

The LIGO logo features the word "LIGO" in a bold, black, sans-serif font. To the left of the text are several concentric, light gray circles of varying radii, suggesting gravitational waves or a signal.

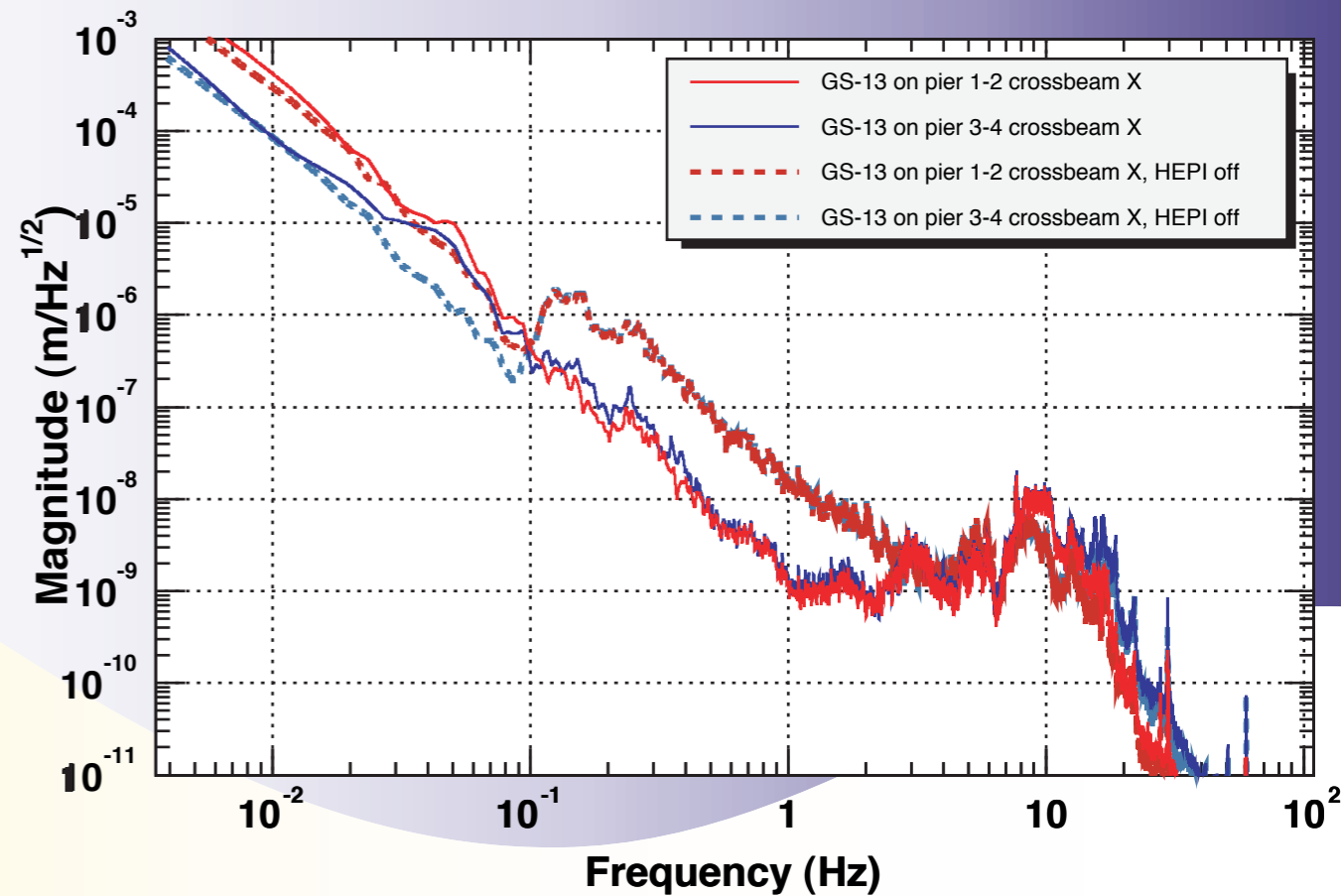
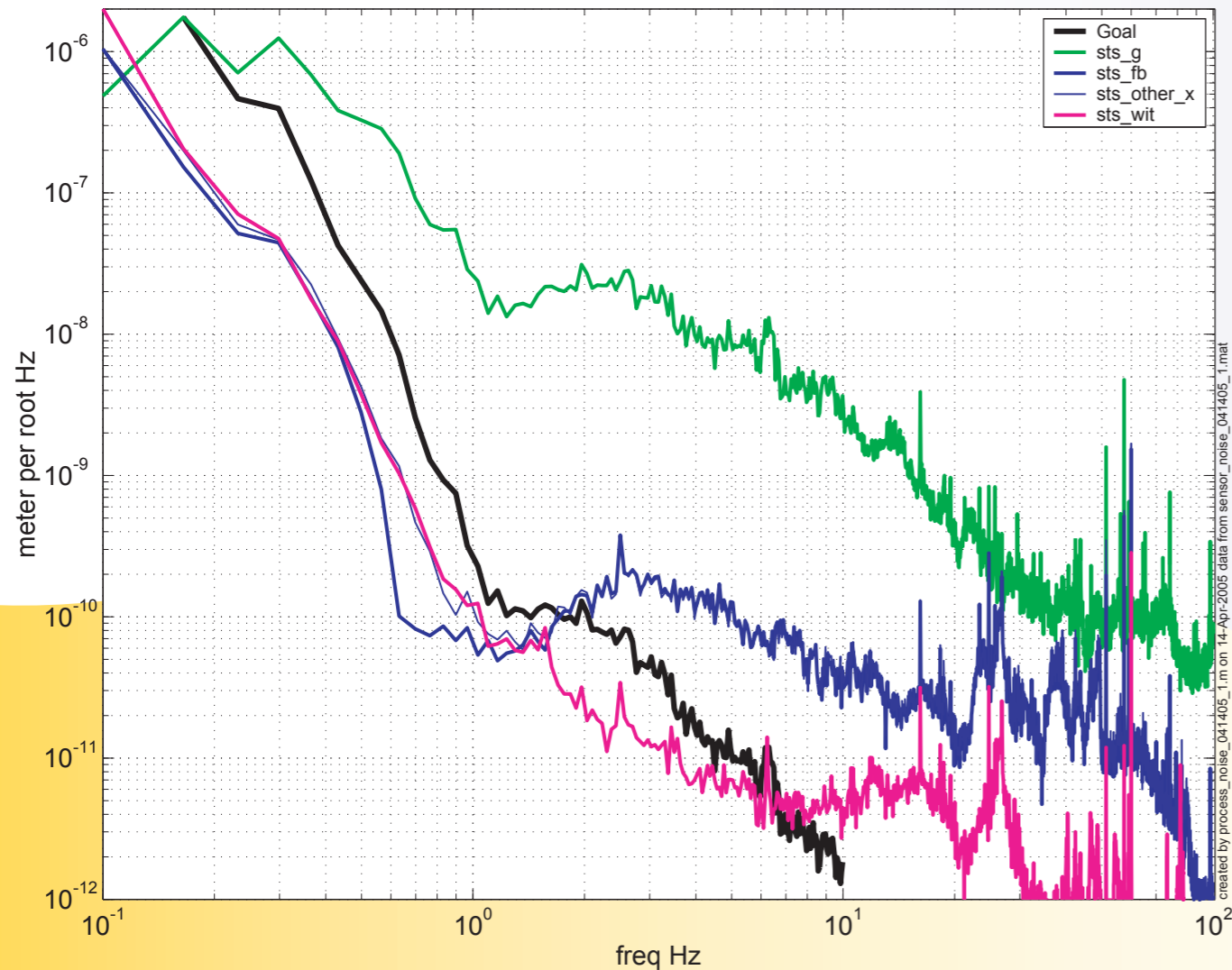
Adv LIGO SEI critical review update

J. Giaime, 25 May 05

LIGO-G050270-00-R

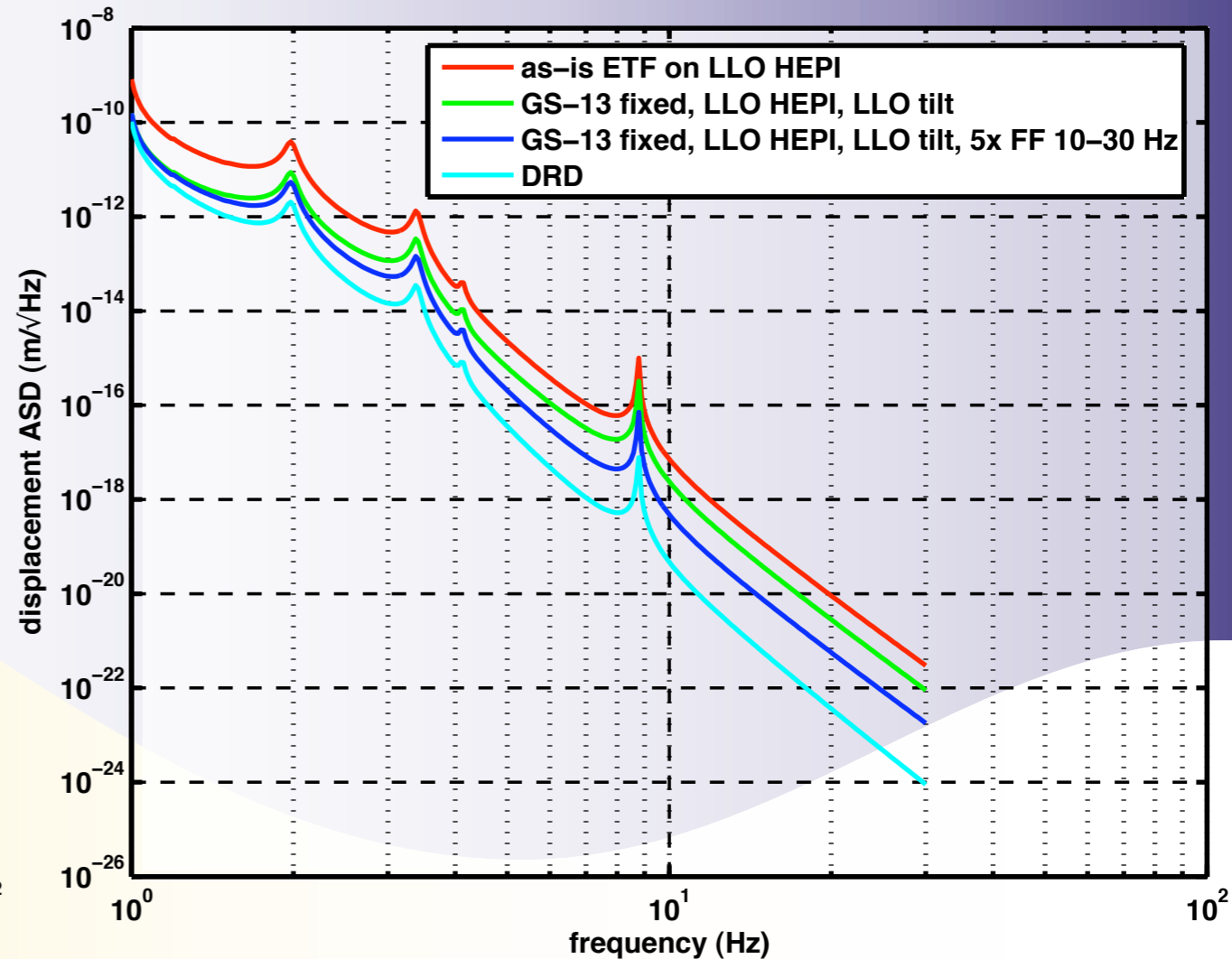
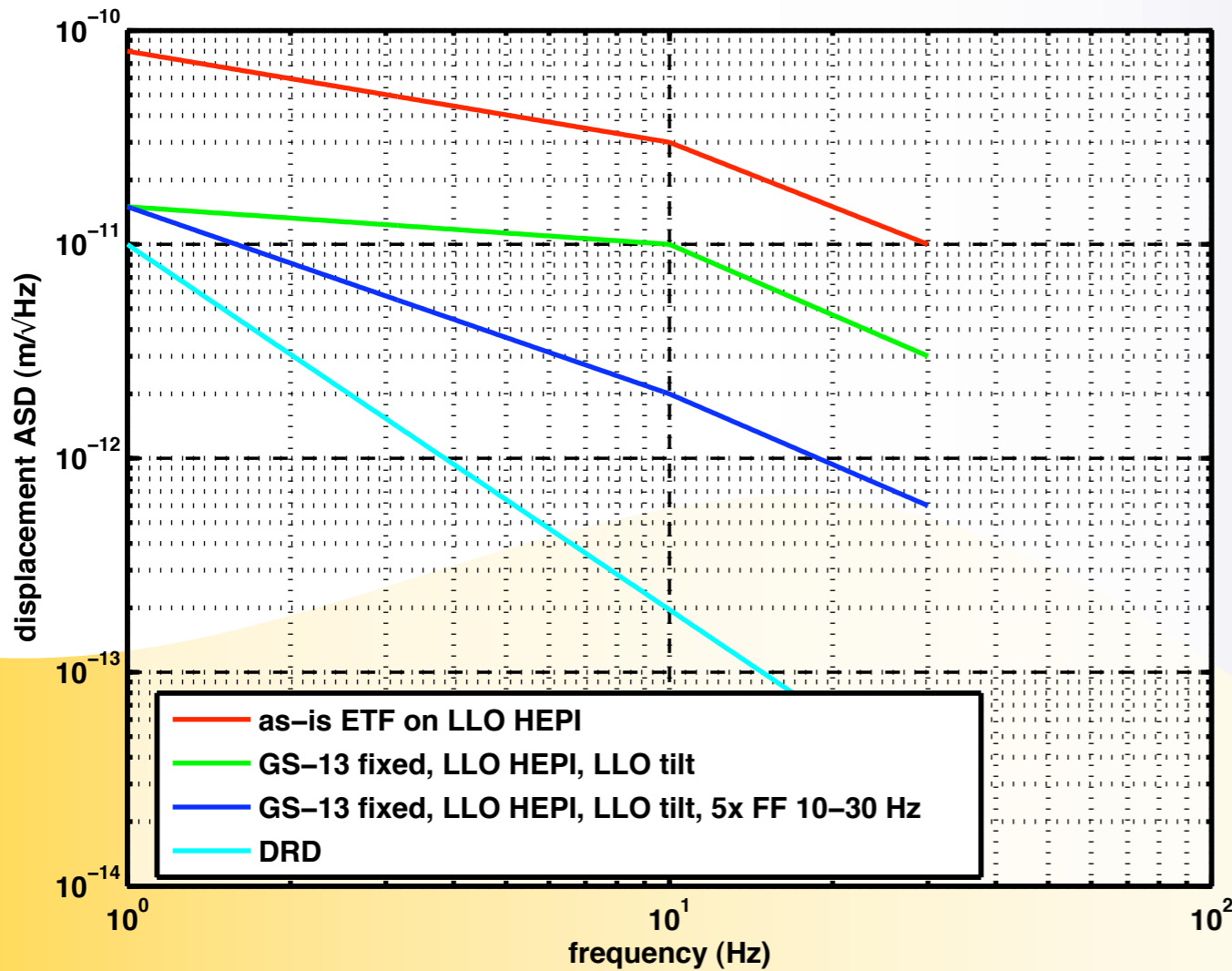
Noise from experimental results

Horizontal FIR blending performance X



- Make set of noise curves for SEI, based on demonstrated performance, and with predictable improvements.
- Stanford noise curves well understood, and effect of better sensor instrumentation and tilt input can be predicted.
- HEPI performance at LLO taken as-is, without assuming any improvements for Adv LIGO.

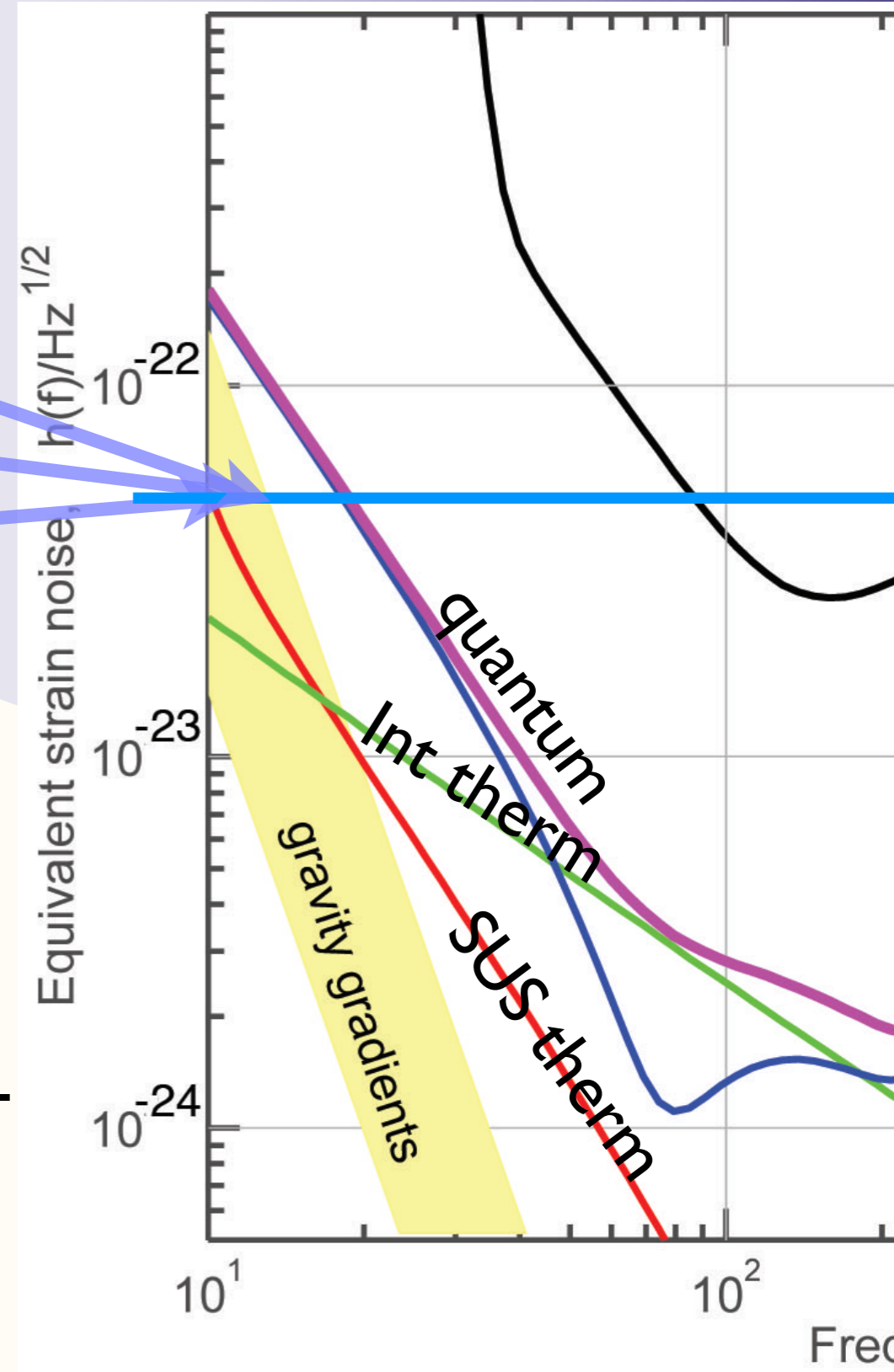
Performance predictions



- **Red (worst case):** demonstrated ETF performance, assuming no improvement in either sensor noise floor or mechanics. Tilt input is as at Stanford. HEPI translational noise is as measured at LLO HEPI crossbeams.
- **Green:** GS-13 noise floor using LT1012 op-amps, Tilt input as measured at LLO HEPI.
- **Blue:** Factor of **5** amelioration of HEPI 'shoulder' using feedforward from HEPI geophones to stage I actuators, in the 10–30 Hz band.
- **Cyan:** DRD curve.
- N.B. same SEI spectrum used for horizontal and vertical, in each case. Excess vertical at 10 Hz will be fixed with softer stage 0-I springs.

Effects on Adv LIGO

	10 Hz ASD (m/√Hz)	Freq for 1e-19 m/√Hz at test mass
Worst case	6.6e-18	15.2 Hz
simple fixes	2.2e-18	13.4 Hz
w/ 5x FF	4.4e-19	11.4 Hz
DRD	4.3e-20	9.6 Hz



- Hard to distinguish cases unless we assume low-power laser or improved quantum noise.
- blue case is at expected gravity gradient level.

Plans

- Complete ISI modeling (BTL), studying effect of reduced blade spring stiffness. Modify system noise predictions accordingly.
- Design new blade springs (ASI), based on design rough geometry worked out by team. Check for effect on mechanical stiffness matrix, etc.
- Continue HEPI / external structure modeling and measurements; perhaps understanding will result in proposal for modifications of mechanical structure. (we are not counting on this, though.)
- At LASTI, study FF techniques from HEPI to stage 1.