

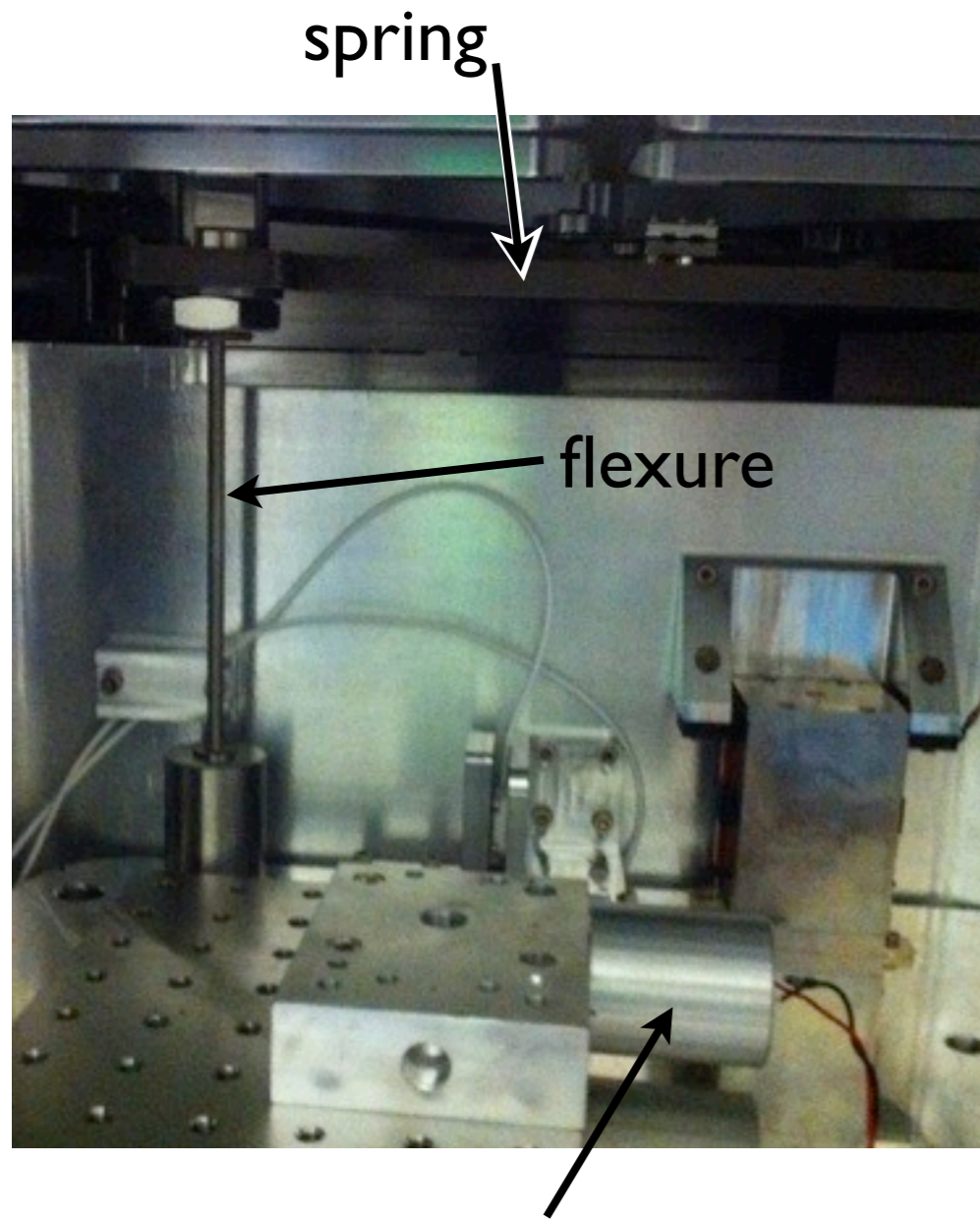
Damping tests on a Flexure of the Tech Demo - in support of ECR 1500282 to damp the flexures of ISI-HAM6

Brian Lantz, G1500880-v1, July 3, 2015

Recommendations and Observations:

1. A little viton should be added to HAM6 to provide some damping of the flexure mode. Since the coupling now is 2x below DARM, a modest improvement should put this noise out of sight for a long time.
2. The pieces located by Jeremy et. al. at LLO are expected to work.
3. Either the “poofy” or “hat” configurations are both good. “Poofy” is preferred because it provides slightly better performance, minimizes space usage, and has no free ends whose location might drift over time. The “hat” configuration is easier to install, and requires 1 less zip-tie, so may be chosen for practical reasons.
4. The damping does seem to come from the viton, not via air-flow loss.
5. Work should continue in parallel to explore how to damp the higher order modes of the blade spring.

Pictures of various viton configurations used to damp the stage 1-2 flexure of the Tech Demo, GS-13 unit H2 removed. Both stages are locked.



HS-1, screwed to base.
base just resting on stage 2



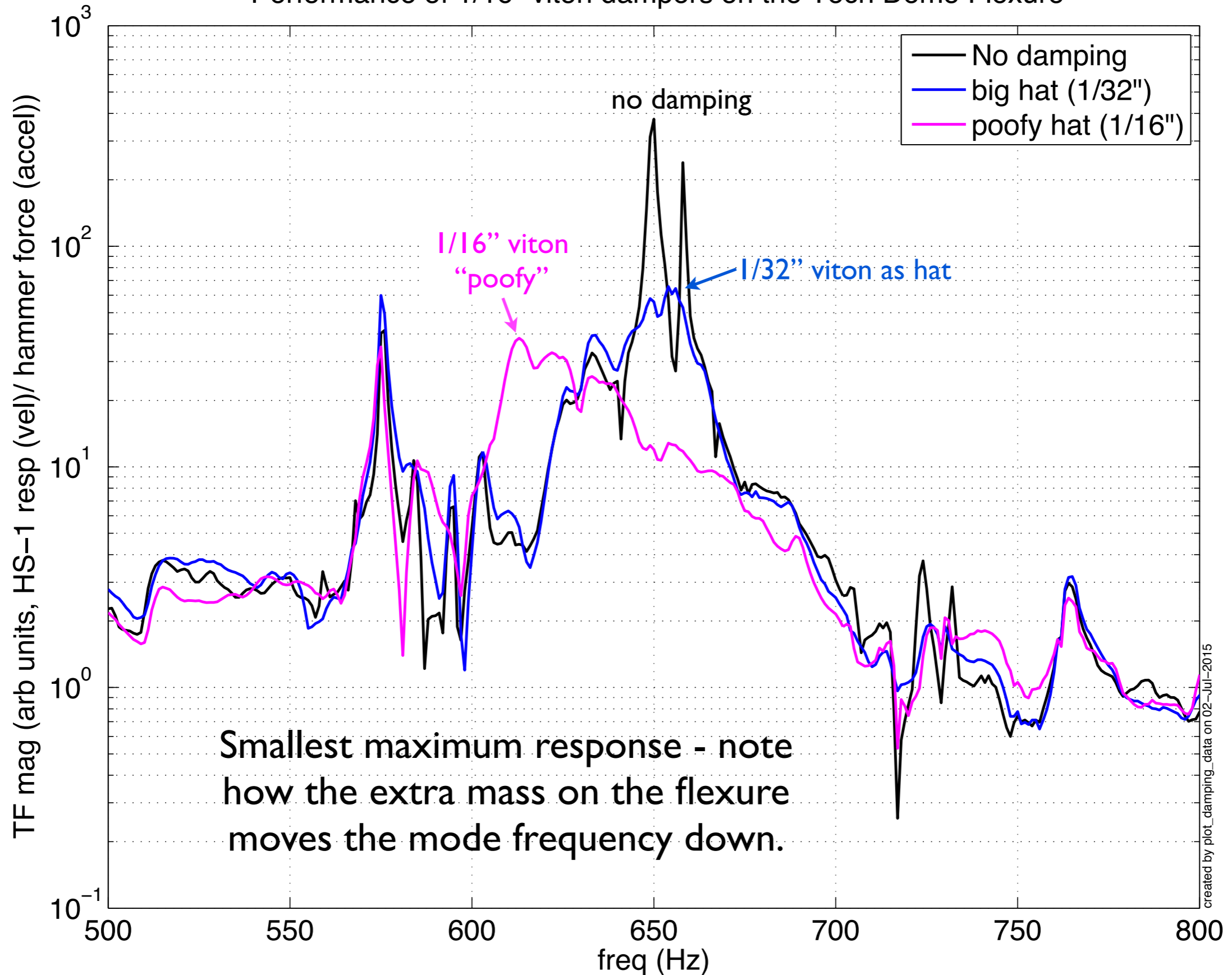
impact location
(approximately)



this "poofy" configuration
is the best one I've tried

Best Configuration is "Poofy"

Performance of 1/16" viton dampers on the Tech Demo Flexure



Viton configurations with 1/32" viton

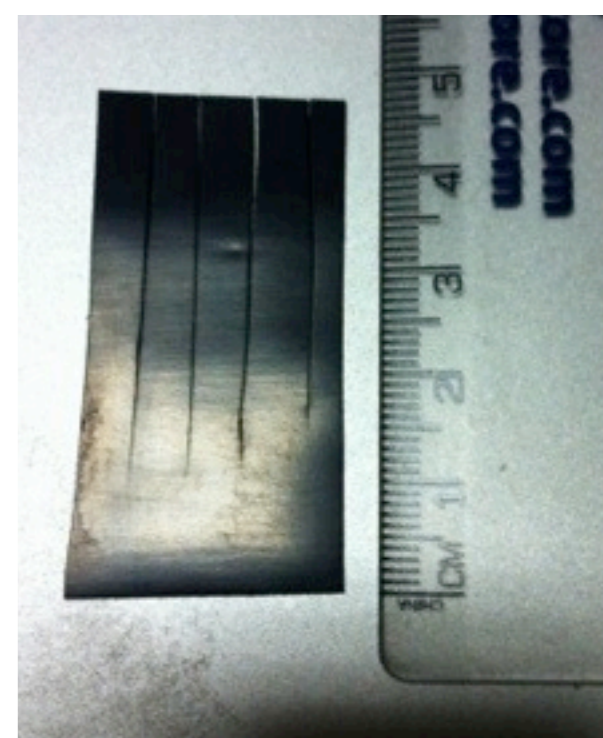
I started with 1/32" viton because I had some on hand. The best configuration I tried is the "Hawaiian Punch Hat" or just "hat" configuration.



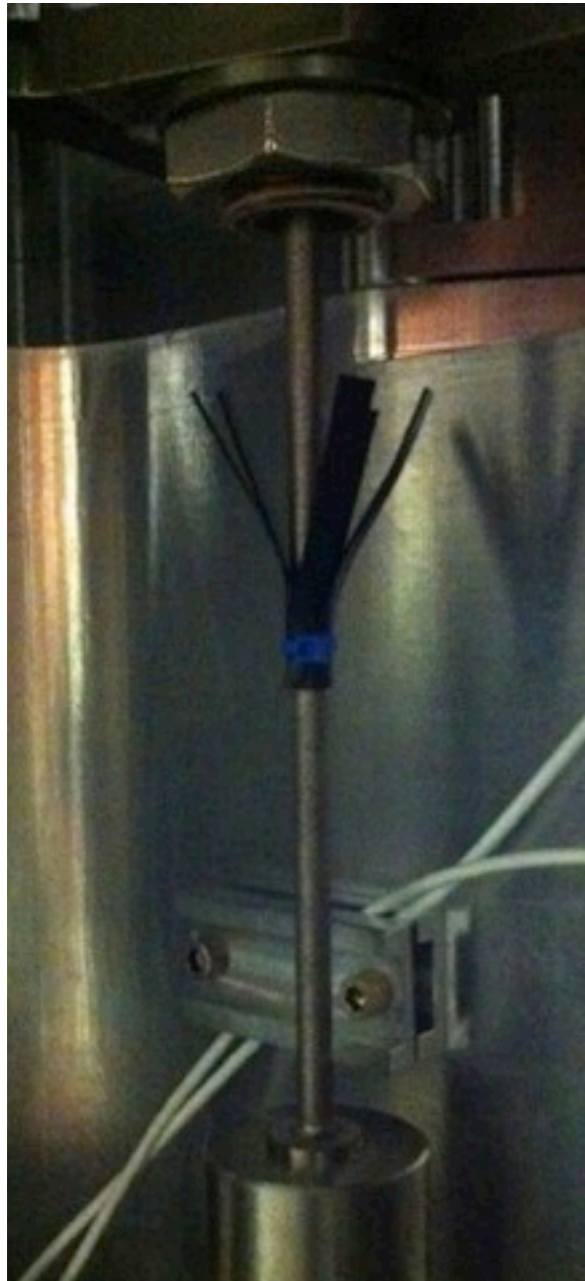
tight wrap with 1" x 1" square
This is worthless



hawaiian punch hat configuration
This works pretty well



4 versions of the hat with 1/32" viton



big hat



big hat,
curled over



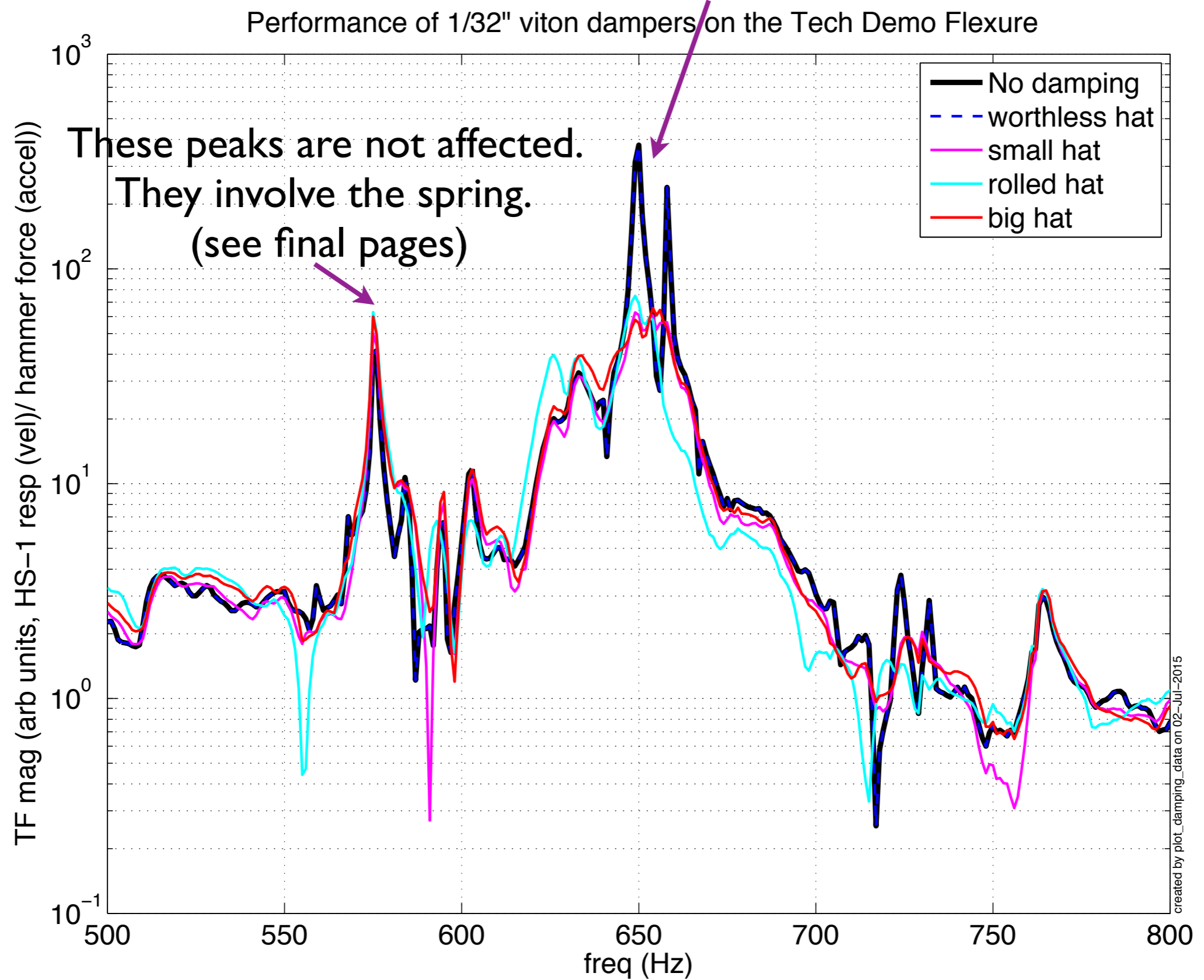
small hat



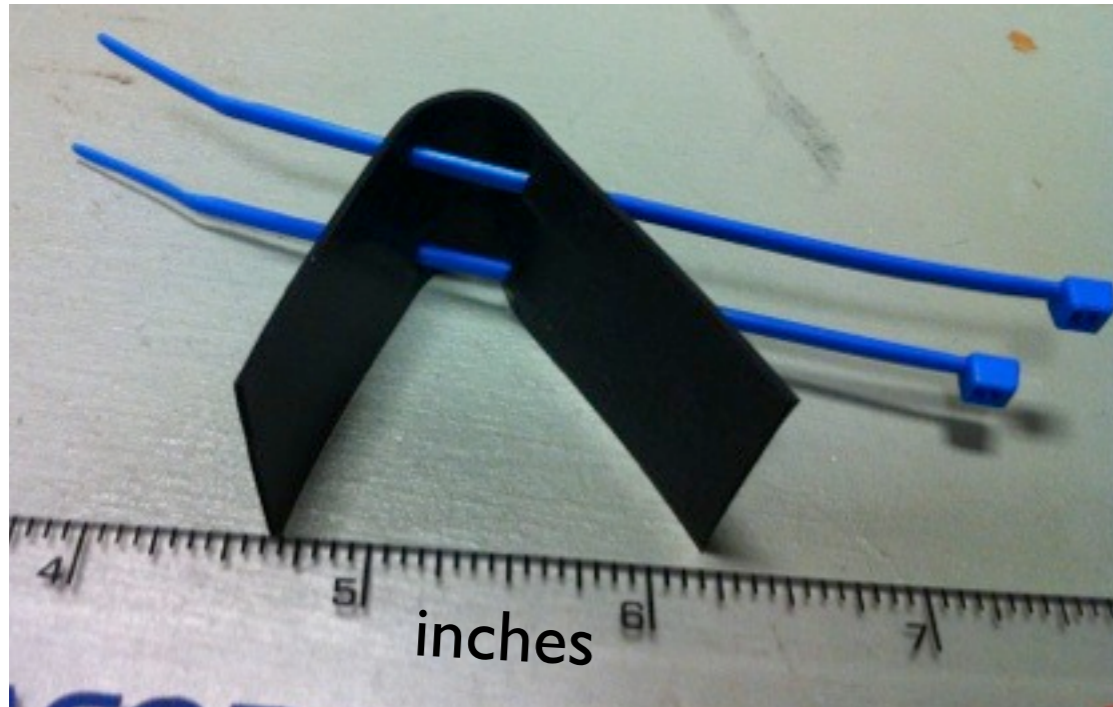
worthless hat

4 versions of the hat - Data

These peaks are damped. All but the "worthless hat" work about the same.



big flap



This is a 1" x 3" rectangle of 1/32" thick viton

Repeated hats with 1/16" thick viton



big hat



small hat

Repeat with piece of similar dimension to pieces at LLO
piece is 1.65" long, 0.90 inches wide. width chosen to wrap once around
Tech Demo flexure of diameter 0.228". HAM flexure diameter is 0.189"

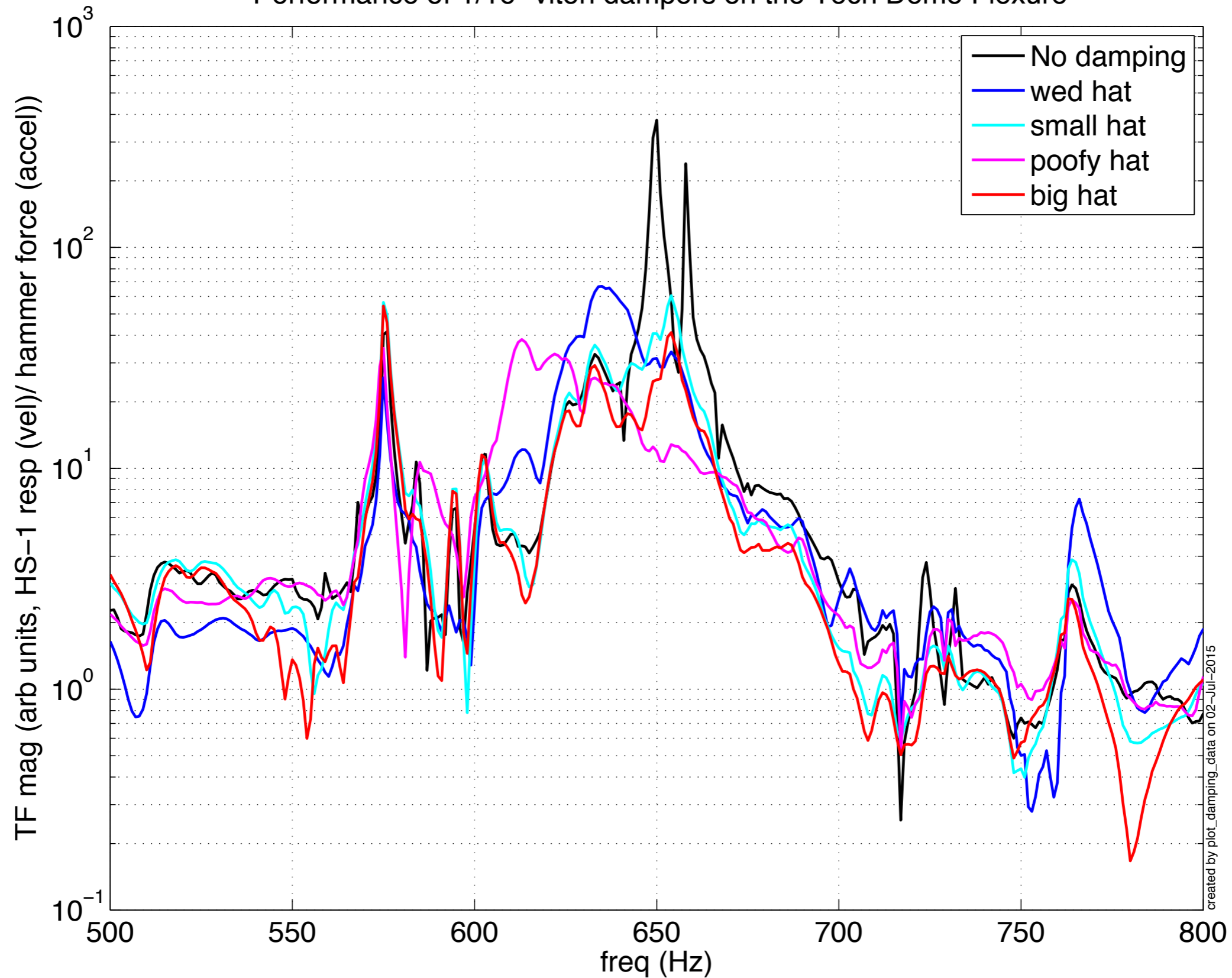


Wednesday Hat



Poofy Hat

Performance of 1/16" viton dampers on the Tech Demo Flexure



Big hat is really good, but the LLO sized piece (Wed Hat) does not quite repeat results from previous day - one might expect it to be about 1/2 way between the big hat and small hat. Also note that the poofy hat freq's are lower because of added mass on the flexure - 1 more zip tie and more viton.

Influence of location and orientation

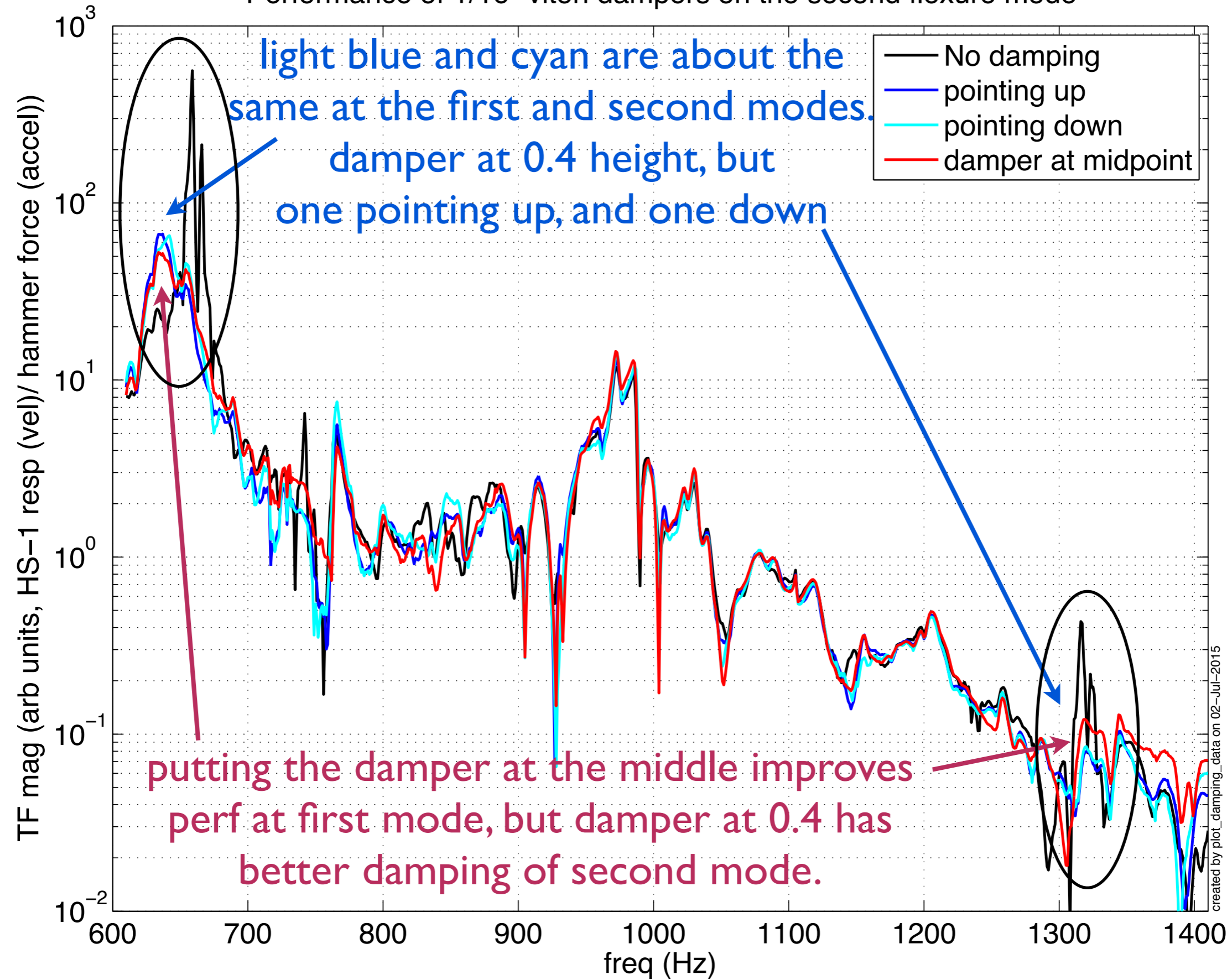


direction of flaps with same spread
has no impact on performance
(drooping over time is an issue)

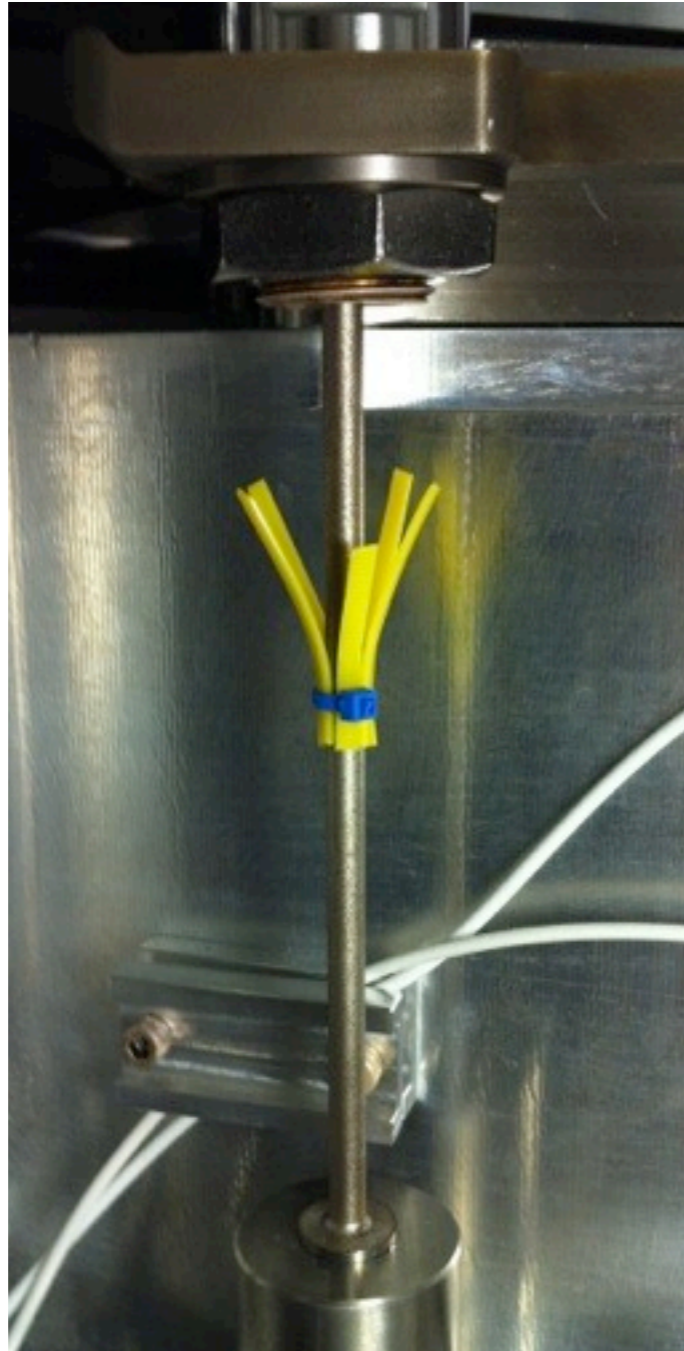
moving attach from 0.4 of height up to
0.5 of height (middle) does matter

Influence of location and orientation

Performance of 1/16" viton dampers on the second flexure mode



The viton material provides the damping,
it is not just the shape moving through the air

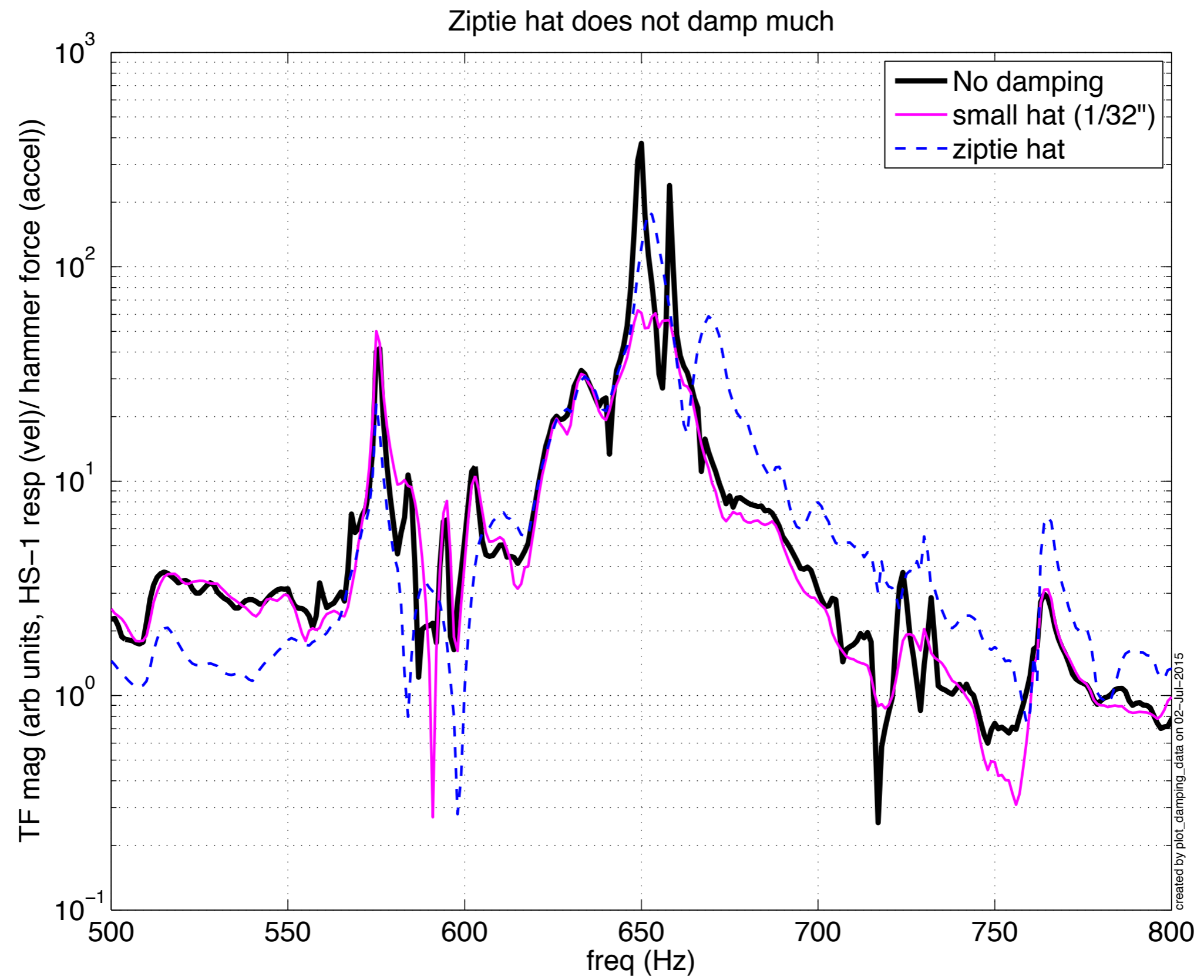


hat made from zipties



small viton hat, 1/32" thick

The viton material provides the damping, it is not just the shape moving through the air

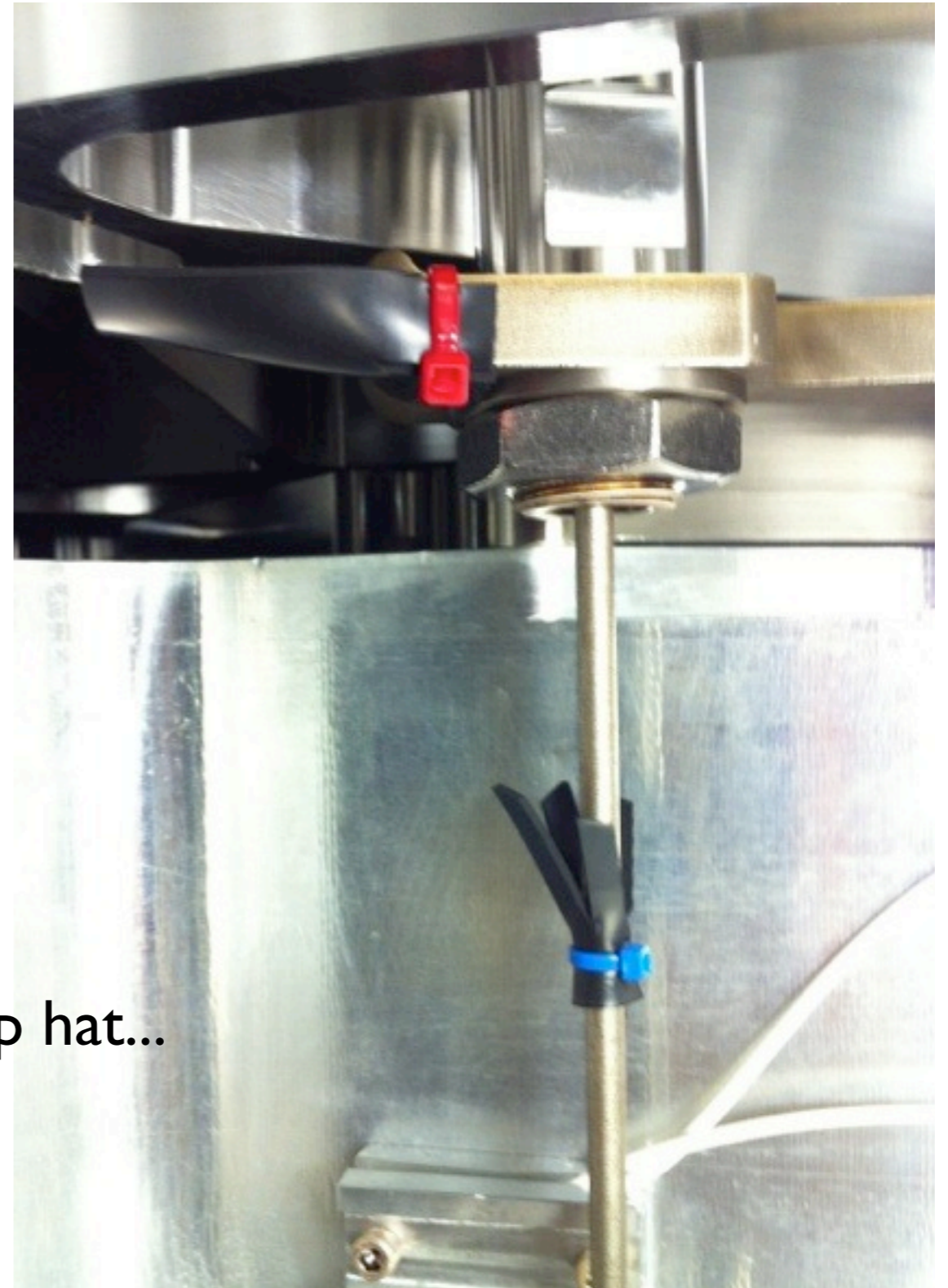


add some viton to the blade spring



this “tongue” helps a little.

There is a lot of motion in that aluminum top hat...



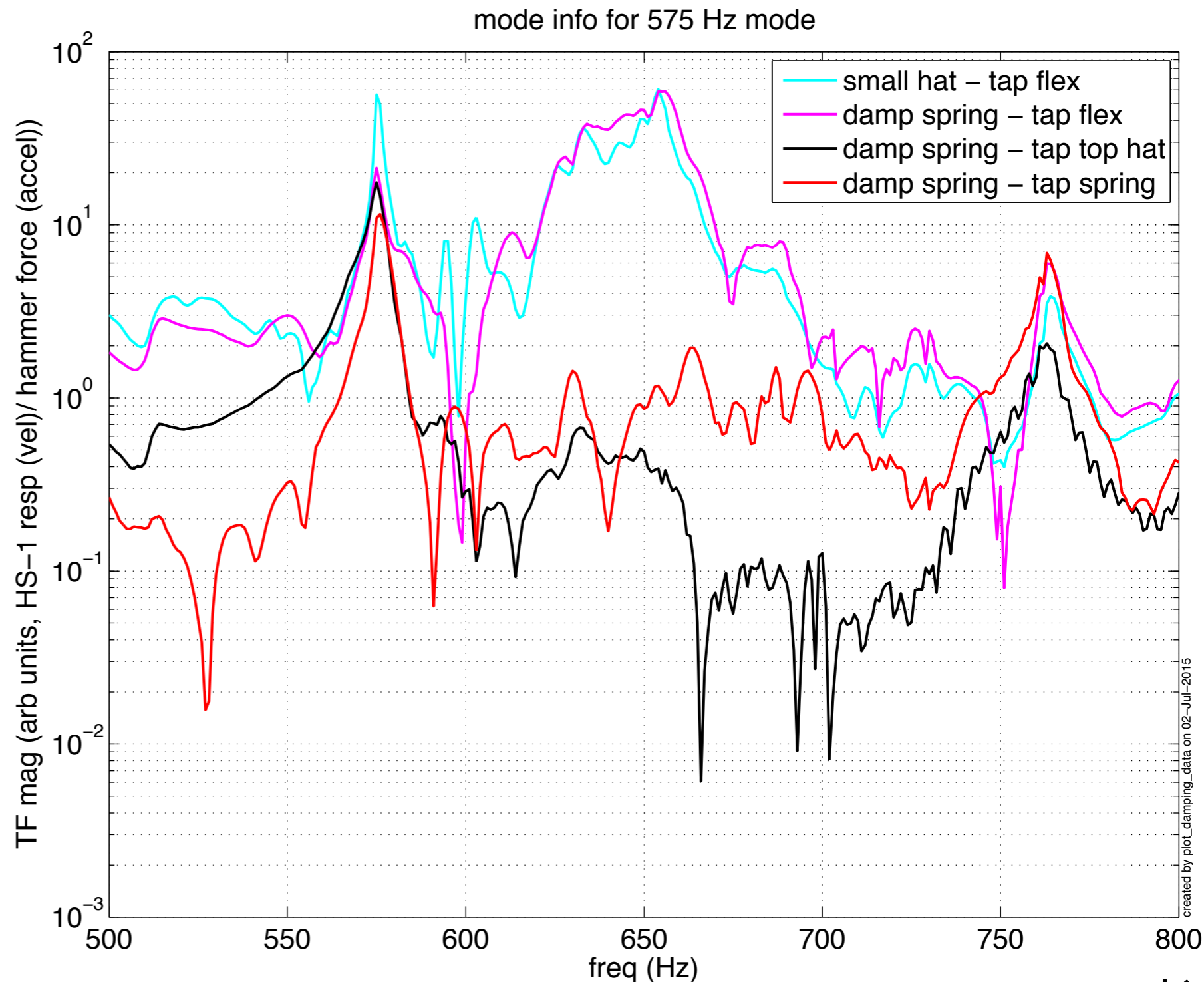
add some viton to the blade spring

Adding viton to the spring reduces the Q of the mode at 575 Hz
(diff. seen in cyan to to magenta curves)

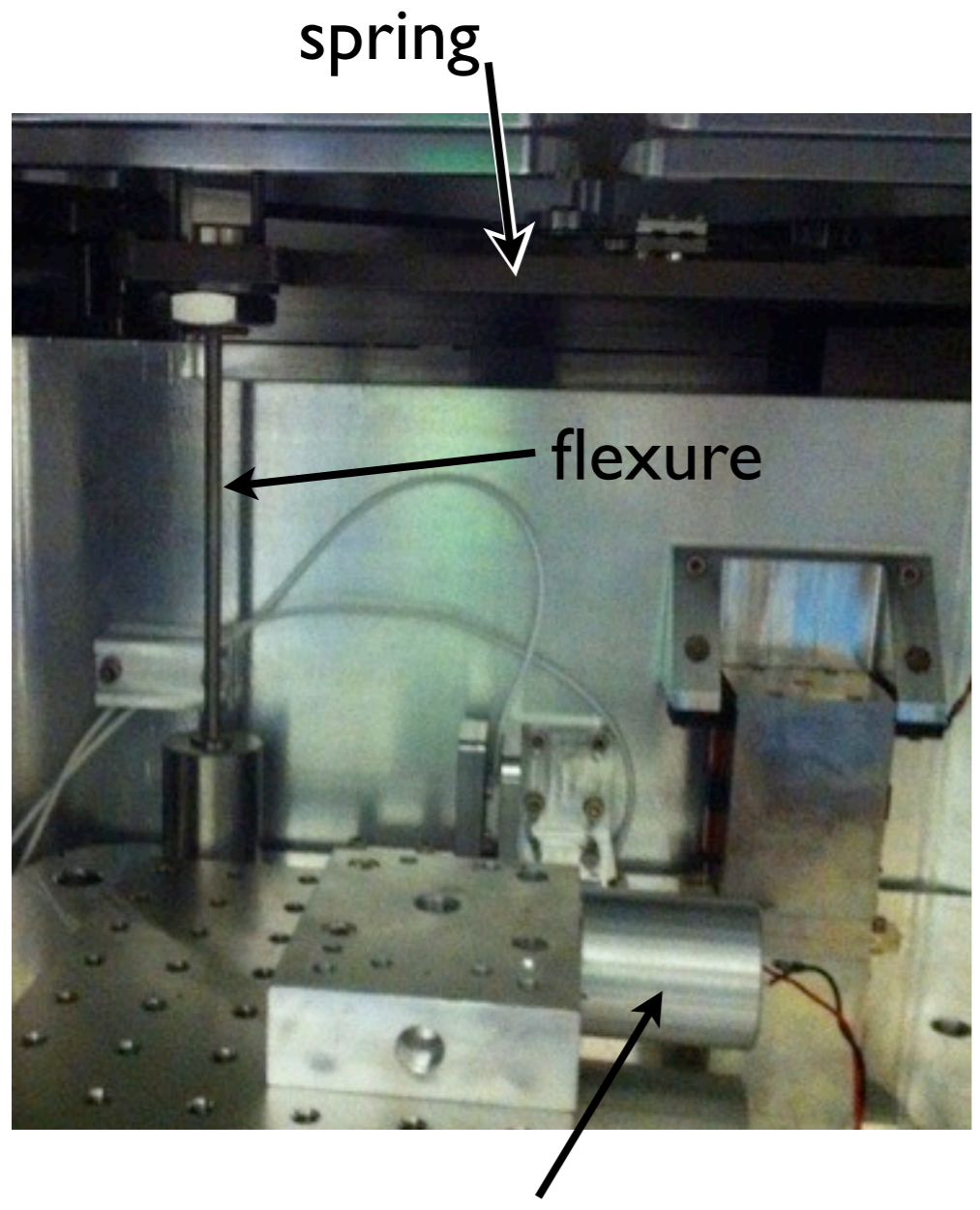
Spring motion is important here.
Magenta is the response when tapping on the flexure.

Black is the response when tapping horizontally on the base of the aluminum flexure holder.
Magnitude matches flexure taps, so similar participation in this mode (but not in the flexure modes at 650-660 Hz).

Red is the response when tapping up vertically on the blade, near the flexure, but towards the base. Mode here is about 1/2 of the amplitude at the flexure or flexure holder.



Viton jammed into the gap between the flexure and the top flexure holder at the Tech Demo.



HS-1, screwed to base.
Base just resting on stage 2



This piece of viton, from an iLIGO spring-seat, is normally used to damp the Tech Demo. This works very well, but is not appropriate for aLIGO because of uncertainty in drift, uncertainty in DC stiffness, and potential to fall out during an observing run.

Viton jammed into the gap between the flexure and the top flexure holder at the Tech Demo.

