

# MIT Quadruple Pendulum

Rich Mittleman, MIT PAC, 27 June 02

## Objectives

### 1) Verify the Model

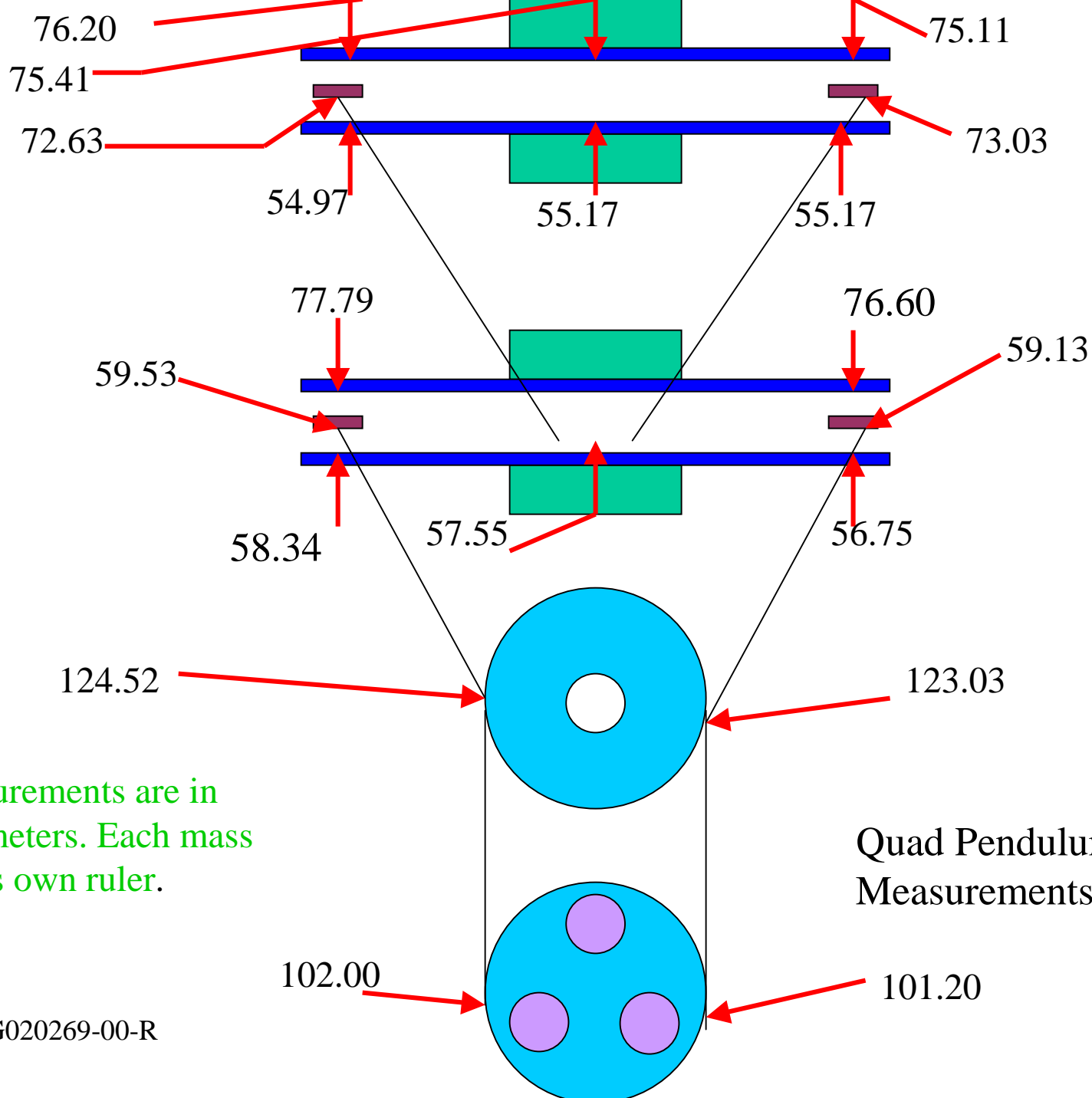
Compare Measured Mode Frequencies and Shapes

Compare Local Damping Predictions

### 2) Understand Construction Issues

Heavier Masses Create New Problems

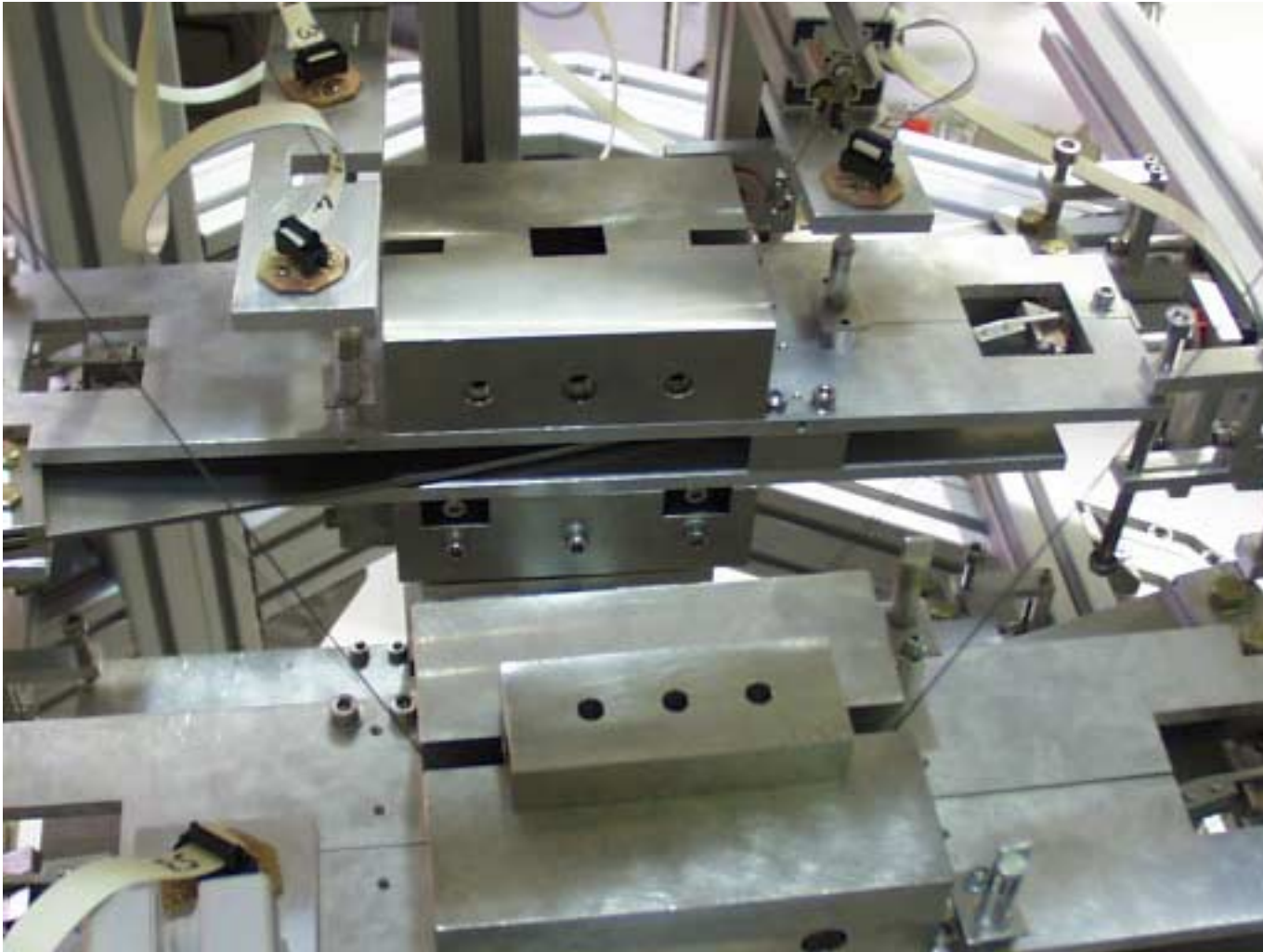
### 3) Investigate Control Ability



Masses 3 and 4  
On both chains  
Can be seen.

Mass #4 has  
stainless steel  
inserts to more  
closely mimic  
the test mass.

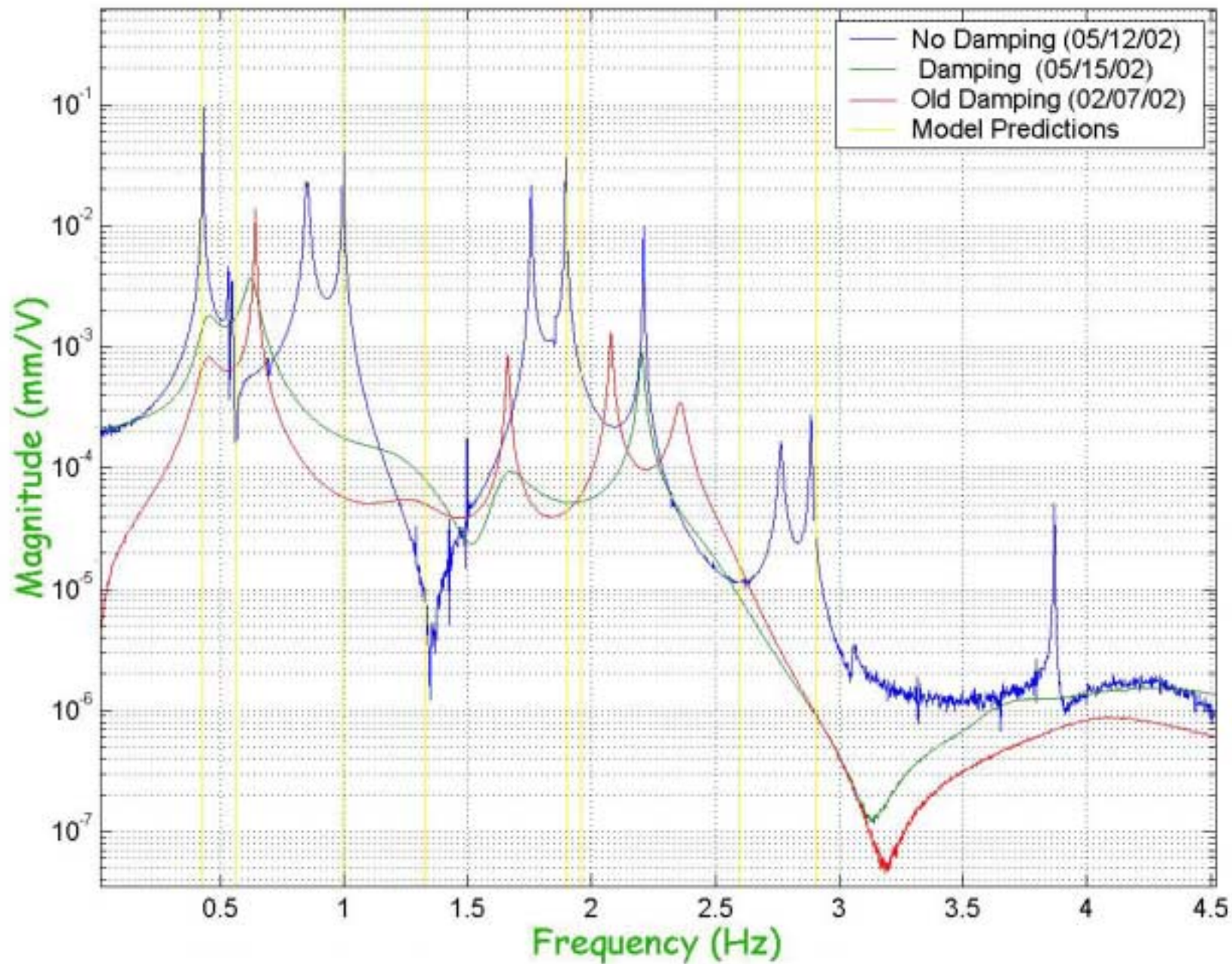




G020269-00R Top View of both chains. The actuators are partially installed. The ends of the Mass #1 blade springs can be seen.



# Mass 4 Pitch Transfer Functions



# Future plans for the Quadruple Pendulum

- 1) Work out the remaining discrepancies between the model and measurements
- 2) Investigate our control ability when actuating between the lower masses of the two chains.

This will lead into tests of electrostatic and/or photon actuators in LASTI in 2003-2004

*This work will have a lower priority than the pre-isolator work which is expected to take most of our time for the next 6 months.*

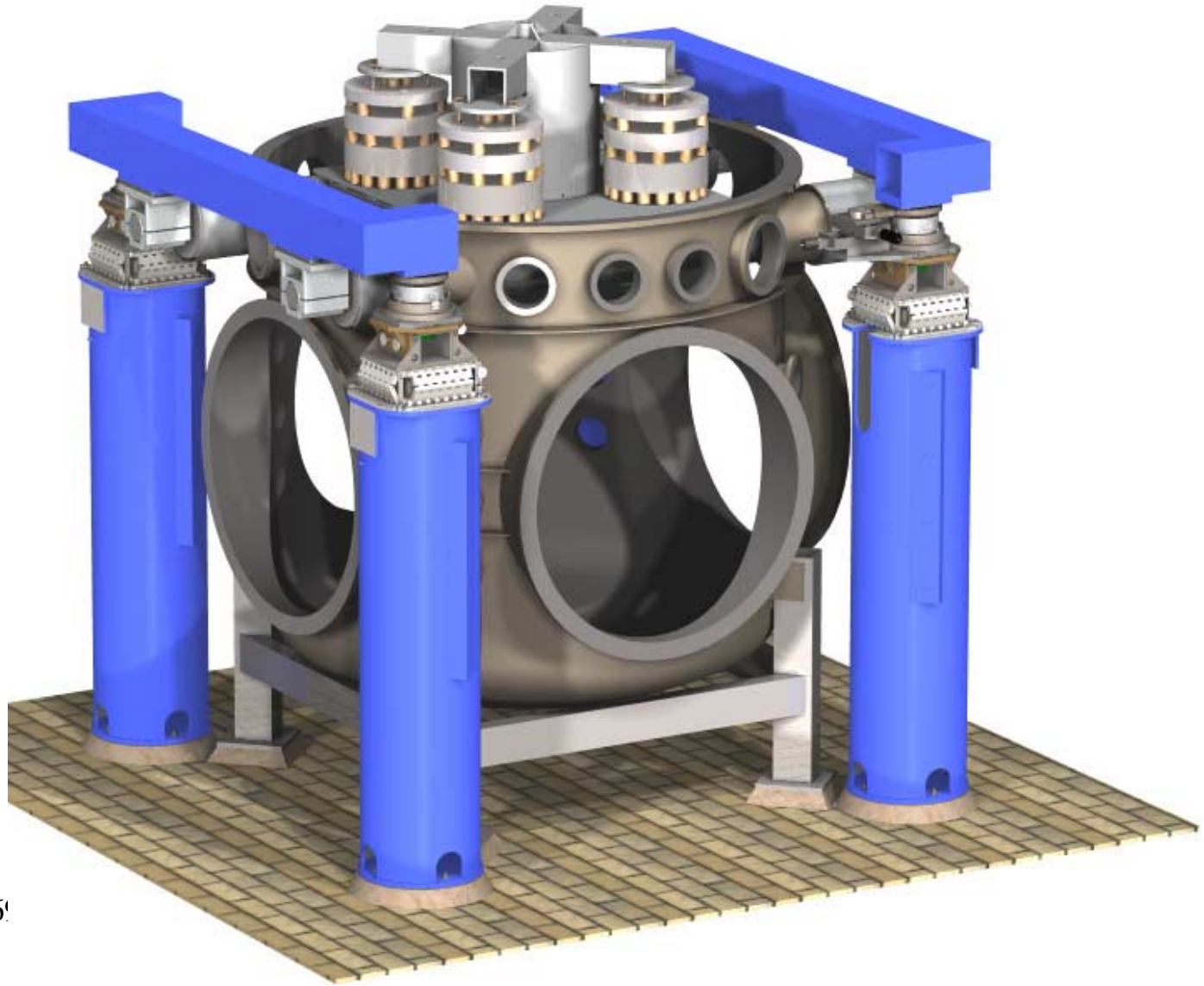
# MIT BSC Stack Characterization

## Objectives

- 1) Measure Stack Transfer Function on all 6 DOF
- 2) Measure Support Structure Compliance

These measurements will be used in the development of the pre-isolator control system.

# BSC Vibration Isolation System

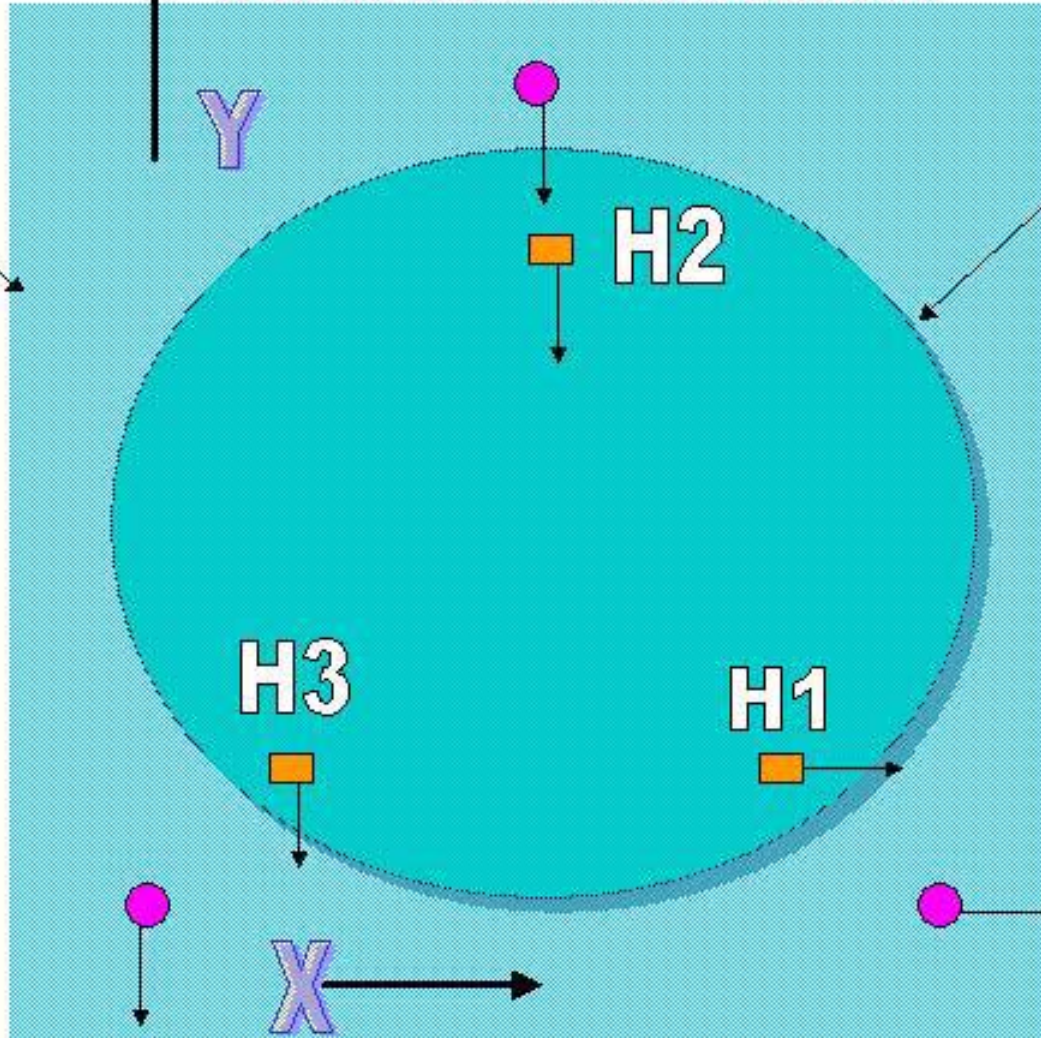




# Internal BSC Sensor Placement

Support Table

Optics Table



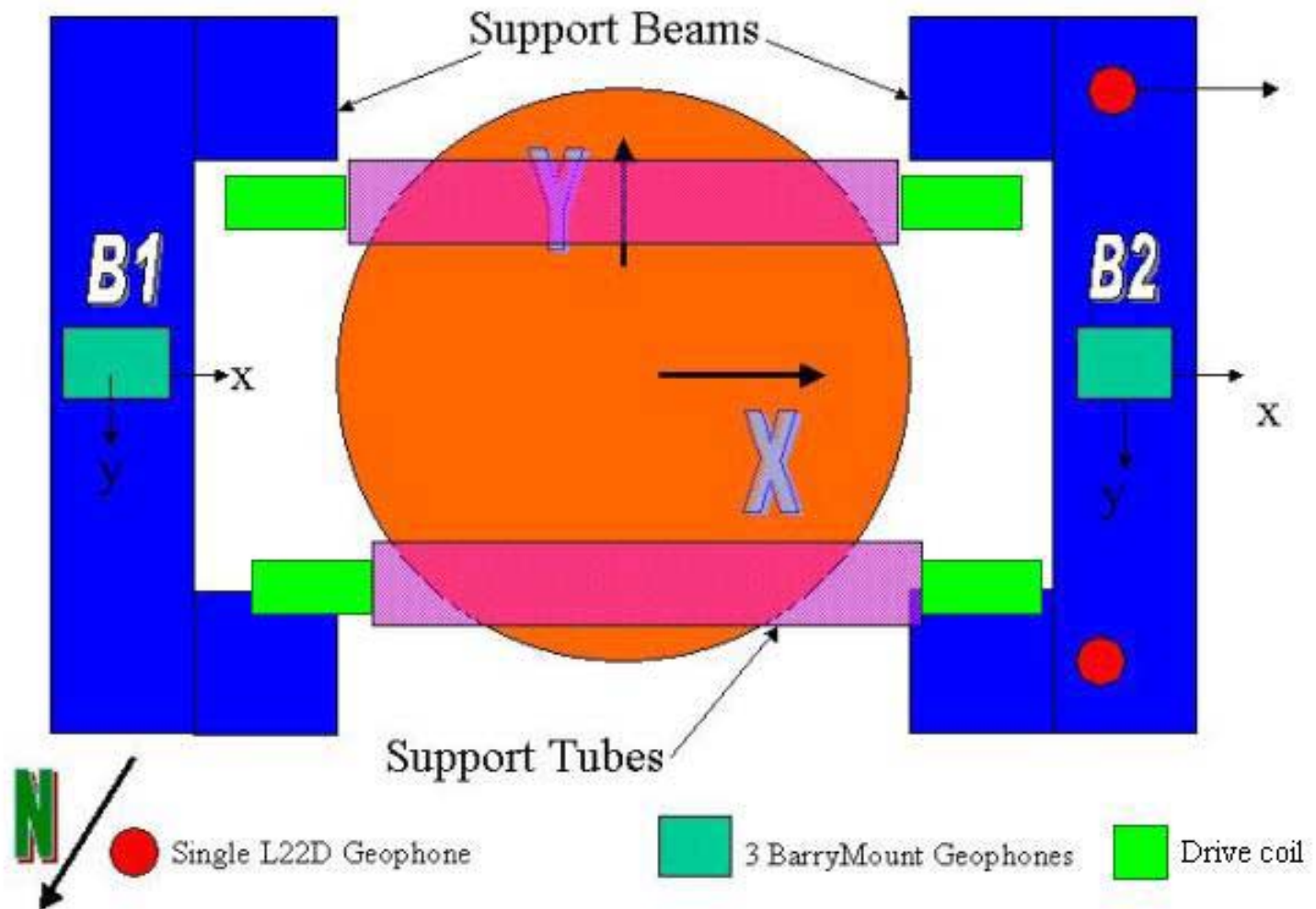
Pair of Geophones



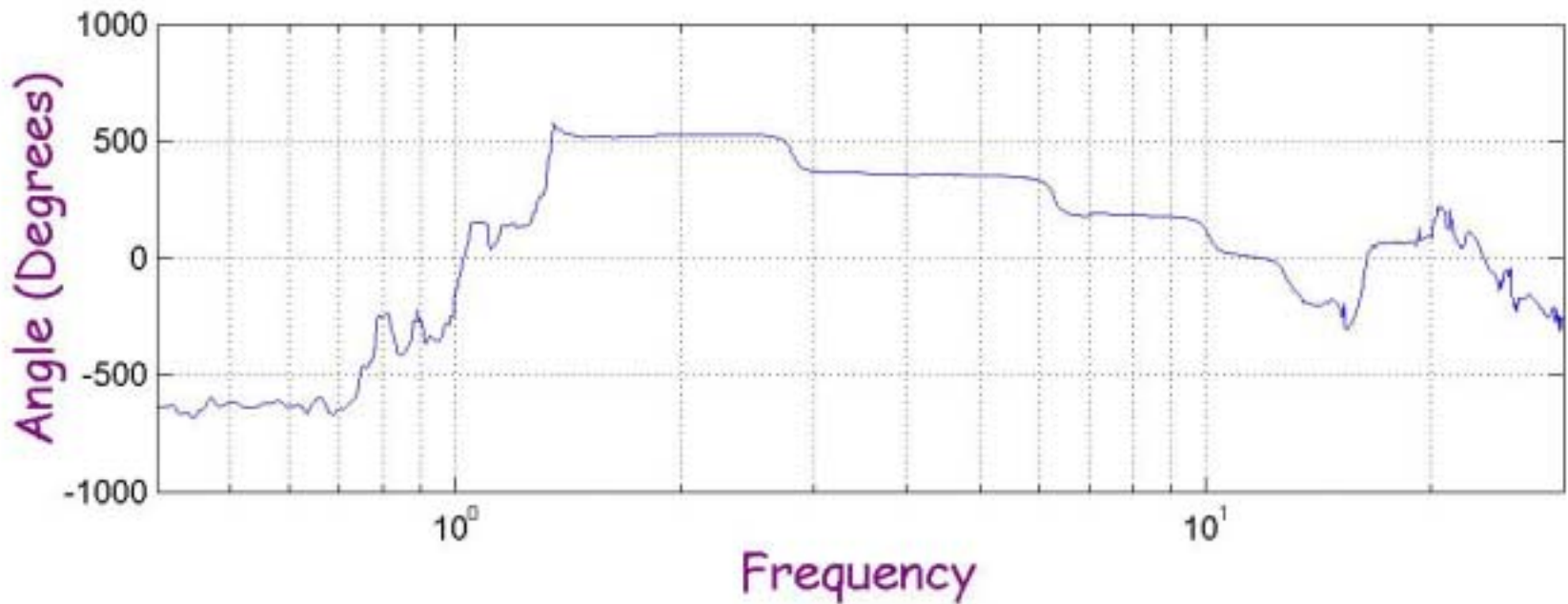
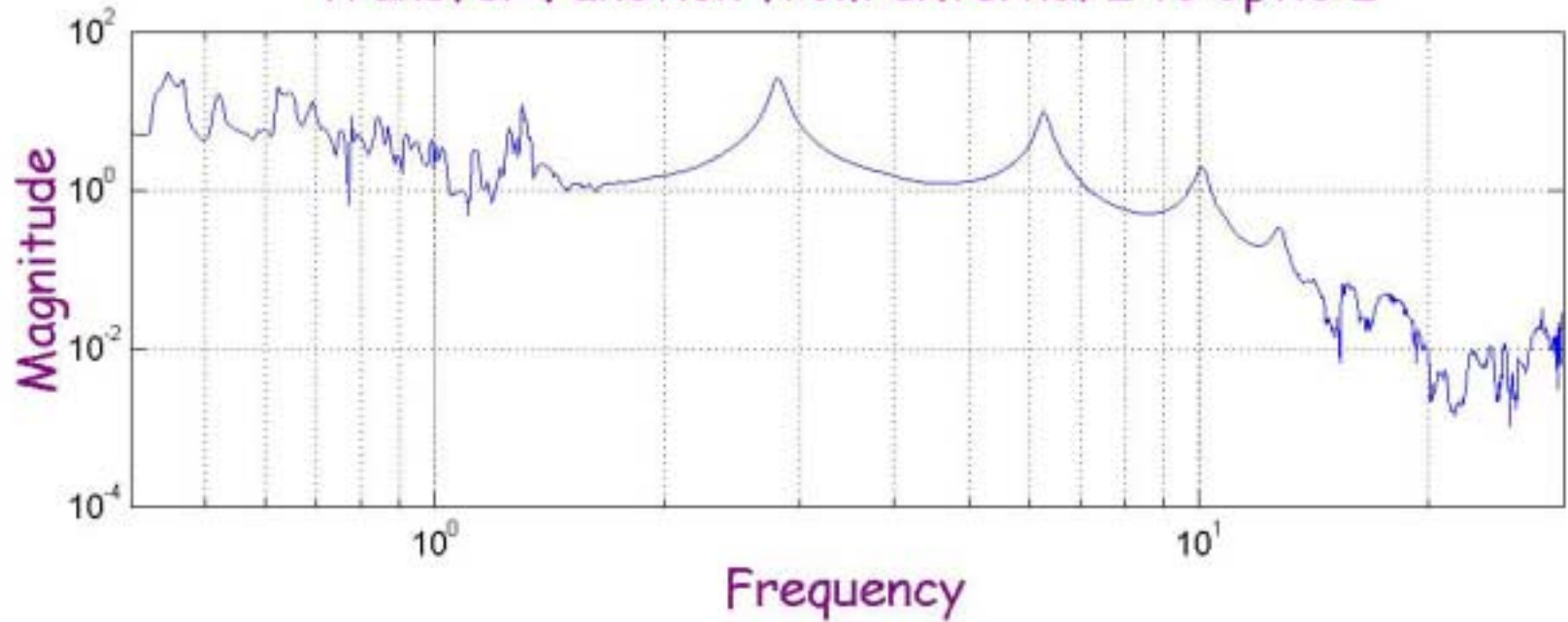
Pair of Wilcoxon Accelerometers

# External BSC Sensor Placement

Looking Down



# Transfer Function from external z to optic z



# Last Slide

This is the first time that a complete characterization of the BSC stack has been done. We have measured transfer functions from all 6 DOF of the external support to all 6 DOF of the support table and the optics table. These 72 transfer functions will be used to develop the control laws for the pre-isolator and will be compared to the existing model over the summer.