

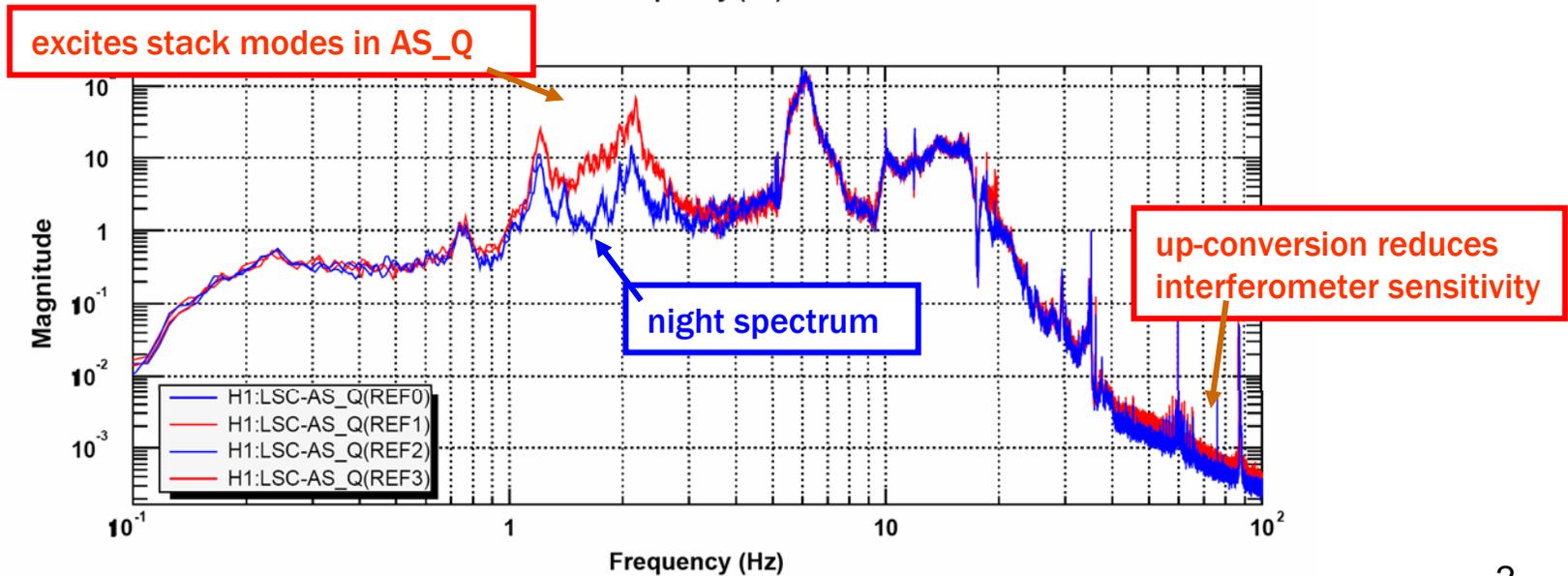
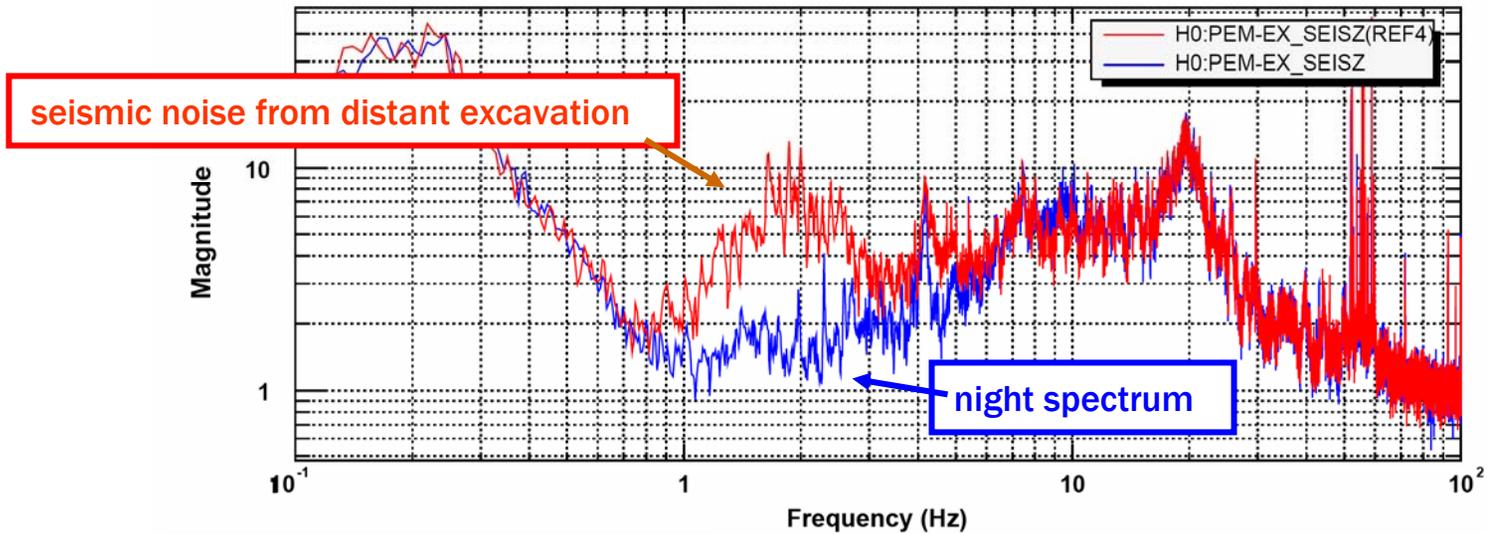
Environmental Disturbances: S4 and Pre-S5

Robert Schofield, U of O

Doug Cook, Fred Raab, Richard McCarthy, LHO

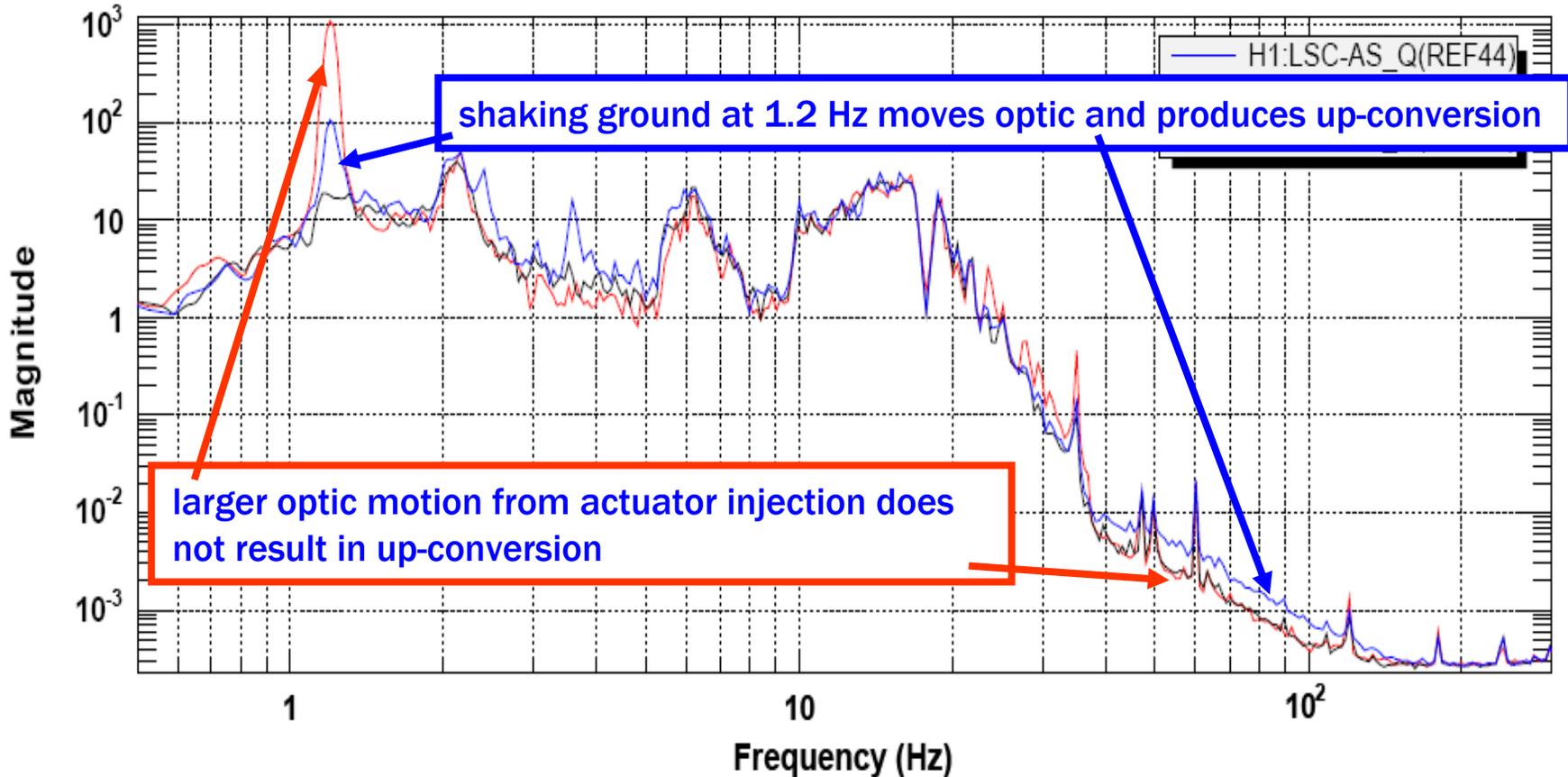
- I. Seismic up-conversion
- II. Some peak identification for upper limits groups
 - VME produced
 - seismic/acoustic
- III. Seismic/acoustic mitigation
 - acoustic enclosures
 - floating the H2 dark port

Up-conversion of low frequency seismic noise



DARM injection does not produce up-conversion.

Blue: 1.2 Hz beam-axis mechanical shaker, Red: DARM injection, Black: normal



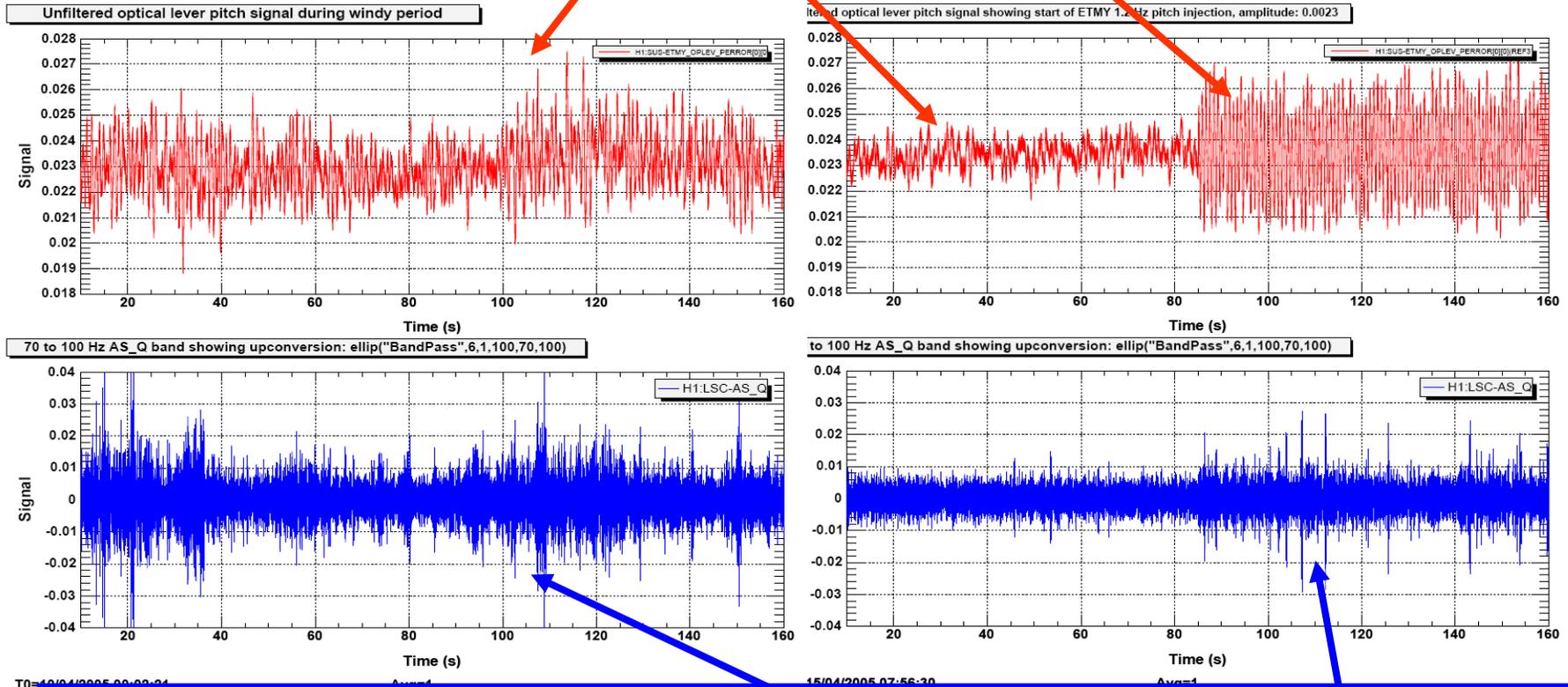
*T0=03/06/2005 02:59:03

Avg=1/Bin=20L

BW=0.0468742

Up-conversion with injection to mimic pitch during wind

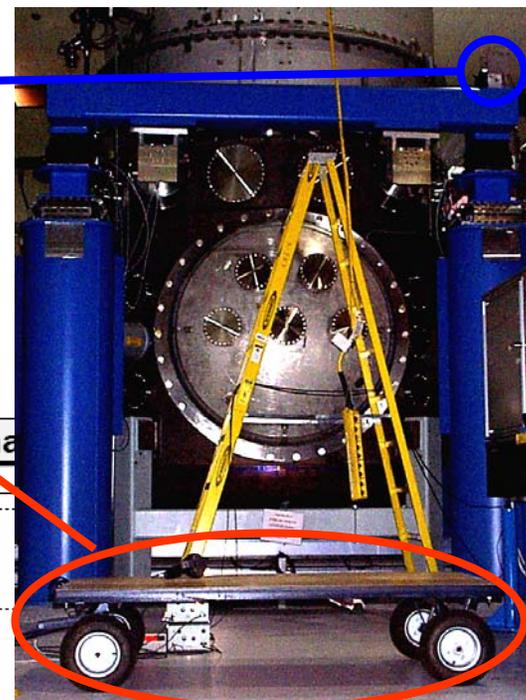
Optical lever during periods of wind, quiet and actuator injections to “match” wind.



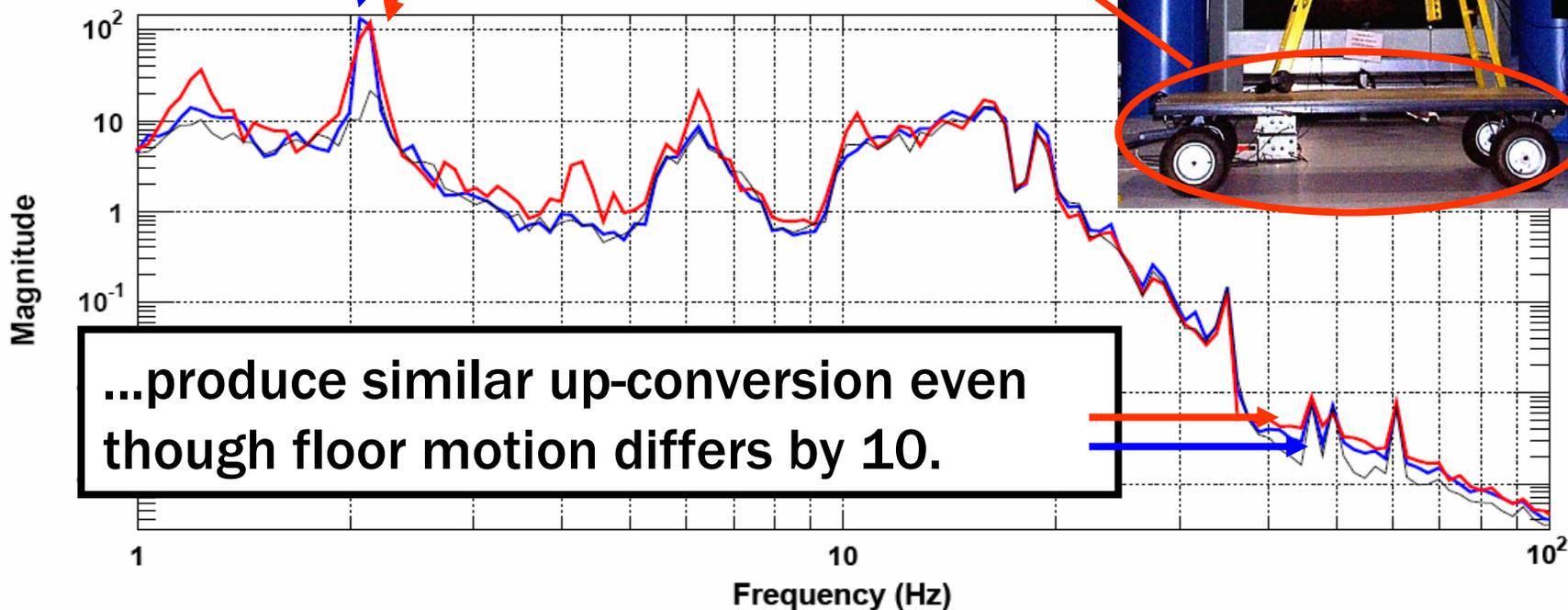
70-100 Hz band in AS_Q showing up-conversion during wind and actuator injection.

Up-conversion depends on stack motion not floor motion.

Small shaker on cross-beam
and large shaker on floor
adjusted to produce similar
optic motion...



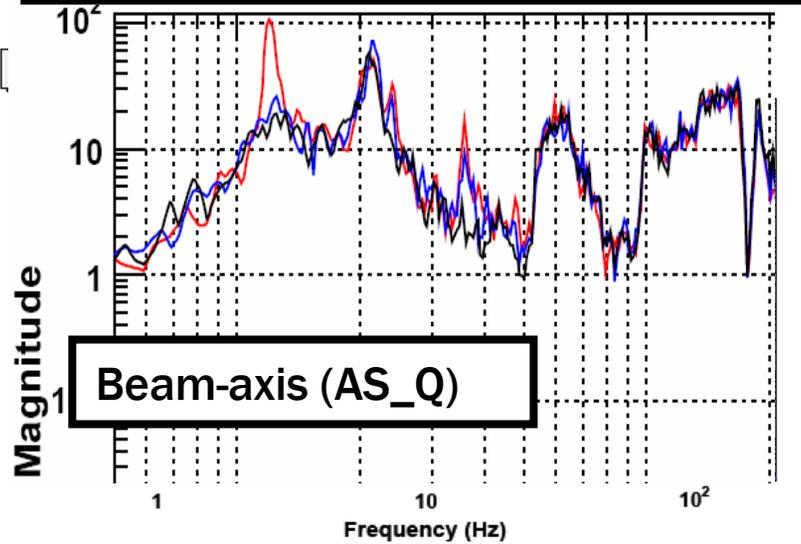
Red: large floor shaker, Blue: small shaker on cross beam, Black: normal



...produce similar up-conversion even
though floor motion differs by 10.

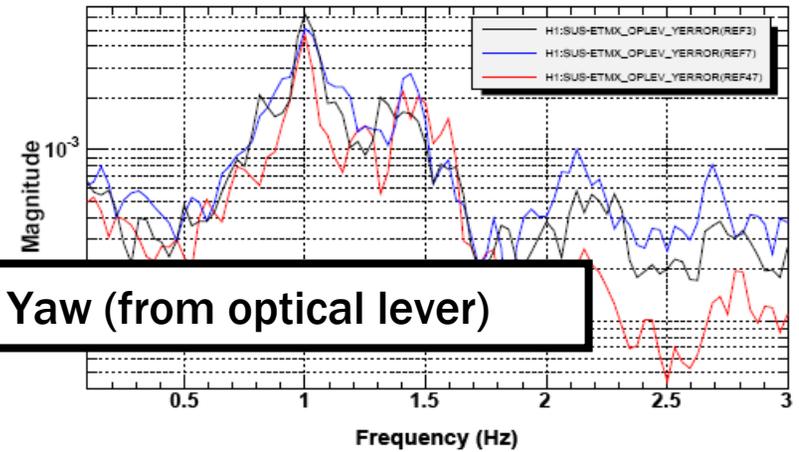
Ground shaking to excite specific motions

Red: mainly beam-axis; Blue: mainly side-to side; Black: no shaking



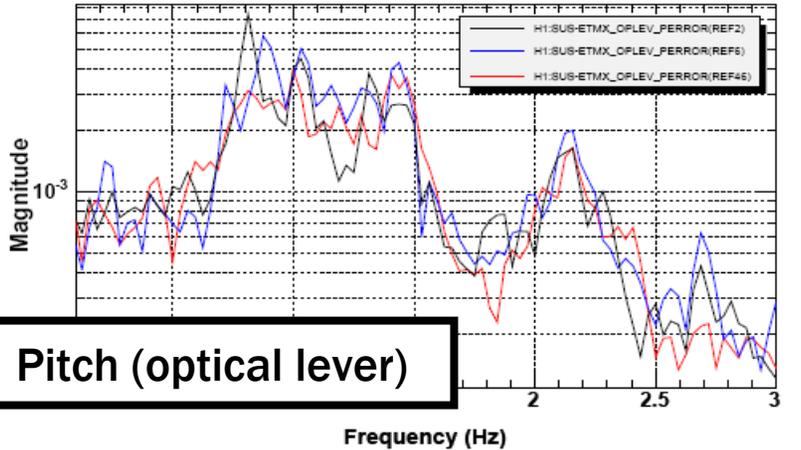
*T0=03/06/2005 02:17:14 Avg=1/Bin=15L BW=0.0468742

Yaw, same color scheme



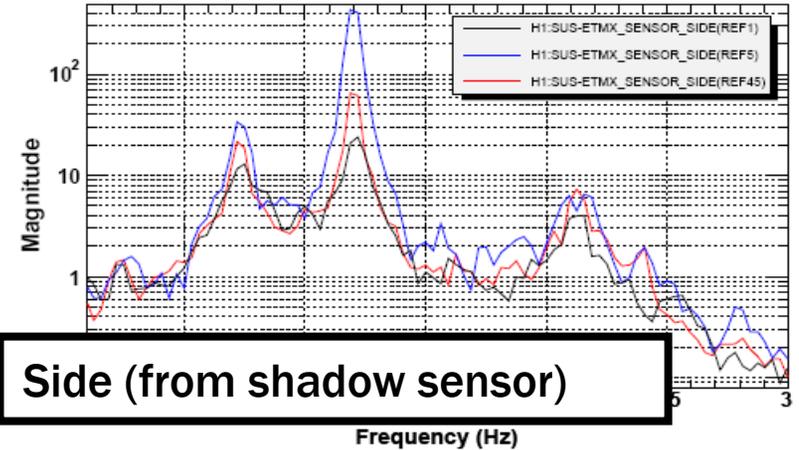
*T0=03/06/2005 02:17:14 Avg=1 BW=0.0468742

Pitch, same color scheme



*T0=03/06/2005 02:17:14 Avg=1 BW=0.0468742

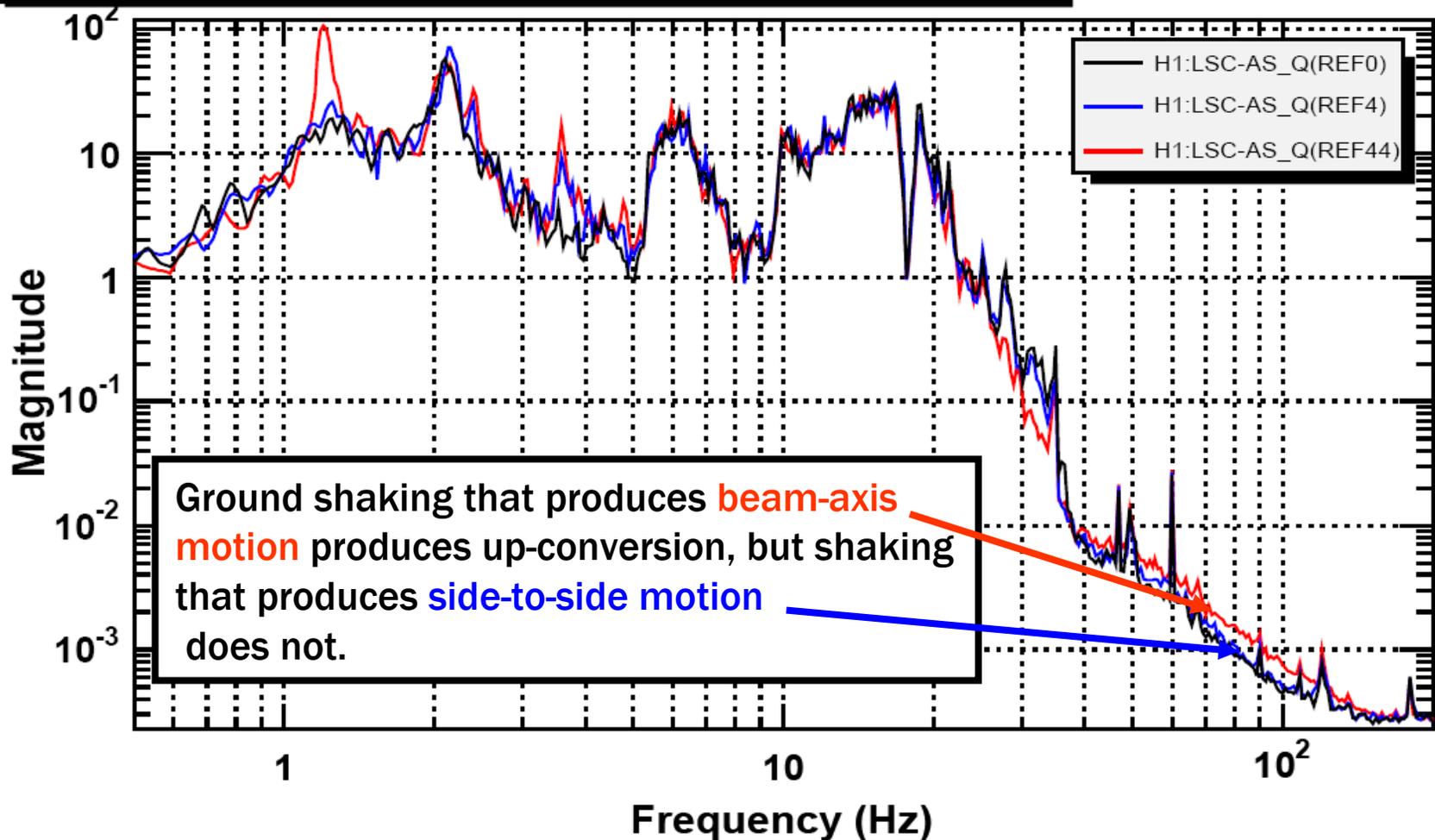
Side, same color scheme



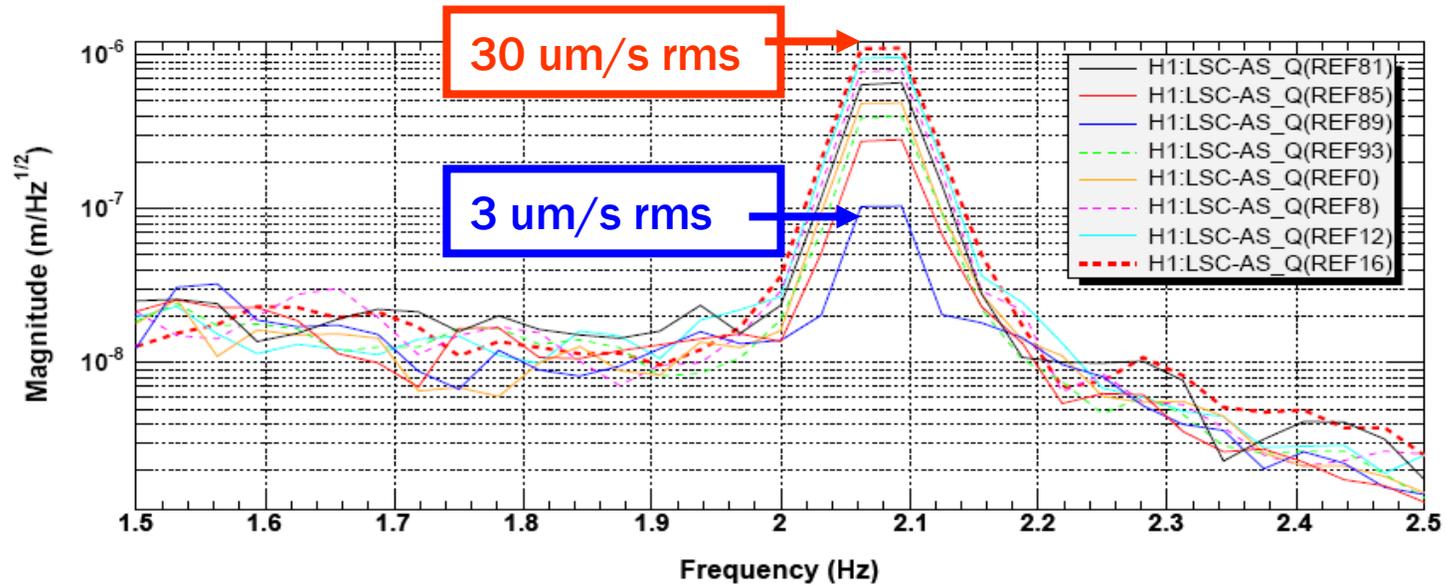
*T0=03/06/2005 02:17:14 Avg=1 BW=0.0468742

Side-to-side shaking does not produce up-conversion.

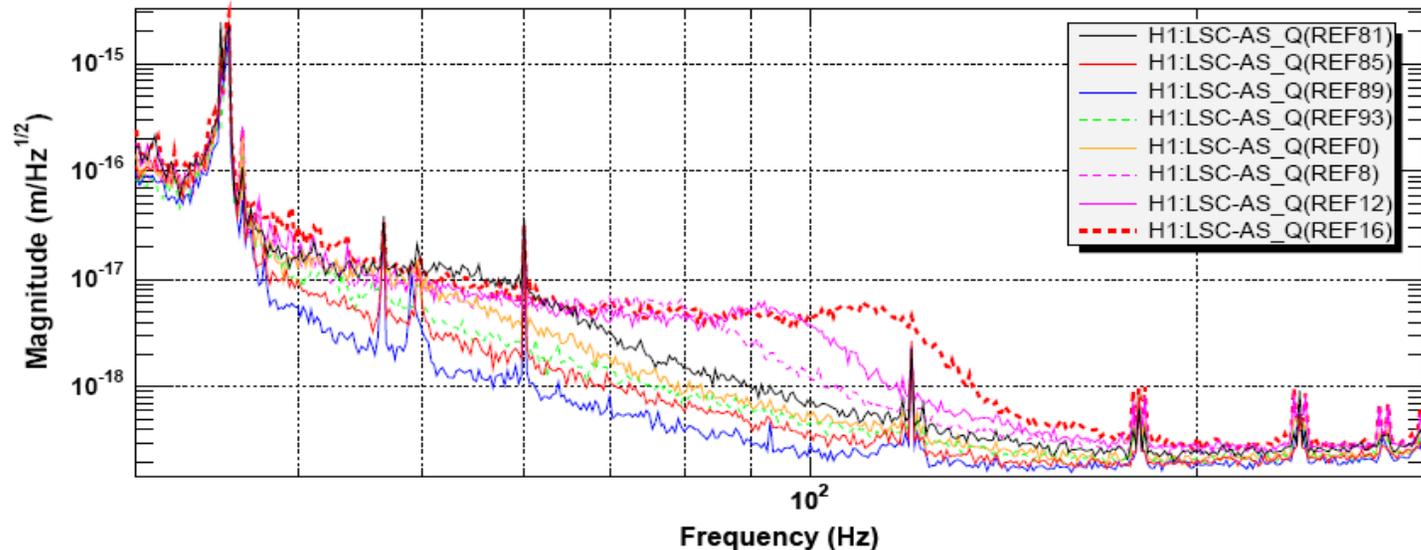
Black: no excite, Blue and Red: 1.2 Hz horizontal shaker at different positions



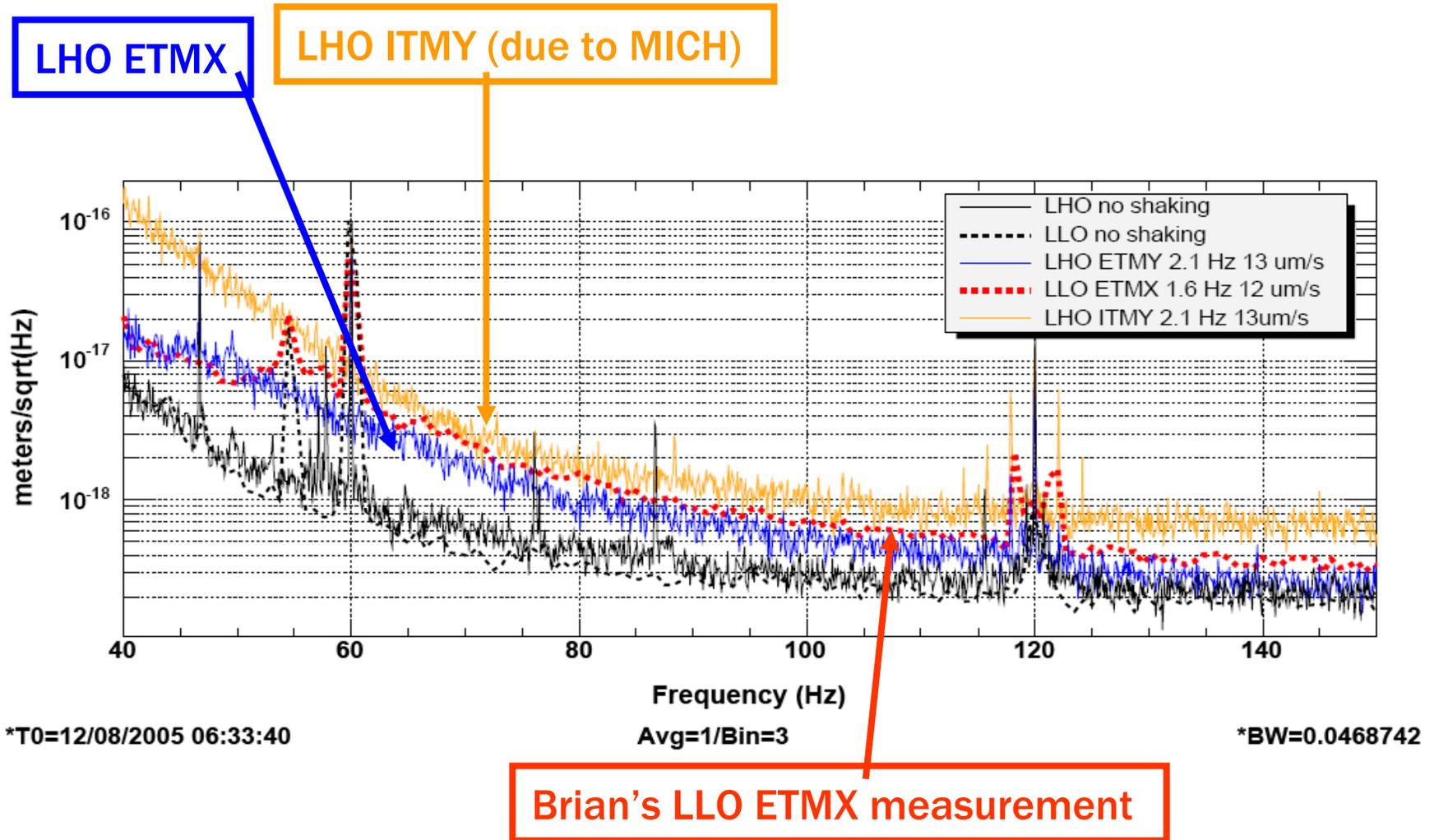
Up-conversion for different shaking amplitudes



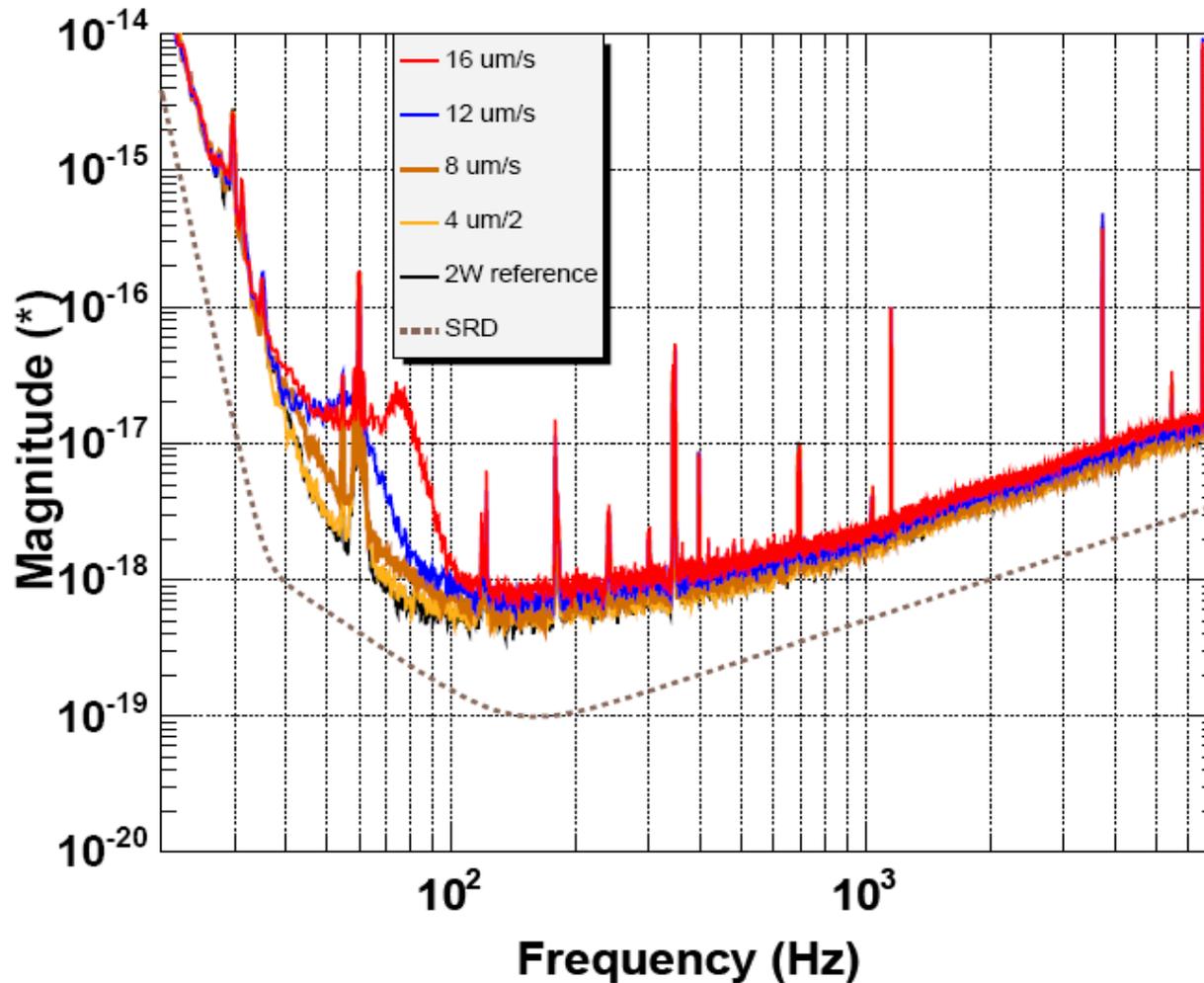
Power spectrum



Up-conversion similar at LHO ETMs; is it similar at ITMs and LLO at similar velocities?



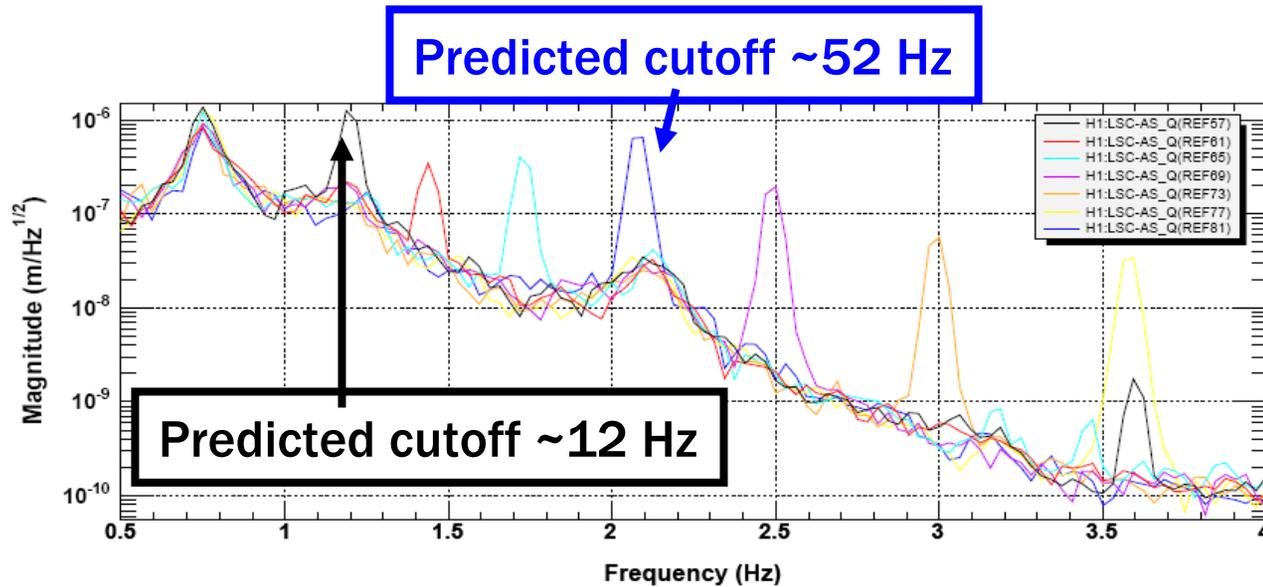
Brian O'Reilly's recent LLO measurements



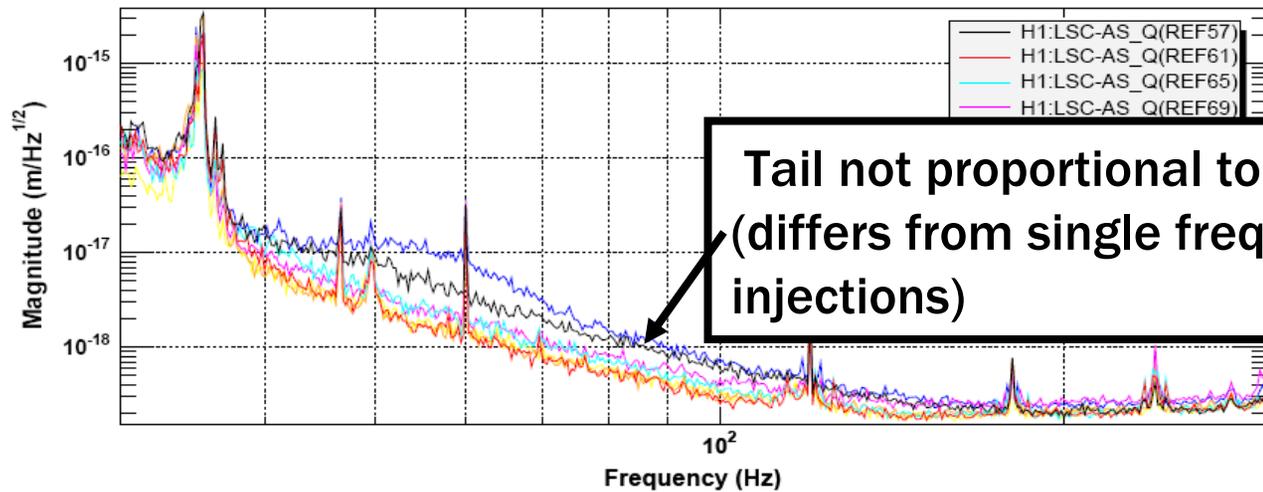
*T0=16/08/2005 19:38:39 *vg=1/Bin=2L

*BW=0.374994

Simple model doesn't explain tail

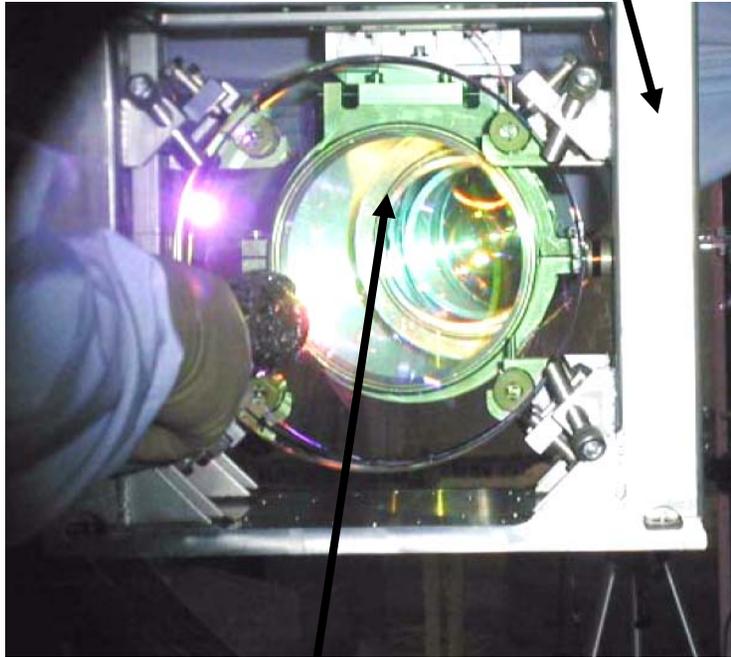


Power spectrum



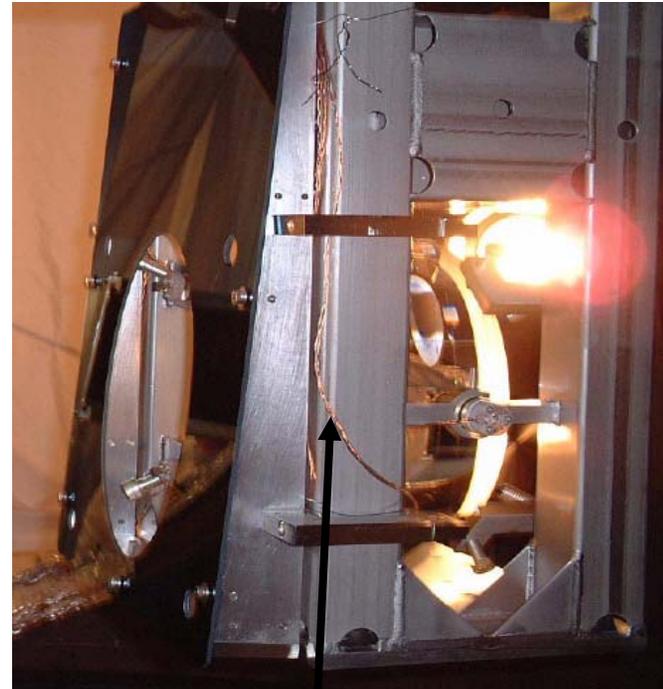
Possible sources of up-conversion

back-scattering from optic-support structure – but why not also from BSC back wall?



back-scattering from output telescope: consistent with lack of up-conversion for side-to side

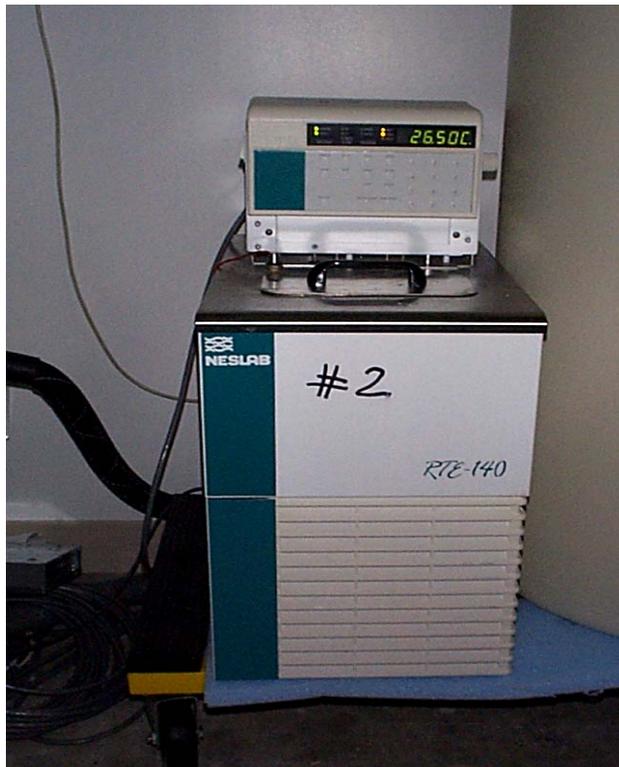
optic support wire at clamps



brushing cables on test mass support structure - not consistent with side-to side

S4 H1-H2 coherence peak identification for stochastic group

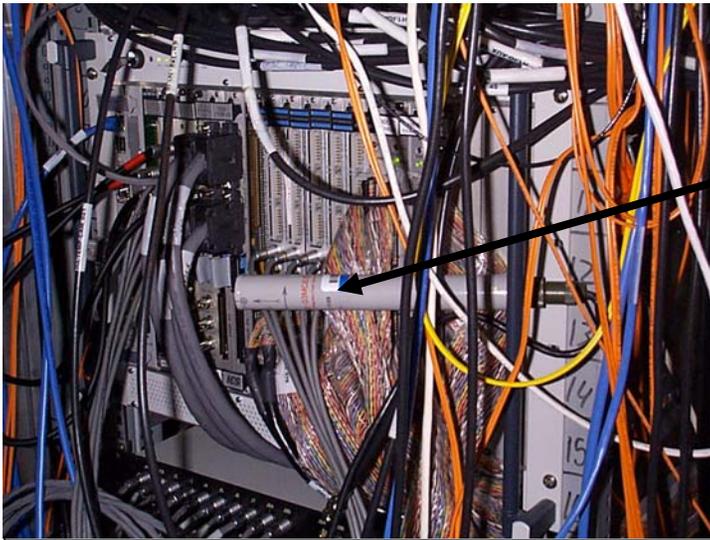
133 Hz: Neslab PSL chillers



330 Hz HVAC turbine SF01



Pulsars in VME crates (harmonics of 70.12 Hz)



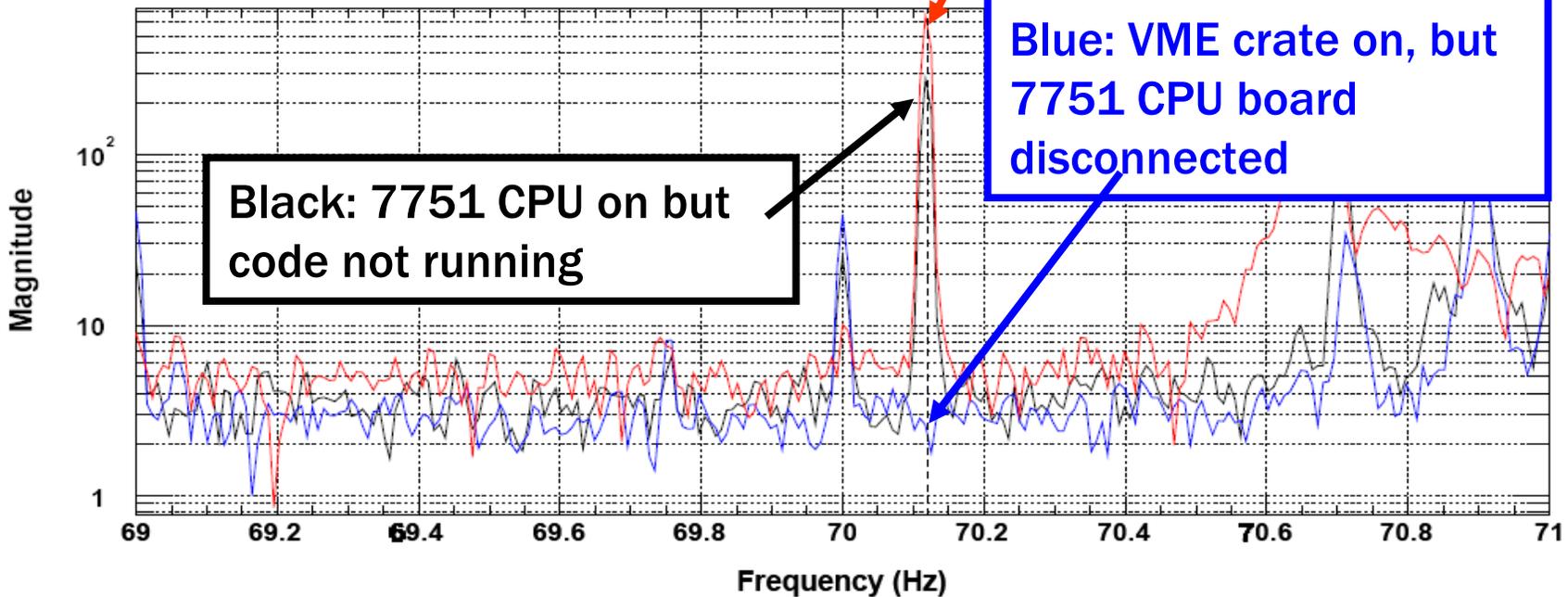
magnetometer near VME crate detects pulsar candidate frequencies. Magnetometers elsewhere don't.

Red: normal operation of VME crate

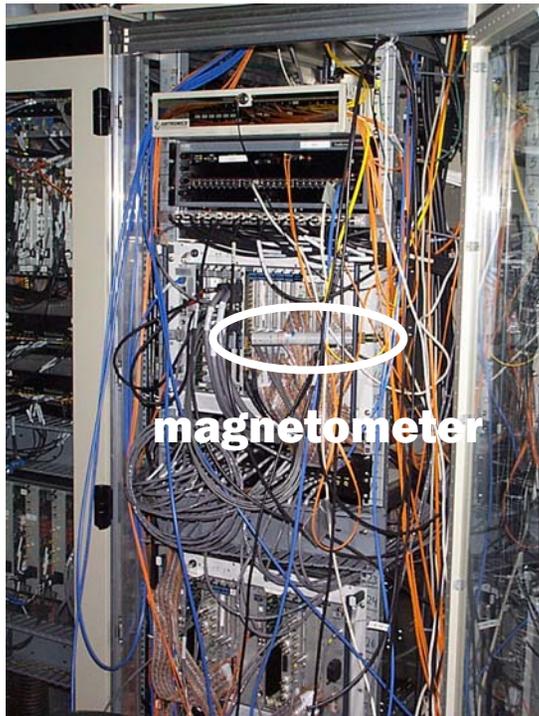
LACK: CPU on but code not running

Blue: VME crate on, but 7751 CPU board disconnected

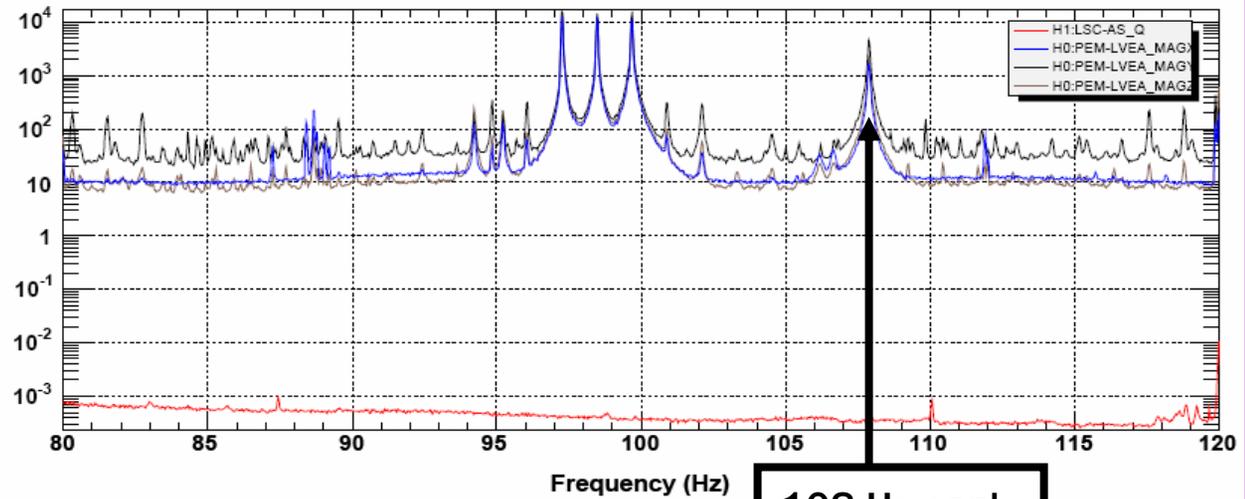
Black: 7751 CPU on but code not running



Coherence between AS_Q and VME magnetometer

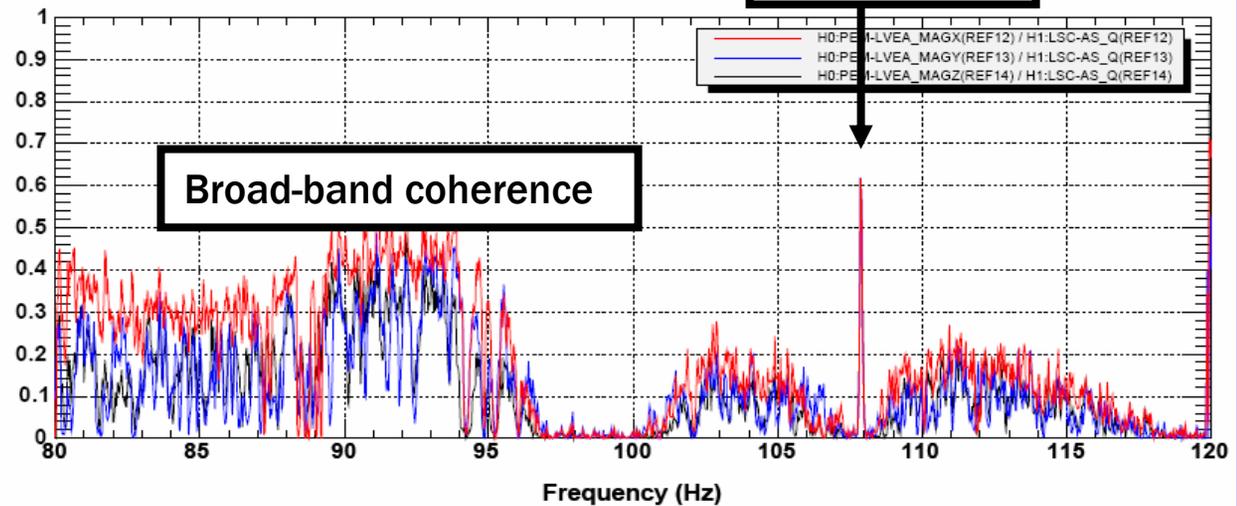


top traces: magnetometer signals from h1dsc13, bottom trace: AS_Q



coherence between AS_Q and a magnetometer at h1dsc13

108 Hz peak



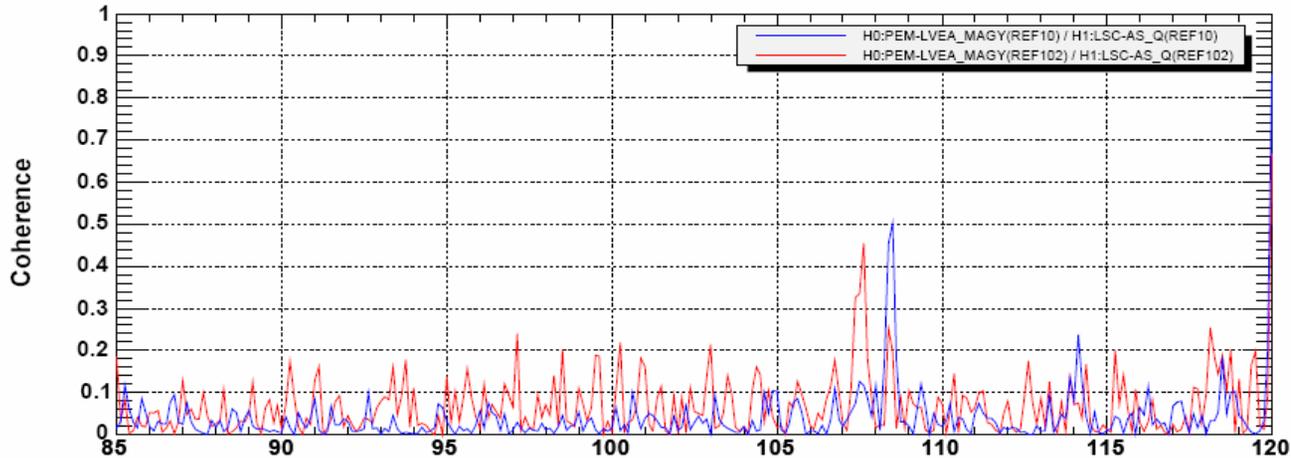
T0=15/05/2005 07:30:25

Avg=1

BW=0.046874

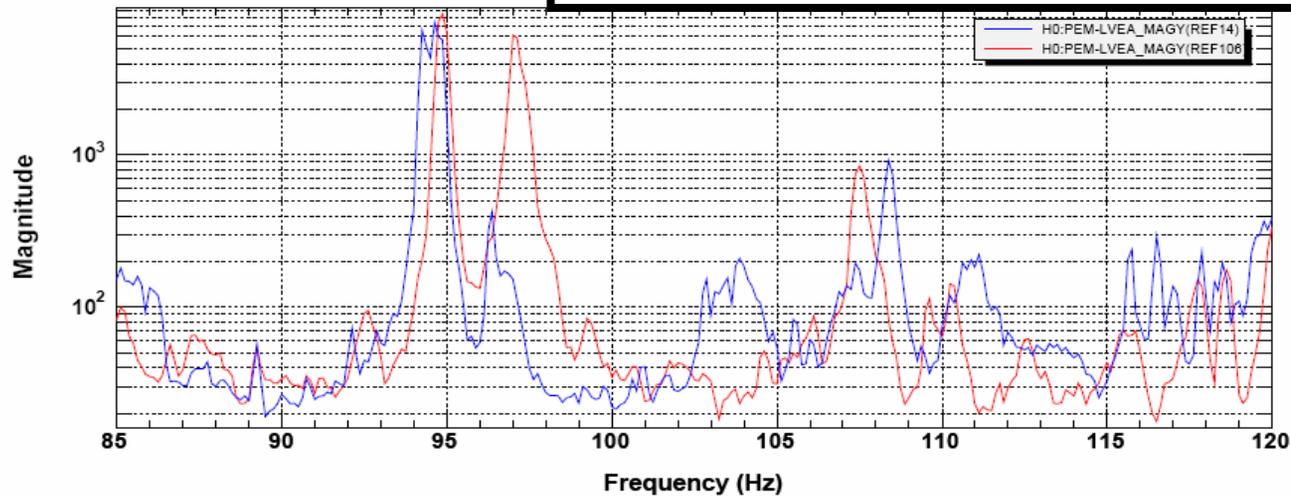
108 Hz peak moves with air-flow to fans

blue: normal air flow, red: extra air flow, top plot: AS_Q-magnetometer coherence



magnetometer

Blue: normal air; Red: extra air

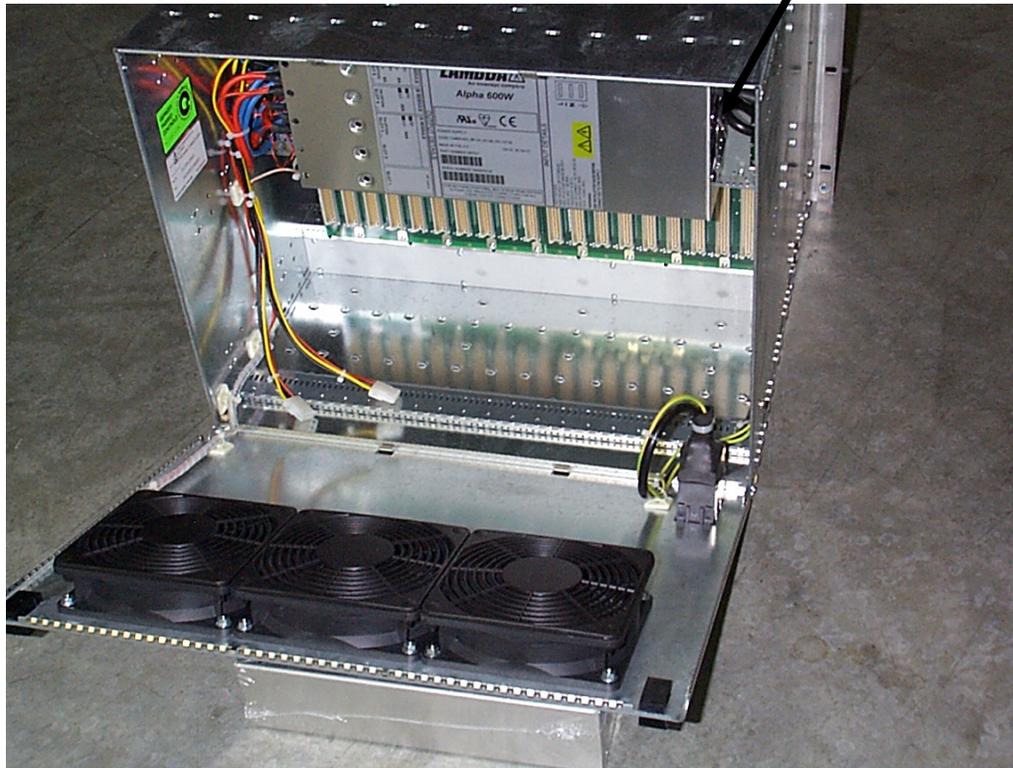


*T0=10/06/2005 23:55:20

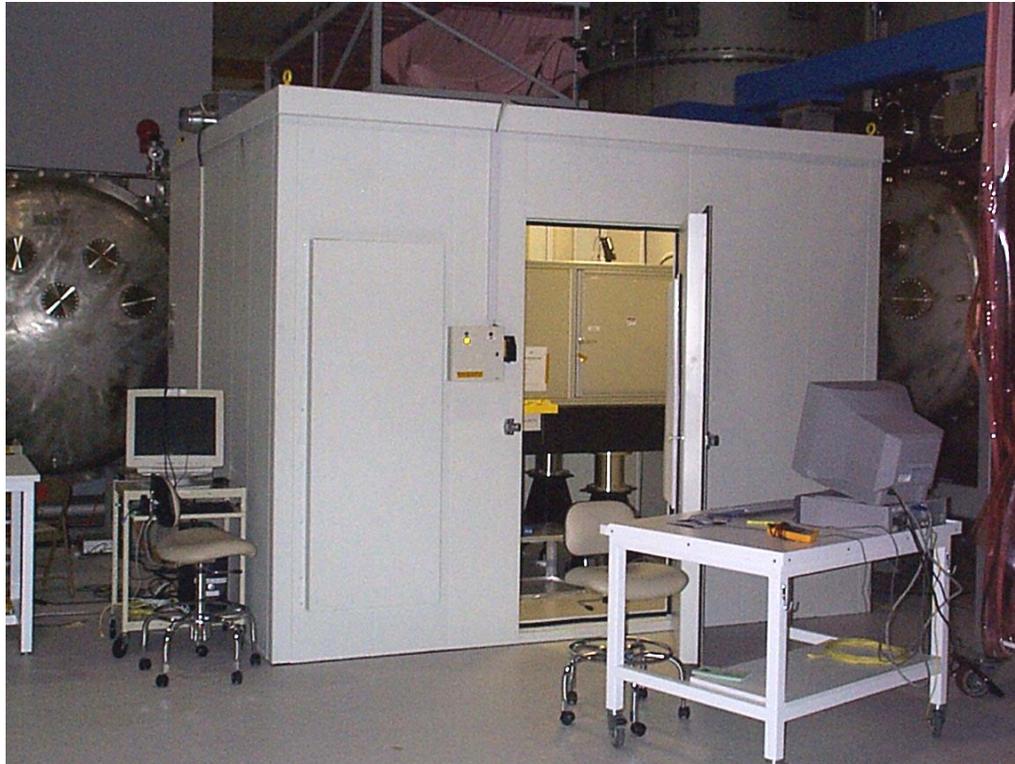
Avg=1

BW=0.187499

108 Hz peak goes away when power supply fan disconnected.



Acoustic enclosures for LHO reflected port by S5

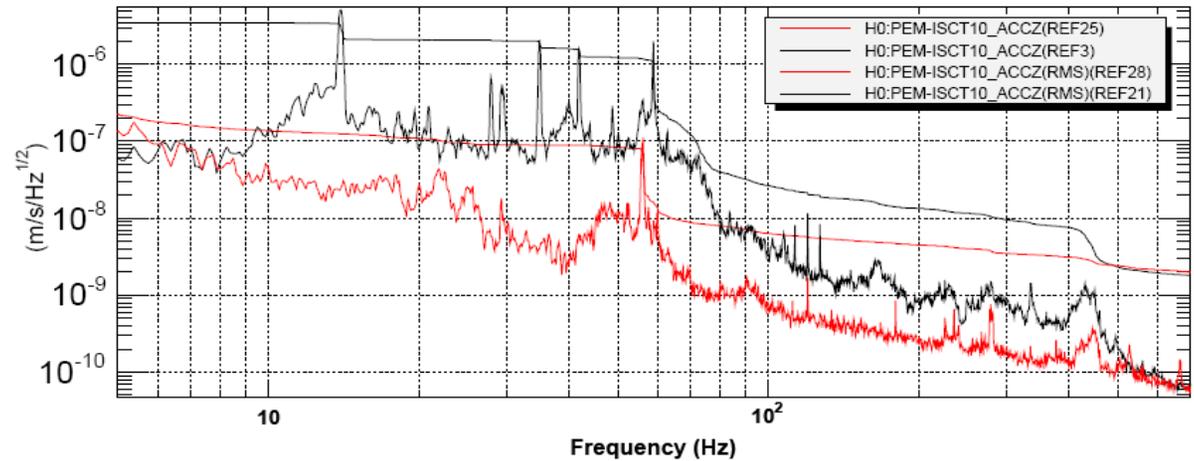


Acoustic coupling at ISCT4 was reduced beyond expectations, making it worth while to enclose what was the second worst coupling site – the reflected port. We have also ordered an enclosure for the H2 REFL port, though we don't expect improvement.

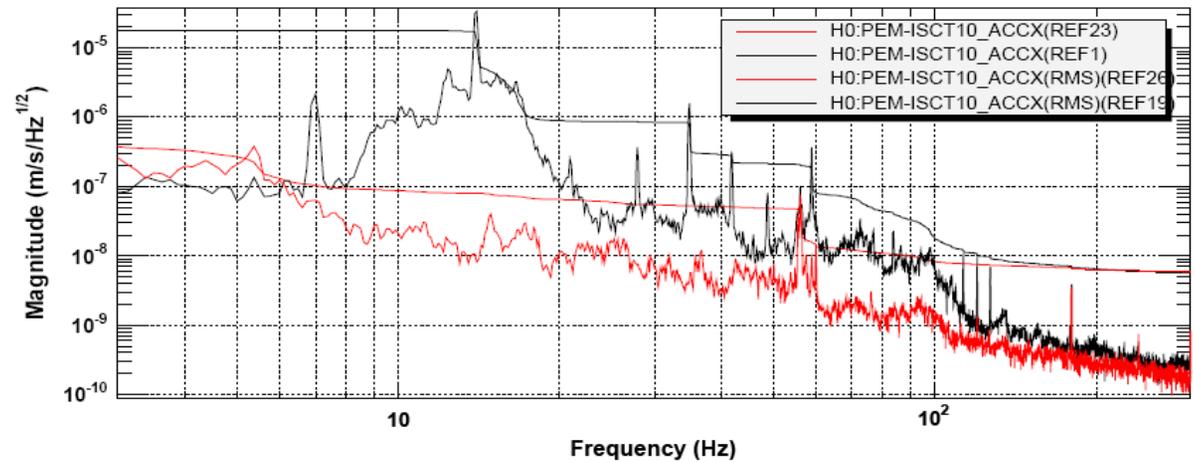
ISCT10 floated yesterday, velocity down more than 10



Black: before , Red: float, Z axis



Black: before, Red: float, X axis



*T0=16/08/2005 08:00:26.009277

Avg=8

BW=0.187499

Summary

I. Seismic Up-conversion

- a. several types, focus on the anthropogenic type characterized by b.**
- b. not reproduced by DARM injections**
- c. not produced by side-to-side motions; possibly not by yaw (n=1)**
- d. looks like back-scattering, at least at large amplitudes**
- e. similar at LHO ETMX and ETMY, as well as LLO ETMX, MICH noise dominates LHO ITMY**
- f. at least at LHO noise starts showing up at a few times background, which is not atypical of seismic transients**

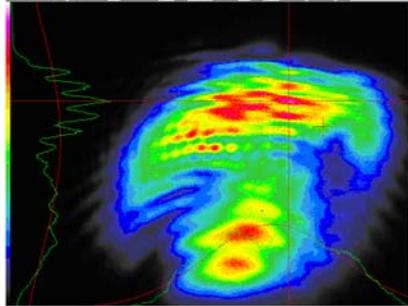
II. Peak identification

- a. 70.12 from crate controller**
- b. 108 from crate power supply fan**
- c. 133 from chiller**
- d. 330 from HVAC turbine**

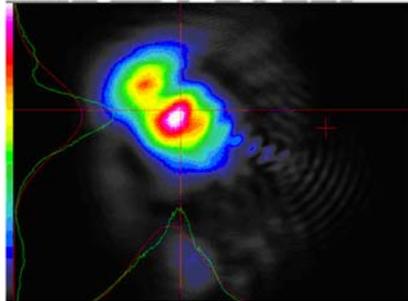
III. Acoustic/seismic mitigation

- a. acoustic enclosures for LHO dark port are on their way**
- b. H2 dark port is now floating – more than 10 reduction in velocity, should reduce H1-H2 coherence, range increased 0.5 Mpc**

H1-detect



H2-detect



H2-detect same attenuation as for H1

