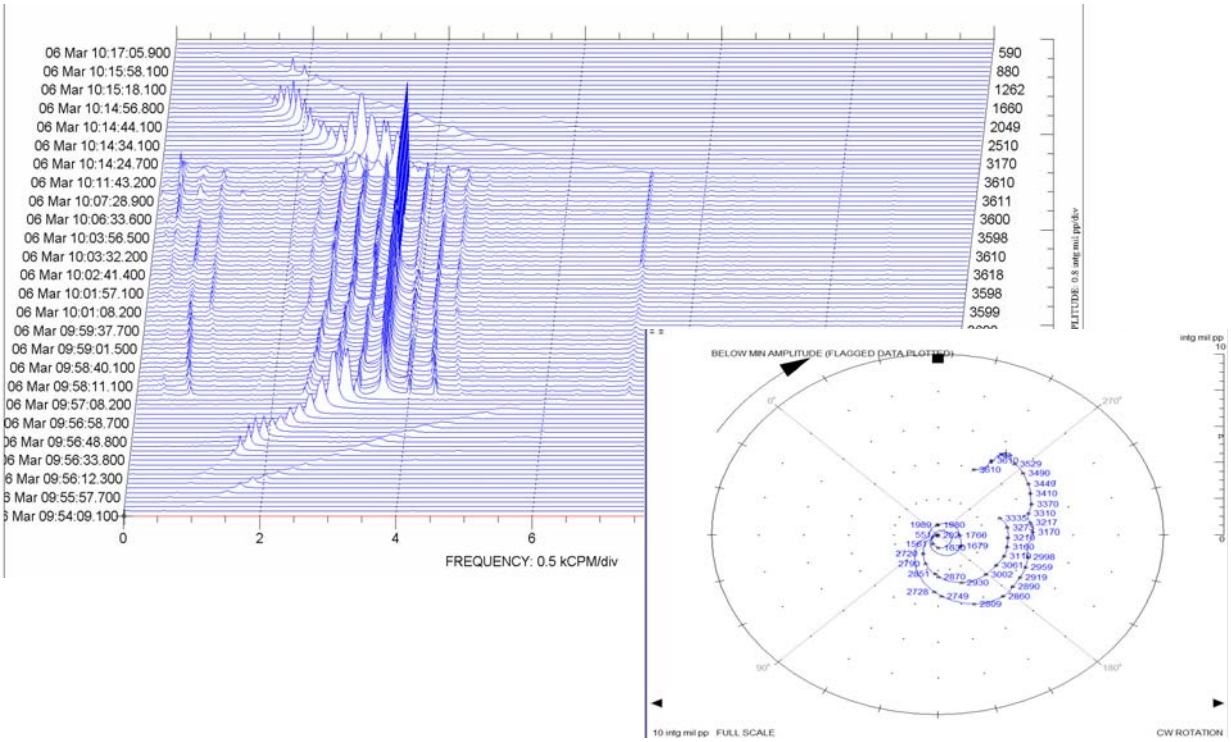
VIBRATION ANALYSIS AND BALANCE REPORT

Sample Facility

Main Gas Turbine Generator

DATA COLLECTED: 3/6/14



Condition Monitoring Services Inc.

Customer Contact
Title
Company
Job Location

March 11, 2014

Subject: Vibration Analysis And Balance of Main Gas Turbine Generator

Following reports of an increase in shaft vibration on the Main Gas Turbine Generator at the Sample Client facility, Condition Monitoring Services was contacted to evaluate the vibration characteristics on March 6th, 2014.

History

The unit had undergone a rotor inspection late last year, at which time several of the recommendations from earlier analyses were carried out. Significantly, the rotor out-of-level condition was corrected, and a soft-foot shim condition on the drive end pedestal was eliminated. However, on return to service, the axial hunting and pedestal movement appeared to be unchanged. More recently, the plant had removed both SKF backplane analysis computer and local patch panel connections from the circuit. This is when the step increase in indicated shaft vibration occurred. This system has a known grounding issue, and it is likely the removal of the attached panels resulted in the readings rising to their actual levels.

Procedure

An ADRE instrument was connected directly to the proximiters, seismic probes were mounted to the pedestals, and a laser tachometer was set up for speed and phase reference. Initial startup to minimum load revealed both high shaft and pedestal seismic levels at speed and loads (see Figure 1, showing a listing of the initial filtered data for each point, and Figures 3&5, showing the trend of both the initial shaft and pedestal data). The frequency content of the vibration showed similar data to previous surveys; with sideband peaks around the 1X component indicating strong impacts of the shaft on the thrust pads (see Figure 9 showing the initial Waterfall spectrum plots).

However, one significant difference from past data was that the bearing-to-bearing phase relationship was now primarily out-of-phase, indicating a strong couple (dynamic) force acting on the rotor (see initial data polar plot, Figure 7). This condition made it conducive to an in-situ trim balance.

A couple pair balance shots of 14.7 ounces placed 180° opposite each other on both ends resulted in reduced vibration levels on both the shaft and pedestal measurements (see final data listing, Figure 2, and final shaft and pedestal trend plots, Figure 4&6). More importantly, by eliminating the large couple component on the rotor, the axial hunting of the shaft and the resultant impact at the pedestals was also eliminated (see Figure 8, showing the final Polar plot, and Figure 10, showing the final Waterfall spectrum plots). It is believed this occurred as a result of the reduction in the "crank" effect on the unit. It is also felt that the correction of both the unit level and the drive end pedestal soft foot was beneficial in lining up the imbalance as a large couple, allowing the field trim balance to succeed with minimal weight changes.

The remaining concerns are with the NDE seal leakage and the lack of a buffered patch panel for readings. Feel free to contact me if there are any questions.

Sincerely,

Certified Level III Vibration Analyst
Condition Monitoring Services, Inc.
www.conditionmonitoringservices.com

Graphical Data:

LIST OF FIGURES

Figure 1 - Initial Run Direct and Filtered Data, showing high levels on most positions

CH#	Channel Name	Machine Name	Status	Angle	Direction	Run Type	Date	Speed Units(P)	Speed Units(S)	Amp Unit	Phase
1	Generator DE X	Generator	OK	45°	Left	Shut Down	06Mar2014 09:54:09.100 To 06Mar2014 10:17:52.808	rpm	rpm	mil pp	deg
2	Generator DE Y	Generator	OK	45°	Right	Shut Down	06Mar2014 09:54:09.100 To 06Mar2014 10:17:52.808	rpm	rpm	mil pp	deg
3	Generator NDE X	Generator	OK	45°	Left	Shut Down	06Mar2014 09:54:09.100 To 06Mar2014 10:17:52.808	rpm	rpm	mil pp	deg
4	Generator NDE Y	Generator	OK	45°	Right	Shut Down	06Mar2014 09:54:09.100 To 06Mar2014 10:17:52.808	rpm	rpm	mil pp	deg
5	Gen DE X Seis	Generator	OK	45°	Left	Shut Down	06Mar2014 09:54:09.100 To 06Mar2014 10:17:52.808	rpm	rpm	intg mil pp	deg
6	Gen NDE X Seis	Generator	OK	45°	Left	Shut Down	06Mar2014 09:54:09.100 To 06Mar2014 10:17:52.808	rpm	rpm	intg mil pp	deg

CH#	Channe...	Sample#	Sample...	Date	Speed(P)	Speed(S)	Direct	Avg Gap	Inst Gap	1XAmpli...	1X Phase	2XAmpli...	2X Phase
1	Genera...	746	DR-T	06Mar2014 10:07...	3598	0	3.449	-11.877	0....	1.110	135	0.237	185
2	Genera...	746	DR-T	06Mar2014 10:07...	3598	0	3.459	-12.109	0....	1.902	95	0.262	31
3	Genera...	746	DR-T	06Mar2014 10:07...	3598	0	3.953	-11.719	0....	3.372	331	0.277	186
4	Genera...	746	DR-T	06Mar2014 10:07...	3598	0	2.256	-12.219	0....	0.889	158	0.273	9
5	Gen DE...	746	DR-T	06Mar2014 10:07...	3598	0	6.273			4.163	48	0.288	52
6	Gen ND...	746	DR-T	06Mar2014 10:07...	3598	0	5.859			5.330	280	0.062	9BMA

Figure 2 - Final Run Direct and Filtered Data following the balance, showing improved levels

CH#	Channel Name	Machine Name	Status	Angle	Direction	Run Type	Date	Speed Units(P)	Speed Units(S)	Amp Unit	Phase Unit
1	Generator DE X	Generator	OK	45°	Left	Shut Down	06Mar2014 16:39:16.000 To 06Mar2014 17:08:26.709	rpm	rpm	mil pp	deg
2	Generator DE Y	Generator	OK	45°	Right	Shut Down	06Mar2014 16:39:16.000 To 06Mar2014 17:08:26.709	rpm	rpm	mil pp	deg
3	Generator NDE X	Generator	OK	45°	Left	Shut Down	06Mar2014 16:39:16.000 To 06Mar2014 17:08:26.709	rpm	rpm	mil pp	deg
4	Generator NDE Y	Generator	OK	45°	Right	Shut Down	06Mar2014 16:39:16.000 To 06Mar2014 17:08:26.709	rpm	rpm	mil pp	deg
5	Gen DE X Seis	Generator	OK	45°	Left	Shut Down	06Mar2014 16:39:16.000 To 06Mar2014 17:08:26.709	rpm	rpm	intg mil pp	deg
6	Gen NDE X Seis	Generator	OK	45°	Left	Shut Down	06Mar2014 16:39:16.000 To 06Mar2014 17:08:26.709	rpm	rpm	intg mil pp	deg

CH#	Channe...	Sample#	Sample...	Date	Speed(P)	Speed(S)	Direct	Avg Gap	Inst Gap	1XAmpli...	1X Phase	2XAmpli...	2X Phase
1	Genera...	413	DT-T	06Mar2014 17:00:16.000	3602	0	2.251	-11.731	0....	0.802	228	0.221	169
2	Genera...	413	DT-T	06Mar2014 17:00:16.000	3602	0	1.907	-12.109	0....	0.236	337	0.247	33
3	Genera...	413	DT-T	06Mar2014 17:00:16.000	3602	0	1.632	-12.085	0....	1.275	77	0.236	198
4	Genera...	413	DT-T	06Mar2014 17:00:16.000	3602	0	2.272	-12.512	0....	1.691	153	0.226	43
5	Gen DE...	413	DT-T	06Mar2014 17:00:16.000	3602	0	2.806			2.159	357	0.288	90
6	Gen ND...	413	DT-T	06Mar2014 17:00:16.000	3602	0	1.095			1.033	115	0.103	66

Figure 3 - DE Pedestal Direct and Filtered Vibration Trend for Initial Run

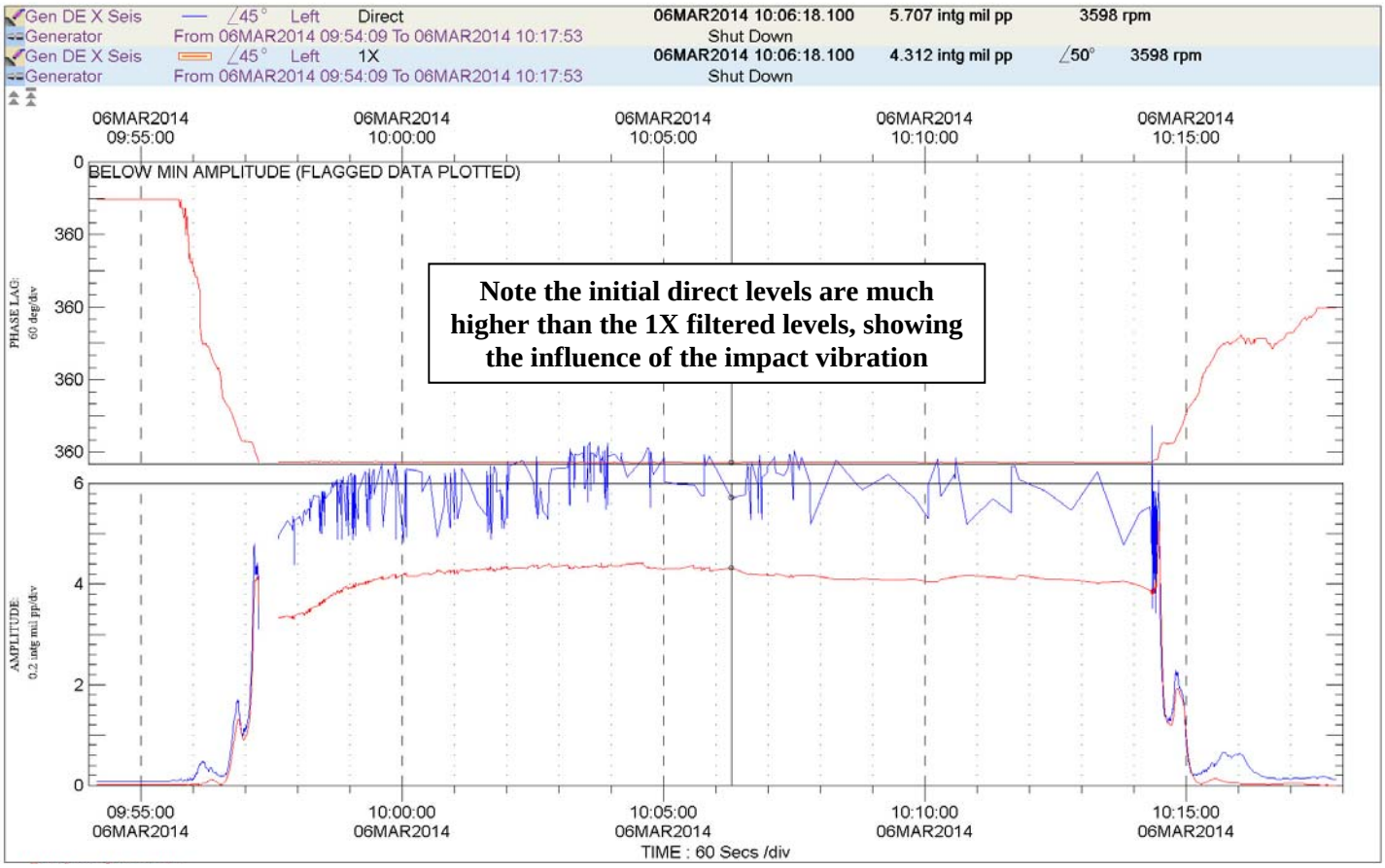


Figure 4- DE Pedestal Direct and Filtered Vibration Trend for Final Run

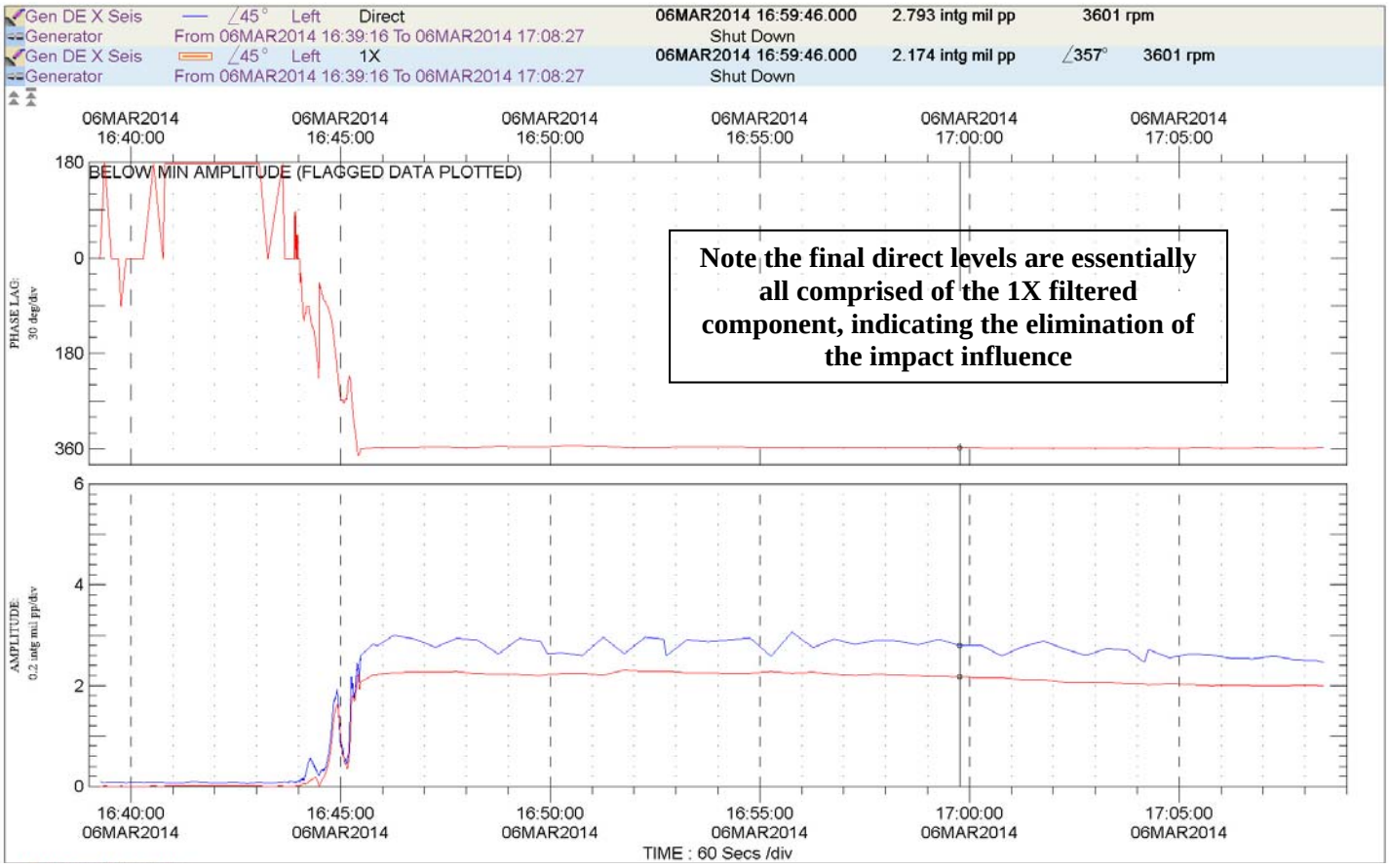


Figure 5 - NDE Shaft Relative Direct and Filtered Vibration Trend for Initial Run

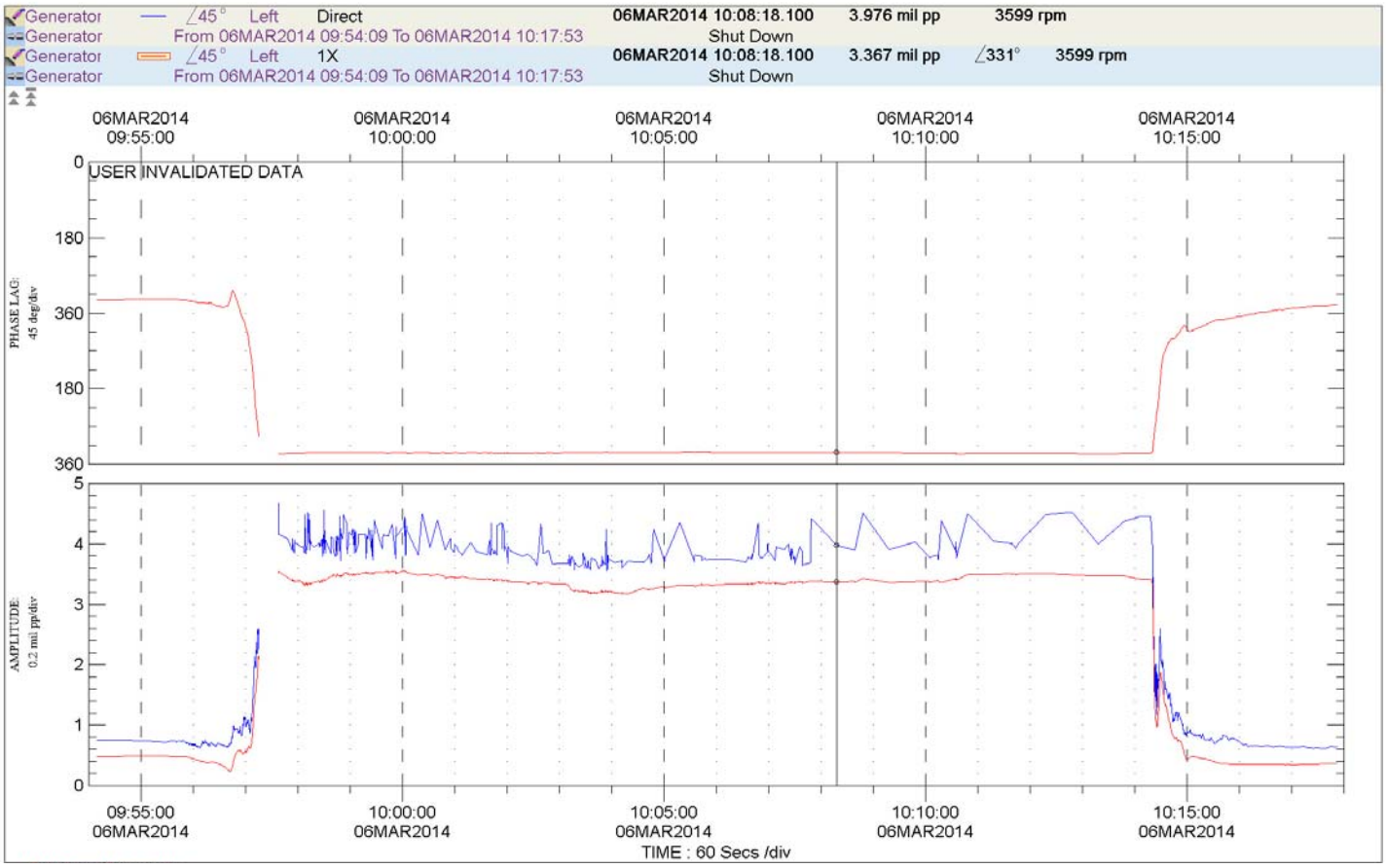


Figure 6 - NDE Shaft Relative Direct and Filtered Vibration Trend for Final Run

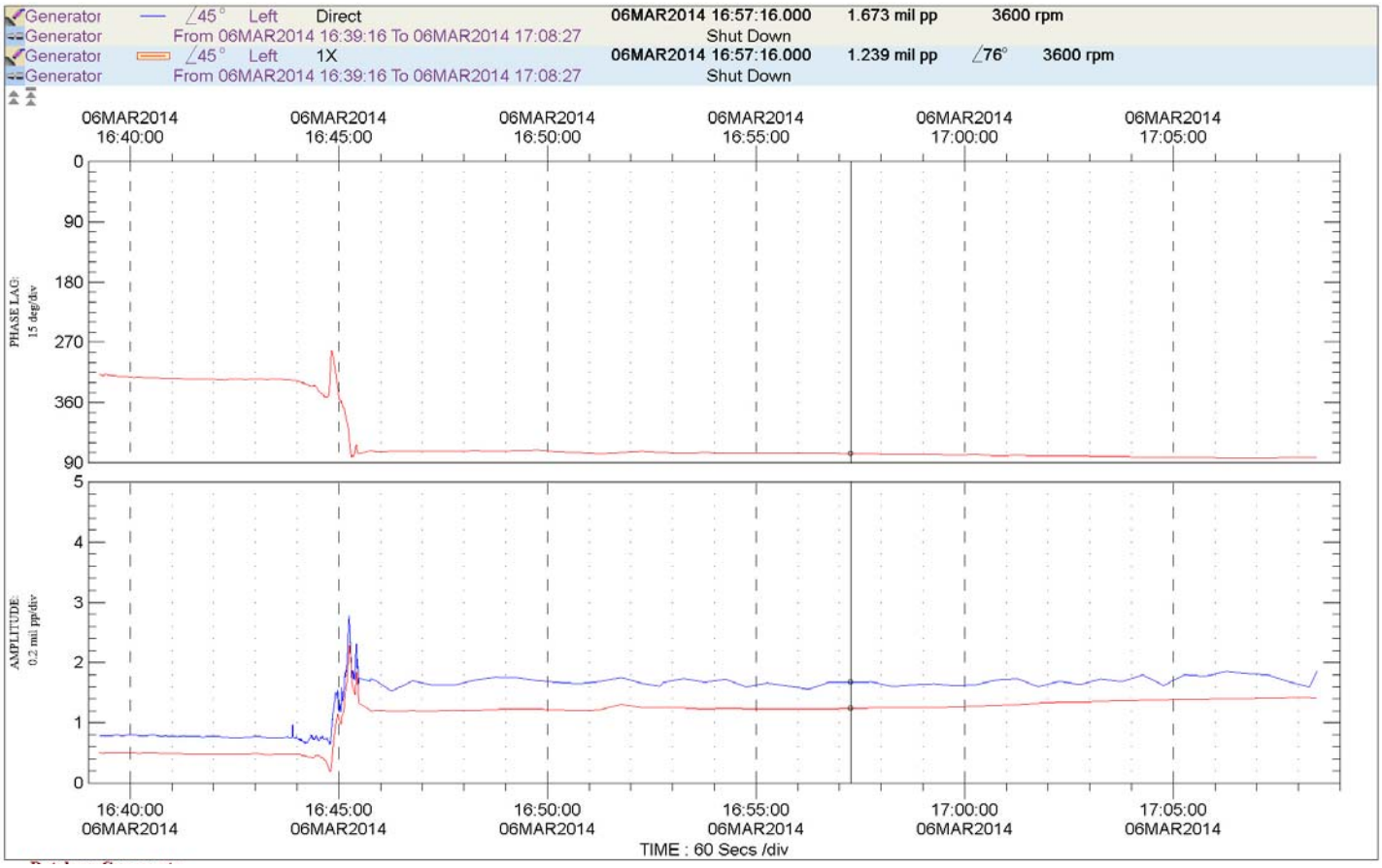


Figure 7 - Pedestal Filtered Vibration Polar Plots for Initial Run

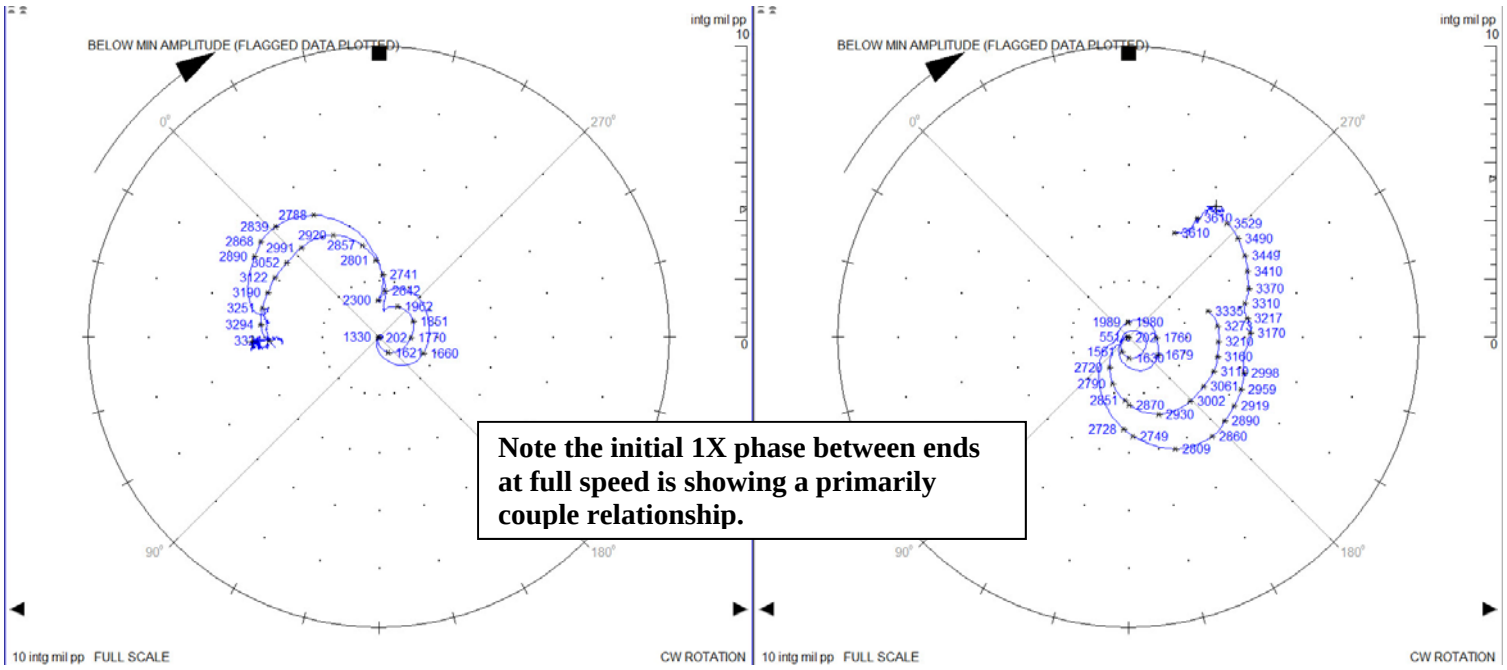


Figure 8 - Pedestal Filtered Vibration Polar Plots for Final Run

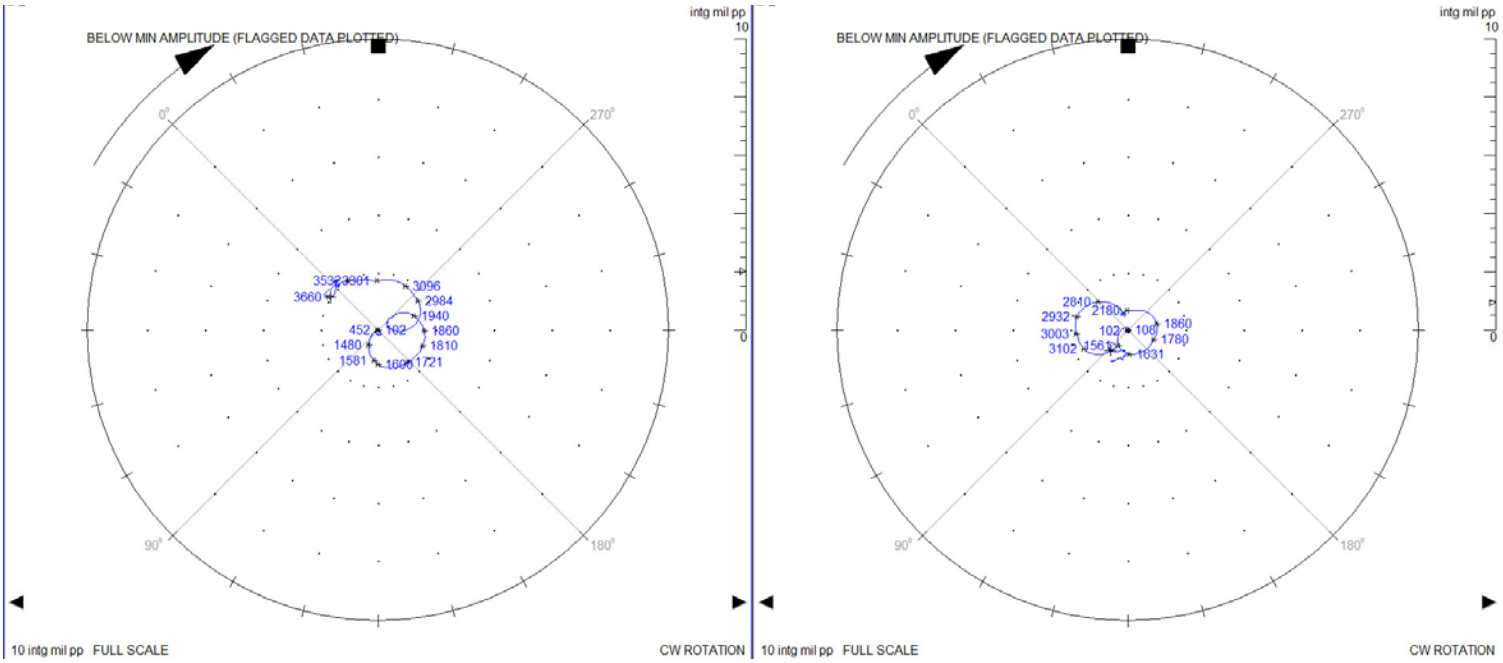


Figure 9 - Pedestal Waterfall Plot for Initial Run

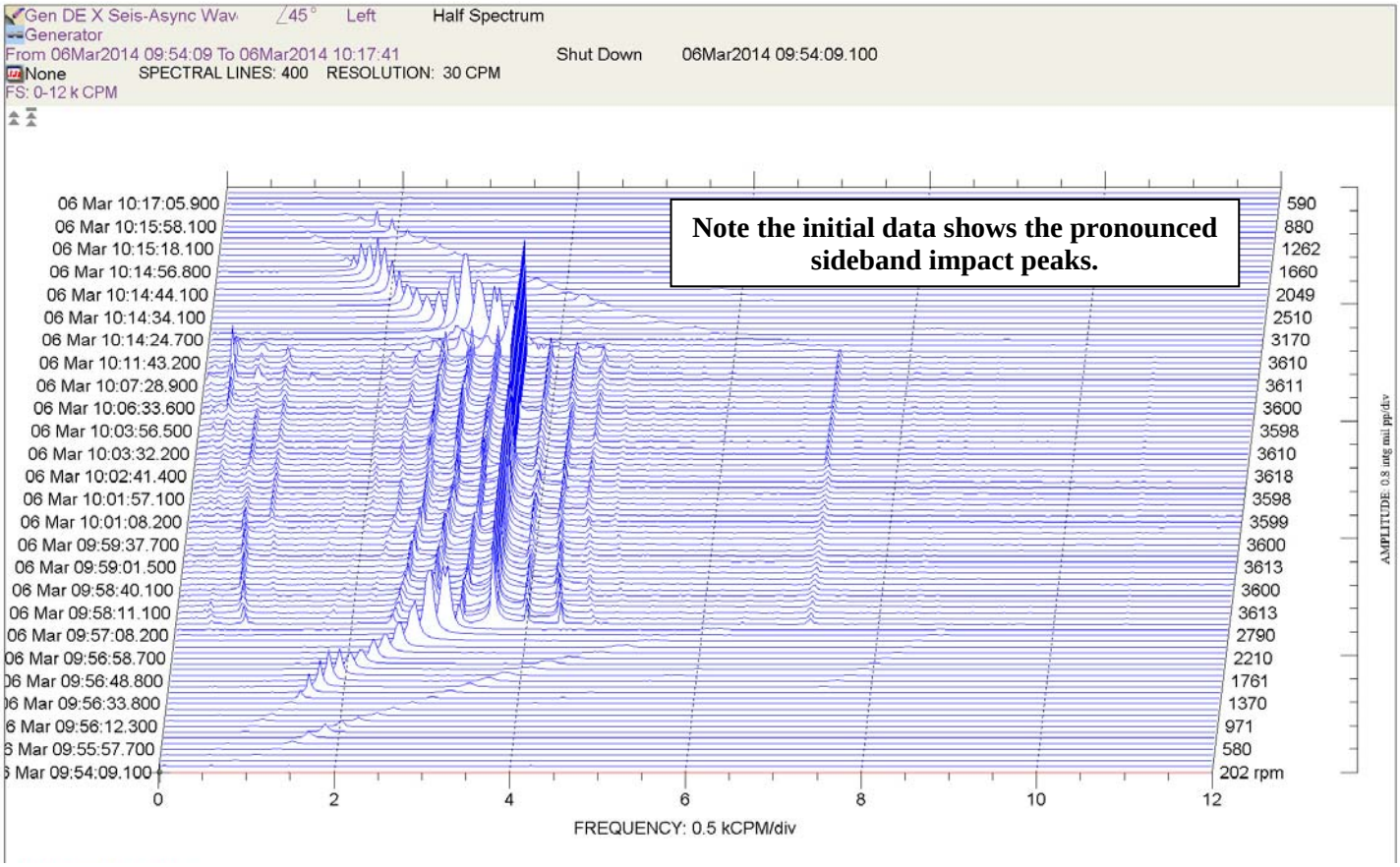


Figure 10 - Pedestal Waterfall Plot for Final Run