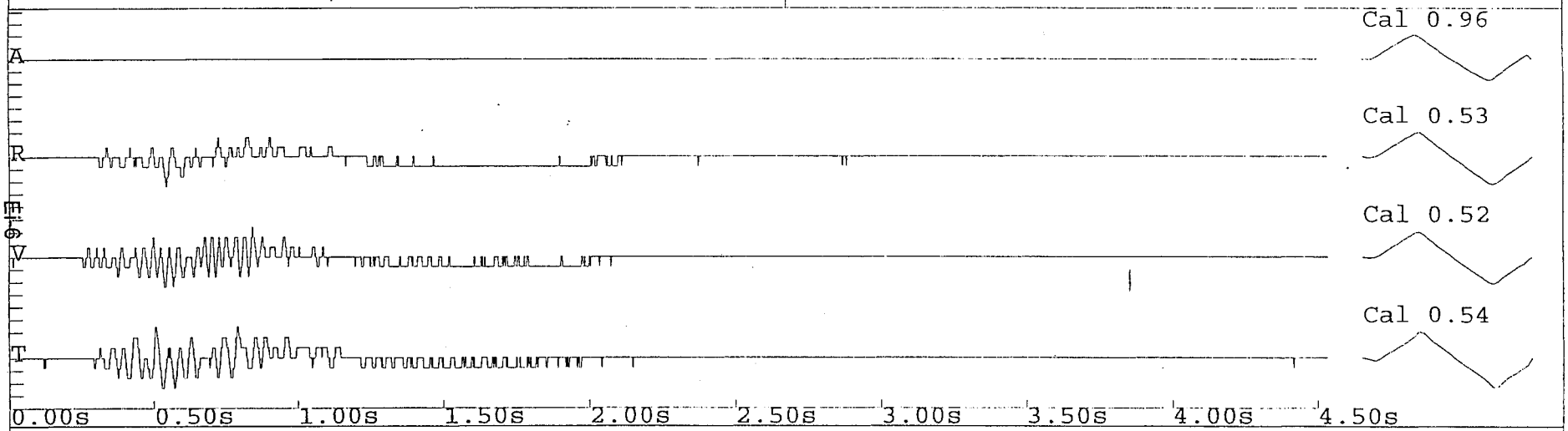
Fourier Analysis (Amplitude Spectrum)



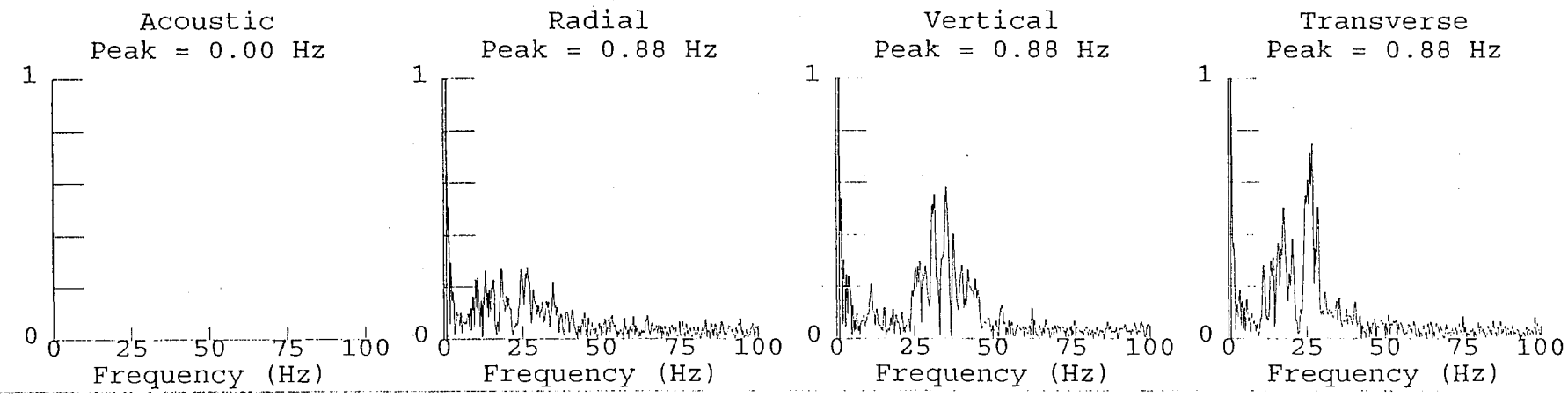
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

Event: 008 Date: 6/ 9/95 Time: 16:17
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



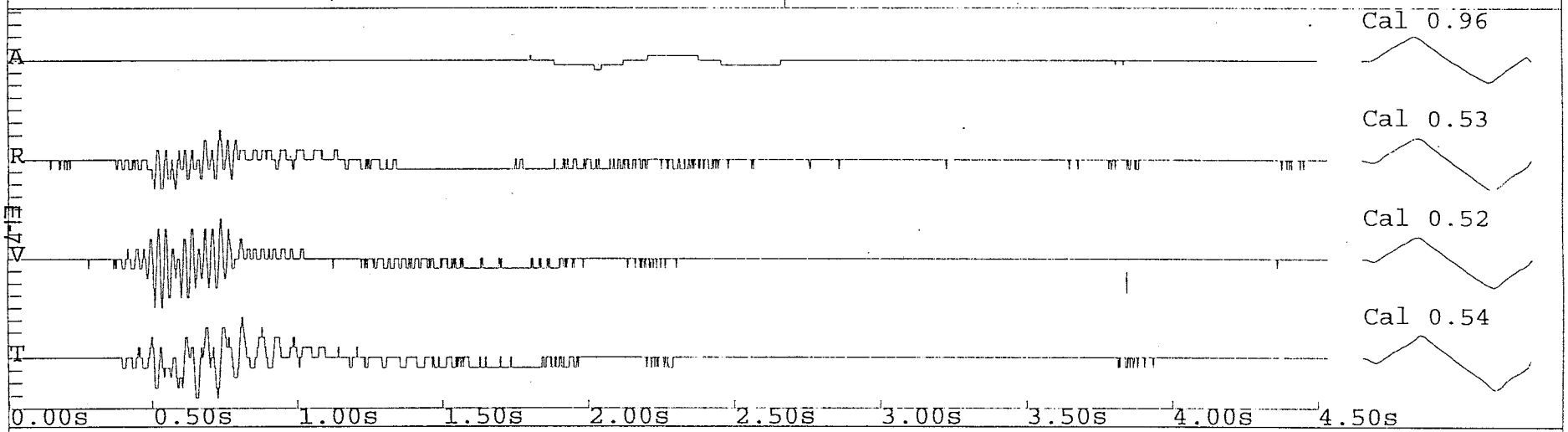
Fourier Analysis (Amplitude Spectrum)



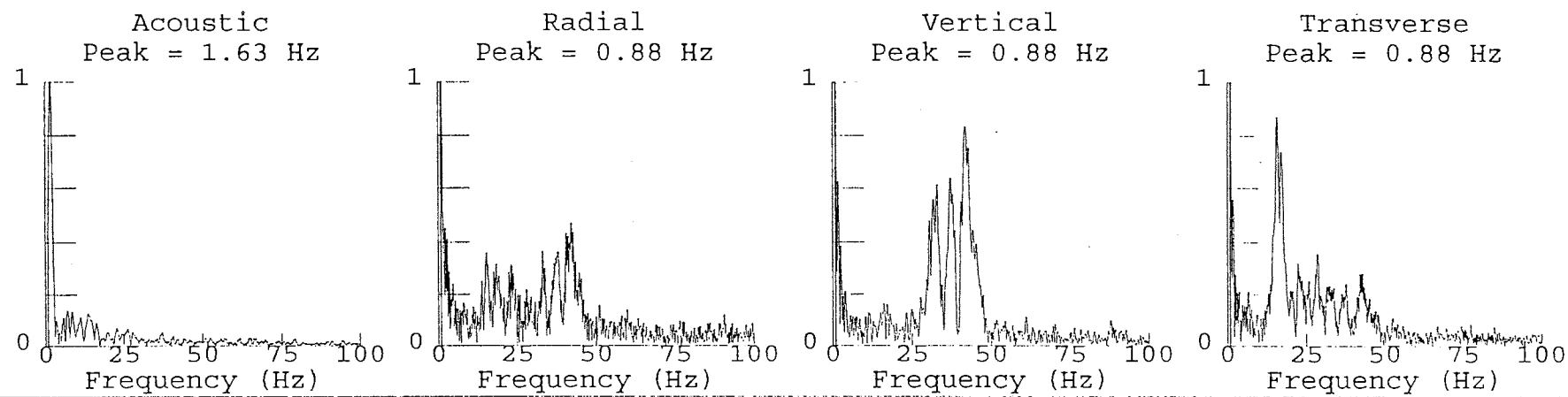
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

Event: 011 Date: 6/12/95 Time: 17:24
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 42.6 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 15.0 Hz.	Time Lines at: 0.50 sec intervals



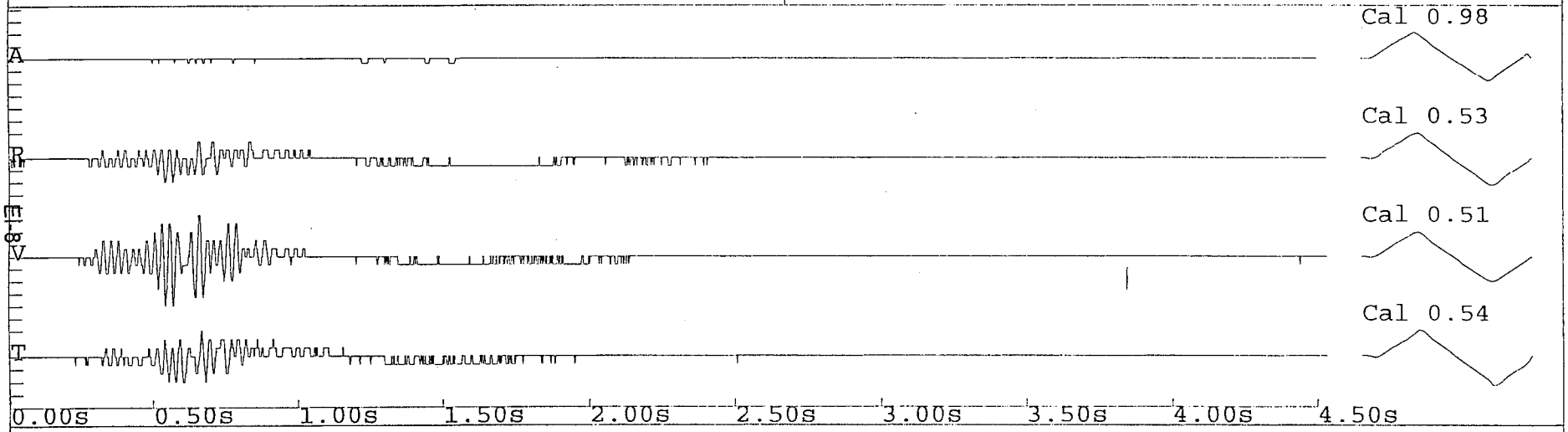
Fourier Analysis (Amplitude Spectrum)



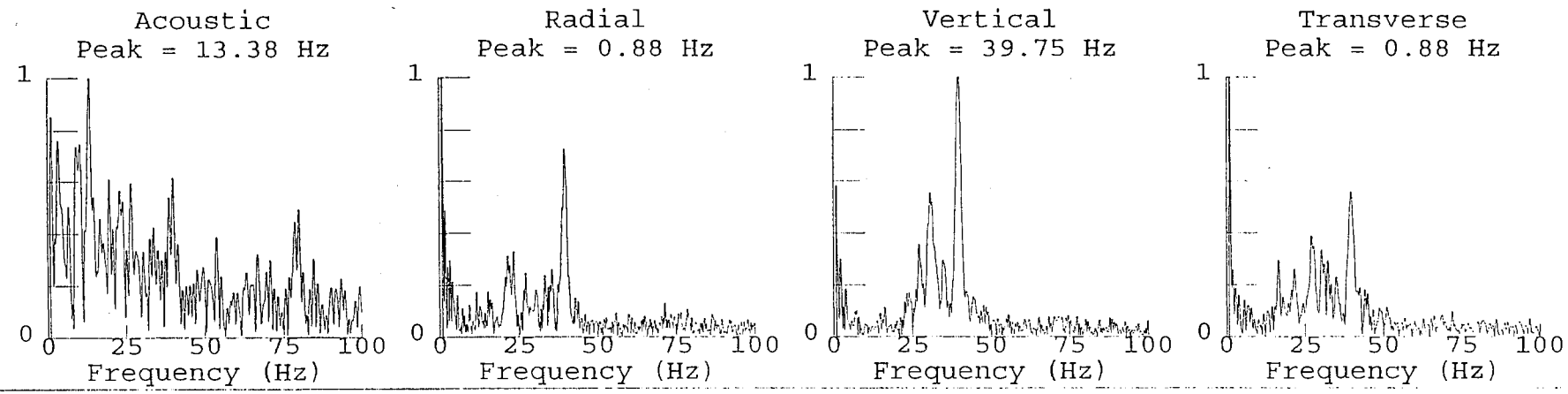
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

Event: 014 Date: 6/15/95 Time: 13:30
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.06 in/s 39.3 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



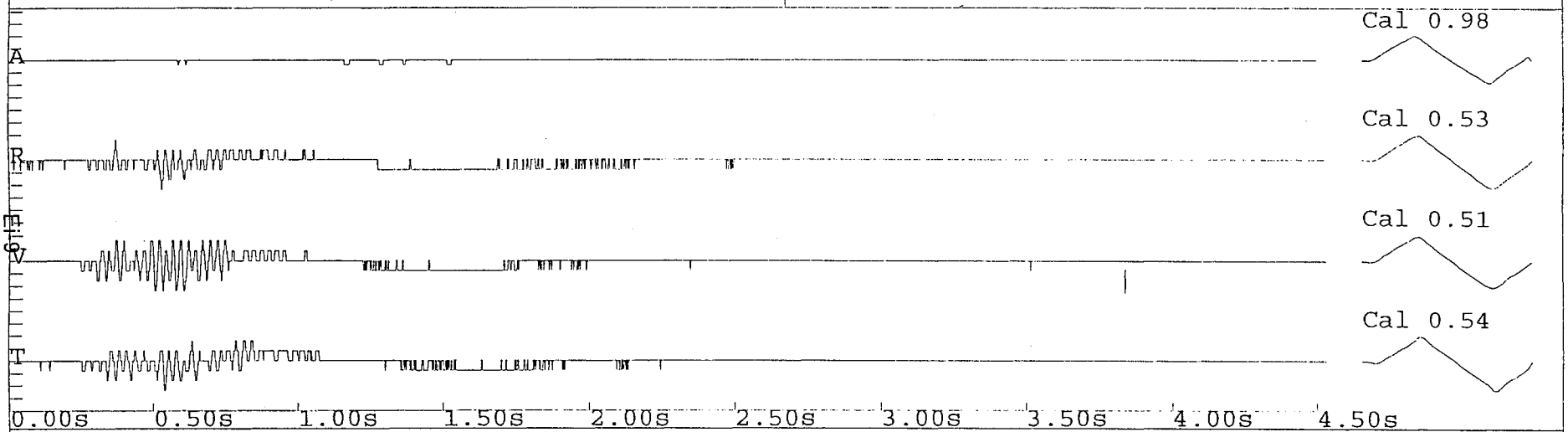
Fourier Analysis (Amplitude Spectrum)



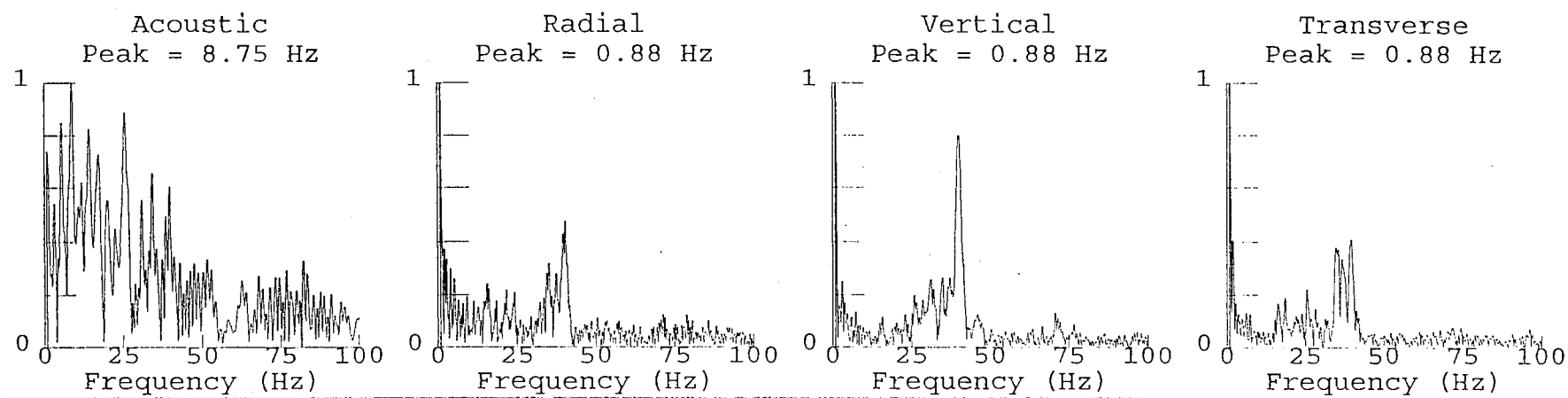
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

Event: 015 Date: 6/16/95 Time: 11:05
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



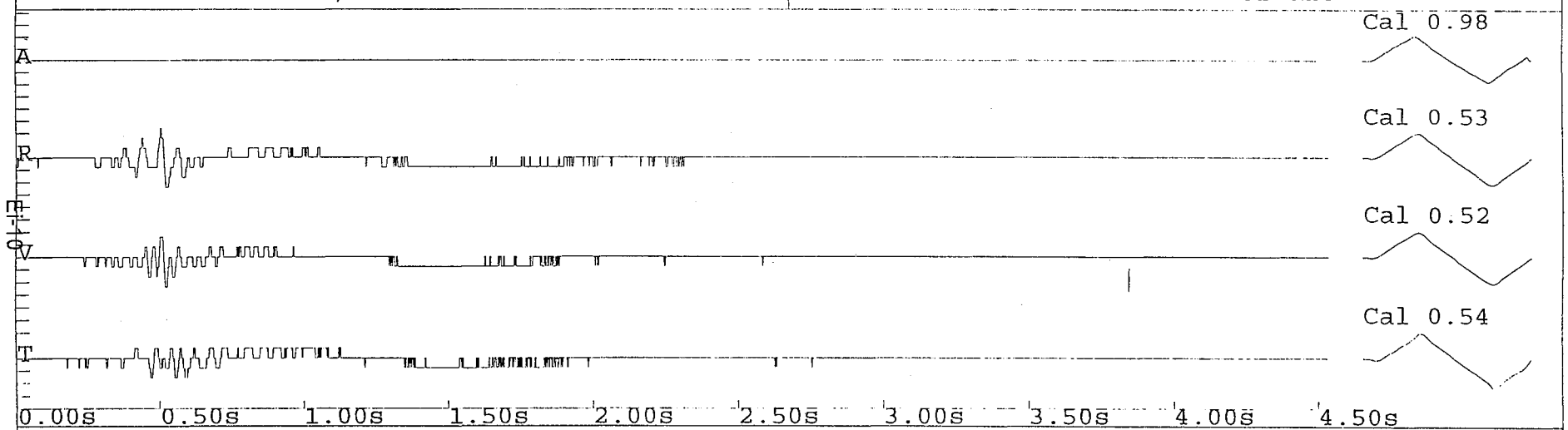
Fourier Analysis (Amplitude Spectrum)



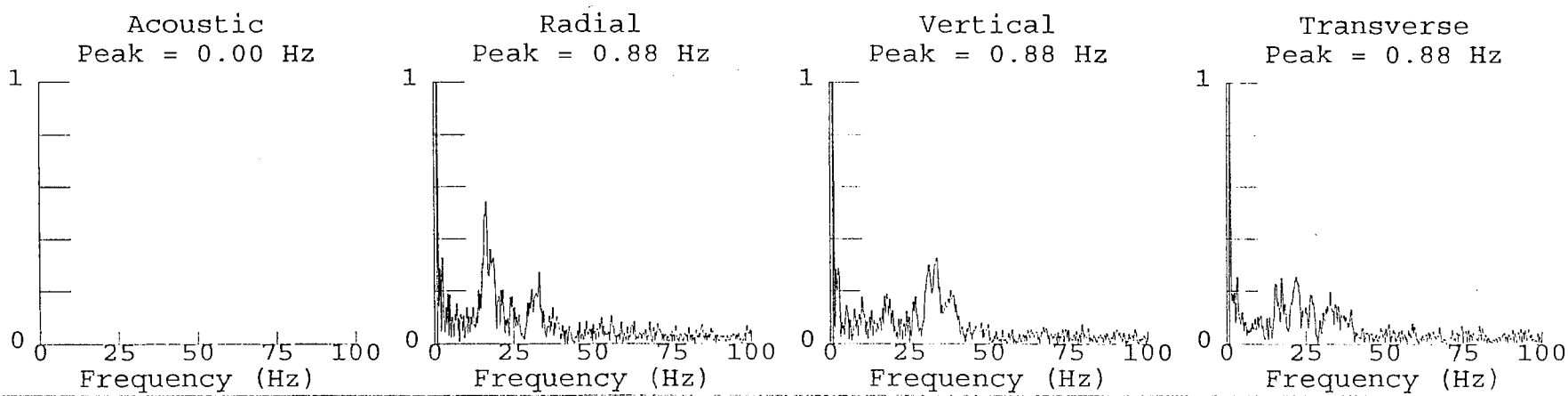
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

Event: 016 Date: 6/16/95 Time: 17:53
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

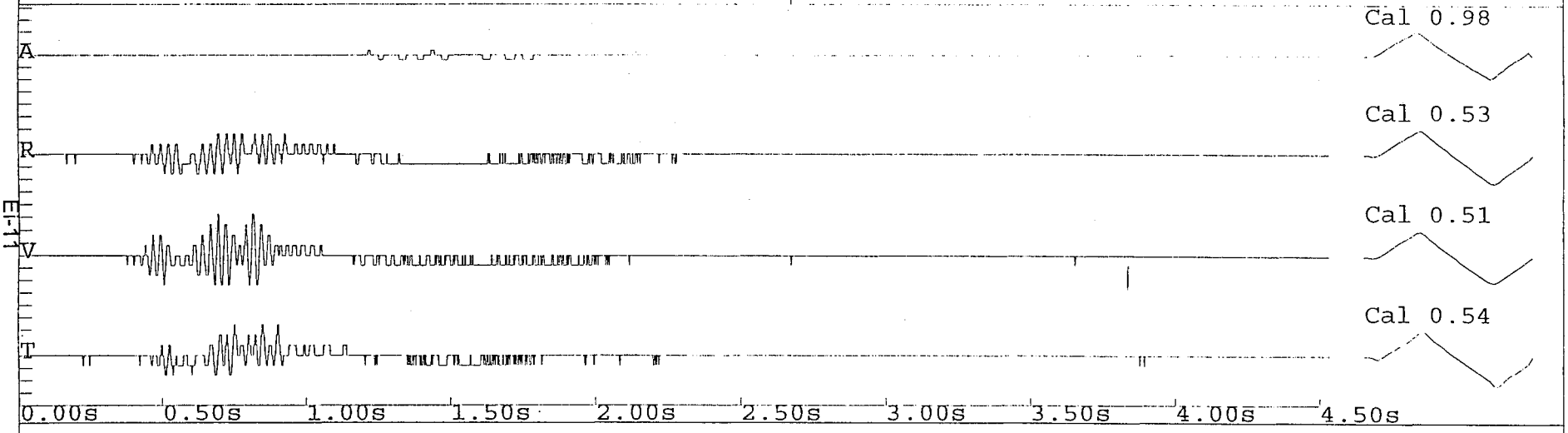
Event: 017 Date: 6/17/95 Time: 9:13
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

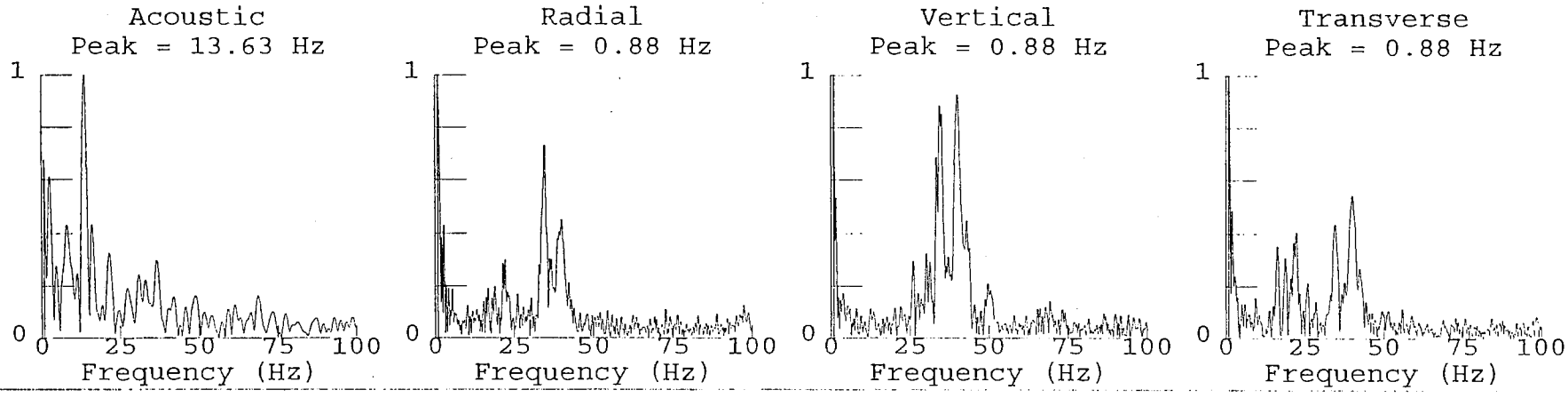
Acoustic: 100 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.04 in/s 56.8 Hz.
Transverse: 0.03 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



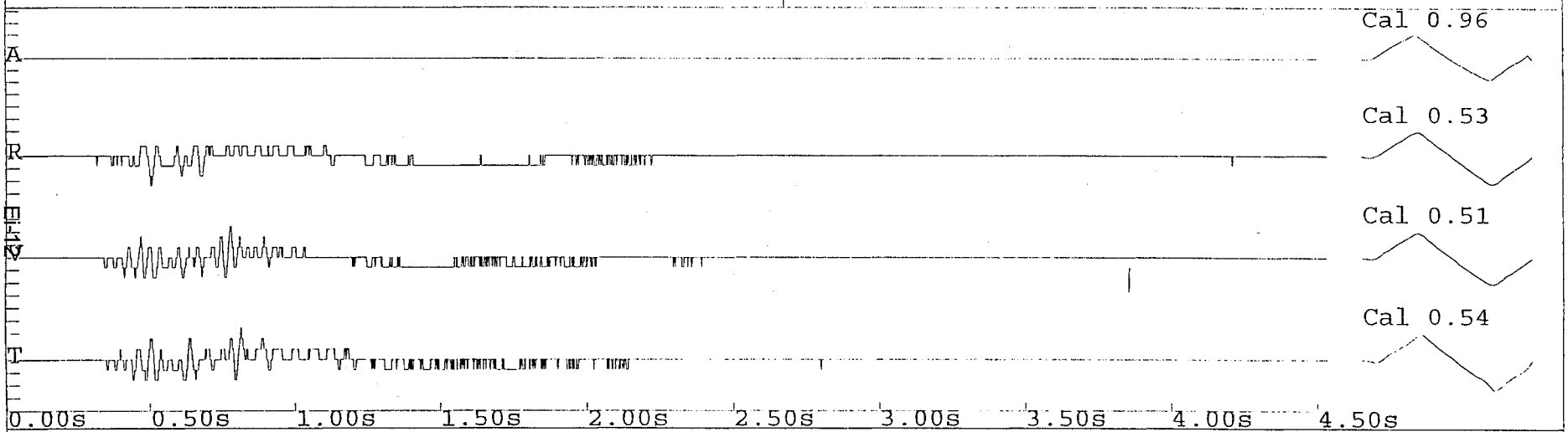
Fourier Analysis (Amplitude Spectrum)



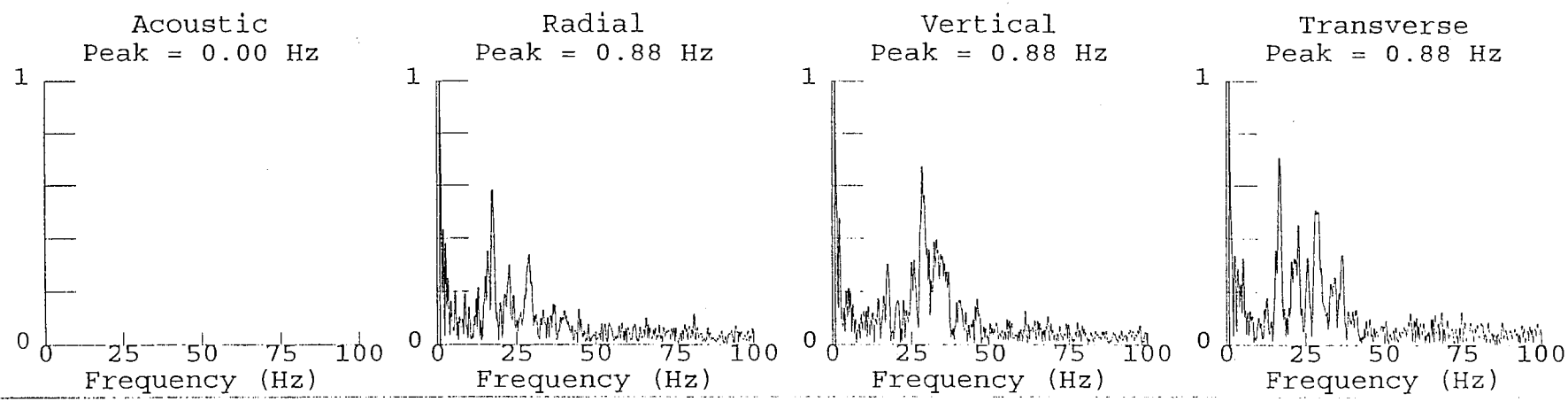
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

Event: 018 Date: 6/21/95 Time: 18:18
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



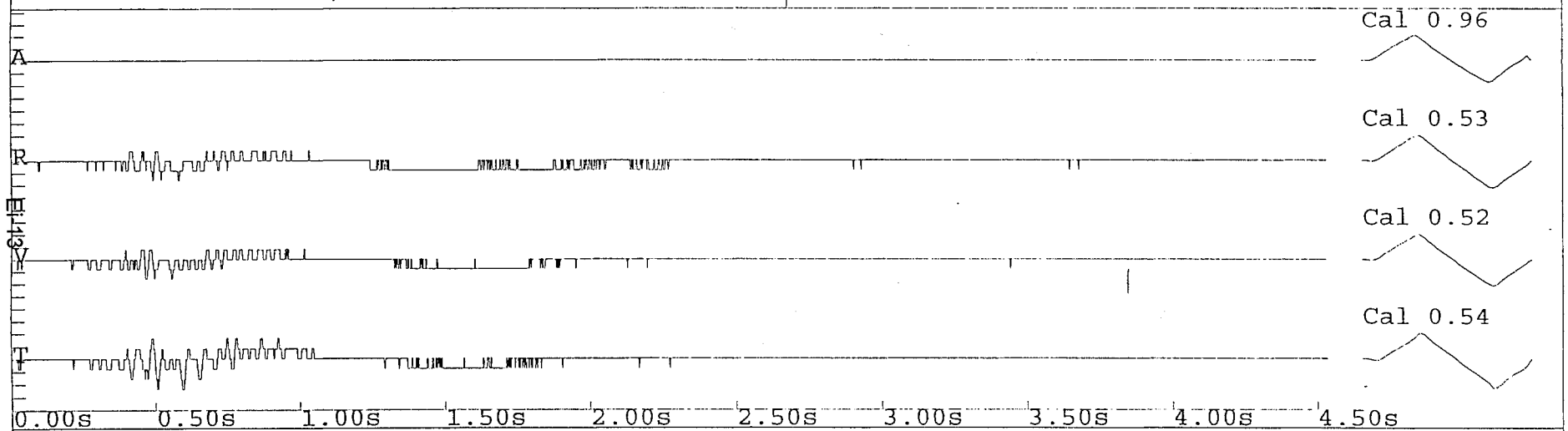
Fourier Analysis (Amplitude Spectrum)



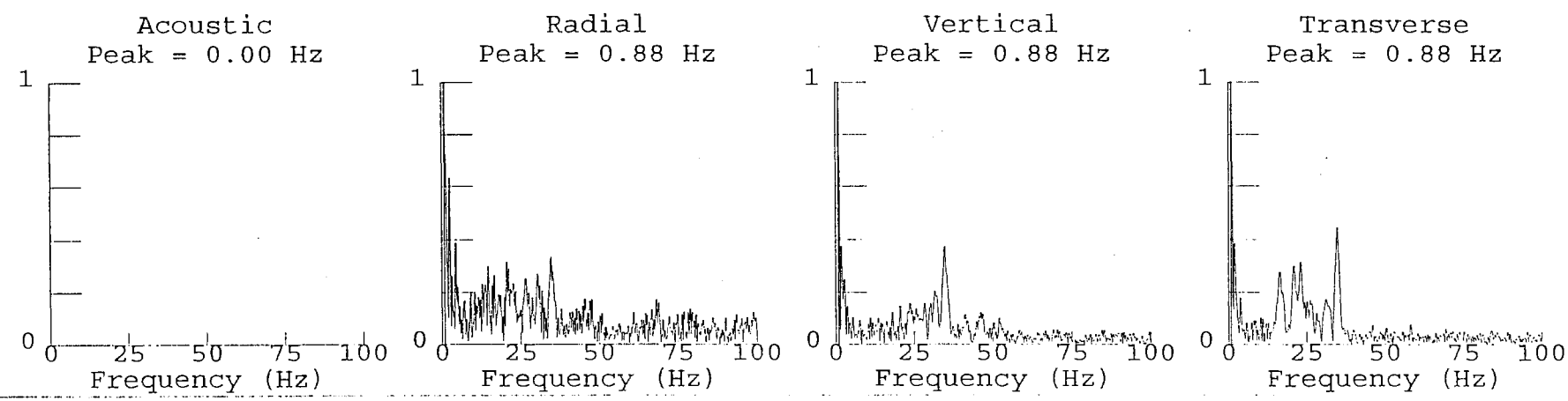
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

Event: 019 Date: 6/23/95 Time: 17:40
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



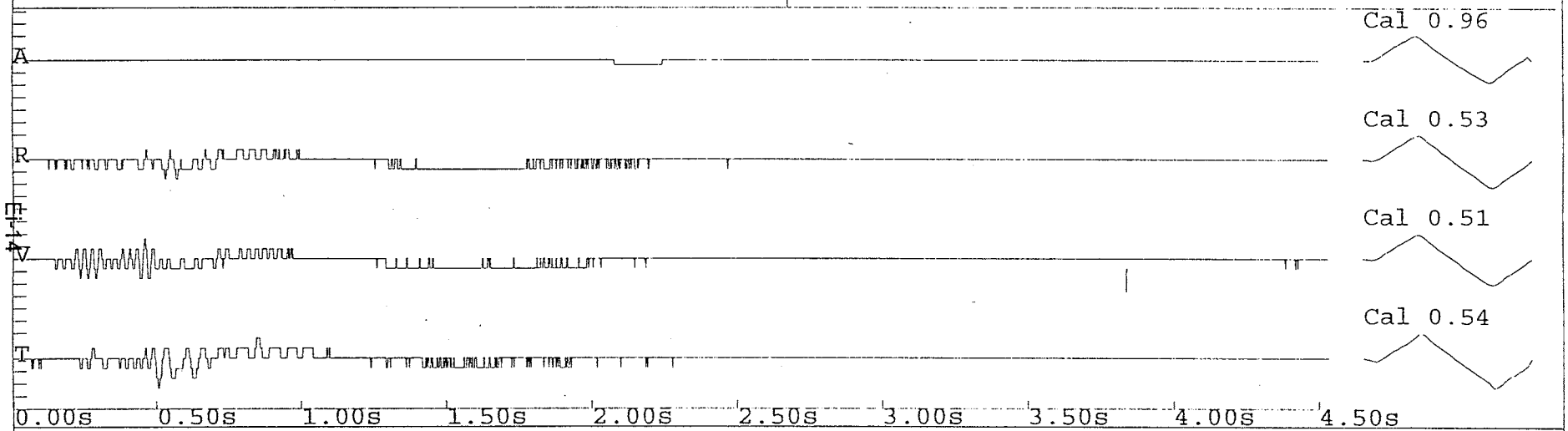
Fourier Analysis (Amplitude Spectrum)



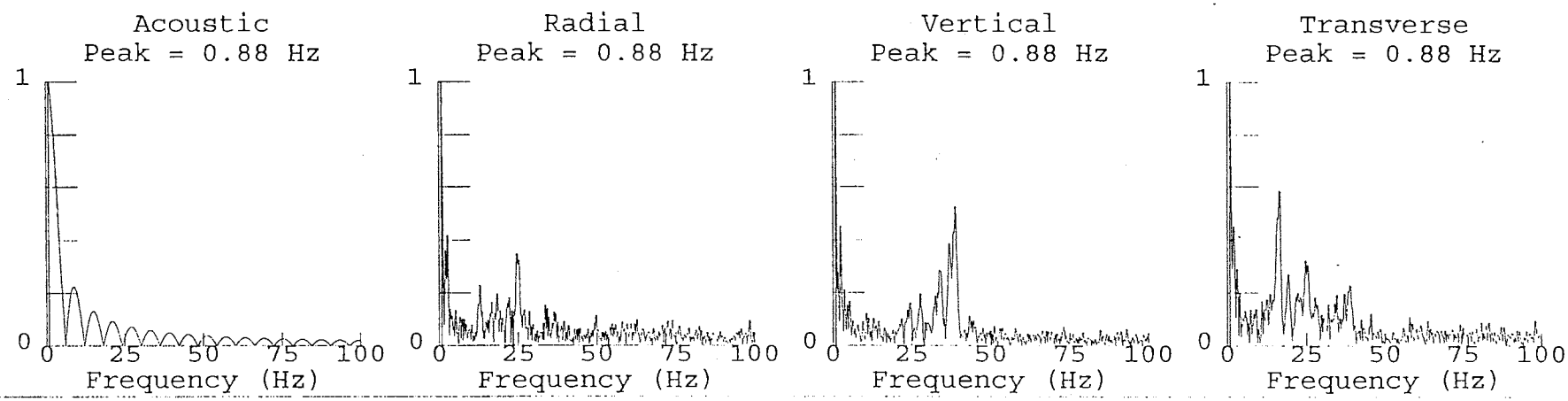
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

Event: 020 Date: 6/28/95 Time: 17:37
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.01 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance

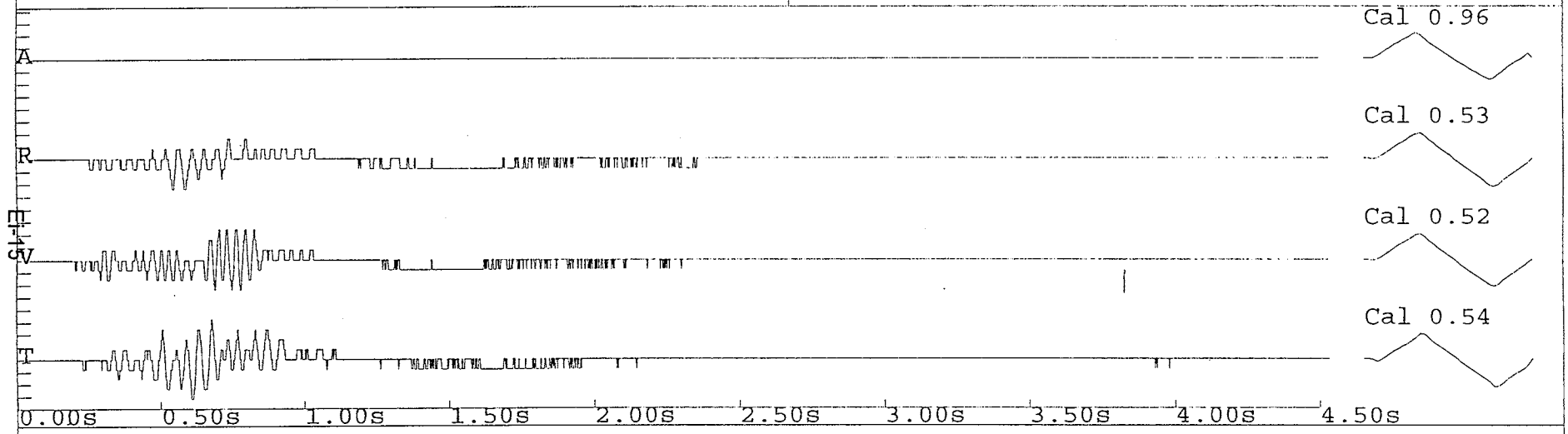
Event: 021 Date: 6/28/95 Time: 17:47
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

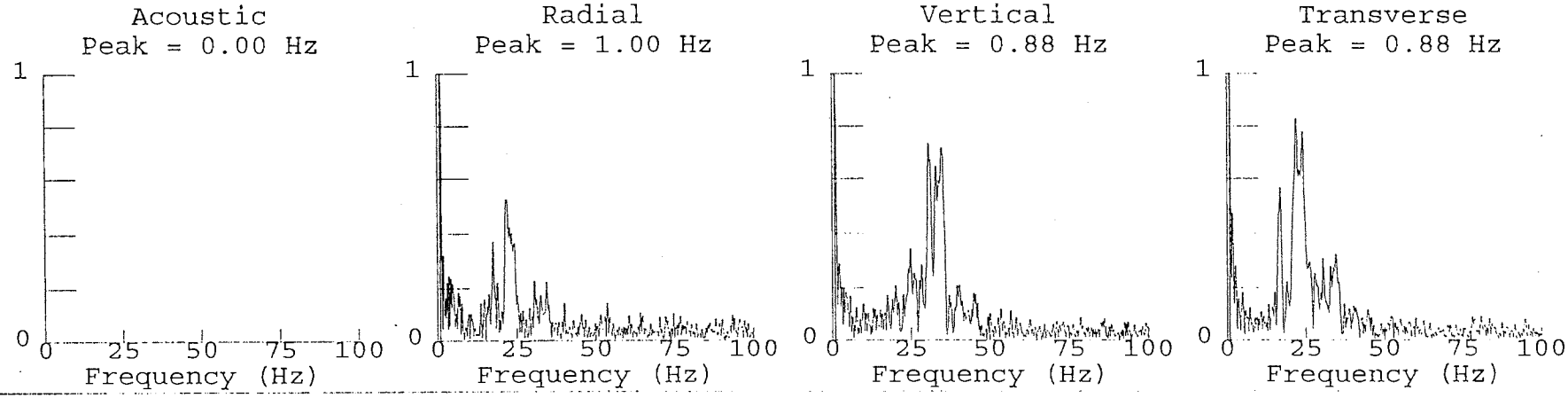
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 39.3 Hz.
Transverse: 0.04 in/s 32.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

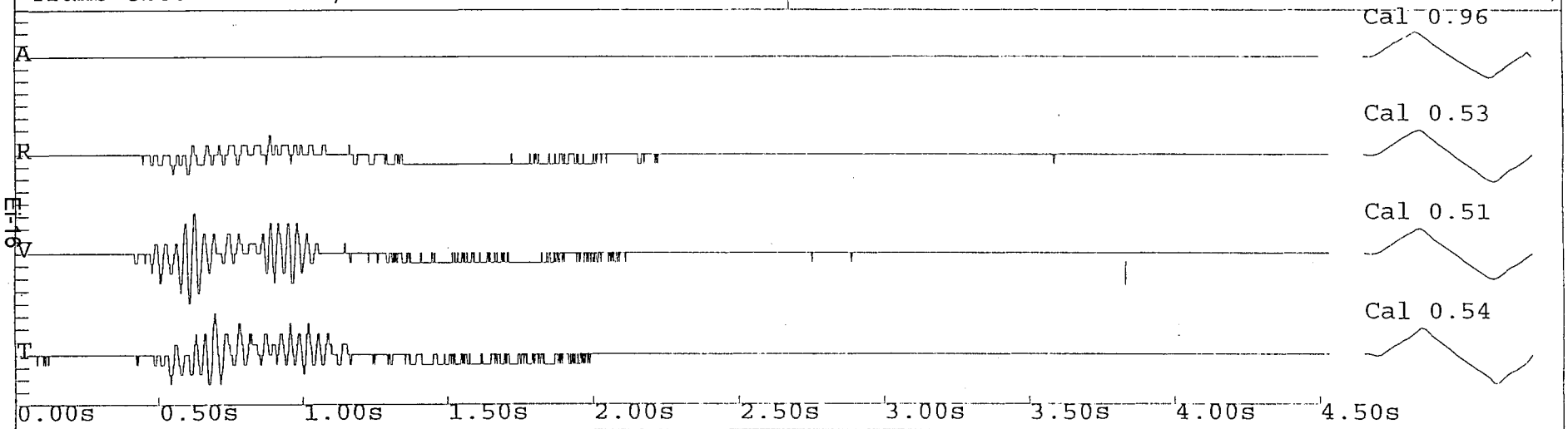
Event: 022 Date: 6/29/95 Time: 17:33
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

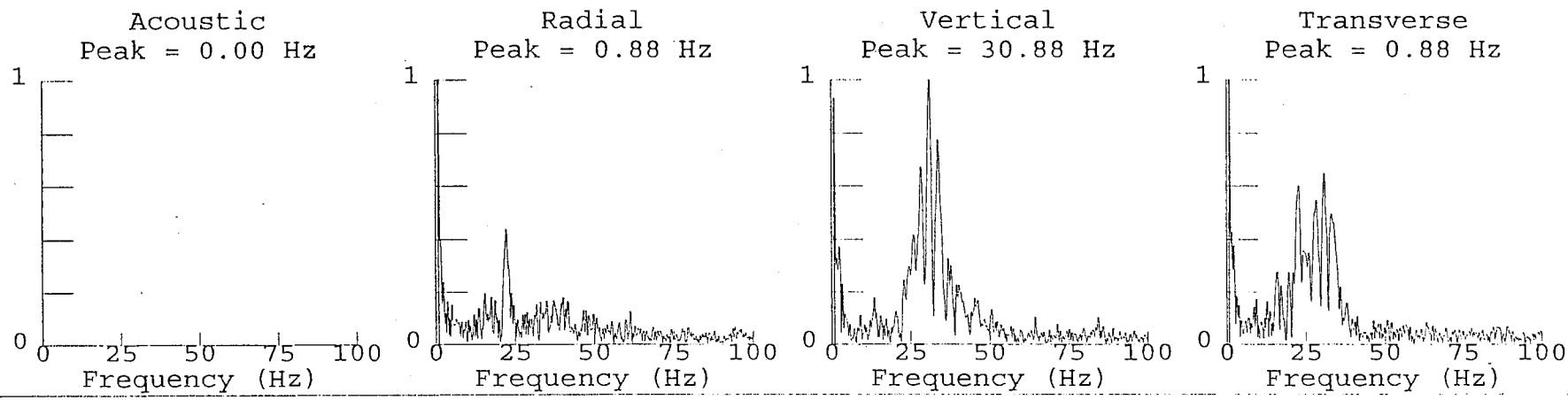
Acoustic: 0 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.05 in/s 34.1 Hz.
Transverse: 0.04 in/s 32.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

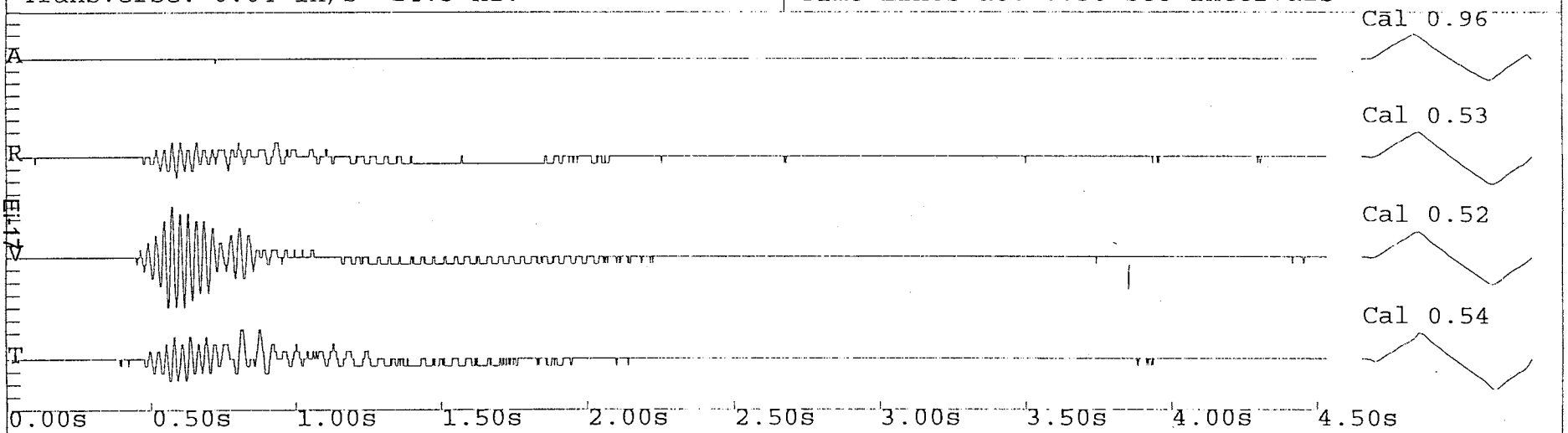
Event: 024 Date: 7/ 1/95 Time: 12:35
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

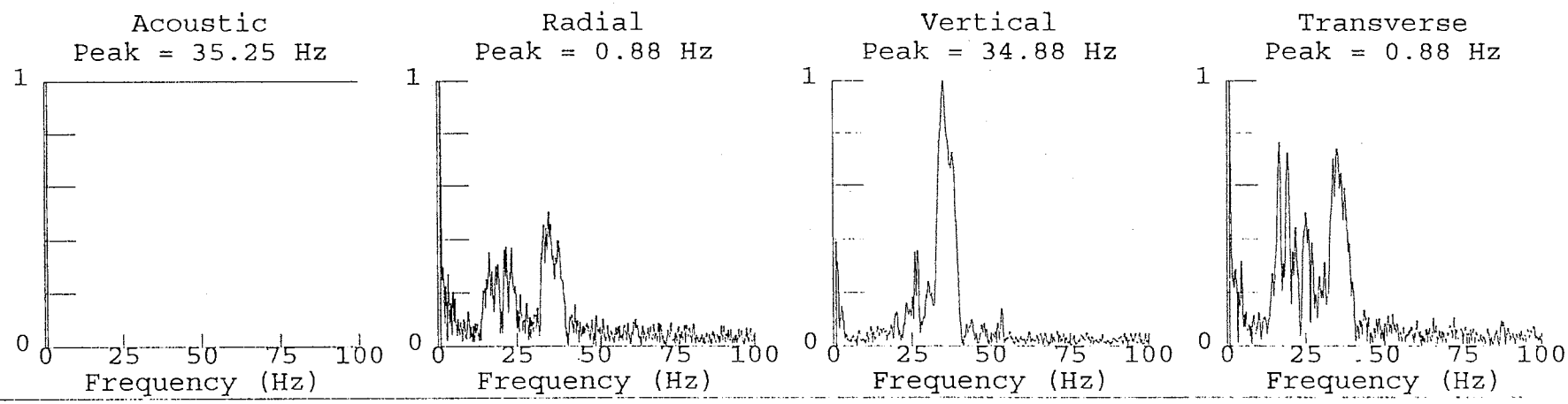
Acoustic: 100 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.07 in/s 39.3 Hz.
Transverse: 0.04 in/s 24.3 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.07 in/s (0.0175 in/s/div)
Time Lines at: 0.50 sec intervals



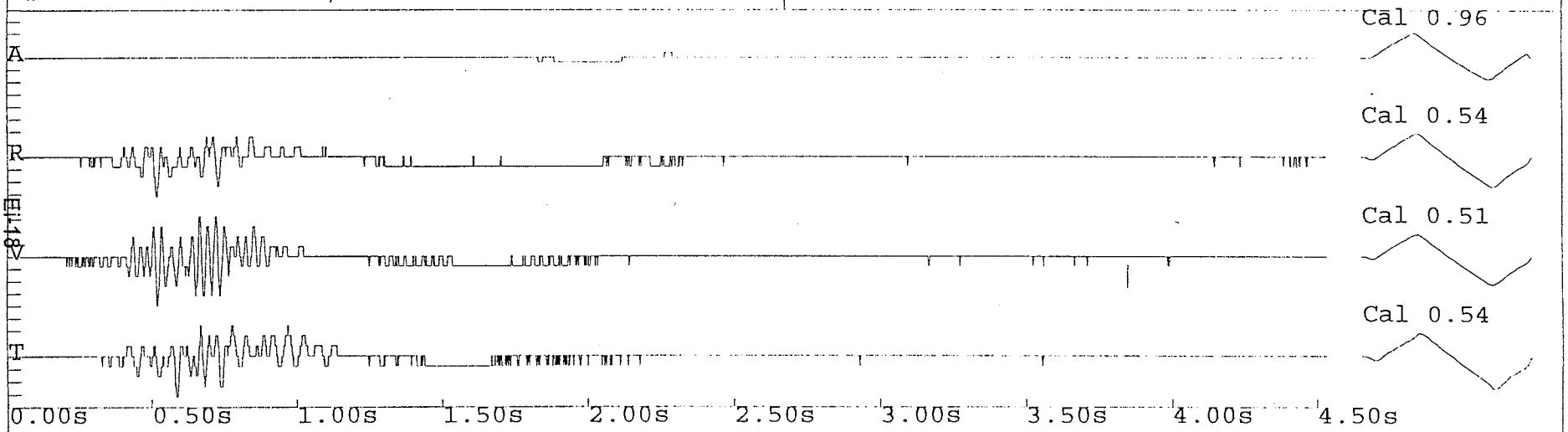
Fourier Analysis (Amplitude Spectrum)



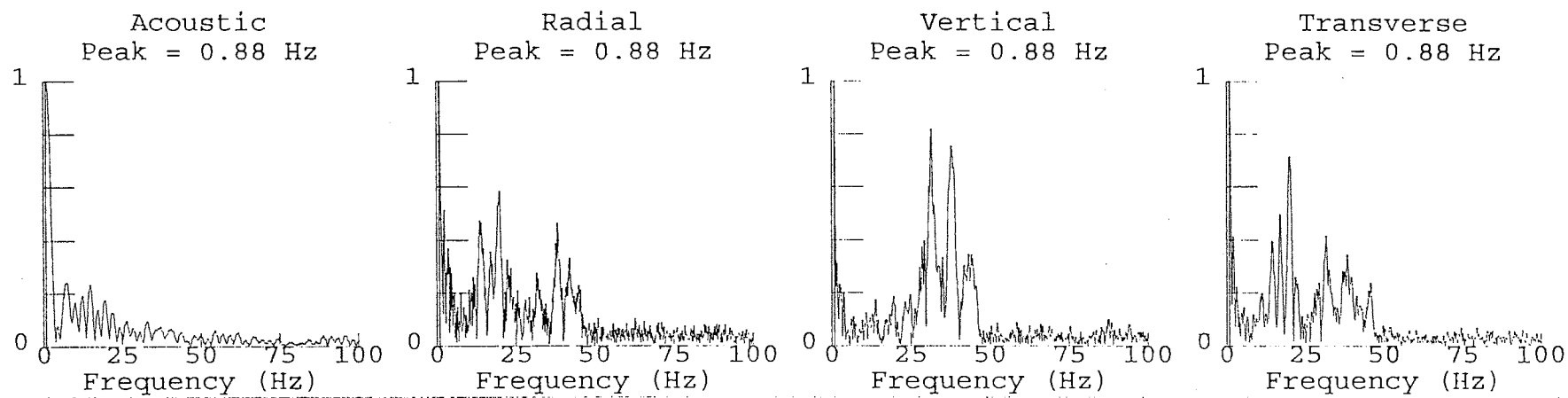
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 025 Date: 7/ 5/95 Time: 17:25
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 26.9 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 36.5 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 30.1 Hz.	Time Lines at: 0.50 sec intervals



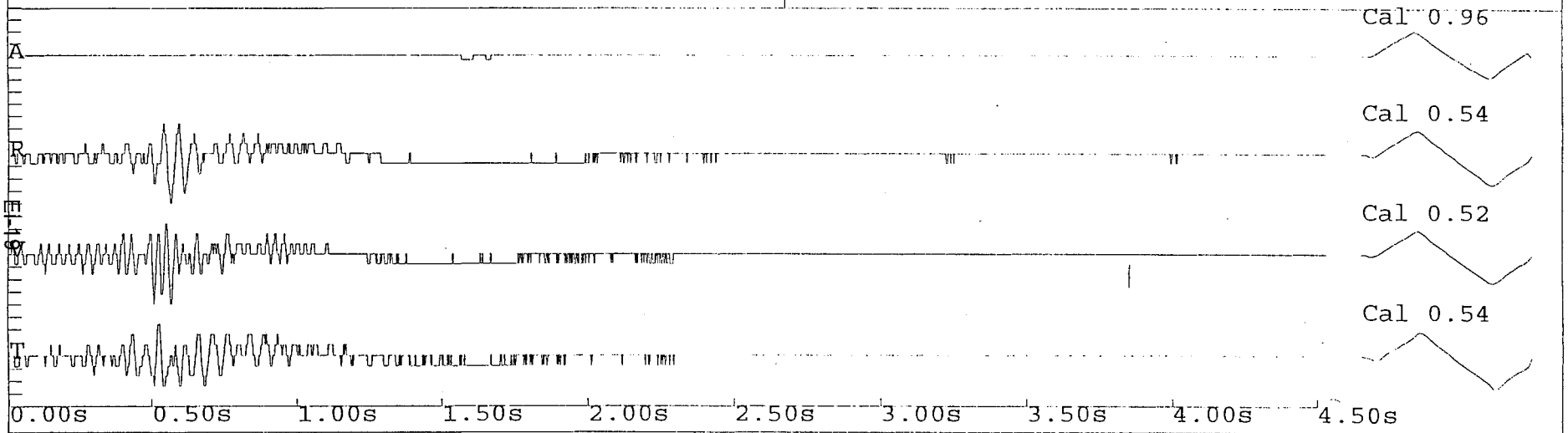
Fourier Analysis (Amplitude Spectrum)



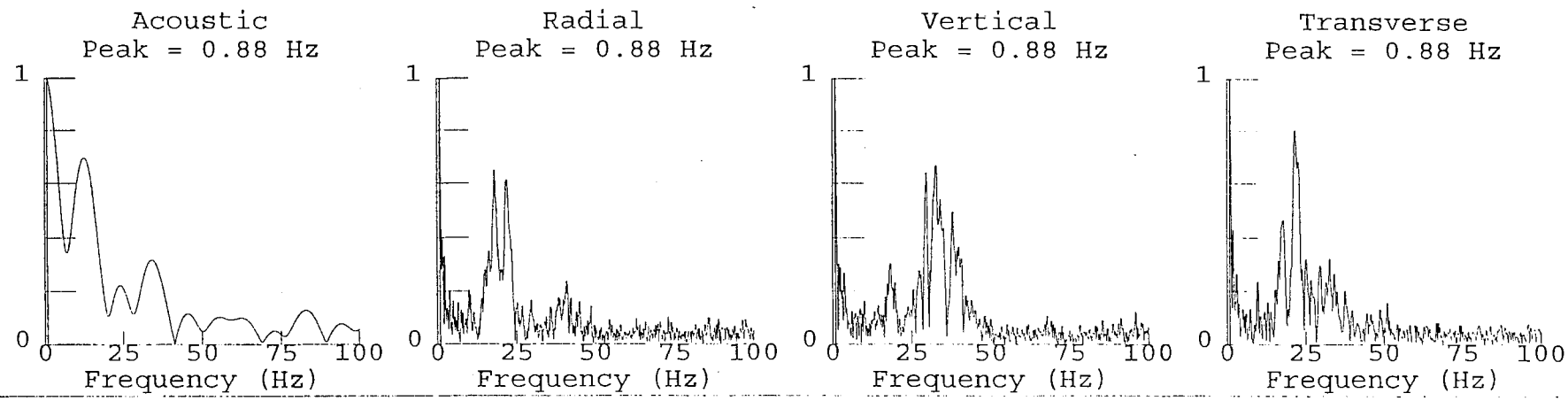
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 026 Date: 7/ 6/95 Time: 18:22
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.05 in/s 18.9 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 36.5 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

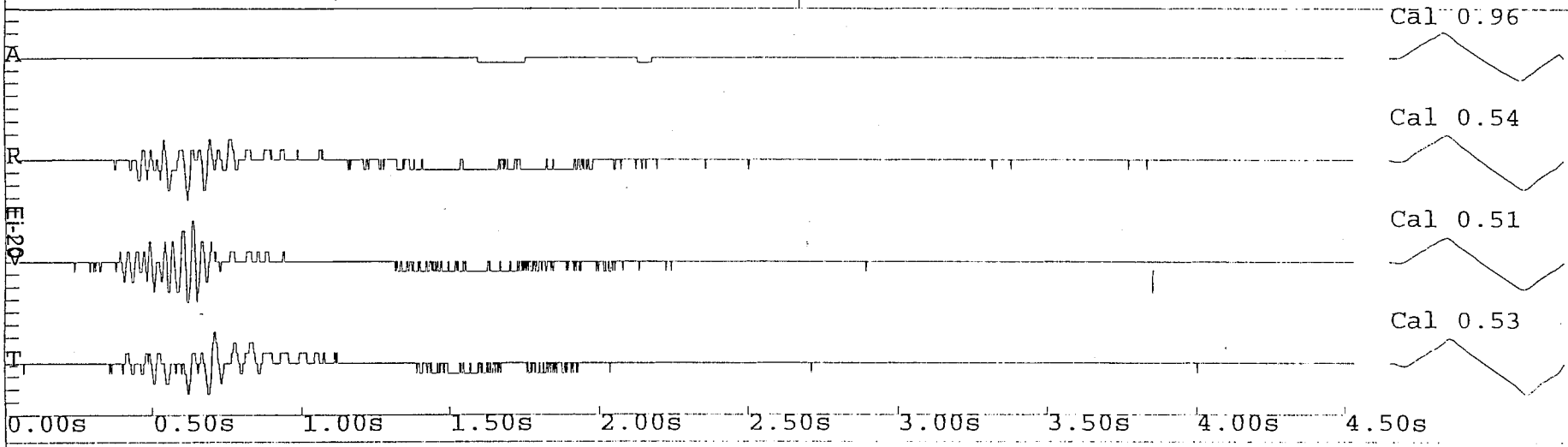
Event: 027 Date: 7/ 7/95 Time: 17:50
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

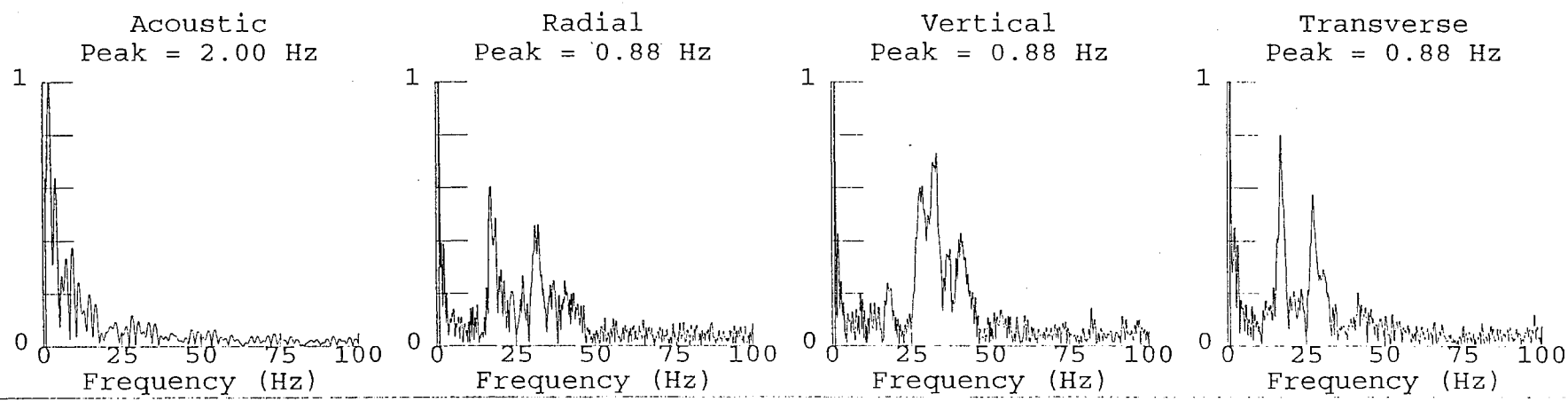
Acoustic: 100 dB 0.0 Hz.
Radial: 0.04 in/s 26.9 Hz.
Vertical: 0.04 in/s 42.6 Hz.
Transverse: 0.03 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

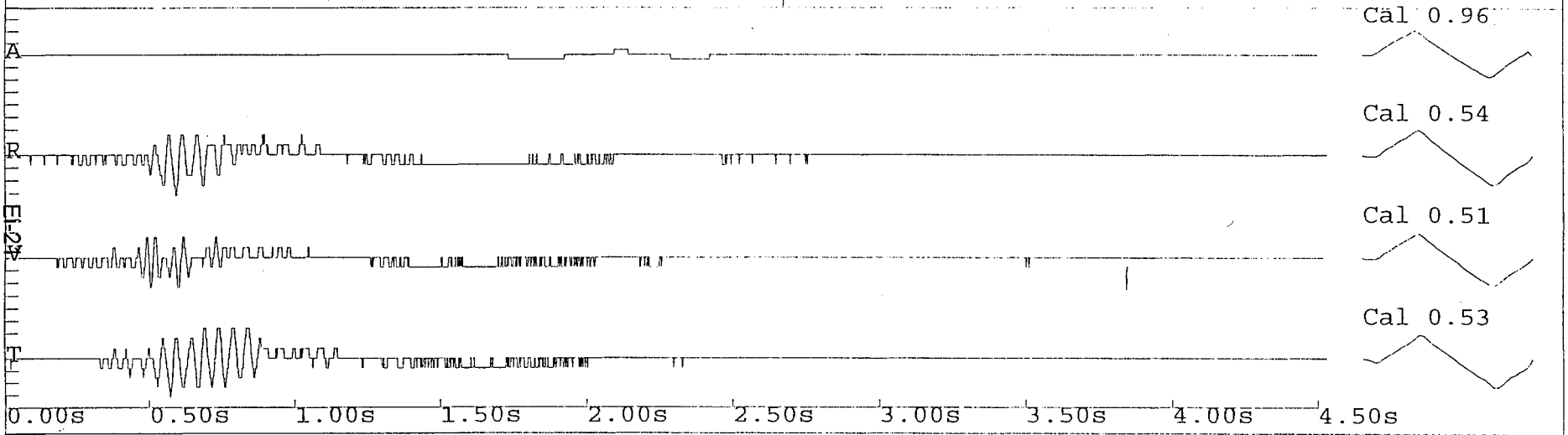
Event: 028 Date: 7/ 8/95 Time: 15:32
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

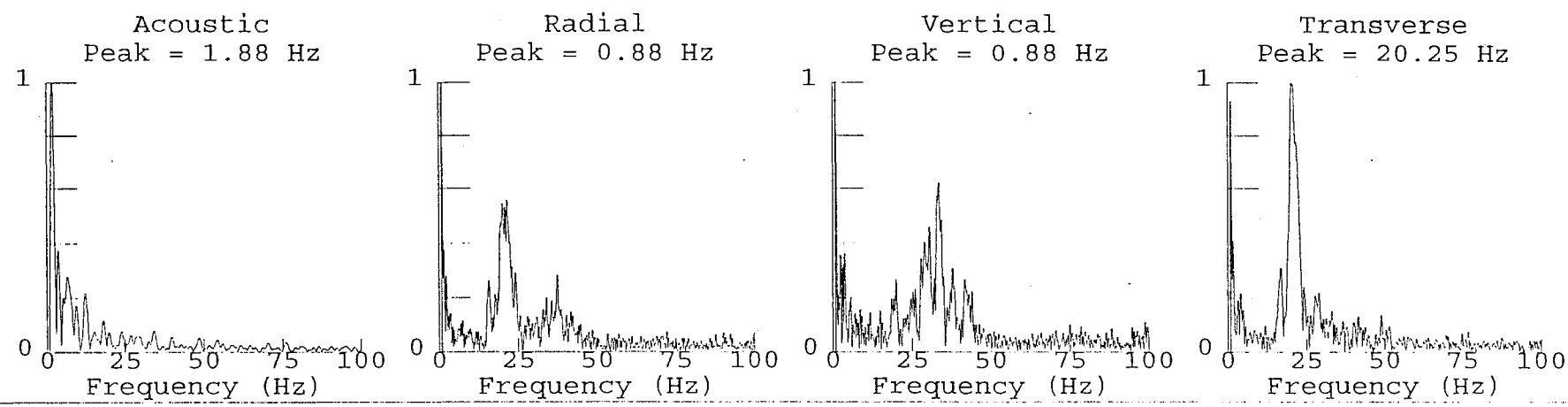
Acoustic: 100 dB 0.0 Hz.
Radial: 0.04 in/s 22.2 Hz.
Vertical: 0.03 in/s 0.0 Hz.
Transverse: 0.04 in/s 25.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

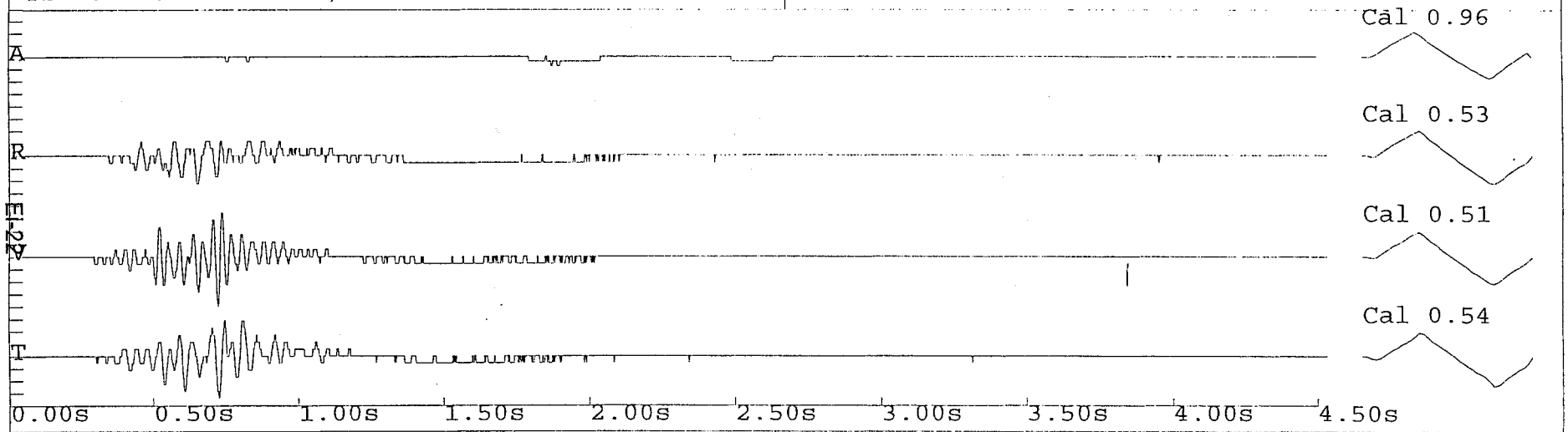
Event: 029 Date: 7/10/95 Time: 17:23
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

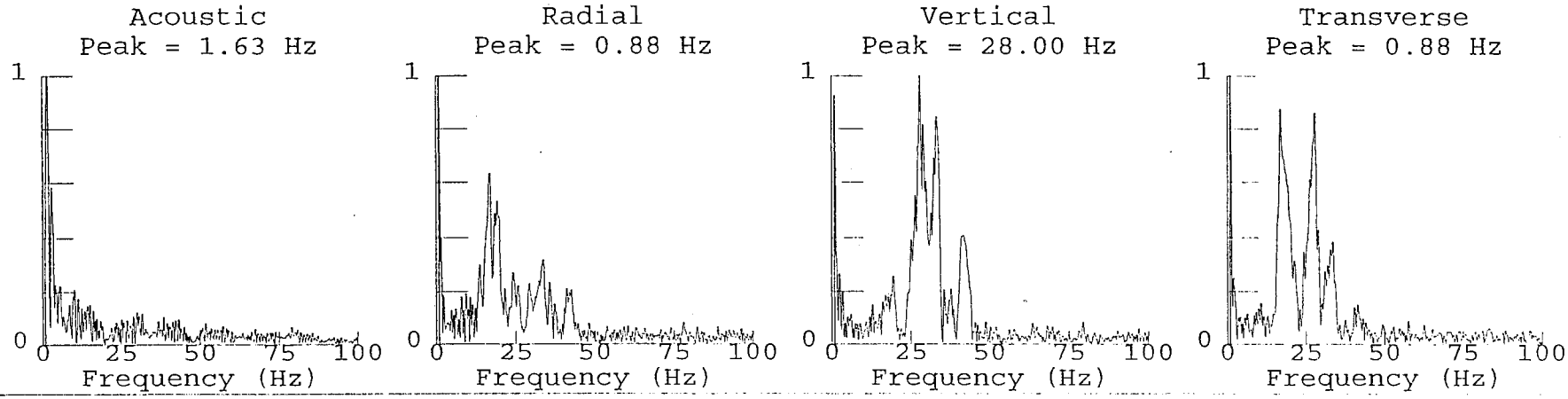
Acoustic: 106 dB 0.0 Hz.
Radial: 0.04 in/s 23.2 Hz.
Vertical: 0.07 in/s 36.5 Hz.
Transverse: 0.06 in/s 26.9 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.07 in/s (0.0175 in/s/div)
Time Lines at: 0.50 sec intervals



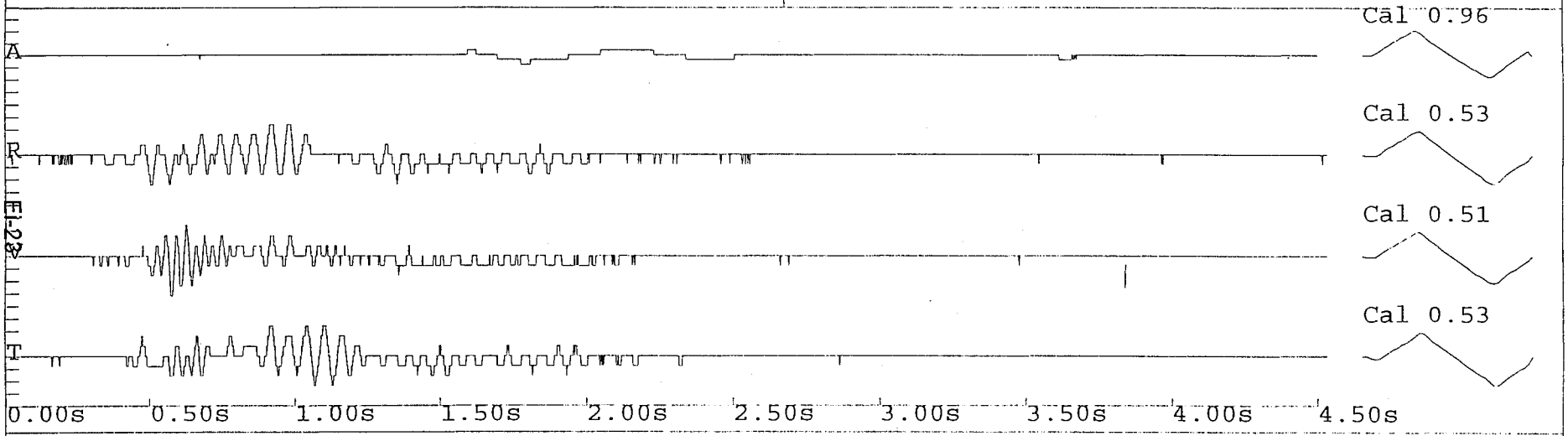
Fourier Analysis (Amplitude Spectrum)



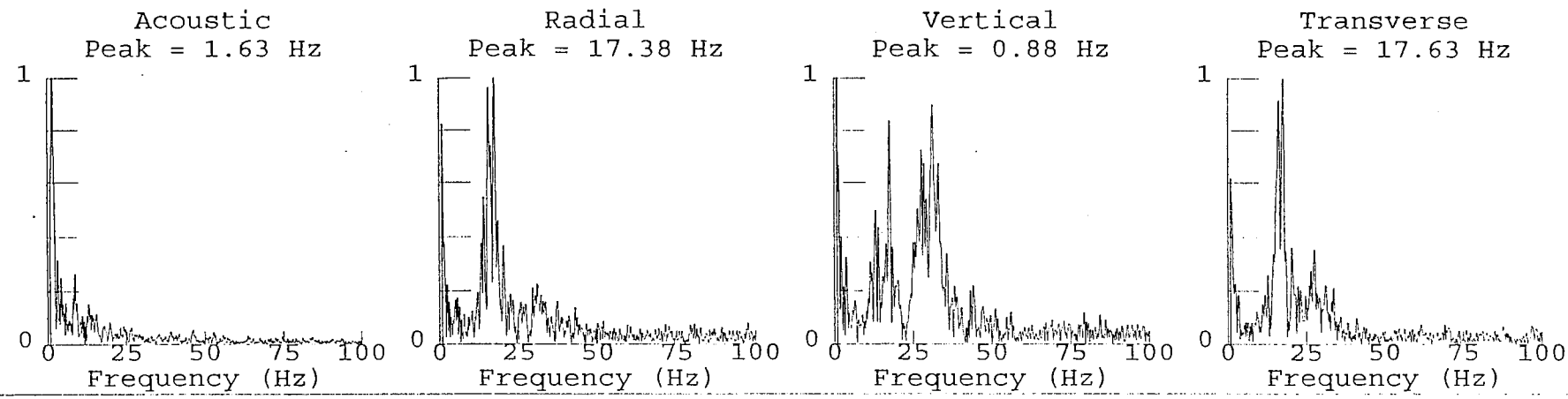
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 030 Date: 7/11/95 Time: 17:31
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 26.9 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



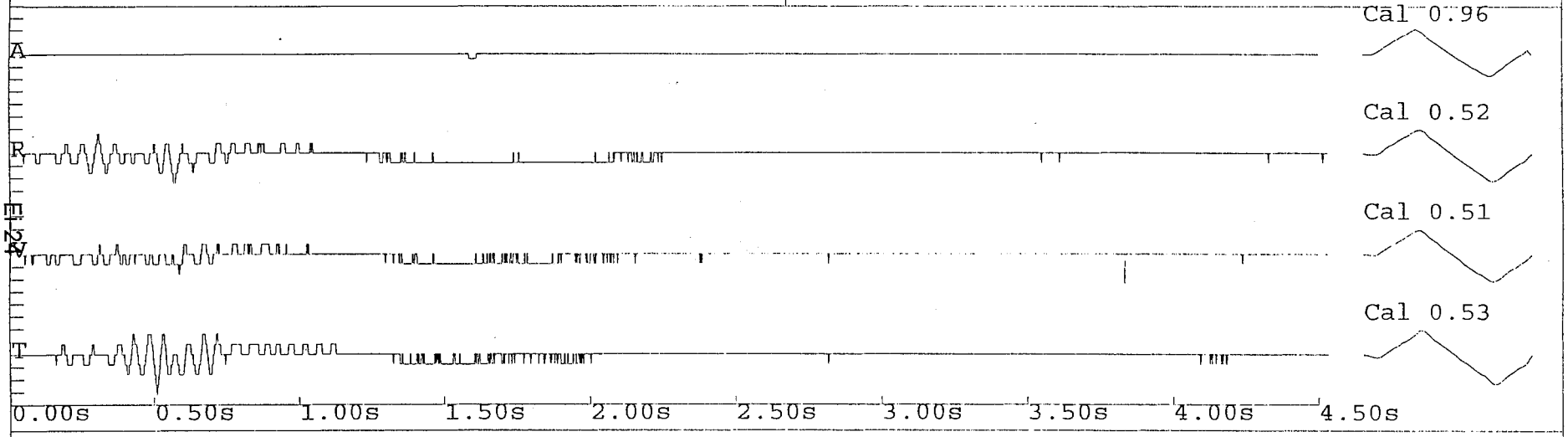
Fourier Analysis (Amplitude Spectrum)



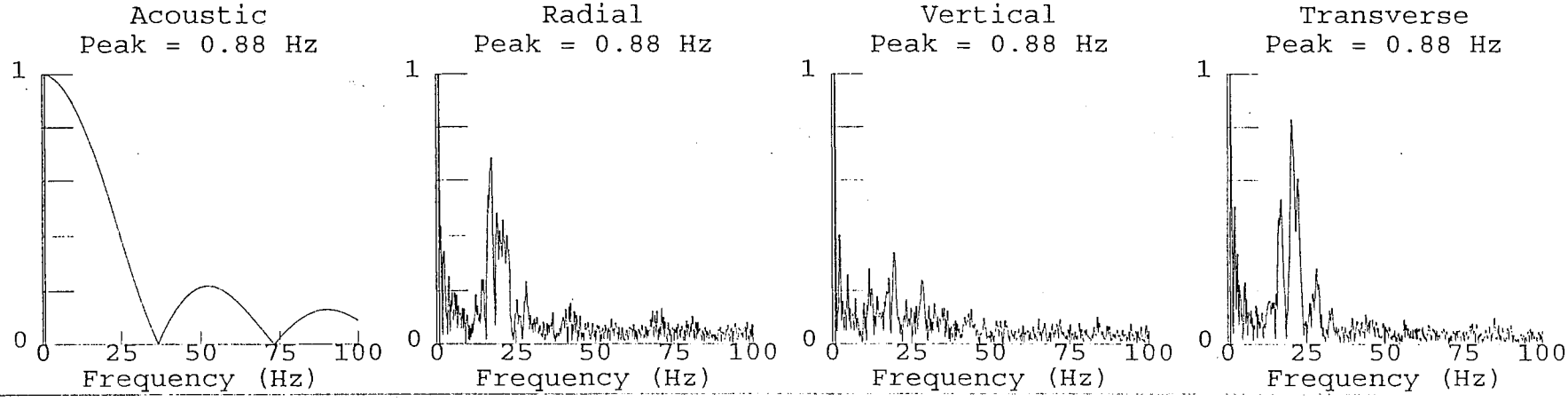
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 031 Date: 7/12/95 Time: 17:42
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 24.3 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

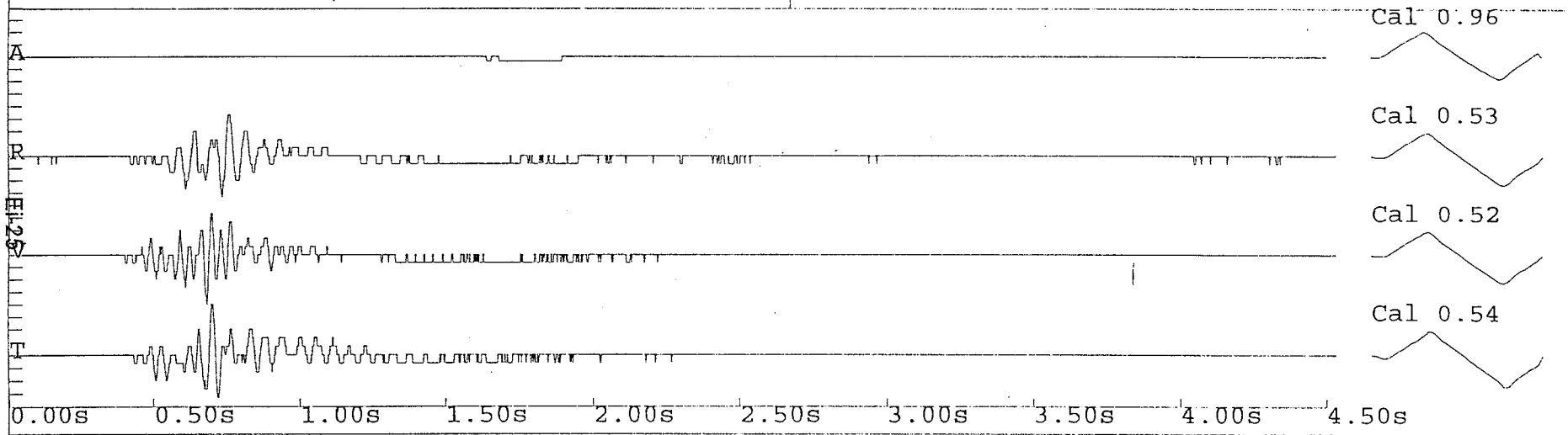
Event: 032 Date: 7/13/95 Time: 16:39
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

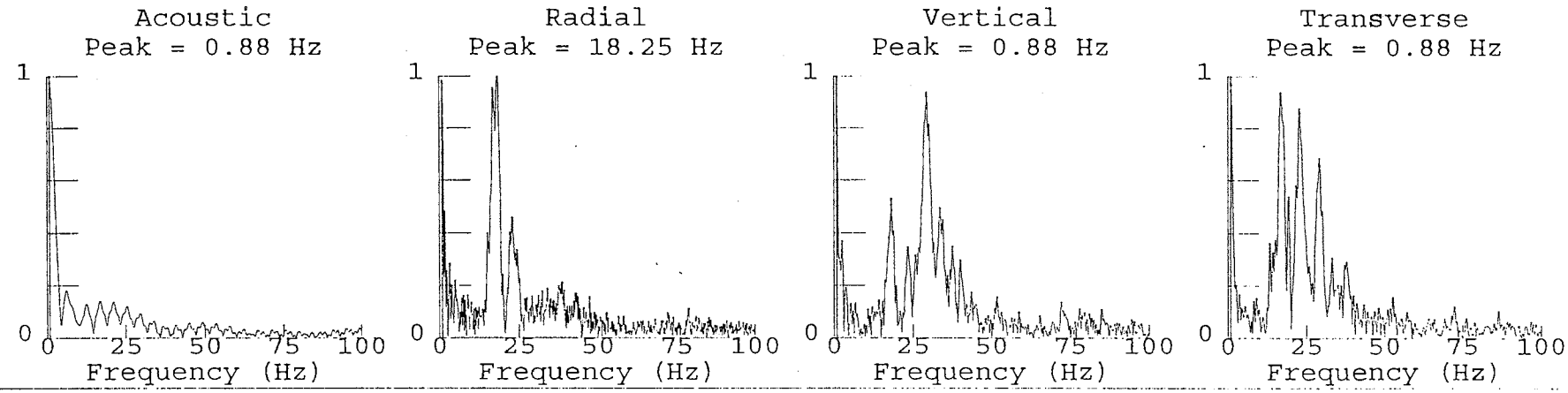
Acoustic: 100 dB 0.0 Hz.
Radial: 0.05 in/s 21.3 Hz.
Vertical: 0.06 in/s 32.0 Hz.
Transverse: 0.06 in/s 26.9 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals



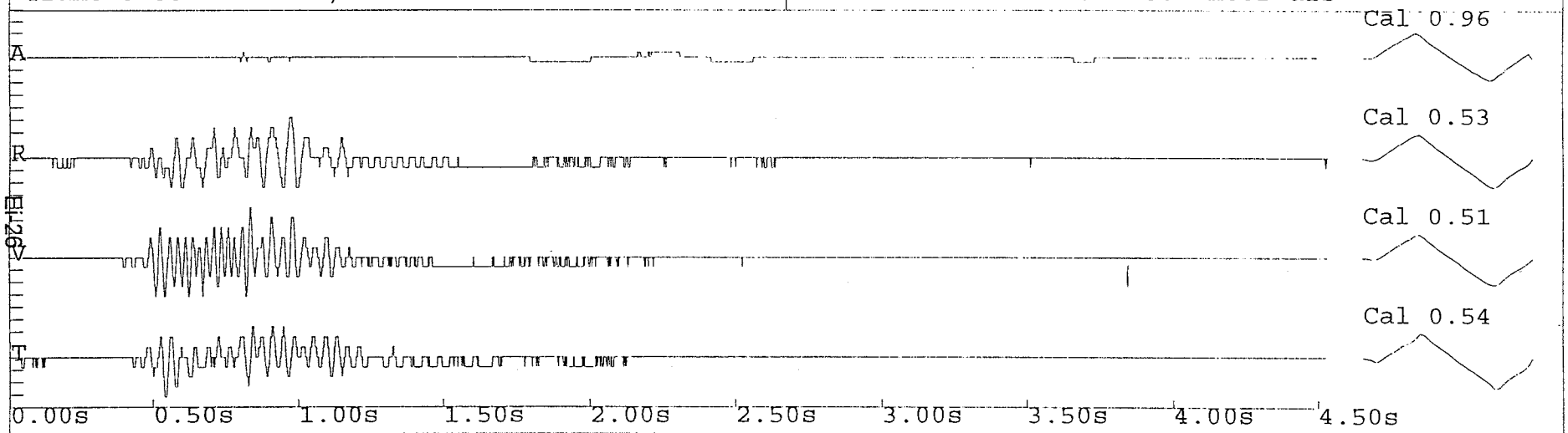
Fourier Analysis (Amplitude Spectrum)



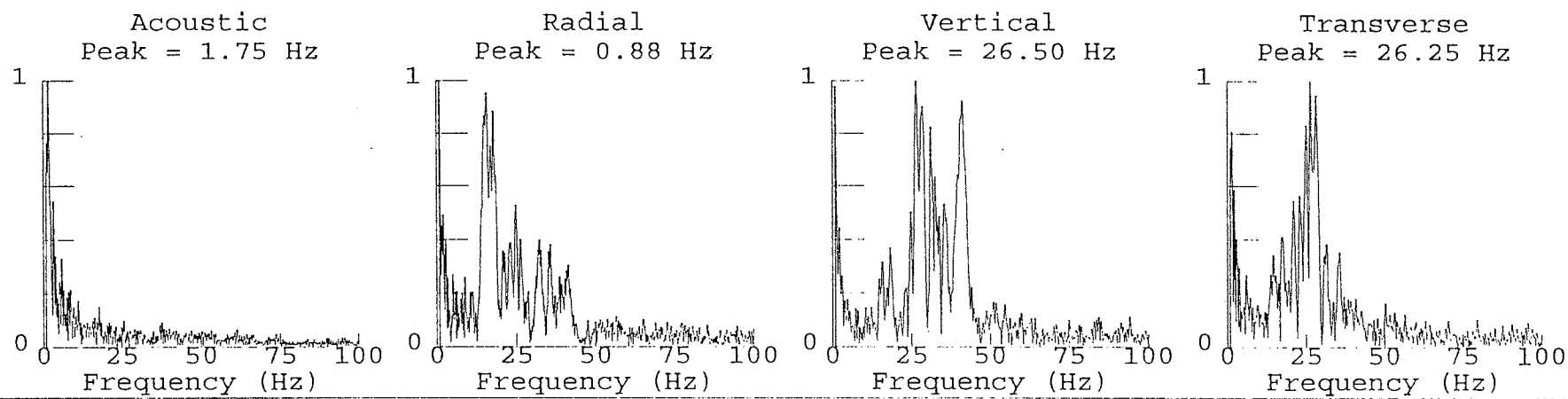
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 033 Date: 7/14/95 Time: 16:17
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 21.3 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 36.5 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 26.9 Hz.	Time Lines at: 0.50 sec intervals



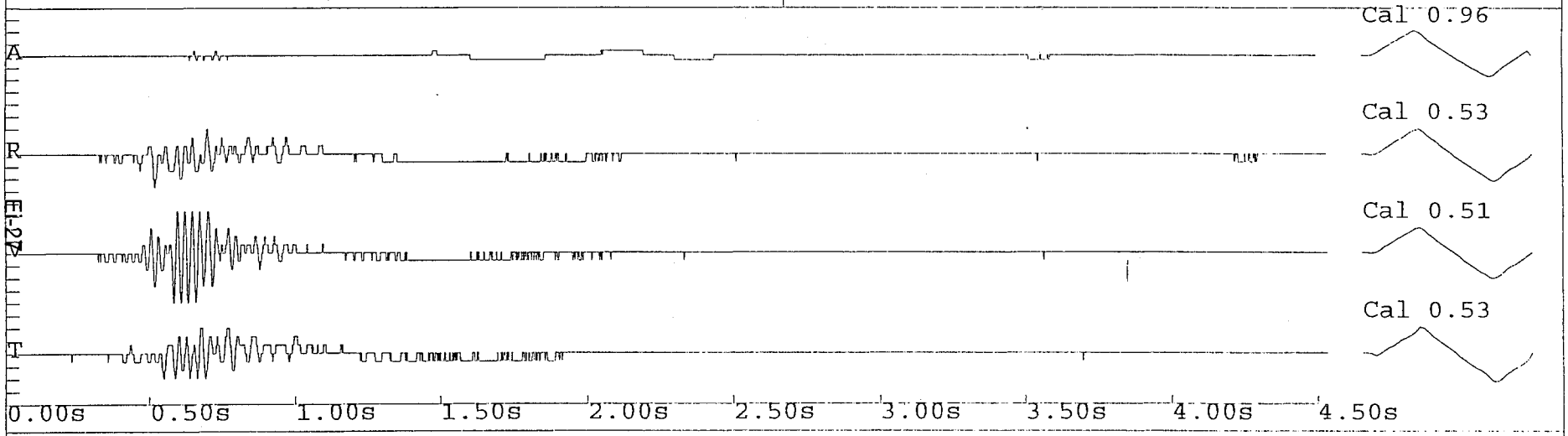
Fourier Analysis (Amplitude Spectrum)



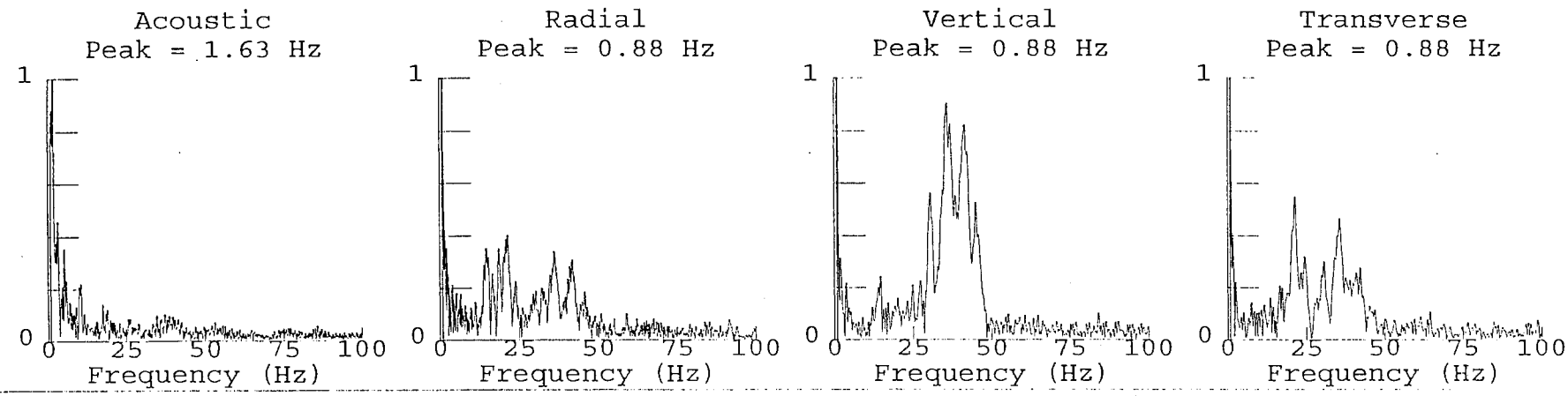
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 035 Date: 7/15/95 Time: 14:29
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 32.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.06 in/s 42.6 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



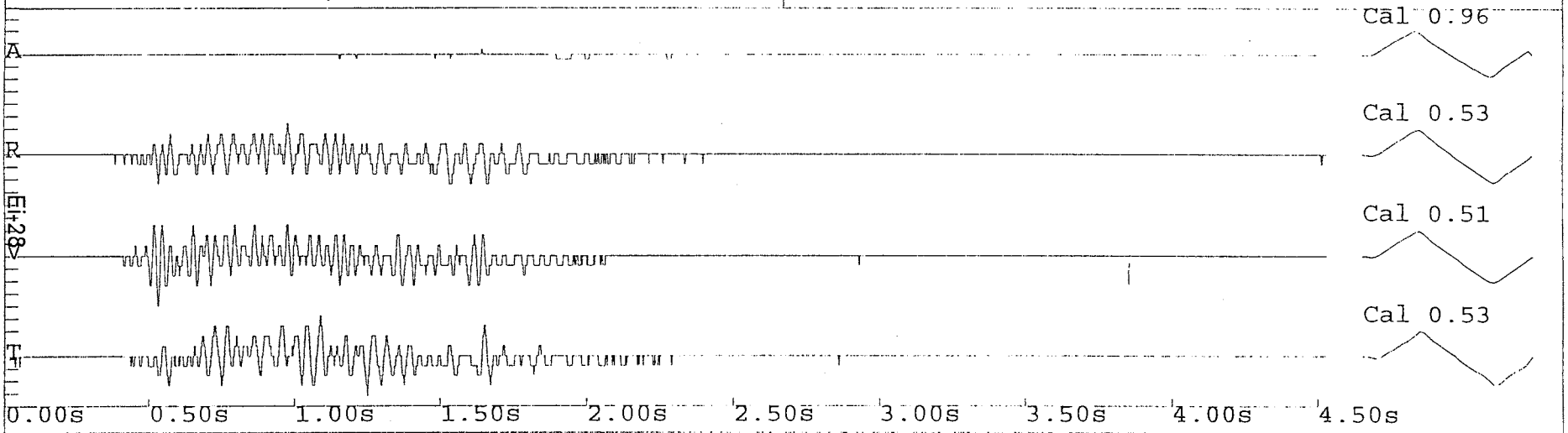
Fourier Analysis (Amplitude Spectrum)



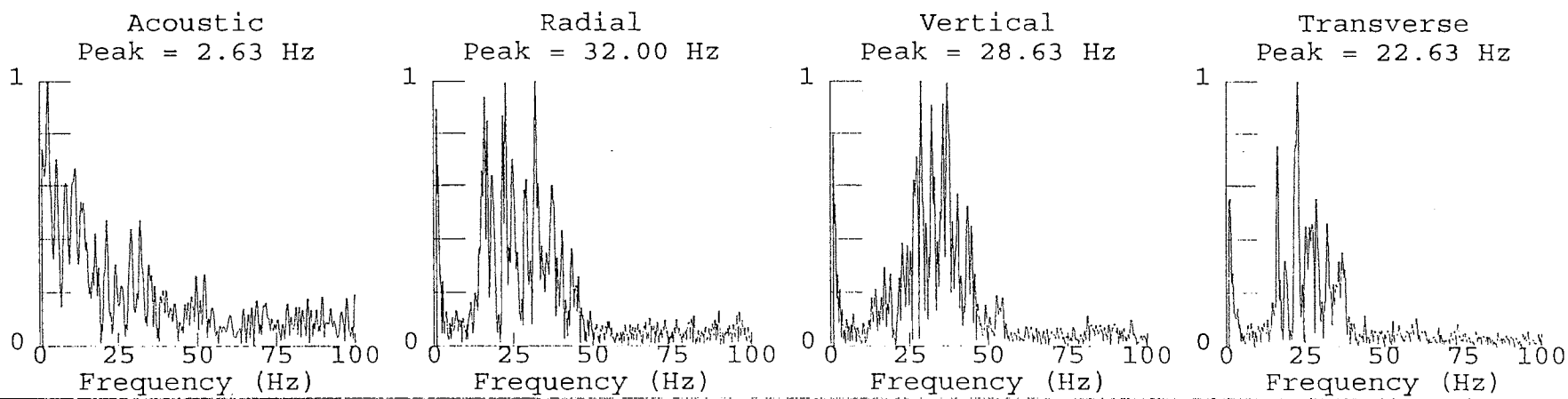
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 036 Date: 7/17/95 Time: 16:35
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 36.5 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 28.4 Hz.	Time Lines at: 0.50 sec intervals



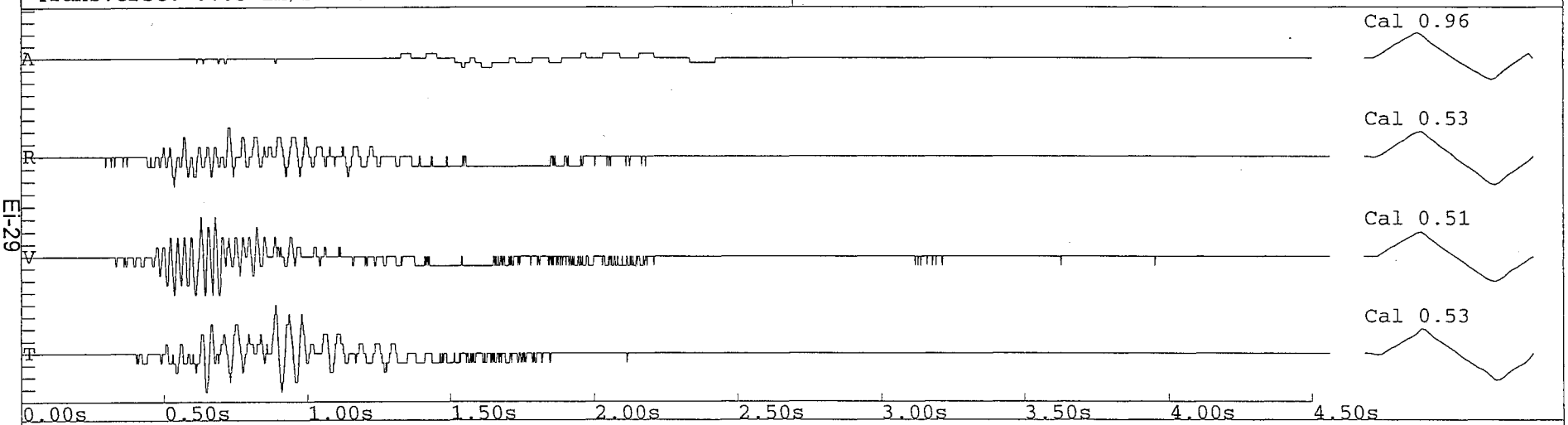
Fourier Analysis (Amplitude Spectrum)



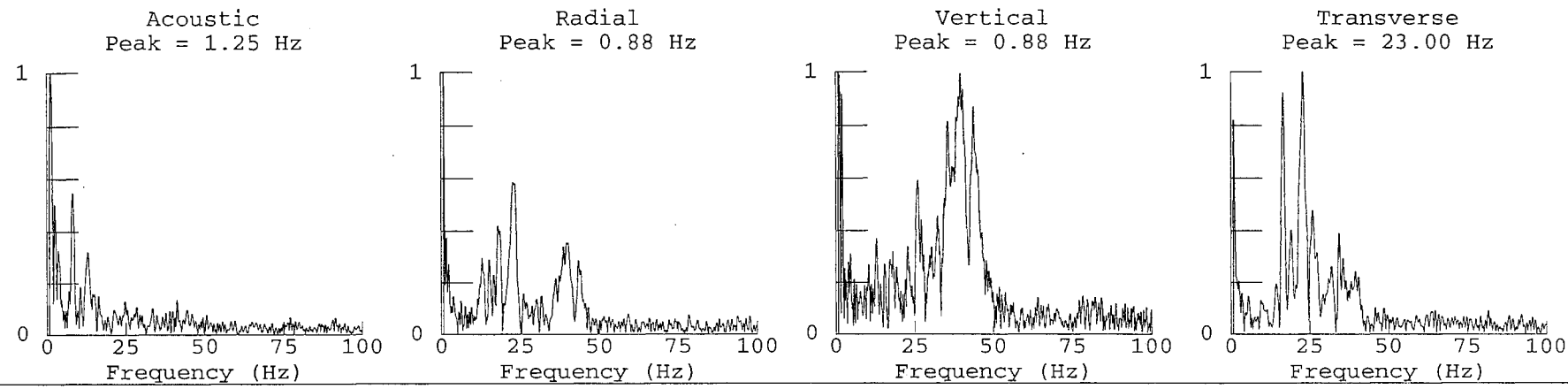
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 037 Date: 7/18/95 Time: 16:52
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 42.6 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.05 in/s 26.9 Hz.	Time Lines at: 0.50 sec intervals



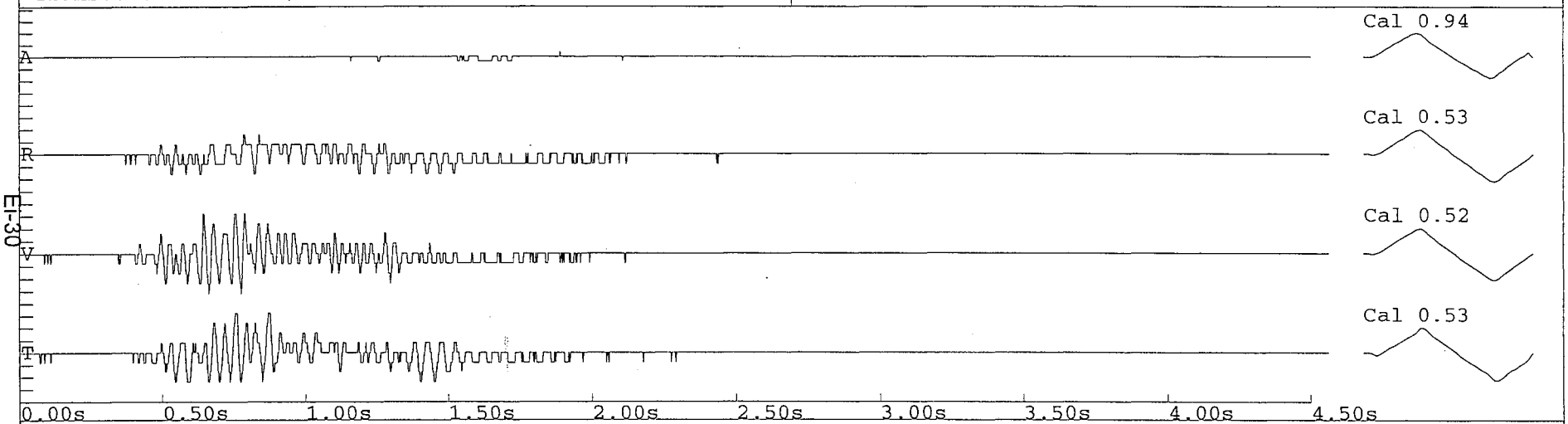
Fourier Analysis (Amplitude Spectrum)



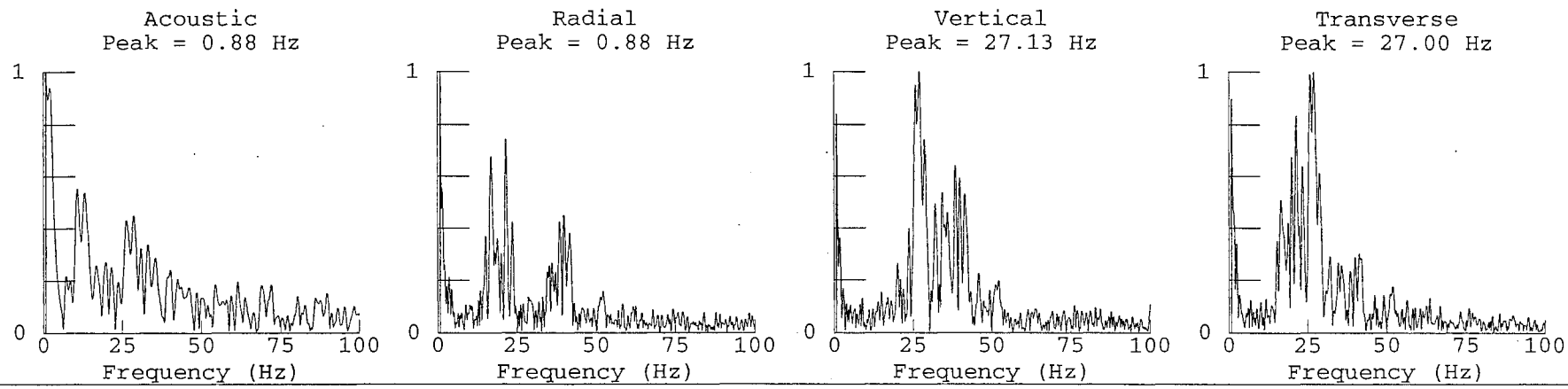
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 040 Date: 7/25/95 Time: 16:27
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 42.6 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 26.9 Hz.	Time Lines at: 0.50 sec intervals



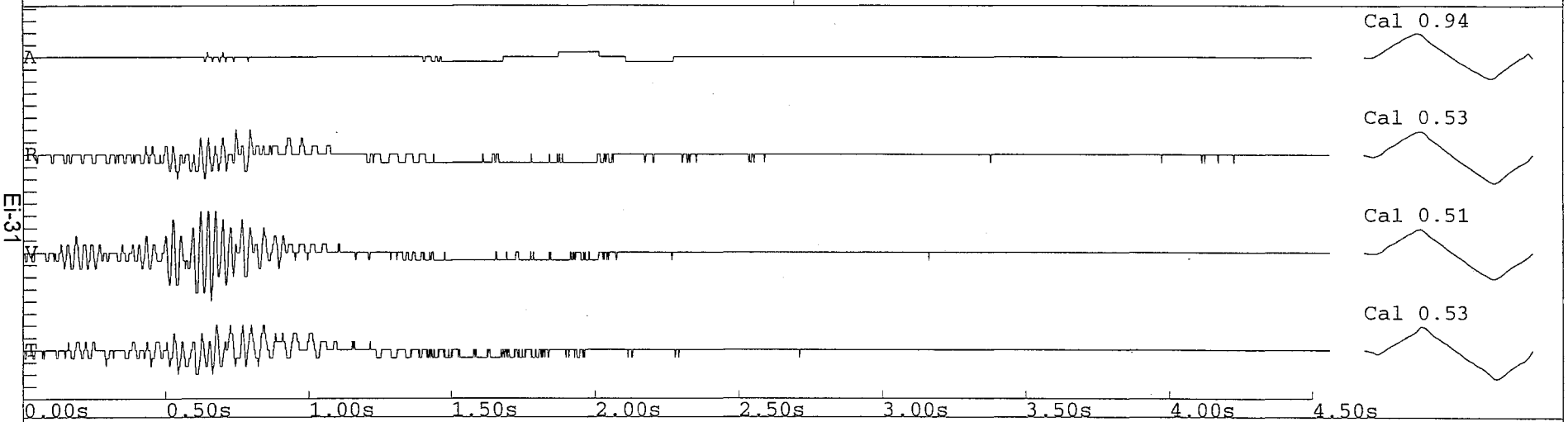
Fourier Analysis (Amplitude Spectrum)



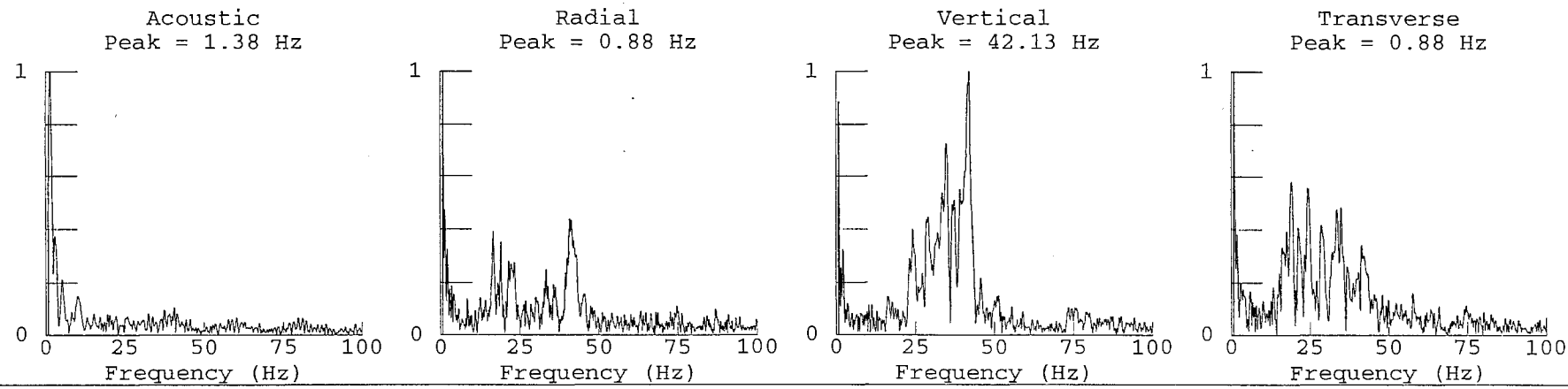
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 041 Date: 7/26/95 Time: 16:21
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.06 in/s 36.5 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.04 in/s 30.1 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 21
Location: Enterance

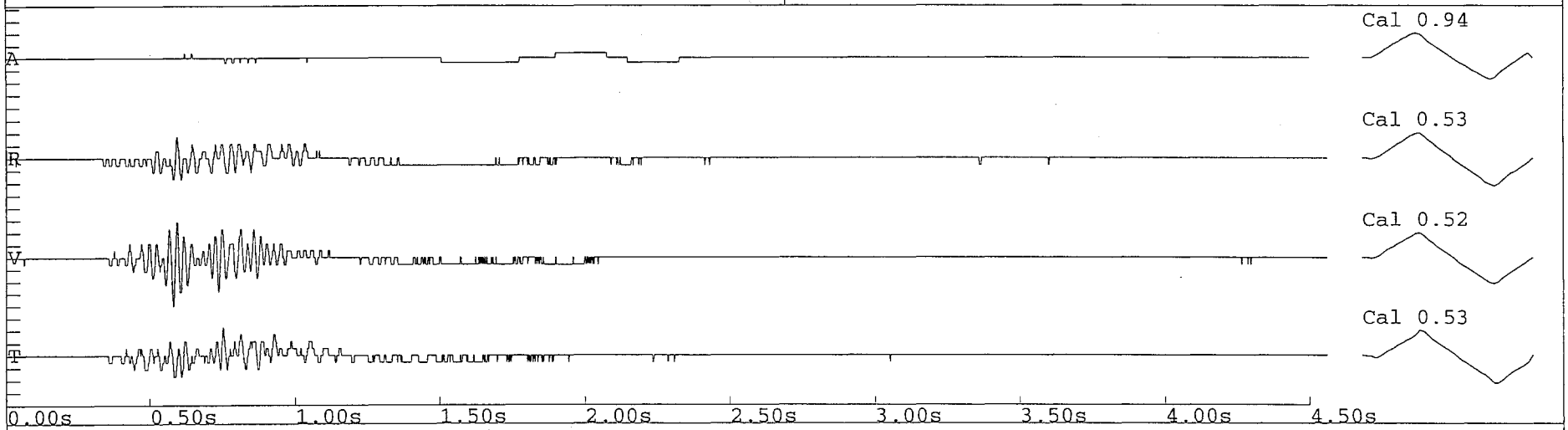
Event: 042 Date: 7/28/95 Time: 10:10
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

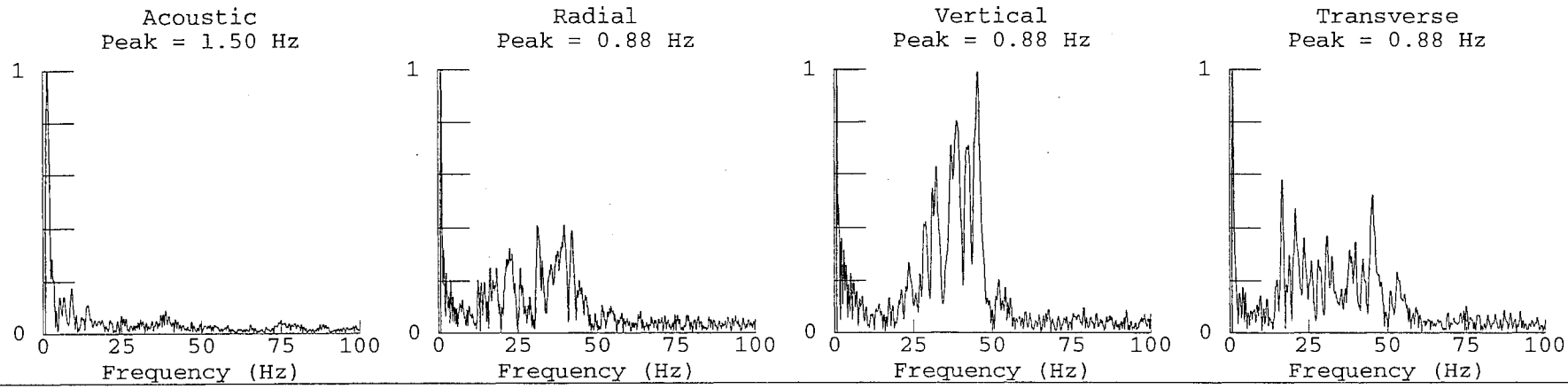
Acoustic: 100 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.07 in/s 39.3 Hz.
Transverse: 0.04 in/s 46.5 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.07 in/s (0.0175 in/s/div)
Time Lines at: 0.50 sec intervals



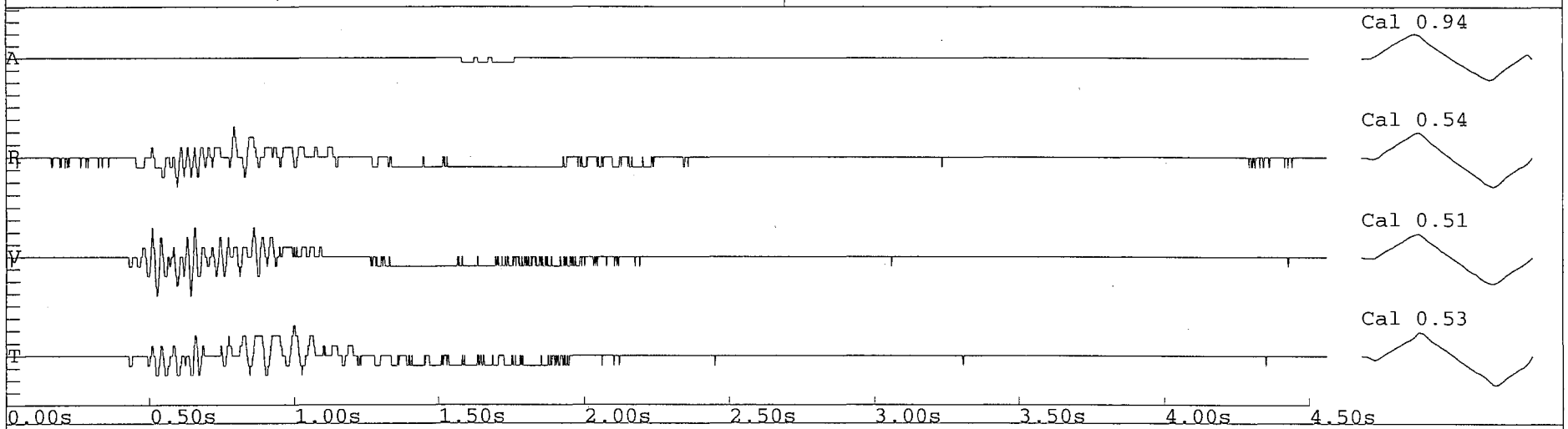
Fourier Analysis (Amplitude Spectrum)



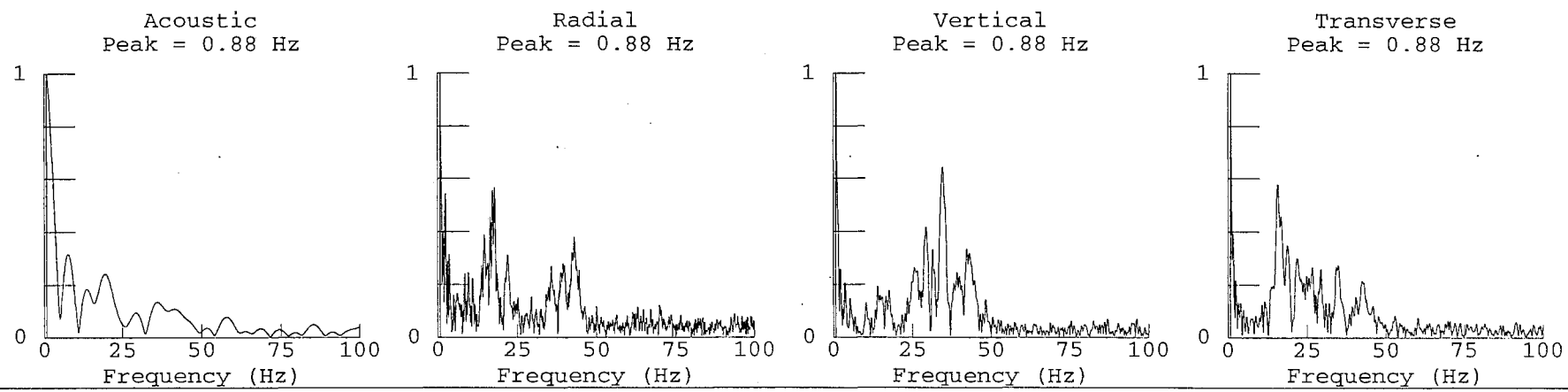
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 043 Date: 7/28/95 Time: 16:10
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 34.1 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



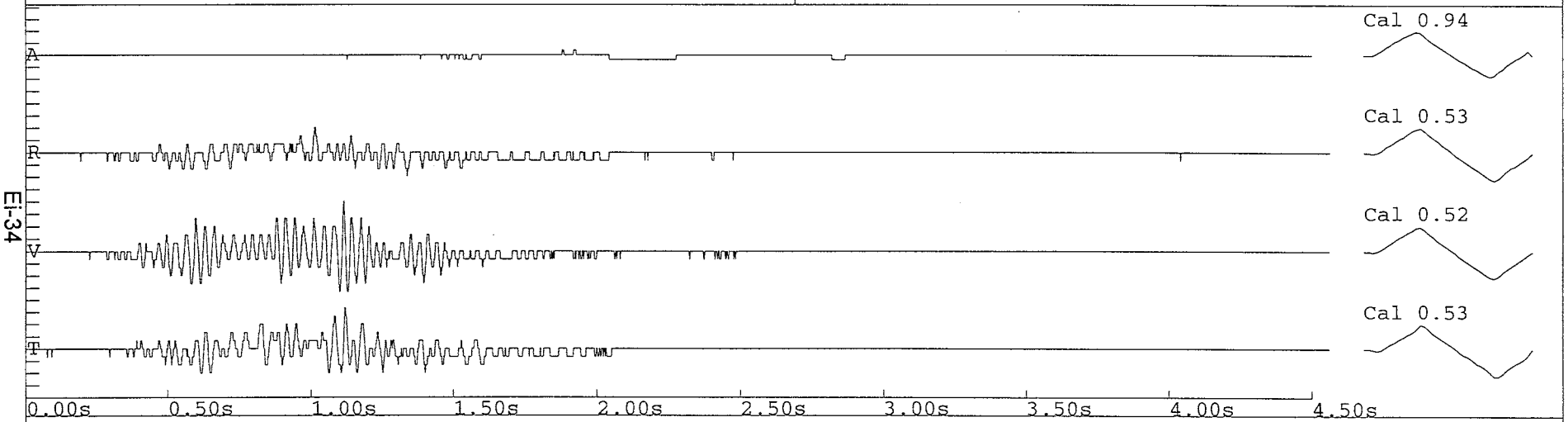
Fourier Analysis (Amplitude Spectrum)



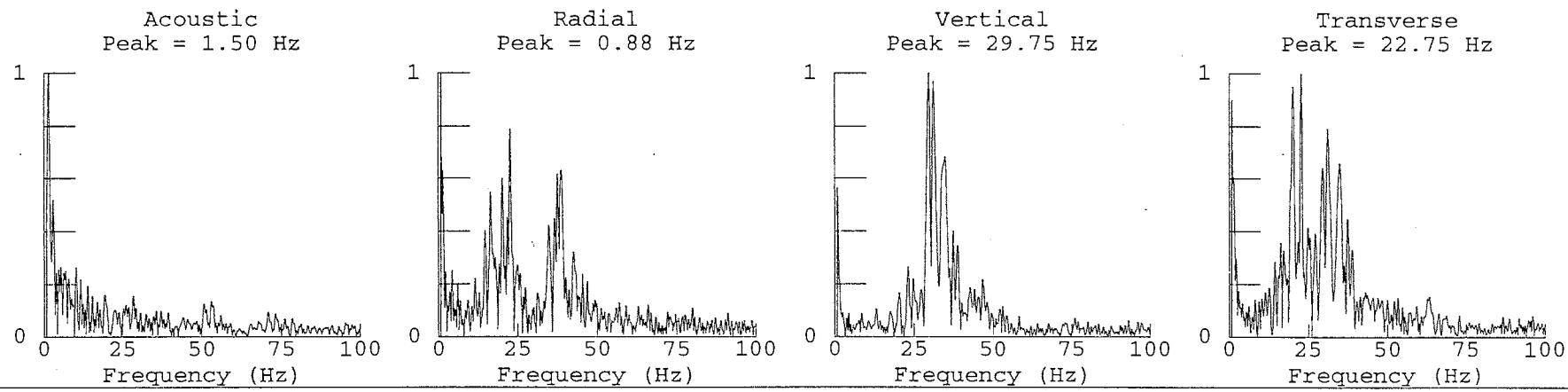
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 21
Location: Enterance

Event: 045 Date: 7/31/95 Time: 16:48
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.06 in/s 42.6 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.05 in/s 36.5 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 21
Location: Enterance

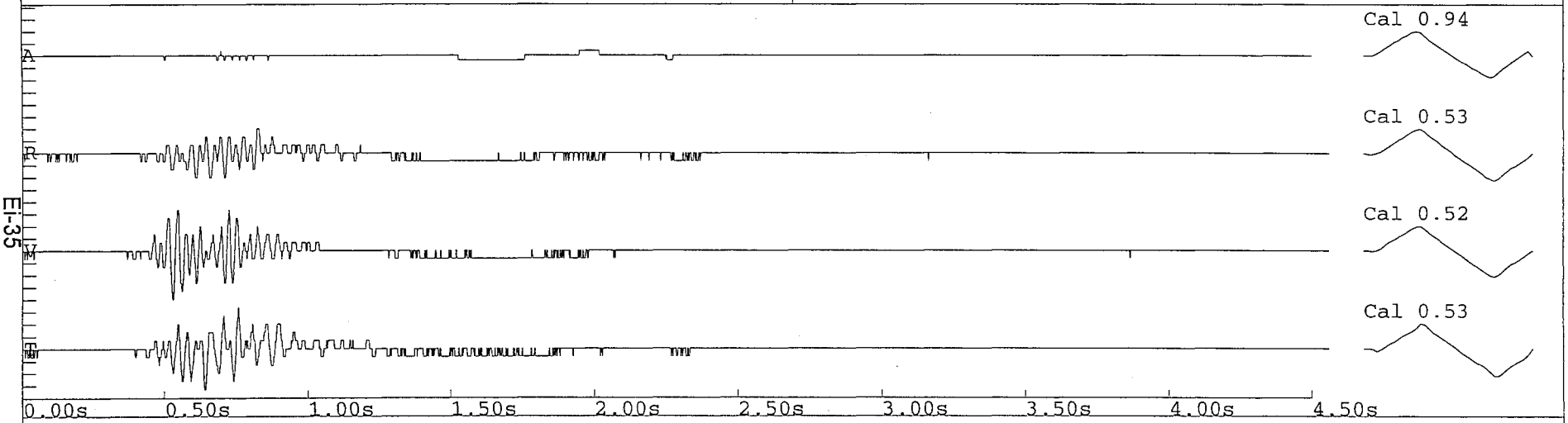
Event: 046 Date: 8/ 1/95 Time: 14:19
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

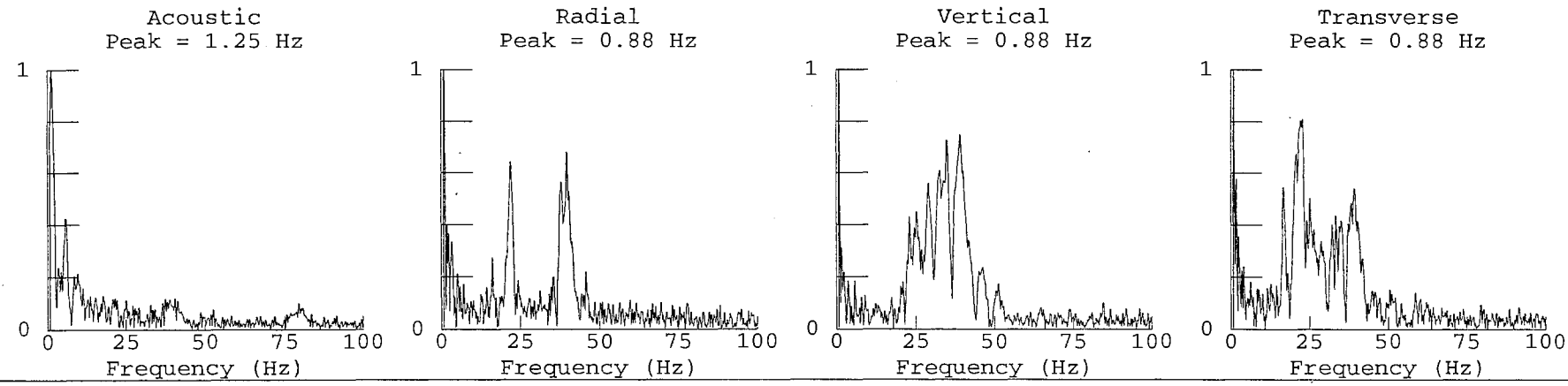
Acoustic: 100 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.06 in/s 32.0 Hz.
Transverse: 0.05 in/s 34.1 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



APPENDIX Eii

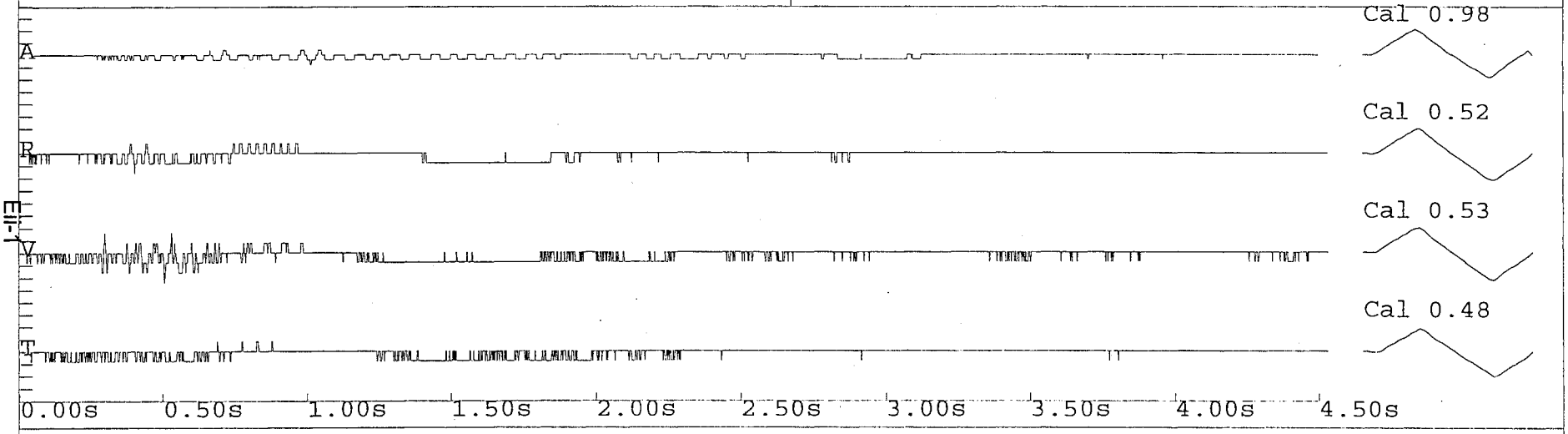
FULL WAVEFORM DATA

HANGING BALCONY

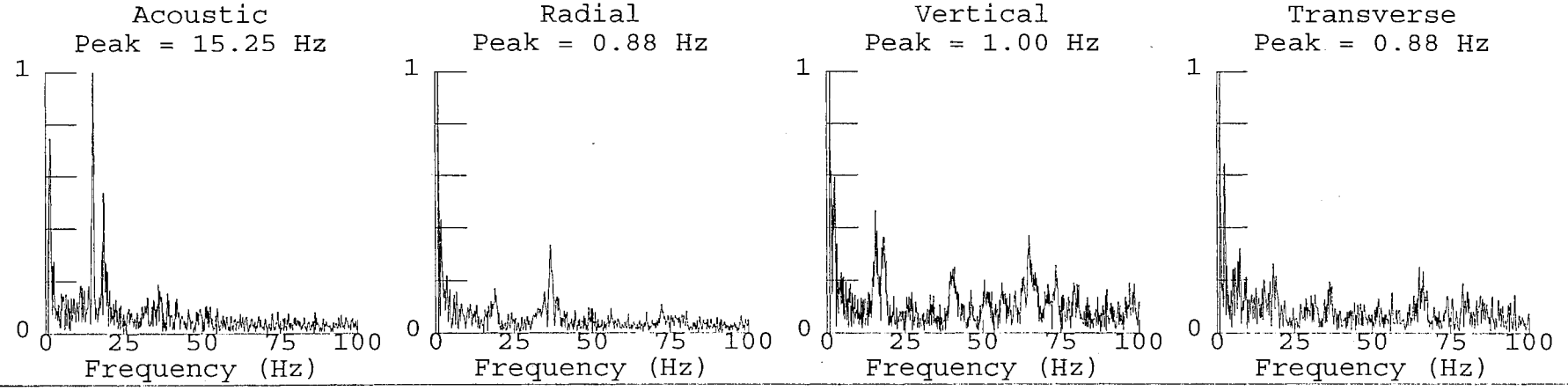
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 006 Date: 6/14/95 Time: 16:29
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



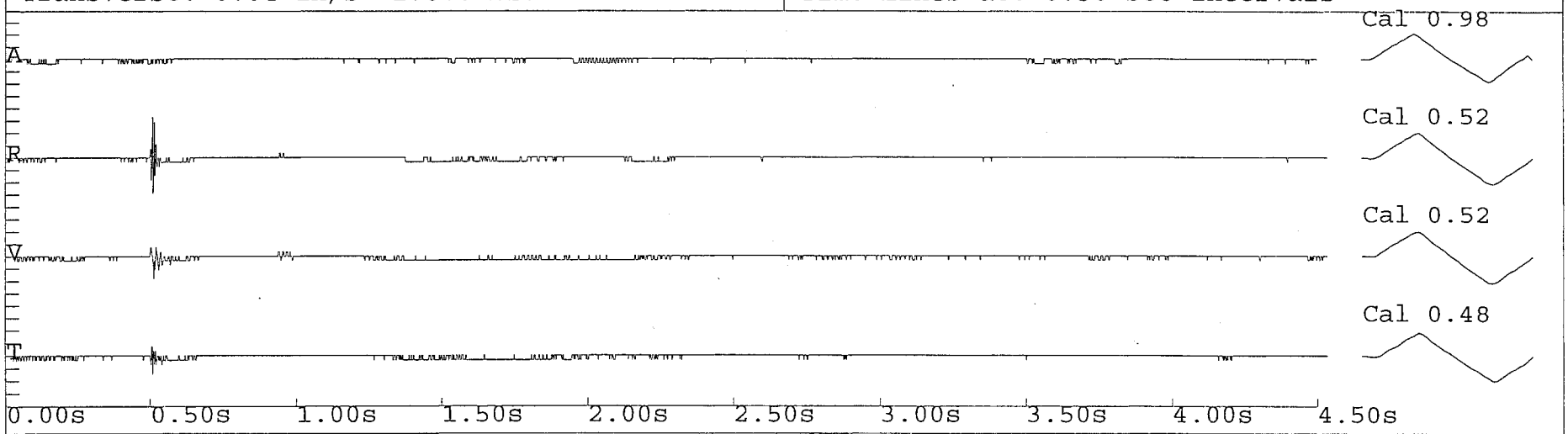
Fourier Analysis (Amplitude Spectrum)



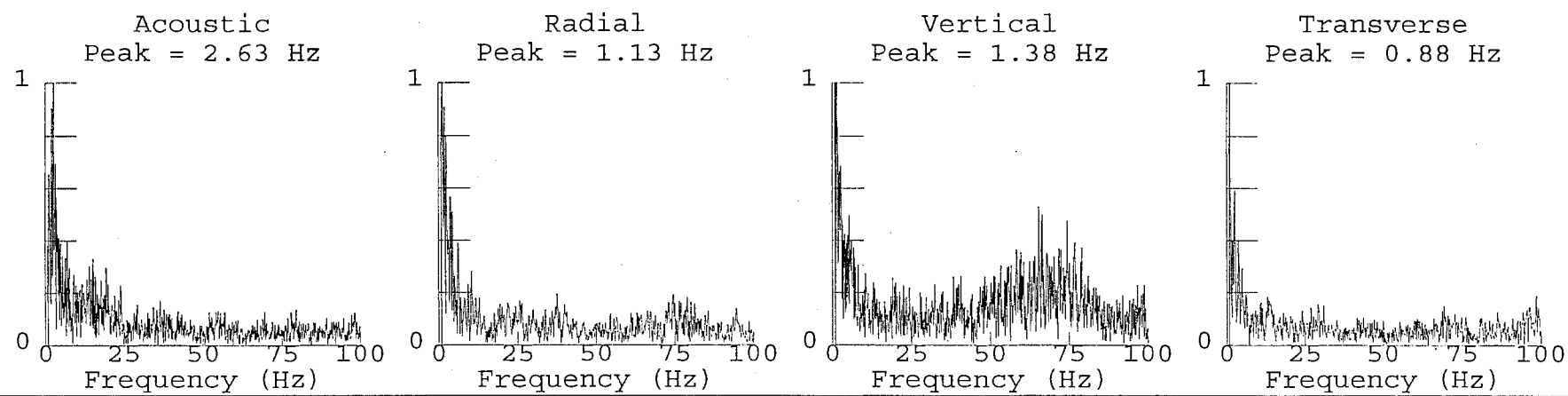
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 013 Date: 6/29/95 Time: 12:14
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.11 in/s 170.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 56.8 Hz.	Seis: 0.11 in/s (0.0275 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



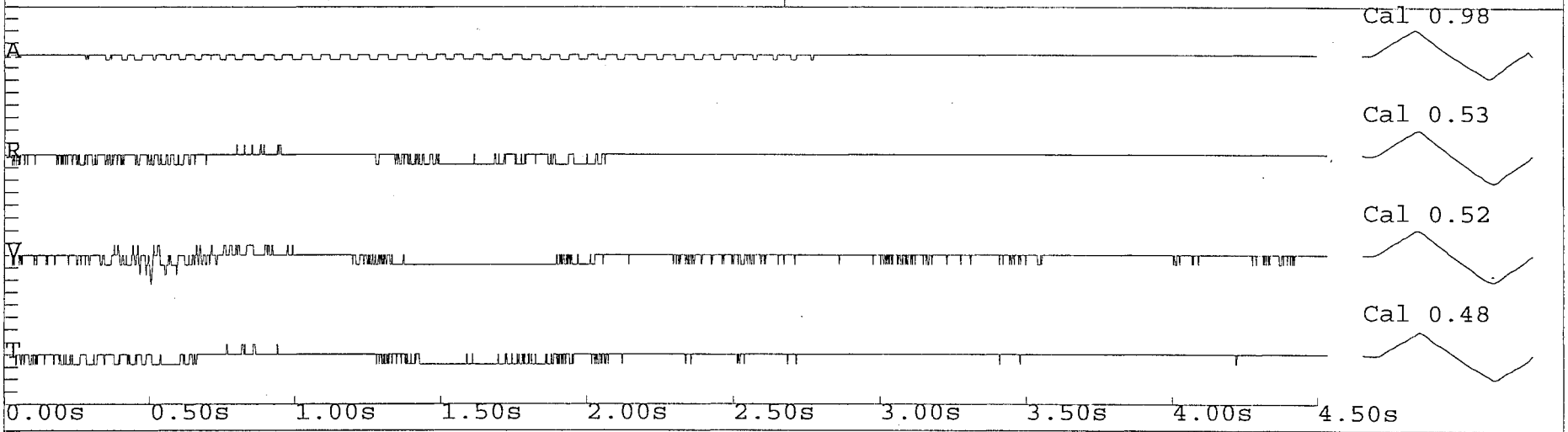
Fourier Analysis (Amplitude Spectrum)



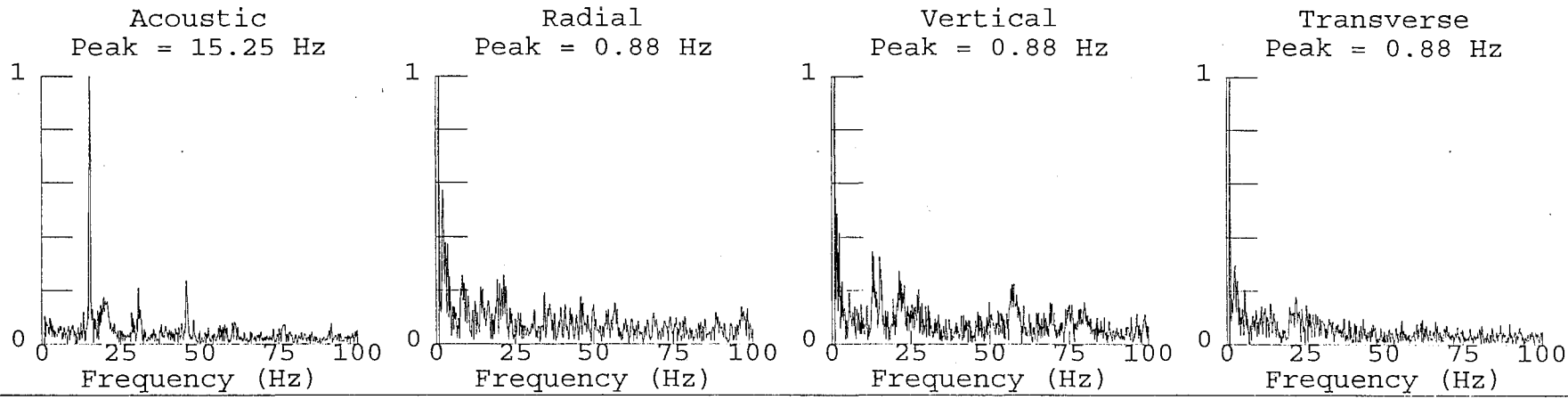
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 016 Date: 6/29/95 Time: 17:32
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



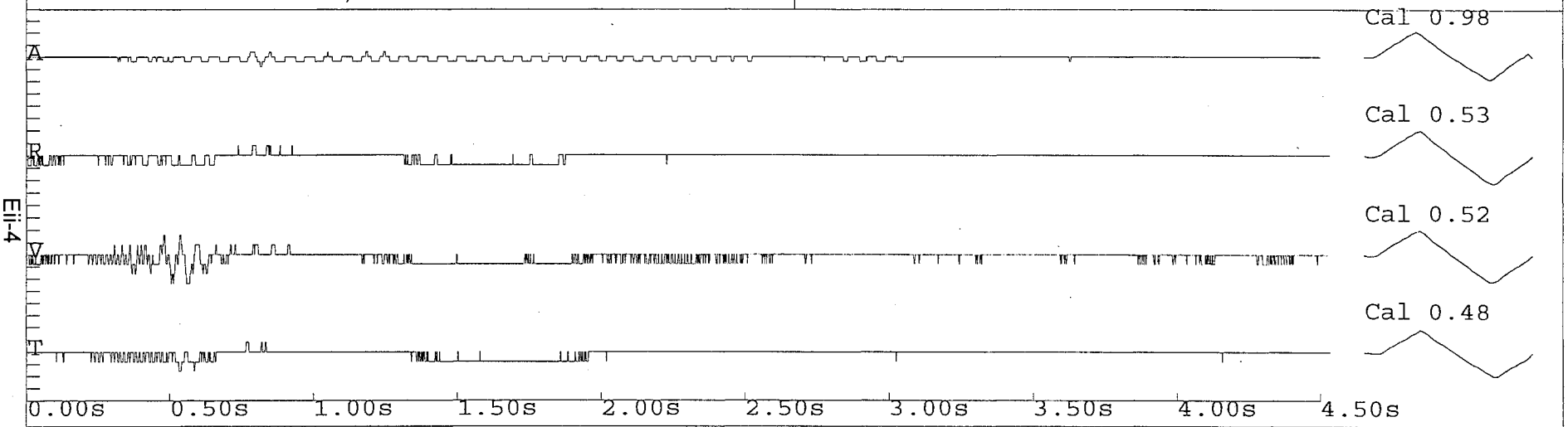
Fourier Analysis (Amplitude Spectrum)



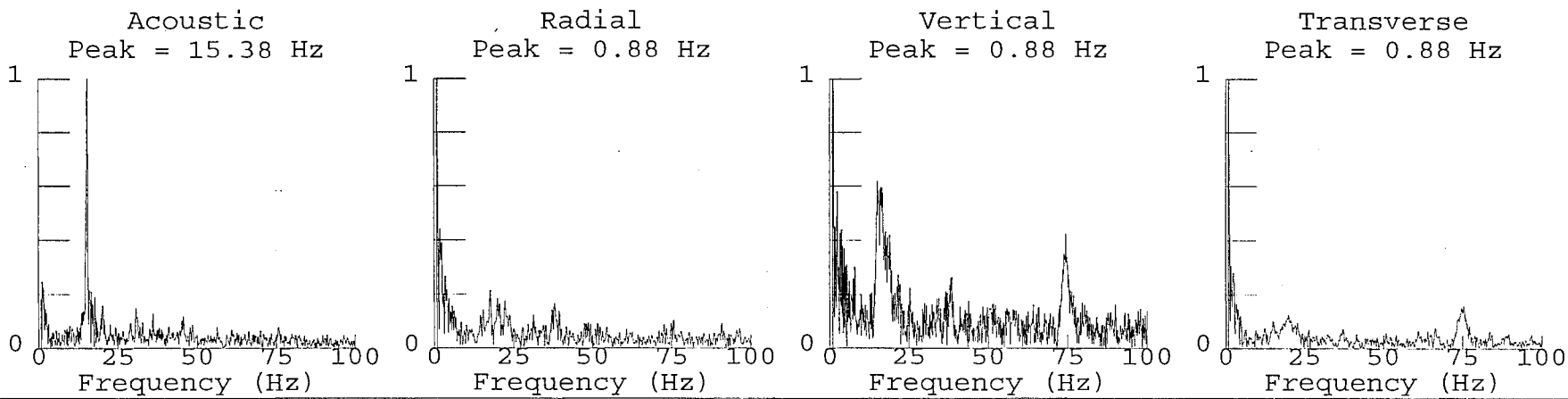
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 017 Date: 7/ 1/95 Time: 12:34
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



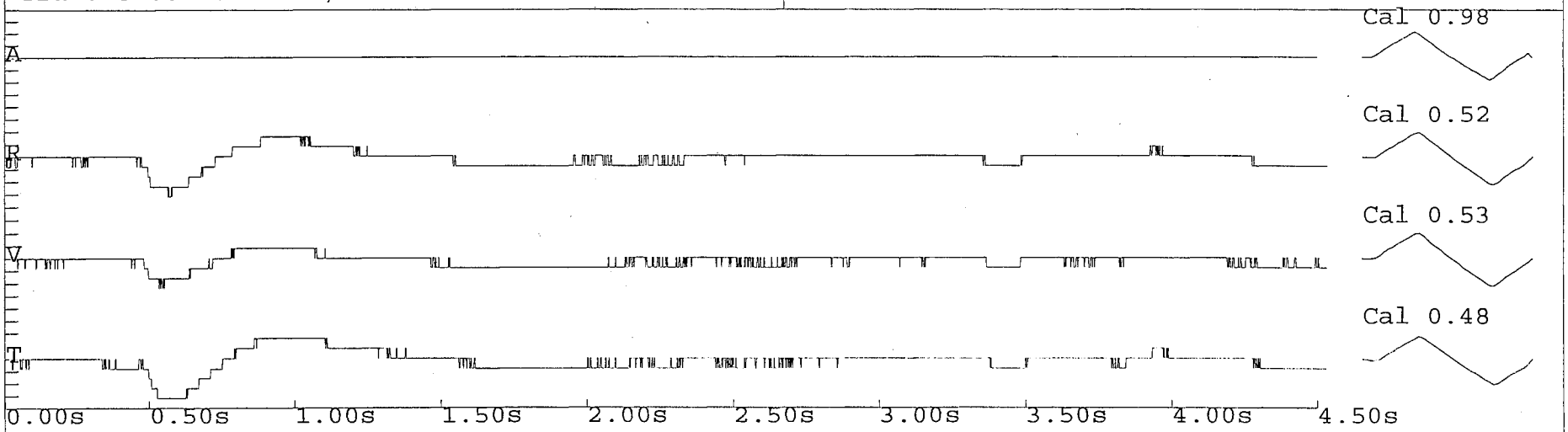
Fourier Analysis (Amplitude Spectrum)



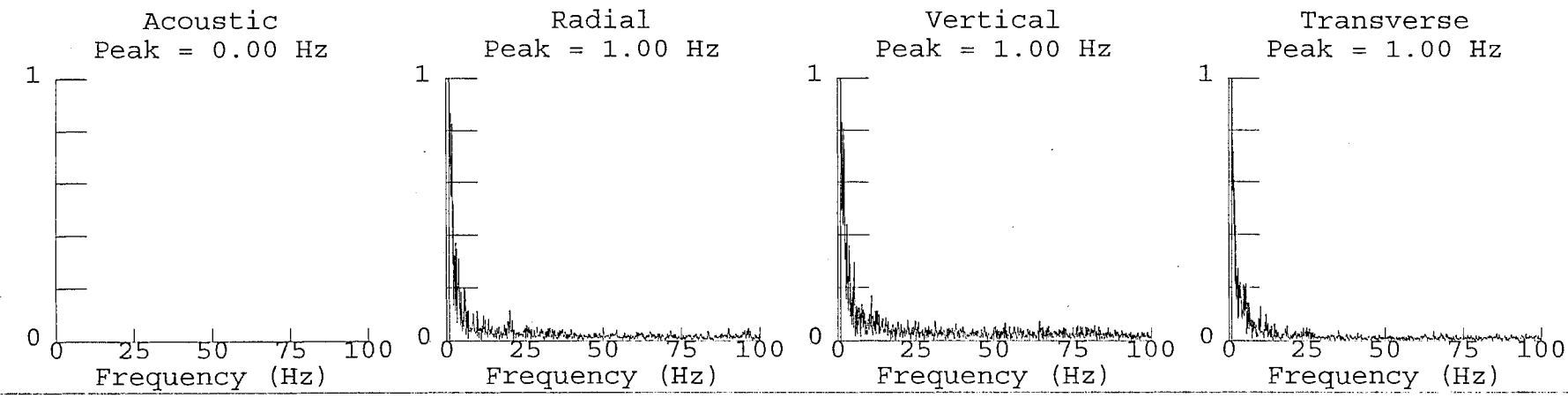
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 028 Date: 7/ 7/95 Time: 17:50
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 2.1 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 1.9 Hz.	Time Lines at: 0.50 sec intervals



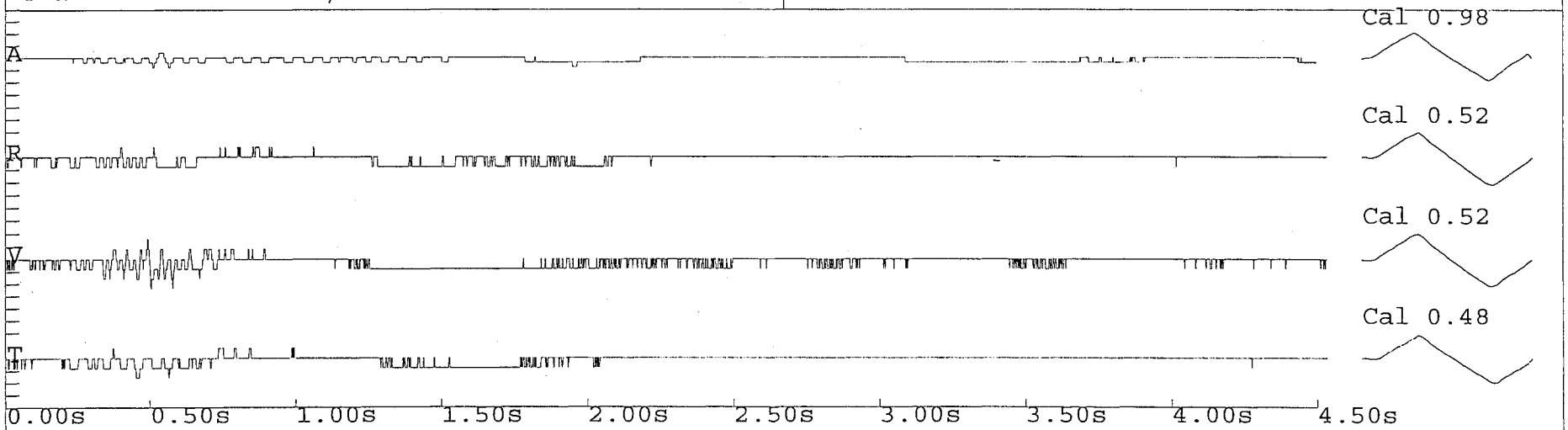
Fourier Analysis (Amplitude Spectrum)



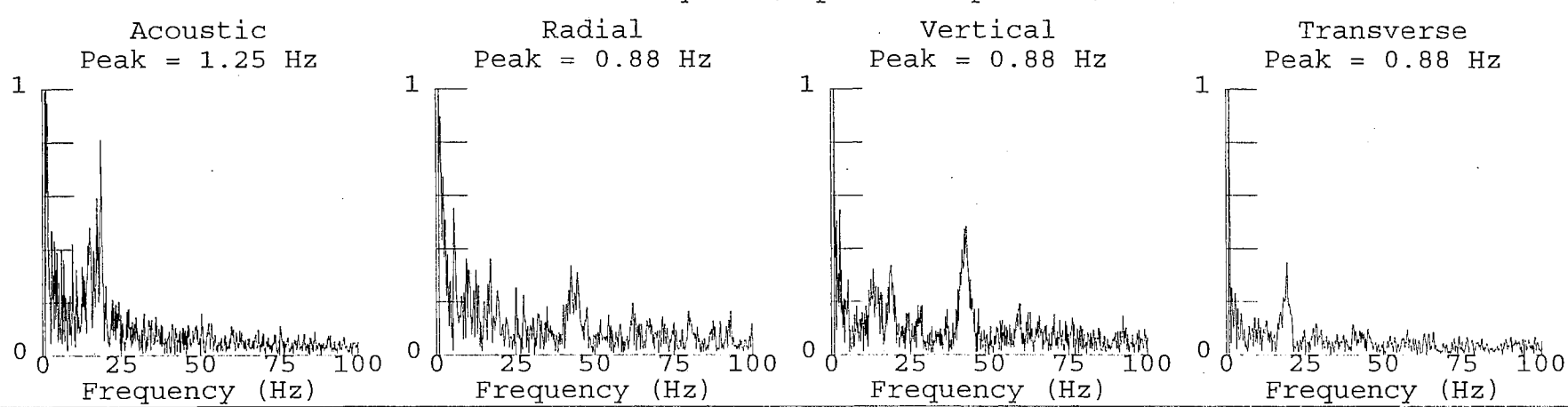
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 034 Date: 7/10/95 Time: 17:22
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



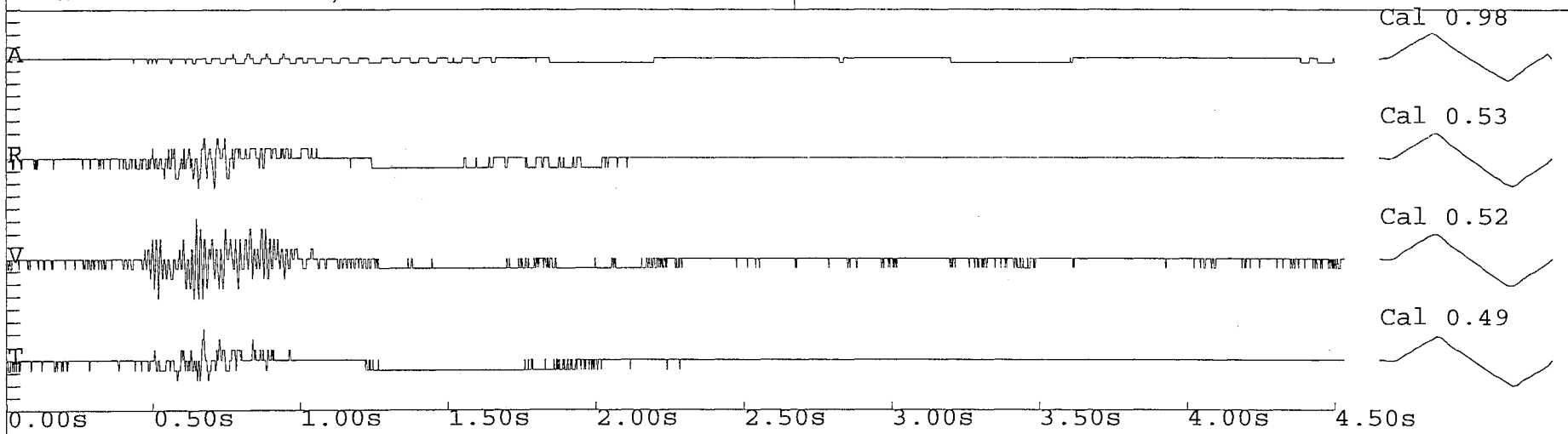
Fourier Analysis (Amplitude Spectrum)



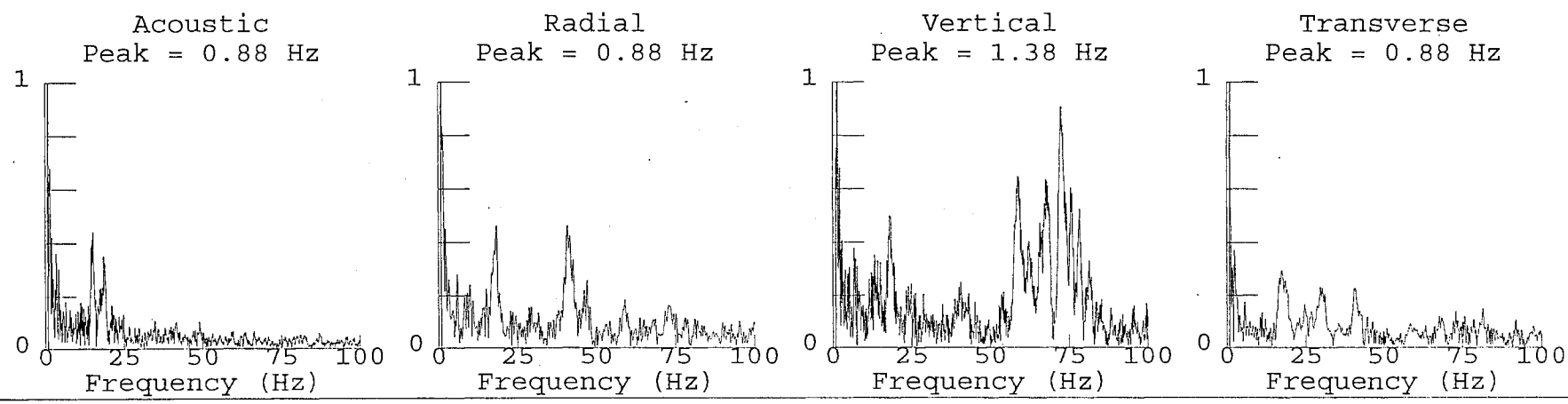
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 037 Date: 7/13/95 Time: 16:38
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 85.3 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



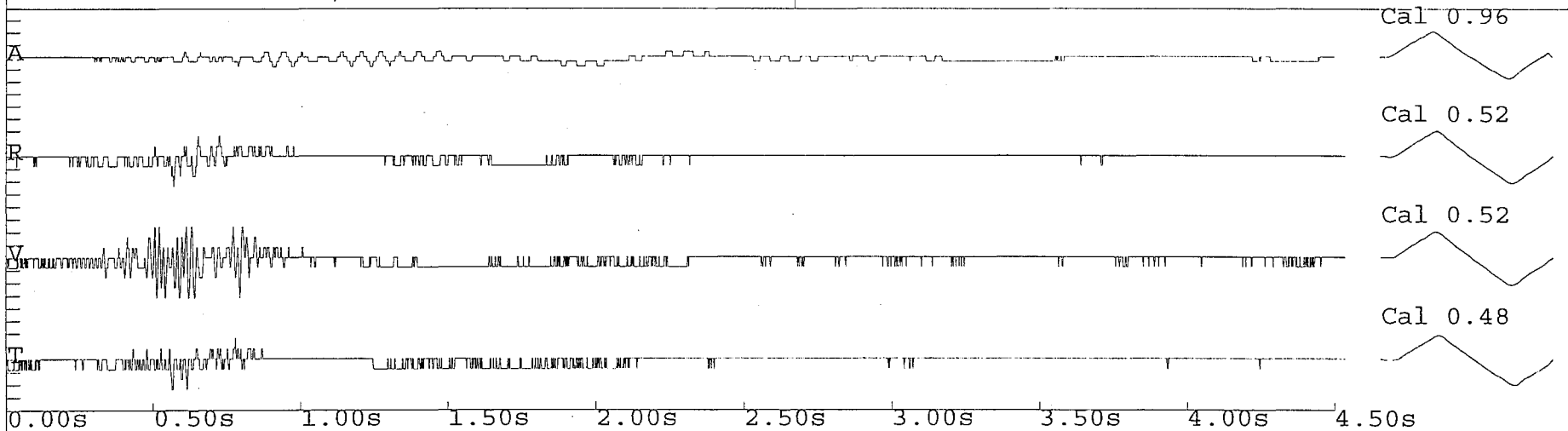
Fourier Analysis (Amplitude Spectrum)



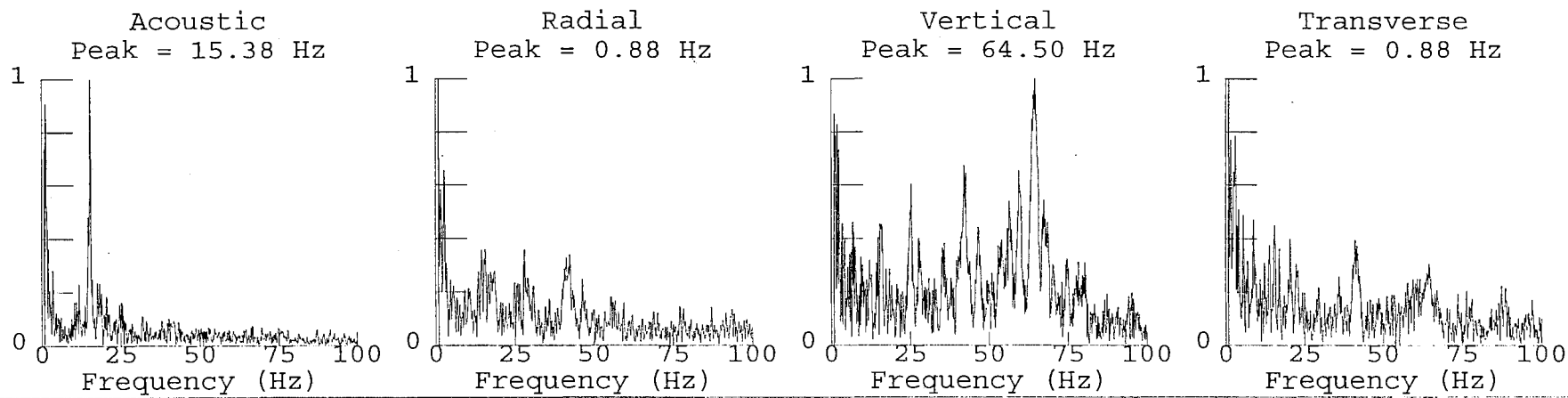
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 040 Date: 7/14/95 Time: 16:16
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 56.8 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



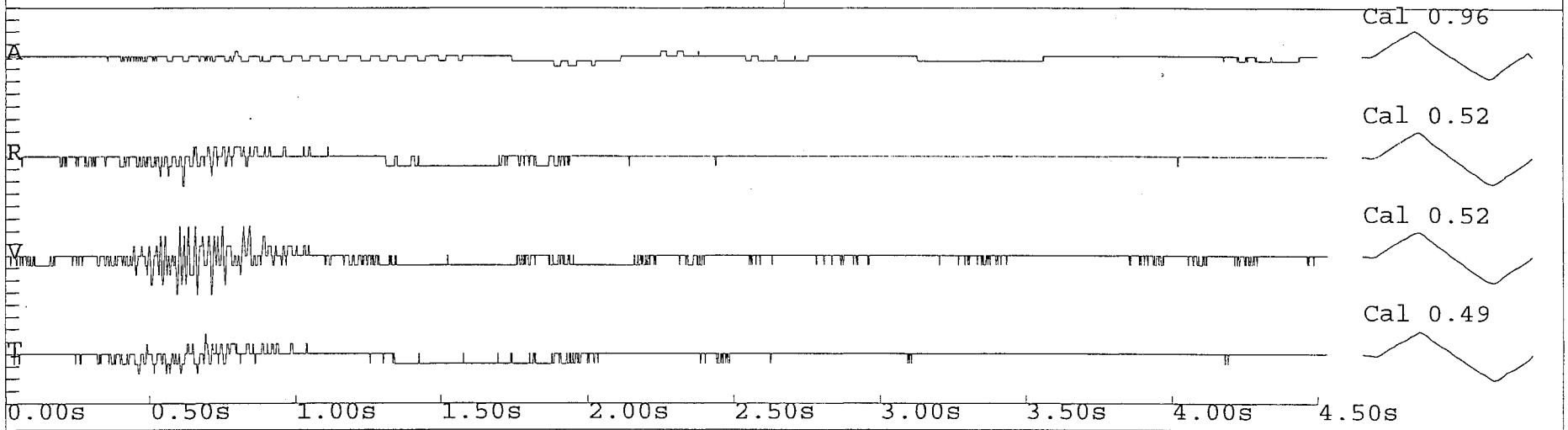
Fourier Analysis (Amplitude Spectrum)



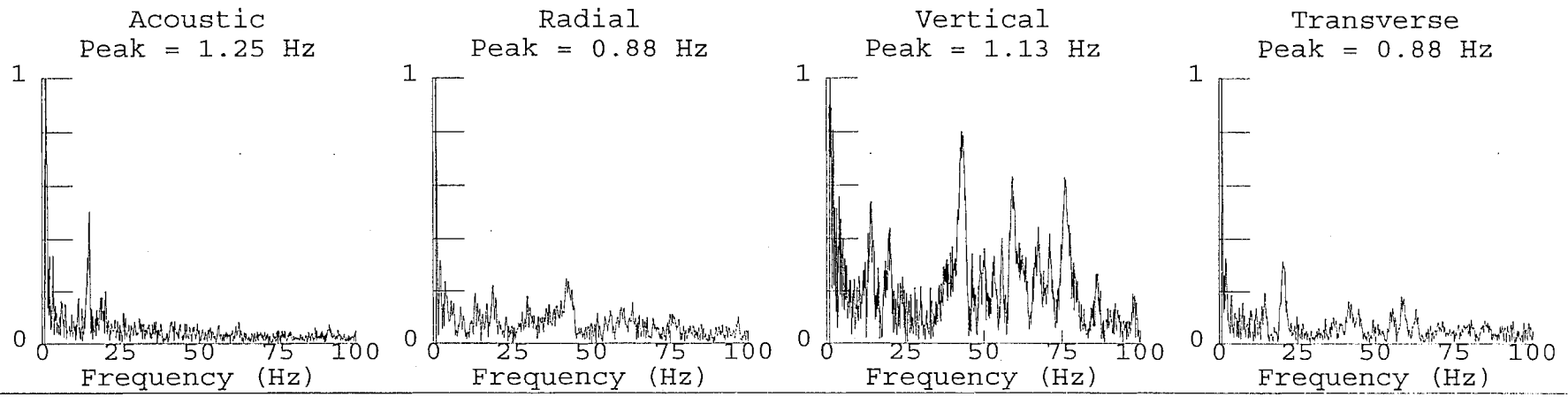
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 041 Date: 7/15/95 Time: 14:28
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 56.8 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



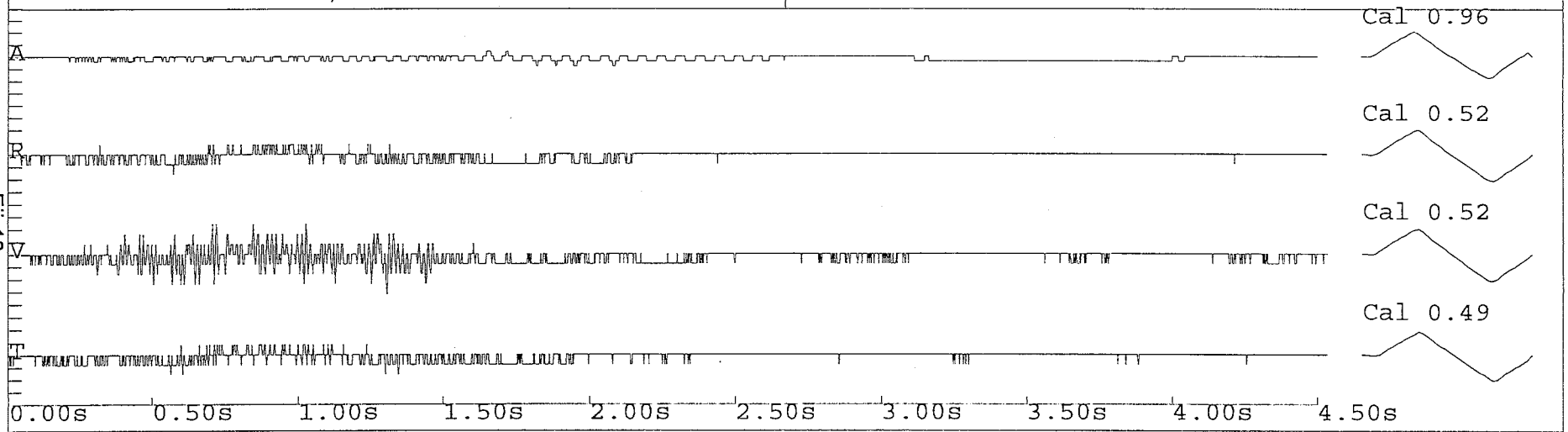
Fourier Analysis (Amplitude Spectrum)



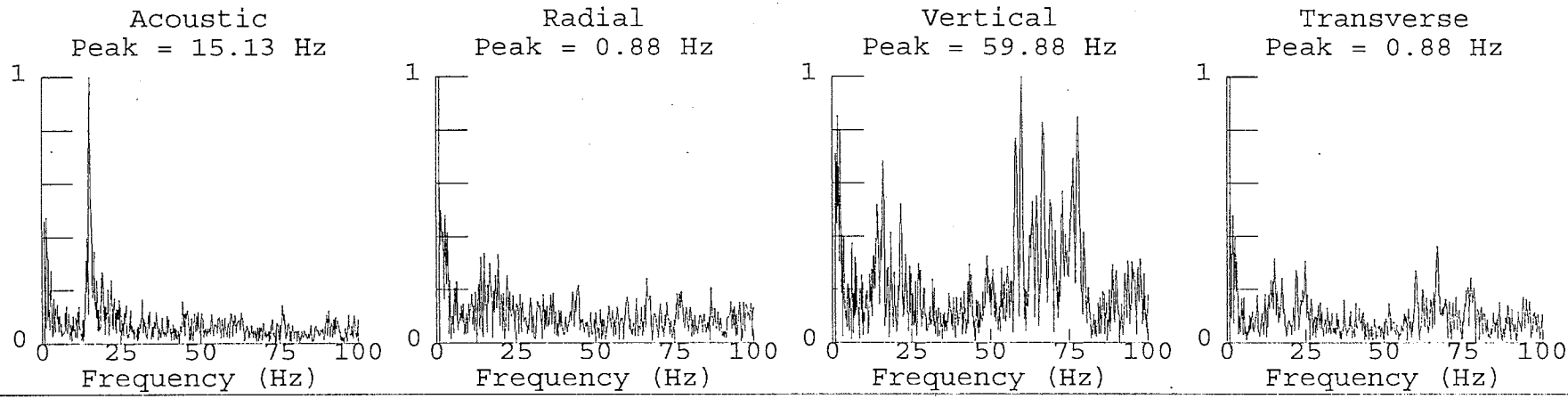
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 043 Date: 7/17/95 Time: 16:35
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 56.8 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



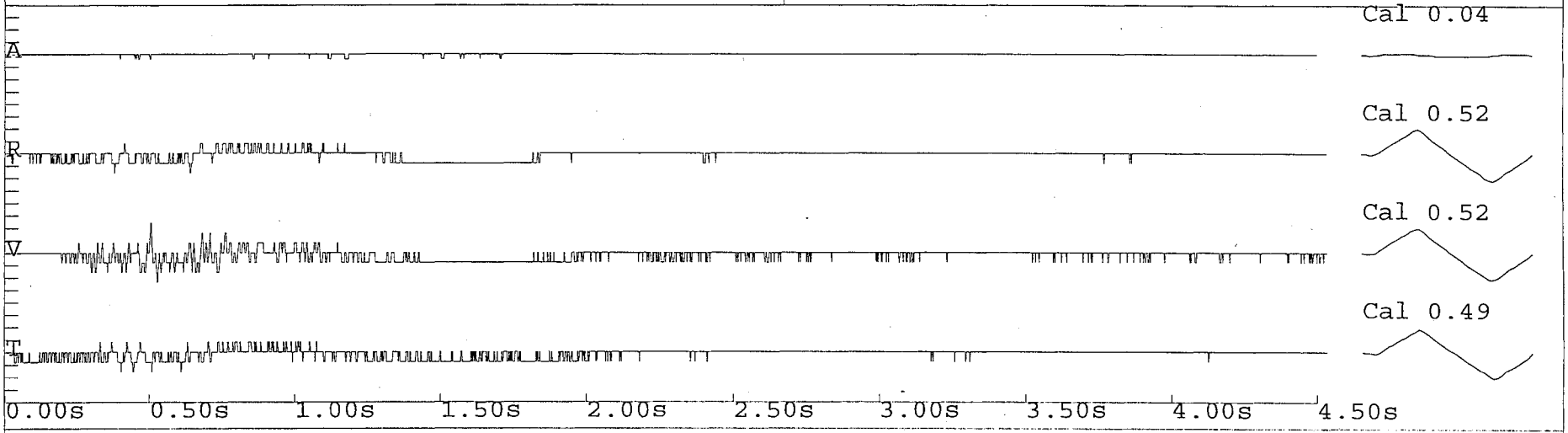
Fourier Analysis (Amplitude Spectrum)



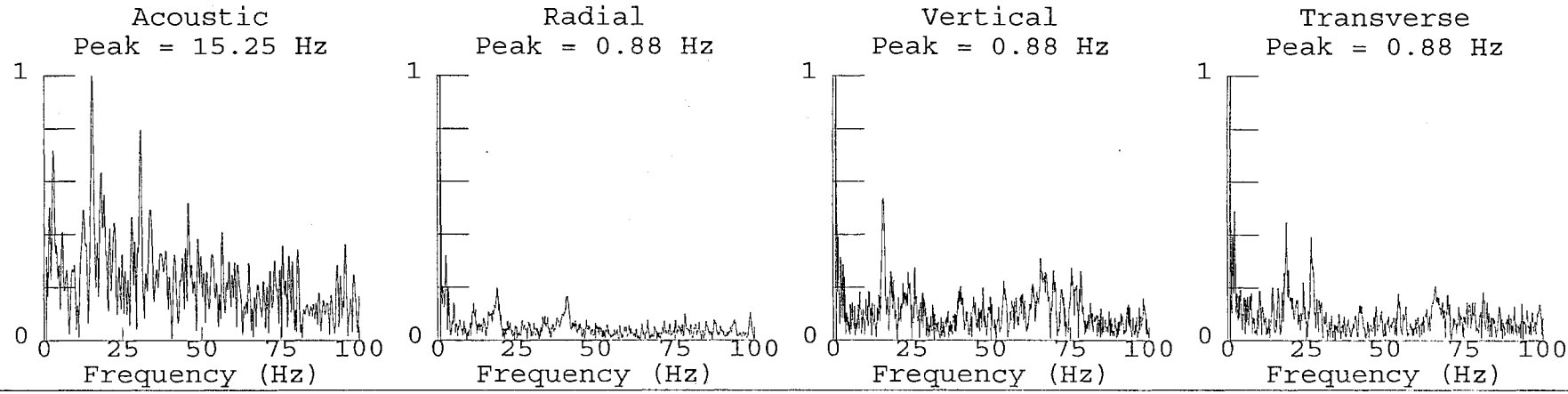
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 045 Date: 7/19/95 Time: 16:48
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



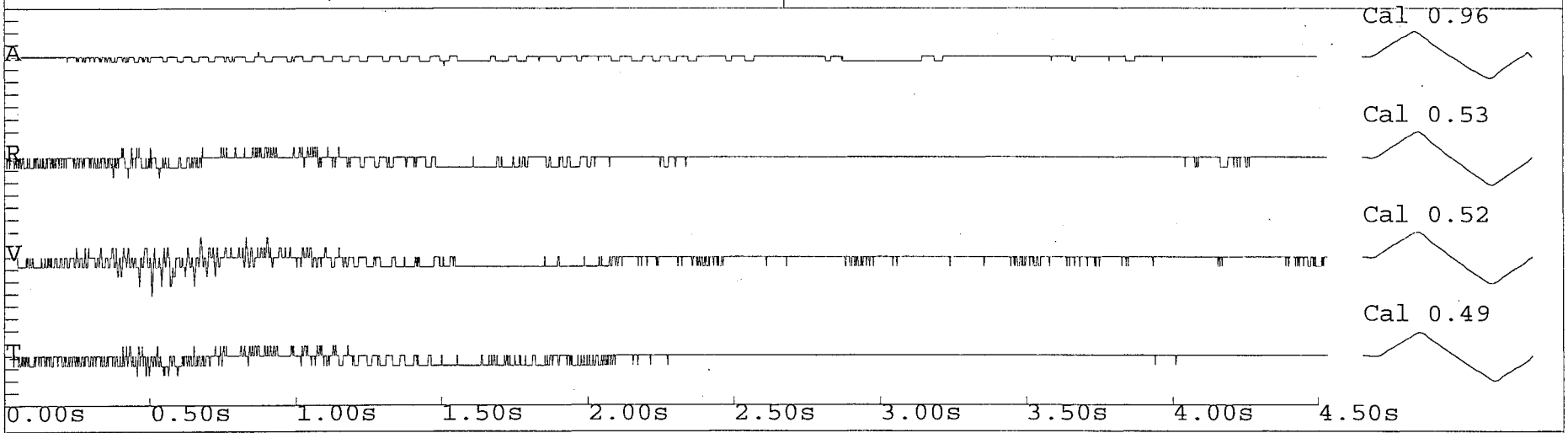
Fourier Analysis (Amplitude Spectrum)



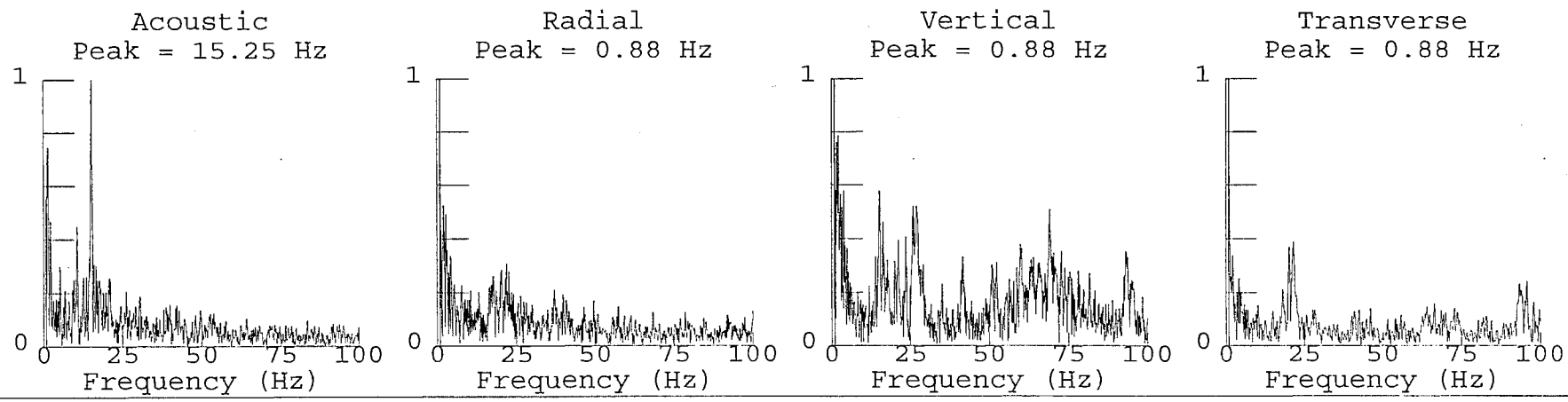
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 048 Date: 7/25/95 Time: 16:26
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 64.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



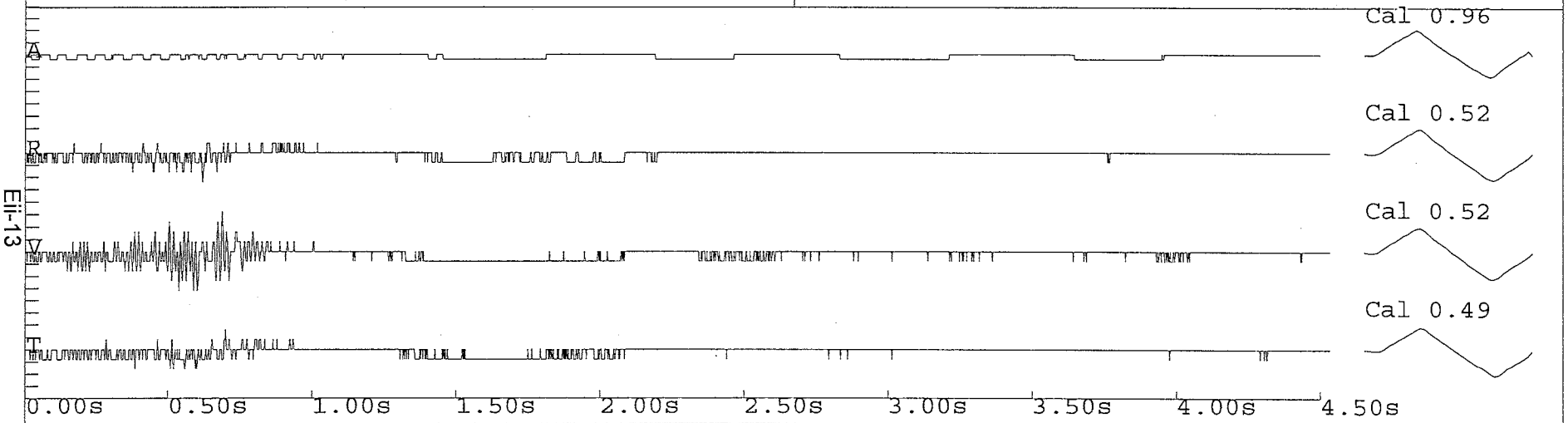
Fourier Analysis (Amplitude Spectrum)



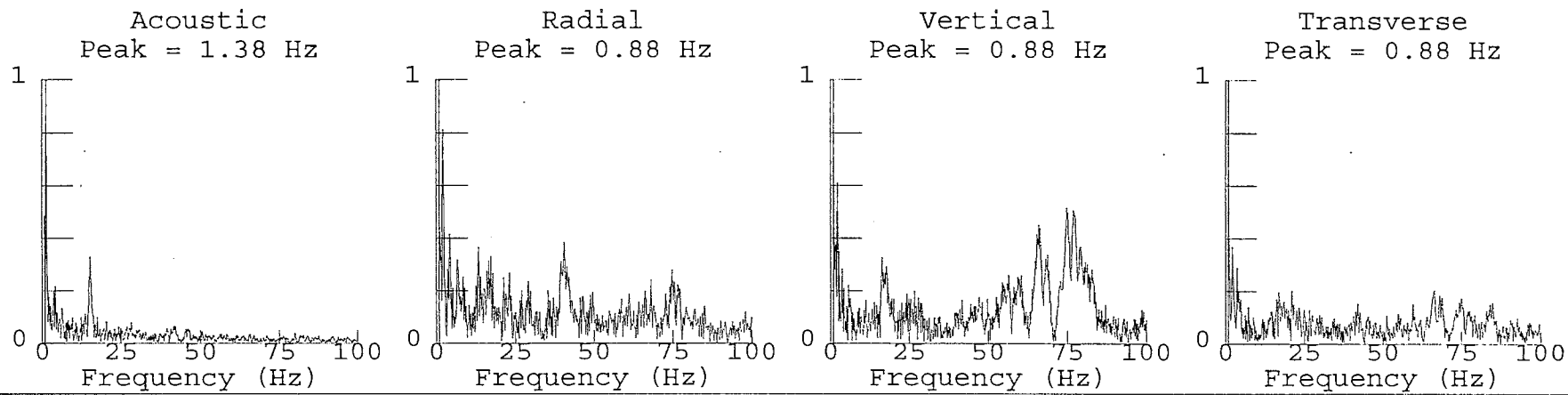
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 050 Date: 7/26/95 Time: 16:20
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 73.1 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



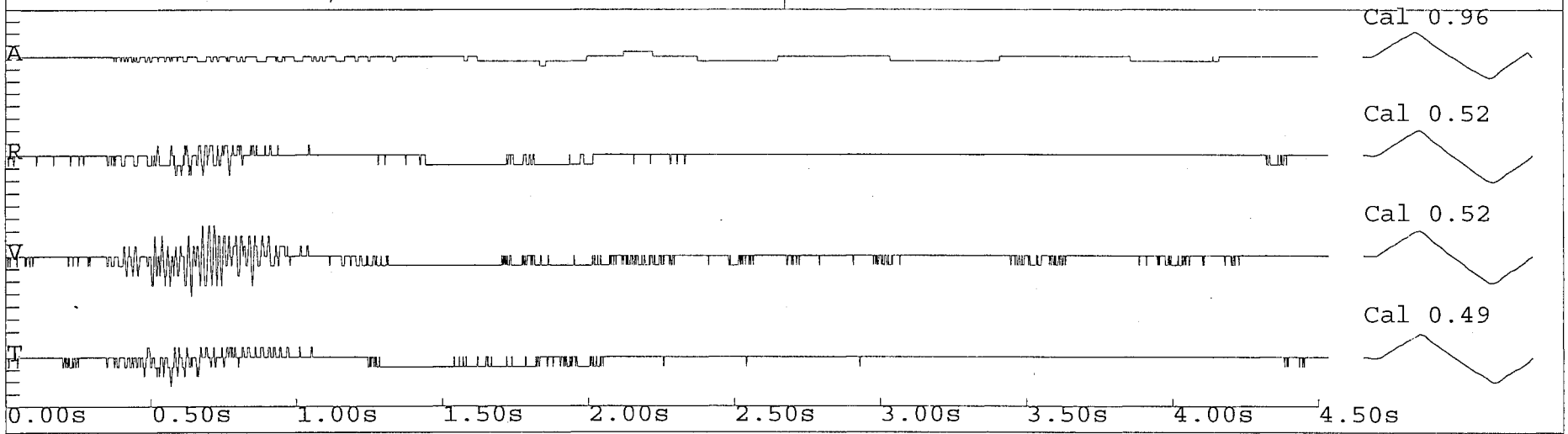
Fourier Analysis (Amplitude Spectrum)



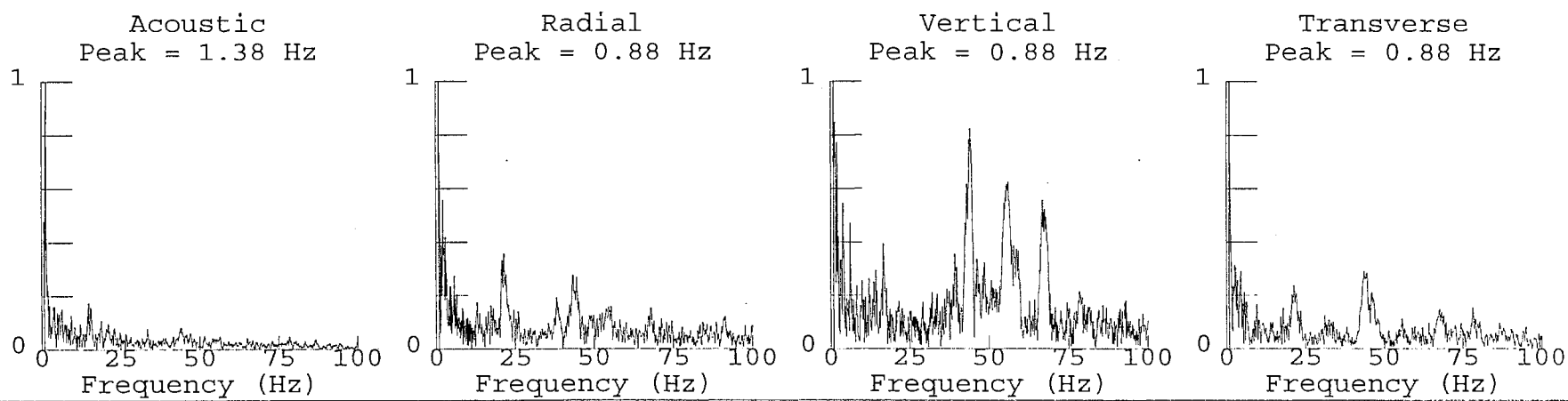
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 051 Date: 7/28/95 Time: 10:09
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 64.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



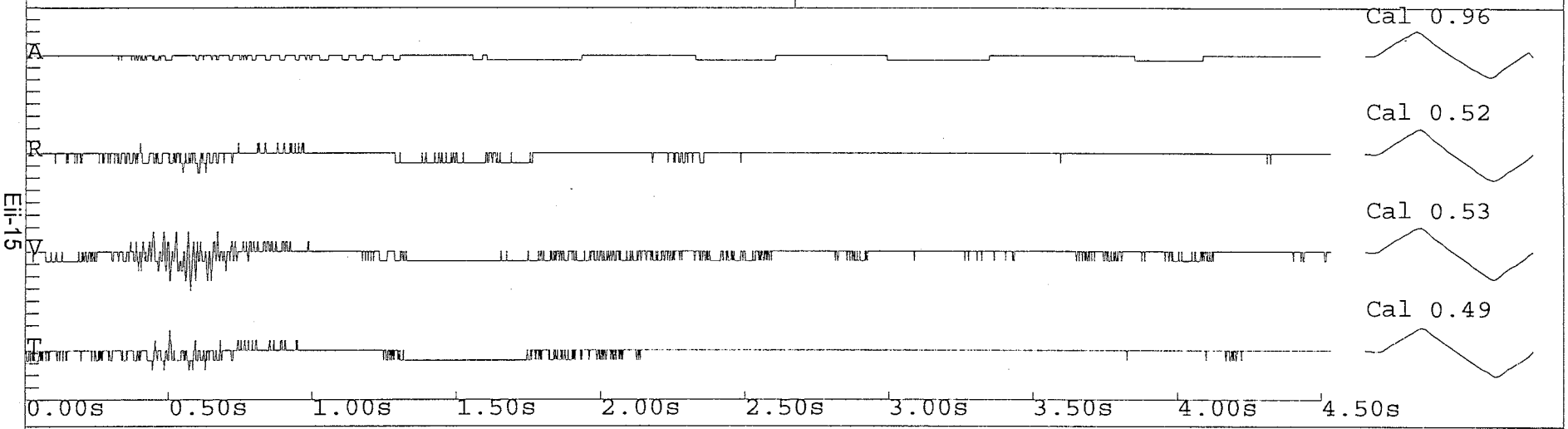
Fourier Analysis (Amplitude Spectrum)



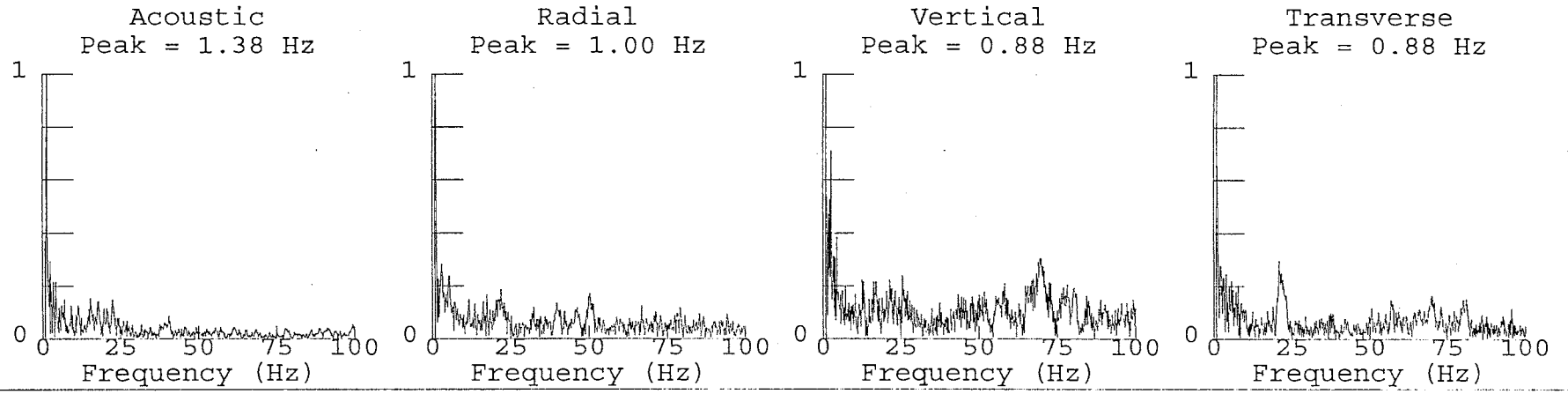
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 056 Date: 8/ 1/95 Time: 14:18
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 51.2 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



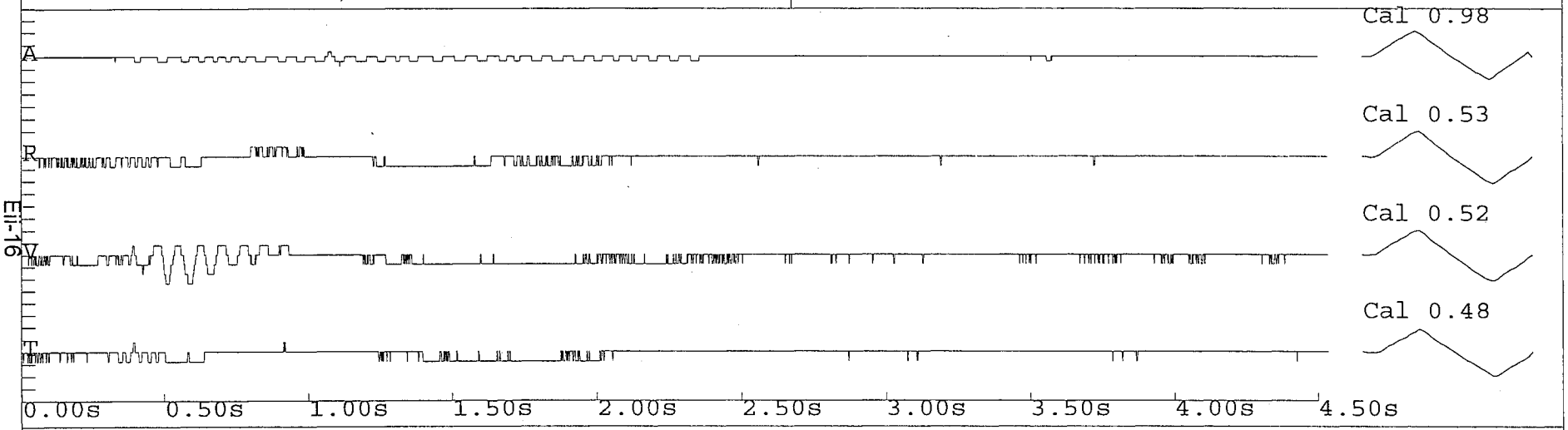
Fourier Analysis (Amplitude Spectrum)



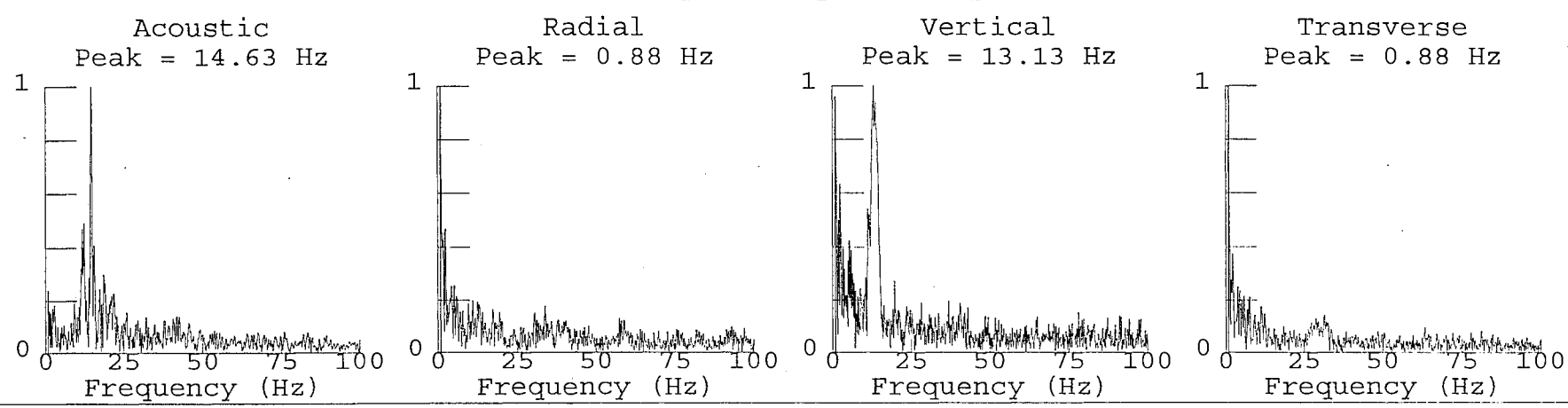
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 003 Date: 6/ 2/95 Time: 17:28
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



APPENDIX Eiii

FULL WAVEFORM DATA

INDIAN SLEEPING CHAMBER

University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

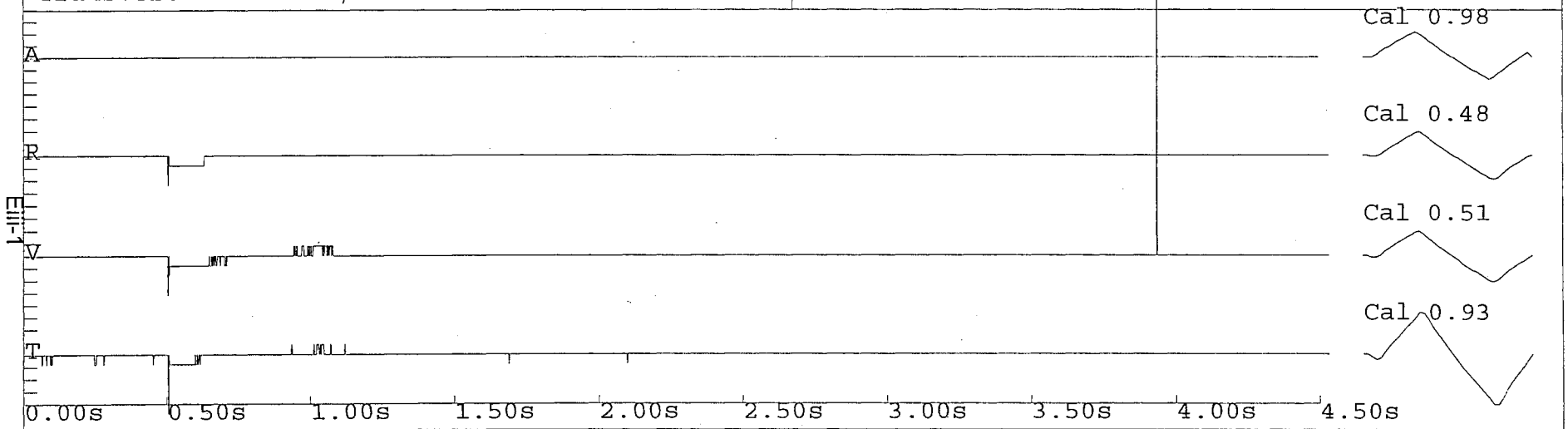
Event: 003 Date: 6/20/95 Time: 15:02
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

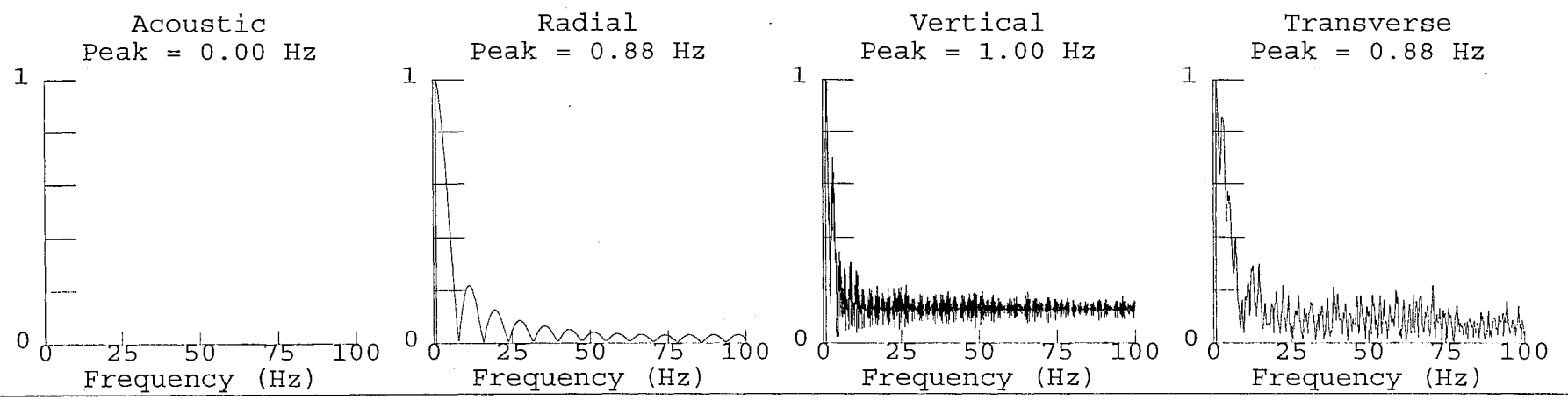
Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



E-III-1

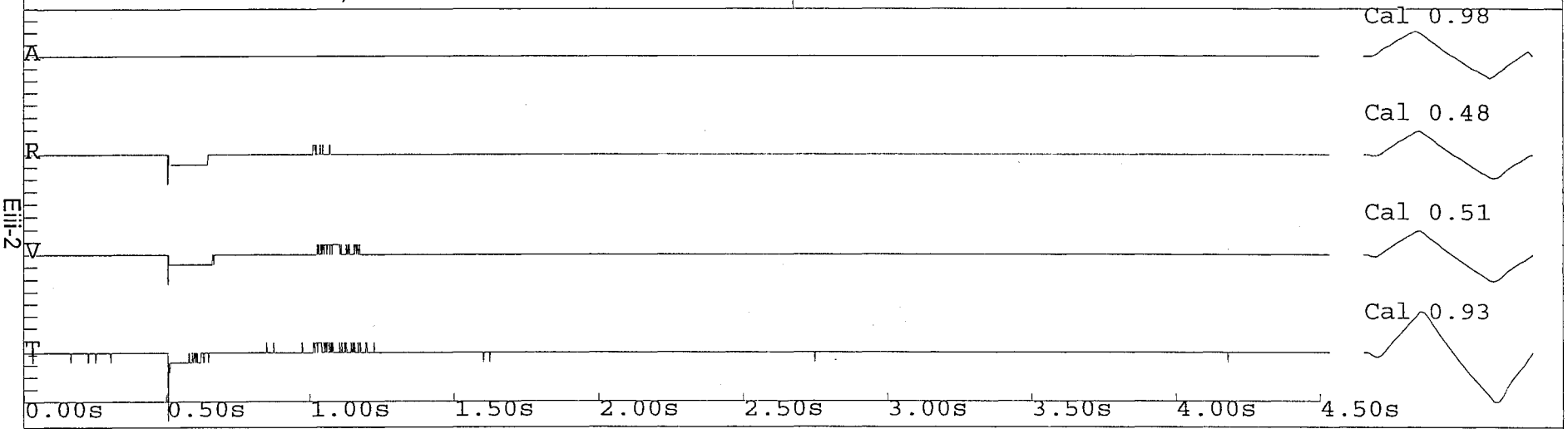
Fourier Analysis (Amplitude Spectrum)



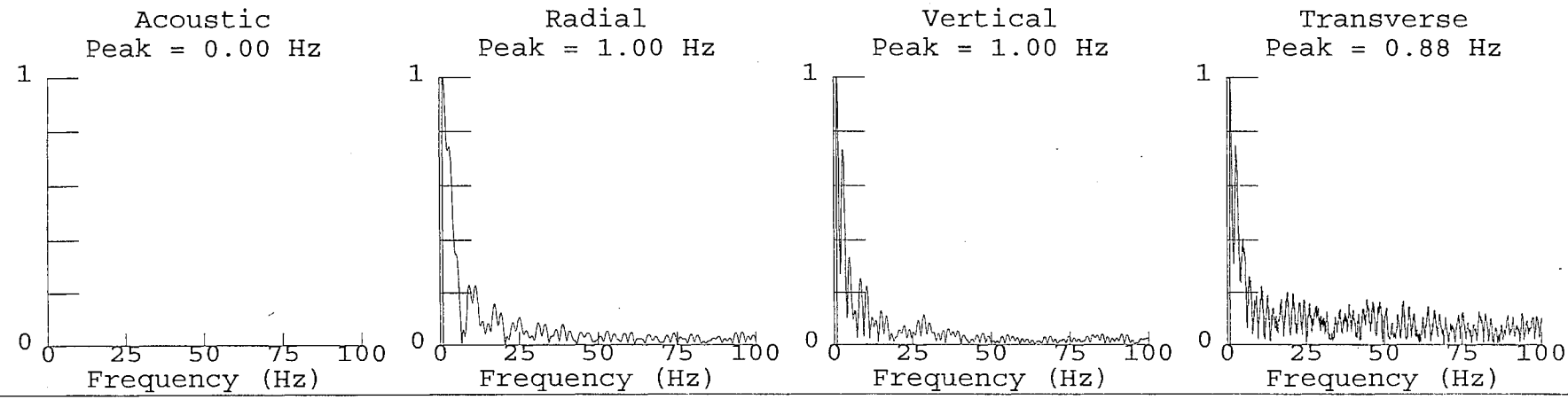
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 005 Date: 6/20/95 Time: 15:06
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

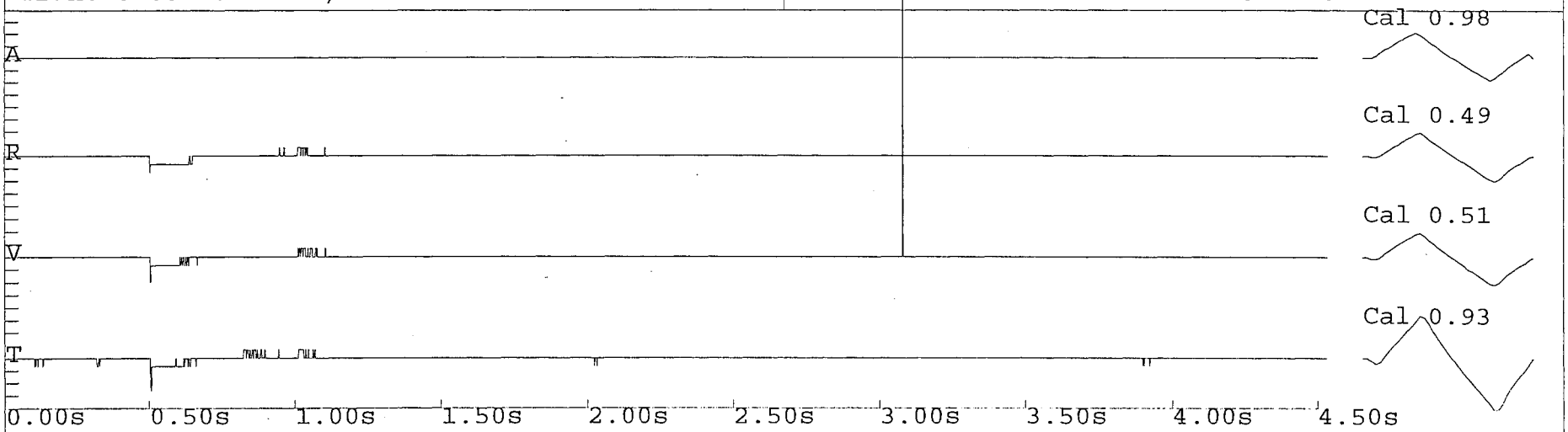
Event: 006 Date: 6/20/95 Time: 15:08
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

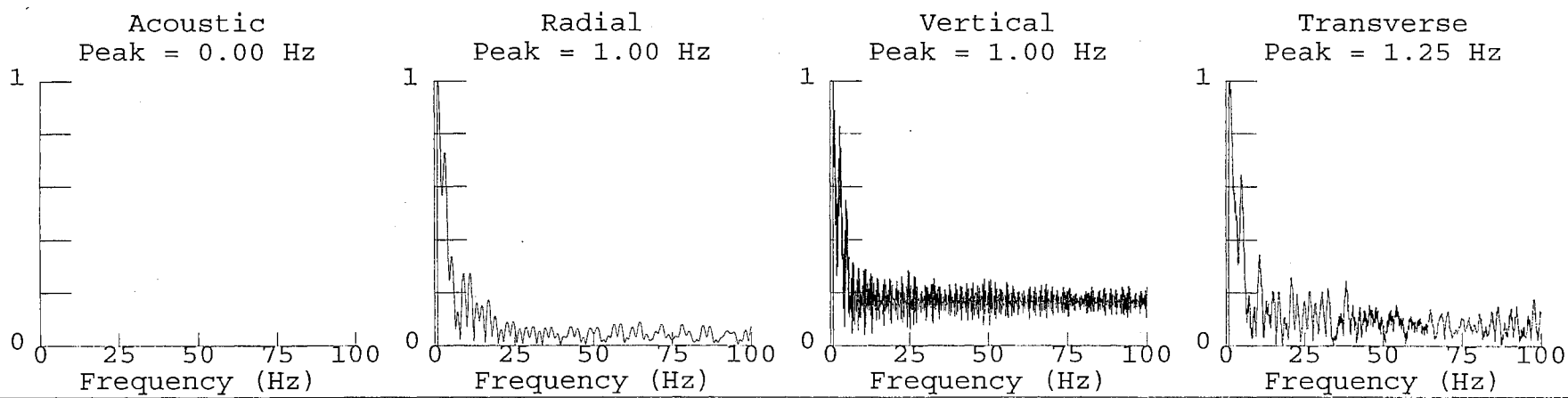
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 170.6 Hz.
Transverse: 0.06 in/s 5.8 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals



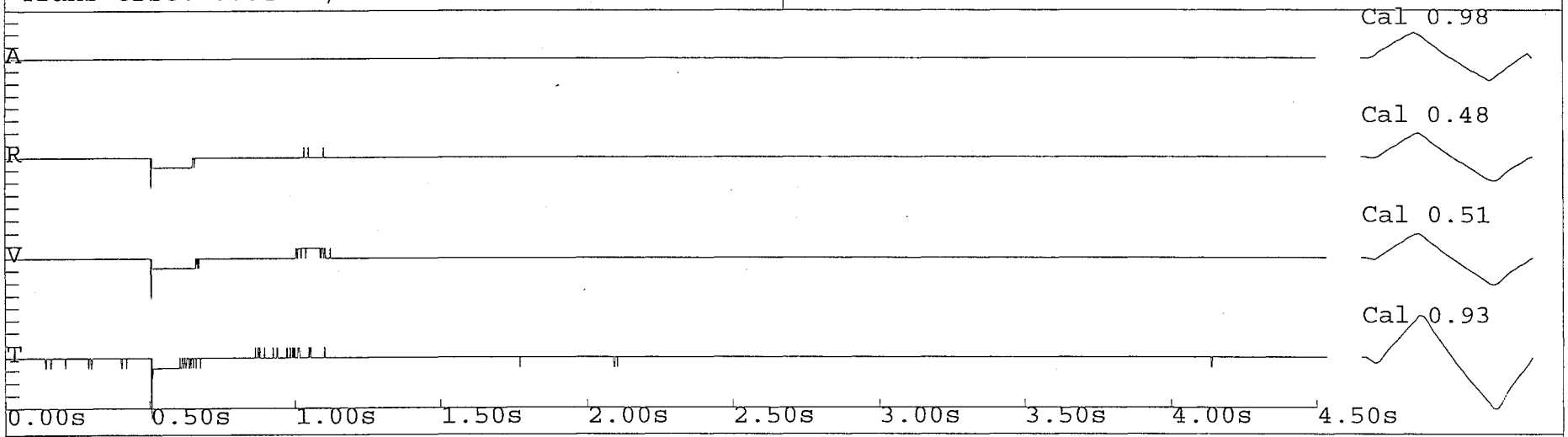
Fourier Analysis (Amplitude Spectrum)



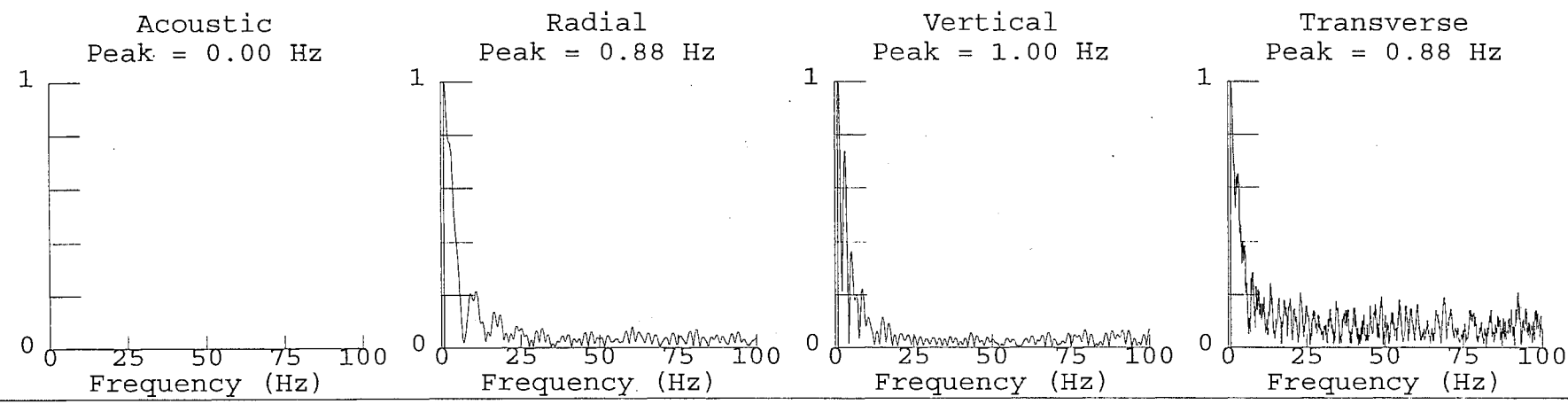
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 007 Date: 6/20/95 Time: 15:10
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

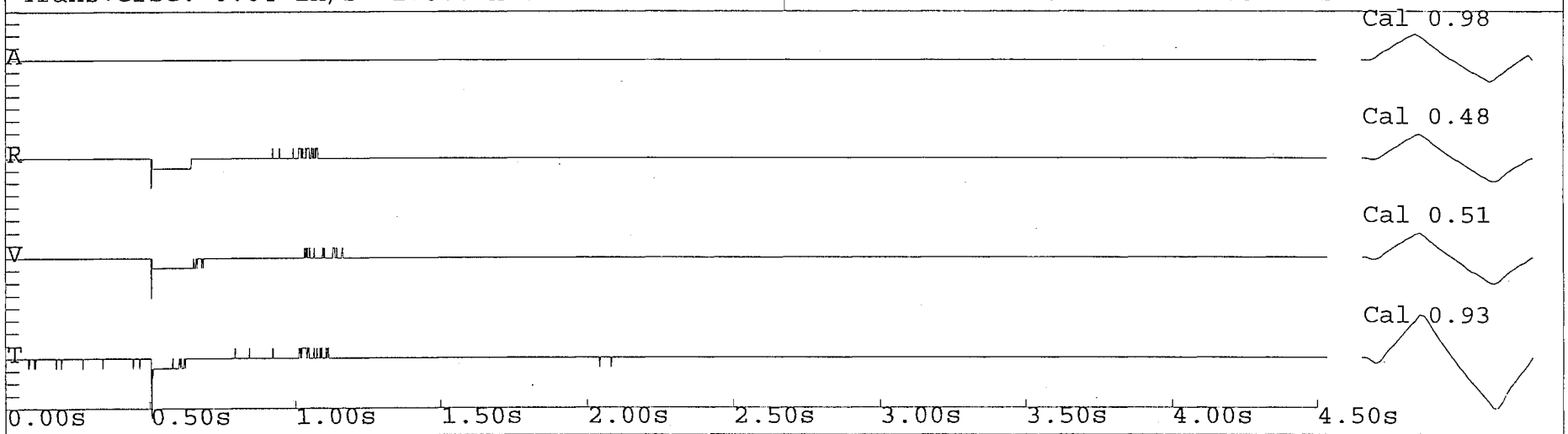
Event: 008 Date: 6/20/95 Time: 15:12
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

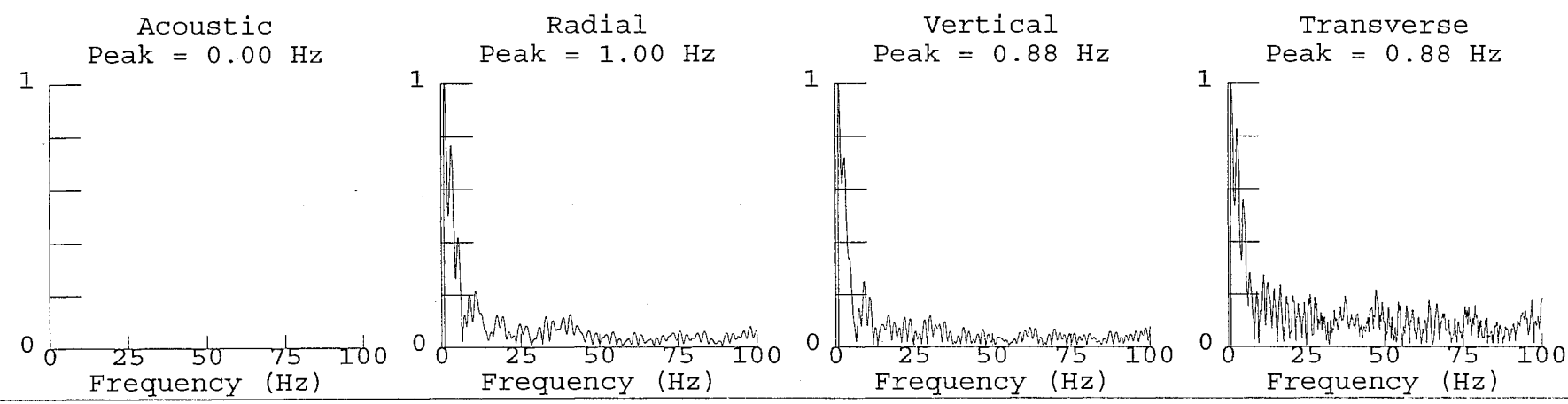
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



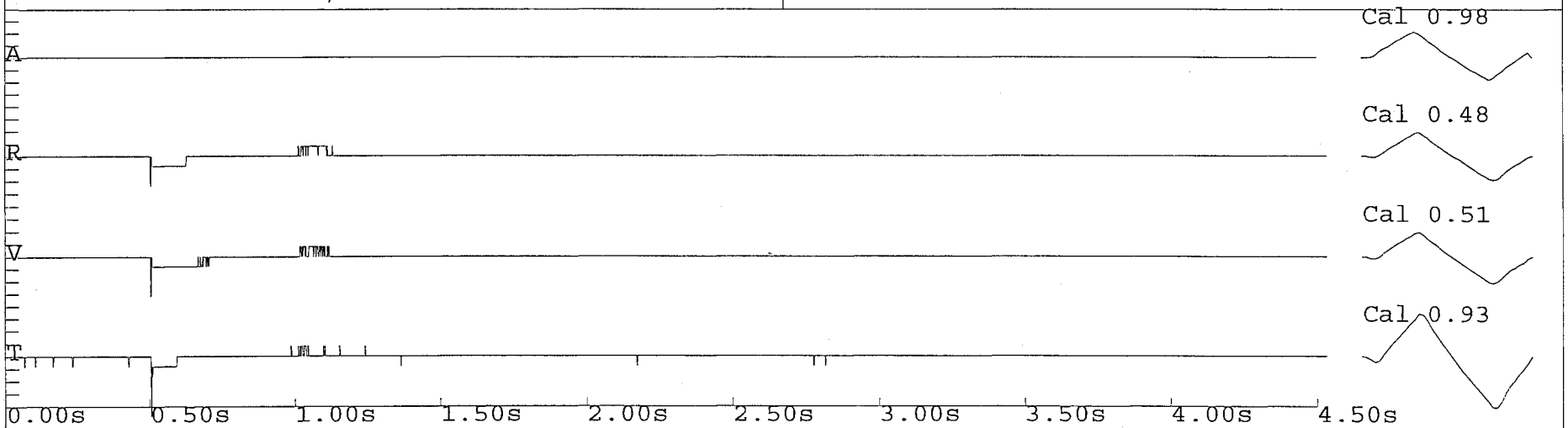
Fourier Analysis (Amplitude Spectrum)



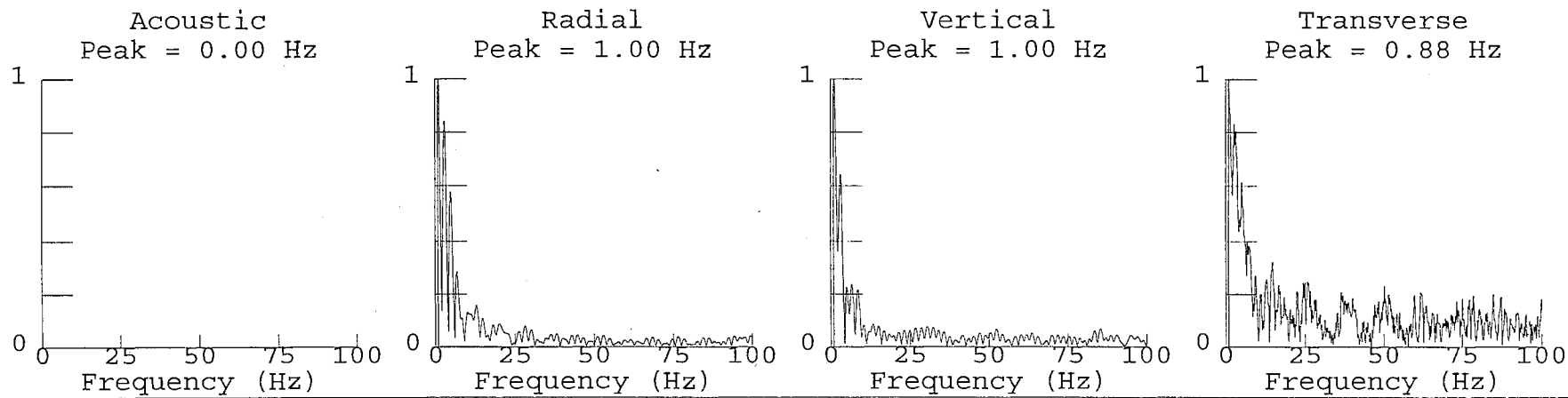
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 010 Date: 6/20/95 Time: 15:16
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



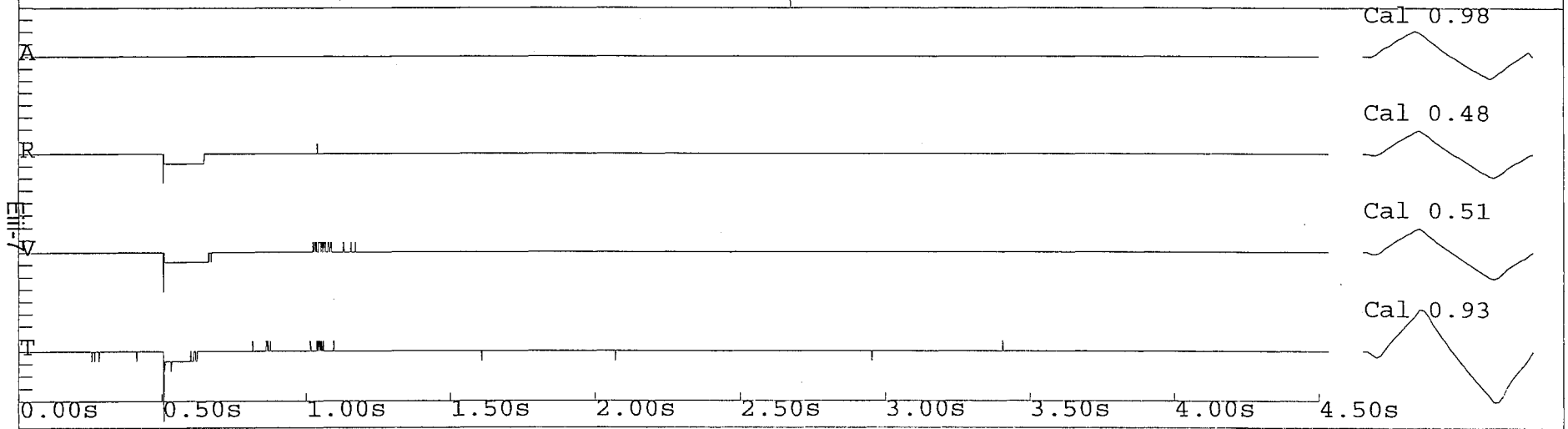
Fourier Analysis (Amplitude Spectrum)



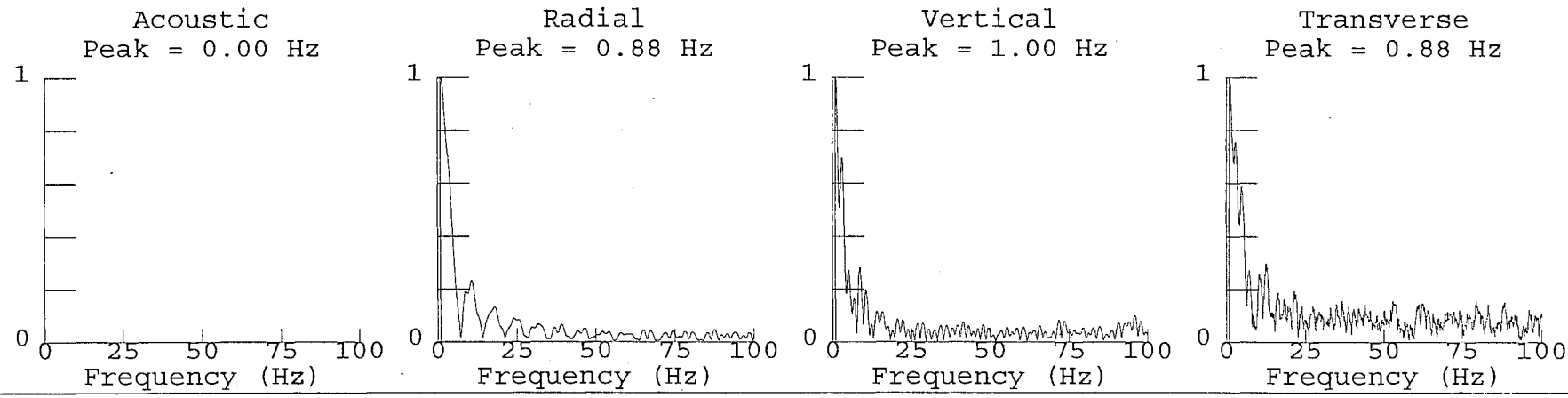
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 011 Date: 6/20/95 Time: 15:18
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

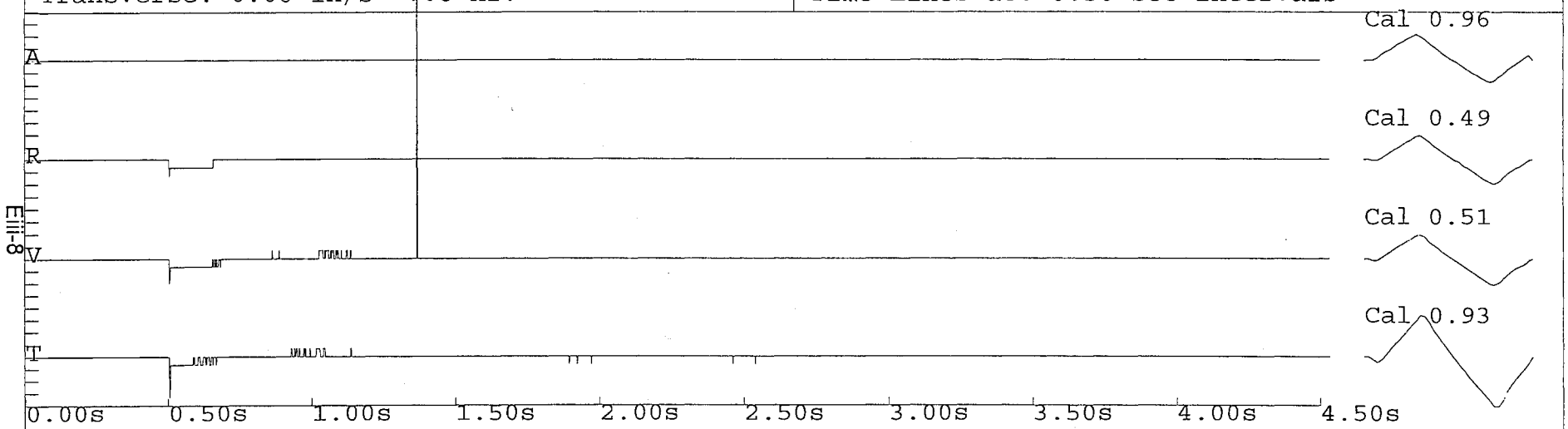
Event: 012 Date: 6/20/95 Time: 15:20
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

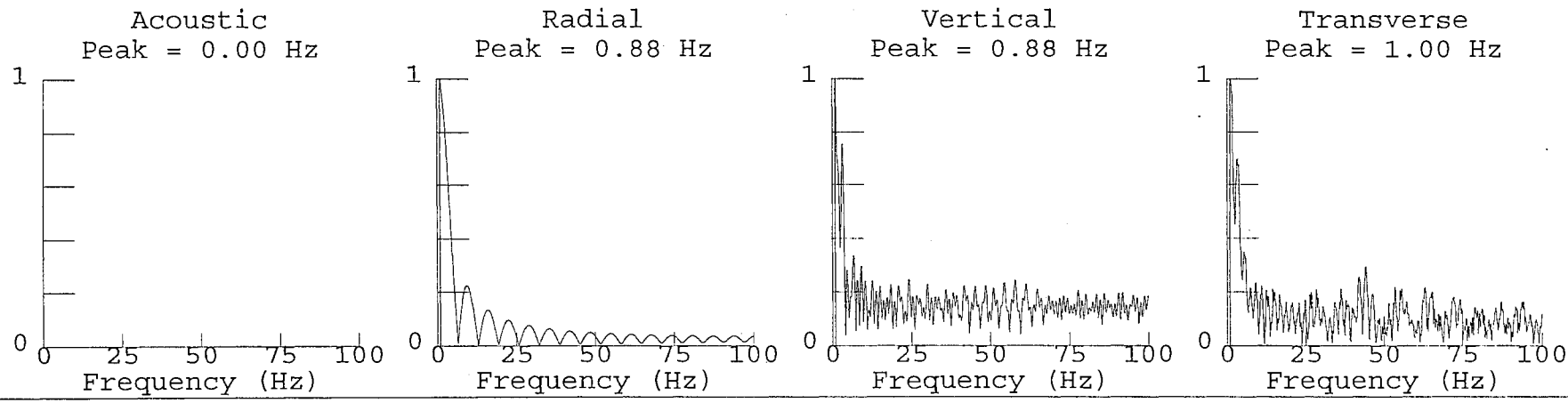
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 170.6 Hz.
Transverse: 0.06 in/s 7.8 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals



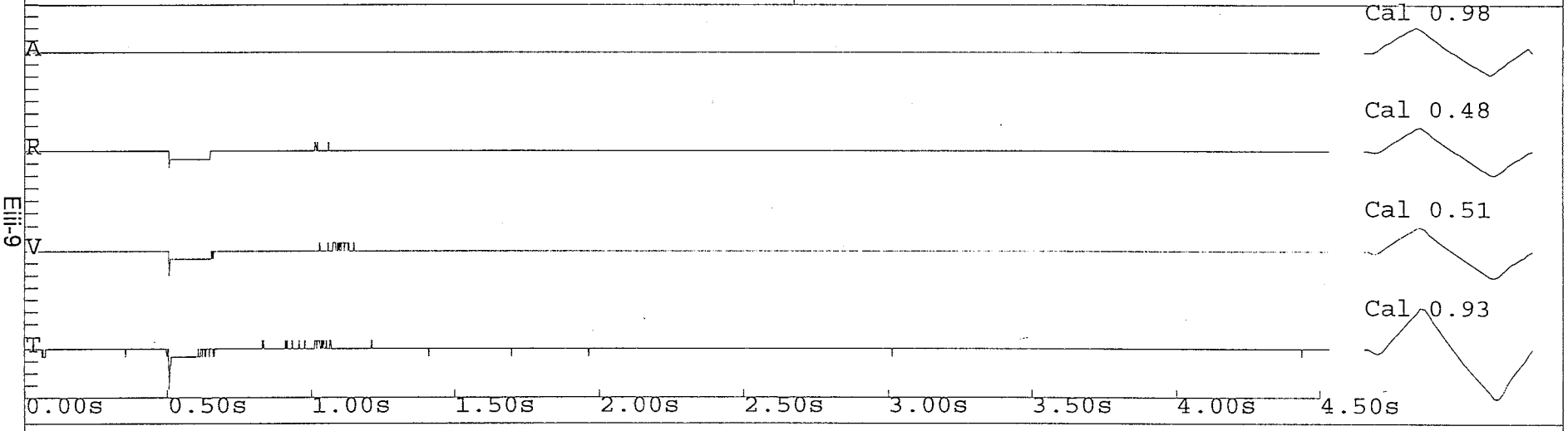
Fourier Analysis (Amplitude Spectrum)



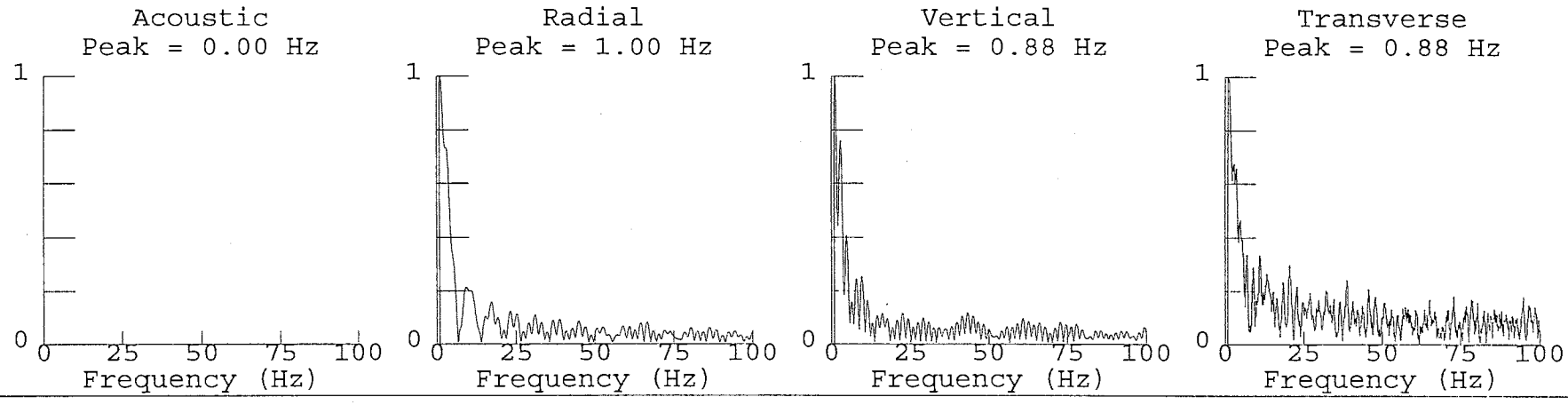
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 013 Date: 6/20/95 Time: 15:22
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 170.6 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 4.9 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

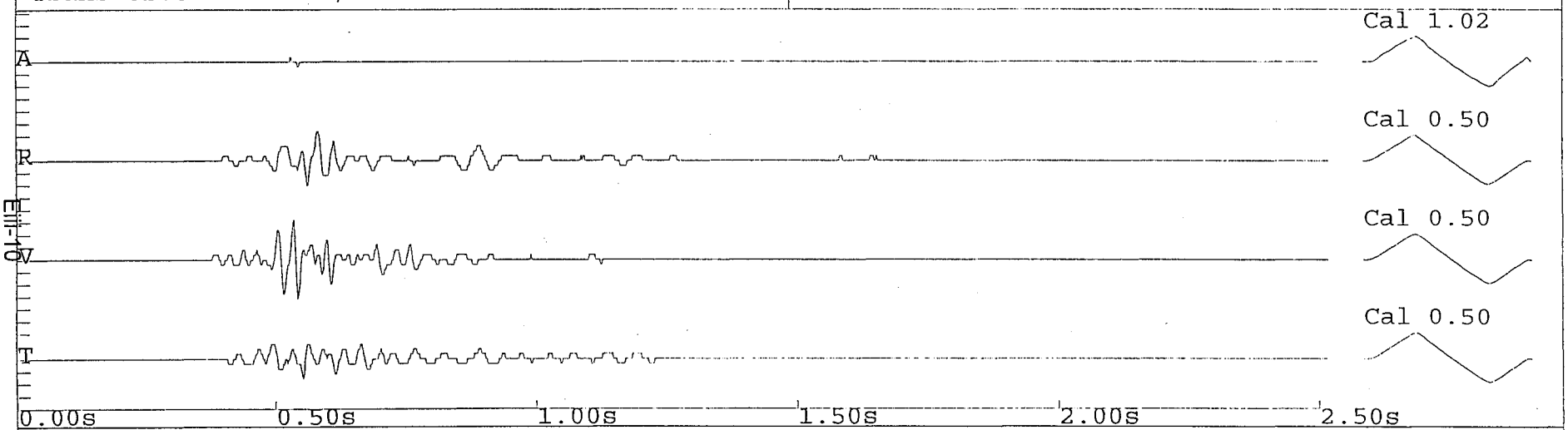
Event: 018 Date: 6/16/95 Time: 17:52
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies

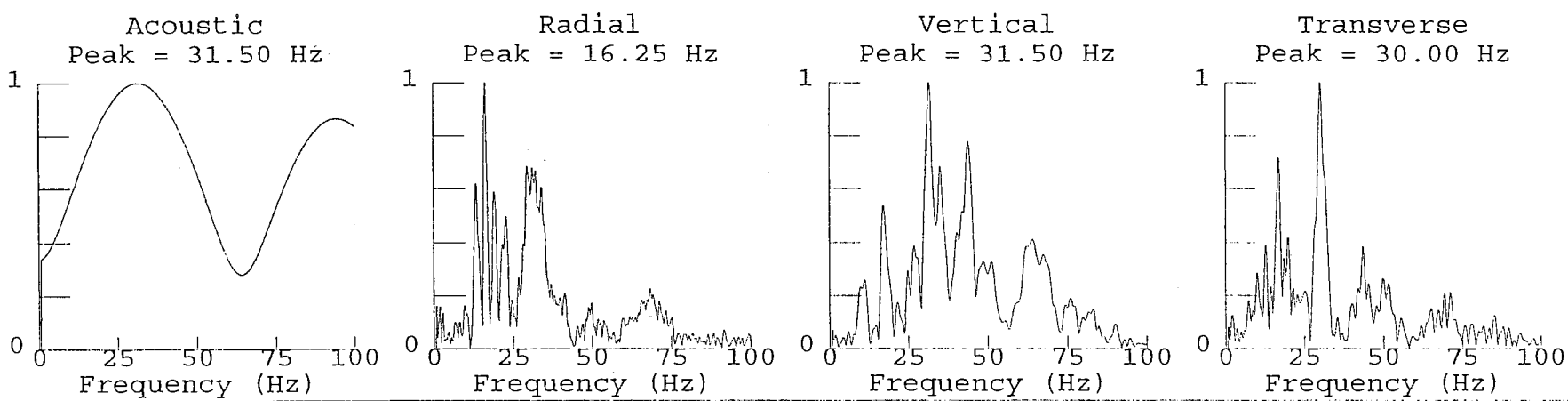
Acoustic: 100 dB 0.0 Hz.
Radial: 0.03 in/s 34.1 Hz.
Vertical: 0.04 in/s 51.2 Hz.
Transverse: 0.02 in/s 56.8 Hz.

Graph Information

Duration: 0.000 sec To: 2.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



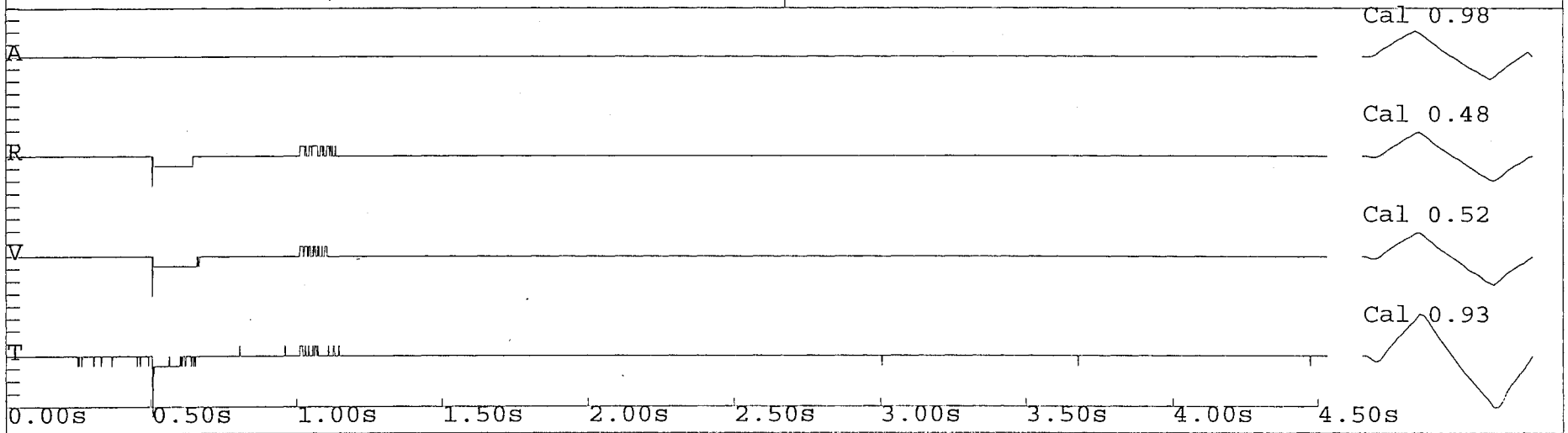
Fourier Analysis (Amplitude Spectrum)



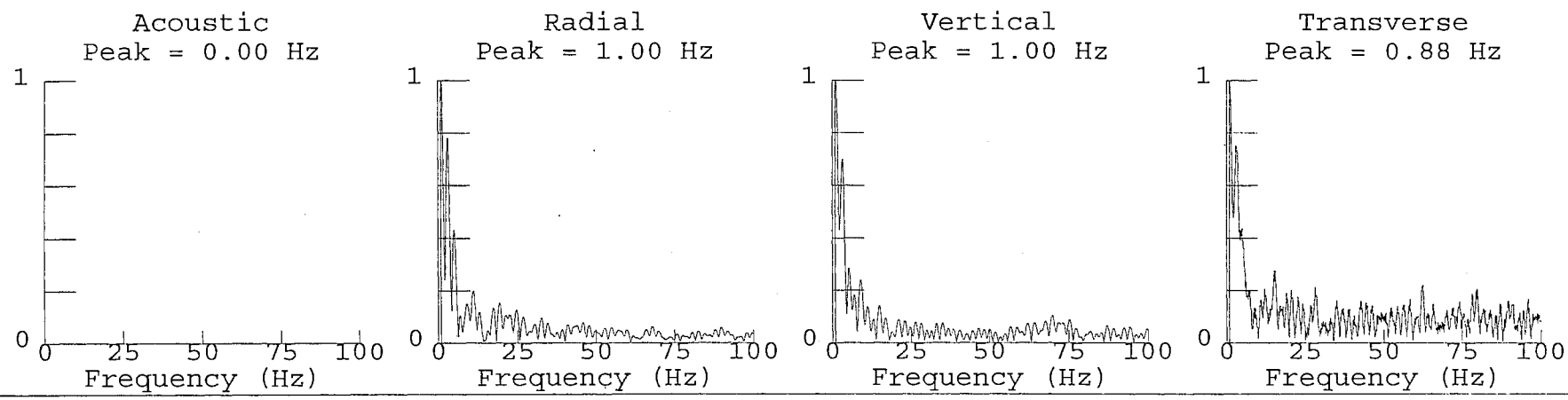
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 019 Date: 6/20/95 Time: 15:34
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



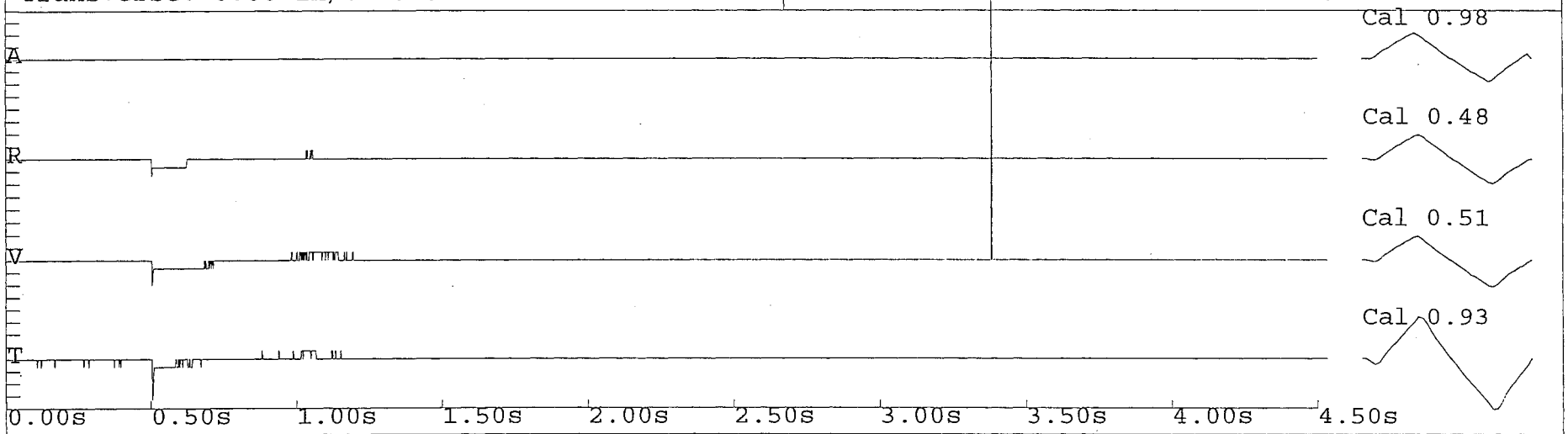
Fourier Analysis (Amplitude Spectrum)



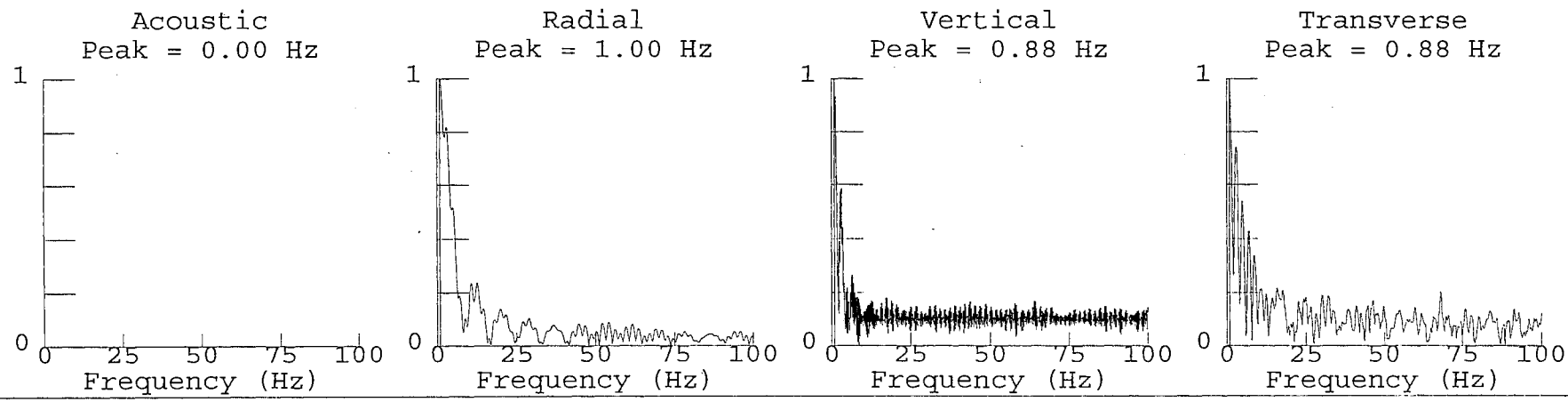
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 020 Date: 6/20/95 Time: 15:36
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 170.6 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 6.3 Hz.	Time Lines at: 0.50 sec intervals



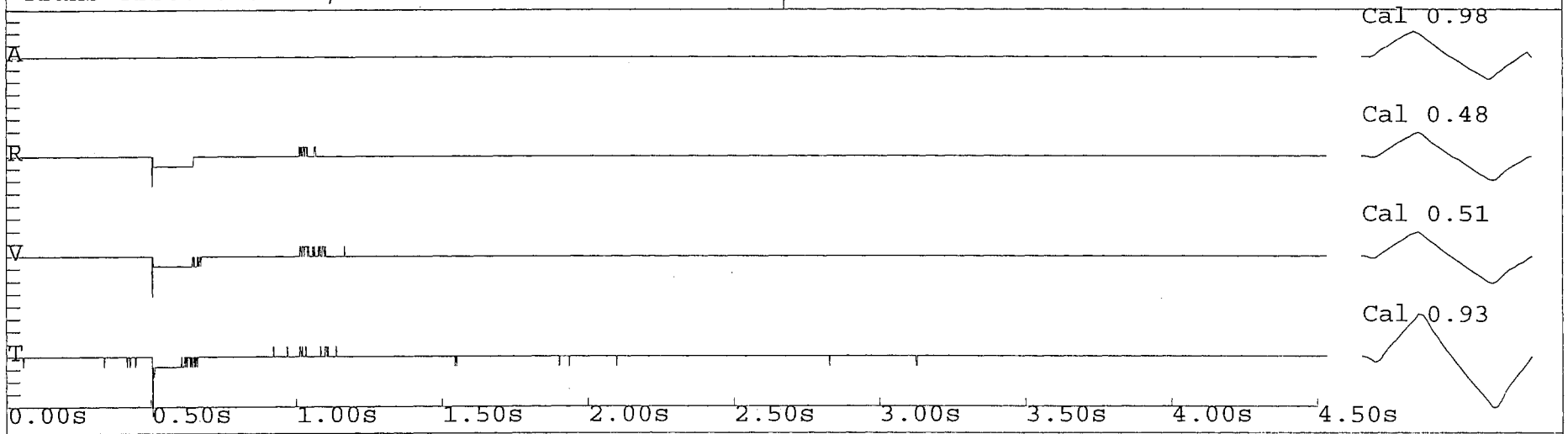
Fourier Analysis (Amplitude Spectrum)



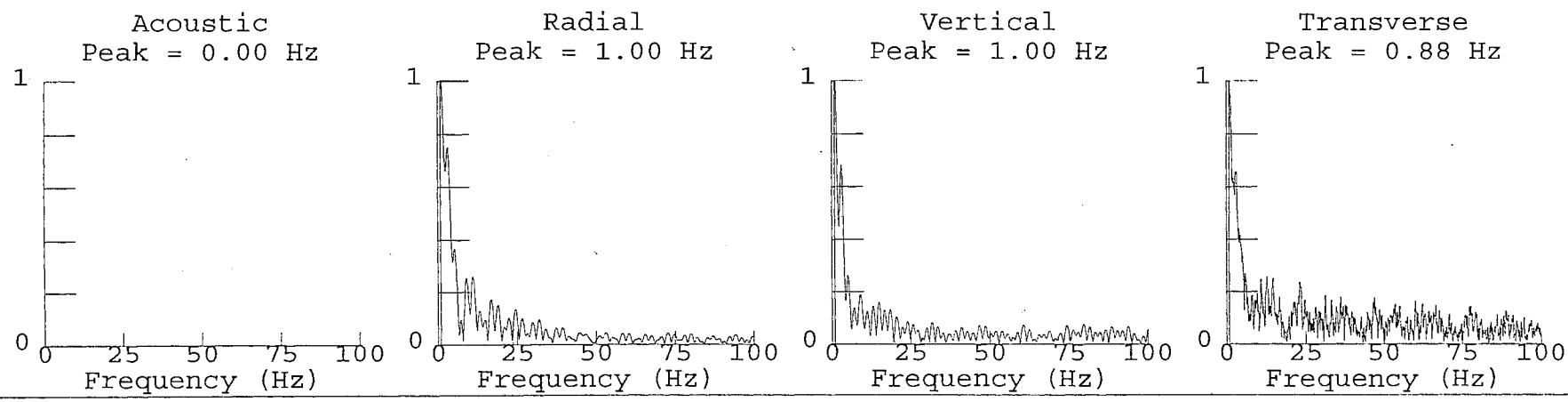
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 021 Date: 6/20/95 Time: 15:38
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

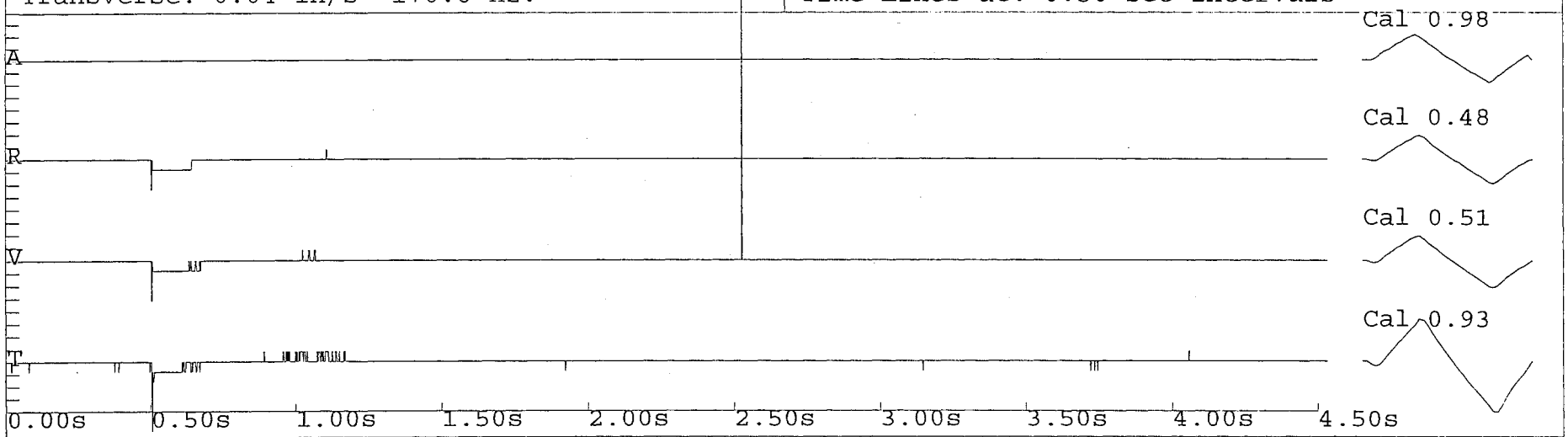
Event: 023 Date: 6/20/95 Time: 15:42
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

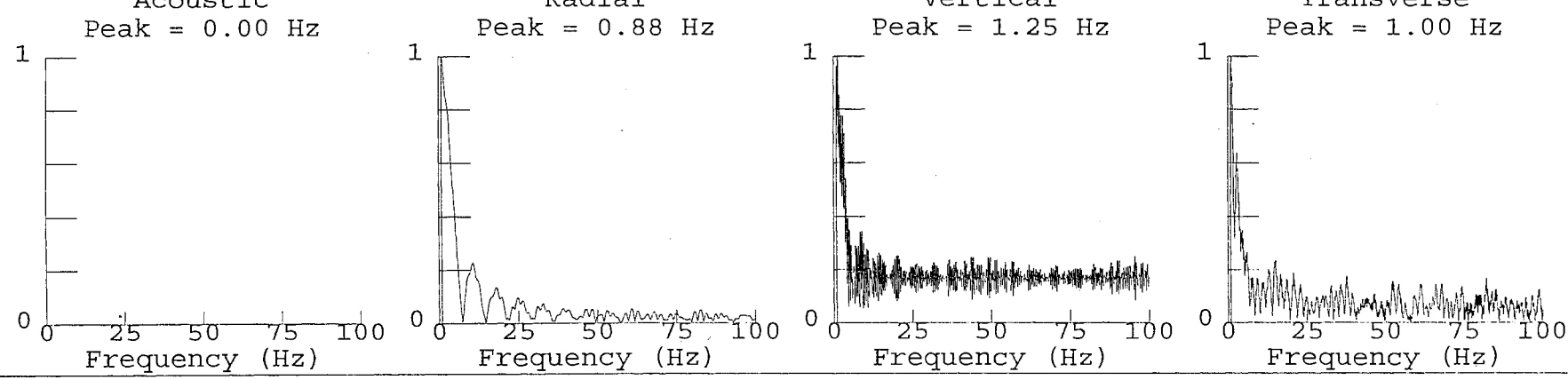
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



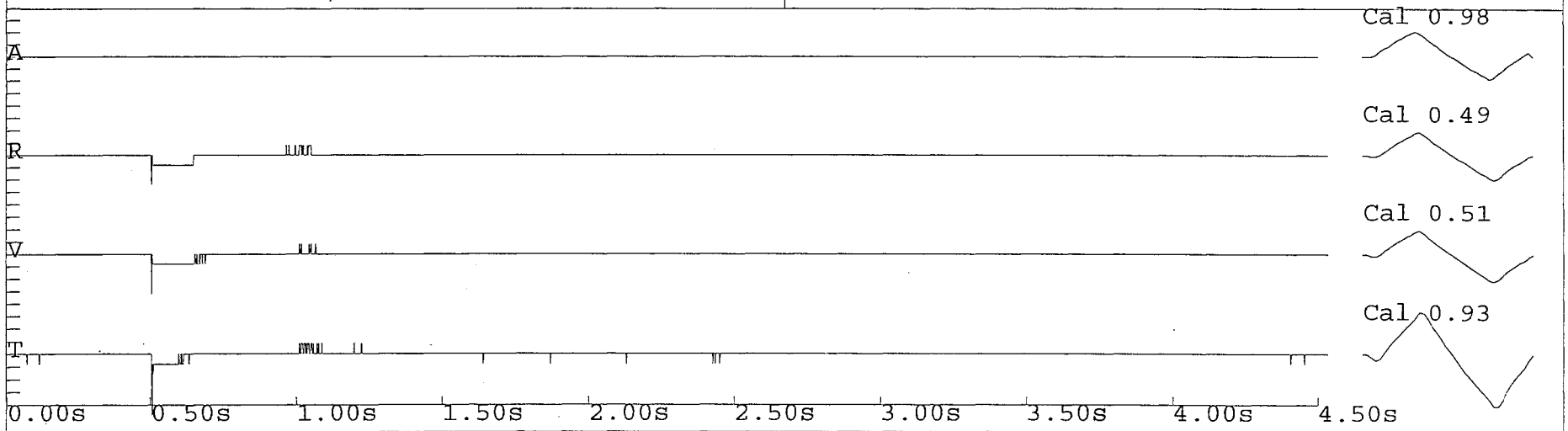
Fourier Analysis (Amplitude Spectrum)



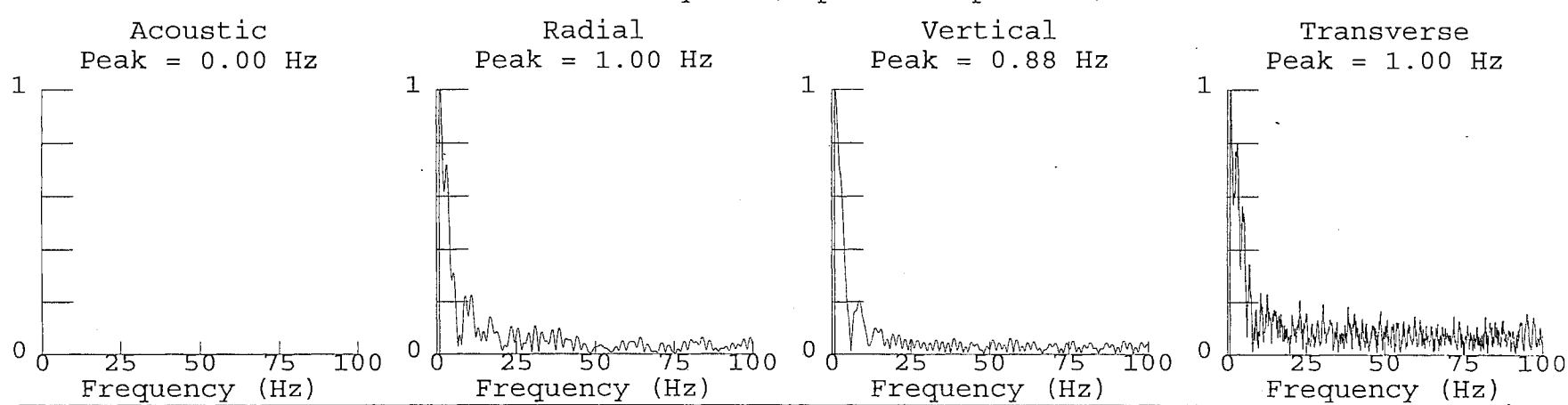
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 024 Date: 6/20/95 Time: 15:44
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



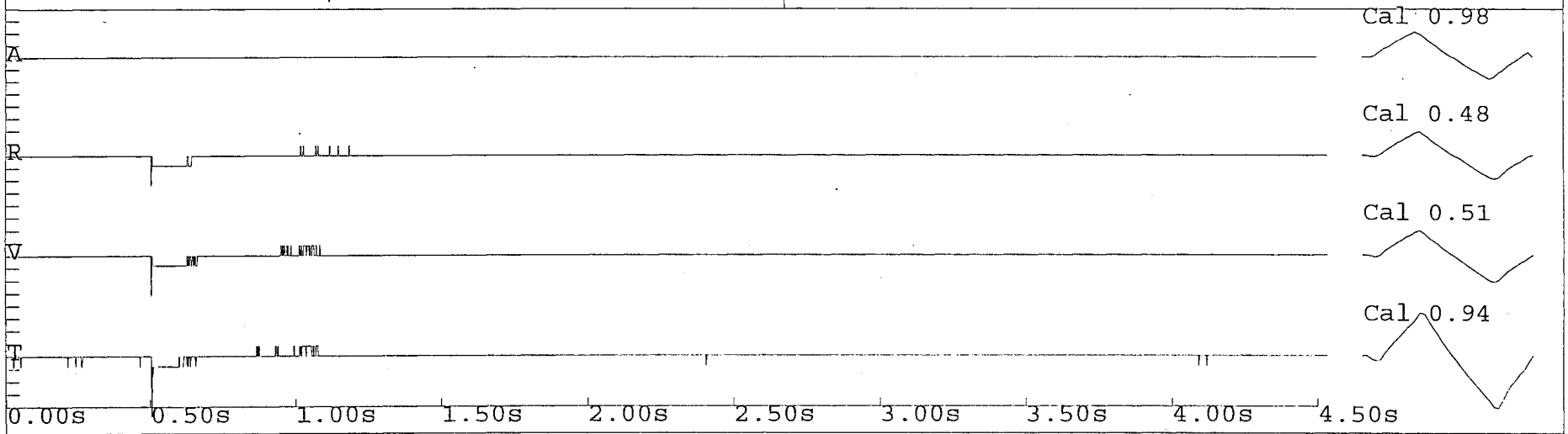
Fourier Analysis (Amplitude Spectrum)



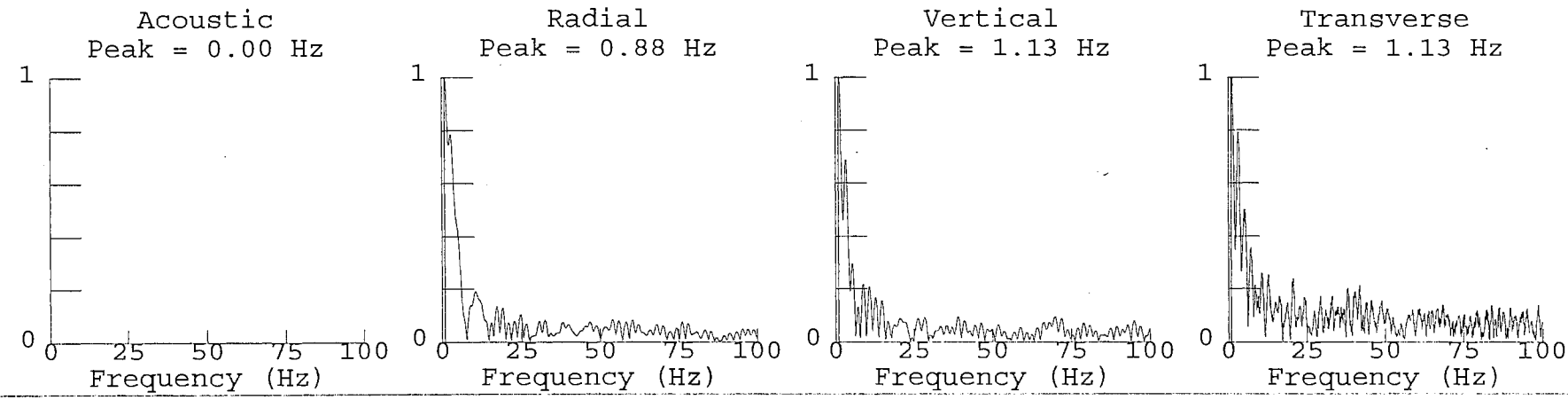
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 025 Date: 6/20/95 Time: 15:46
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

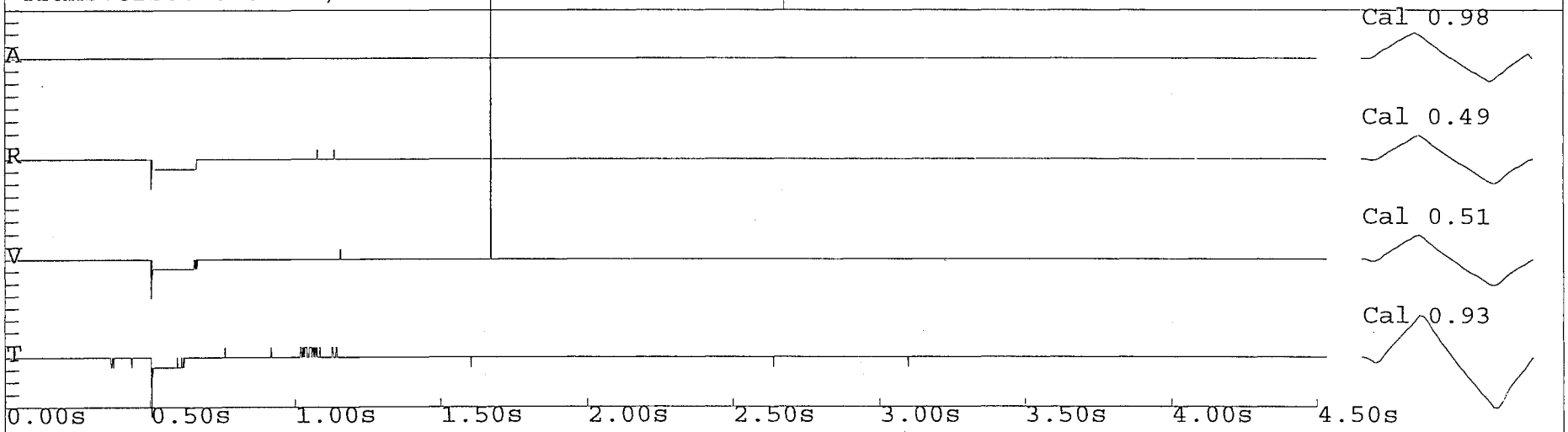
Event: 026 Date: 6/20/95 Time: 15:48
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

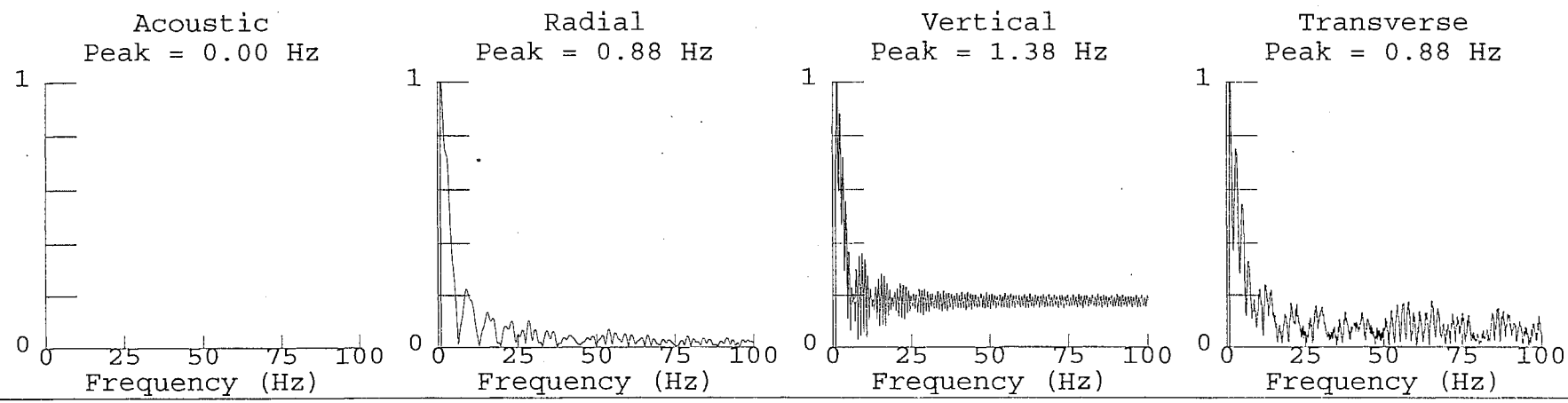
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



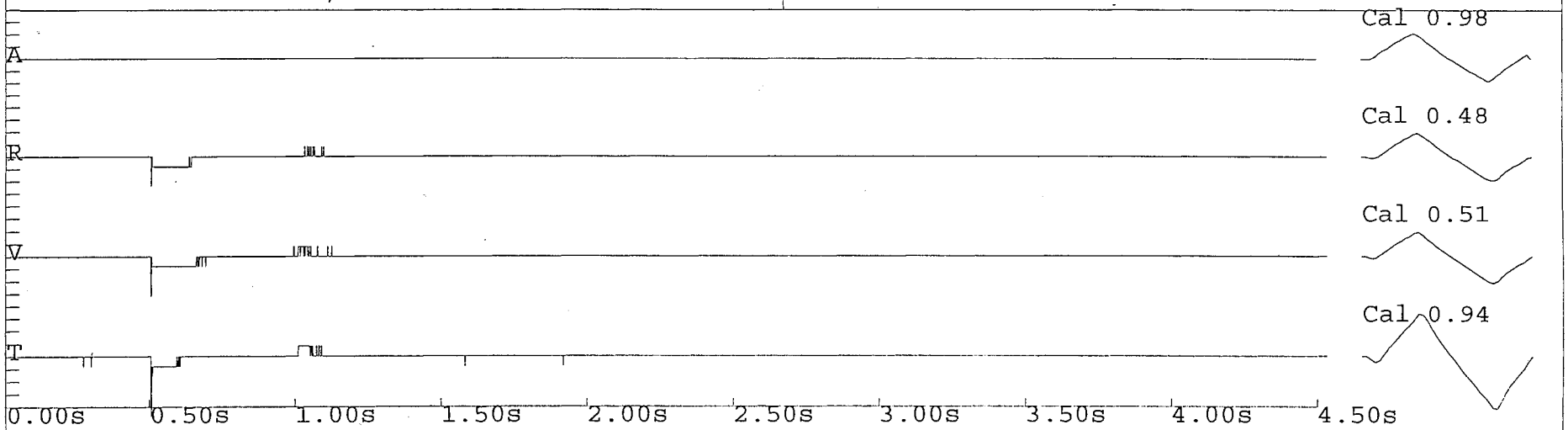
Fourier Analysis (Amplitude Spectrum)



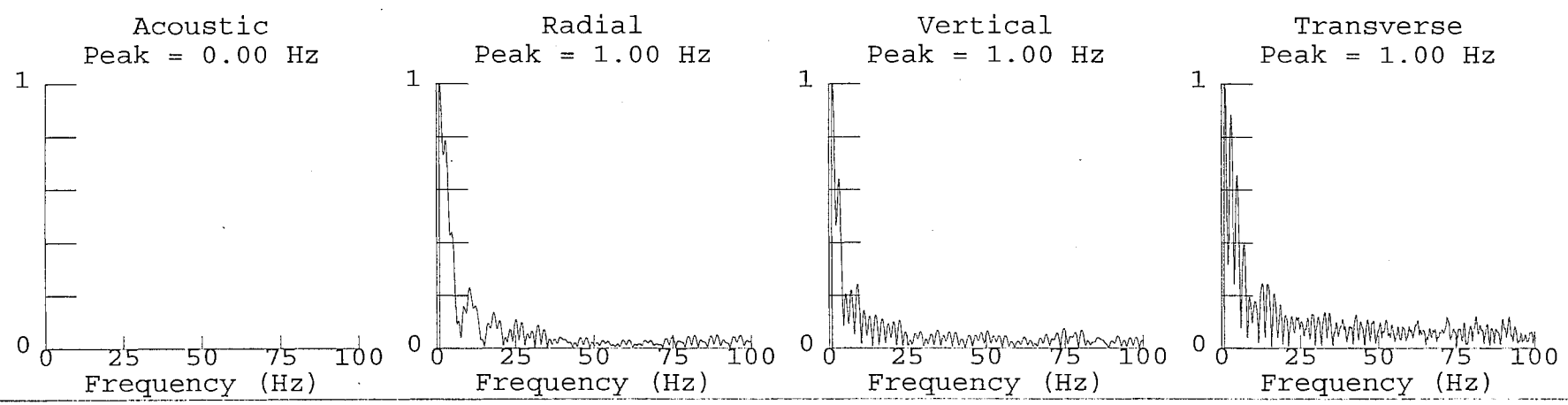
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 027 Date: 6/20/95 Time: 15:50
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



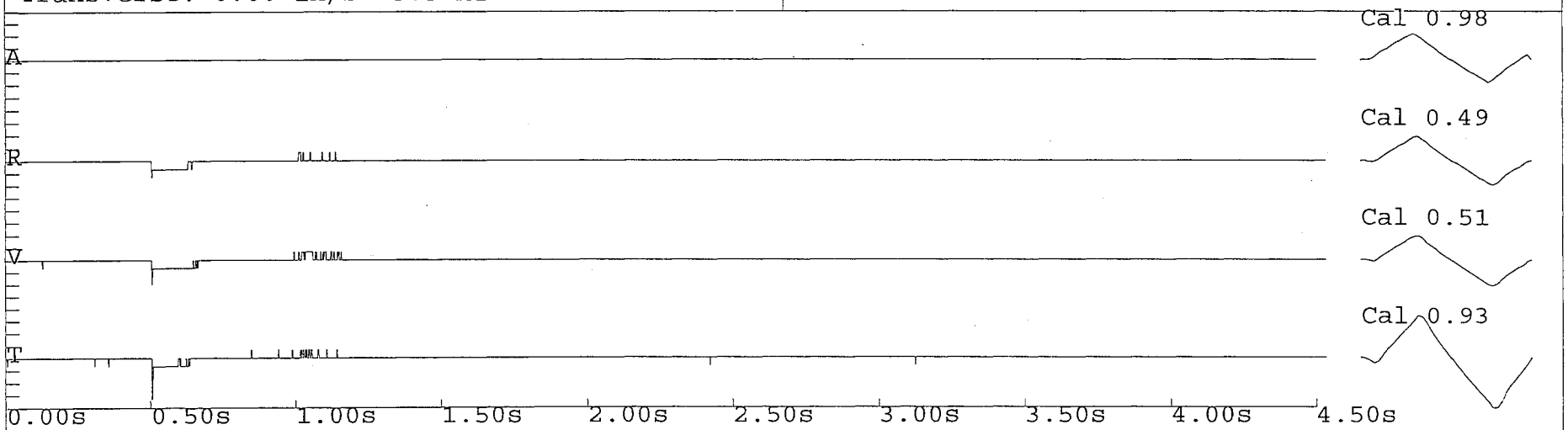
Fourier Analysis (Amplitude Spectrum)



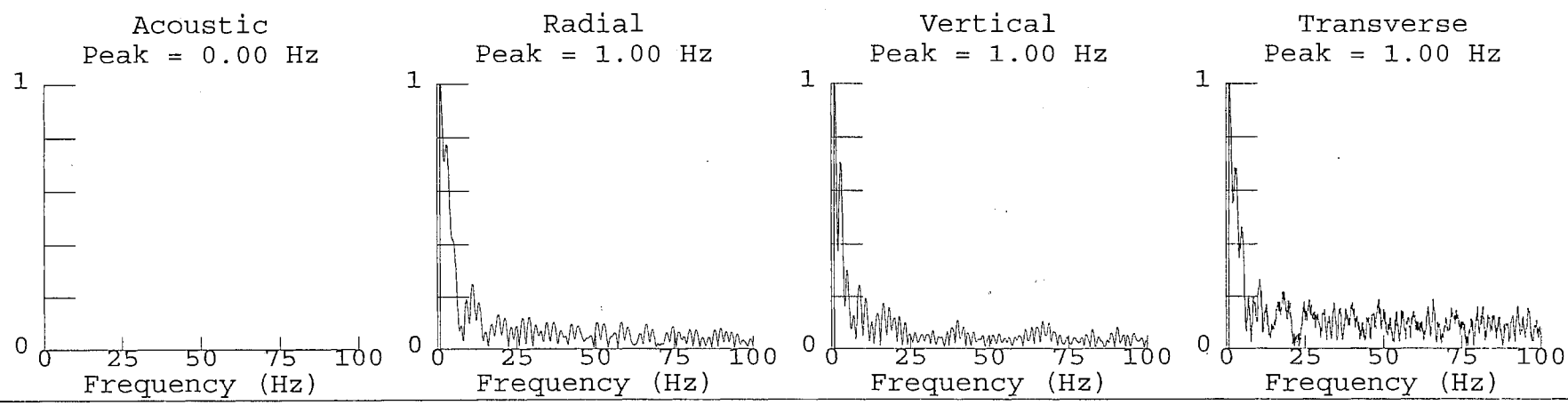
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 002 Date: 6/20/95 Time: 15:00
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 5.5 Hz.	Time Lines at: 0.50 sec intervals



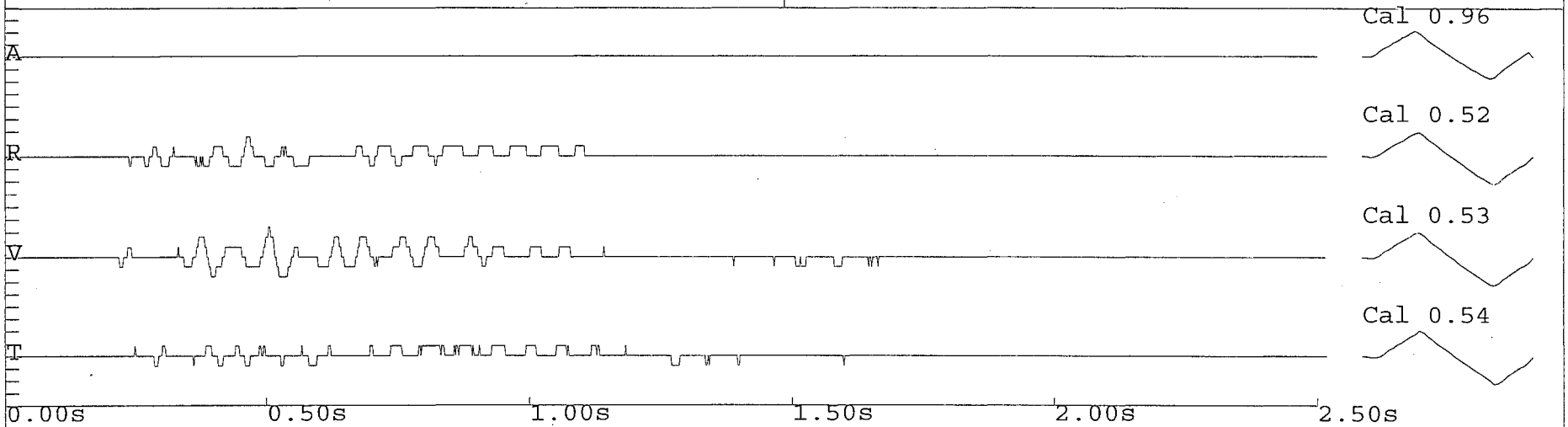
Fourier Analysis (Amplitude Spectrum)



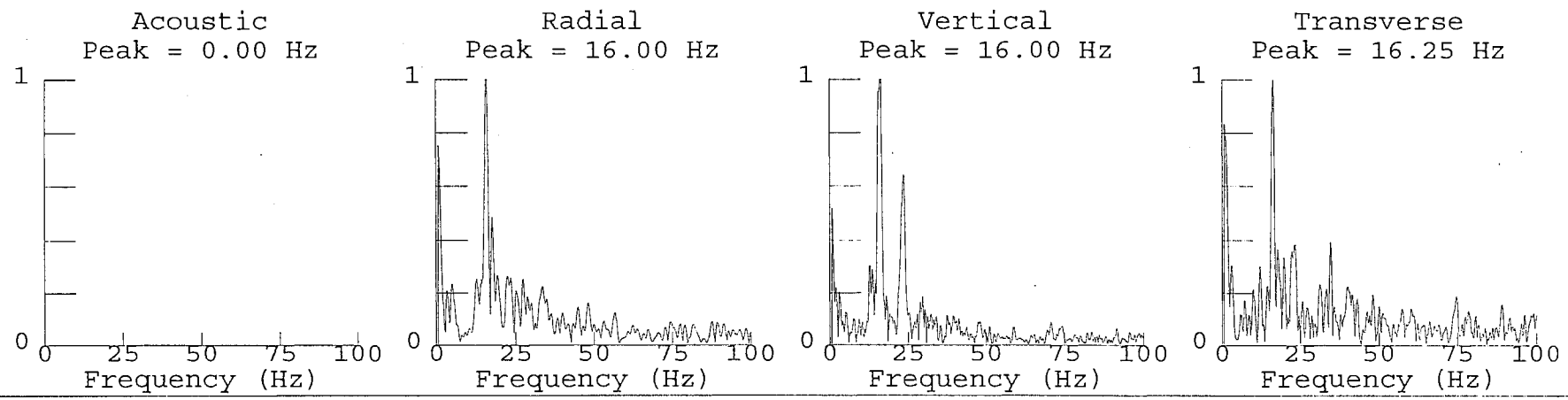
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 002 Date: 6/22/95 Time: 17:51
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



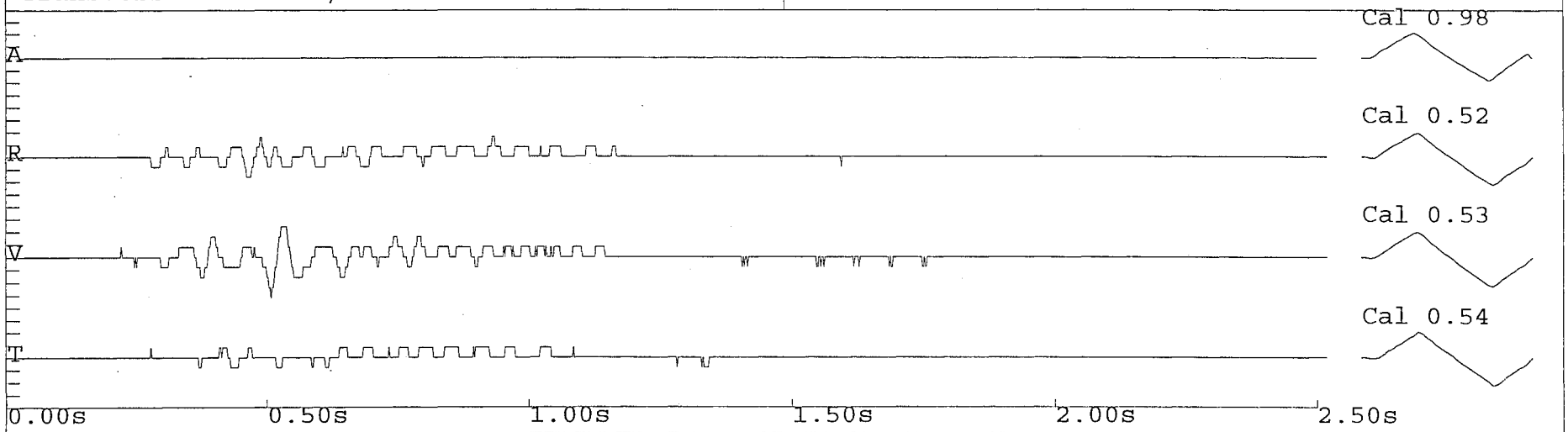
Fourier Analysis (Amplitude Spectrum)



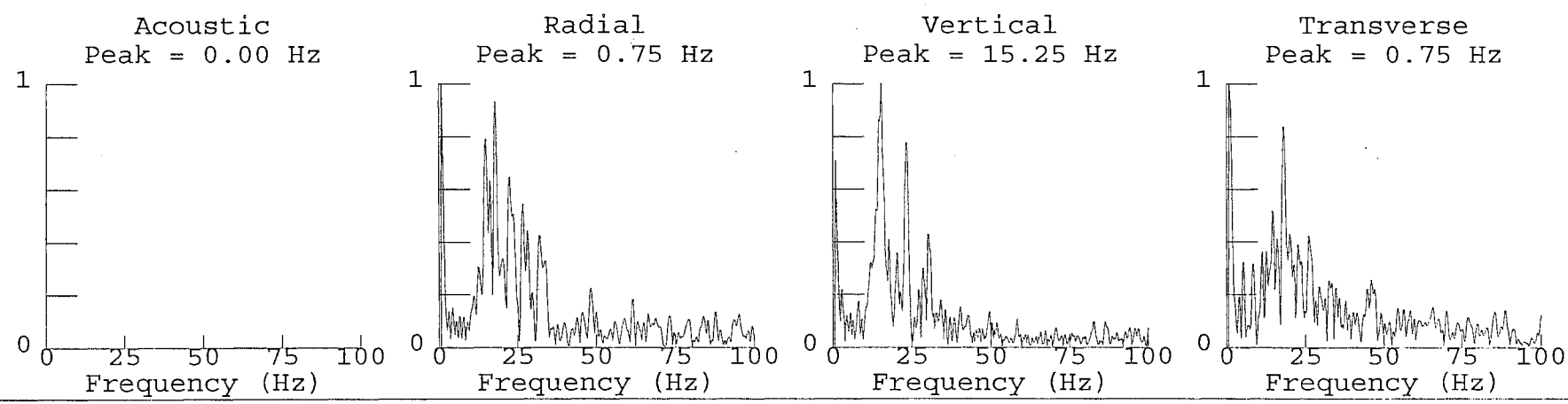
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 004 Date: 6/23/95 Time: 17:38
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 26.9 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



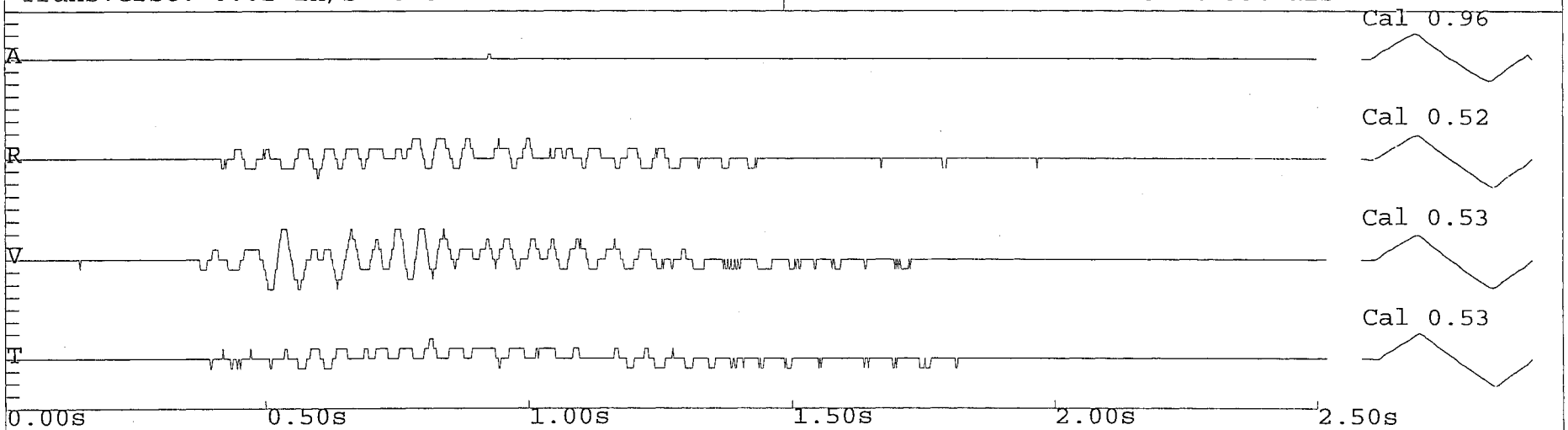
Fourier Analysis (Amplitude Spectrum)



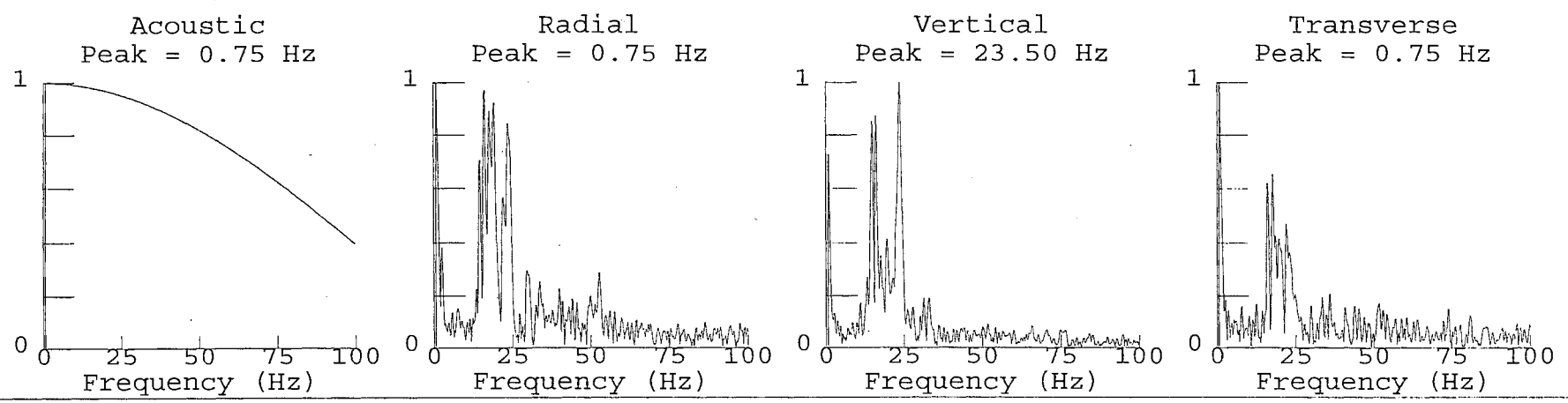
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 006 Date: 6/28/95 Time: 17:45
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



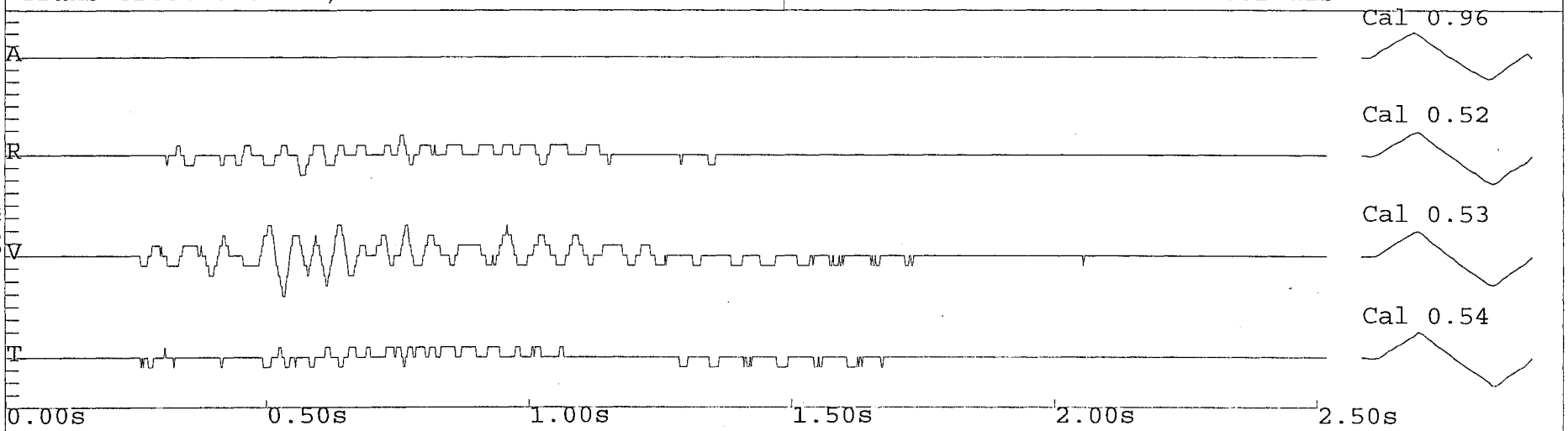
Fourier Analysis (Amplitude Spectrum)



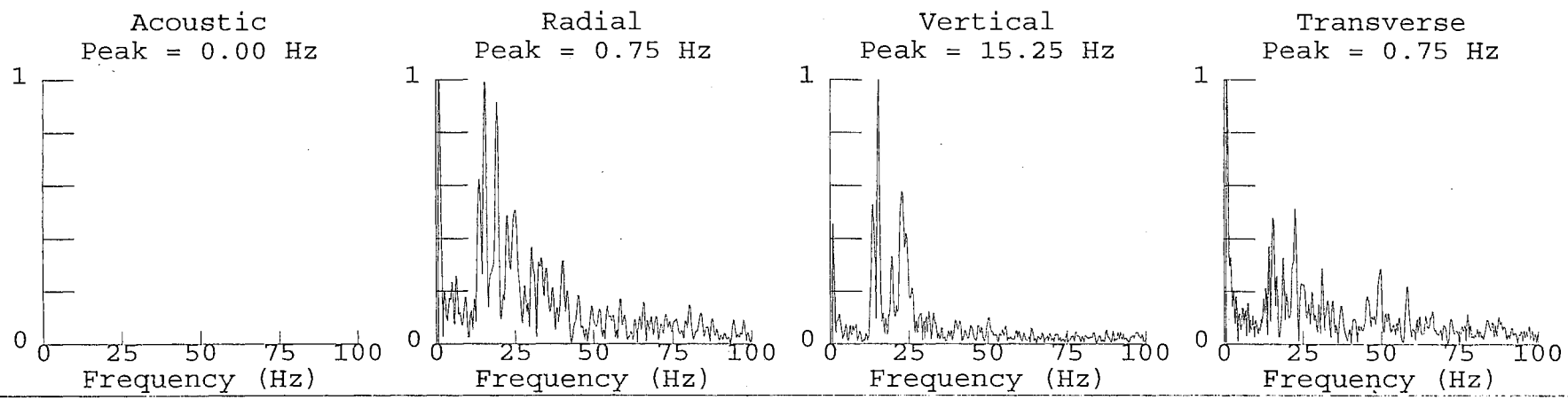
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 007 Date: 6/29/95 Time: 17:32
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 23.2 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



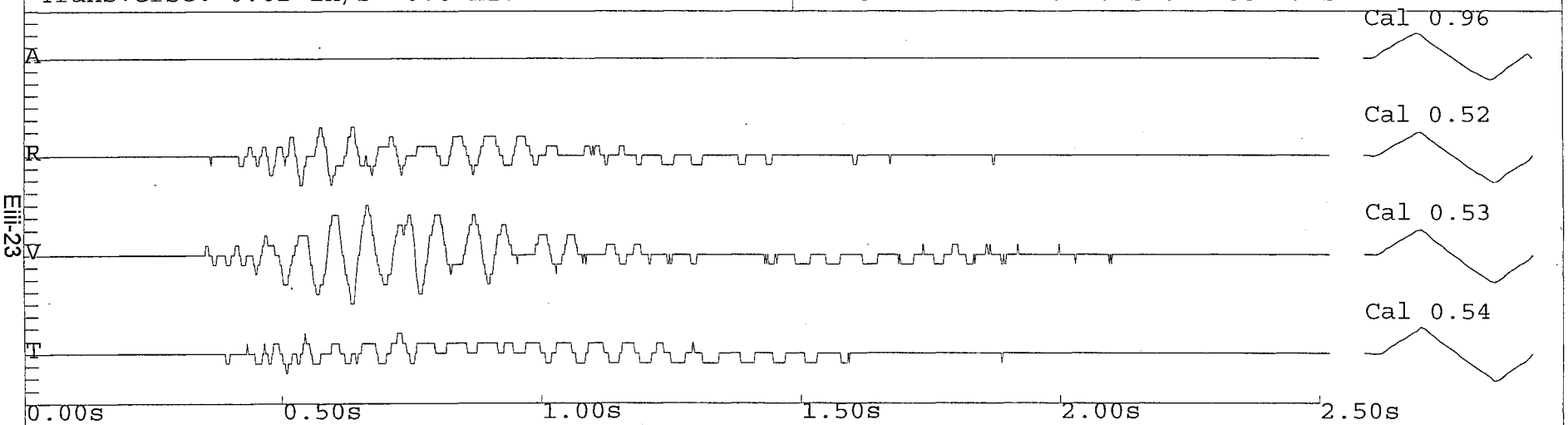
Fourier Analysis (Amplitude Spectrum)



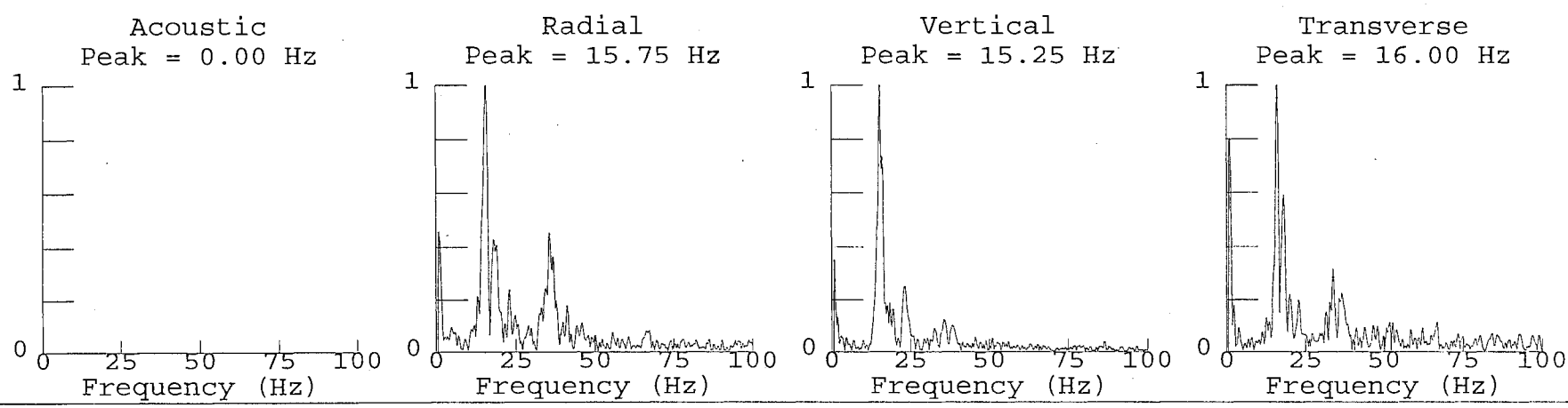
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 008 Date: 7/ 1/95 Time: 12:33
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 17.6 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



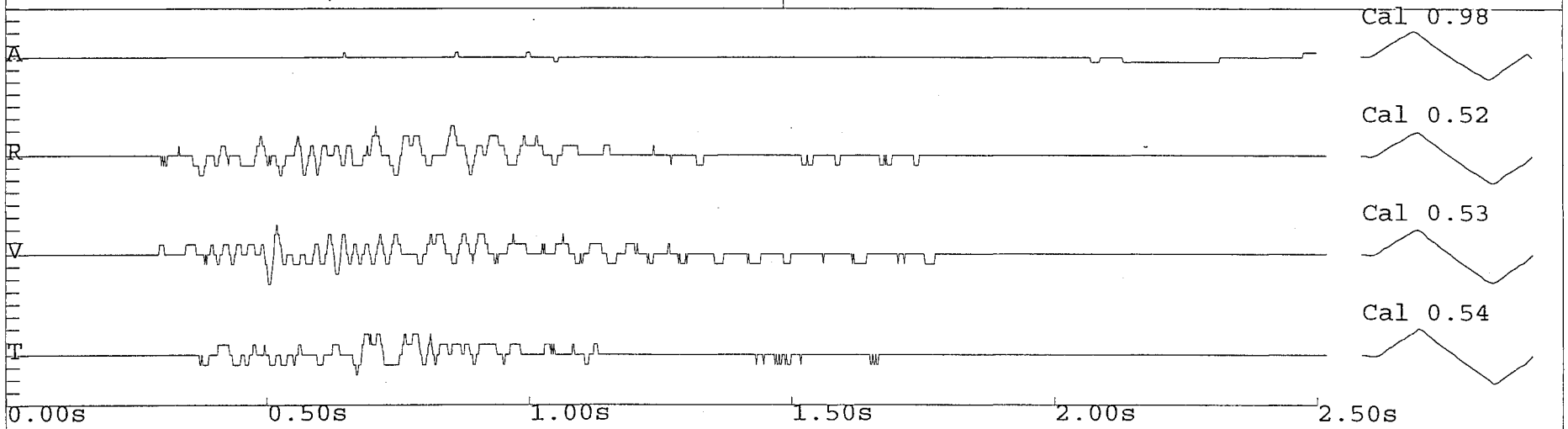
Fourier Analysis (Amplitude Spectrum)



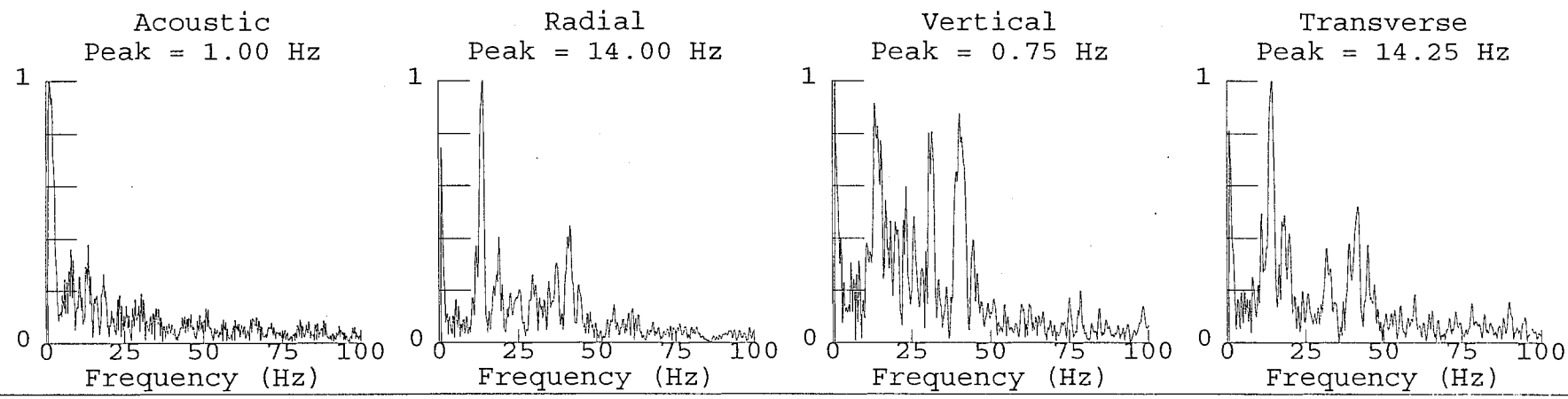
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 010 Date: 7/ 5/95 Time: 17:24
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



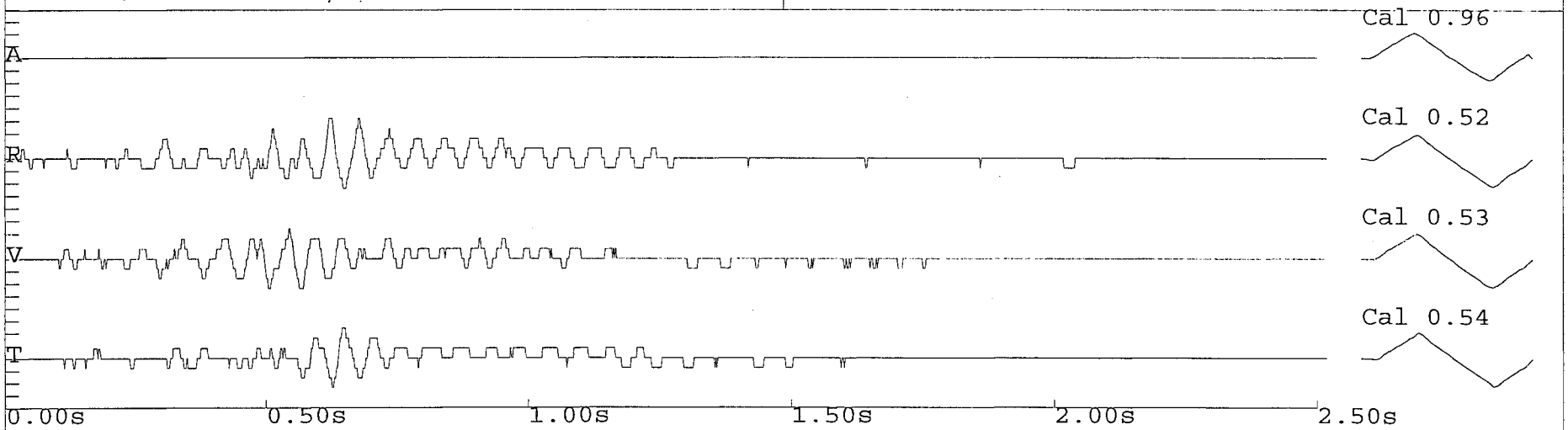
Fourier Analysis (Amplitude Spectrum)



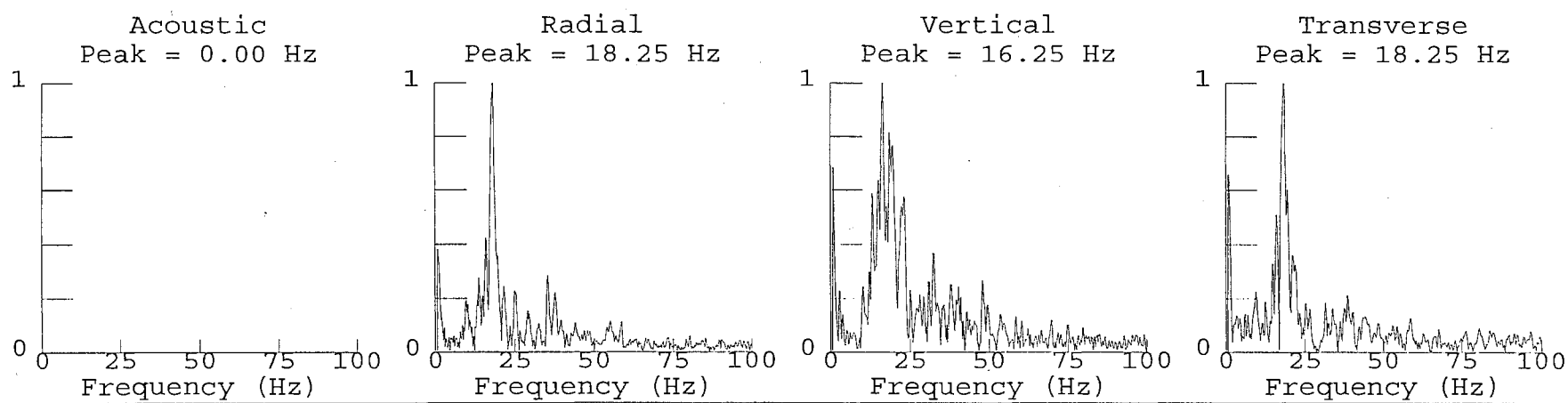
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 011 Date: 7/ 6/95 Time: 18:20
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.04 in/s 26.9 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



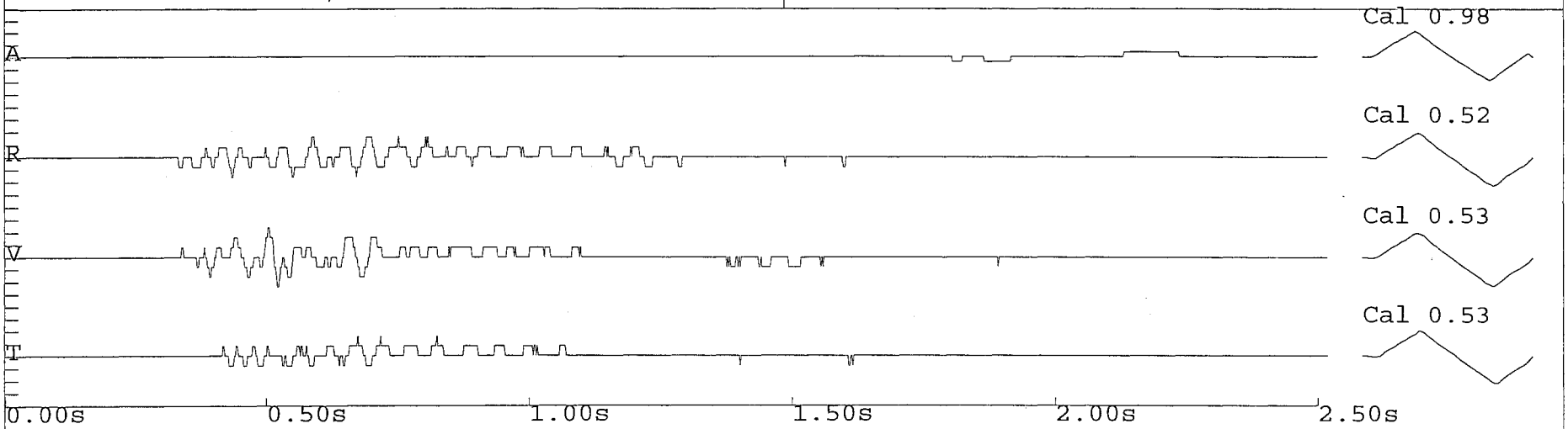
Fourier Analysis (Amplitude Spectrum)



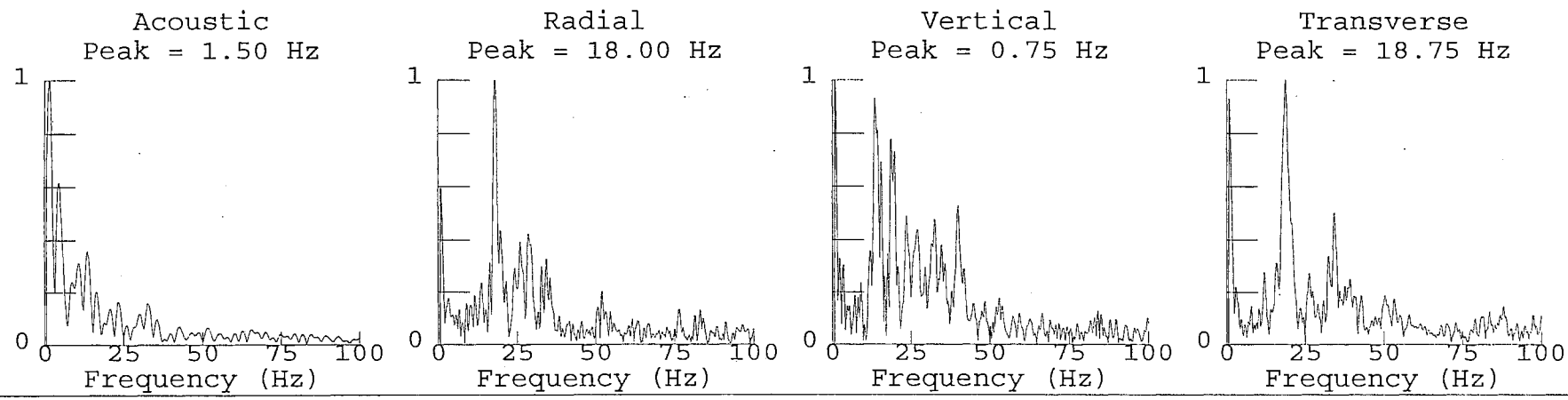
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 012 Date: 7/ 7/95 Time: 17:49
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



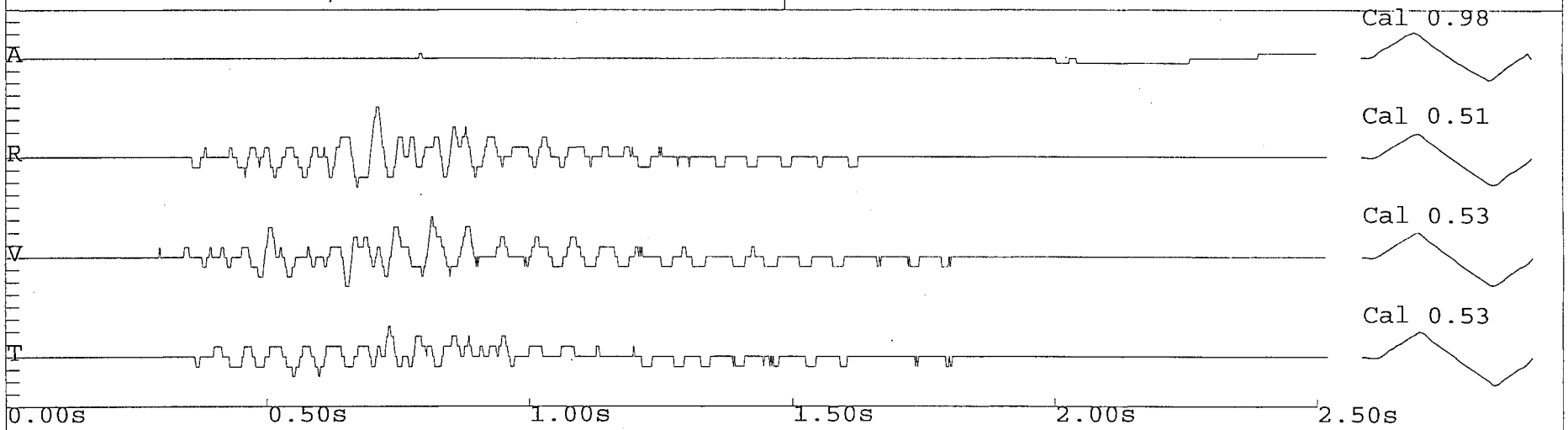
Fourier Analysis (Amplitude Spectrum)



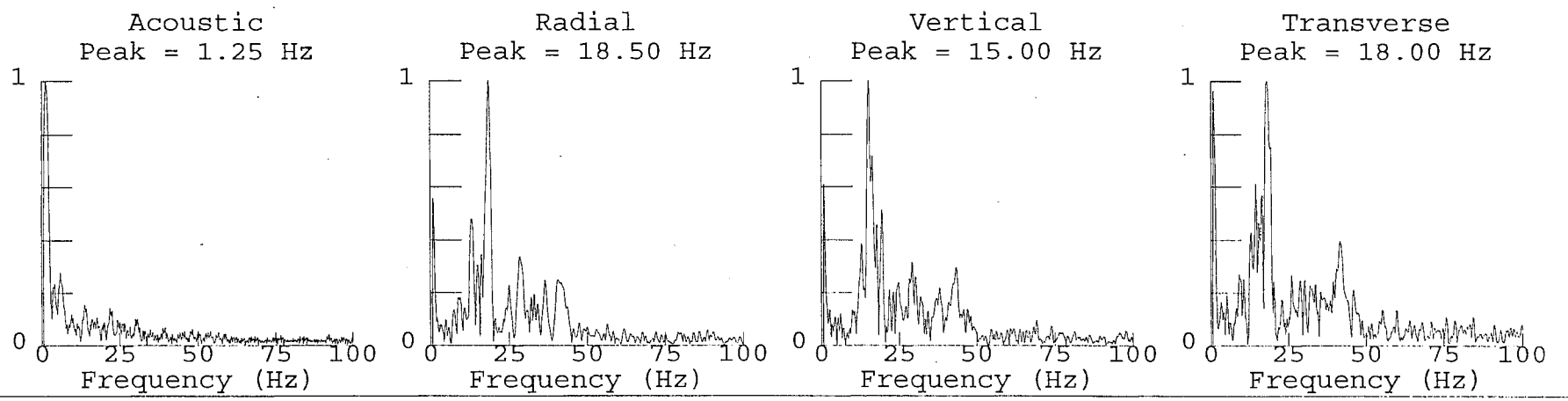
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 013 Date: 7/10/95 Time: 17:21
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.05 in/s 22.2 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 16.5 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



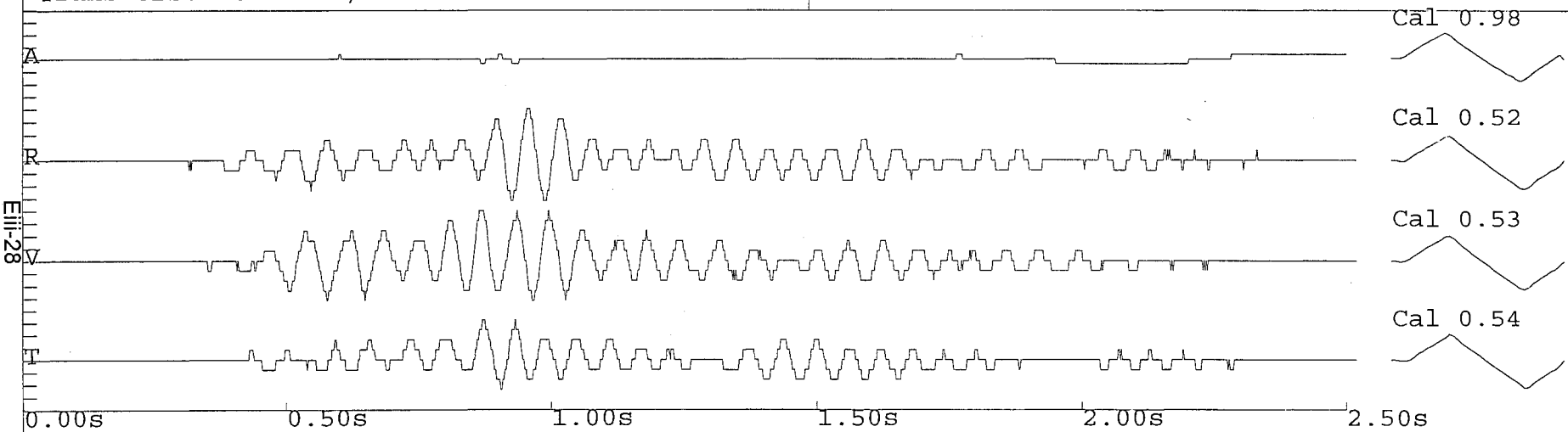
Fourier Analysis (Amplitude Spectrum)



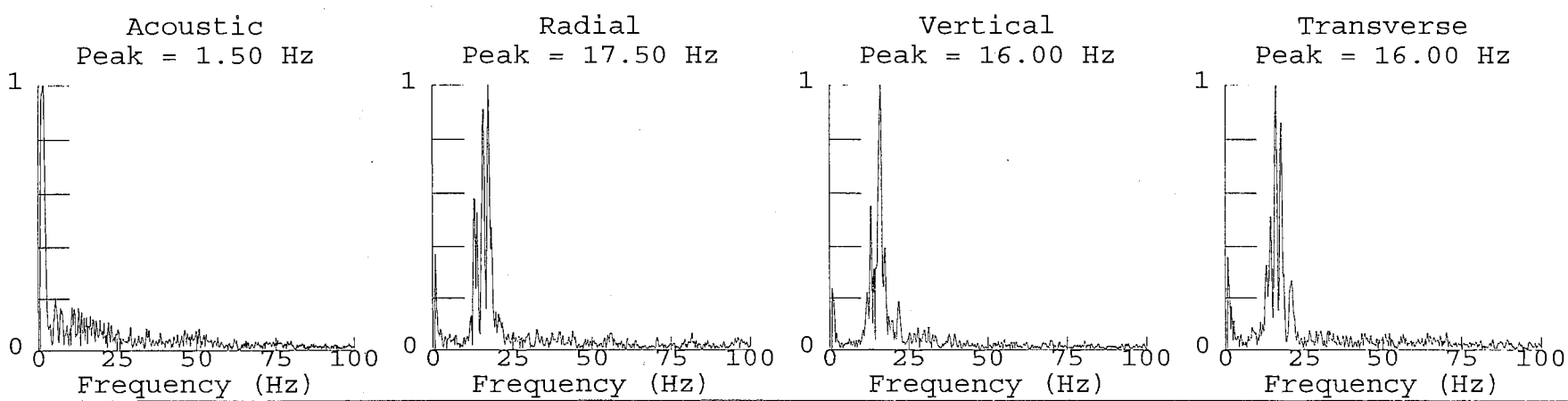
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 014 Date: 7/11/95 Time: 17:29
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.05 in/s 17.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 18.2 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 17.6 Hz.	Time Lines at: 0.50 sec intervals



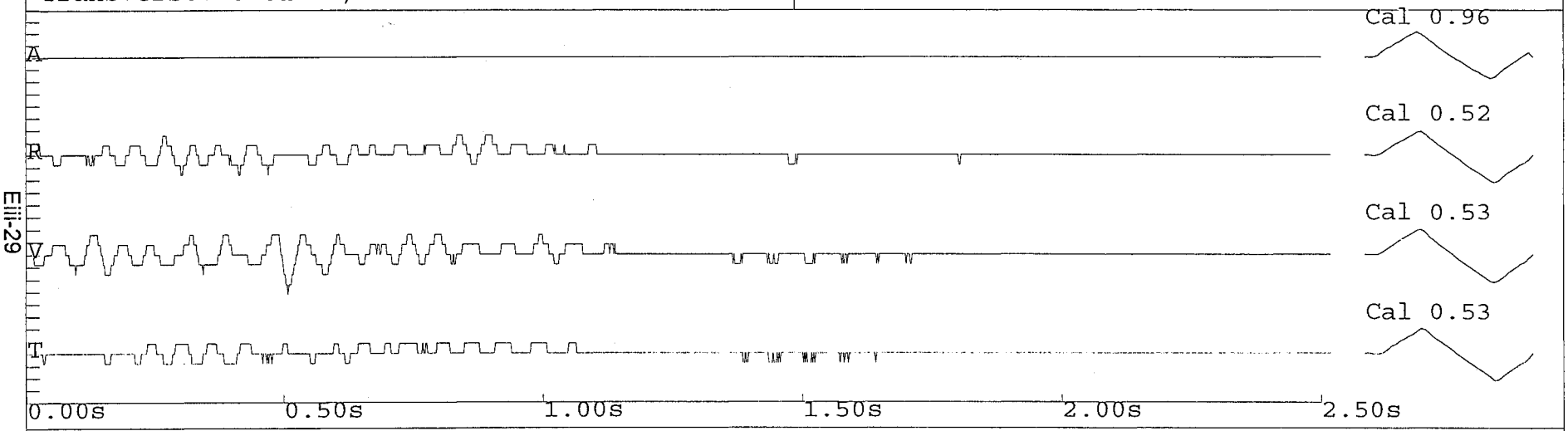
Fourier Analysis (Amplitude Spectrum)



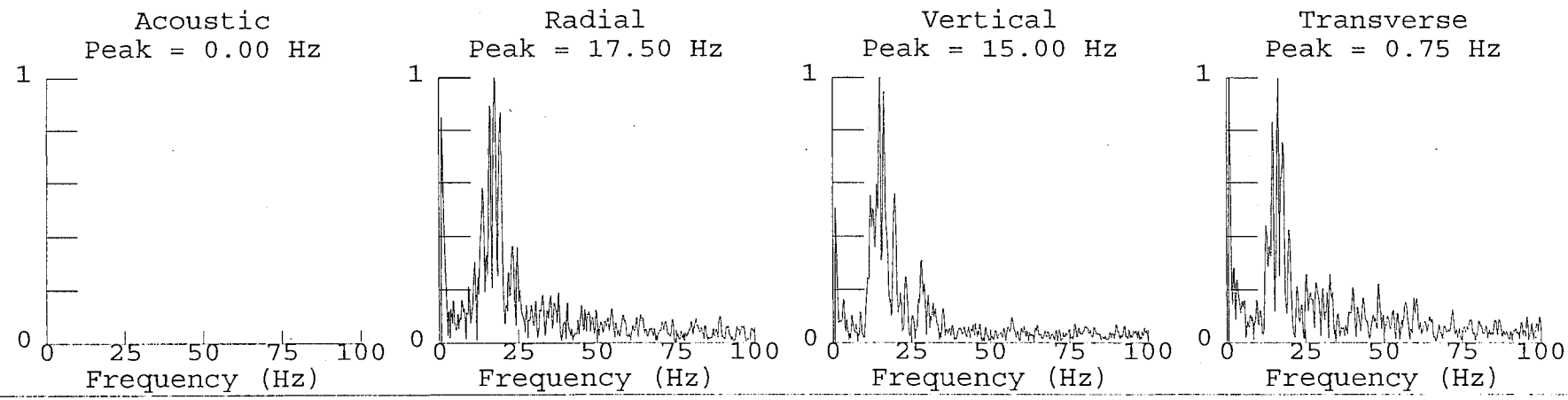
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 015 Date: 7/12/95 Time: 17:40
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 22.2 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



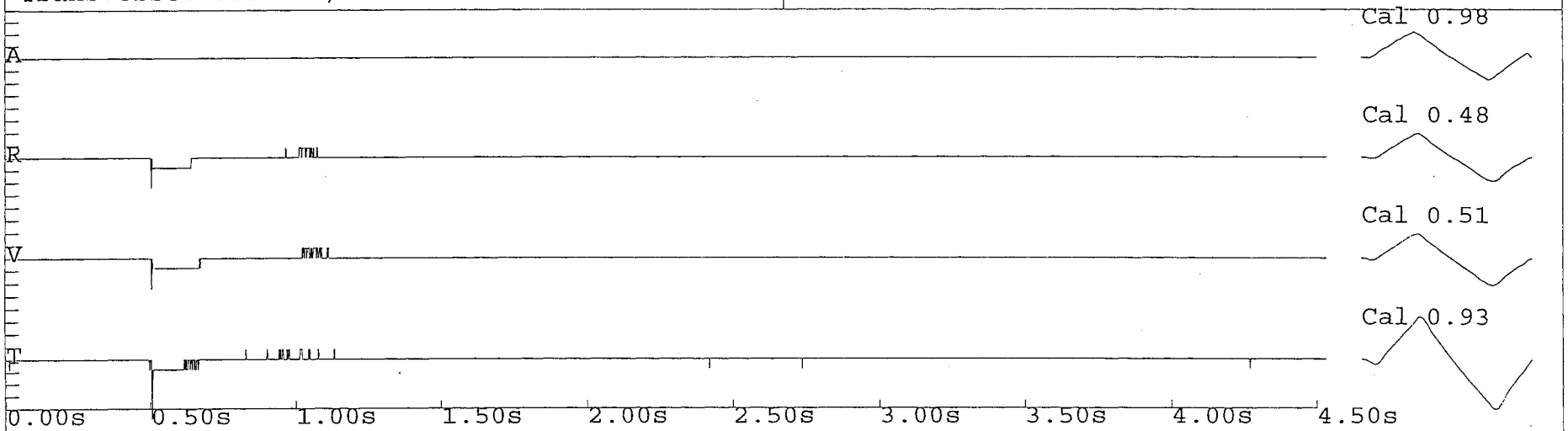
Fourier Analysis (Amplitude Spectrum)



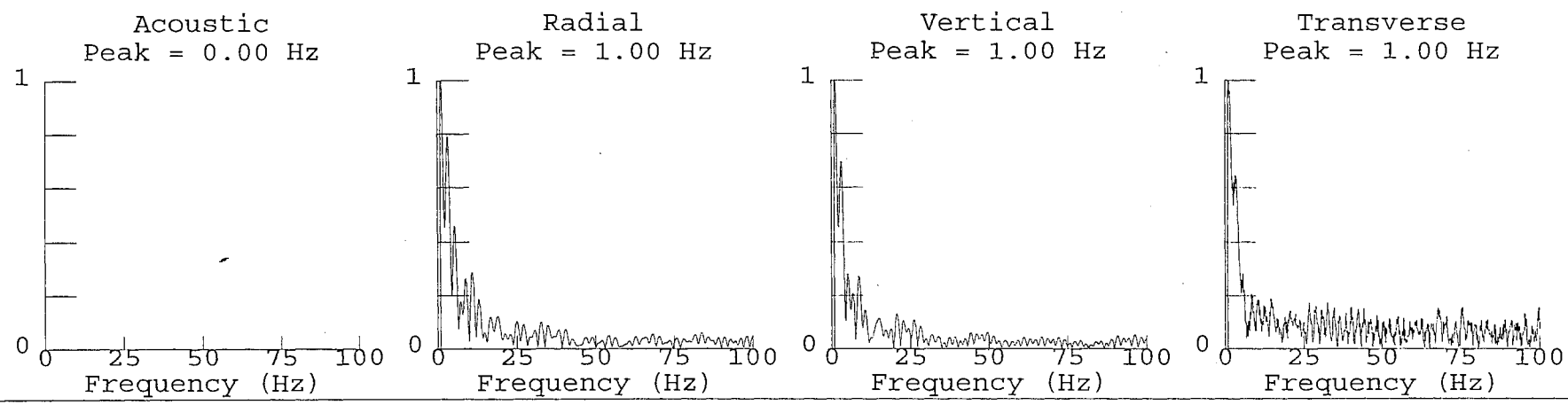
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 014 Date: 6/20/95 Time: 15:24
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



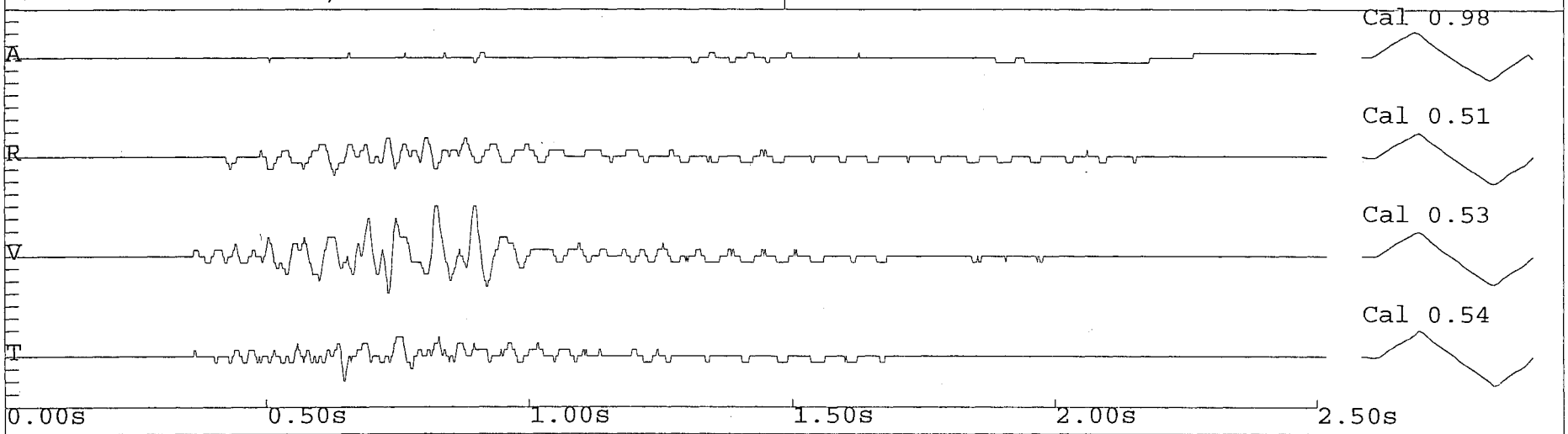
Fourier Analysis (Amplitude Spectrum)



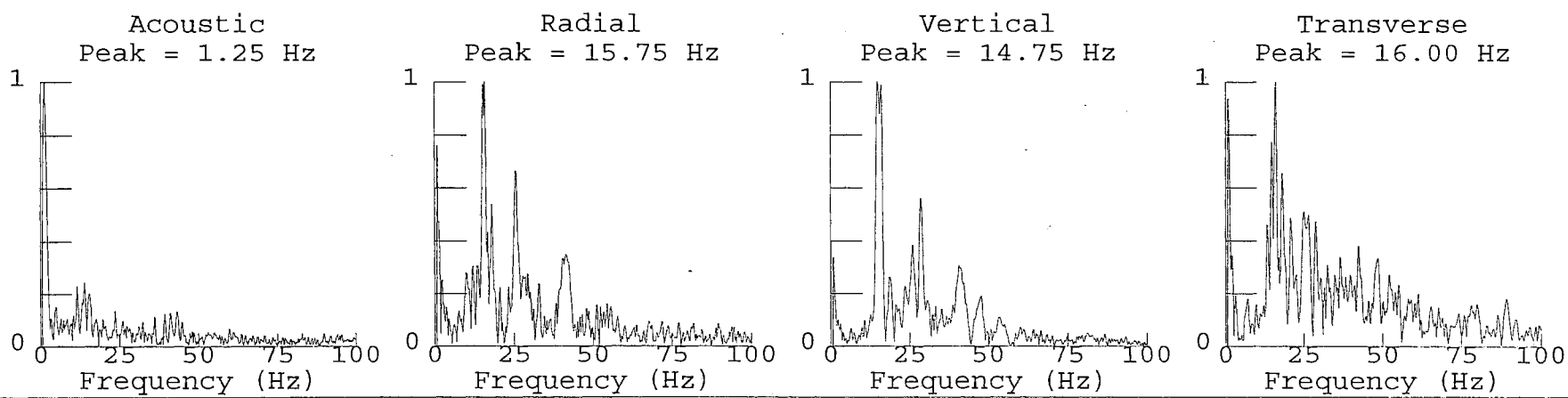
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 017 Date: 7/14/95 Time: 16:16
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.08 in/s 22.2 Hz.	Seis: 0.08 in/s (0.02 in/s/div)
Transverse: 0.04 in/s 39.3 Hz.	Time Lines at: 0.50 sec intervals



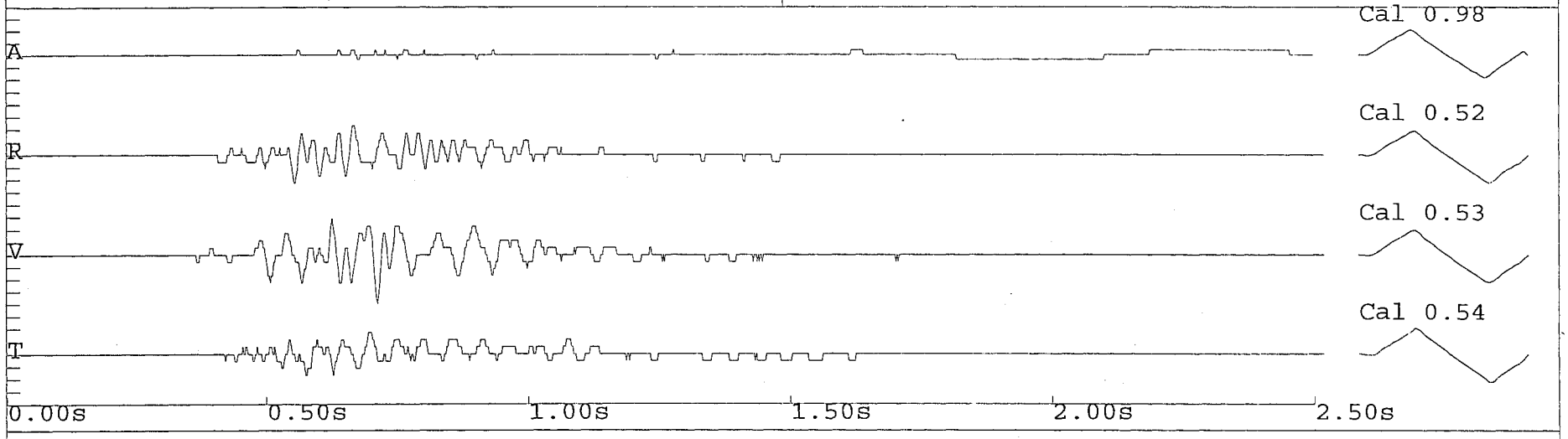
Fourier Analysis (Amplitude Spectrum)



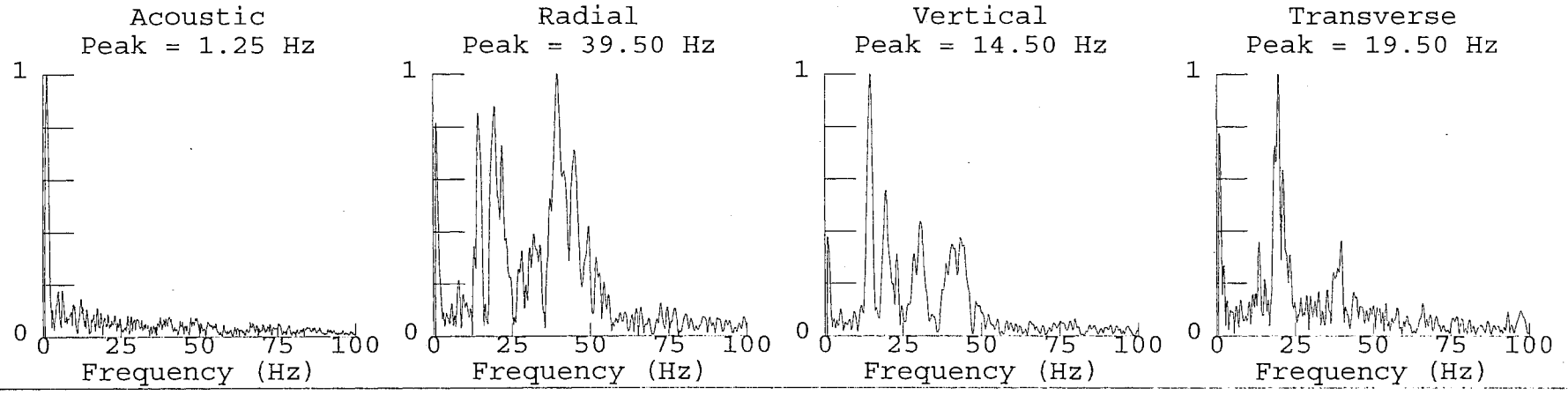
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 018 Date: 7/15/95 Time: 14:28
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.04 in/s 32.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.07 in/s 34.1 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



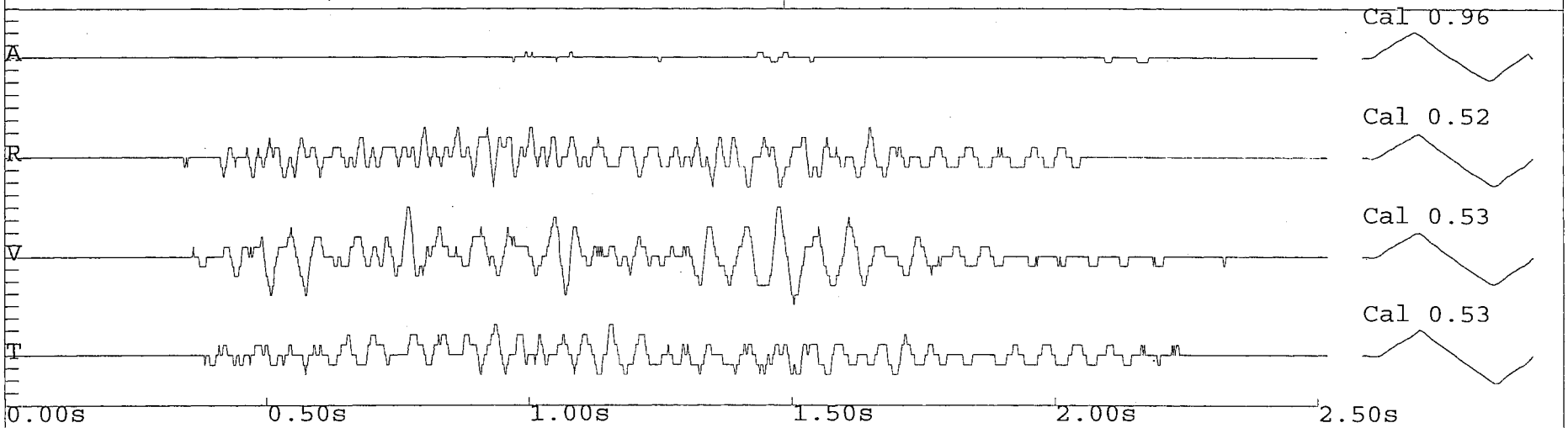
Fourier Analysis (Amplitude Spectrum)



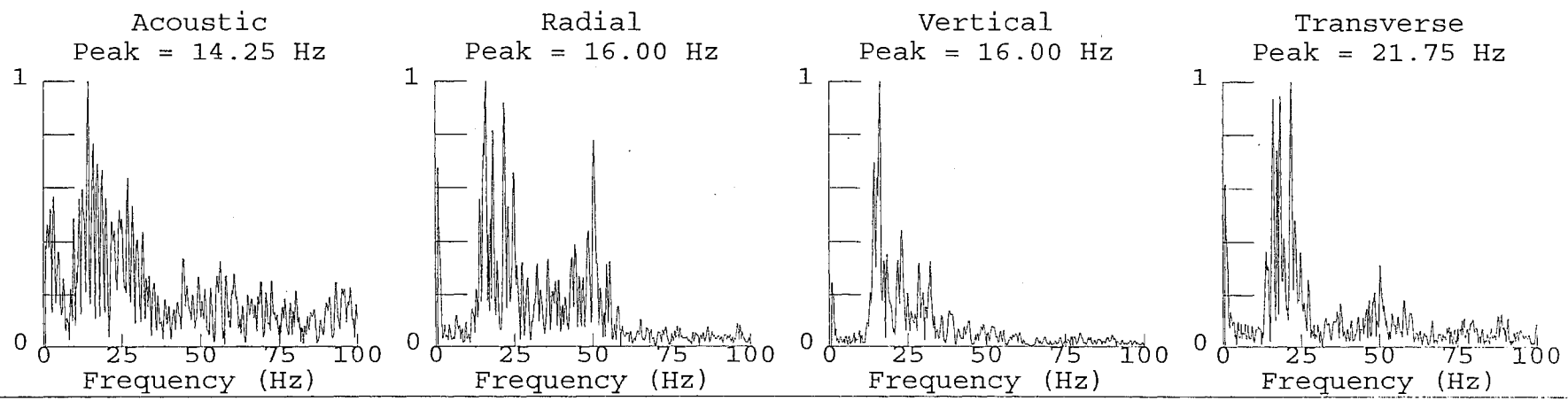
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 019 Date: 7/17/95 Time: 16:34
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 26.9 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



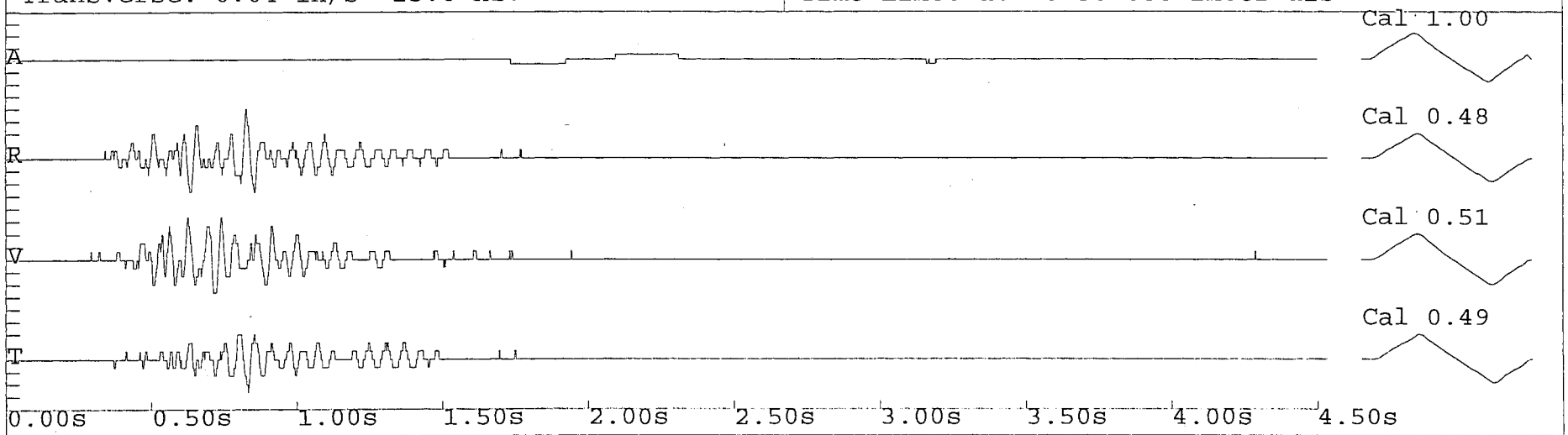
Fourier Analysis (Amplitude Spectrum)



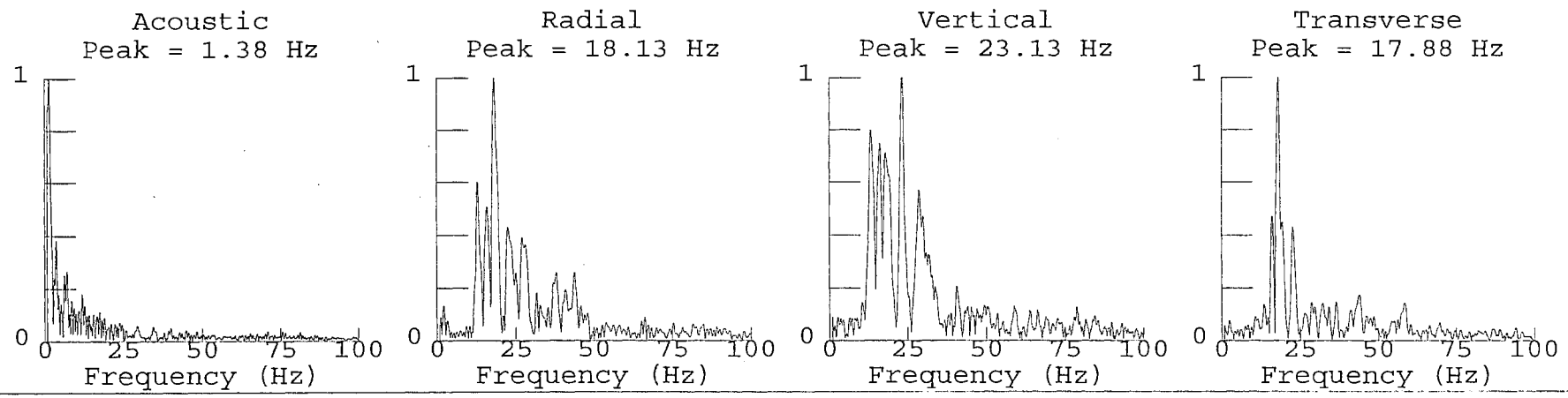
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 103 Date: 7/18/95 Time: 16:51
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.06 in/s 22.2 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 23.2 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.04 in/s 25.6 Hz.	Time Lines at: 0.50 sec intervals



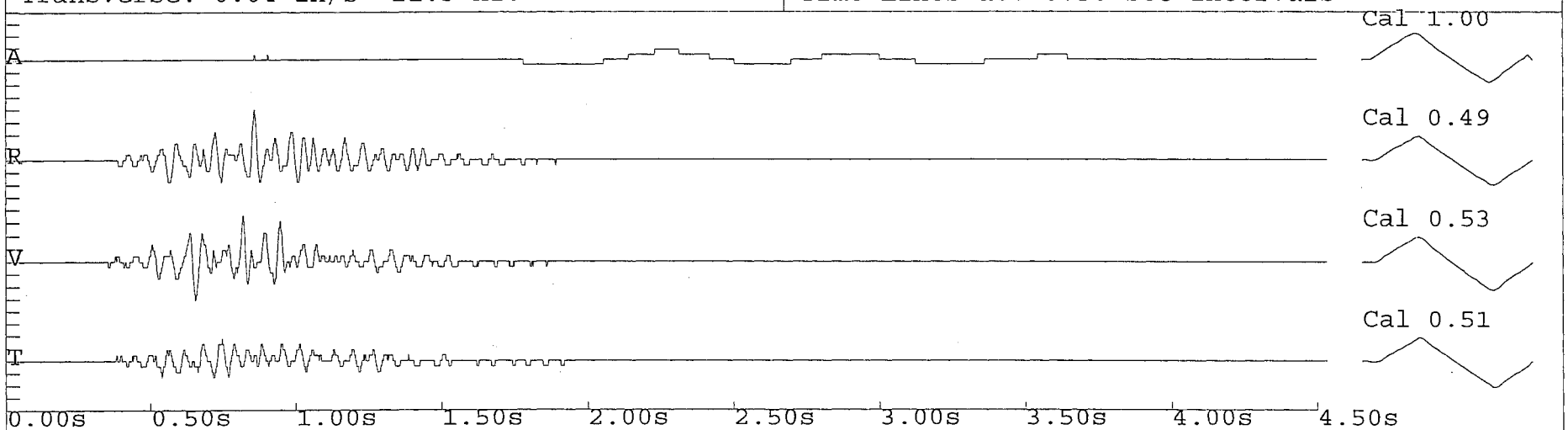
Fourier Analysis (Amplitude Spectrum)



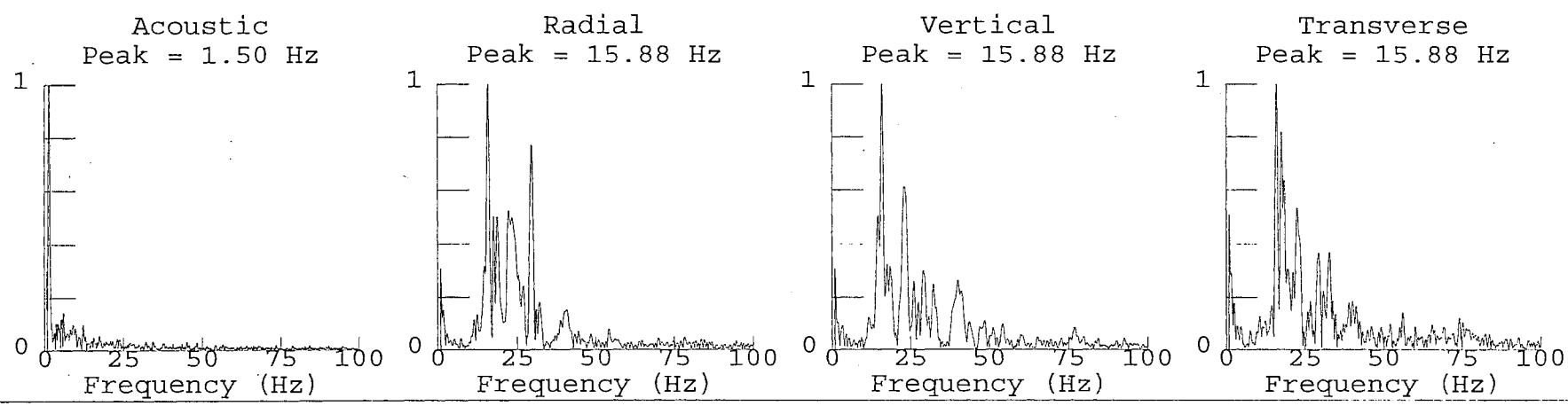
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 104 Date: 7/19/95 Time: 16:48
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.09 in/s 24.3 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.08 in/s 26.9 Hz.	Seis: 0.09 in/s (0.0225 in/s/div)
Transverse: 0.04 in/s 21.3 Hz.	Time Lines at: 0.50 sec intervals



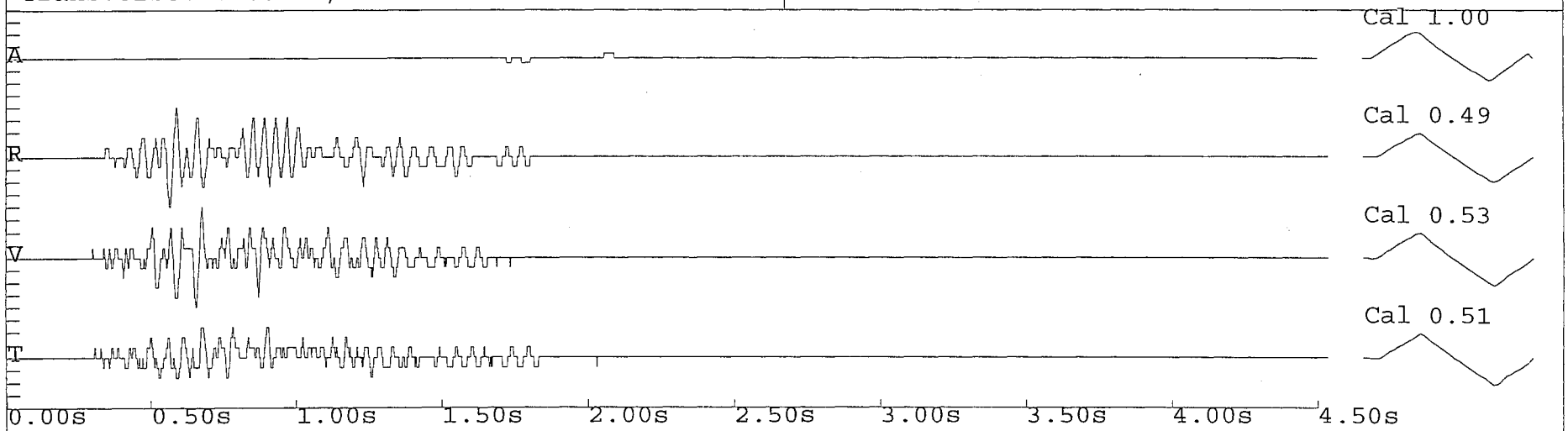
Fourier Analysis (Amplitude Spectrum)



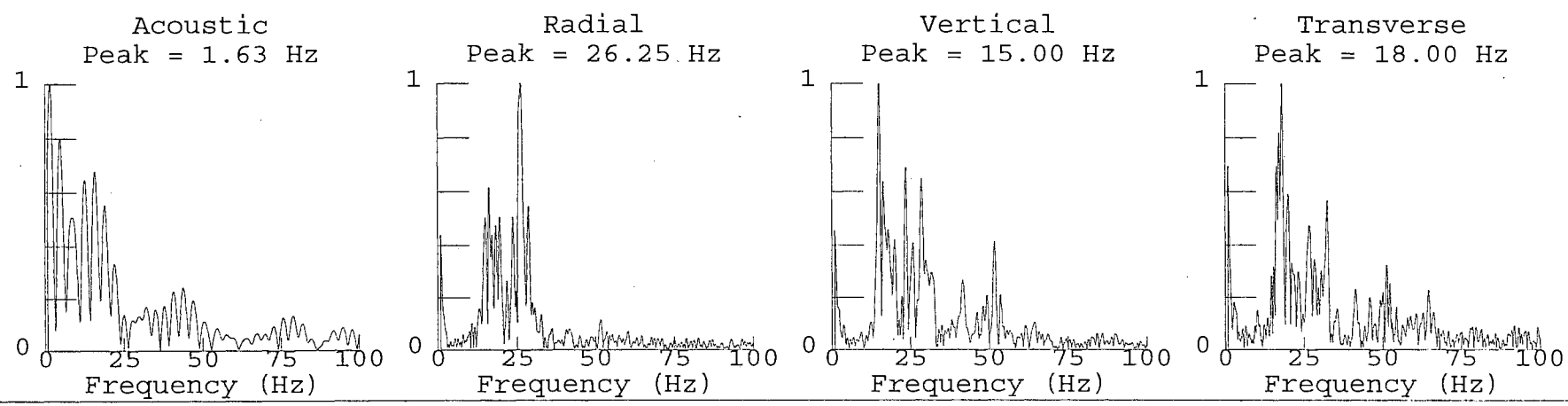
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 105 Date: 7/25/95 Time: 16:27
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.05 in/s 25.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 28.4 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



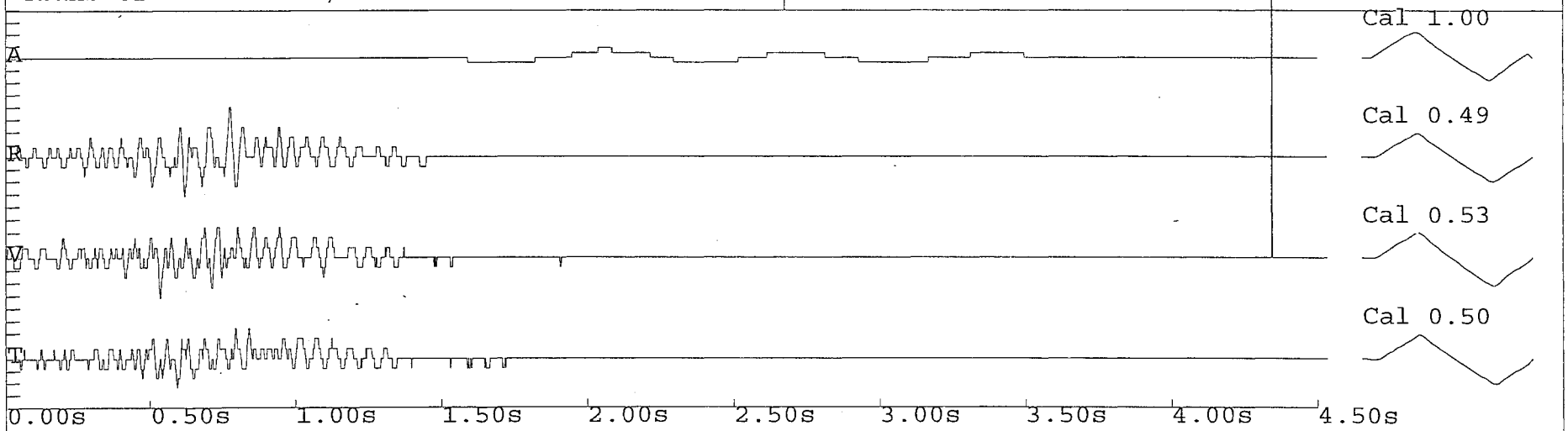
Fourier Analysis (Amplitude Spectrum)



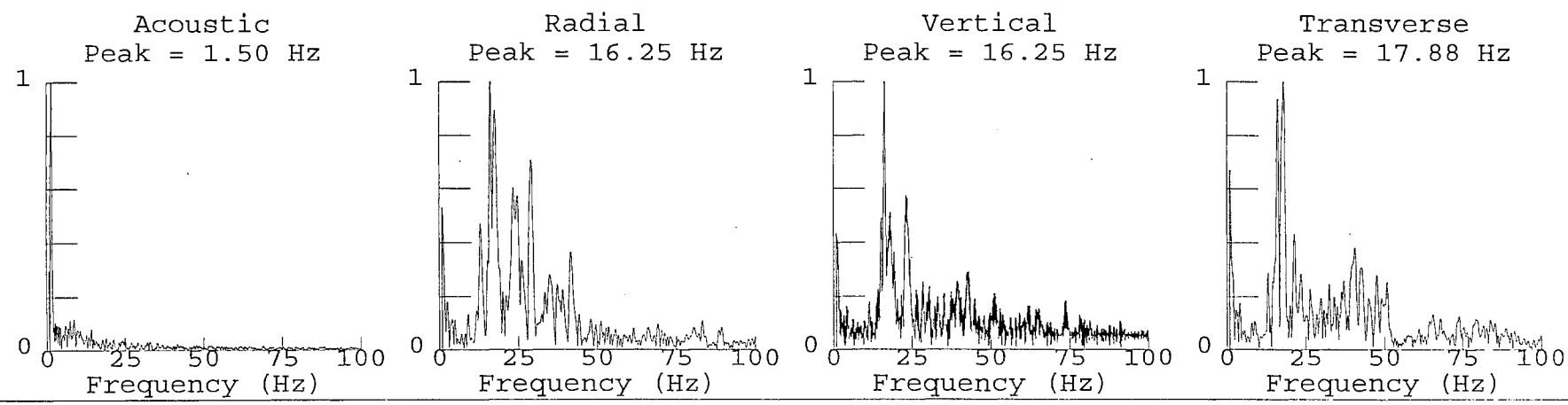
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 106 Date: 7/26/95 Time: 16:21
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.05 in/s 24.3 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 26.9 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



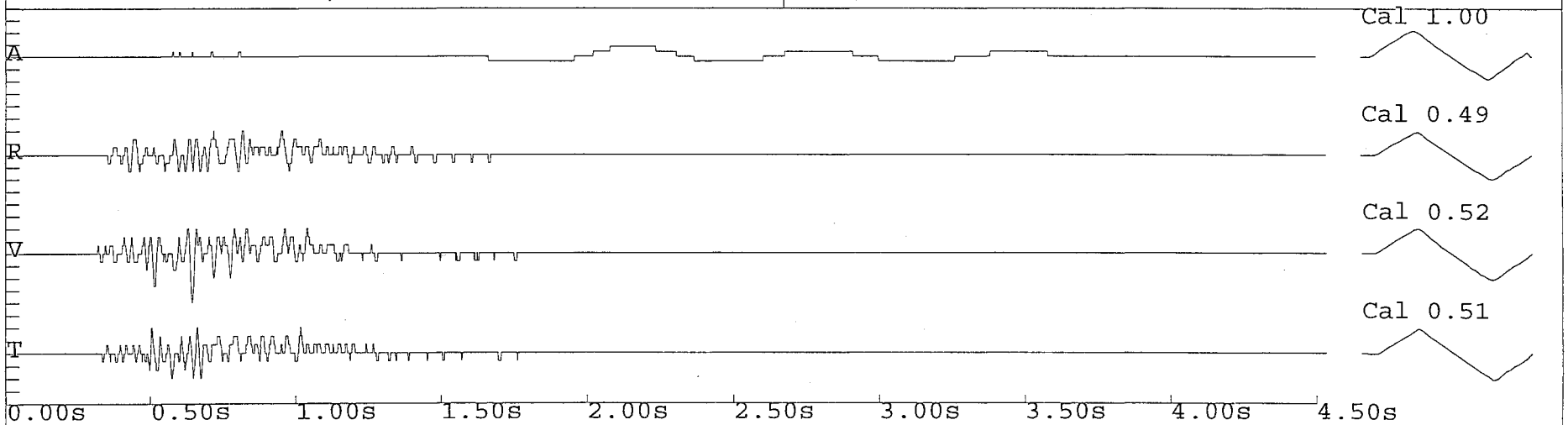
Fourier Analysis (Amplitude Spectrum)



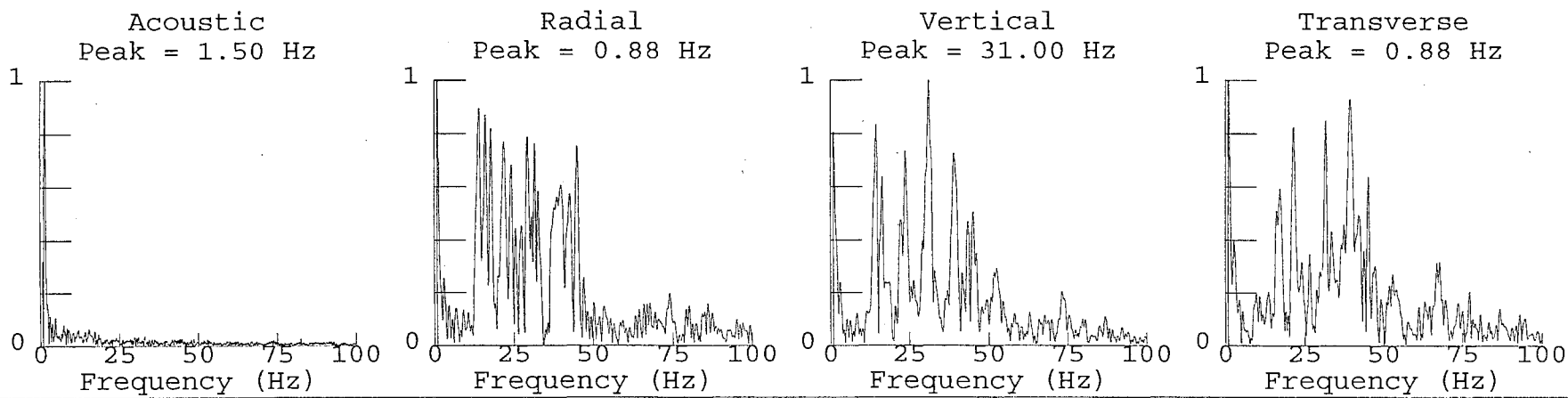
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 107 Date: 7/28/95 Time: 10:09
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.06 in/s 34.1 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



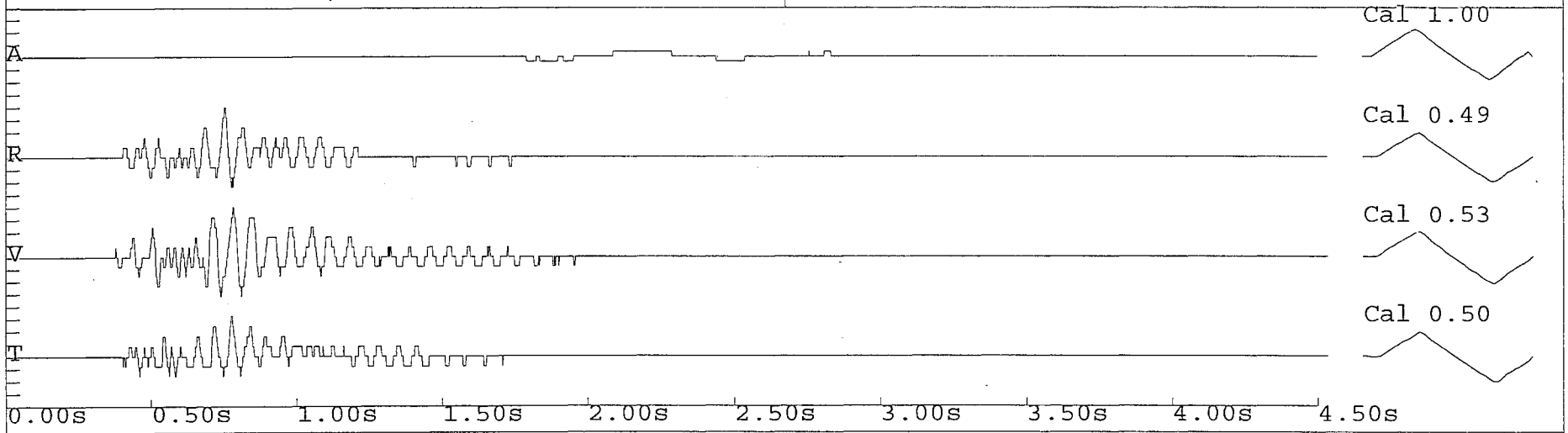
Fourier Analysis (Amplitude Spectrum)



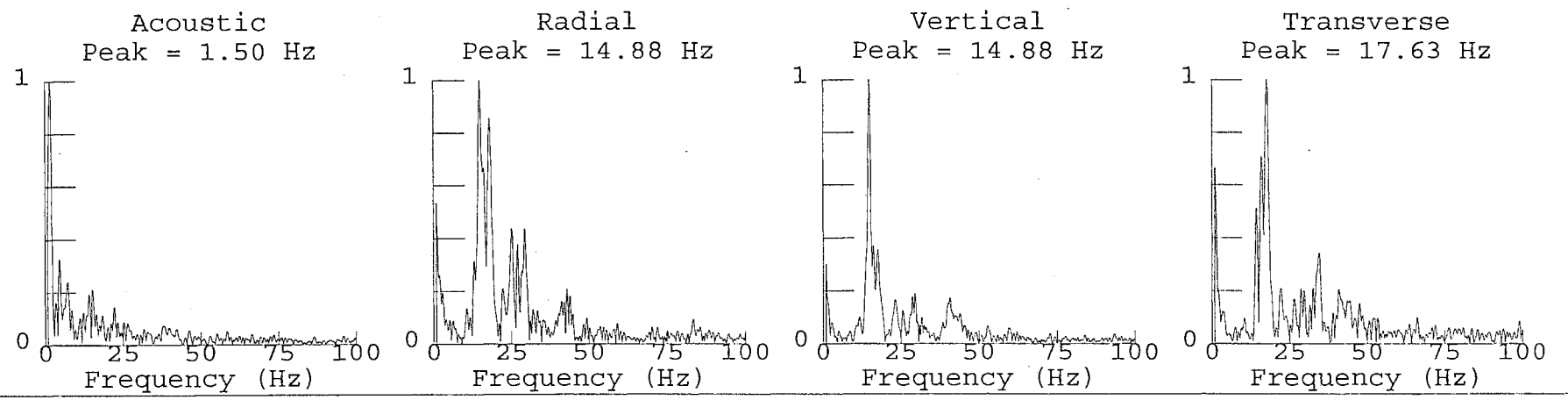
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 108 Date: 7/28/95 Time: 16:10
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.05 in/s 20.4 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 17.6 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 22.2 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

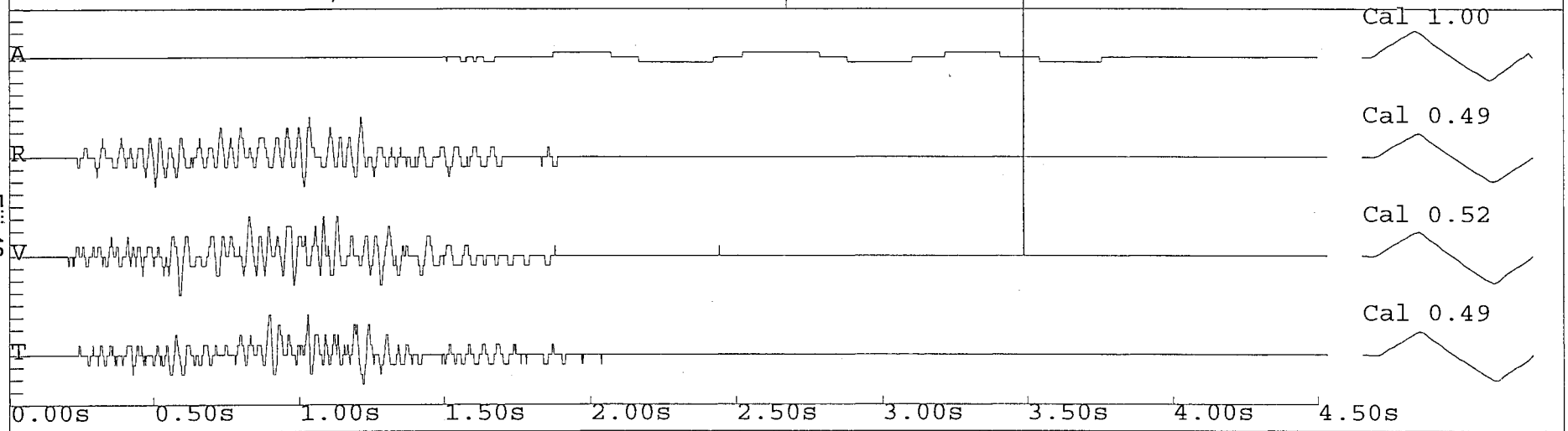
Event: 109 Date: 7/31/95 Time: 16:47
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

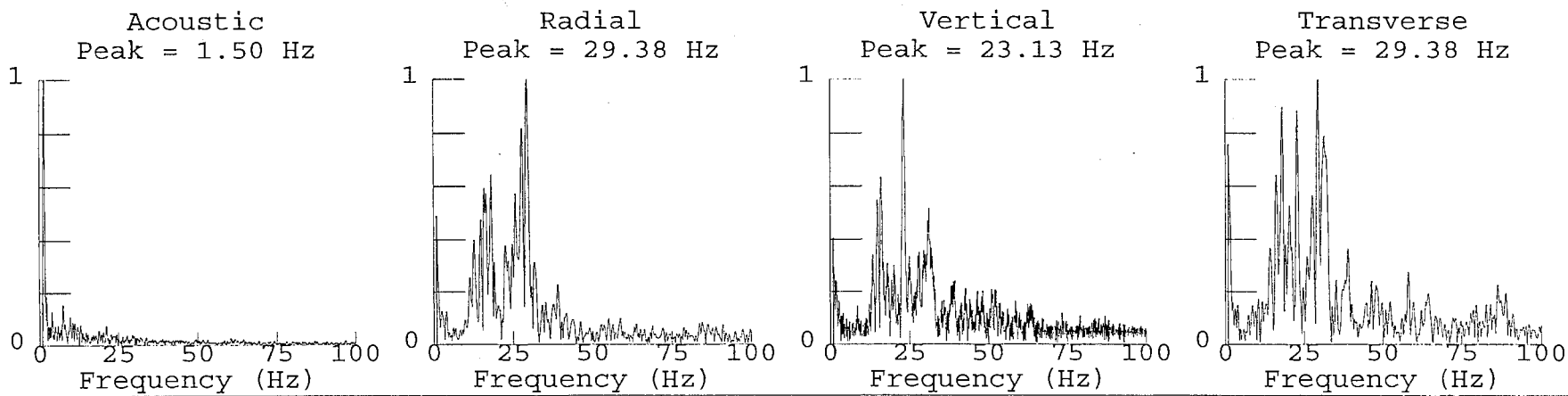
Acoustic: 100 dB 0.0 Hz.
Radial: 0.04 in/s 19.6 Hz.
Vertical: 0.04 in/s 25.6 Hz.
Transverse: 0.04 in/s 30.1 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



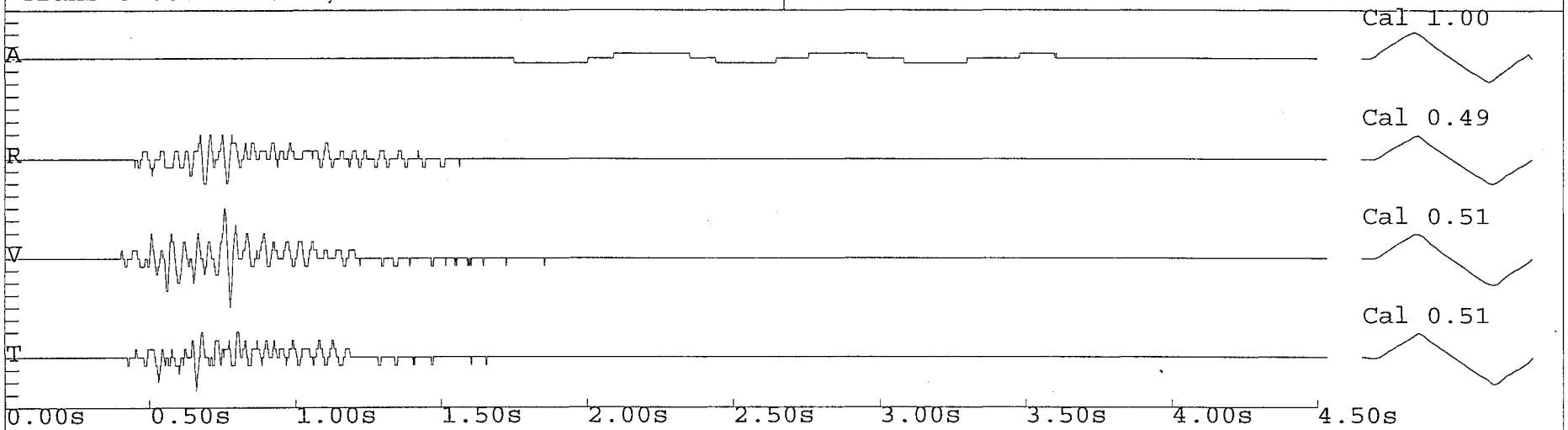
Fourier Analysis (Amplitude Spectrum)



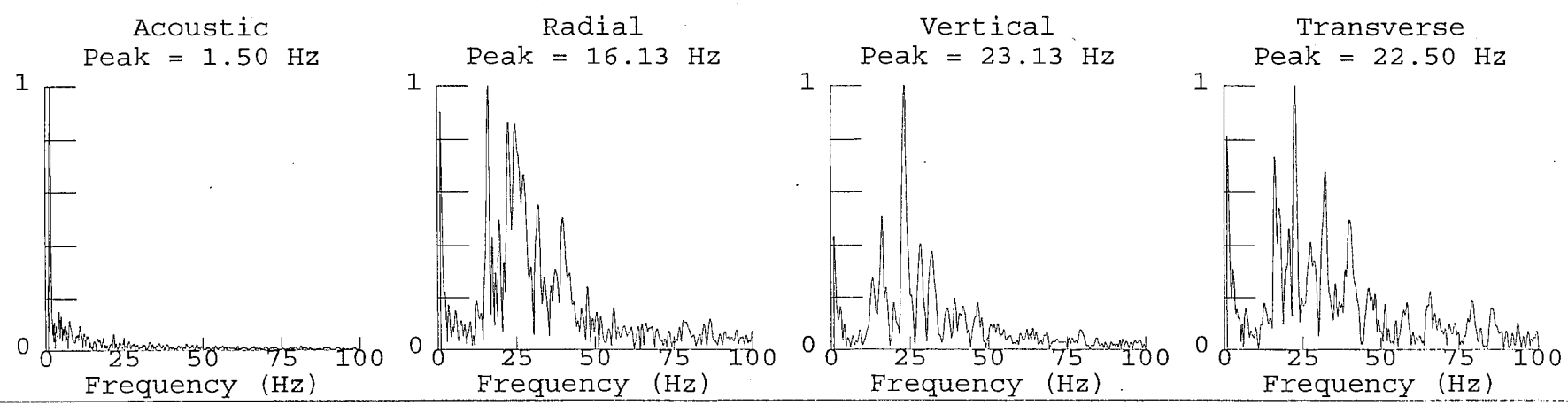
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber

Event: 110 Date: 8/ 1/95 Time: 14:19
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.06 in/s 20.4 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.04 in/s 36.5 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



APPENDIX Eiv

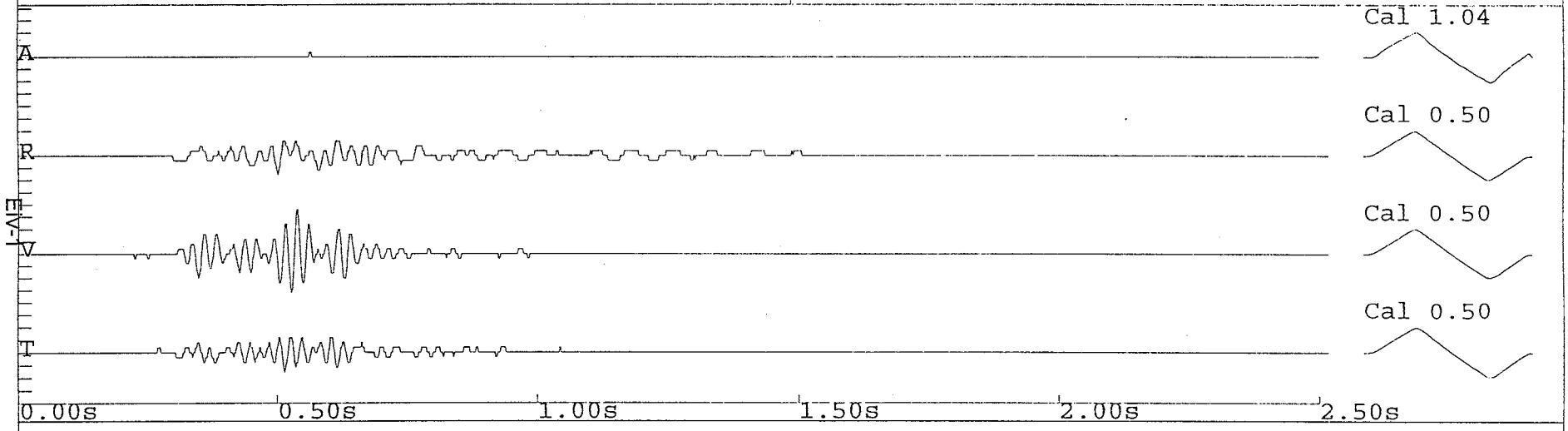
FULL WAVEFORM DATA

JACOB'S ROOM

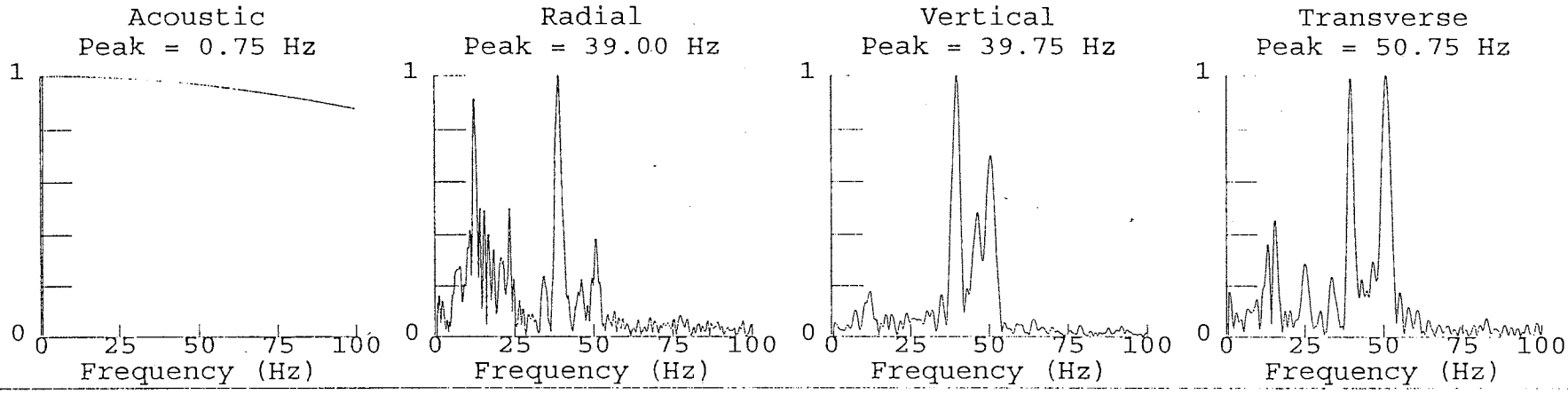
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

Event: 005 Date: 5/23/95 Time: 17:23
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.015 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.045 in/s 46.5 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 51.2 Hz.	Time Lines at: 0.50 sec intervals



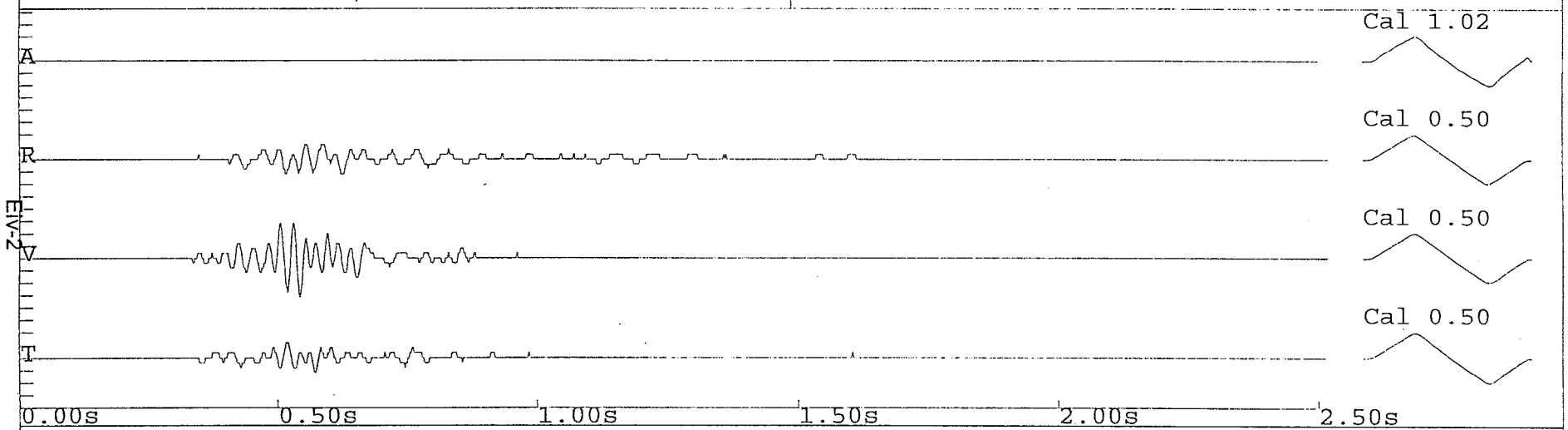
Fourier Analysis (Amplitude Spectrum)



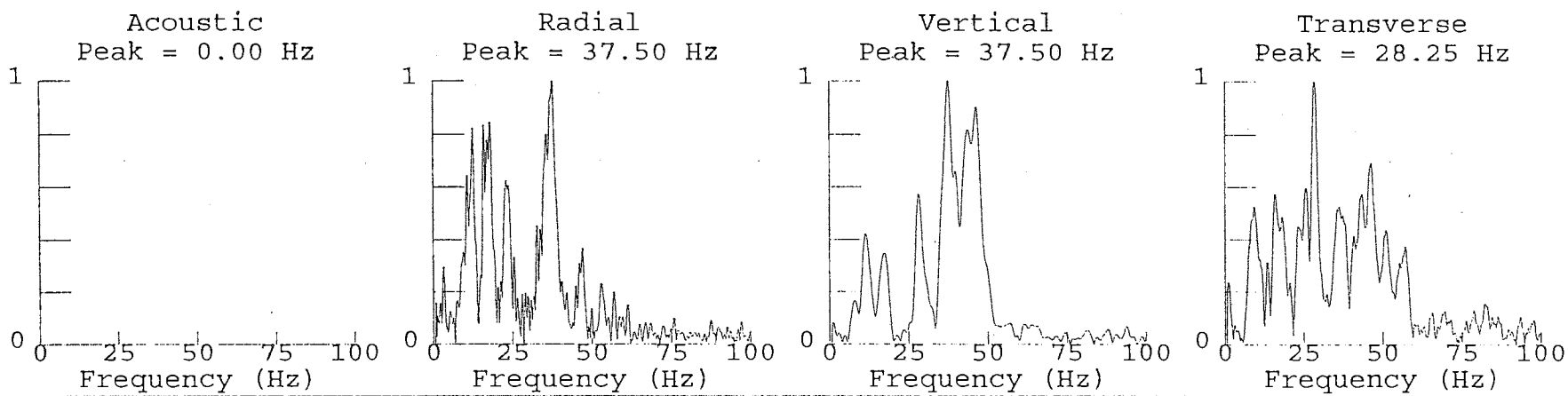
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

Event: 007 Date: 5/30/95 Time: 16:43
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.015 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 42.6 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.015 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



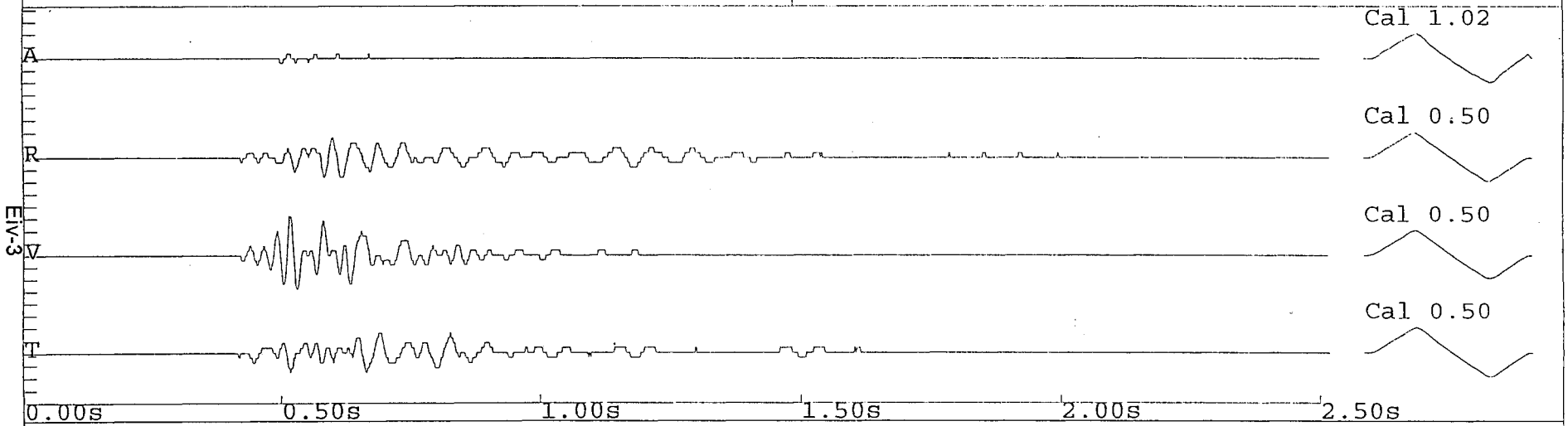
Fourier Analysis (Amplitude Spectrum)



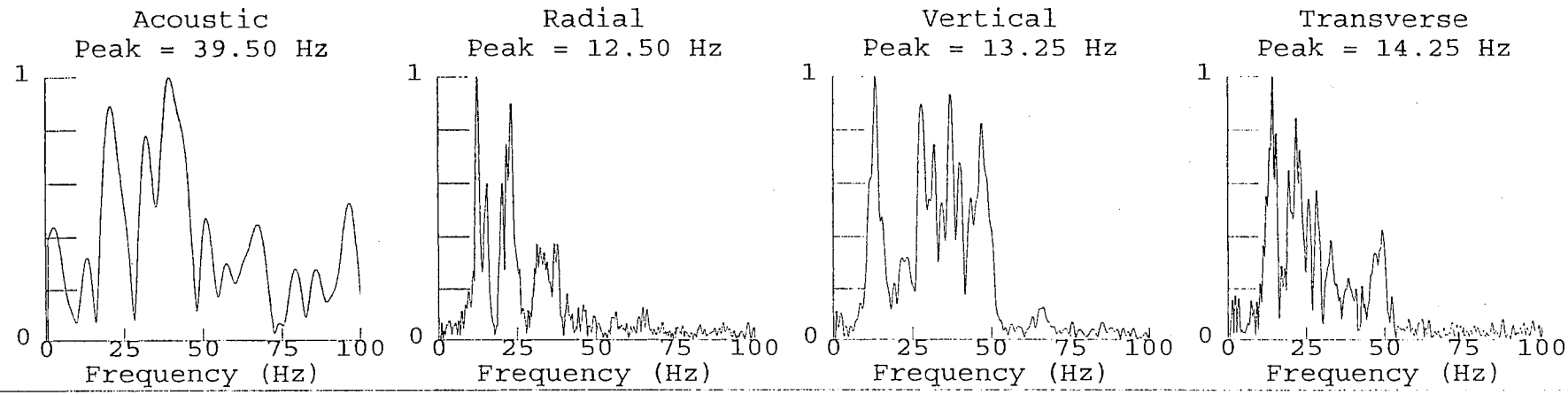
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

Event: 008 Date: 6/ 2/95 Time: 17:28
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.02 in/s 39.3 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.045 in/s 42.6 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 28.4 Hz.	Time Lines at: 0.50 sec intervals



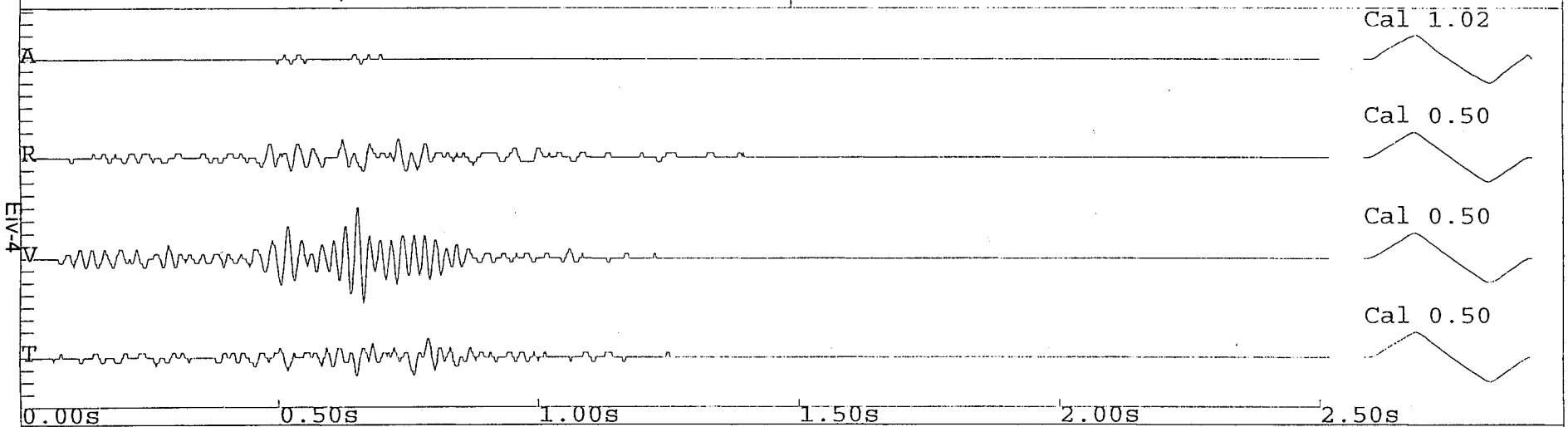
Fourier Analysis (Amplitude Spectrum)



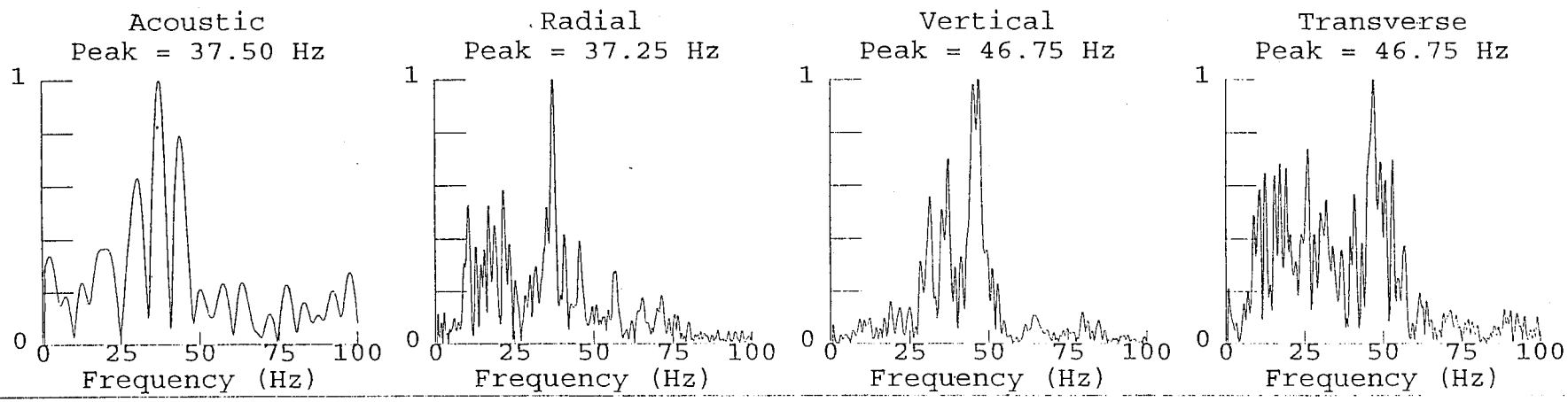
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

Event: 010 Date: 6/ 6/95 Time: 17:20
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.02 in/s 36.5 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.055 in/s 42.6 Hz.	Seis: 0.055 in/s (0.0138 in/s/div)
Transverse: 0.02 in/s 42.6 Hz.	Time Lines at: 0.50 sec intervals



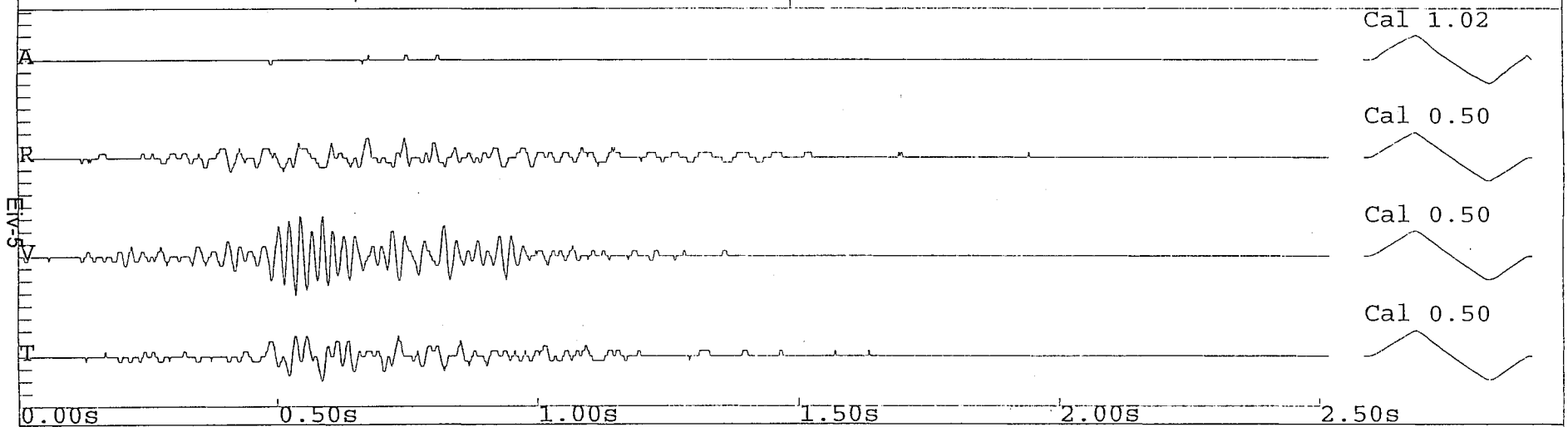
Fourier Analysis (Amplitude Spectrum)



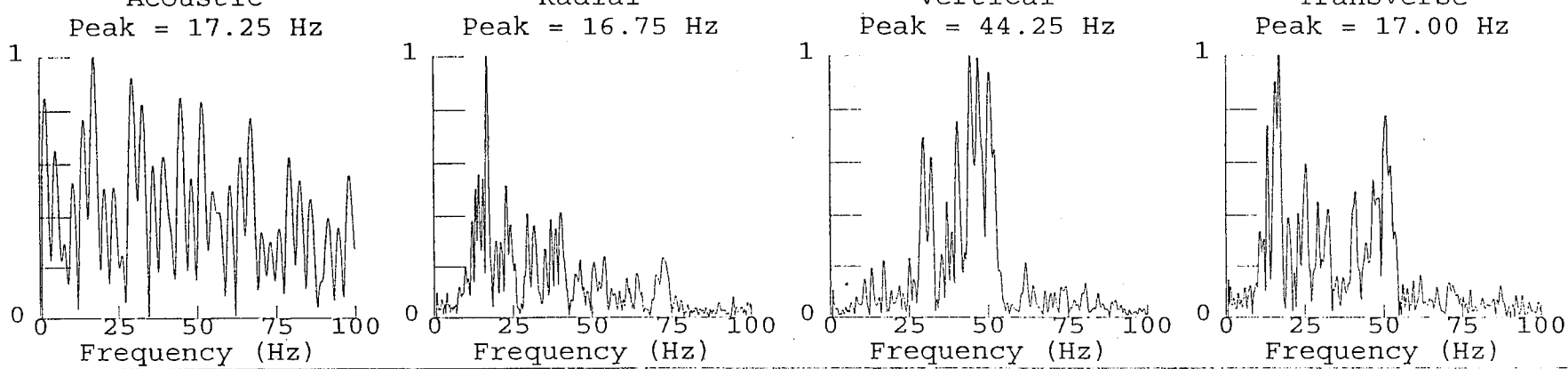
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

Event: 011 Date: 6/ 7/95 Time: 17:54
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.02 in/s 36.5 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 51.2 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.025 in/s 34.1 Hz.	Time Lines at: 0.50 sec intervals



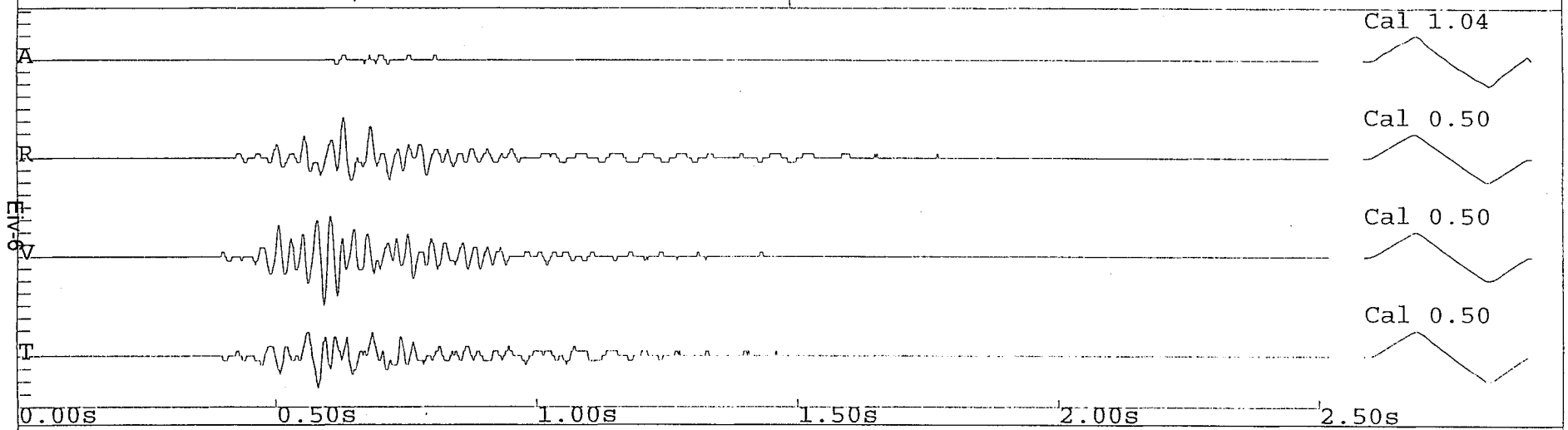
Fourier Analysis (Amplitude Spectrum)



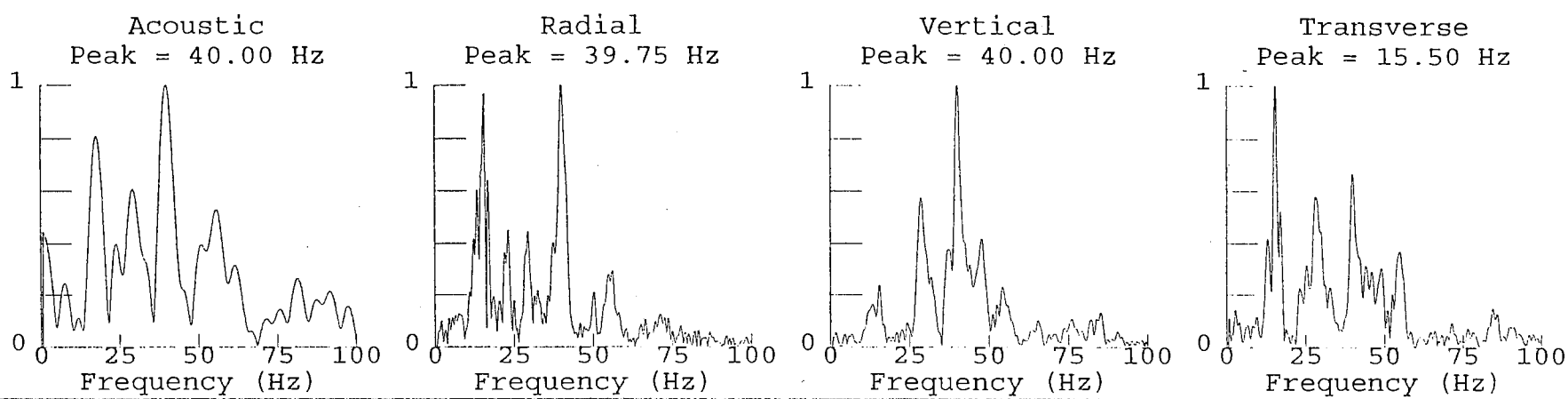
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

Event: 013 Date: 6/12/95 Time: 17:23
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.045 in/s 36.5 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.055 in/s 42.6 Hz.	Seis: 0.055 in/s (0.0138 in/s/div)
Transverse: 0.035 in/s 34.1 Hz.	Time Lines at: 0.50 sec intervals



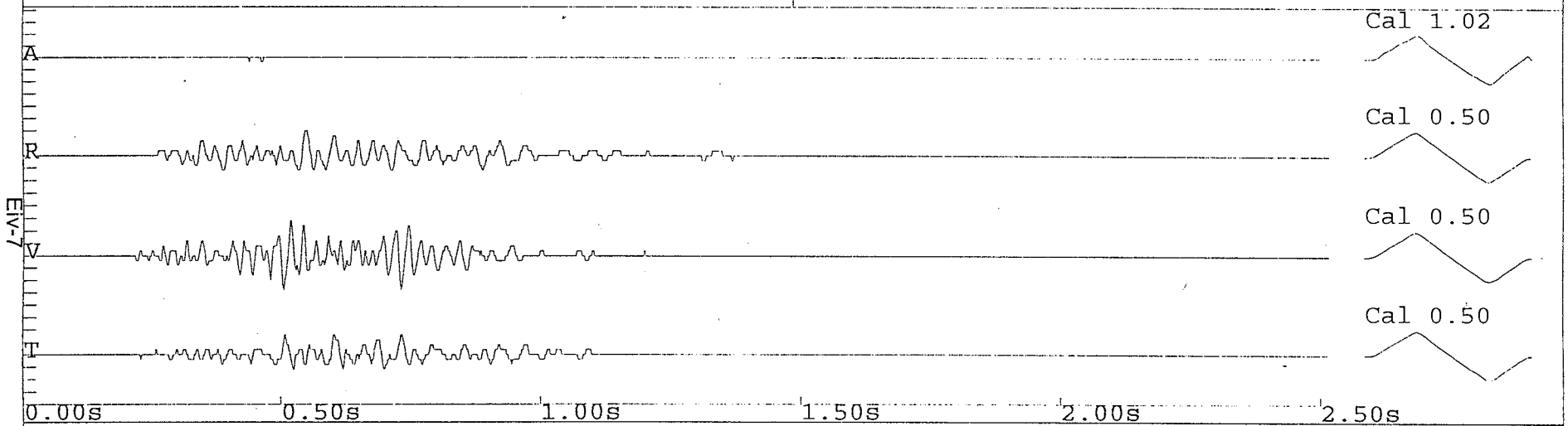
Fourier Analysis (Amplitude Spectrum)



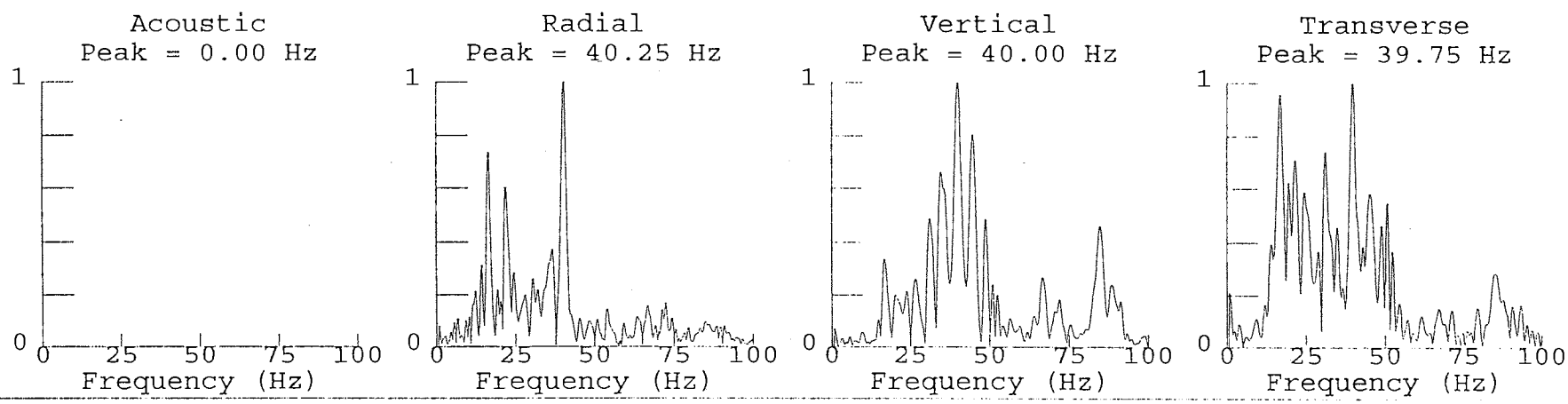
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

Event: 016 Date: 6/15/95 Time: 13:30
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.025 in/s 34.1 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.035 in/s 51.2 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 39.3 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

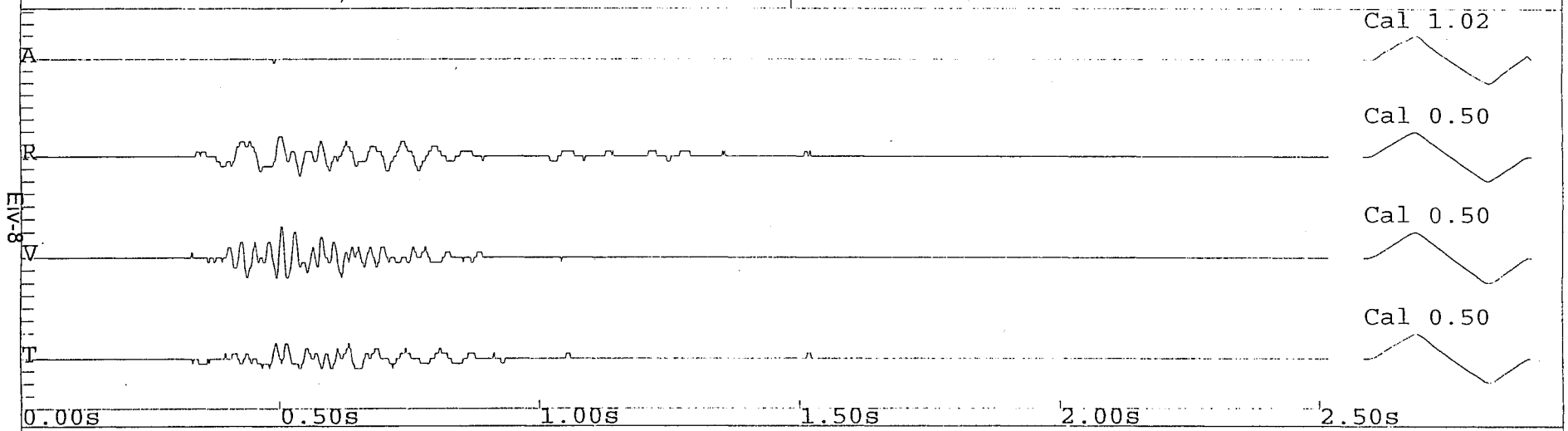
Event: 017 Date: 6/16/95 Time: 17:52
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies

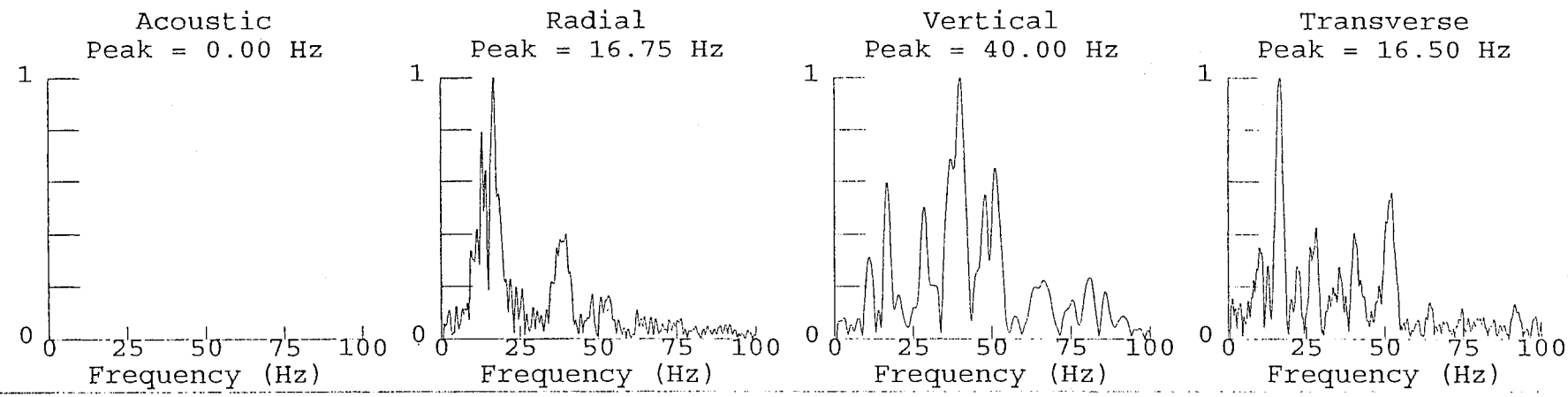
Acoustic: 0 dB 0.0 Hz.
Radial: 0.02 in/s 28.4 Hz.
Vertical: 0.03 in/s 51.2 Hz.
Transverse: 0.02 in/s 46.5 Hz.

Graph Information

Duration: 0.000 sec To: 2.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



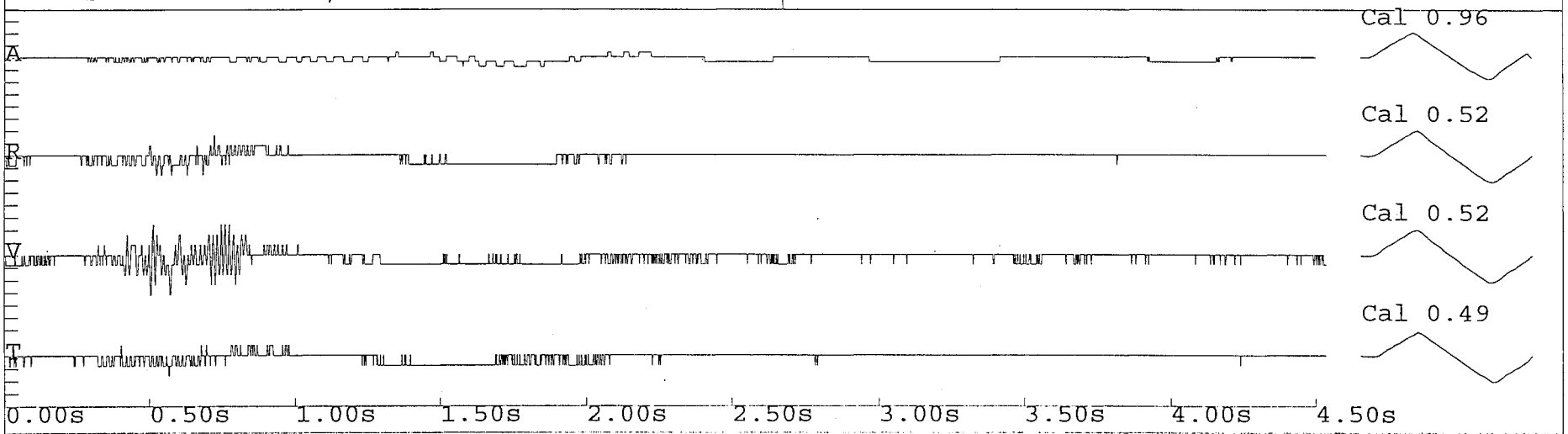
Fourier Analysis (Amplitude Spectrum)



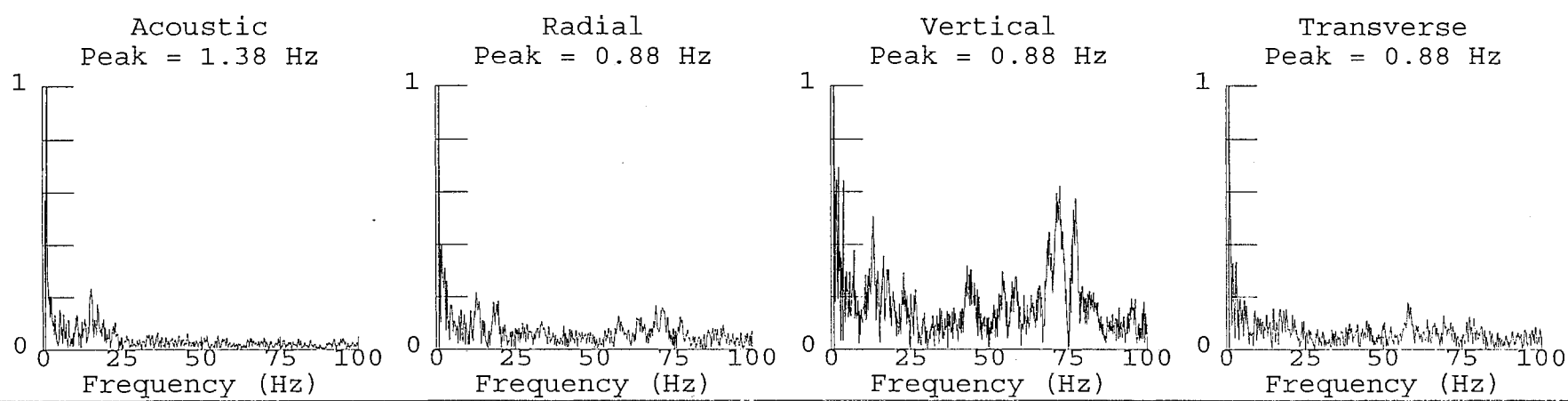
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 16
Location: Hanging Balcony

Event: 044 Date: 7/18/95 Time: 16:51
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 64.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



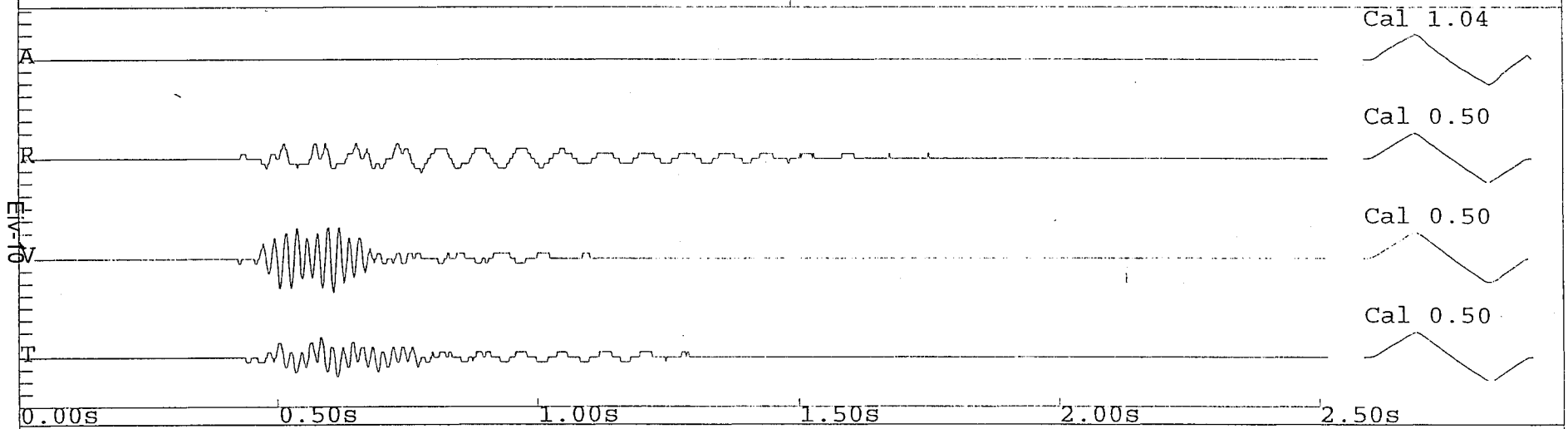
Fourier Analysis (Amplitude Spectrum)



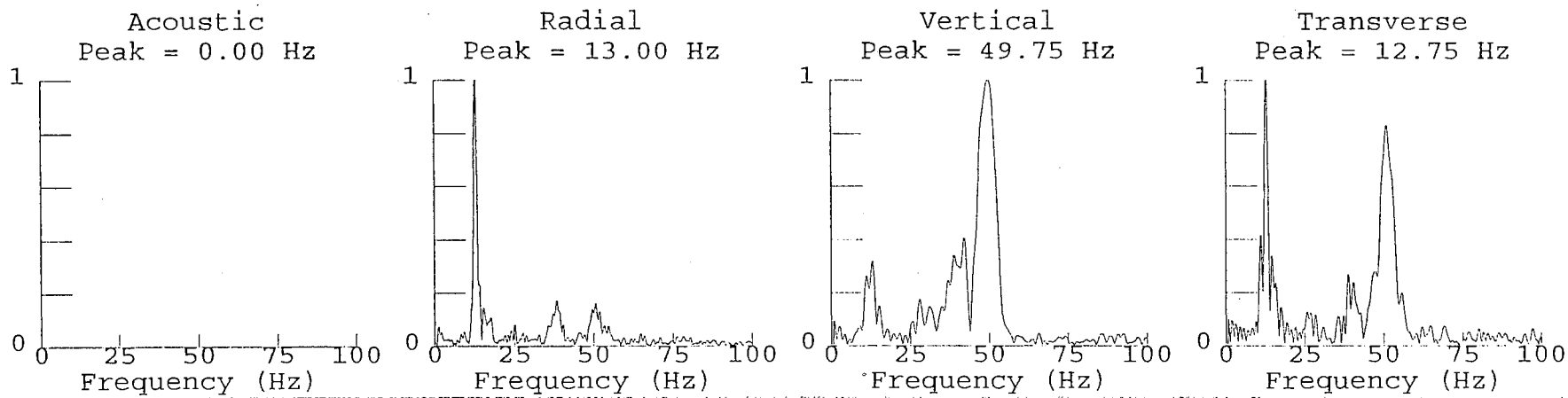
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

Event: 003 Date: 5/22/95 Time: 14:19
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.015 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.035 in/s 51.2 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 56.8 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

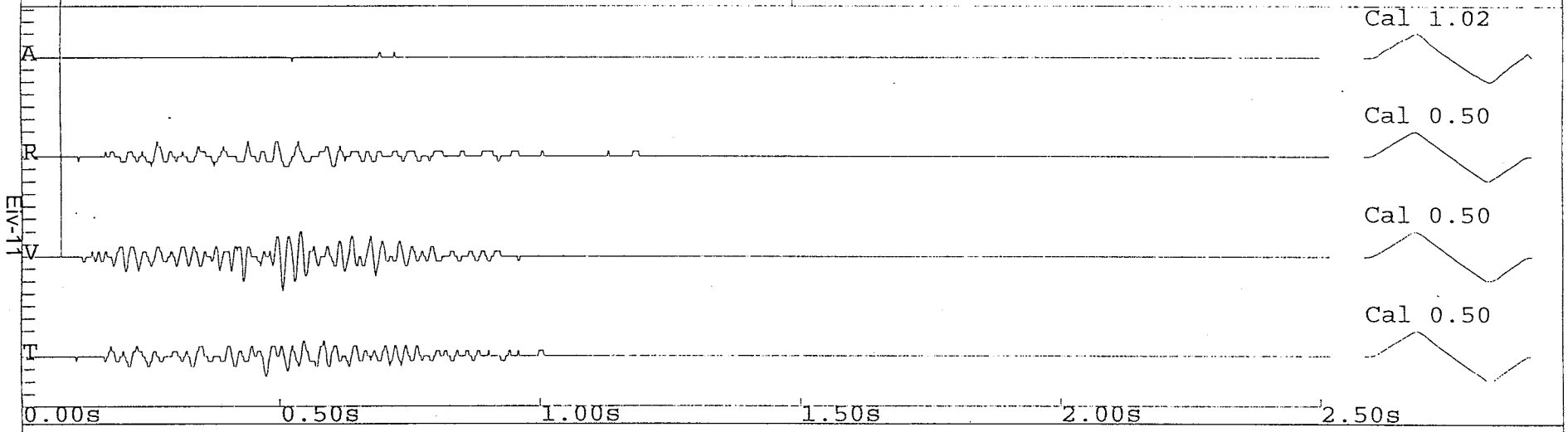
Event: 019 Date: 6/17/95 Time: 9:13
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies

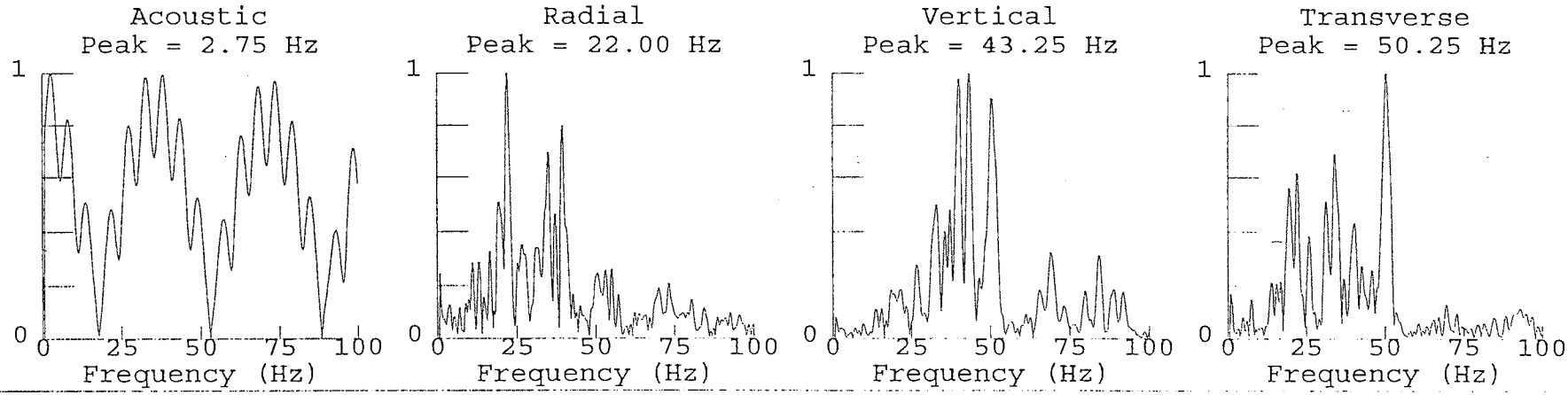
Acoustic: 100 dB 0.0 Hz.
Radial: 0.015 in/s 0.0 Hz.
Vertical: 0.035 in/s 51.2 Hz.
Transverse: 0.015 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 2.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



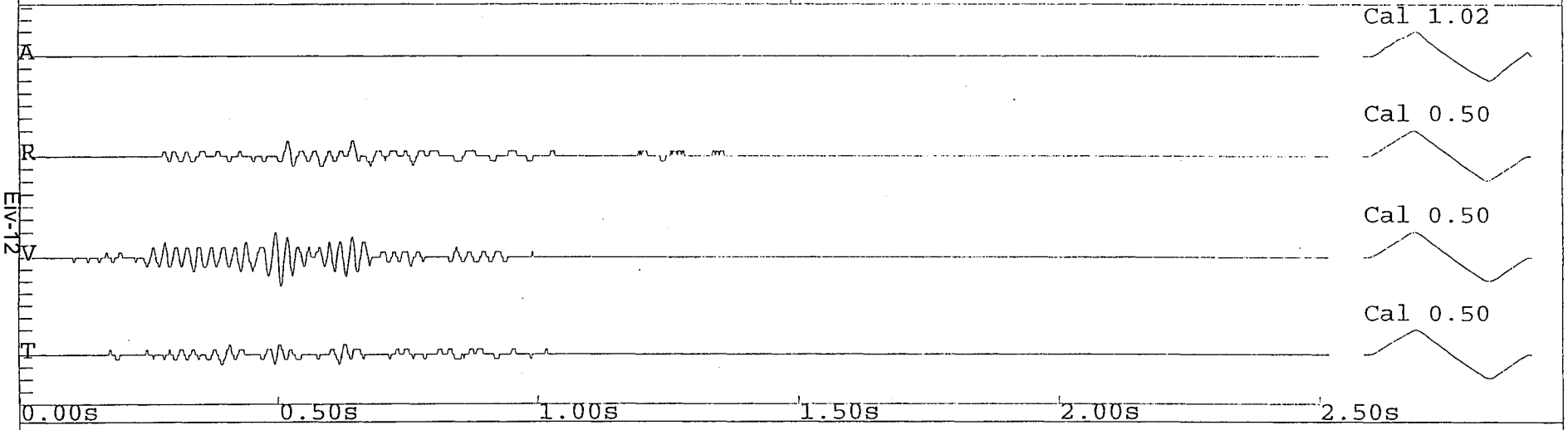
Fourier Analysis (Amplitude Spectrum)



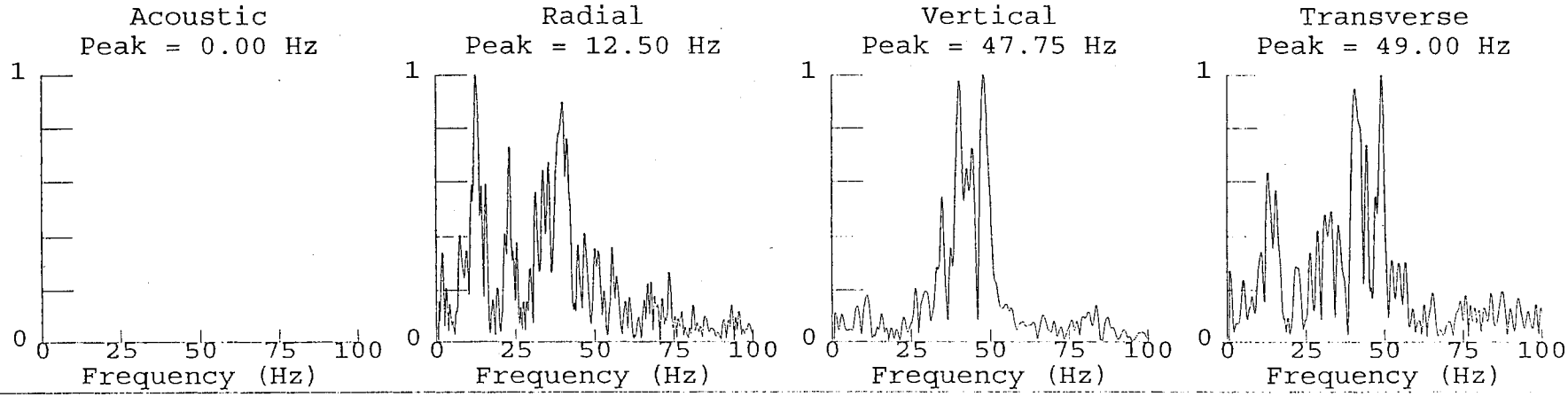
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

Event: 020 Date: 6/21/95 Time: 18:09
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.015 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 46.5 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



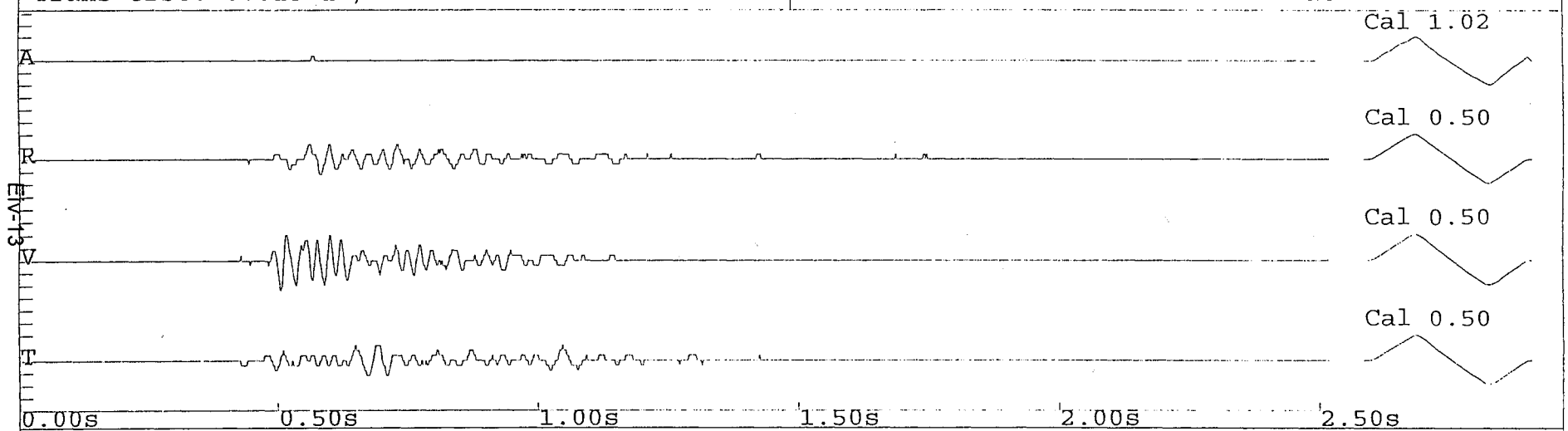
Fourier Analysis (Amplitude Spectrum)



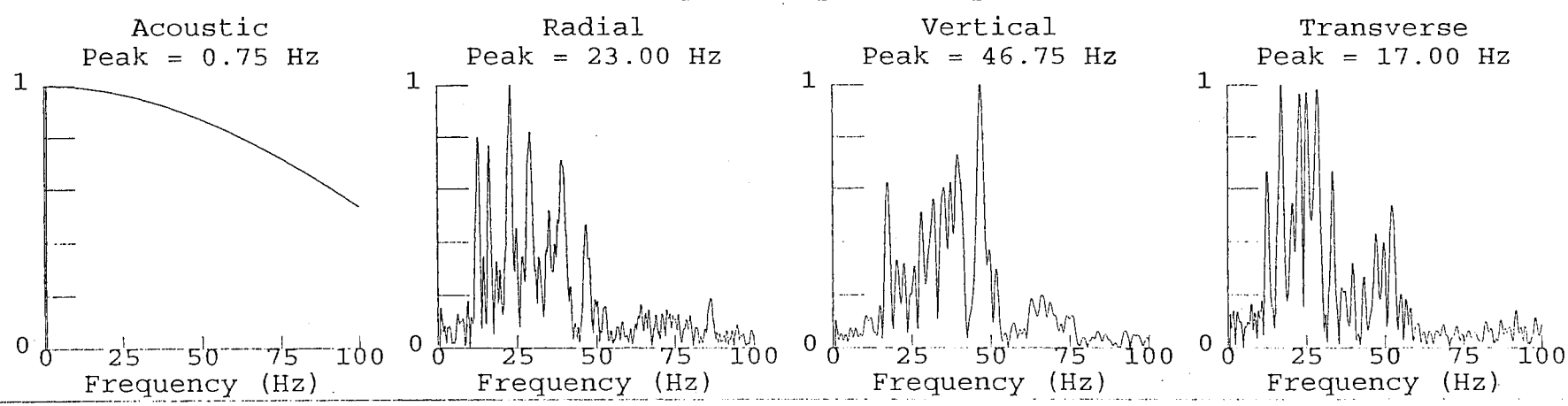
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

Event: 021 Date: 6/21/95 Time: 18:18
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.015 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 46.5 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.015 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Jacob's Room

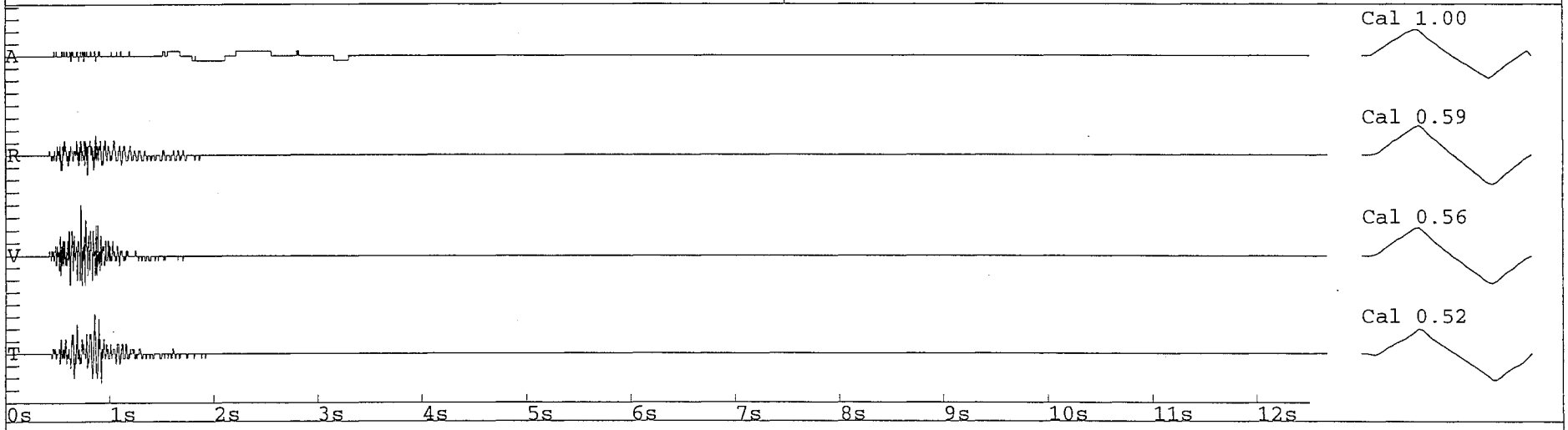
Event: 216 Date: 7/18/95 Time: 16:51
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies

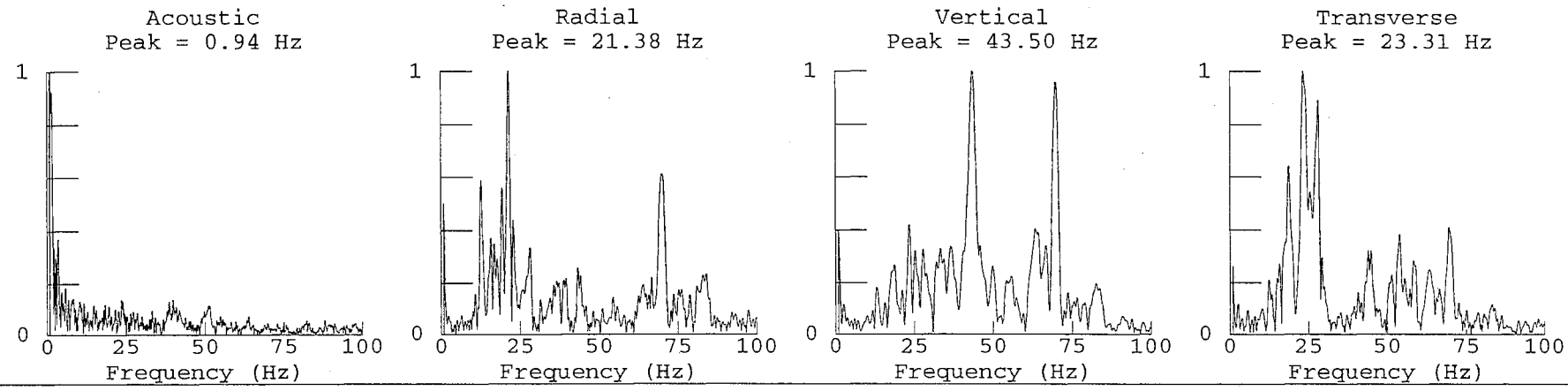
Acoustic: 100 dB 0.0 Hz.
Radial: 0.04 in/s 73.1 Hz.
Vertical: 0.10 in/s 51.2 Hz.
Transverse: 0.08 in/s 25.6 Hz.

Graph Information

Duration: 0.000 sec To: 12.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.10 in/s (0.025 in/s/div)
Time Lines at: 1.00 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Jacob's Room

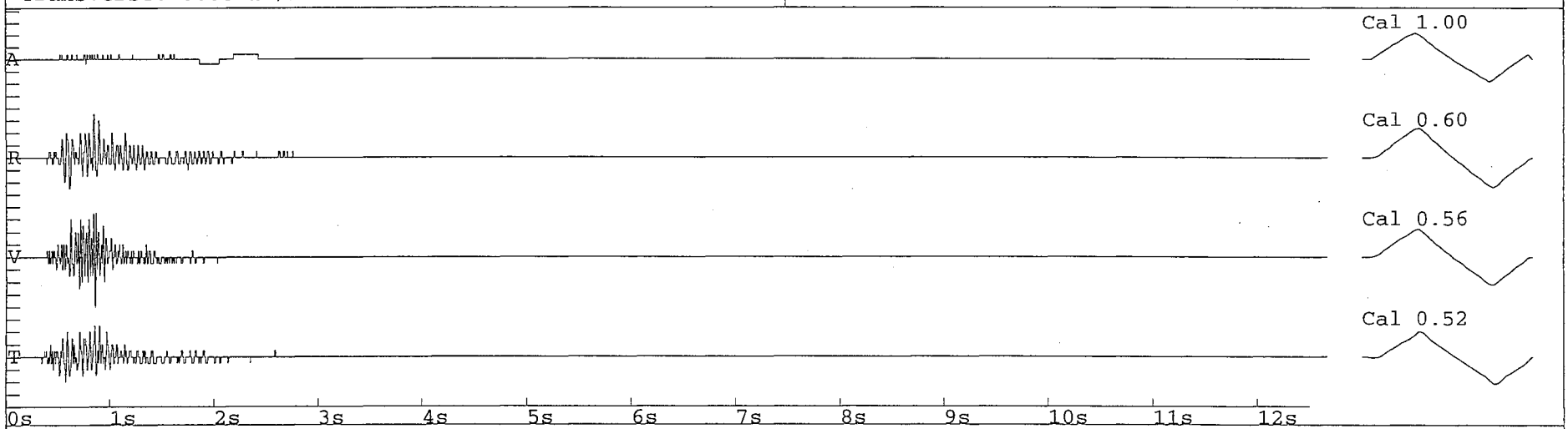
Event: 217 Date: 7/19/95 Time: 16:48
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies

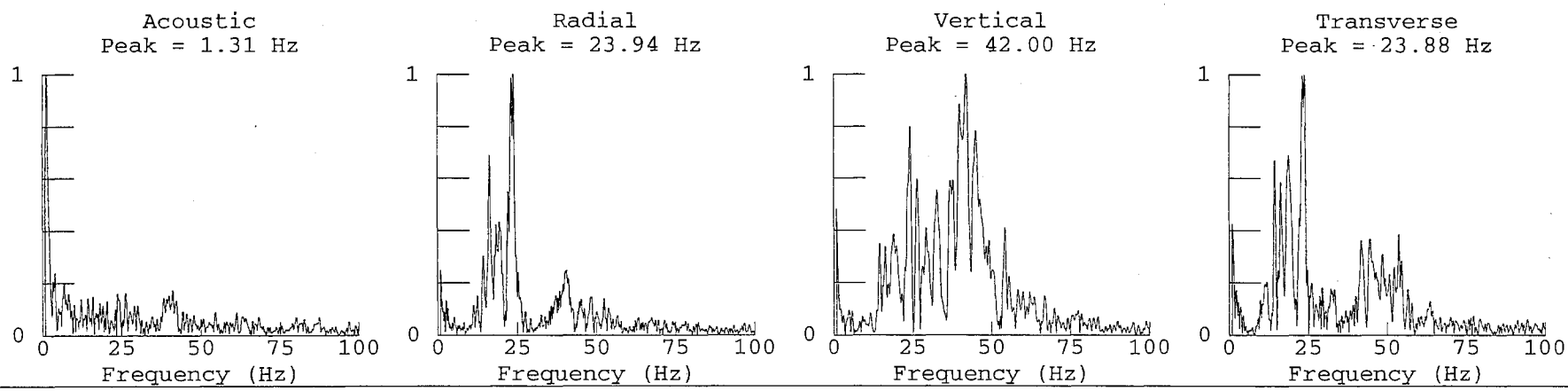
Acoustic: 100 dB 0.0 Hz.
Radial: 0.07 in/s 26.9 Hz.
Vertical: 0.08 in/s 46.5 Hz.
Transverse: 0.05 in/s 22.2 Hz.

Graph Information

Duration: 0.000 sec To: 12.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.08 in/s (0.02 in/s/div)
Time Lines at: 1.00 sec intervals



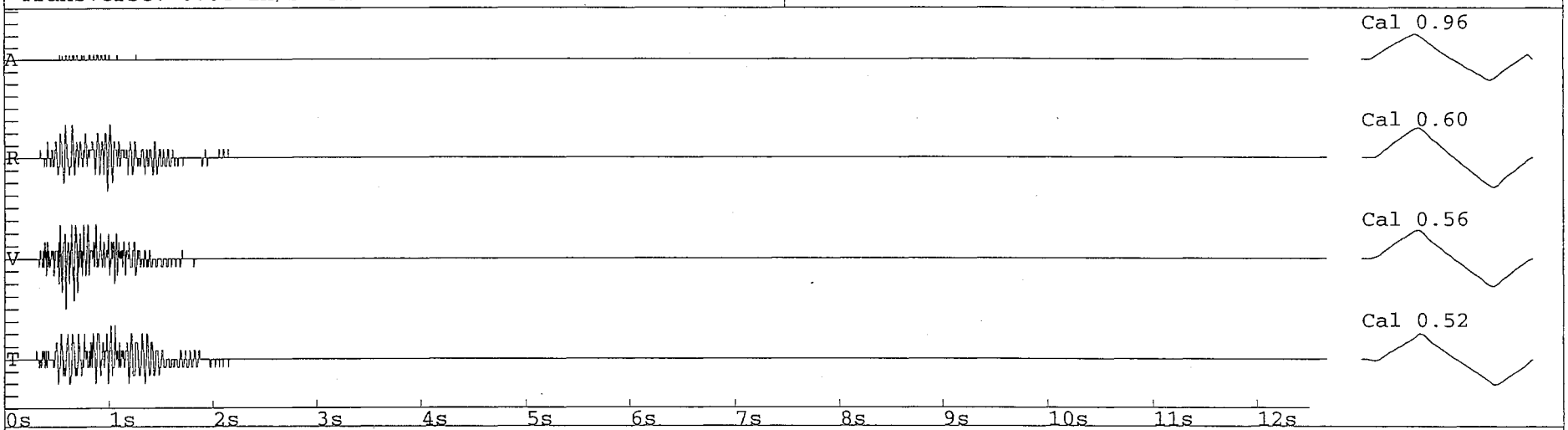
Fourier Analysis (Amplitude Spectrum)



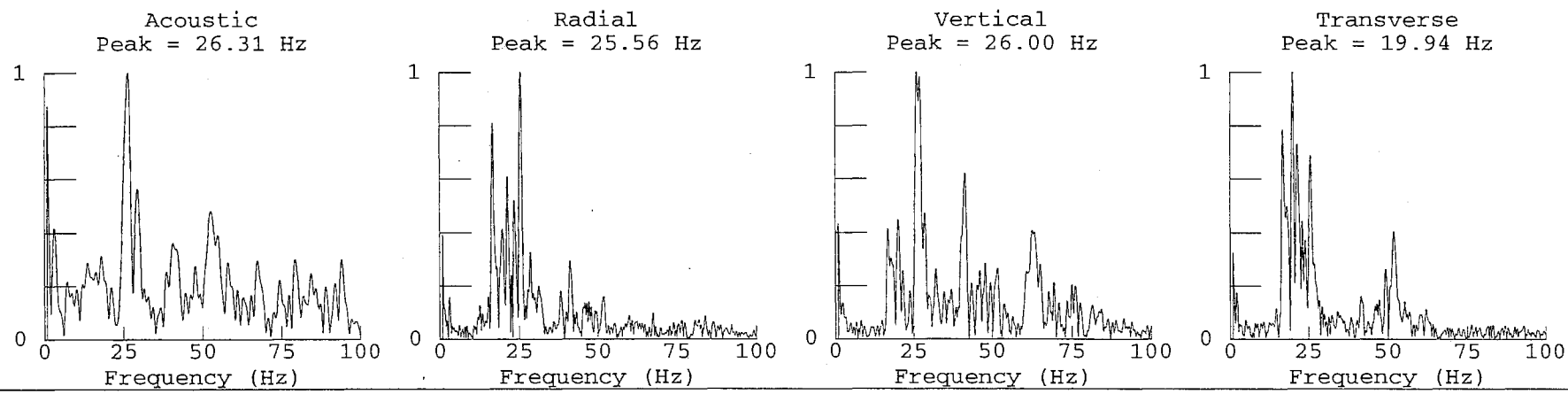
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Jacob's Room

Event: 218 Date: 7/25/95 Time: 16:26
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.04 in/s 26.9 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.06 in/s 39.3 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.04 in/s 34.1 Hz.	Time Lines at: 1.00 sec intervals



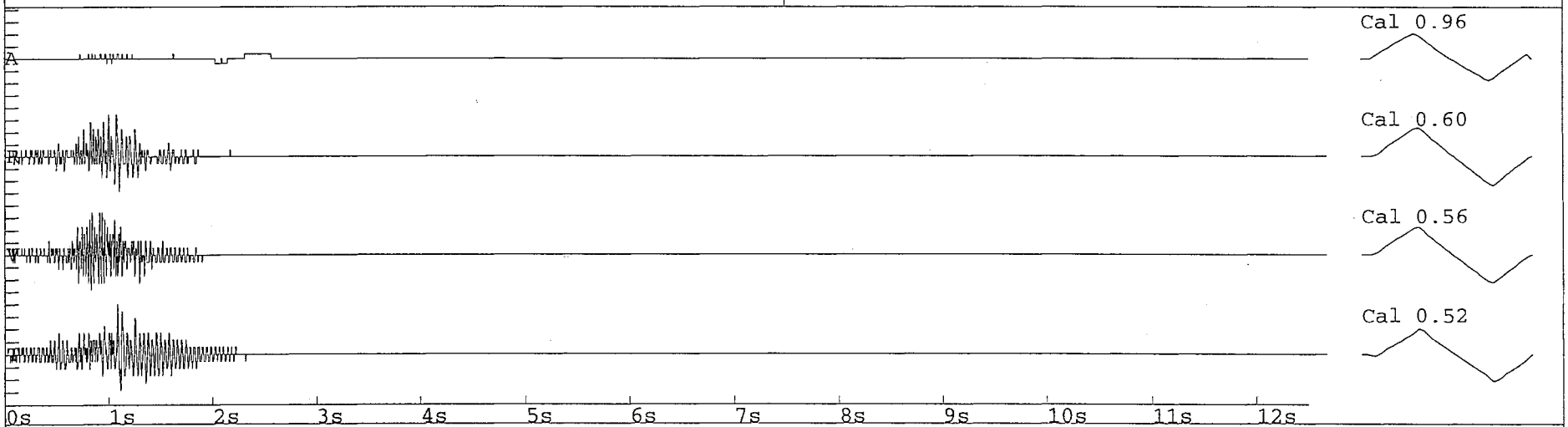
Fourier Analysis (Amplitude Spectrum)



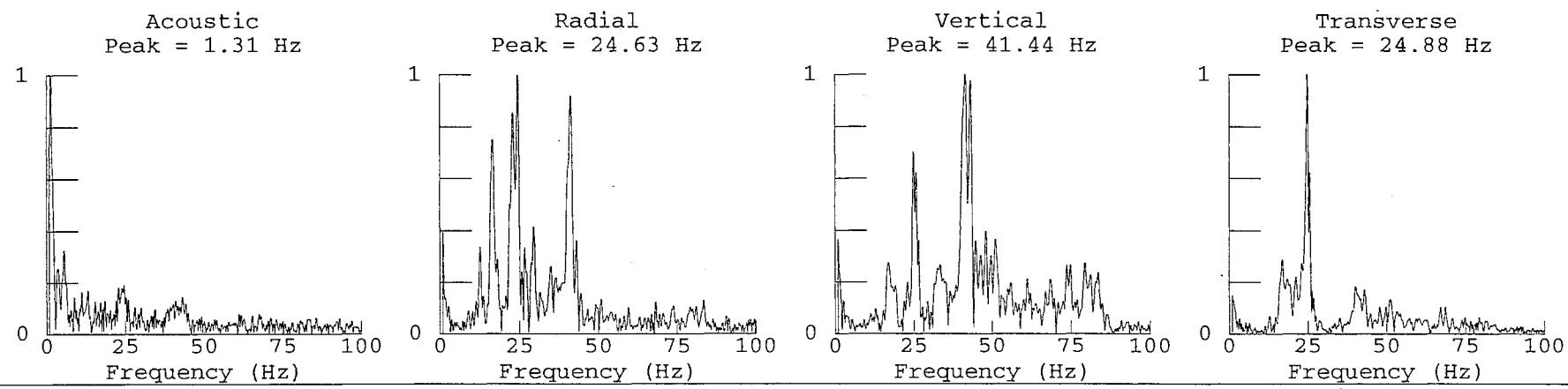
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Jacob's Room

Event: 219 Date: 7/26/95 Time: 16:20
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.06 in/s 34.1 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.06 in/s 42.6 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.07 in/s 32.0 Hz.	Time Lines at: 1.00 sec intervals



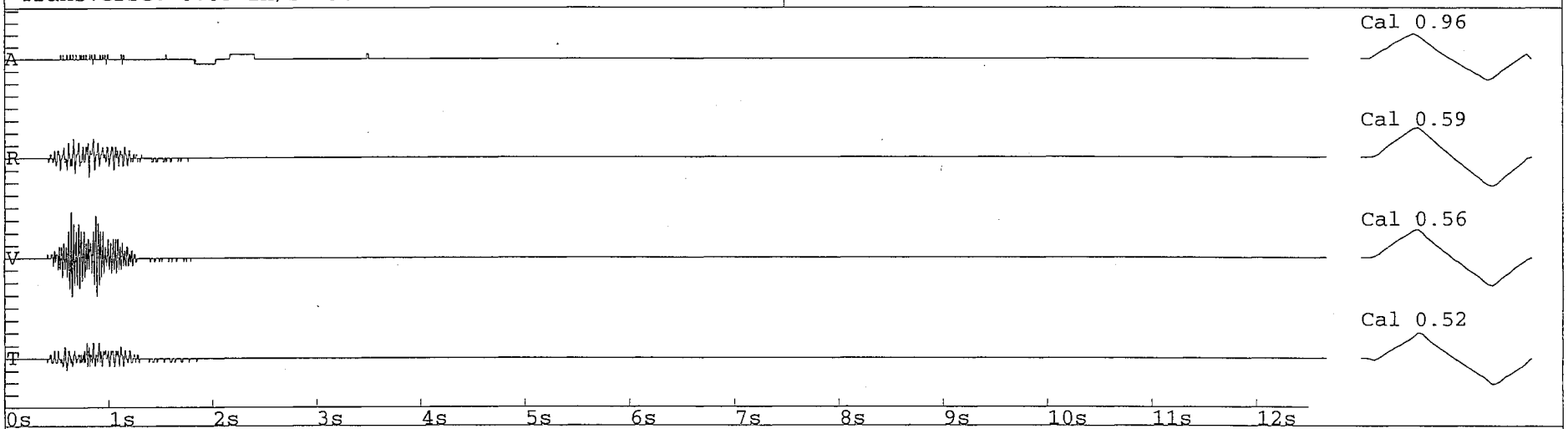
Fourier Analysis (Amplitude Spectrum)



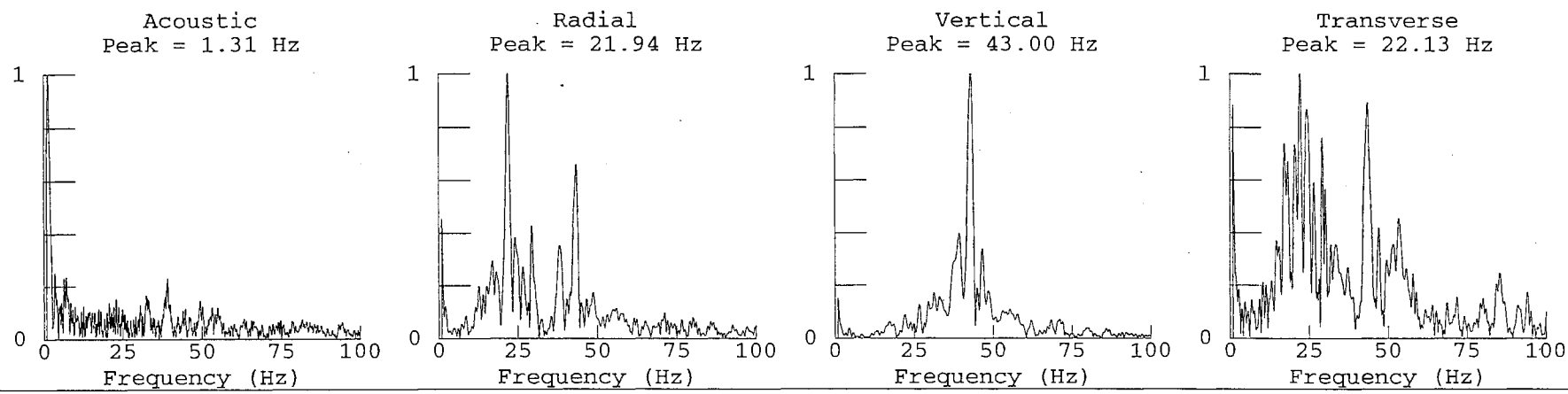
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Jacob's Room

Event: 220 Date: 7/28/95 Time: 10:09
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.05 in/s 34.1 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.13 in/s 42.6 Hz.	Seis: 0.13 in/s (0.0325 in/s/div)
Transverse: 0.05 in/s 36.5 Hz.	Time Lines at: 1.00 sec intervals



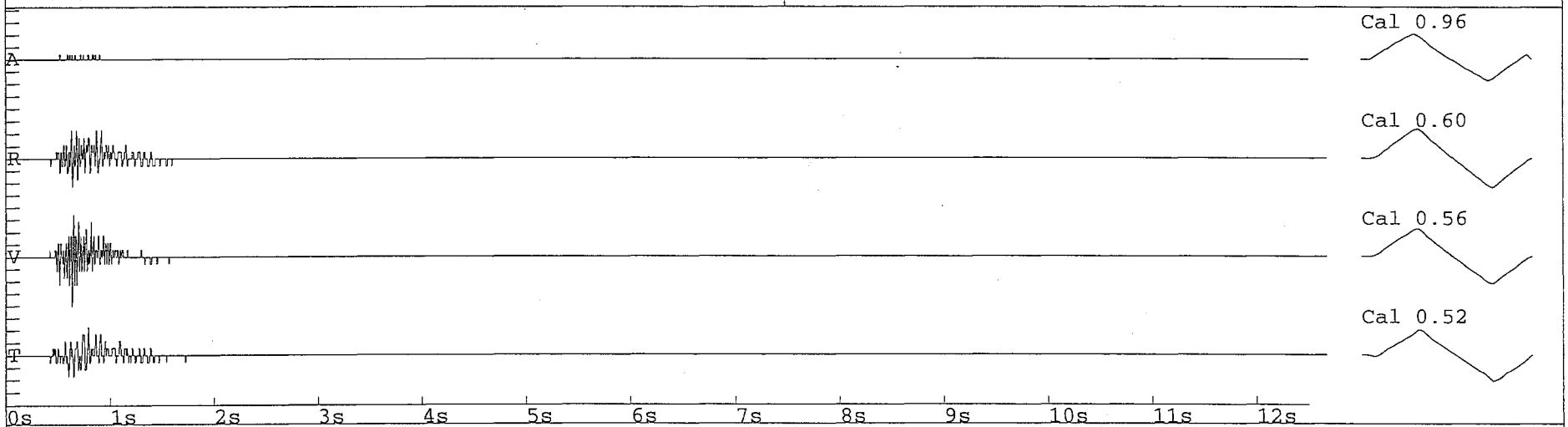
Fourier Analysis (Amplitude Spectrum)



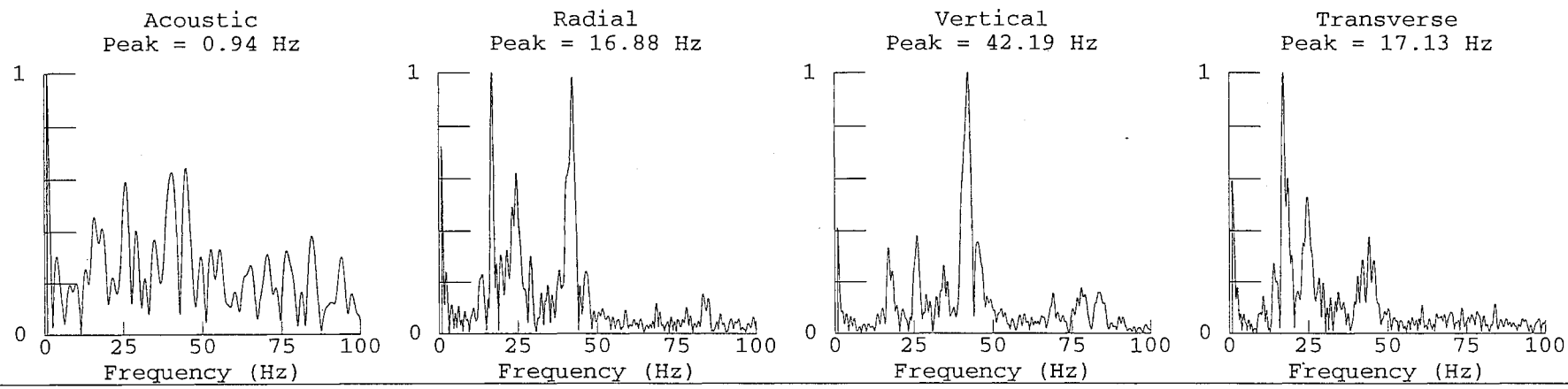
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Jacob's Room

Event: 221 Date: 7/28/95 Time: 16:09
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.04 in/s 42.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.07 in/s 51.2 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.04 in/s 32.0 Hz.	Time Lines at: 1.00 sec intervals



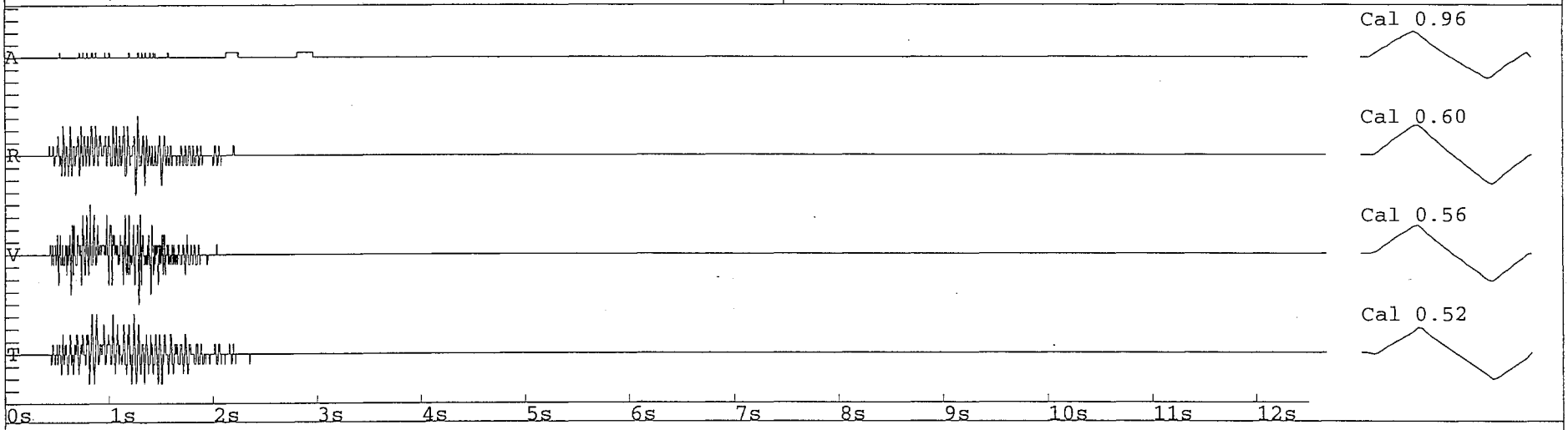
Fourier Analysis (Amplitude Spectrum)



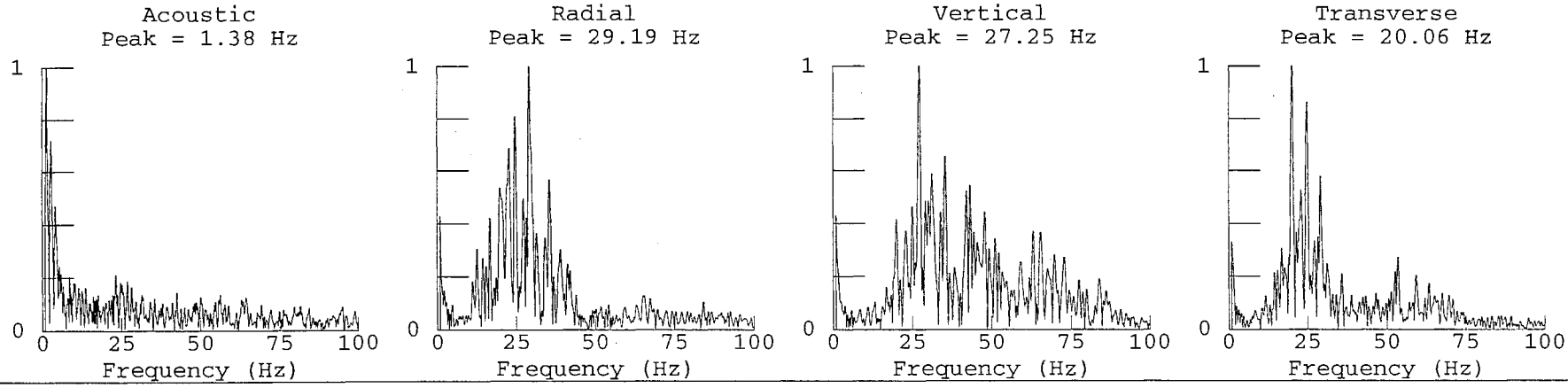
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Jacob's Room

Event: 222 Date: 7/31/95 Time: 16:47
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.04 in/s 30.1 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 39.3 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 30.1 Hz.	Time Lines at: 1.00 sec intervals



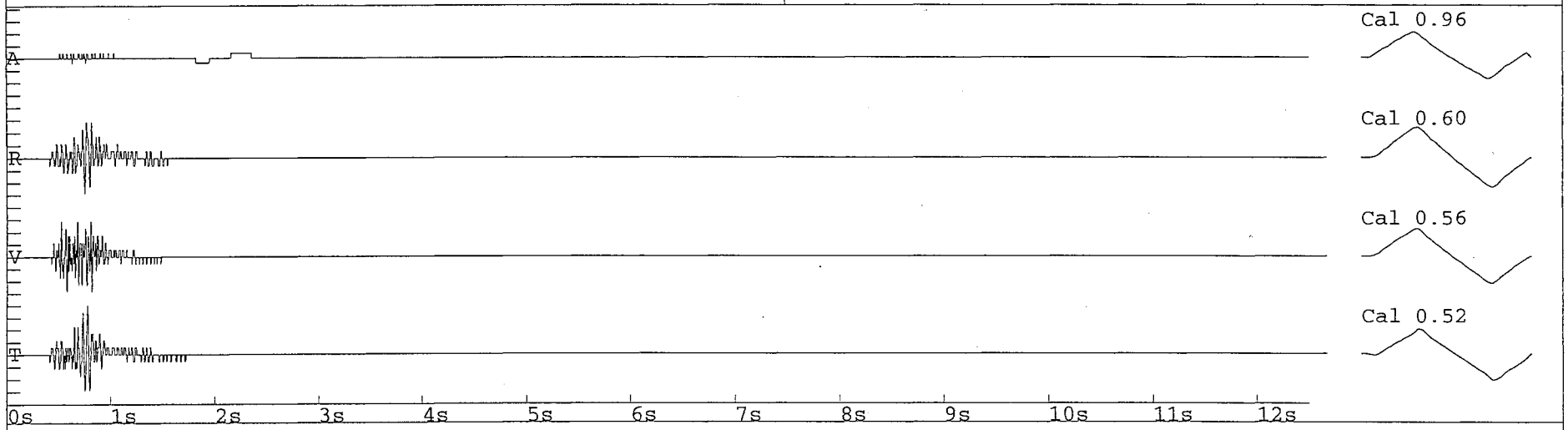
Fourier Analysis (Amplitude Spectrum)



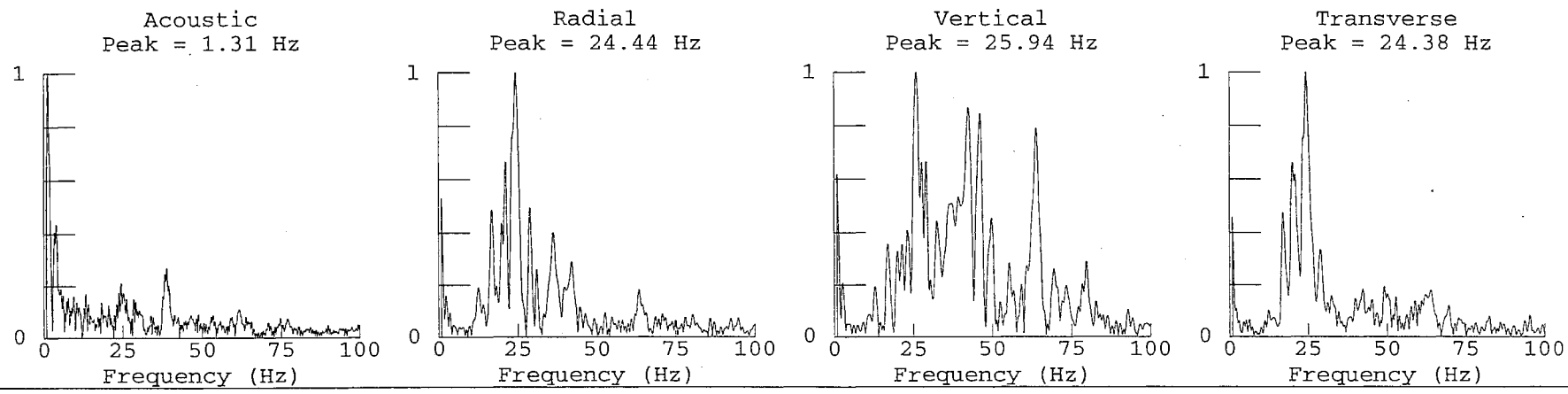
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Jacob's Room

Event: 223 Date: 8/ 1/95 Time: 14:19
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.05 in/s 17.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 51.2 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.07 in/s 24.3 Hz.	Time Lines at: 1.00 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room

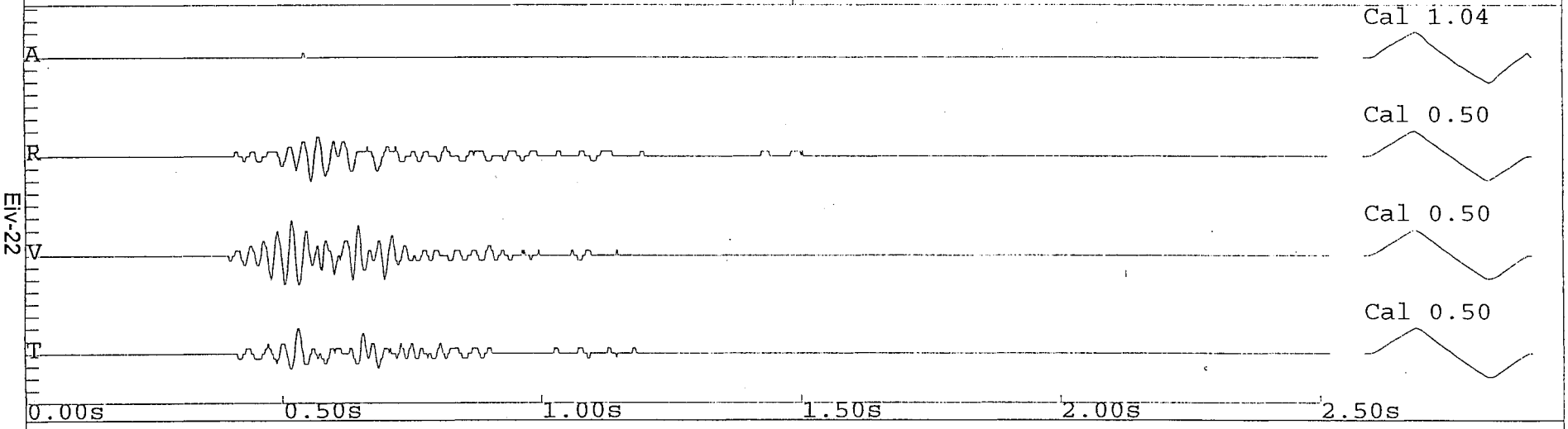
Event: 004 Date: 5/23/95 Time: 16:32
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies

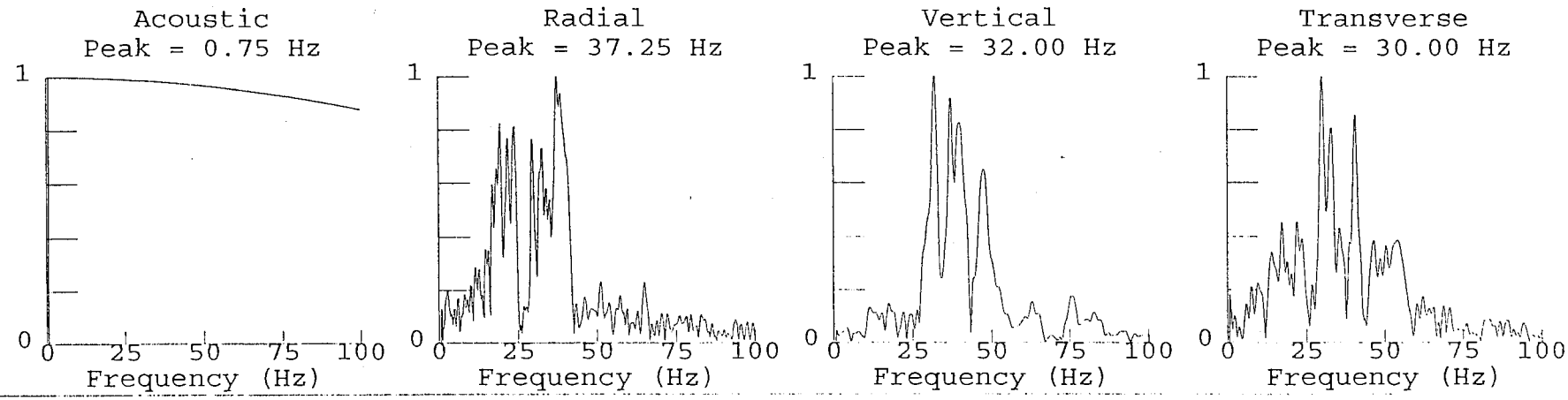
Acoustic: 100 dB 0.0 Hz.
Radial: 0.025 in/s 46.5 Hz.
Vertical: 0.035 in/s 39.3 Hz.
Transverse: 0.025 in/s 36.5 Hz.

Graph Information

Duration: 0.000 sec To: 2.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



APPENDIX Ev

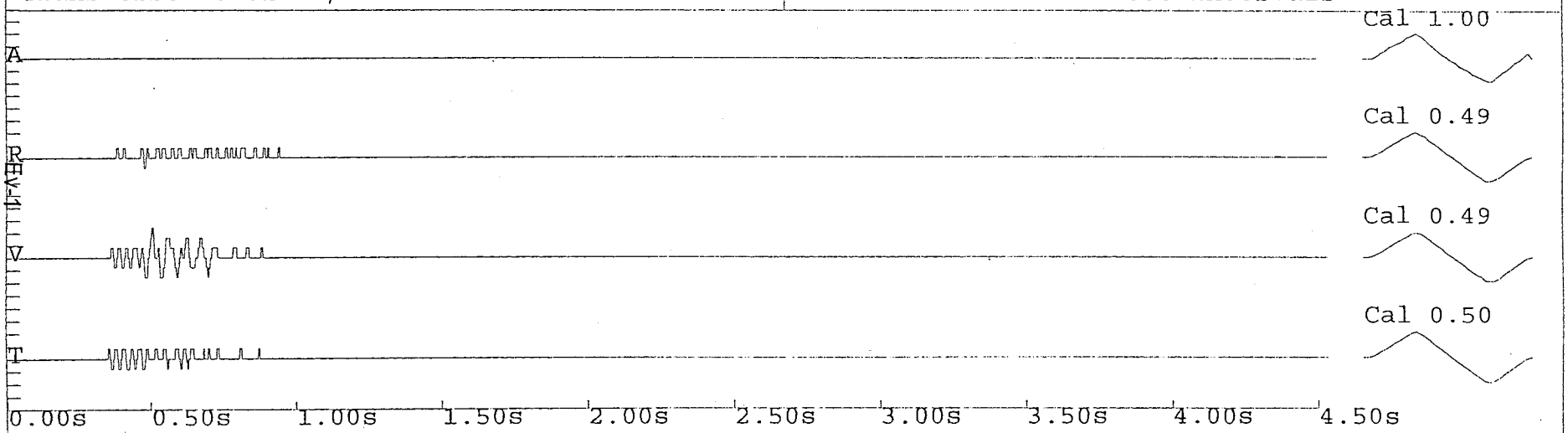
FULL WAVEFORM DATA

HELICTITE ROOM

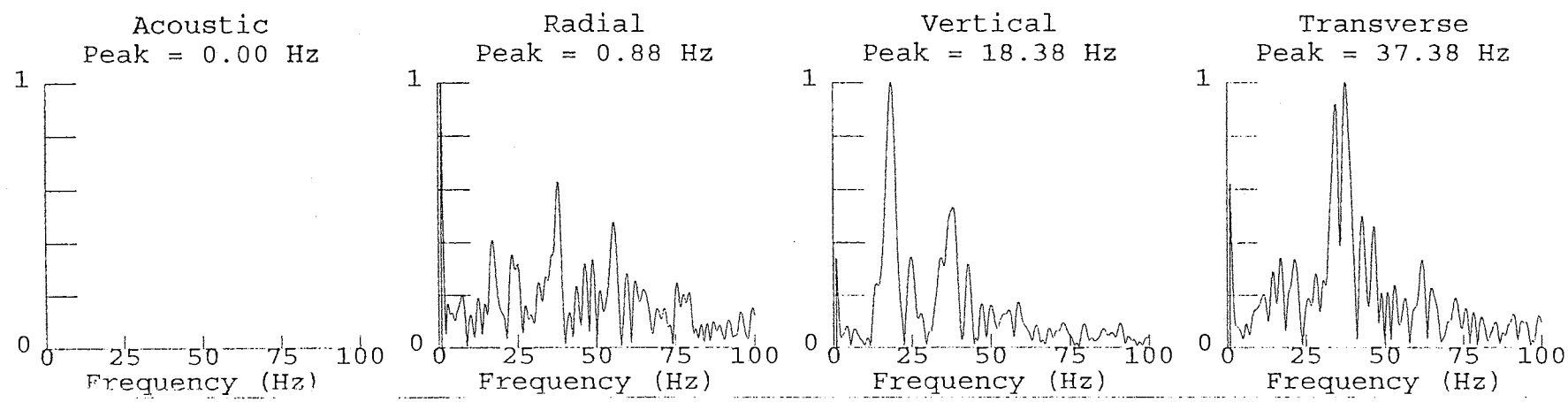
2B2D91C4D95969D626CAC91DB1369D6D91CACB78
9B2B2D3AC4DB23B6F75ECACBC822091AC00D2A95
4AA5A7291C85C4B74A6DA6DC85B74A6D892505C8
E4121908841030340F8901A7FE

29C0 07.2 07-01-95 12:34 IPS 014 P
Ÿ 0.010T 0.030V 0.010R 100 A 0.030VS A
BAT Event: 014 Date: 7/ 1/95 Time: 12:34
Air Trigger: 148 dB Seis Trigger: 0.03 in/s S/N: 491

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



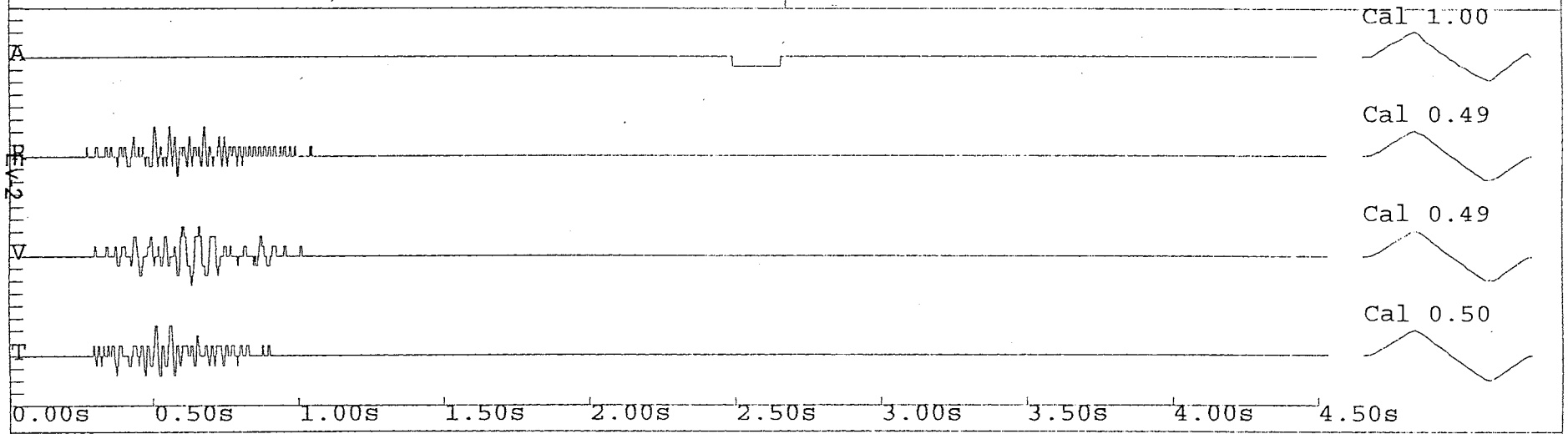
Fourier Analysis (Amplitude Spectrum)



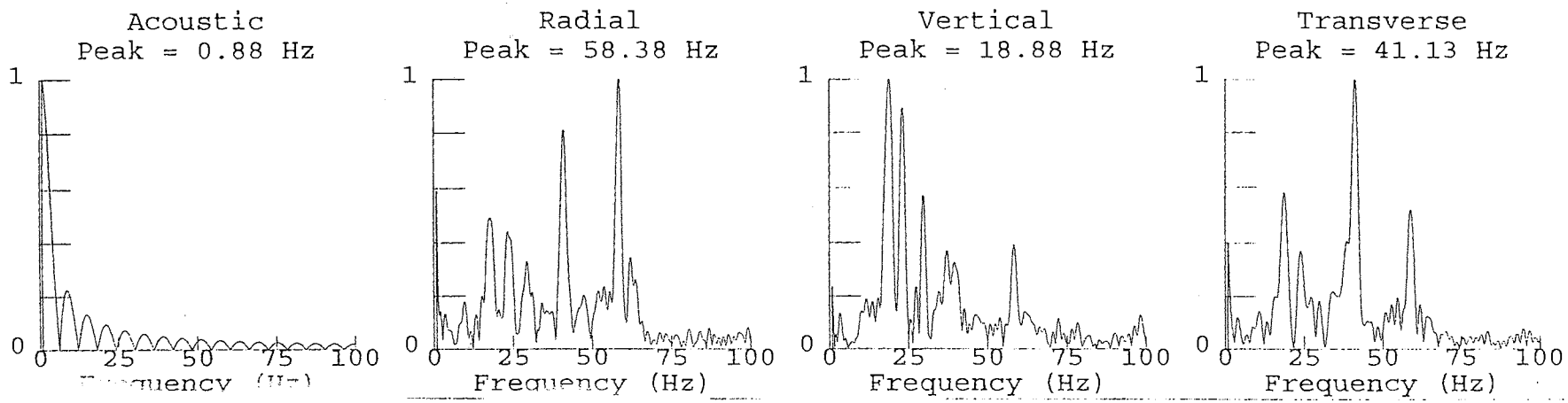
4DD2B256591C4D89B69D6CAC91DB1369D6D91CAC
B789B2B2D3AC4DB23B6F6DEDBC8241235801A552
A954B4E52390B896E94DB4DB90B6E94DB2429282
C904864304A030340DA408A7FE

639C 07.2 07-13-95 16:38 IPS 015 P
Ÿ 0.030T 0.030V 0.030R 106 A 0.040VS A
BAT Event: 015 Date: 7/13/95 Time: 16:38
Air Trigger: 148 dB Seis Trigger: 0.03 in/s S/N: 491

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



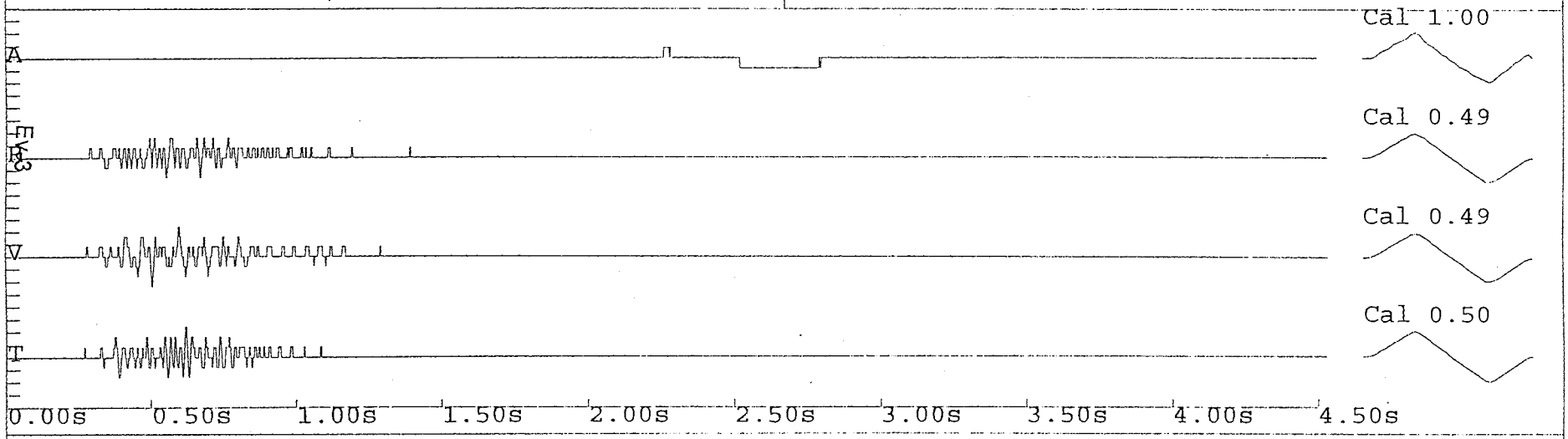
Fourier Analysis (Amplitude Spectrum)



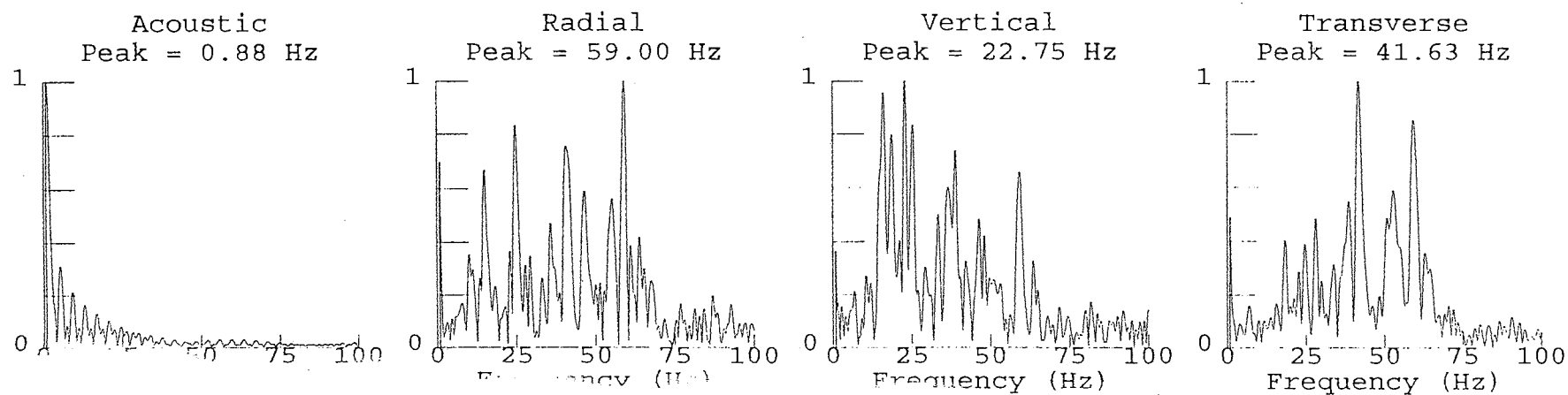
B1374AC95964713626DA75B2B2476C4DA75B6472
B2DE26CACB4EB136C8EDBDB7B6F209048D56954A
6969D48E42E25BA536D36E42DBA536C90A4A0B24
12190C1280C0D03E40090127FE

8EE4 07.2 07-14-95 16:16 IPS 016 P
Ÿ 0.030T 0.030V 0.020R 106 A 0.035VS A
BAT Event: 016 Date: 7/14/95 Time: 16:16
Air Trigger: 148 dB Seis Trigger: 0.03 in/s S/N: 491

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



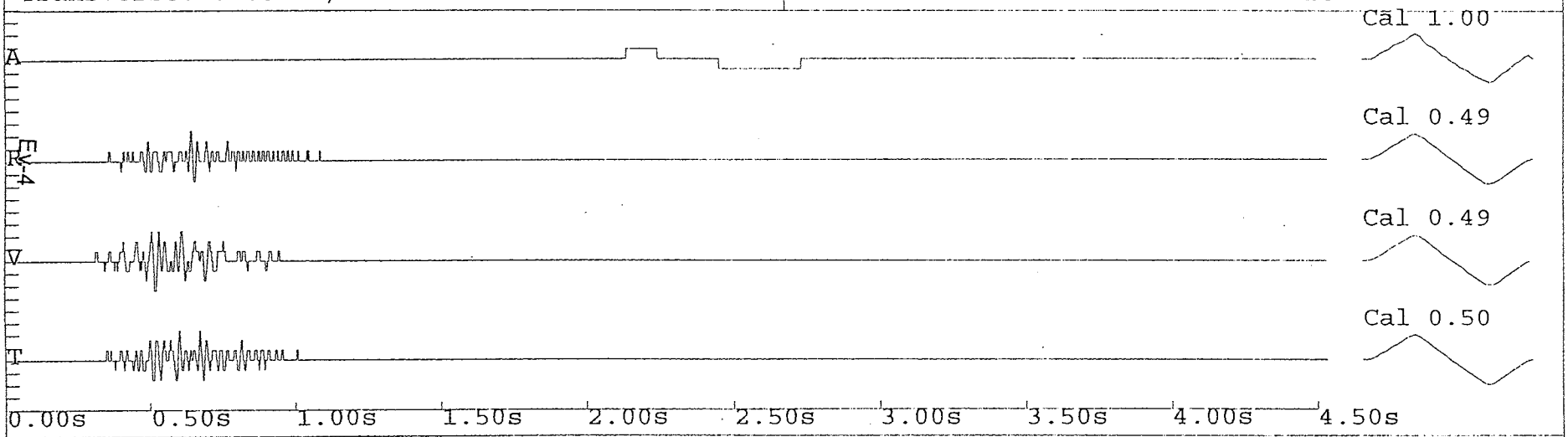
Fourier Analysis (Amplitude Spectrum)



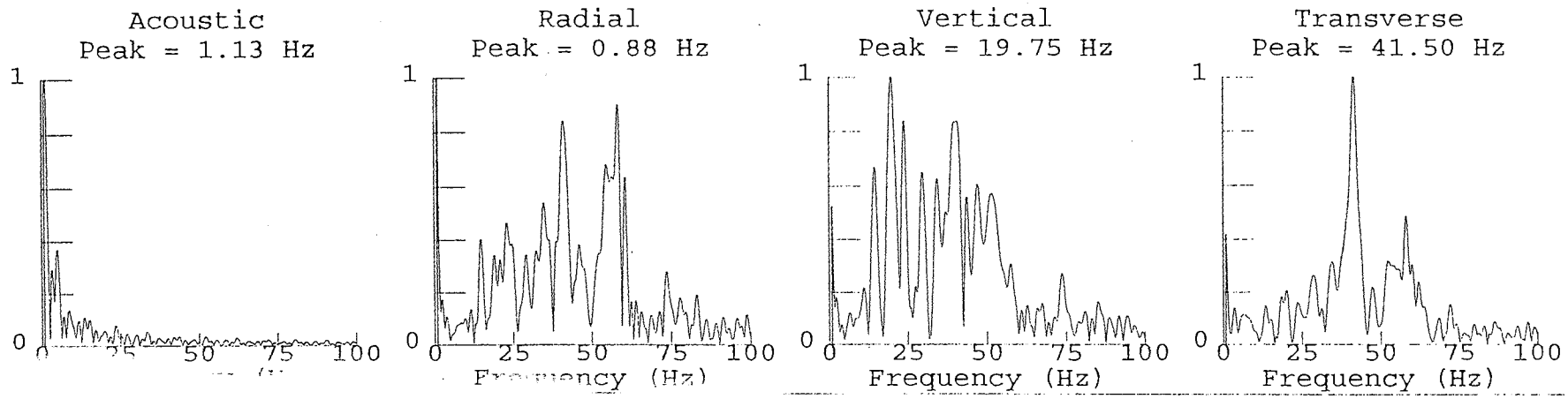
1374AC95964713626DA75B2B2476C4DA75B6472B
2DE26CACB4EB136C8EDBDB7B6F209048D6006954
AA552D3948E42E25BA536D36E42DBA536C90A4A0
B2412190C1280C0D03690229FF

7C96 07.2 07-15-95 14:27 IPS 017 P
Ÿ 0.030T 0.030V 0.030R 106 A 0.035VS A
BAT Event: 017 Date: 7/15/95 Time: 14:27
Air Trigger: 148 dB Seis Trigger: 0.03 in/s S/N: 491

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



256591C4D89B69D6CAC91DB1369D6D91CACB789B
6D3ACACB23B136F75ECACBC822091AC00D2A954A
A5A7291C85C4B74A6DA6DC85B74A6D892505C824
12190E804050340F03A4069FF8

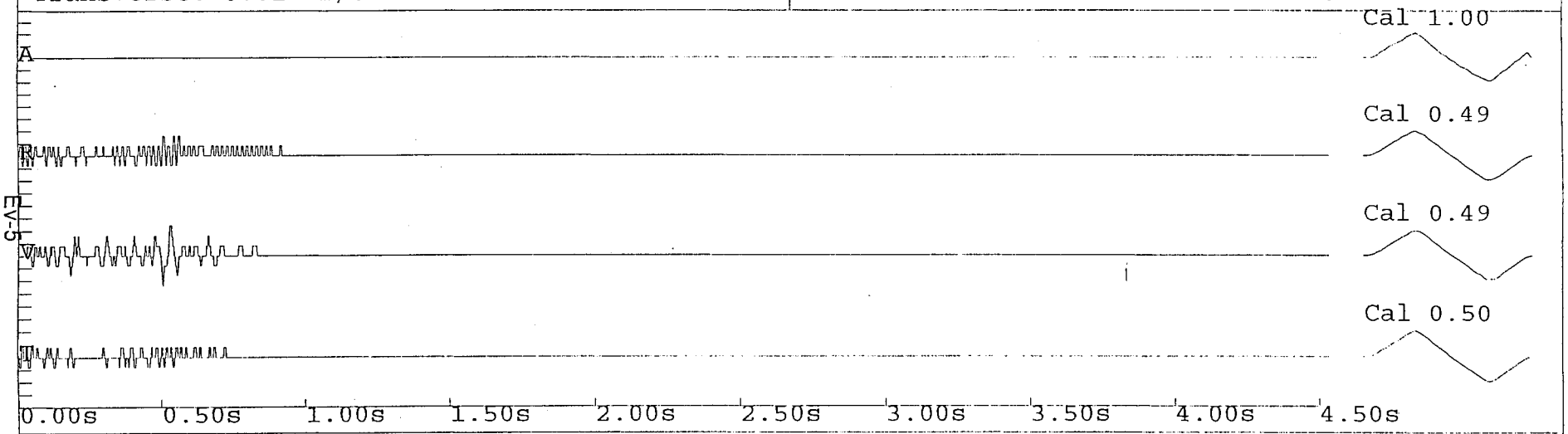
5D37 07.2 07-17-95 16:34 IPS 018 P
Ÿ 0.010T 0.030V 0.020R 100 A 0.030VS A
BAT Event: 018 Date: 7/17/95 Time: 16:34
Air Trigger: 148 dB Seis Trigger: 0.03 in/s S/N: 491

Amplitudes and Frequencies

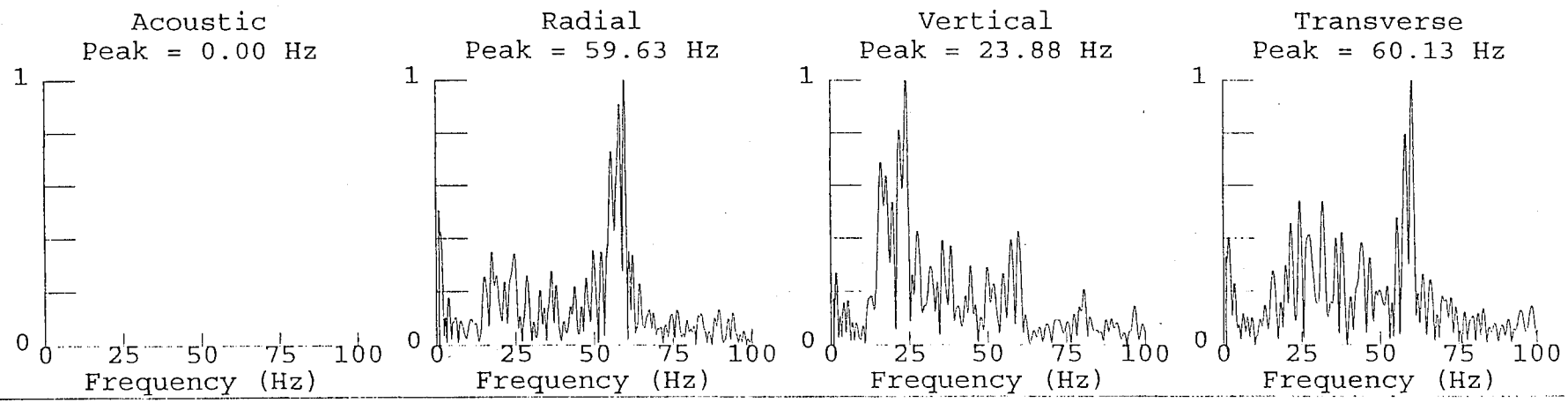
Acoustic: 0 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.03 in/s 0.0 Hz.
Transverse: 0.01 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)

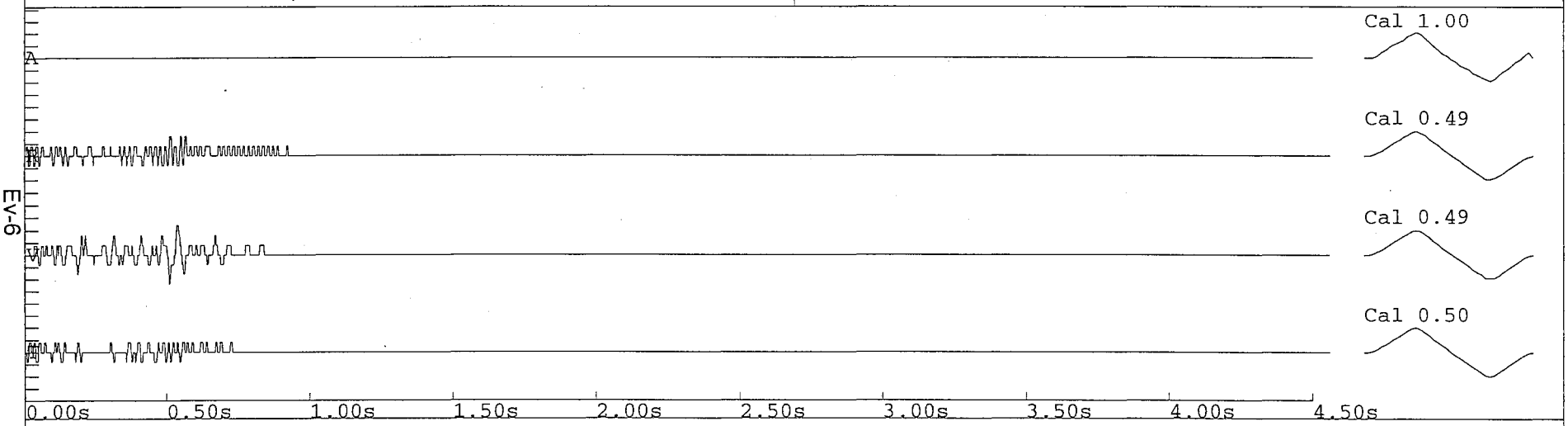


1455A552A954A49C85B54A6DC85B6A496DD29272
16D32190C87A774EA76A6DD2B2DD136564ACD626
C4DD2B256591C4D89B69D6CAC91DB1369D6D91CA
CB789B6D3ACACB23B136F75ECACBC822091AC00D
2A954AA5A7291C85C4B74A6DA6DC85B74A6D8925
05C82412190E804050340F03A4069FF8

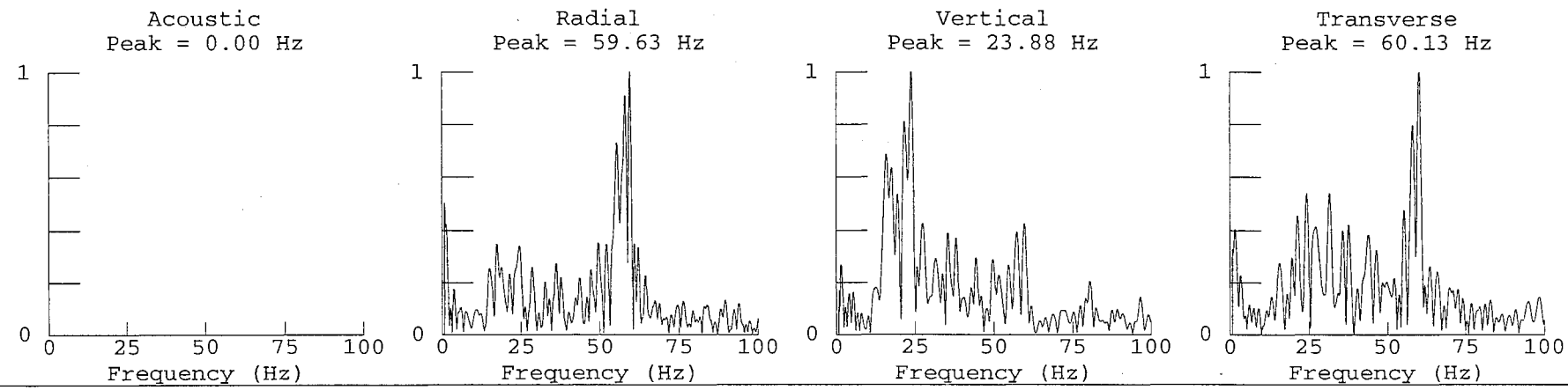
5D37

Event: 018 Date: 7/17/95 Time: 16:34
Air Trigger: 148 dB Seis Trigger: 0.03 in/s S/N: 491

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



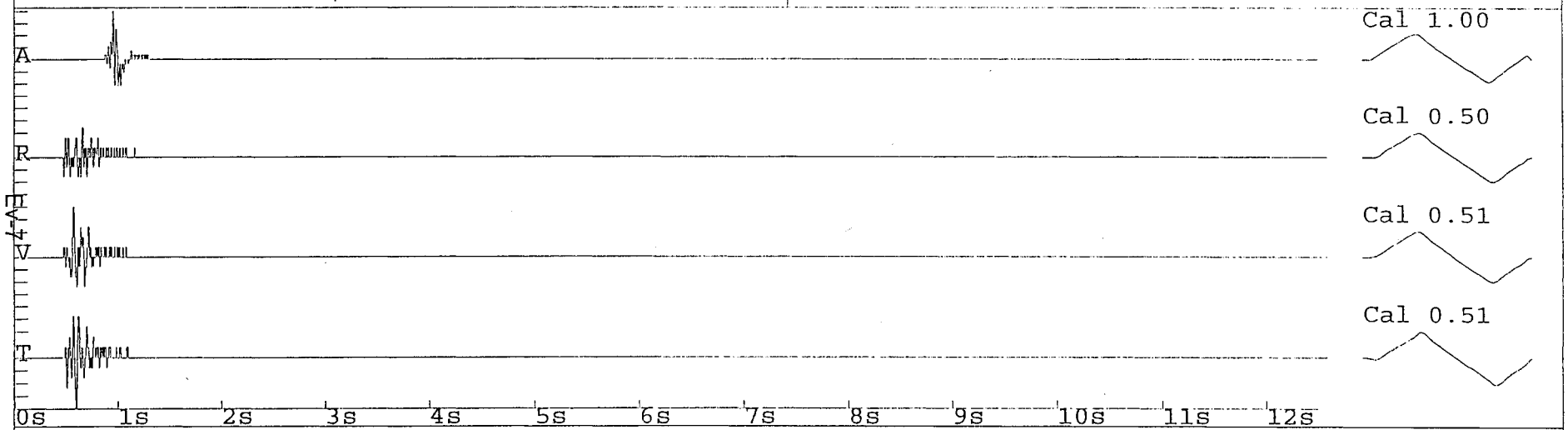
Fourier Analysis (Amplitude Spectrum)



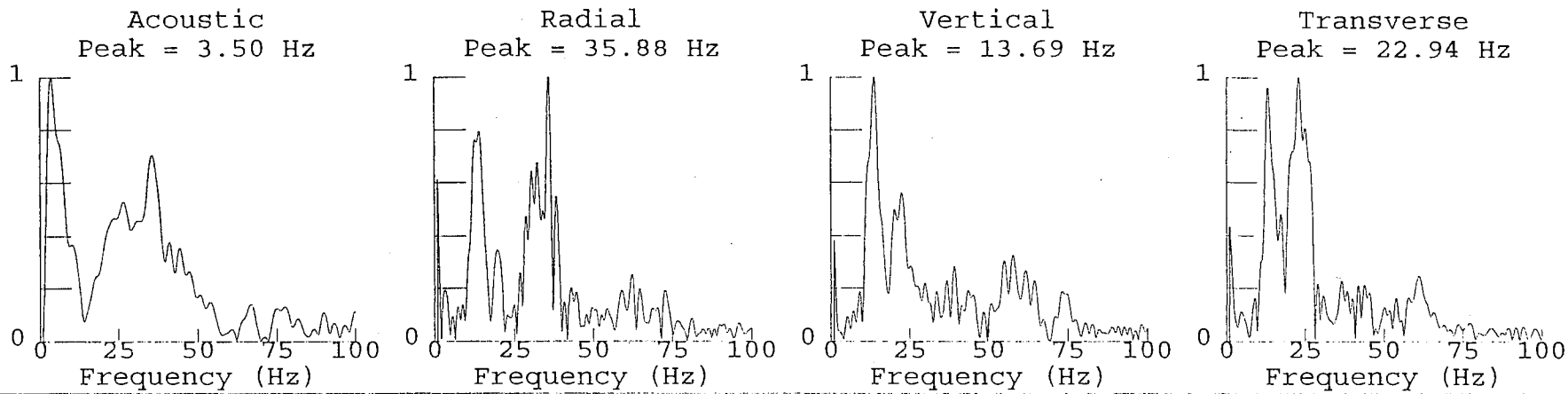
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Exterior

Event: 077 Date: 6/ 2/95 Time: 17:24
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 121 dB 32.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.22 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 18.9 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.05 in/s 21.3 Hz.	Time Lines at: 1.00 sec intervals



Fourier Analysis (Amplitude Spectrum)



APPENDIX Evi

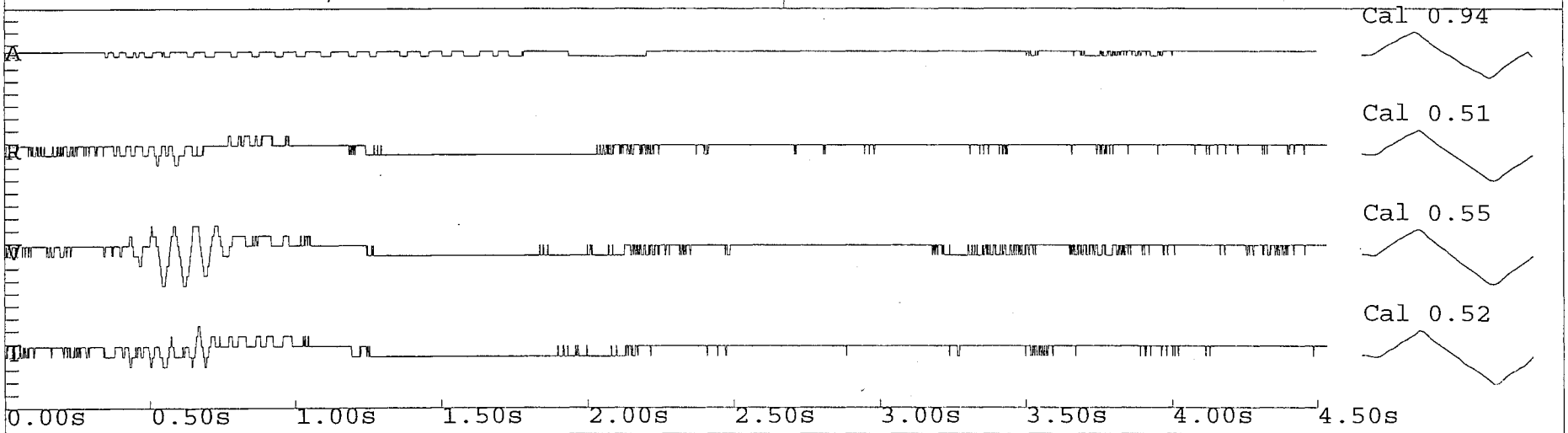
FULL WAVEFORM DATA

LLOYD'S ROOM

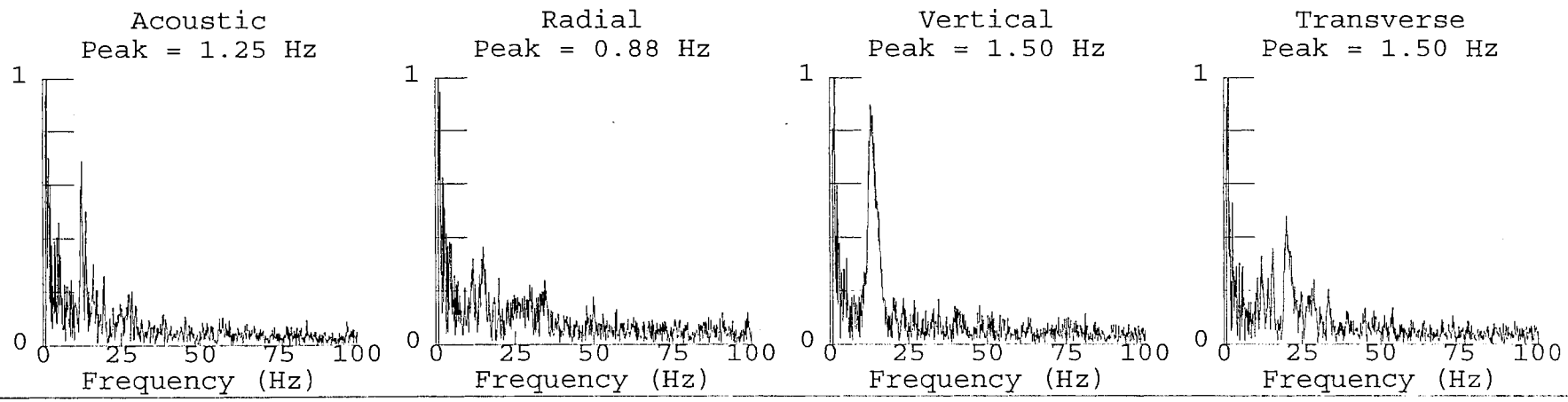
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 001 Date: 6/ 2/95 Time: 17:28
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



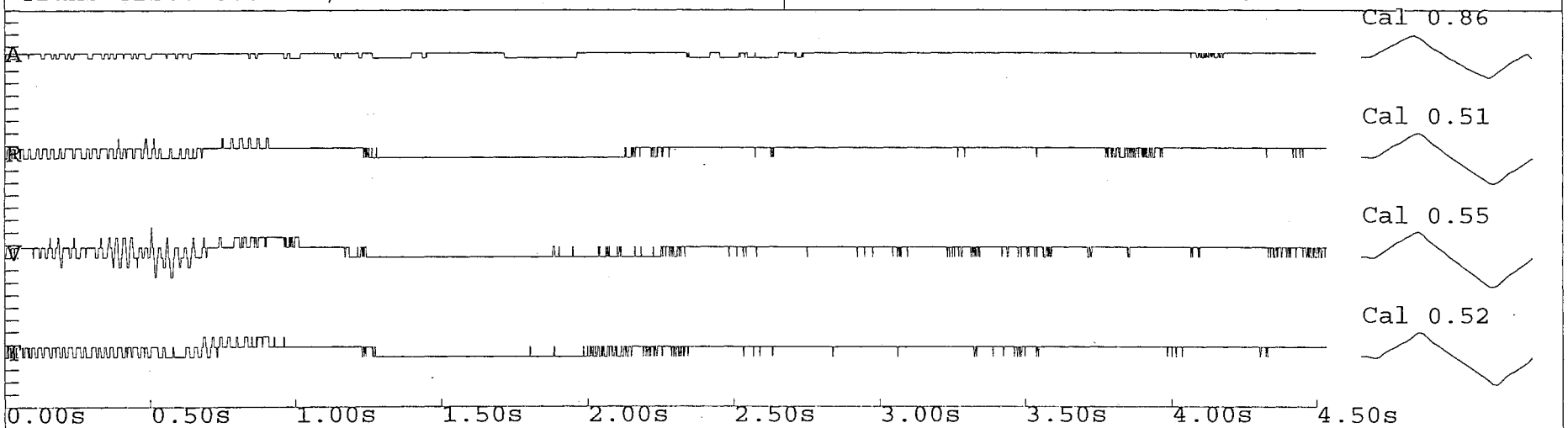
Fourier Analysis (Amplitude Spectrum)



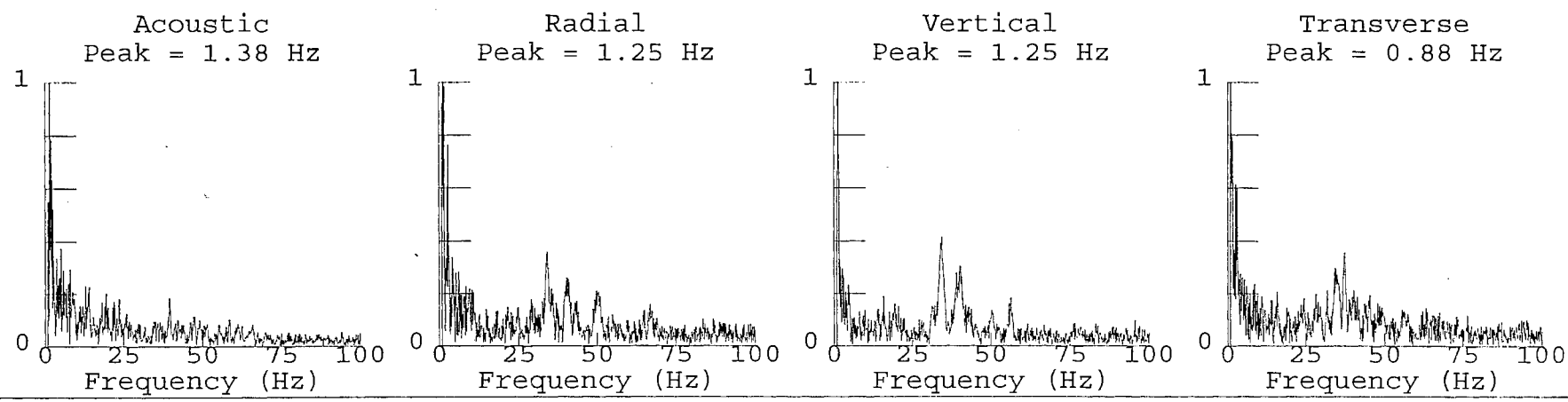
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 004 Date: 6/17/95 Time: 9:13
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



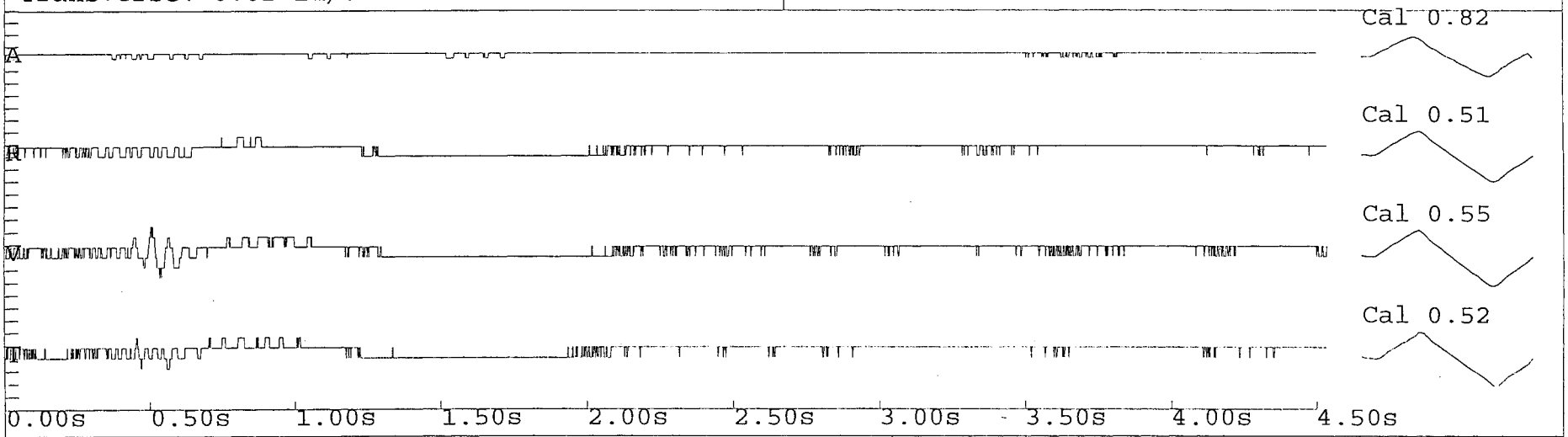
Fourier Analysis (Amplitude Spectrum)



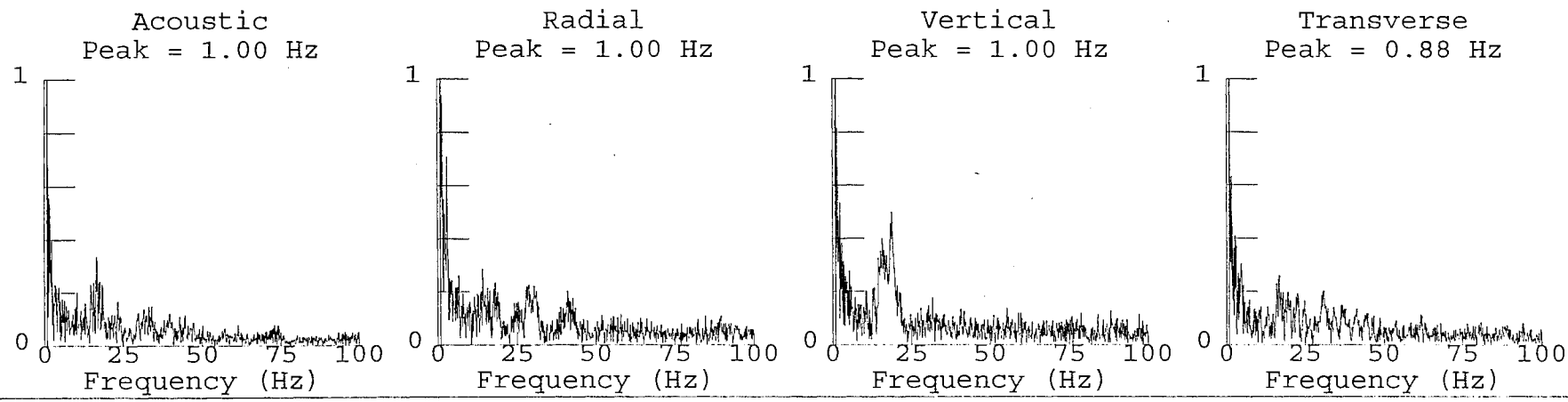
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 005 Date: 6/19/95 Time: 18:39
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



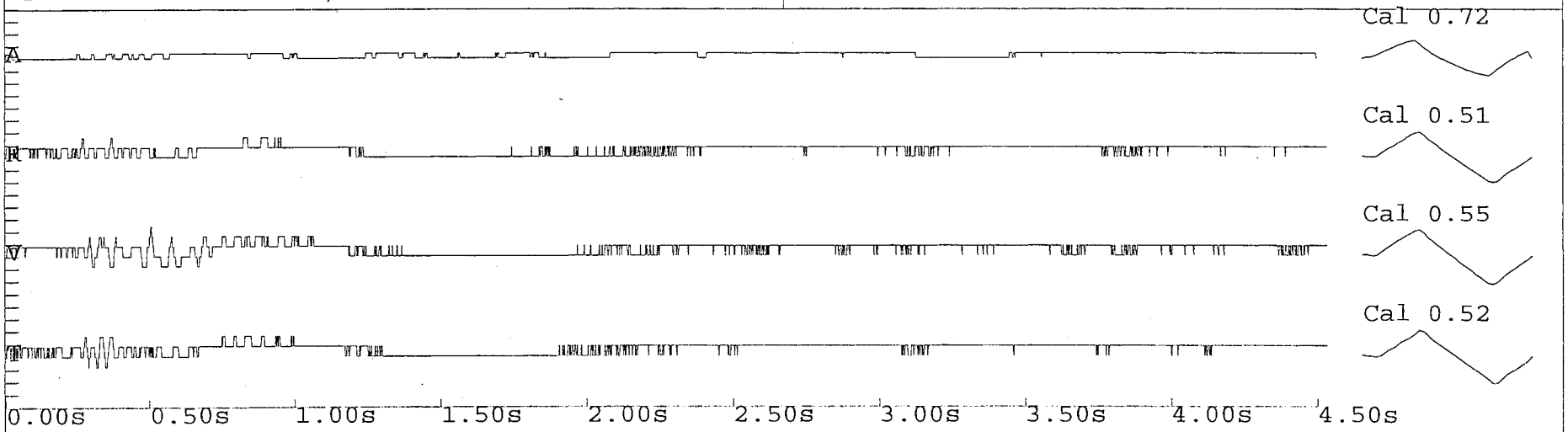
Fourier Analysis (Amplitude Spectrum)



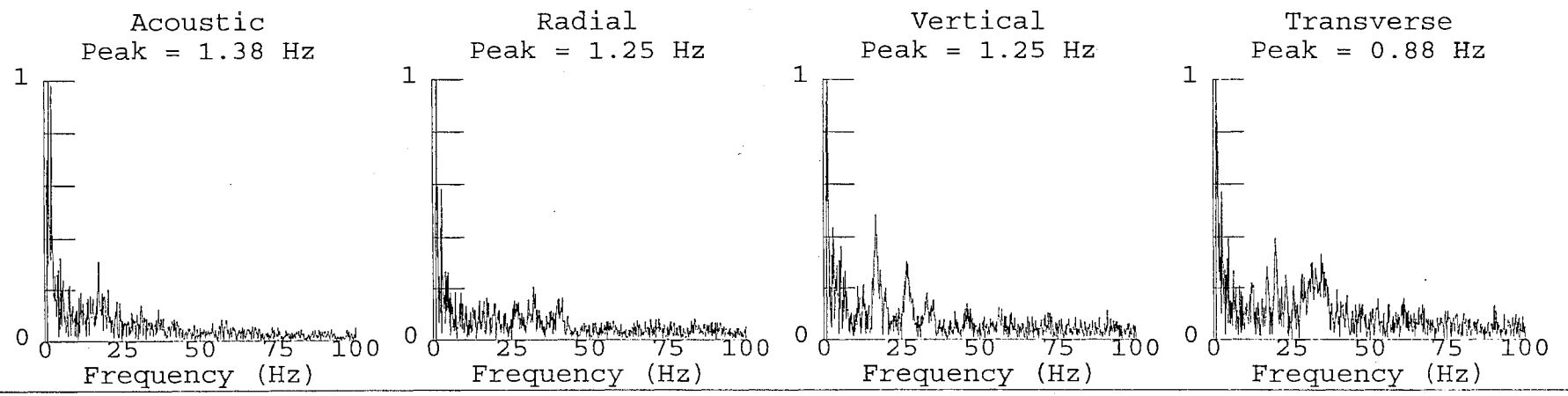
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 006 Date: 6/21/95 Time: 18:18
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



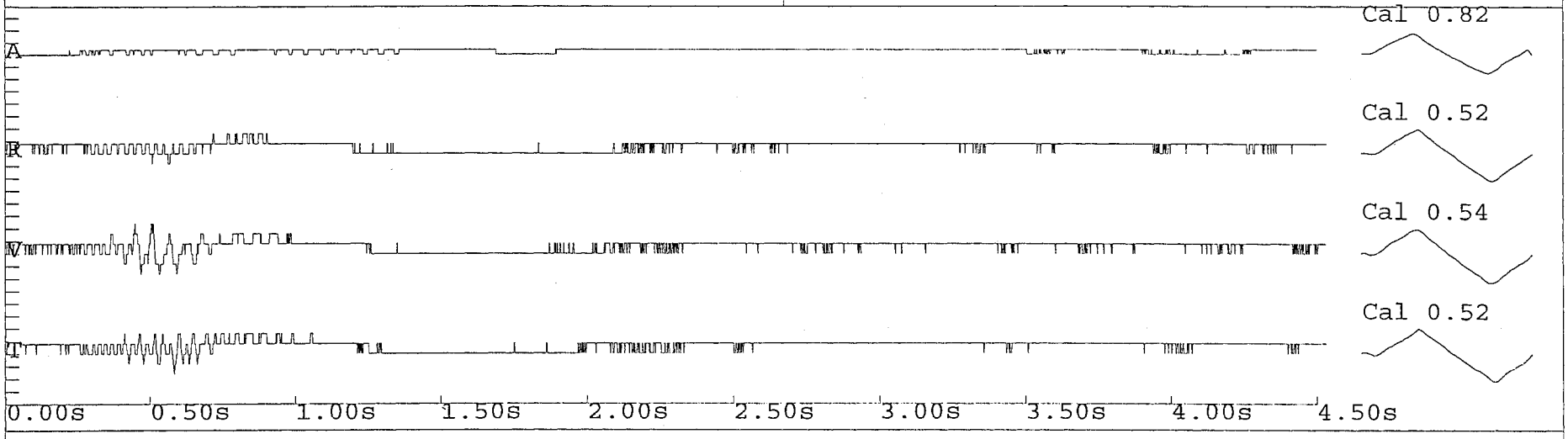
Fourier Analysis (Amplitude Spectrum)



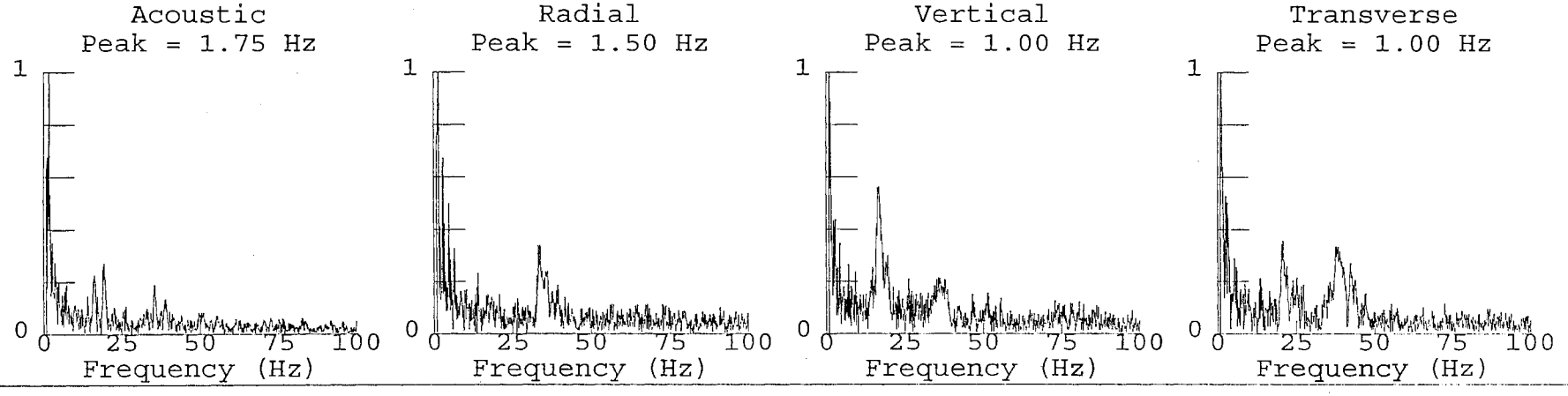
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 007 Date: 7/ 1/95 Time: 12:35
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



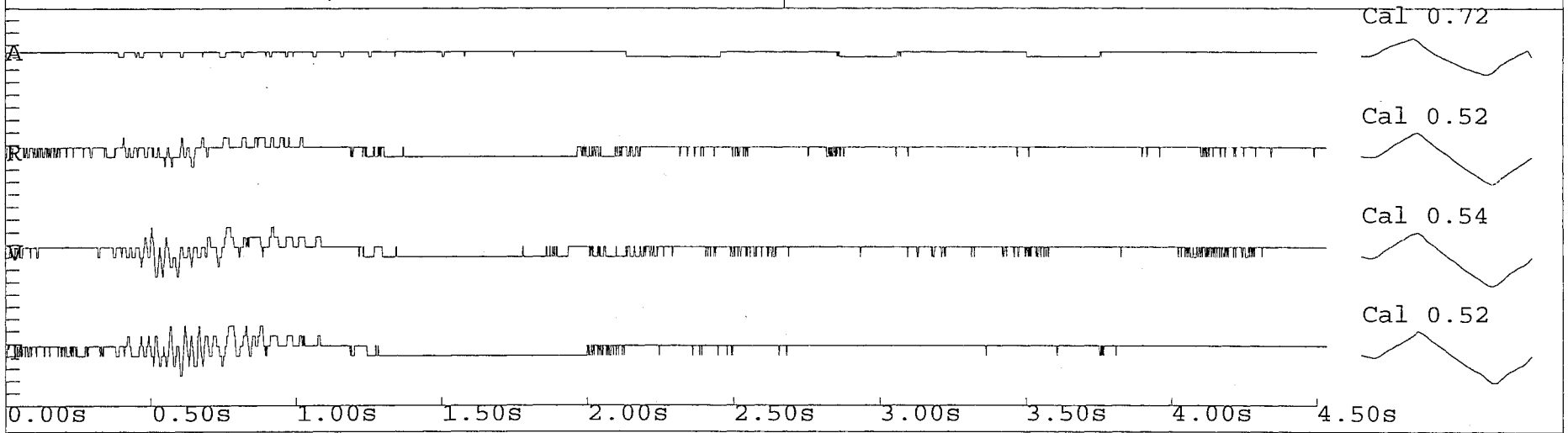
Fourier Analysis (Amplitude Spectrum)



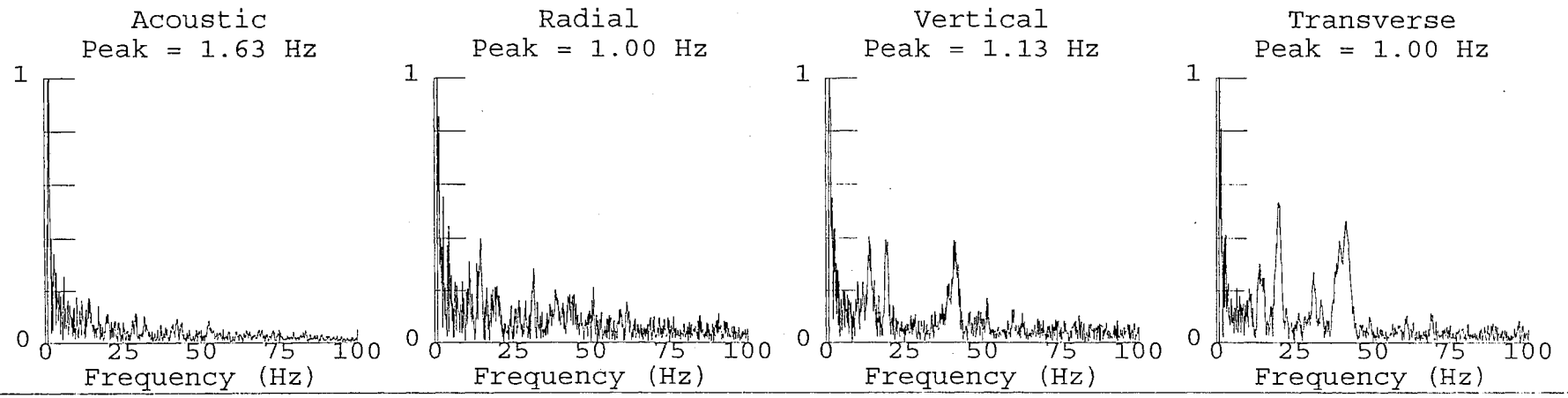
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 008 Date: 7/ 5/95 Time: 17:25
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



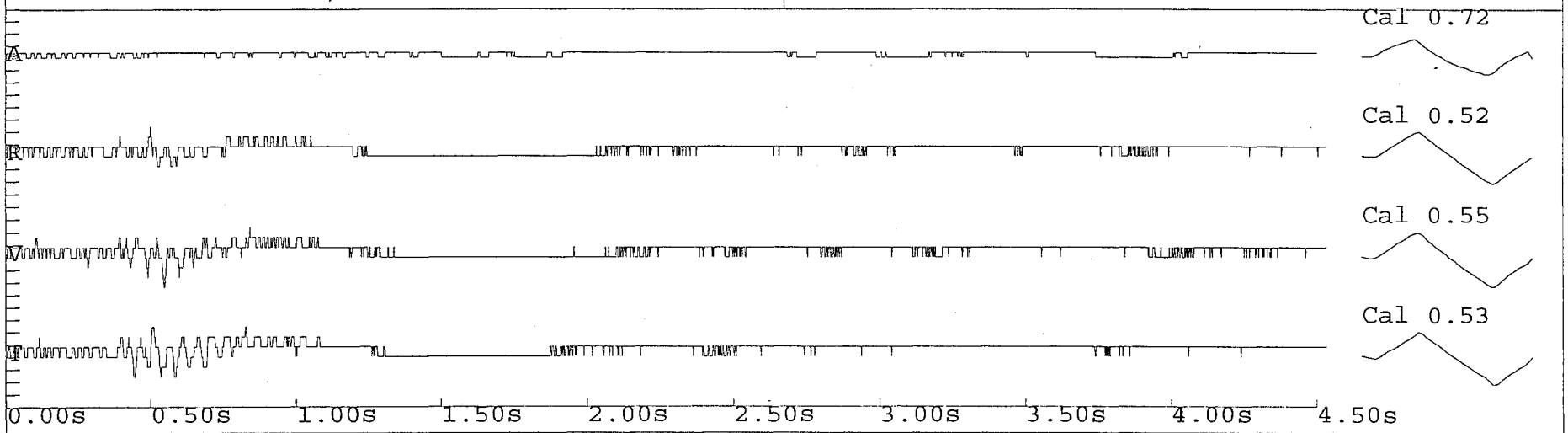
Fourier Analysis (Amplitude Spectrum)



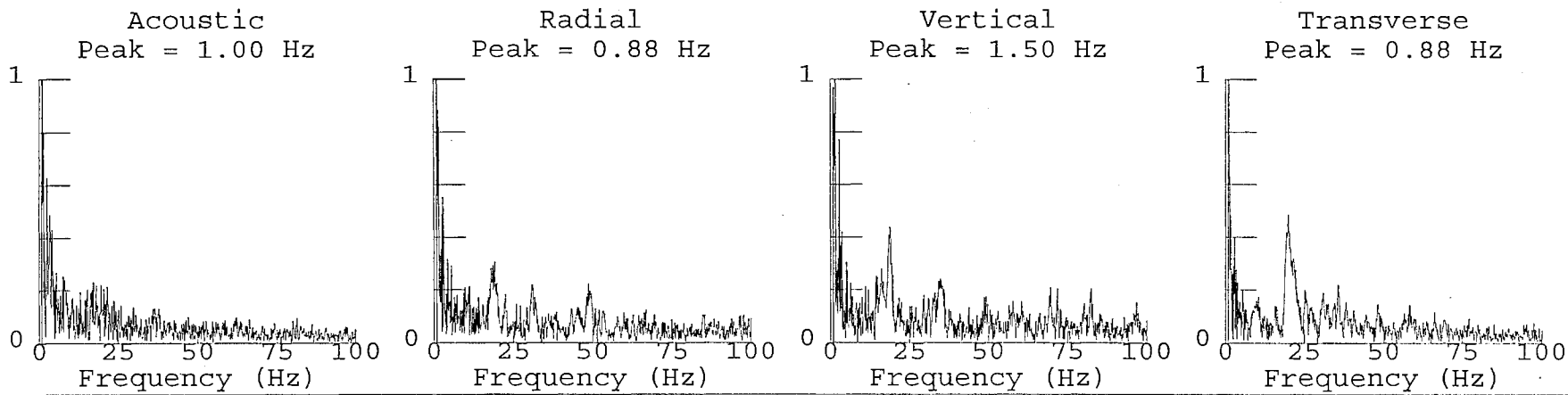
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 009 Date: 7/ 6/95 Time: 18:22
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



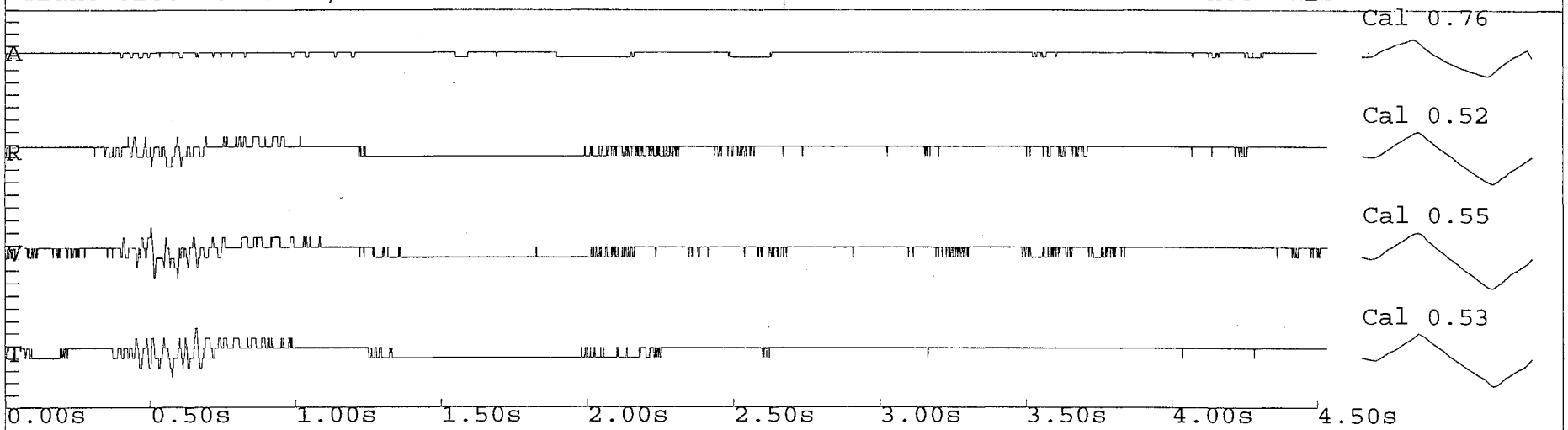
Fourier Analysis (Amplitude Spectrum)



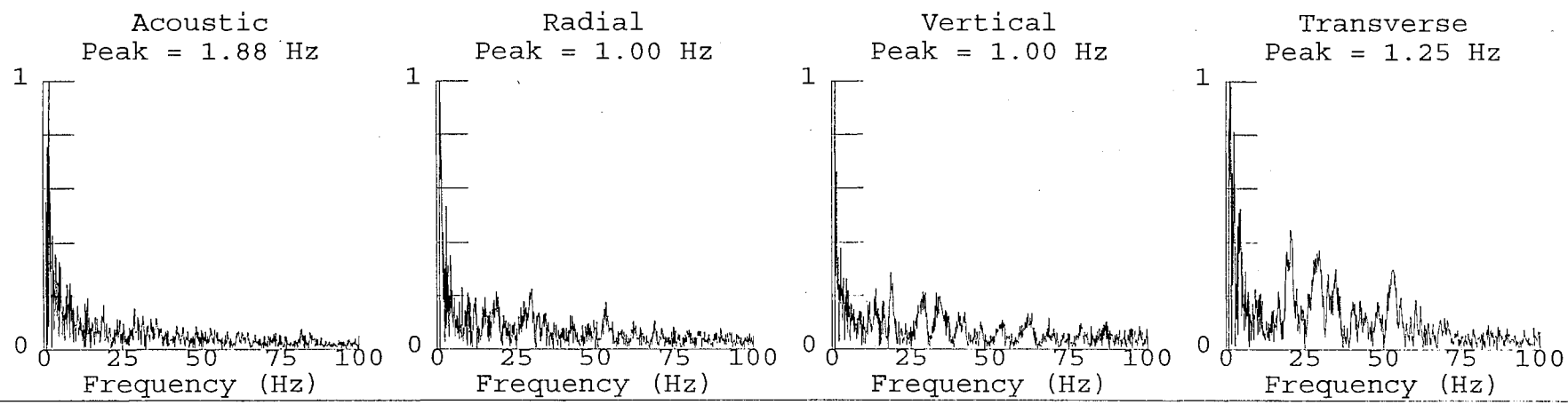
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 010 Date: 7/ 7/95 Time: 17:51
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



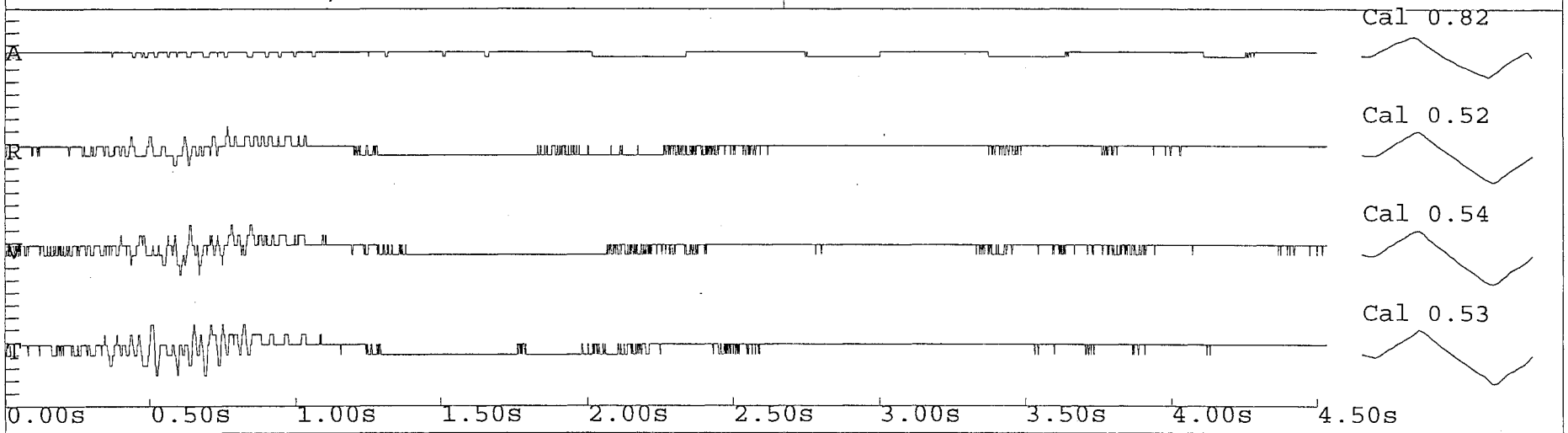
Fourier Analysis (Amplitude Spectrum)



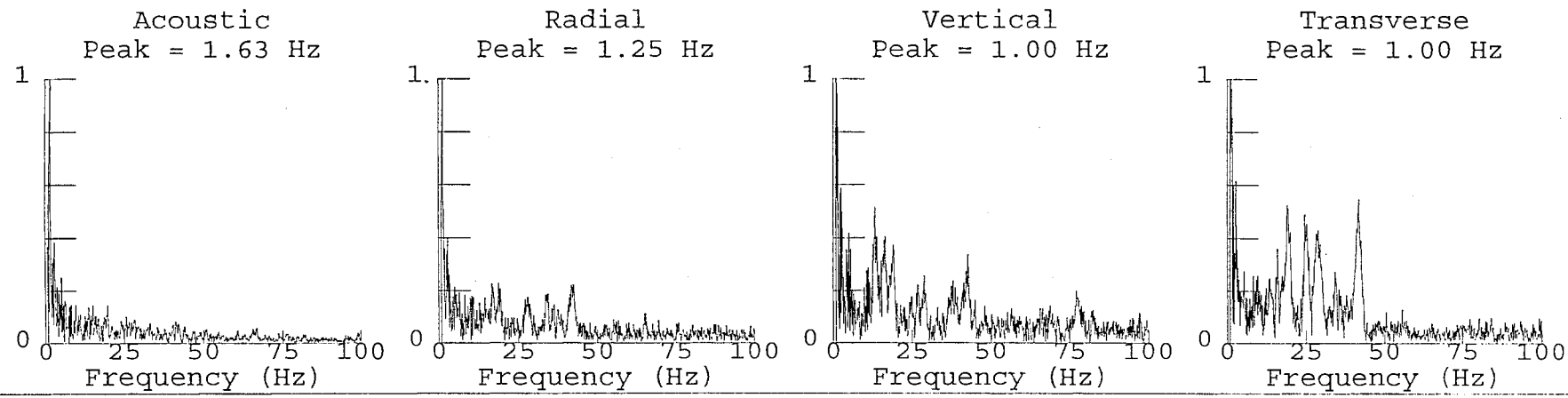
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 011 Date: 7/10/95 Time: 17:23
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



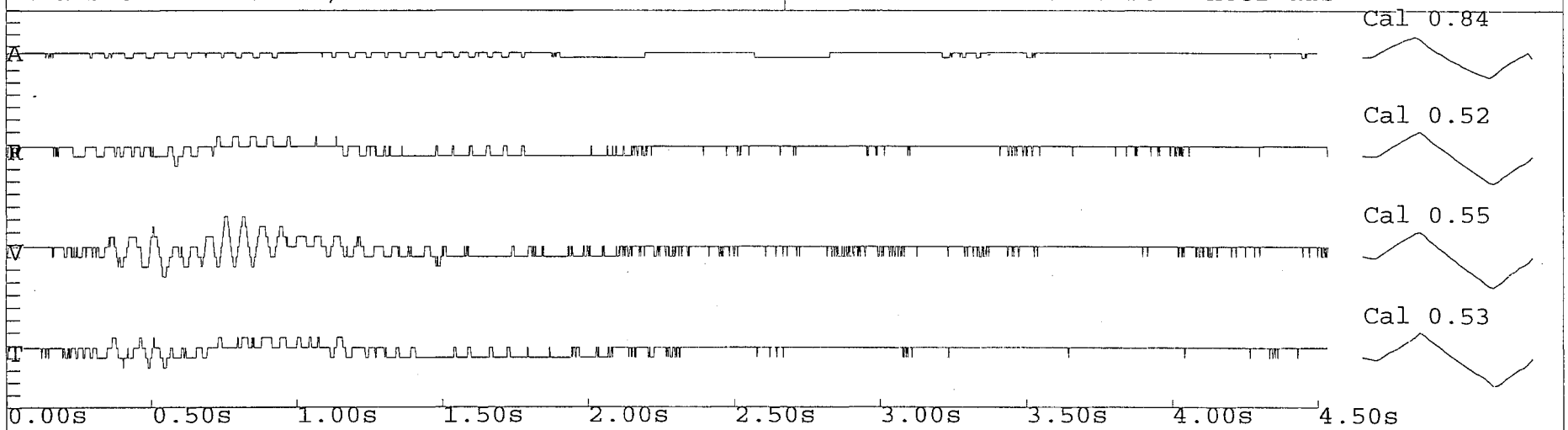
Fourier Analysis (Amplitude Spectrum)



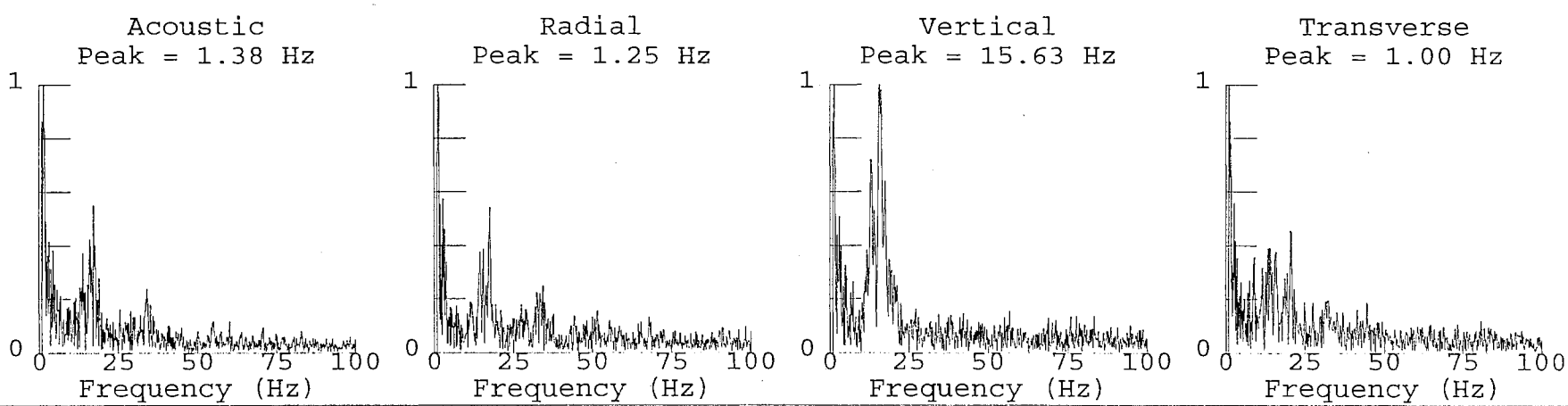
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 012 Date: 7/11/95 Time: 17:31
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 16.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



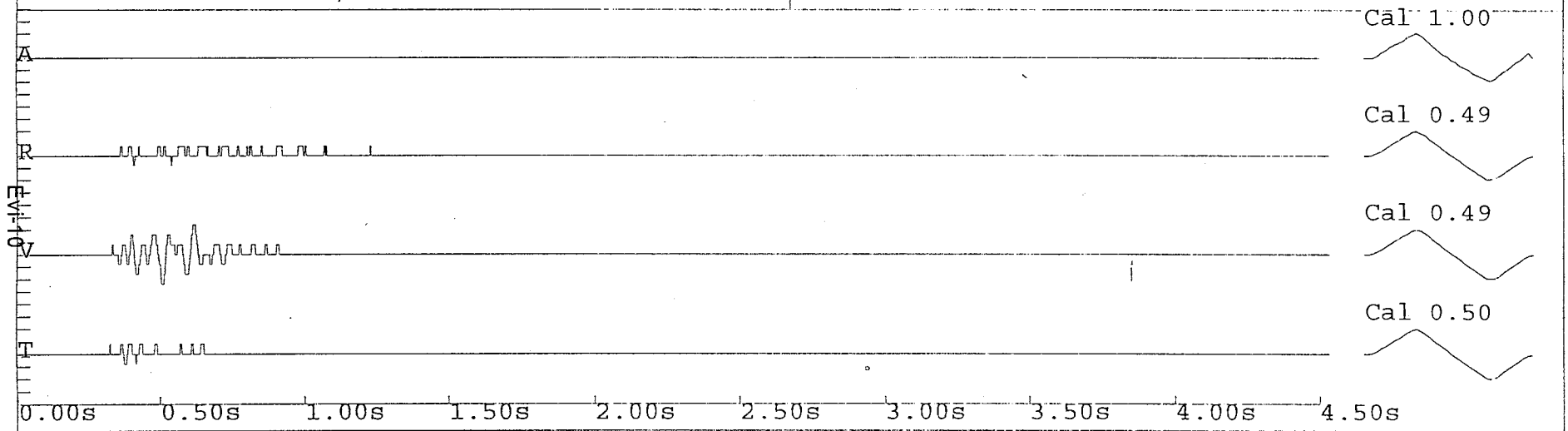
4420555A552A954A49C85B54A6DC85B6A496DD29
27216D32190C87A774EA76A6DD2B2DD136564ACD
626C4DD2B256591C4D89B69D6CAC91DB1369D6D9
1CAC959789B136D3ADB23B6F6DEDBC8241235801
A552A954B4E52390B896E94DB4DB90B6E94DB124
A0B91C8243211082080606819204 53FF

1B25

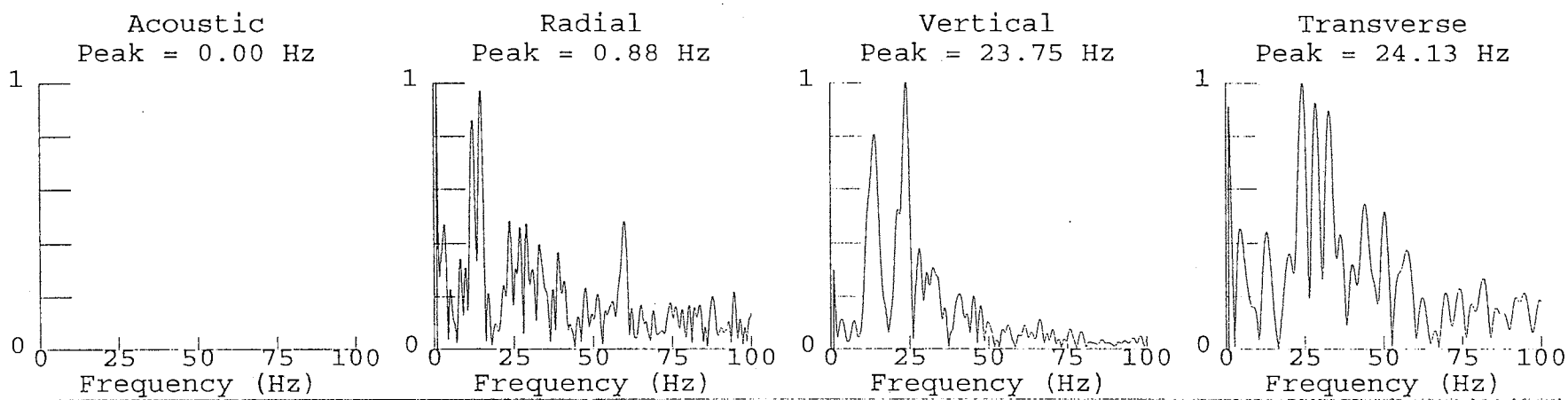
Event: 012 Date: 6/ 2/95 Time: 17:27

Air Trigger: 148 dB Seis Trigger: 0.03 in/s S/N: 491

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



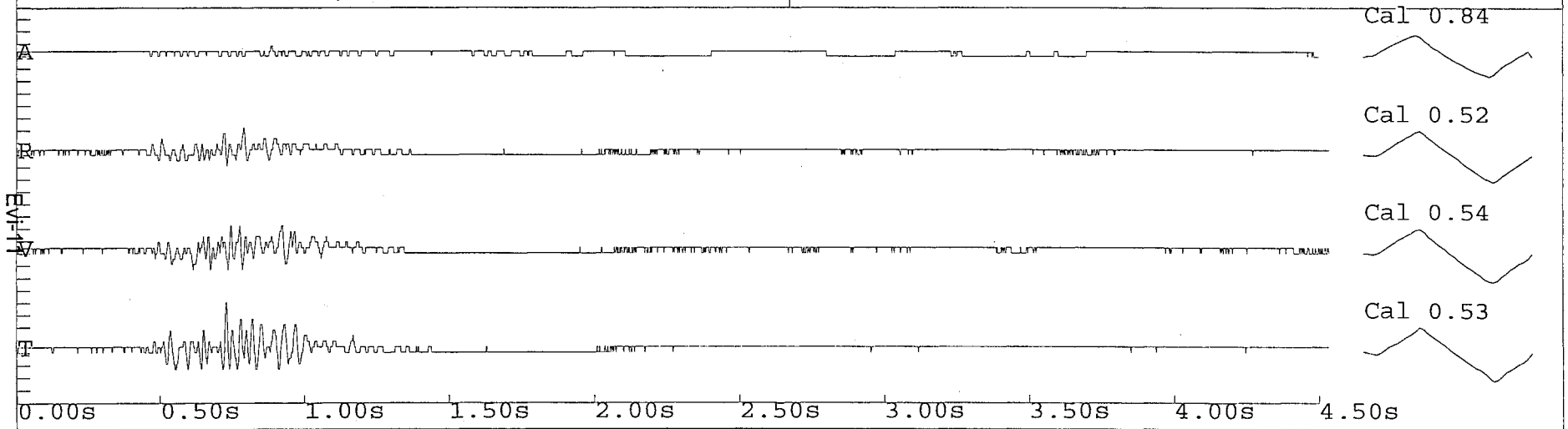
Fourier Analysis (Amplitude Spectrum)



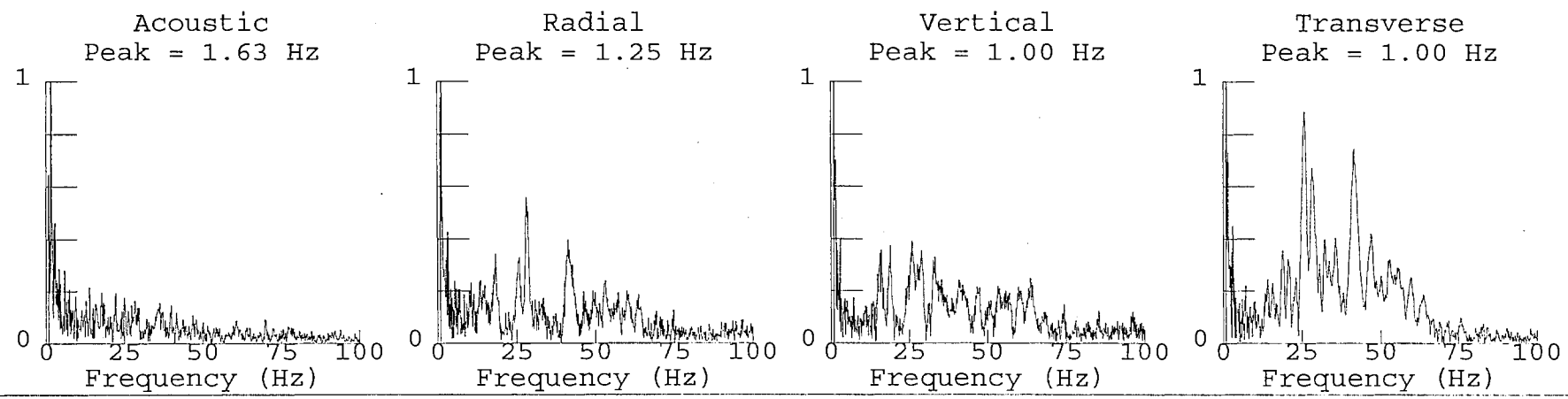
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 014 Date: 7/14/95 Time: 16:18
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.05 in/s 32.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.06 in/s 46.5 Hz.	Seis: 0.09 in/s (0.0225 in/s/div)
Transverse: 0.09 in/s 39.3 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

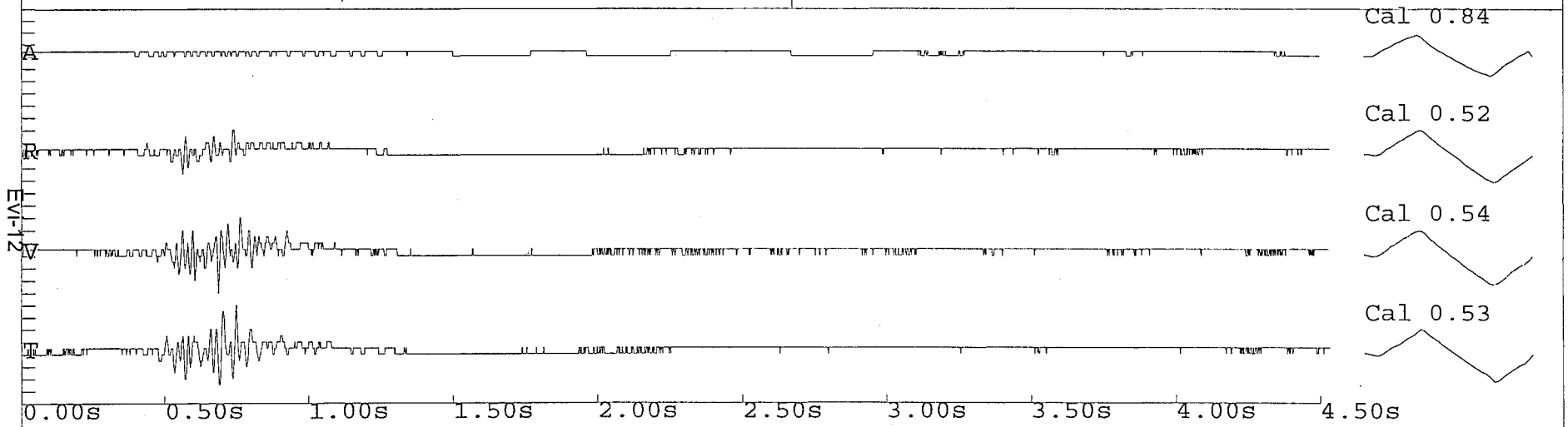
Event: 015 Date: 7/15/95 Time: 14:29
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies

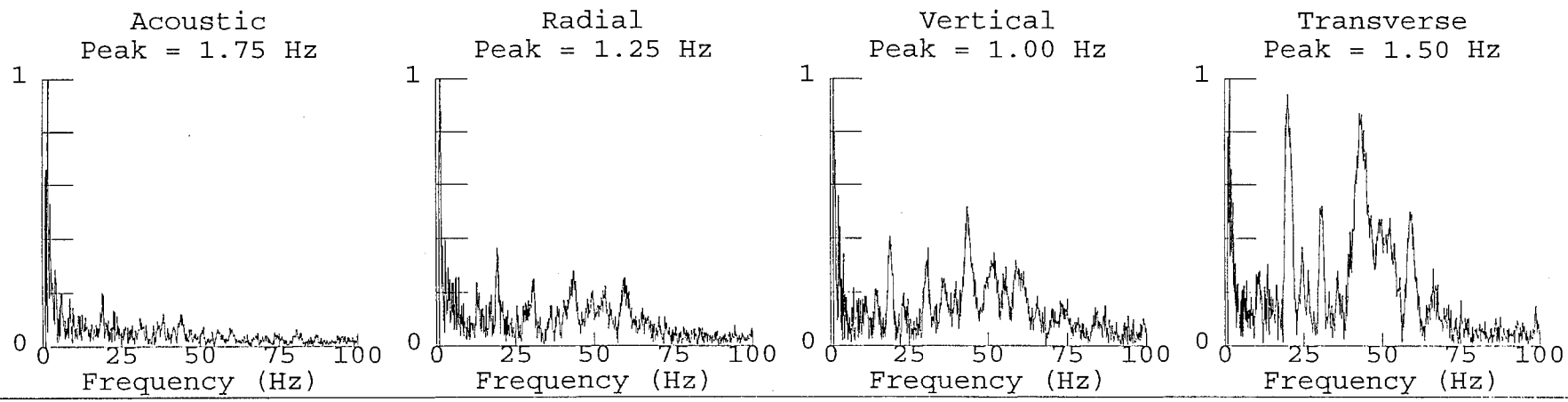
Acoustic: 100 dB 0.0 Hz.
Radial: 0.04 in/s 42.6 Hz.
Vertical: 0.06 in/s 22.2 Hz.
Transverse: 0.08 in/s 39.3 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.08 in/s (0.02 in/s/div)
Time Lines at: 0.50 sec intervals



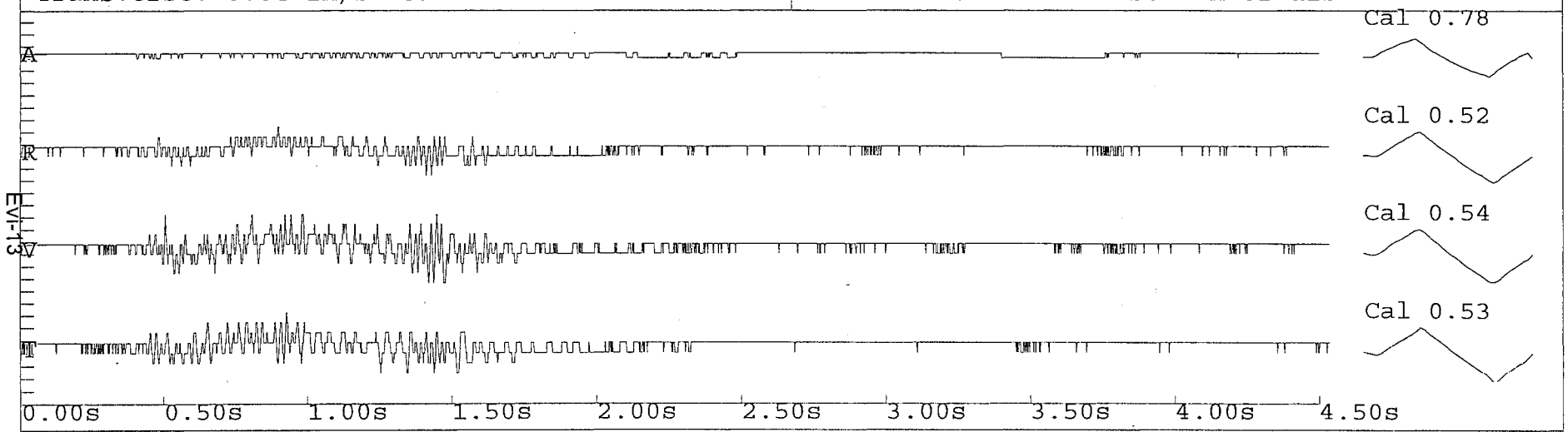
Fourier Analysis (Amplitude Spectrum)



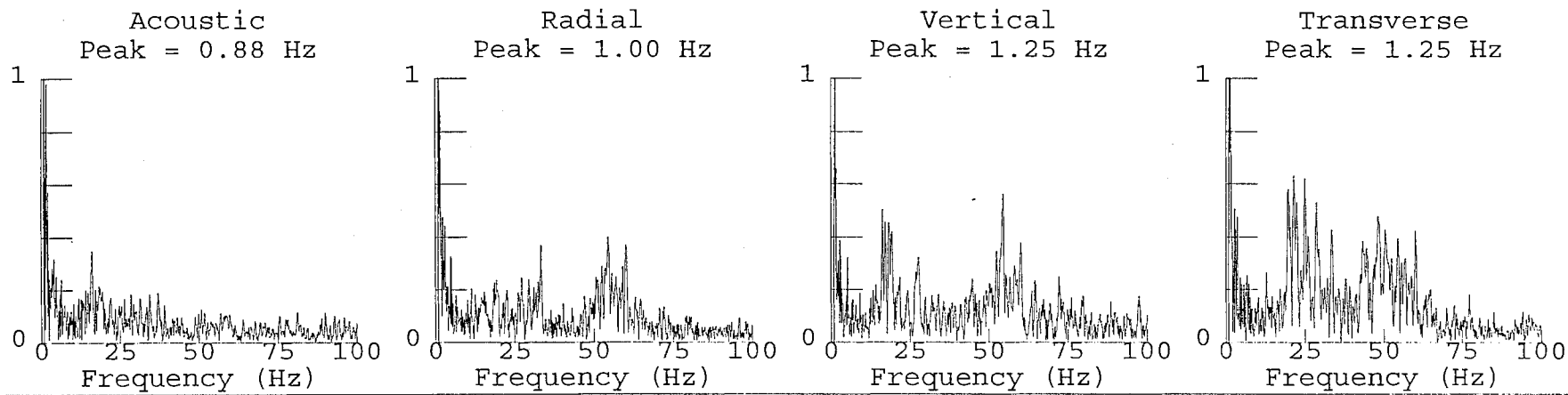
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 016 Date: 7/17/95 Time: 16:36
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 64.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 39.3 Hz.	Time Lines at: 0.50 sec intervals



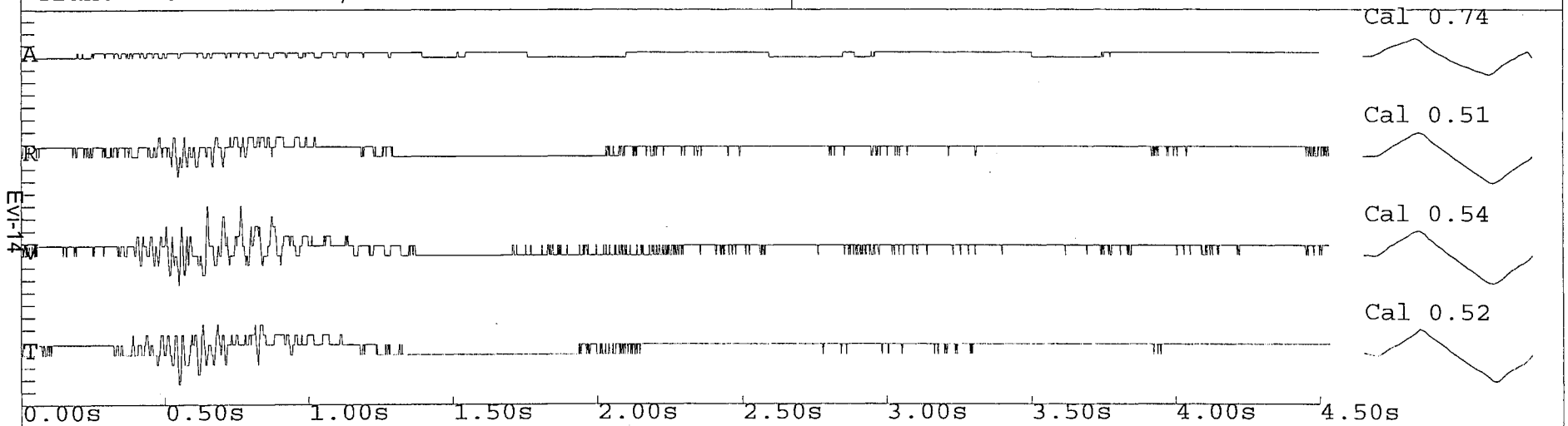
Fourier Analysis (Amplitude Spectrum)



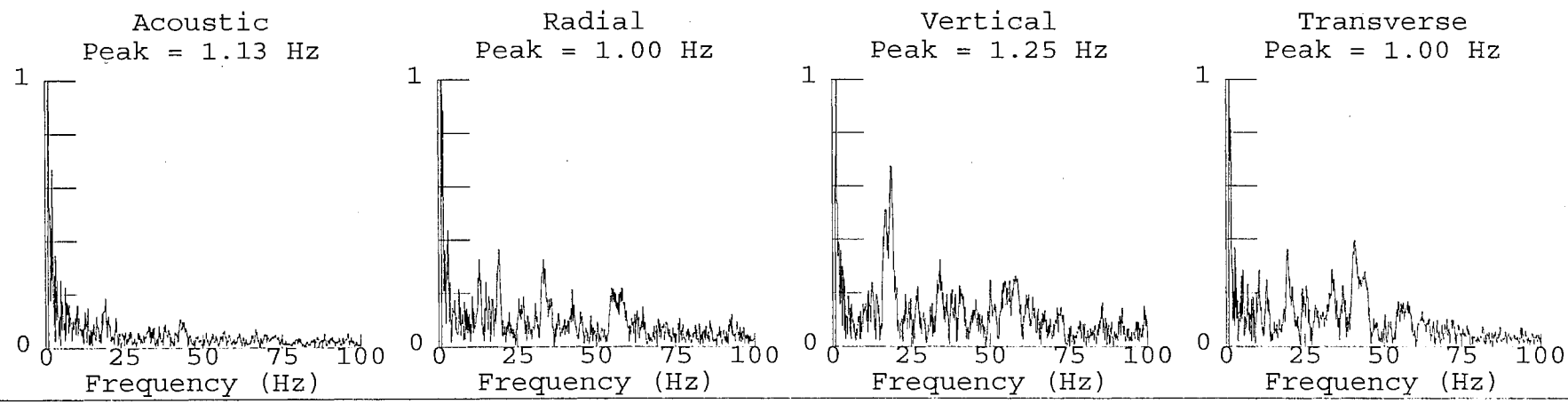
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 017 Date: 7/18/95 Time: 16:52
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 18.9 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



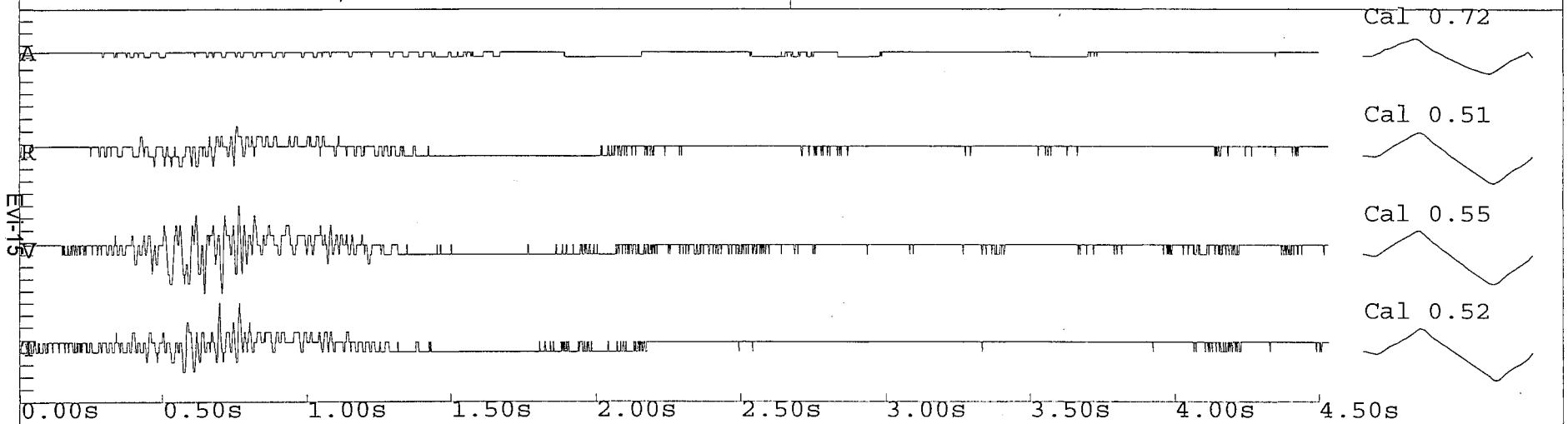
Fourier Analysis (Amplitude Spectrum)



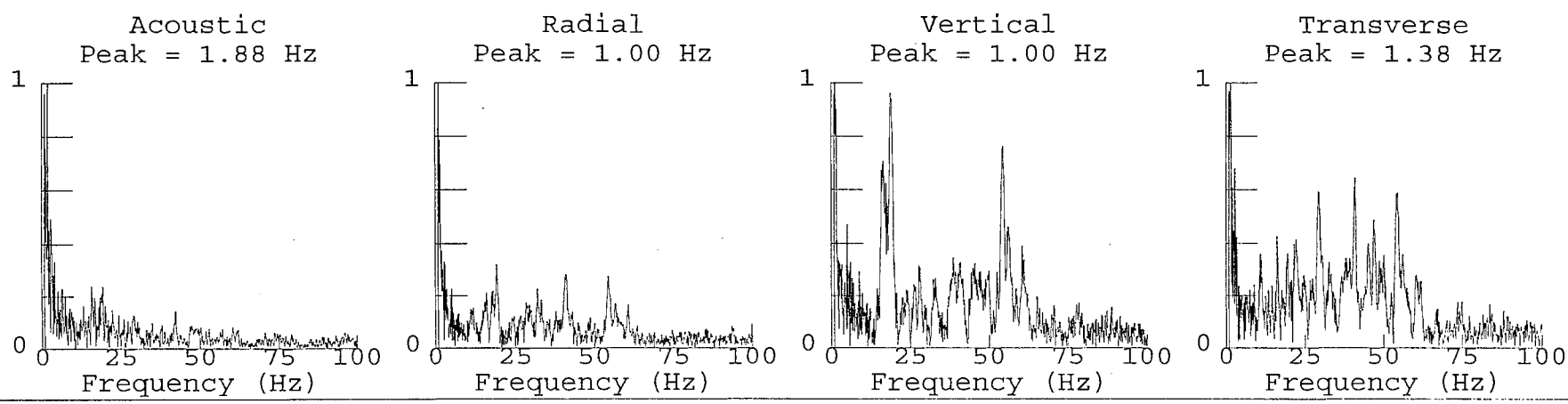
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 018 Date: 7/19/95 Time: 16:49
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 46.5 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.05 in/s 42.6 Hz.	Time Lines at: 0.50 sec intervals



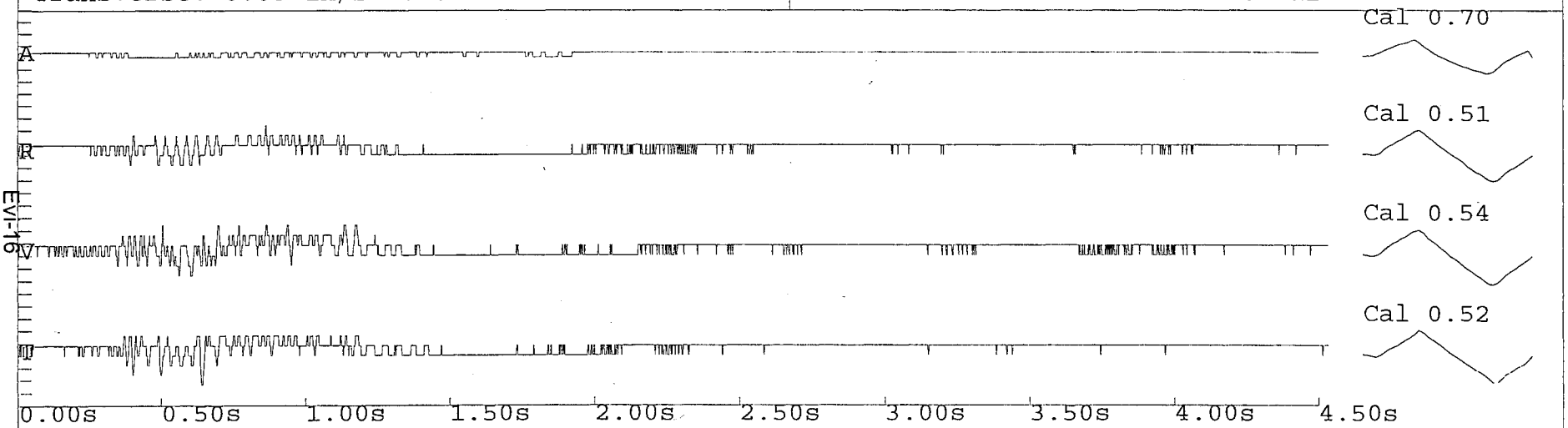
Fourier Analysis (Amplitude Spectrum)



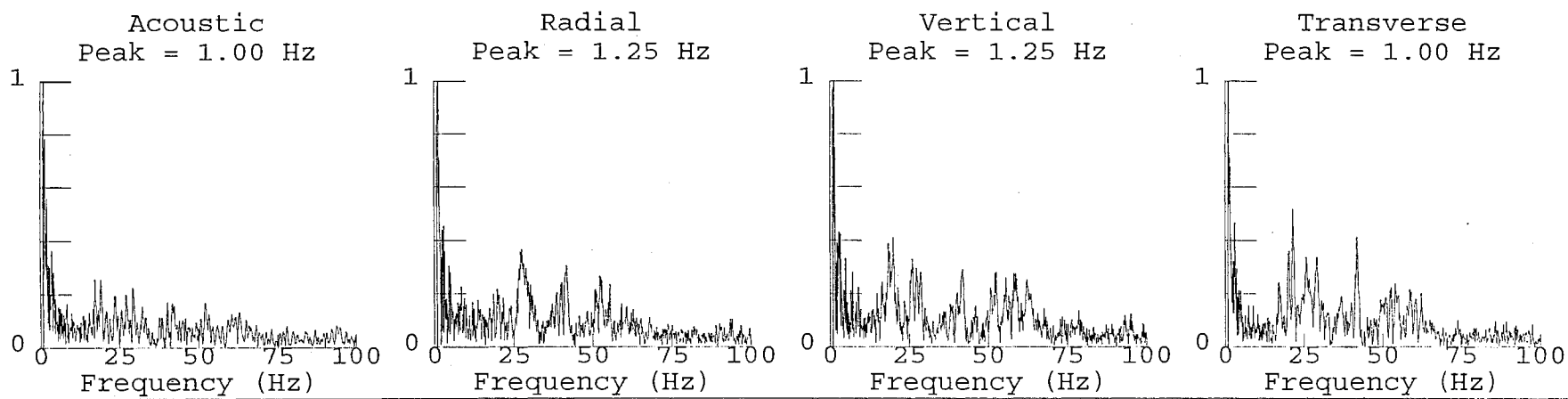
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 019 Date: 7/25/95 Time: 16:27
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



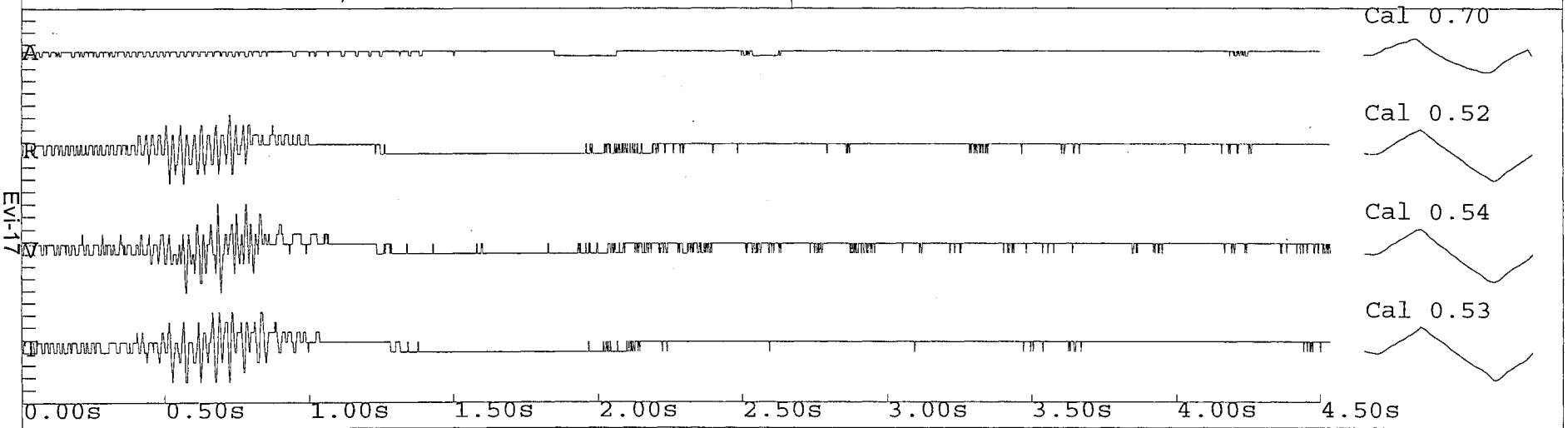
Fourier Analysis (Amplitude Spectrum)



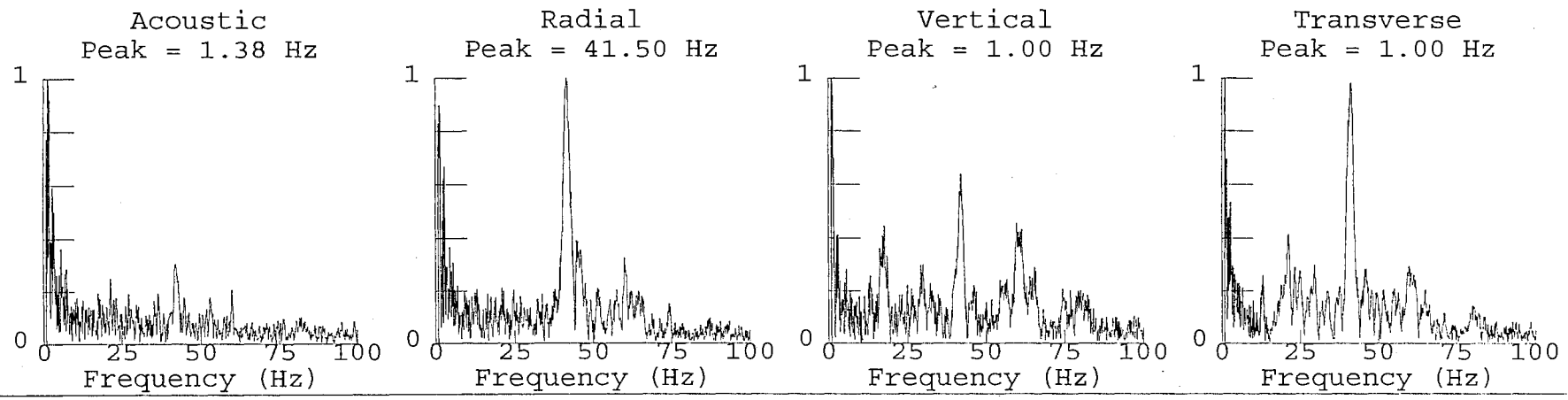
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 020 Date: 7/26/95 Time: 16:21
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 42.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 64.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 42.6 Hz.	Time Lines at: 0.50 sec intervals



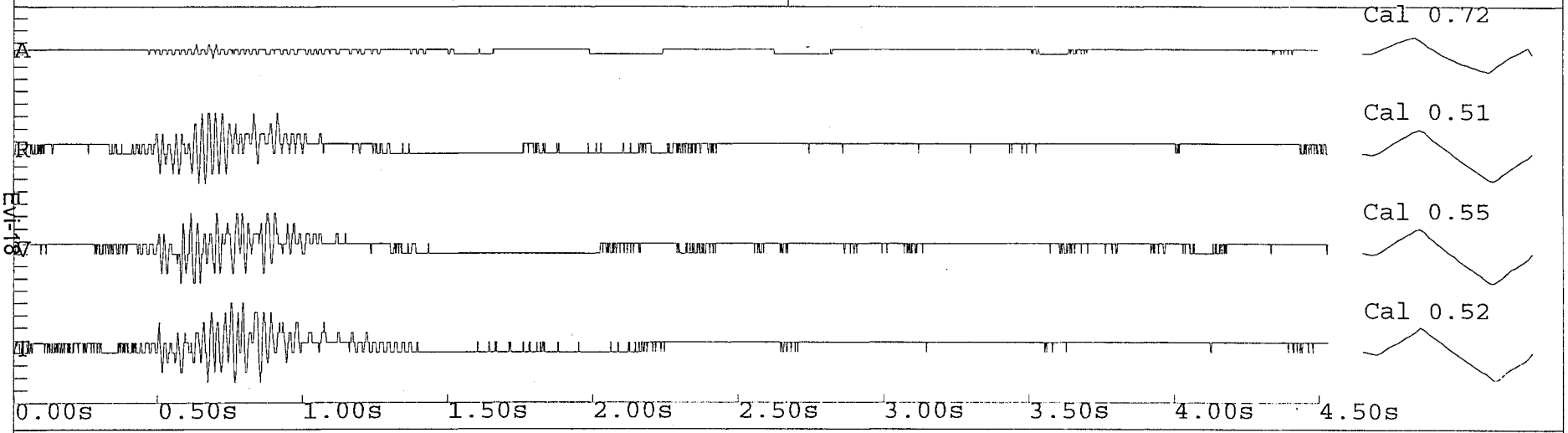
Fourier Analysis (Amplitude Spectrum)



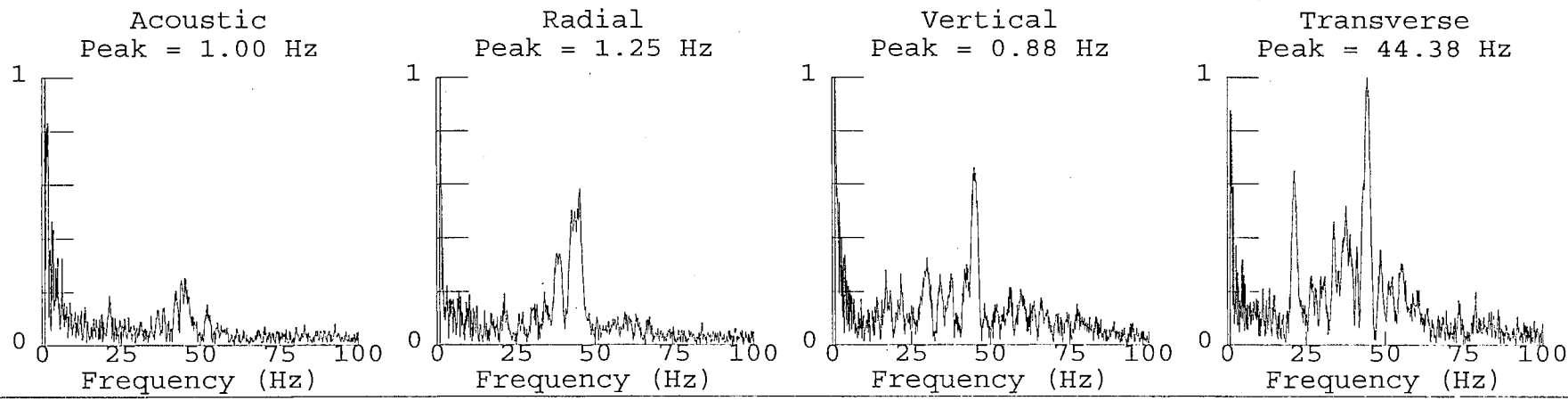
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 021 Date: 7/28/95 Time: 10:10
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 106 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 46.5 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 56.8 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.05 in/s 42.6 Hz.	Time Lines at: 0.50 sec intervals



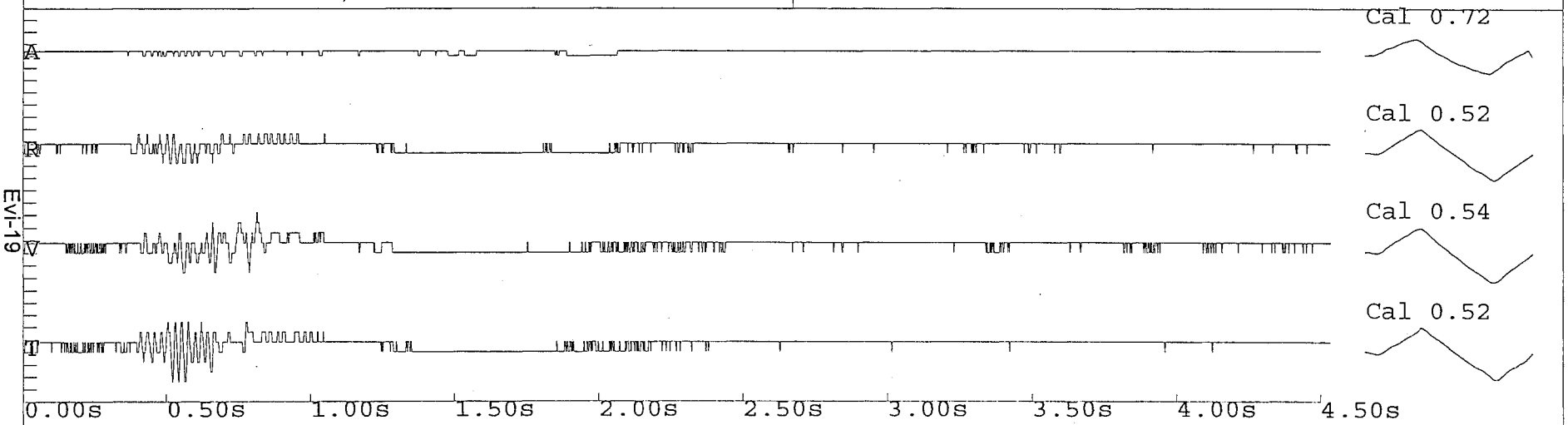
Fourier Analysis (Amplitude Spectrum)



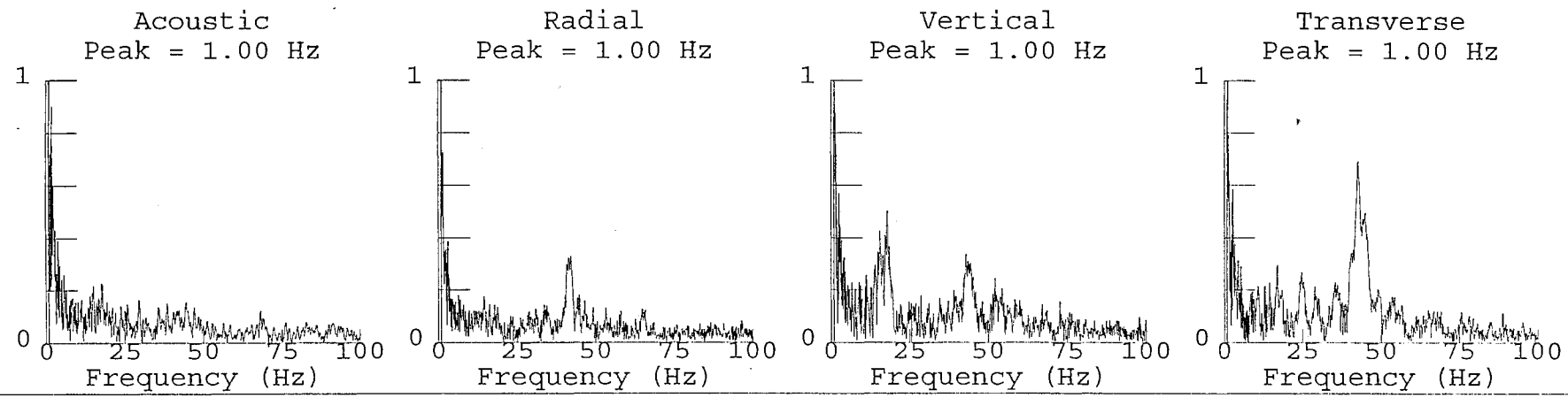
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 022 Date: 7/28/95 Time: 16:11
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 16.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



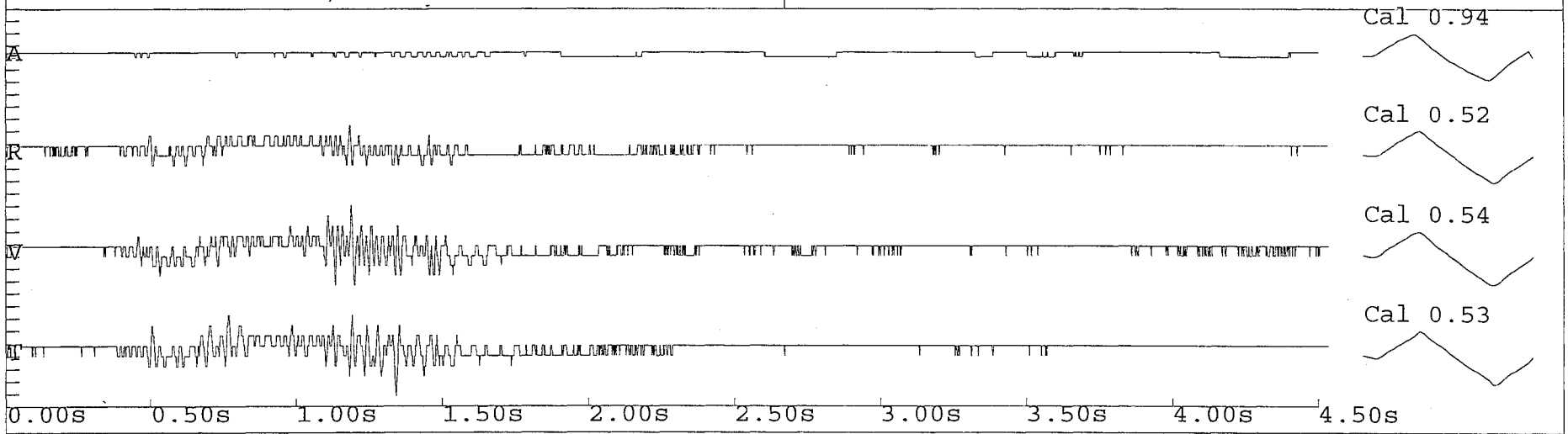
Fourier Analysis (Amplitude Spectrum)



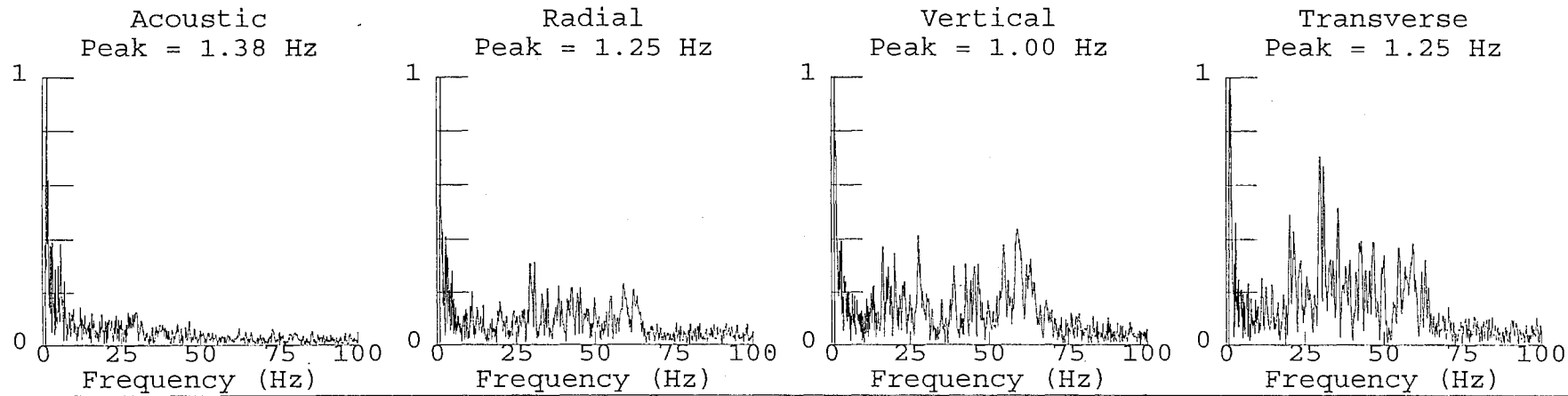
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 023 Date: 7/31/95 Time: 16:48
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 51.2 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 34.1 Hz.	Time Lines at: 0.50 sec intervals



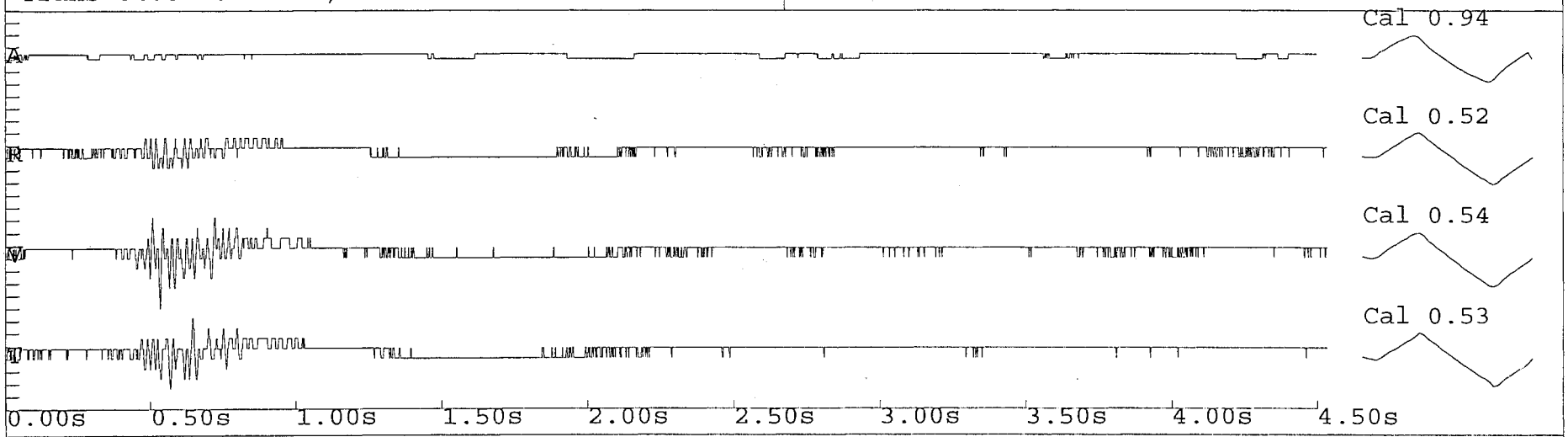
Fourier Analysis (Amplitude Spectrum)



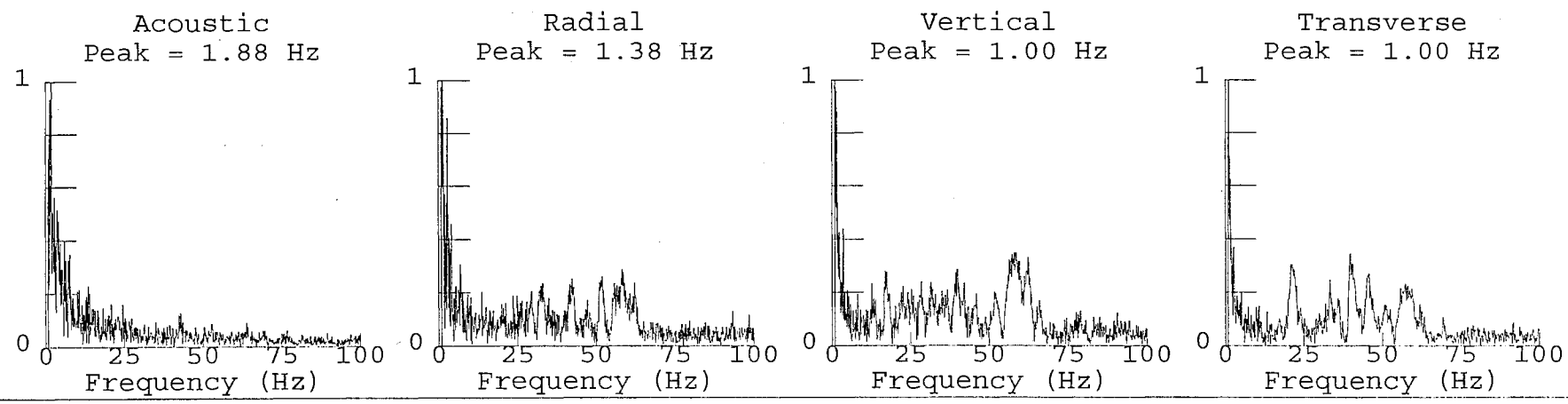
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 20
Location: LLoyd's Room

Event: 024 Date: 8/ 1/95 Time: 14:20
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 56.8 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 42.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



APPENDIX Evii

FULL WAVEFORM DATA

ENTRANCE TO LAKE ROOM

APPENDIX Eviii

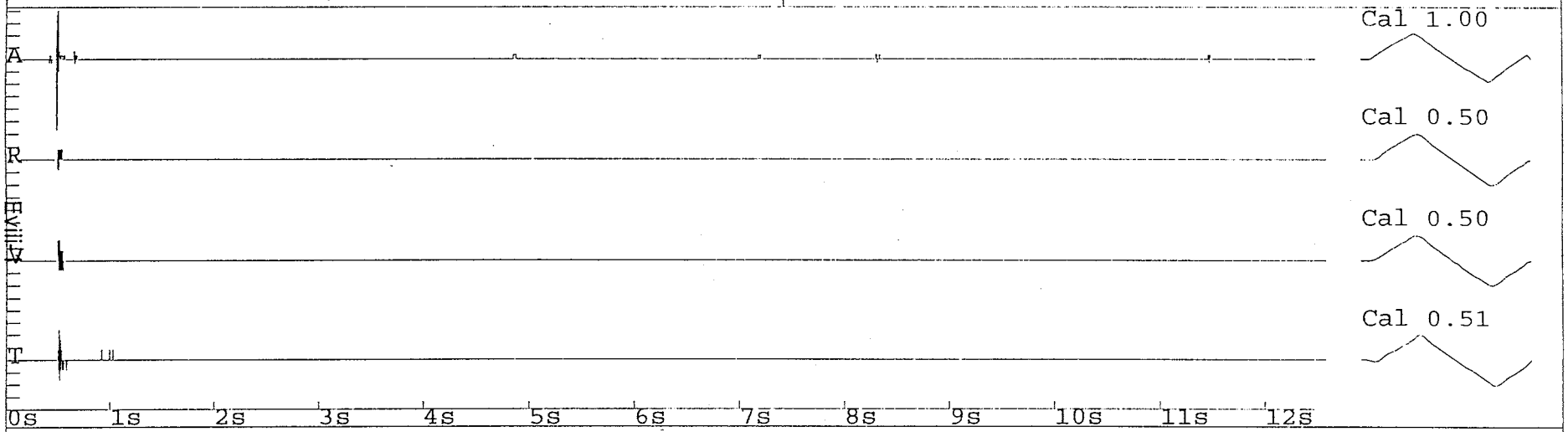
FULL WAVEFORM DATA

EXTERIOR

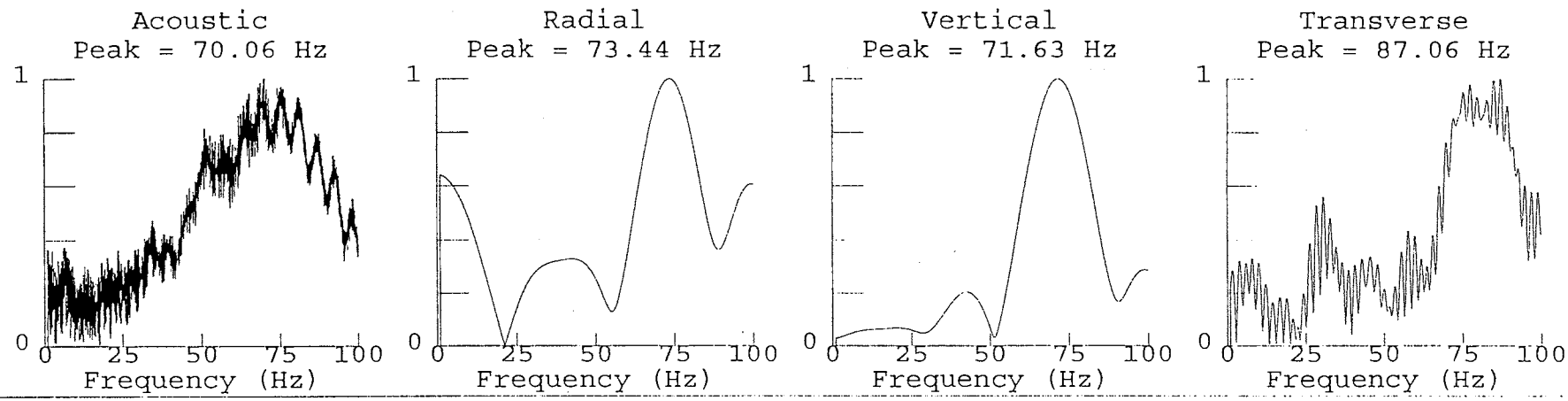
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Exterior

Event: 078 Date: 6/ 5/95 Time: 15:25
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 122 dB 64.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.24 Mb (0.06 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 1.00 sec intervals



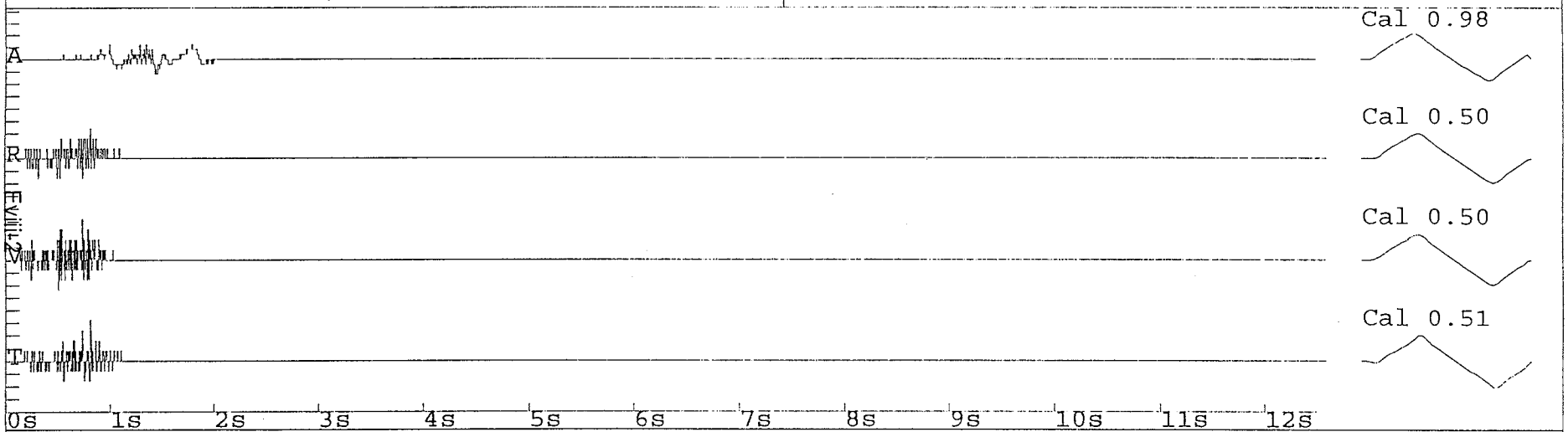
Fourier Analysis (Amplitude Spectrum)



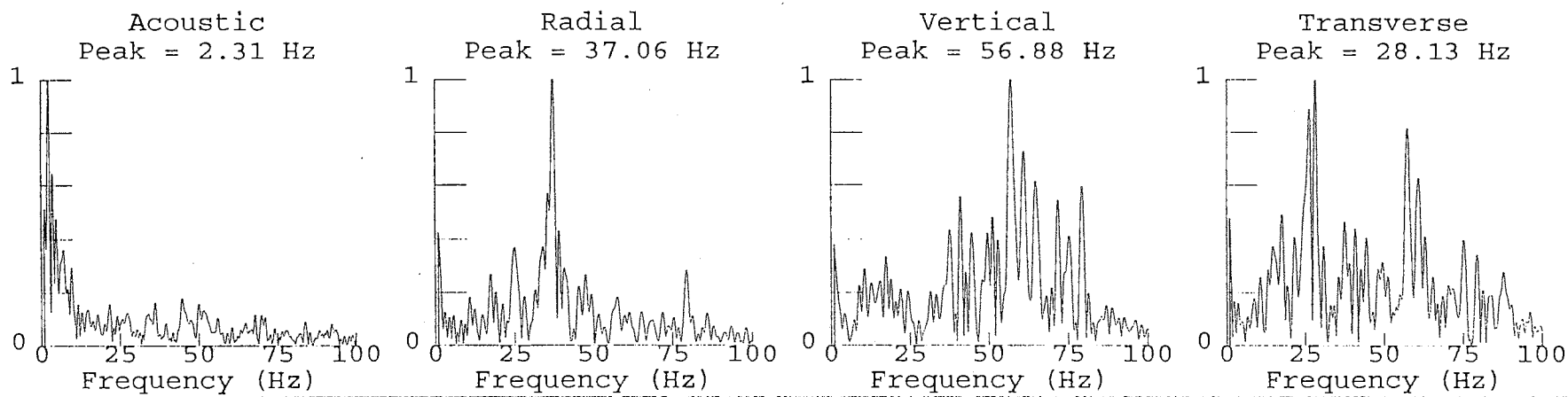
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Exterior

Event: 079 Date: 6/ 6/95 Time: 17:16
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 110 dB 0.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 56.8 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 56.8 Hz.	Time Lines at: 1.00 sec intervals



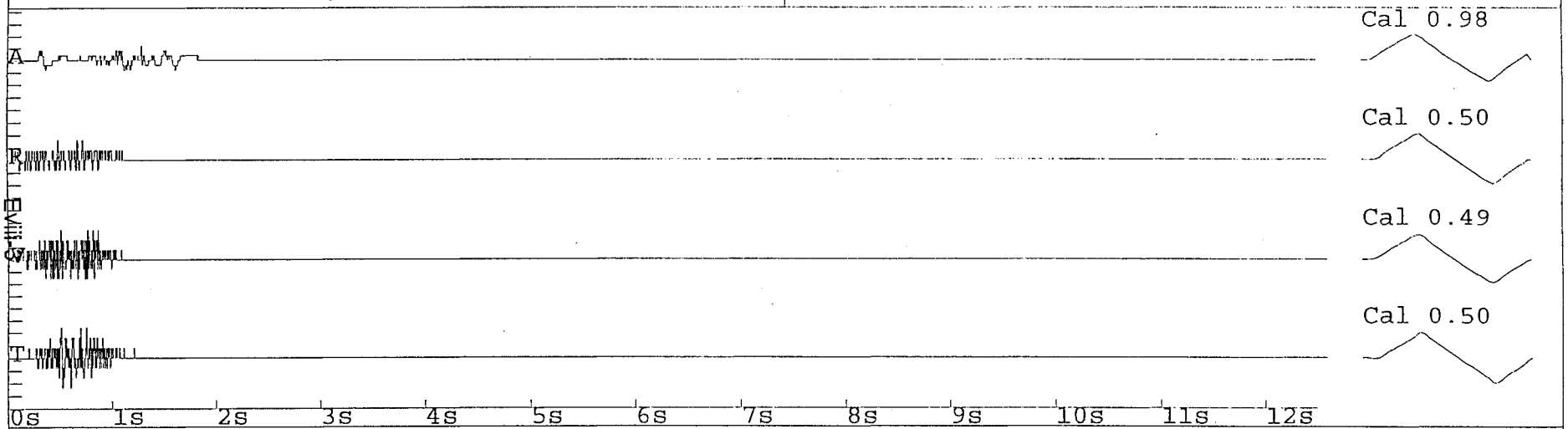
Fourier Analysis (Amplitude Spectrum)



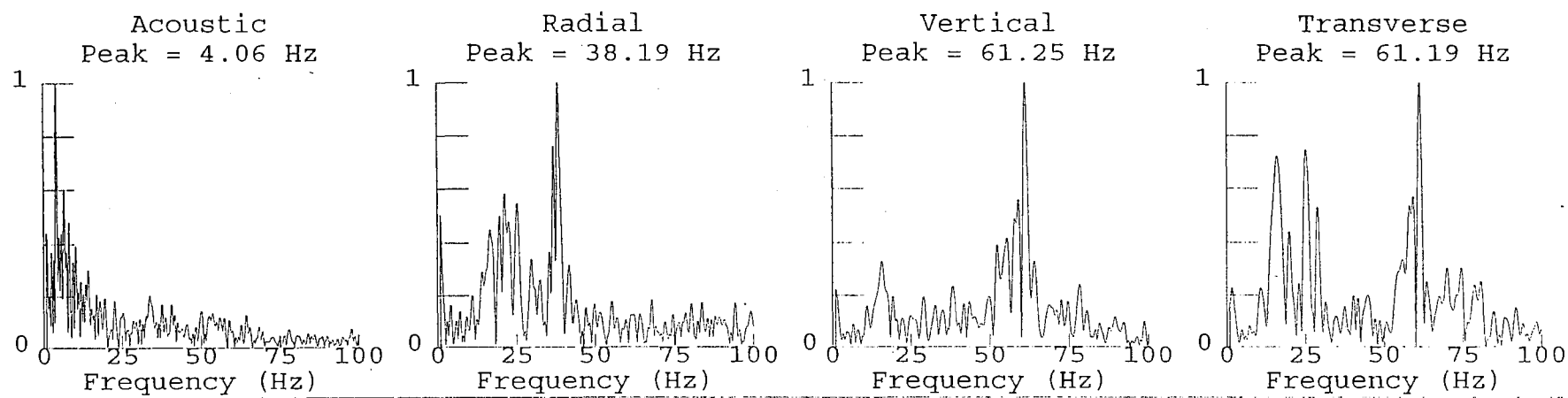
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Exterior

Event: 080 Date: 6/ 7/95 Time: 17:53
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 110 dB 0.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 1.00 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Exterior

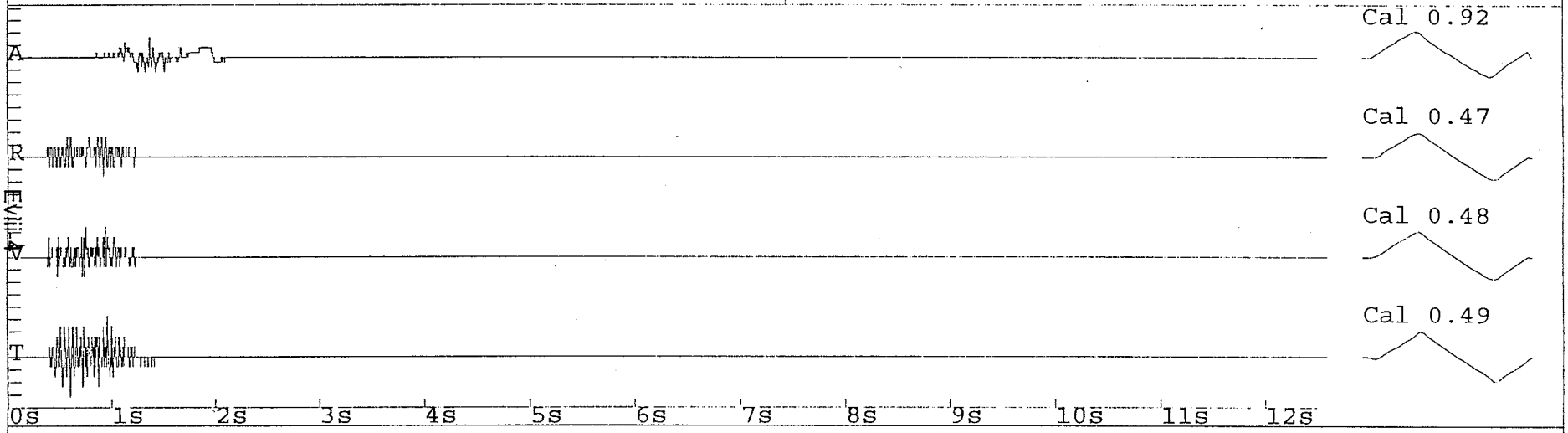
Event: 081 Date: 6/ 9/95 Time: 16:16
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies

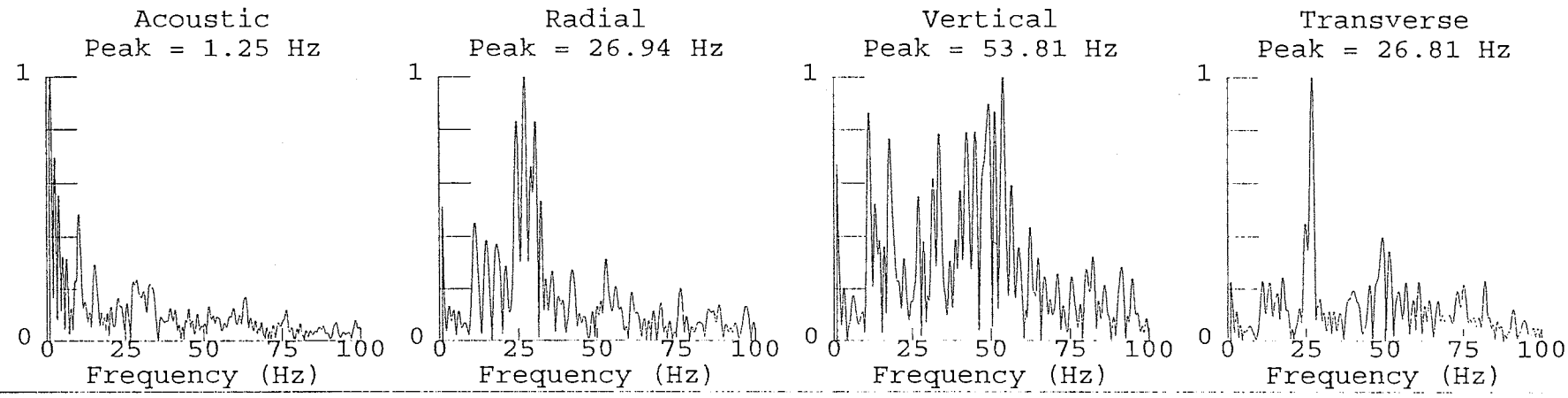
Acoustic: 112 dB 73.1 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.03 in/s 0.0 Hz.
Transverse: 0.04 in/s 42.6 Hz.

Graph Information

Duration: 0.000 sec To: 12.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 1.00 sec intervals



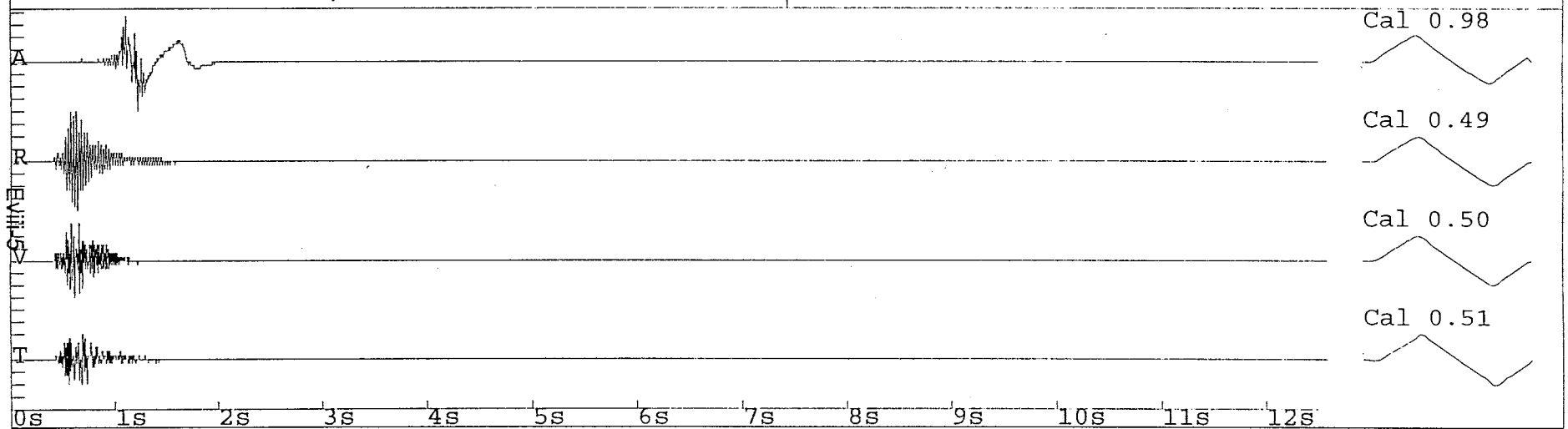
Fourier Analysis (Amplitude Spectrum)



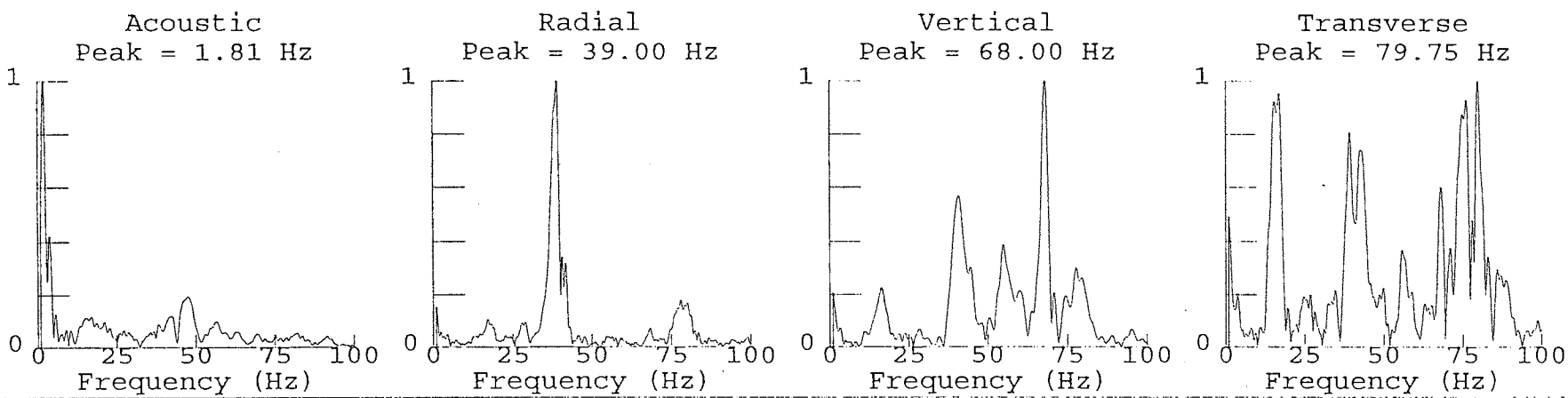
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Exterior

Event: 208 Date: 6/12/95 Time: 17:22
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 123 dB 12.8 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.12 in/s 51.2 Hz.	Acoustic: 0.28 Mb (0.07 Mb/div)
Vertical: 0.10 in/s 64.0 Hz.	Seis: 0.12 in/s (0.03 in/s/div)
Transverse: 0.06 in/s 26.9 Hz.	Time Lines at: 1.00 sec intervals



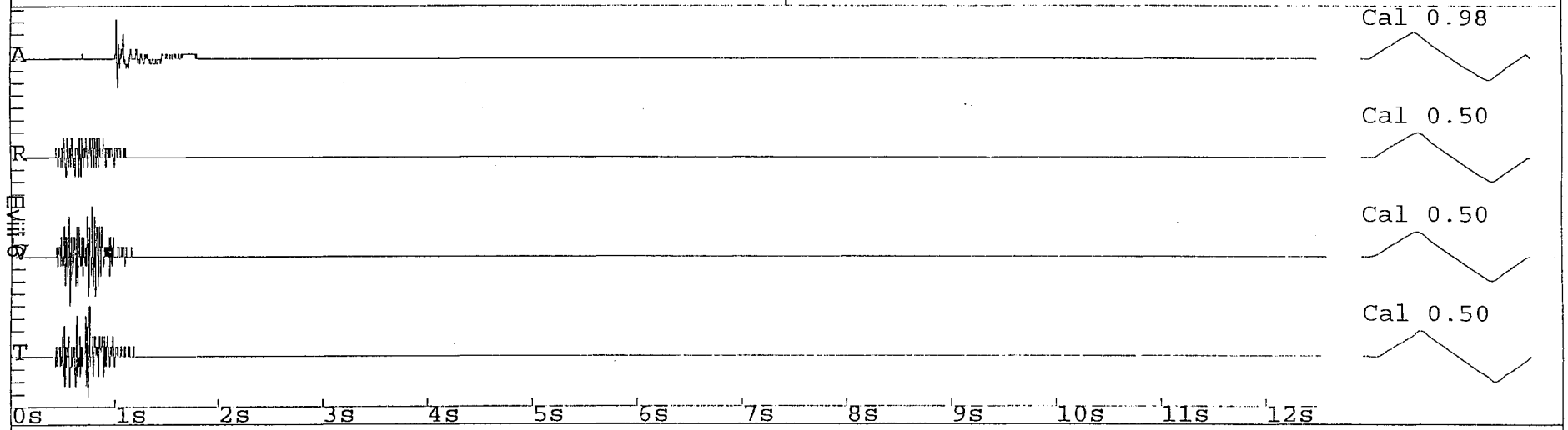
Fourier Analysis (Amplitude Spectrum)



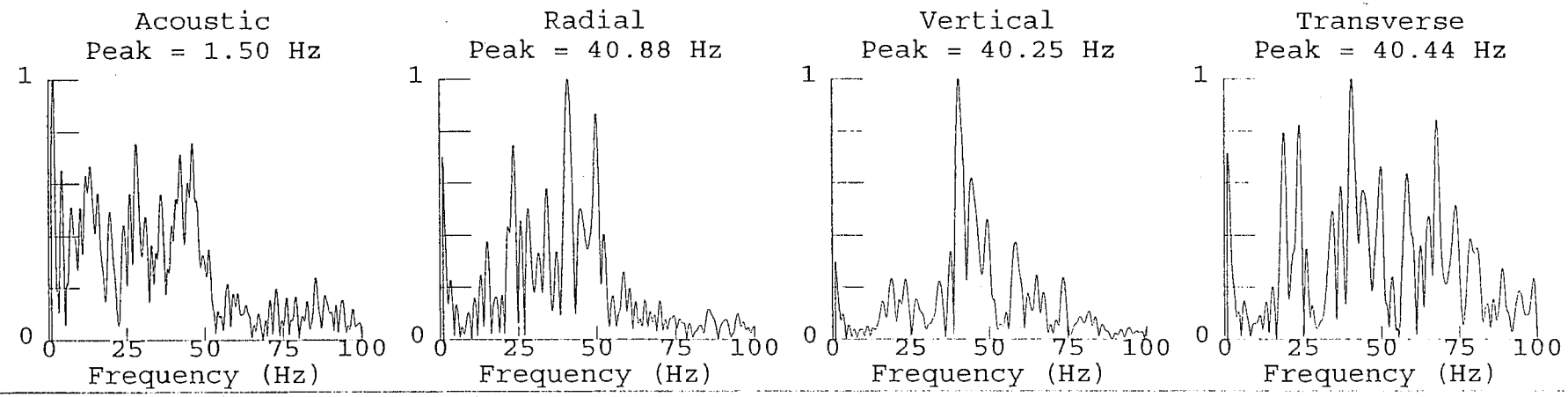
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Exterior

Event: 209 Date: 6/14/95 Time: 16:29
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 118 dB 56.8 Hz.	Duration: 0.000 sec To: 12.500 sec.
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 51.2 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.05 in/s 56.8 Hz.	Time Lines at: 1.00 sec intervals



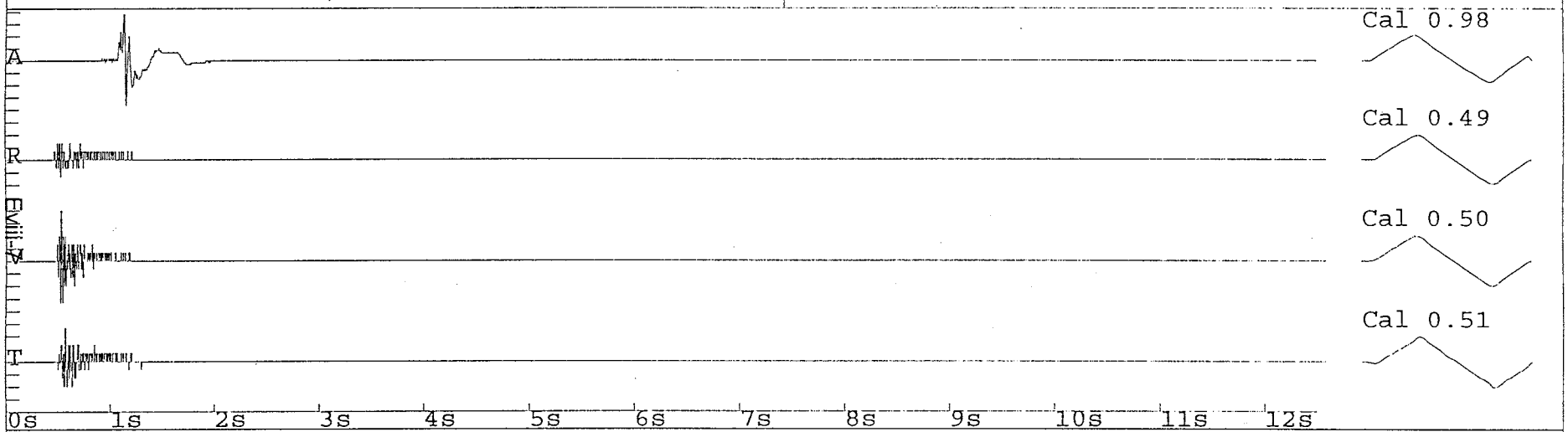
Fourier Analysis (Amplitude Spectrum)



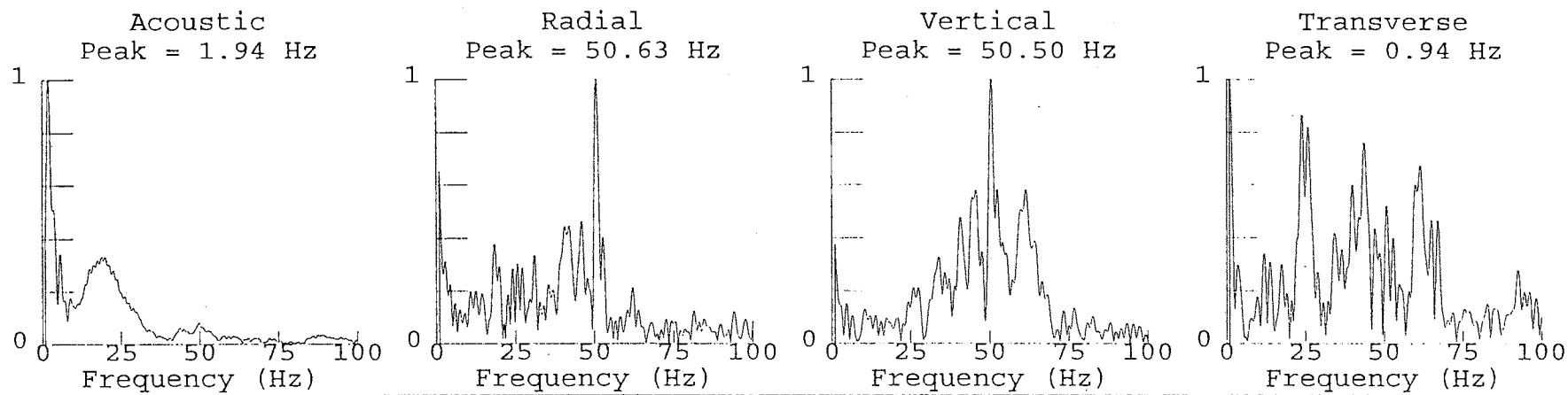
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Exterior

Event: 210 Date: 6/14/95 Time: 16:53
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 128 dB 7.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.48 Mb (0.12 Mb/div)
Vertical: 0.06 in/s 51.2 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.04 in/s 56.8 Hz.	Time Lines at: 1.00 sec intervals



Fourier Analysis (Amplitude Spectrum)



University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 18
Location: Exterior

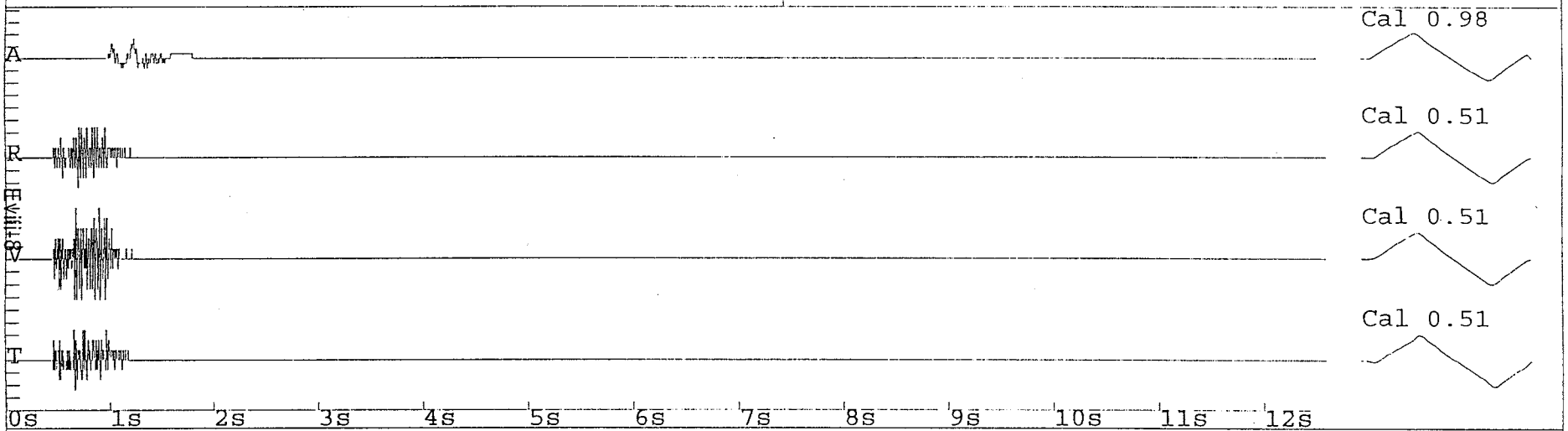
Event: 211 Date: 6/15/95 Time: 13:29
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies

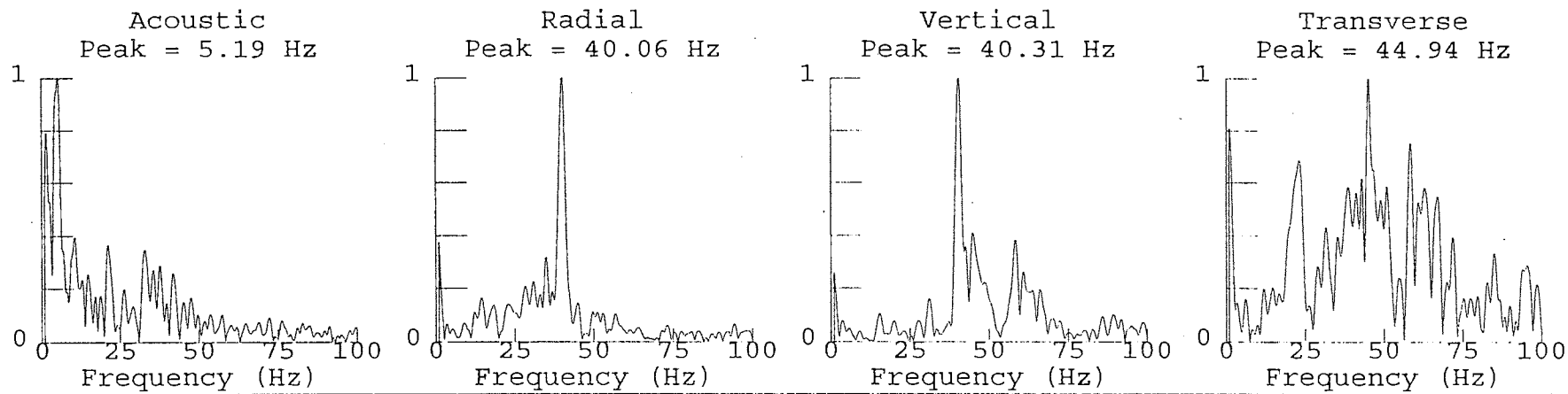
Acoustic: 112 dB 8.1 Hz.
Radial: 0.04 in/s 39.3 Hz.
Vertical: 0.05 in/s 56.8 Hz.
Transverse: 0.03 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 12.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 1.00 sec intervals



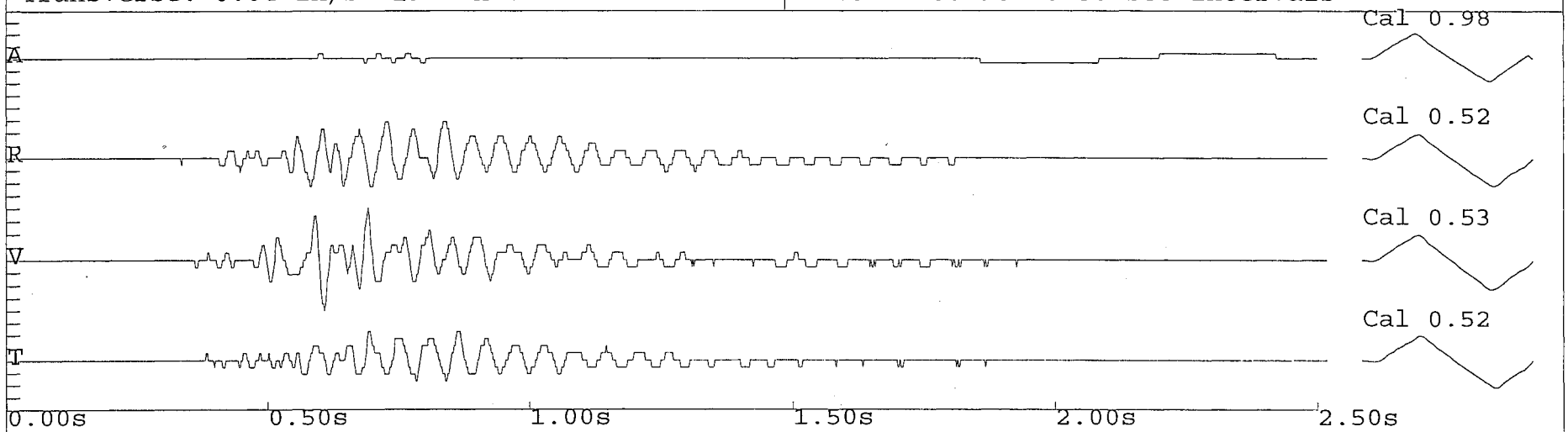
Fourier Analysis (Amplitude Spectrum)



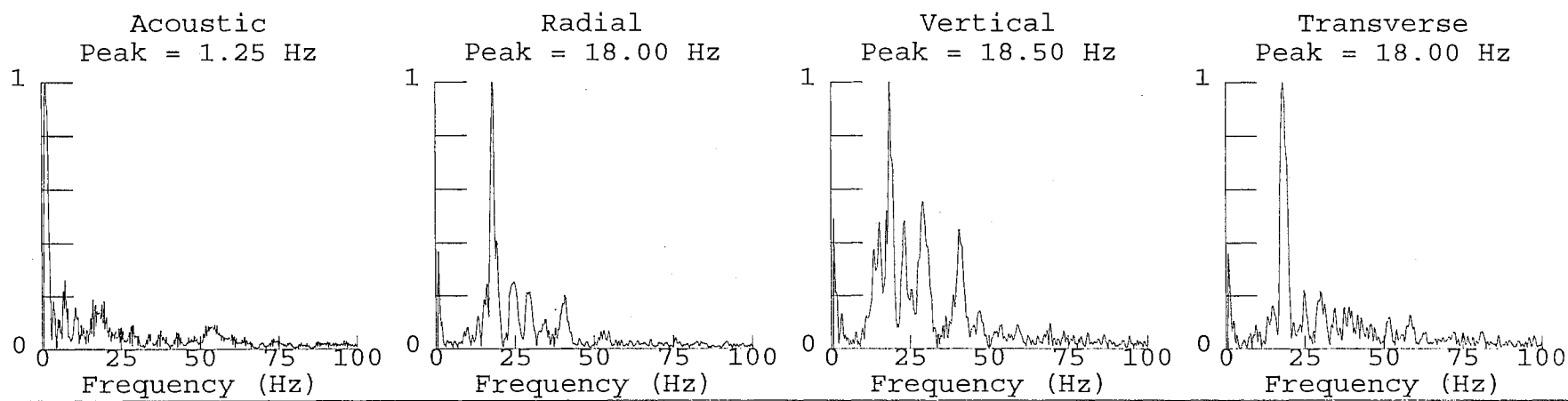
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 19
Location: Indian Sleeping Chamber

Event: 016 Date: 7/13/95 Time: 16:38
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 19

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 2.500 sec
Radial: 0.05 in/s 23.2 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.07 in/s 30.1 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.04 in/s 19.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



APPENDIX Eix

FULL WAVEFORM DATA

NON-BLAST TRIGGERS

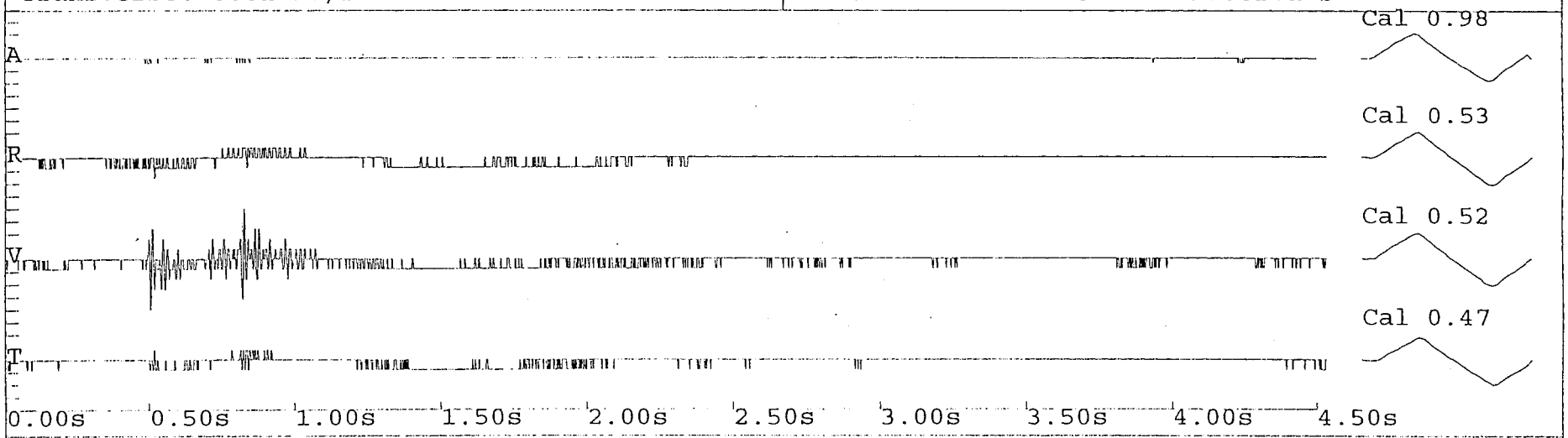
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 001 Date: 5/14/95 Time: 8:32
Air Trigger: 142 dB Seis Trigger: 0.05 in/s S/N: 16

Amplitudes and Frequencies

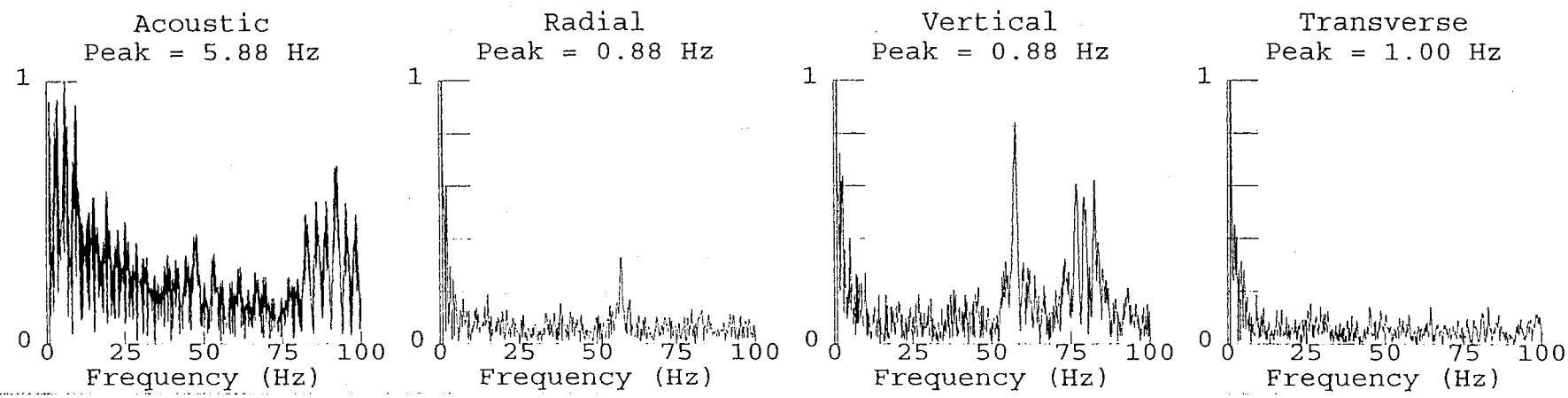
Acoustic: 100 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.05 in/s 85.3 Hz.
Transverse: 0.01 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

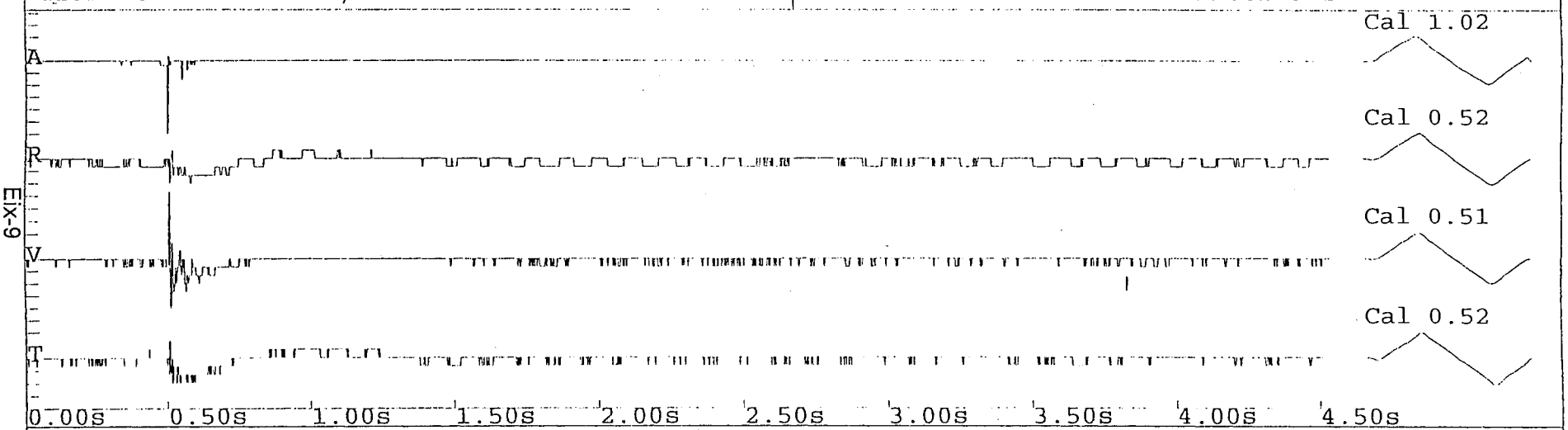


Fourier Analysis (Amplitude Spectrum)

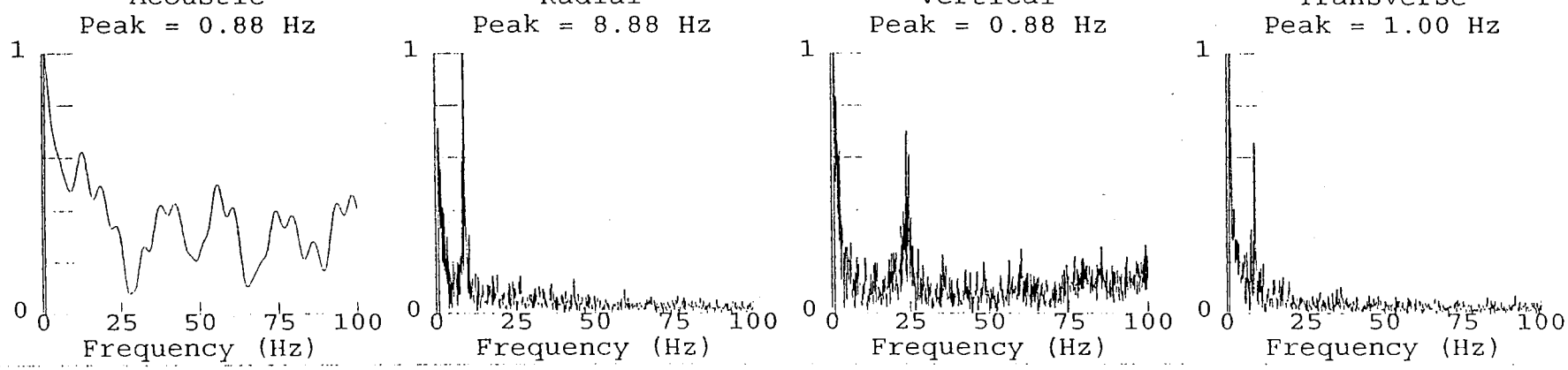


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance
Non-blast triggers
Event: 001 Date: 5/16/95 Time: 8:11
Air Trigger: 142 dB Seis Trigger: 0.05 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 116 dB 170.6 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.06 in/s 170.6 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.04 in/s 2.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



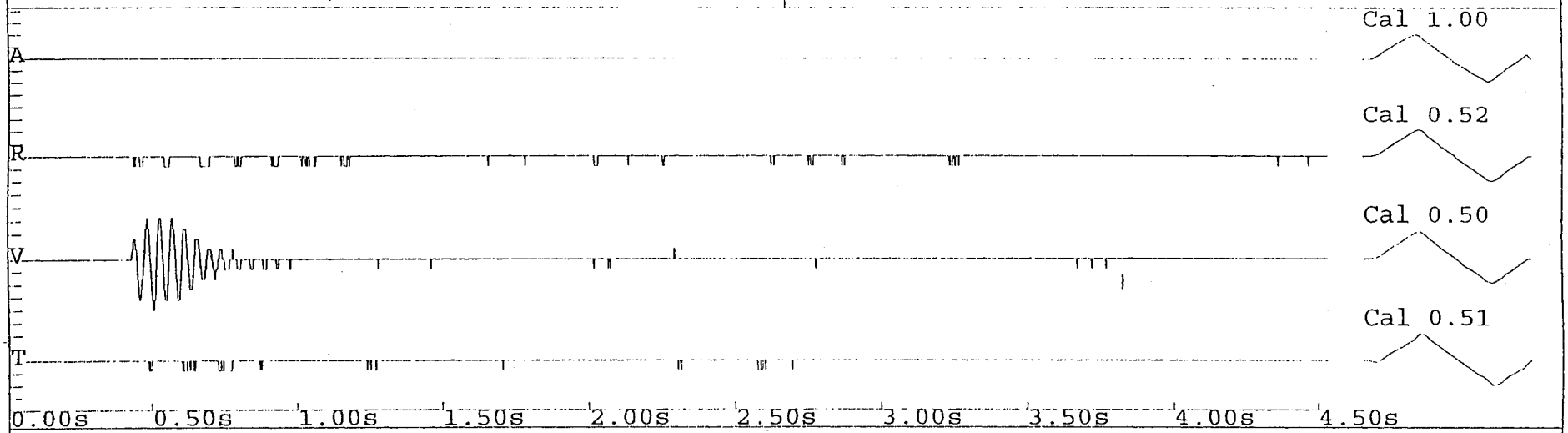
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance
Non-blast triggers
Event: 002 Date: 5/16/95 Time: 8:12
Air Trigger: 142 dB Seis Trigger: 0.05 in/s S/N: 21

Amplitudes and Frequencies

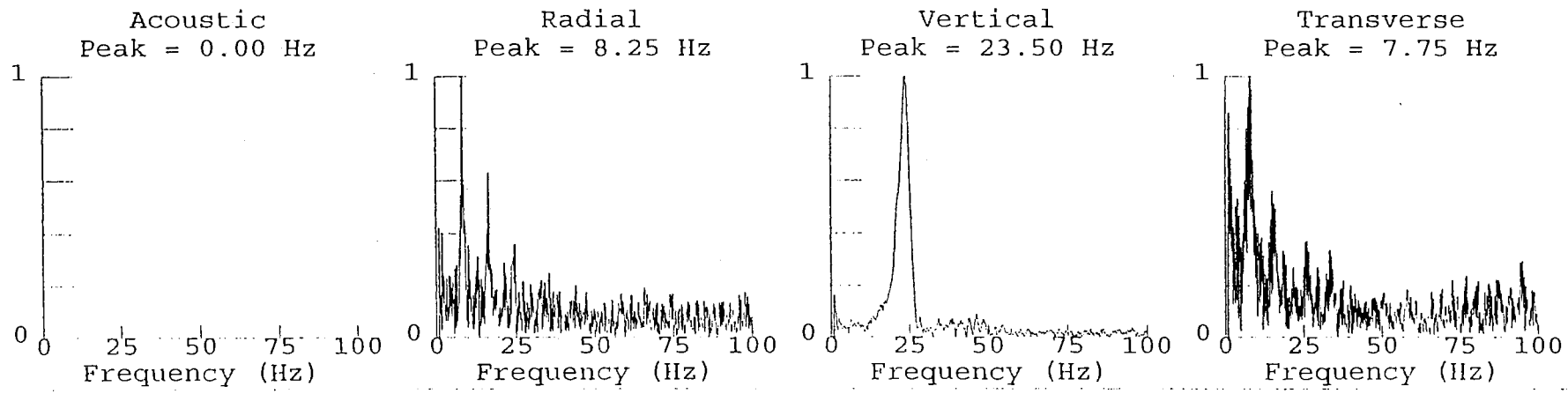
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.05 in/s 25.6 Hz.
Transverse: 0.01 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

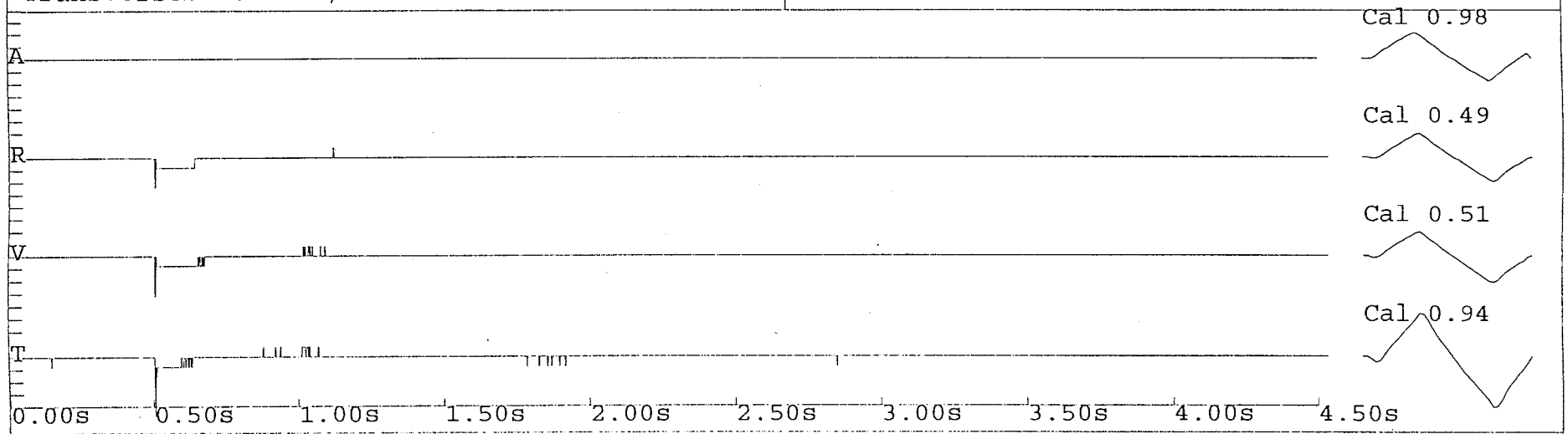


Fourier Analysis (Amplitude Spectrum)

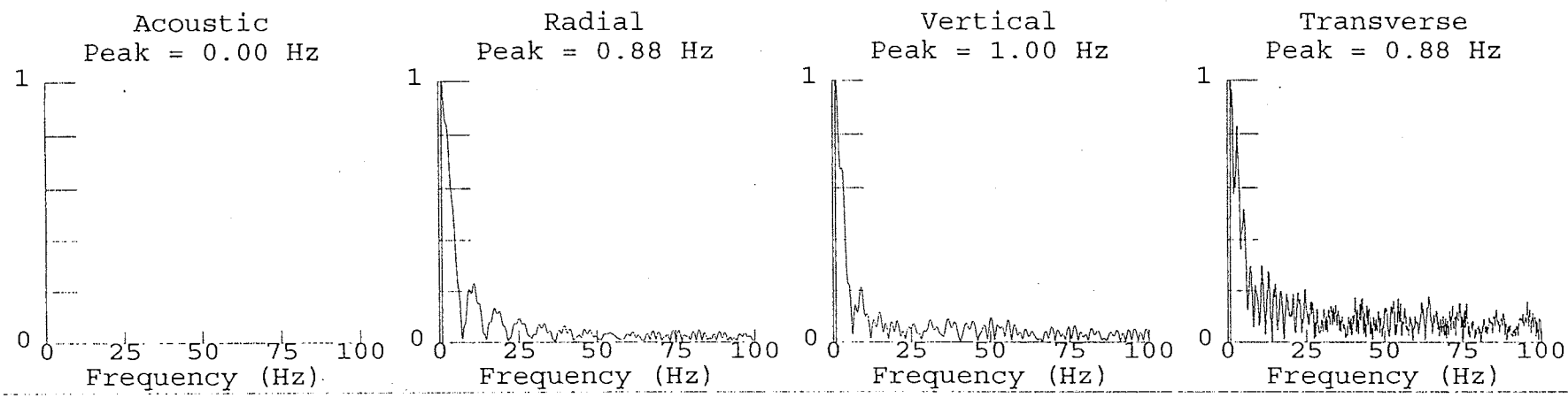


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 001 Date: 6/20/95 Time: 14:58
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

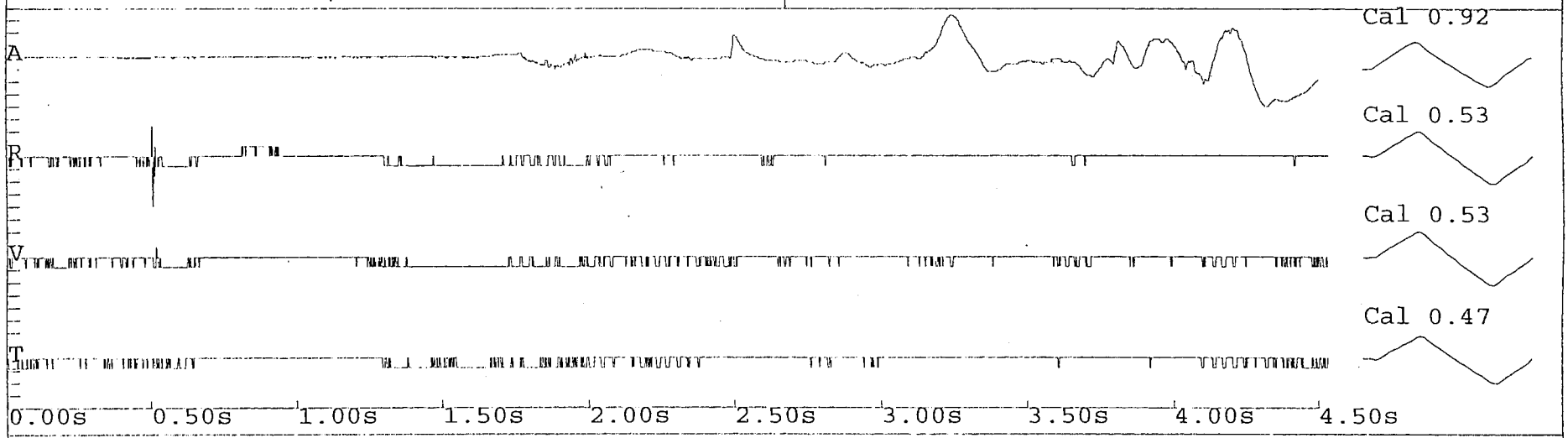


Fourier Analysis (Amplitude Spectrum)

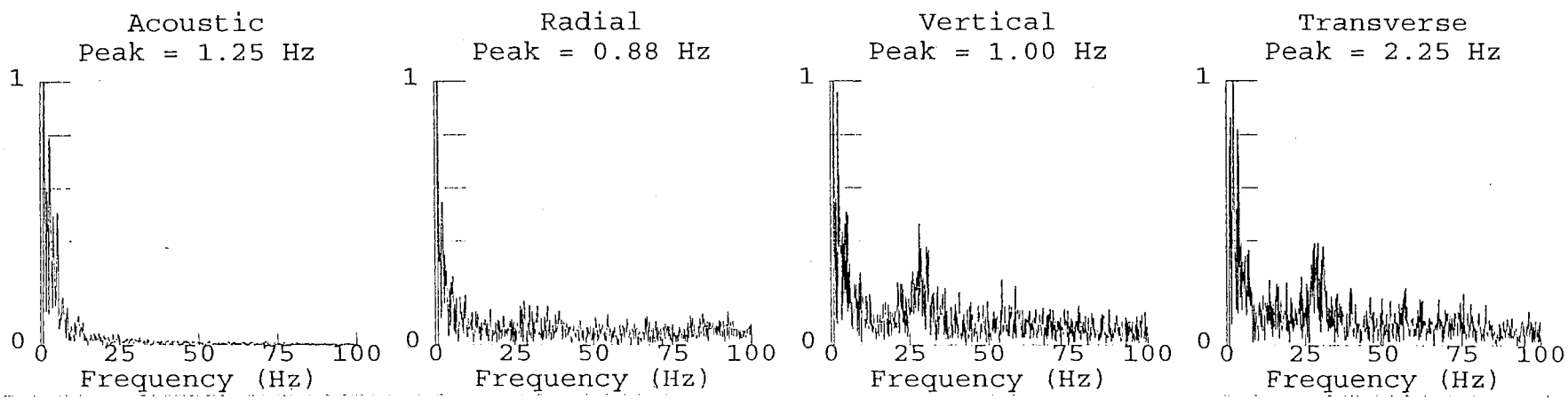


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 002 Date: 6/ 1/95 Time: 16:25
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 129 dB 1.9 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.05 in/s 128.0 Hz.	Acoustic: 0.54 Mb (0.14 Mb/div)
Vertical: 0.01 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

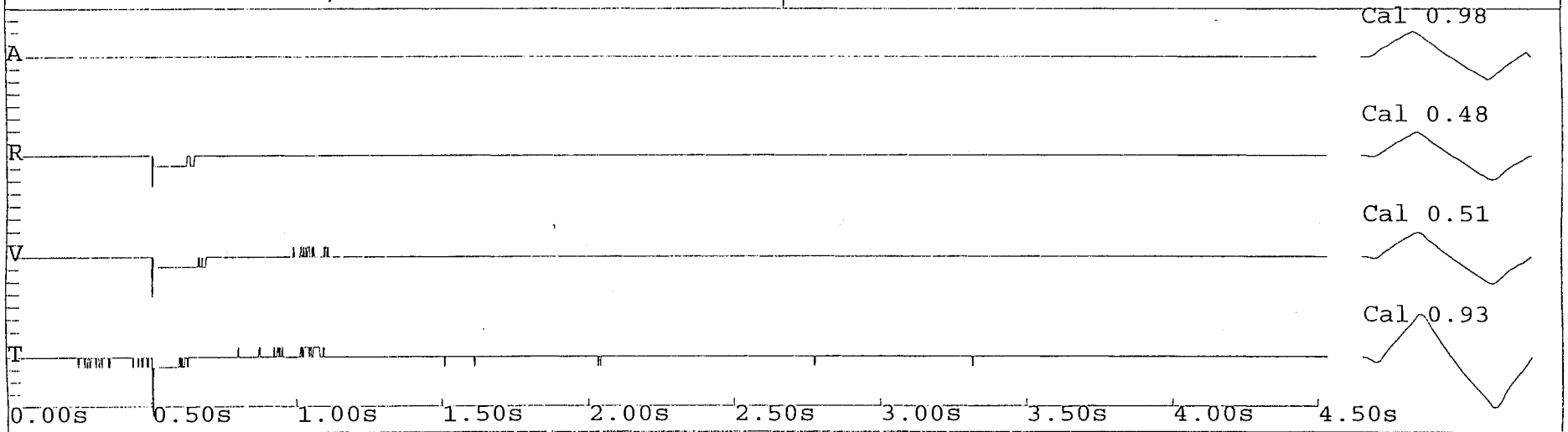


Fourier Analysis (Amplitude Spectrum)

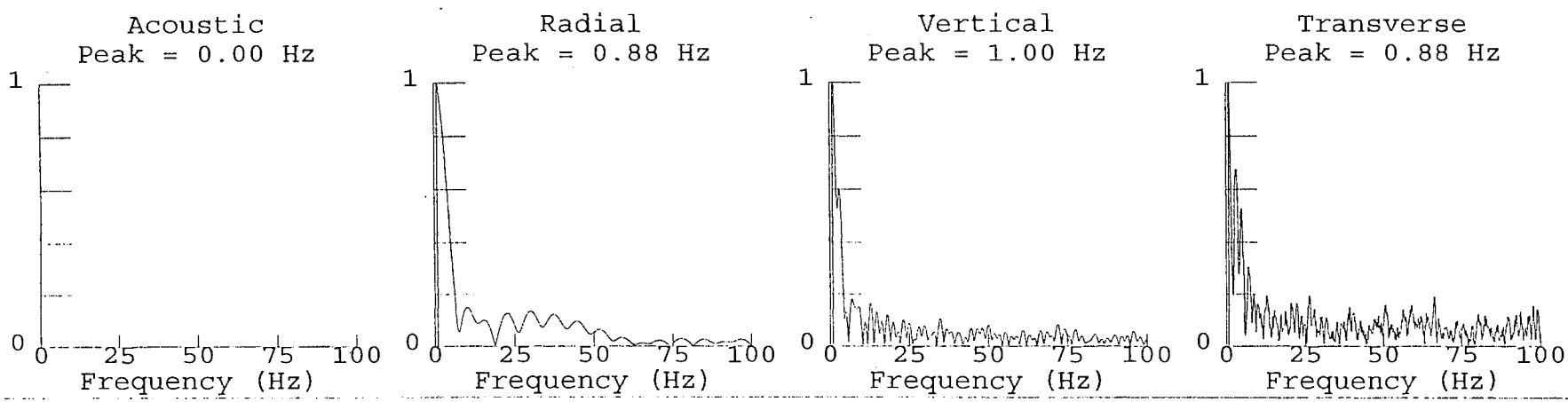


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 009 Date: 6/20/95 Time: 15:14
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

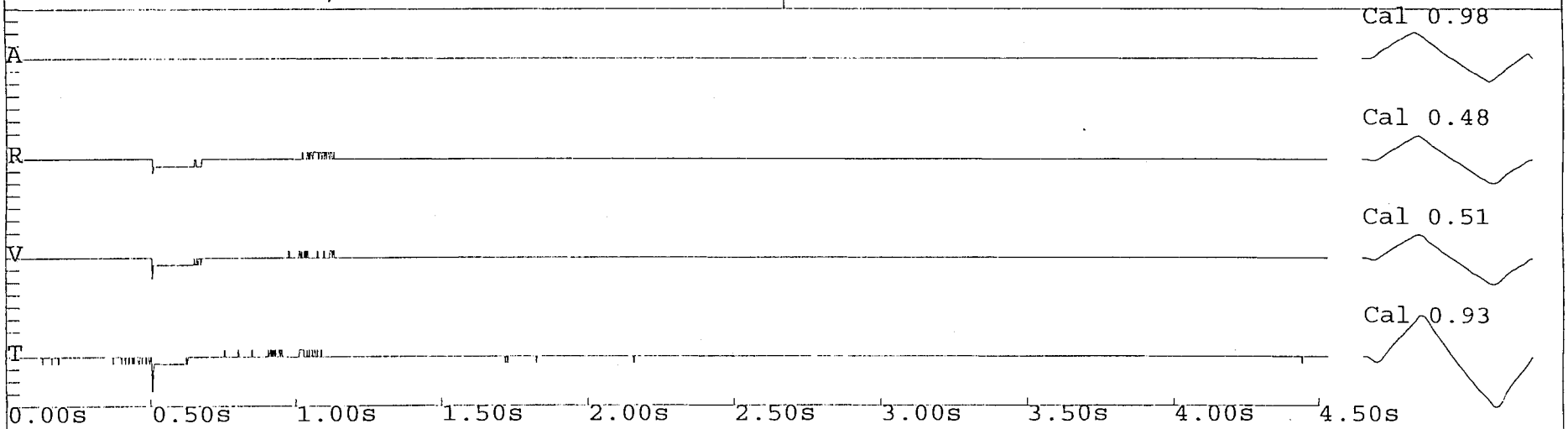


Fourier Analysis (Amplitude Spectrum)

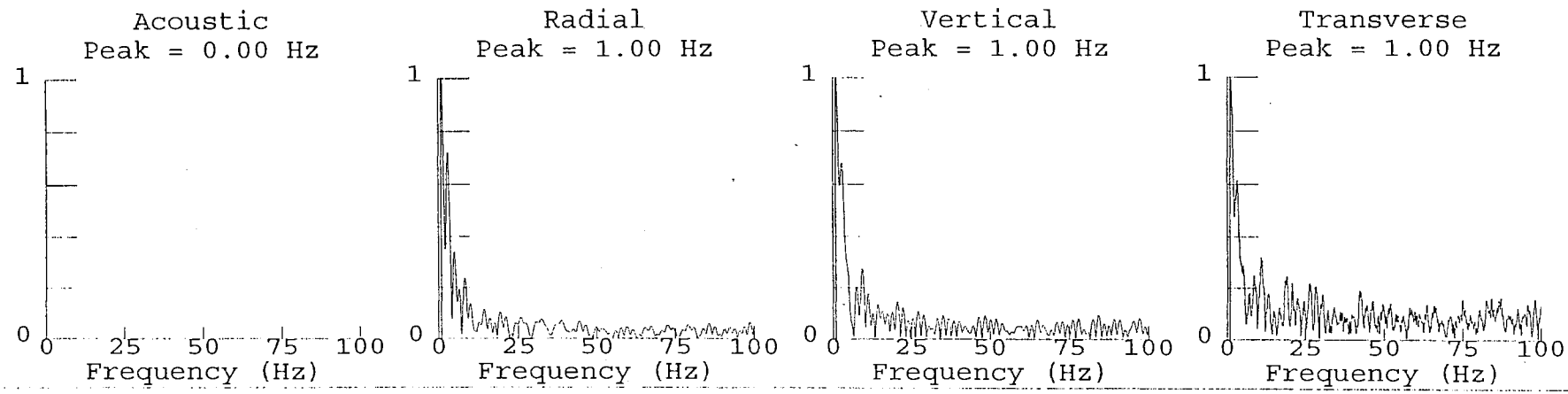


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 016 Date: 6/20/95 Time: 15:28
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 170.6 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.07 in/s 4.5 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



Ex-4

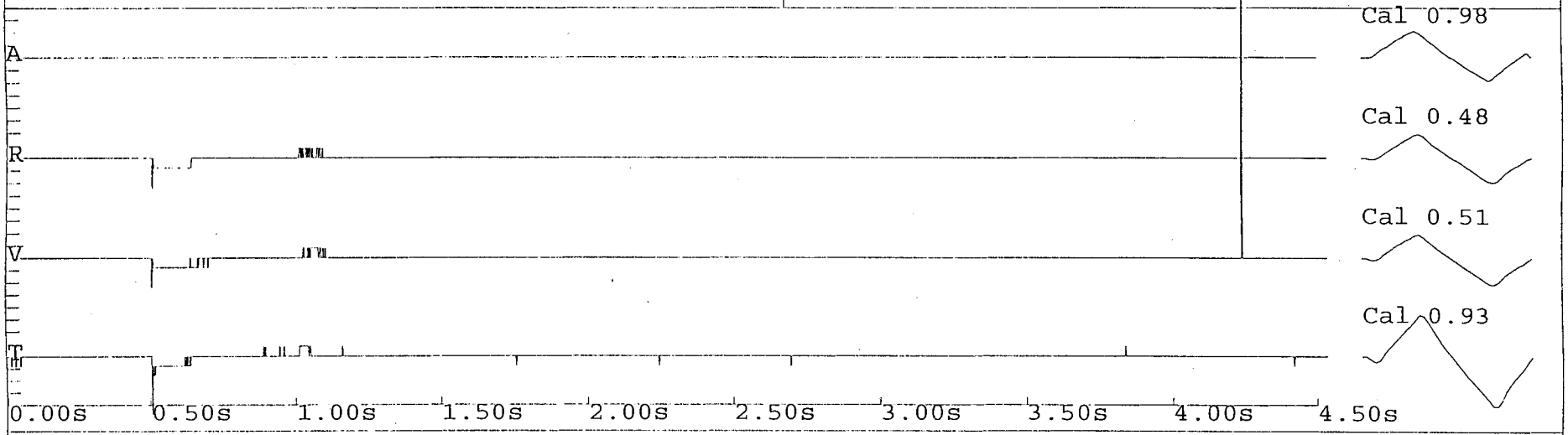
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 017 Date: 6/20/95 Time: 15:30
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

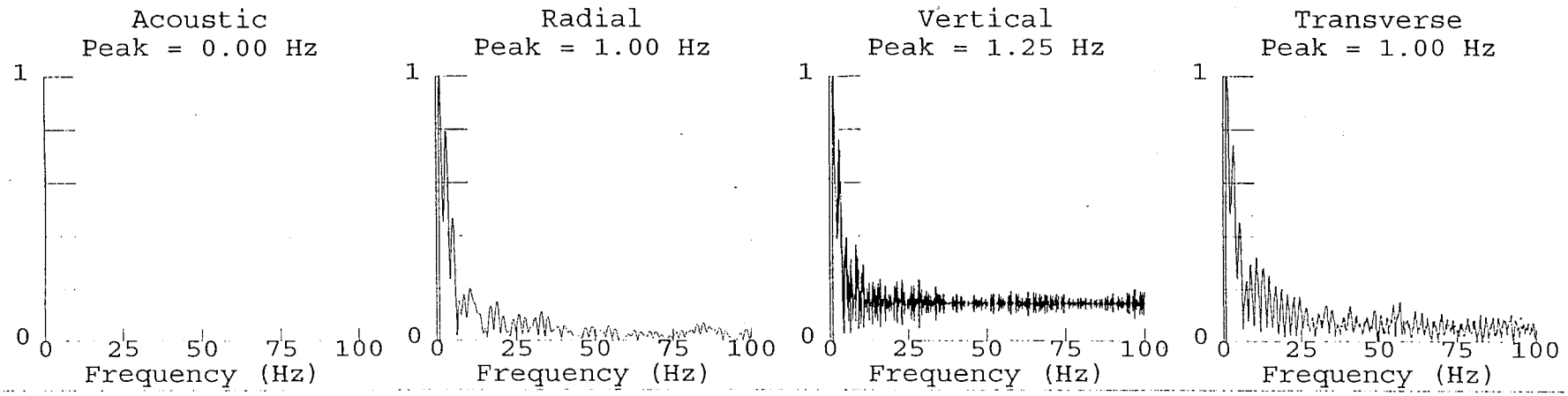
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

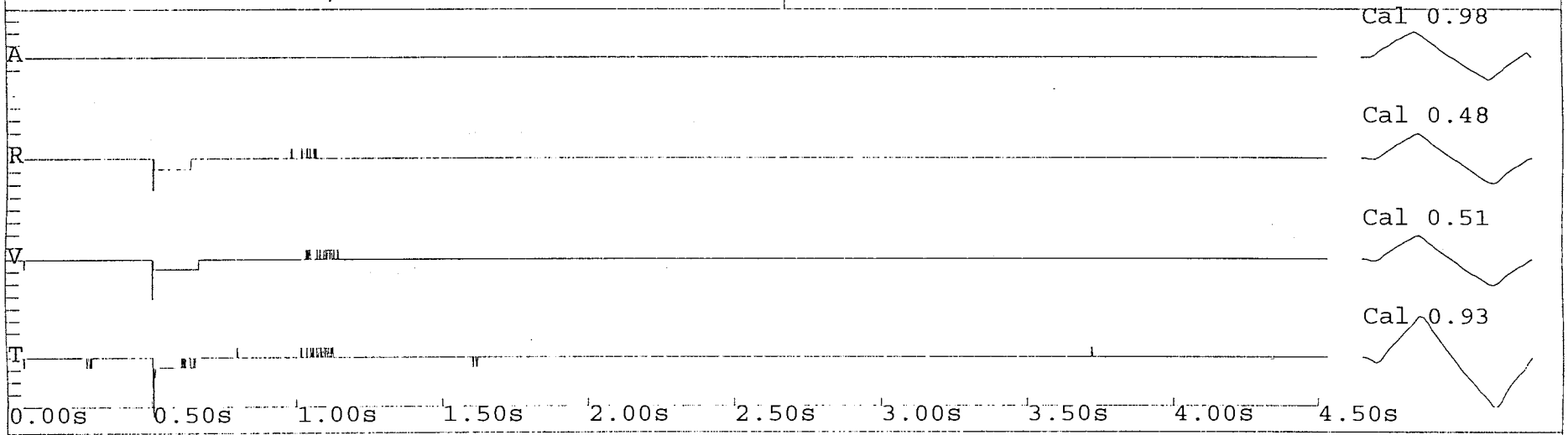


Fourier Analysis (Amplitude Spectrum)

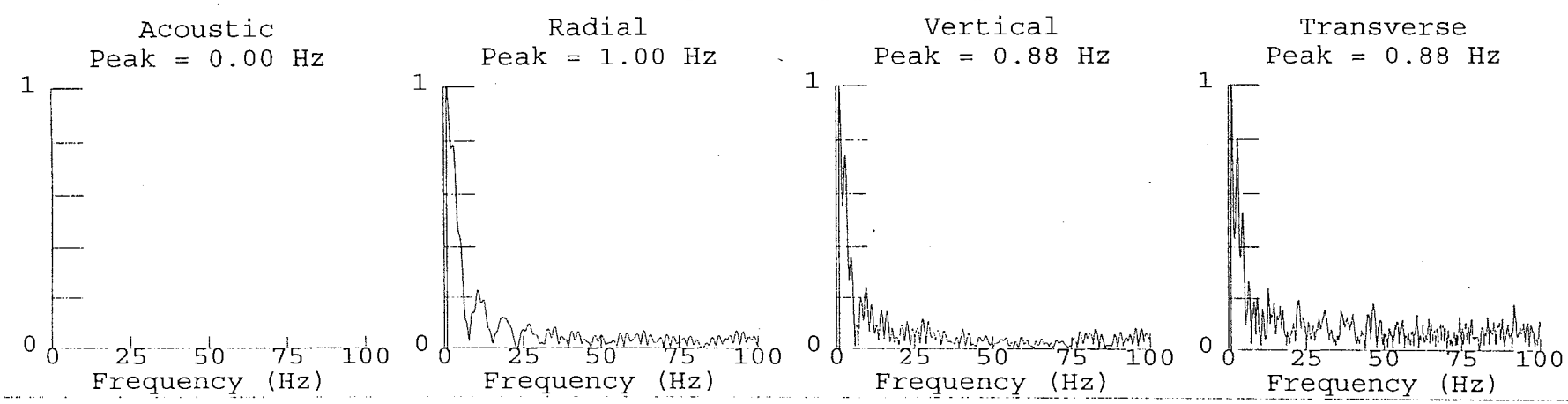


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 018 Date: 6/20/95 Time: 15:32
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



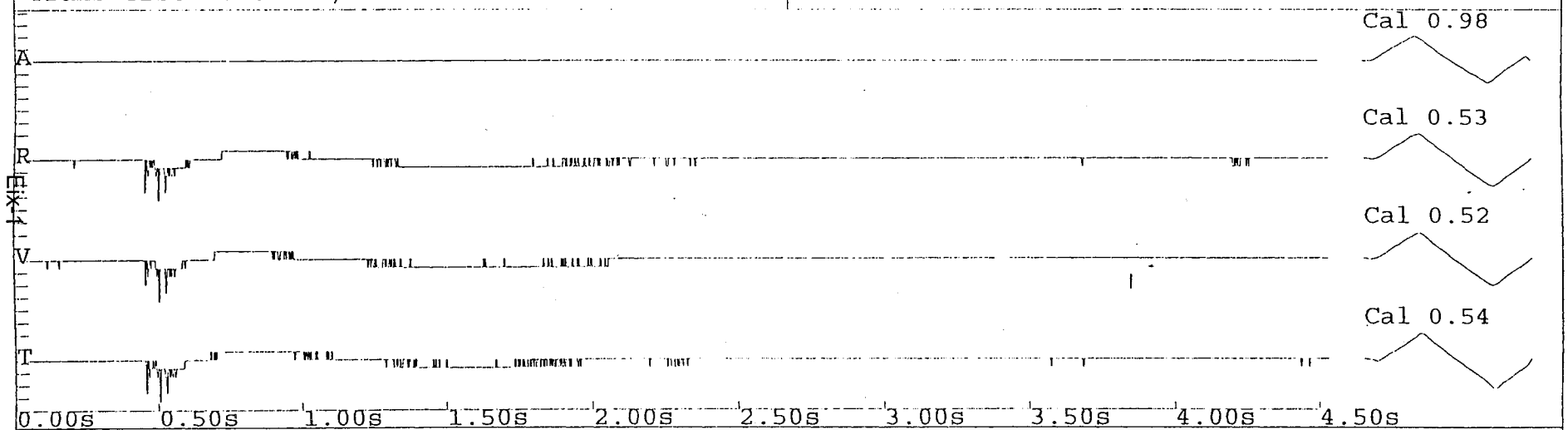
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance
Non-blast triggers
Event: 009 Date: 6/ 9/95 Time: 18:01
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

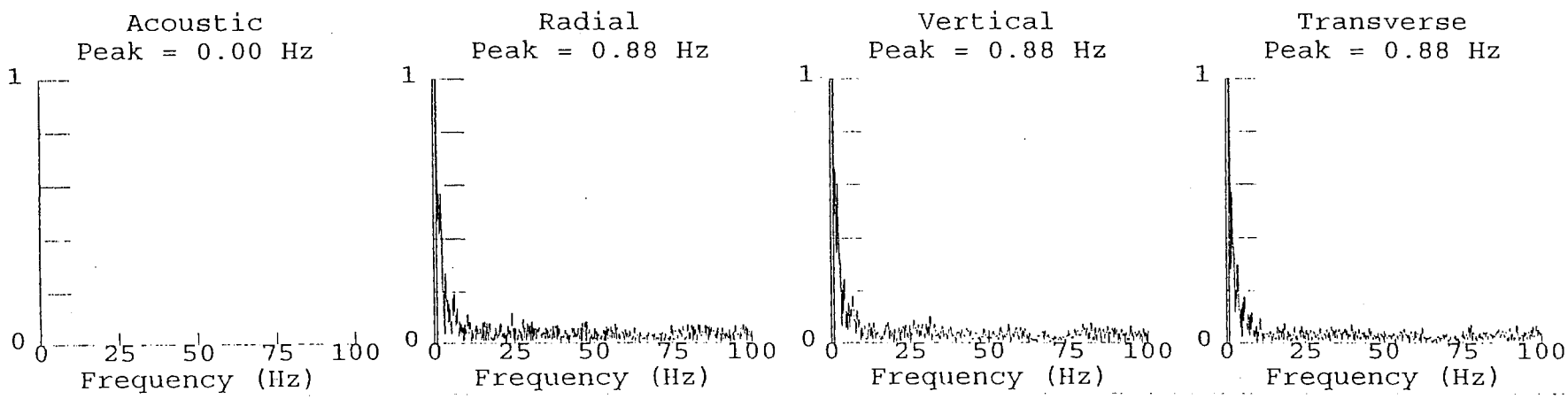
Acoustic: 0 dB 0.0 Hz.
Radial: 0.05 in/s 5.3 Hz.
Vertical: 0.05 in/s 6.1 Hz.
Transverse: 0.06 in/s 5.8 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



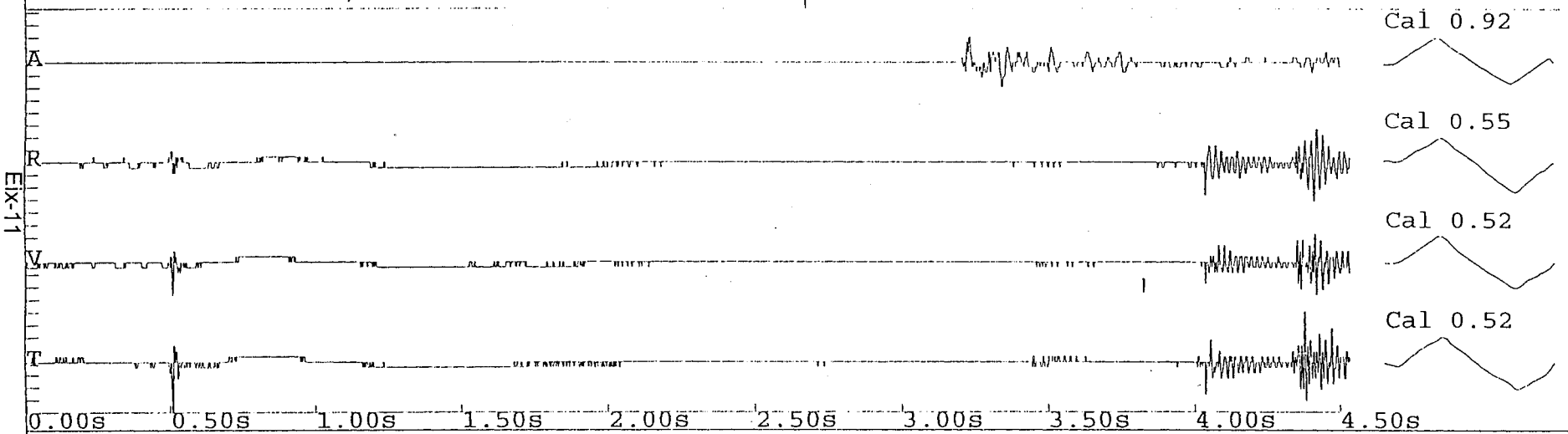
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance
Non-blast triggers
Event: 010 Date: 6/12/95 Time: 10:47
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

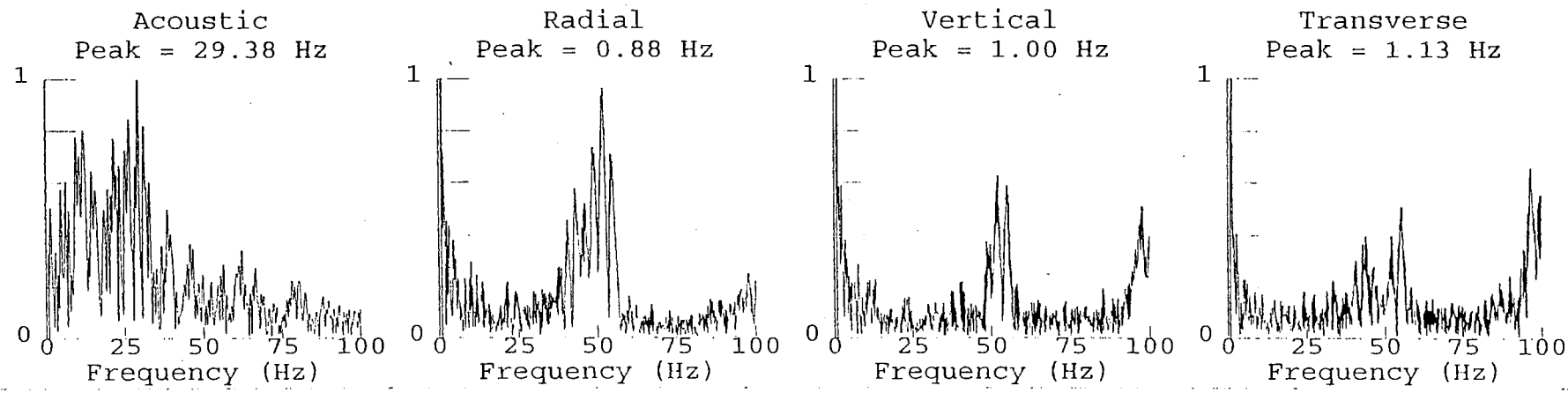
Acoustic: 114 dB 28.4 Hz.
Radial: 0.07 in/s 64.0 Hz.
Vertical: 0.06 in/s 85.3 Hz.
Transverse: 0.09 in/s 85.3 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.09 in/s (0.0225 in/s/div)
Time Lines at: 0.50 sec intervals

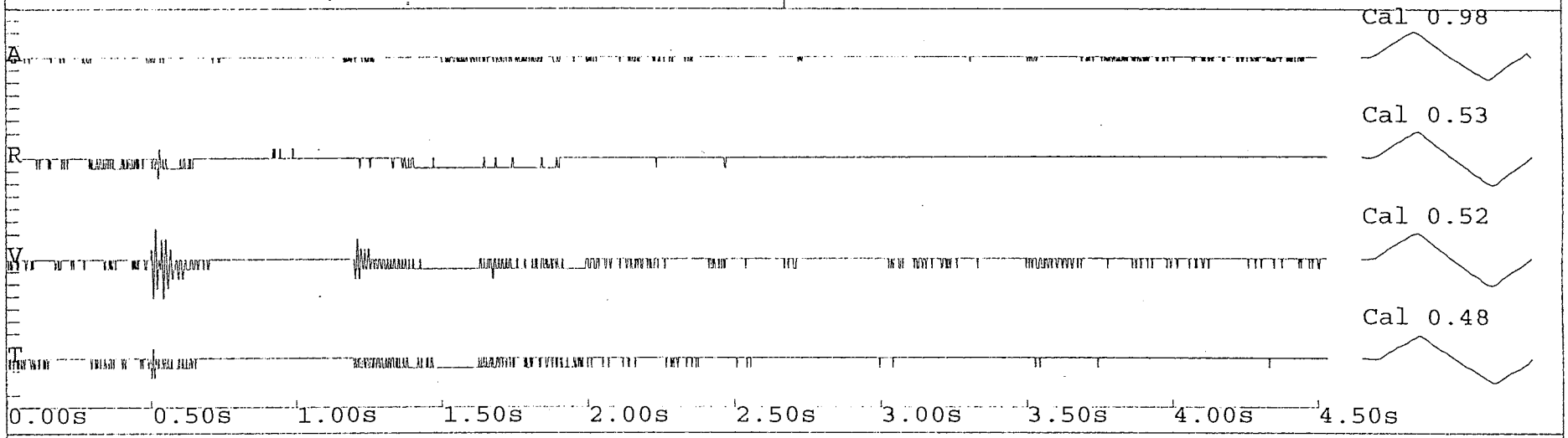


Fourier Analysis (Amplitude Spectrum)

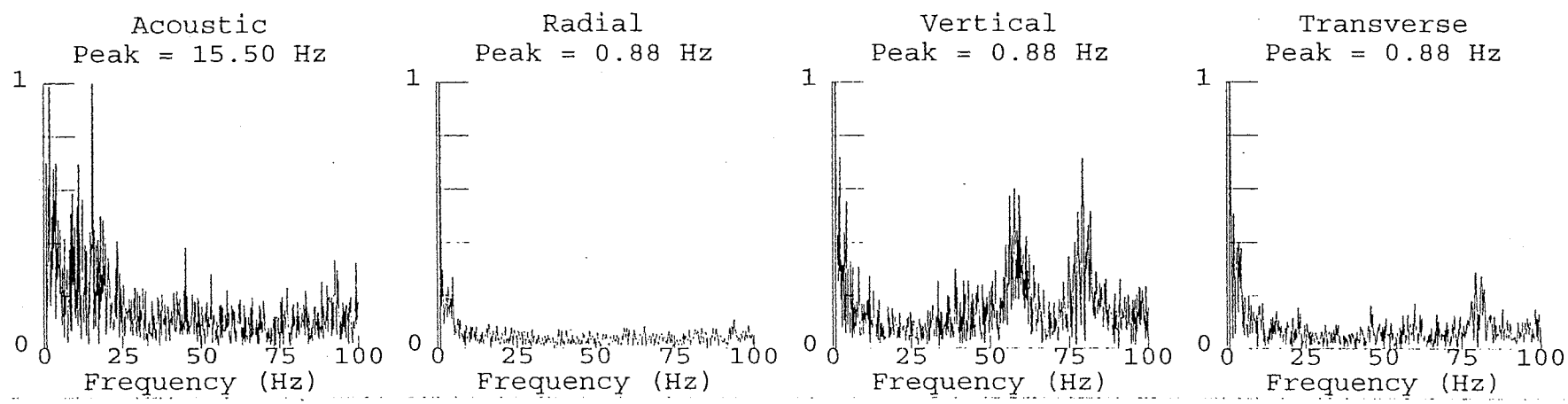


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 005 Date: 6/12/95 Time: 17:45
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 73.1 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



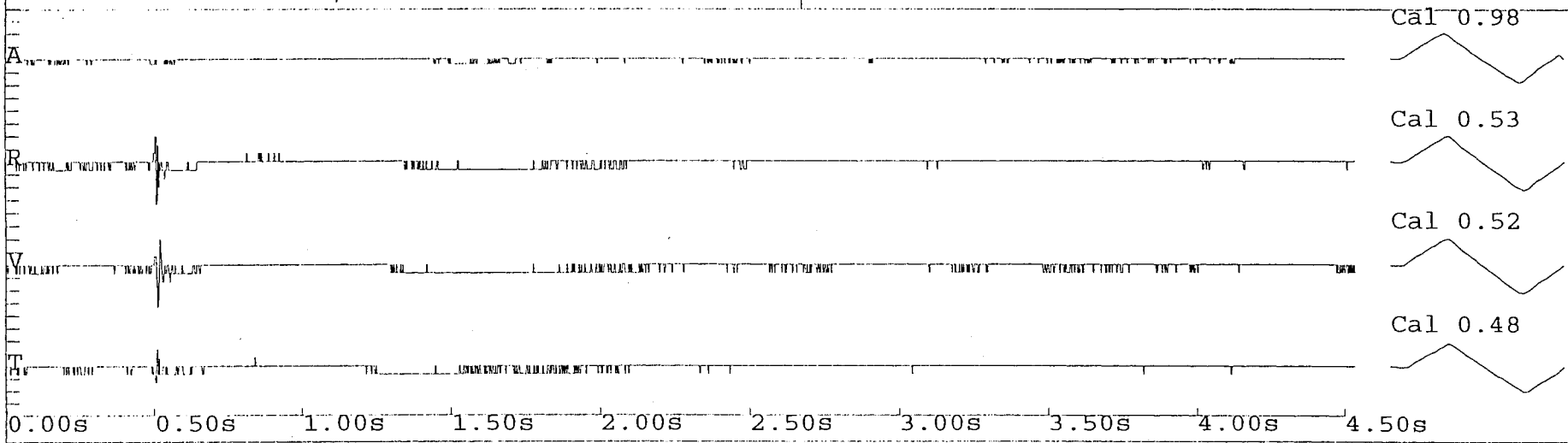
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 007 Date: 6/16/95 Time: 10:11
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

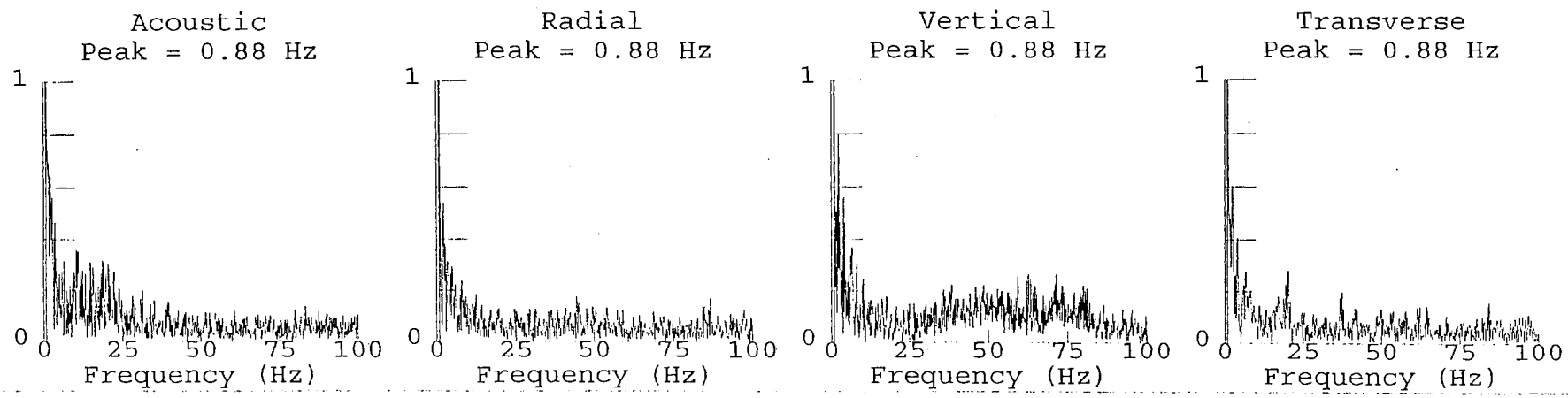
Acoustic: 100 dB 0.0 Hz.
Radial: 0.06 in/s 170.6 Hz.
Vertical: 0.05 in/s 64.0 Hz.
Transverse: 0.03 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals

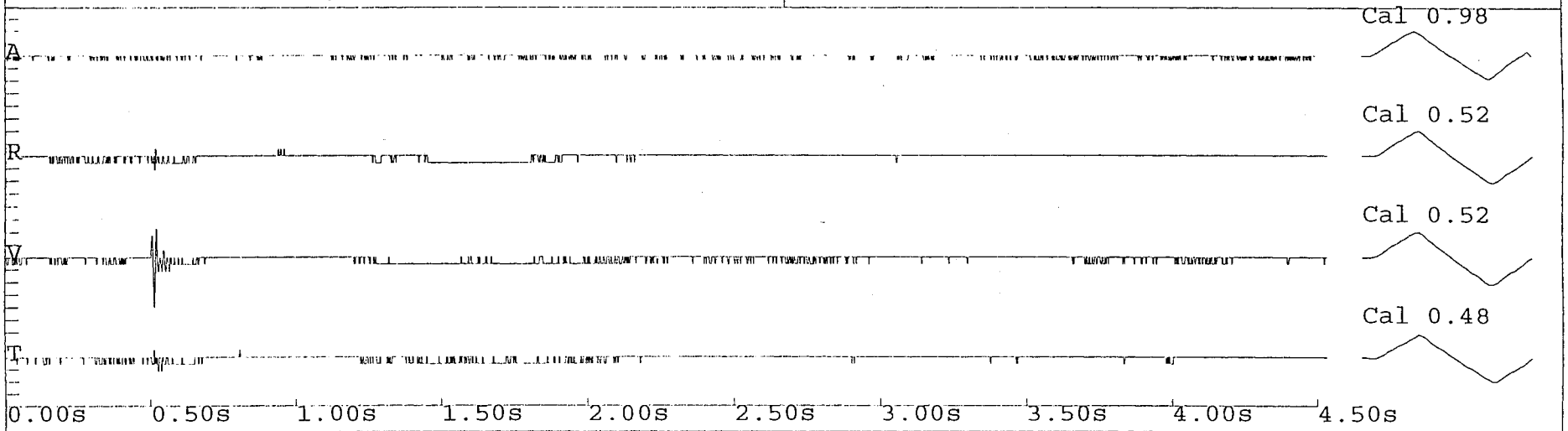


Fourier Analysis (Amplitude Spectrum)

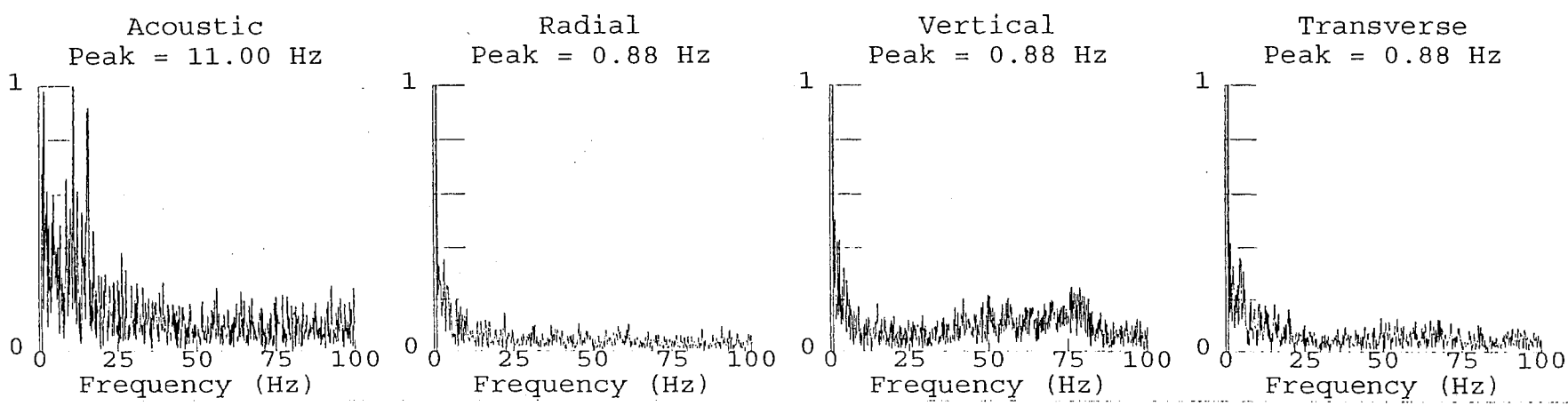


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 008 Date: 6/16/95 Time: 10:14
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.07 in/s 56.8 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

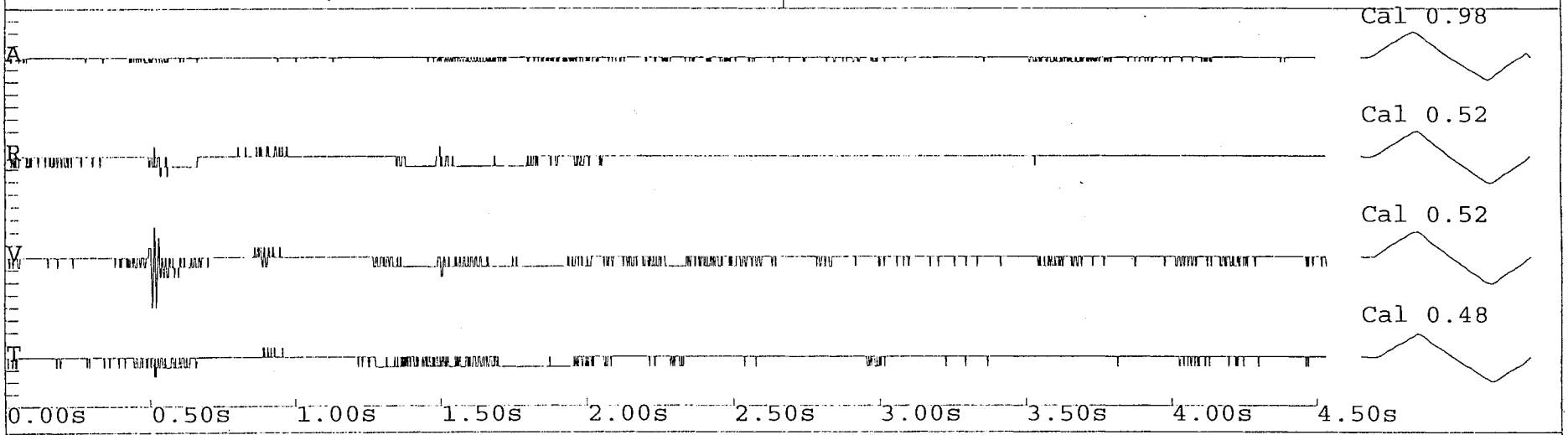


Fourier Analysis (Amplitude Spectrum)

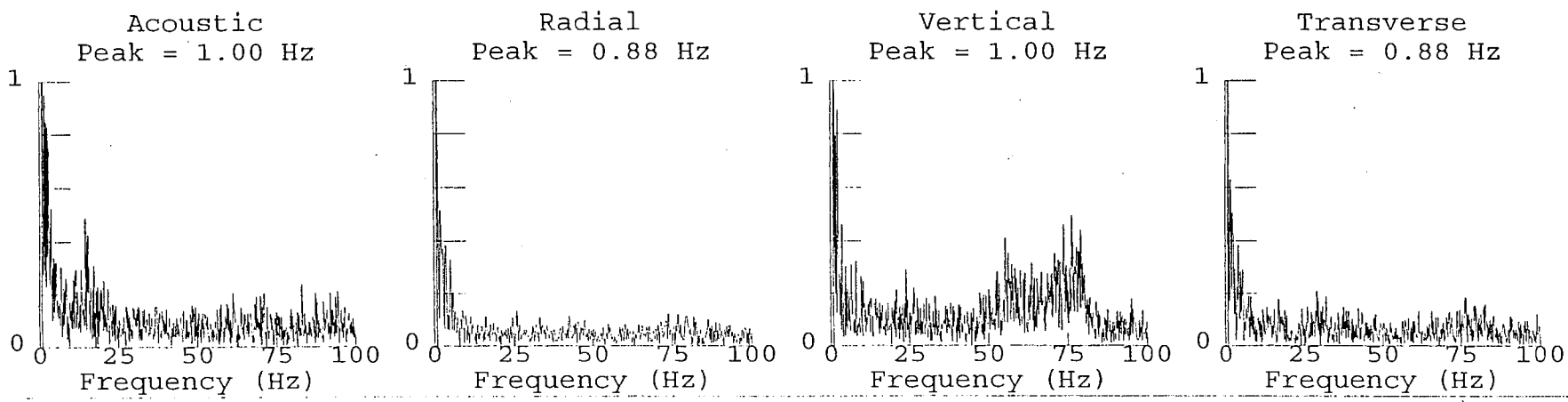


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 009 Date: 6/16/95 Time: 13:01
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 73.1 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

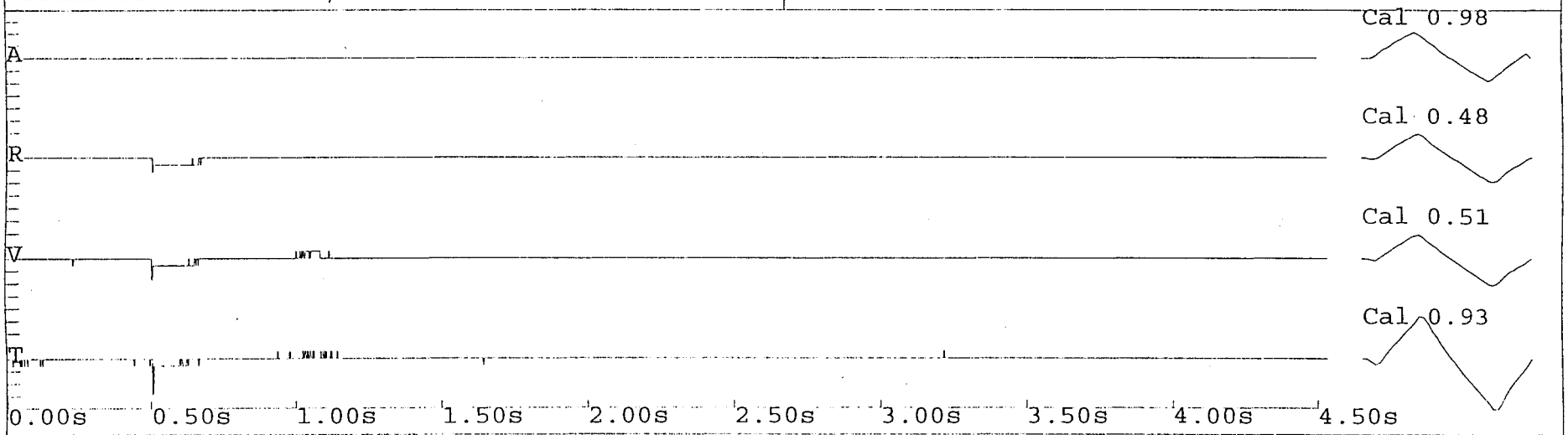


Fourier Analysis (Amplitude Spectrum)

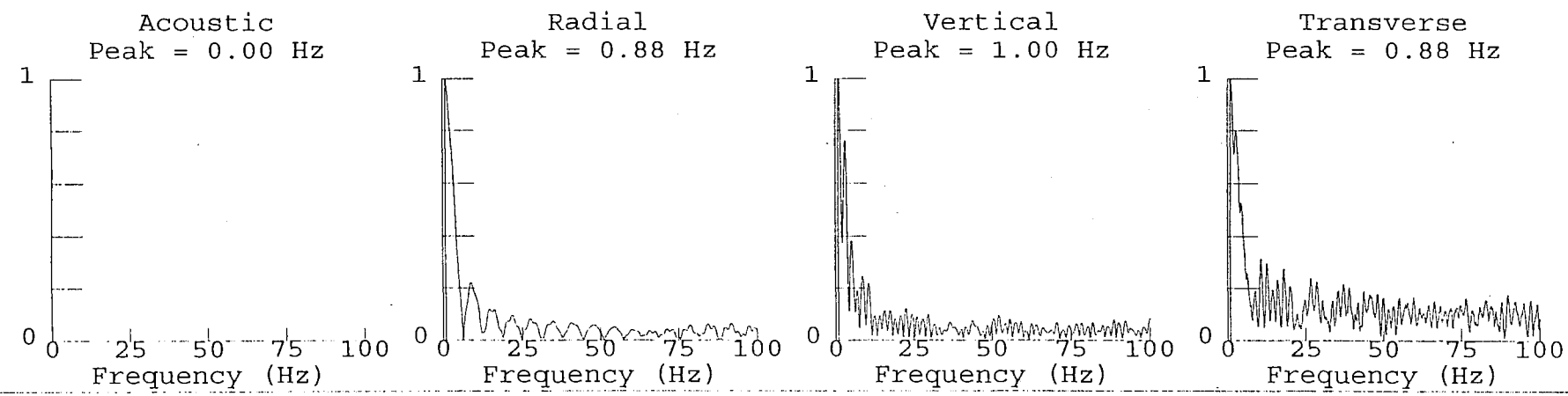


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 022 Date: 6/20/95 Time: 15:40
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 170.6 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.07 in/s 5.4 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



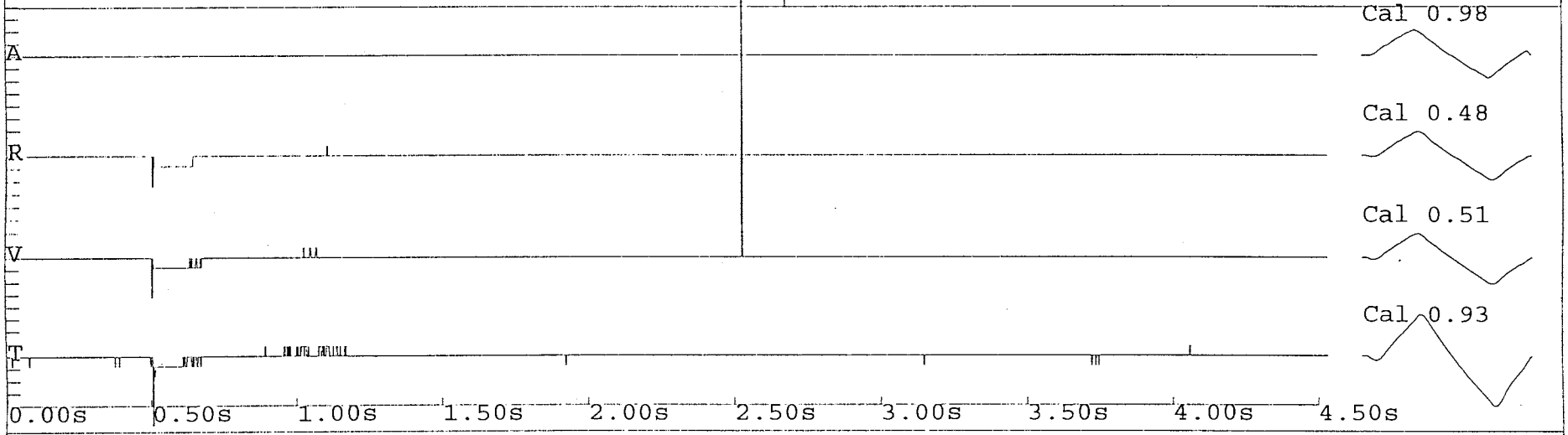
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 023 Date: 6/20/95 Time: 15:42
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

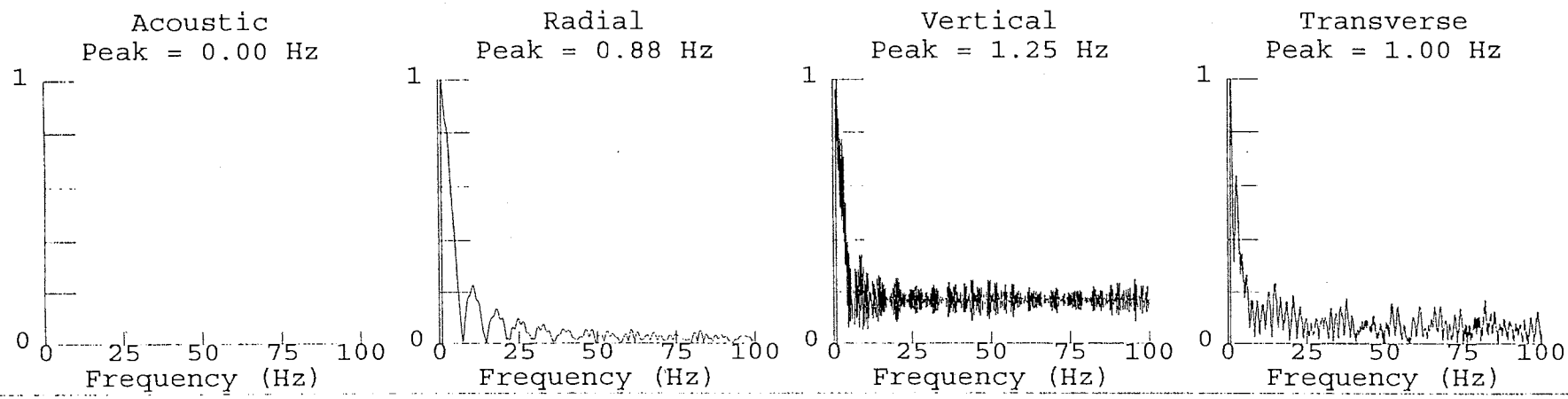
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



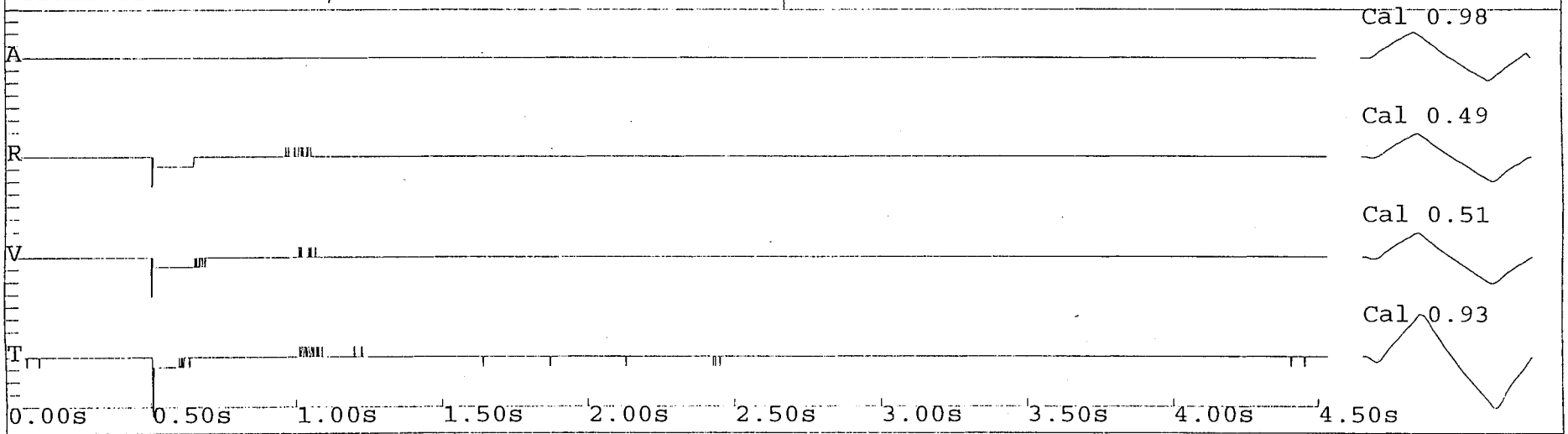
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 024 Date: 6/20/95 Time: 15:44
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

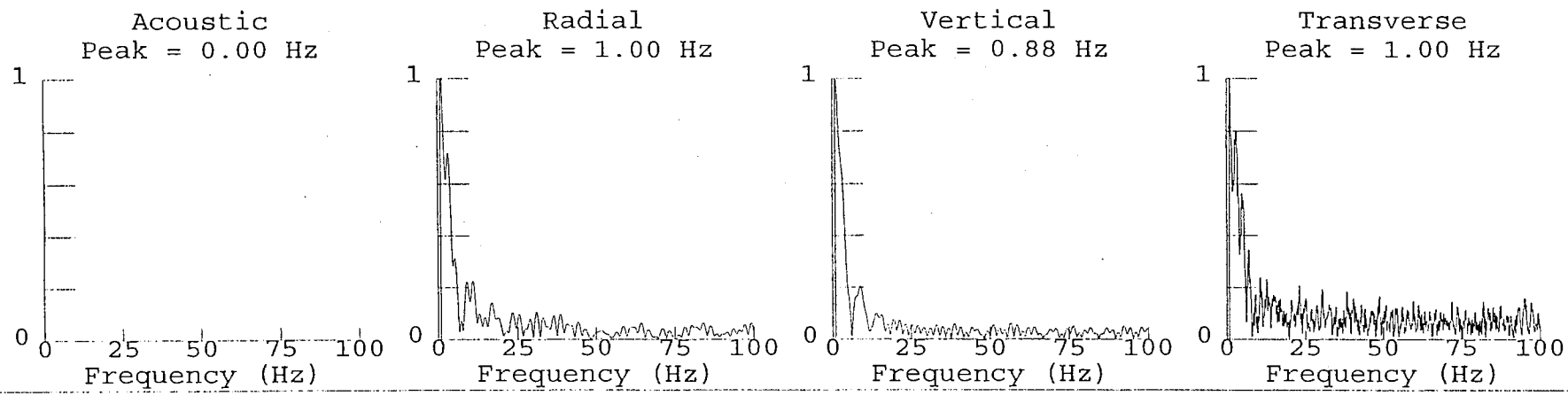
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

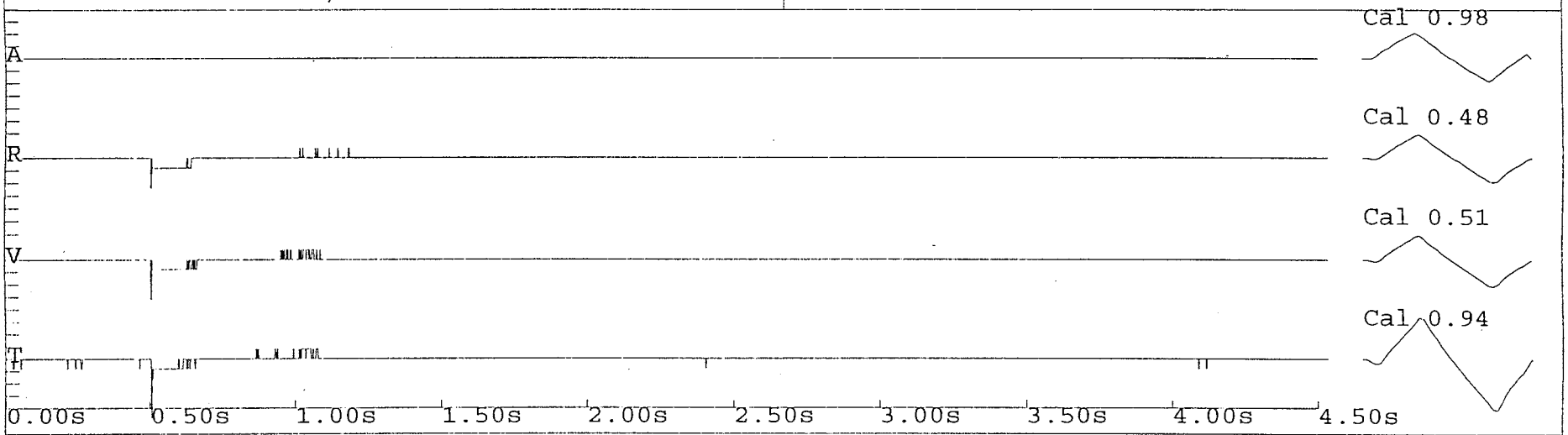


Fourier Analysis (Amplitude Spectrum)

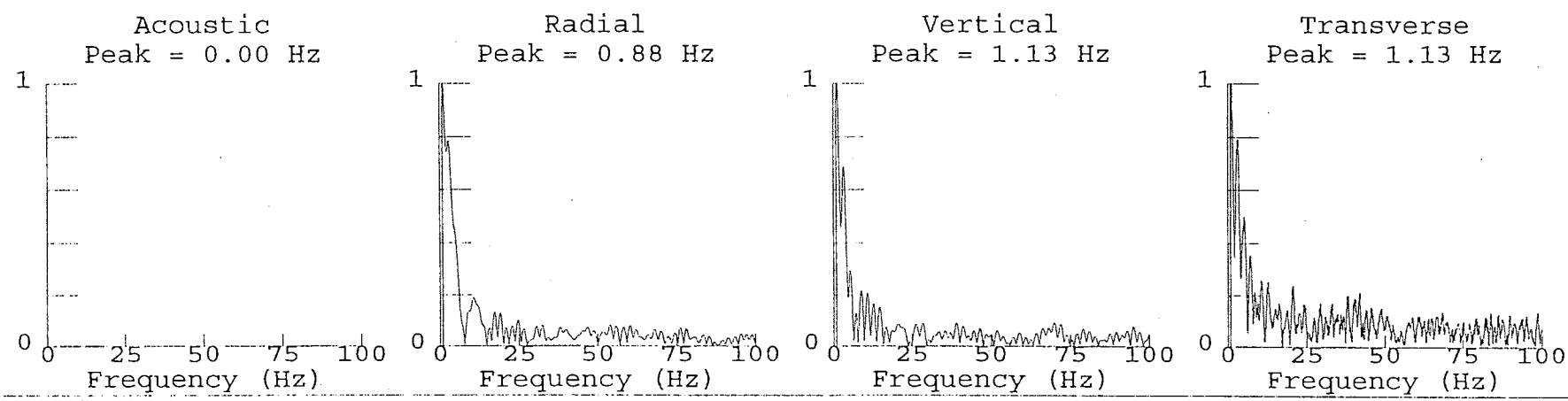


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 025 Date: 6/20/95 Time: 15:46
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



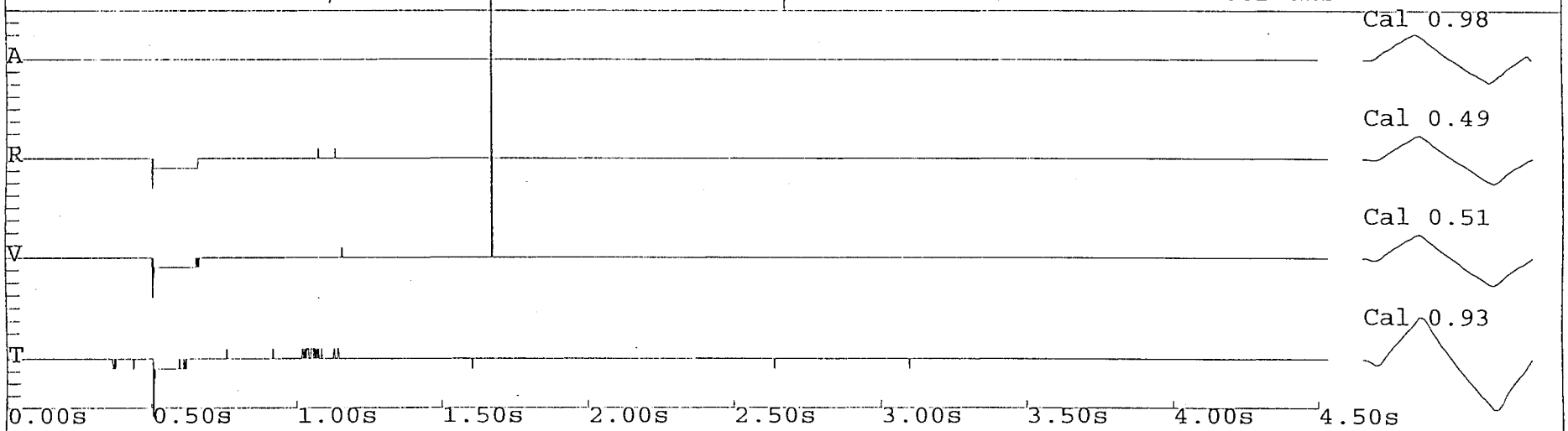
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 026 Date: 6/20/95 Time: 15:48
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

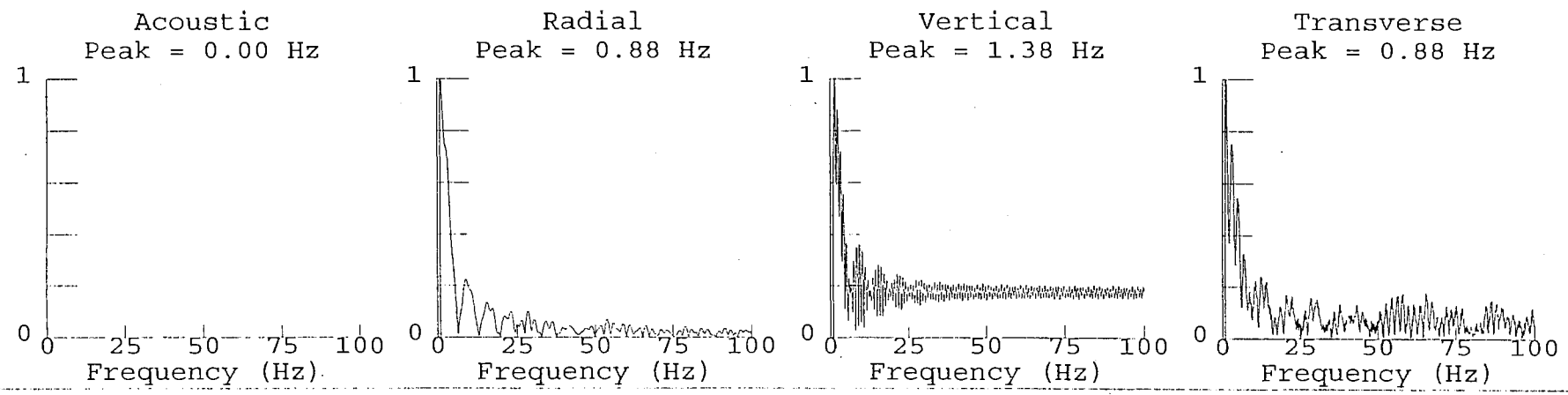
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

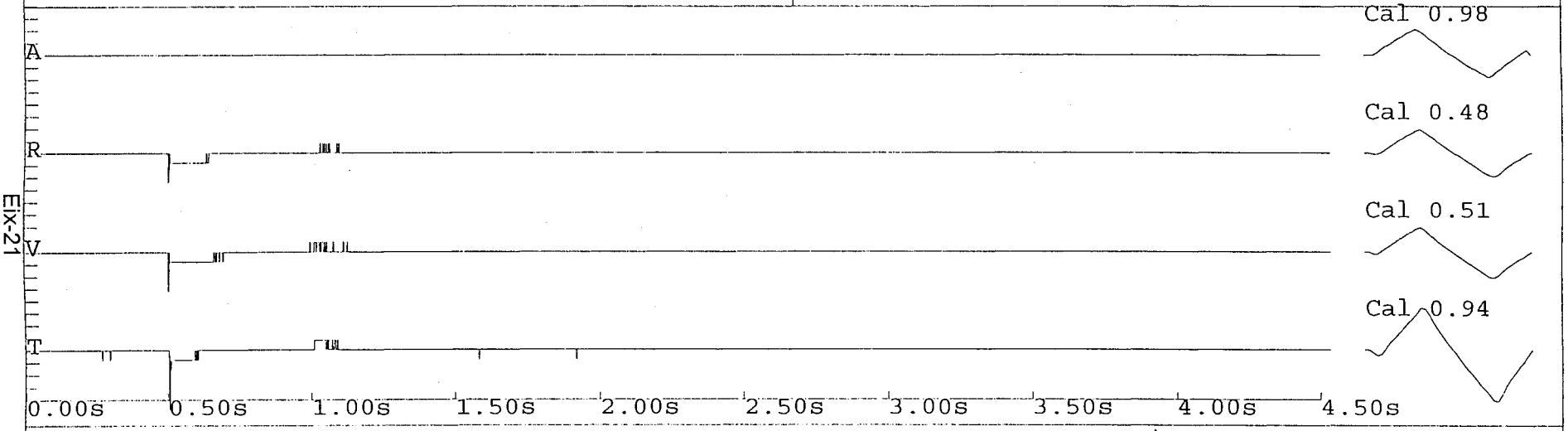


Fourier Analysis (Amplitude Spectrum)

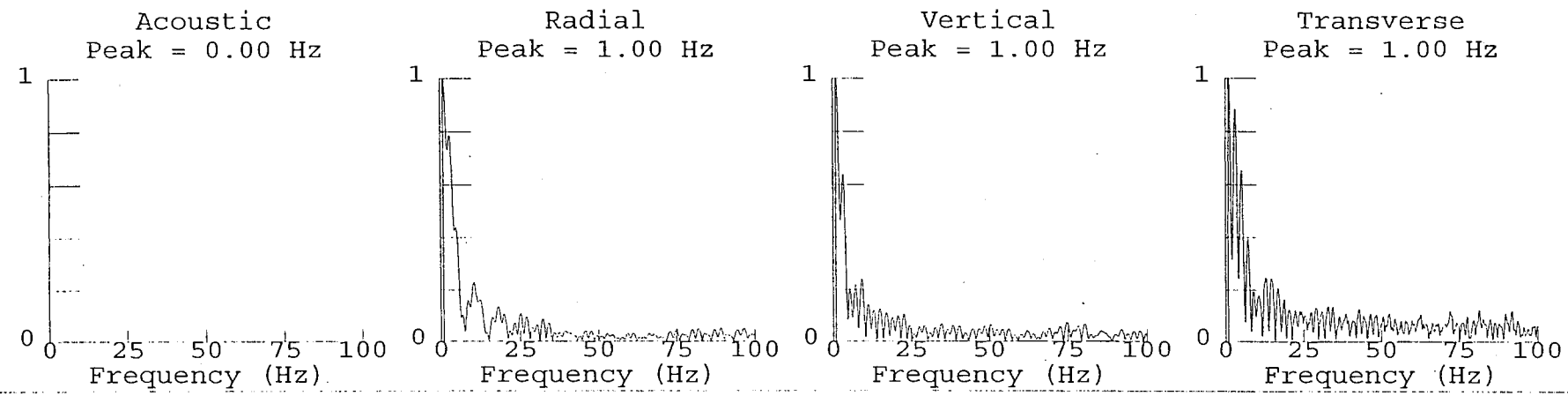


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 027 Date: 6/20/95 Time: 15:50
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

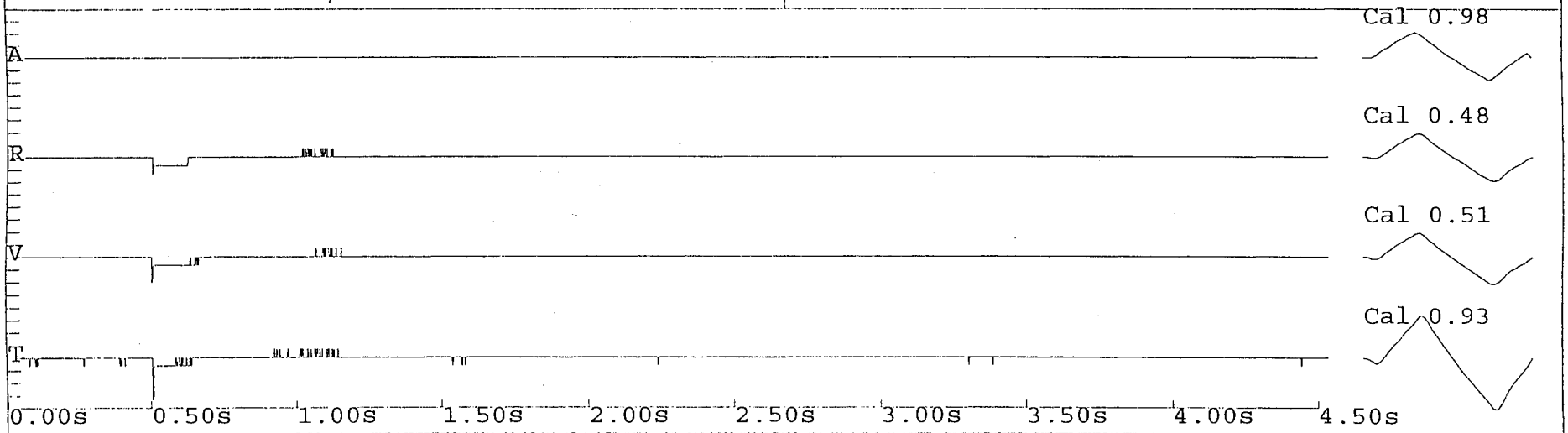


Fourier Analysis (Amplitude Spectrum)

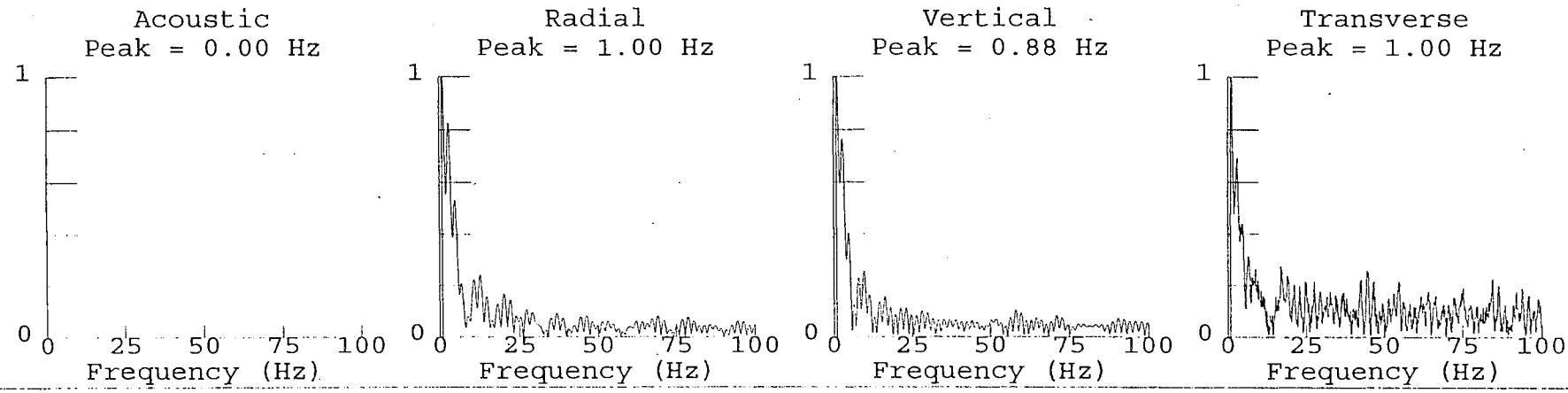


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 028 Date: 6/20/95 Time: 15:52
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 5.3 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 6.8 Hz.	Time Lines at: 0.50 sec intervals

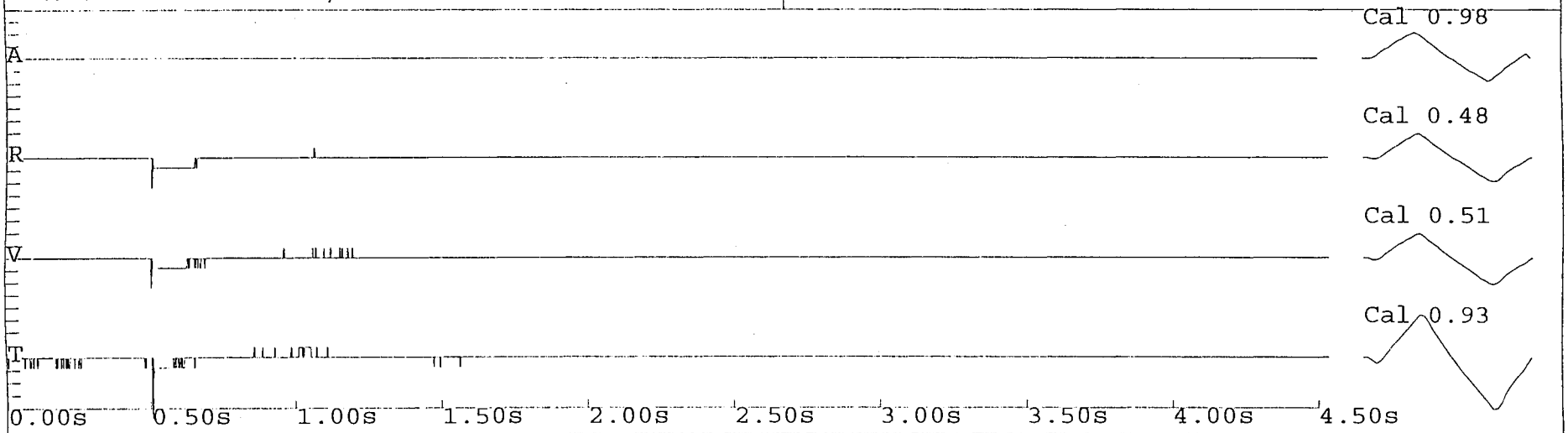


Fourier Analysis (Amplitude Spectrum)

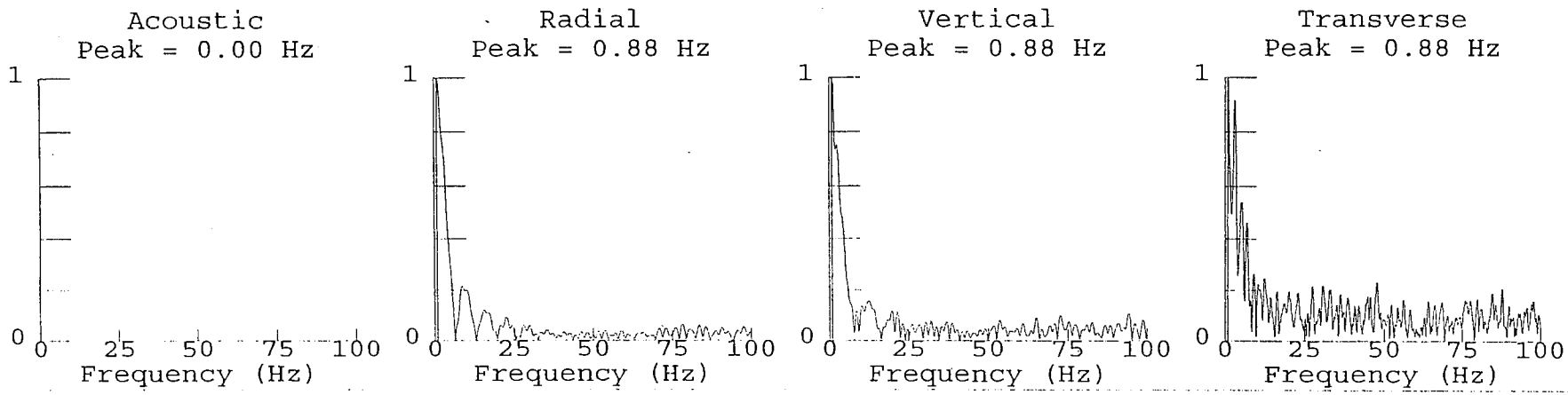


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 029 Date: 6/20/95 Time: 15:54
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

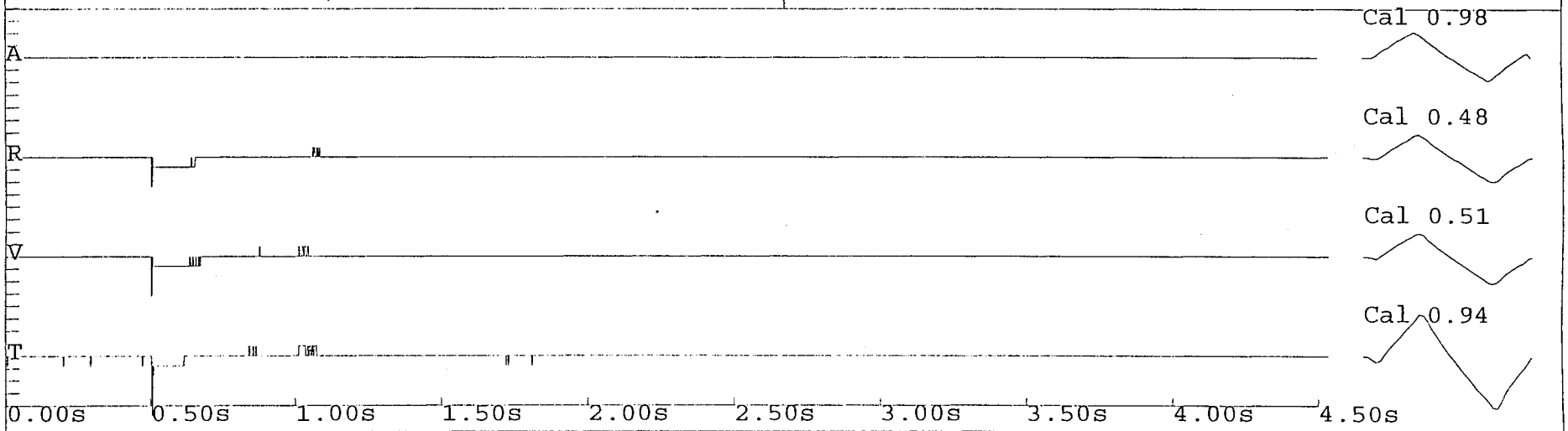


Fourier Analysis (Amplitude Spectrum)

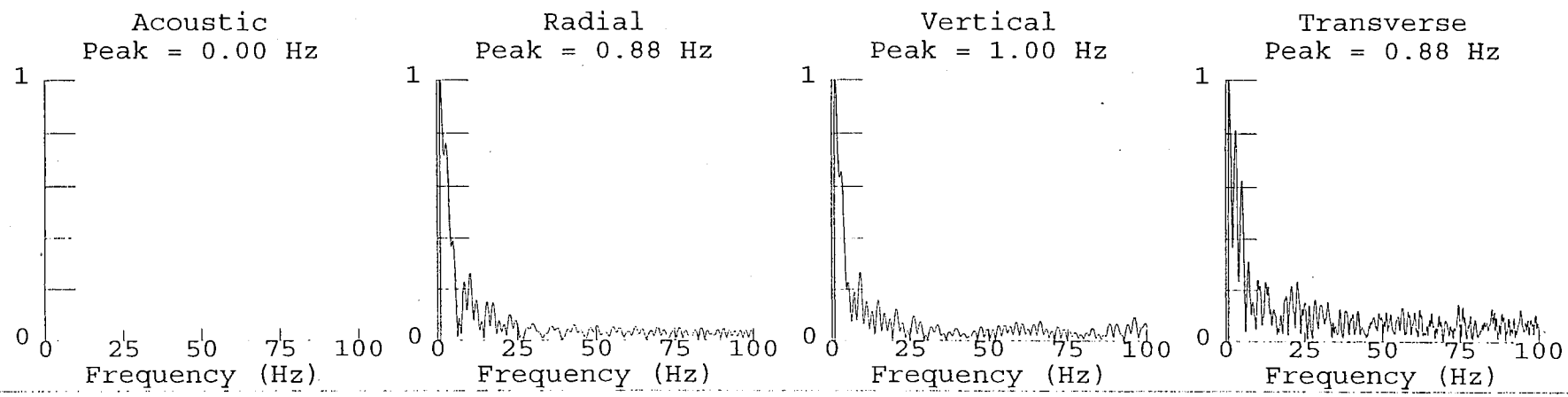


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 030 Date: 6/20/95 Time: 15:56
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

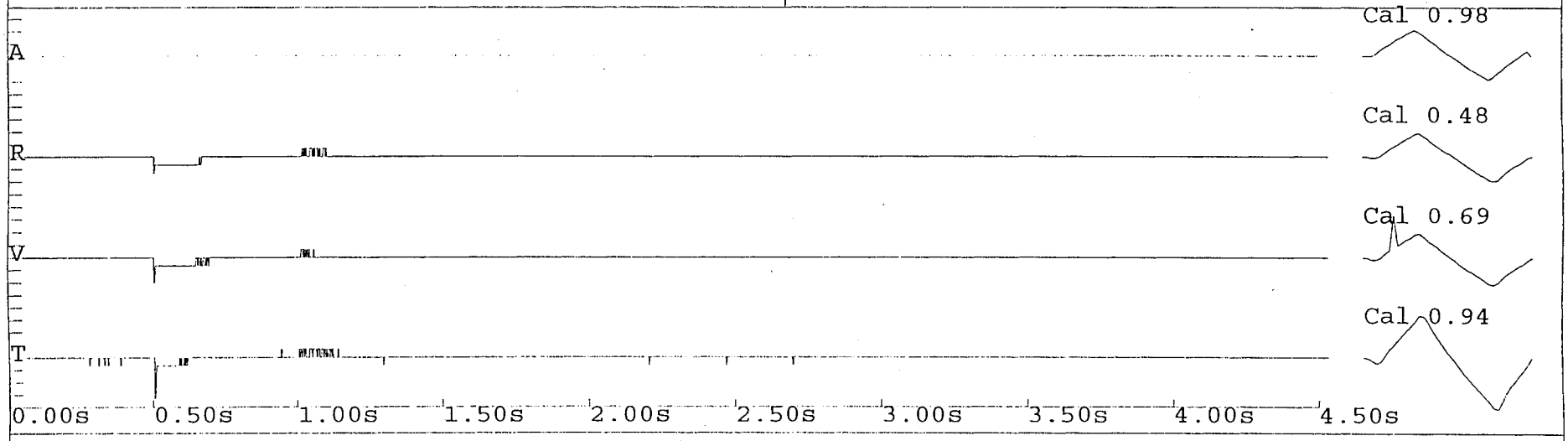


Fourier Analysis (Amplitude Spectrum)

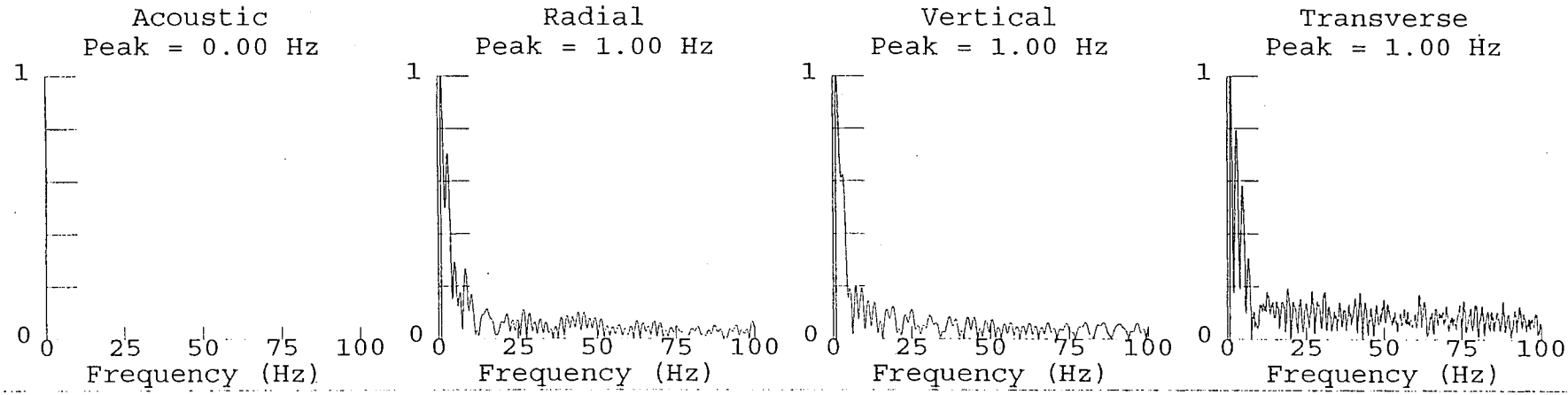


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 031 Date: 6/20/95 Time: 15:58
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 5.8 Hz.	Time Lines at: 0.50 sec intervals

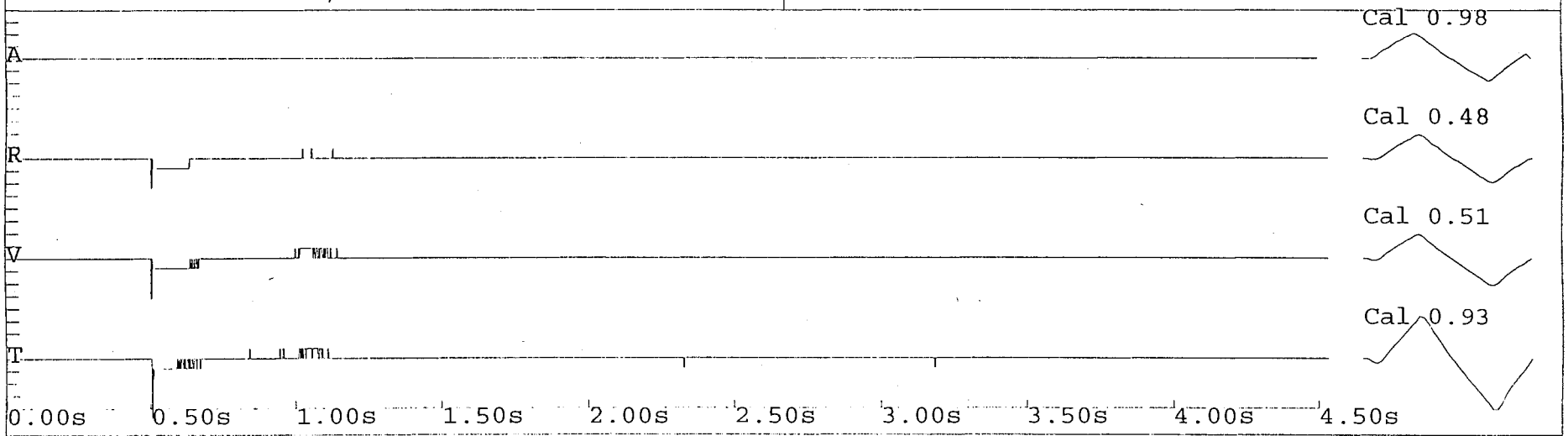


Fourier Analysis (Amplitude Spectrum)

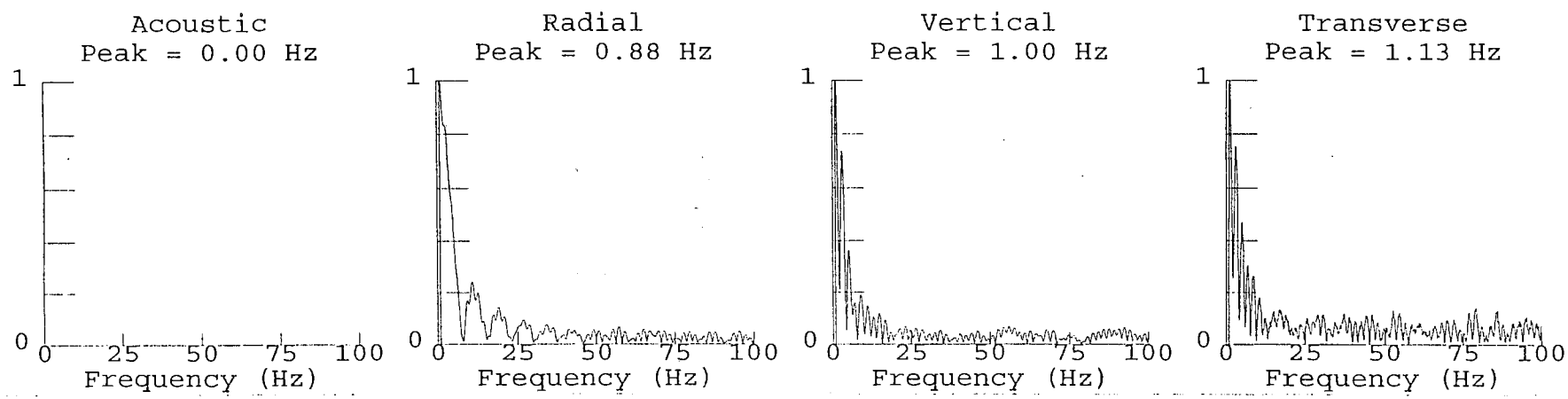


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 032 Date: 6/20/95 Time: 16:00
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



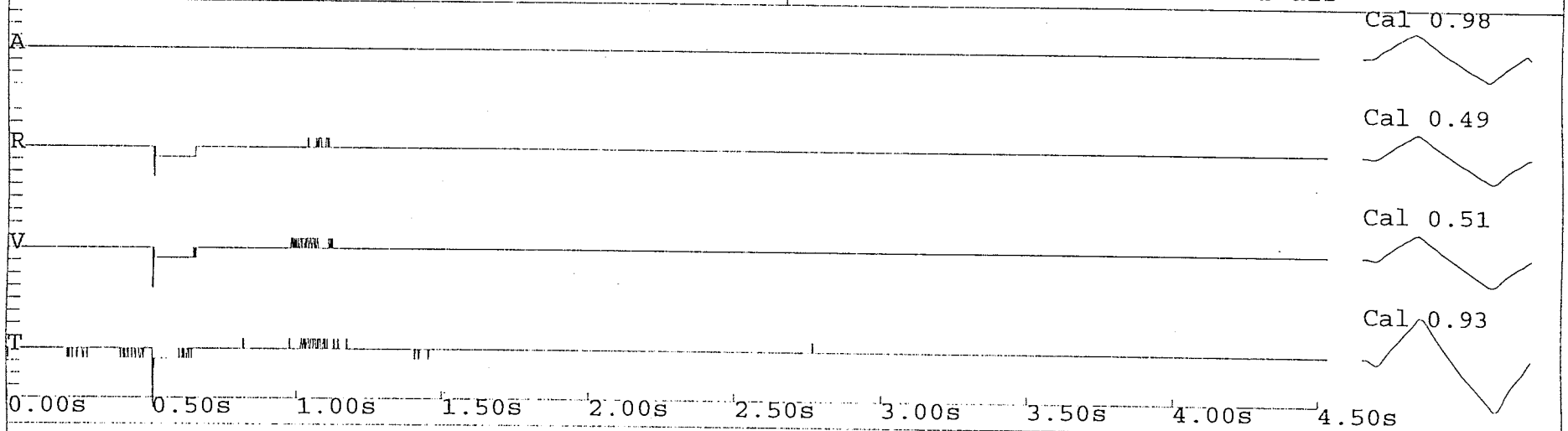
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 033 Date: 6/20/95 Time: 16:02
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

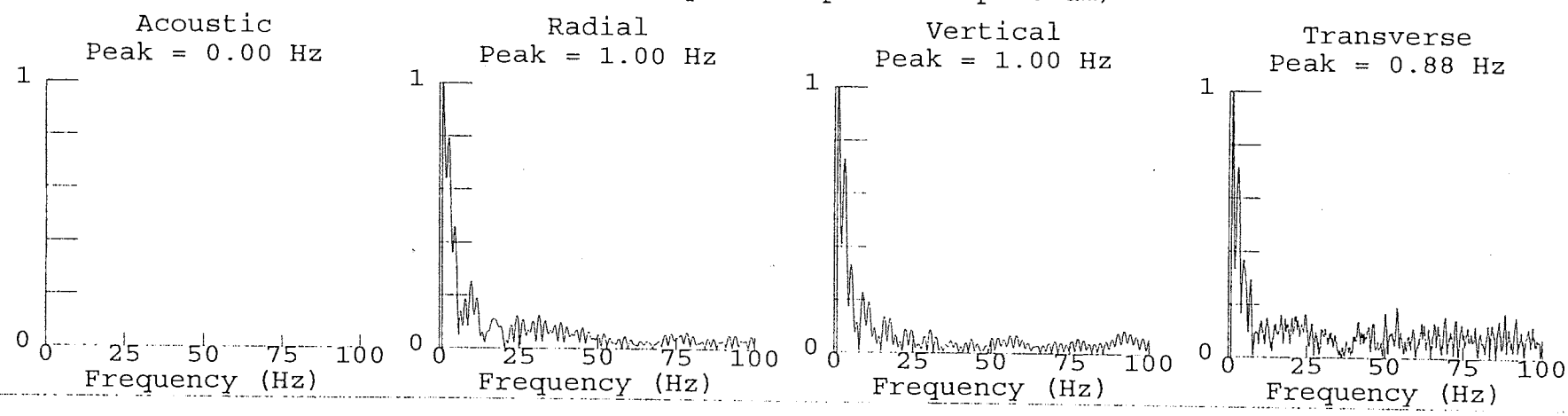
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



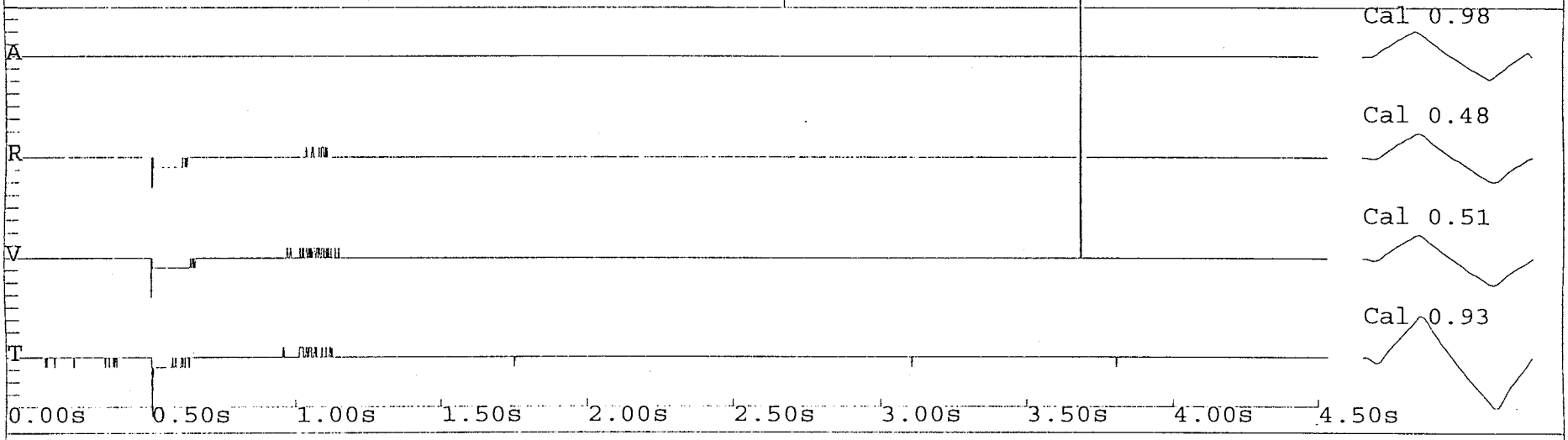
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 034 Date: 6/20/95 Time: 16:04
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

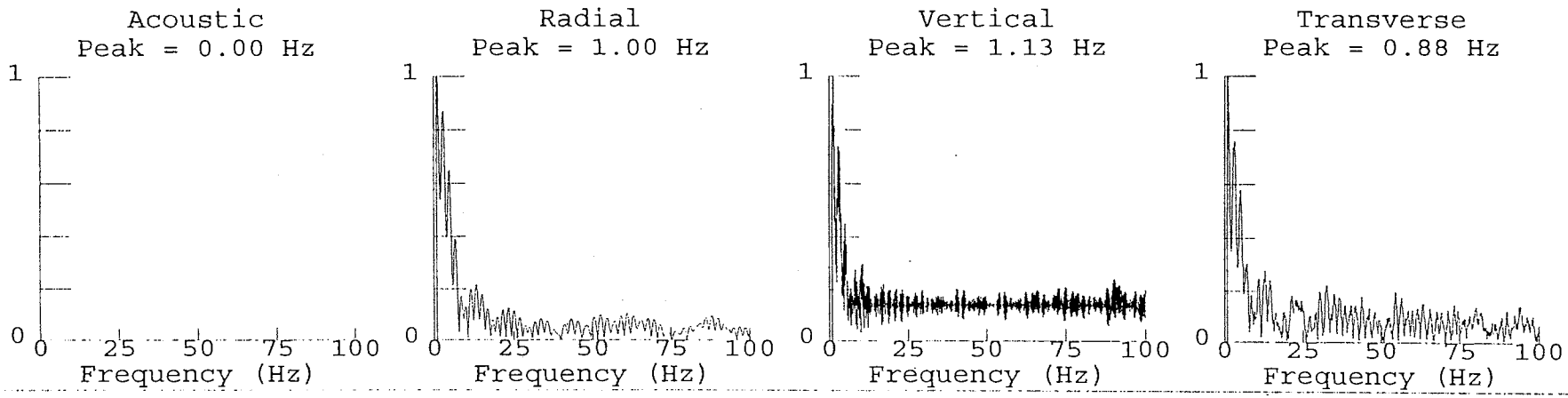
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

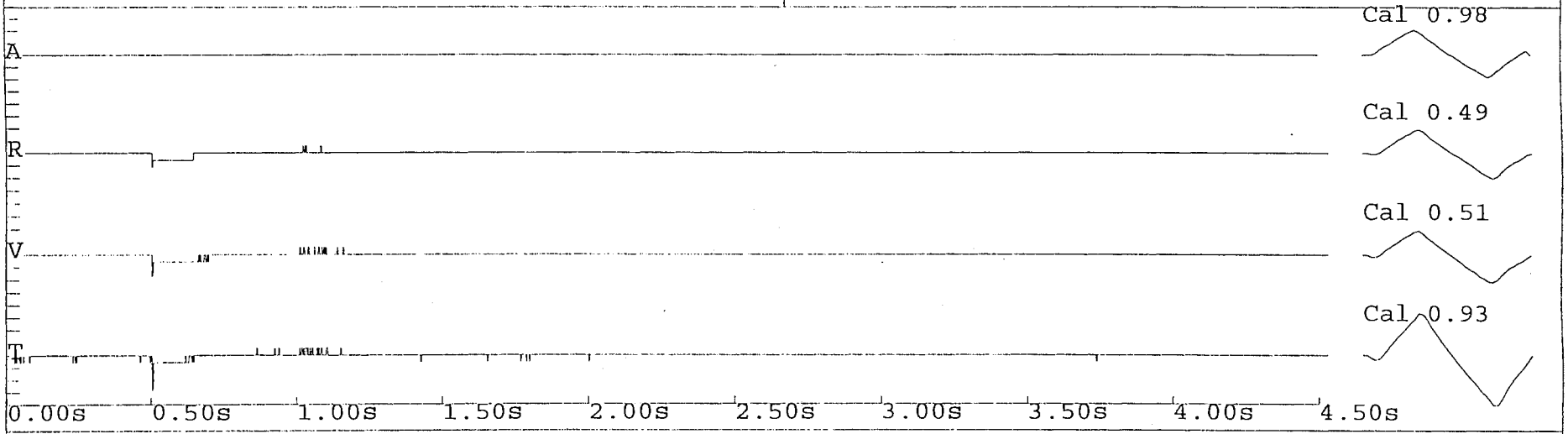


Fourier Analysis (Amplitude Spectrum)

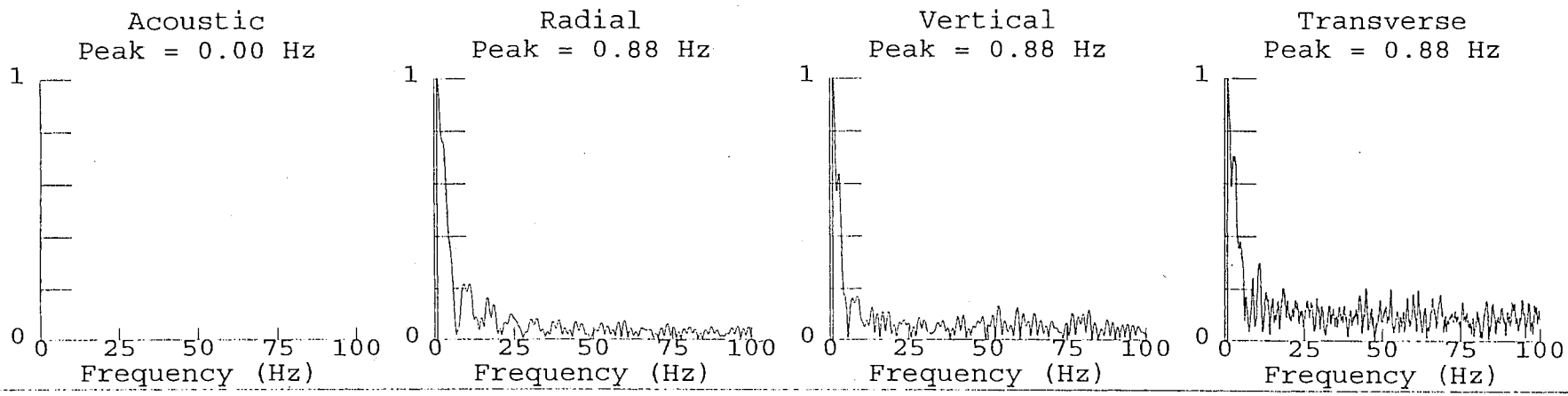


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 035 Date: 6/20/95 Time: 16:06
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 3.5 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.07 in/s 4.6 Hz.	Time Lines at: 0.50 sec intervals

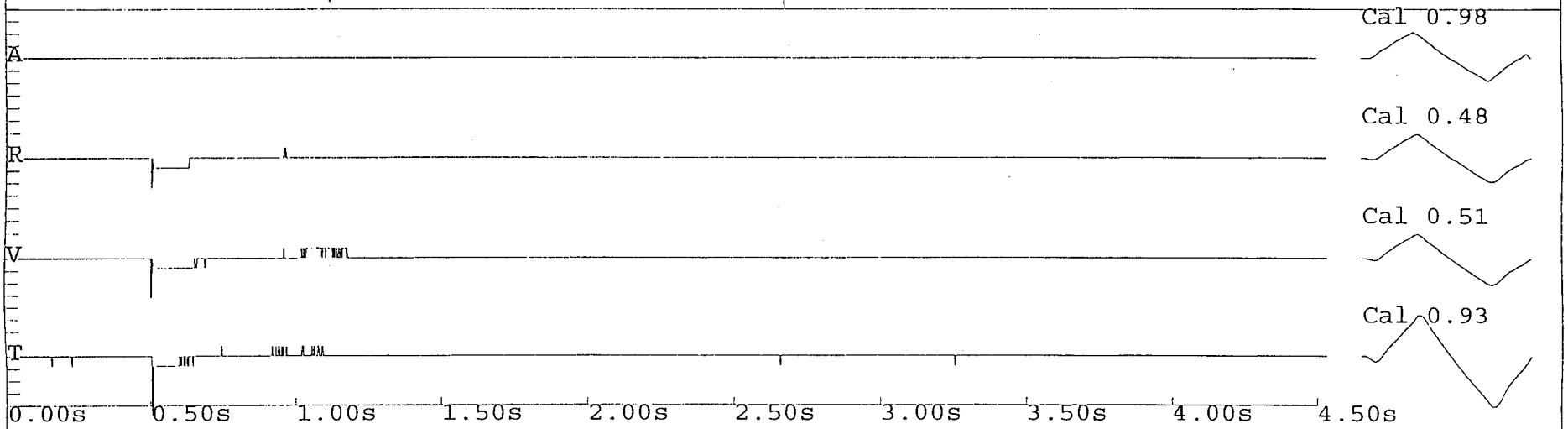


Fourier Analysis (Amplitude Spectrum)

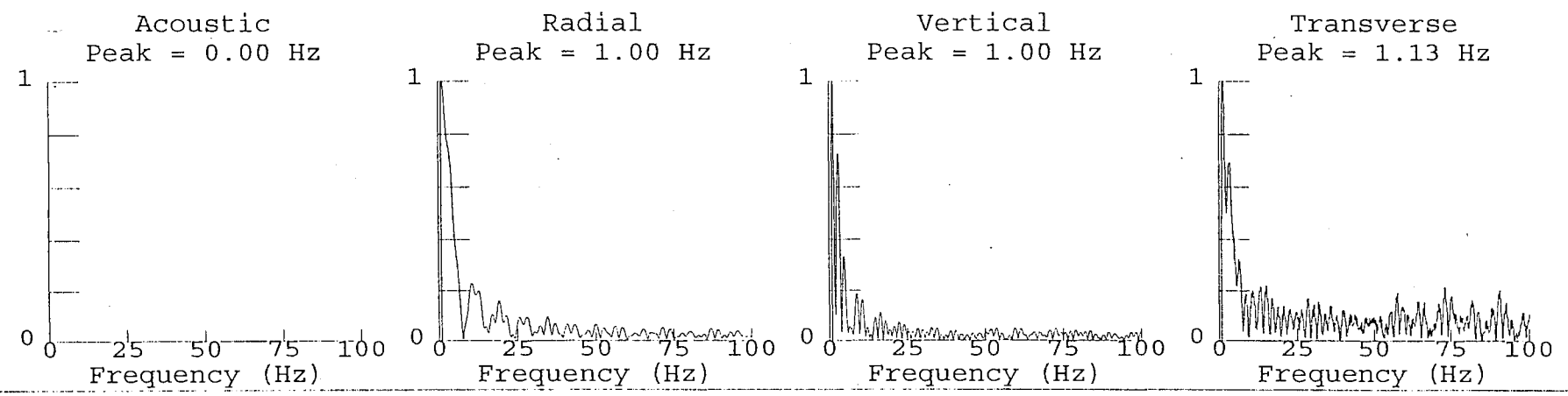


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 036 Date: 6/20/95 Time: 16:08
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



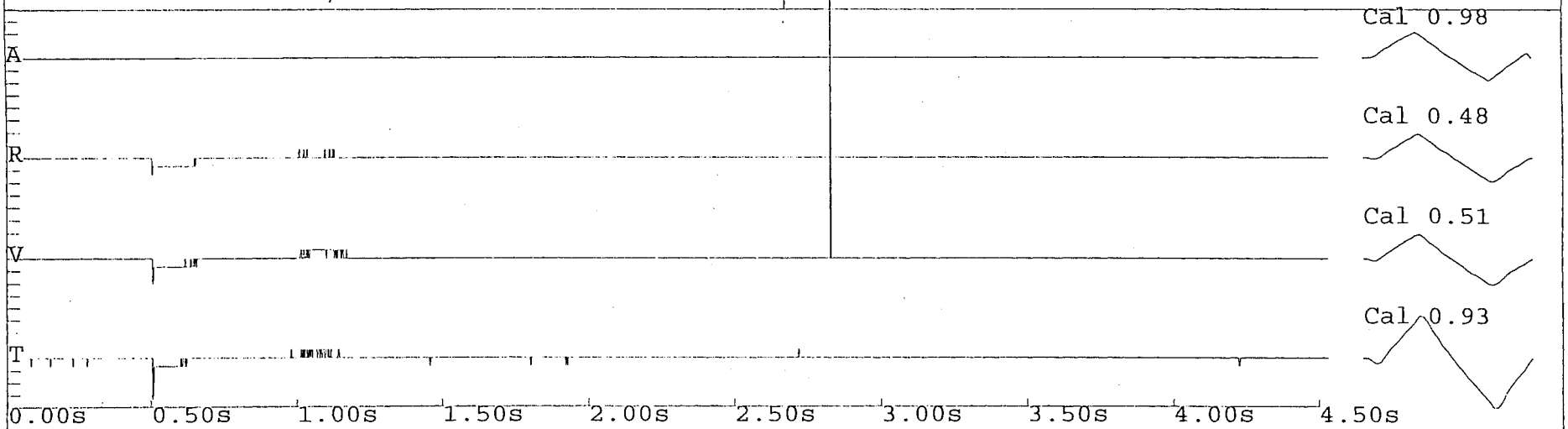
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 037 Date: 6/20/95 Time: 16:10
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

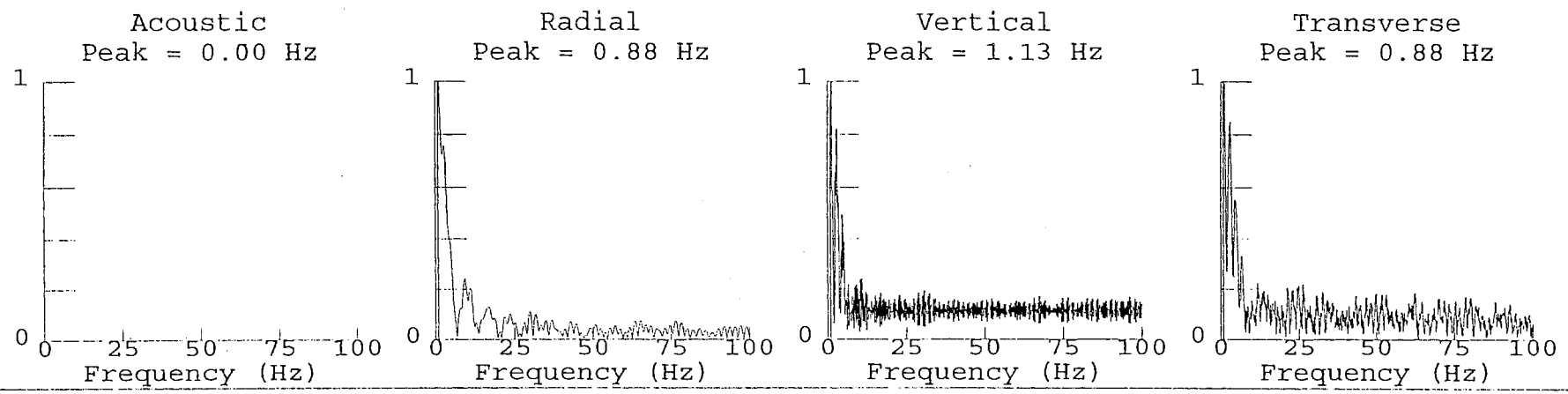
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 170.6 Hz.
Transverse: 0.06 in/s 5.2 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



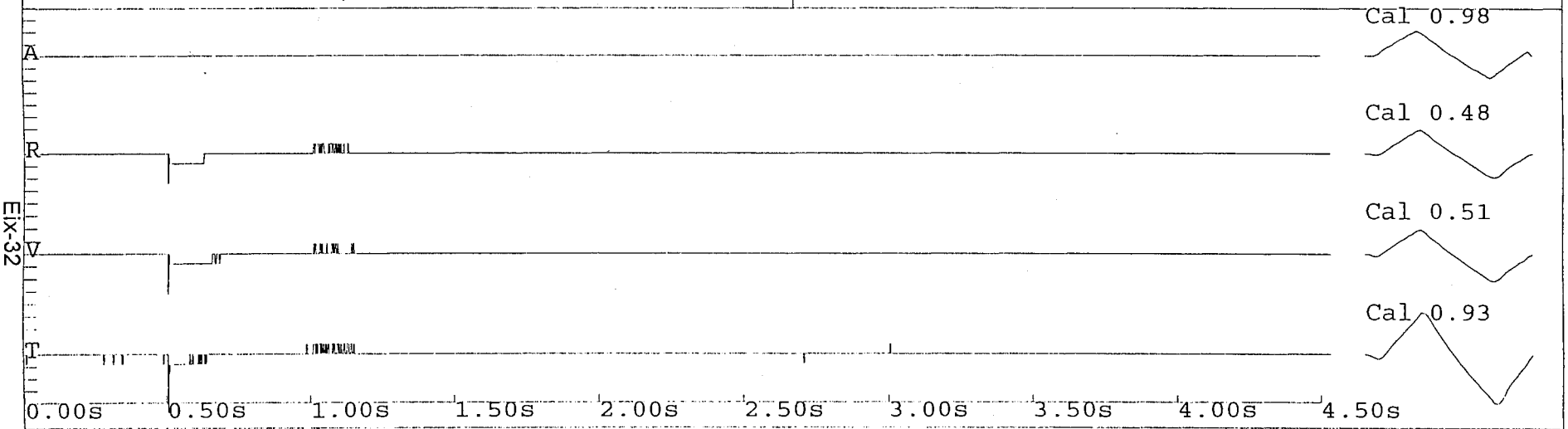
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 038 Date: 6/20/95 Time: 16:12
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

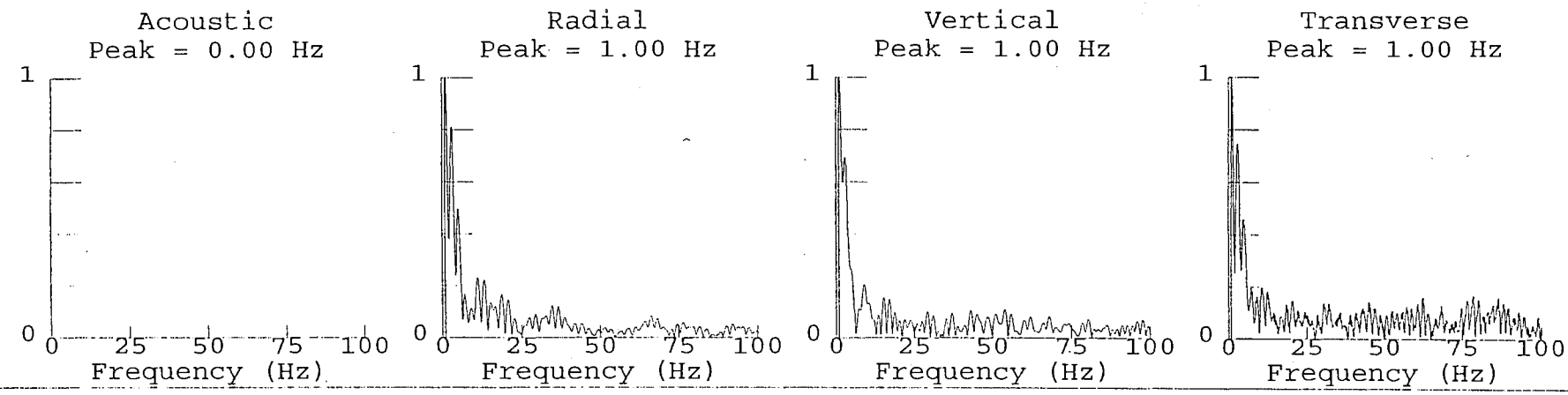
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

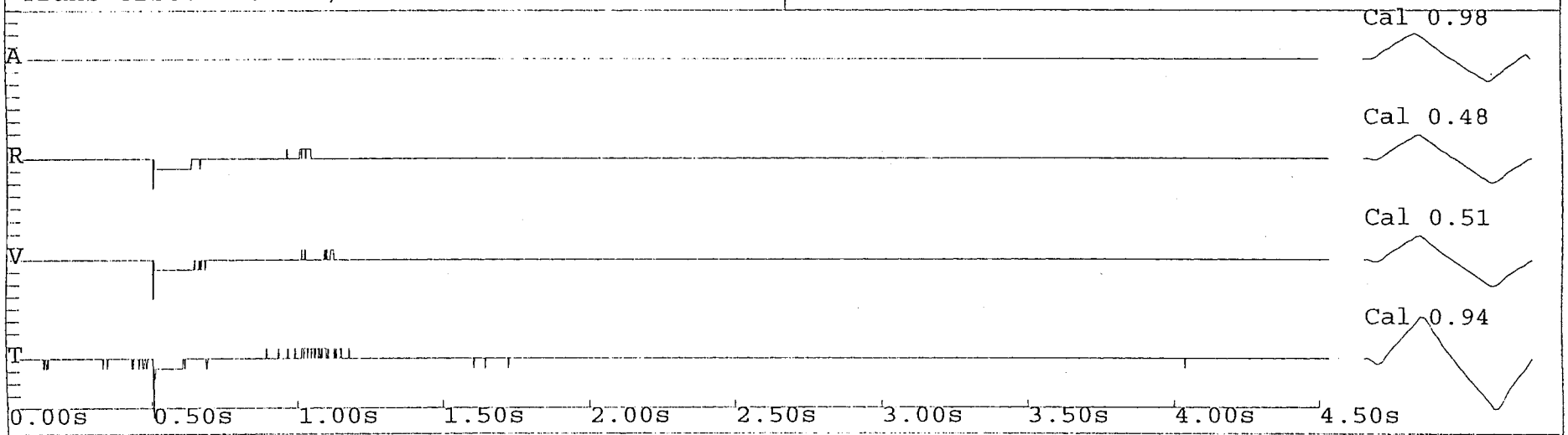


Fourier Analysis (Amplitude Spectrum)

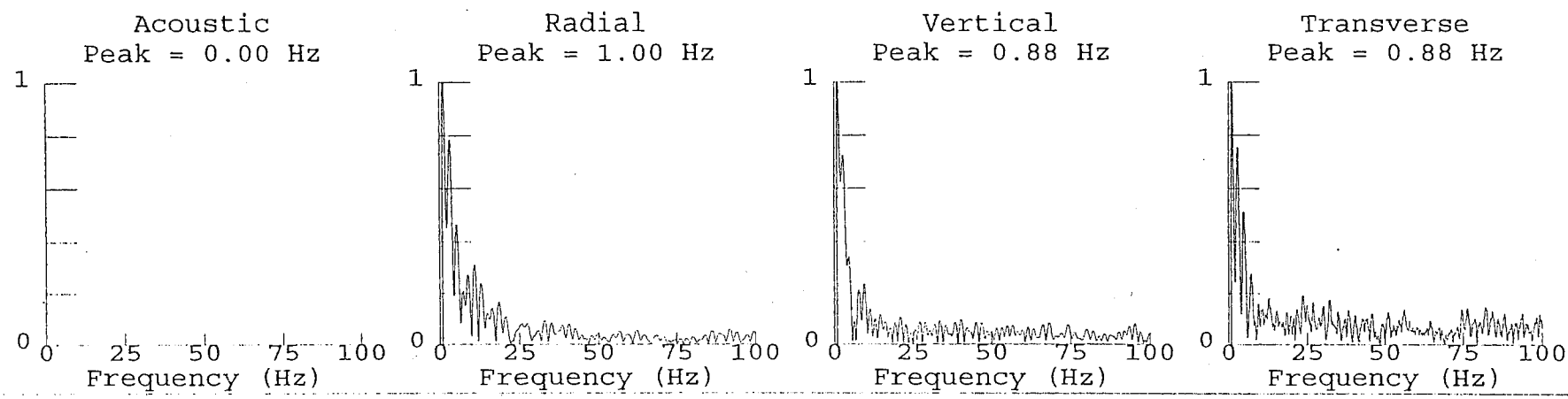


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 039 Date: 6/20/95 Time: 16:14
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



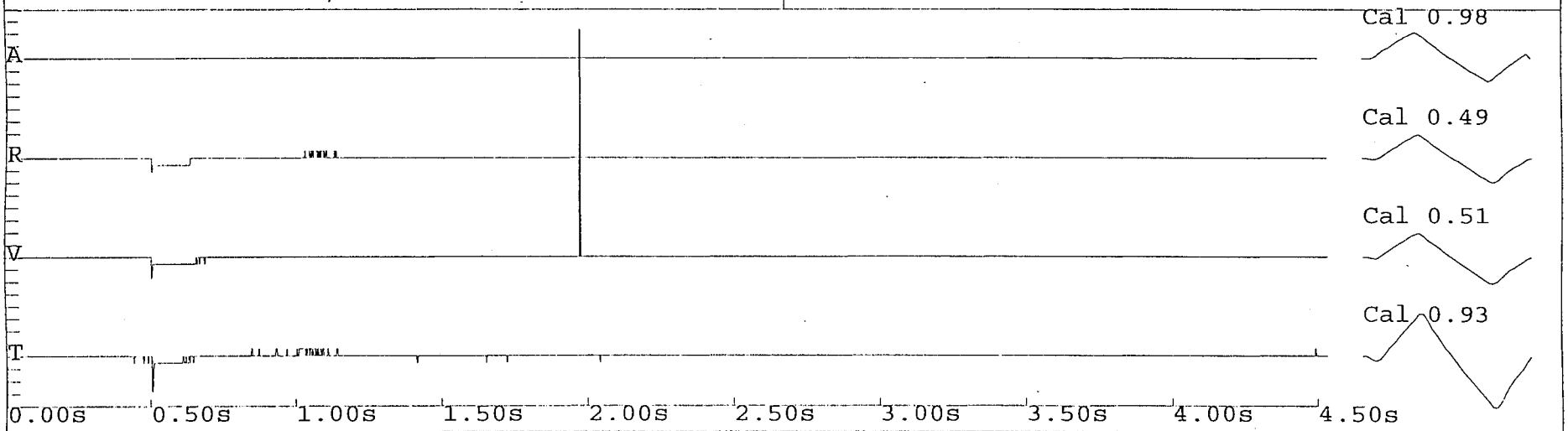
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 040 Date: 6/20/95 Time: 16:16
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

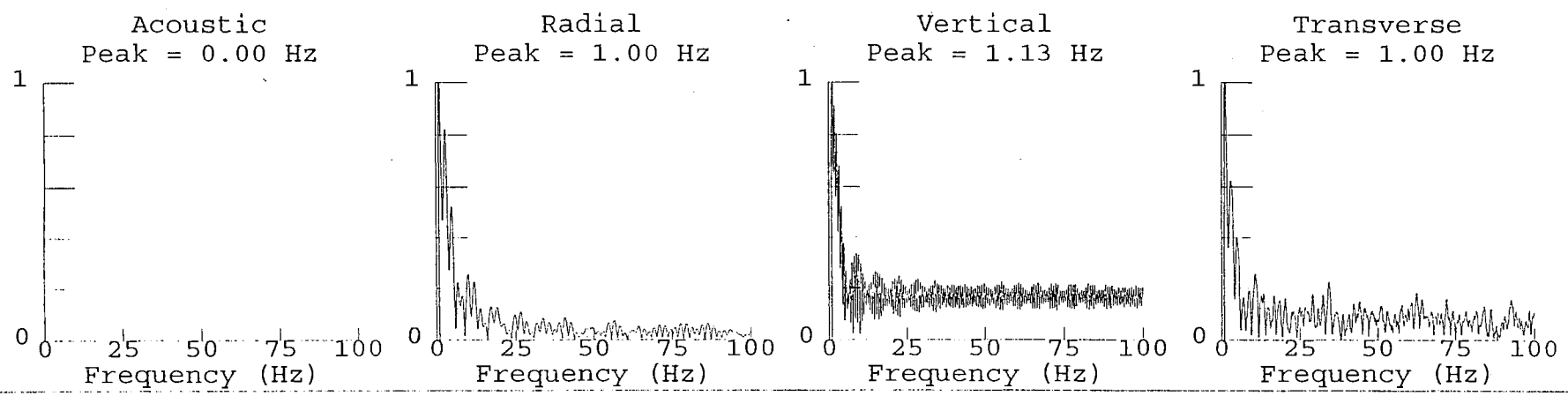
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 3.2 Hz.
Transverse: 0.07 in/s 5.3 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.07 in/s (0.0175 in/s/div)
Time Lines at: 0.50 sec intervals

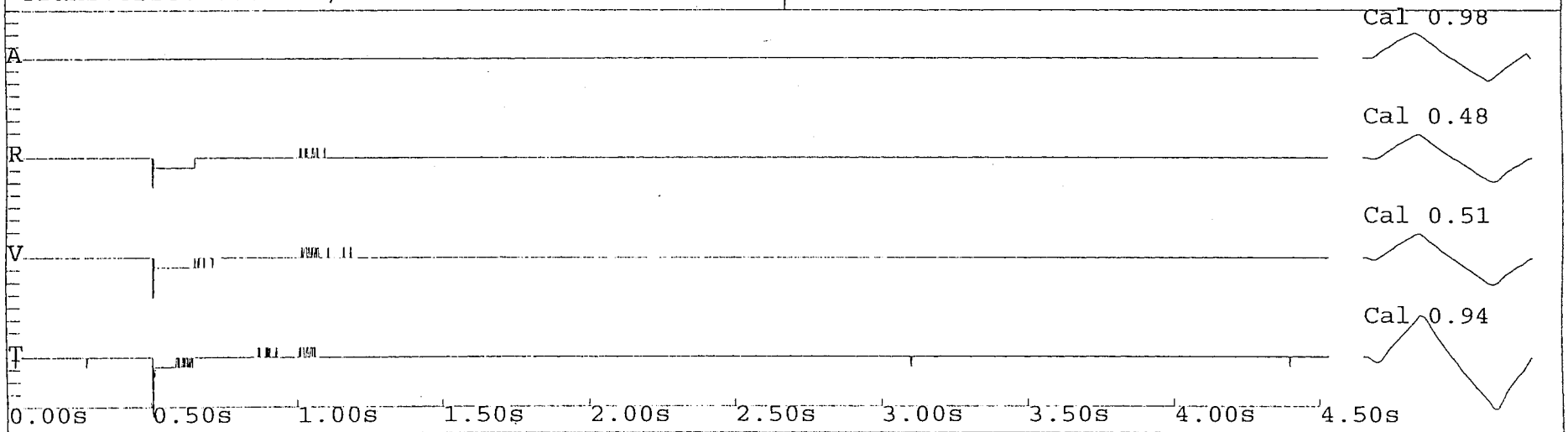


Fourier Analysis (Amplitude Spectrum)

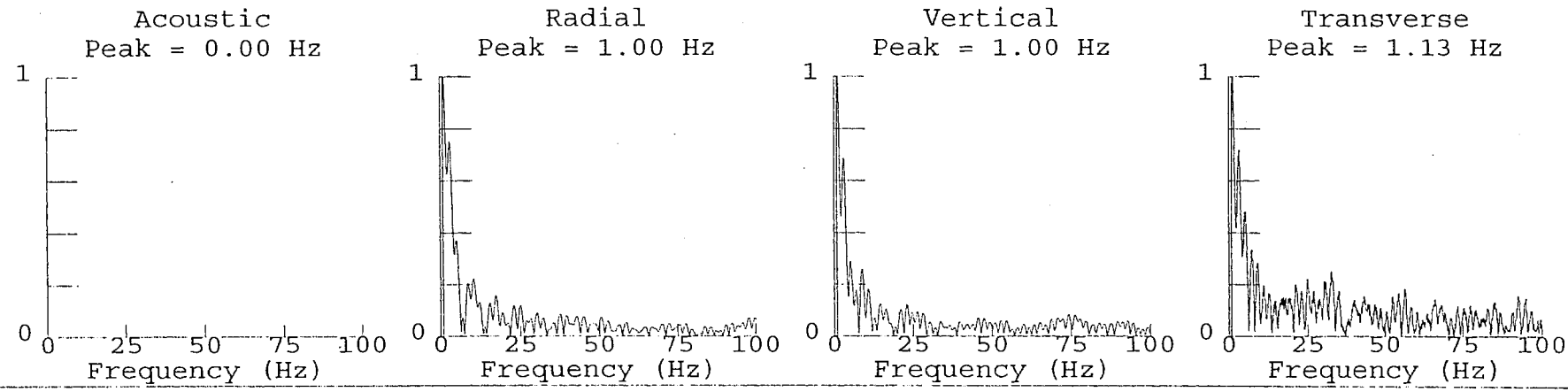


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 041 Date: 6/20/95 Time: 16:18
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

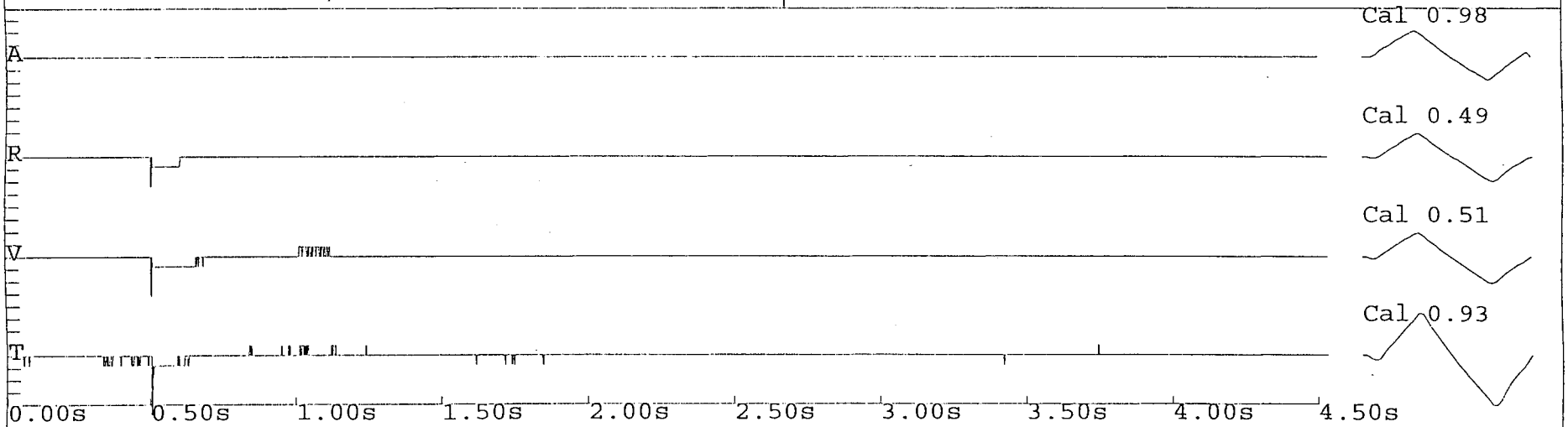


Fourier Analysis (Amplitude Spectrum)

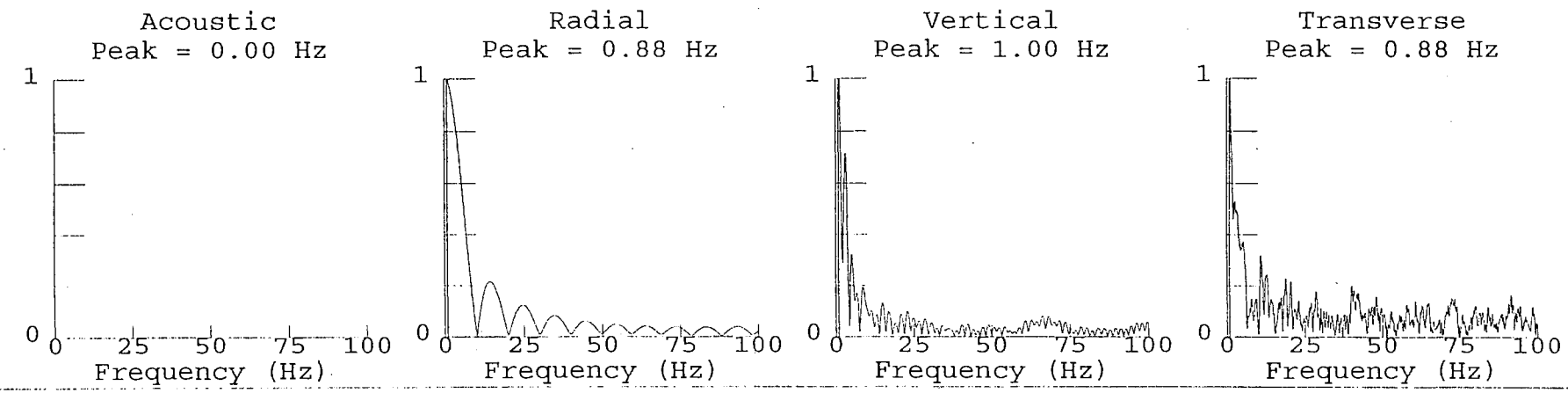


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 042 Date: 6/20/95 Time: 16:20
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



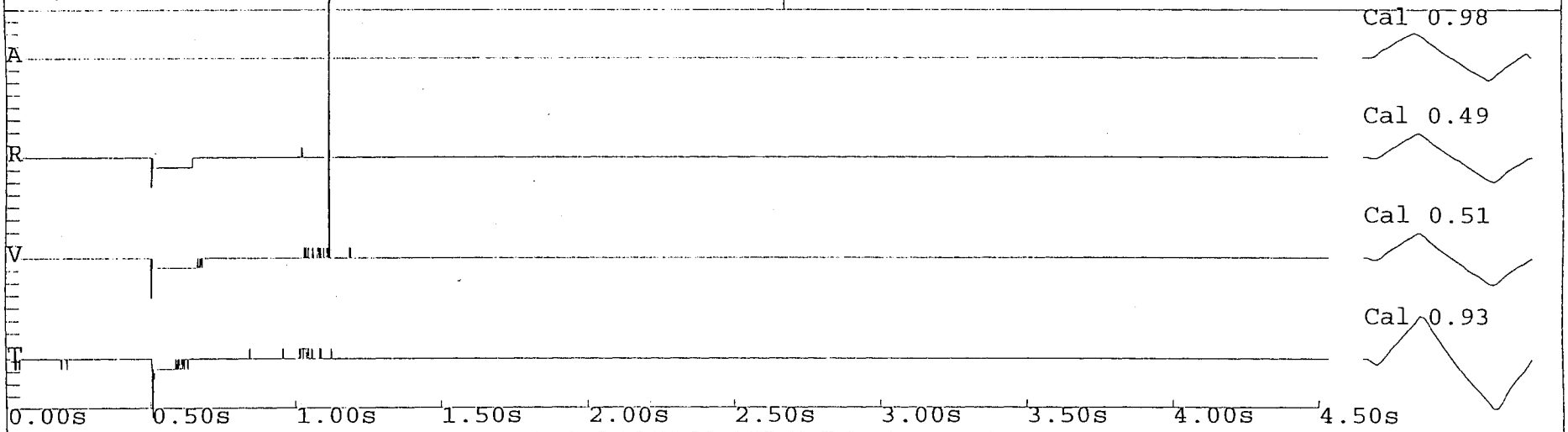
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 043 Date: 6/20/95 Time: 16:22
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

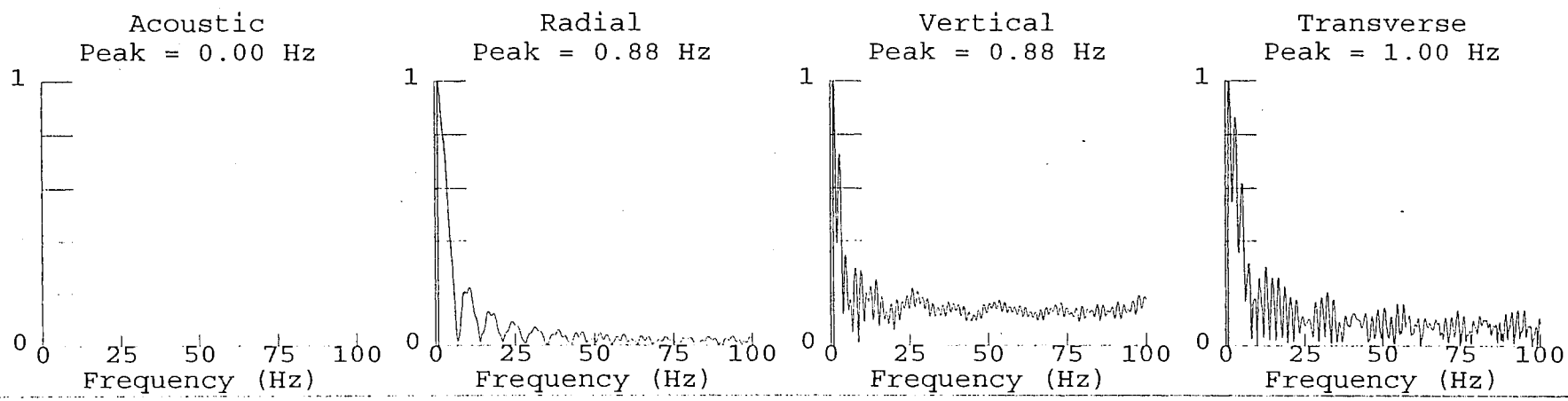
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

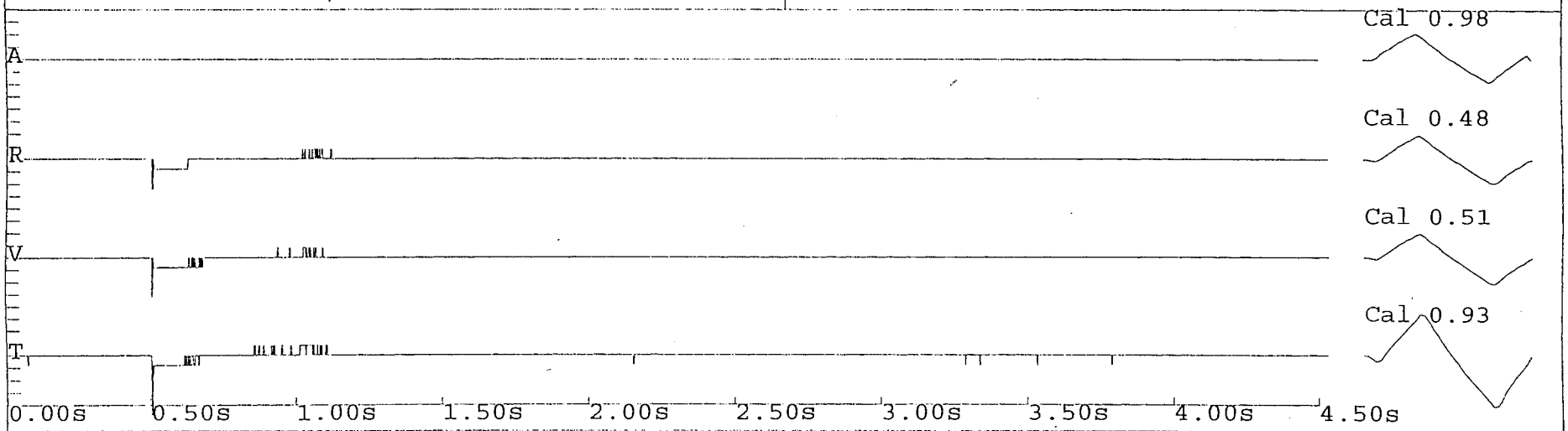


Fourier Analysis (Amplitude Spectrum)

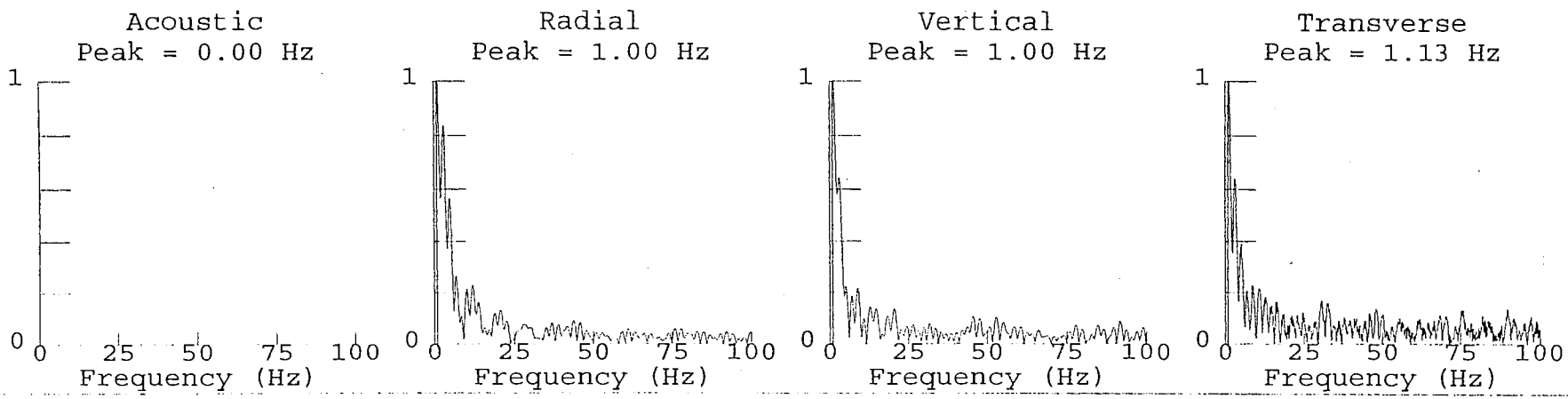


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 044 Date: 6/20/95 Time: 16:24
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



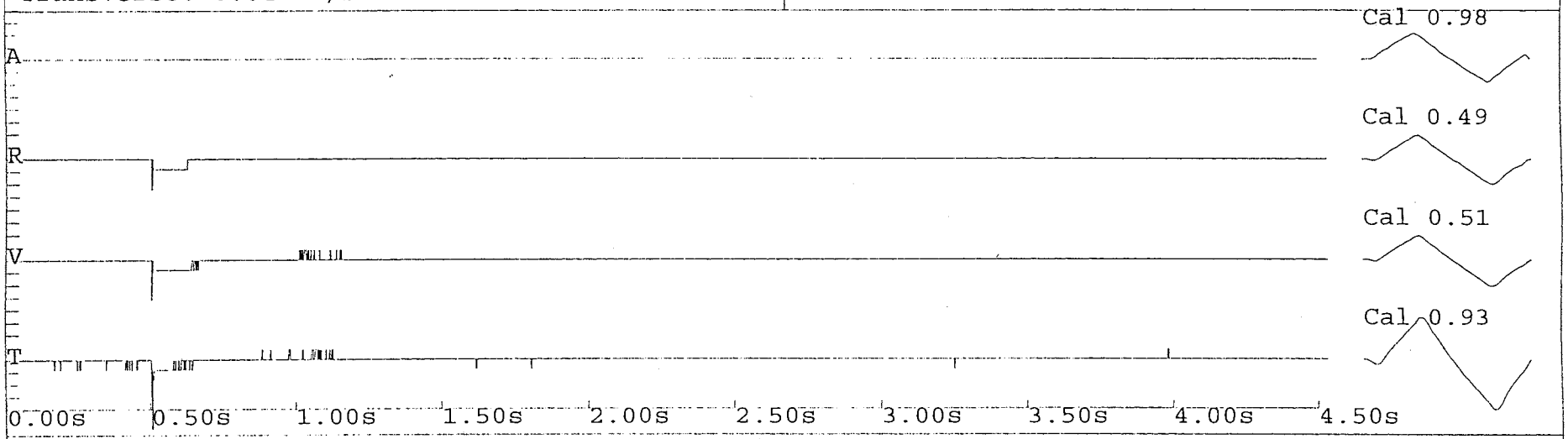
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 045 Date: 6/20/95 Time: 16:26
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

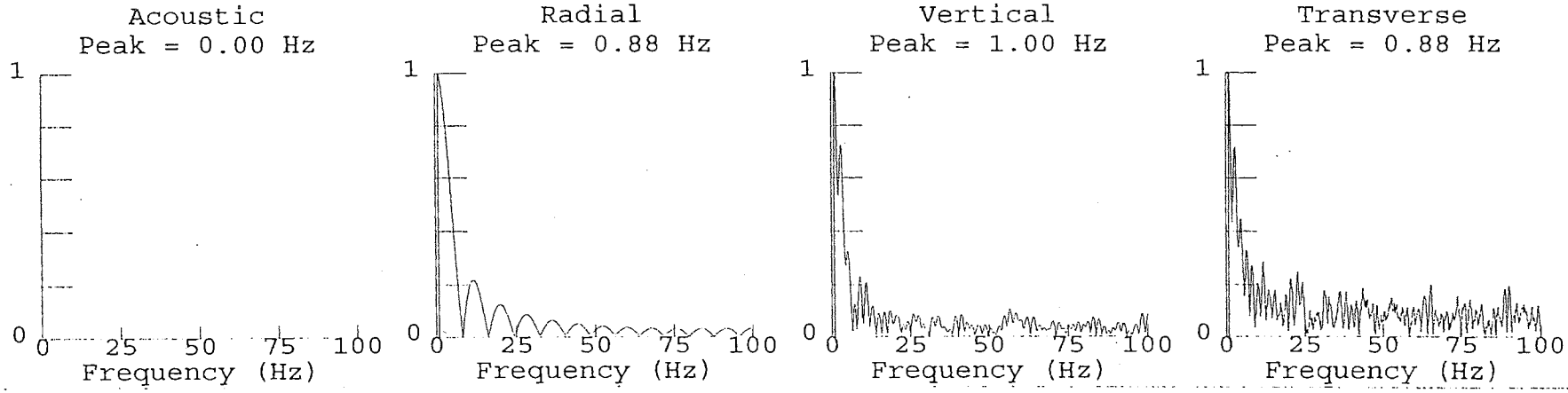
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

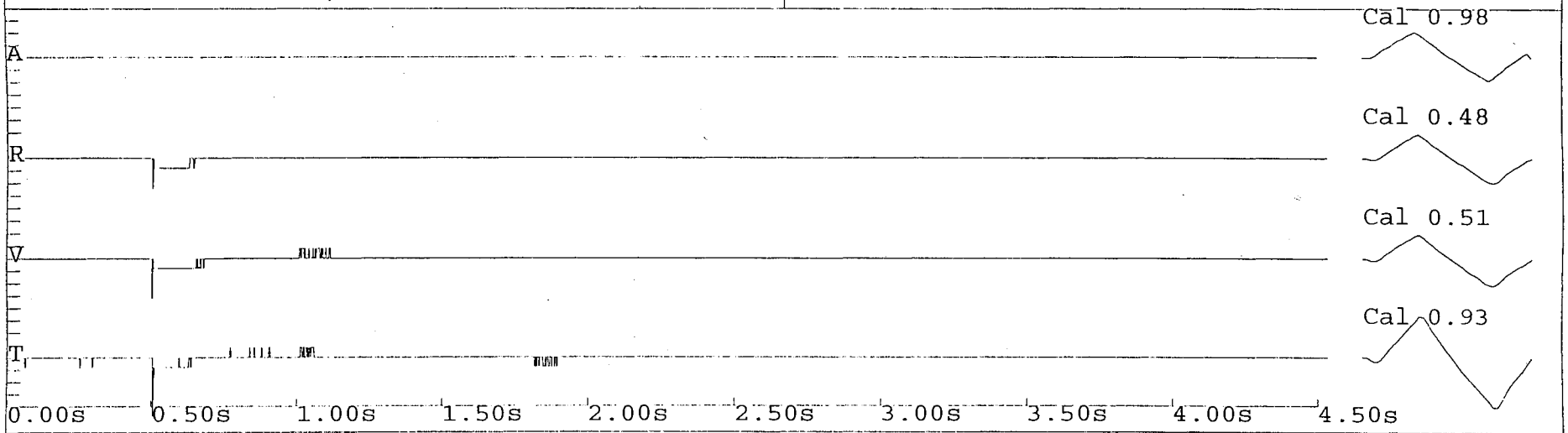


Fourier Analysis (Amplitude Spectrum)

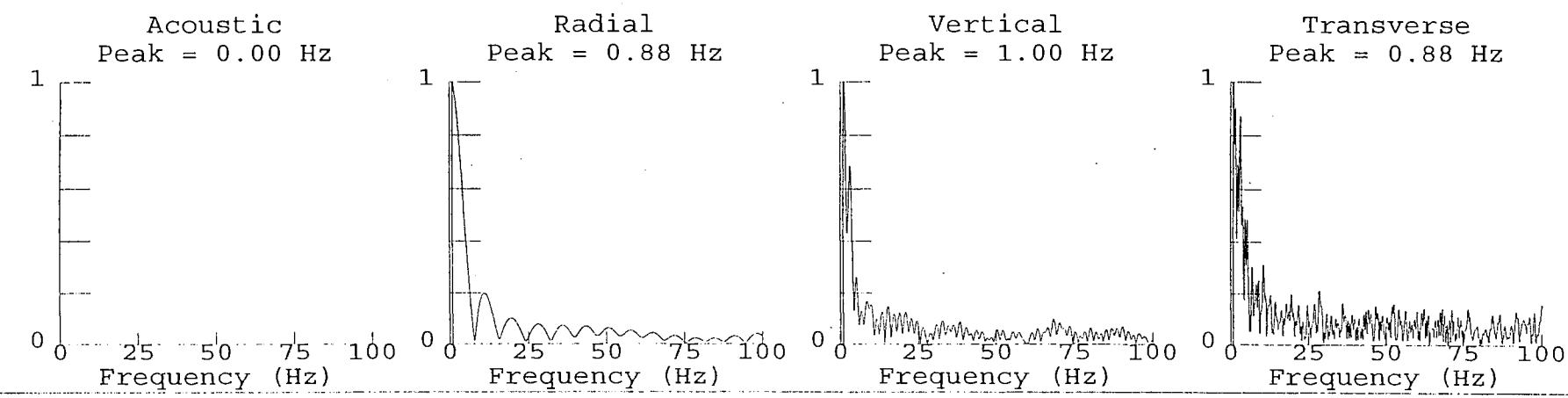


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 046 Date: 6/20/95 Time: 16:28
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

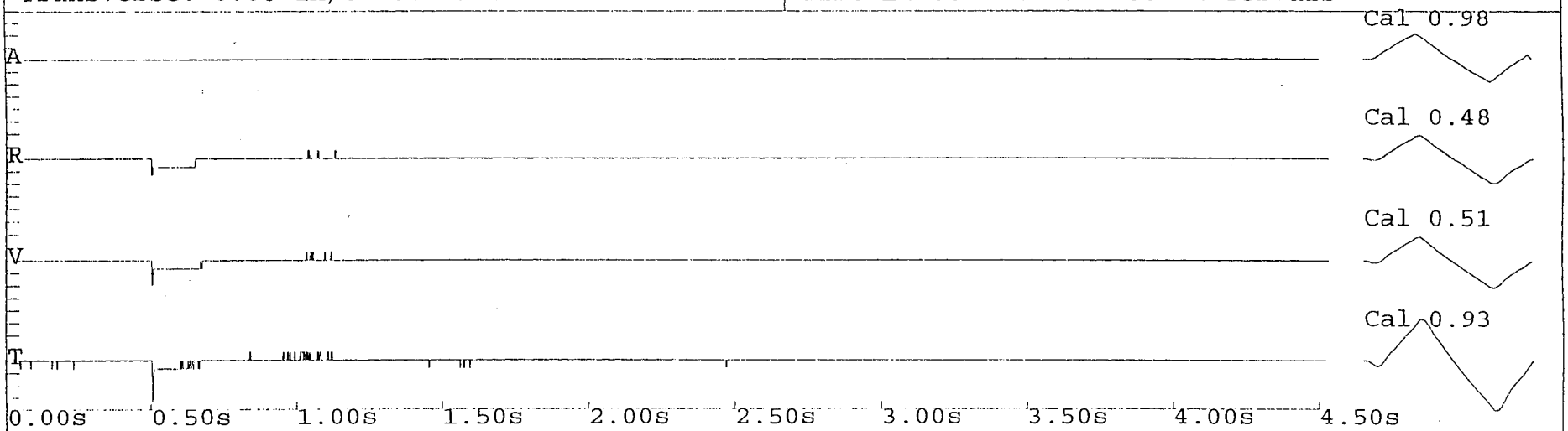


Fourier Analysis (Amplitude Spectrum)

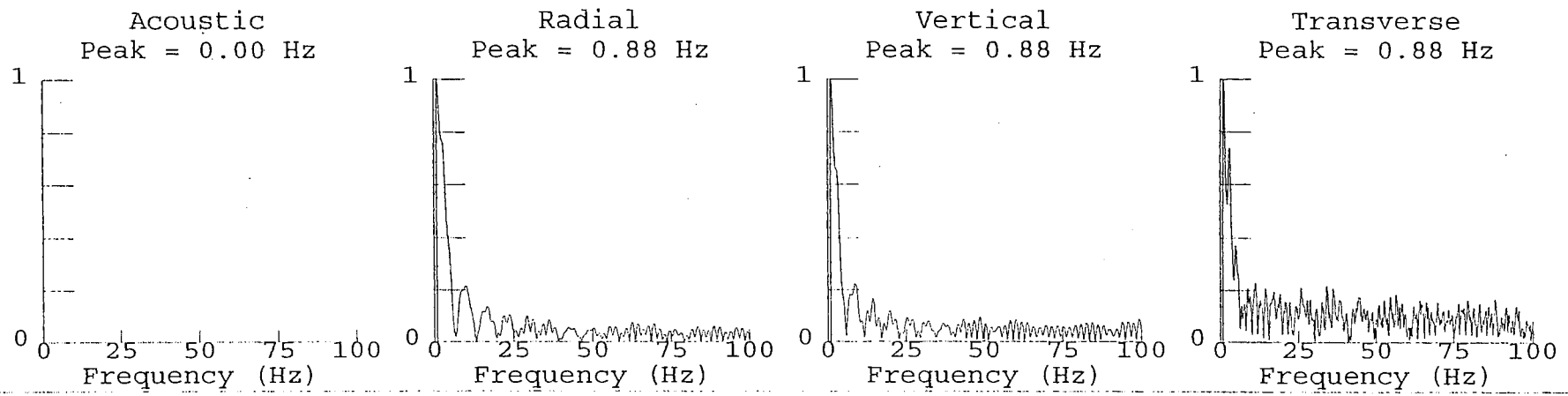


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 047 Date: 6/20/95 Time: 16:30
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 2.9 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 5.2 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



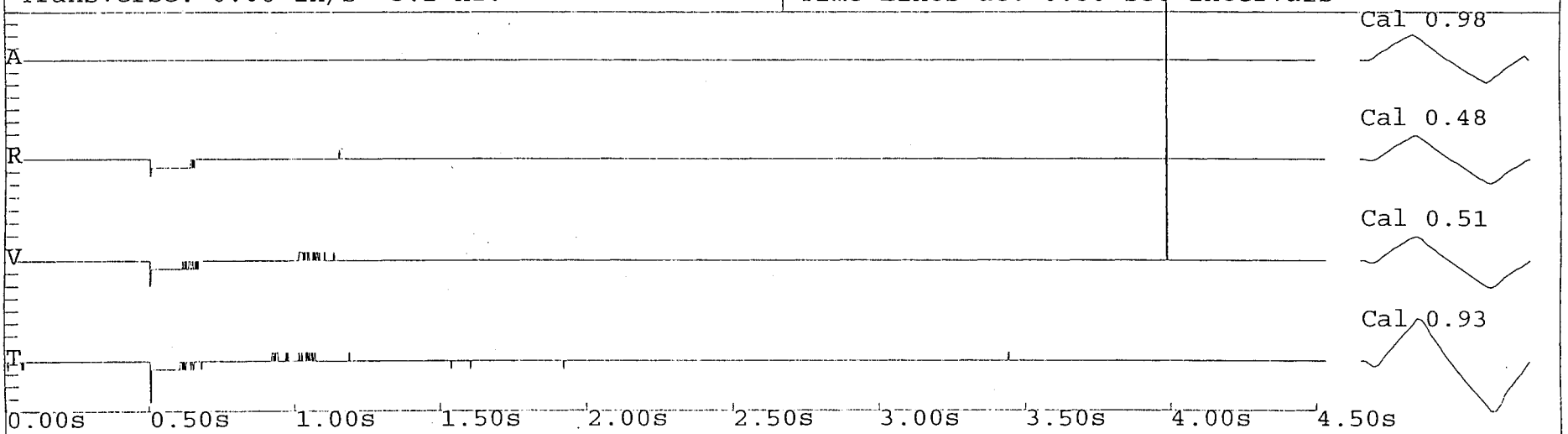
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 048 Date: 6/20/95 Time: 16:32
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

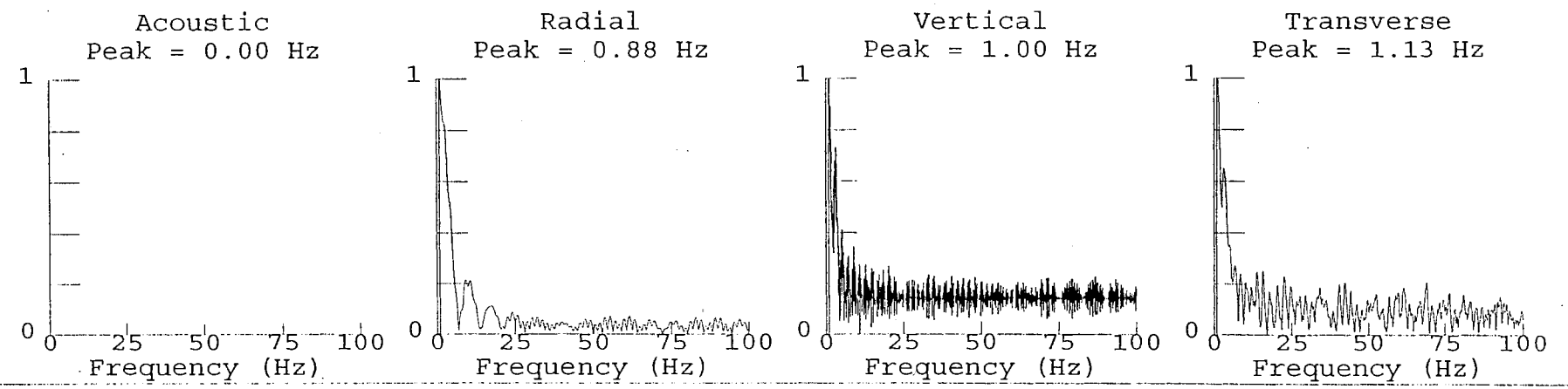
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 4.4 Hz.
Transverse: 0.06 in/s 5.2 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals

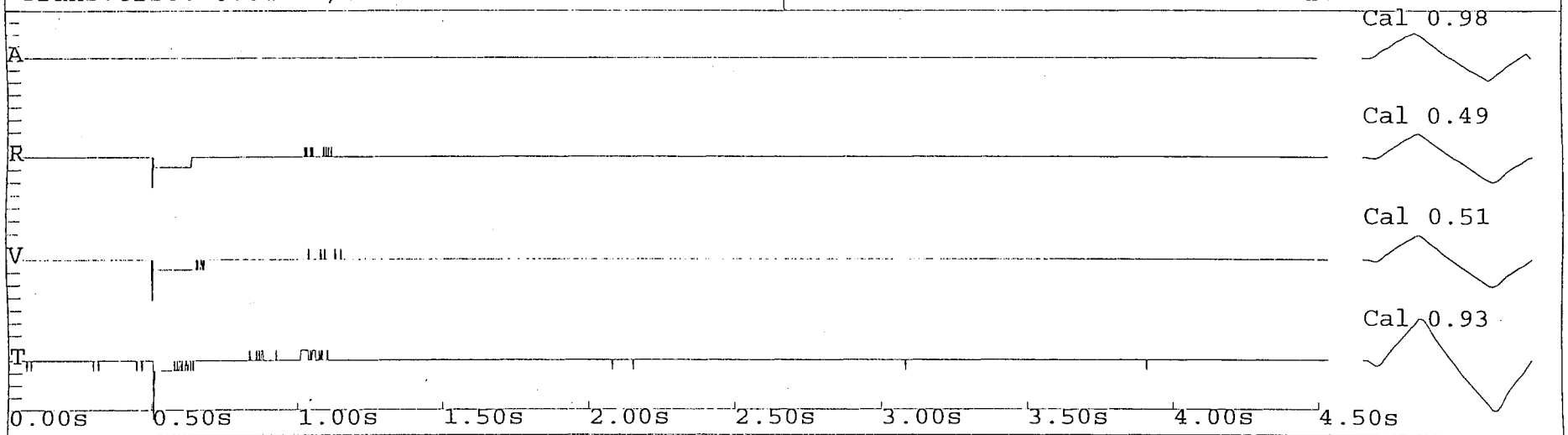


Fourier Analysis (Amplitude Spectrum)

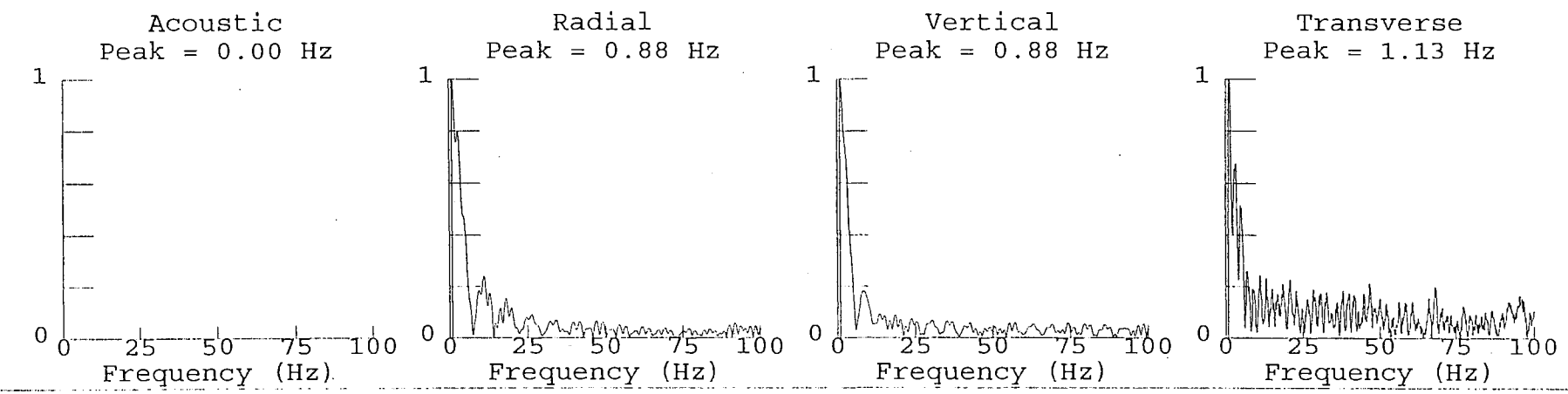


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 049 Date: 6/20/95 Time: 16:34
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

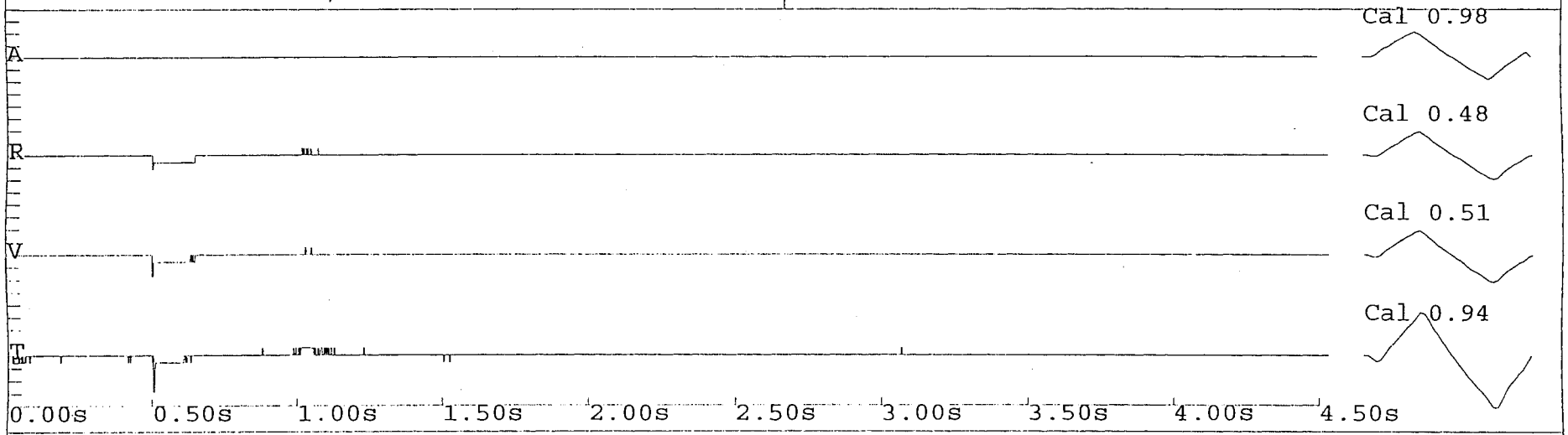


Fourier Analysis (Amplitude Spectrum)

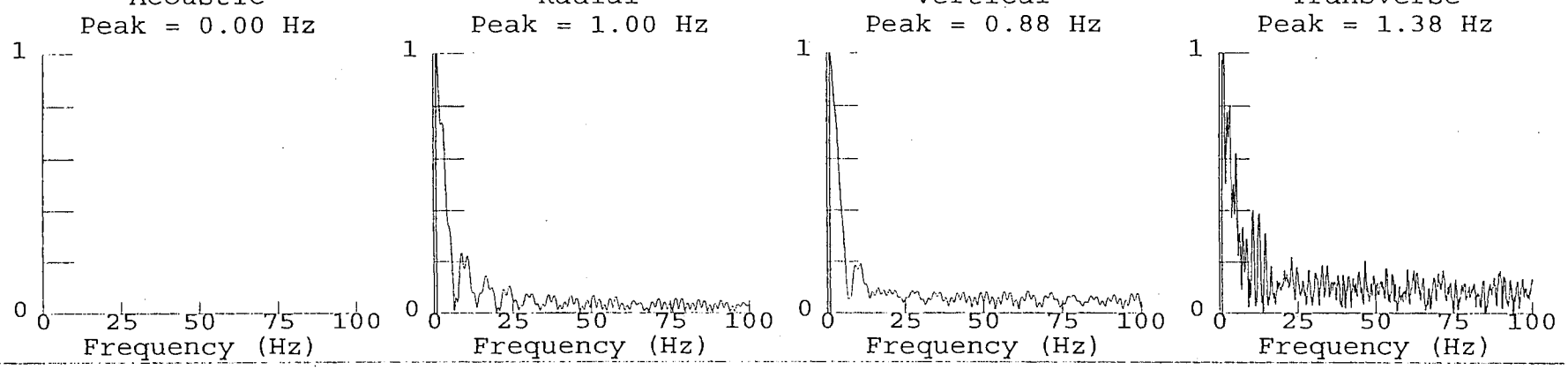


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 050 Date: 6/20/95 Time: 16:36
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 4.0 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.07 in/s 9.3 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



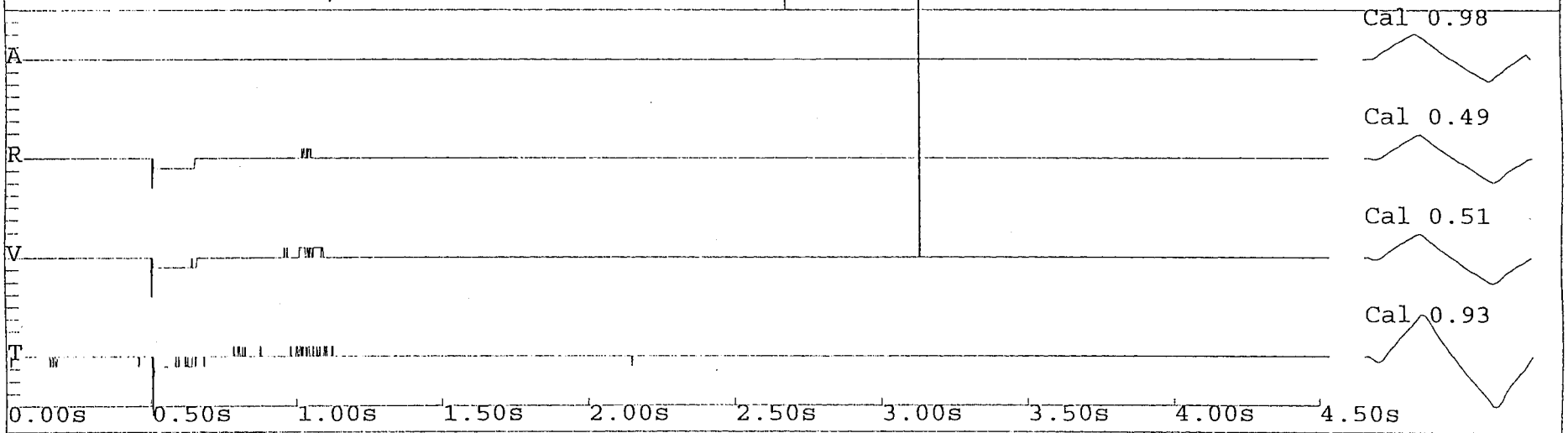
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 051 Date: 6/20/95 Time: 16:38
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

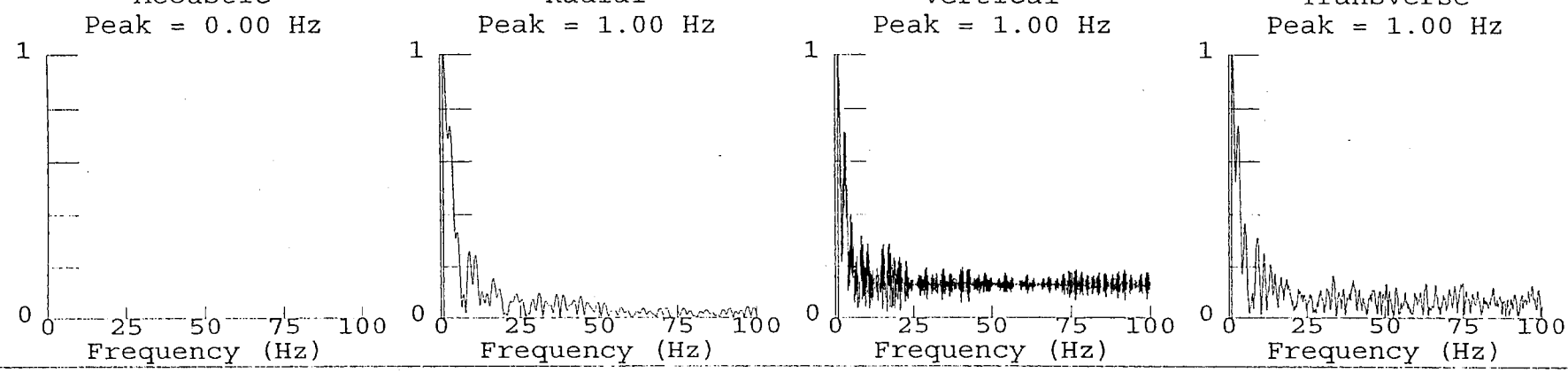
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

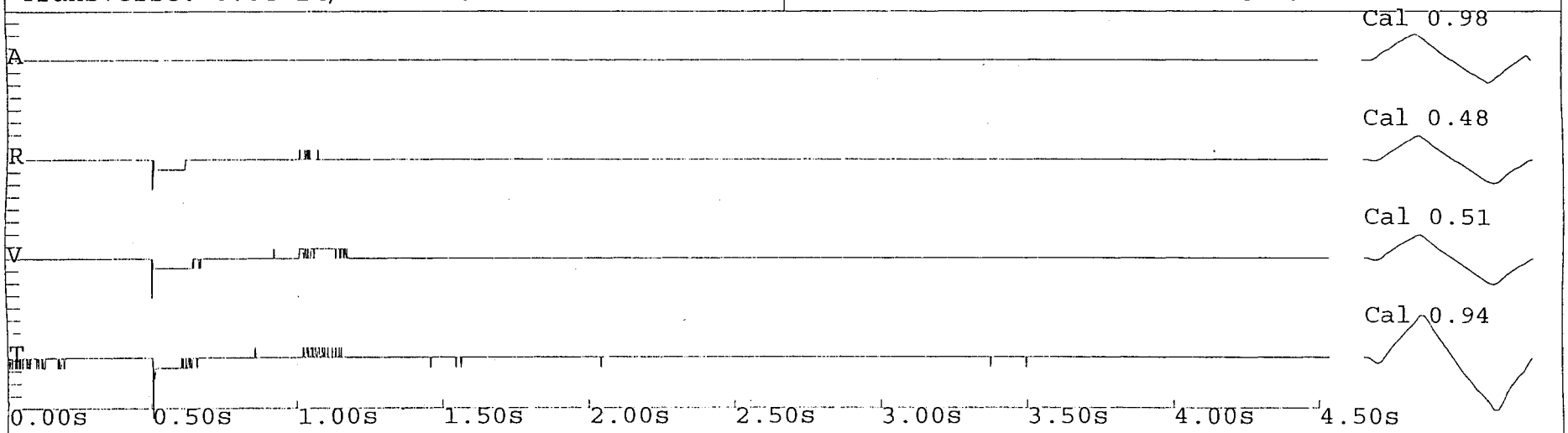


Fourier Analysis (Amplitude Spectrum)

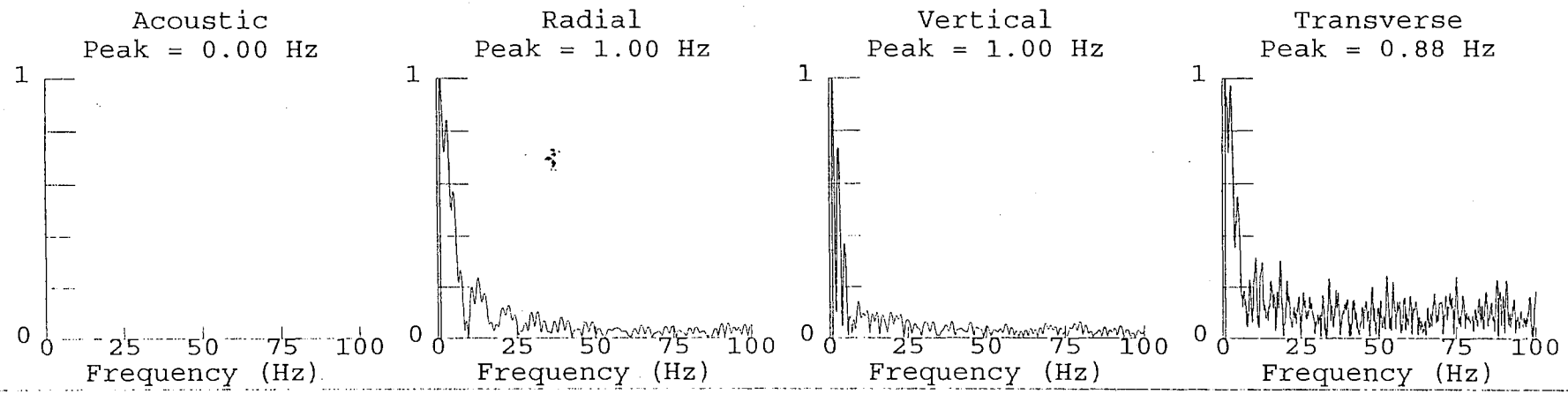


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 052 Date: 6/20/95 Time: 16:40
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

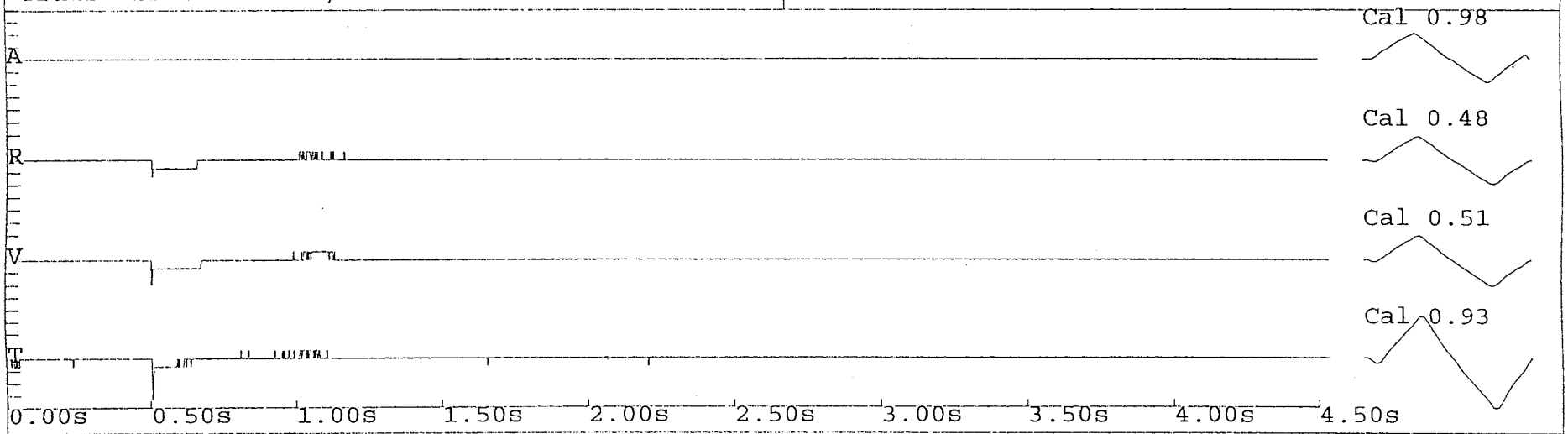


Fourier Analysis (Amplitude Spectrum)

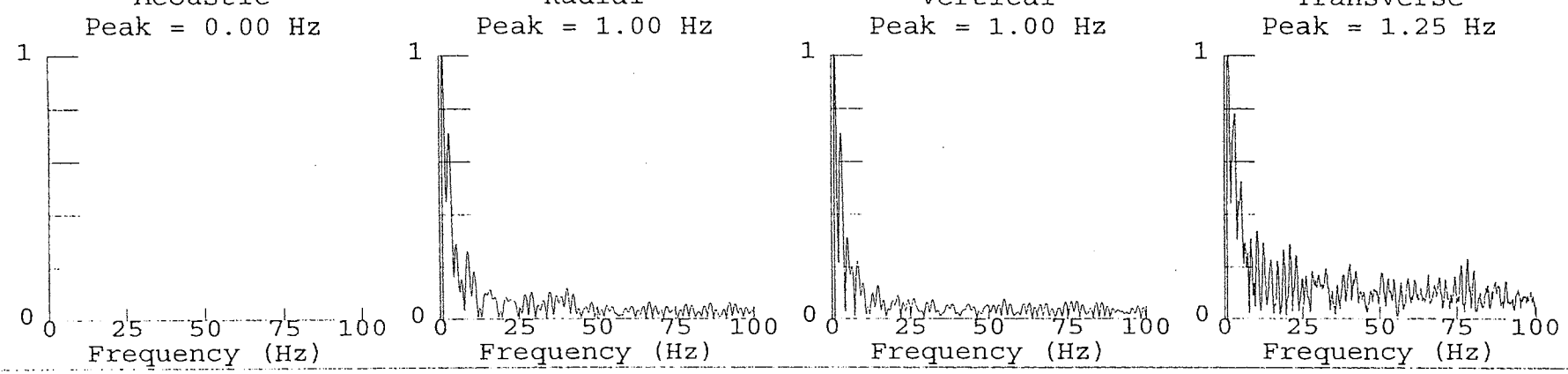


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 053 Date: 6/20/95 Time: 16:42
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 3.2 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 5.8 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



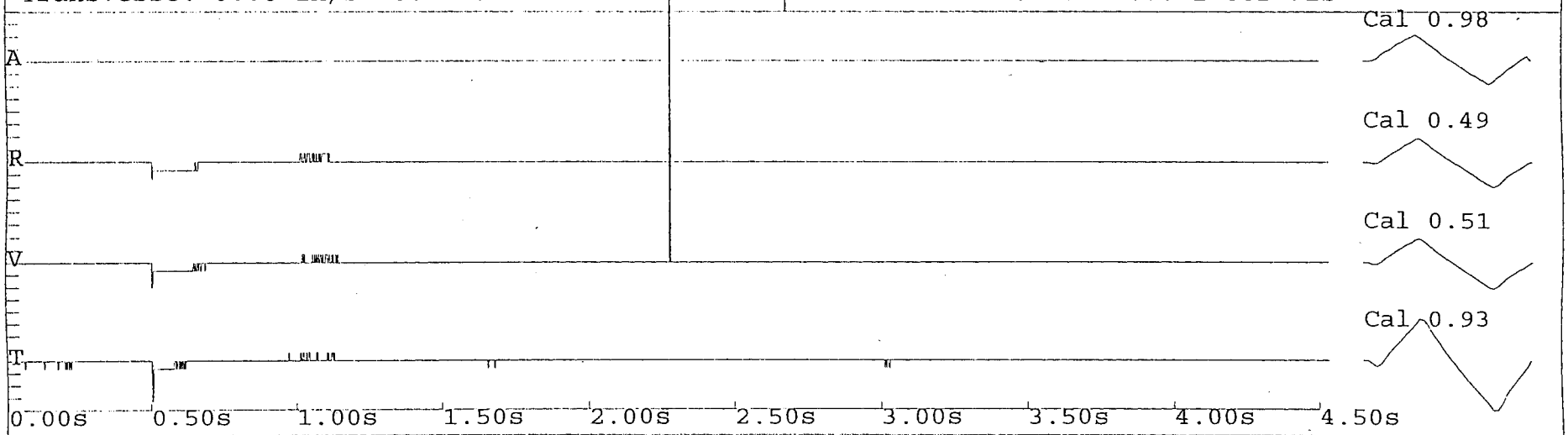
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 054 Date: 6/20/95 Time: 16:44
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

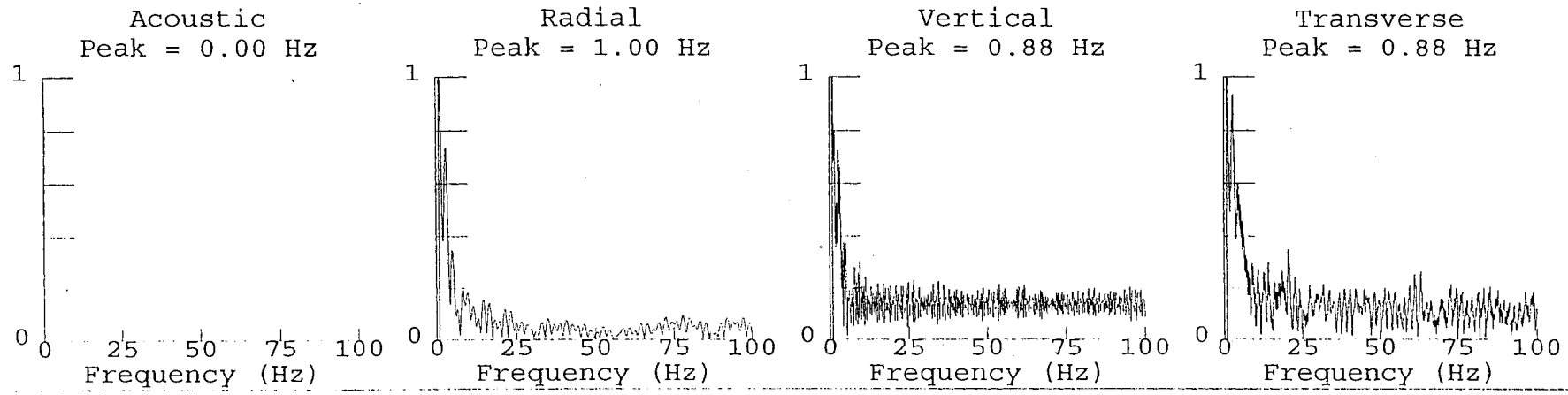
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 170.6 Hz.
Transverse: 0.06 in/s 6.7 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals

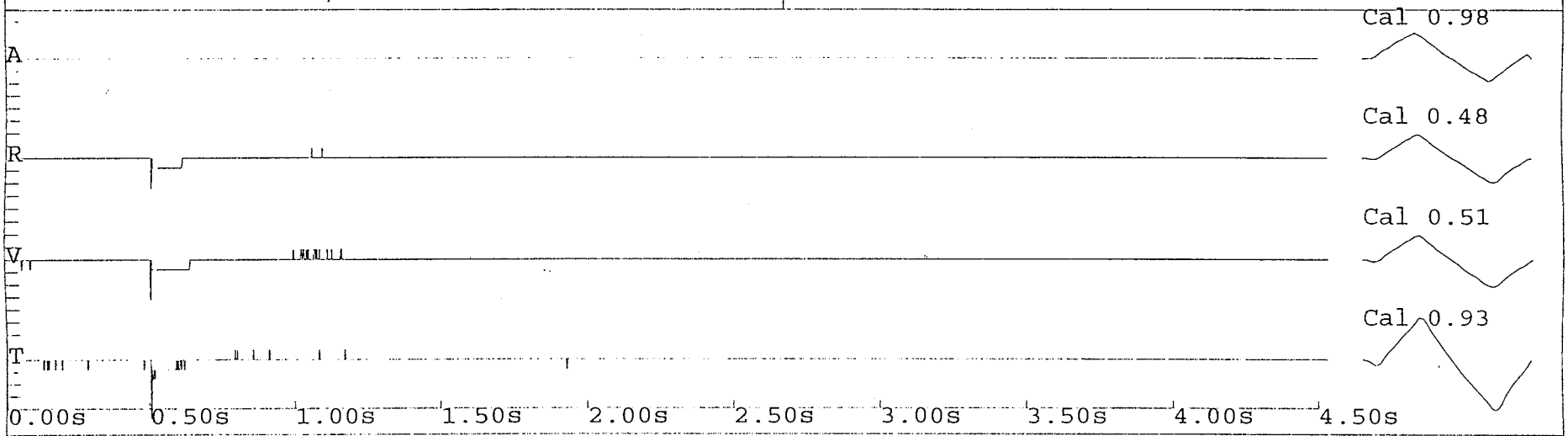


Fourier Analysis (Amplitude Spectrum)

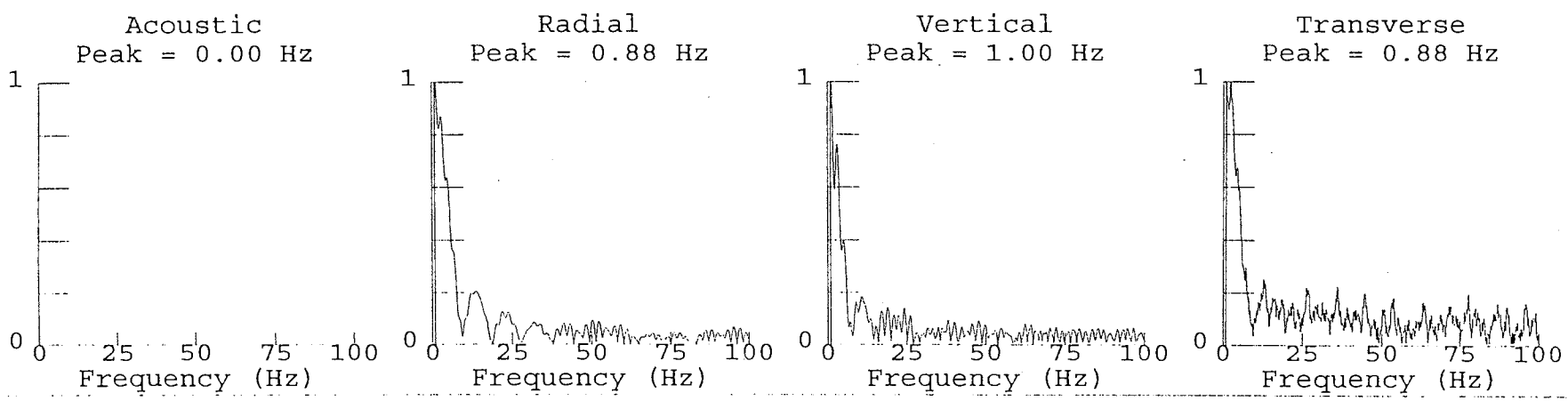


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 055 Date: 6/20/95 Time: 16:46
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



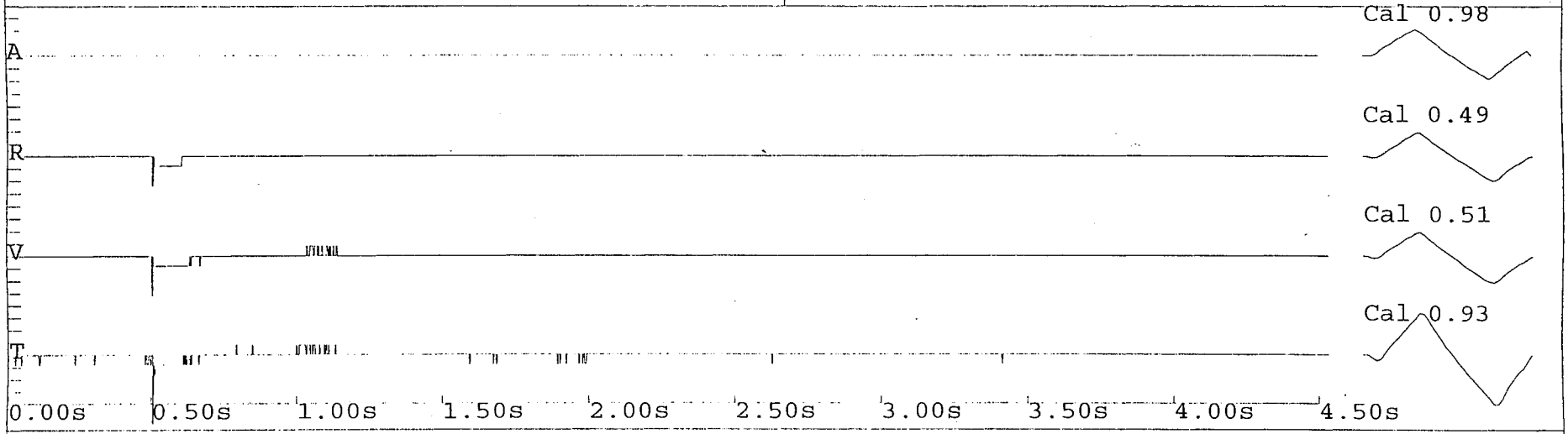
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 056 Date: 6/20/95 Time: 16:48
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

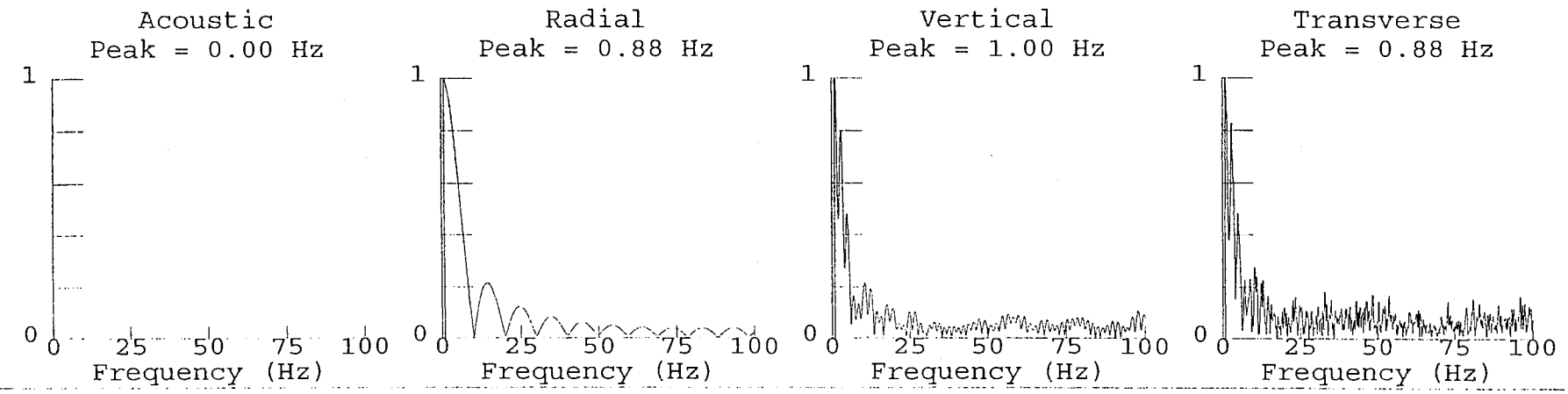
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



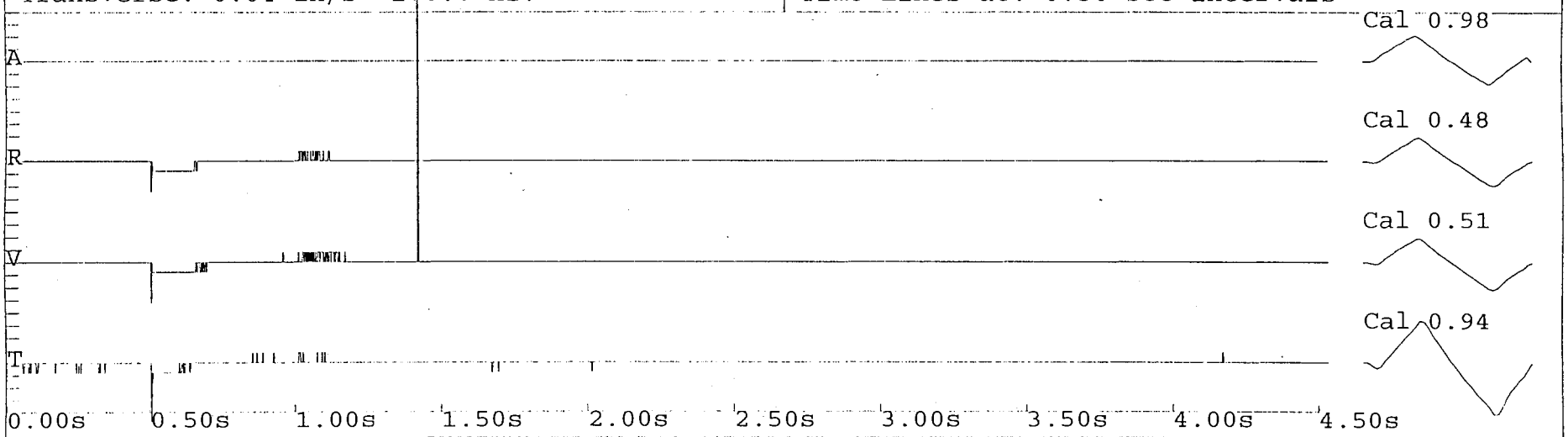
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 057 Date: 6/20/95 Time: 16:50
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

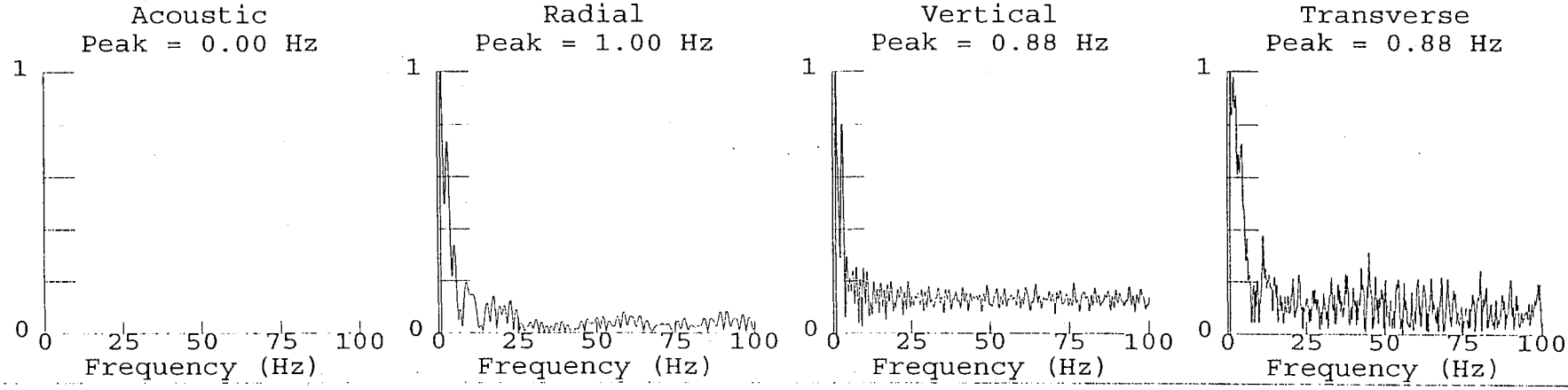
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

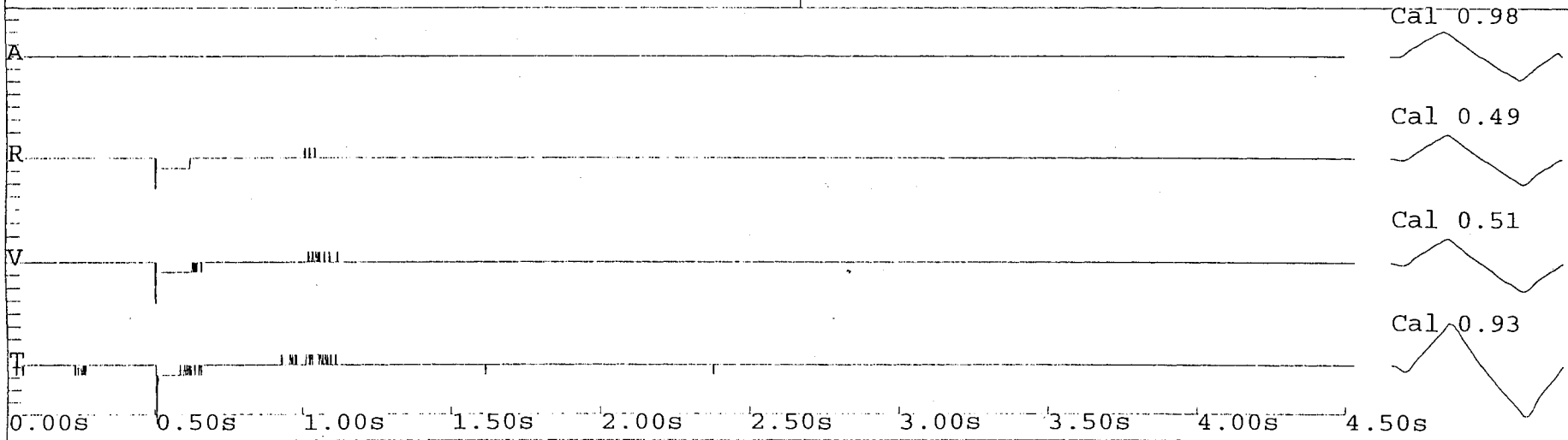


Fourier Analysis (Amplitude Spectrum)

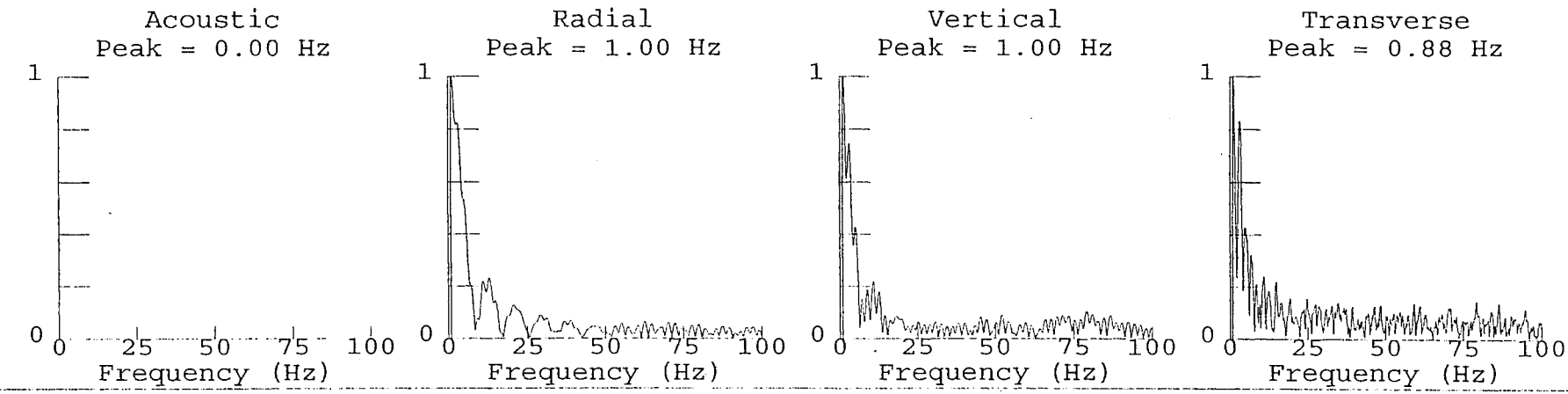


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 058 Date: 6/20/95 Time: 16:52
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

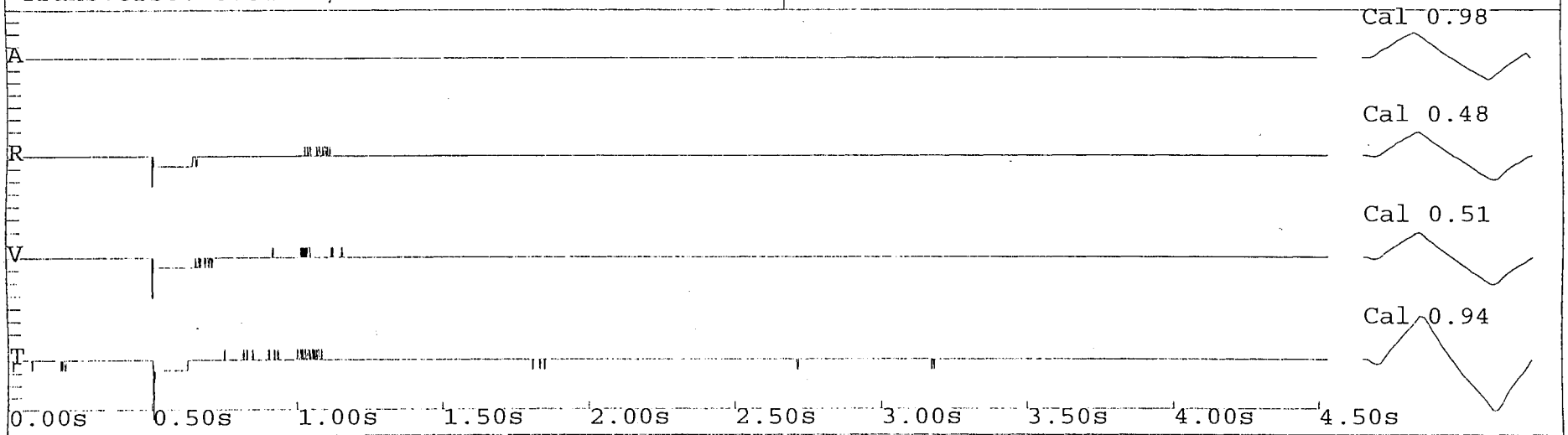


Fourier Analysis (Amplitude Spectrum)

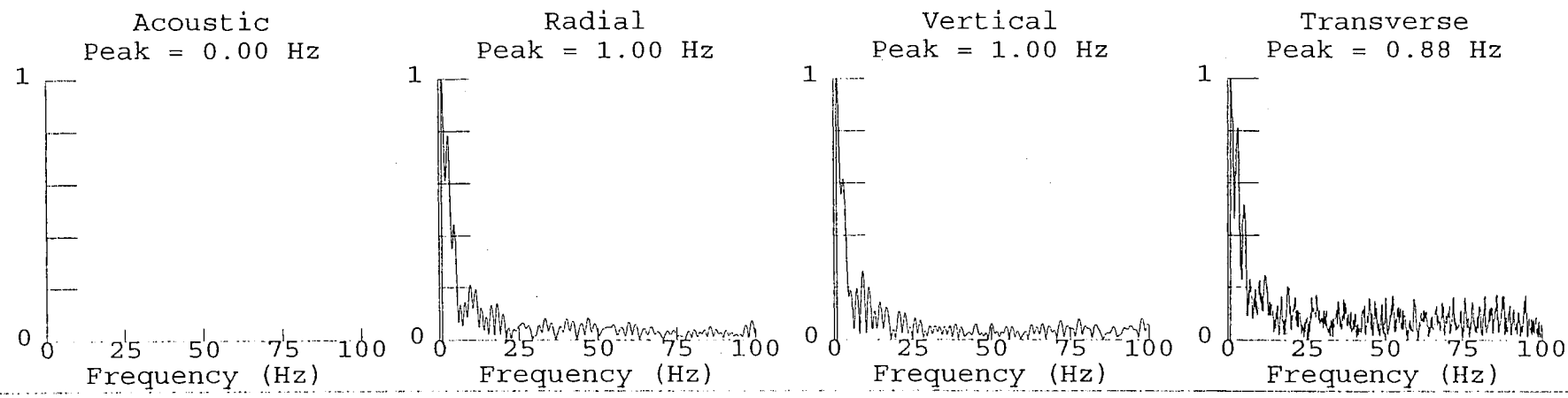


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 059 Date: 6/20/95 Time: 16:54
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

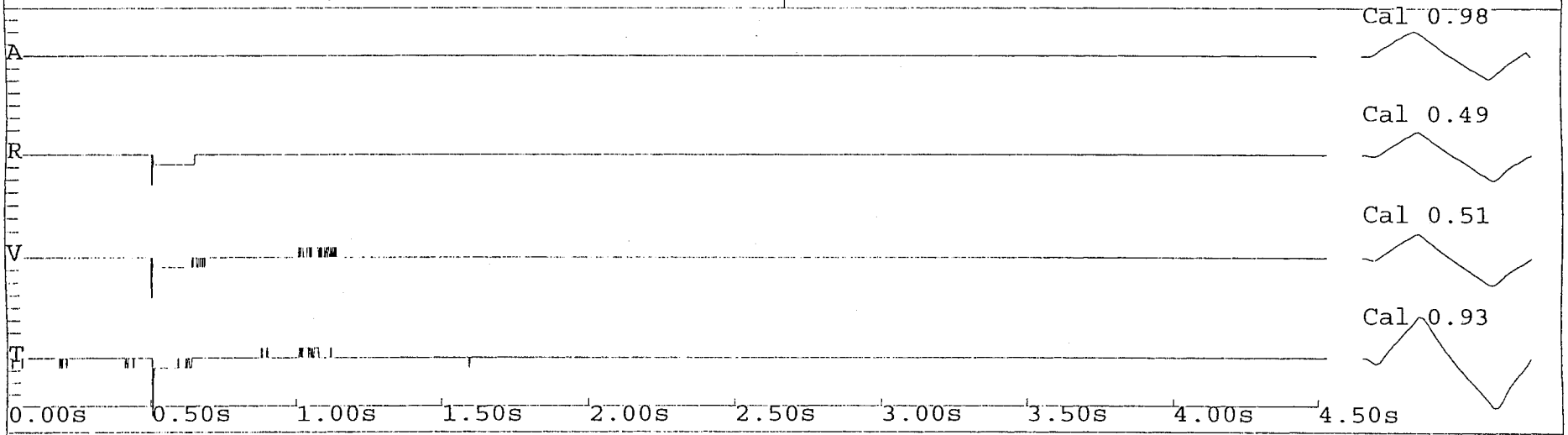


Fourier Analysis (Amplitude Spectrum)

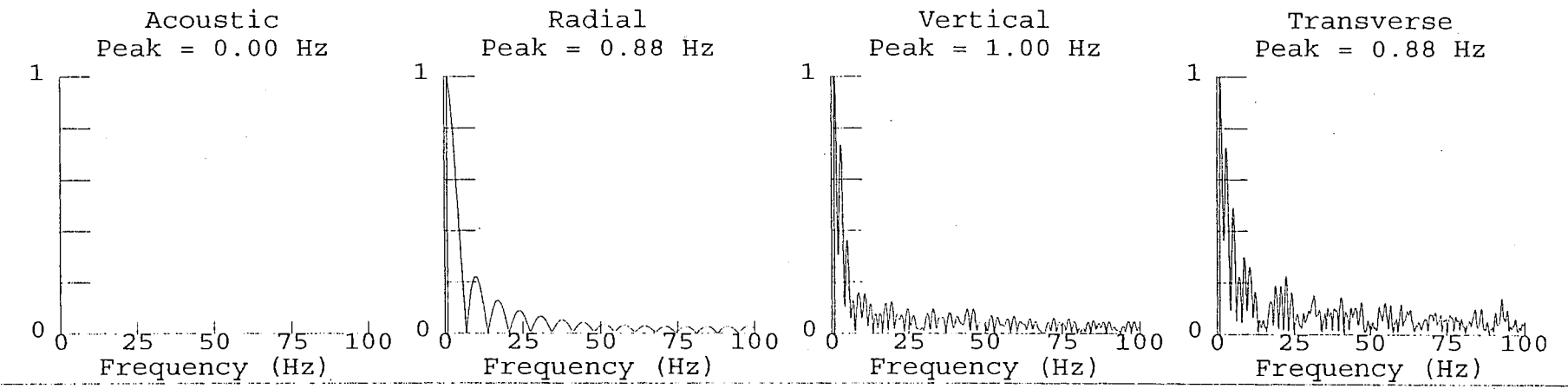


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 060 Date: 6/20/95 Time: 16:56
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

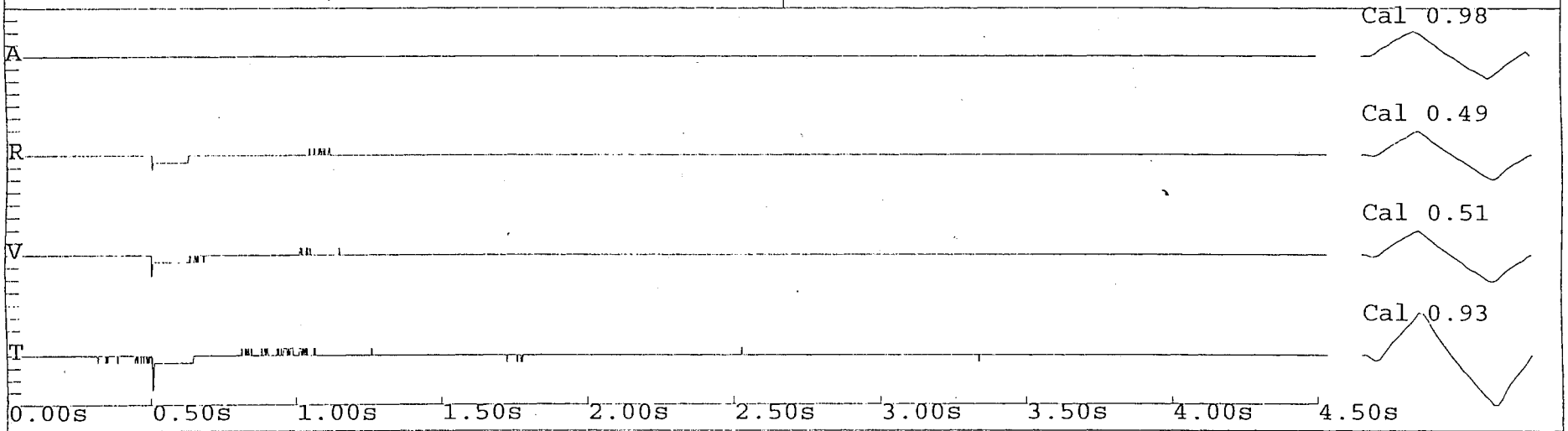


Fourier Analysis (Amplitude Spectrum)

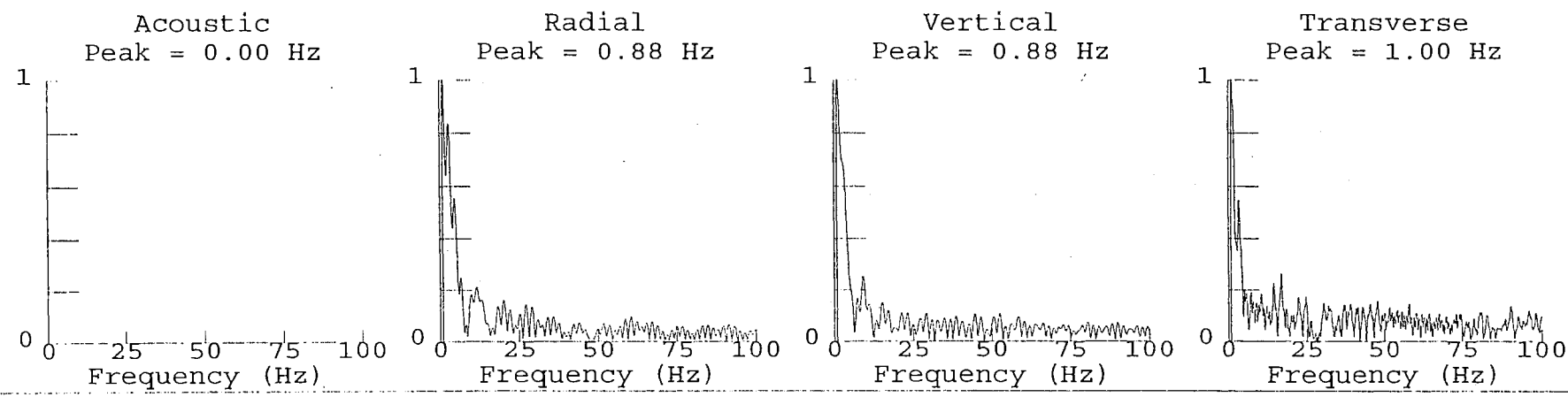


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 061 Date: 6/20/95 Time: 16:58
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 3.8 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.07 in/s 4.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



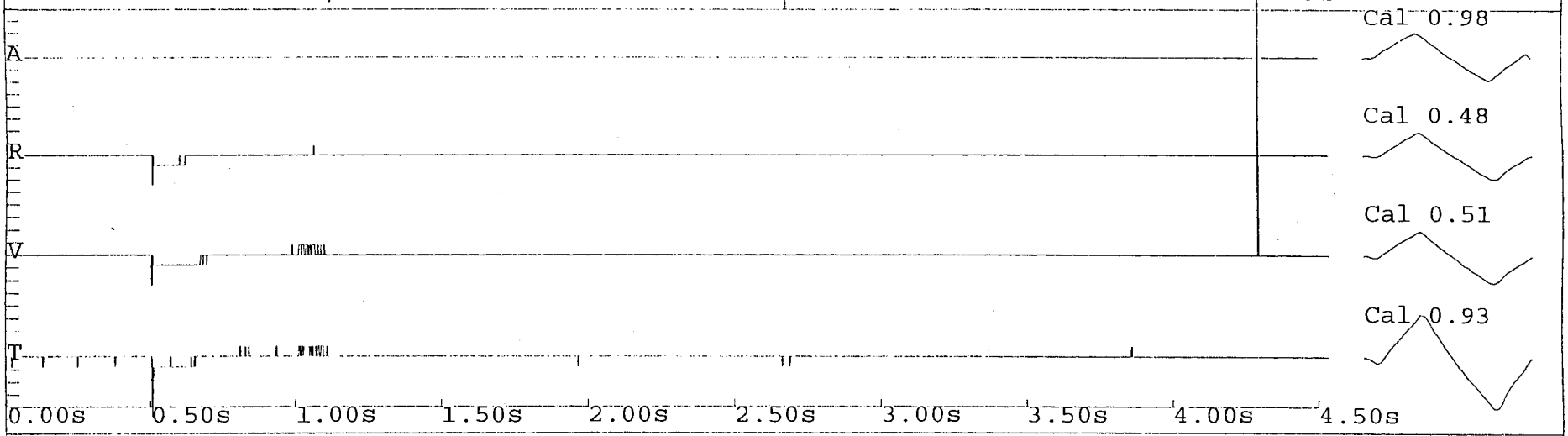
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 062 Date: 6/20/95 Time: 17:00
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

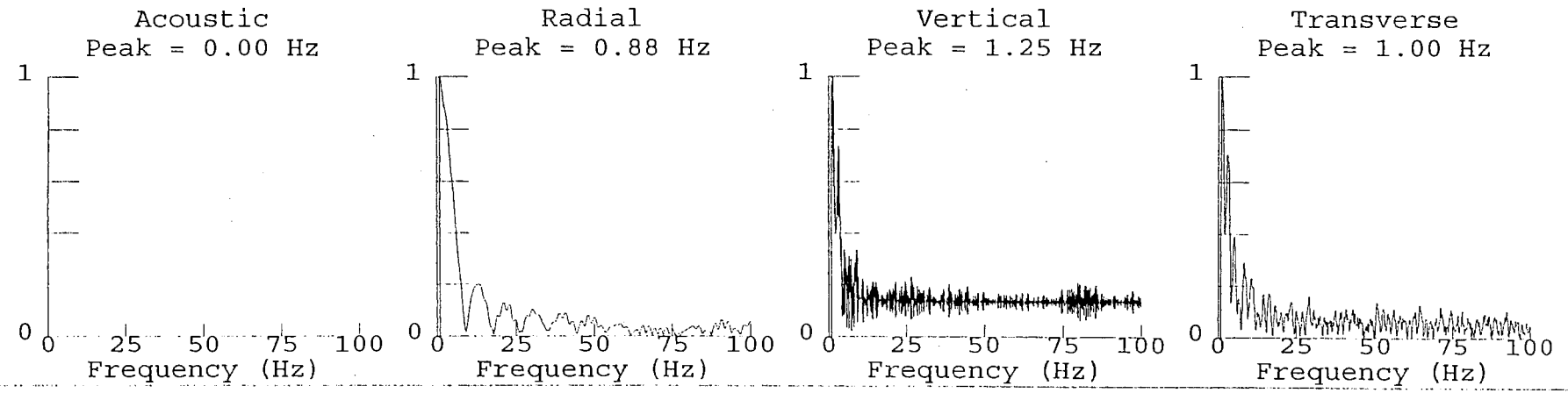
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

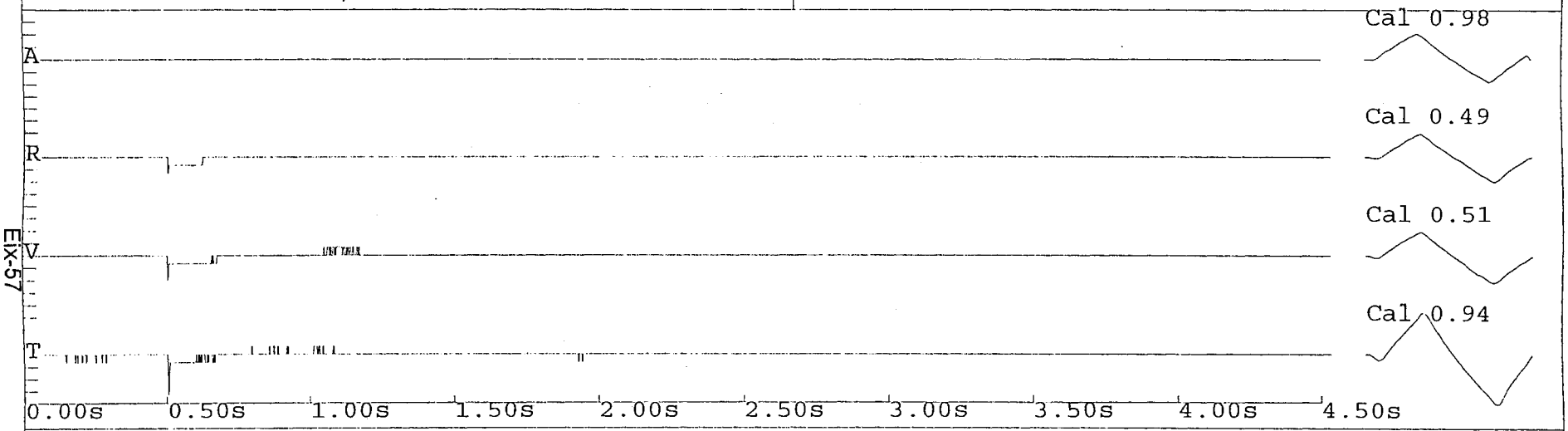


Fourier Analysis (Amplitude Spectrum)

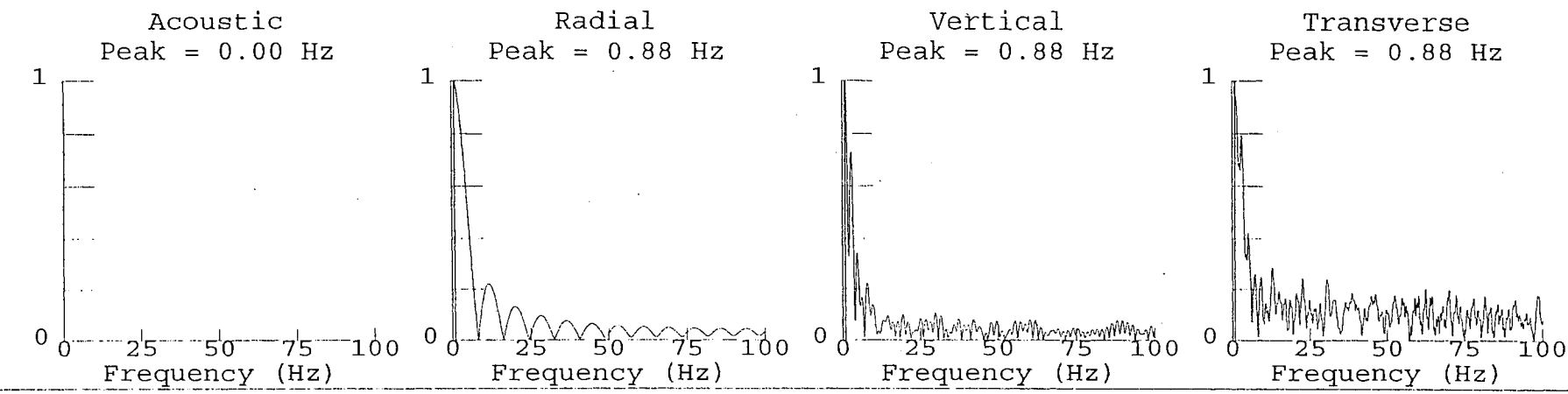


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 063 Date: 6/20/95 Time: 17:02
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 170.6 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 5.1 Hz.	Time Lines at: 0.50 sec intervals

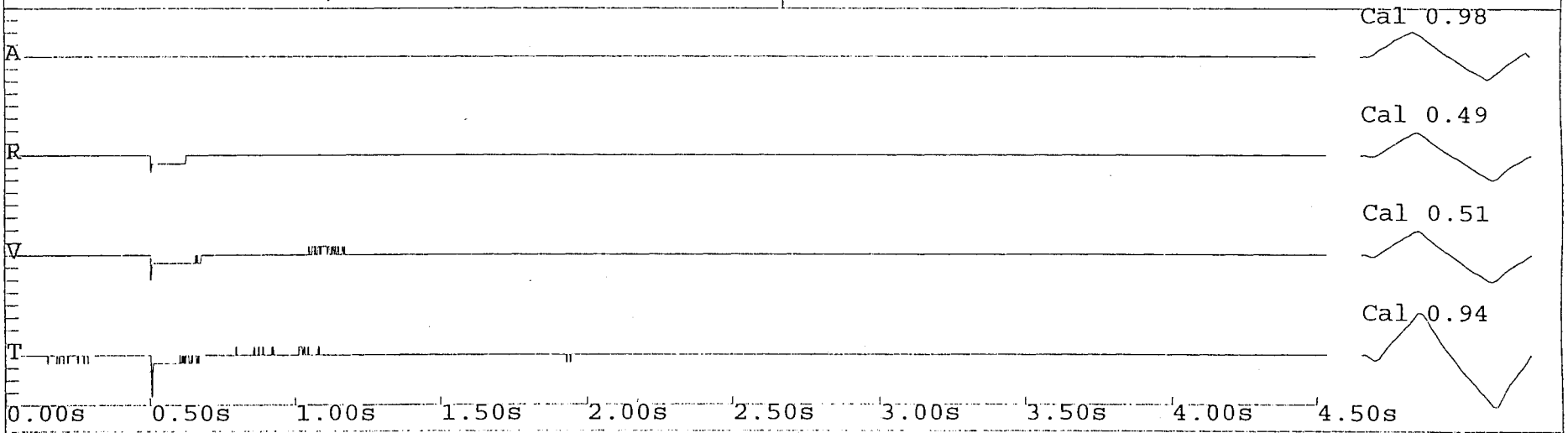


Fourier Analysis (Amplitude Spectrum)

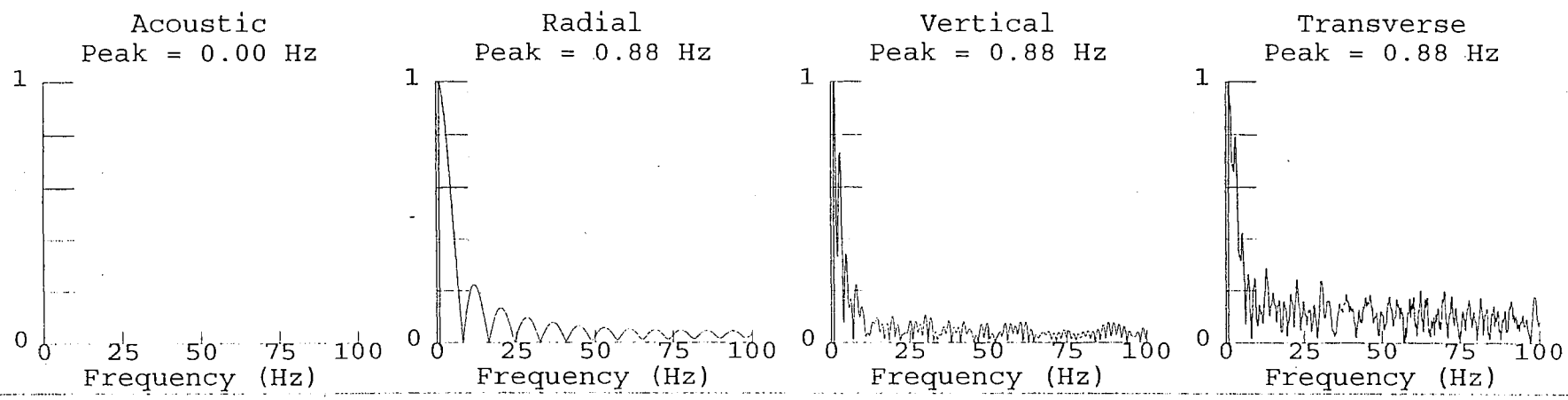


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 063 Date: 6/20/95 Time: 17:02
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 170.6 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 5.1 Hz.	Time Lines at: 0.50 sec intervals

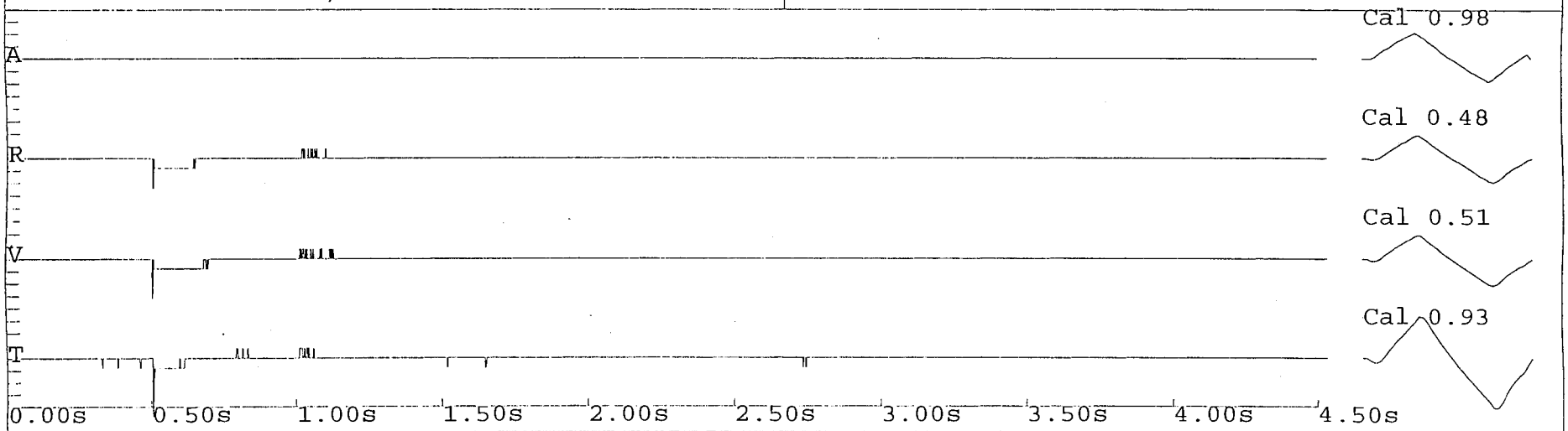


Fourier Analysis (Amplitude Spectrum)

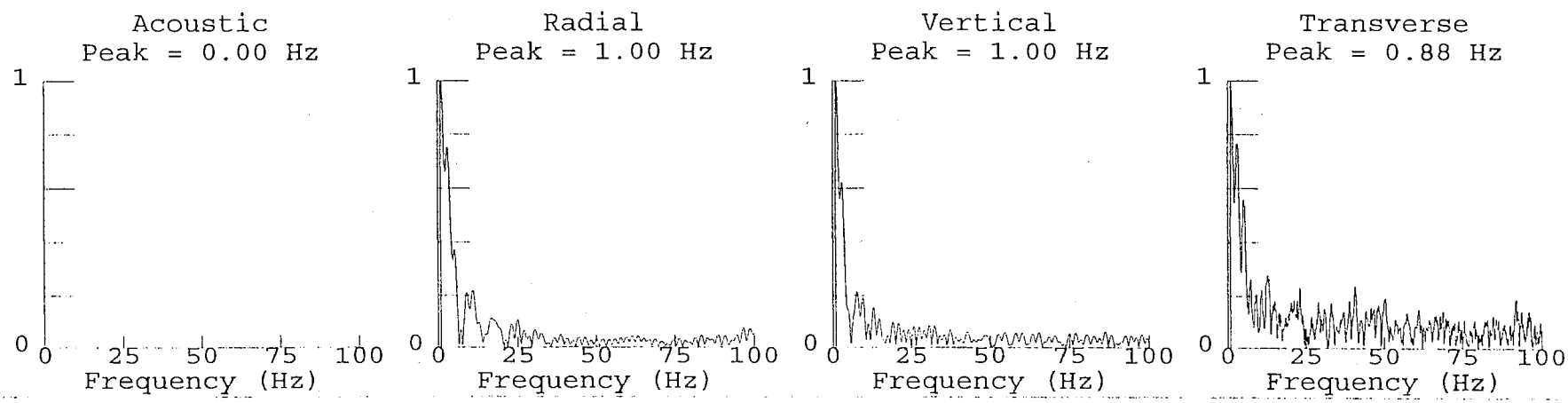


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 064 Date: 6/20/95 Time: 17:04
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

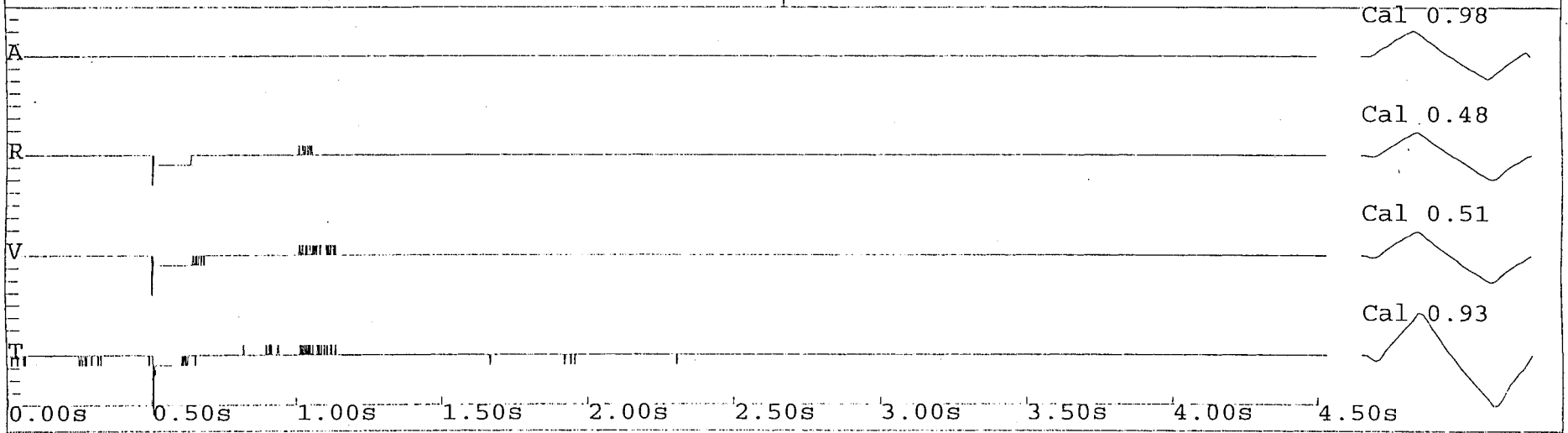


Fourier Analysis (Amplitude Spectrum)

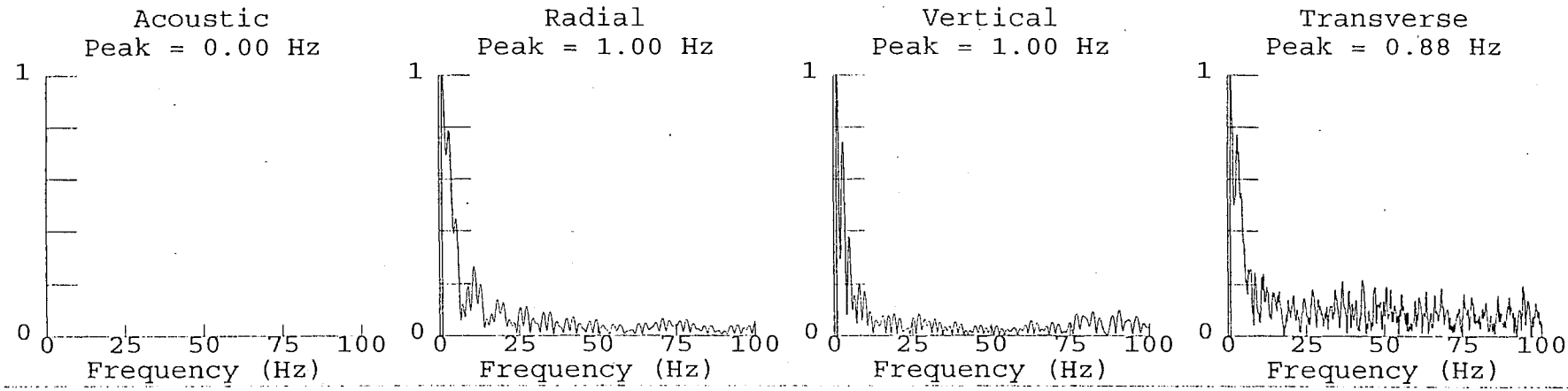


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 065 Date: 6/20/95 Time: 17:06
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

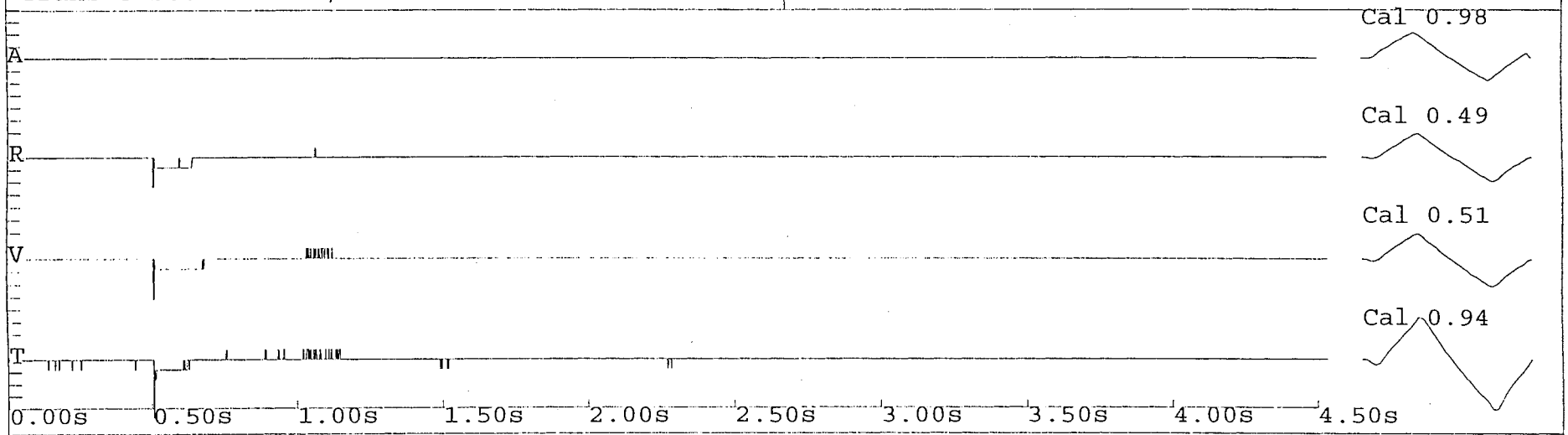


Fourier Analysis (Amplitude Spectrum)

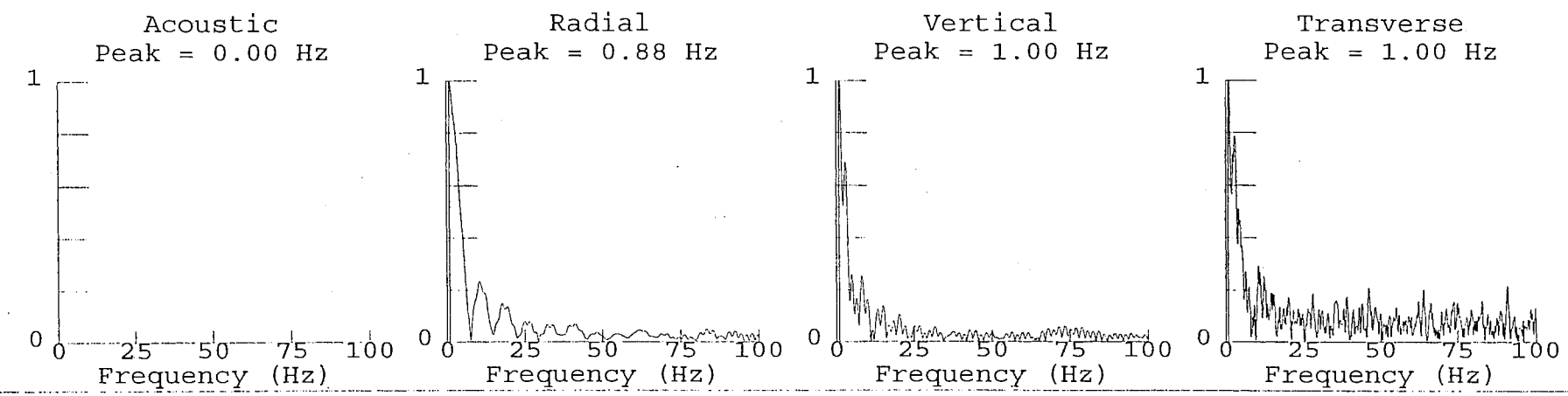


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 066 Date: 6/20/95 Time: 17:08
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

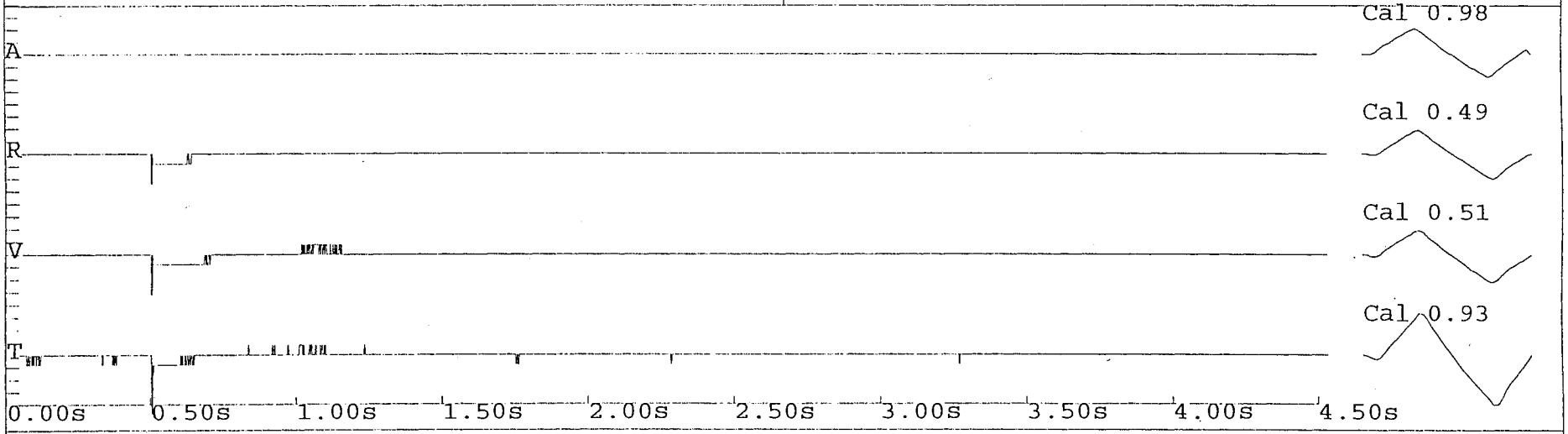


Fourier Analysis (Amplitude Spectrum)

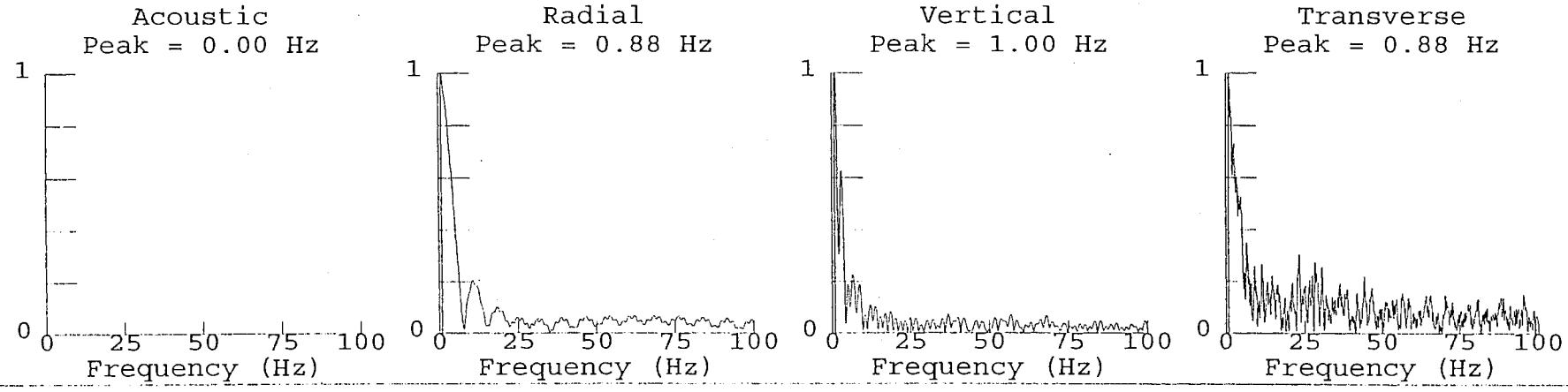


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 067 Date: 6/20/95 Time: 17:10
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



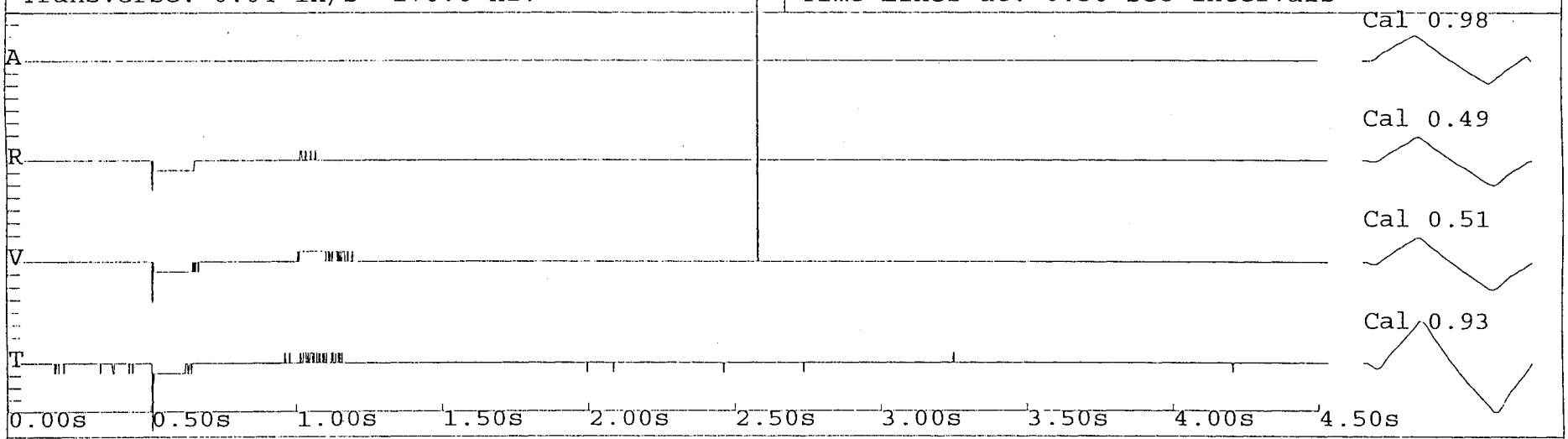
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 068 Date: 6/20/95 Time: 17:12
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

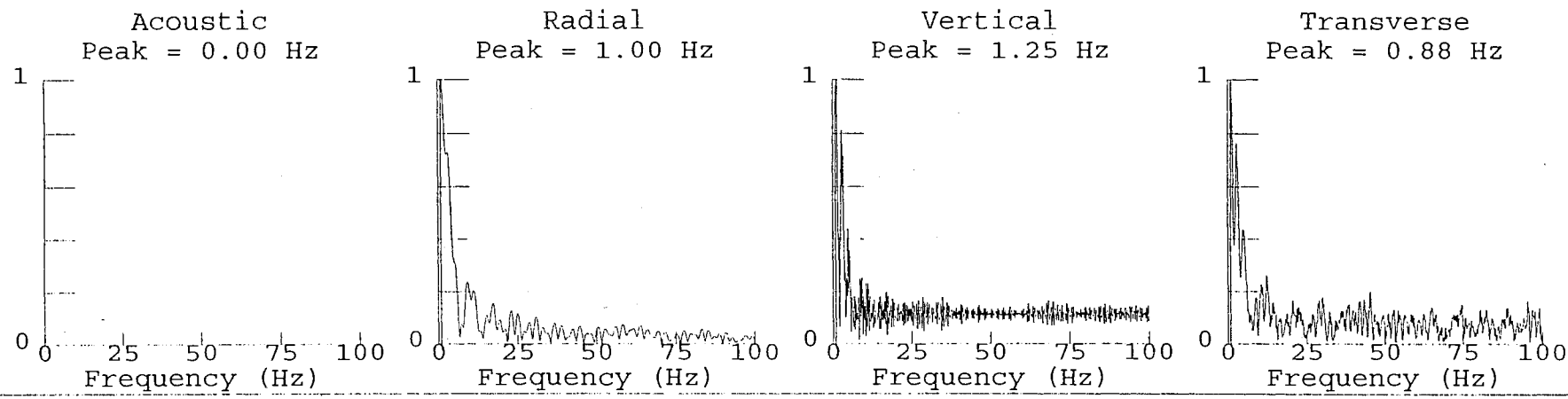
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



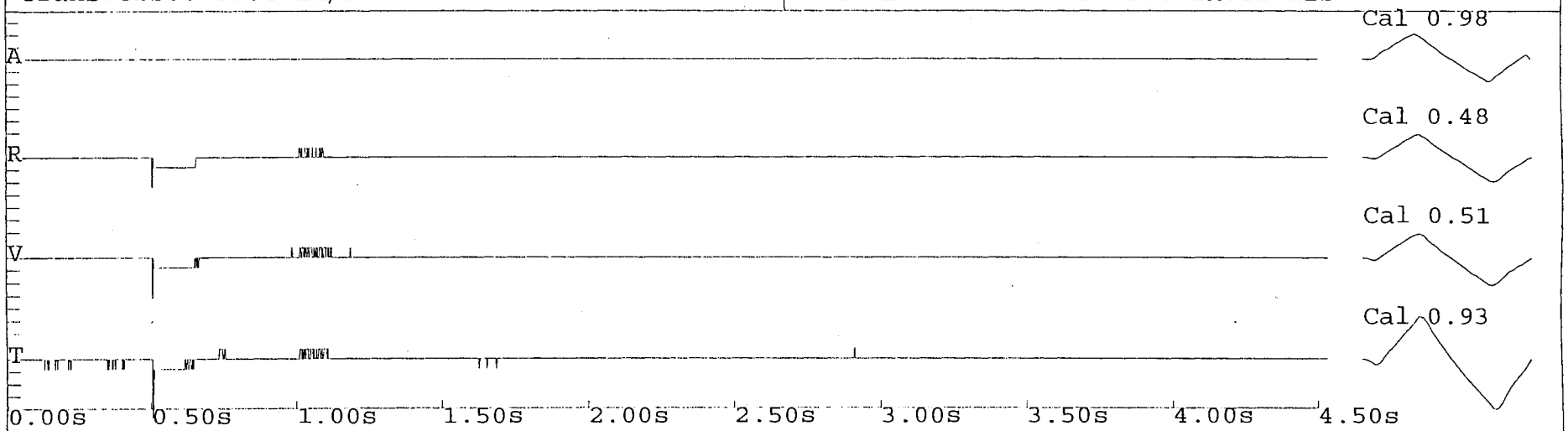
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 069 Date: 6/20/95 Time: 17:14
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

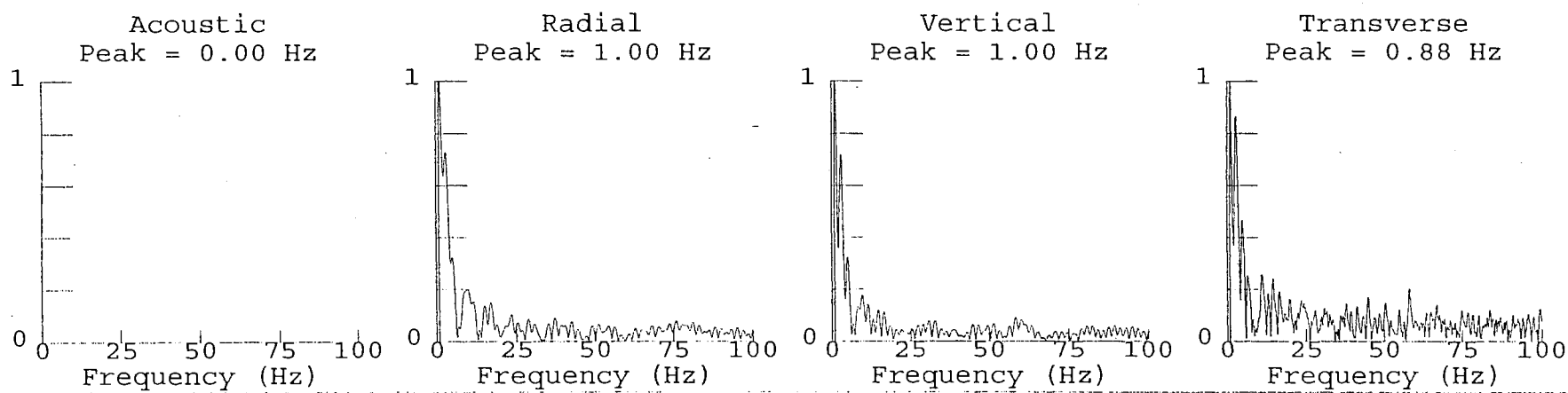
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

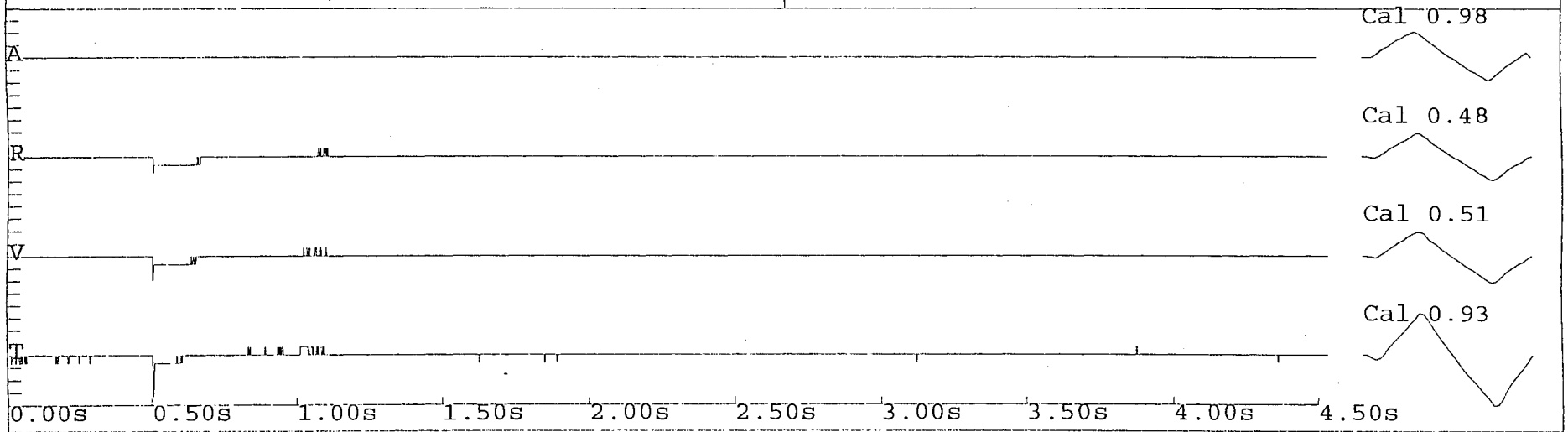


Fourier Analysis (Amplitude Spectrum)

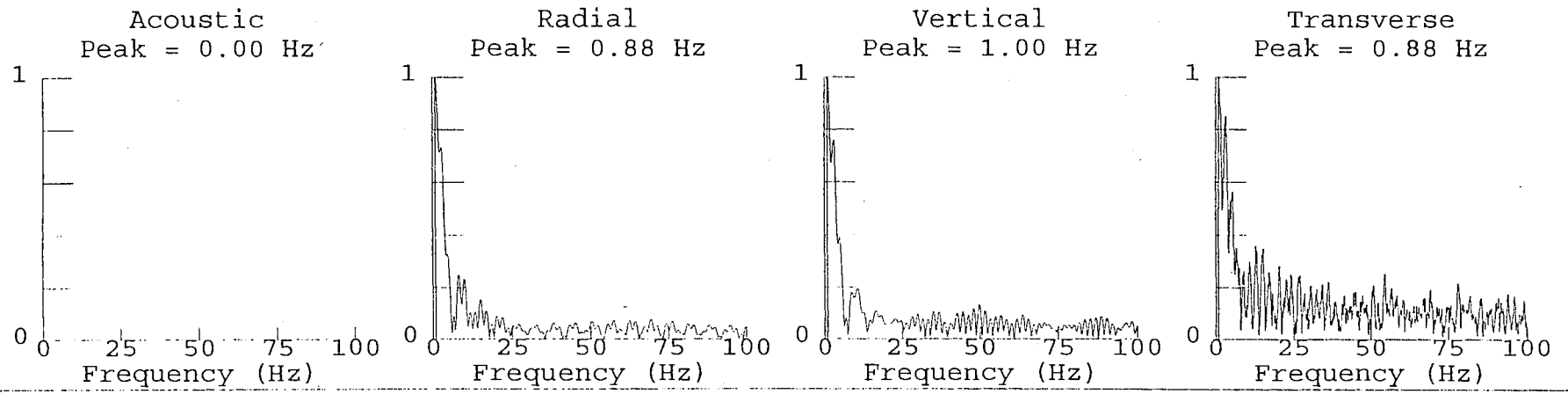


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 070 Date: 6/20/95 Time: 17:16
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 4.0 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 6.1 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



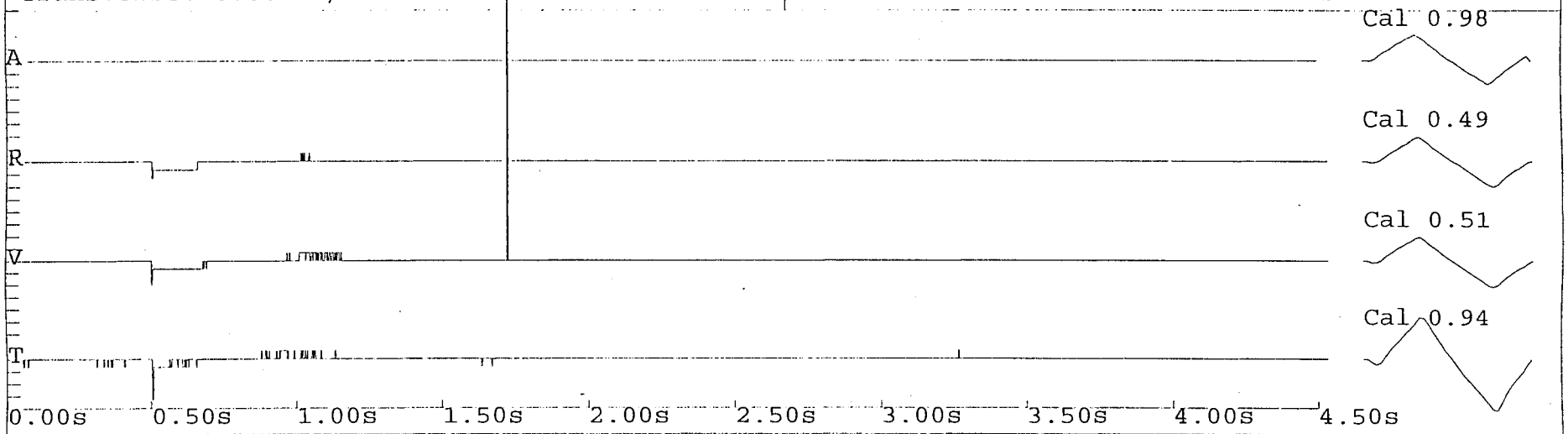
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 071 Date: 6/20/95 Time: 17:18
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

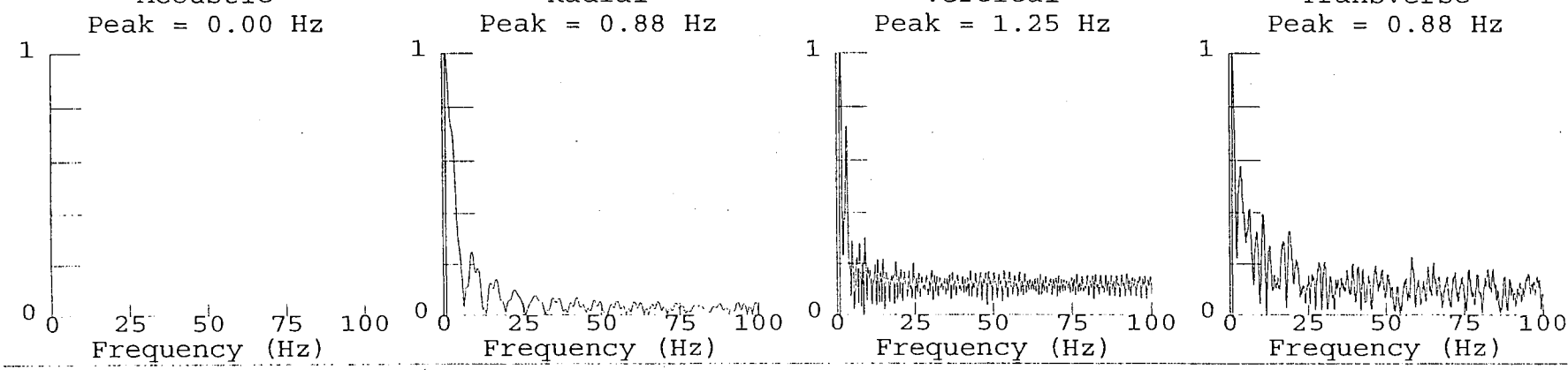
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 2.8 Hz.
Transverse: 0.06 in/s 8.5 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals

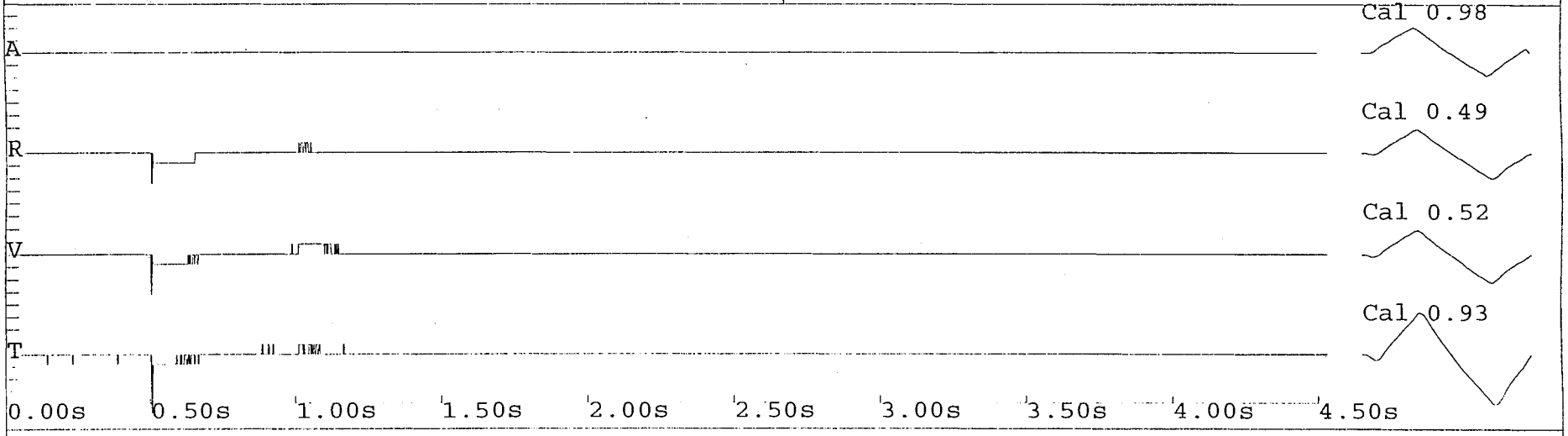


Fourier Analysis (Amplitude Spectrum)

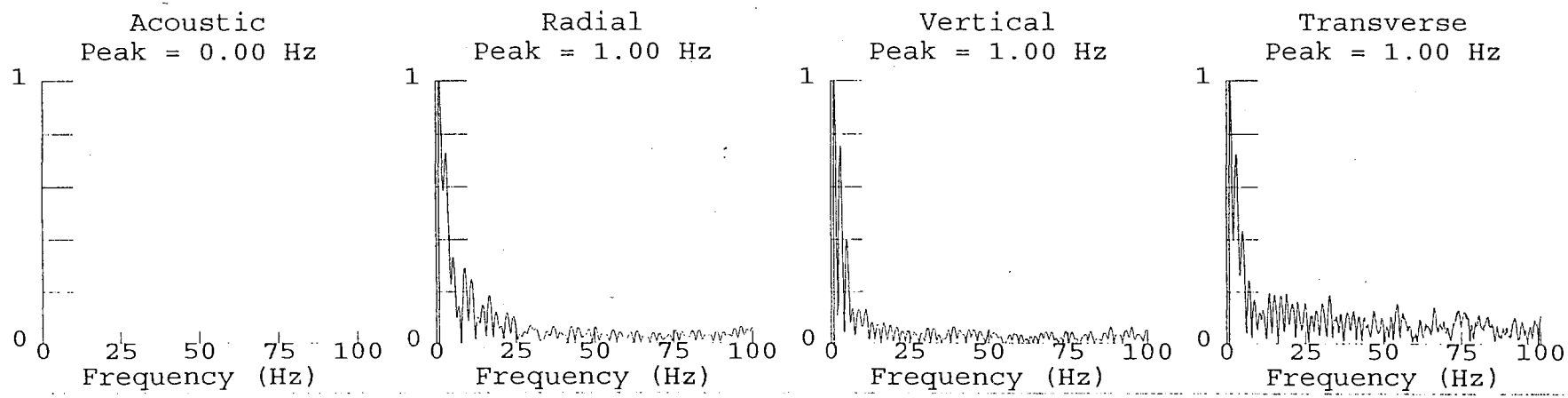


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 072 Date: 6/20/95 Time: 17:20
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

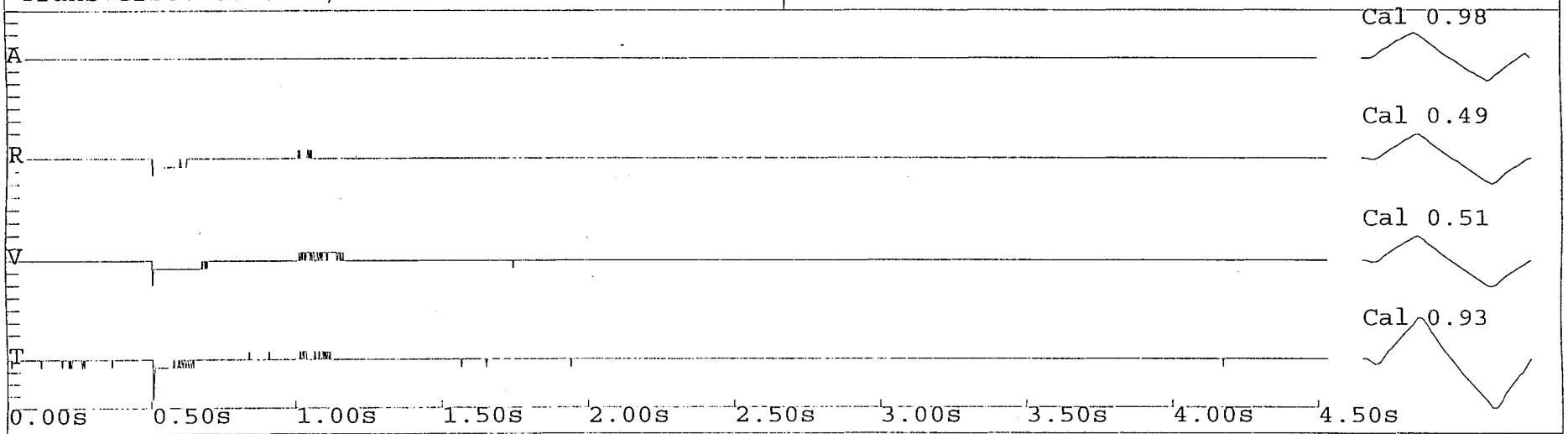


Fourier Analysis (Amplitude Spectrum)

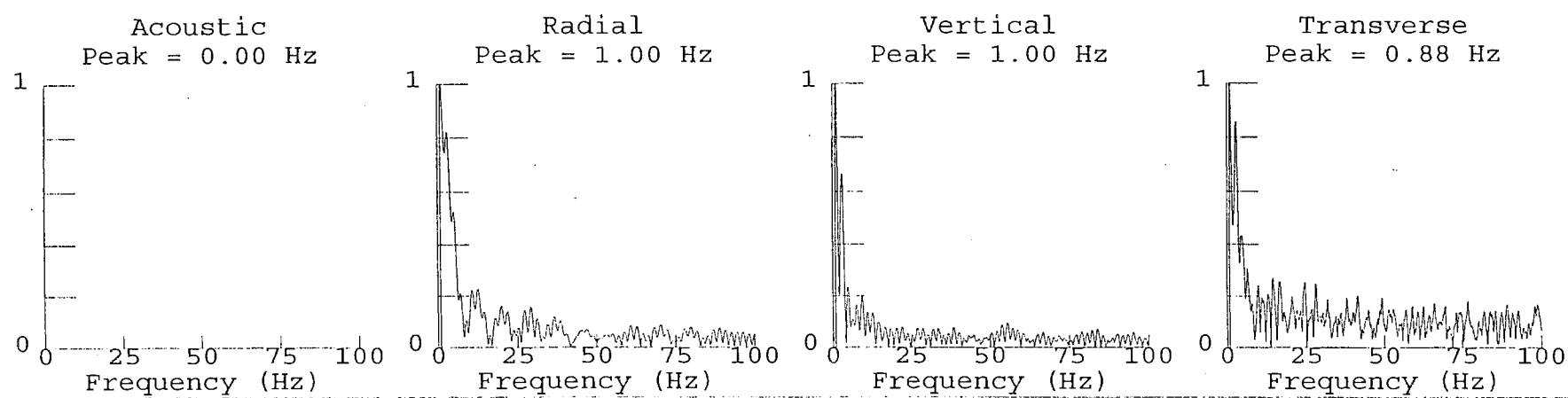


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 073 Date: 6/20/95 Time: 17:22
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 3.1 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 7.1 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



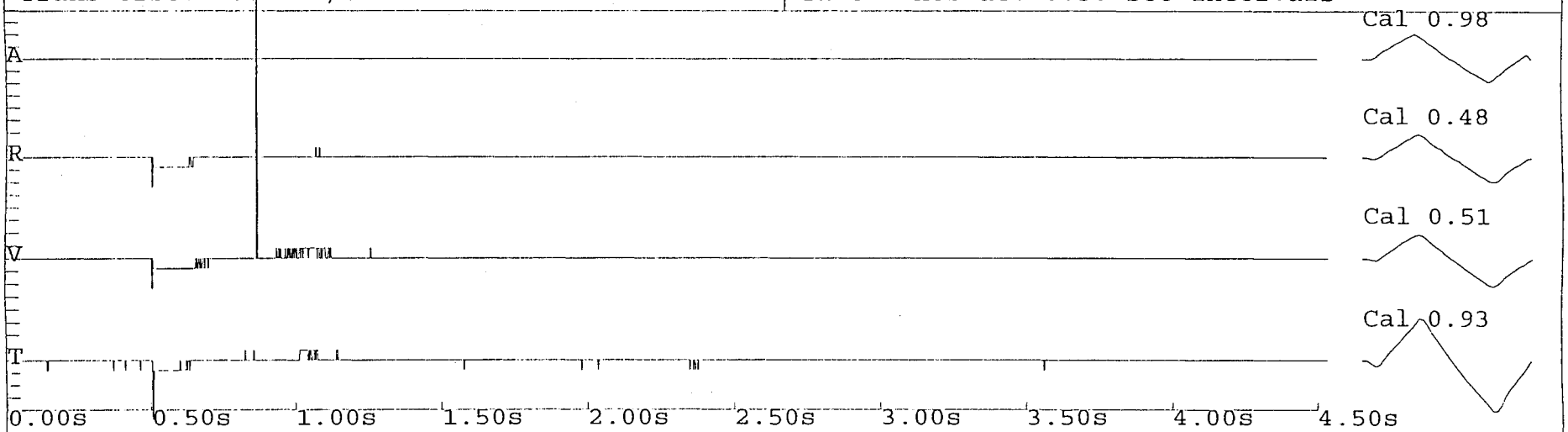
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 074 Date: 6/20/95 Time: 17:24
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

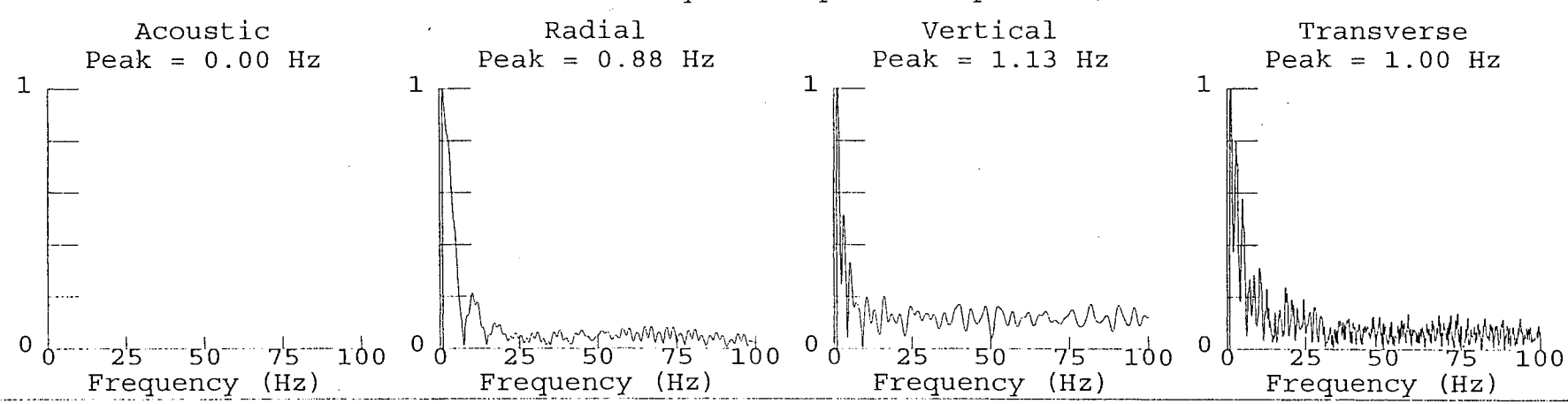
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

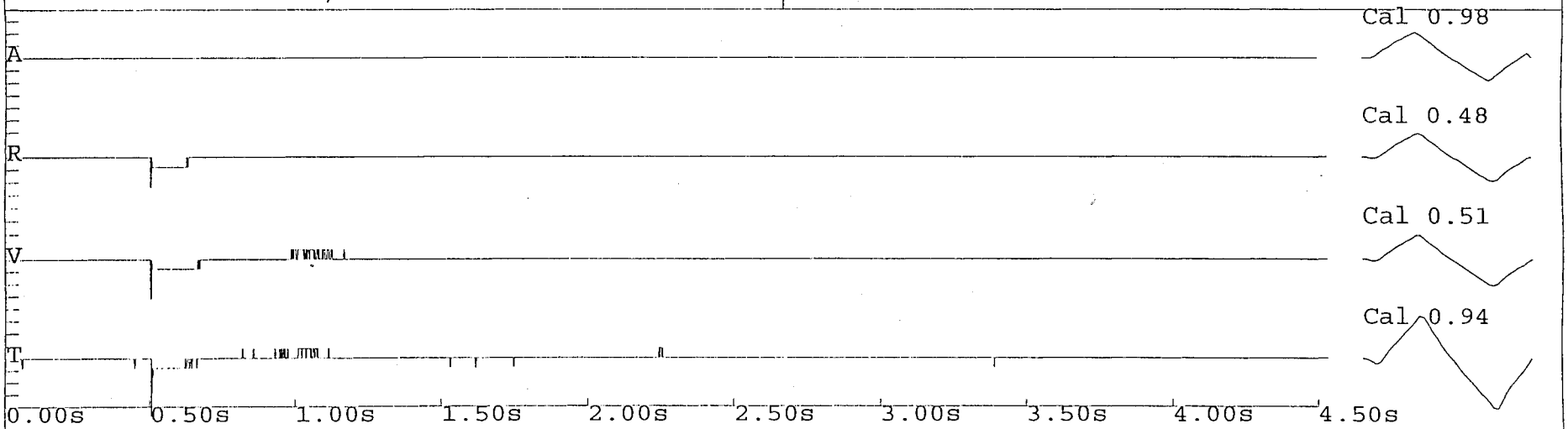


Fourier Analysis (Amplitude Spectrum)

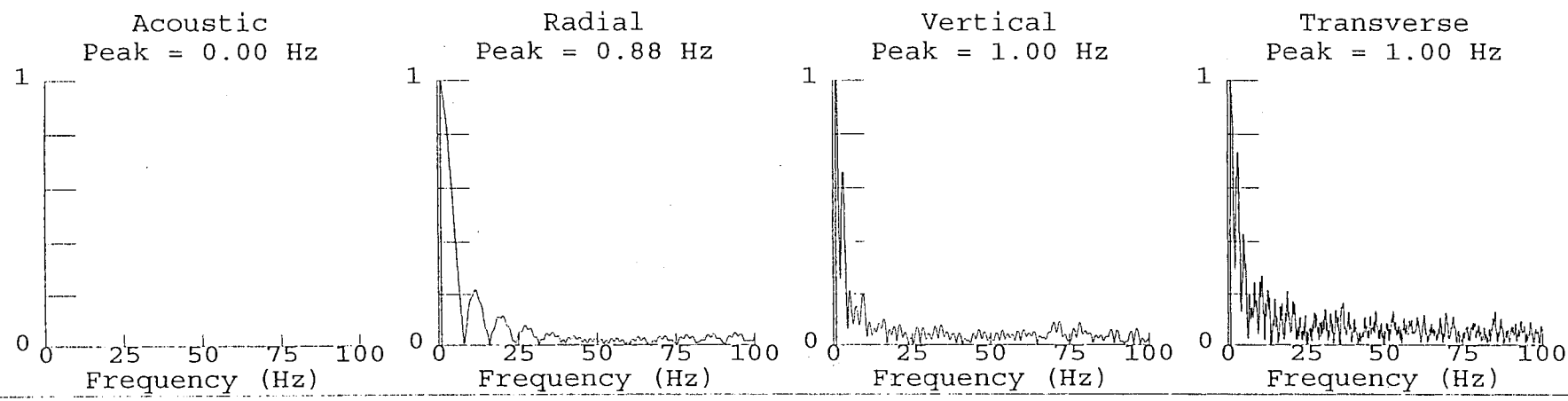


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 075 Date: 6/20/95 Time: 17:26
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



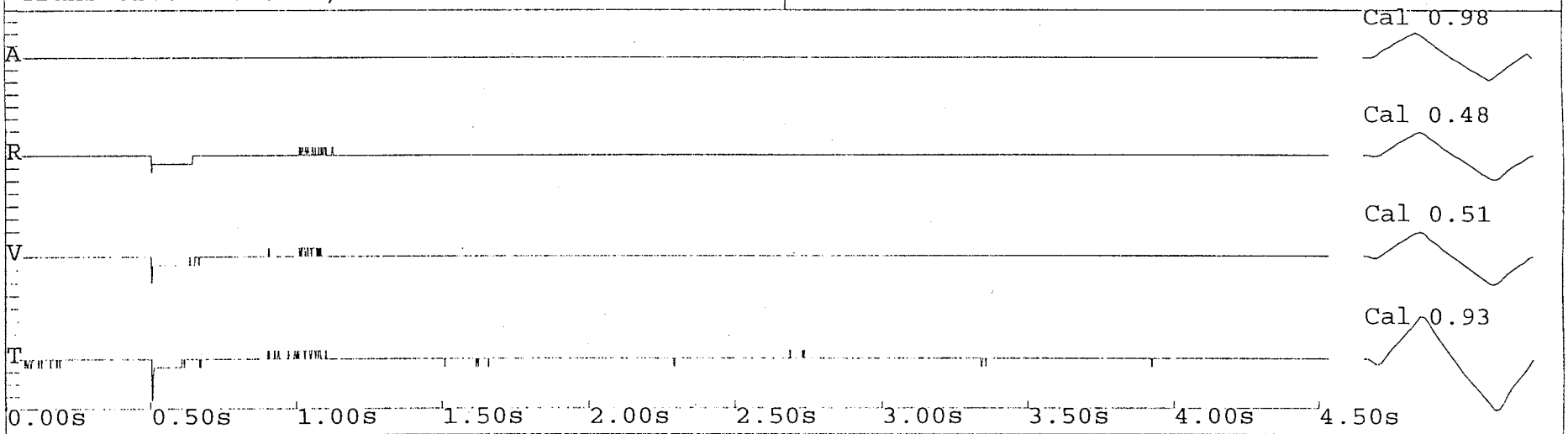
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 076 Date: 6/20/95 Time: 17:28
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

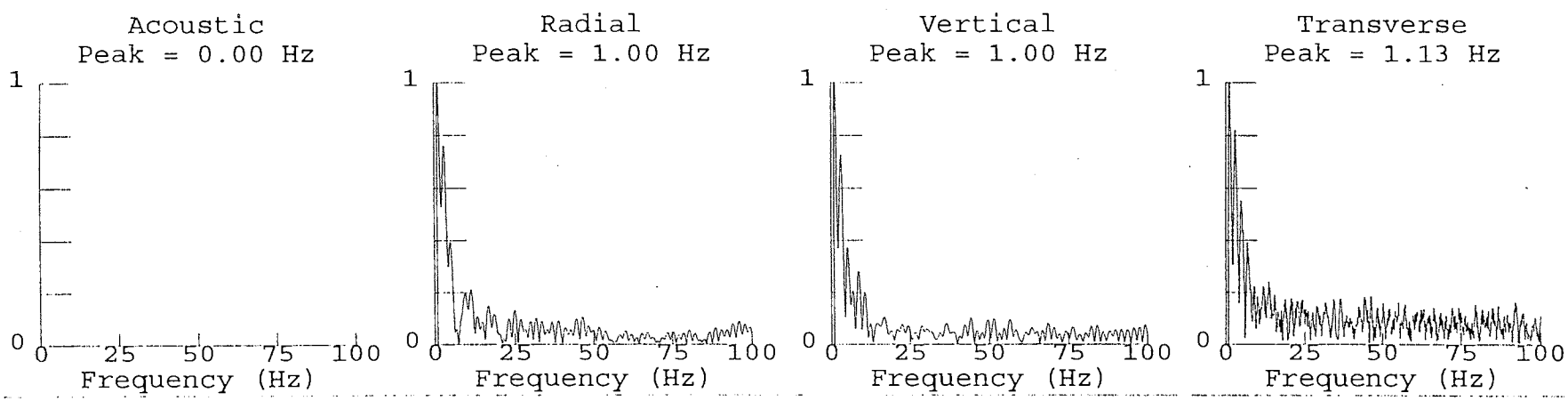
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 3.8 Hz.
Transverse: 0.06 in/s 4.9 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



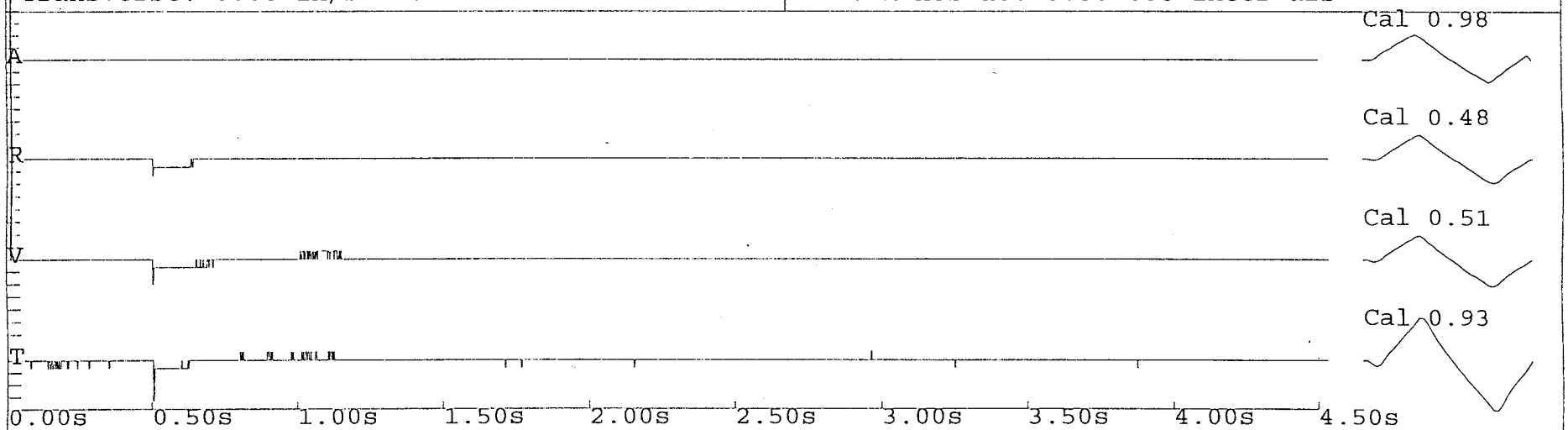
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 077 Date: 6/20/95 Time: 17:30
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

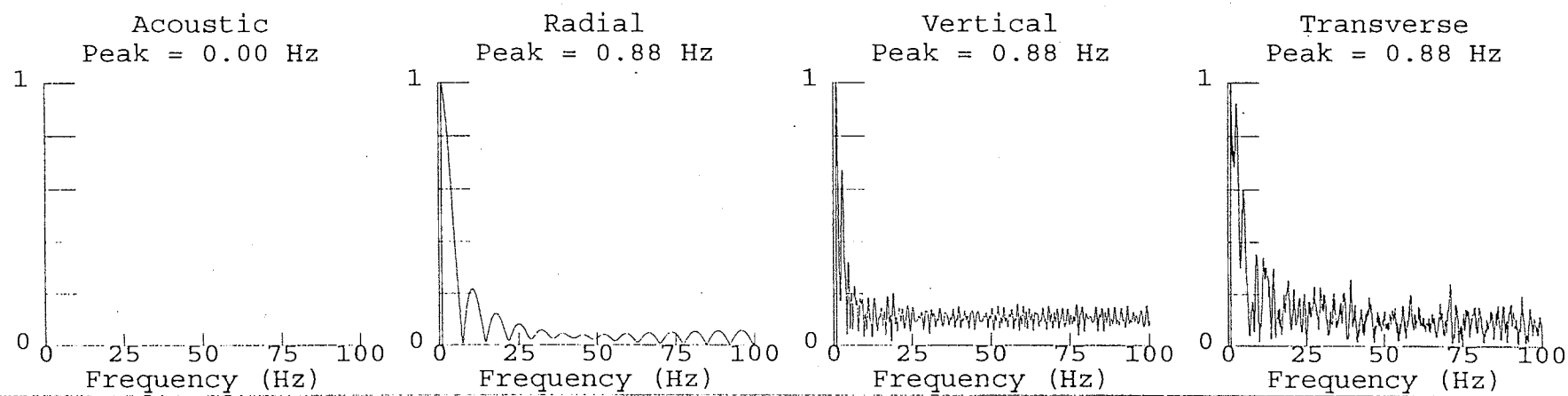
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 170.6 Hz.
Transverse: 0.06 in/s 5.2 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals

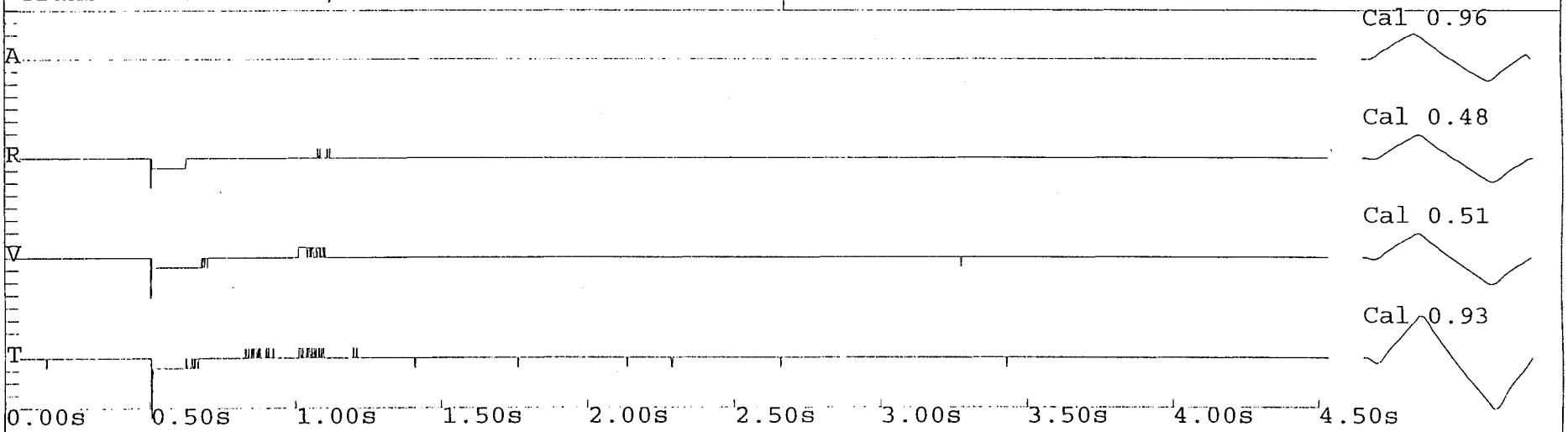


Fourier Analysis (Amplitude Spectrum)

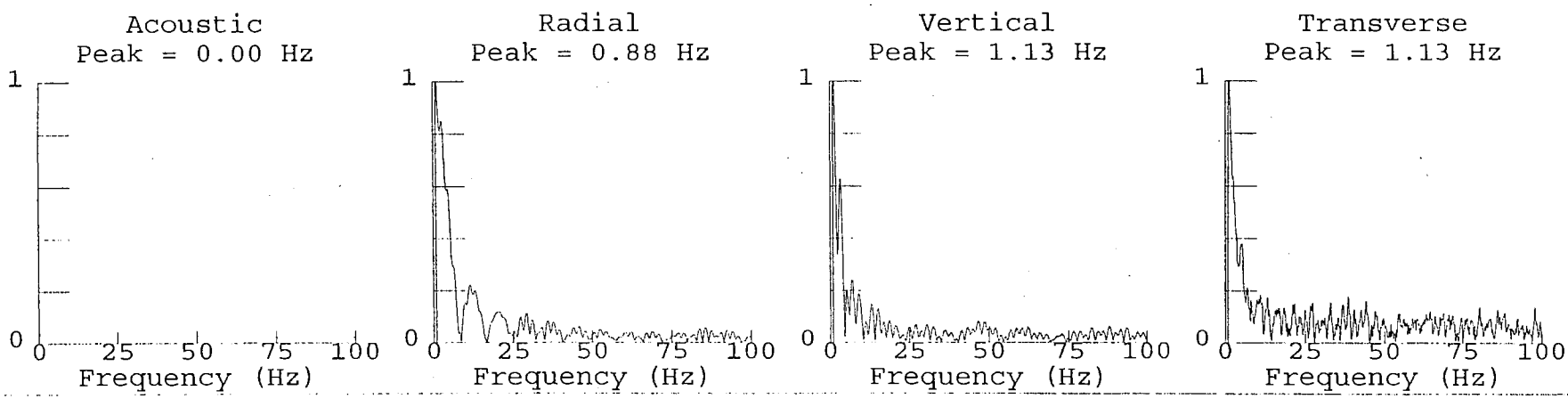


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 078 Date: 6/20/95 Time: 17:32
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



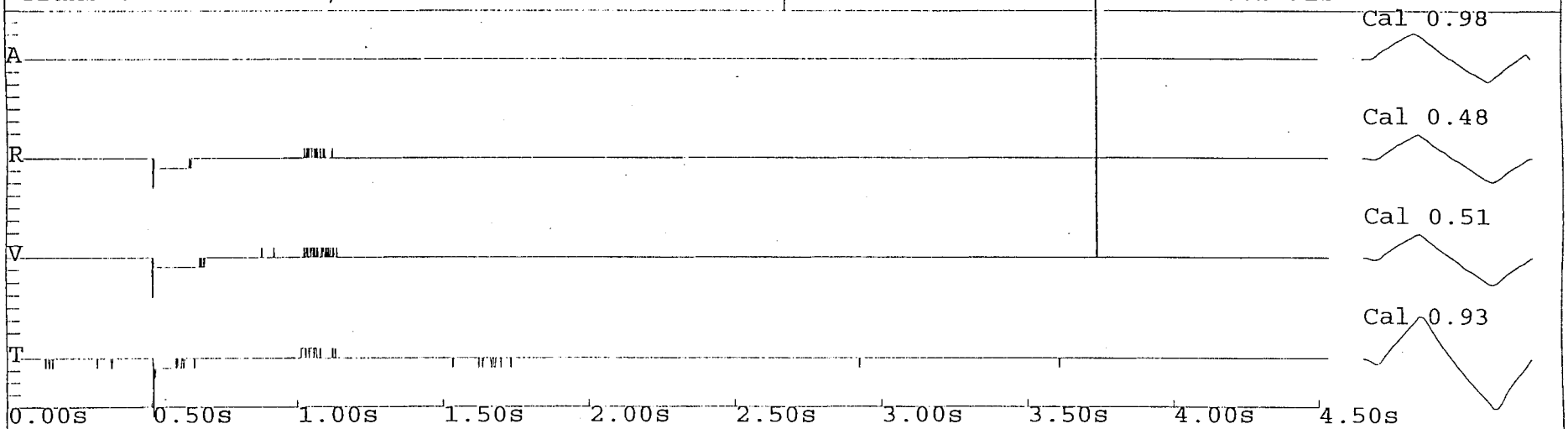
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 079 Date: 6/20/95 Time: 17:34
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

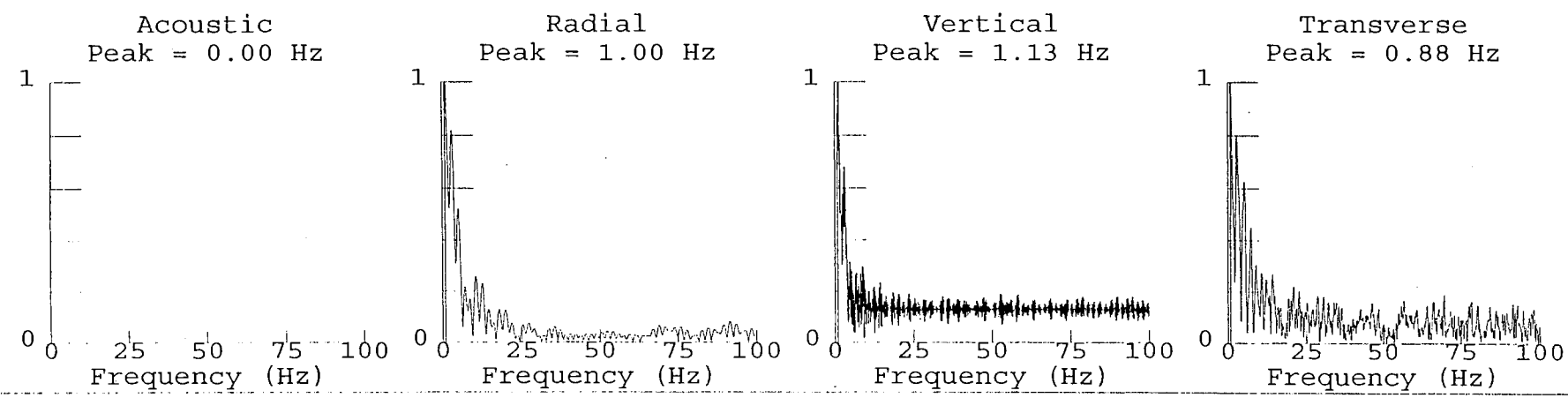
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



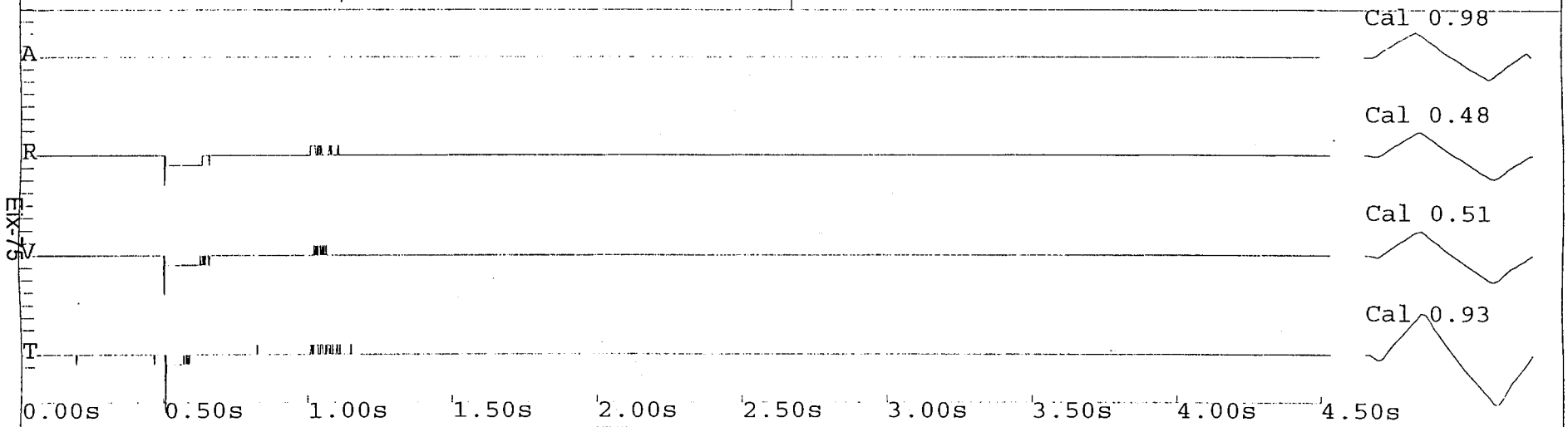
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 080 Date: 6/20/95 Time: 17:36
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

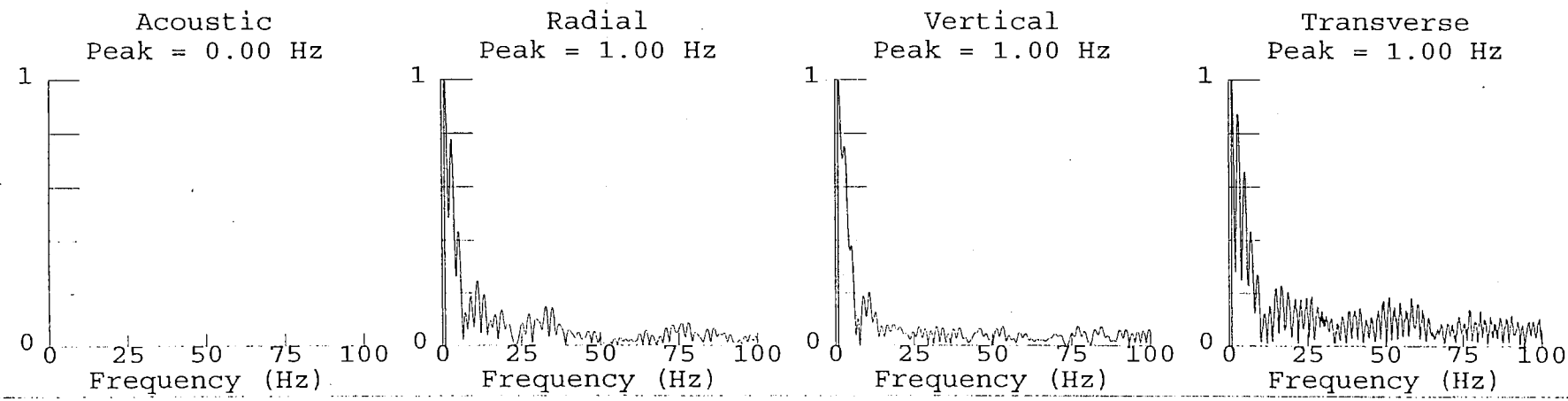
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

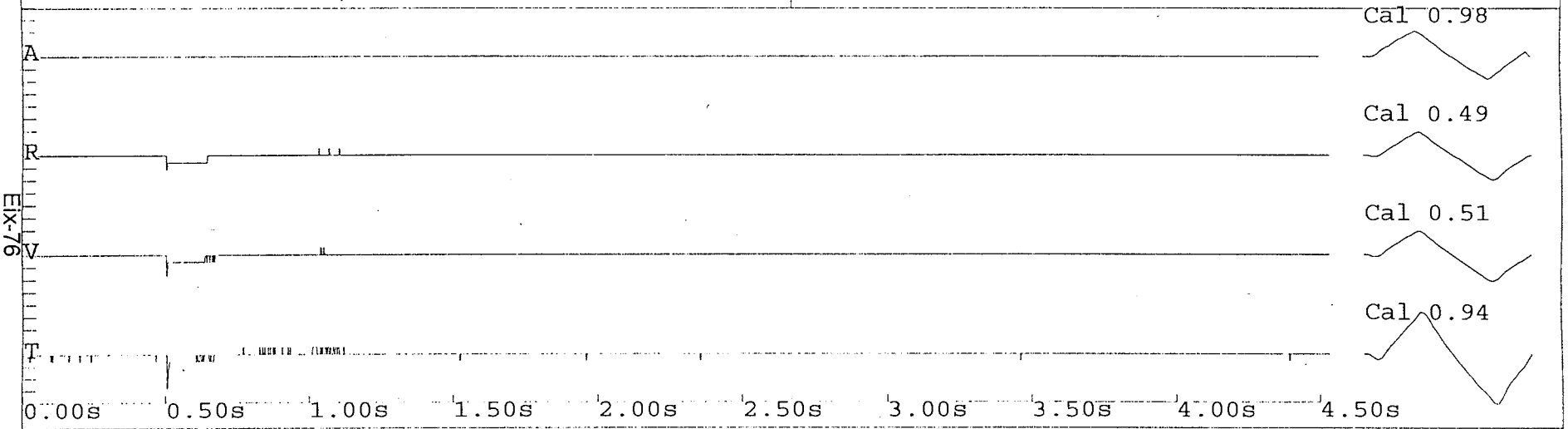


Fourier Analysis (Amplitude Spectrum)

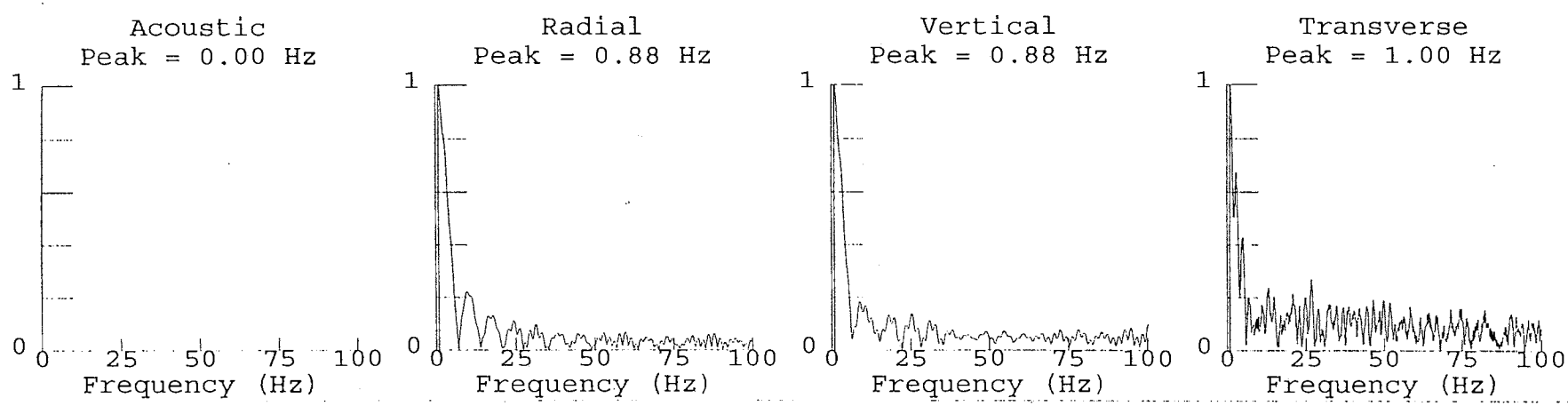


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 081 Date: 6/20/95 Time: 17:38
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 3.7 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.07 in/s 5.3 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



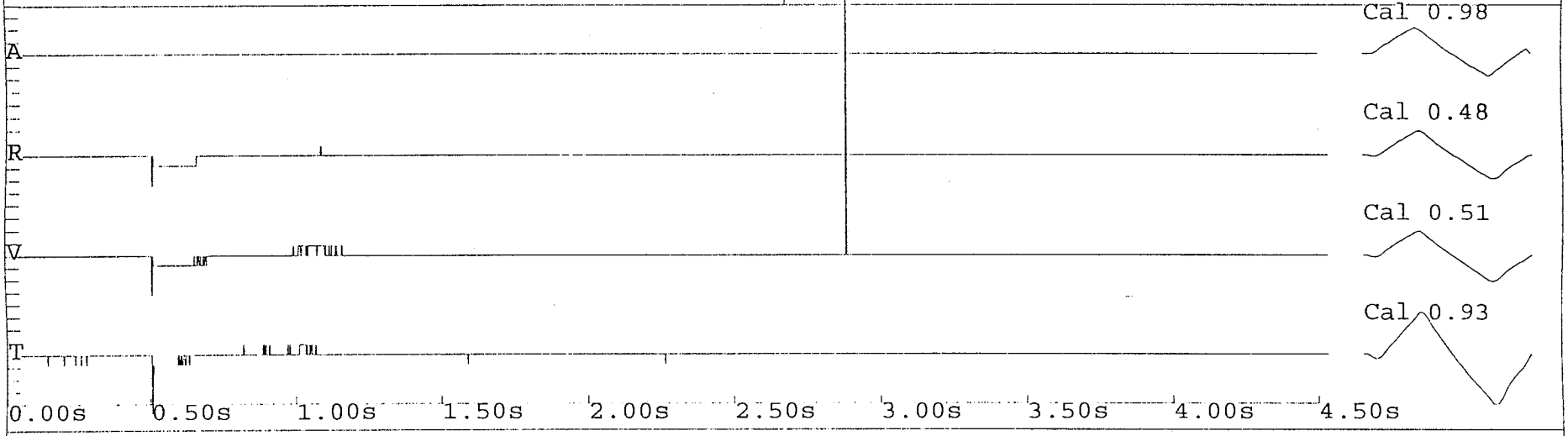
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 082 Date: 6/20/95 Time: 17:40
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

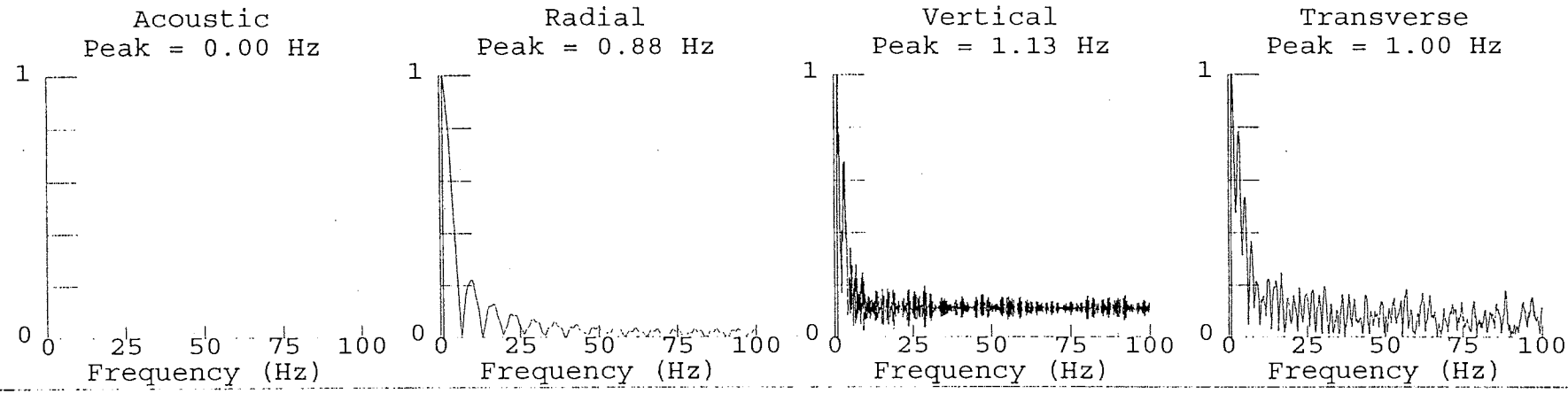
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



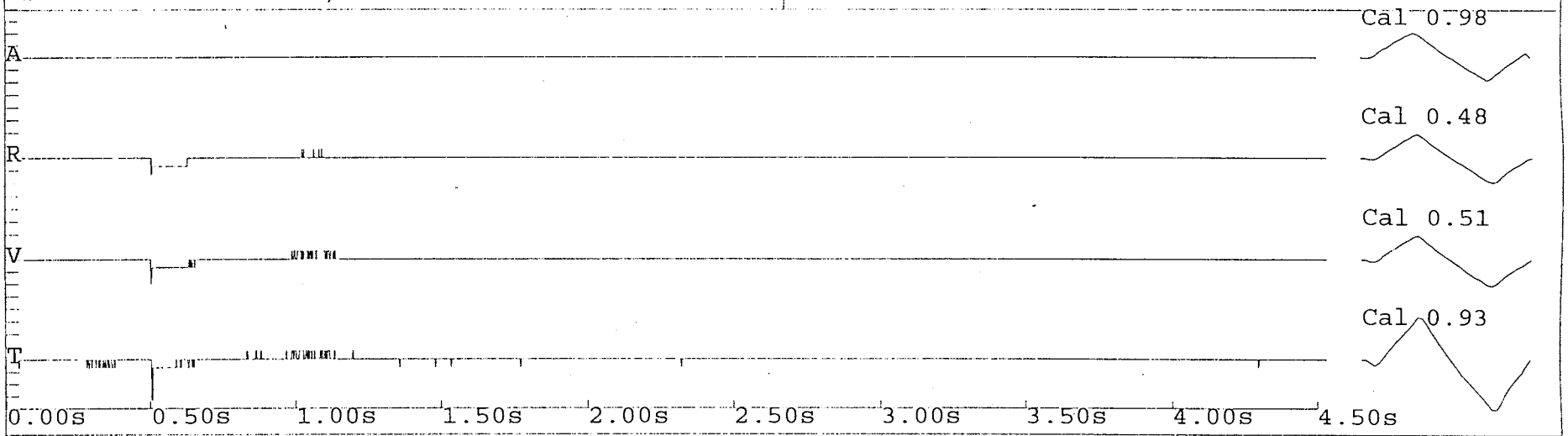
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 083 Date: 6/20/95 Time: 17:42
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

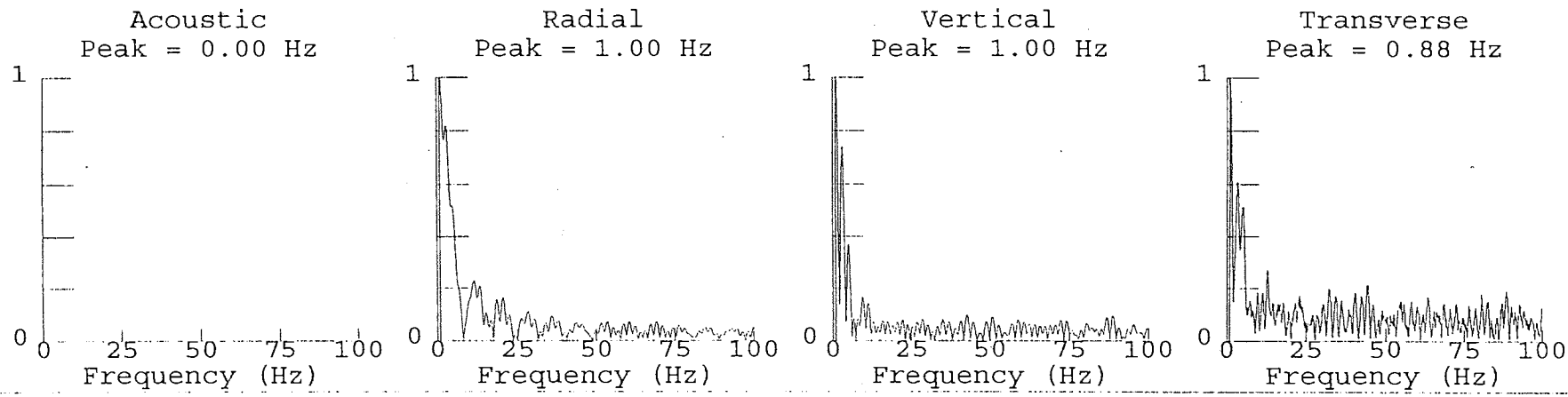
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 3.9 Hz.
Transverse: 0.06 in/s 6.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals

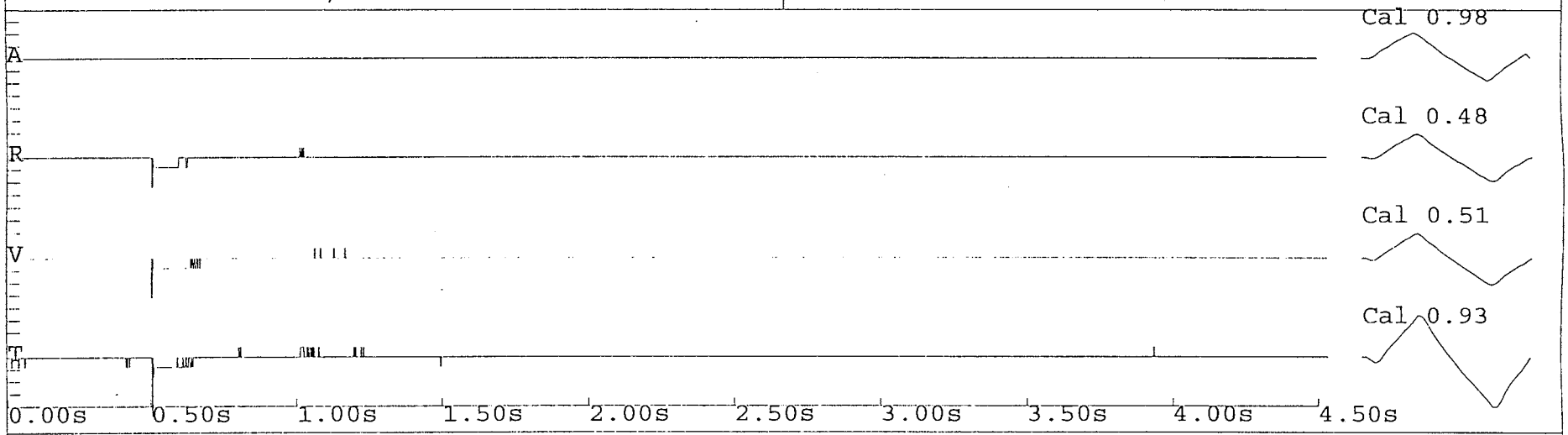


Fourier Analysis (Amplitude Spectrum)

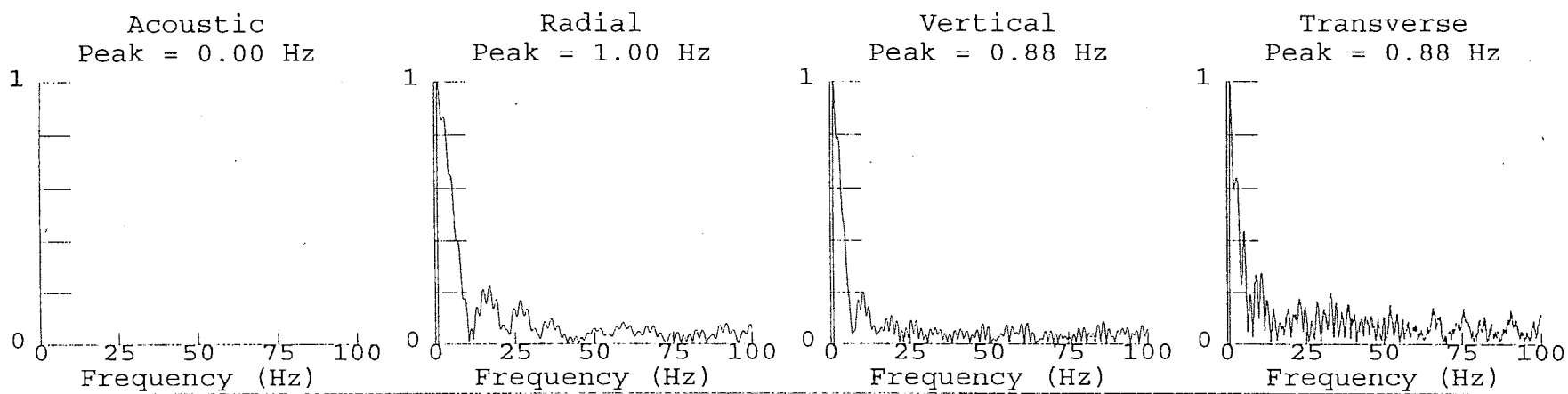


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 084 Date: 6/20/95 Time: 17:44
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



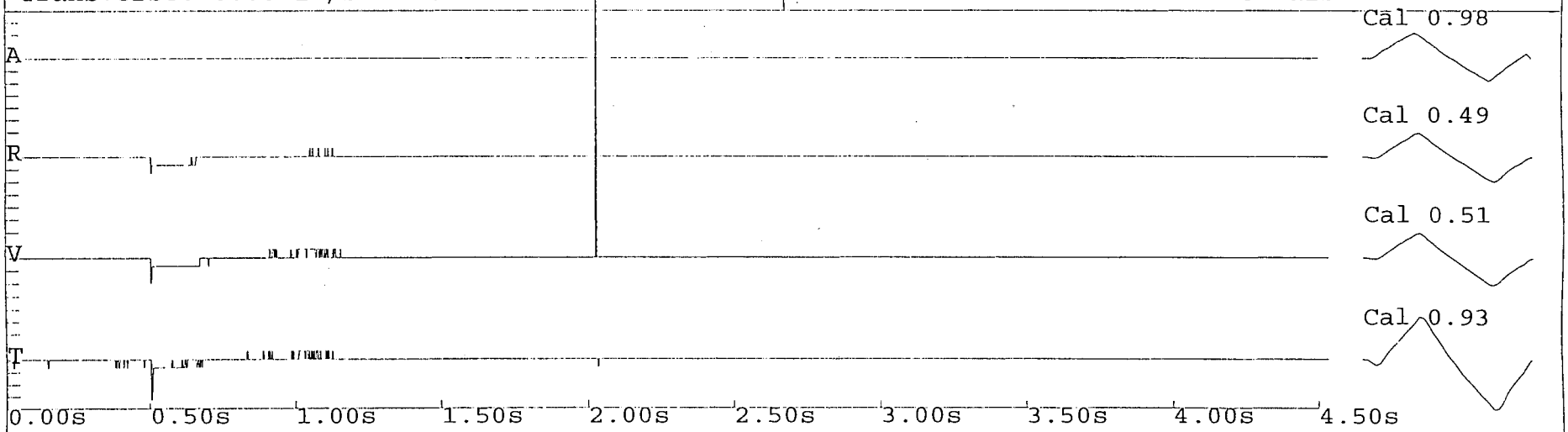
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 085 Date: 6/20/95 Time: 17:46
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

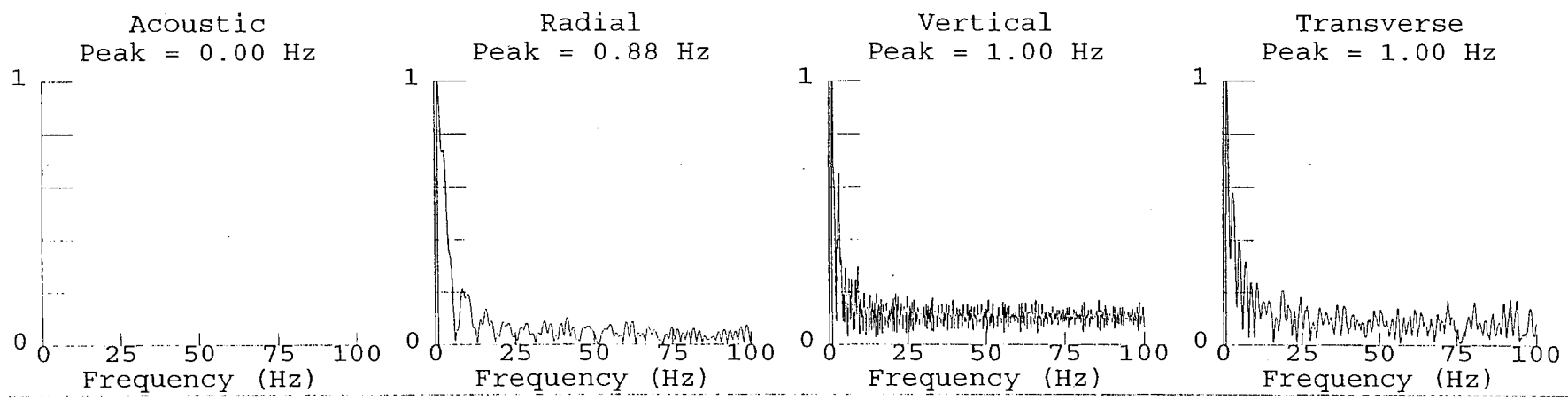
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 2.9 Hz.
Transverse: 0.06 in/s 7.1 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



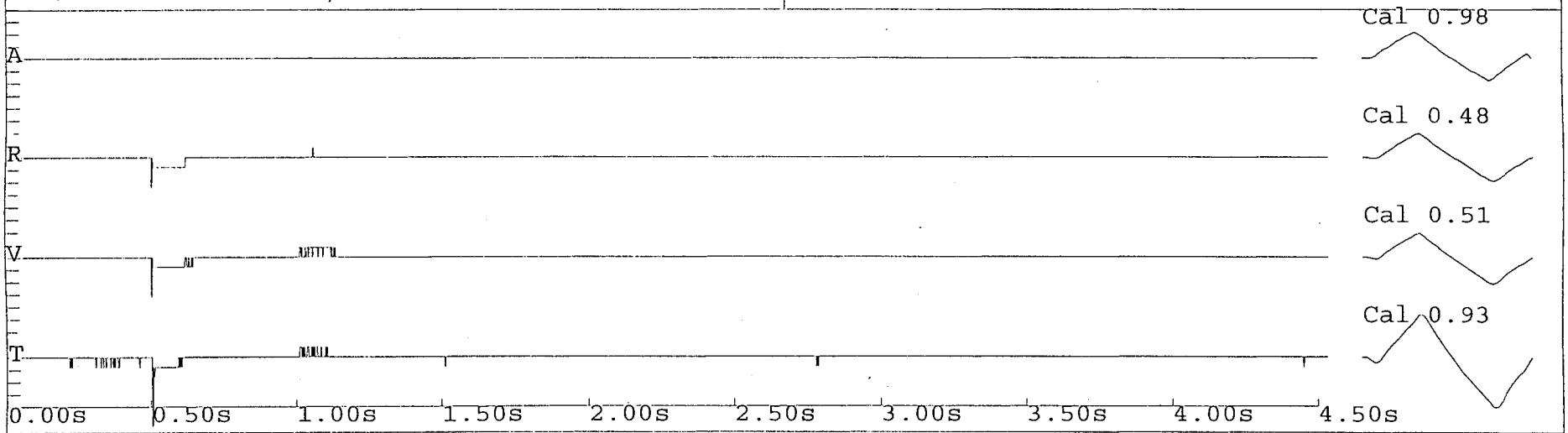
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 086 Date: 6/20/95 Time: 17:48
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

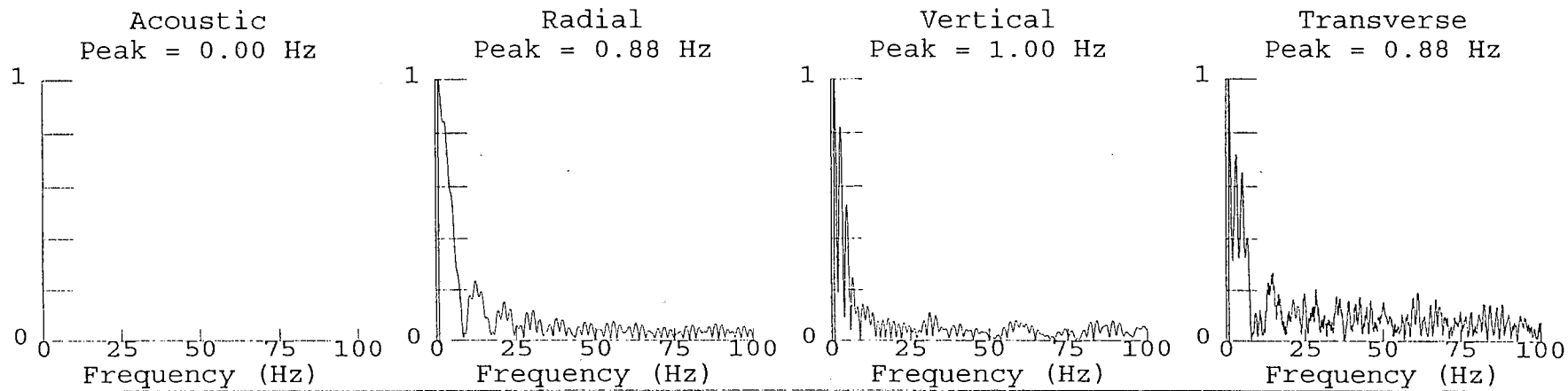
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

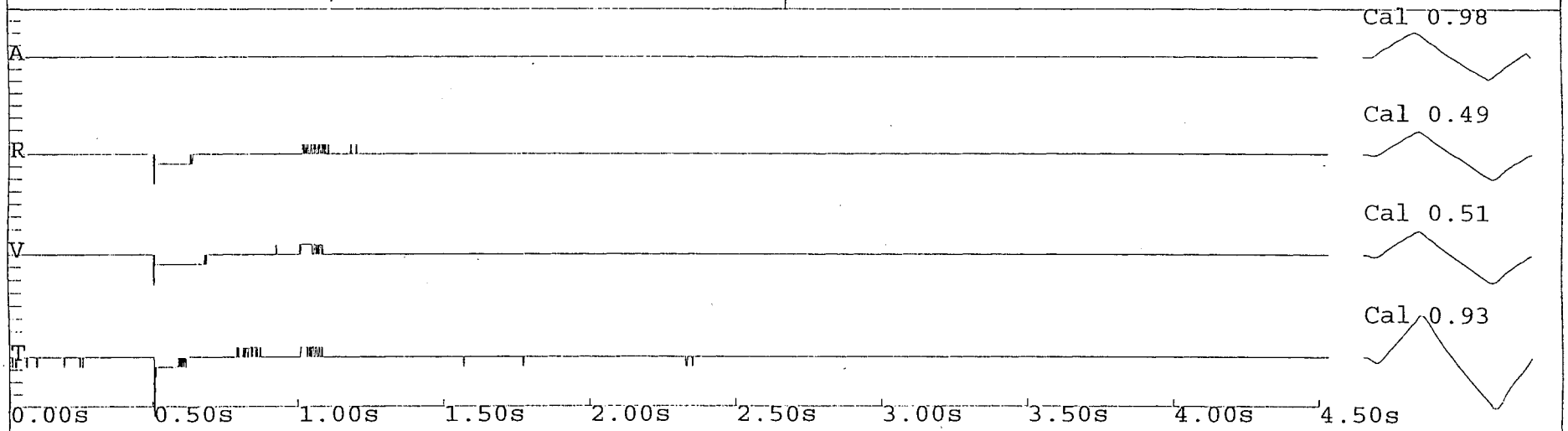


Fourier Analysis (Amplitude Spectrum)

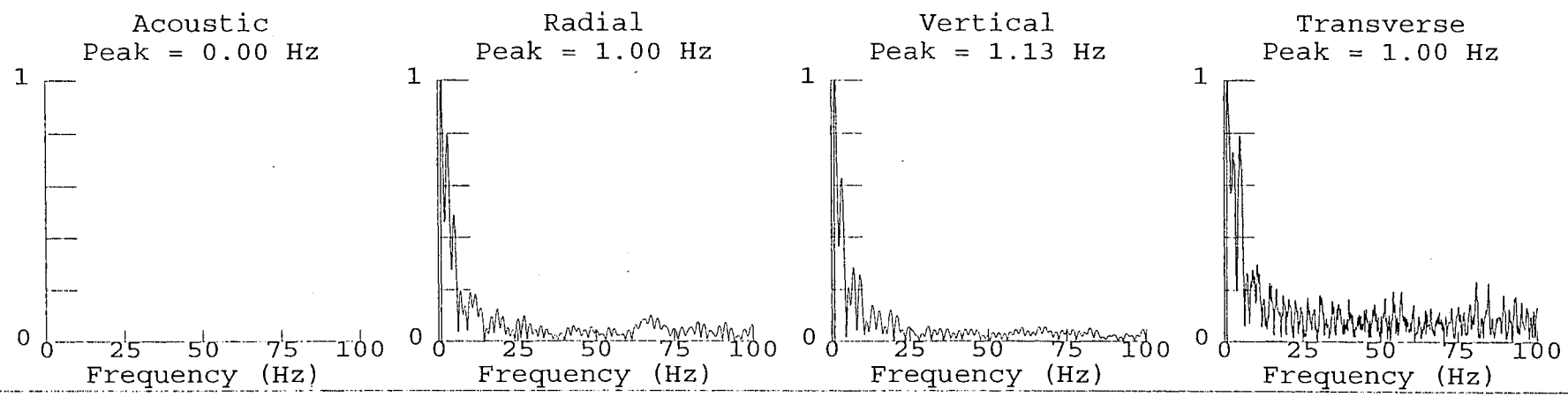


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 087 Date: 6/20/95 Time: 17:50
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



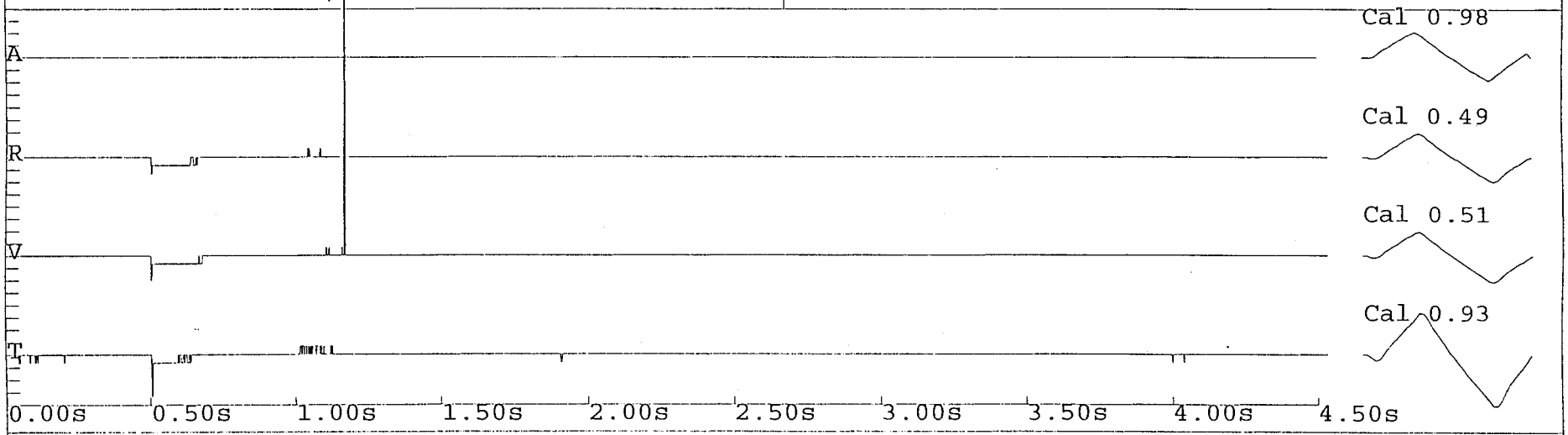
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 088 Date: 6/20/95 Time: 17:52
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

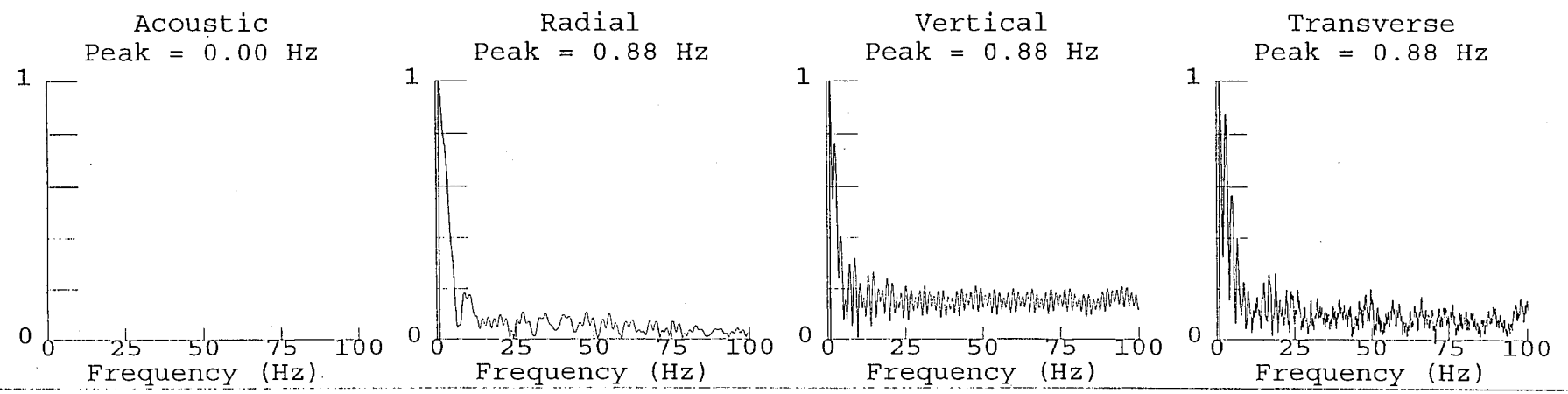
Acoustic: 0 dB 0.0 Hz.
Radial: 0.03 in/s 0.0 Hz.
Vertical: 0.04 in/s 3.0 Hz.
Transverse: 0.06 in/s 13.8 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.06 in/s (0.015 in/s/div)
Time Lines at: 0.50 sec intervals

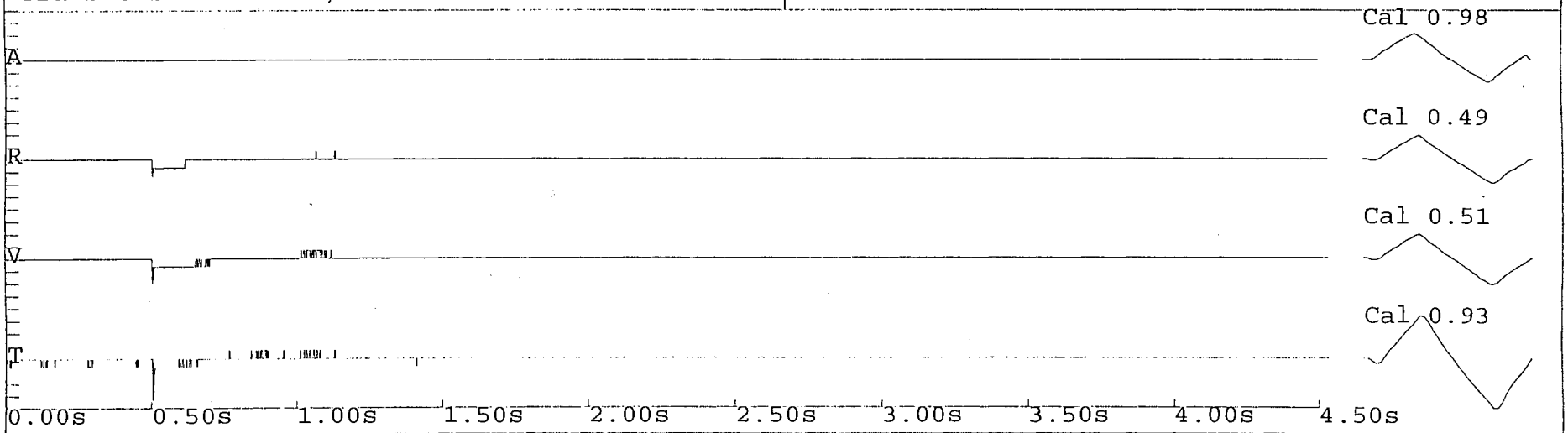


Fourier Analysis (Amplitude Spectrum)

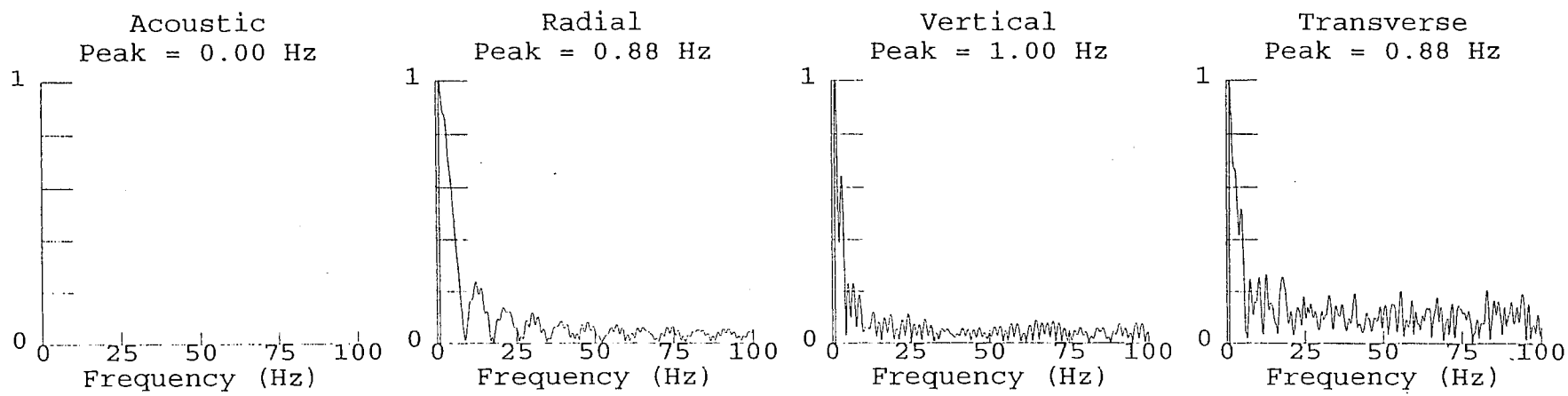


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 089 Date: 6/20/95 Time: 17:54
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 3.3 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 5.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



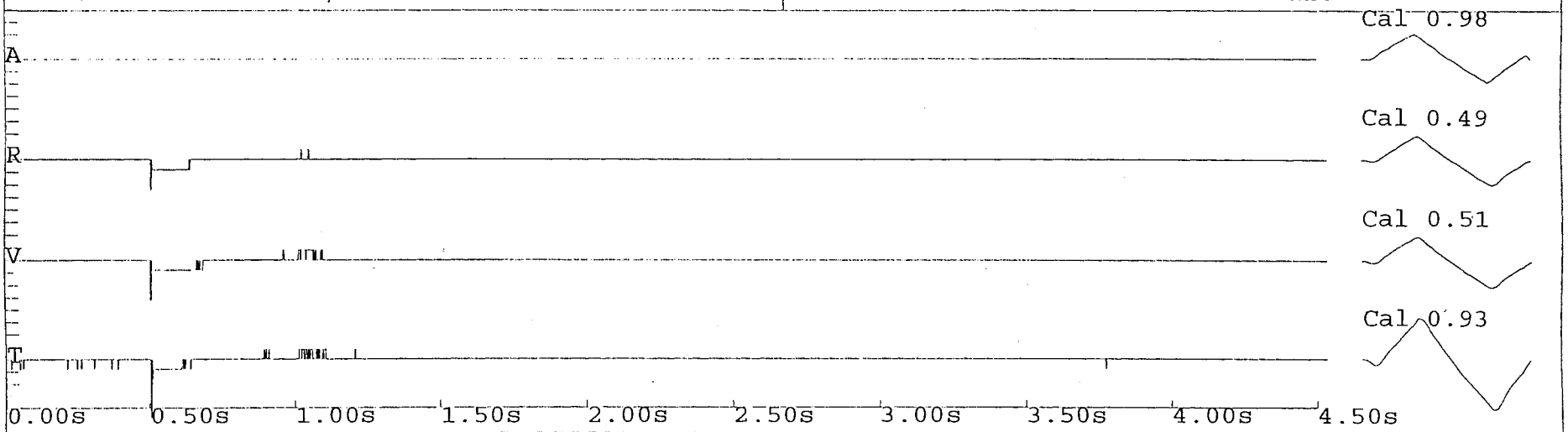
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 090 Date: 6/20/95 Time: 17:56
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies

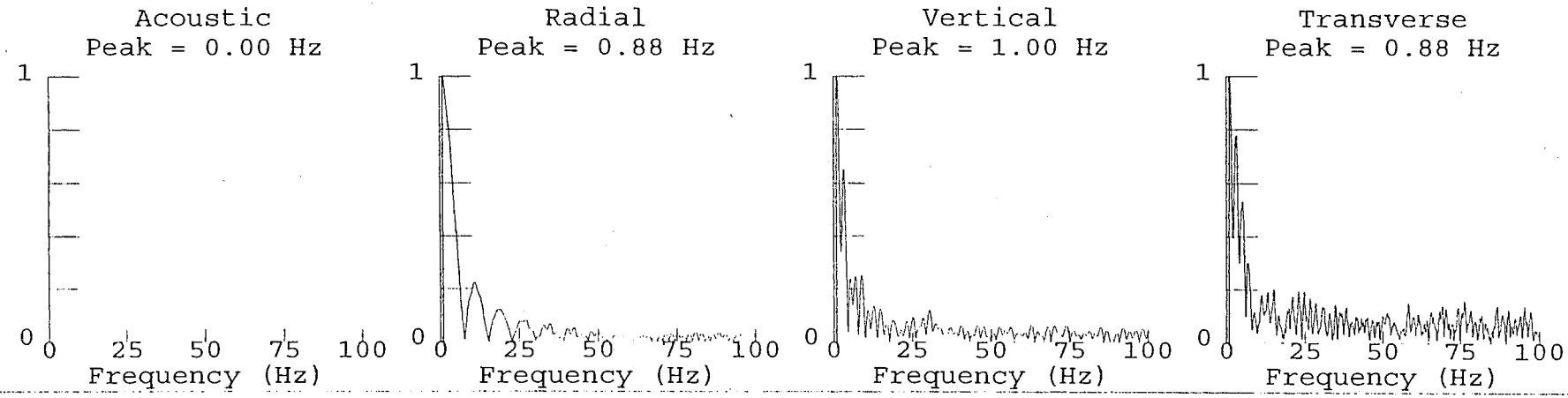
Acoustic: 0 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.04 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

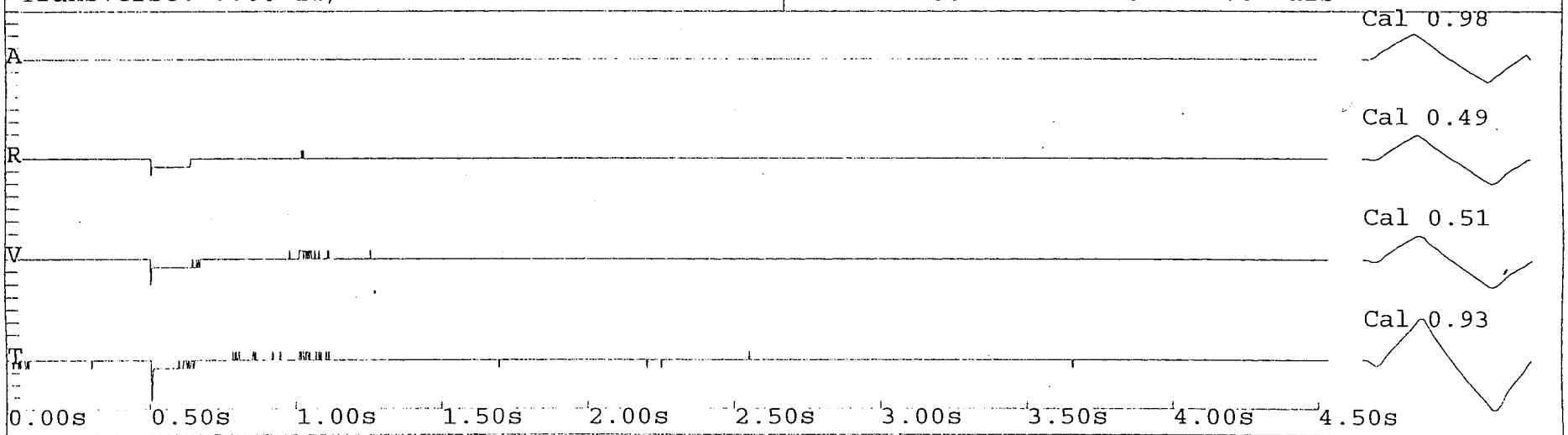


Fourier Analysis (Amplitude Spectrum)

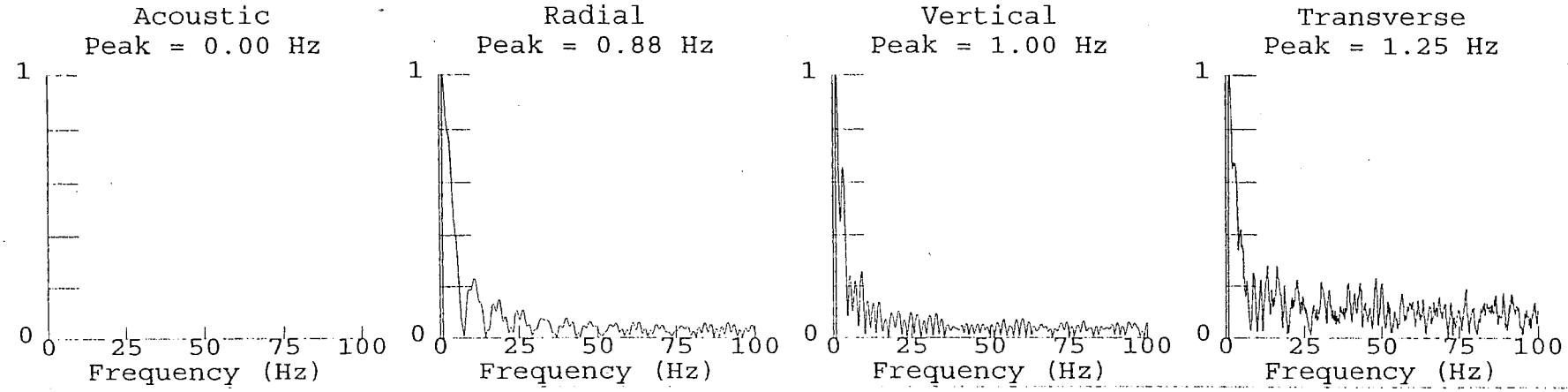


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 091 Date: 6/20/95 Time: 17:58
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 170.6 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 5.3 Hz.	Time Lines at: 0.50 sec intervals

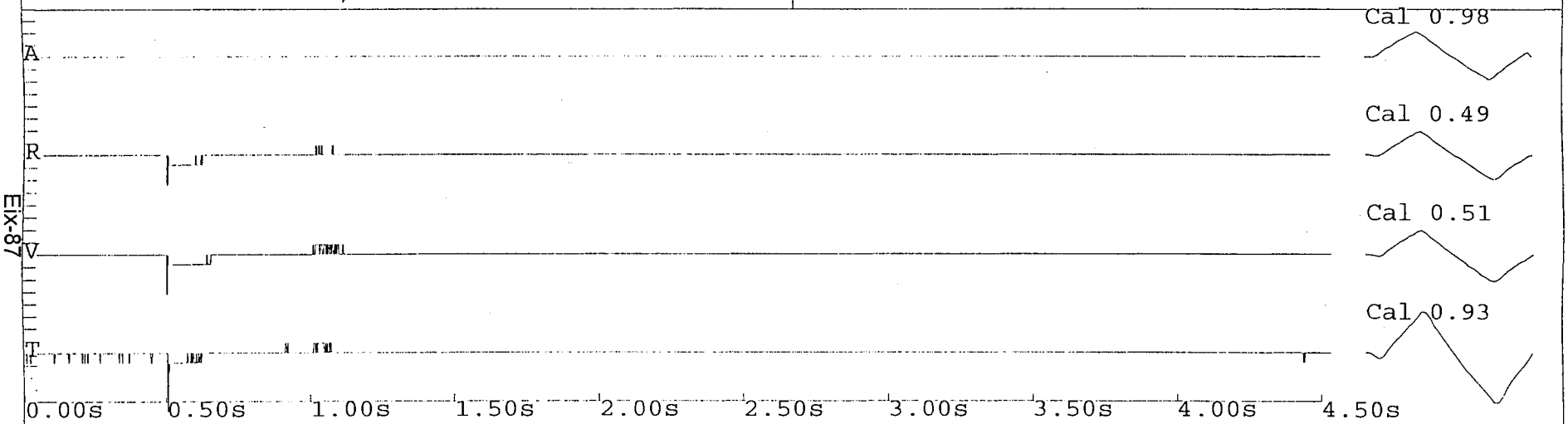


Fourier Analysis (Amplitude Spectrum)

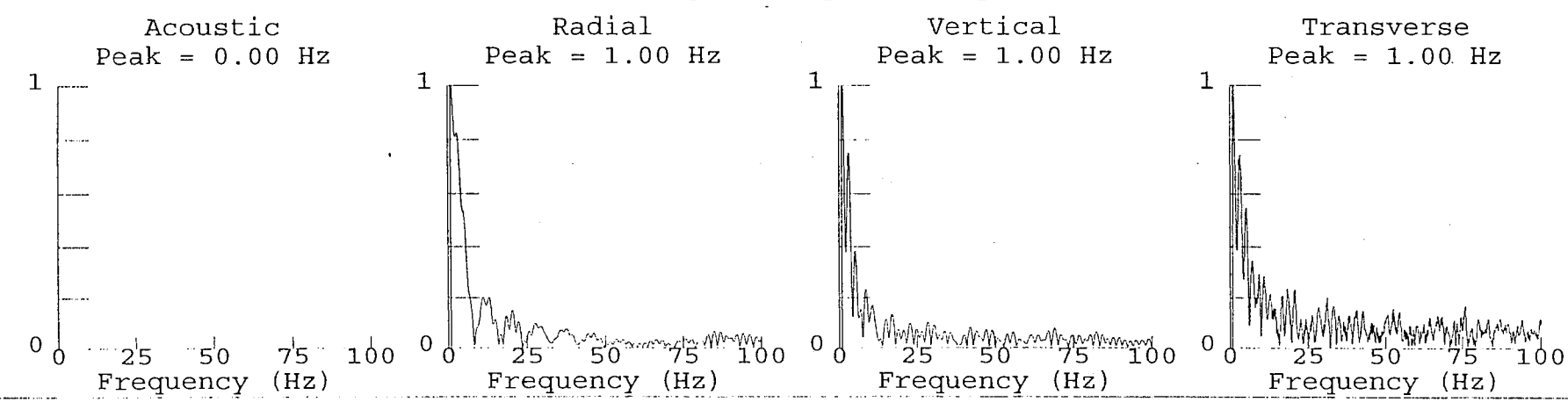


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 092 Date: 6/20/95 Time: 18:00
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

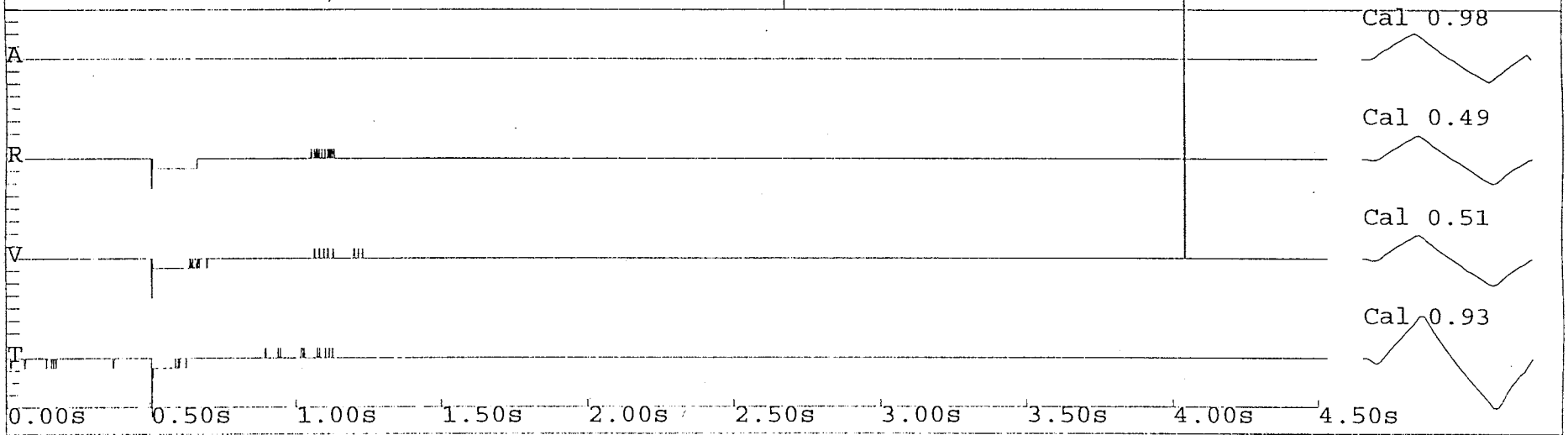


Fourier Analysis (Amplitude Spectrum)

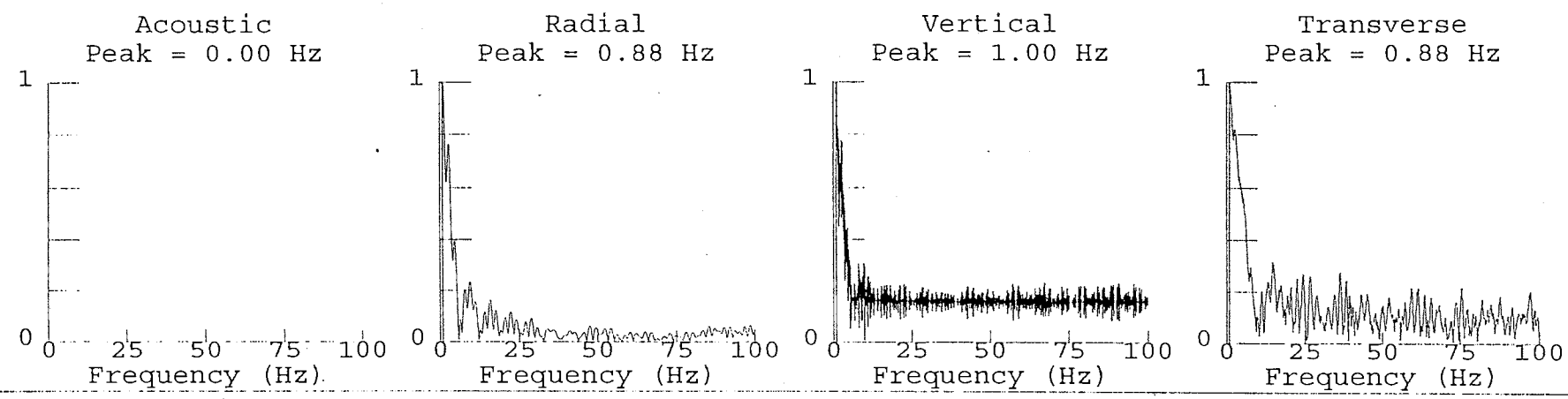


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 093 Date: 6/20/95 Time: 18:02
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

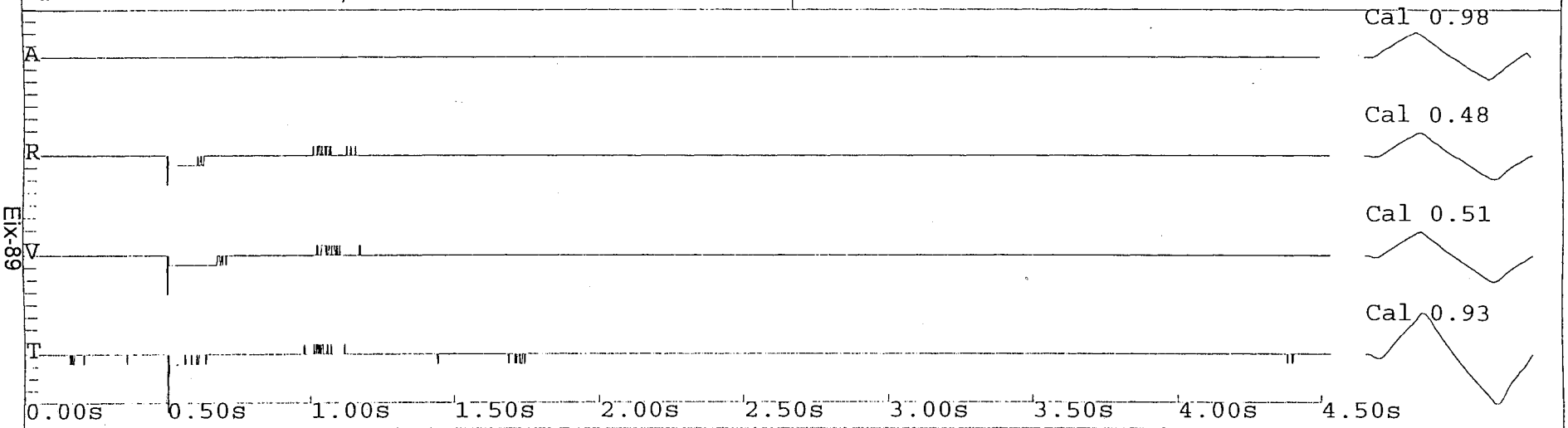


Fourier Analysis (Amplitude Spectrum)

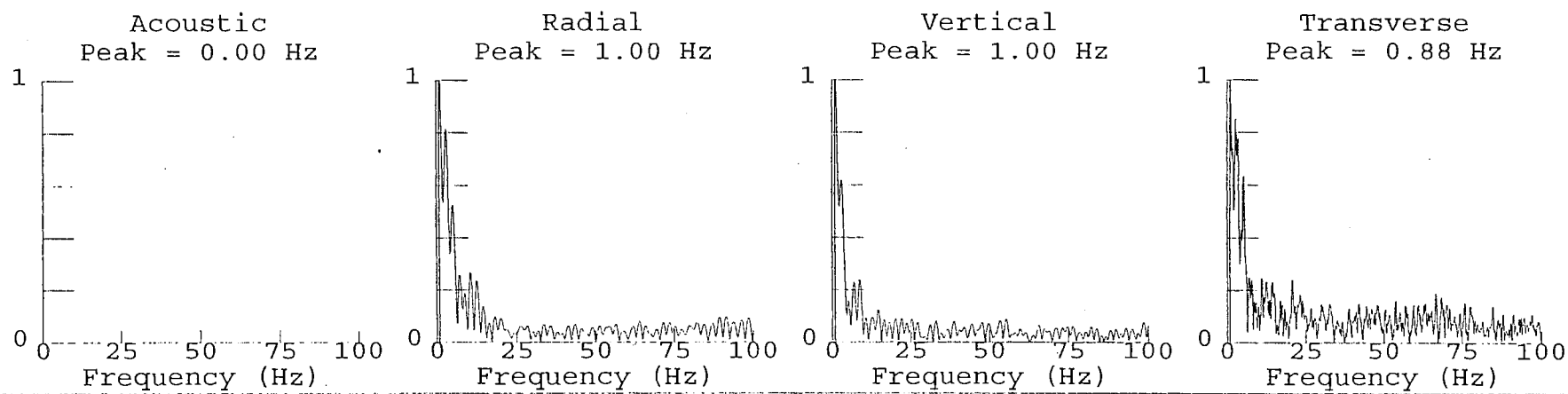


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 094 Date: 6/20/95 Time: 18:04
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

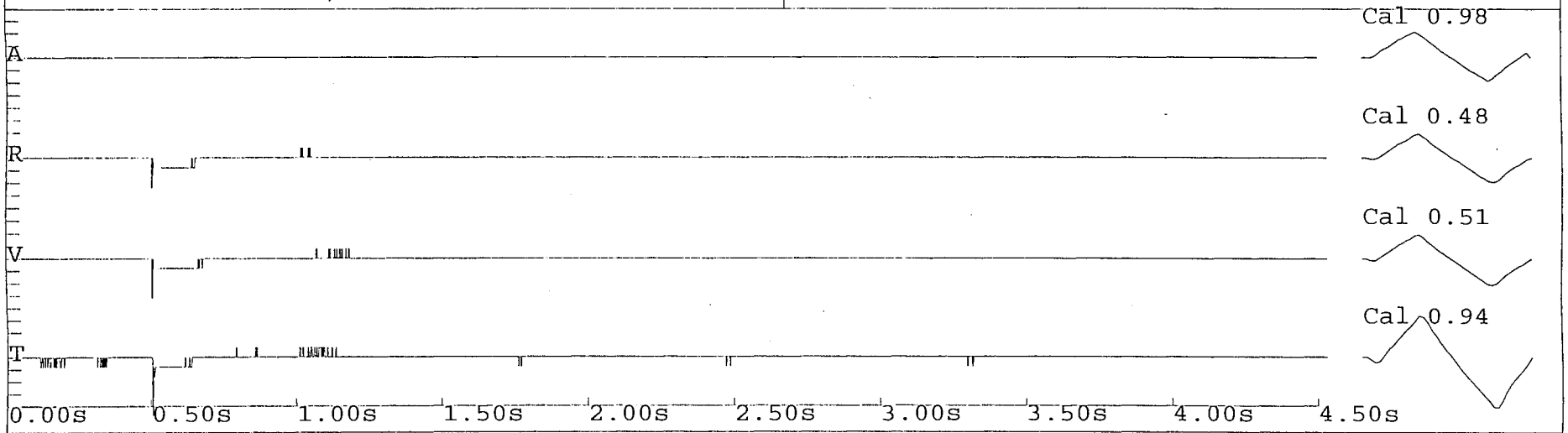


Fourier Analysis (Amplitude Spectrum)

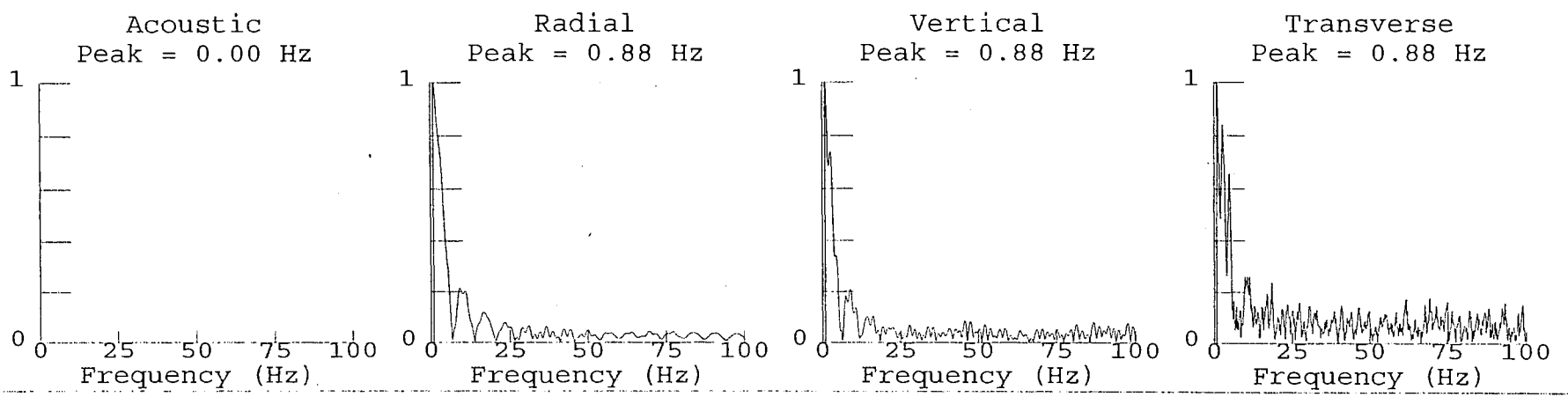


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 095 Date: 6/20/95 Time: 18:06
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

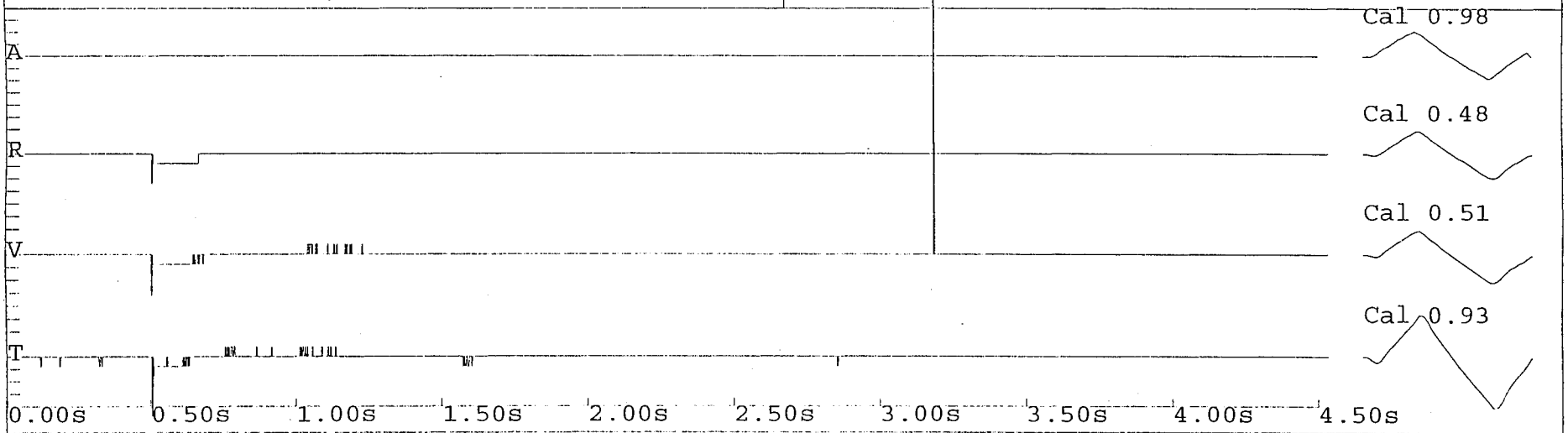


Fourier Analysis (Amplitude Spectrum)

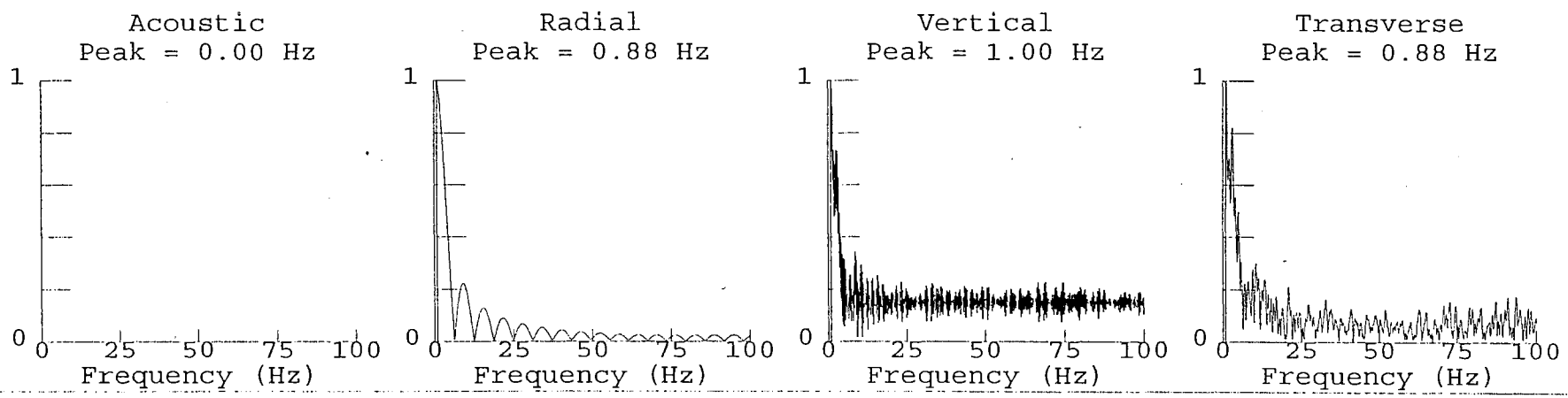


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 096 Date: 6/20/95 Time: 18:08
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

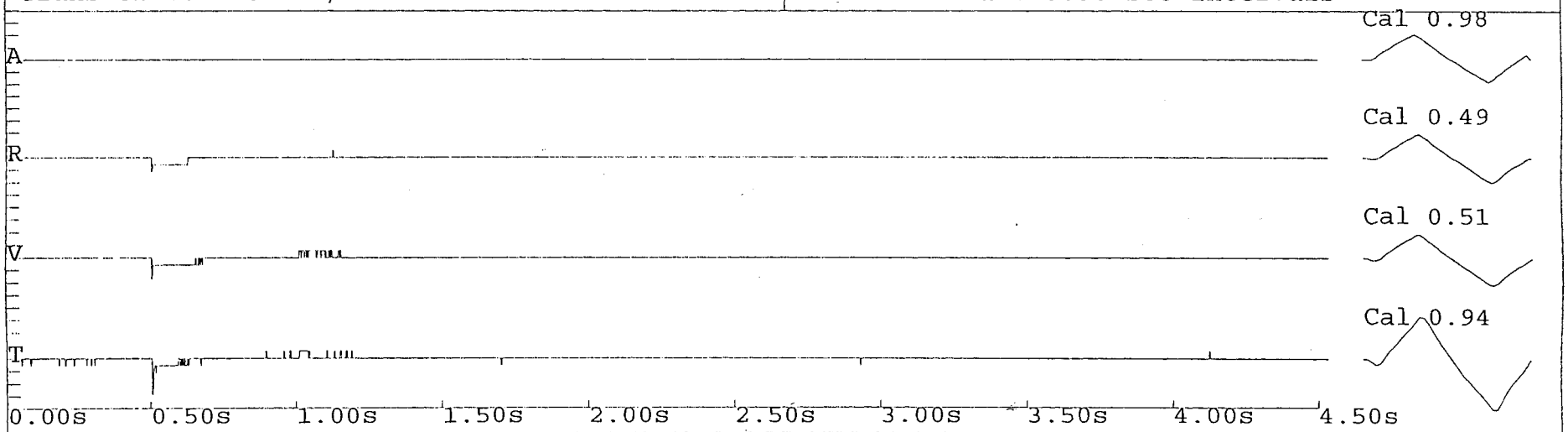


Fourier Analysis (Amplitude Spectrum)

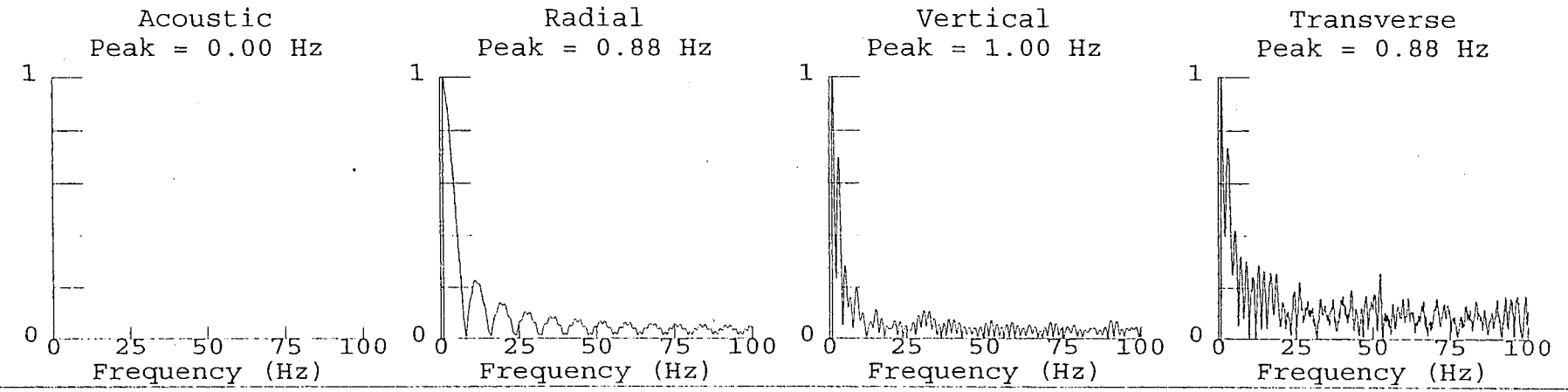


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 097 Date: 6/20/95 Time: 18:10
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 170.6 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.07 in/s 5.7 Hz.	Time Lines at: 0.50 sec intervals

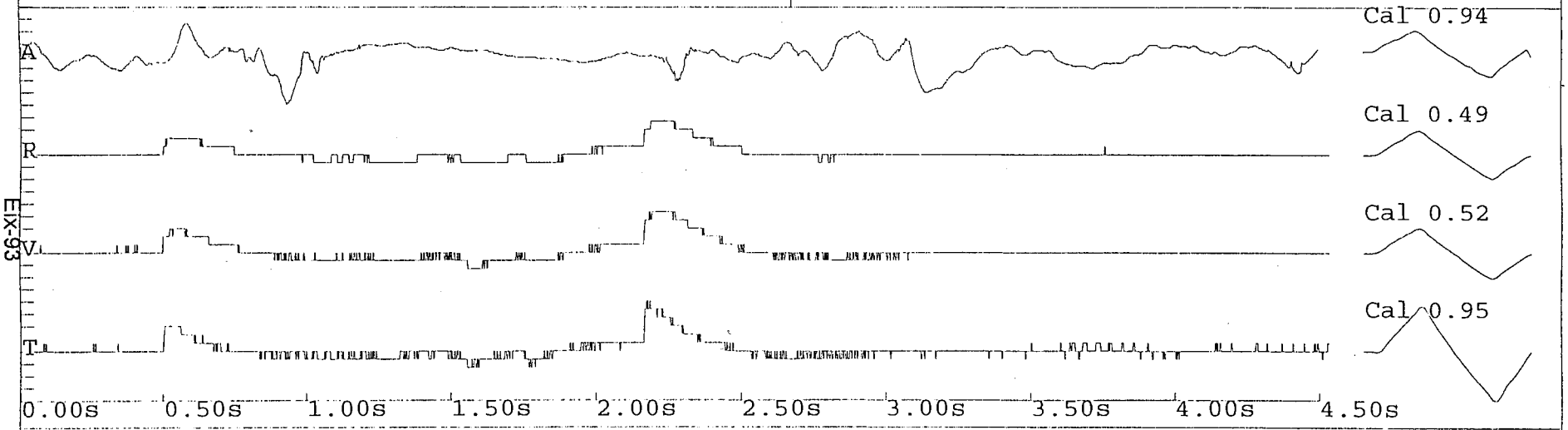


Fourier Analysis (Amplitude Spectrum)

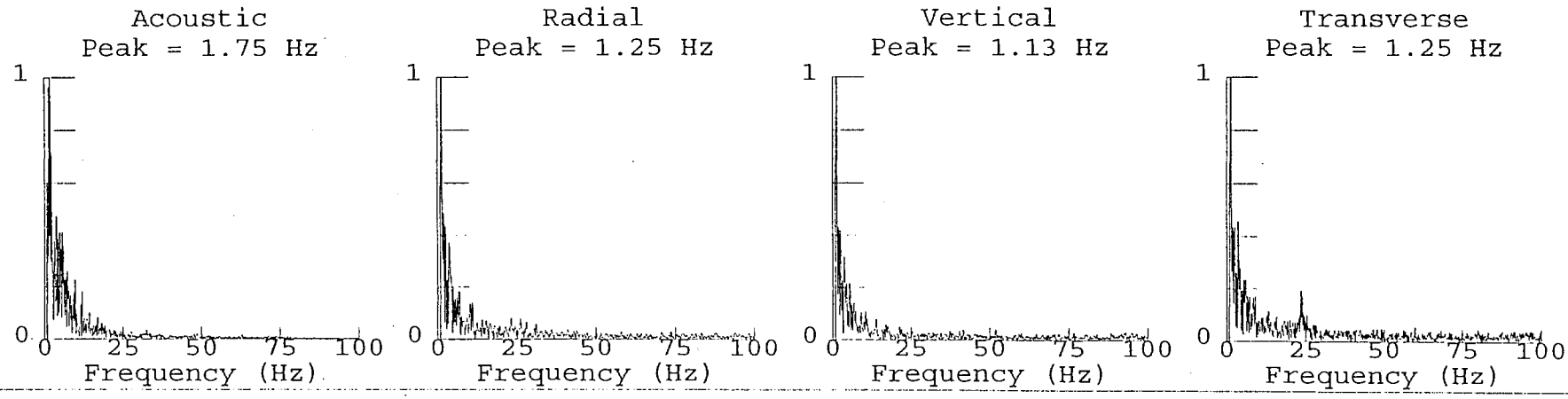


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 098 Date: 6/20/95 Time: 18:11
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 131 dB 3.6 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 1.8 Hz.	Acoustic: 0.70 Mb (0.17 Mb/div)
Vertical: 0.05 in/s 1.8 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.06 in/s 1.9 Hz.	Time Lines at: 0.50 sec intervals

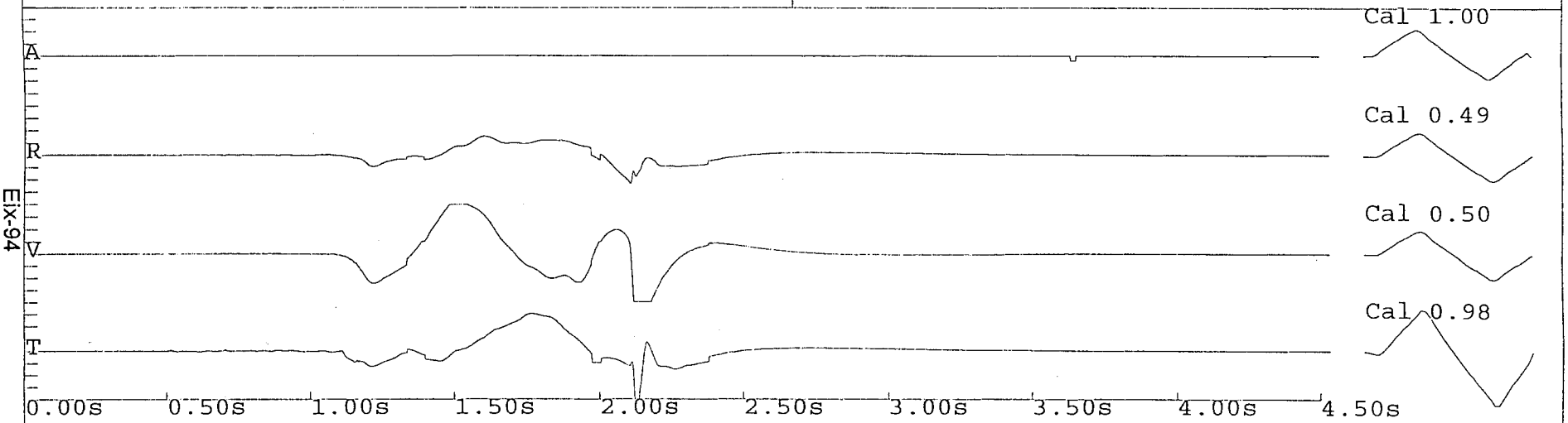


Fourier Analysis (Amplitude Spectrum)

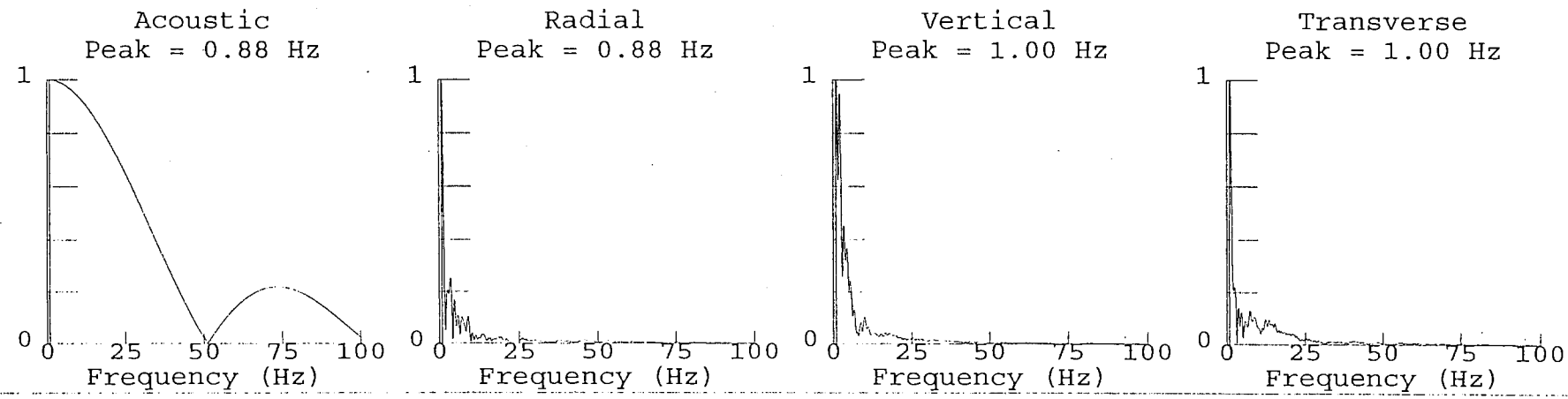


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 099 Date: 7/ 5/95 Time: 8:23
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 3.04 in/s 1.4 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 5.12 in/s 2.6 Hz.	Seis: 5.12 in/s (1.28 in/s/div)
Transverse: 5.12 in/s 2.6 Hz.	Time Lines at: 0.50 sec intervals

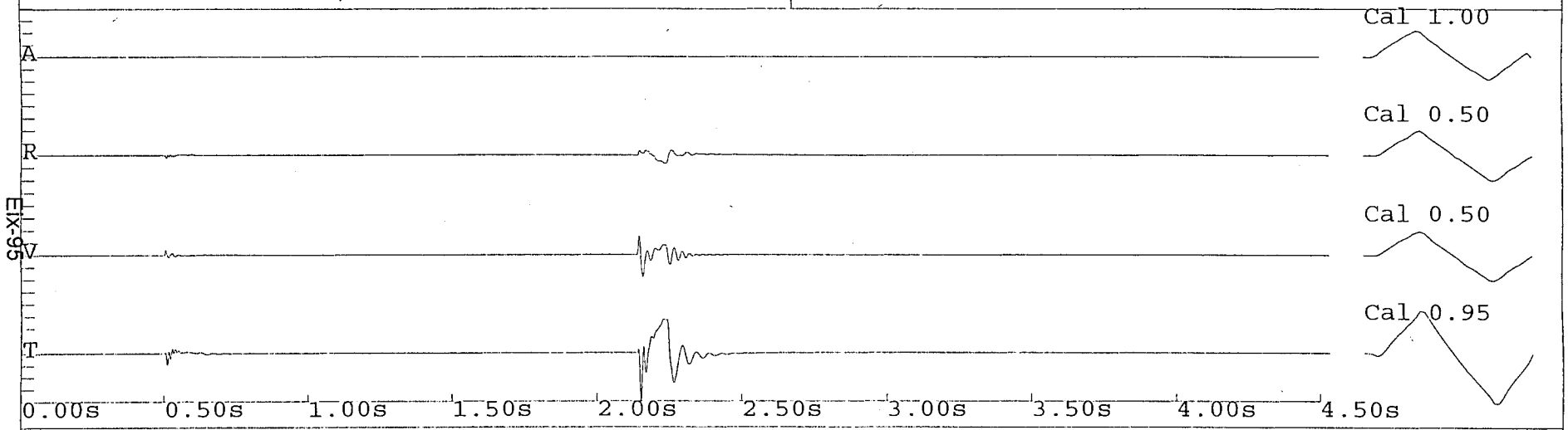


Fourier Analysis (Amplitude Spectrum)

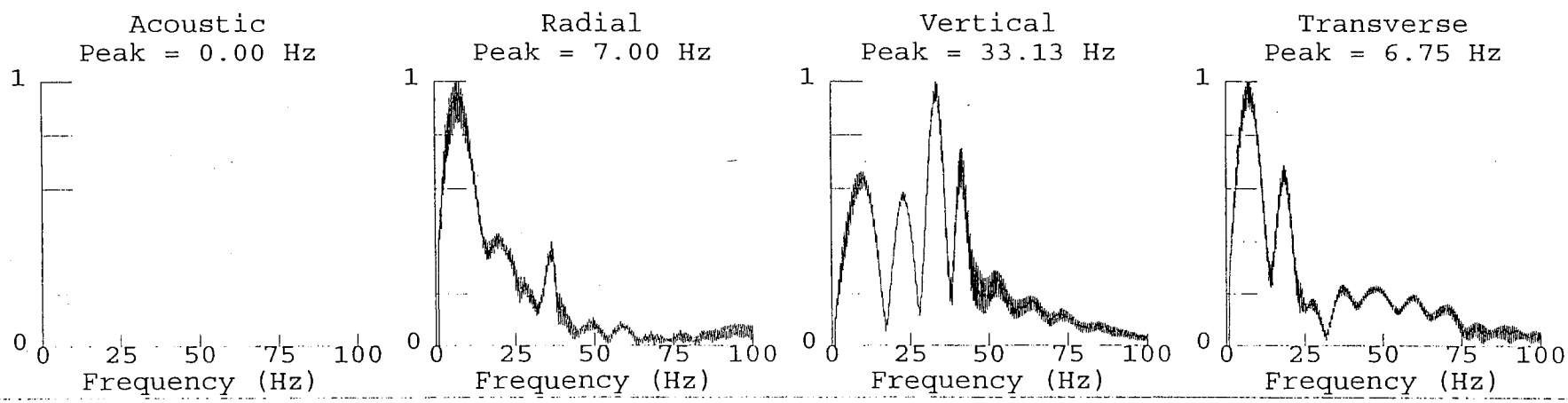


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 100 Date: 7/ 5/95 Time: 13:30
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.68 in/s 8.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 1.76 in/s 26.9 Hz.	Seis: 3.88 in/s (0.97 in/s/div)
Transverse: 3.88 in/s 36.5 Hz.	Time Lines at: 0.50 sec intervals



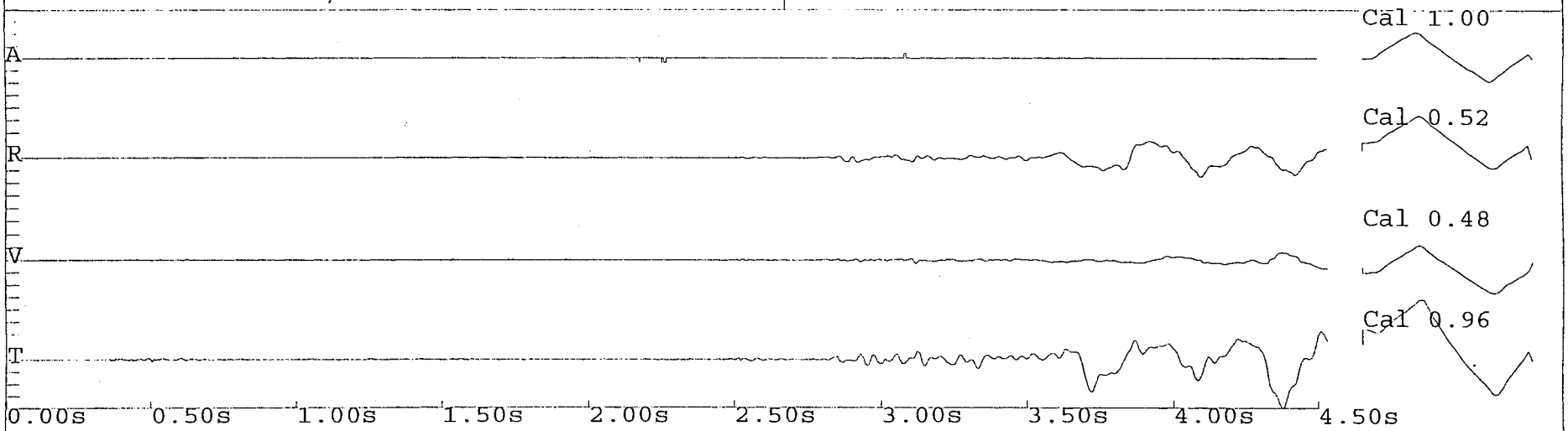
Fourier Analysis (Amplitude Spectrum)



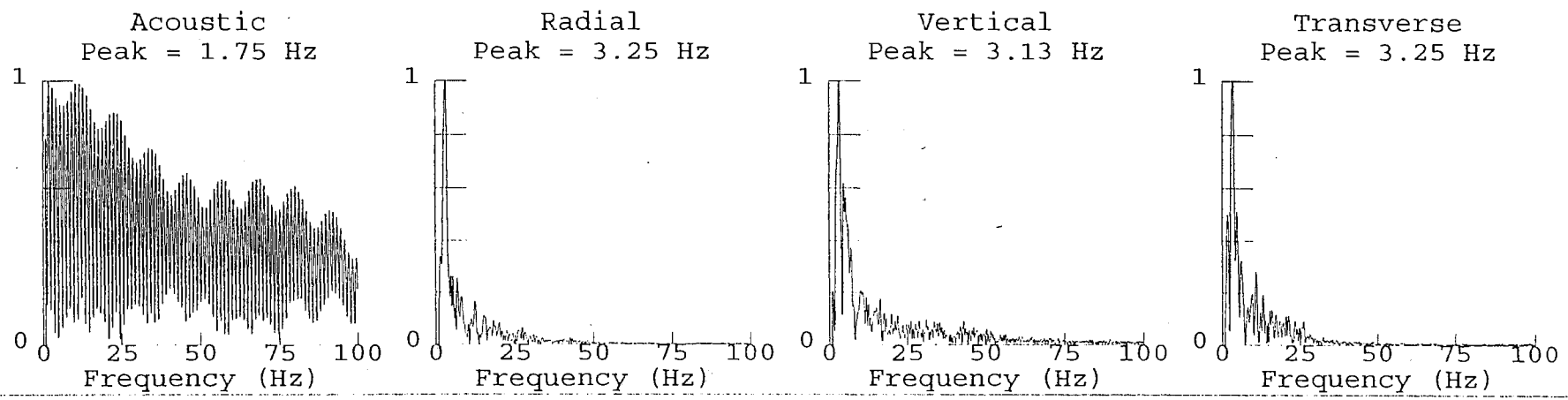
EIX-95

University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 101 Date: 7/ 5/95 Time: 13:30
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.30 in/s 3.2 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.14 in/s 4.7 Hz.	Seis: 0.81 in/s (0.2025 in/s/div)
Transverse: 0.81 in/s 3.9 Hz.	Time Lines at: 0.50 sec intervals

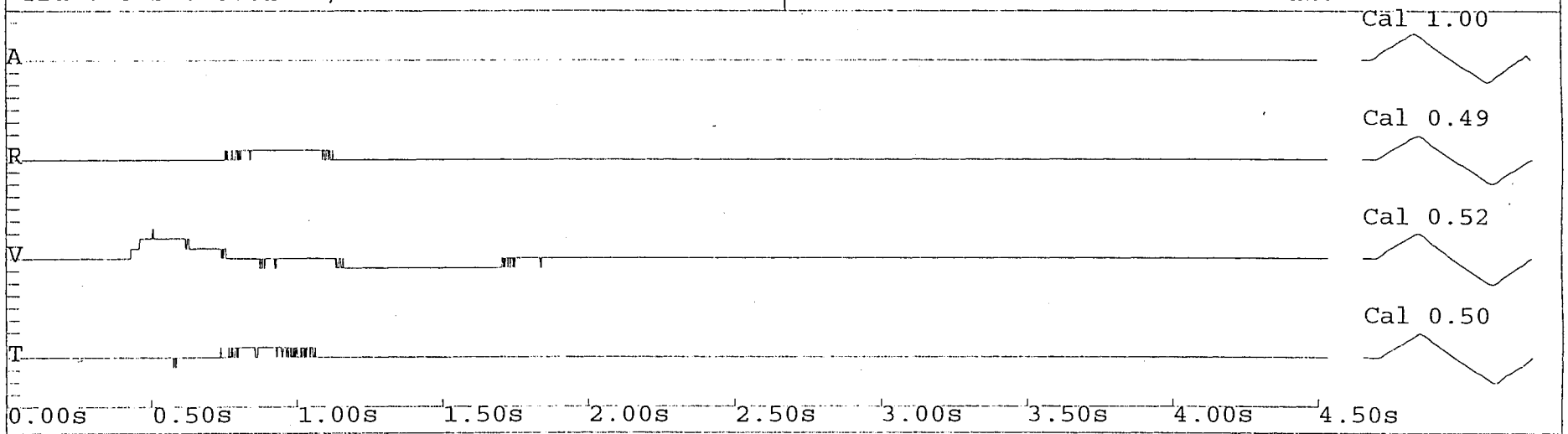


Fourier Analysis (Amplitude Spectrum)

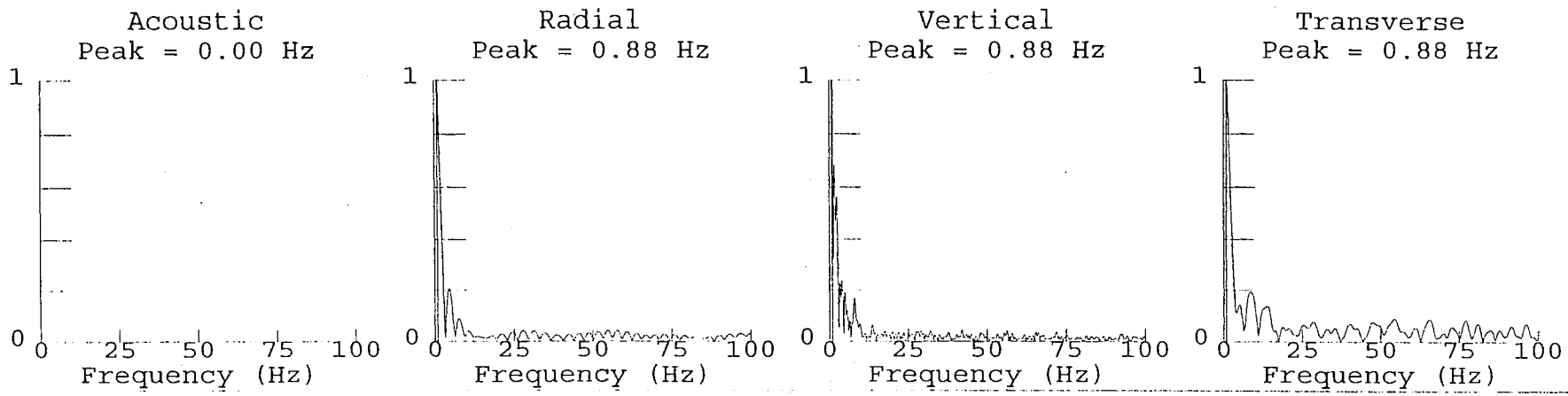


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 17
Location: Indian Sleeping Chamber
Non-blast Trigger
Event: 102 Date: 7/18/95 Time: 16:50
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 17

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

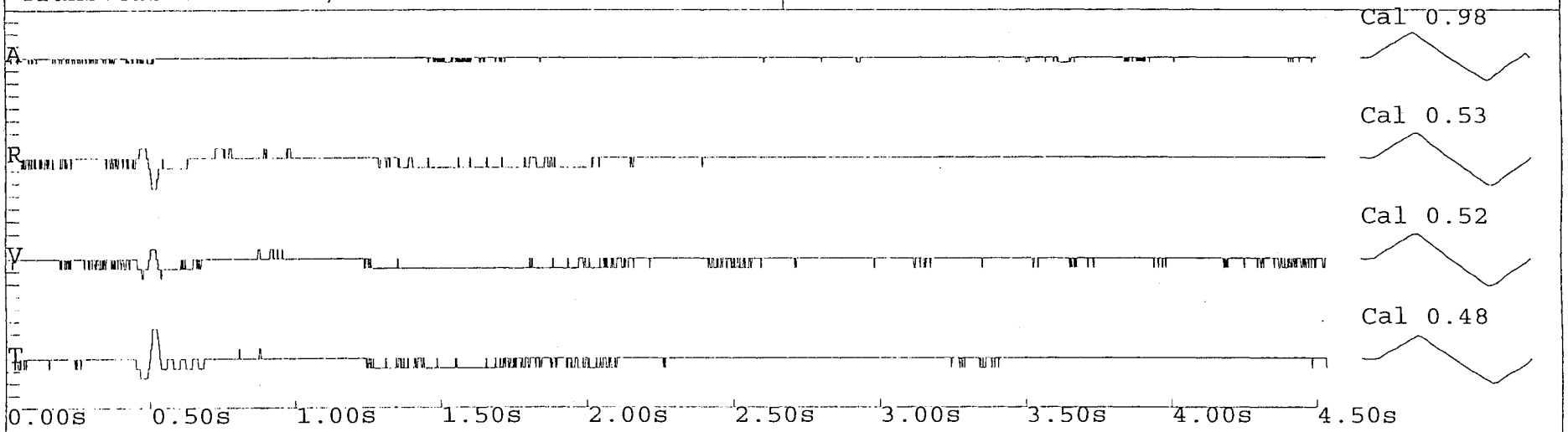


Fourier Analysis (Amplitude Spectrum)

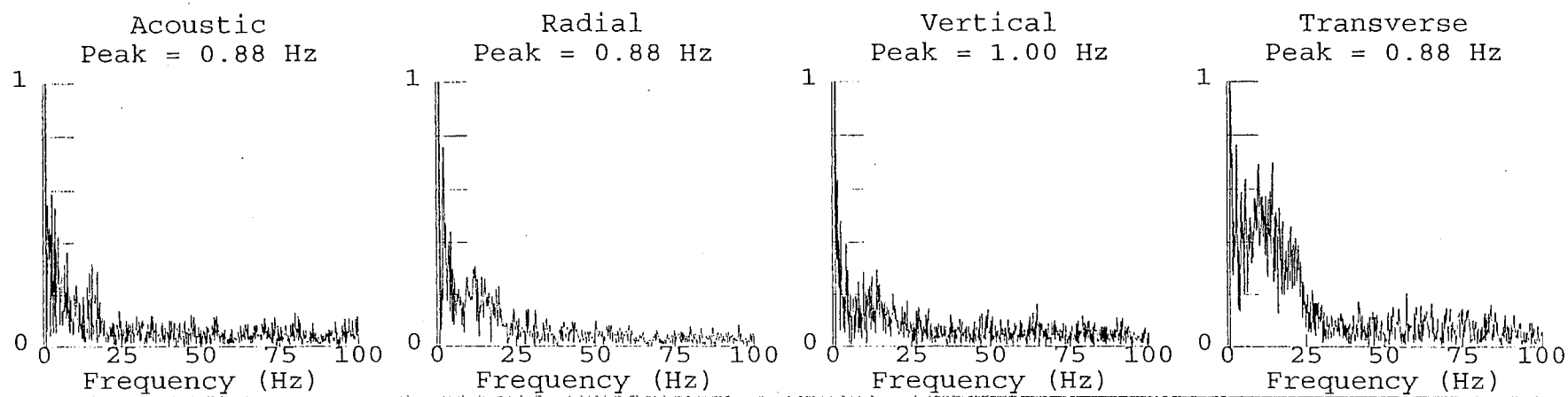


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 010 Date: 6/19/95 Time: 13:40
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 11.9 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

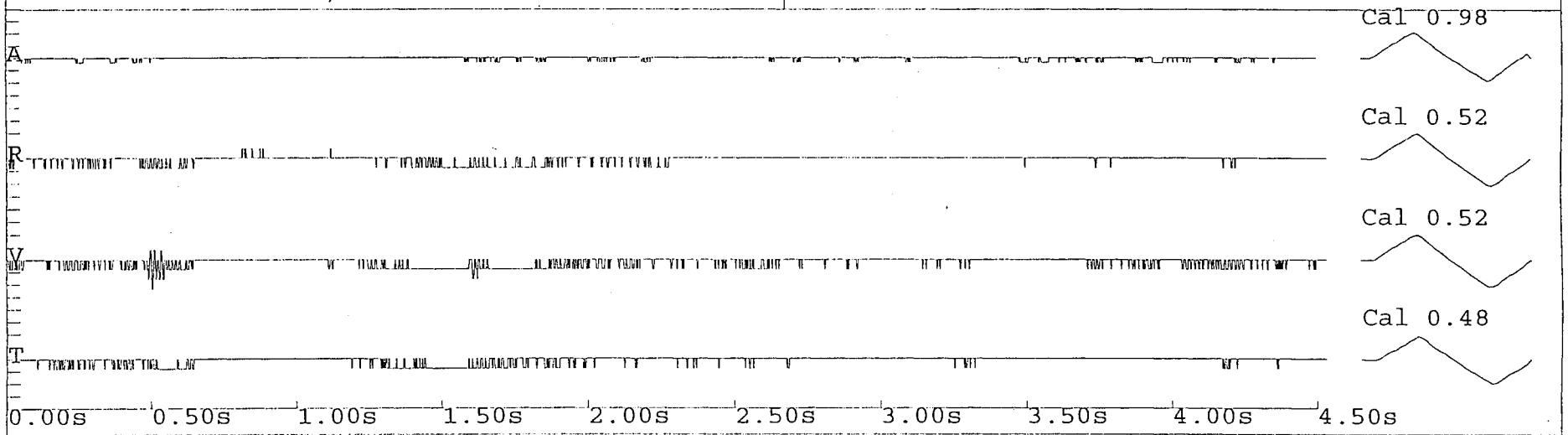


Fourier Analysis (Amplitude Spectrum)

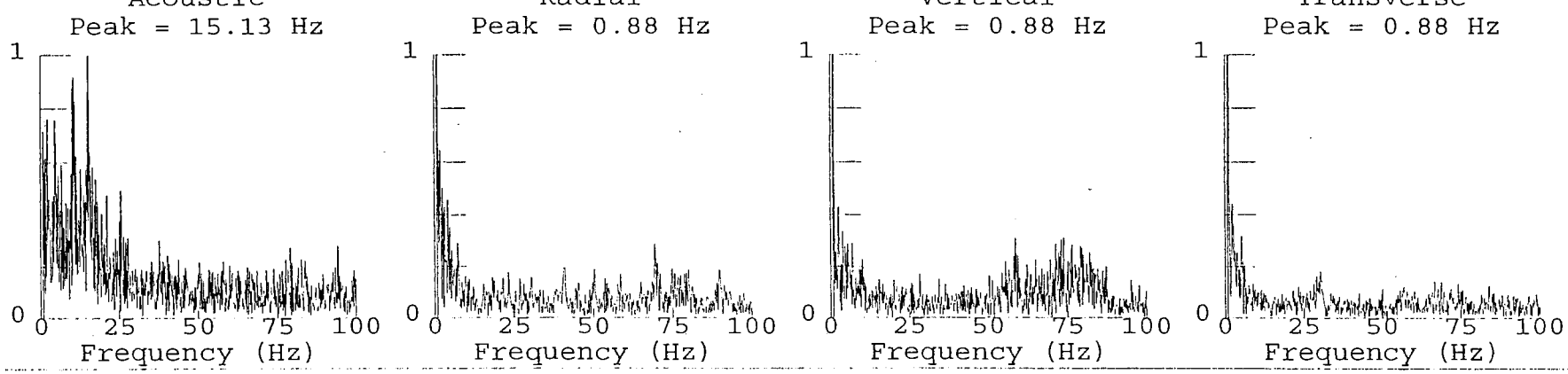


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 011 Date: 6/29/95 Time: 11:57
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



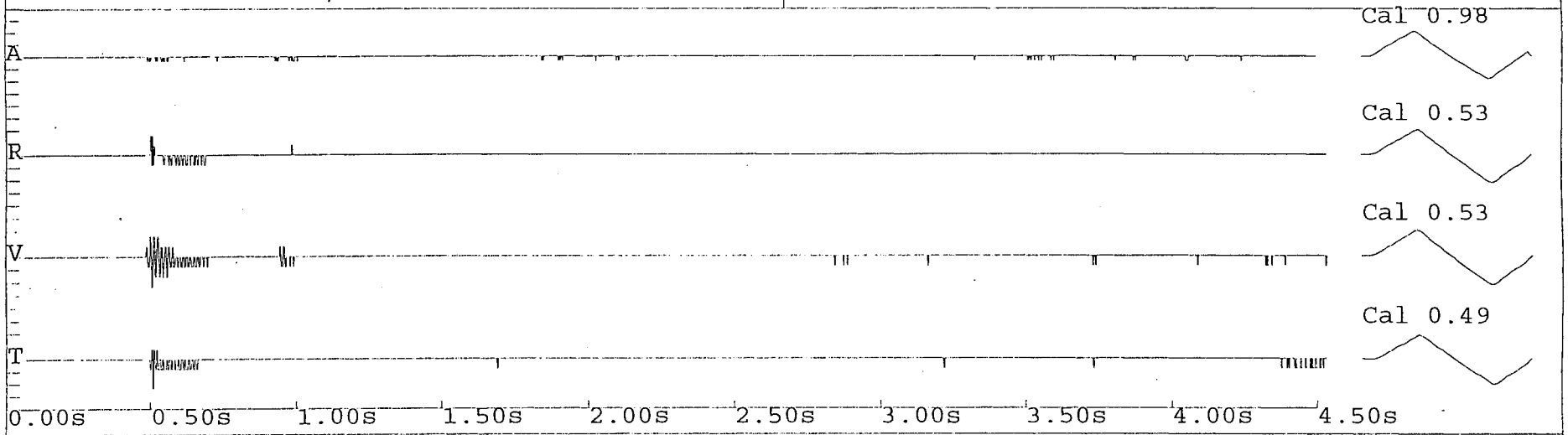
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 012 Date: 6/29/95 Time: 11:57
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

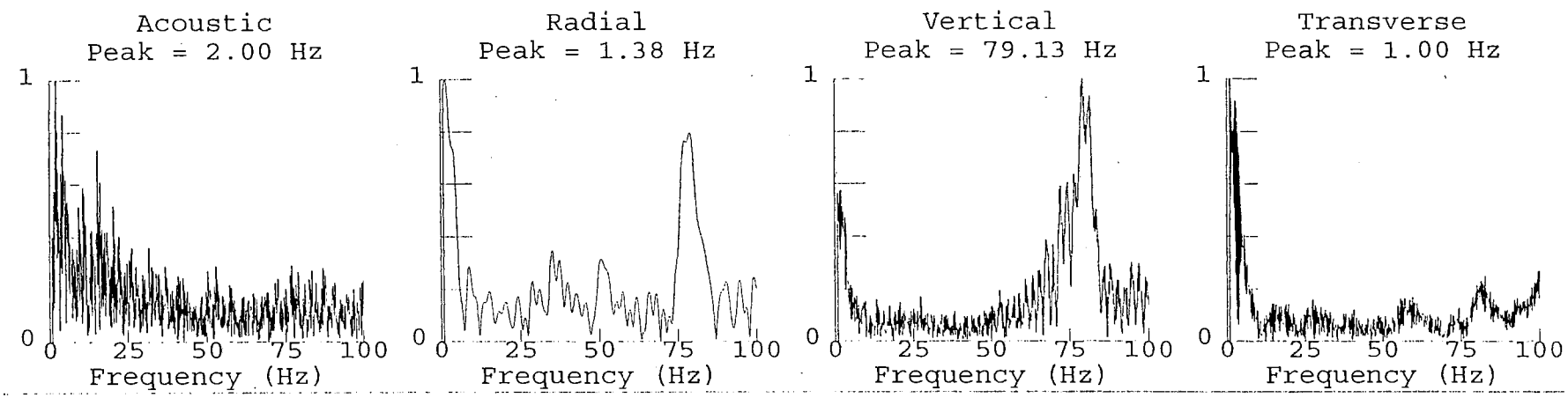
Acoustic: 100 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.03 in/s 0.0 Hz.
Transverse: 0.03 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

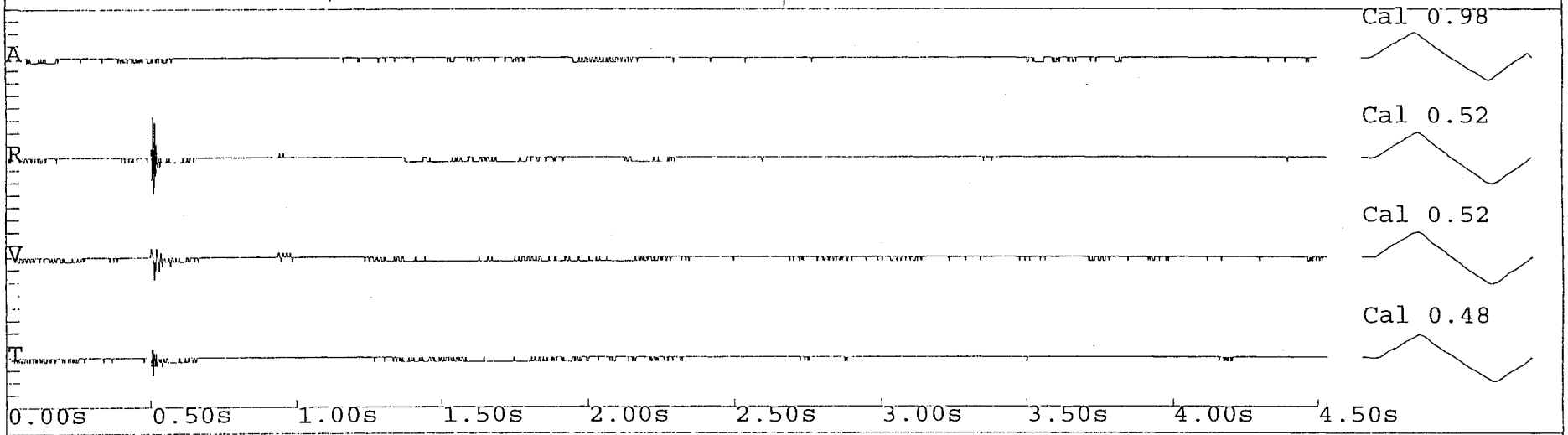


Fourier Analysis (Amplitude Spectrum)

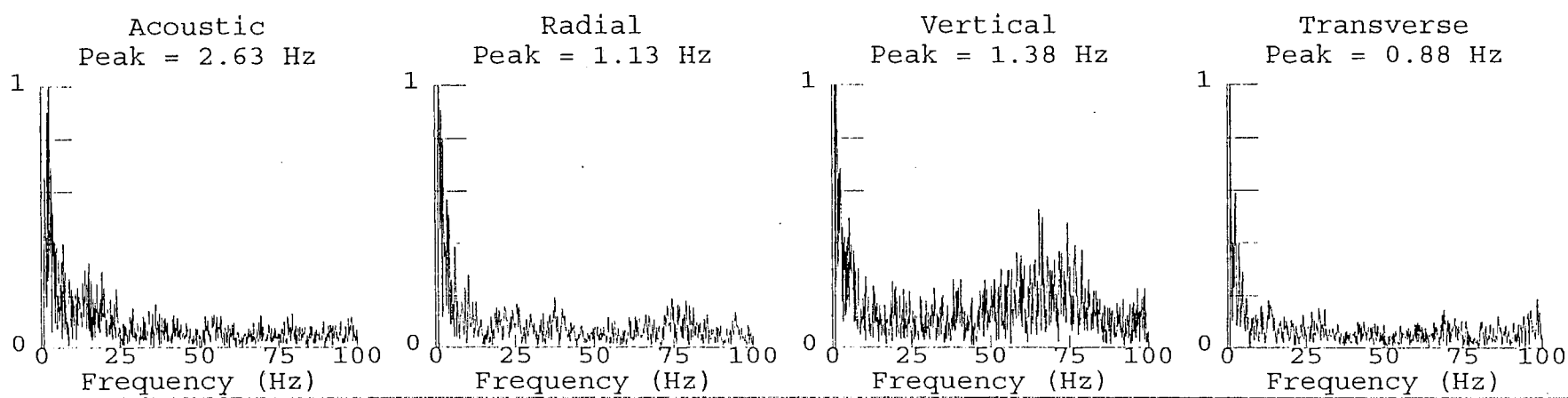


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 013 Date: 6/29/95 Time: 12:14
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.11 in/s 170.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 56.8 Hz.	Seis: 0.11 in/s (0.0275 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



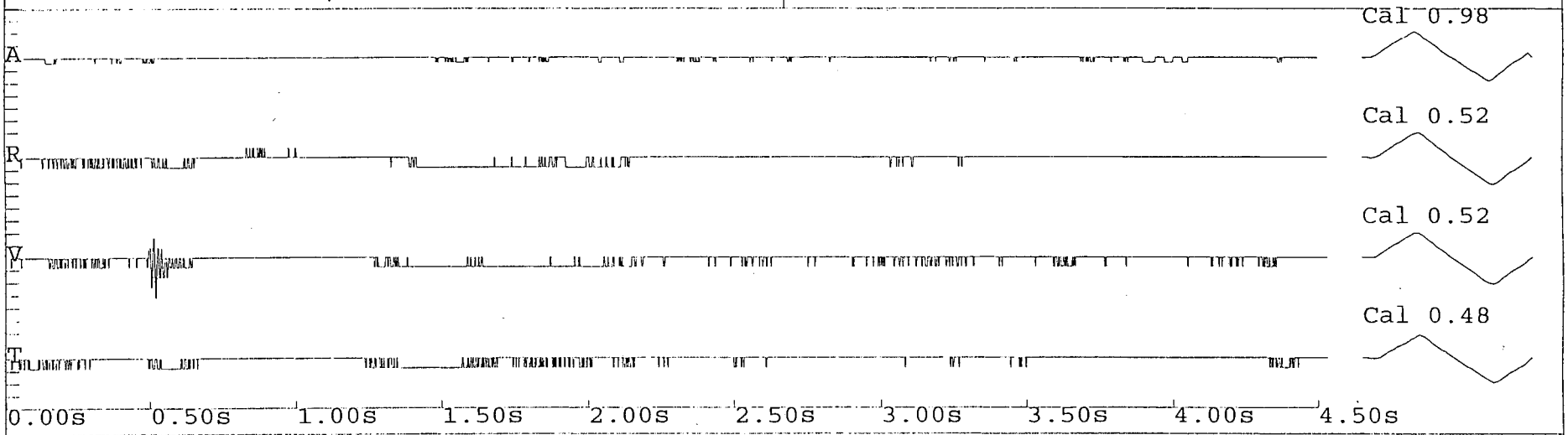
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 014 Date: 6/29/95 Time: 12:35
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

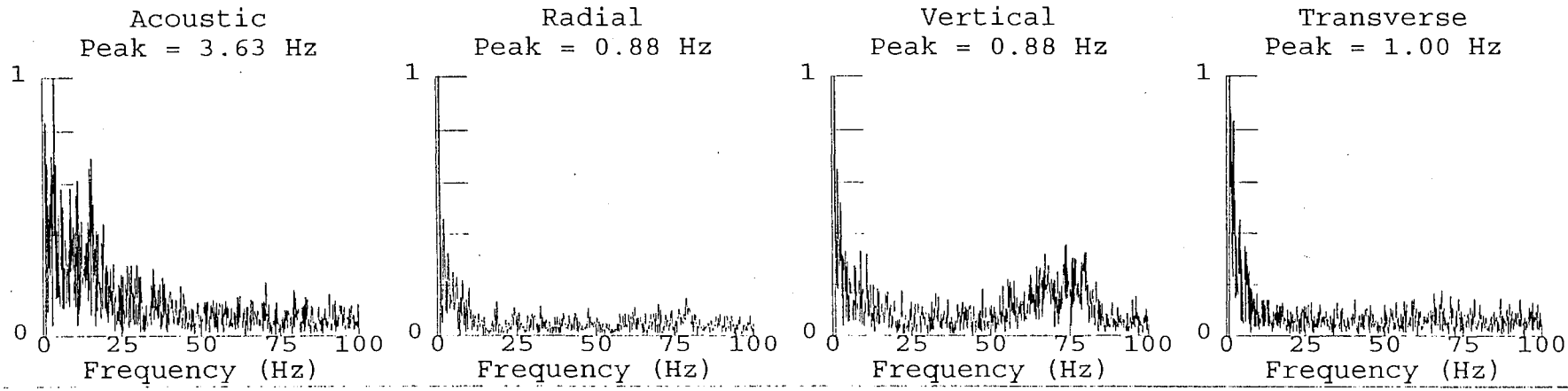
Acoustic: 100 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.04 in/s 73.1 Hz.
Transverse: 0.01 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

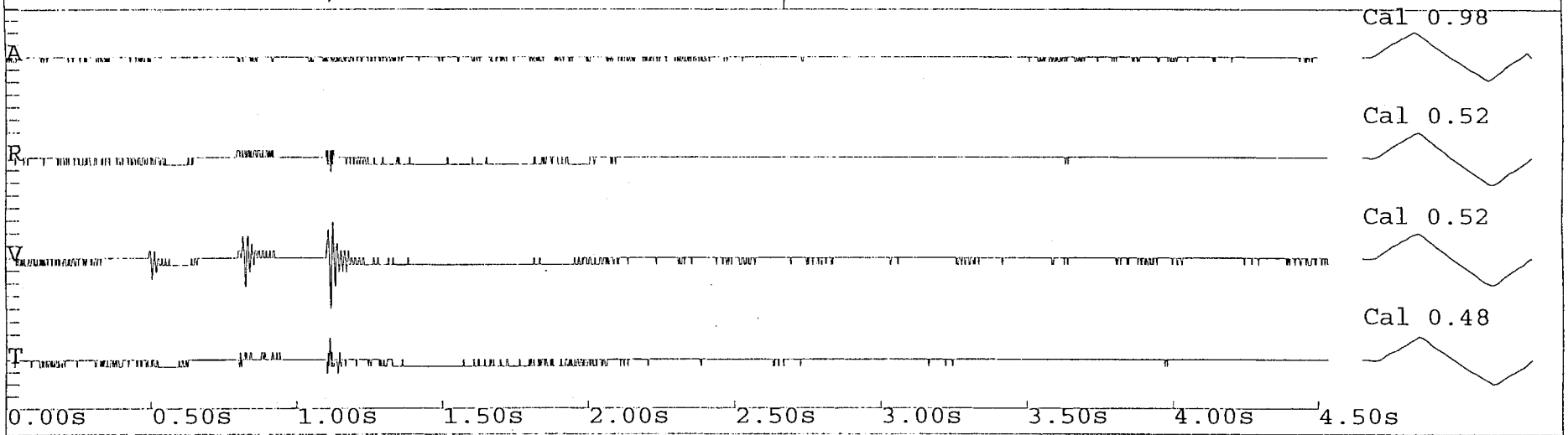


Fourier Analysis (Amplitude Spectrum)

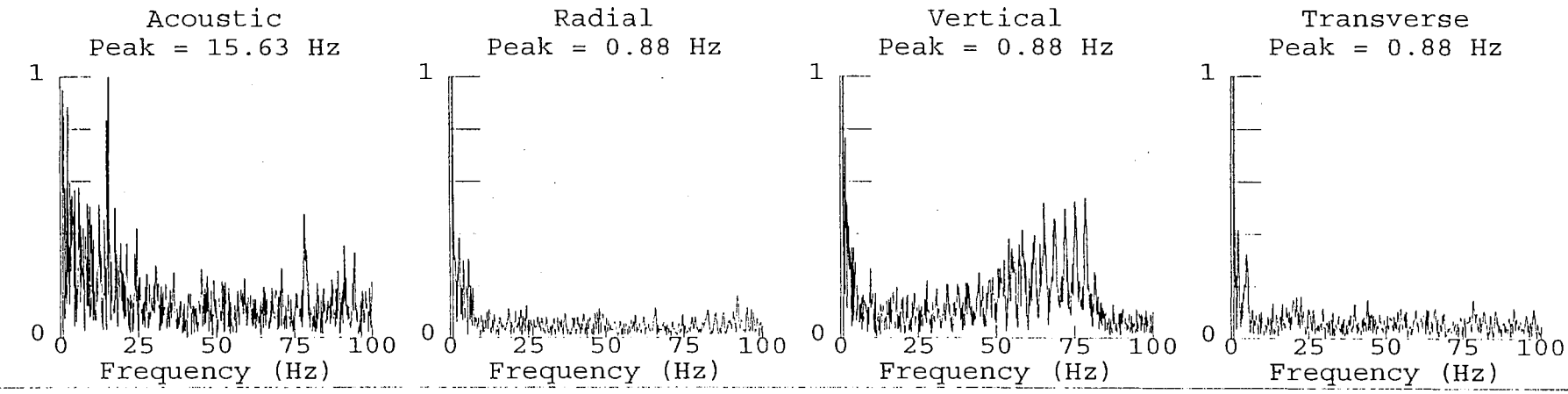


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 015 Date: 6/29/95 Time: 13:07
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.07 in/s 64.0 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



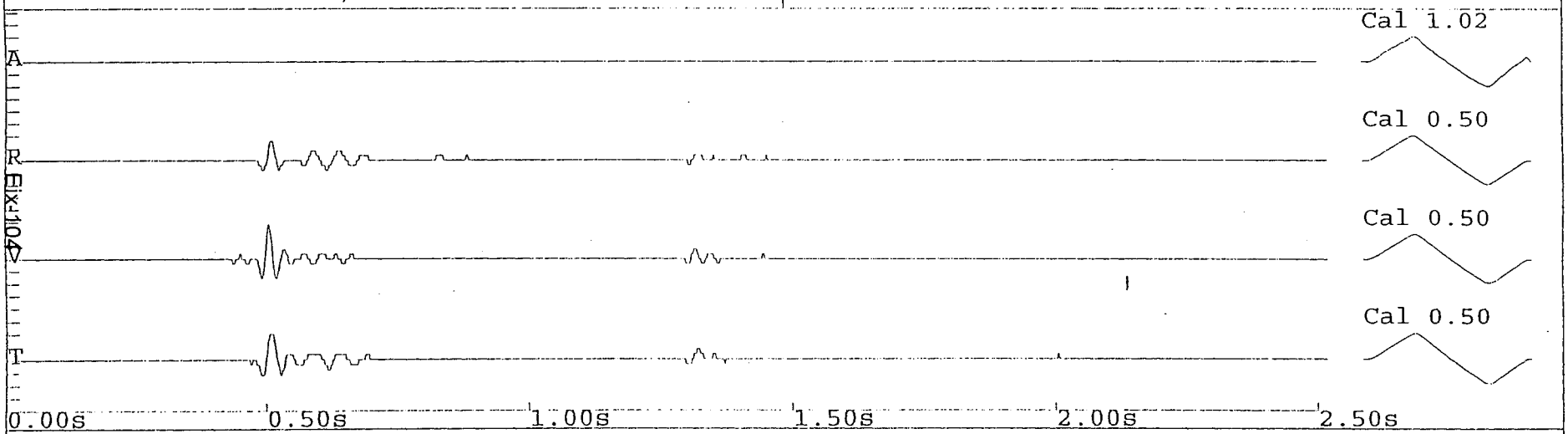
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 492
Location: Jacob's Room
Non-blast triggers
Event: 028 Date: 7/ 1/95 Time: 18:04
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 492

Amplitudes and Frequencies

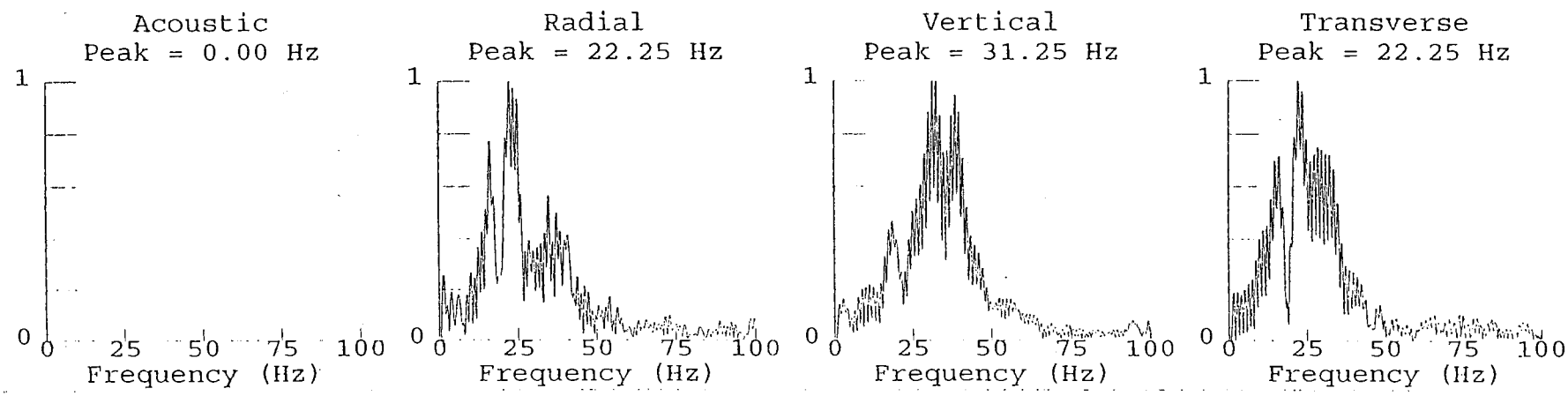
Acoustic: 0 dB 0.0 Hz.
Radial: 0.02 in/s 36.5 Hz.
Vertical: 0.035 in/s 39.3 Hz.
Transverse: 0.025 in/s 28.4 Hz.

Graph Information

Duration: 0.000 sec To: 2.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



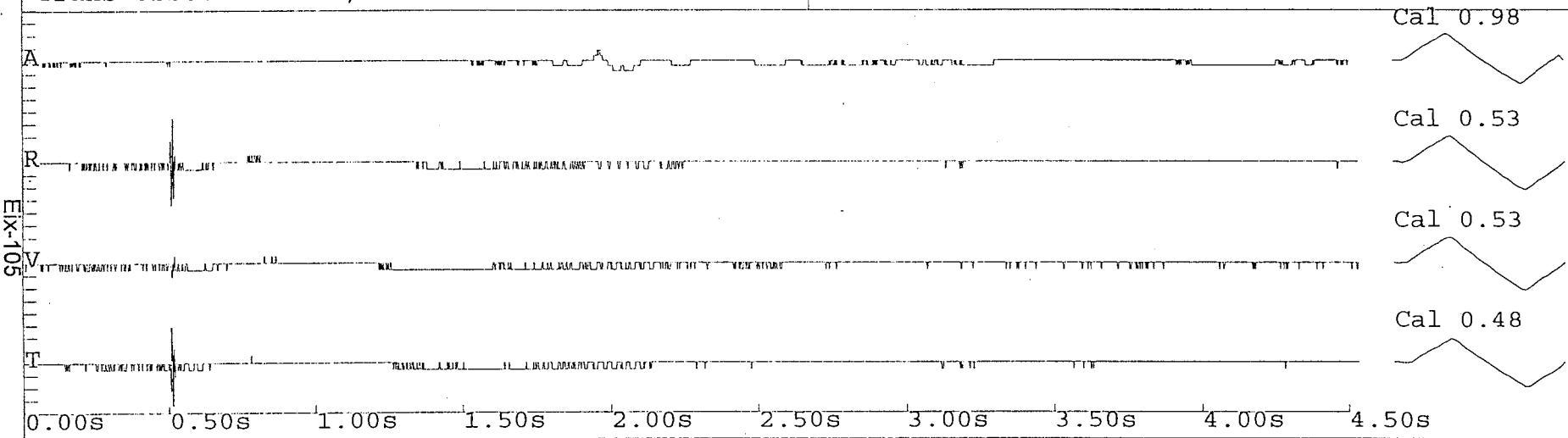
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 018 Date: 7/ 4/95 Time: 12:23
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

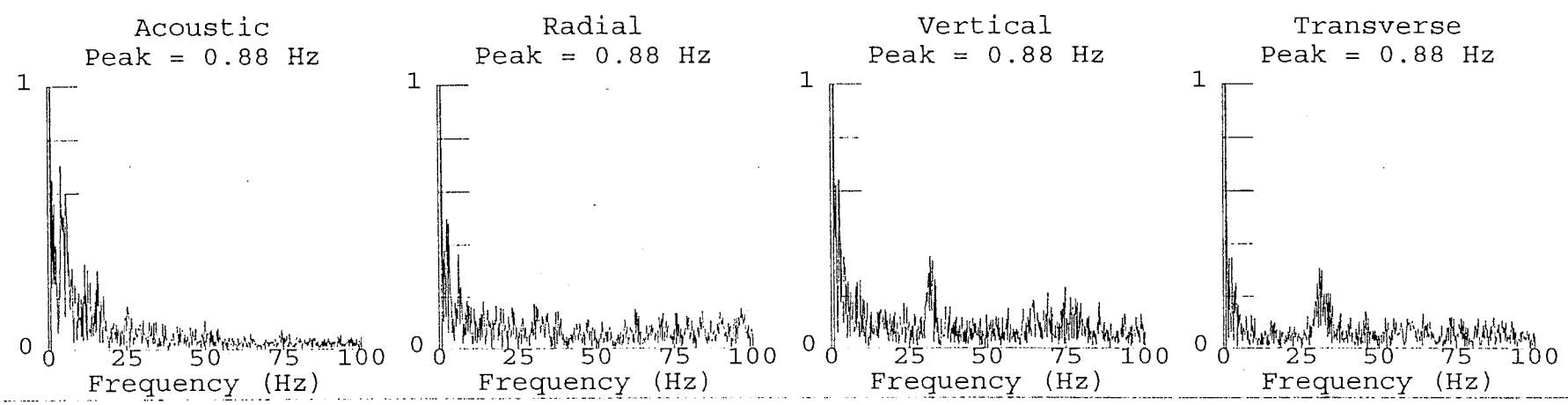
Acoustic: 106 dB 0.0 Hz.
Radial: 0.07 in/s 128.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.06 in/s 170.6 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.07 in/s (0.0175 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



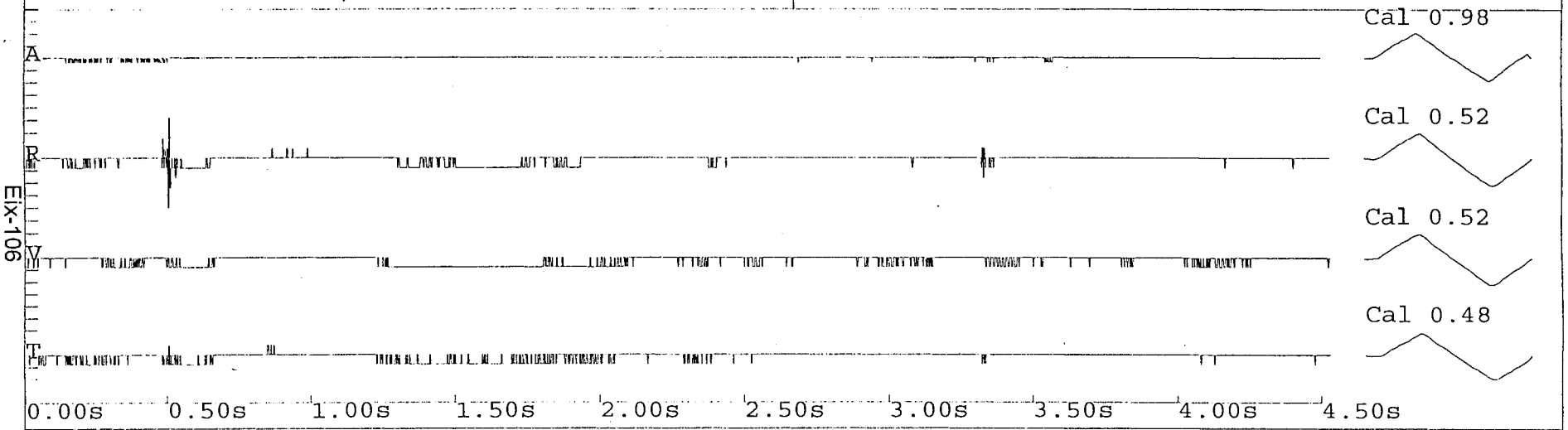
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 019 Date: 7/ 4/95 Time: 12:53
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

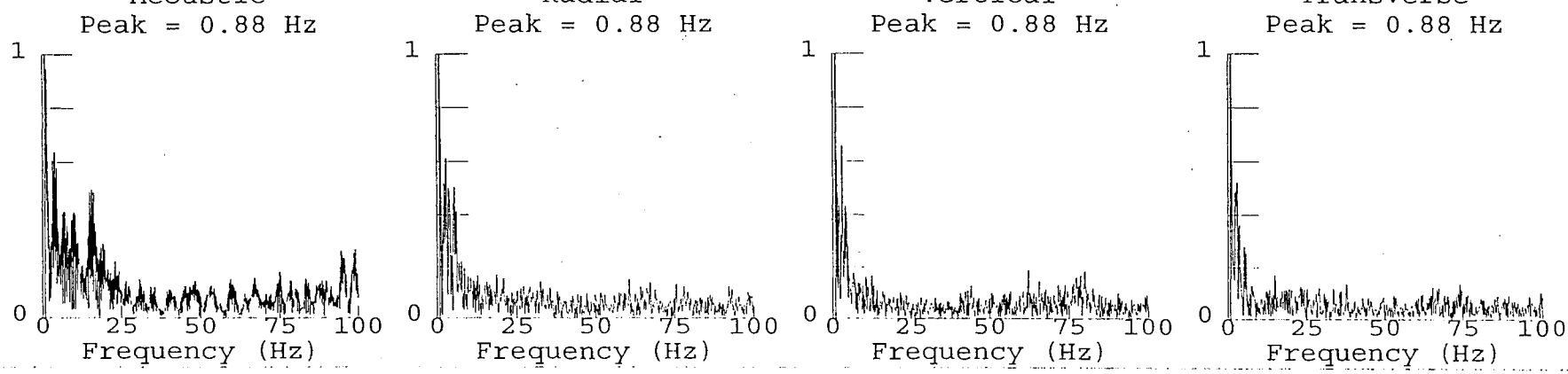
Acoustic: 100 dB 0.0 Hz.
Radial: 0.05 in/s 128.0 Hz.
Vertical: 0.01 in/s 0.0 Hz.
Transverse: 0.01 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

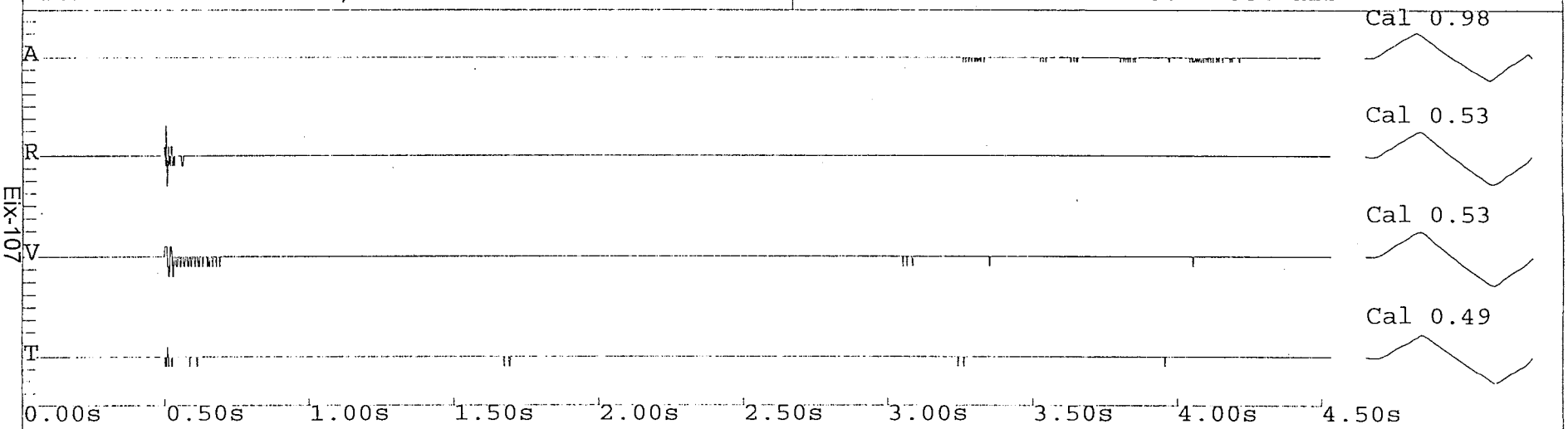


Fourier Analysis (Amplitude Spectrum)

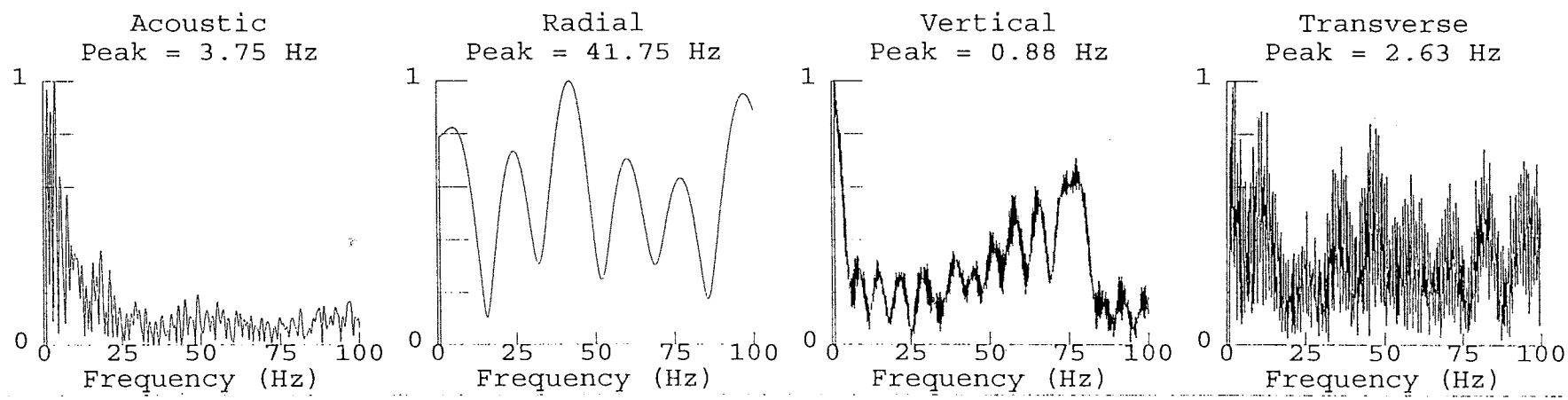


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 020 Date: 7/ 4/95 Time: 12:53
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

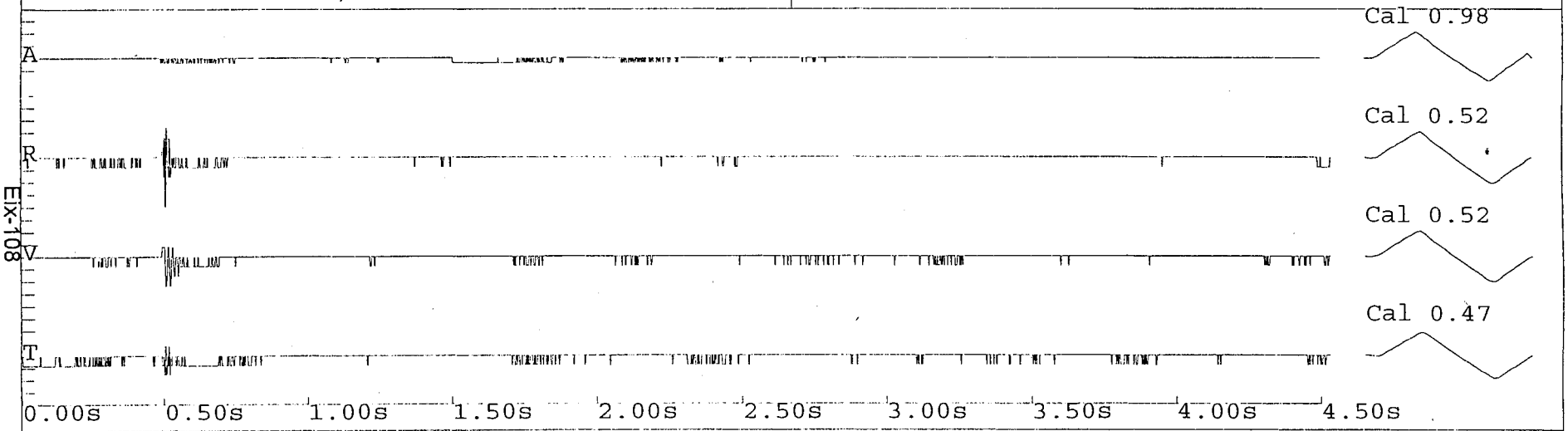


Fourier Analysis (Amplitude Spectrum)

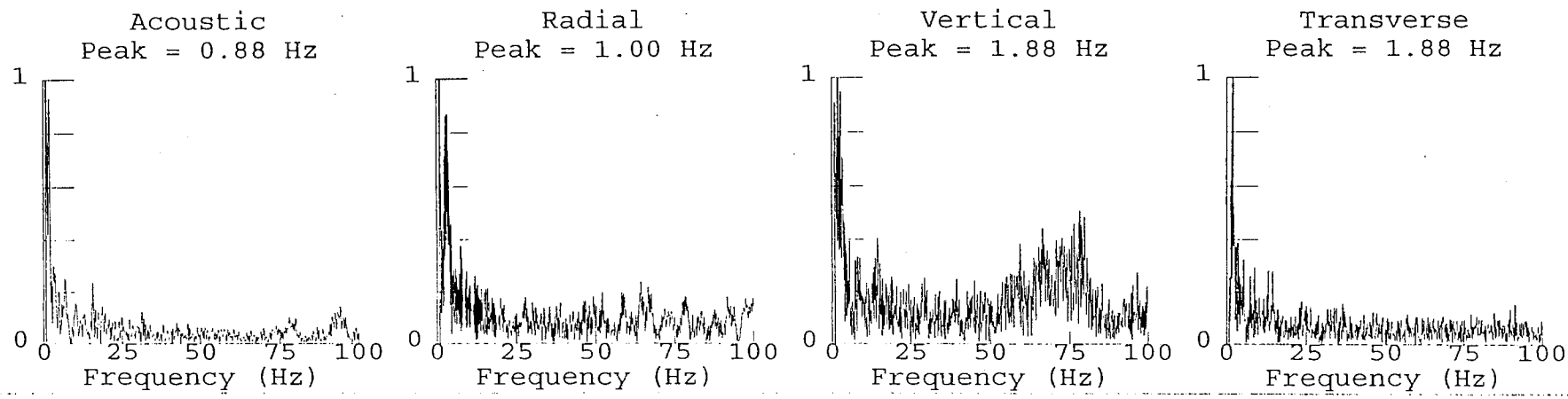


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 021 Date: 7/ 4/95 Time: 12:53
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 128.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



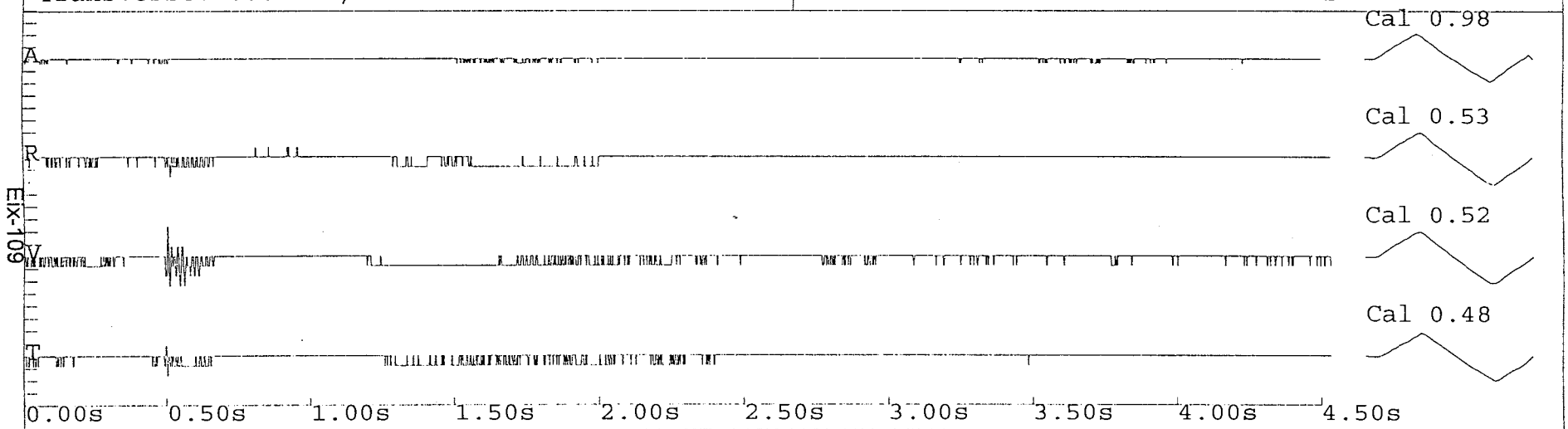
Fourier Analysis (Amplitude Spectrum)



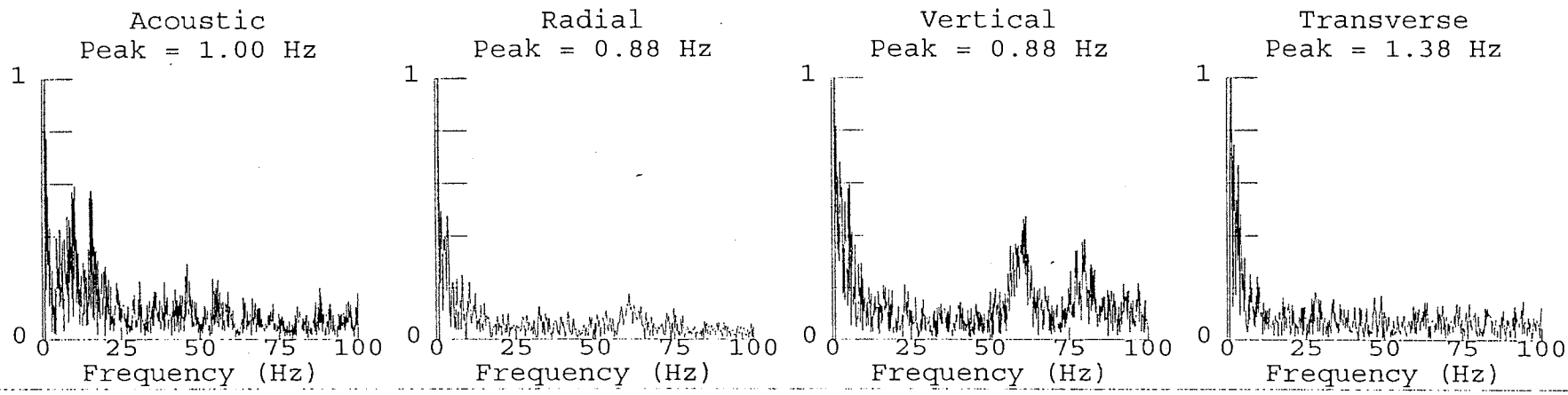
Ex-108

University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 022 Date: 7/ 4/95 Time: 14:34
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



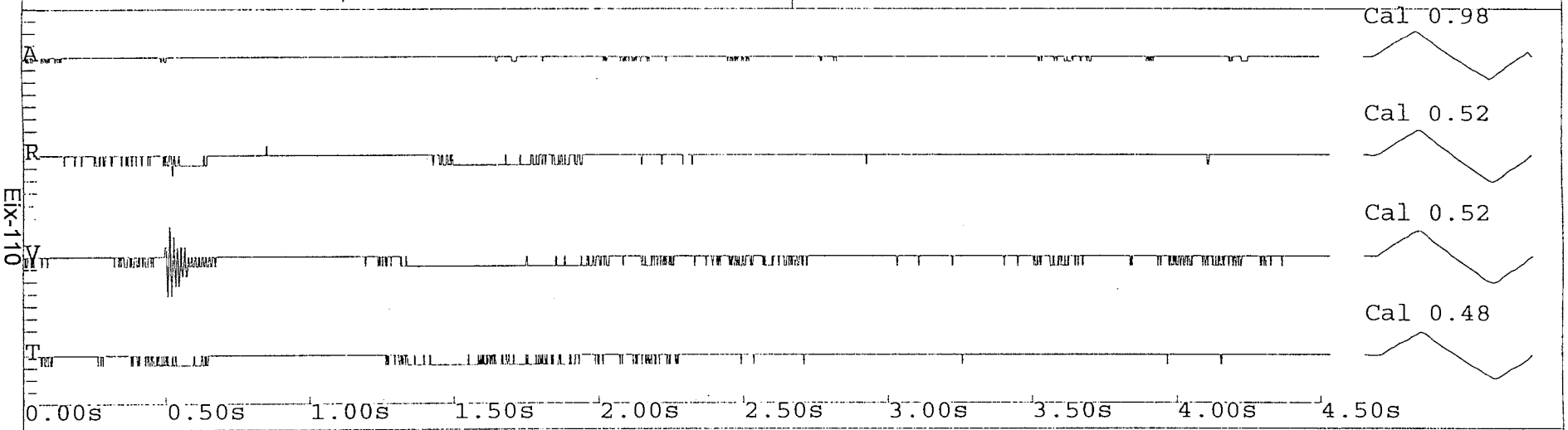
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 023 Date: 7/ 5/95 Time: 10:38
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

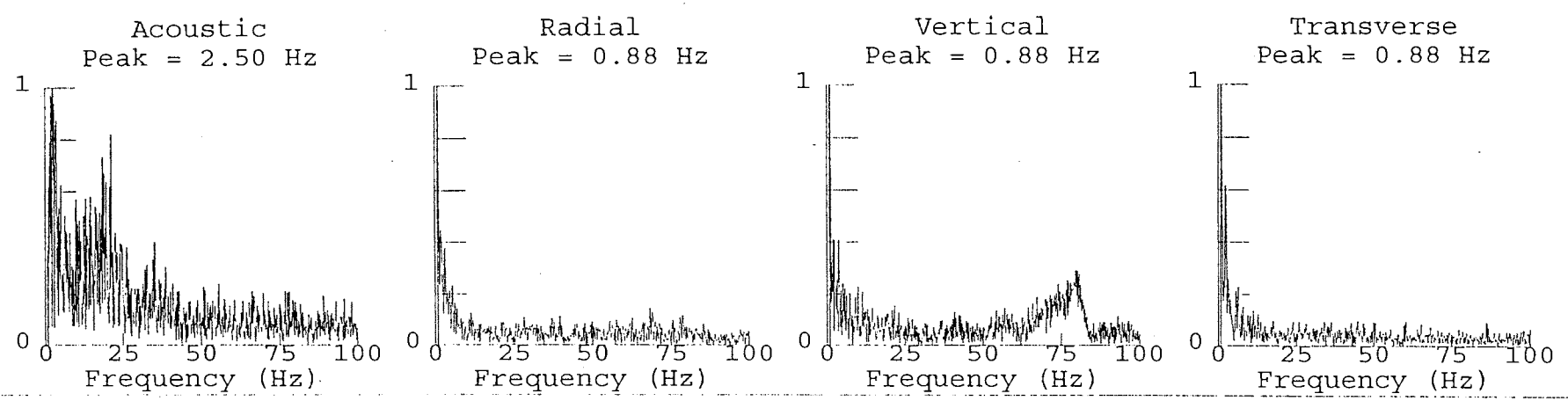
Acoustic: 100 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.04 in/s 73.1 Hz.
Transverse: 0.01 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

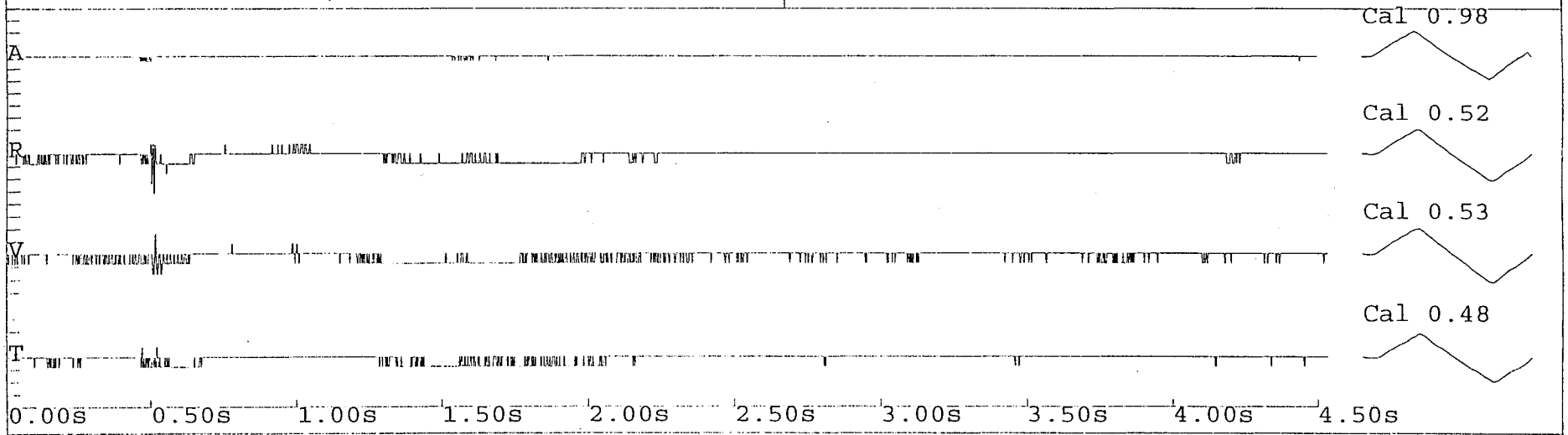


Fourier Analysis (Amplitude Spectrum)

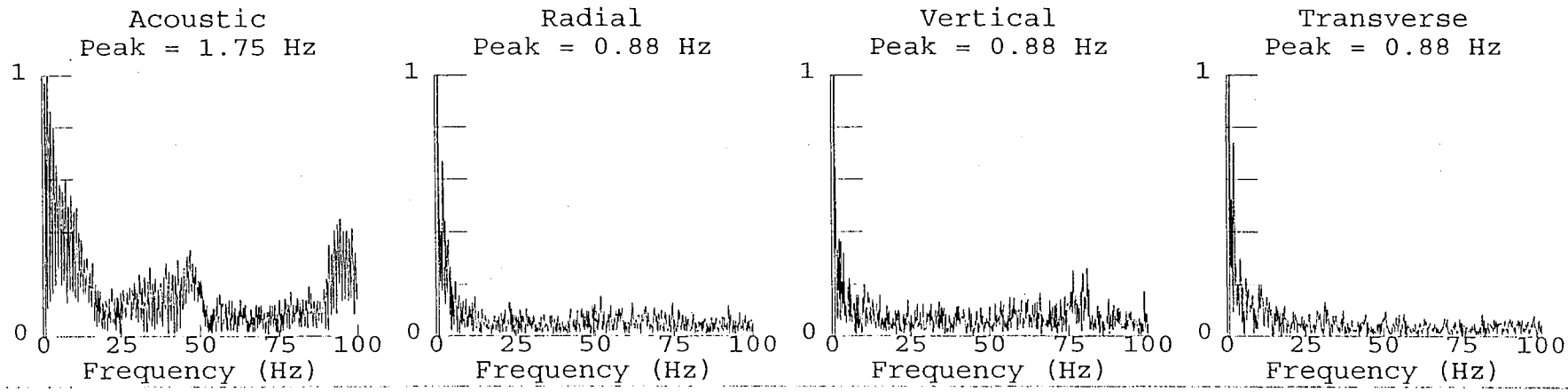


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 024 Date: 7/ 5/95 Time: 12:55
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 170.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

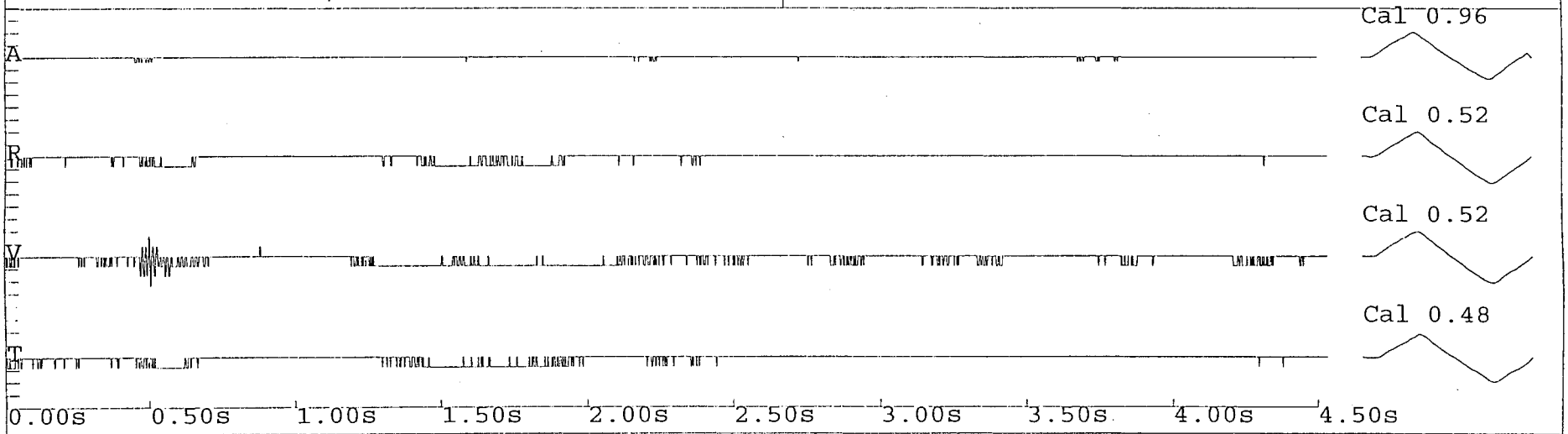


Fourier Analysis (Amplitude Spectrum)

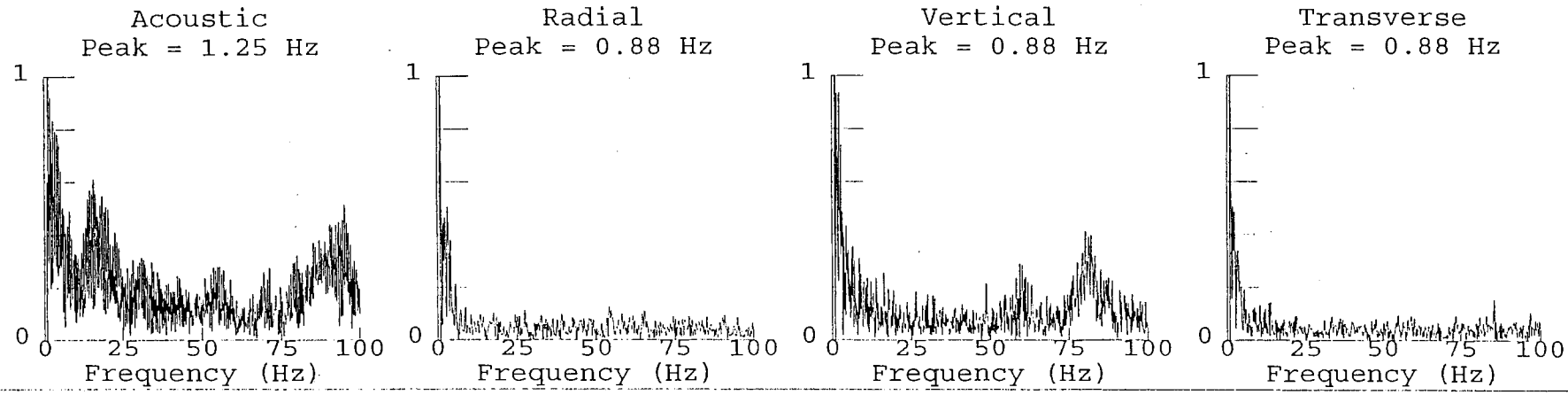


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 026 Date: 7/ 7/95 Time: 10:34
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

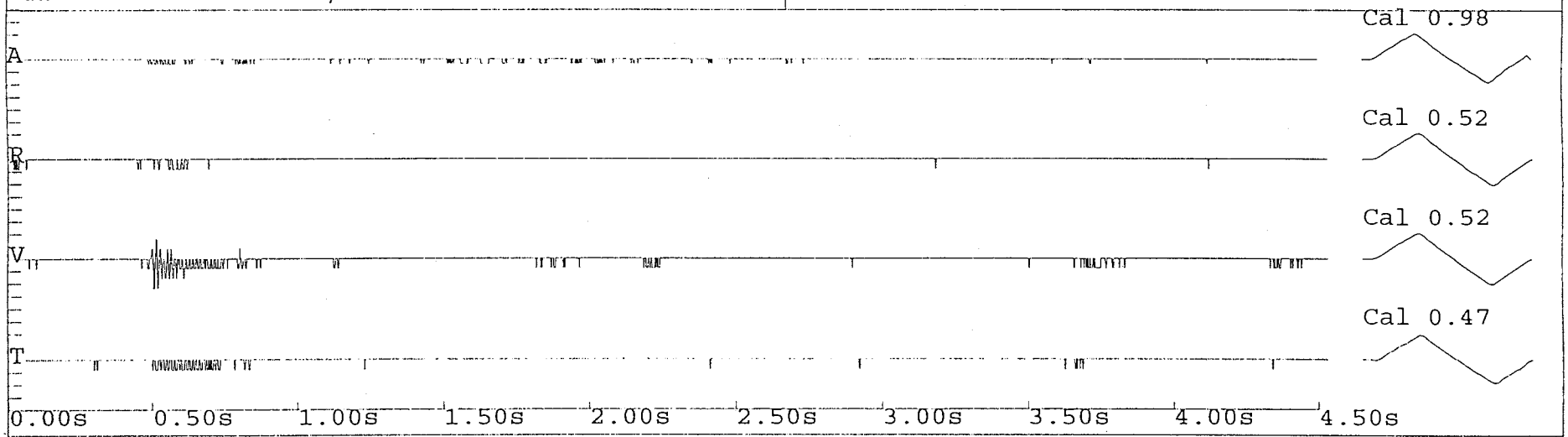


Fourier Analysis (Amplitude Spectrum)

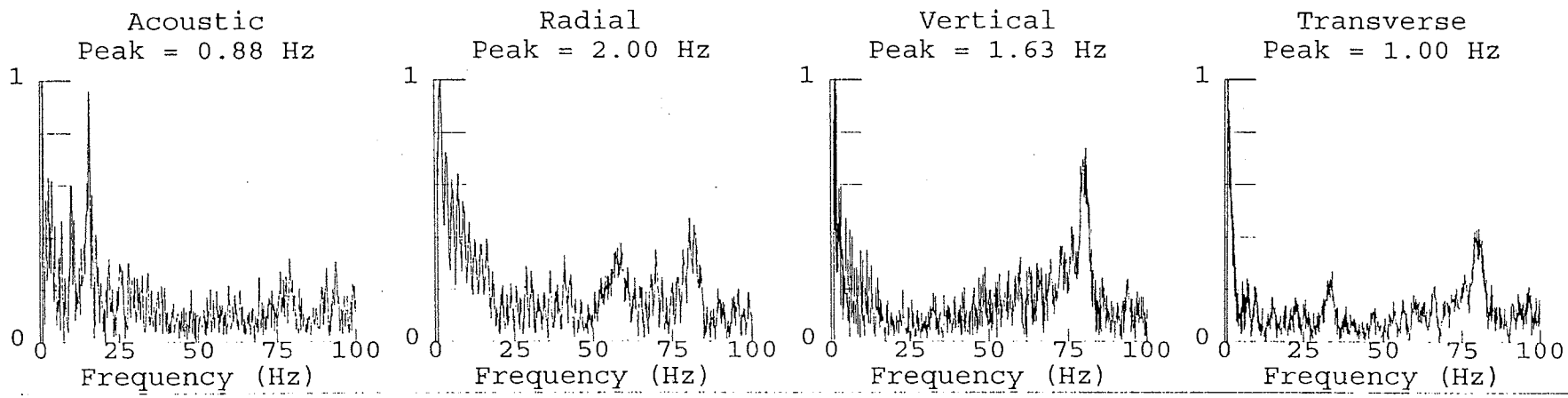


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 027 Date: 7/ 7/95 Time: 10:34
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

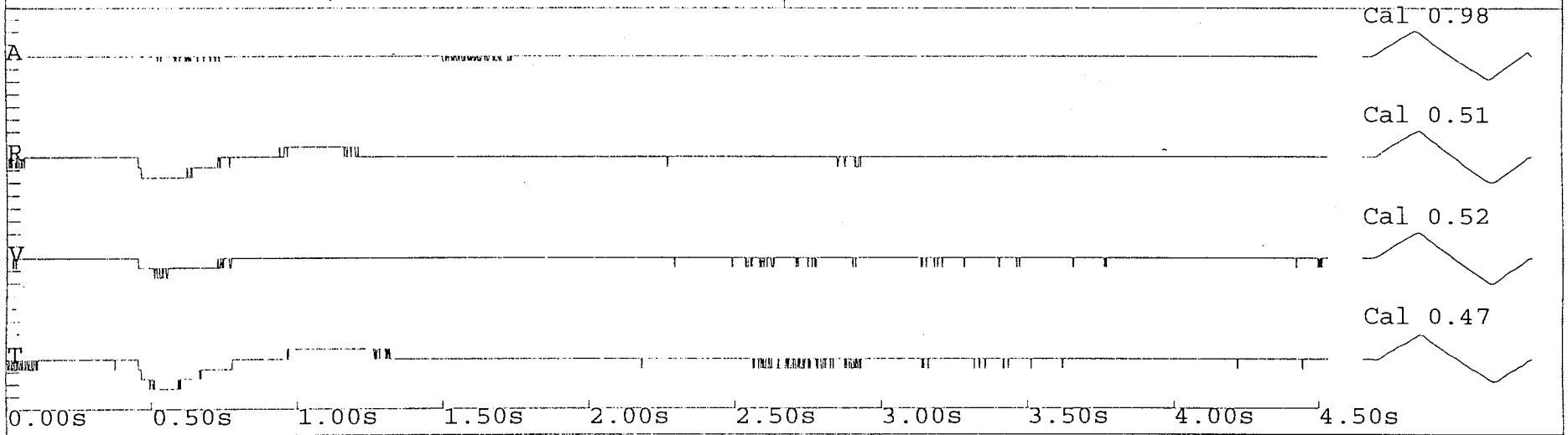


Fourier Analysis (Amplitude Spectrum)

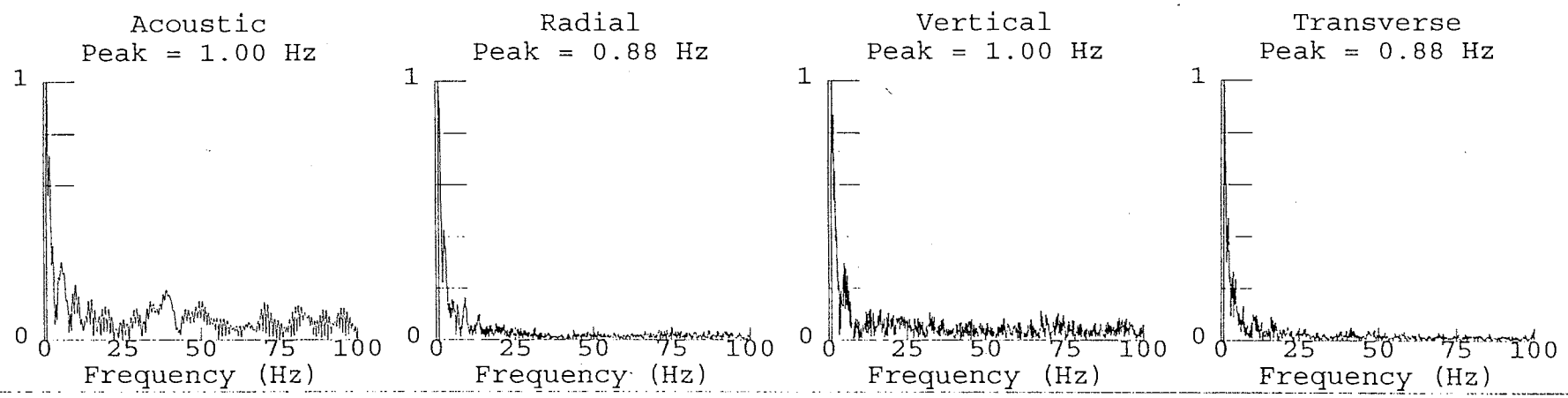


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 029 Date: 7/ 7/95 Time: 17:52
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

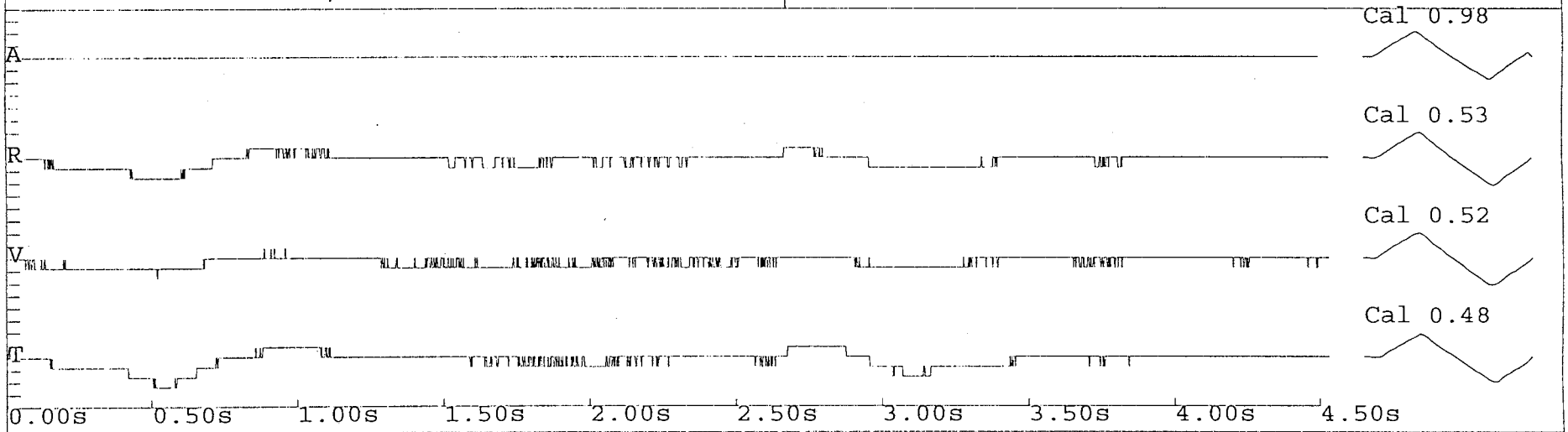


Fourier Analysis (Amplitude Spectrum)

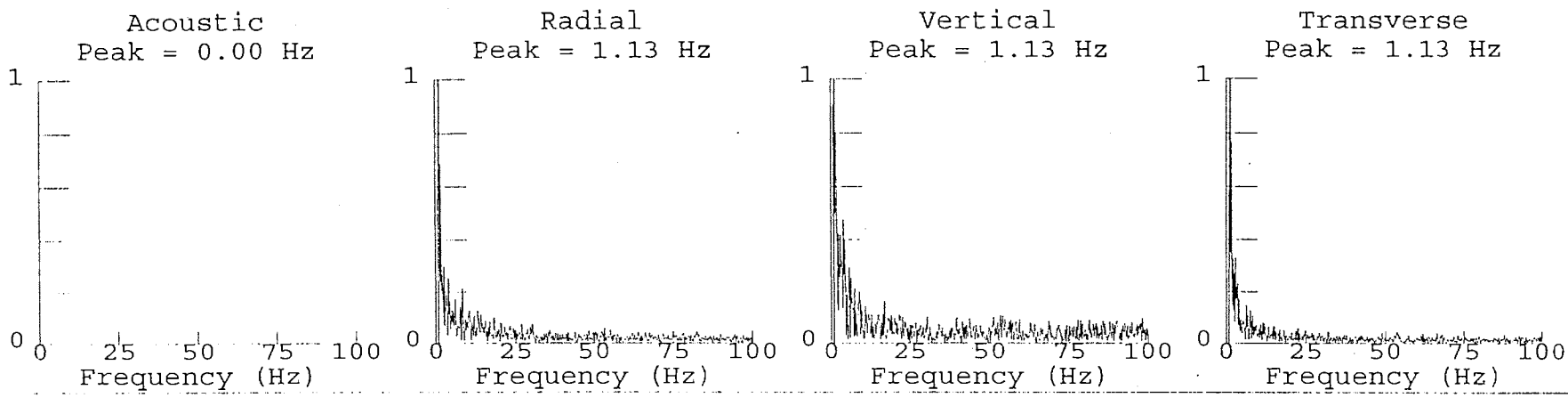


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 030 Date: 7/ 8/95 Time: 8:42
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

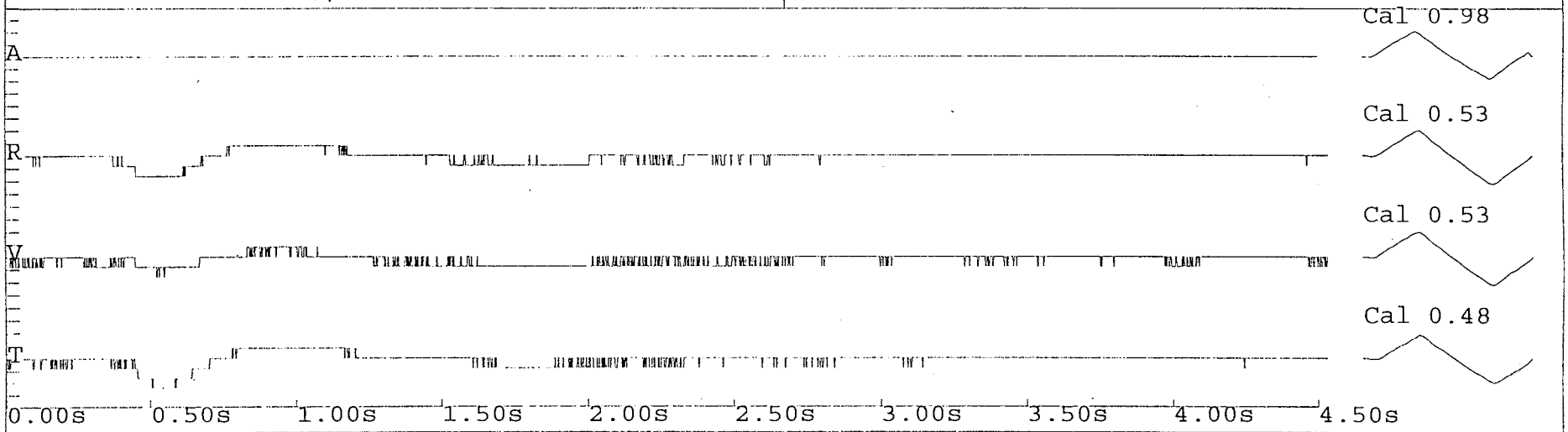


Fourier Analysis (Amplitude Spectrum)

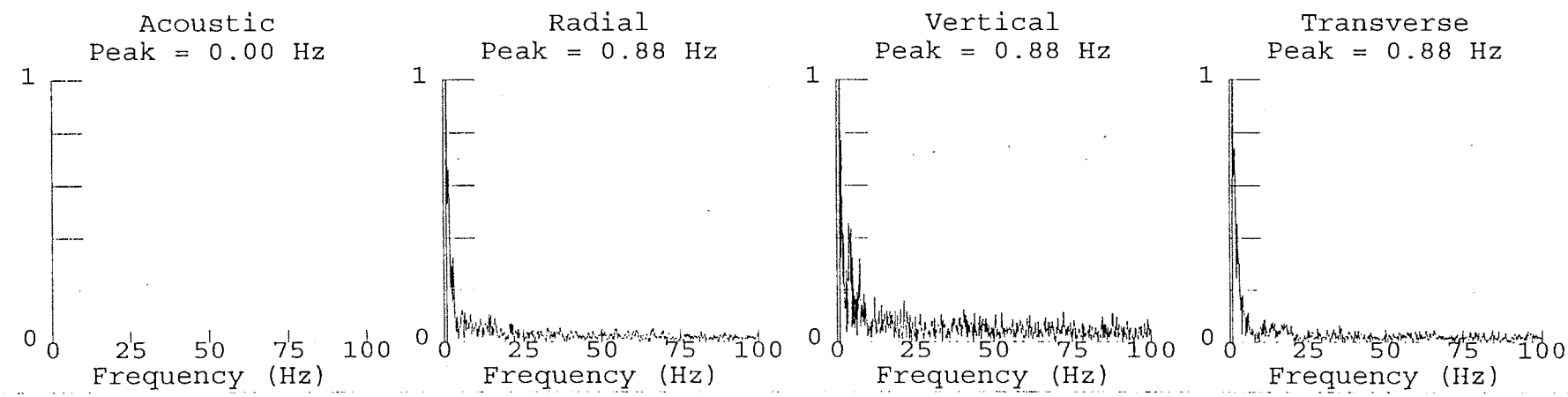


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 031 Date: 7/ 8/95 Time: 9:15
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

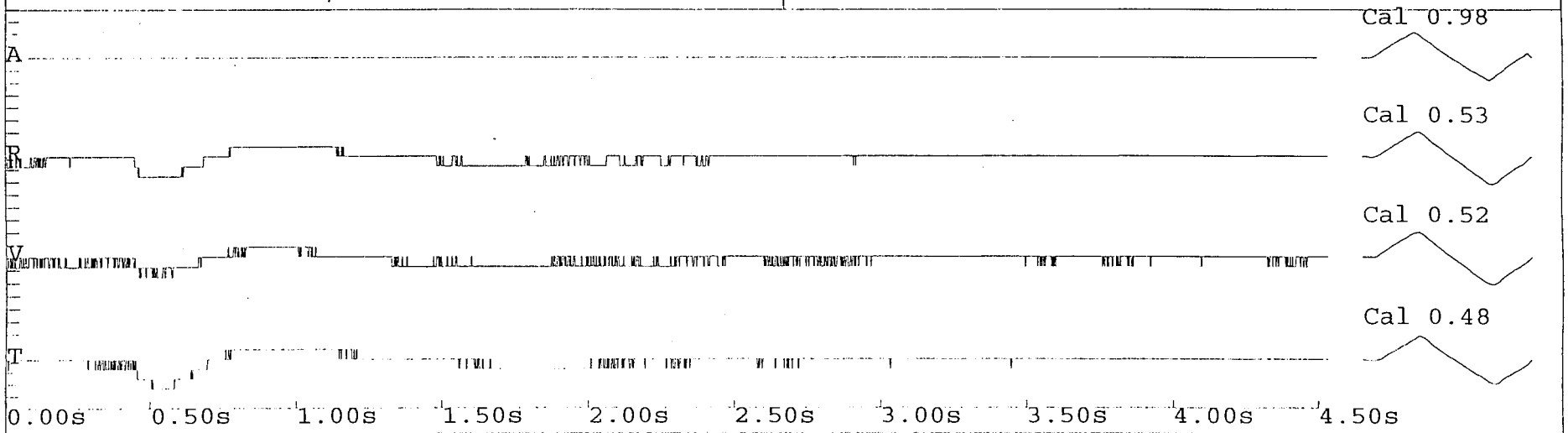


Fourier Analysis (Amplitude Spectrum)

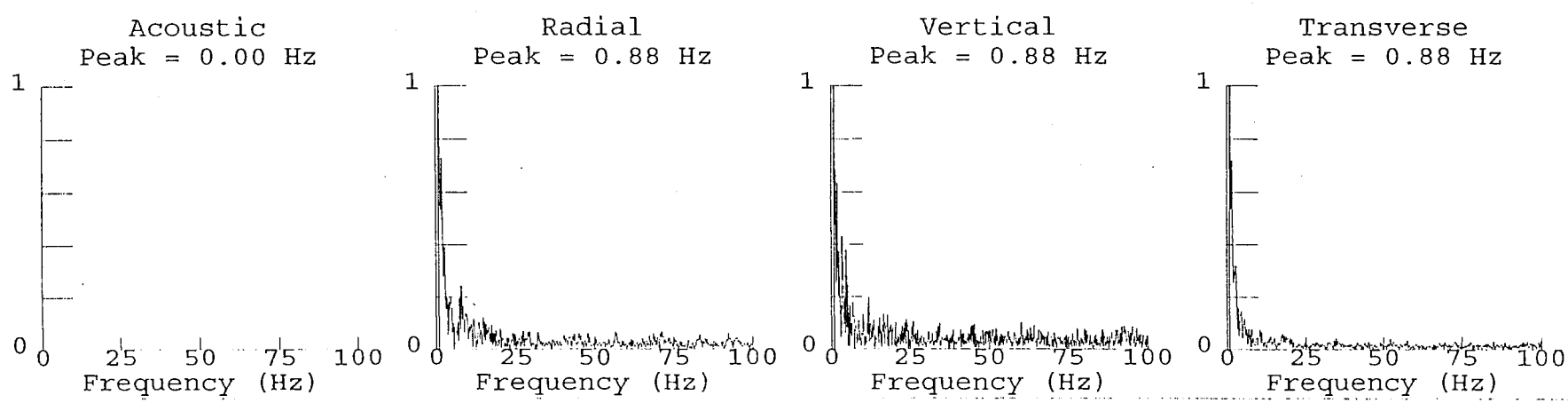


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 032 Date: 7/ 8/95 Time: 9:20
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

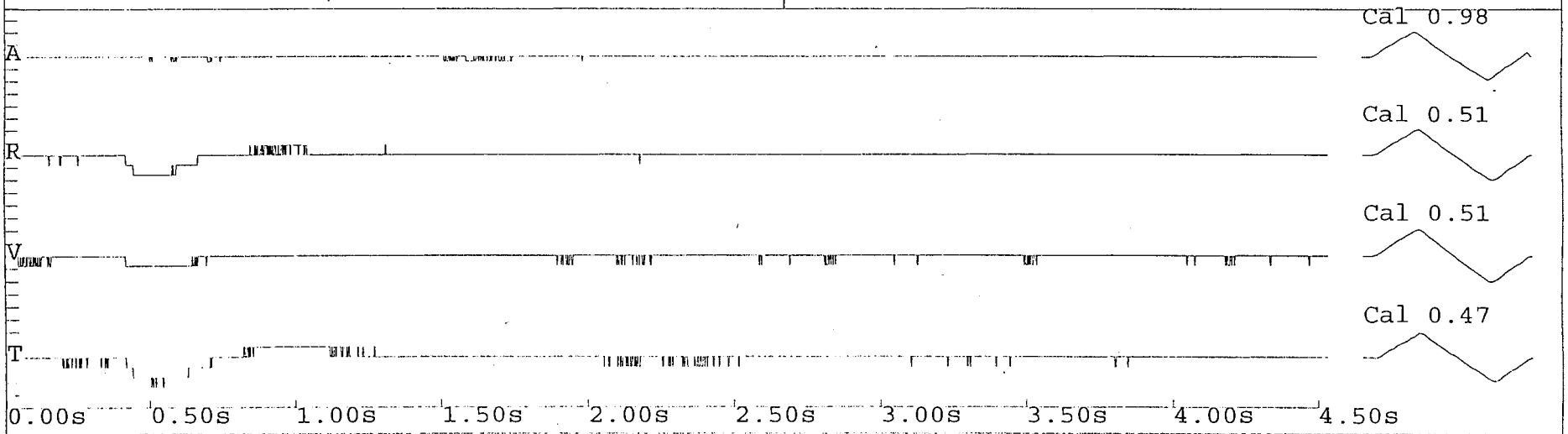


Fourier Analysis (Amplitude Spectrum)

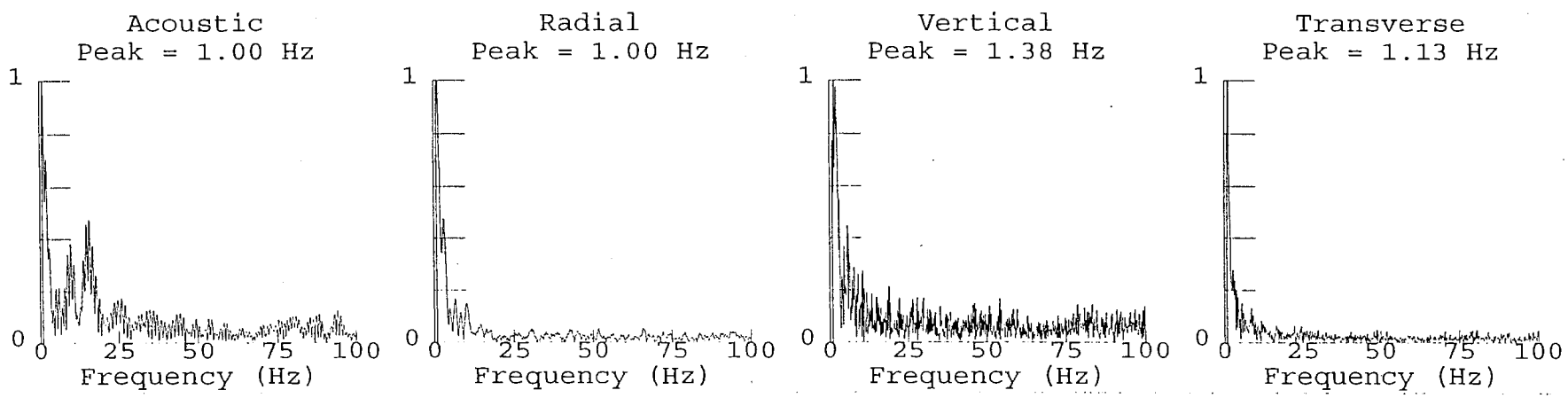


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 033 Date: 7/ 8/95 Time: 9:21
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.01 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

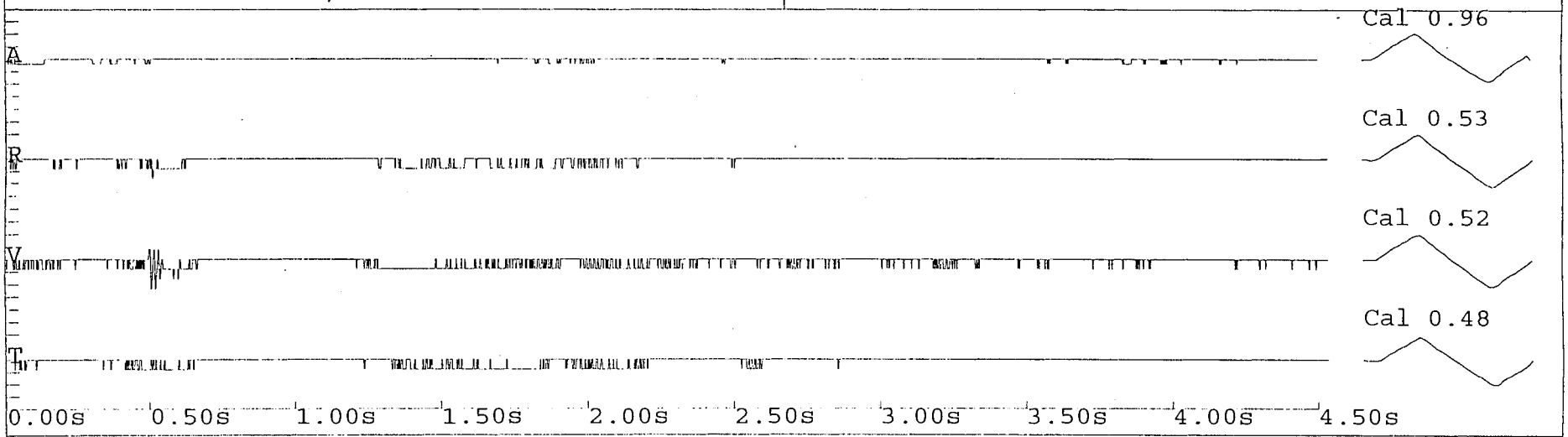


Fourier Analysis (Amplitude Spectrum)

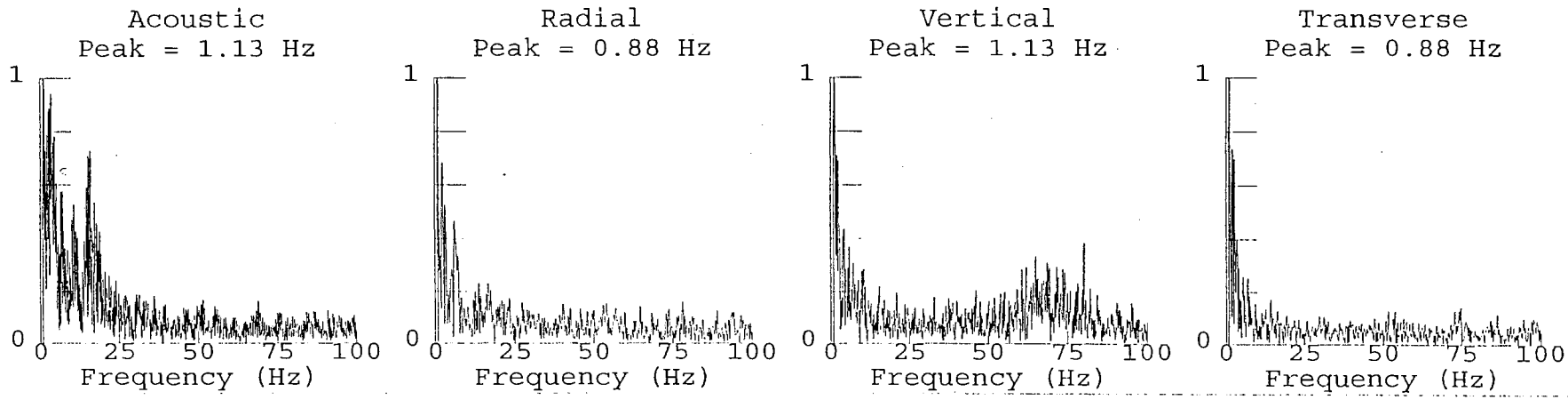


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 035 Date: 7/12/95 Time: 9:45
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

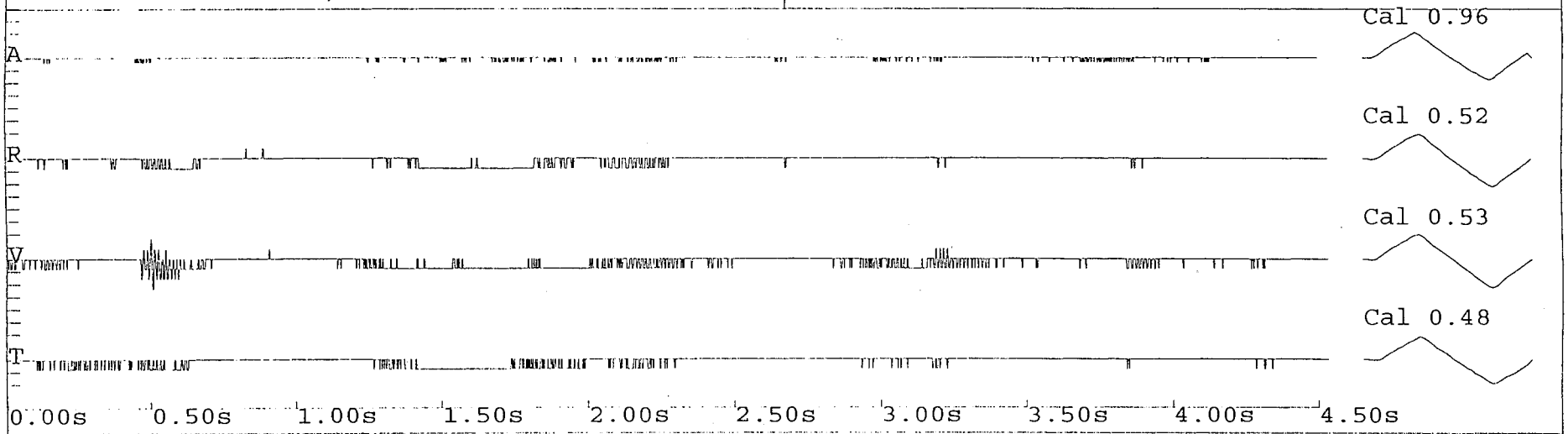


Fourier Analysis (Amplitude Spectrum)

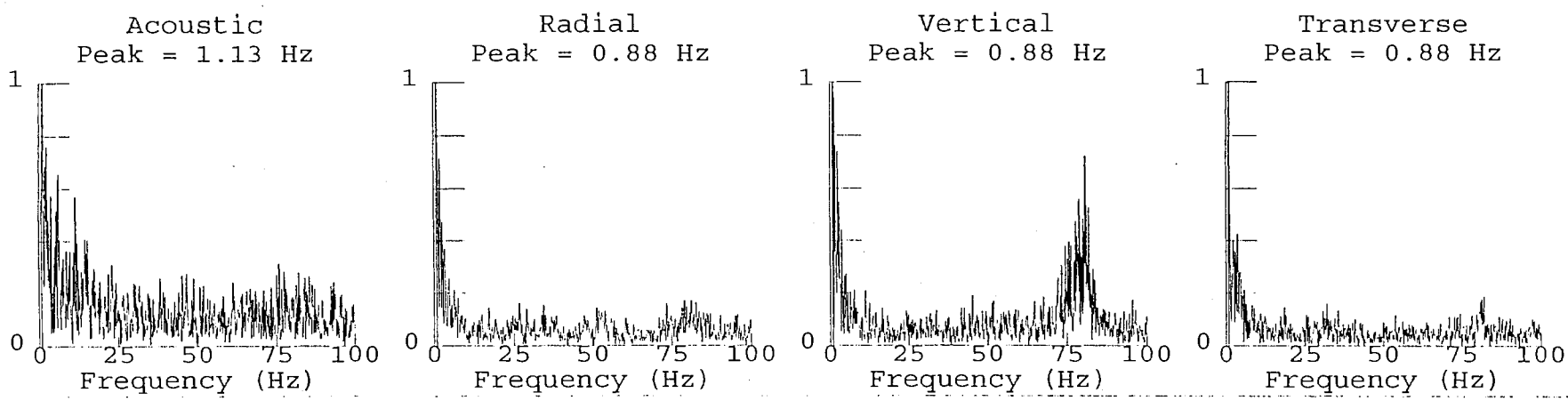


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 036 Date: 7/13/95 Time: 11:43
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

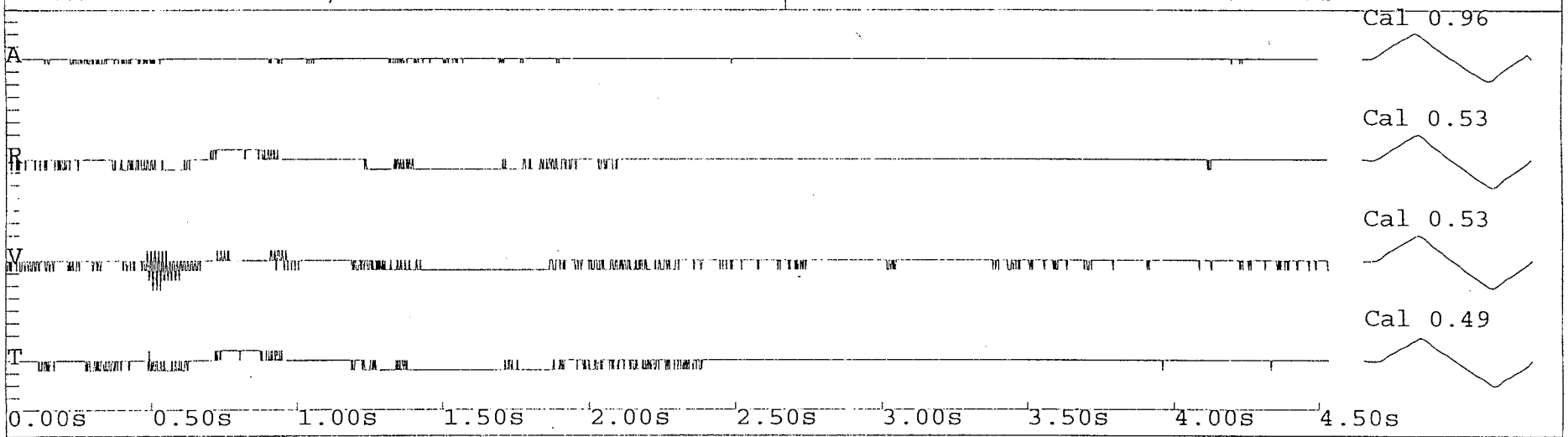


Fourier Analysis (Amplitude Spectrum)

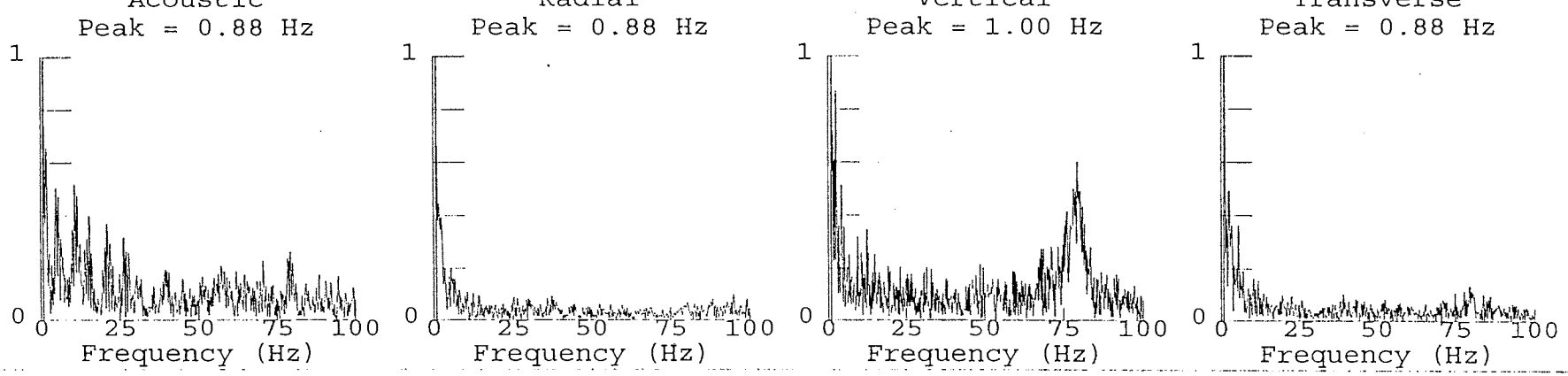


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 038 Date: 7/14/95 Time: 9:55
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

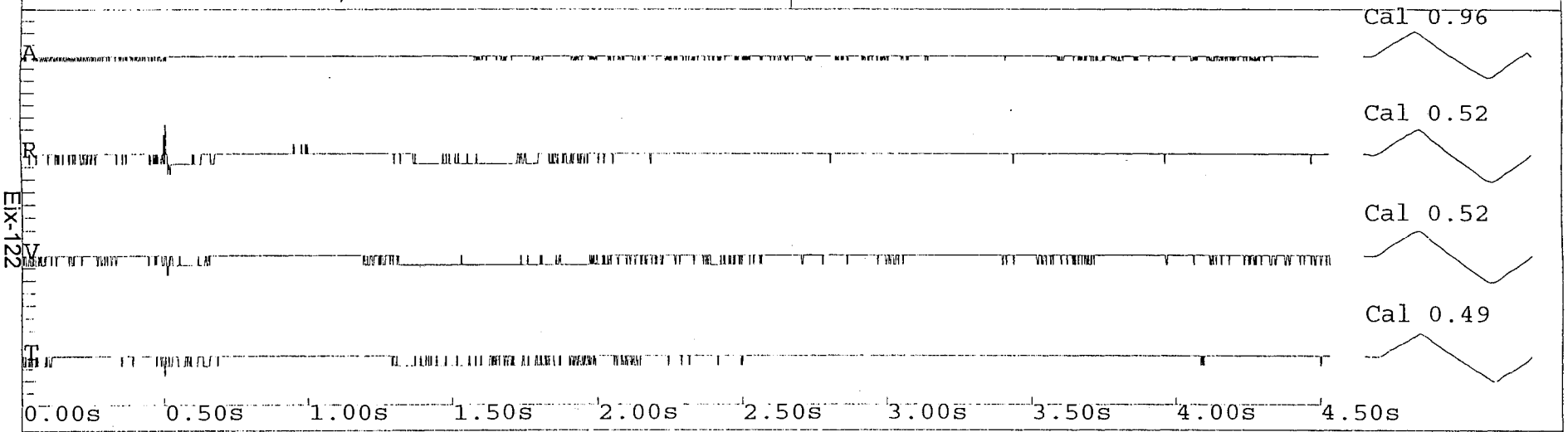


Fourier Analysis (Amplitude Spectrum)

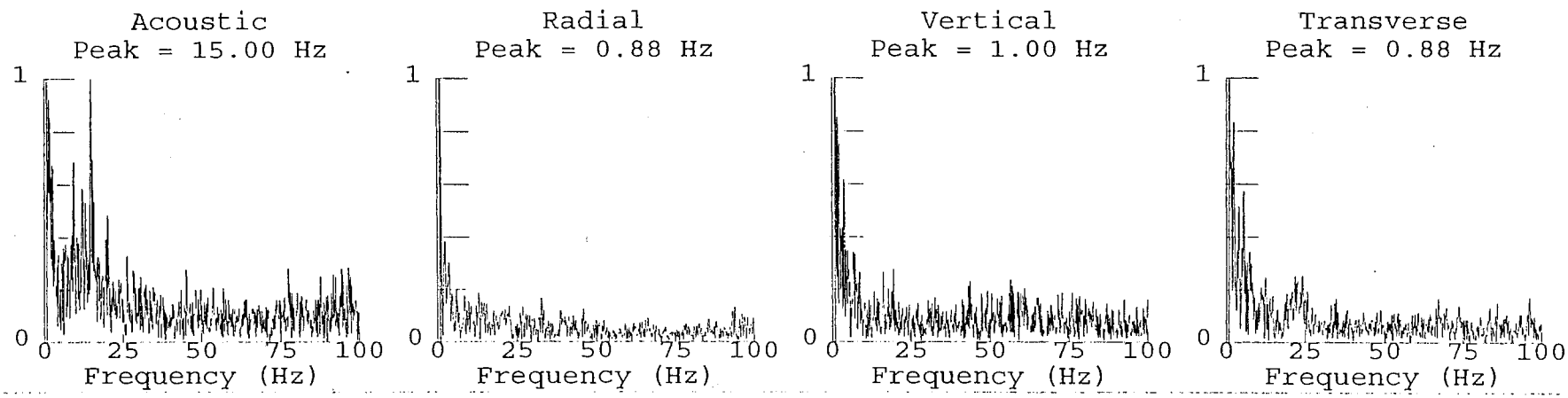


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 039 Date: 7/14/95 Time: 13:49
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 170.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



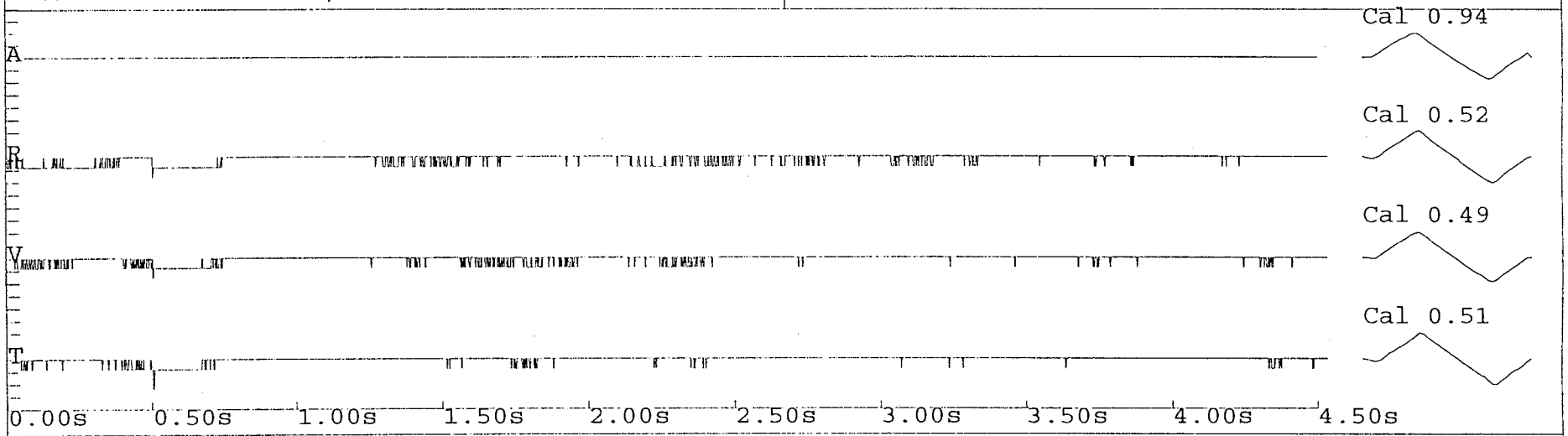
University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance
Non-blast Trigger
Event: 034 Date: 7/14/95 Time: 16:20
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies

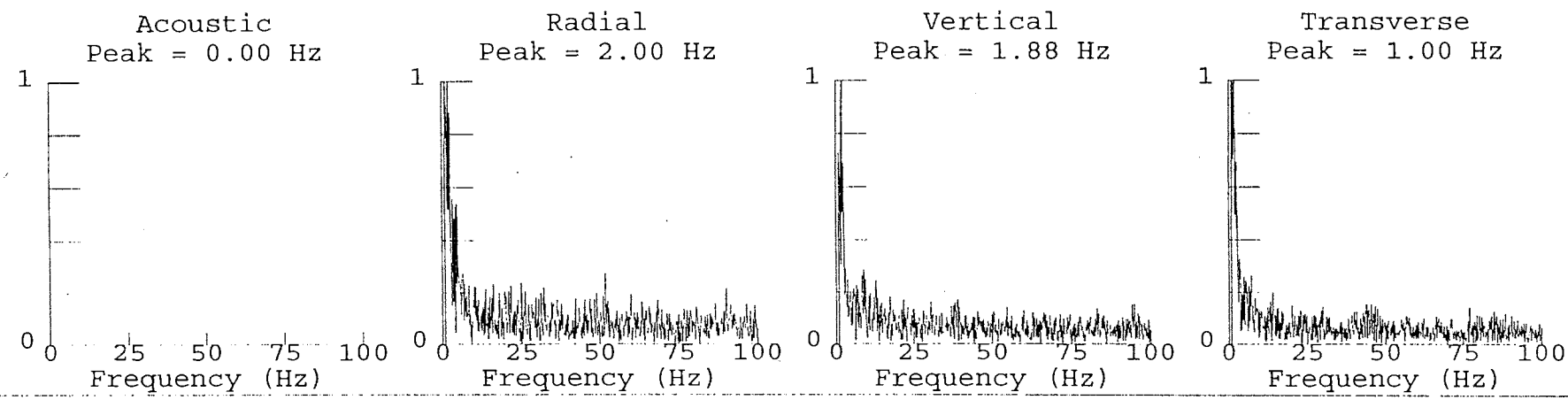
Acoustic: 0 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.02 in/s 0.0 Hz.
Transverse: 0.03 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

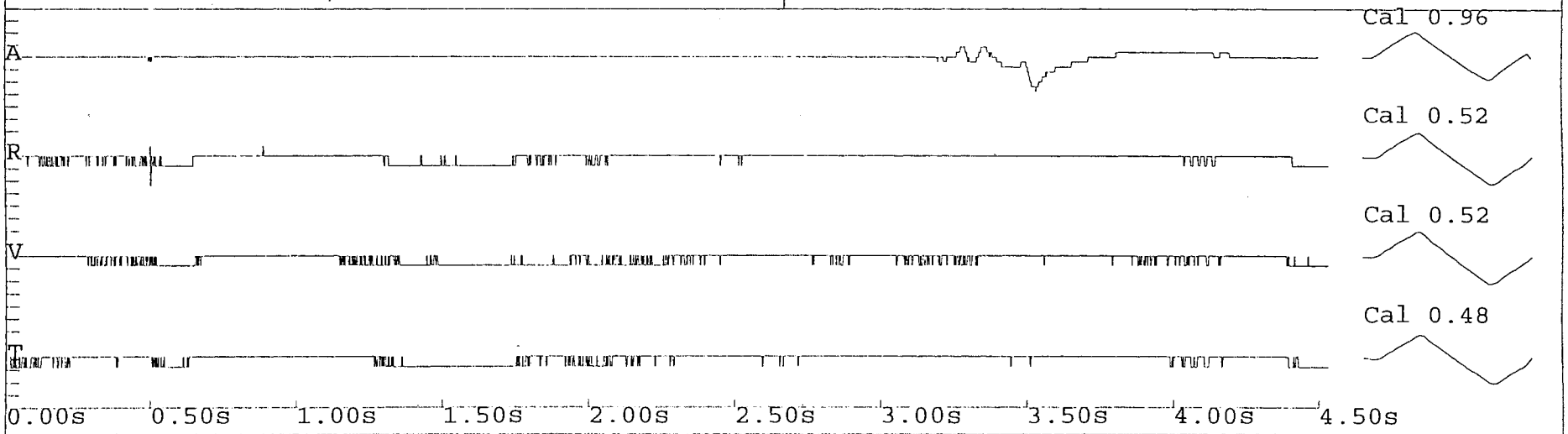


Fourier Analysis (Amplitude Spectrum)

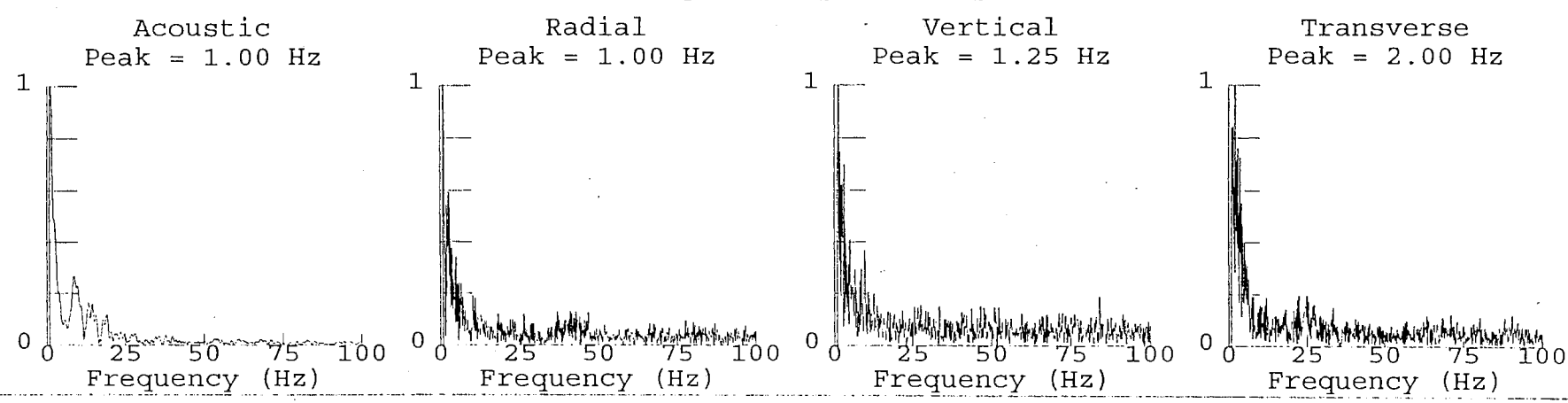


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 042 Date: 7/17/95 Time: 11:30
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 117 dB 2.3 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 170.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.01 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

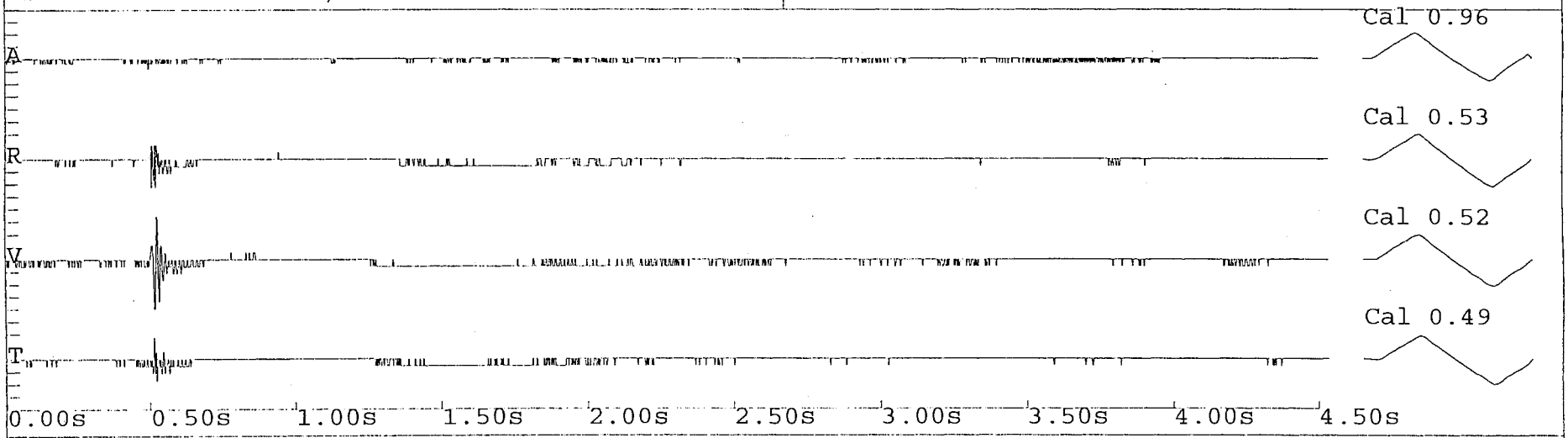


Fourier Analysis (Amplitude Spectrum)

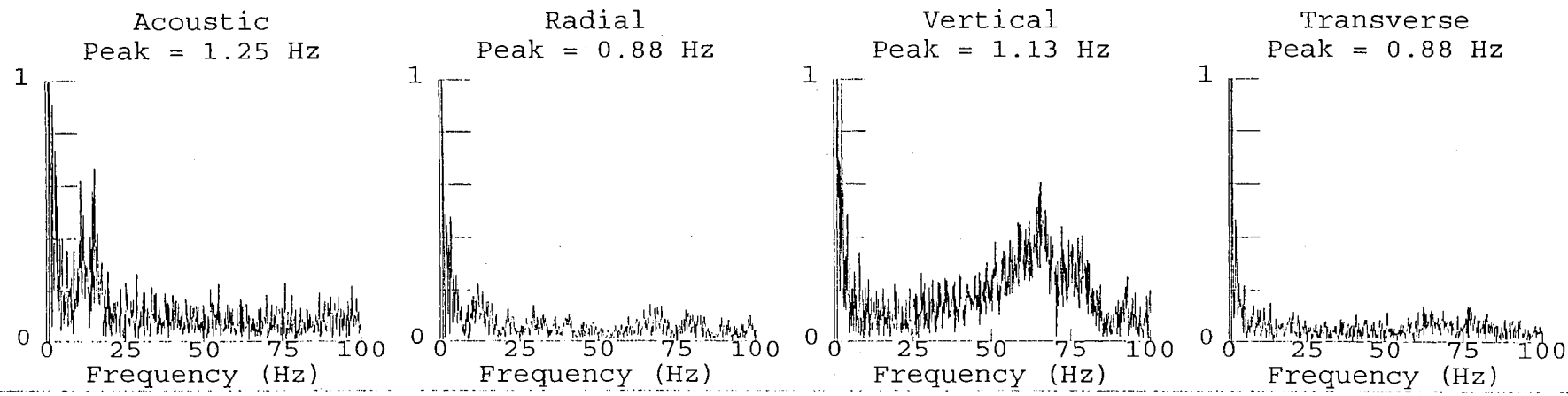


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 046 Date: 7/21/95 Time: 12:58
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.04 in/s 170.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.07 in/s 56.8 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



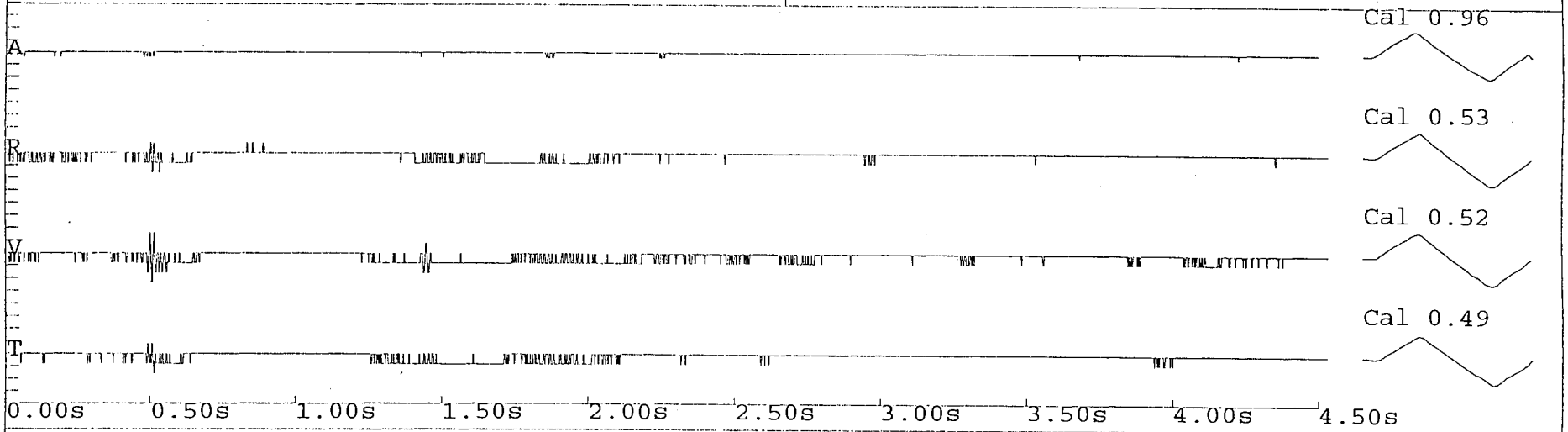
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 047 Date: 7/21/95 Time: 14:49
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

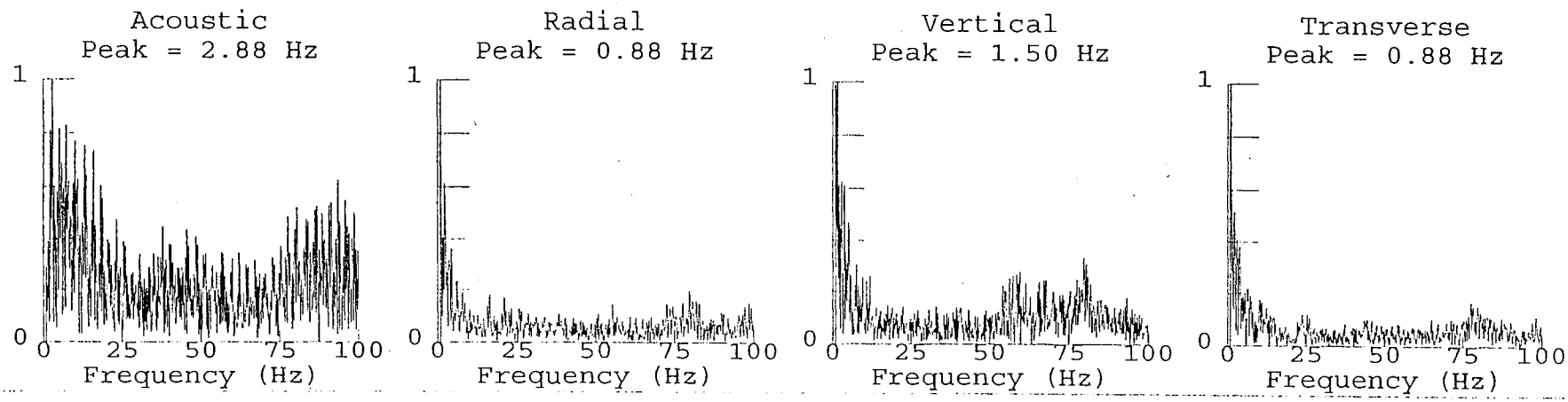
Acoustic: 100 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.03 in/s 0.0 Hz.
Transverse: 0.02 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

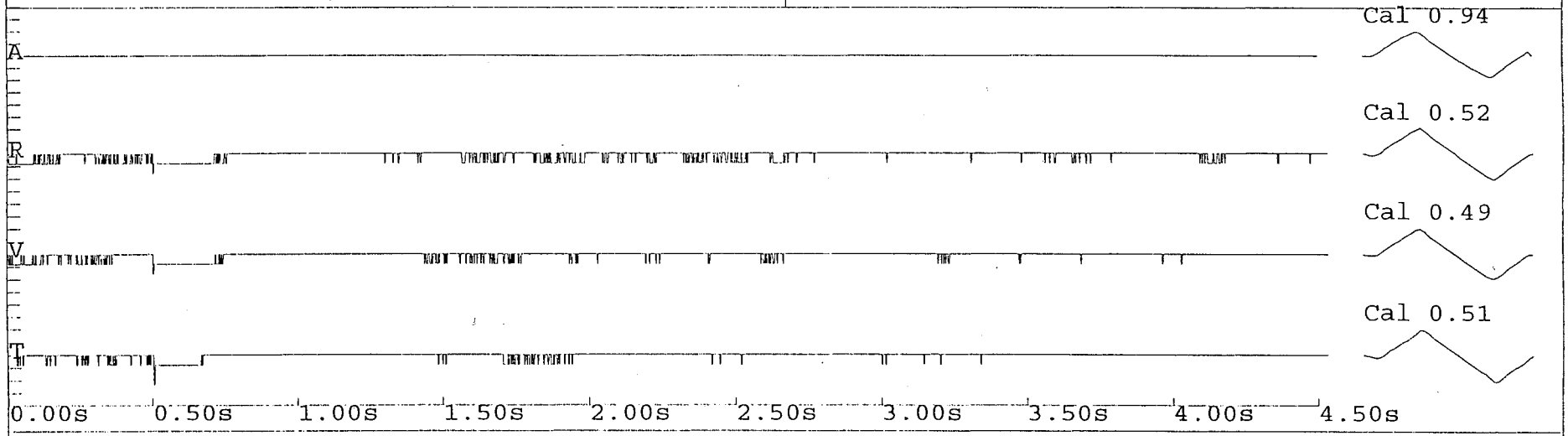


Fourier Analysis (Amplitude Spectrum)

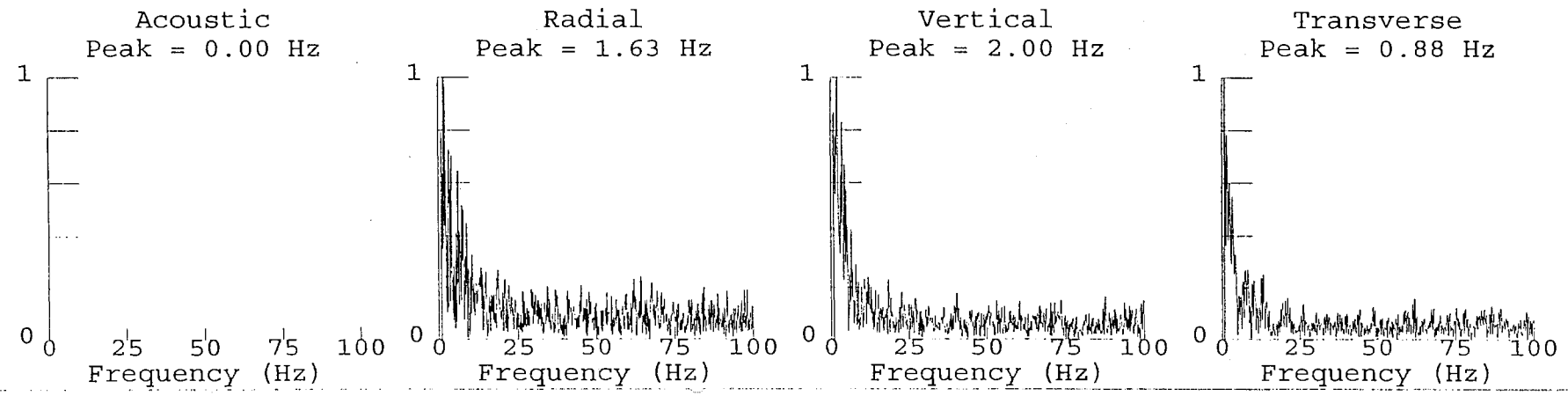


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance
Non-blast Trigger
Event: 039 Date: 7/24/95 Time: 8:02
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



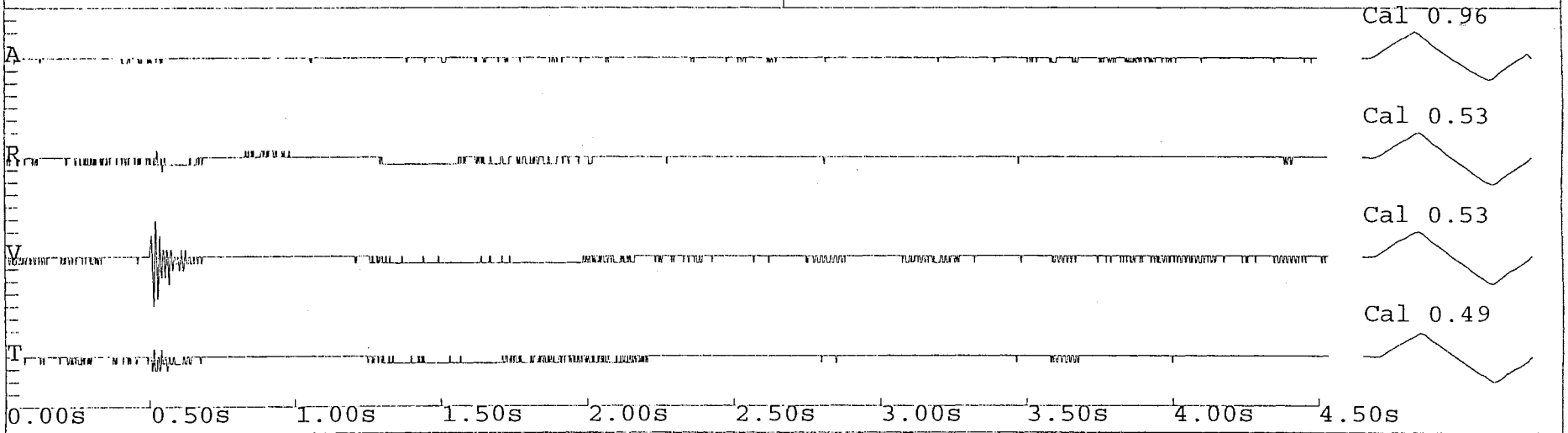
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 049 Date: 7/26/95 Time: 12:32
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

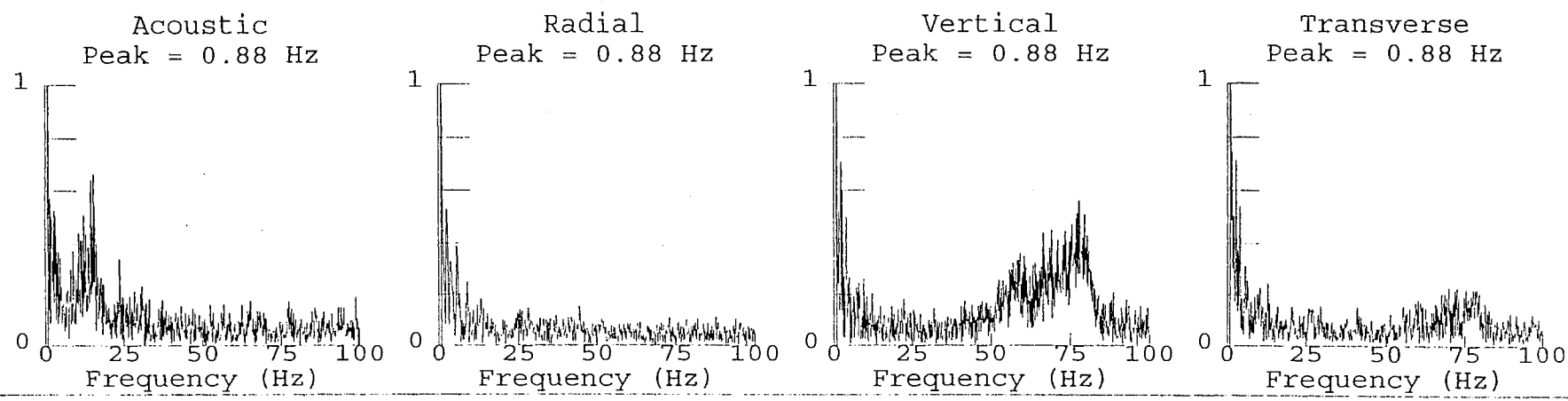
Acoustic: 100 dB 0.0 Hz.
Radial: 0.02 in/s 0.0 Hz.
Vertical: 0.07 in/s 73.1 Hz.
Transverse: 0.02 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.07 in/s (0.0175 in/s/div)
Time Lines at: 0.50 sec intervals

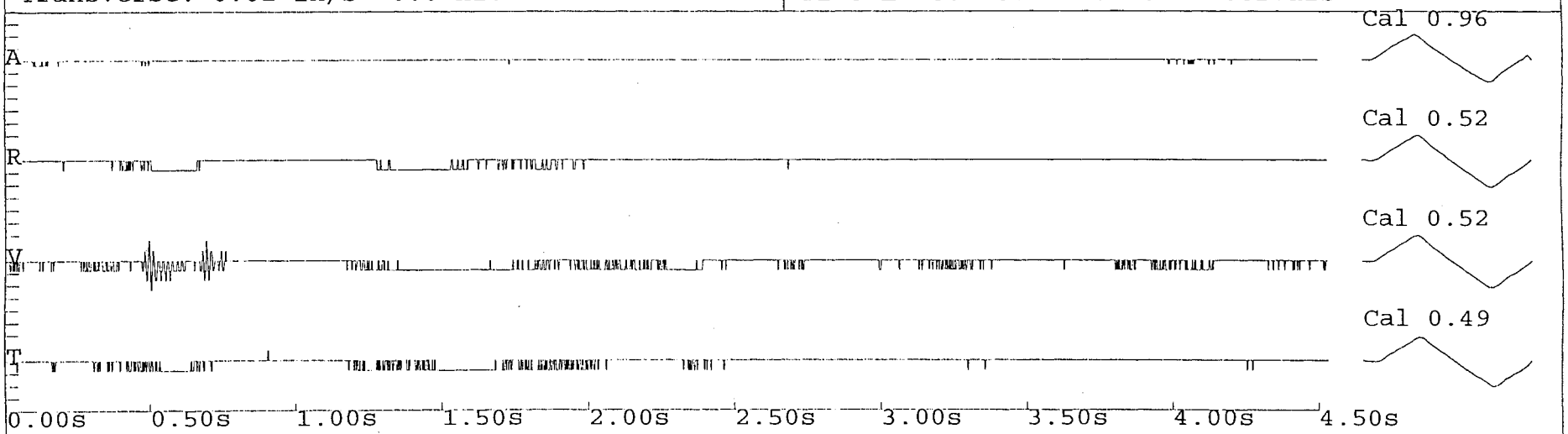


Fourier Analysis (Amplitude Spectrum)

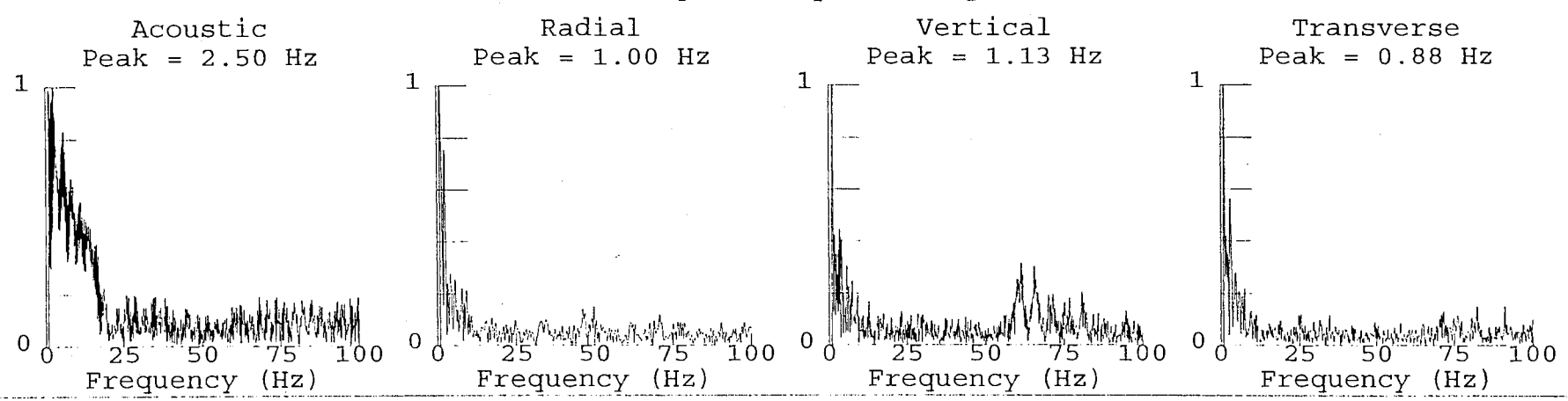


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 052 Date: 7/29/95 Time: 13:44
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

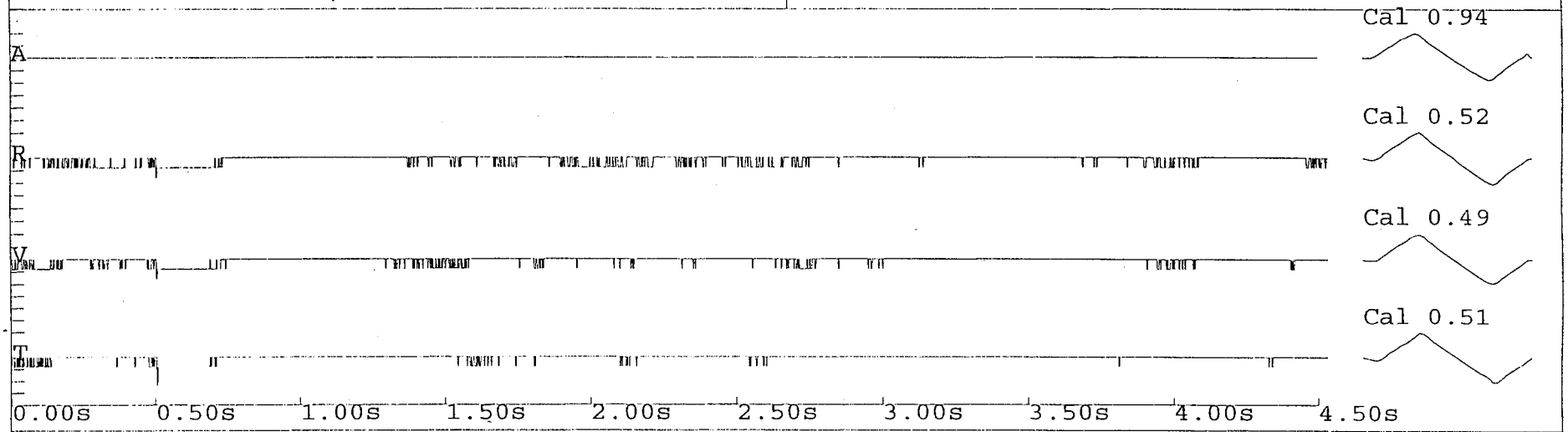


Fourier Analysis (Amplitude Spectrum)

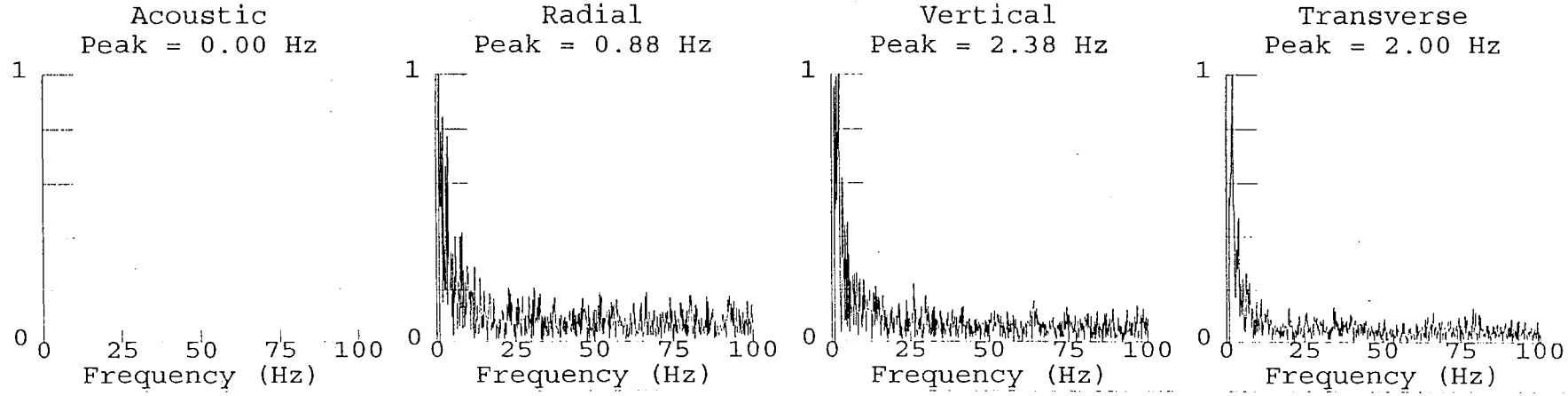


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 21
Location: Entrance
Non-blast Trigger
Event: 044 Date: 7/31/95 Time: 8:02
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 21

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.02 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

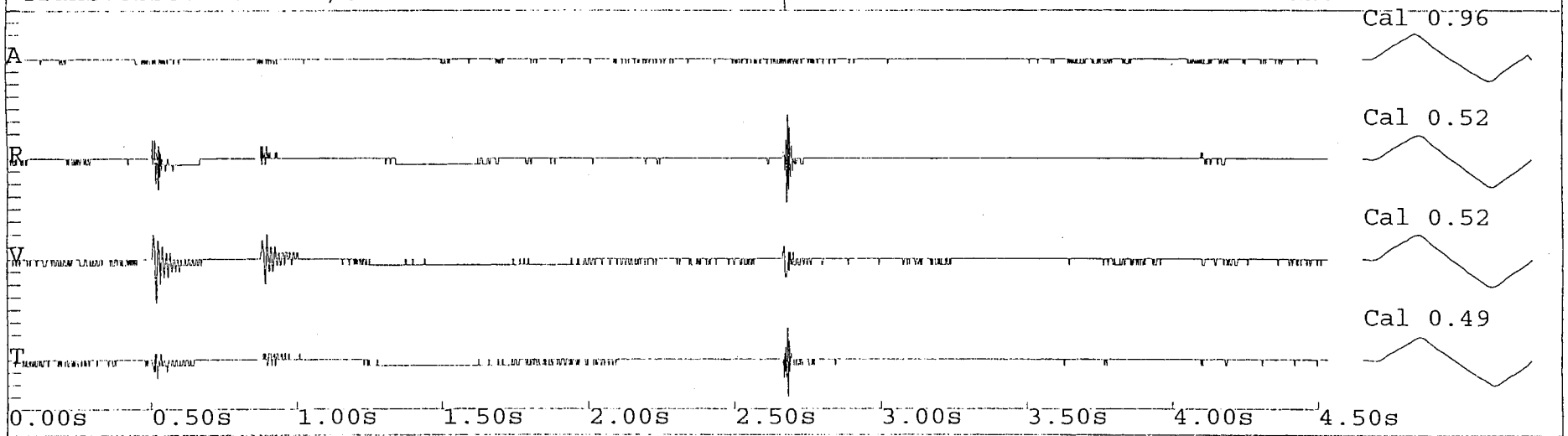


Fourier Analysis (Amplitude Spectrum)

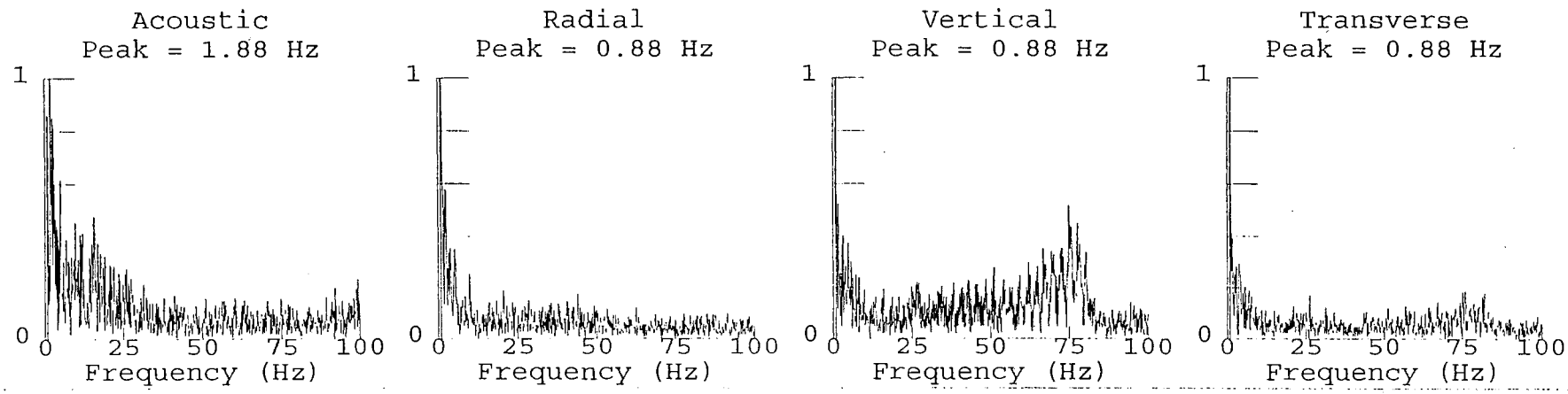


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 053 Date: 8/ 1/95 Time: 11:33
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.08 in/s 170.6 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.07 in/s 56.8 Hz.	Seis: 0.08 in/s (0.02 in/s/div)
Transverse: 0.06 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

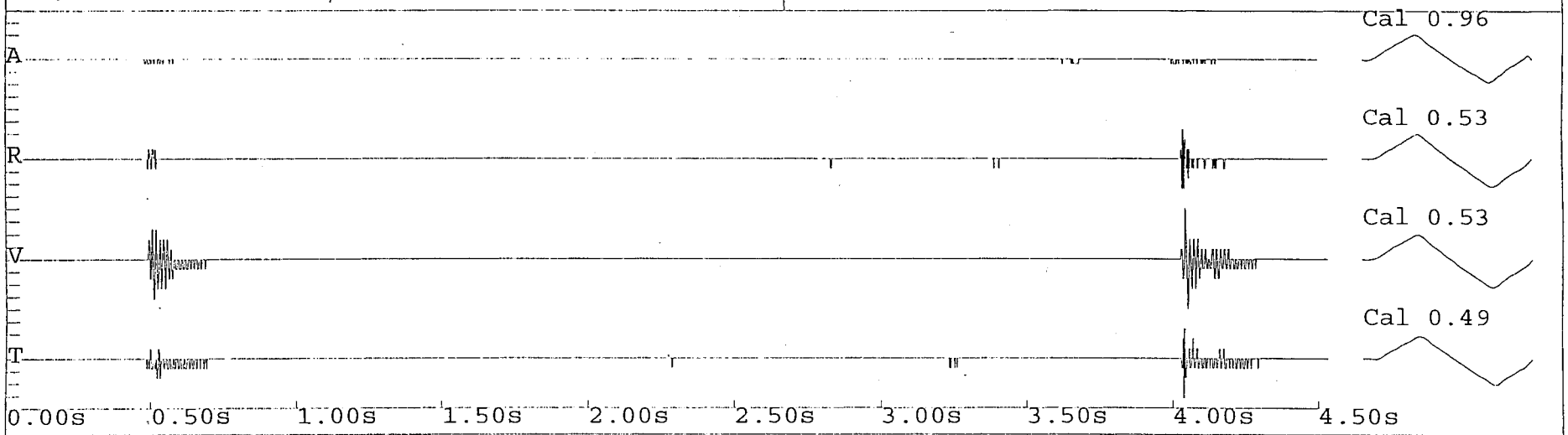


Fourier Analysis (Amplitude Spectrum)

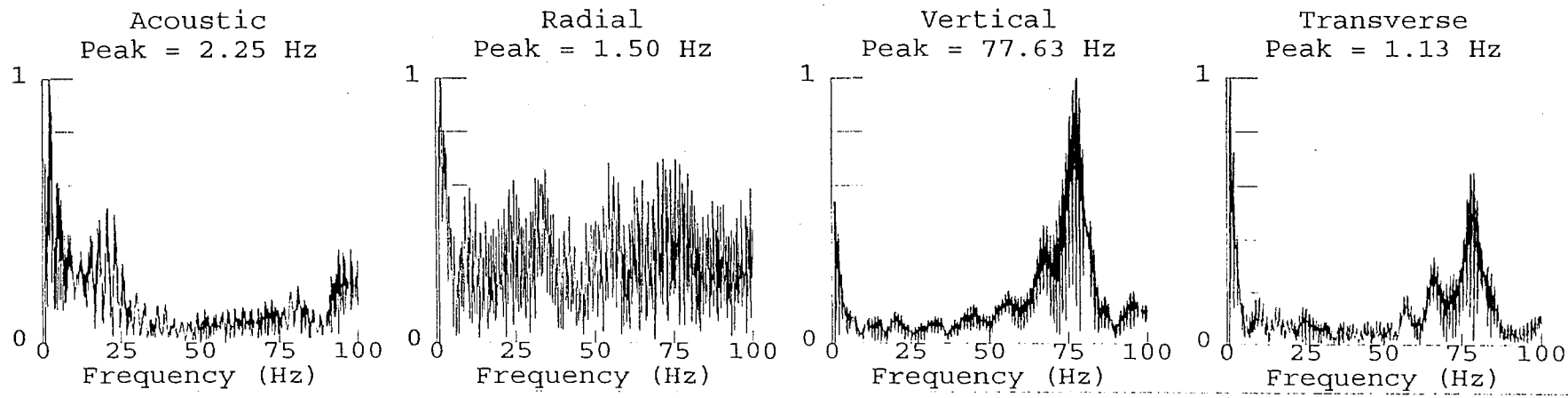


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 054 Date: 8/ 1/95 Time: 11:33
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 85.3 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.04 in/s 170.6 Hz.	Time Lines at: 0.50 sec intervals

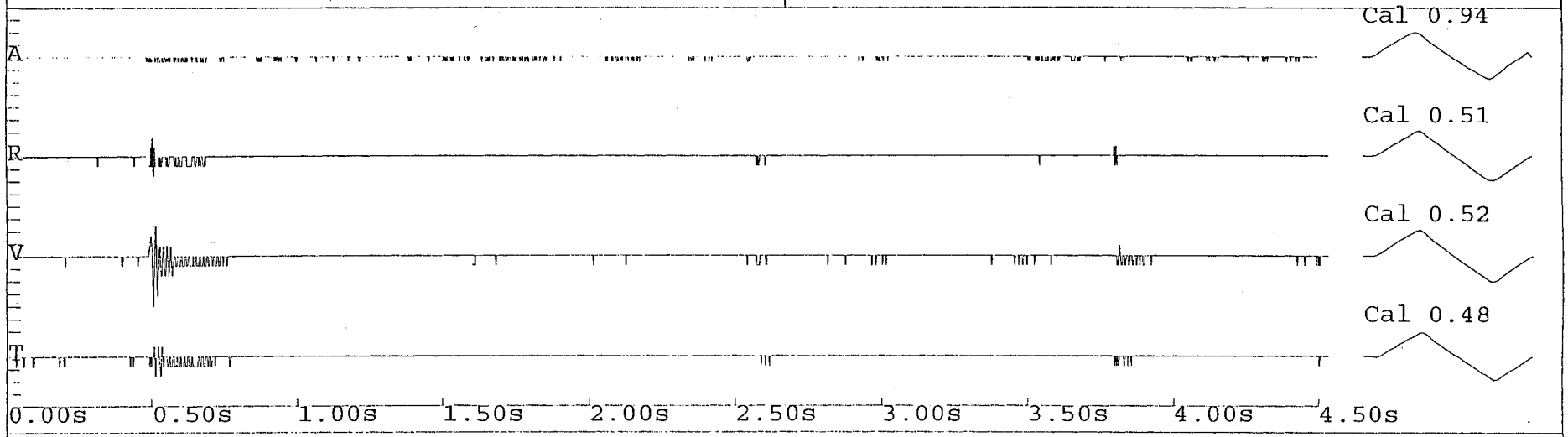


Fourier Analysis (Amplitude Spectrum)

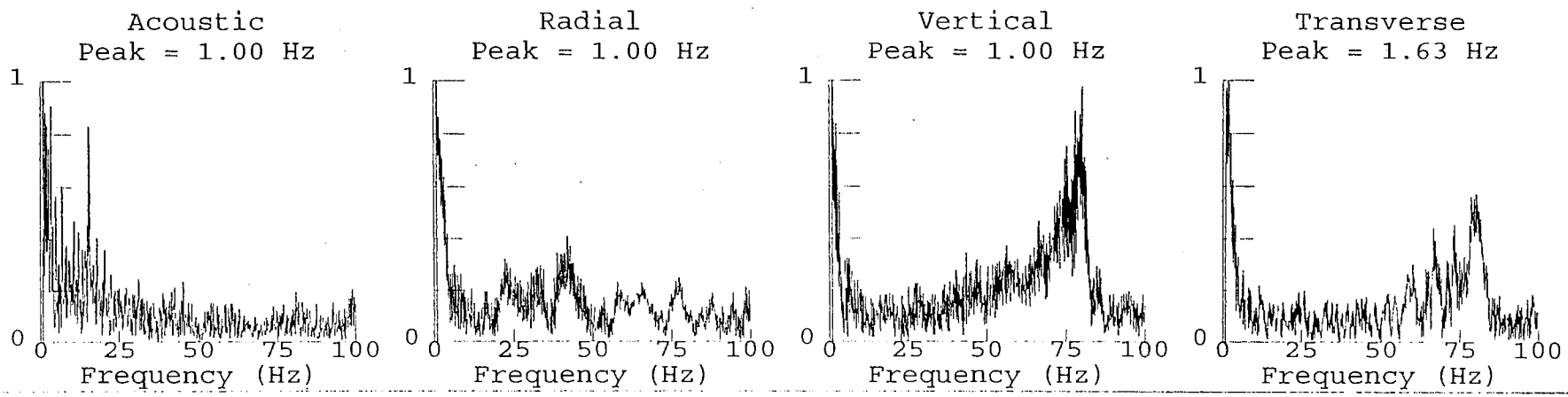


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 055 Date: 8/ 1/95 Time: 11:33
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.03 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 73.1 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



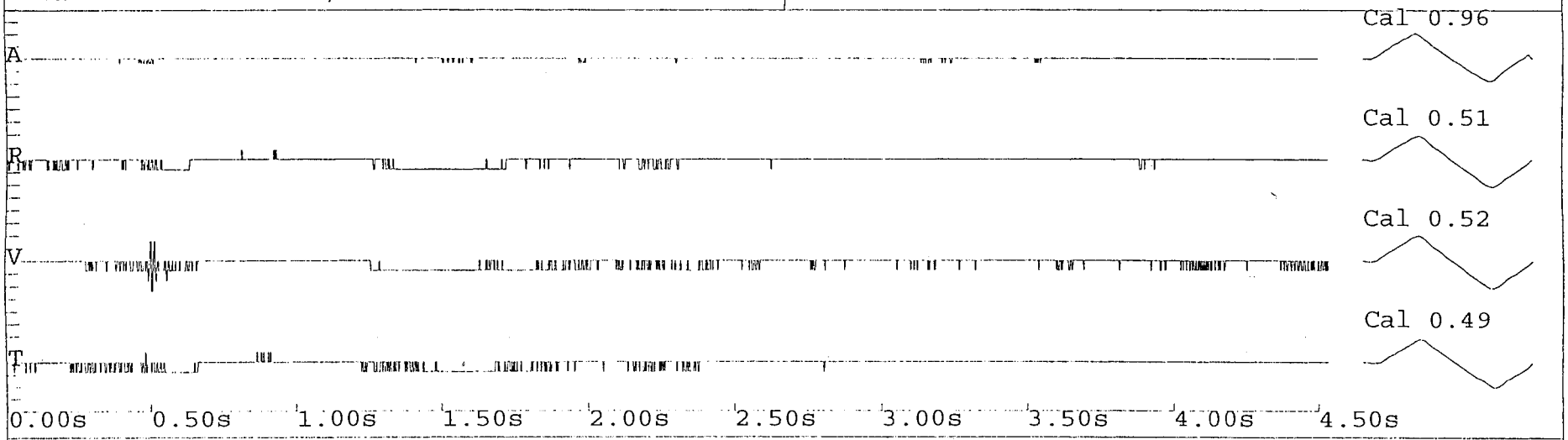
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 057 Date: 8/ 3/95 Time: 10:24
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

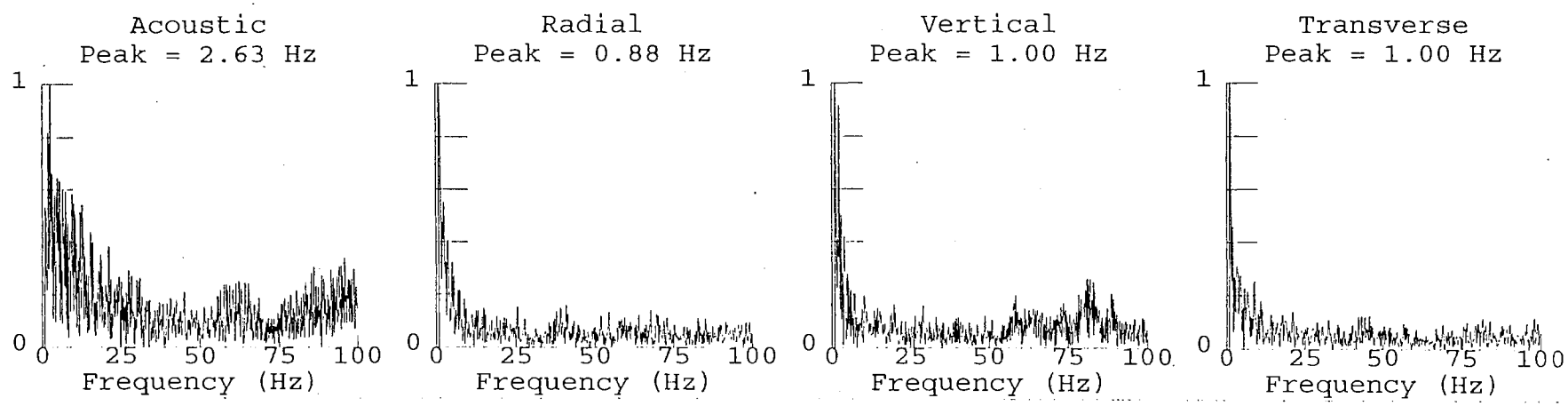
Acoustic: 100 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.03 in/s 0.0 Hz.
Transverse: 0.01 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



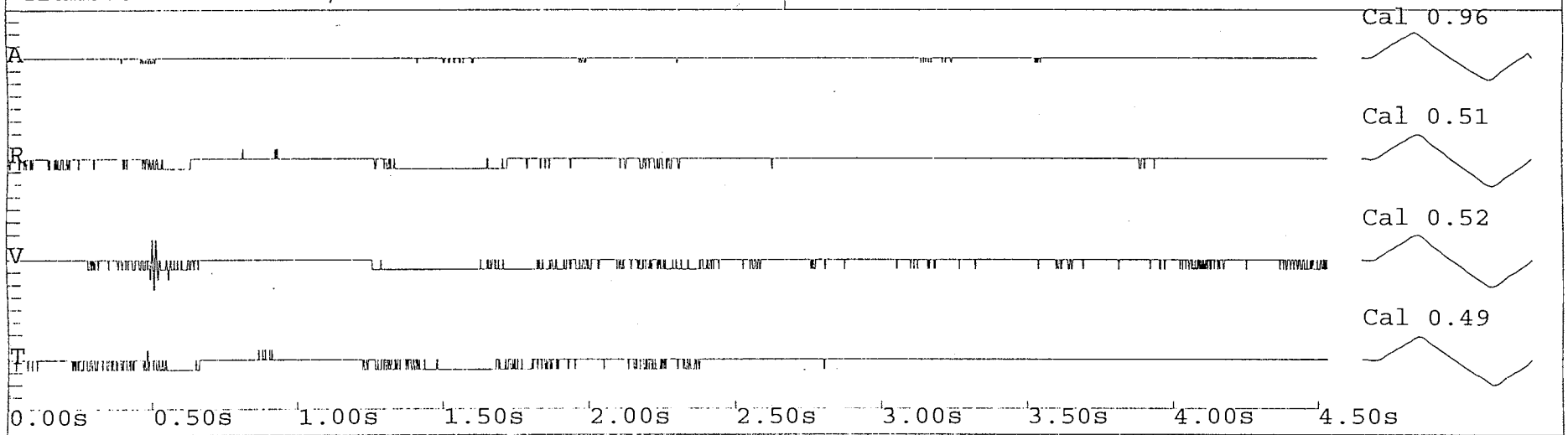
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 057 Date: 8/ 3/95 Time: 10:24
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

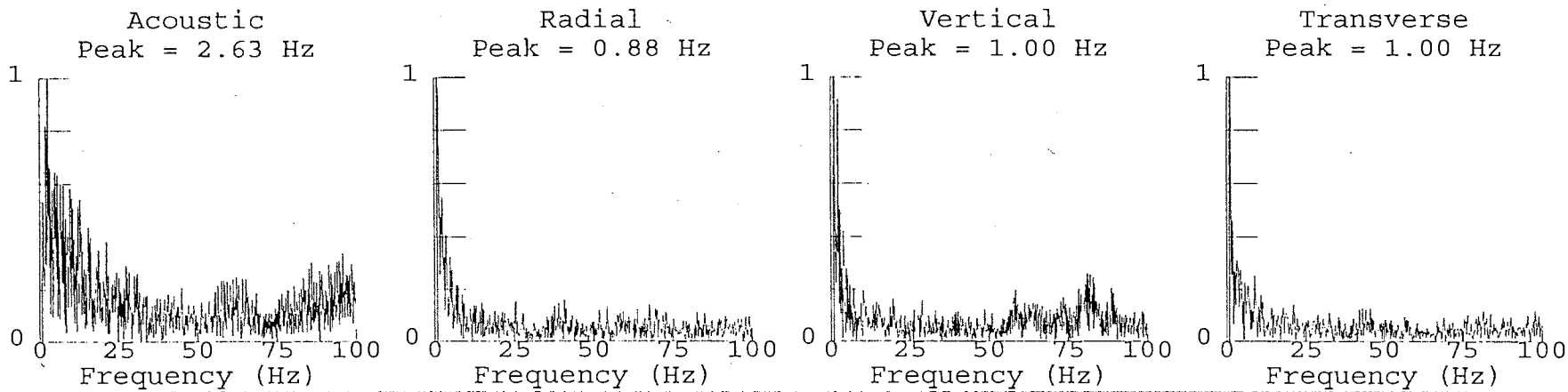
Acoustic: 100 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.03 in/s 0.0 Hz.
Transverse: 0.01 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

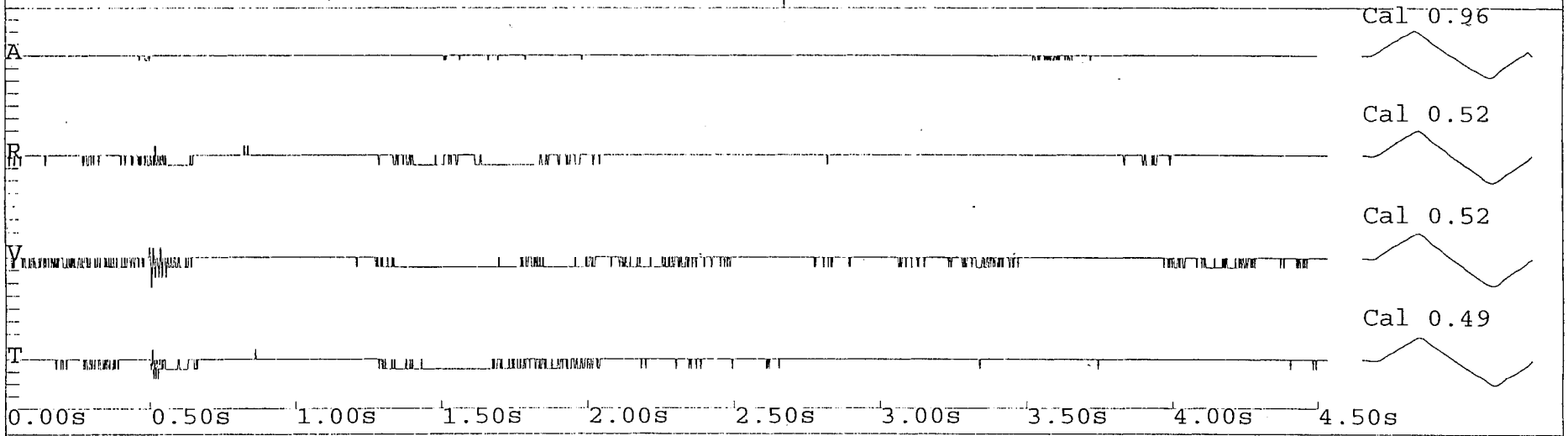


Fourier Analysis (Amplitude Spectrum)

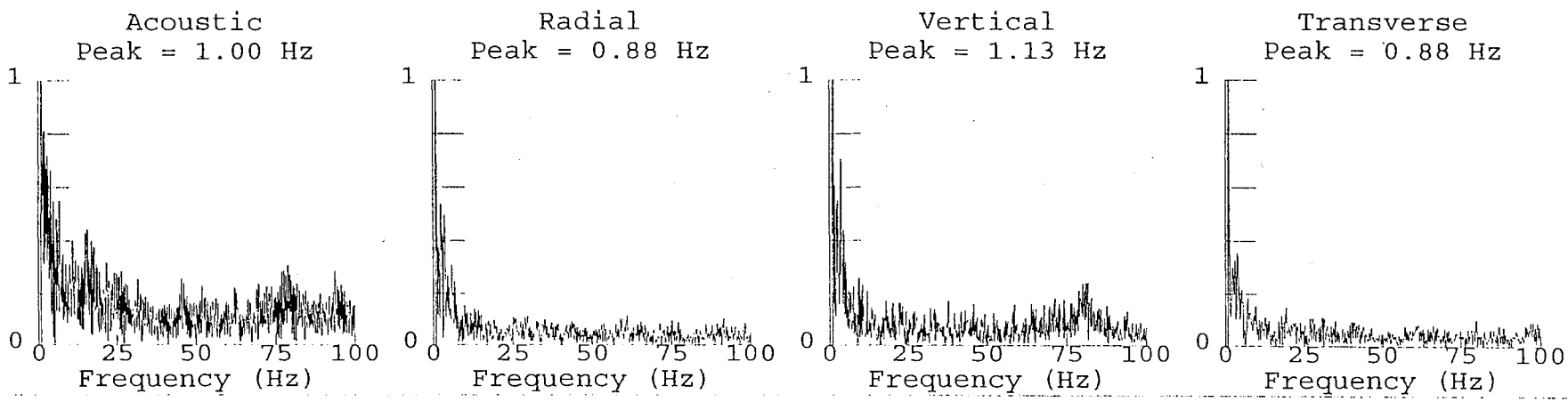


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 058 Date: 8/ 5/95 Time: 12:49
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

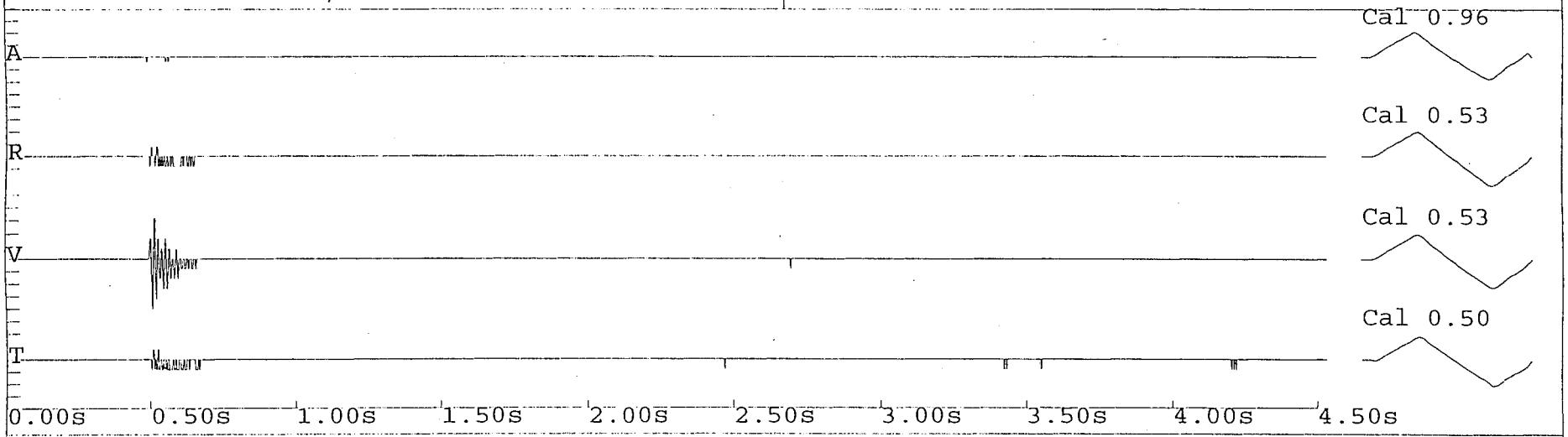


Fourier Analysis (Amplitude Spectrum)

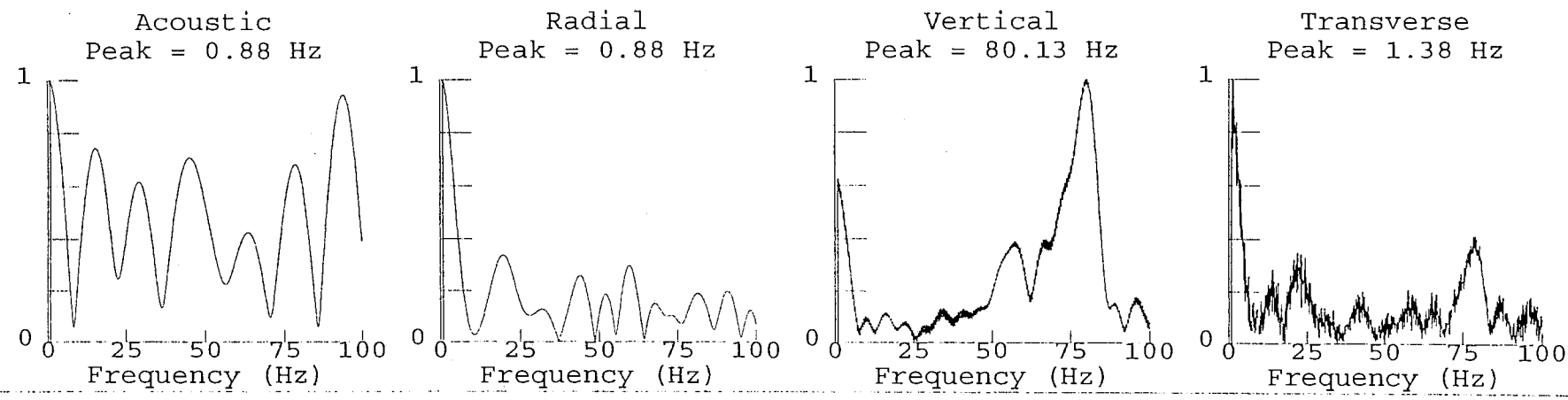


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 059 Date: 8/ 5/95 Time: 12:49
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 256.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.05 in/s 73.1 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



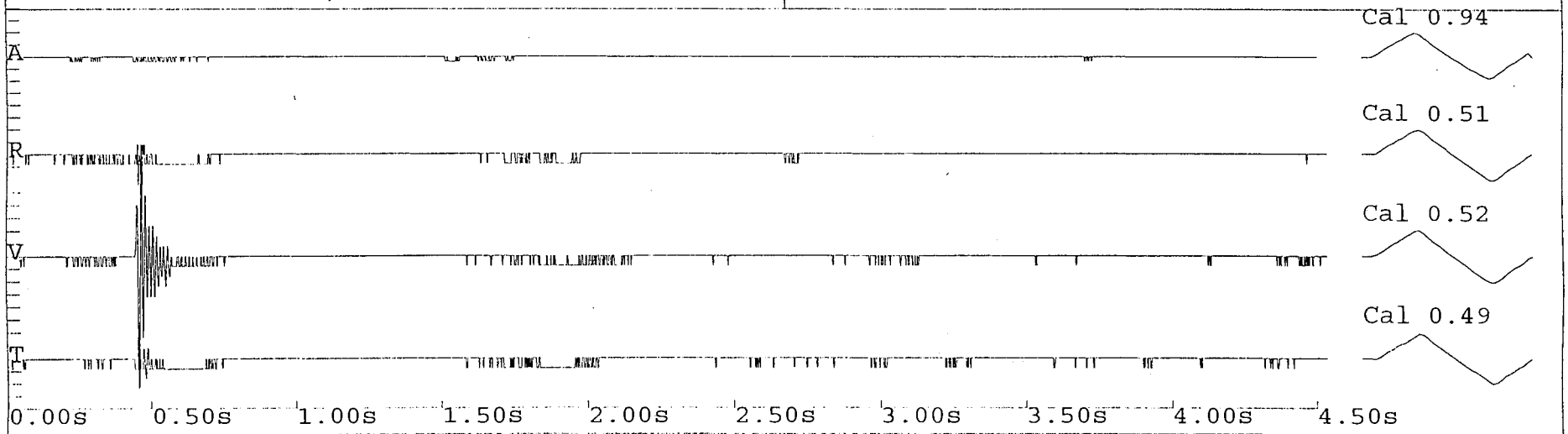
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 060 Date: 8/ 5/95 Time: 12:49
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

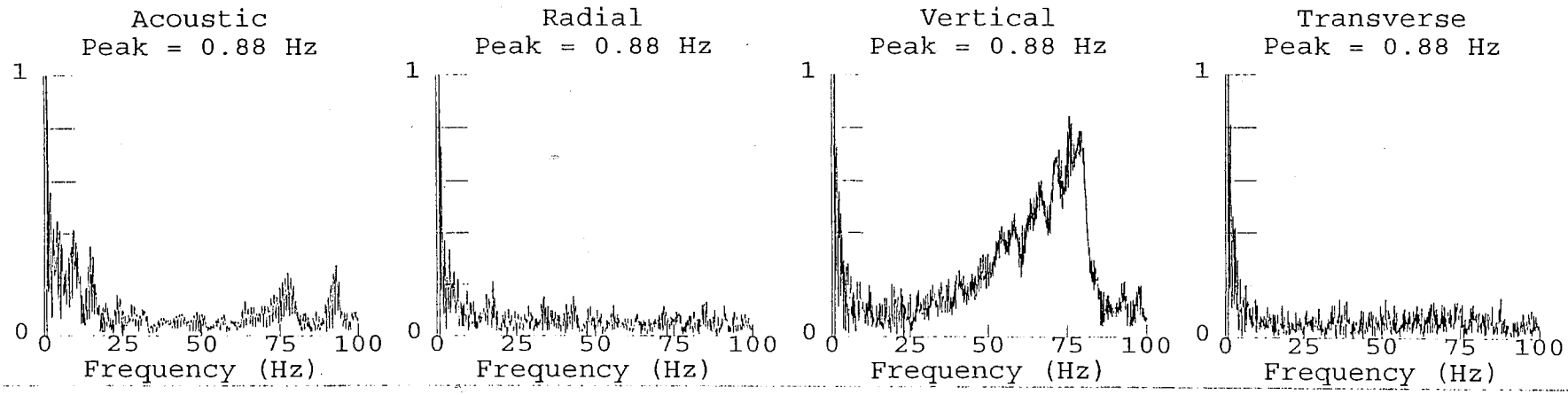
Acoustic: 100 dB 0.0 Hz.
Radial: 0.01 in/s 0.0 Hz.
Vertical: 0.04 in/s 85.3 Hz.
Transverse: 0.01 in/s 0.0 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.05 in/s (0.0125 in/s/div)
Time Lines at: 0.50 sec intervals

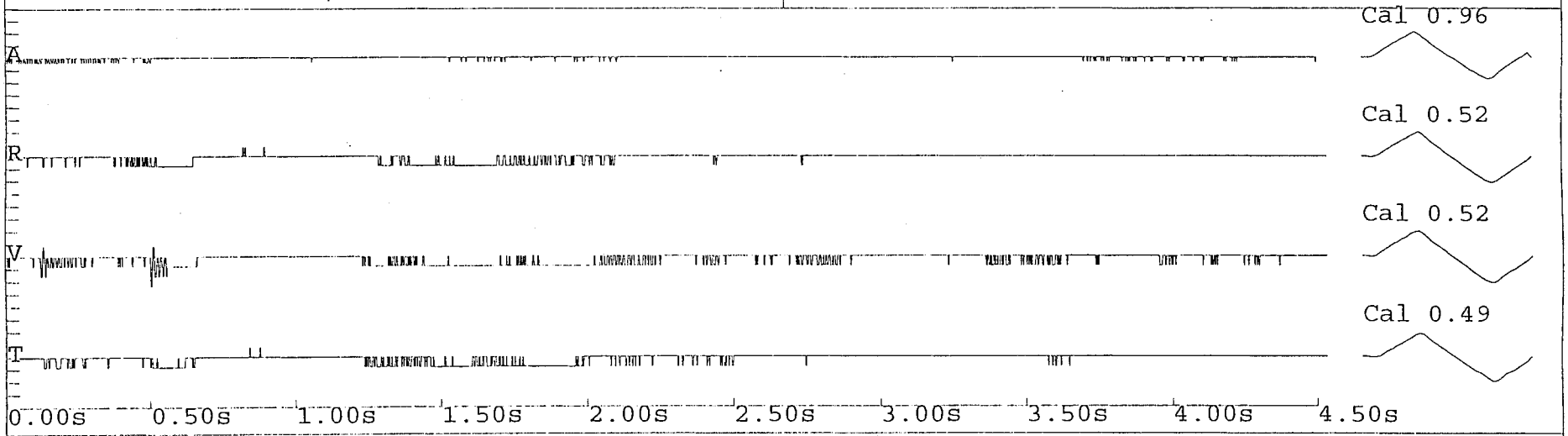


Fourier Analysis (Amplitude Spectrum)

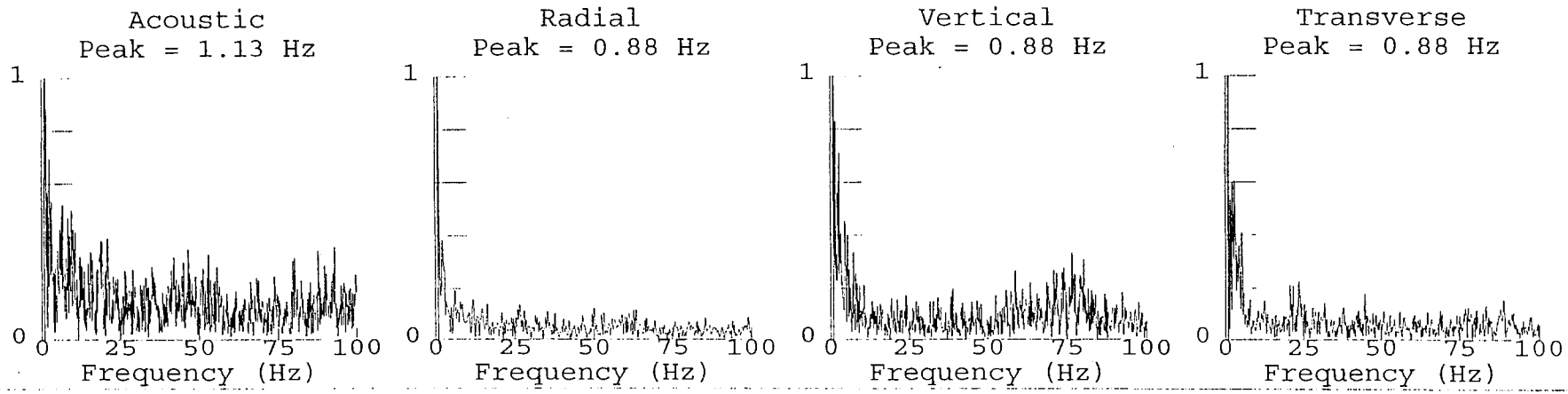


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 061 Date: 8/ 6/95 Time: 14:40
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

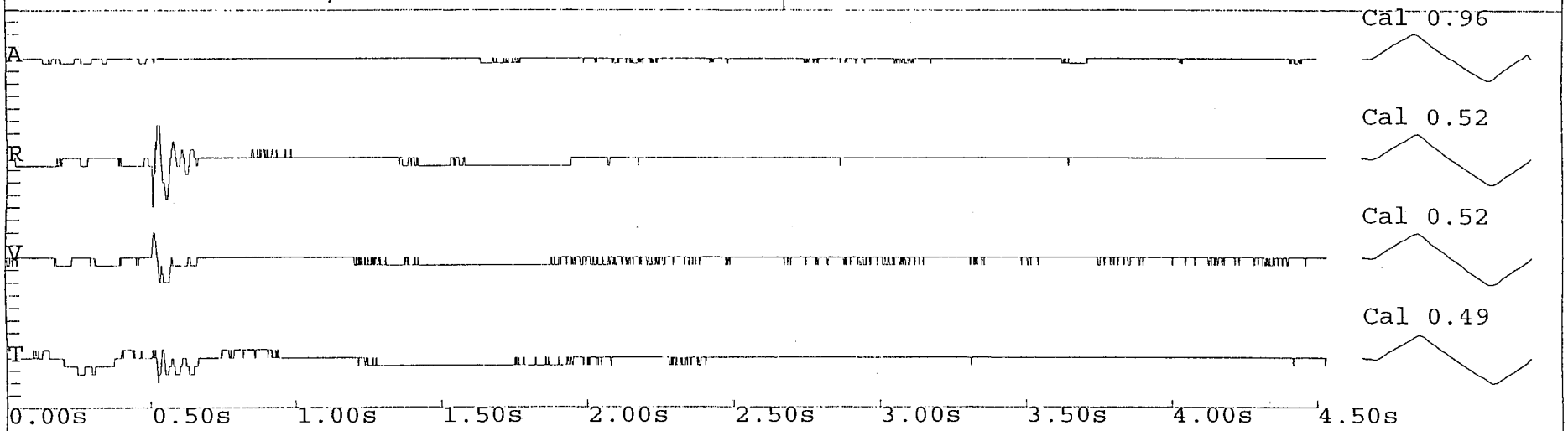


Fourier Analysis (Amplitude Spectrum)

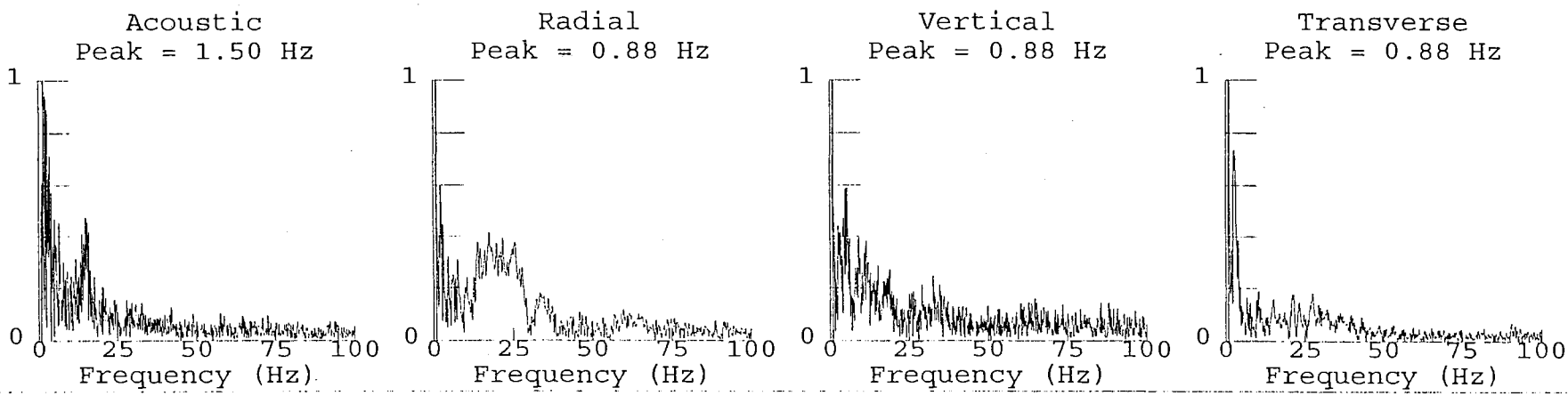


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 062 Date: 8/12/95 Time: 14:22
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.06 in/s 73.1 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.06 in/s (0.015 in/s/div)
Transverse: 0.03 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

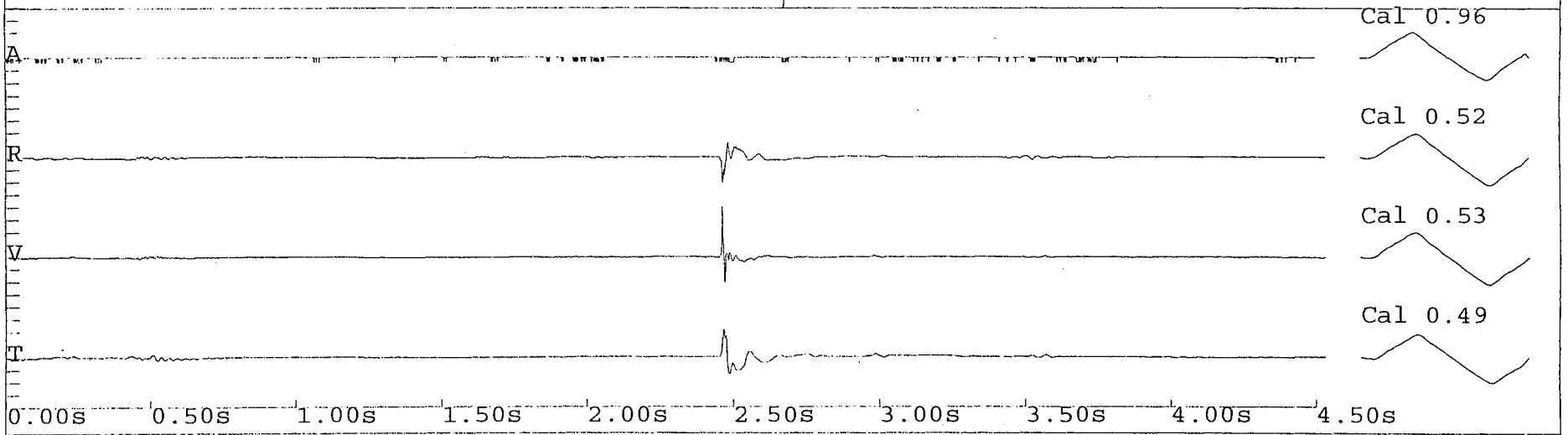


Fourier Analysis (Amplitude Spectrum)

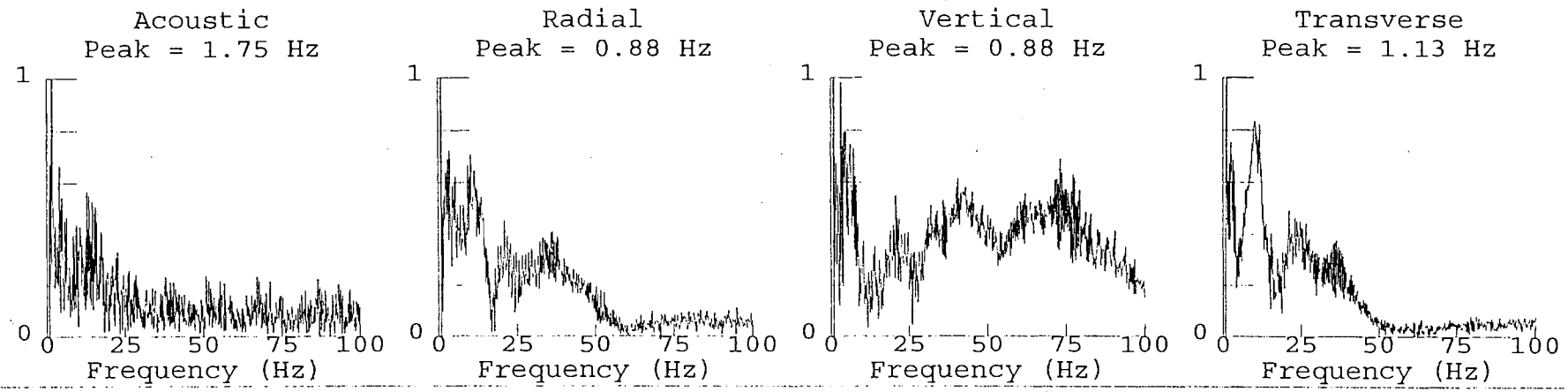


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 063 Date: 8/12/95 Time: 14:45
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.27 in/s 22.2 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.52 in/s 46.5 Hz.	Seis: 0.52 in/s (0.13 in/s/div)
Transverse: 0.28 in/s 23.2 Hz.	Time Lines at: 0.50 sec intervals

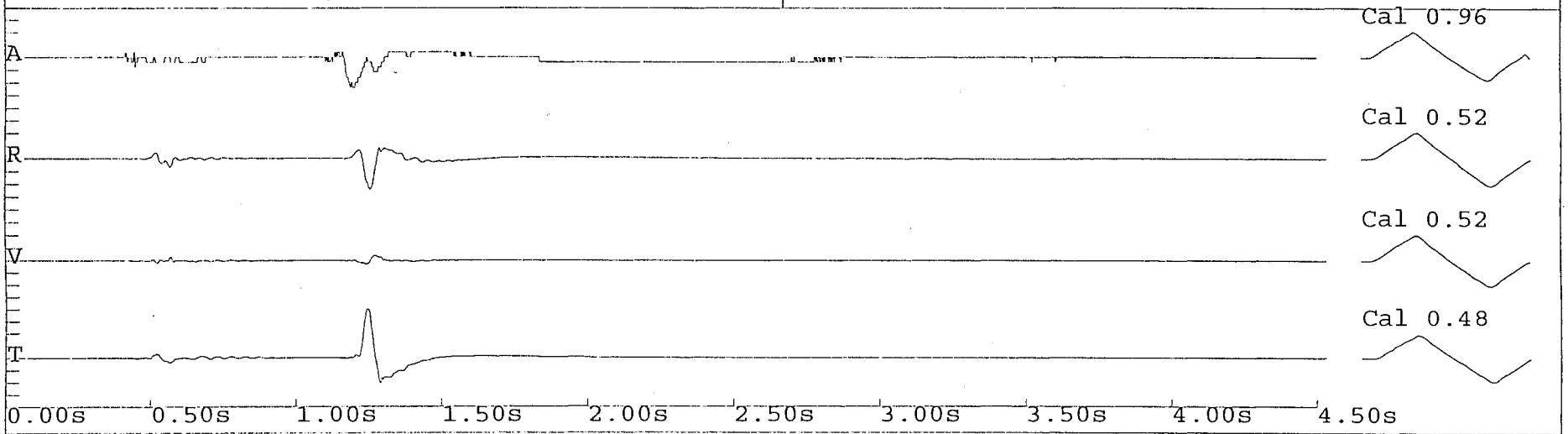


Fourier Analysis (Amplitude Spectrum)

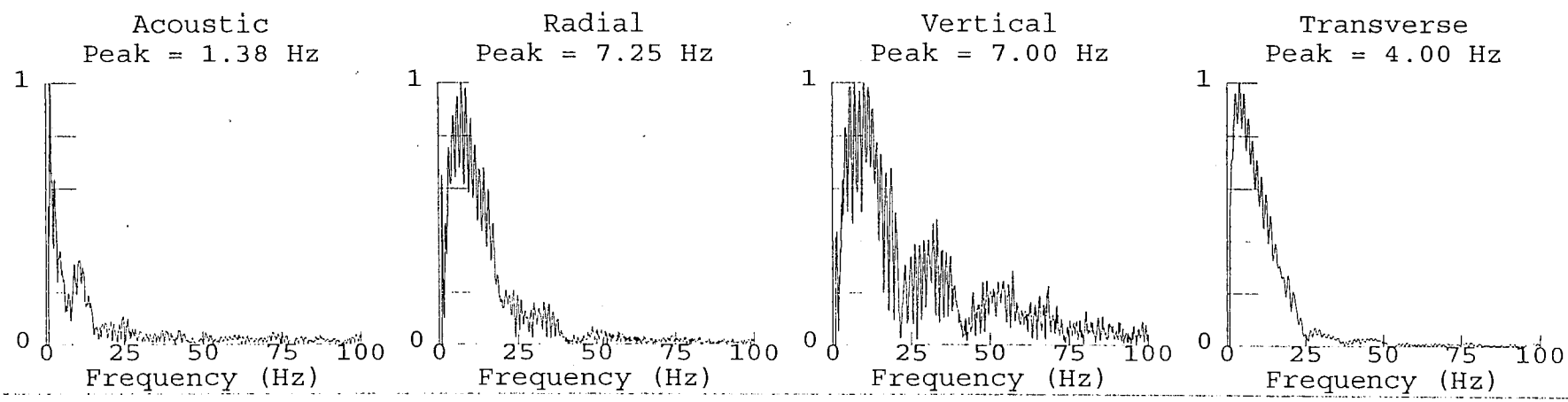


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 064 Date: 8/12/95 Time: 14:45
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 116 dB 6.8 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.50 in/s 10.4 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.08 in/s 12.1 Hz.	Seis: 0.82 in/s (0.205 in/s/div)
Transverse: 0.82 in/s 7.0 Hz.	Time Lines at: 0.50 sec intervals

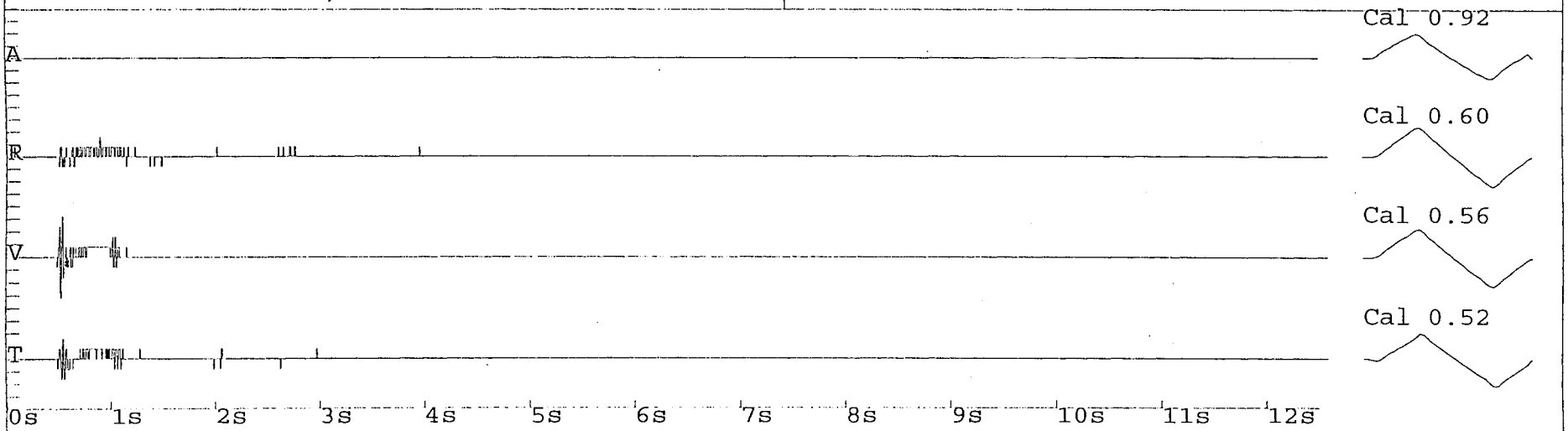


Fourier Analysis (Amplitude Spectrum)

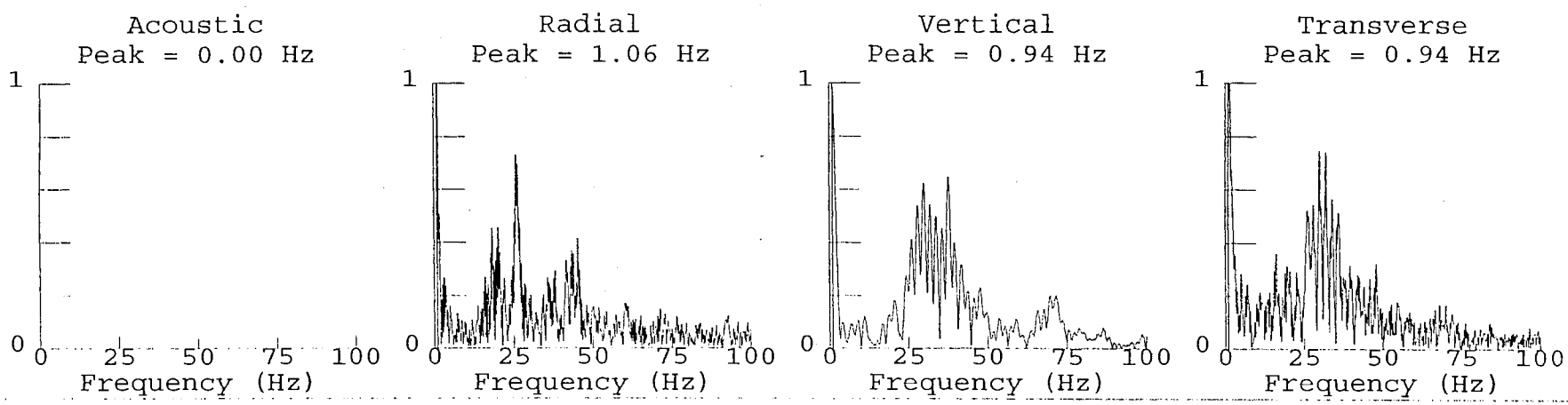


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 18
Location: Jacob's Room
Non-blast Trigger
Event: 224 Date: 8/15/95 Time: 13:46
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 18

Amplitudes and Frequencies	Graph Information
Acoustic: 0 dB 0.0 Hz.	Duration: 0.000 sec To: 12.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.04 in/s 46.5 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.02 in/s 0.0 Hz.	Time Lines at: 1.00 sec intervals

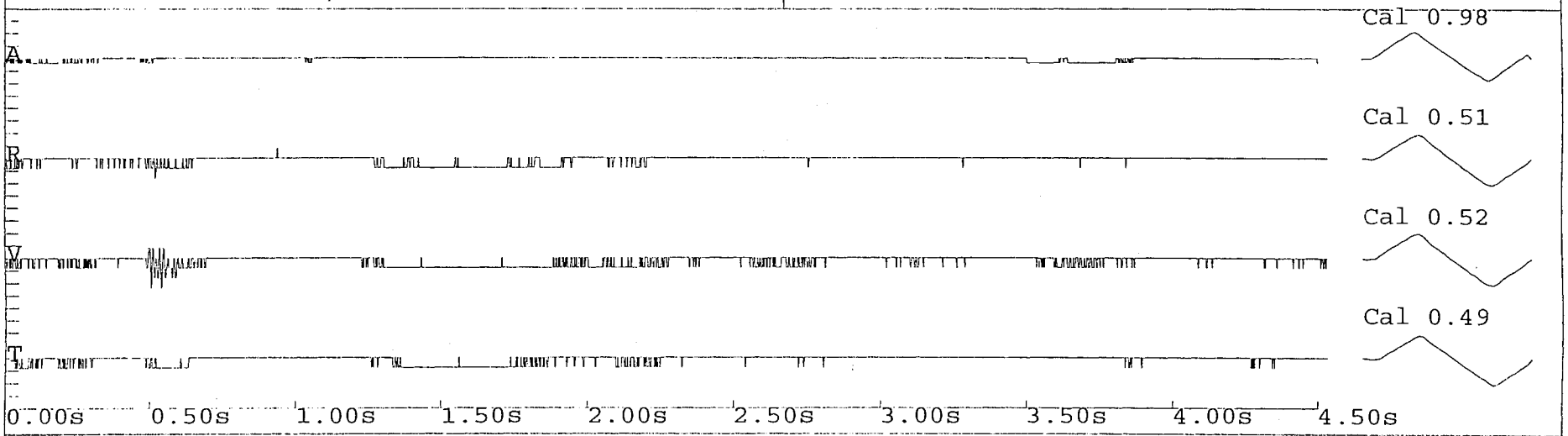


Fourier Analysis (Amplitude Spectrum)

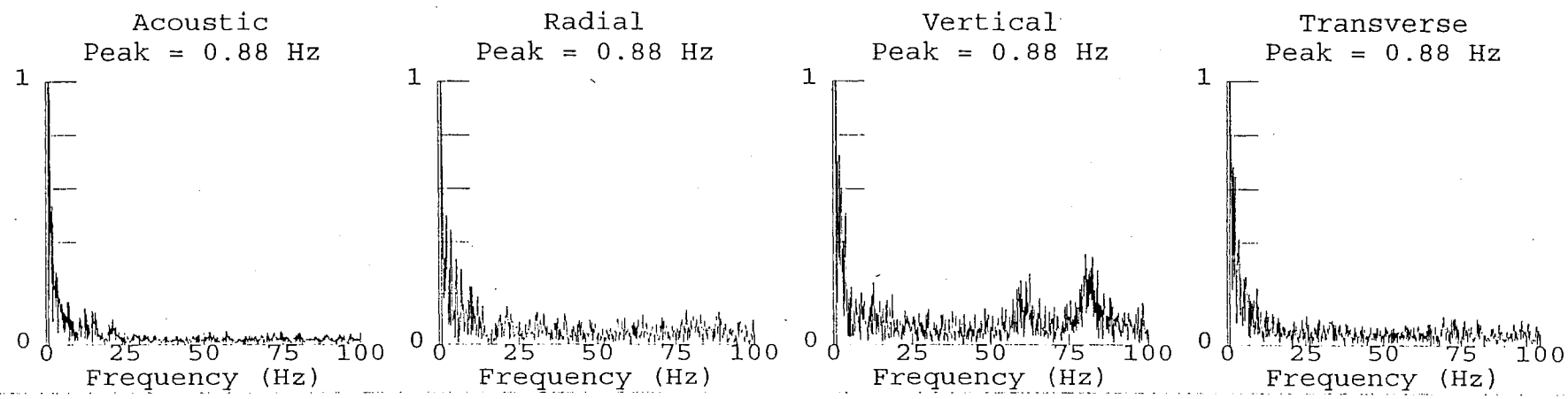


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 065 Date: 8/18/95 Time: 11:11
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.02 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

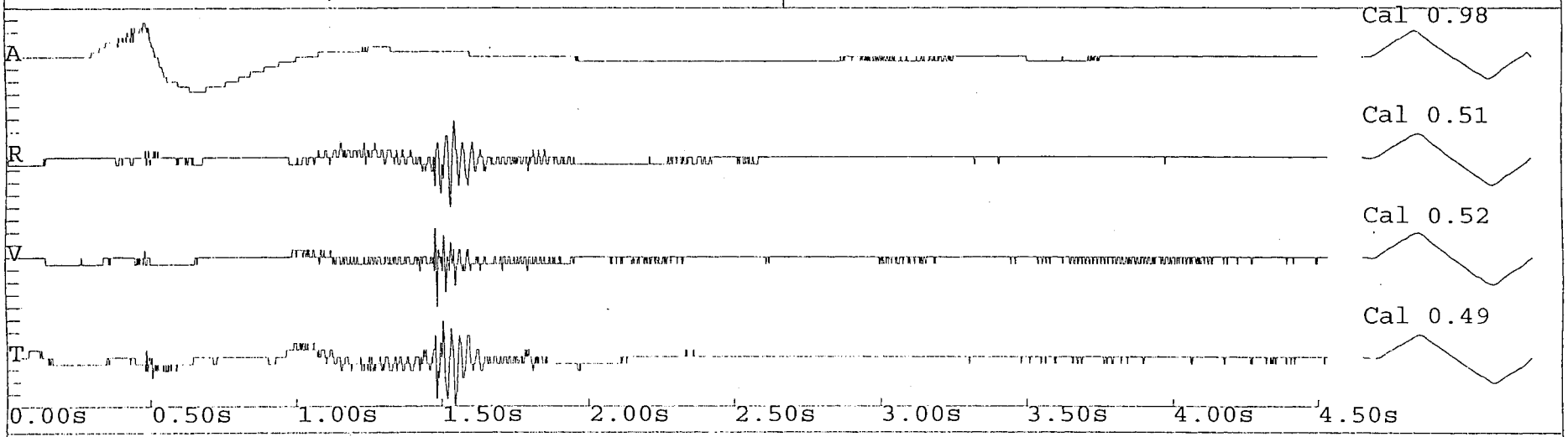


Fourier Analysis (Amplitude Spectrum)

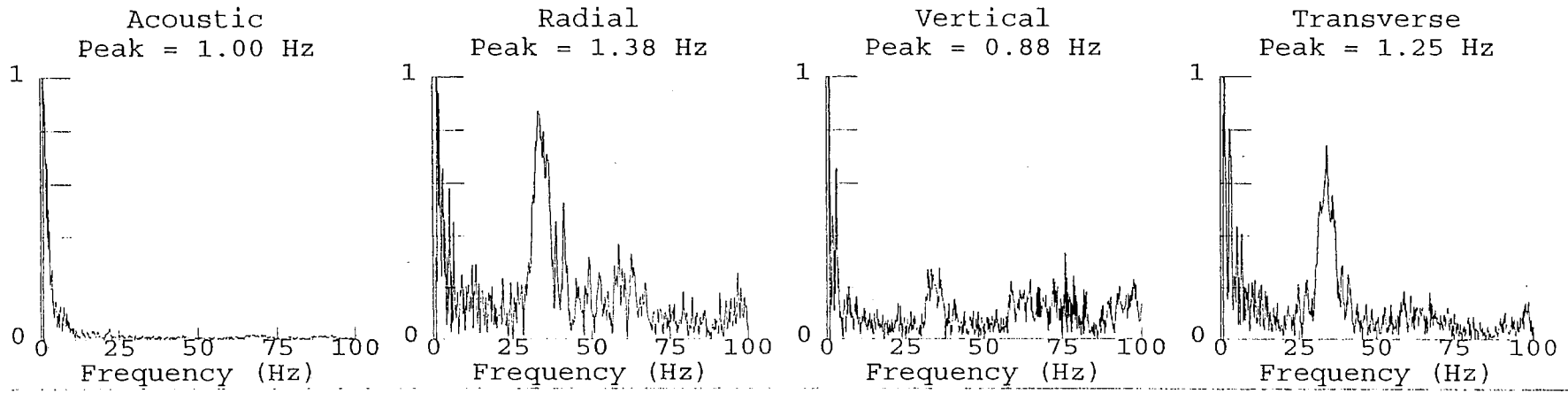


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 066 Date: 8/19/95 Time: 12:32
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 117 dB 1.4 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.07 in/s 46.5 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.07 in/s 73.1 Hz.	Seis: 0.07 in/s (0.0175 in/s/div)
Transverse: 0.07 in/s 34.1 Hz.	Time Lines at: 0.50 sec intervals

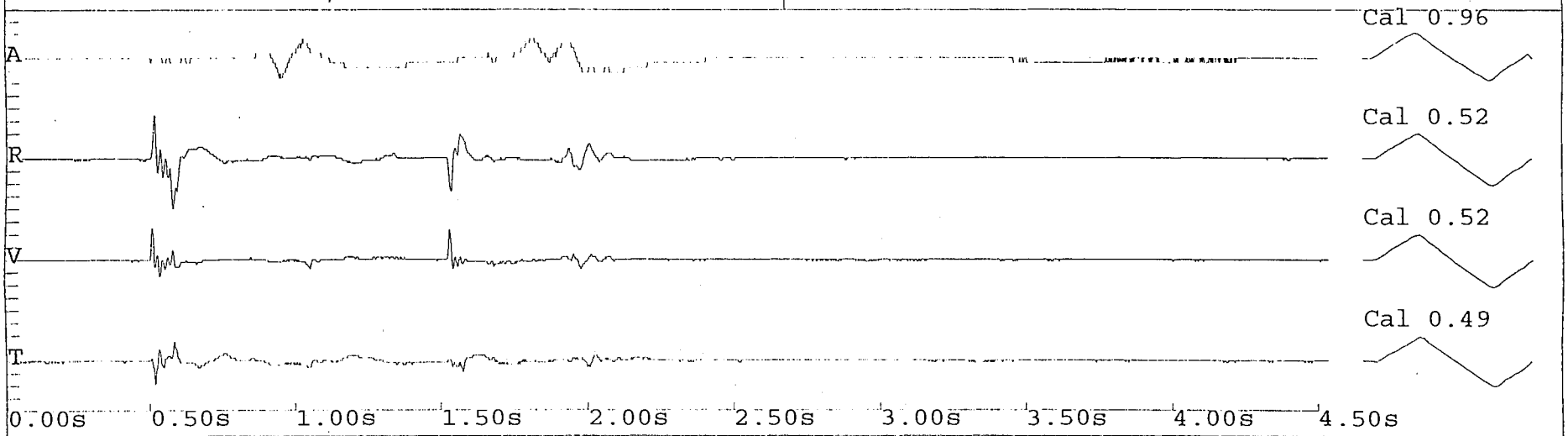


Fourier Analysis (Amplitude Spectrum)

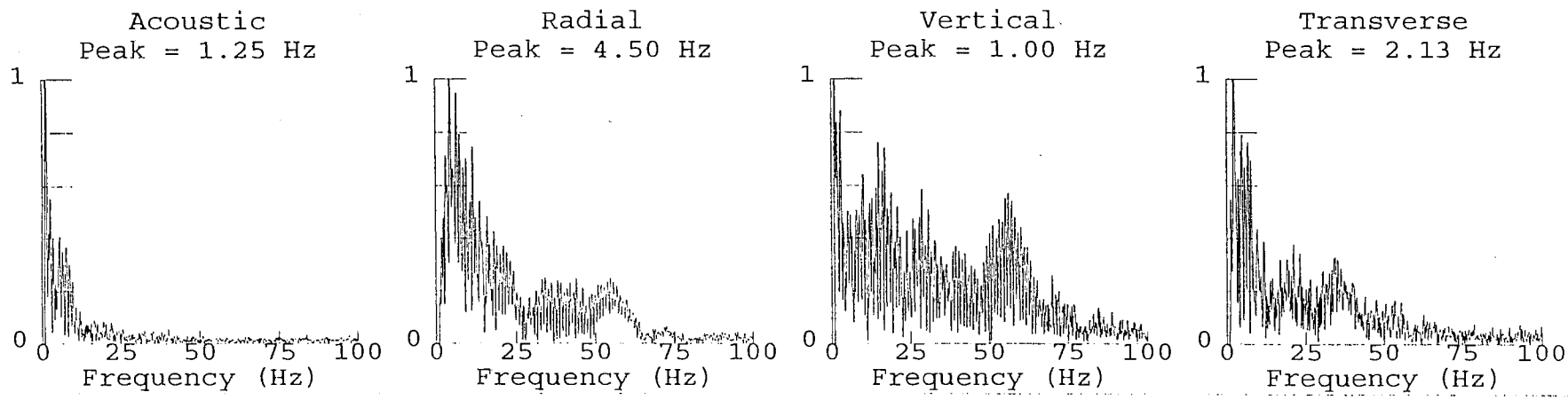


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 067 Date: 8/19/95 Time: 12:32
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 112 dB 5.8 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.21 in/s 10.4 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.13 in/s 42.6 Hz.	Seis: 0.21 in/s (0.0525 in/s/div)
Transverse: 0.10 in/s 30.1 Hz.	Time Lines at: 0.50 sec intervals

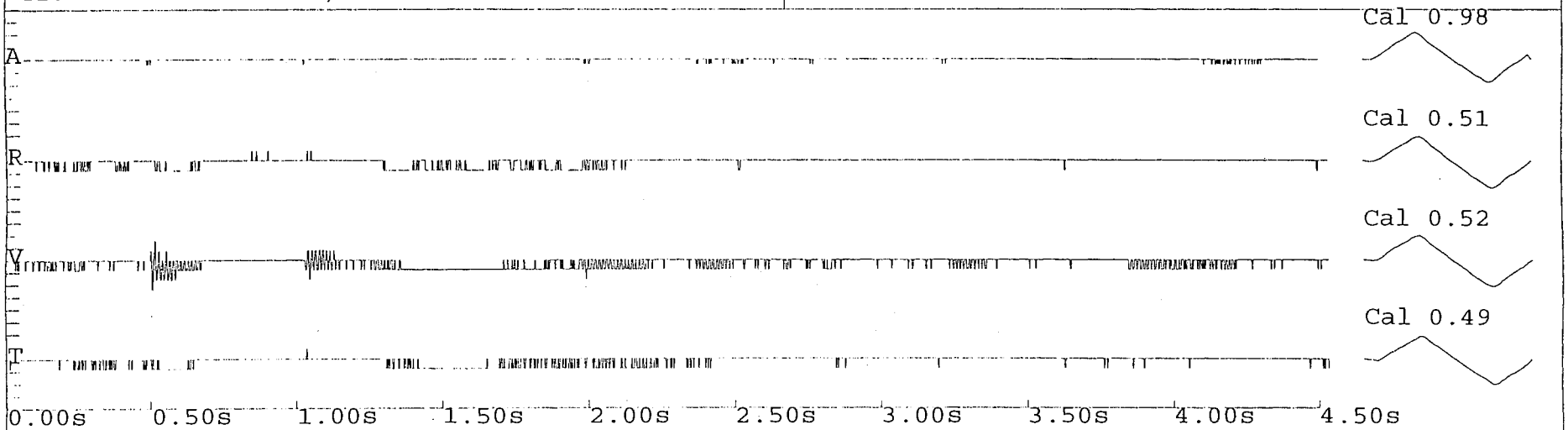


Fourier Analysis (Amplitude Spectrum)

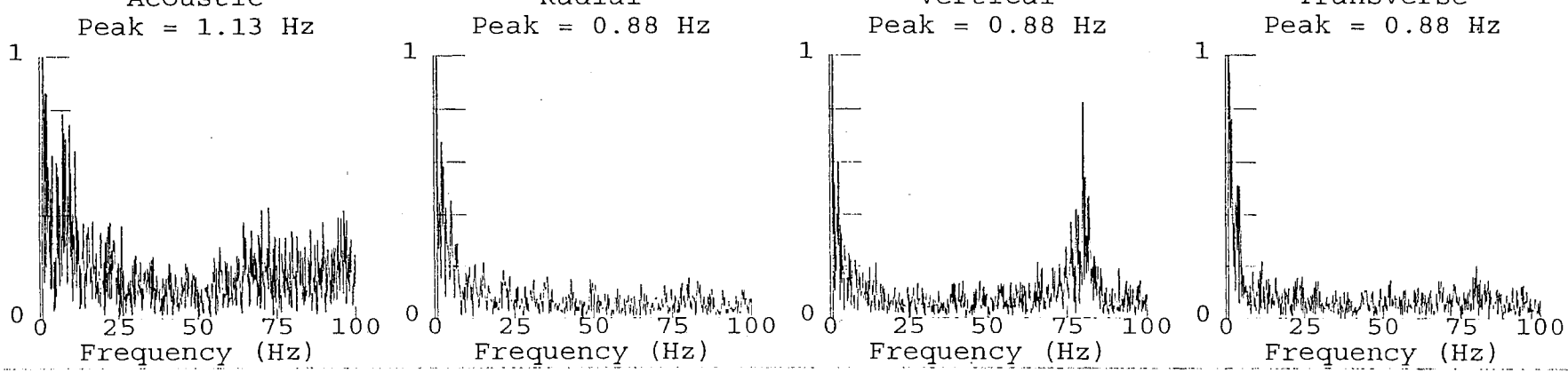


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 068 Date: 8/19/95 Time: 14:19
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.01 in/s 0.0 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.03 in/s 0.0 Hz.	Seis: 0.05 in/s (0.0125 in/s/div)
Transverse: 0.01 in/s 0.0 Hz.	Time Lines at: 0.50 sec intervals

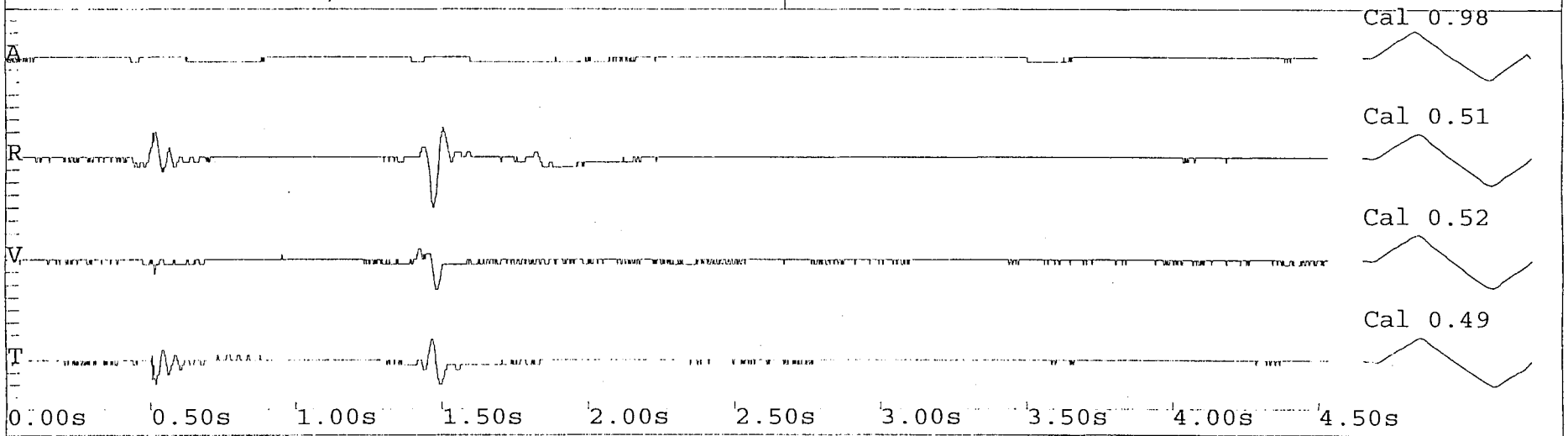


Fourier Analysis (Amplitude Spectrum)

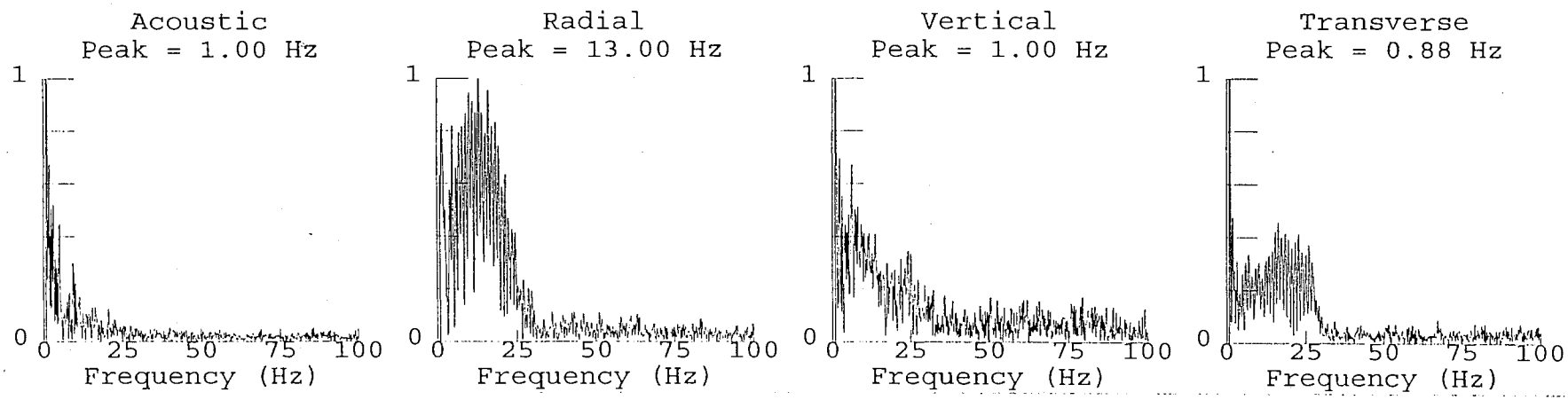


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 069 Date: 8/20/95 Time: 15:07
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.10 in/s 14.2 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.06 in/s 4.2 Hz.	Seis: 0.10 in/s (0.025 in/s/div)
Transverse: 0.05 in/s 23.2 Hz.	Time Lines at: 0.50 sec intervals

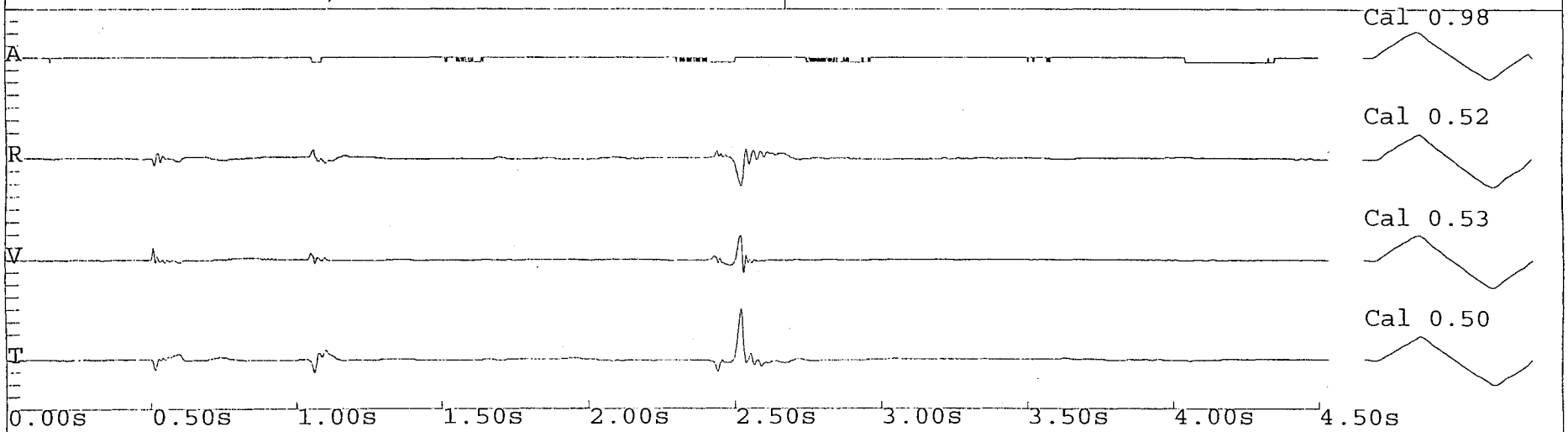


Fourier Analysis (Amplitude Spectrum)

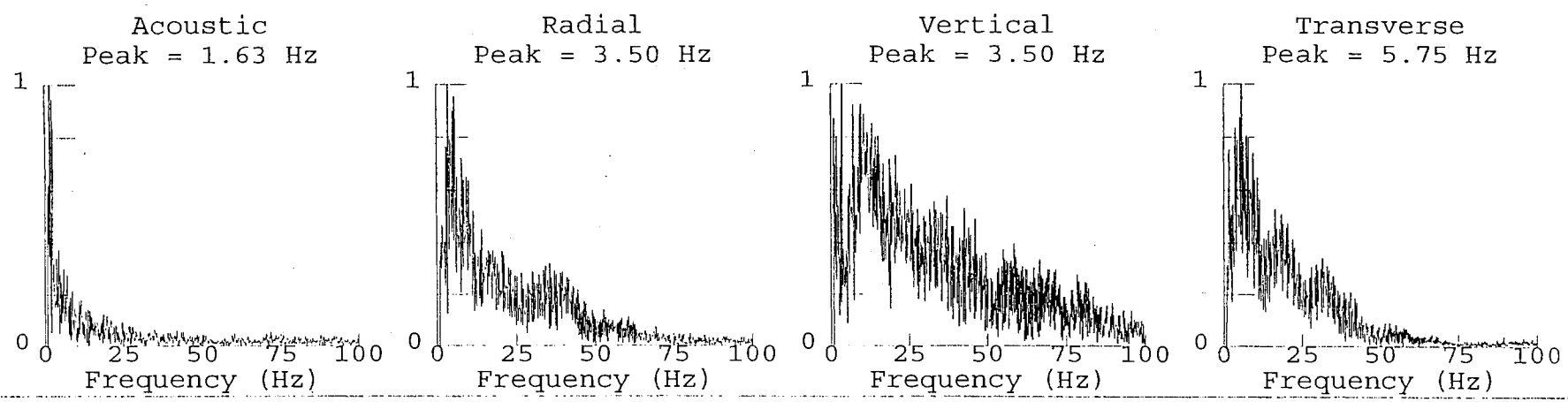


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 070 Date: 8/24/95 Time: 11:30
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.26 in/s 12.4 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.22 in/s 22.2 Hz.	Seis: 0.47 in/s (0.1175 in/s/div)
Transverse: 0.47 in/s 13.8 Hz.	Time Lines at: 0.50 sec intervals

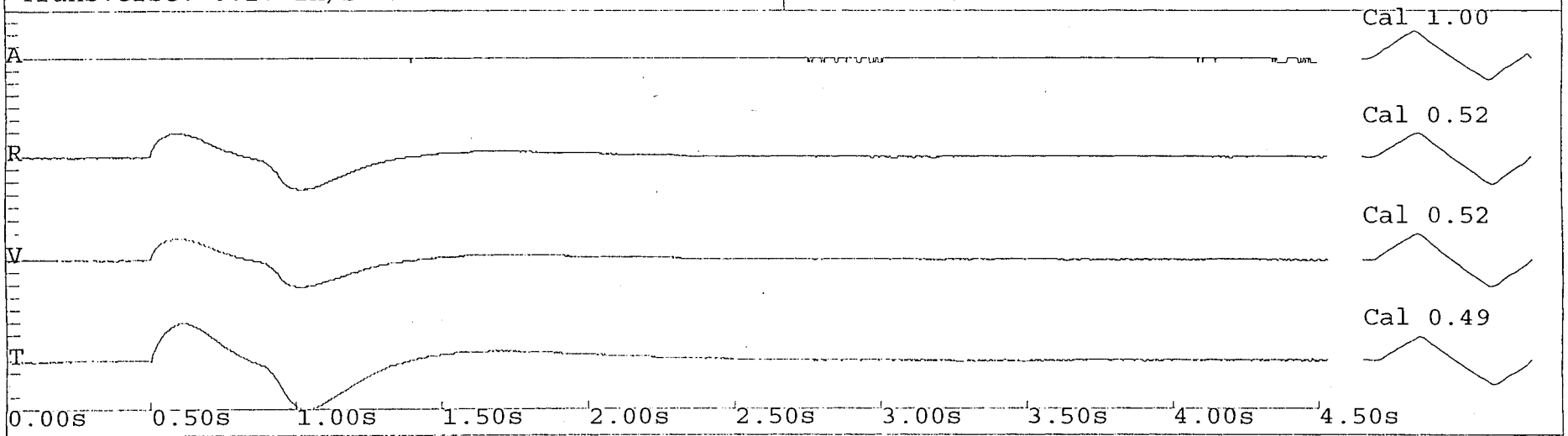


Fourier Analysis (Amplitude Spectrum)

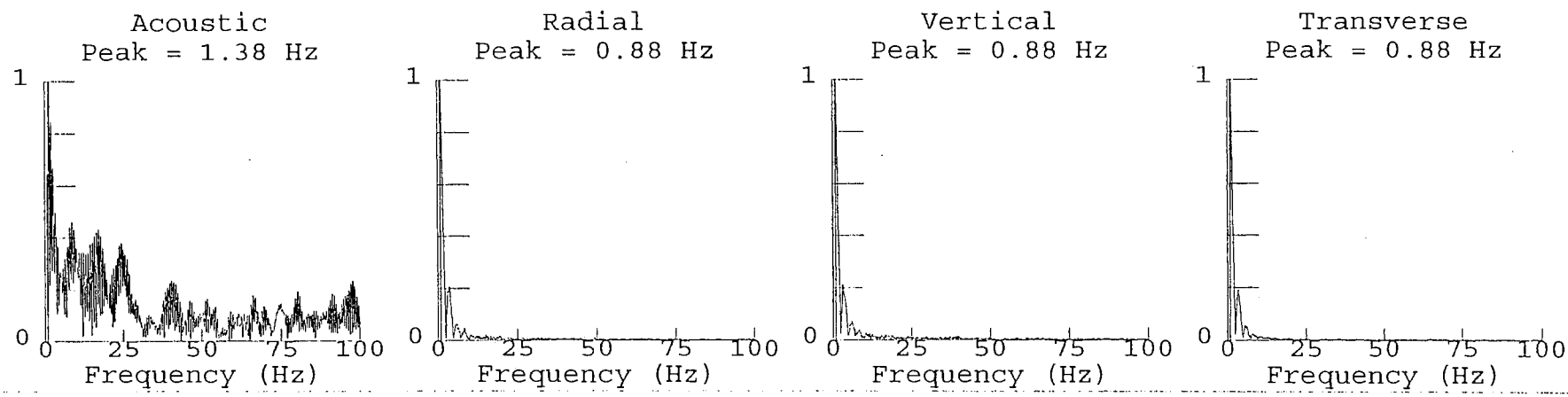


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 071 Date: 8/26/95 Time: 12:05
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.18 in/s 1.3 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.15 in/s 1.3 Hz.	Seis: 0.27 in/s (0.0675 in/s/div)
Transverse: 0.27 in/s 1.2 Hz.	Time Lines at: 0.50 sec intervals

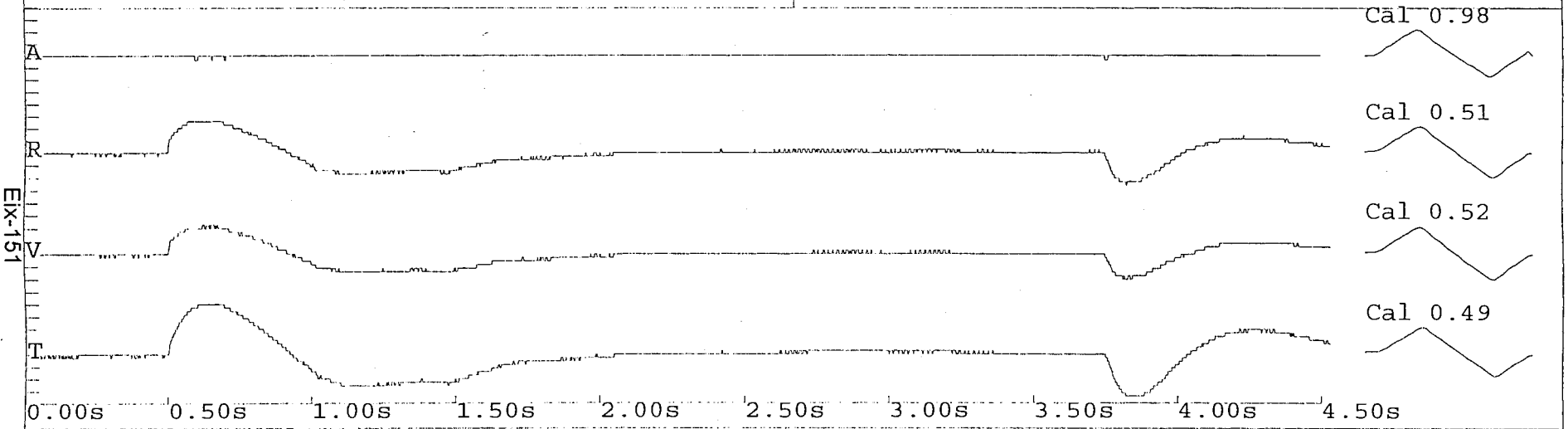


Fourier Analysis (Amplitude Spectrum)

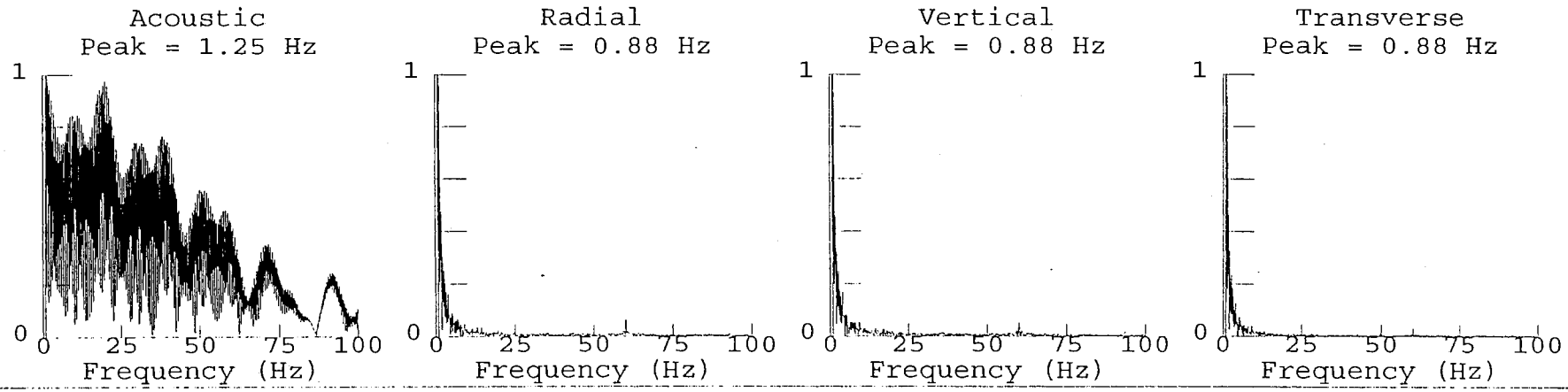


University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 072 Date: 8/26/95 Time: 12:05
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.09 in/s 1.5 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.08 in/s 1.4 Hz.	Seis: 0.14 in/s (0.035 in/s/div)
Transverse: 0.14 in/s 1.4 Hz.	Time Lines at: 0.50 sec intervals



Fourier Analysis (Amplitude Spectrum)



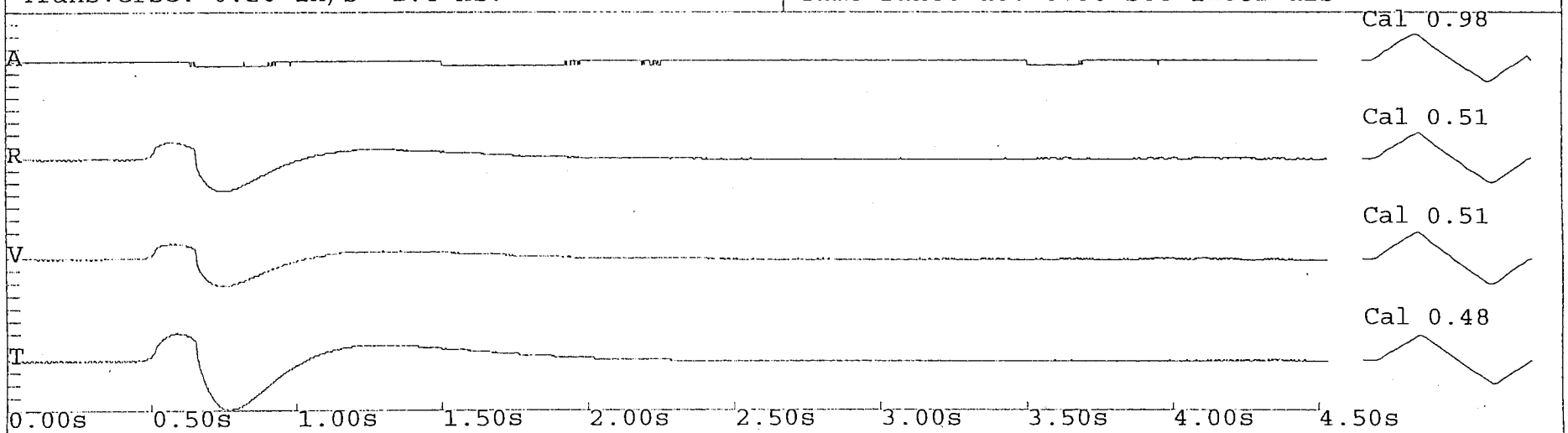
University of Missouri-Rolla
Rock Mechanics and Explosive Research Center
Crystal Cave Project
Unit16
Location: Hanging Balcony
Non-blast Trigger
Event: 073 Date: 8/26/95 Time: 12:05
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 16

Amplitudes and Frequencies

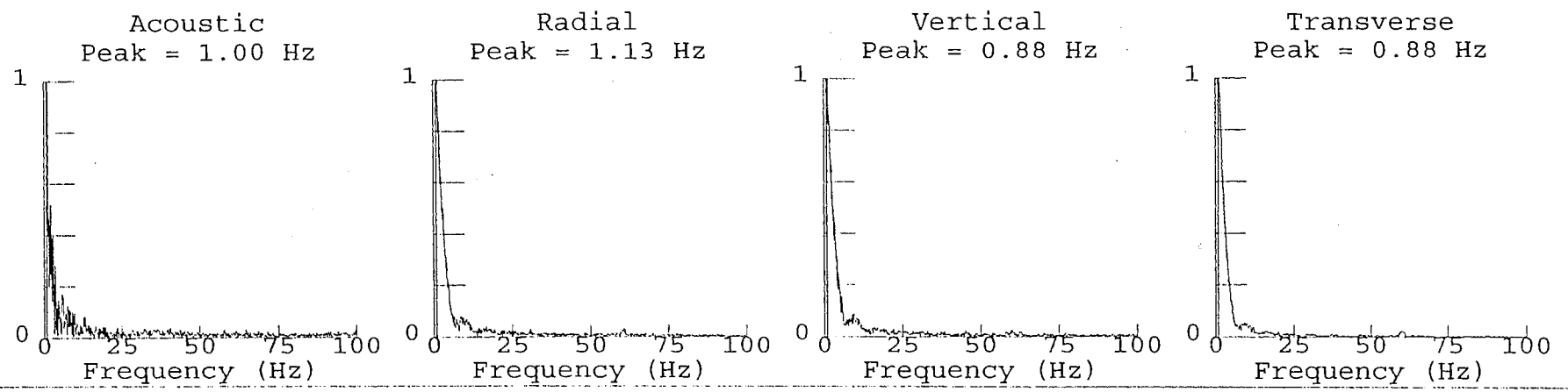
Acoustic: 100 dB 0.0 Hz.
Radial: 0.17 in/s 1.5 Hz.
Vertical: 0.14 in/s 1.5 Hz.
Transverse: 0.26 in/s 1.4 Hz.

Graph Information

Duration: 0.000 sec To: 4.500 sec
Acoustic: 0.20 Mb (0.05 Mb/div)
Seis: 0.26 in/s (0.065 in/s/div)
Time Lines at: 0.50 sec intervals

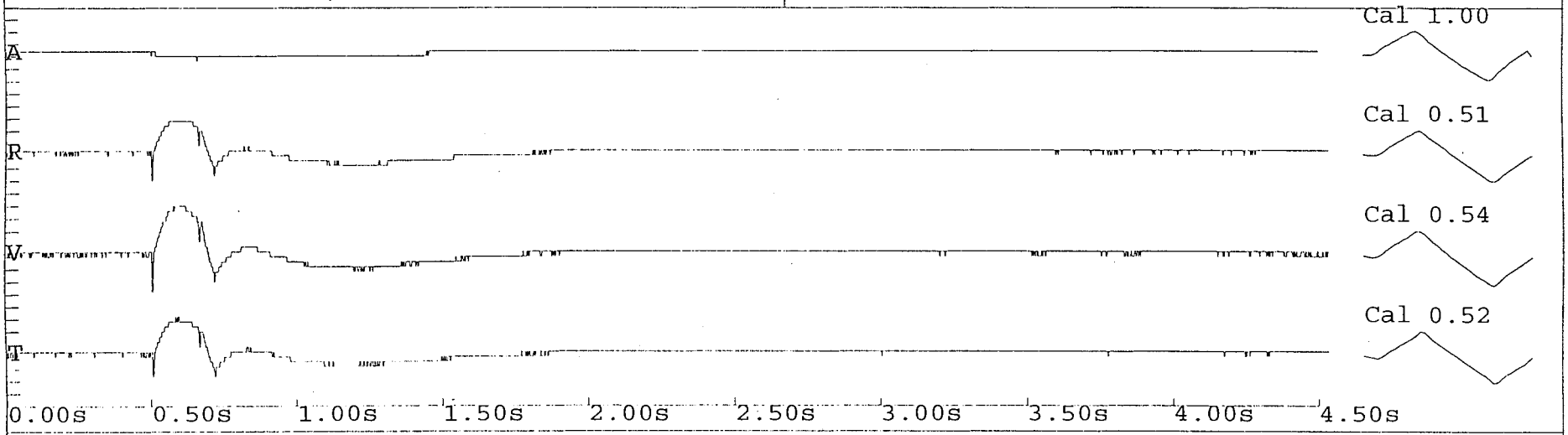


Fourier Analysis (Amplitude Spectrum)

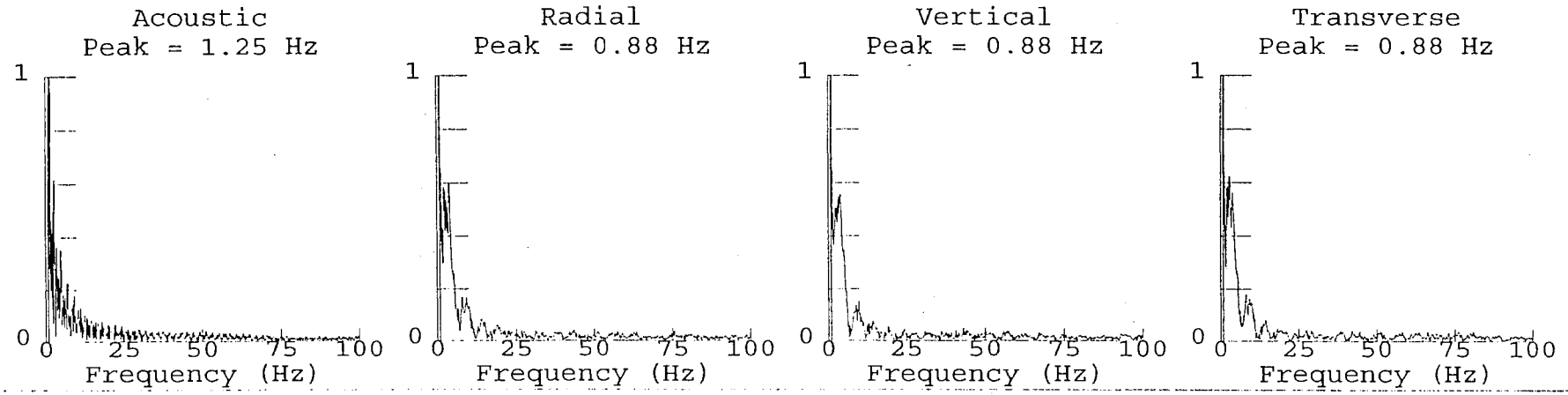


University of Missouri-Rolla
Rock Mechanics and Explosives Research Center
Crystal Cave Project
Unit 20
Location: Lloyd's Room
Non-blast Trigger
Event: 025 Date: 8/26/95 Time: 12:26
Air Trigger: 142 dB Seis Trigger: 0.03 in/s S/N: 20

Amplitudes and Frequencies	Graph Information
Acoustic: 100 dB 0.0 Hz.	Duration: 0.000 sec To: 4.500 sec
Radial: 0.07 in/s 2.7 Hz.	Acoustic: 0.20 Mb (0.05 Mb/div)
Vertical: 0.10 in/s 2.7 Hz.	Seis: 0.10 in/s (0.025 in/s/div)
Transverse: 0.08 in/s 2.7 Hz.	Time Lines at: 0.50 sec intervals



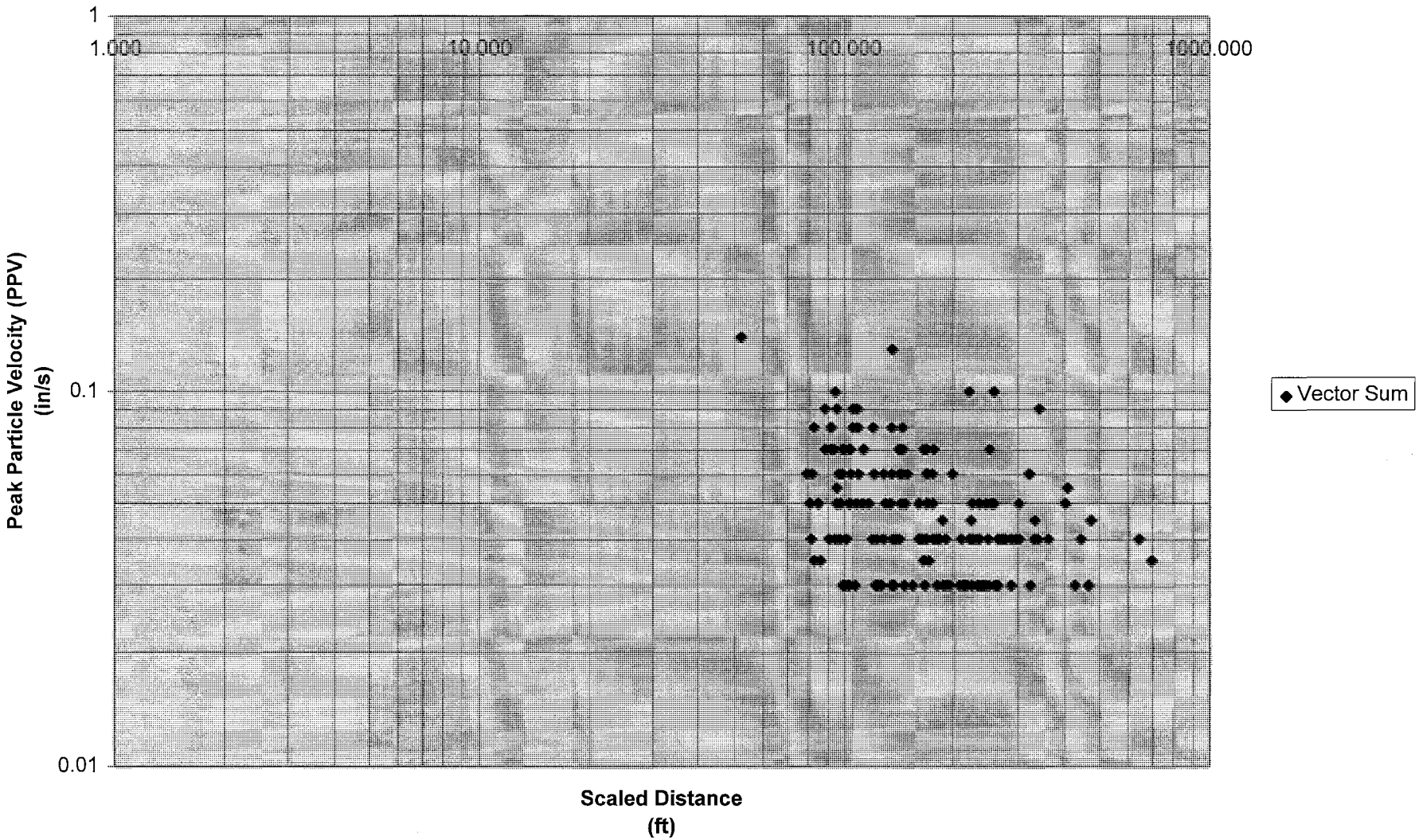
Fourier Analysis (Amplitude Spectrum)



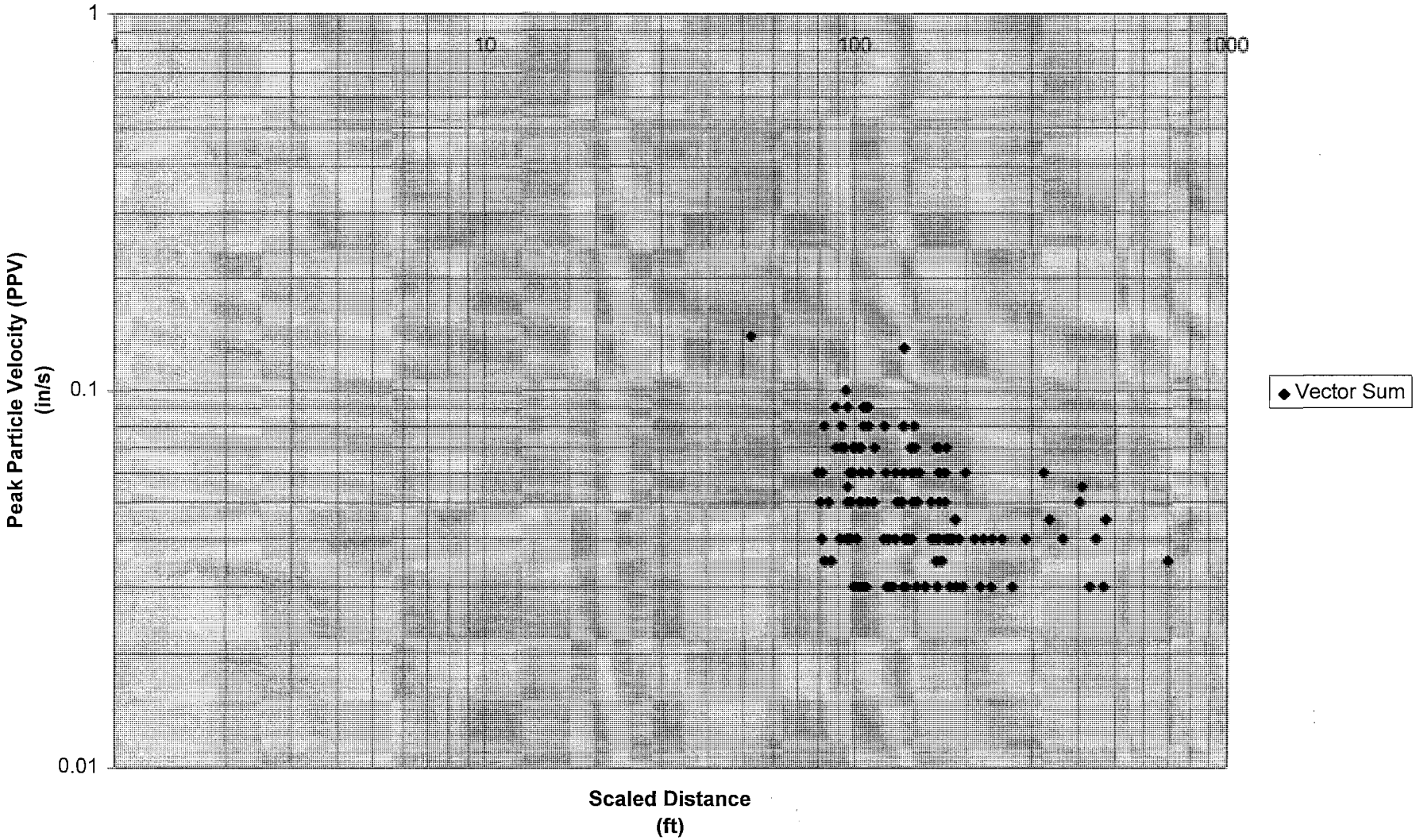
APPENDIX F

LOG-LOG PLOTS

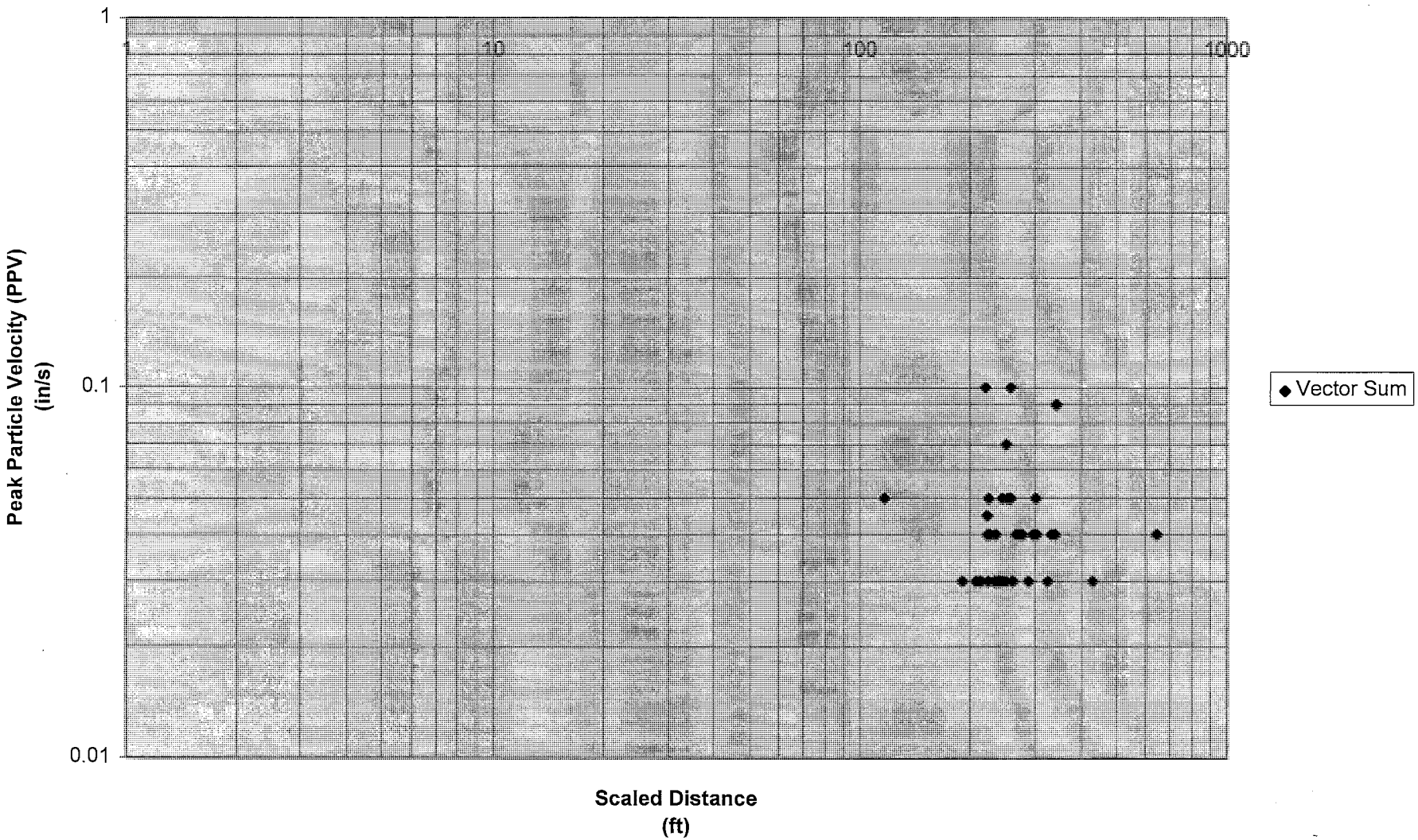
All Blasts
Log-Log Plot

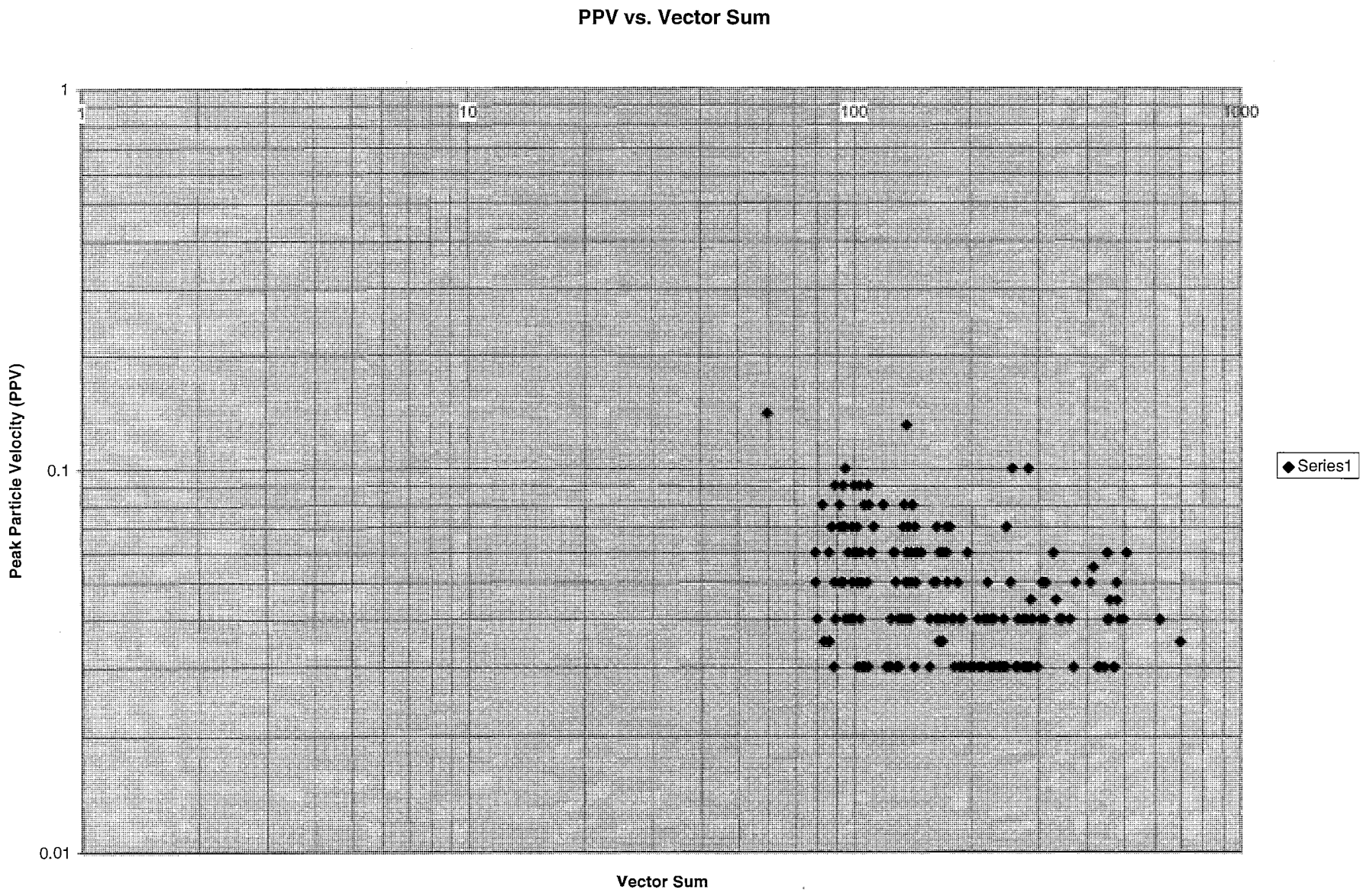


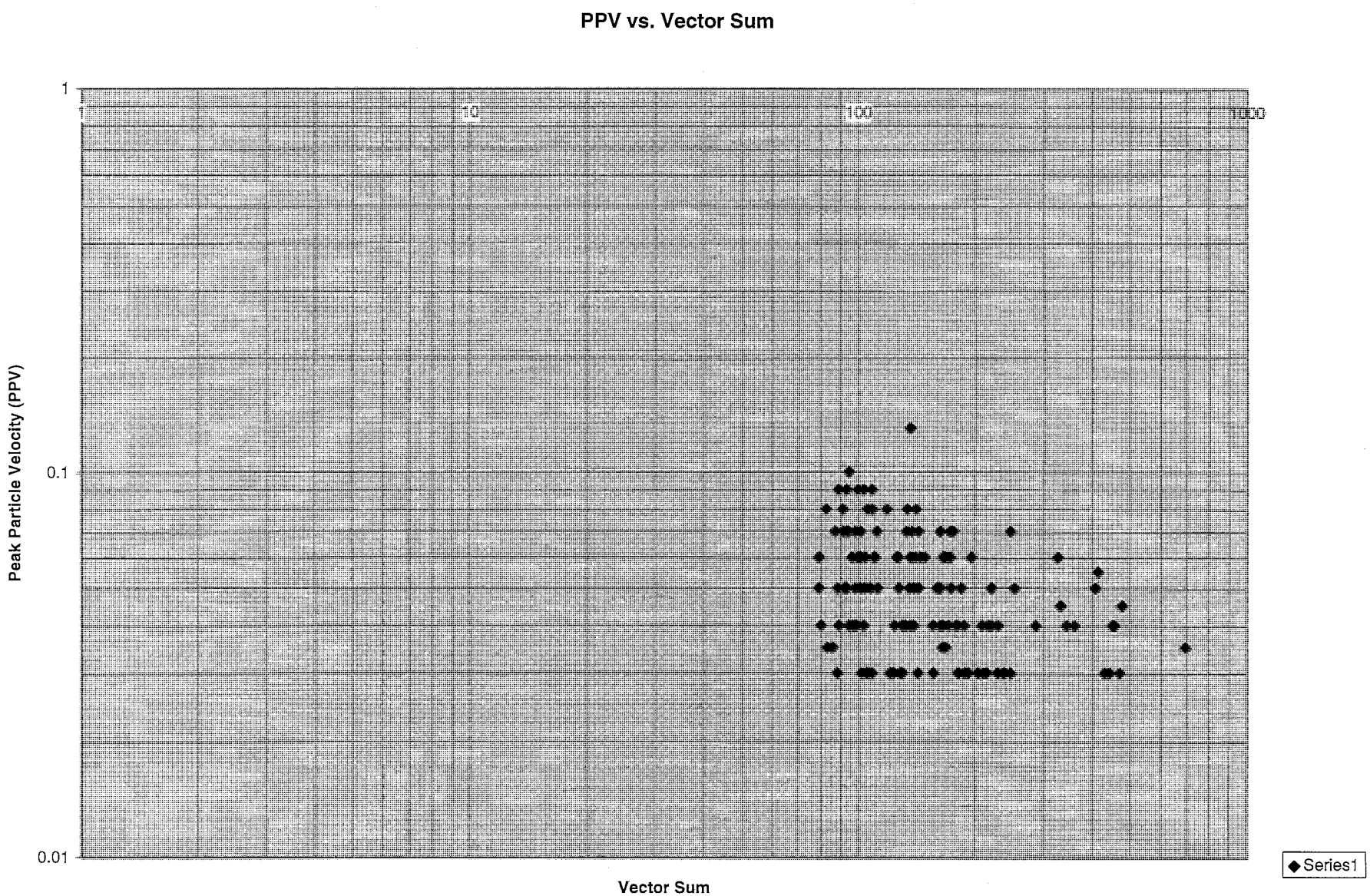
Production Blasts
Log-Log Plot

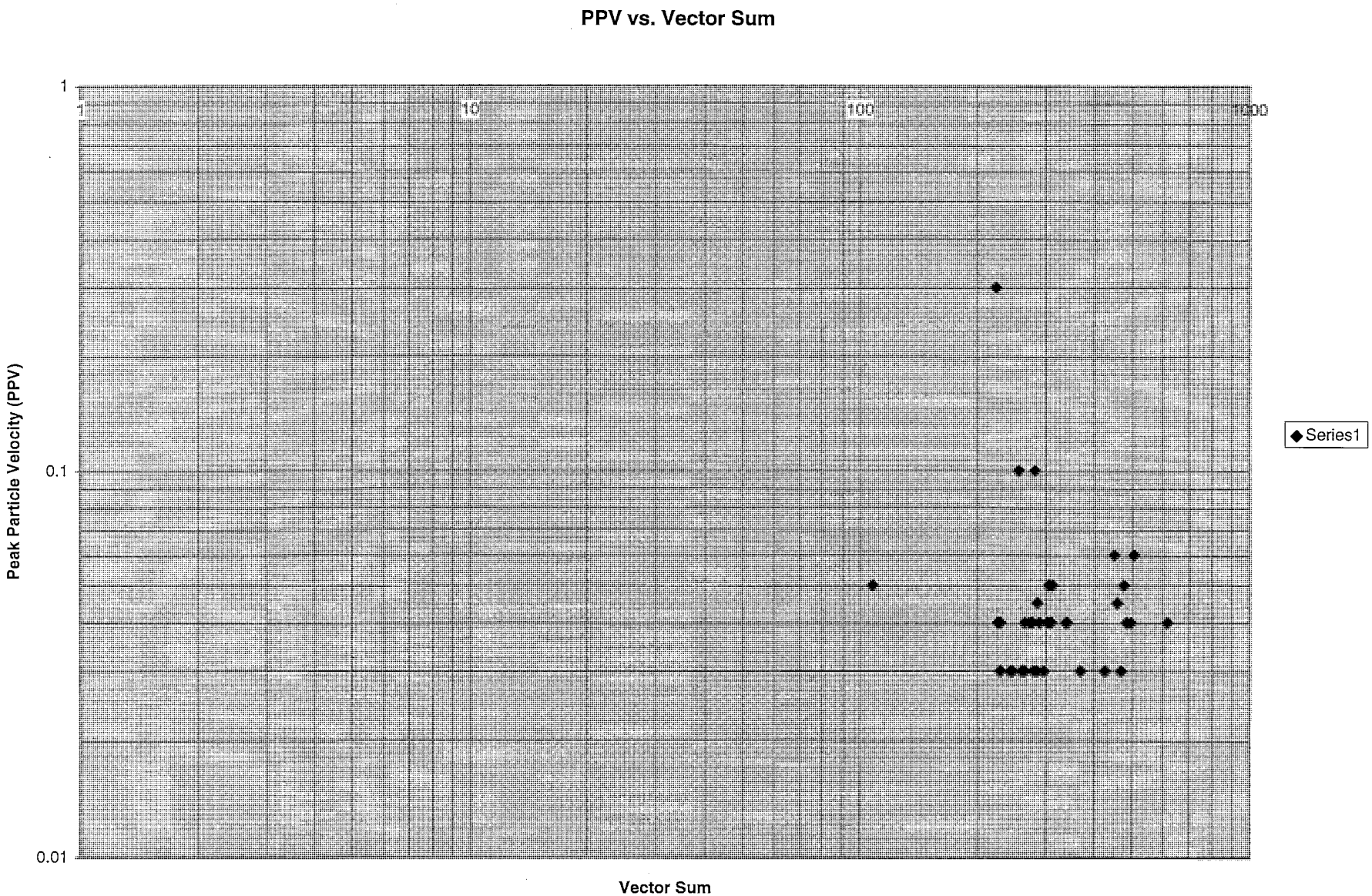


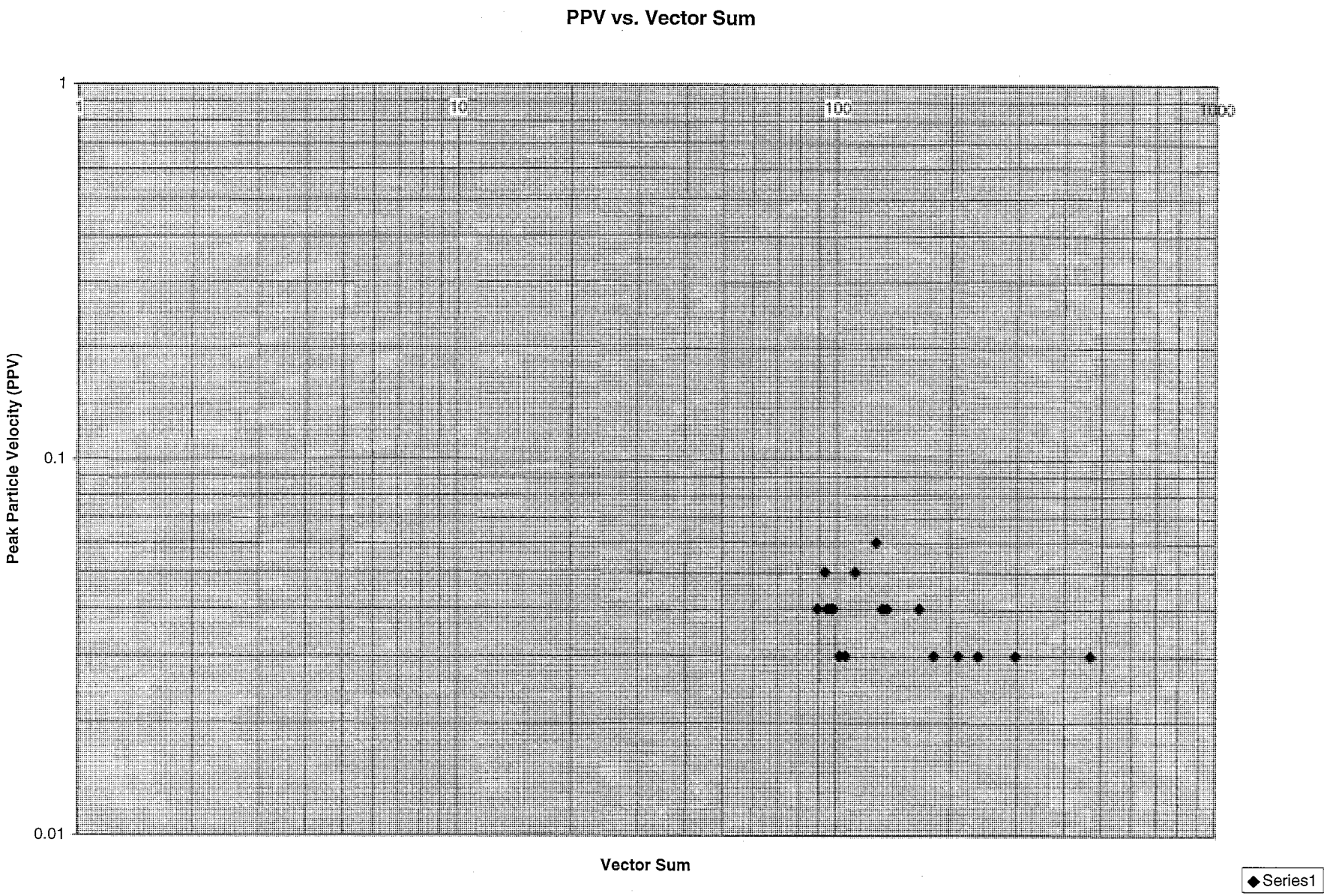
Pre-Split Blasts
Log-Log Plot

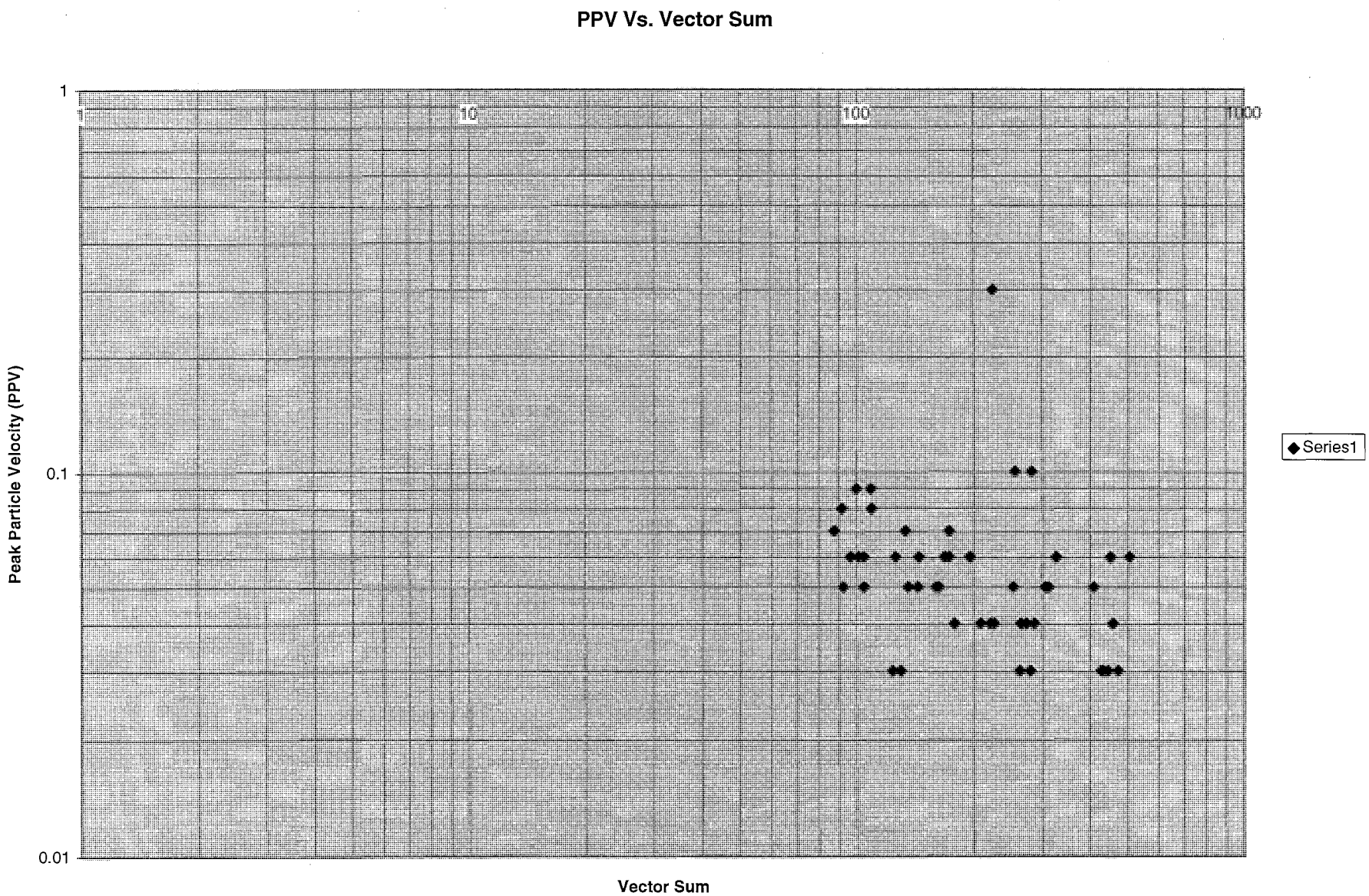


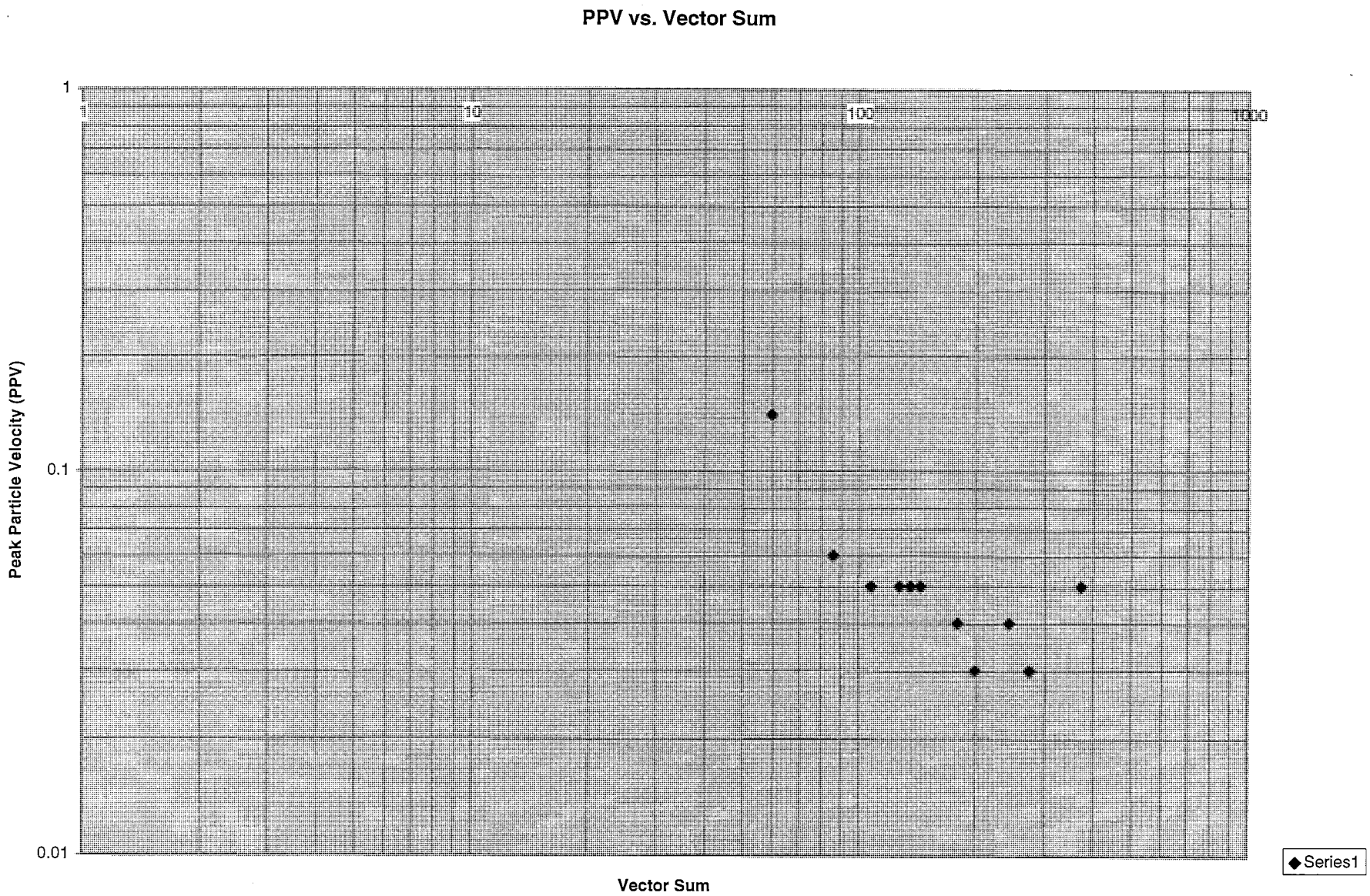

PPV vs. Vector Sum
1
0.1
0.01
1
10
100
1000
Peak Particle Velocity (PPV)
Vector Sum
Series1

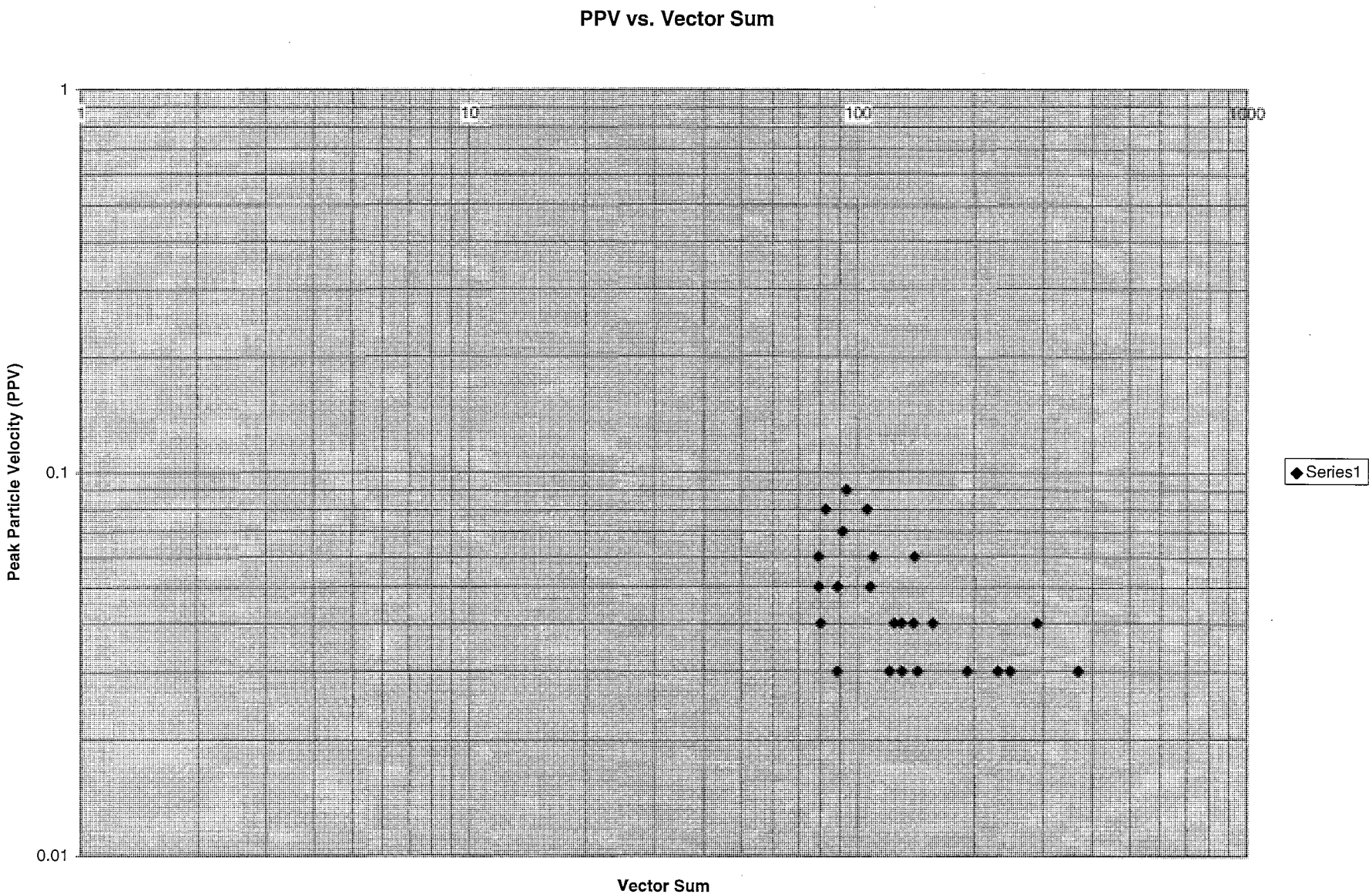

PPV vs. Vector Sum
1
0.1
0.01
1
10
100
1000
Peak Particle Velocity (PPV)
Vector Sum
Series1

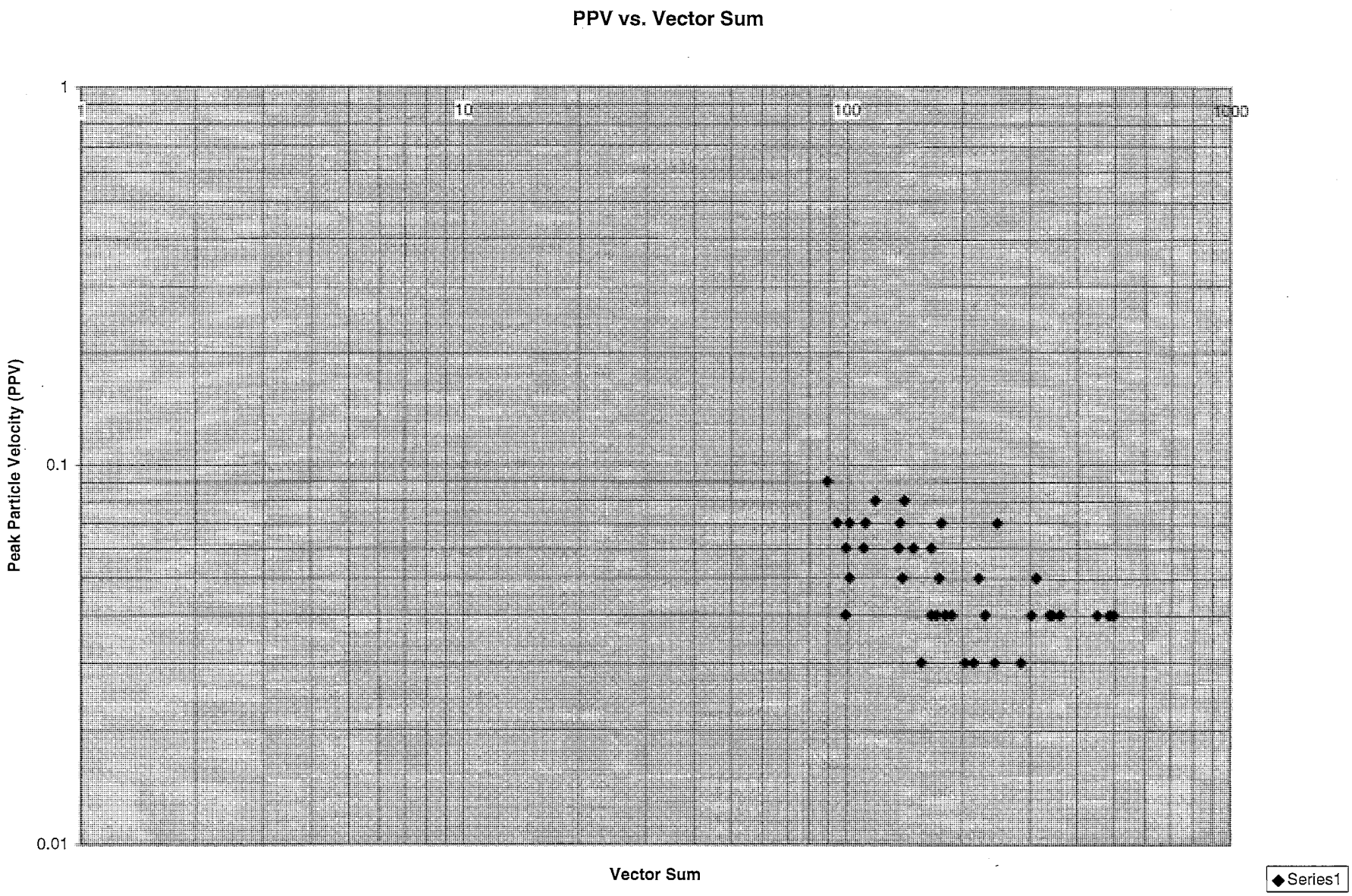

PPV vs. Vector Sum
1
0.1
0.01
1
10
100
1000
Peak Particle Velocity (PPV)
Vector Sum
Series1

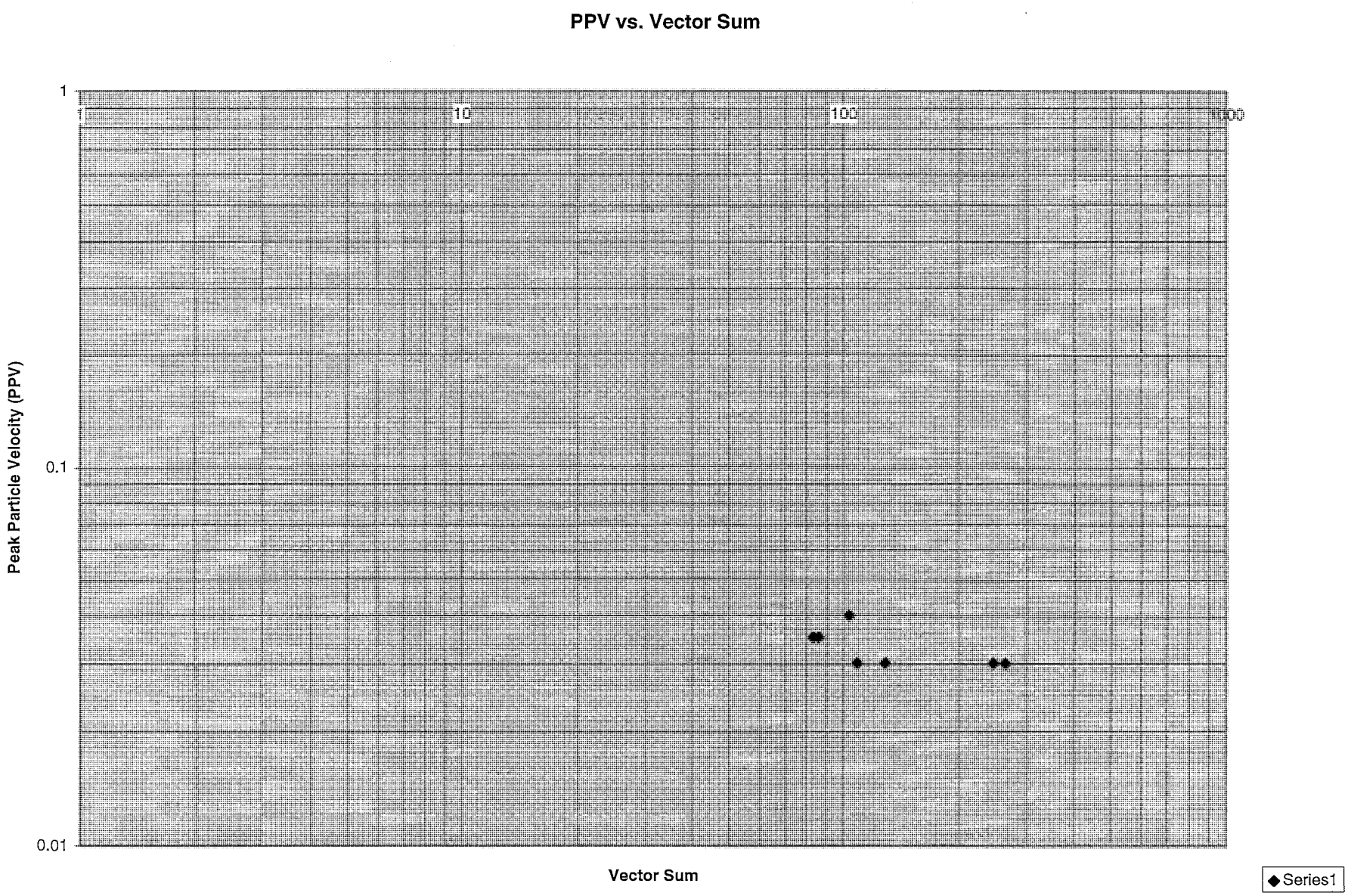

PPV vs. Vector Sum
1
0.1
0.01
1
10
100
1000
Peak Particle Velocity (PPV)
Vector Sum
Series1

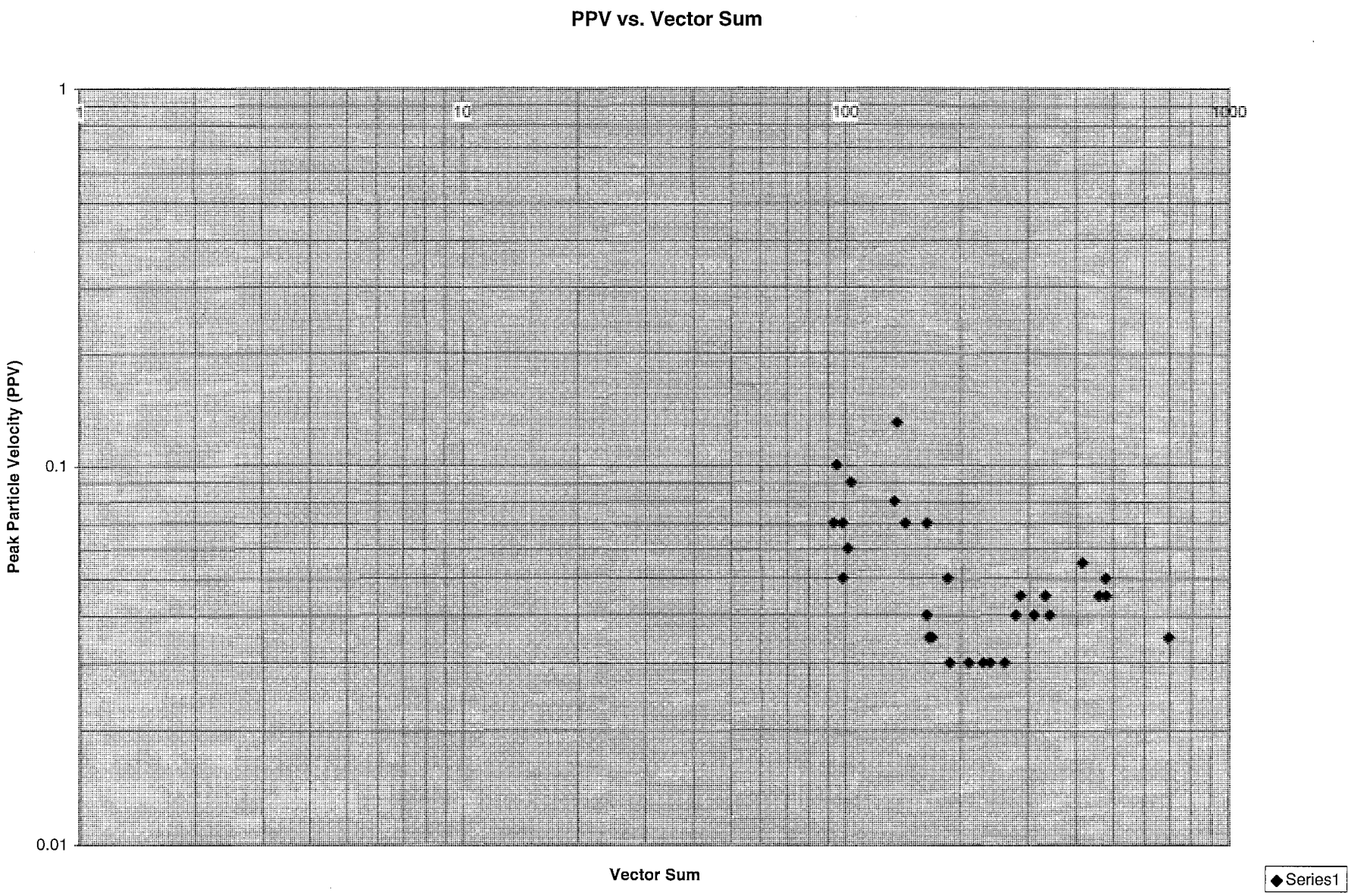

PPV Vs. Vector Sum
1
0.1
0.01
1
10
100
1,000
Peak Particle Velocity (PPV)
Vector Sum
Series1

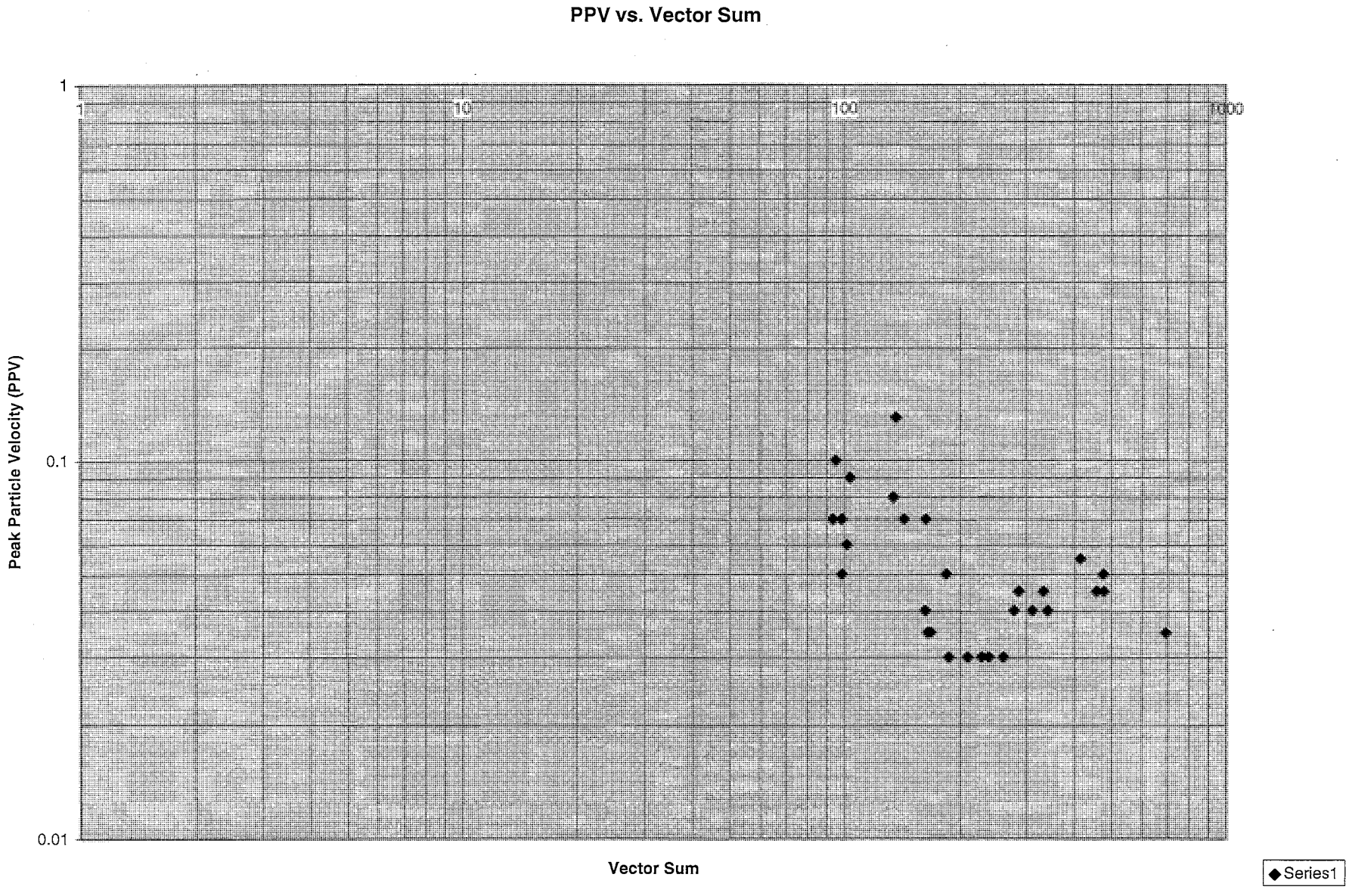

PPV vs. Vector Sum
Peak Particle Velocity (PPV)
1
0.1
0.01
1
10
100
1000
Vector Sum
Series1


PPV vs. Vector Sum
Peak Particle Velocity (PPV)
1
0.1
0.01
1
10
100
1000
Vector Sum
Series1


PPV vs. Vector Sum
1
0.1
0.01
1
10
100
1000
Peak Particle Velocity (PPV)
Vector Sum
Series1


PPV vs. Vector Sum
Peak Particle Velocity (PPV)
1
0.1
0.01
1
10
100
1000
Vector Sum
Series1


PPV vs. Vector Sum
Peak Particle Velocity (PPV)
1
0.1
0.01
1
10
100
1000
Vector Sum
Series1


PPV vs. Vector Sum
Peak Particle Velocity (PPV)
1
0.1
0.01
1
10
100
1000
Vector Sum
Series1