



Quad NP Update

LV Meeting – 22 September 2009

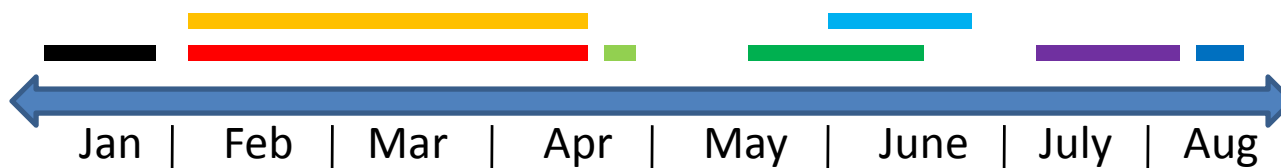
Brett Shapiro

G0900876-v1



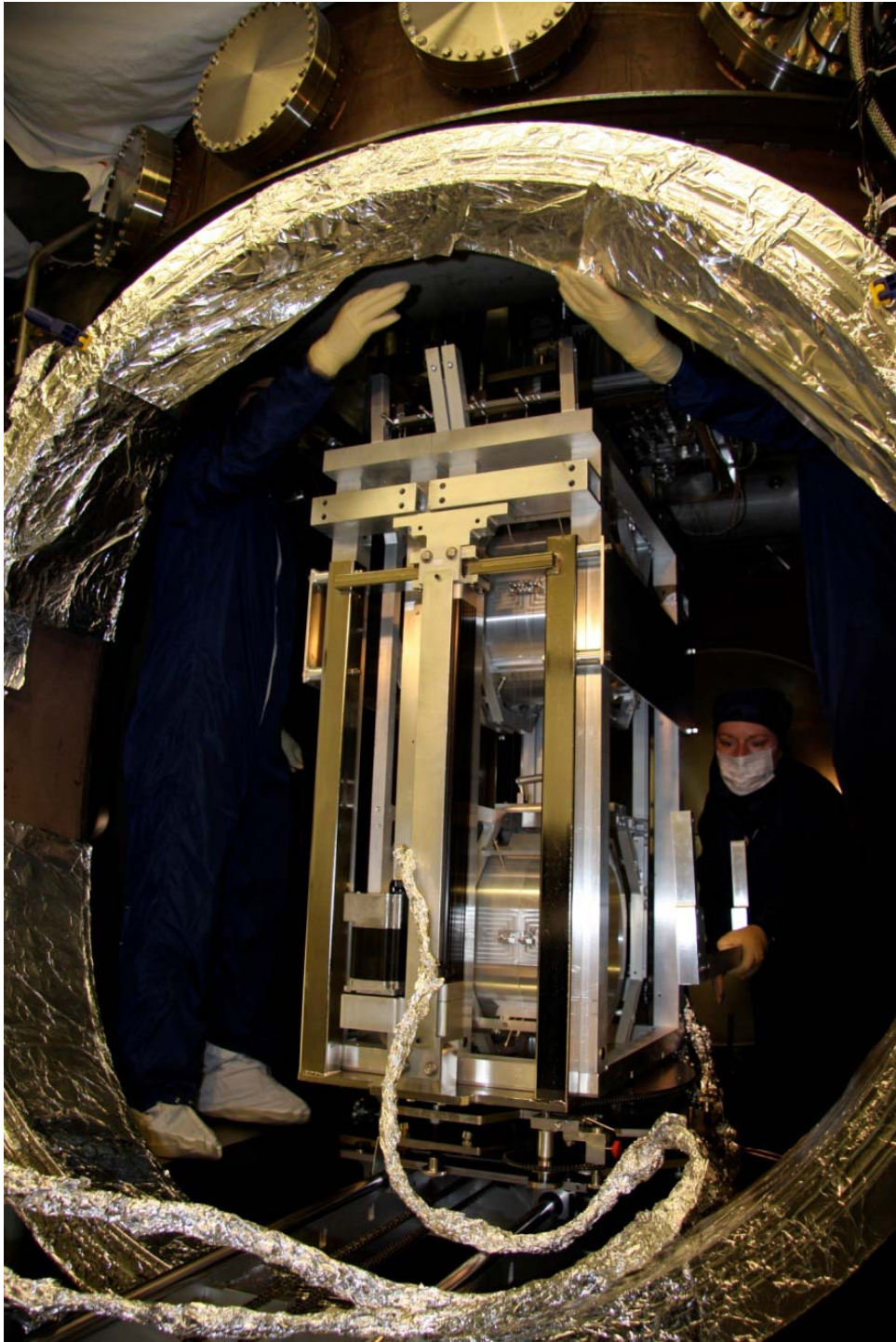
Timeline of Last Year's Progress

- Glass on metal wire hang: Jan
- ESD reworking: Feb-April
- Quad Triple Cavity Setup: Feb-April
- Eddy Current Damping: end of April
- Acoustic Mode Characterization: May-June
- Charging measurements: August
- Ring heater testing: end of August
- Monolithic tests: July-Aug



Wire Hang – Jan 2009





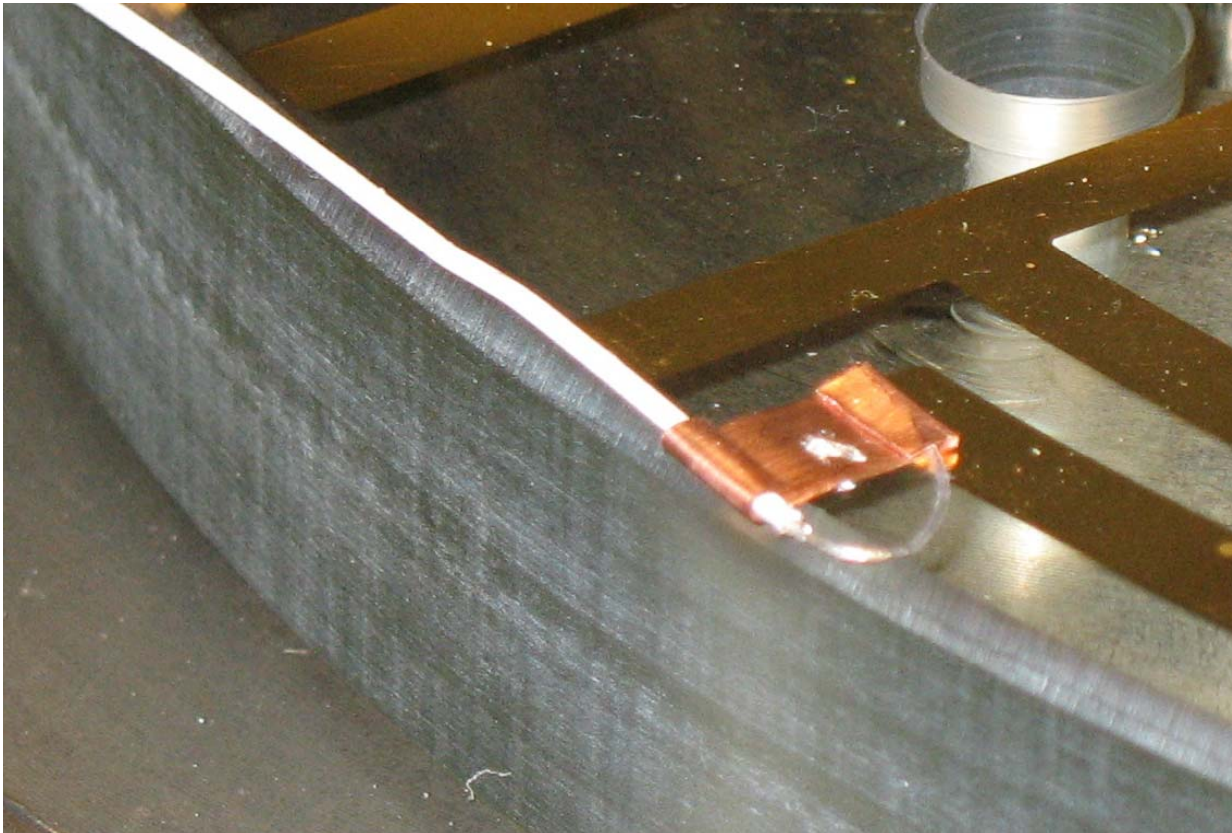


ESD Work



- Old soldering procedure – new tab style
- Suboptimal solder
- Delicate cabling – poor clamping

ESD Work

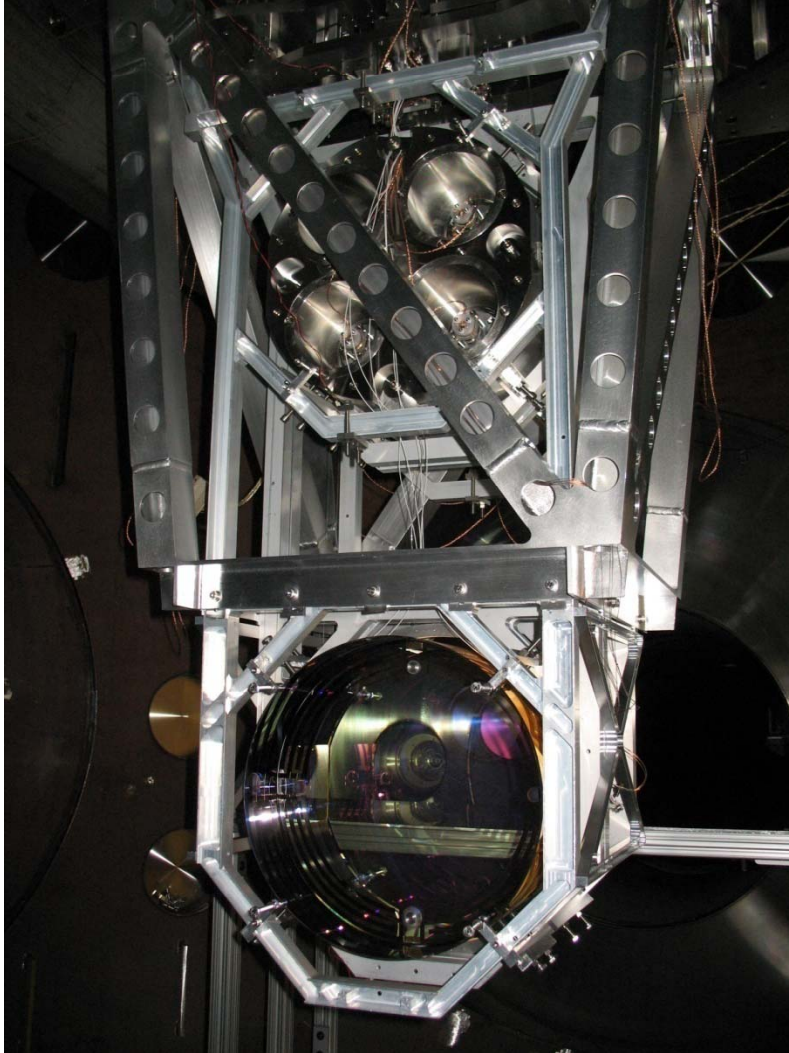


Dirty test ESD pattern from the controls prototype

- Refined soldering procedure
 - Better Geometry
 - Fancier tools
 - Optimal solder
 - More heat
 - Practice!
- Padded clamps
- ESD pattern may yet change
- ESD cables may yet change

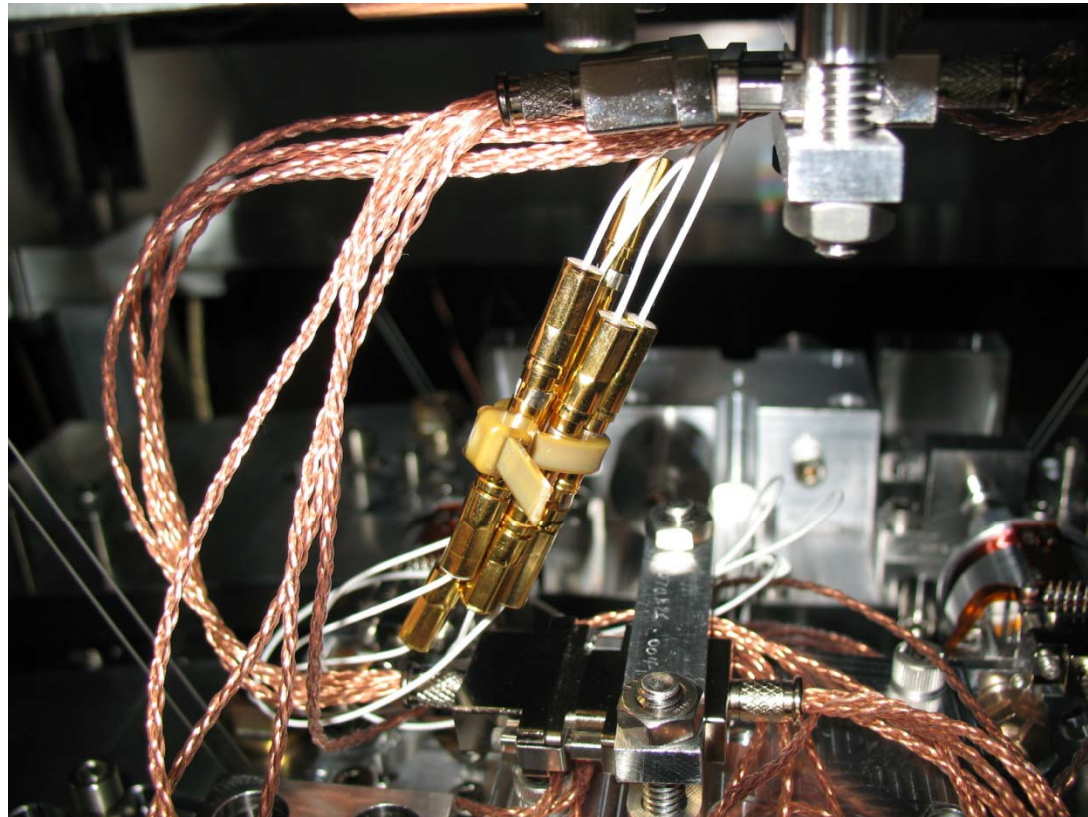
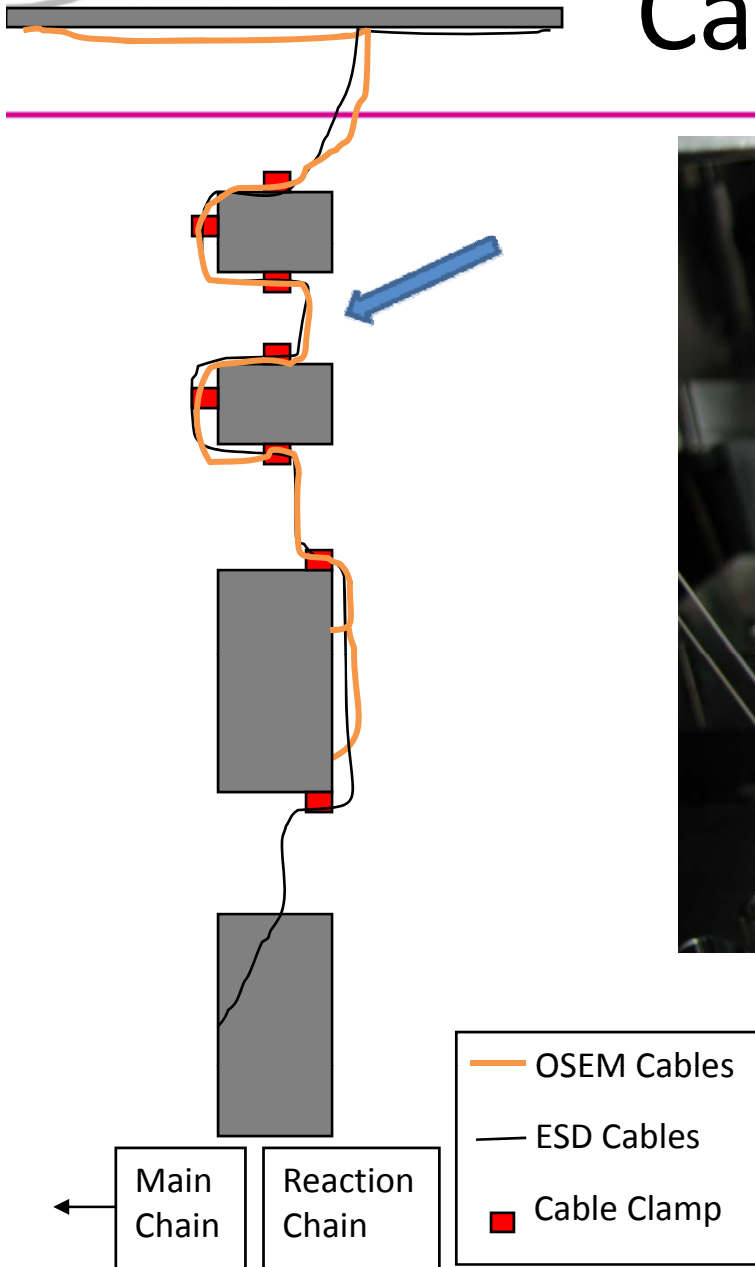


OSEM and ESD Cabling/Clamping Considerations



- Number of clamps at PUM
- Clamps on ISI
- Padding in clamps
- Specialized clamps between top and UI masses

Cable Routing

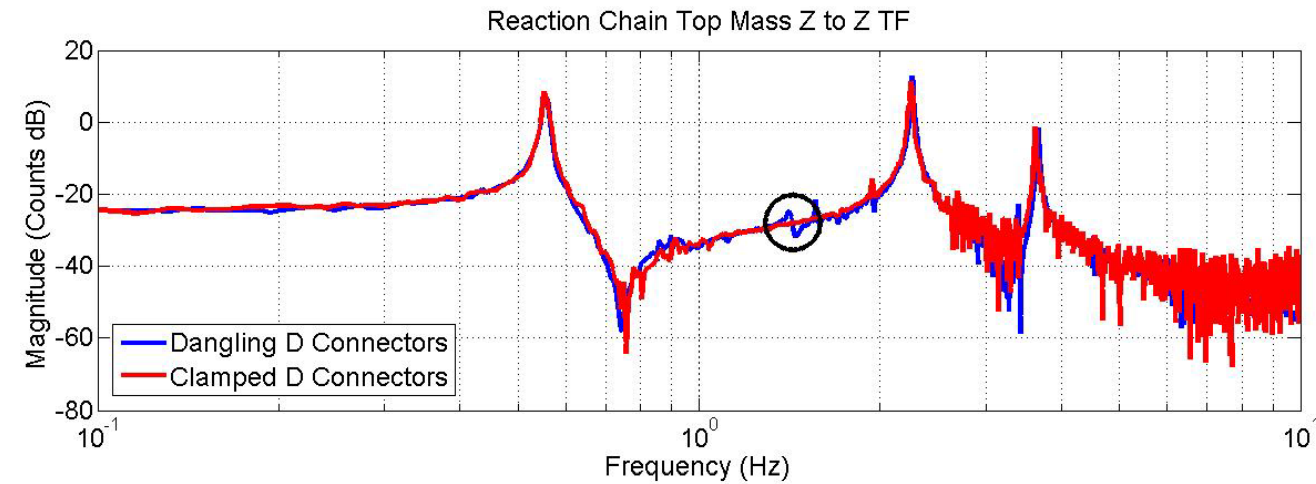


'Large' connectors between top and UI masses.

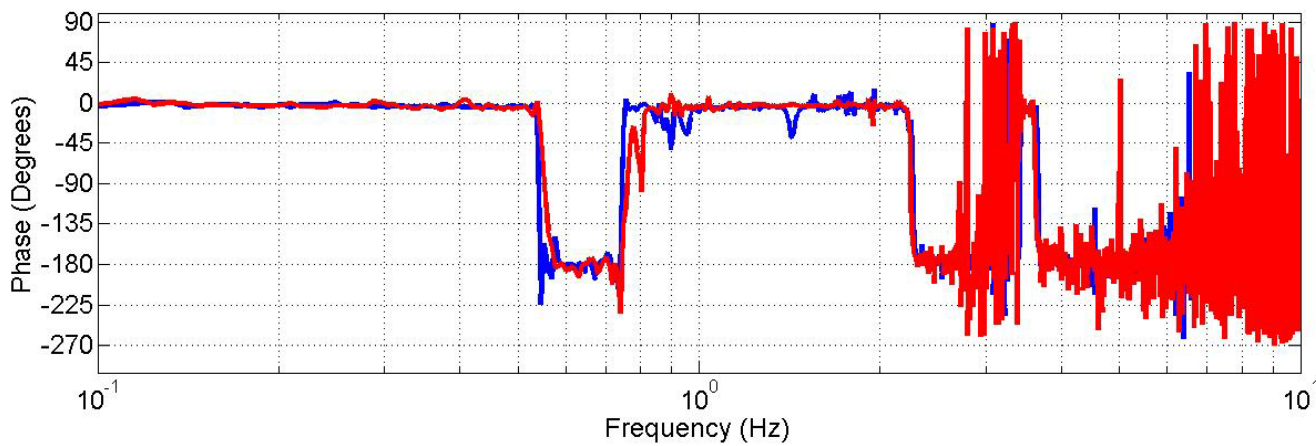
Cable stiffness related to $\frac{Modulus}{f(Length)} \approx \frac{Modulus}{(Length)^3}$



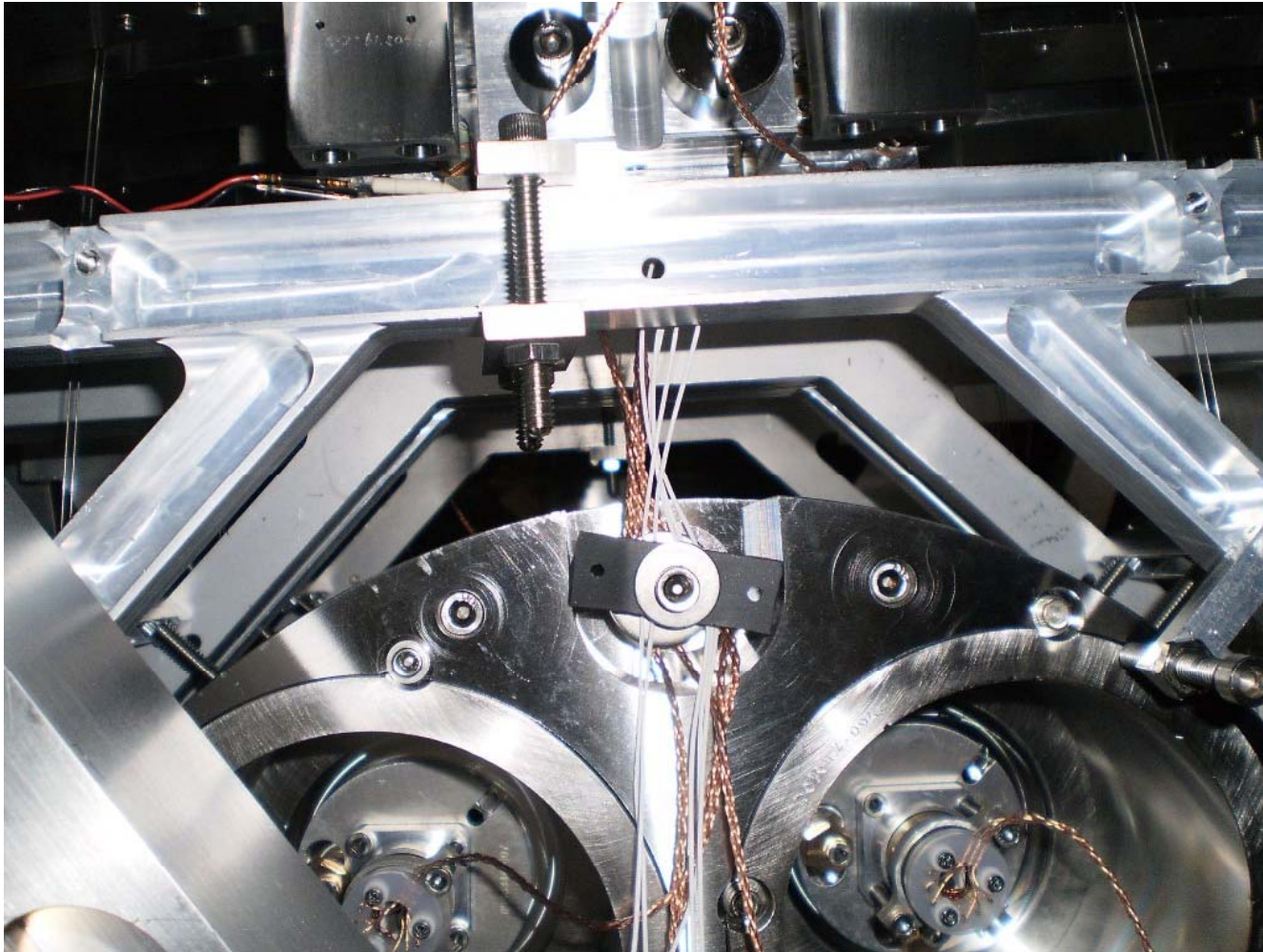
Mechanical Effect on TFs



The large connectors impact *pitch* and *z* modes.

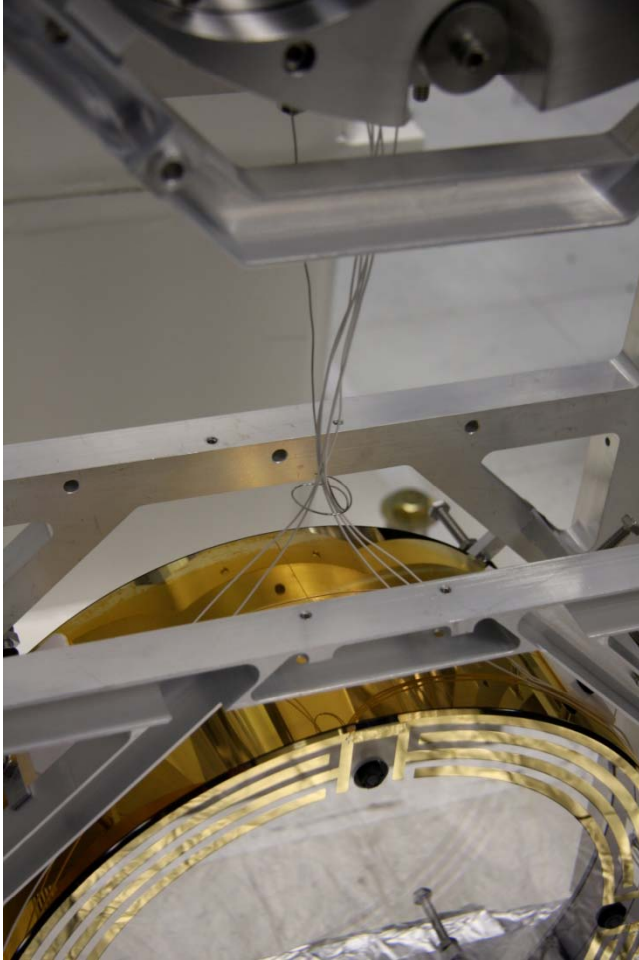


Poor Clamping

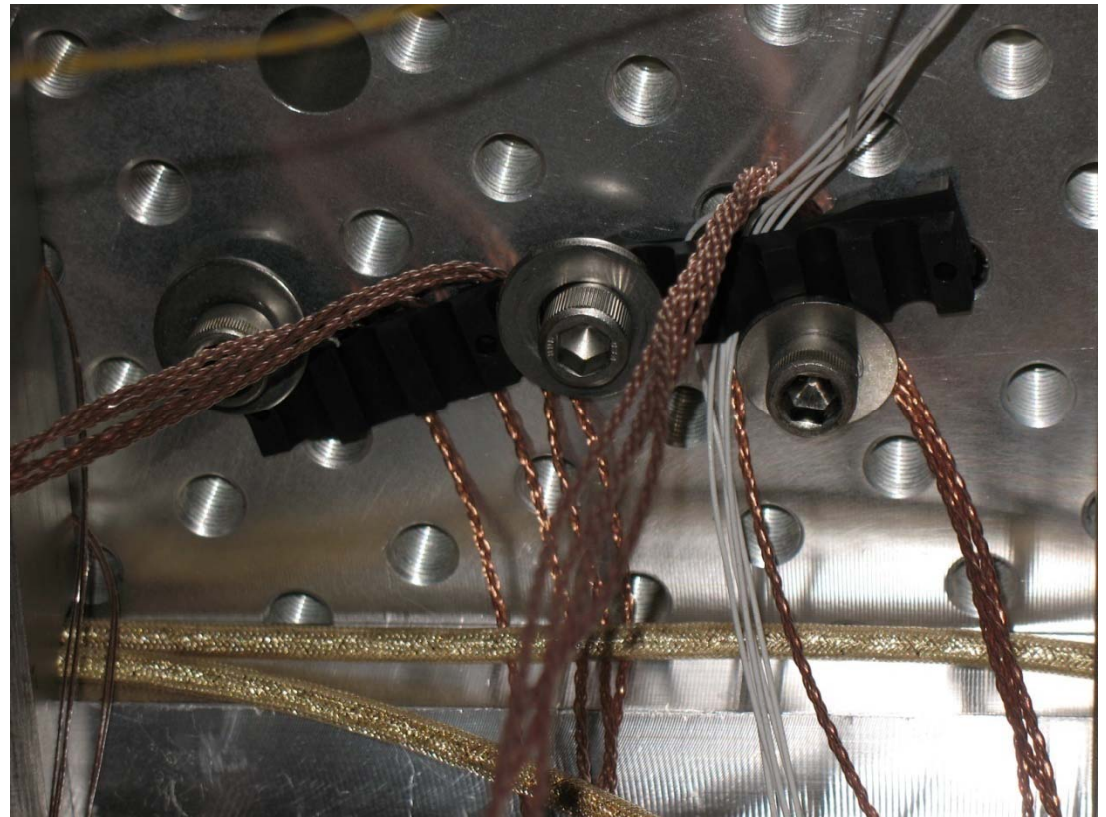


Improved 'clamp' at top of PUM

Additional Cabling Routing Issues



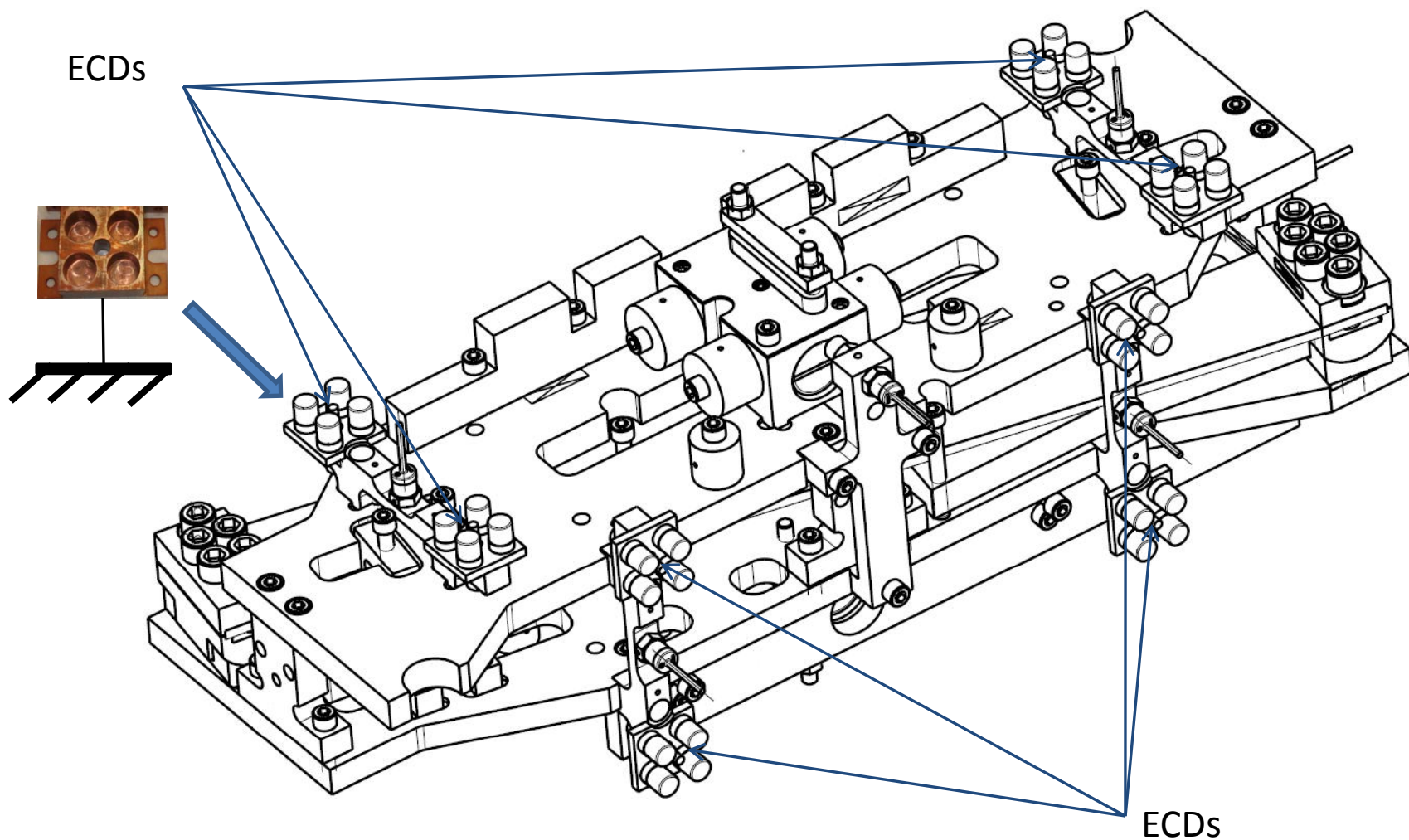
Improvised wire guide to ESD



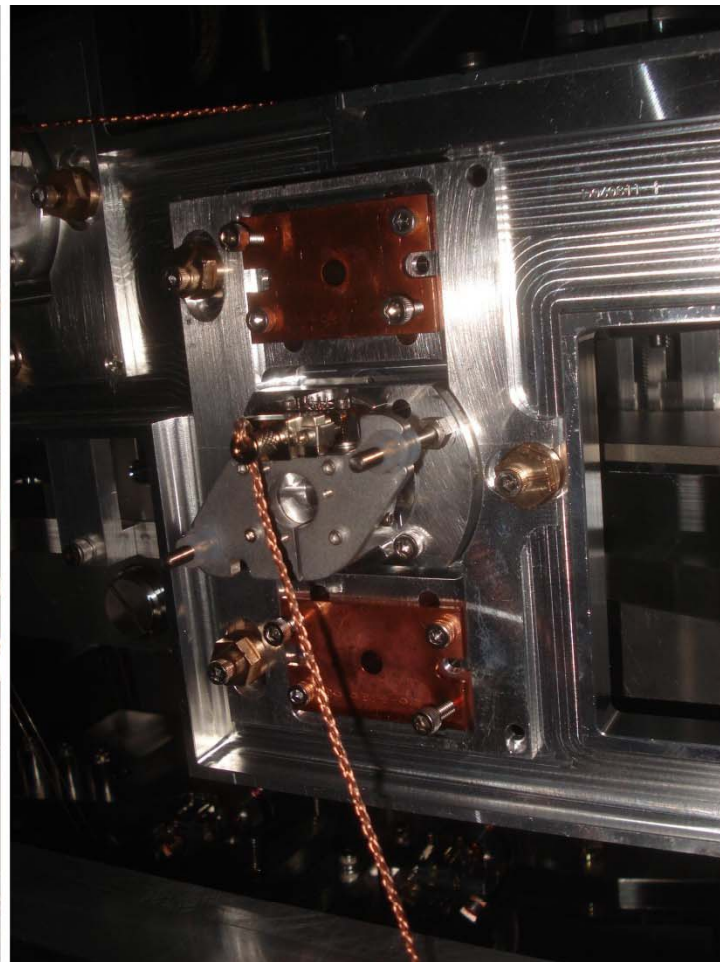
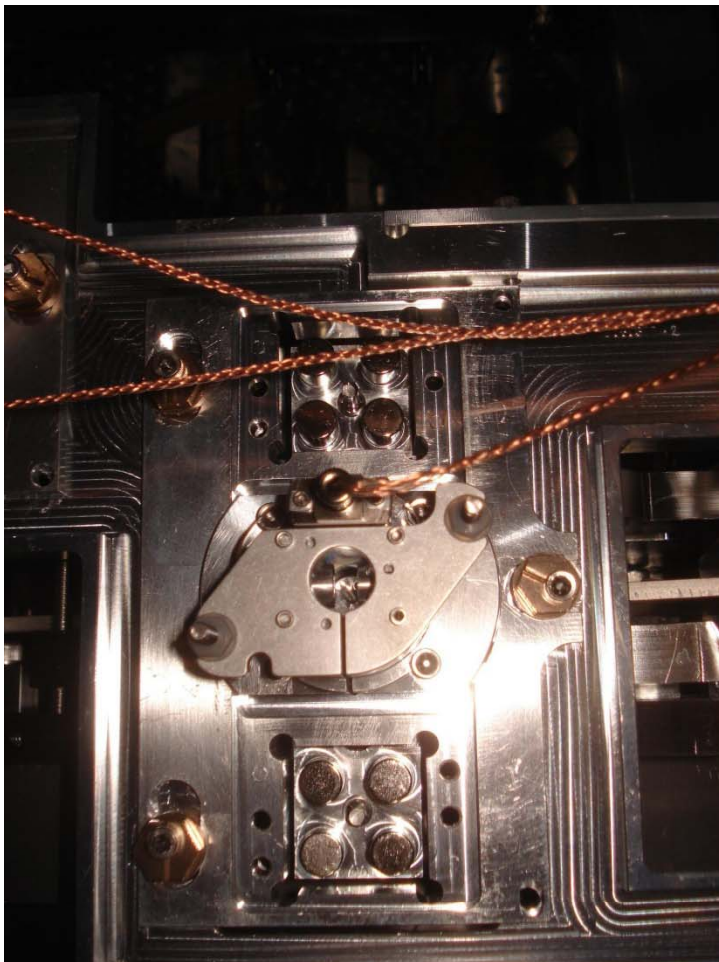
Improvised clamp at ISI optics table

Measurements

Eddy Current Damping (ECD)

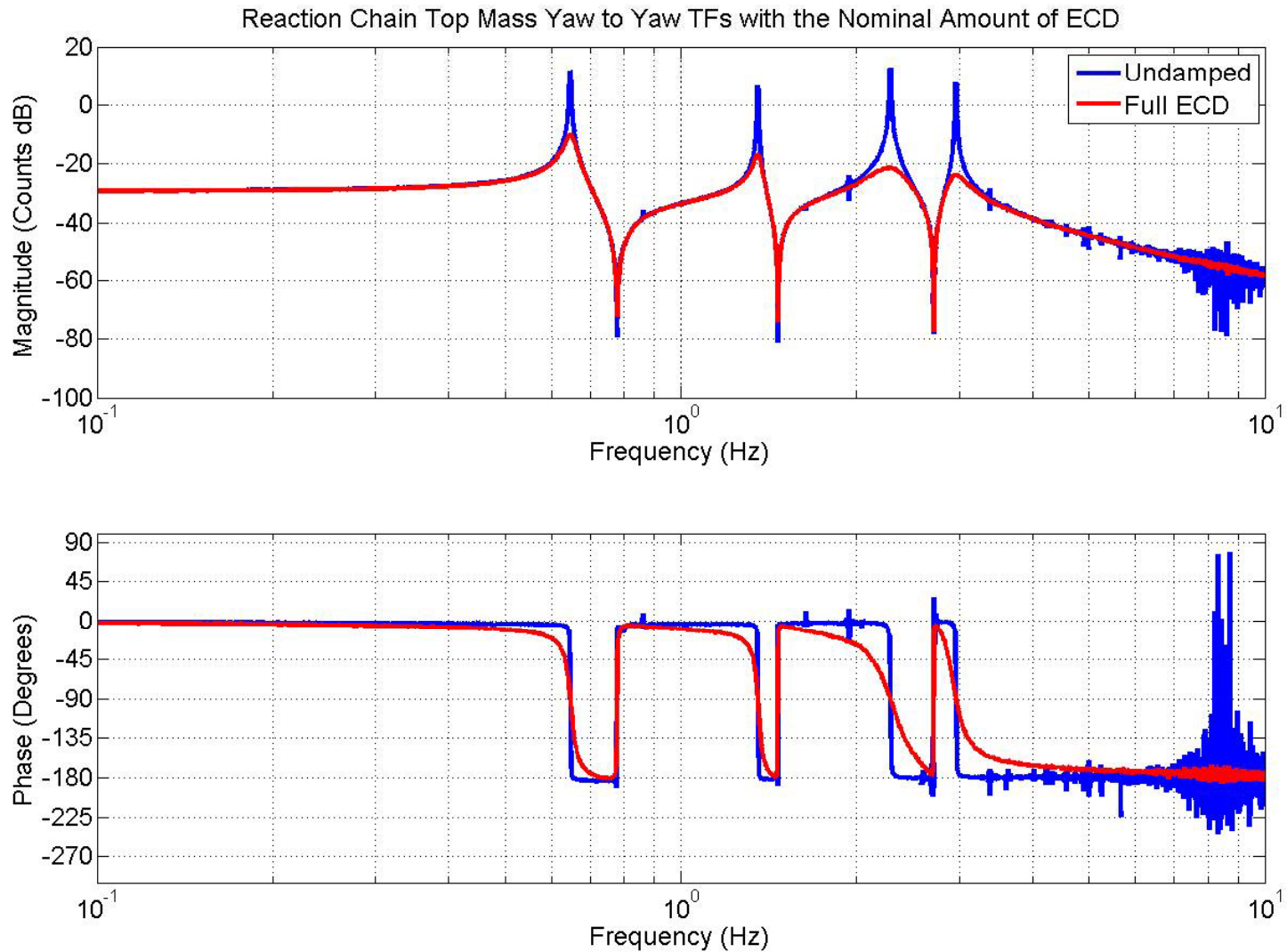


Eddy Current Damping

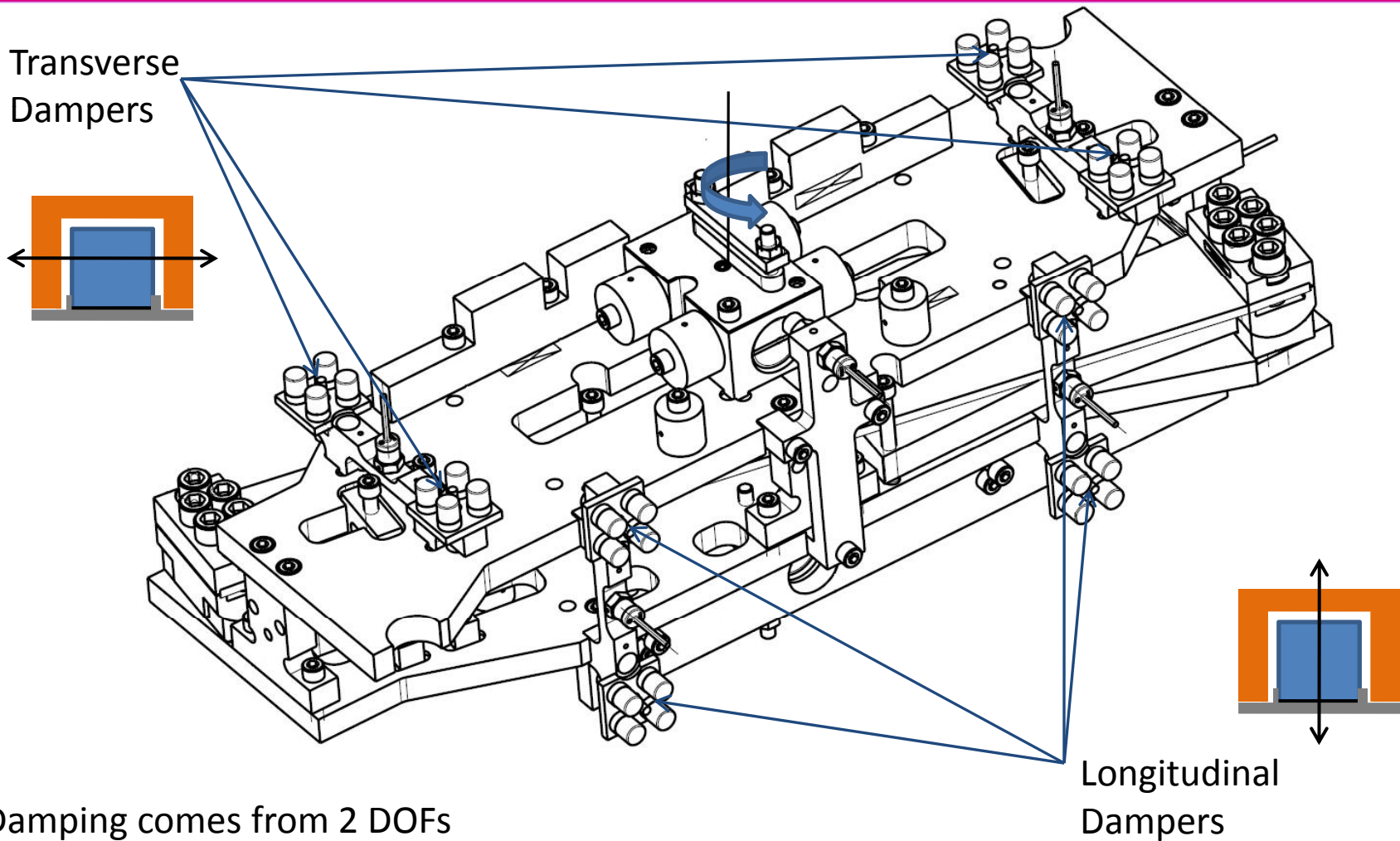




ECD $\approx 2x$ greater than modeled



Yaw Eddy Current Damping

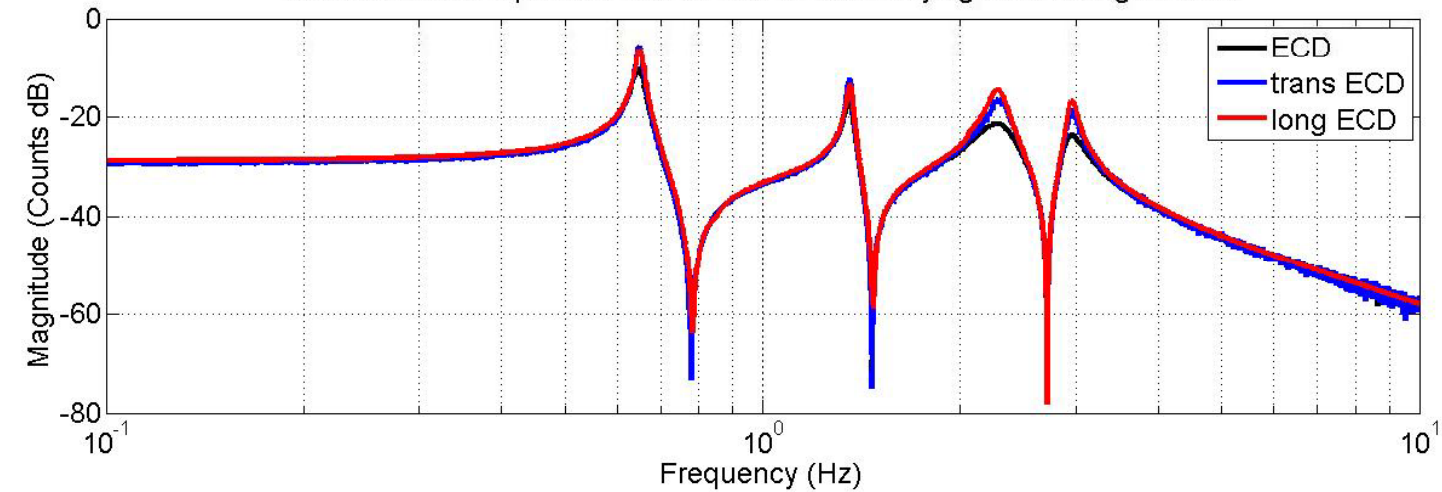


Damping comes from 2 DOFs of magnet motion.

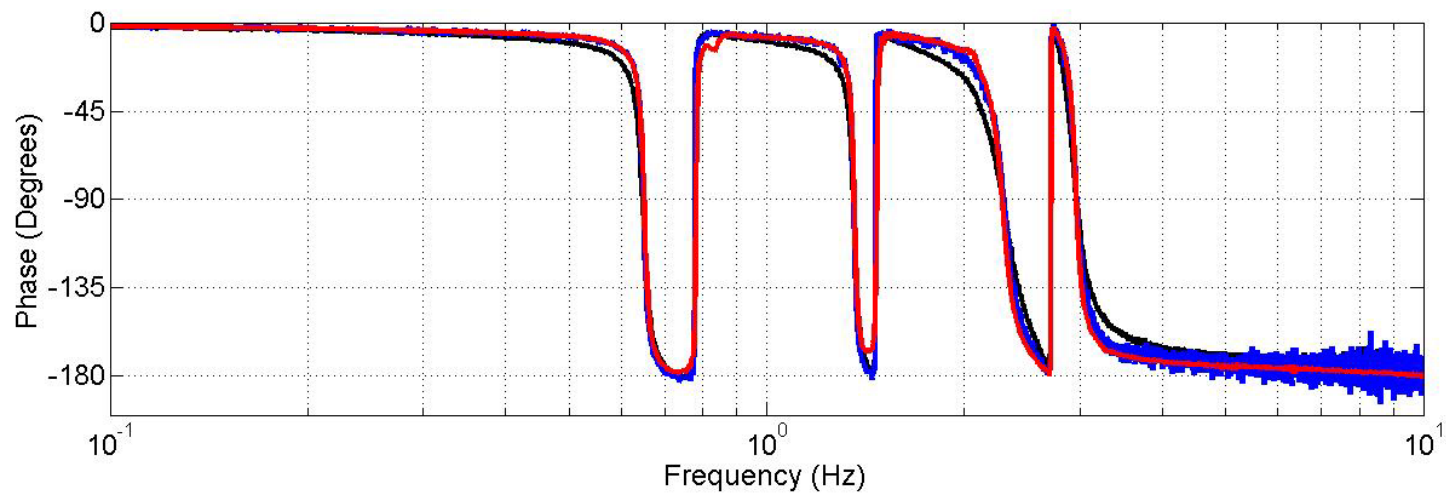


ECD Nominal Results

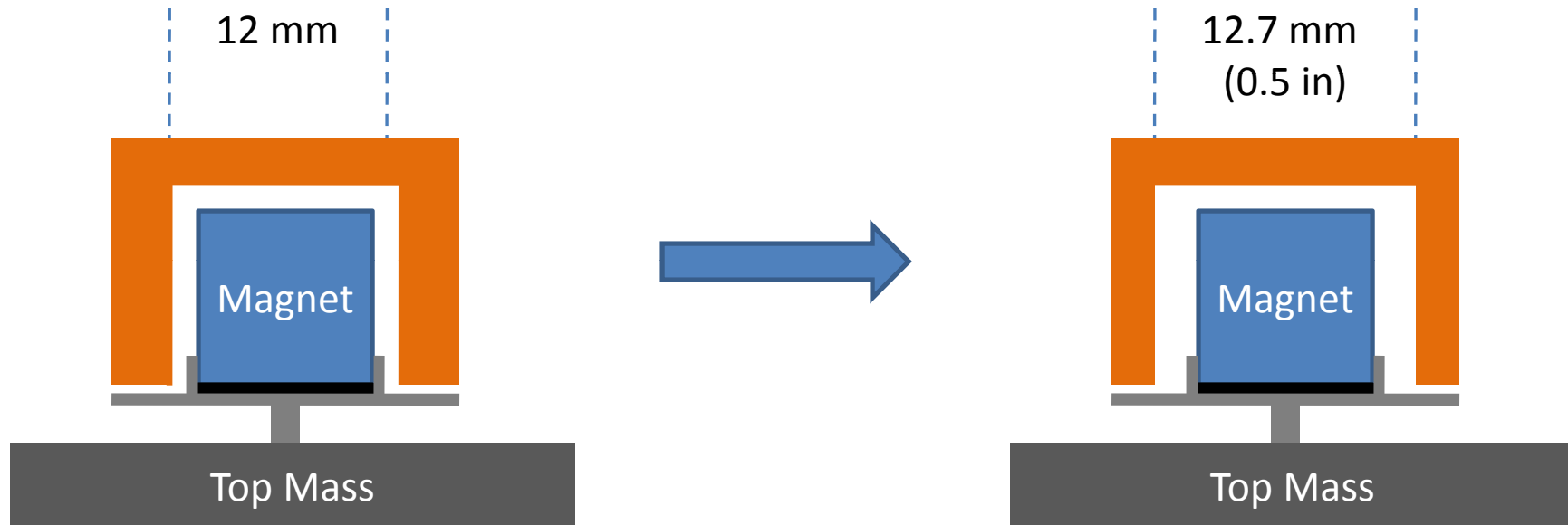
Reaction chain top mass Yaw to Yaw TF with varying ECD configurations



Longitudinal and transverse damping are roughly equal



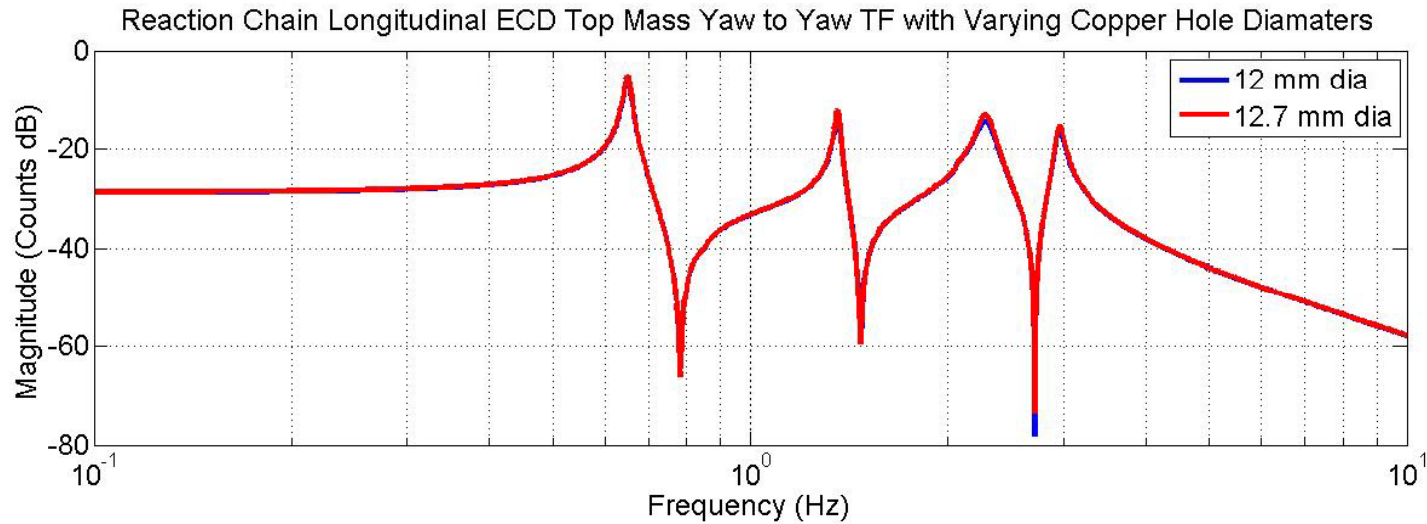
Opening the Magnet Bore from 12 to 12.7 mm



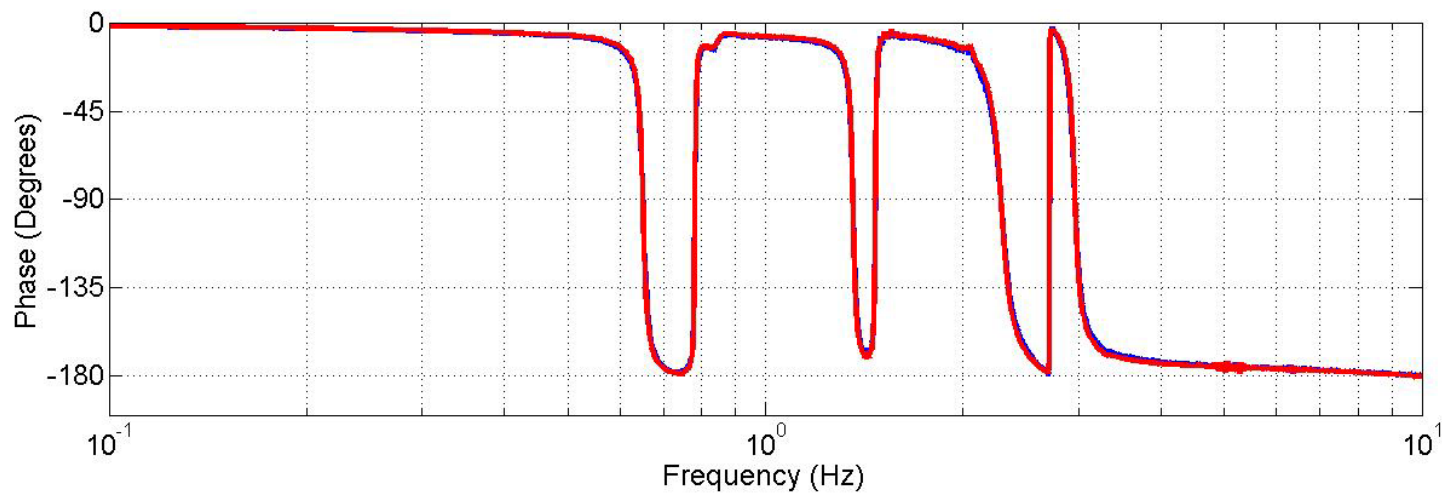
The copper magnet bores were drilled out to simultaneously increase clearance and reduce damping.



12.7 mm Bore Long. Damping

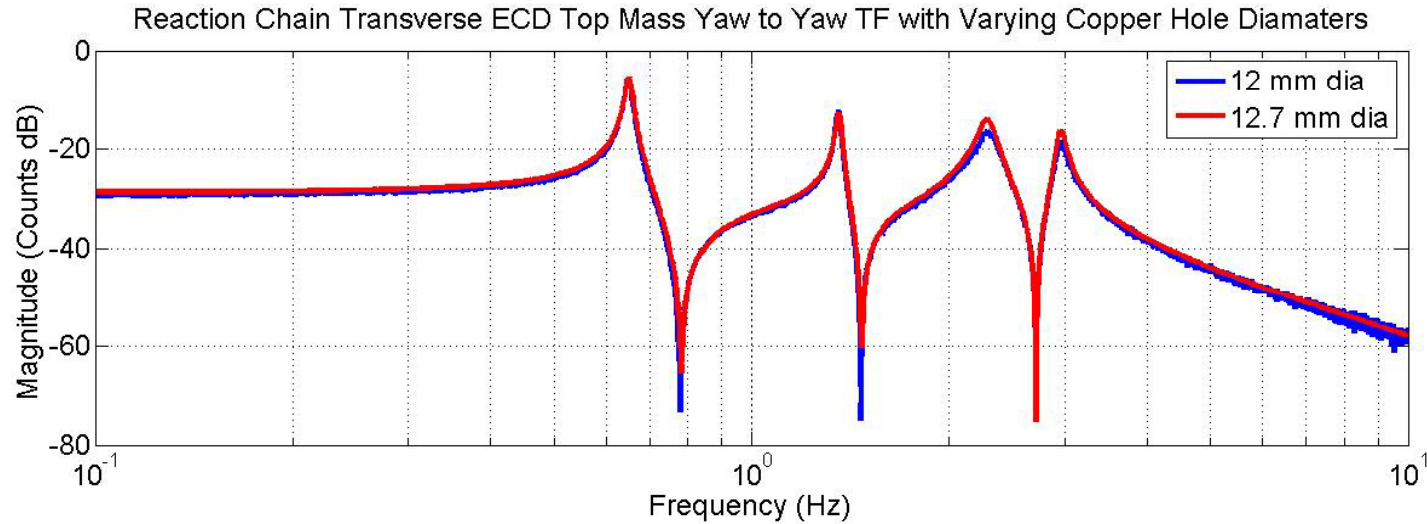


Larger holes have negligible impact on damping.

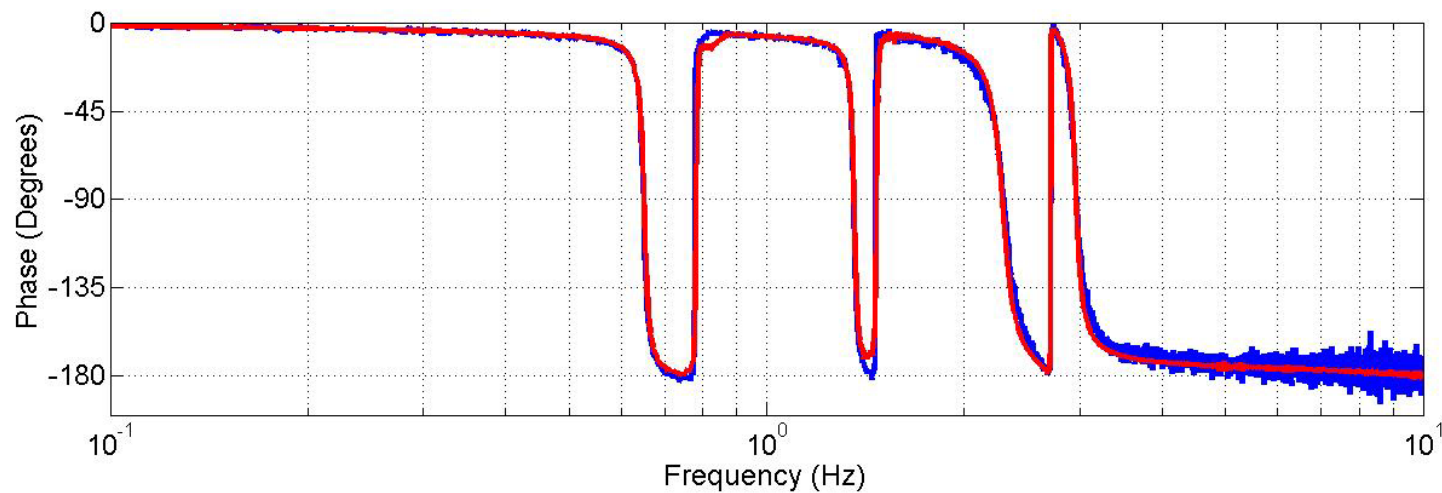




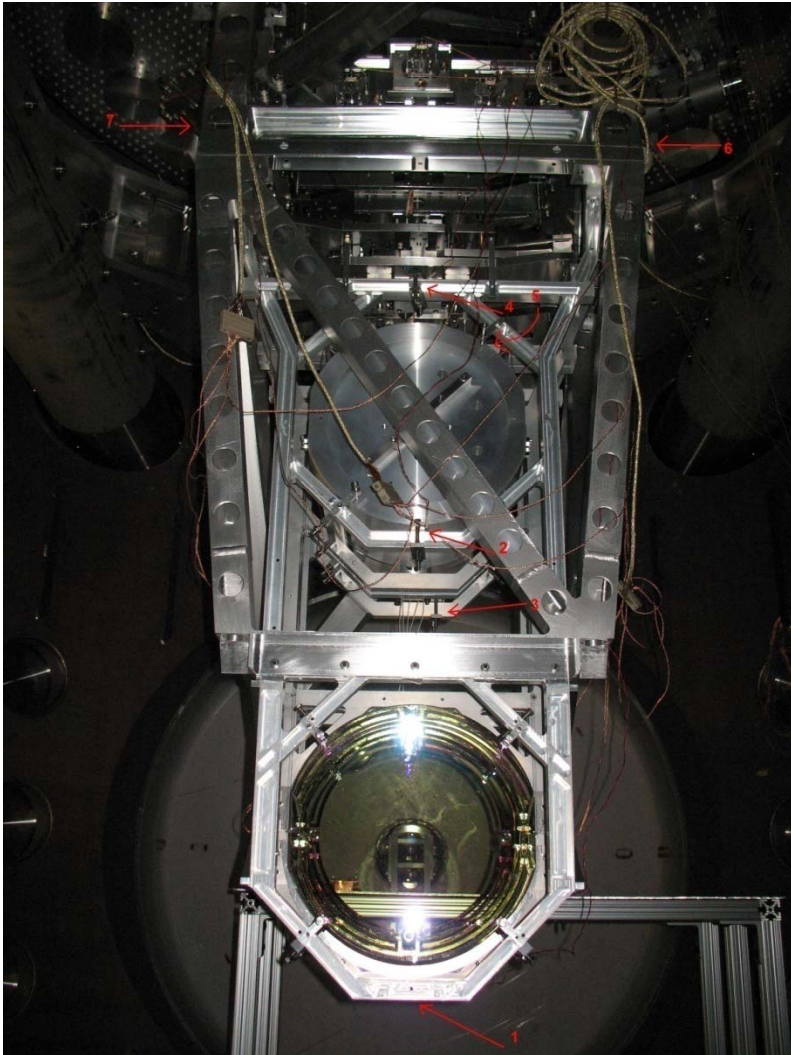
12.7 mm Transverse Damping



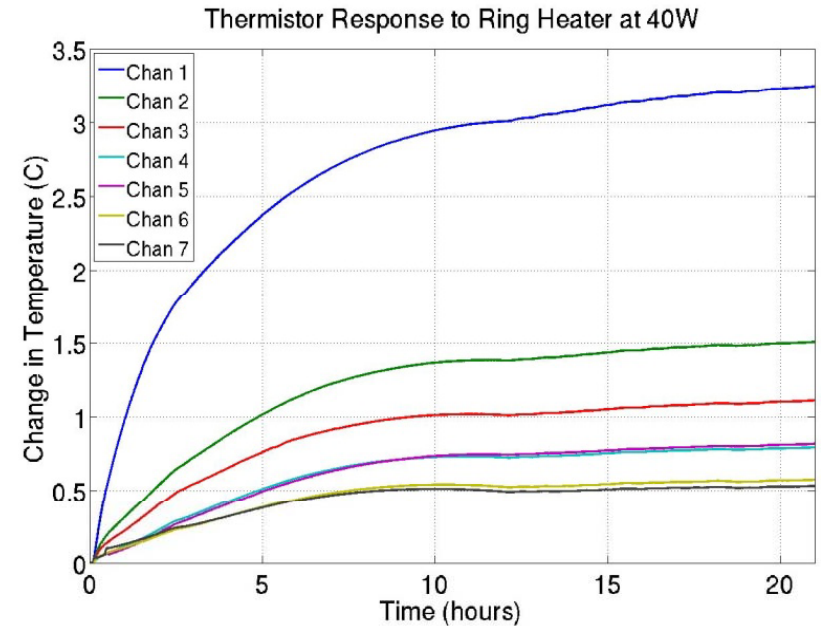
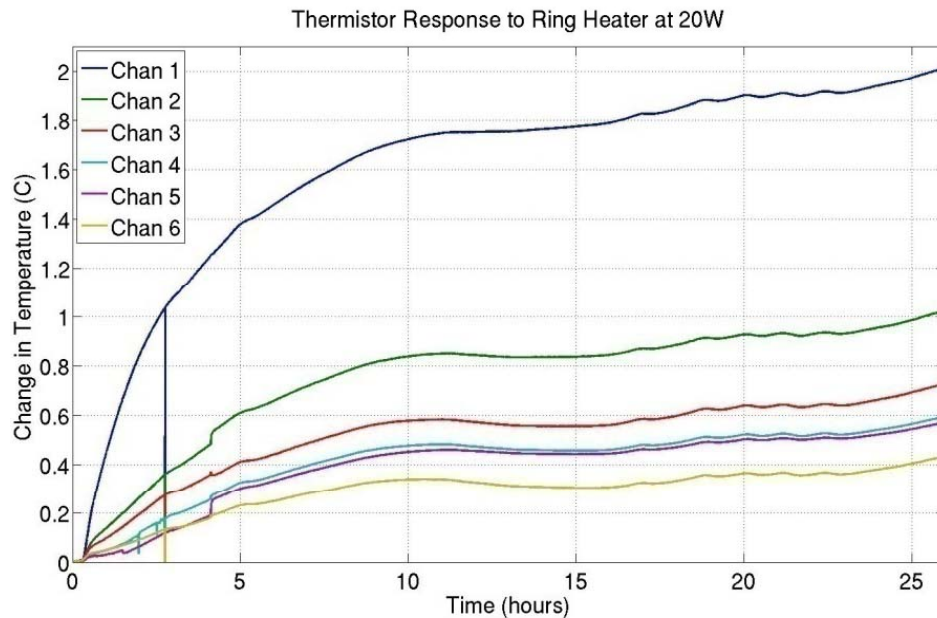
Larger holes have negligible impact on damping.



Ring Heater Testing



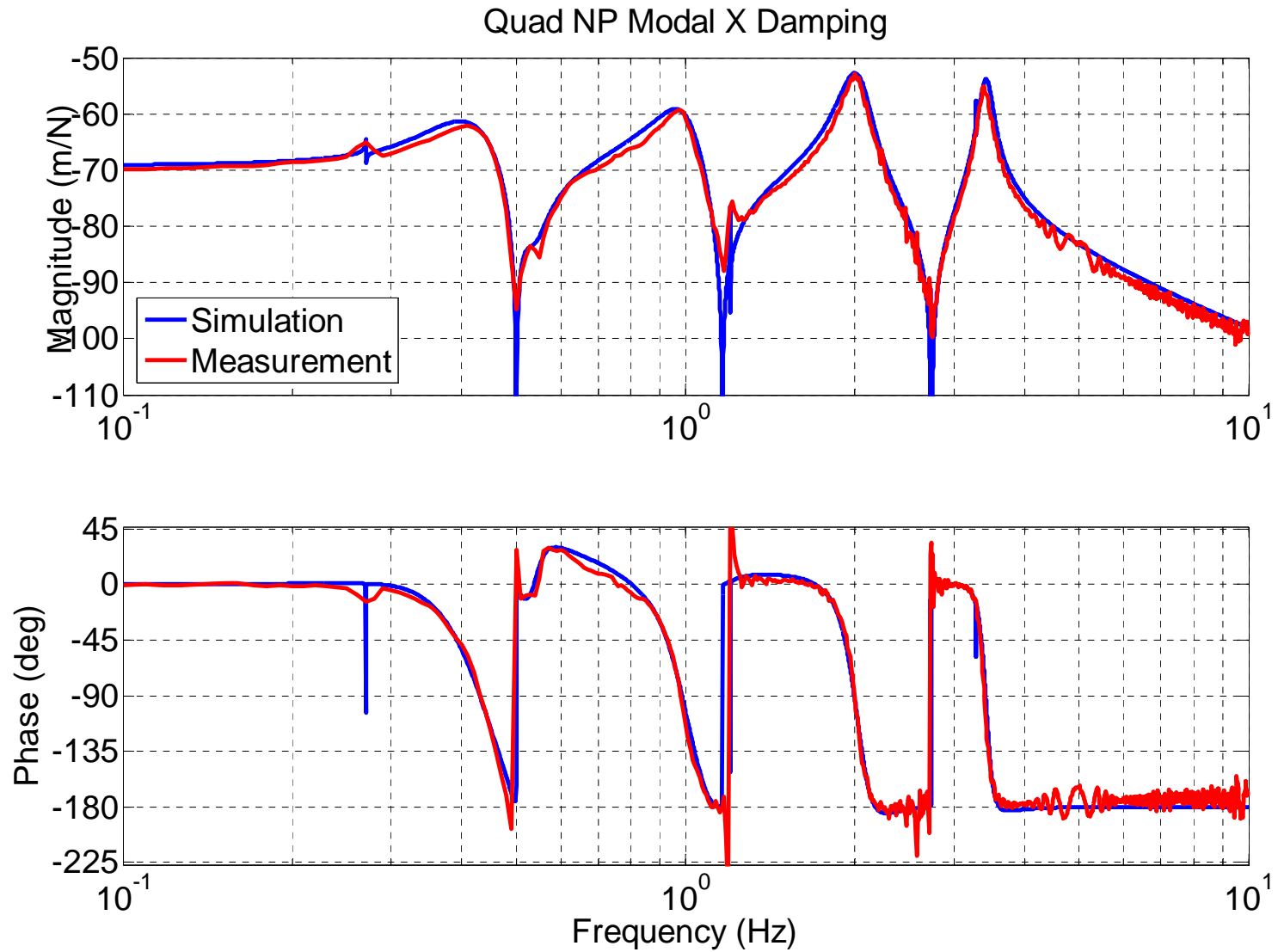
Ring Heater Testing



- The bottom of the quad structure warms by about 0.8 C/10W
- No gross effects on quad or ISI
- Vacuum pressure increase on order of 10 ntorr. No RGA available.
- Will try again with the full monolithic suspension.
- Should find an upper power limit considering the suspension becomes transparent at high power. Ryan Lawrence's thesis to provide insight.



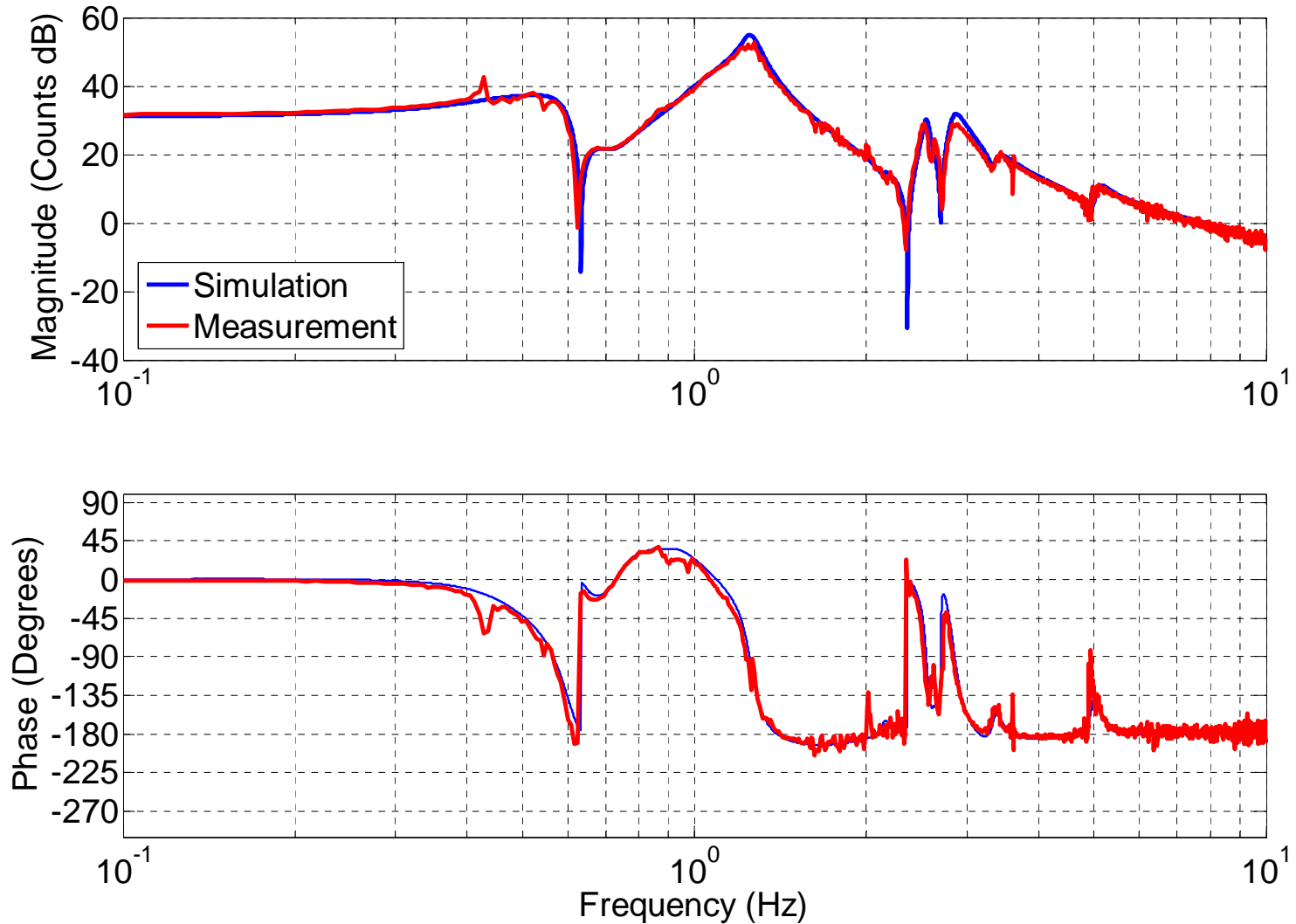
Modal Damping Results





Modal Damping Results

Main Chain Pitch to Pitch TF with Modal Damping





Upcoming Work

- Monolithic installation
- Global control tests
 - Hierarchical
 - New methods
 - HAM ISI integration
- Local Damping
 - Noise measurements with modal damping
- TCS



Documentation Produced this Year

- Summary of ECD Results on the Quad Noise Prototype - T090245-00
- 2. Quad Noise Prototype Cabling Routing - T0900380-v1
- 3. Quad Noise Prototype Results Summary - T0900426
- 4. Rehang of the Quad NP with glass masses but metal wires - T0900055-v1
 - (Includes ESD procedure)