S4 Environmental Disturbances

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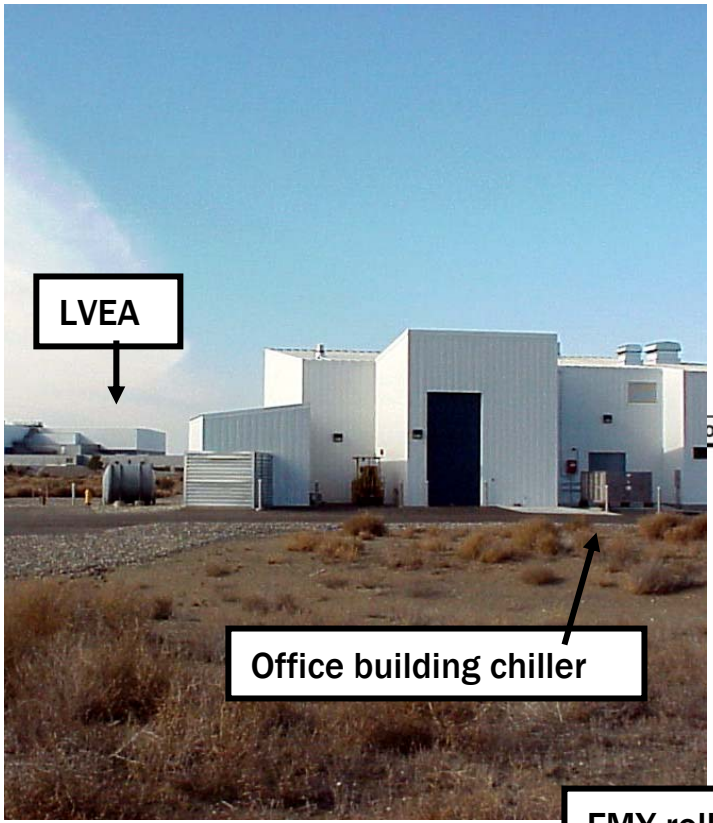
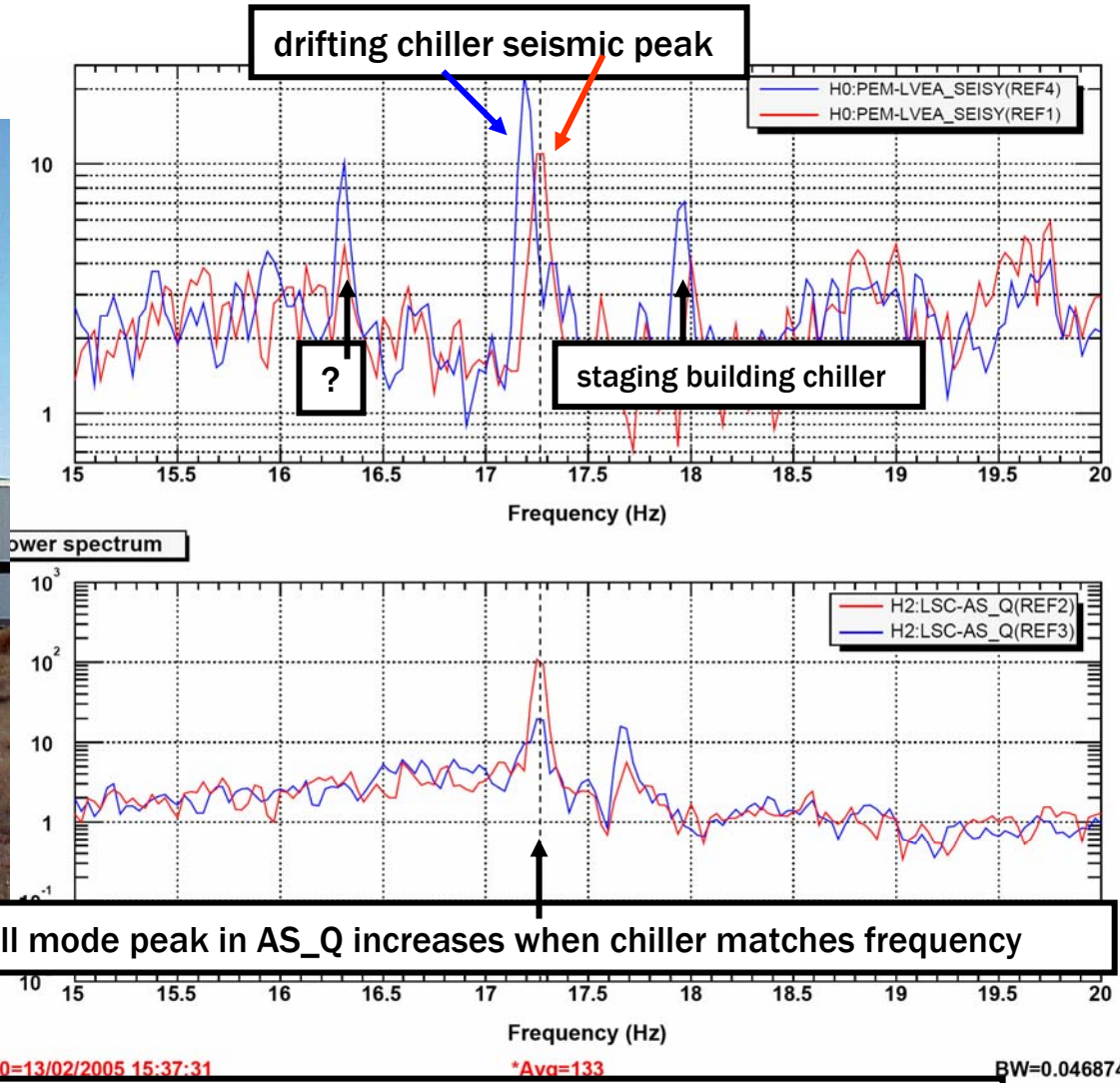
I. Pre-S4 “fixes”
II. Some S4 veto issues
III. Early coupling results from S4 PEM injections

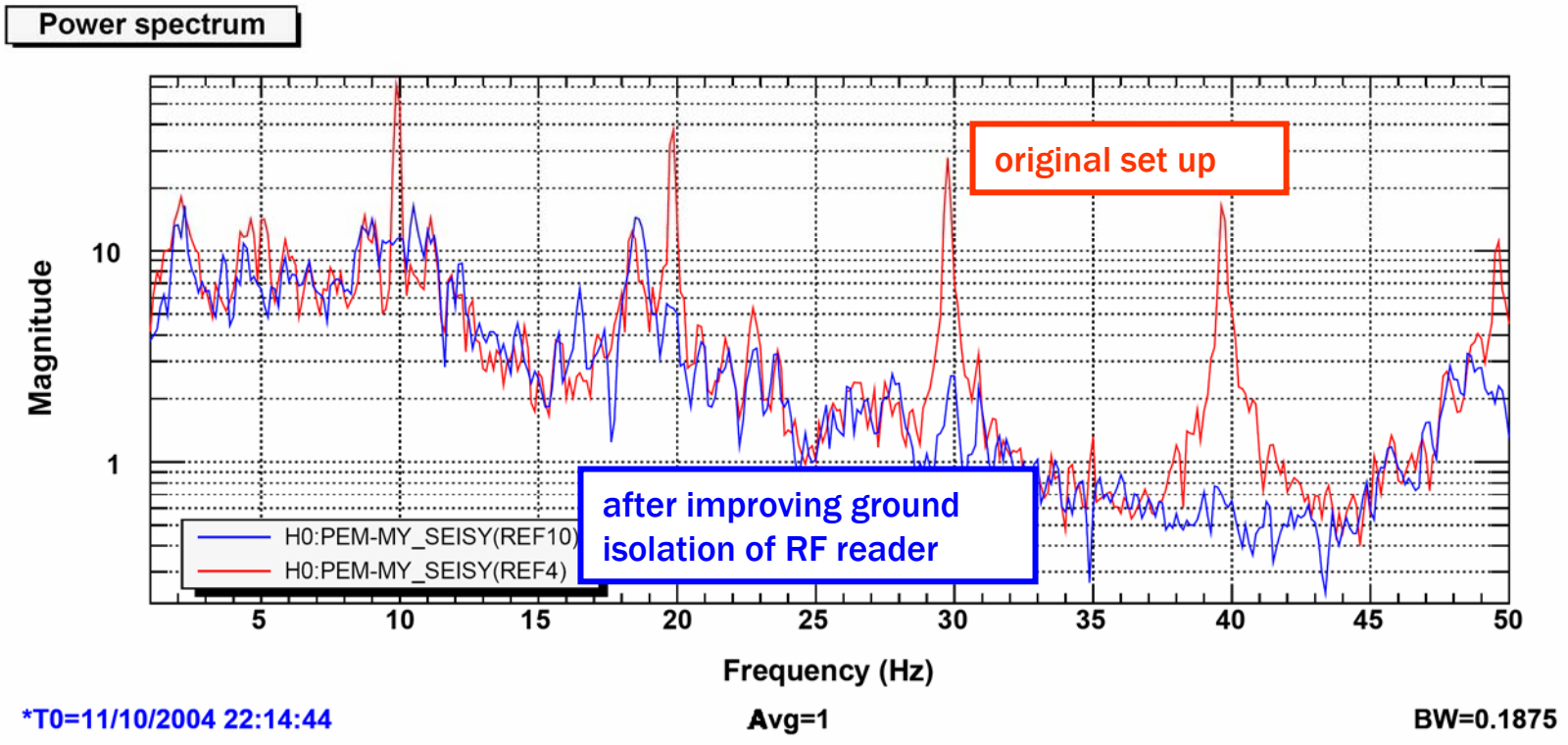
In E12, H2 AS_Q was dominated by FMY roll mode when excited by chiller





Solution: resonant gain at FMY roll mode, seismic isolation of chiller.
D.Q. flag for 10-100 Hz glitches produced by 16 Hz?

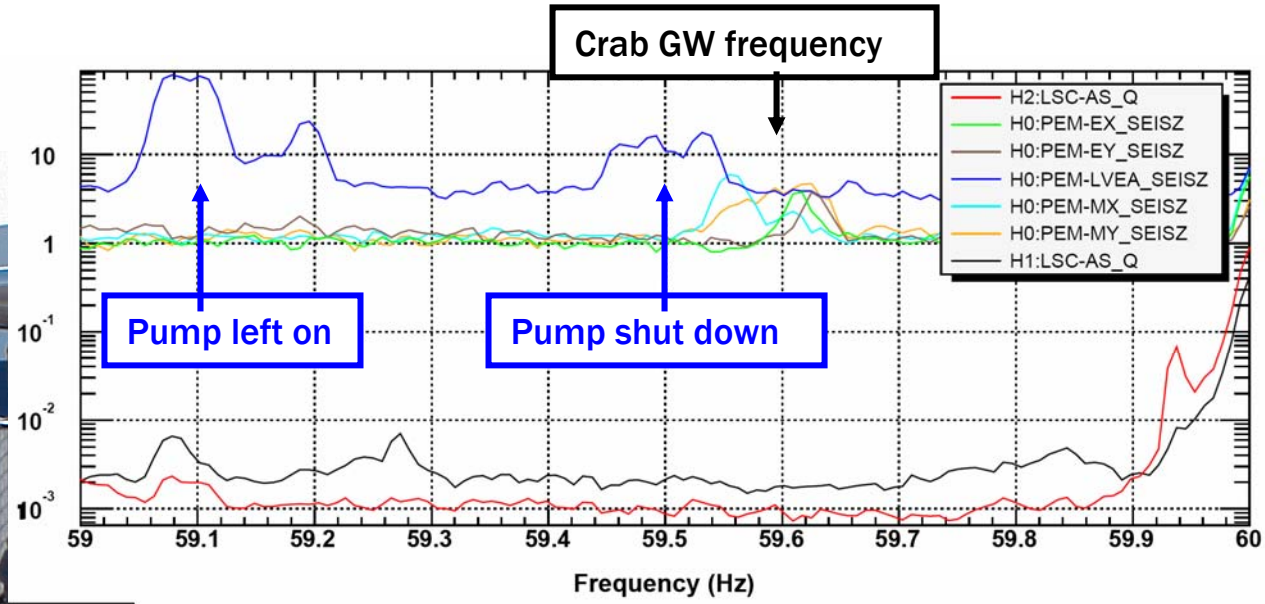
10 Hz seismometer (etc.) peaks from RF card reader

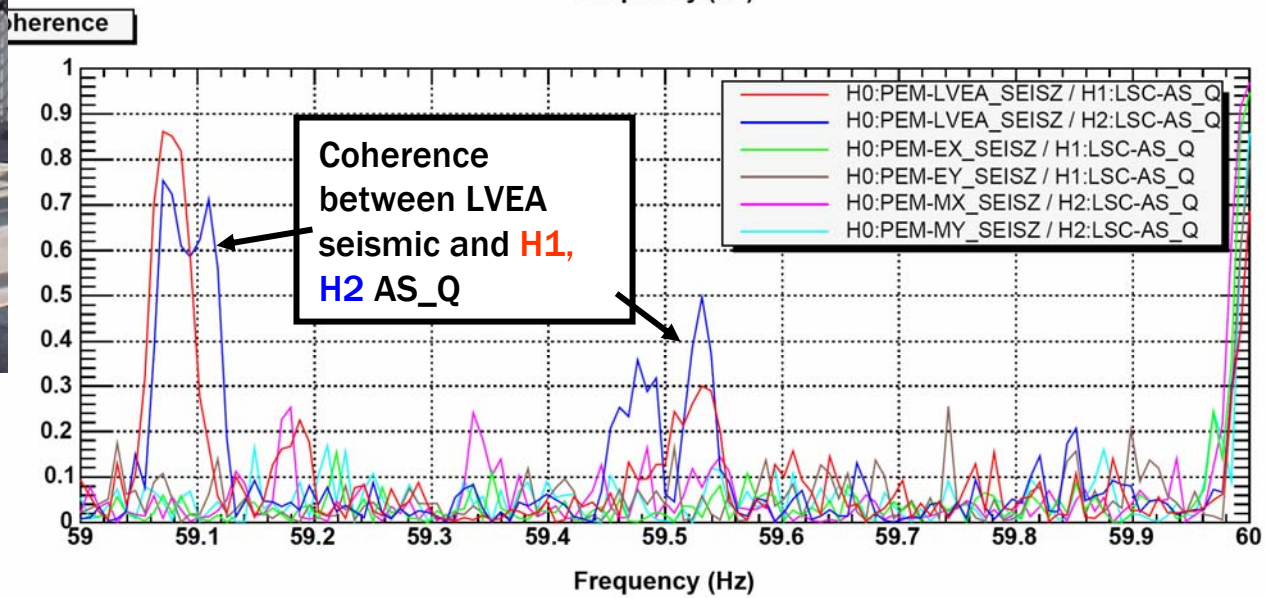


Transformers near test-masses contribute to 60 Hz AS_Q peak

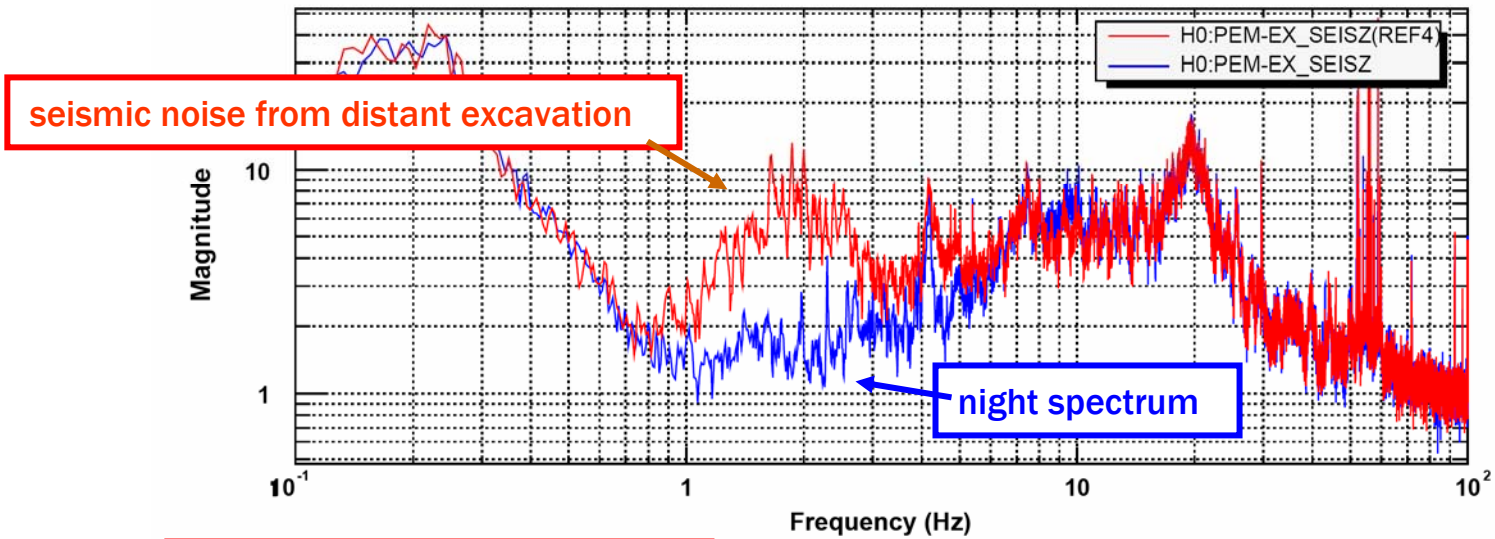
Recommendation: keep transformers at least 15 feet away from chambers (annulus ion pumps?).

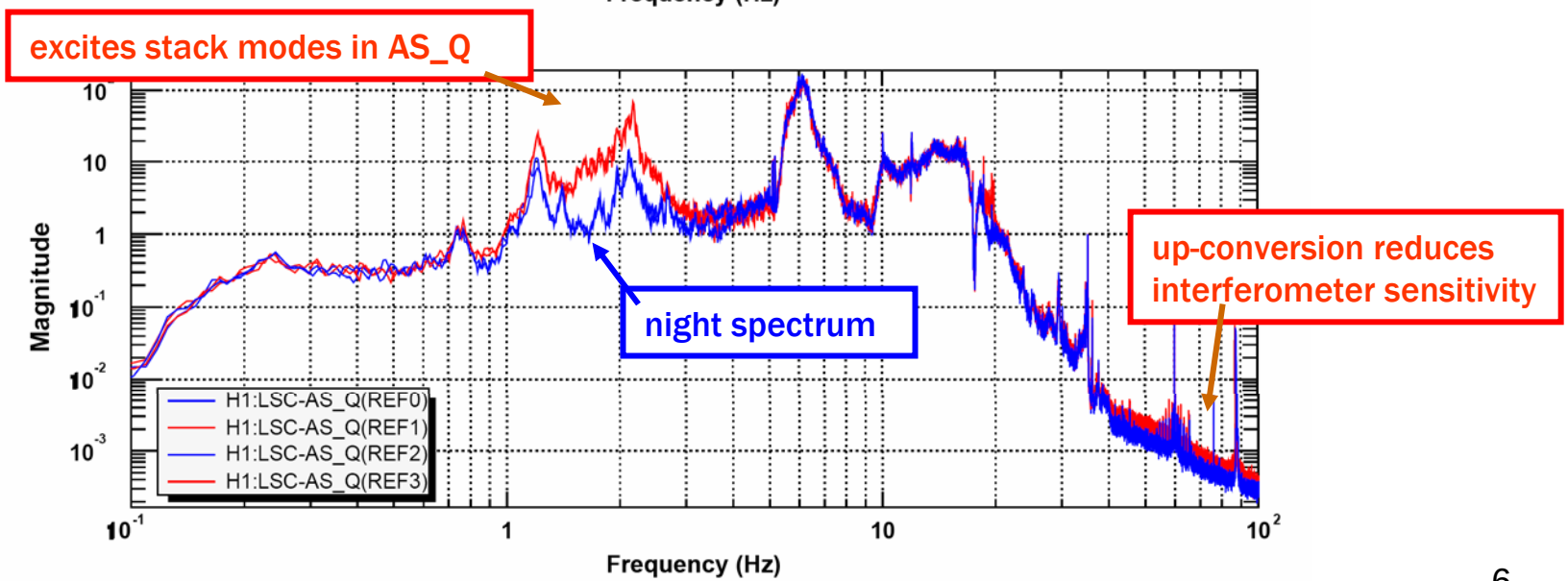
Protecting sensitivity to the crab pulsar





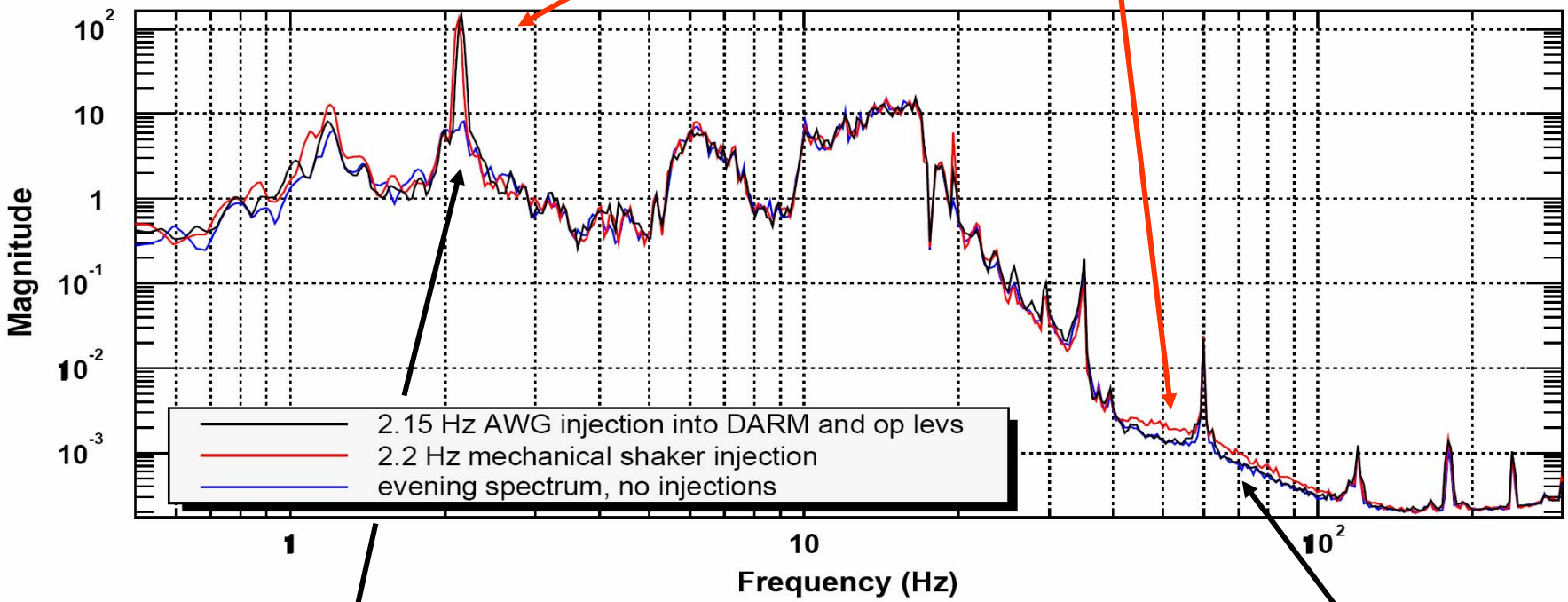
Up-conversion of low frequency seismic noise





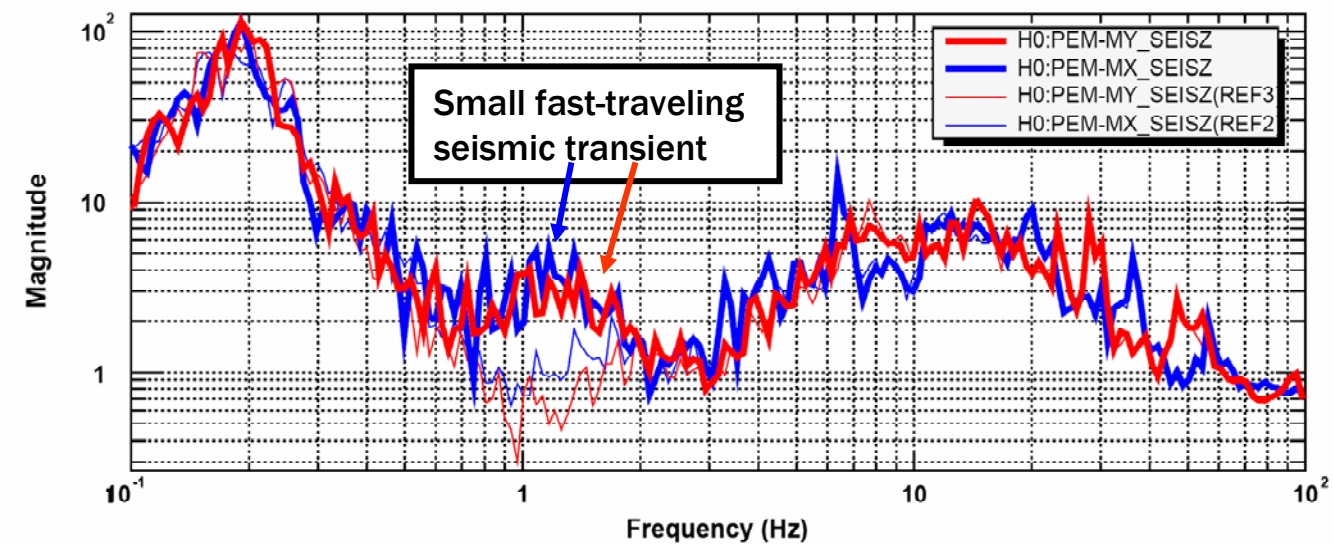
Up-conversion experiments

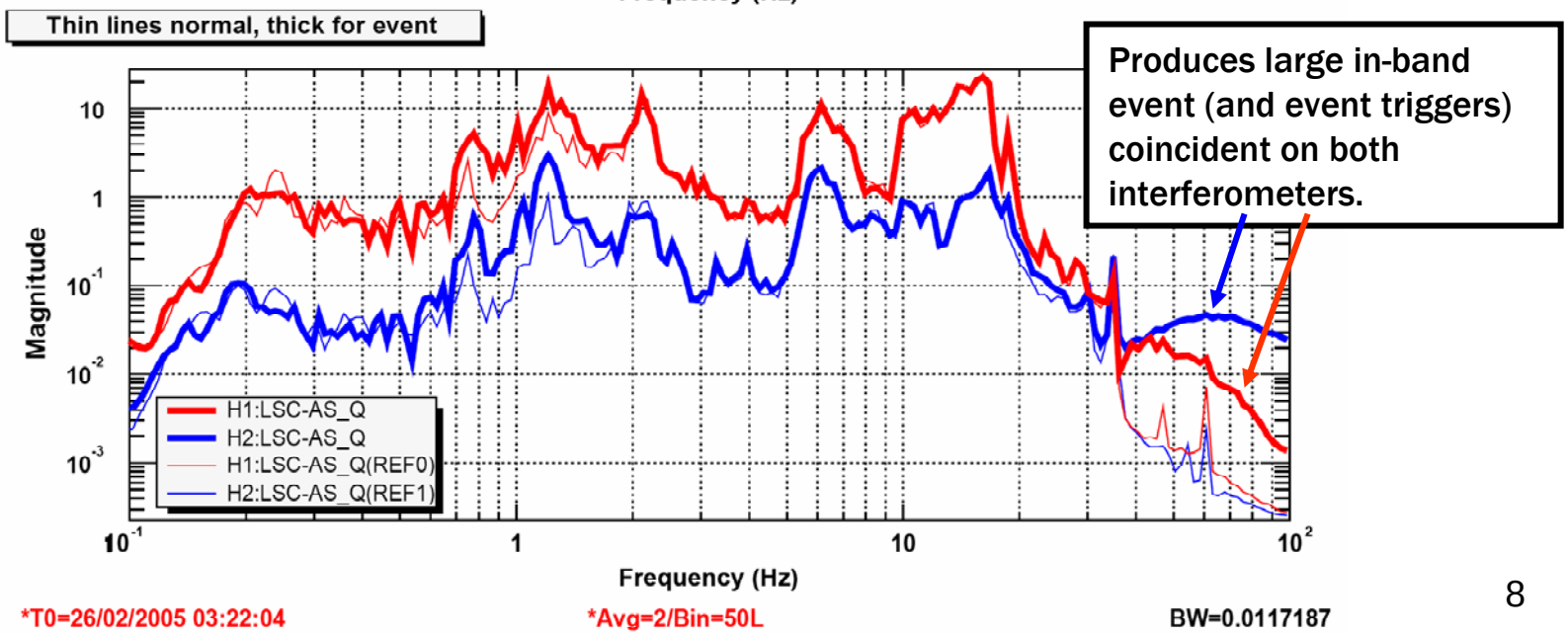
Mechanical shaker at EX produces up-conversion in AS_Q



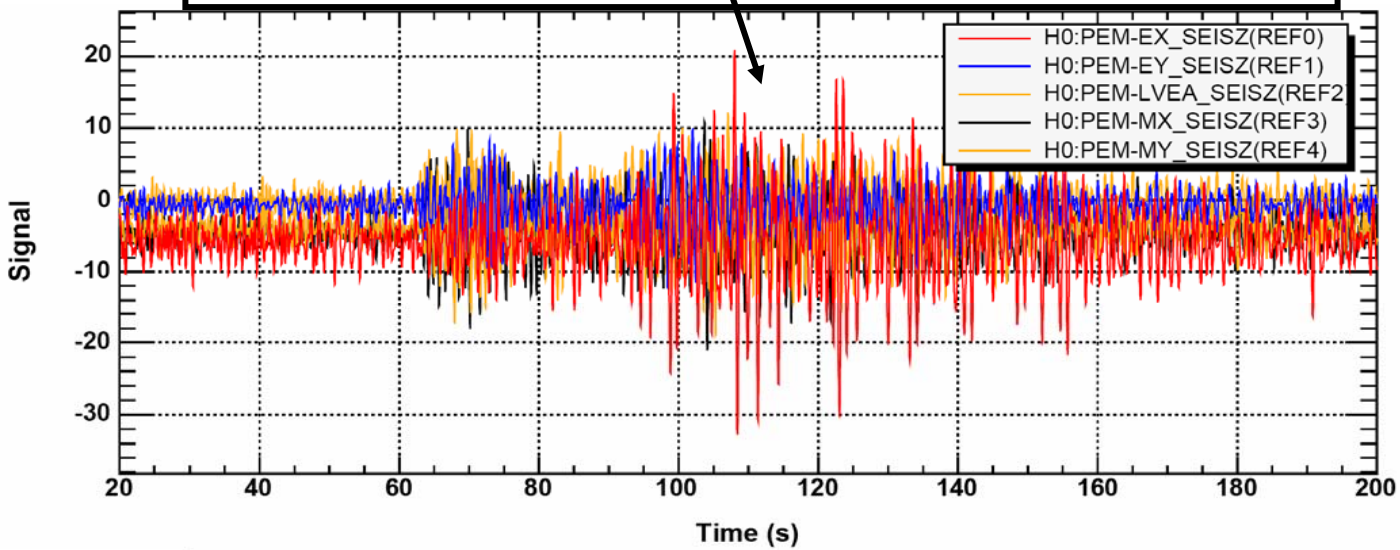
But matched injection into DARM and optical lever servo (pitch and yaw) does not produce up-conversion. This suggests that up-conversion is not produced in servo systems or by optic motion.

Up-conversion of low frequency seismic transients



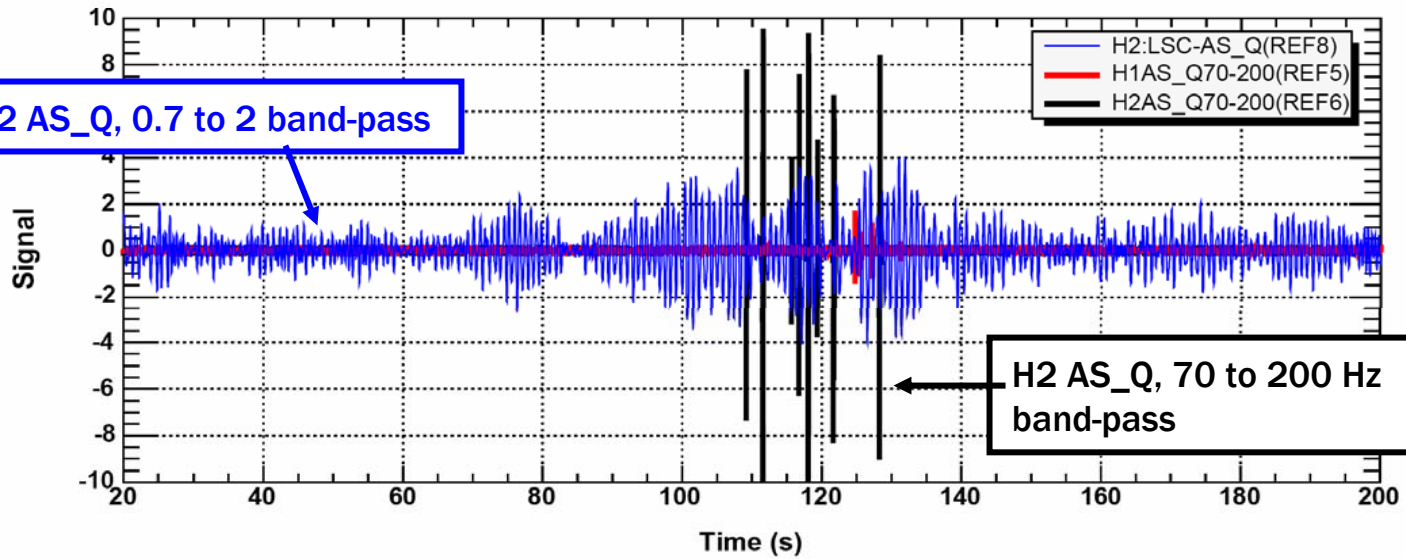


time series of same transient, 0.7 to 2 Hz steep band-pass, seismometers at all stations



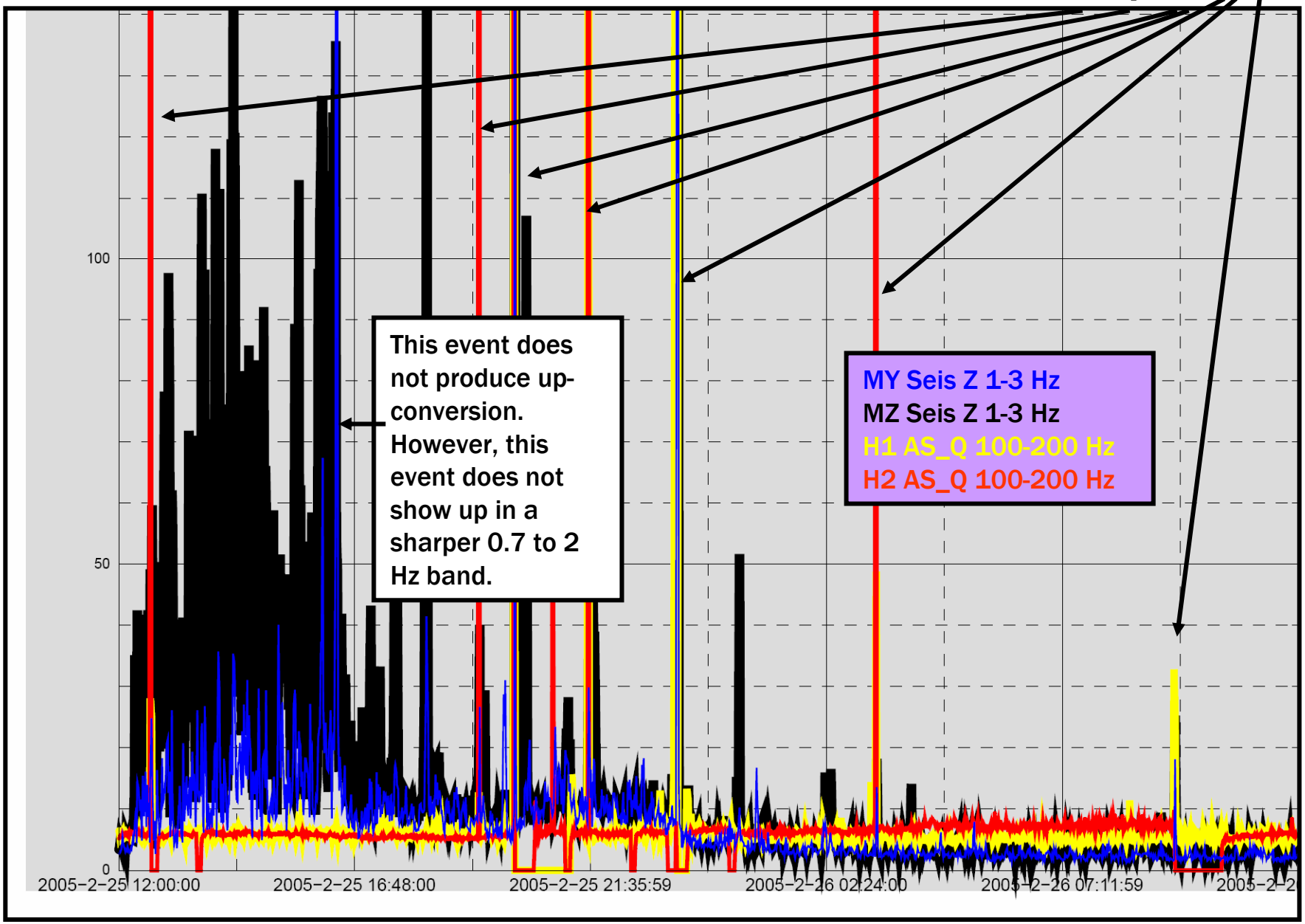
Time series

H2 AS_Q, 0.7 to 2 band-pass



H2 AS_Q, 70 to 200 Hz band-pass

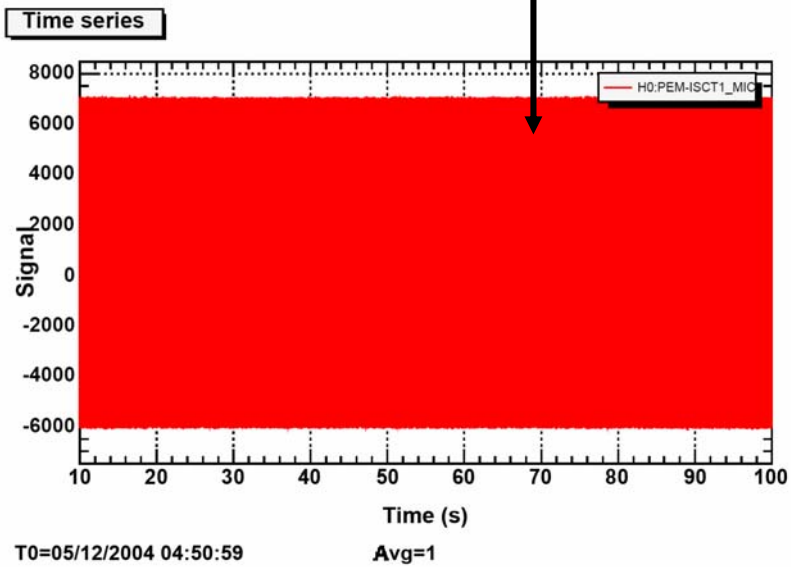
Coincident 1-3 Hz seismic, and 100-200 Hz AS_Q spikes



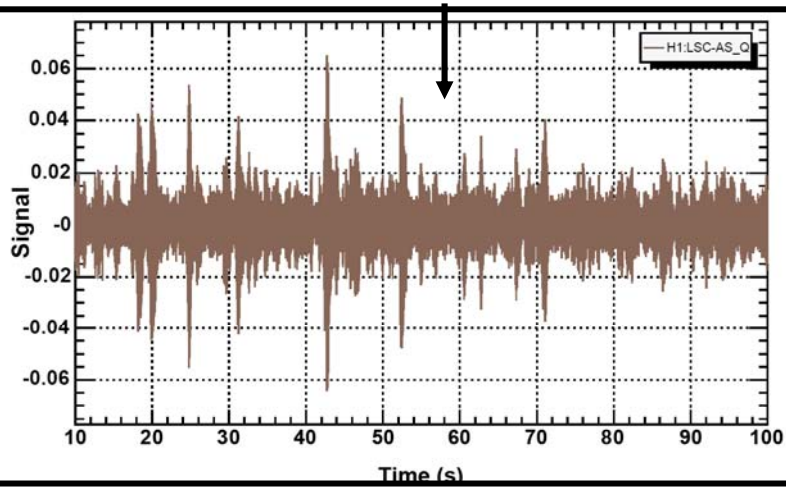
Why are airplanes signals so bursty in AS_Q?

Continuous acoustic sources can produce 5x bursts in AS_Q.

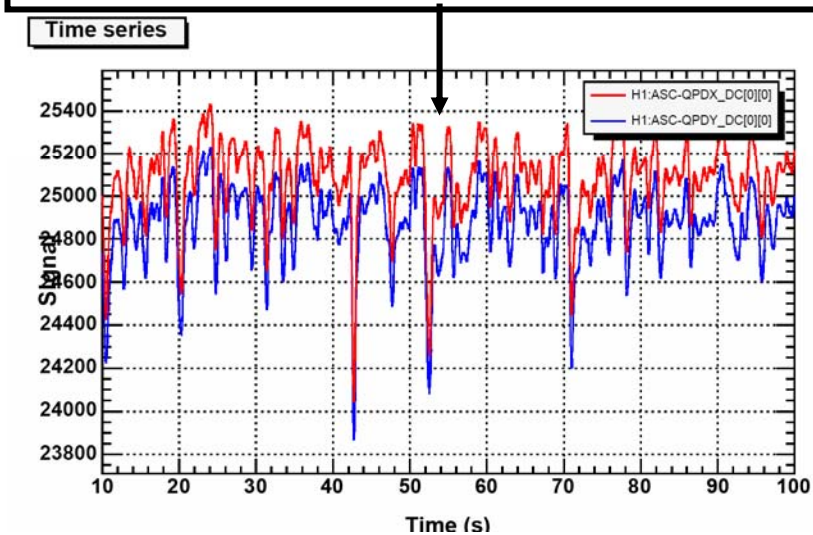
Microphone signal (BP) from sound injection at REFL port



Band Pass on resulting acoustic peak in AS_Q

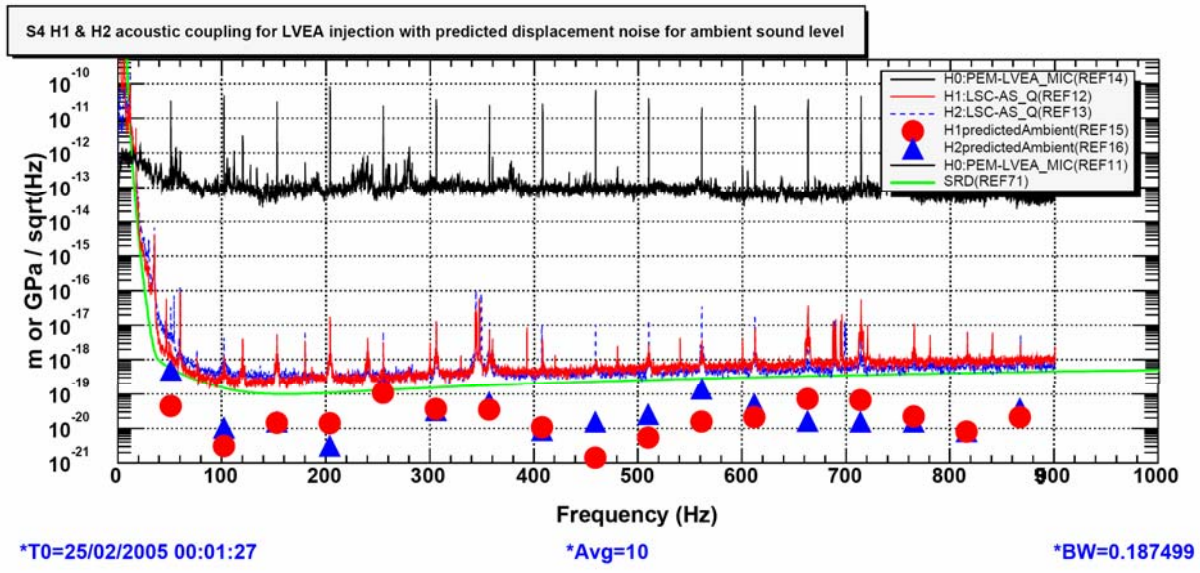


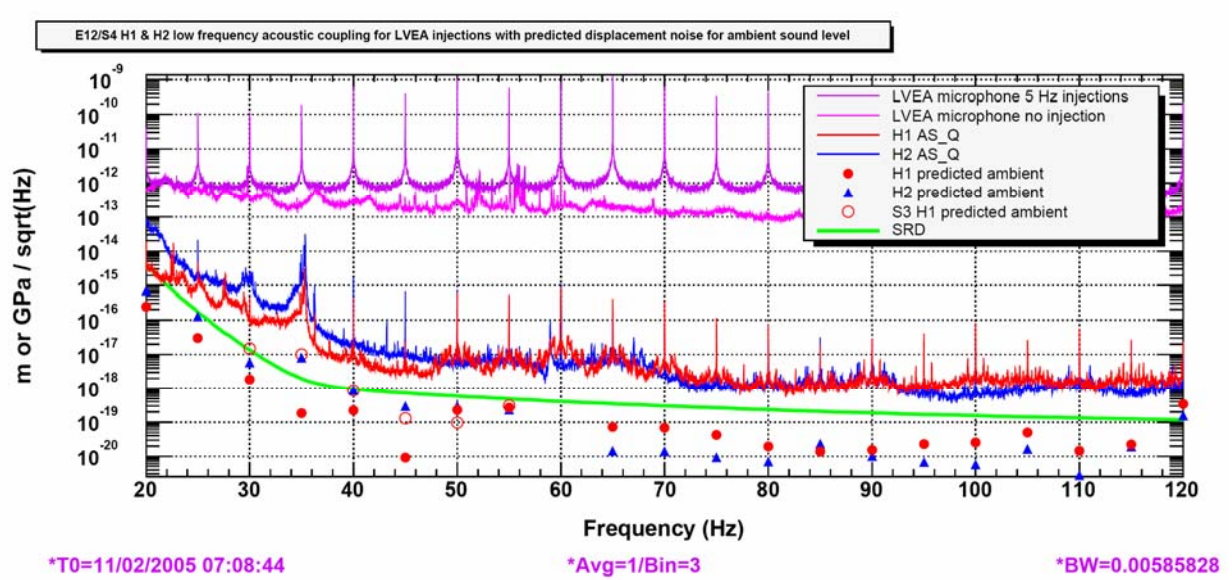
Bursts correspond with slight drops in arm power



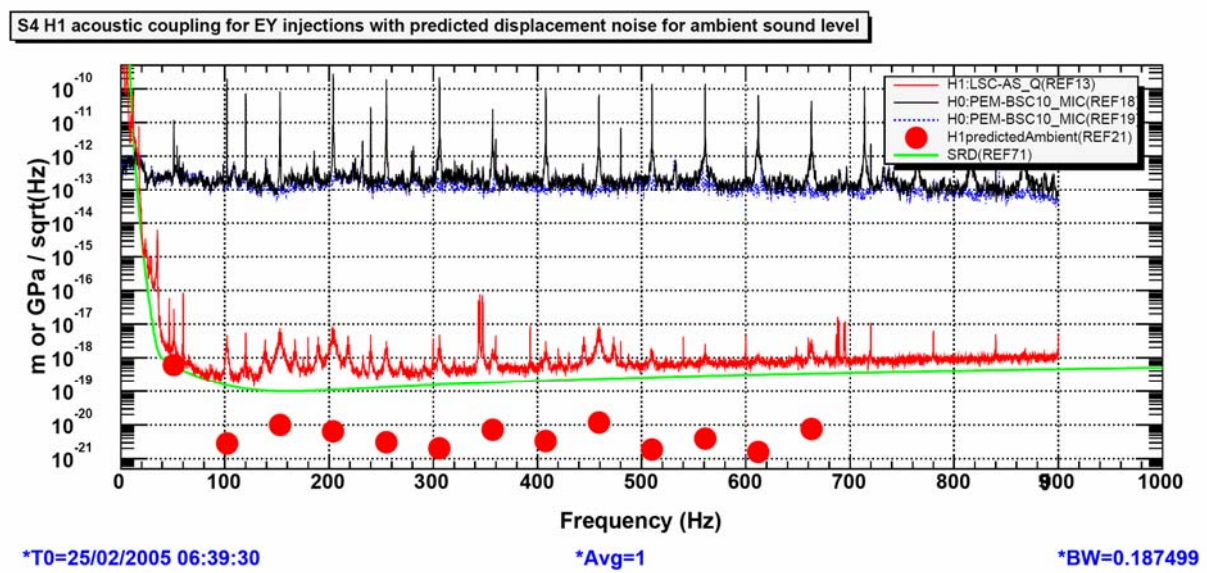
Makes vetoing more complex!

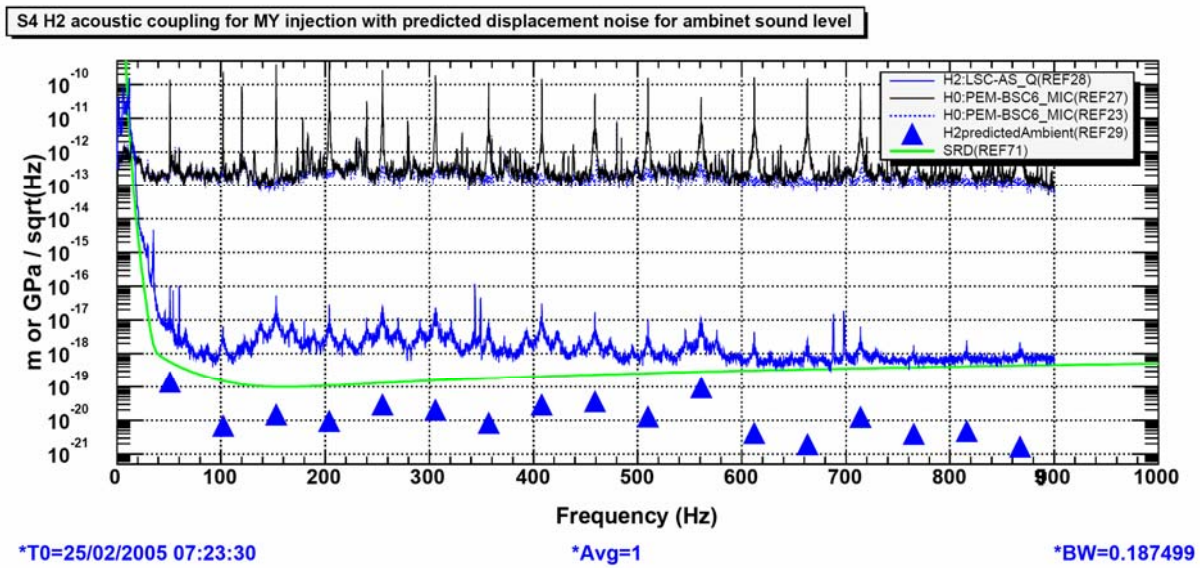
S4 LHO LVEA acoustic coupling from PEM injections



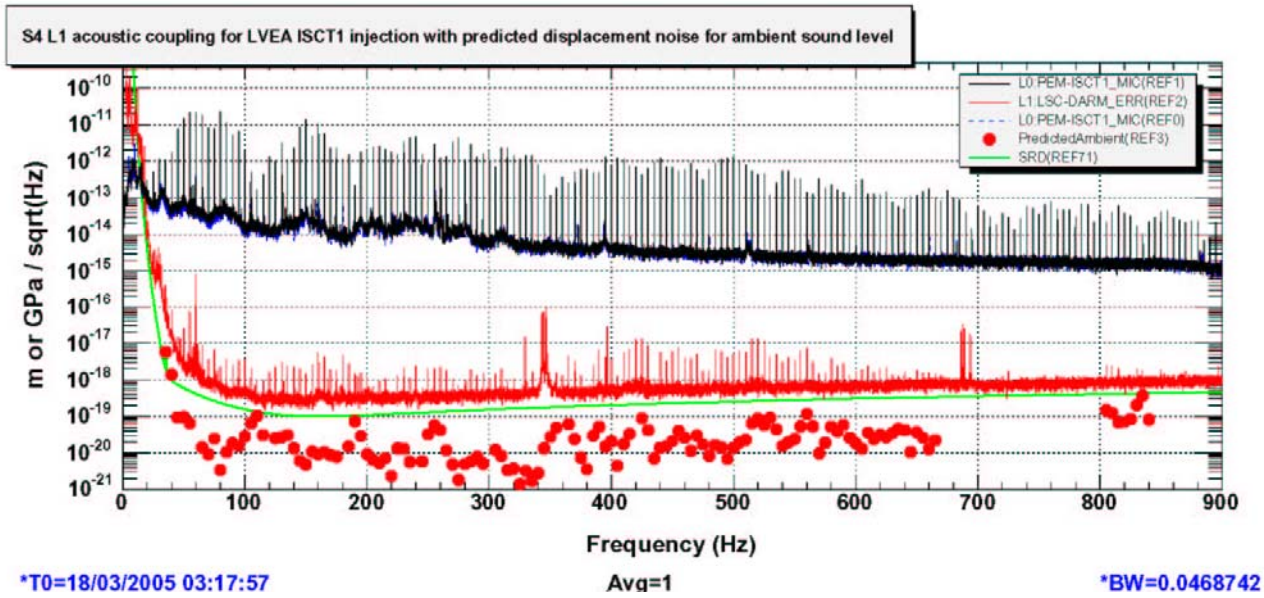


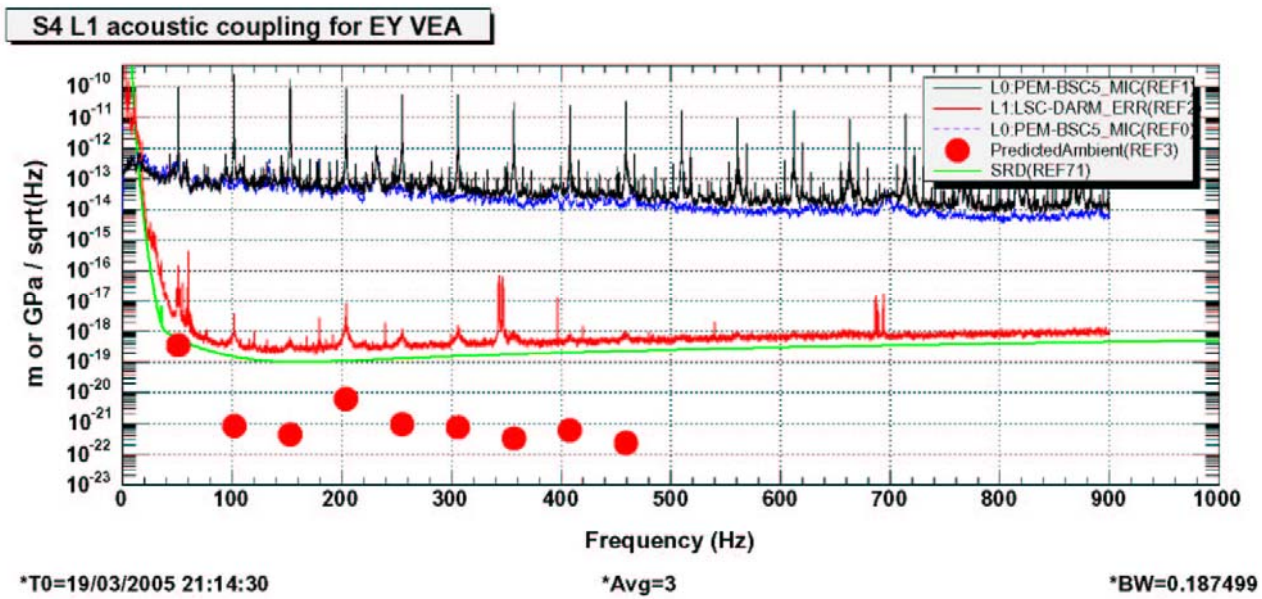
S4 LHO out-station acoustic coupling





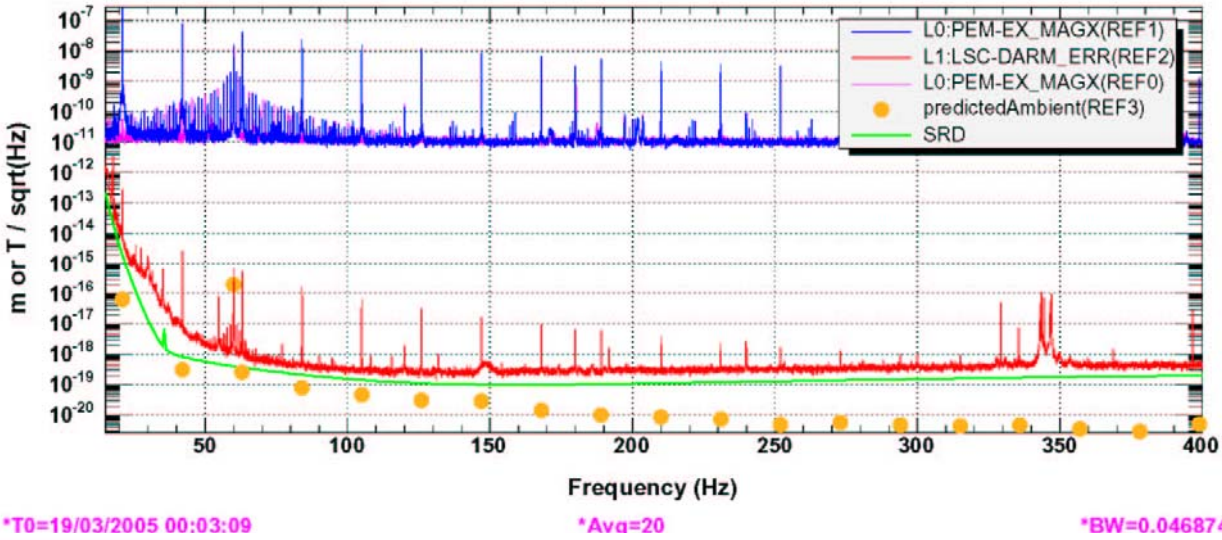
S4 LLO corner and EY acoustic coupling

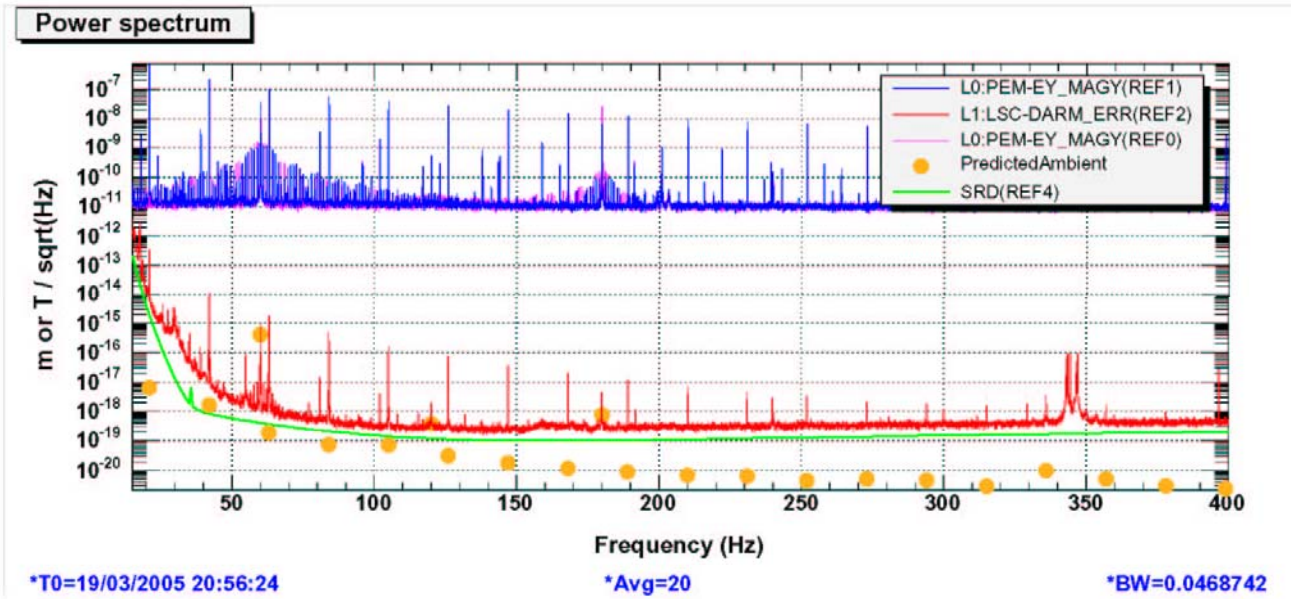




S4 LHO EX, EY magnetic coupling

With predicted upper limits to displacement noise from coupling of ambient fields.





PEM burst injection logs (also in elog)

LHO

BURST INJECTIONS

Injections began Feb. 24 at 23:00:00 and ended on Feb. 25 at 7:45:00

Location	Start Time	Stop Time	Spacing (seconds)
Acoustic/Seismic			
LVEA			
ISCT4 area	23:13:00	23:15:00	5
ISCT7 area	23:29:00	23:32:00	5
ISCT10 area	23:34:00	23:36:00	5
ISCT1 area	23:38:00	23:41:00	5
sitting quiet	23:47:00	23:52:00	5
EX	06:47:00	06:51:00	5
MX	07:07:00	07:10:00	5
MY	07:26:00	07:29:00	5
EY	07:42:00	07:45:00	5

quiet times for end-stations when injections at mid-stations
quiet times for mid-stations when injections at end-stations

RF at 2k carrier frequency + 100 Hz			
LVEA			
10ms long	4:28:30	4:30:30	5
100ms long	4:30:30	4:32:30	5

LLO

BURST INJECTIONS

Location	Start Time (UTC)	Stop Time (UTC)	Spacing (s)
Acoustic/Seismic			
LVEA			
MC area	3/19 17:48:01	17:51:01	5
Dark port area	3/19 17:54:01	17:54:31	5
	3/19 18:29:01	18:31:01	5
X-manifold area	3/19 18:11:01	18:14:01	5
Y-manifold area	3/19 18:17:01	18:17:36	5
EX	3/19 20:17:01	20:20:01	5
EY	3/19 21:09:01	21:12:01	5
RF 24482700 Hz			
LVEA	3/19 18:56:01	18:58:01	5
Magnetic			
LVEA	3/18 22:54:02	22:56:02	5

Summary

I. **Pre-S4 partial fixes**

a. Wandering chiller seismic peak (D.Q. flag for 16 Hz?)
b. 10 Hz from RFID
c. Transformers near test masses (ion pump supplies?)
d. Crab protection (LHO out-stations, LLO?)

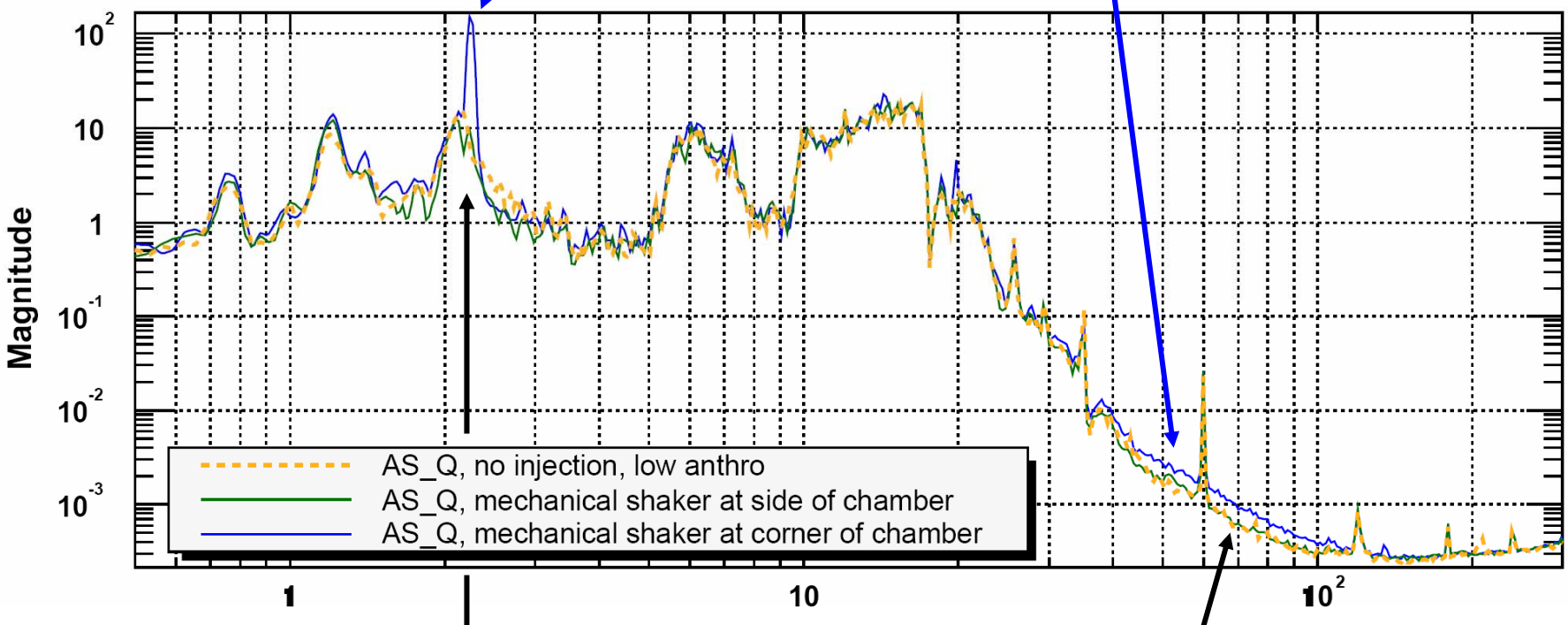
II. **Some S4 Issues**

a. Up-conversion of low frequency "continuous" seismic noise
b. Veto up-converting 0.7-2 Hz seismic transients
c. Continuous environmental sources can produce AS_Q bursts

III. **Preliminary coupling results from S4 PEM injections**

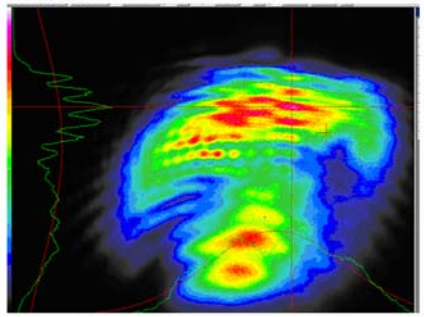
a. LHO LVEA ambient sound level generally less than 1/5 SRD above 60 Hz
b. LHO out-station ambient sound level generally less than 1/10 SRD
c. 60 Hz peak in AS_Q may be dominated by direct coupling of ambient magnetic fields

Mechanical shaker near corner of chamber produces pitch, yaw and displacement motion as well as causing up-conversion in AS_Q.

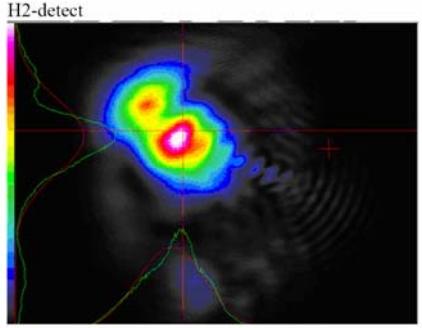


Mechanical shaker beside chamber produces side motion, but little pitch, yaw or displacement, and does not produce up-conversion.

H1-detect



H2-detect



H2-detect same attenuation as for H1