Crossbeam vibration

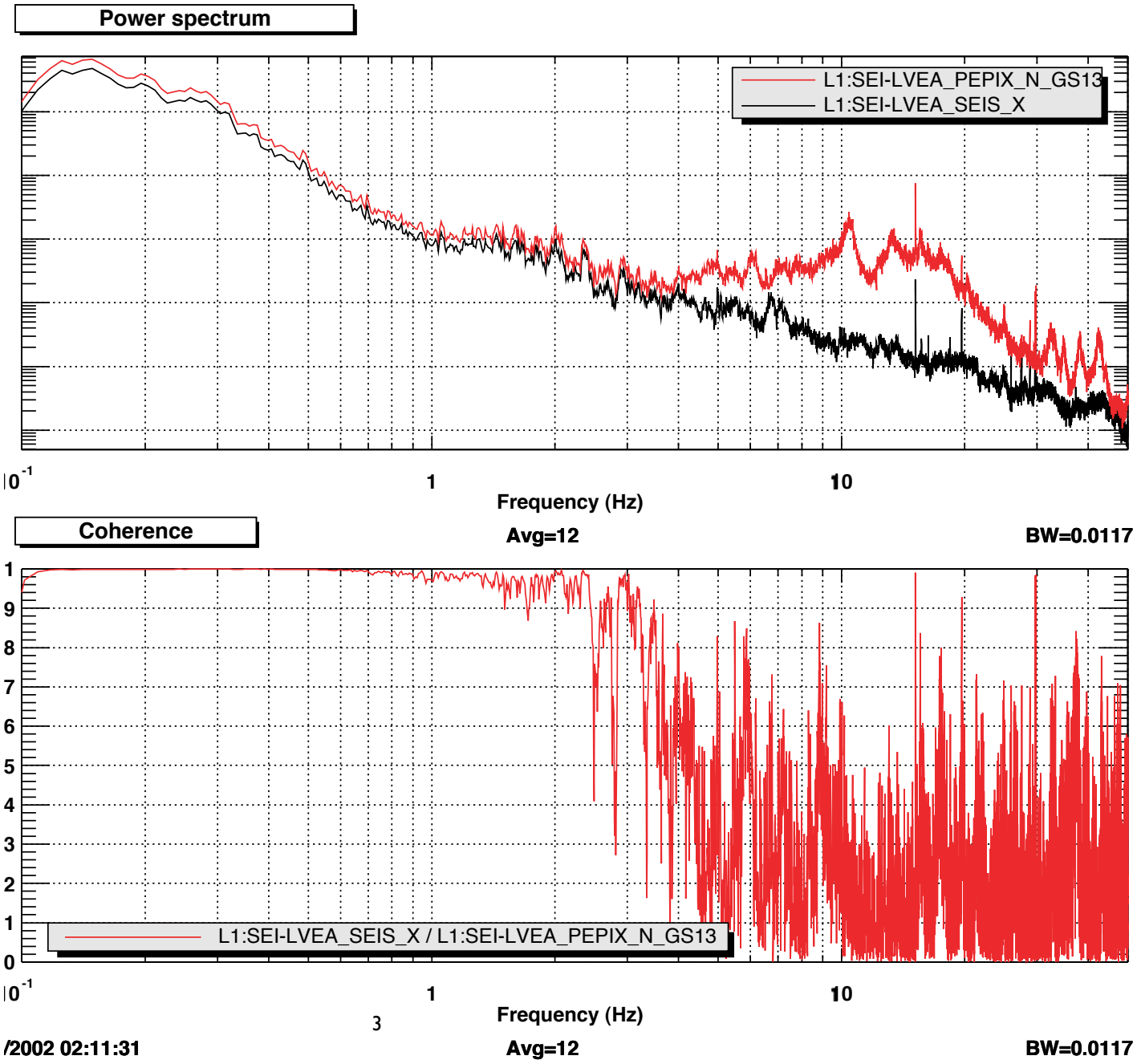
J. Giaime, Laurent Ruet, Rana Adhikari, others.

Summary

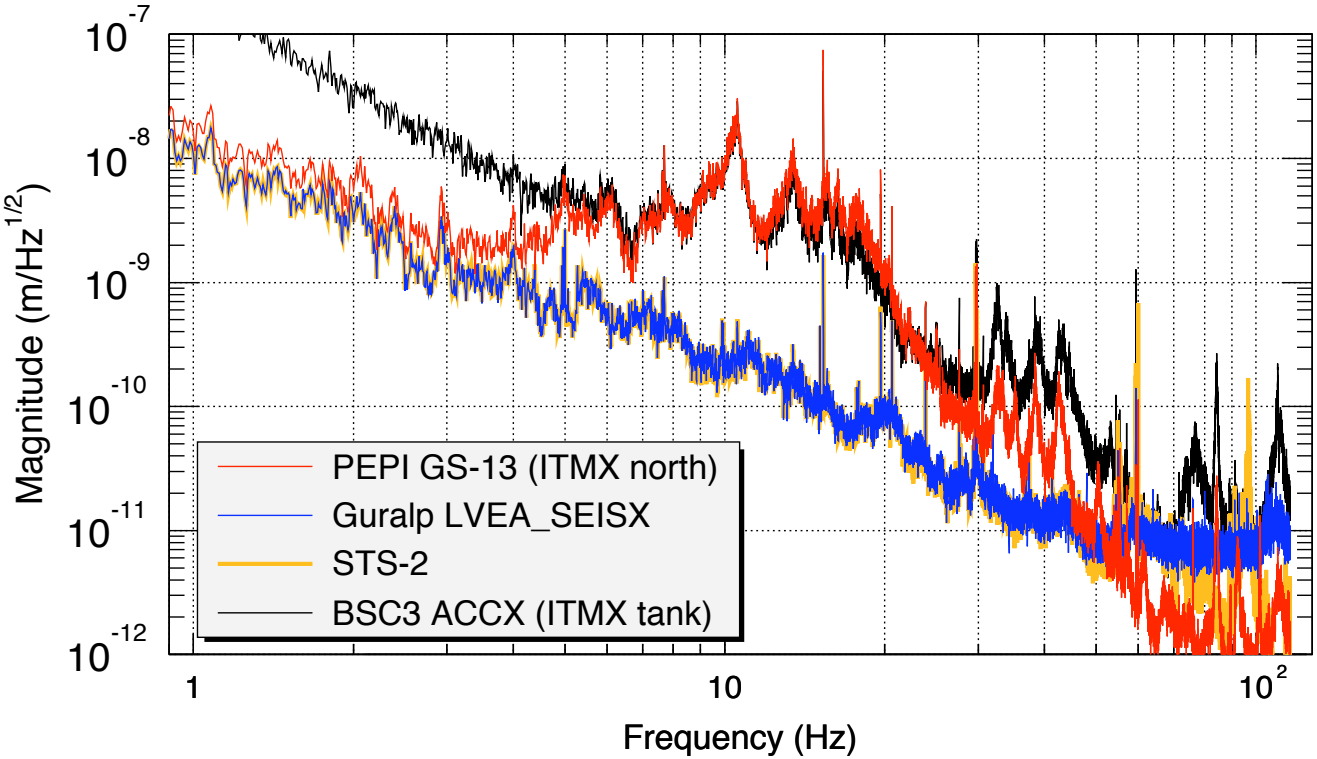
- Vibration on the BSC crossbeams is considerably greater than that on the ground or the pier top.
- Measurements have been carried out on PEPI-fitted systems at LLO and HEPI-fitted systems at LASTI.

LVEA slab versus crossbeam

- Calibrated crossbeam-mounted GS-13 sees much more noise in 5–50 Hz band.
- Coherence down to about 1/3 above 4 Hz.

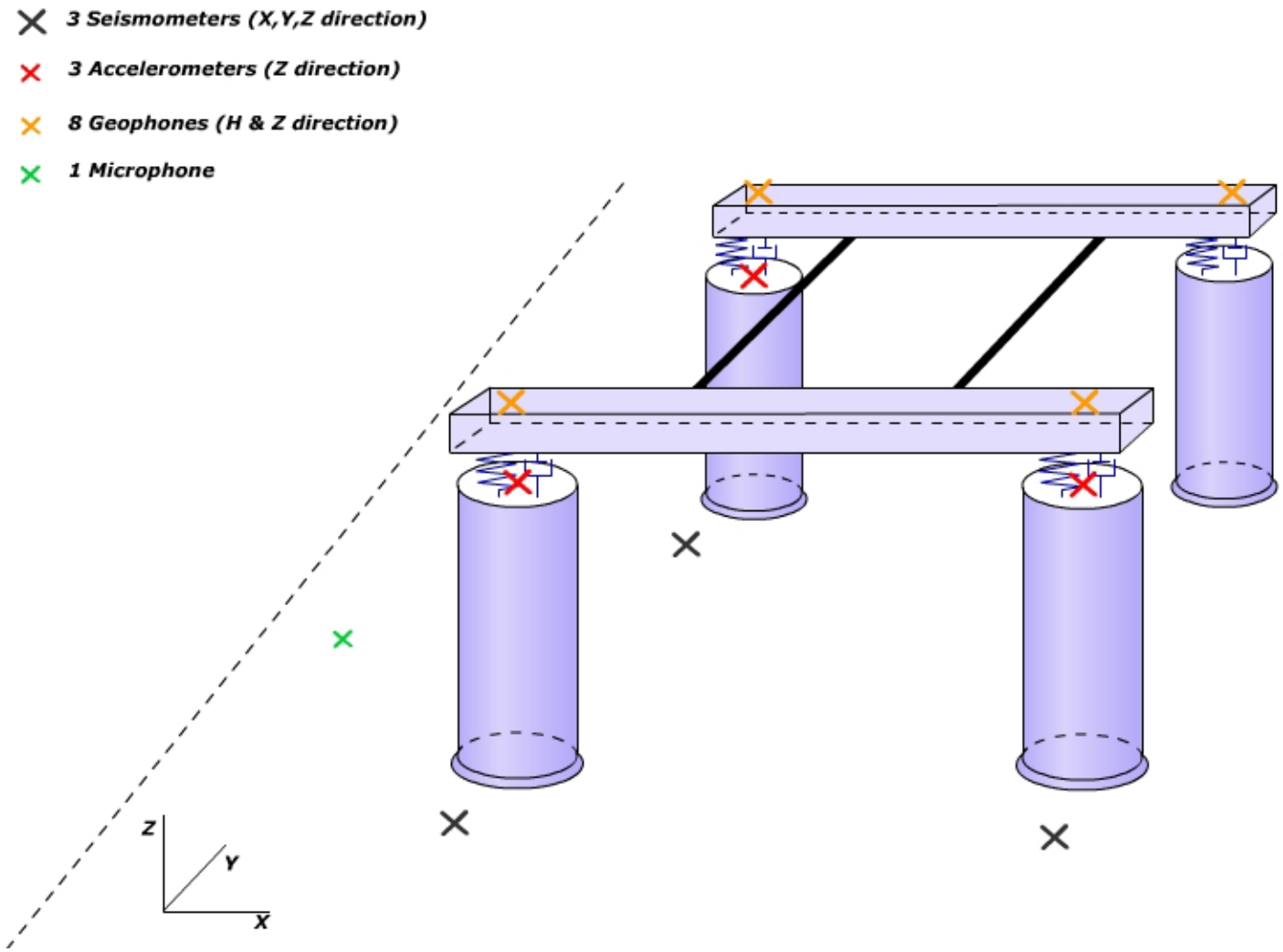


Rana's data from ETMX w/ PEPI installed but off



- In the 5–50 Hz band, where PEPI is irrelevant, almost 2 orders of magnitude enhancement, as before.
- The crossbeam-mounted accelerometer agrees in this band with the GS-13, making it unlikely that the pickup is instrumental microphonics.

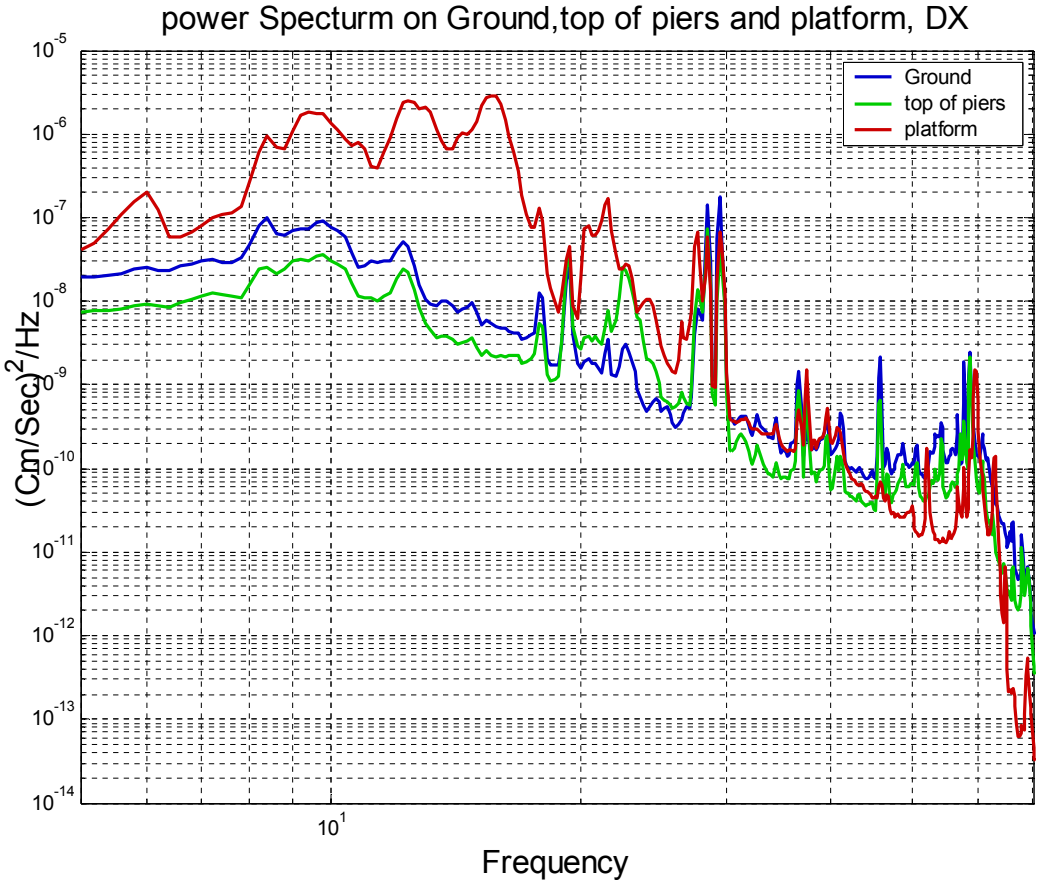
Laurent Ruet's LASTI tests.

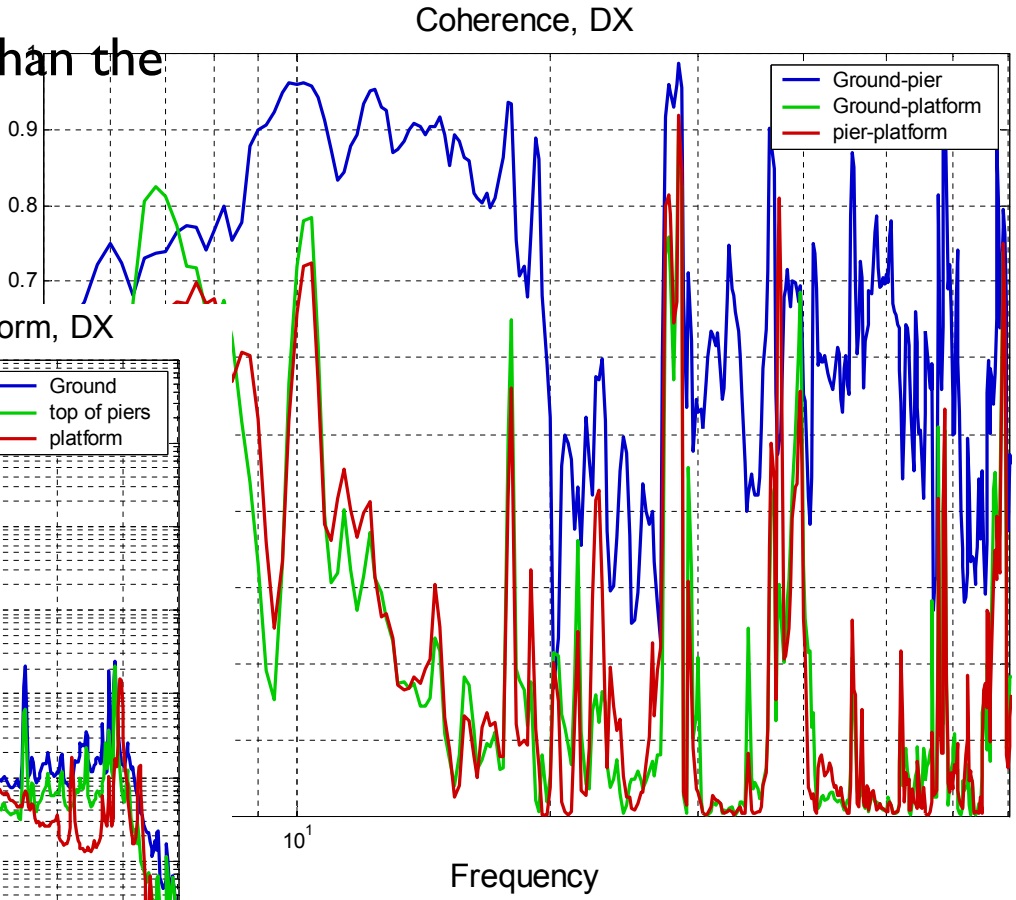


- LASTI BSC, with HEPI, suspended on new springs, but without hydraulic fluid. (Test with clamped payload underway.)

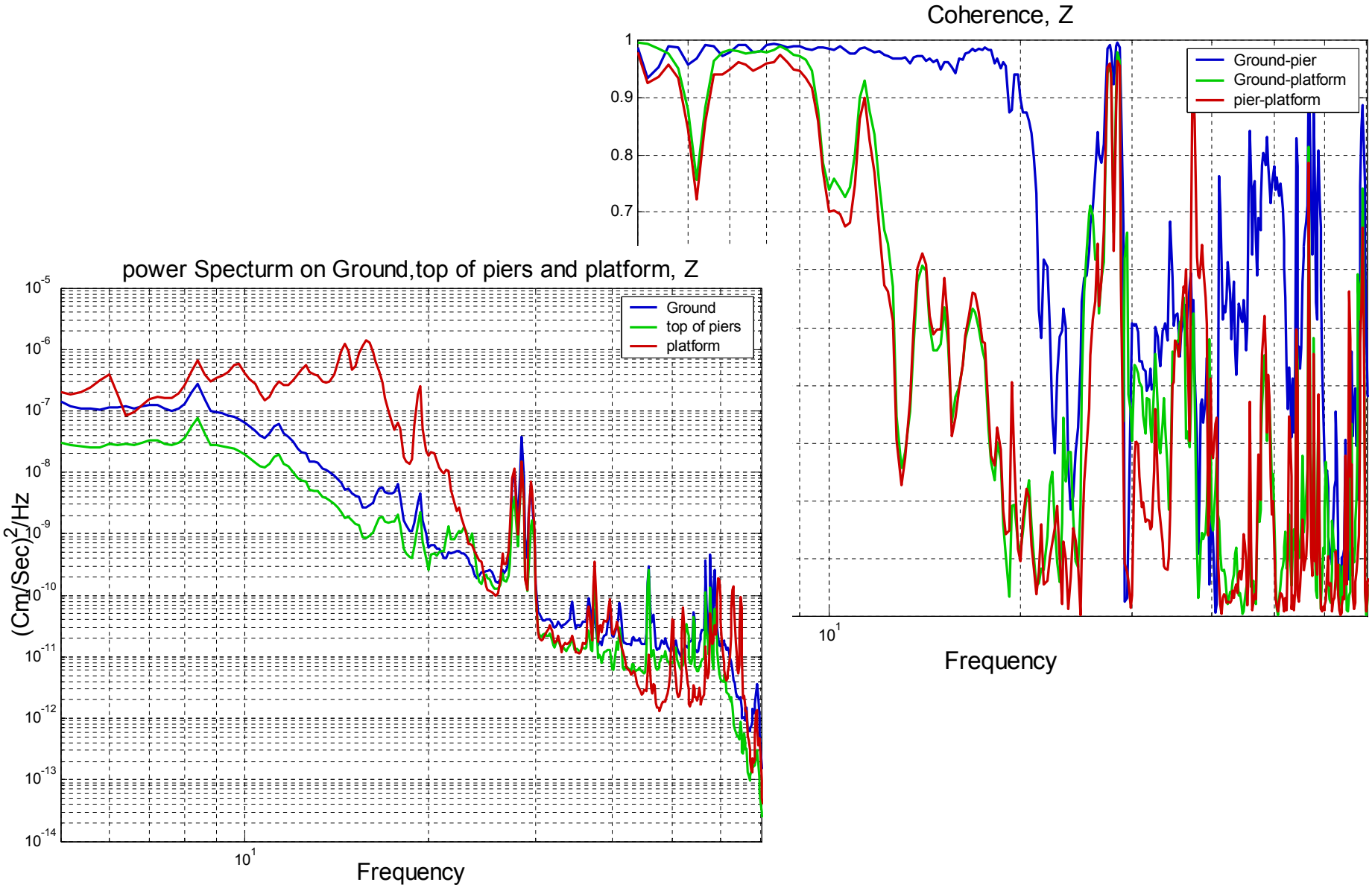
horizontal noise comparison.

- Top of piers is not much noisier than the floor slab; angular amplification is probably not the cause.



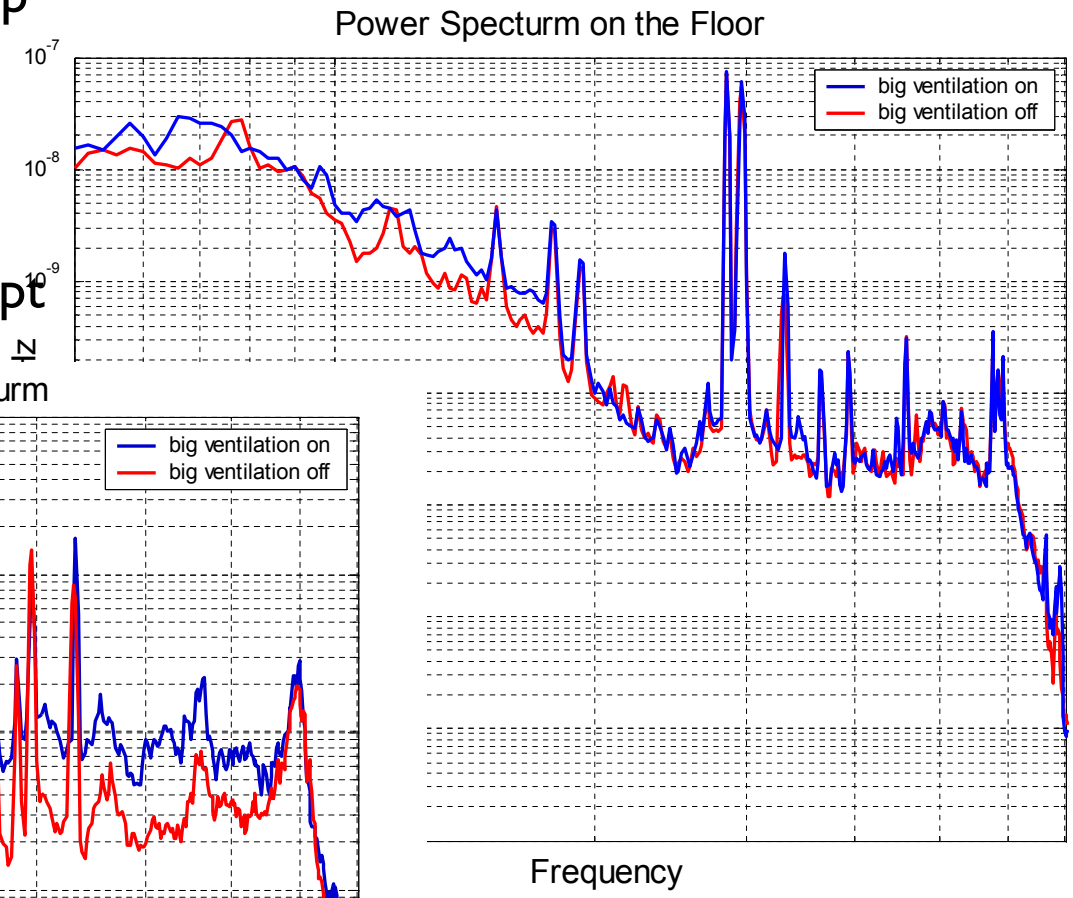


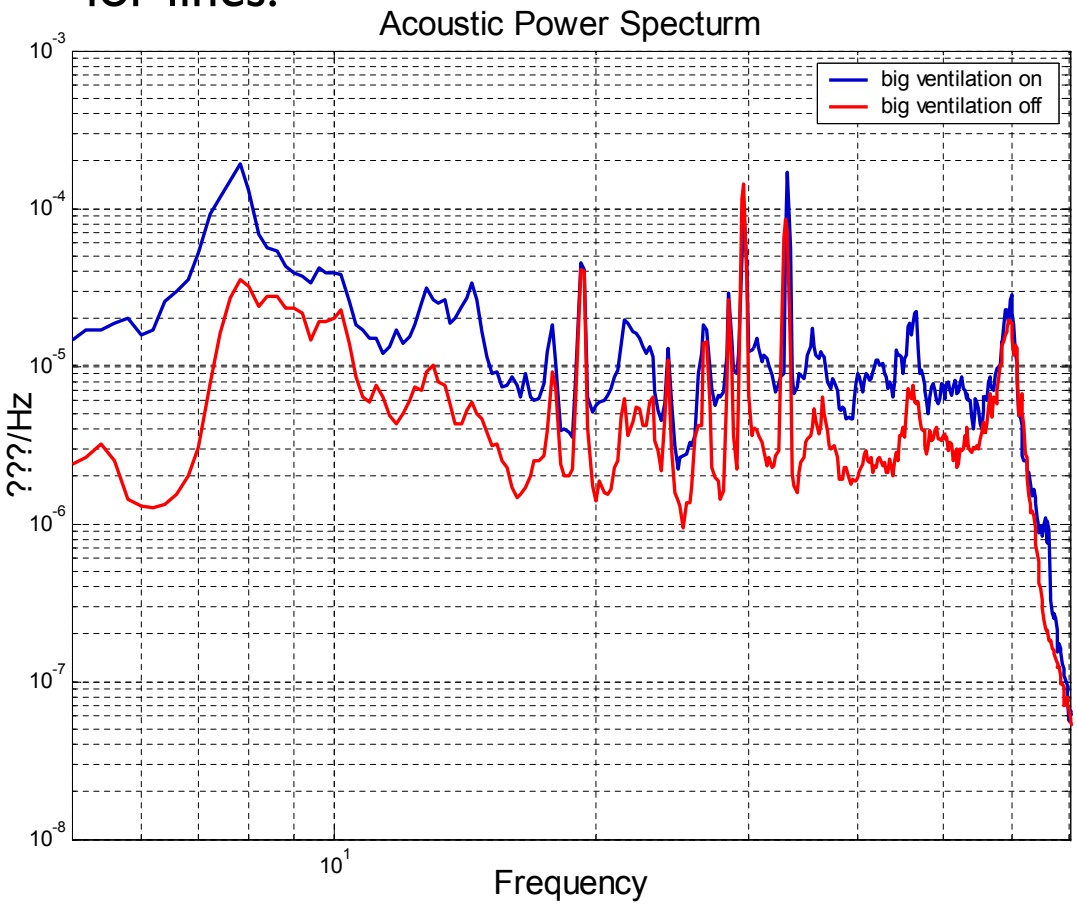
Vertical noise comparison



Acoustic Pickup?

- Ruet's test of acoustic pickup indicates that this is not a problem in LASTI.
- Giaime's similar test at LLO showed no coherence, except for lines.





Plan to study the effect

- Dennis has a finite-element model of the external SEI structure.
- Brian has a state-space model of the hydraulic actuator combined with a modified Hytec stack model.
- Dennis plans to work with Dan Busby to combine the two.
- Laurent Ruet should continue detailed measurements, together with any modeling that may help.
- Once HEPI is working under ETMX at LLO, the commissioning team can study the effect directly at LLO. Busby may spend part of Summer '04 with us.

WAG of the effect on AdvLIGO

- We measure the vibration in the external structure in 8 DOFs in the affected band, with good SNR, using the HEPI geophones.
- It may be possible to measure the 8 → 6 transfer function to the active platform stage 1 motion, and then employ sensor correction to subtract the noise there.
- This can potentially work even if the coupling from the actual disturbance is time-varying and/or non-linear.