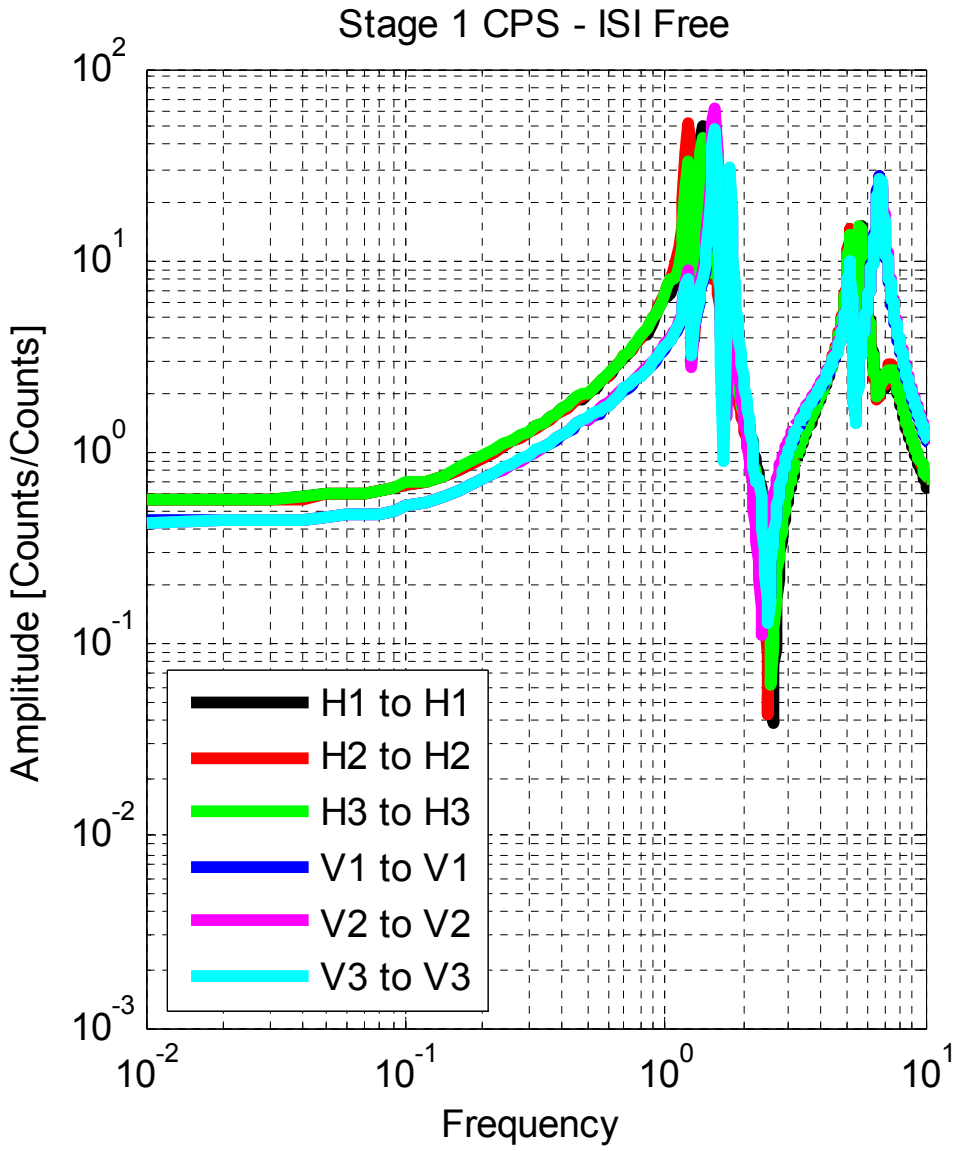
This document compares transfer functions of the BSC-ISI when the two stages are floating (unlocked/free) and when the two stages are locked.

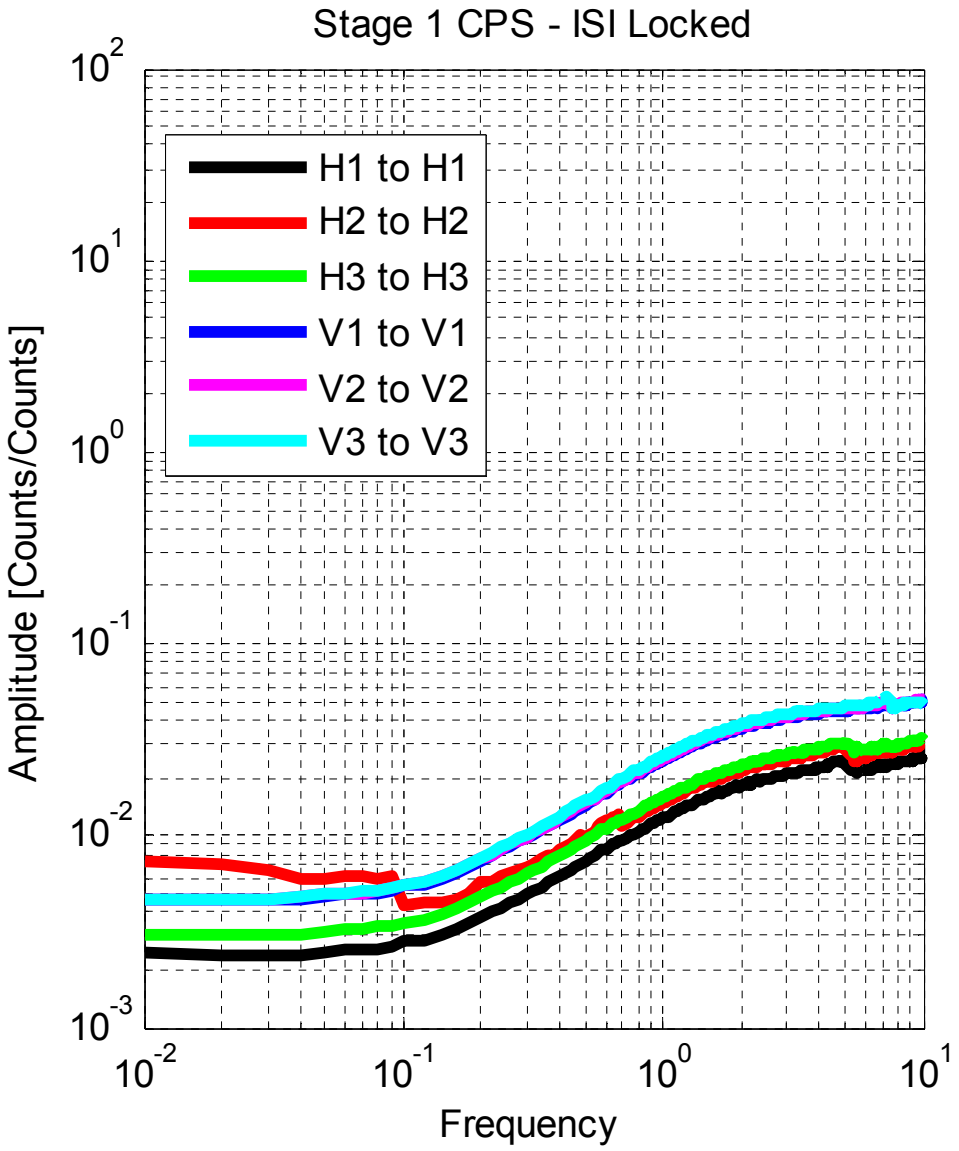
We use two series of measurements performed on ITMY:

- ISI unlocked: H1_ISI_ITMY_TF_L2L_Raw_2013_05_03.mat
- ISI Locked: H1_ISI_ITMY_TF_L2L_Raw_2014_06_24.mat

The goal is to figure out whether the low frequency features in the inertial sensors response are due to motion (translation or tilt coupling) or due to direct pickup (magnetic fields).

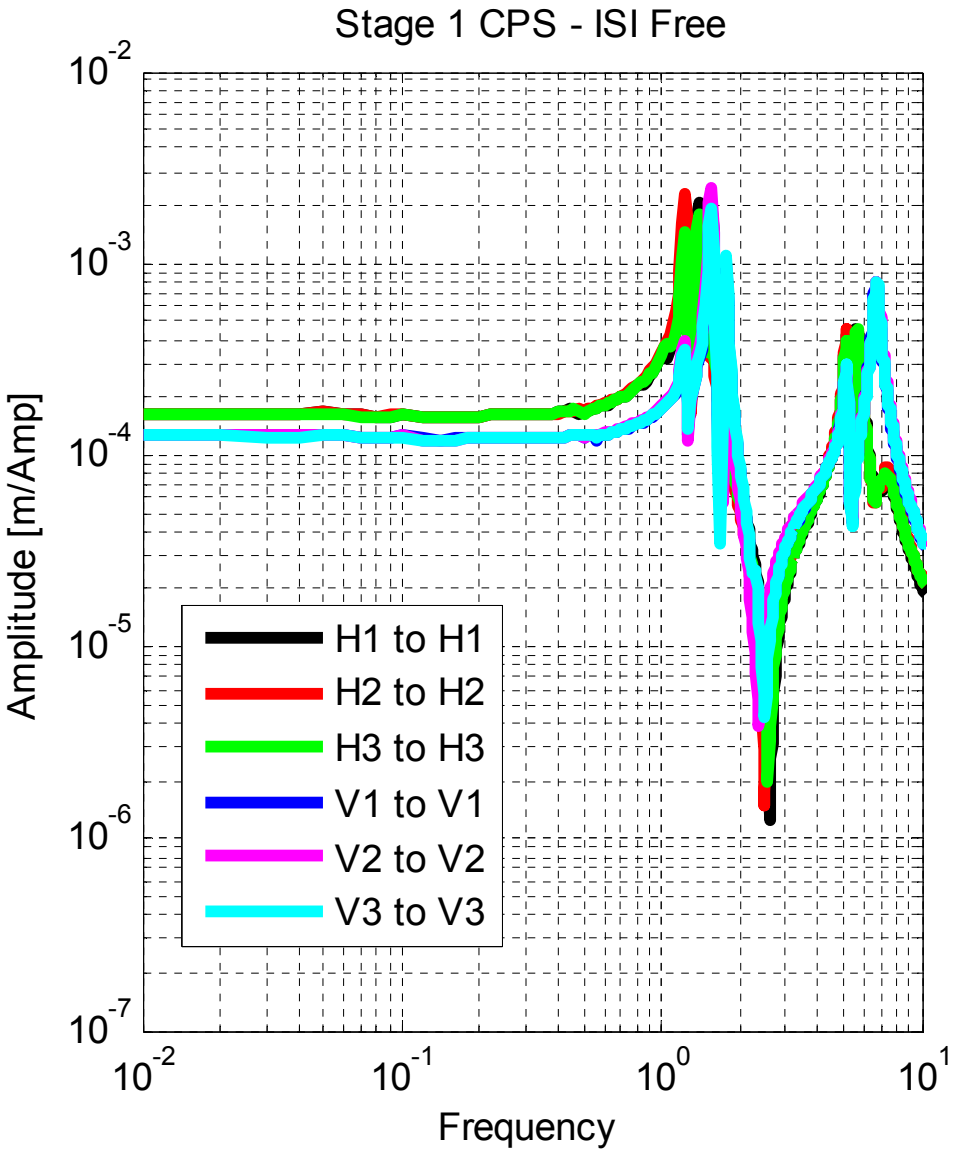
We plan on repeating these measurements and analysis on ITMX and the units currently being tested in the staging building.

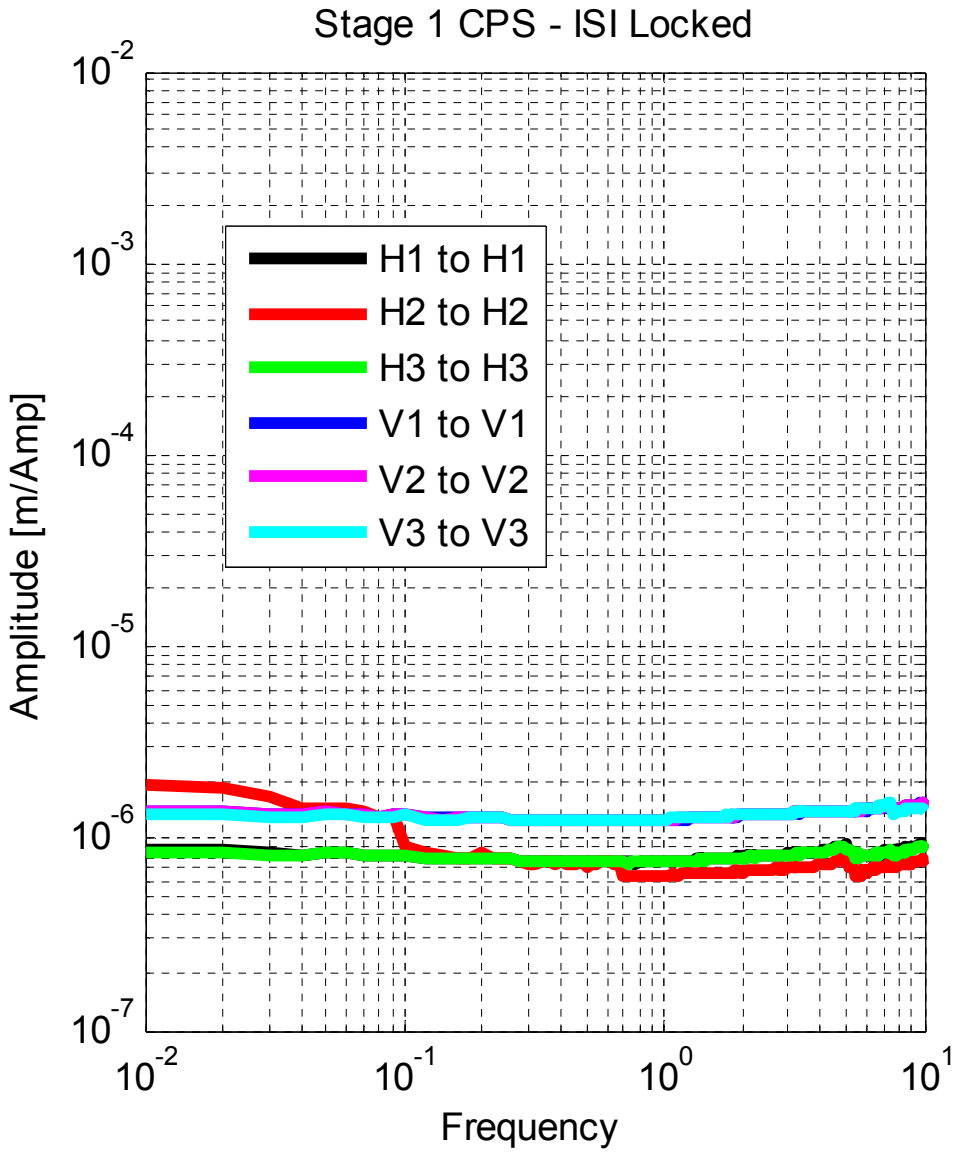




These plots show local to local measurements, from “Stage 1 Actuators” to “Stage 1 Sensors”. On the left, the ISI is floating. On the right the ISI is locked. These transfer functions show the raw data (DAC drive to ADC sensing, units are Counts/Counts).

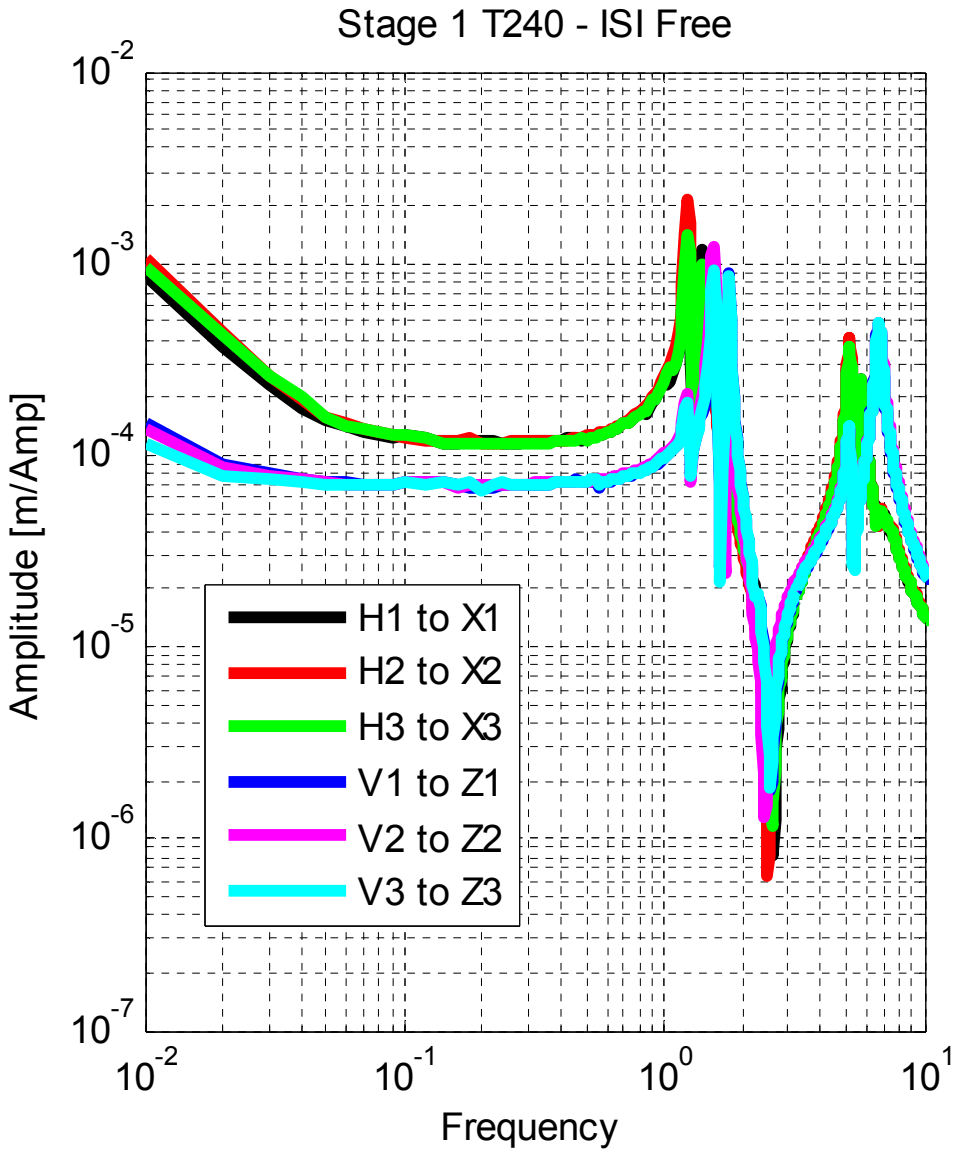
The static response in the locked configuration is about 100 times lower than the response in the floating (“free”) configuration. No more resonances. We can see the [0.1 Hz-1Hz] whitening of the CPS electronics. Everything makes sense.

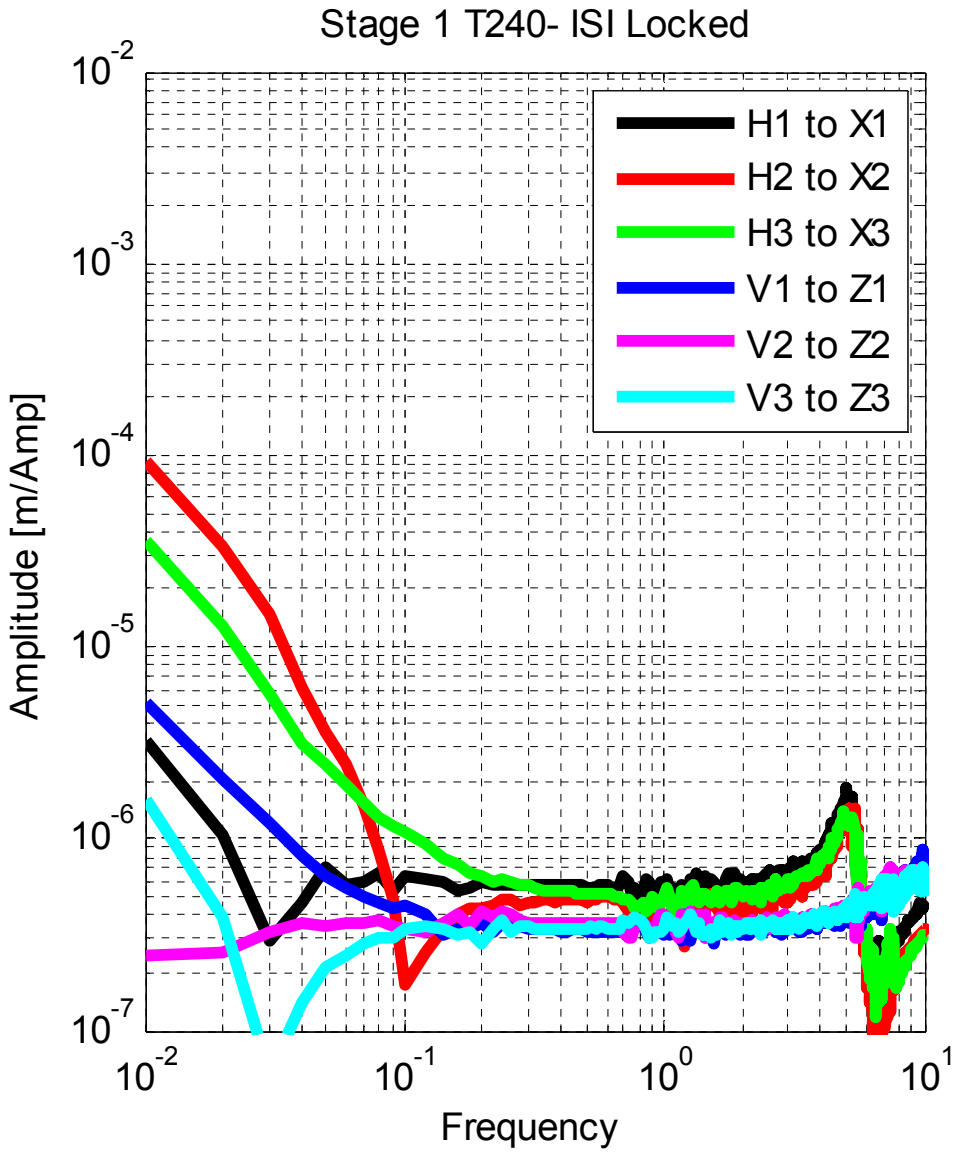




This plot shows the same measurements as on the previous page, but calibrated. The sensor response is in meters. As we are (presumably) chasing a magnetic coupling, the drive is calibrated in current units.

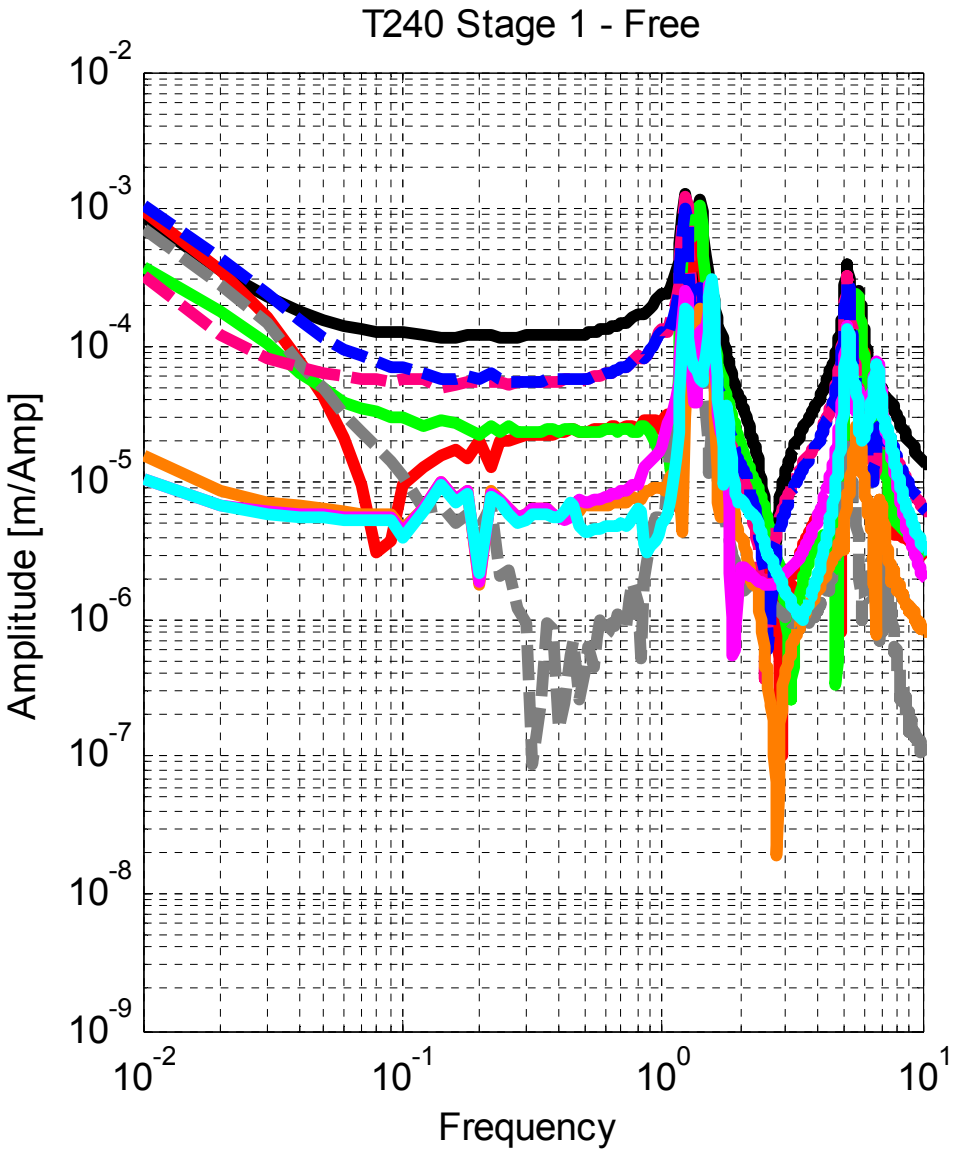
All comments on the previous page still hold.

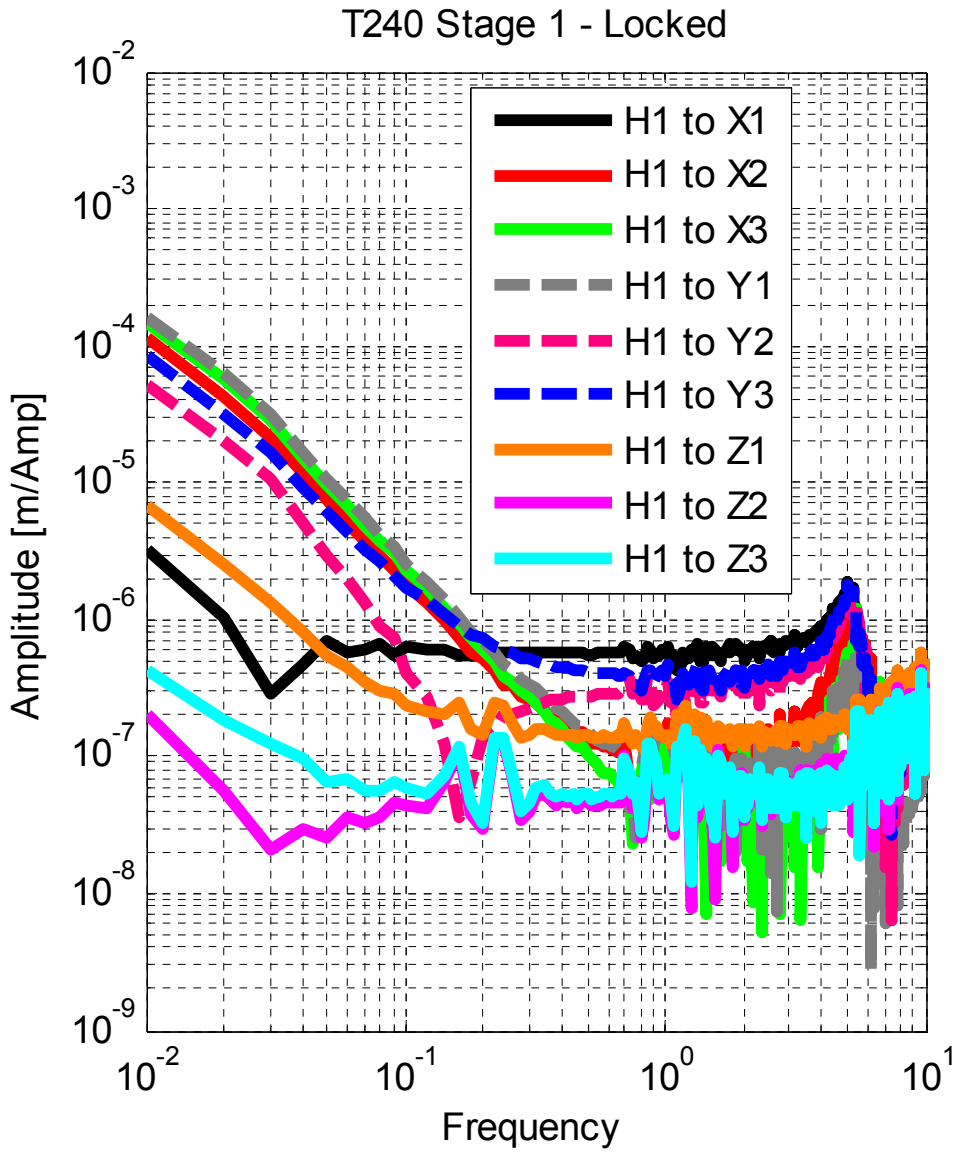




This plot shows the response of the T240's. The curves on the left (ISI unlocked), shows corner frequencies around 50 mHz for the horizontal sensors. It could be due to either tilt or magnetic coupling. The vertical sensors seem to show a corner frequency around 20 mHz. It is most likely an artefact (first point in the transfer function often not reliable), or a magnetic coupling.

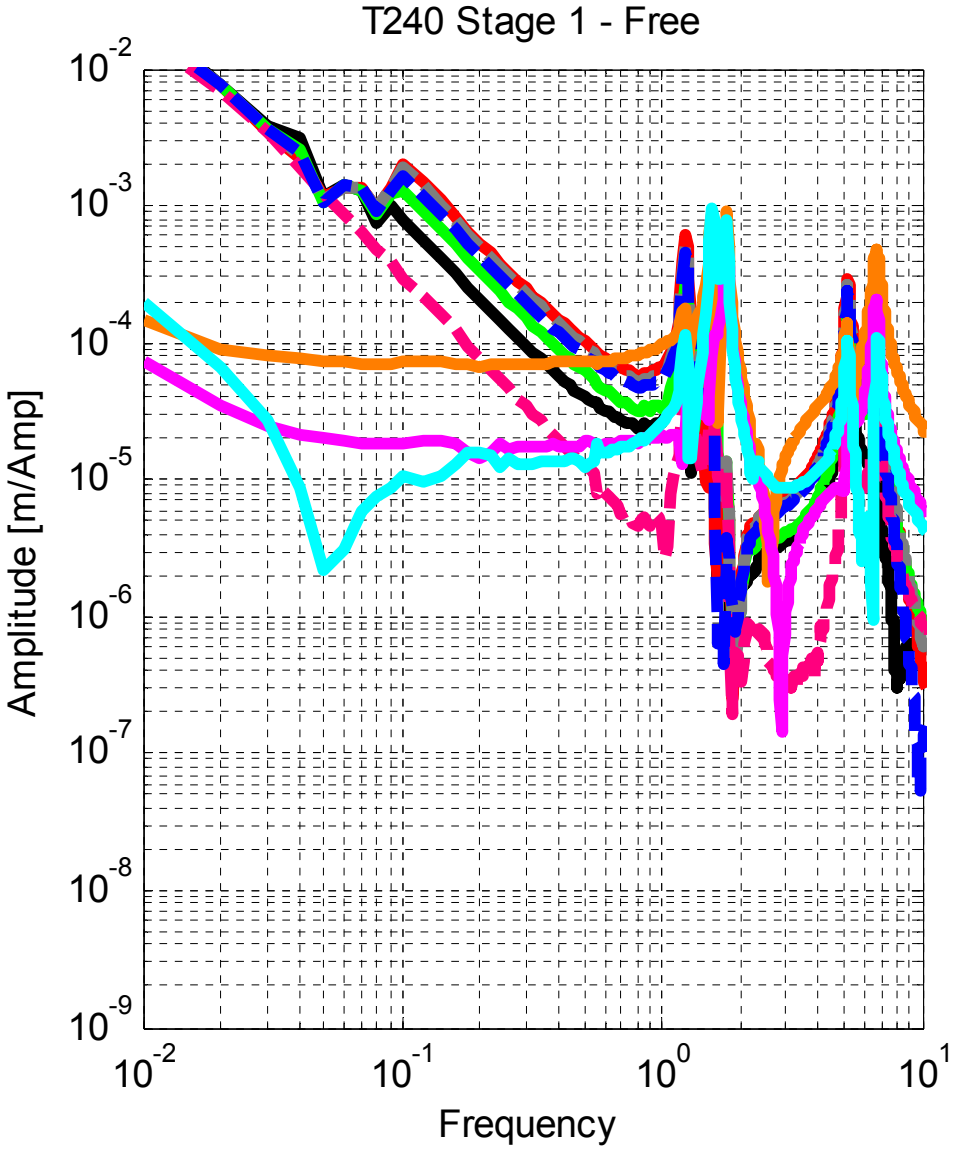
The curves on the right (ISI locked), shows a static response (above 0.1 Hz) around 1 um, which is consistent with the CPS motion. The low frequency couplings (below 0.1 Hz) are much lower now that the ISI is locked. The residual couplings are presumably due to magnetic couplings, but we can't exclude that they are due to tilt in the horizontal directions. We must compute local to Cartesian measurements to answer that question.

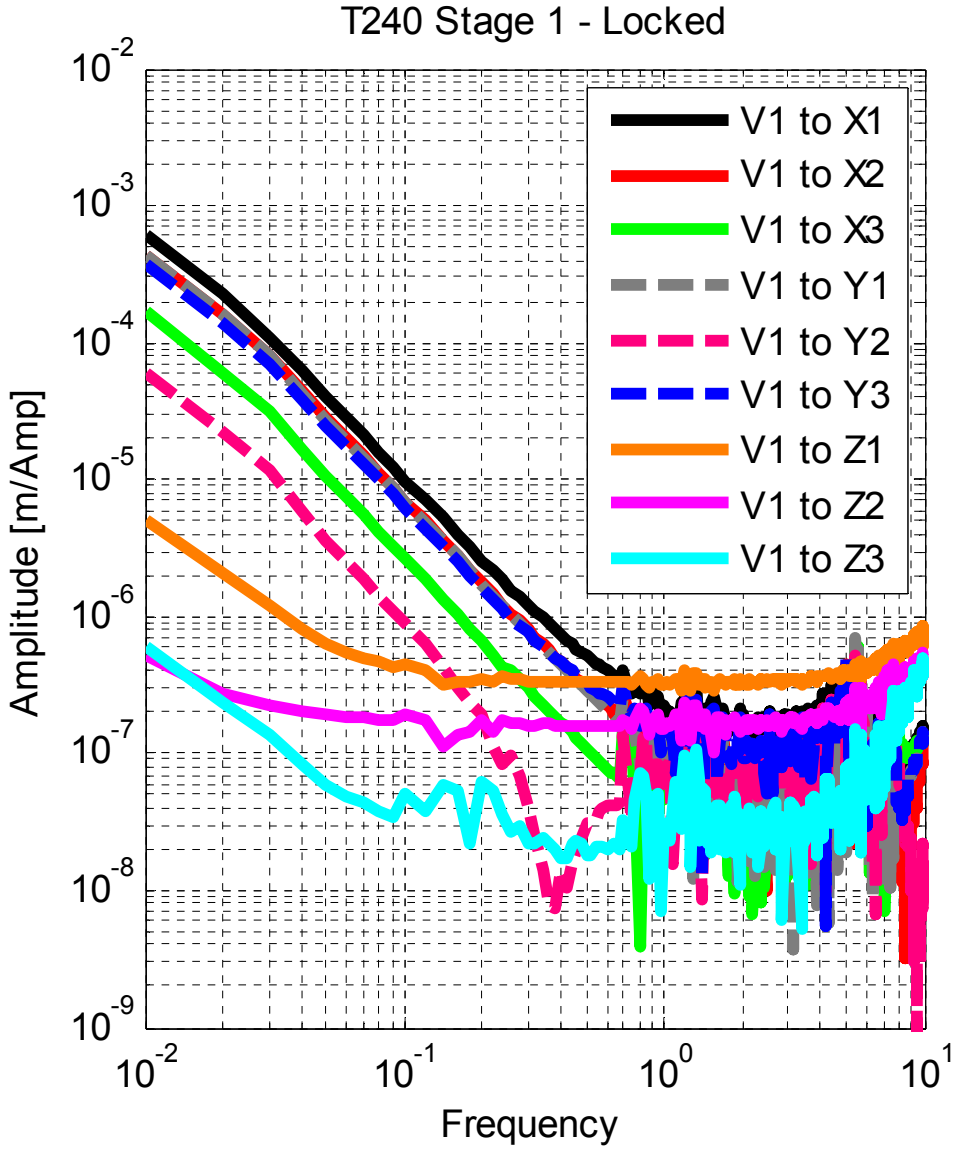




These plot also shows the response of the T240's, but focuses on the cross coupling: we drive H1 actuator and look at the response of all 9 T240's channels. X channels are tangential, Y channels are radial, Z channels are vertical.

As before all low frequency couplings are much lower when the ISI is locked. Only H1 to Z1 is more or less at the same order of magnitude of response in both configurations (Still a factor of 2 lower with the stages locked).





These plot also shows the response of the T240's cross coupling, but we now drive V1 actuator and look at the all 9 channels. The gap at 0.1 Hz in the left figure might be an indication of a non linearity (function of drive amplitude?)

In the left (ISI Free), the low frequency coupling in vertical sensors is puzzling: in theory it can't be due to tilt, so it has to be magnetic coupling. So one would expect that the coupling stays the same when we lock the stage. Unfortunately, that's not what we see on the right: the vertical low frequency coupling is much lower when the unit is locked. We can't therefore draw firm conclusions yet. Next steps is process this data in the Cartesian basis, and make similar measurements in the staging building with vertical actuators brackets disconnected.