Thoughts on HAM Isolation
HEPI + 1 Stage Internal System

Brian Lantz, July 11 2005

HAM system which is

Lower performance, cheaper, and simpler.

HEPI outside, single 6-DOF stage inside.

Stage mechanics like the 2nd stage ETF (optics table).

Stage instrumentation like the 1st stage ETF.

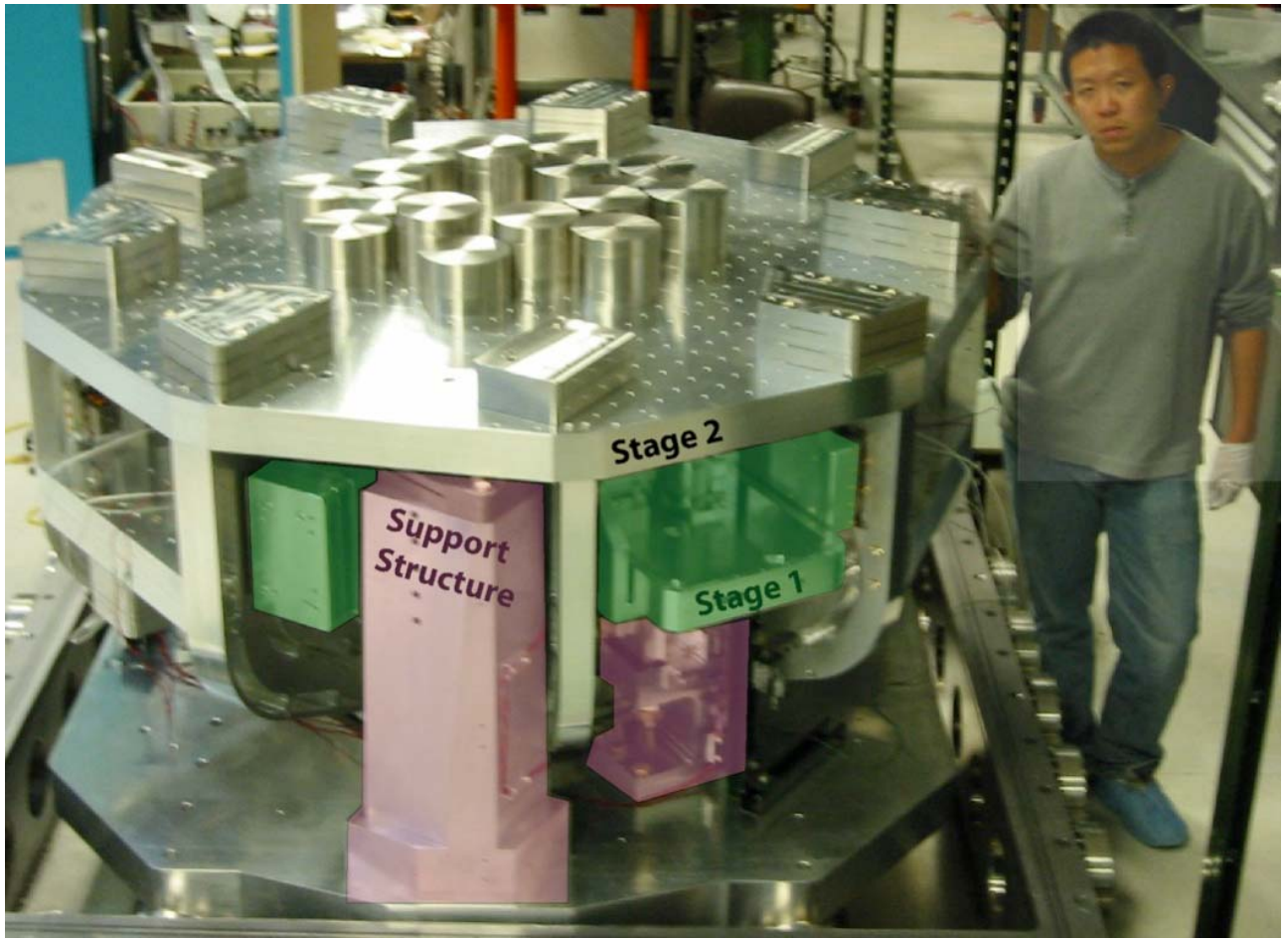
What kind of performance might we expect?

Current ETF design

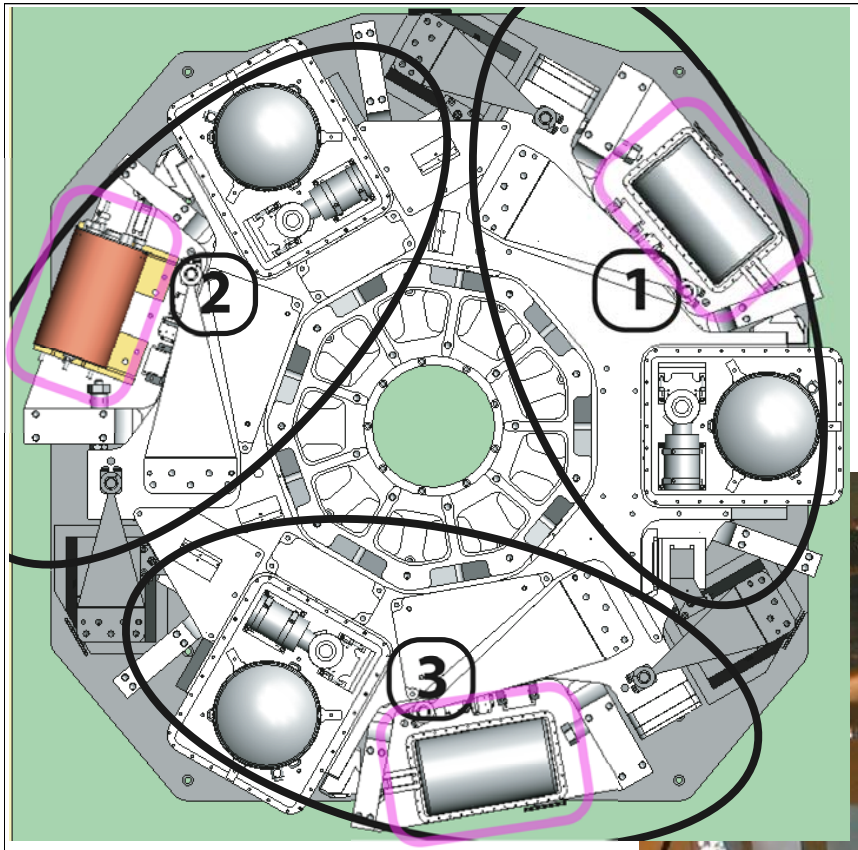
Structure like stage 2

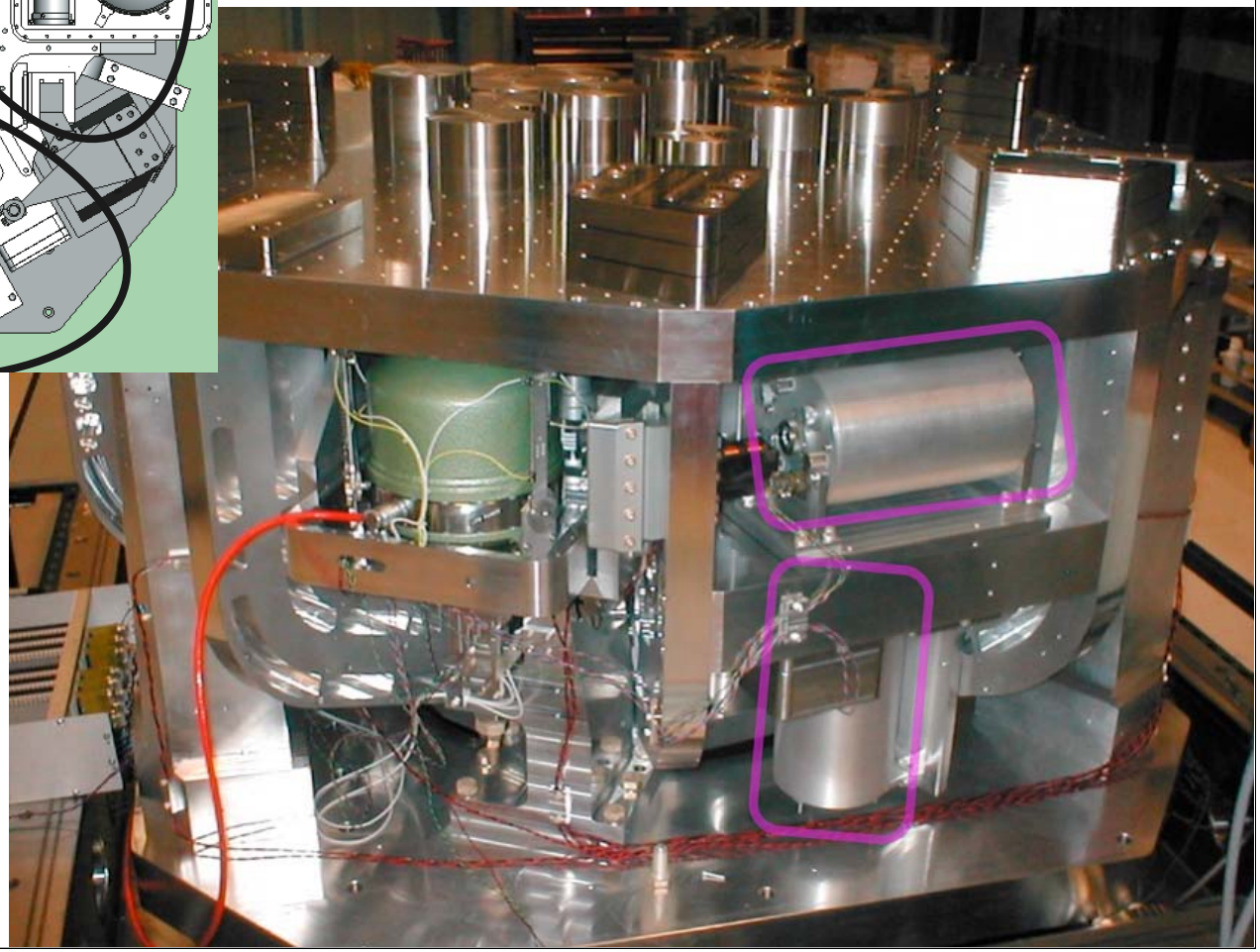
Sensors and actuators like stage 1
(6 actuators,
6 cap. disp,
3 STS-2 seis.
6 L-4C geo.)

Simpler because
- only 1 stage
- no cutout for stage 1
- L-4C < GS-13



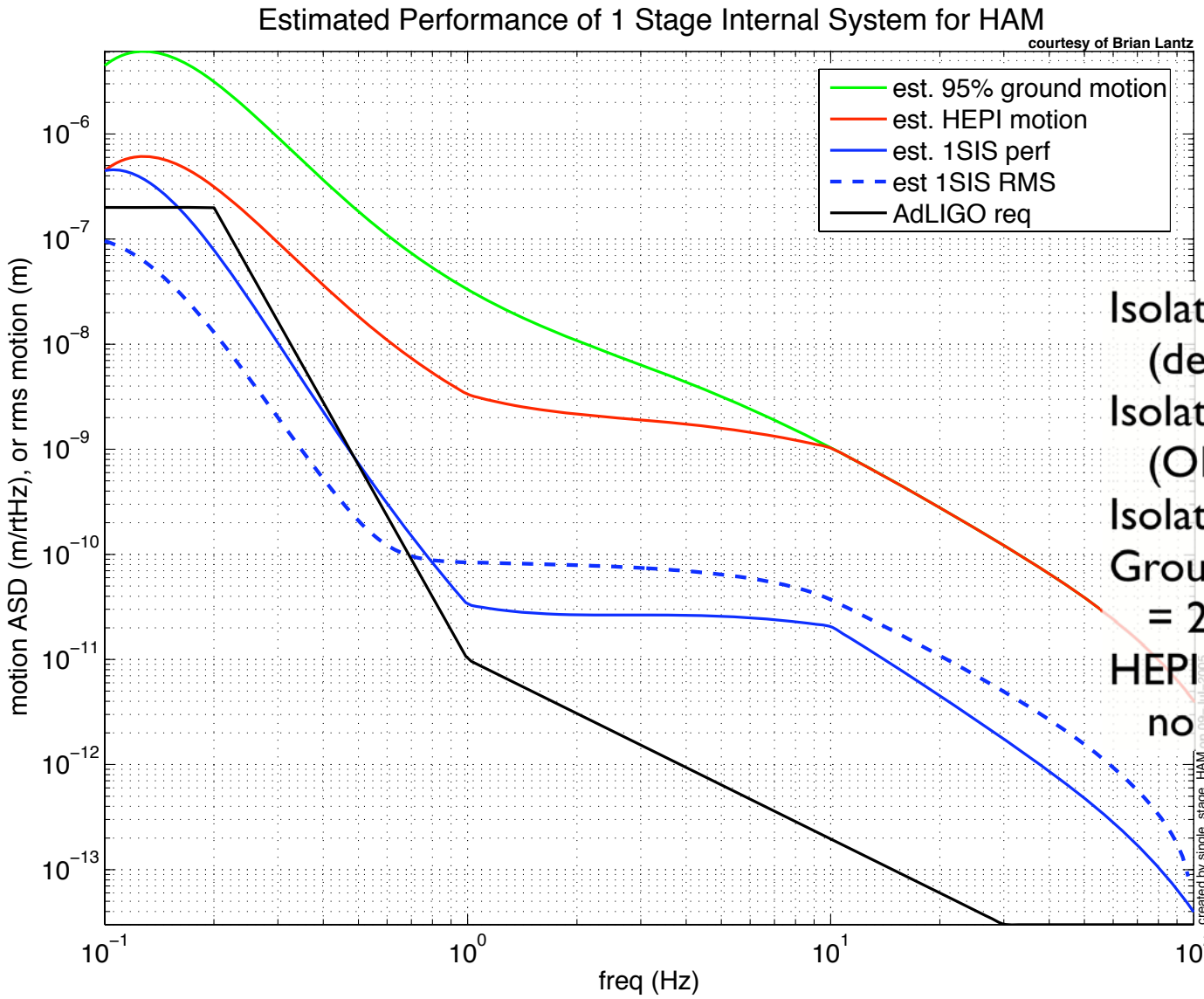
Removing the GS-13s





These get eliminated
(2 of 6 are shown)
LIGO parts bigger
because of vacuum cans

Performance Estimate



Isolation of 100 at 1 Hz
(demonstrated in ETF)
Isolation of 50 at 10 Hz
(OK with 2 Hz susp.)
Isolation of 100 at 100 Hz
Ground is 95% motion
= 2.6 * Peter F. model
HEPI assumes
no pier amplification

Passive Isolation

Stage is 1400 kg, with 600 kg of payload (slightly more than ETF + req)

Set Horizontal mode at 1.4 Hz, 10 Hz isolation of 50

pendulum length of 130 mm

total length of 175 mm (LZMP = 22 mm)

diameter of 4.3 mm

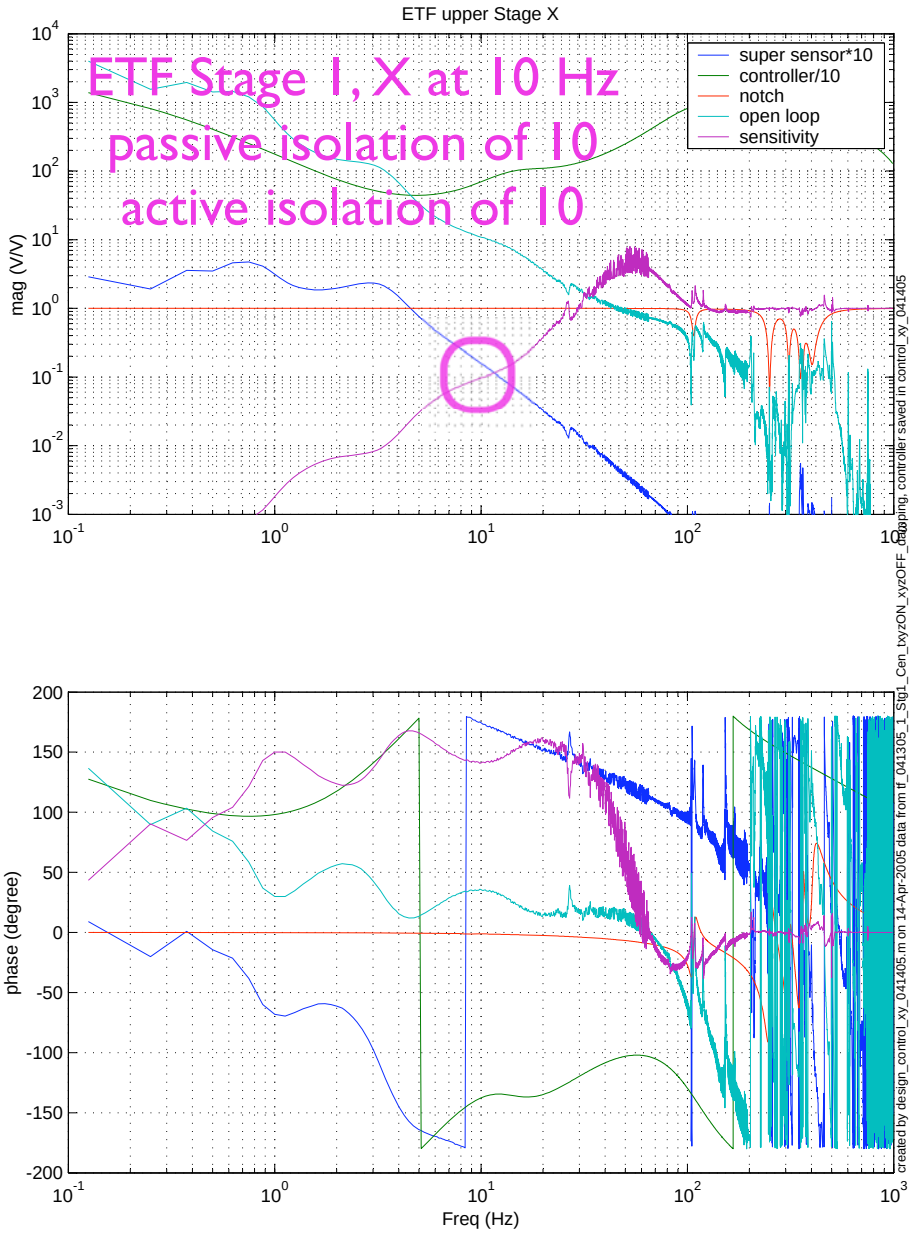
stress, with 1 mm lateral motion = 27% yield

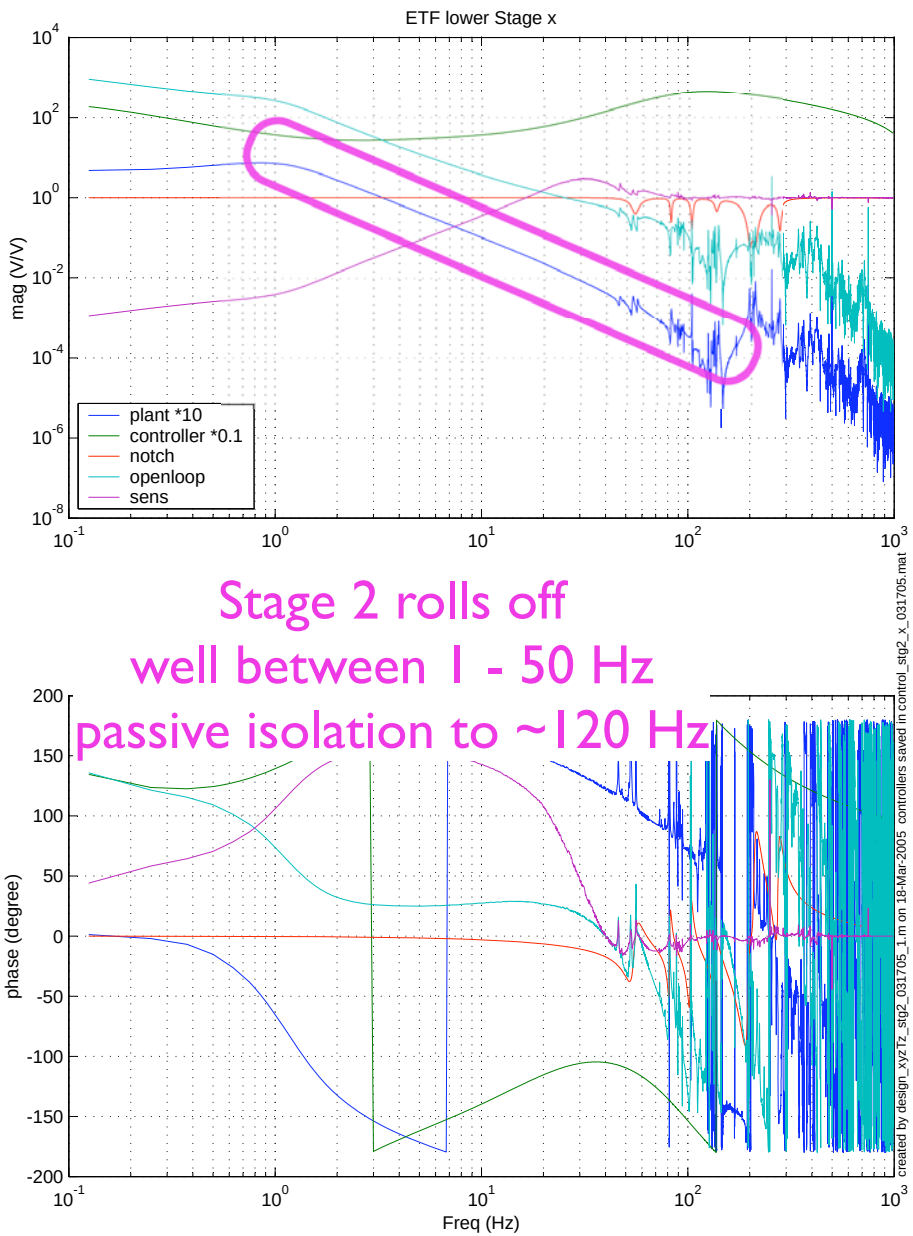
(about as long, slightly thinner than BSC at 5.9 mm)

Set Vertical mode at 2 Hz, 10 Hz isolation of 25

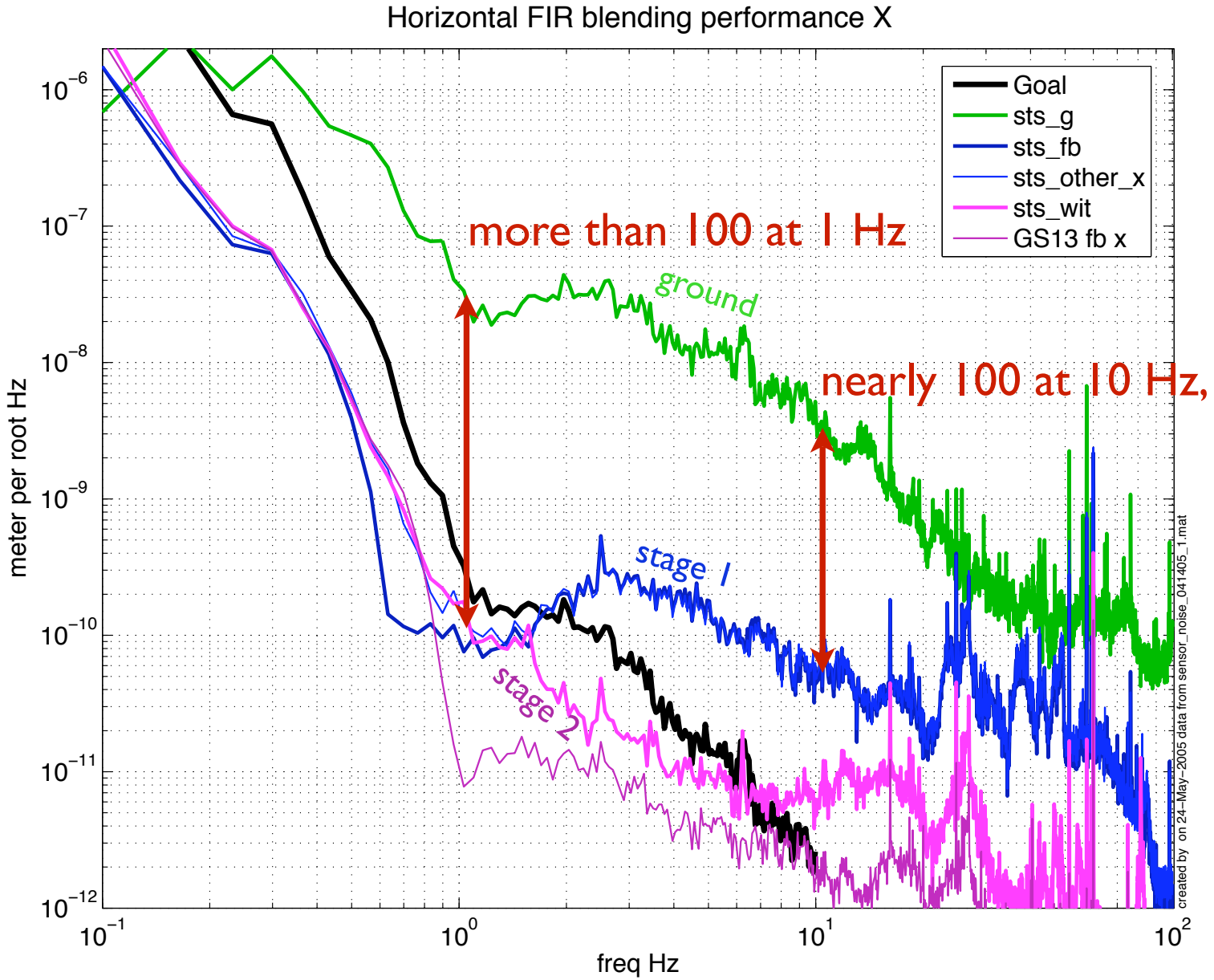
	proposed HAM blade	reference stg 0/1 BSC blade
length	.40 m	.42 m
thickness	10 mm	13 mm
stiffness	1.05e5 N/m	2.28e5 N/m
.3 mm force	31 N	68 N
load	6.5e3 N	11.9e3 N
static sag	62 mm	50 mm
stress	7.4e8 Pa (35% of 0.2% yield)	

Performance Experience at ETF





Performance from the ETF



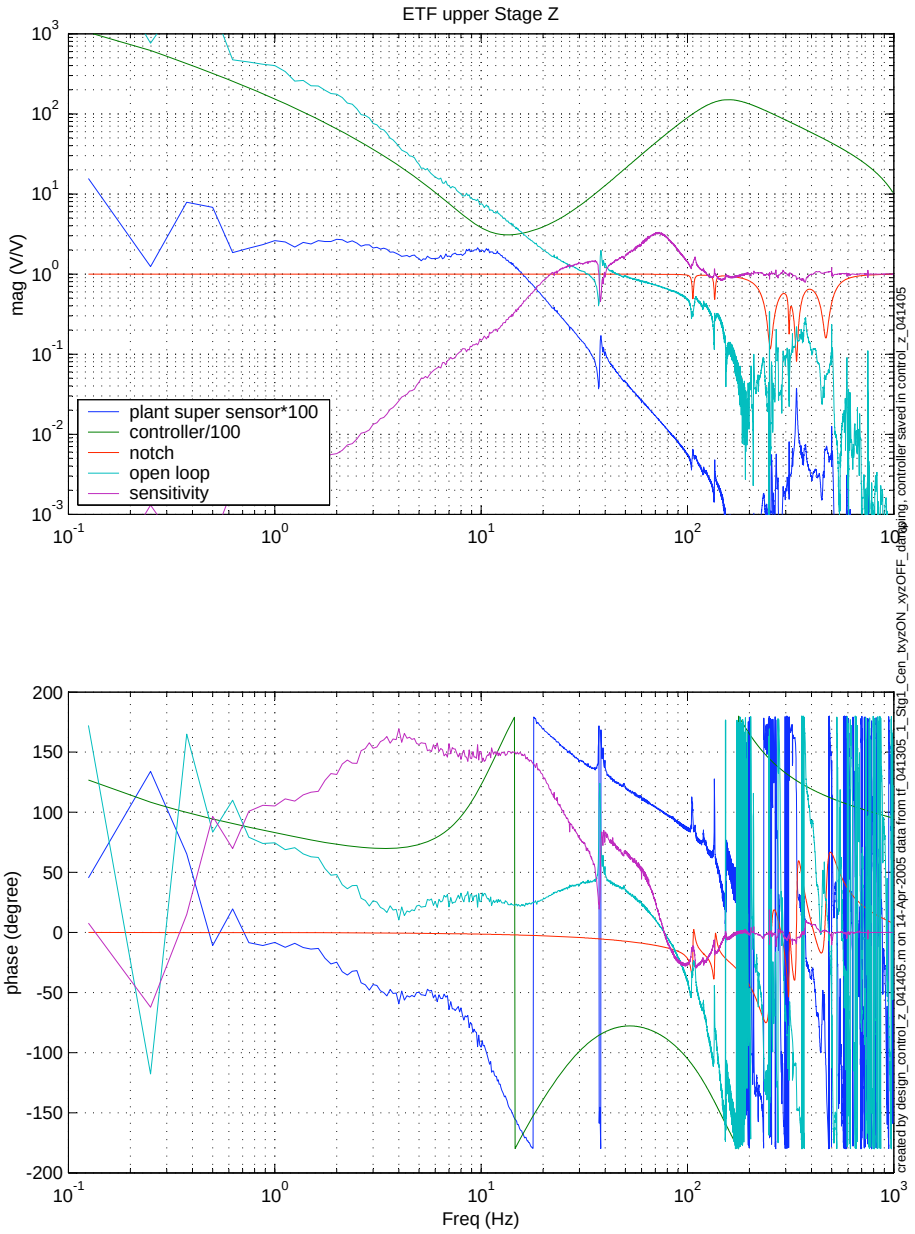
Conclusions

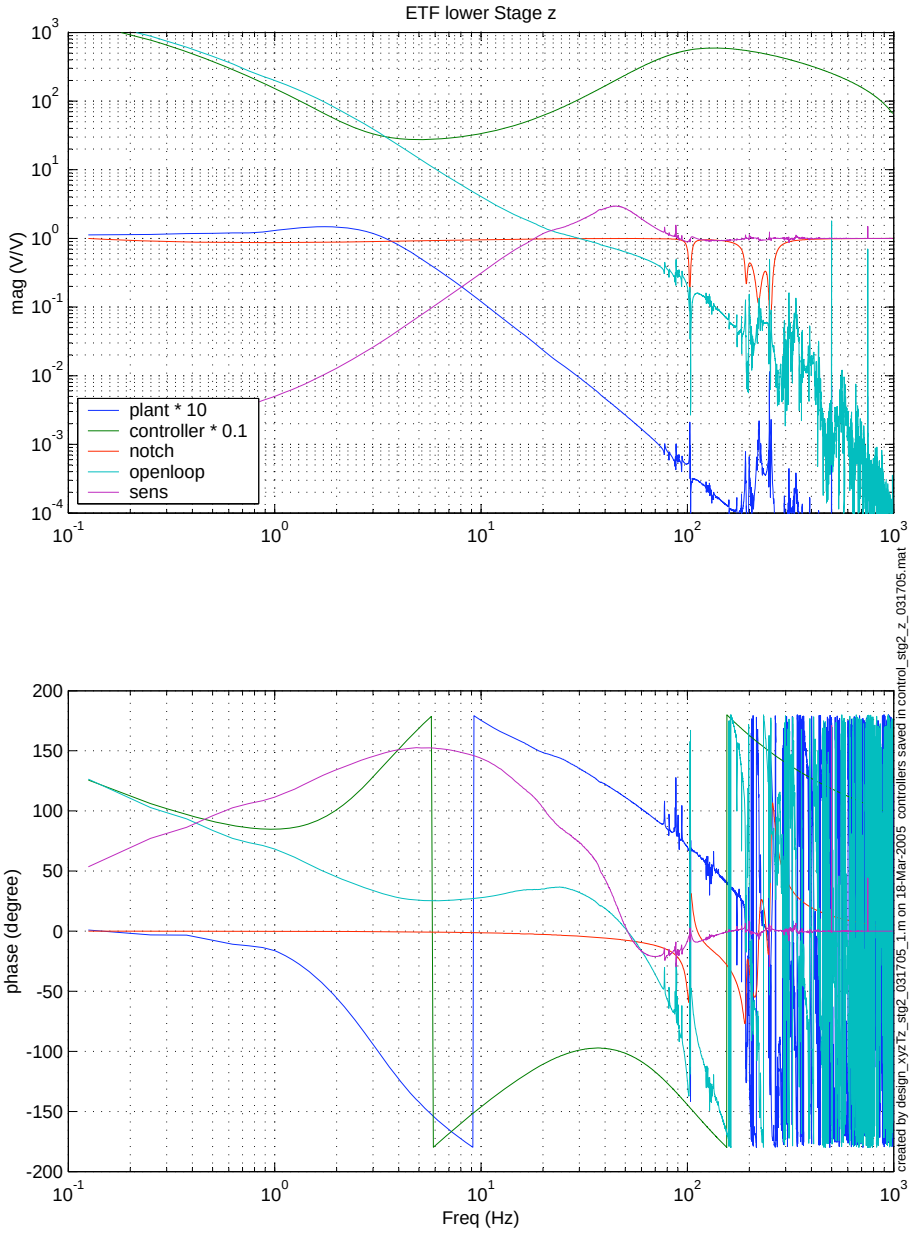
We should get about 2e-11 m/rtHz at 10 Hz (within x2),
which is much worse than the original req.

We can get about 3e-11 m/rtHz at 1 Hz,
which is about the same as the original req.
and the 1-10 Hz rms is small (~1e-10 meters)

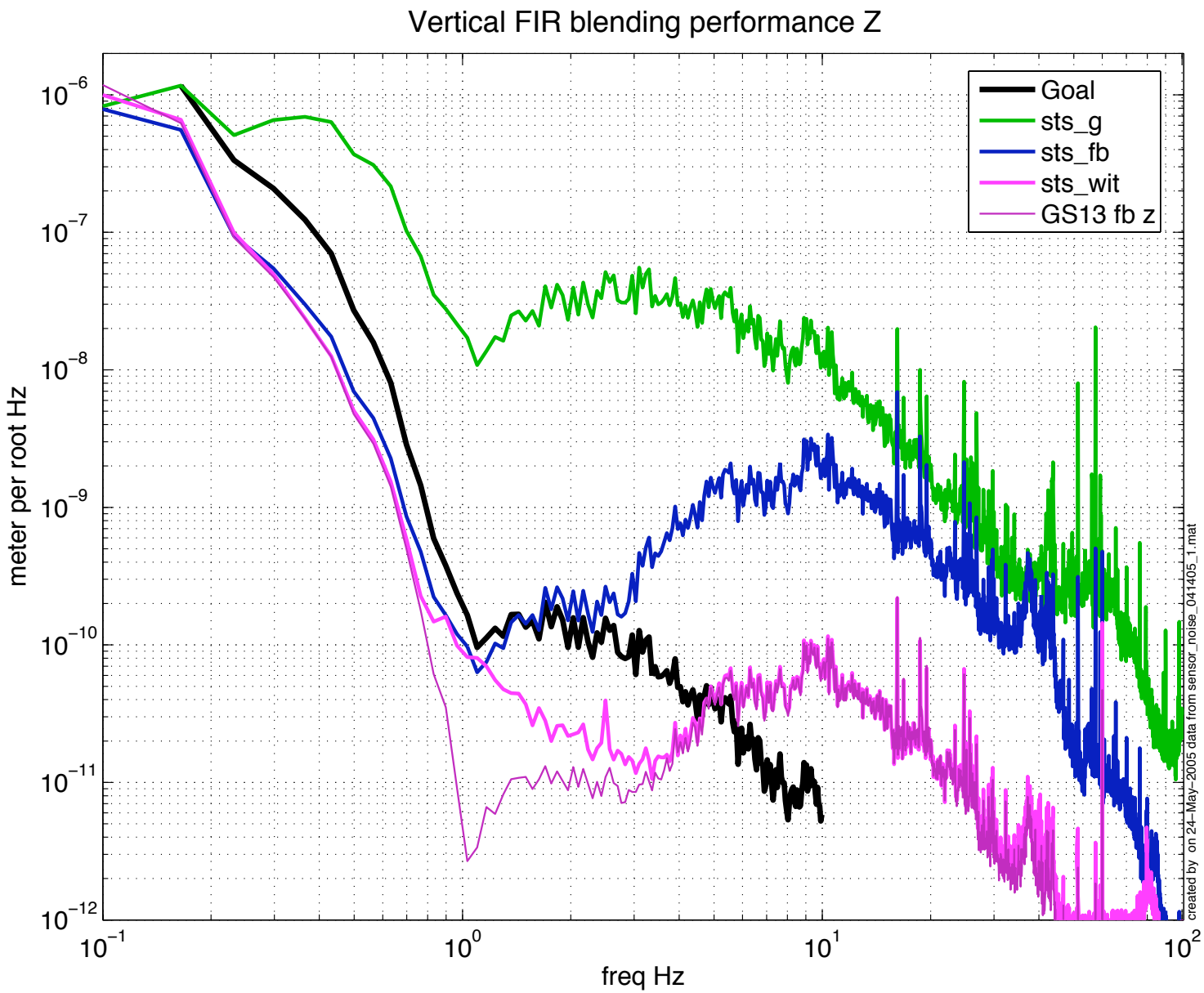
The single layer system is much simpler,
and probably rather cheaper.

ETF control for Z





ETF performance in Z



Sensor Performance