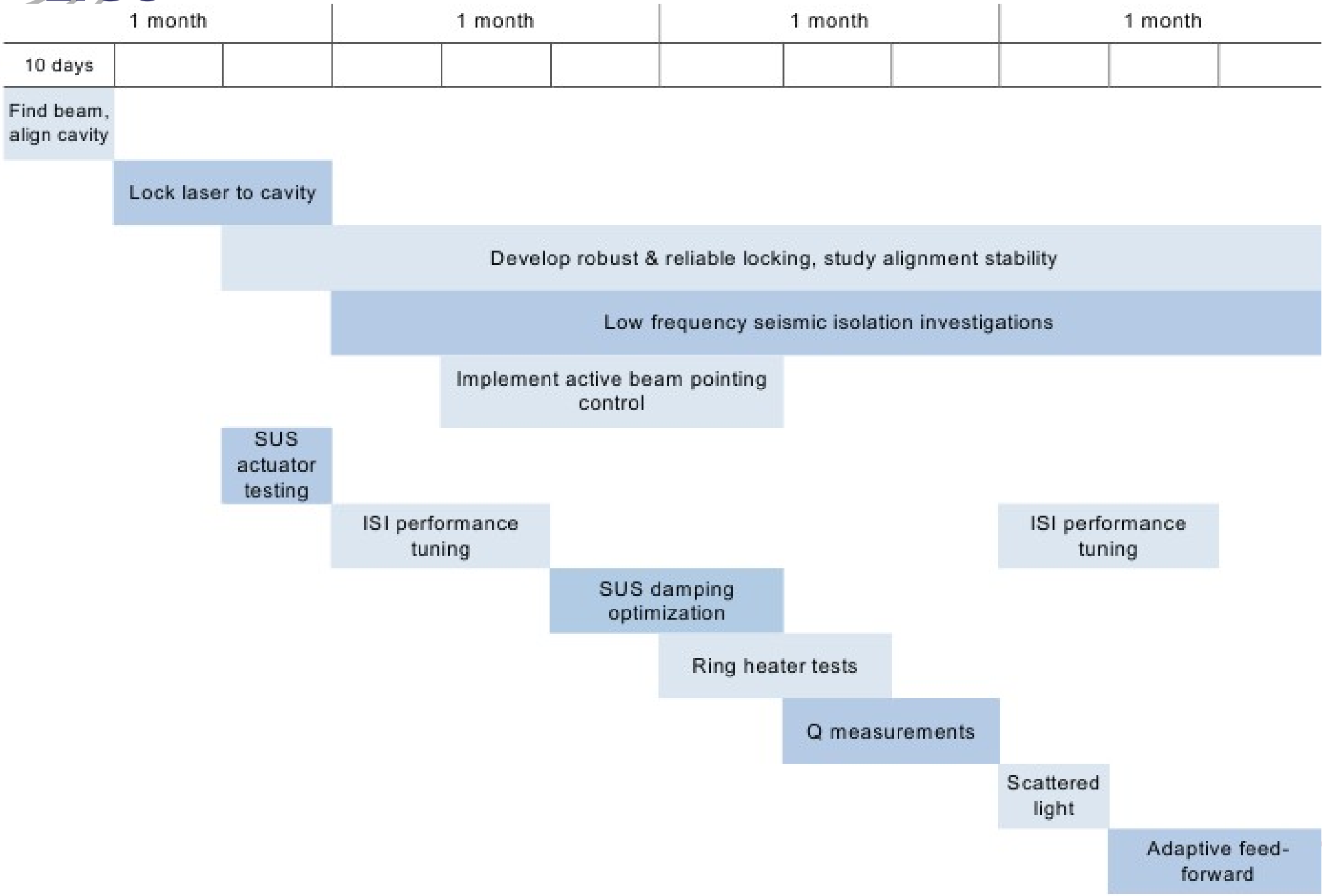
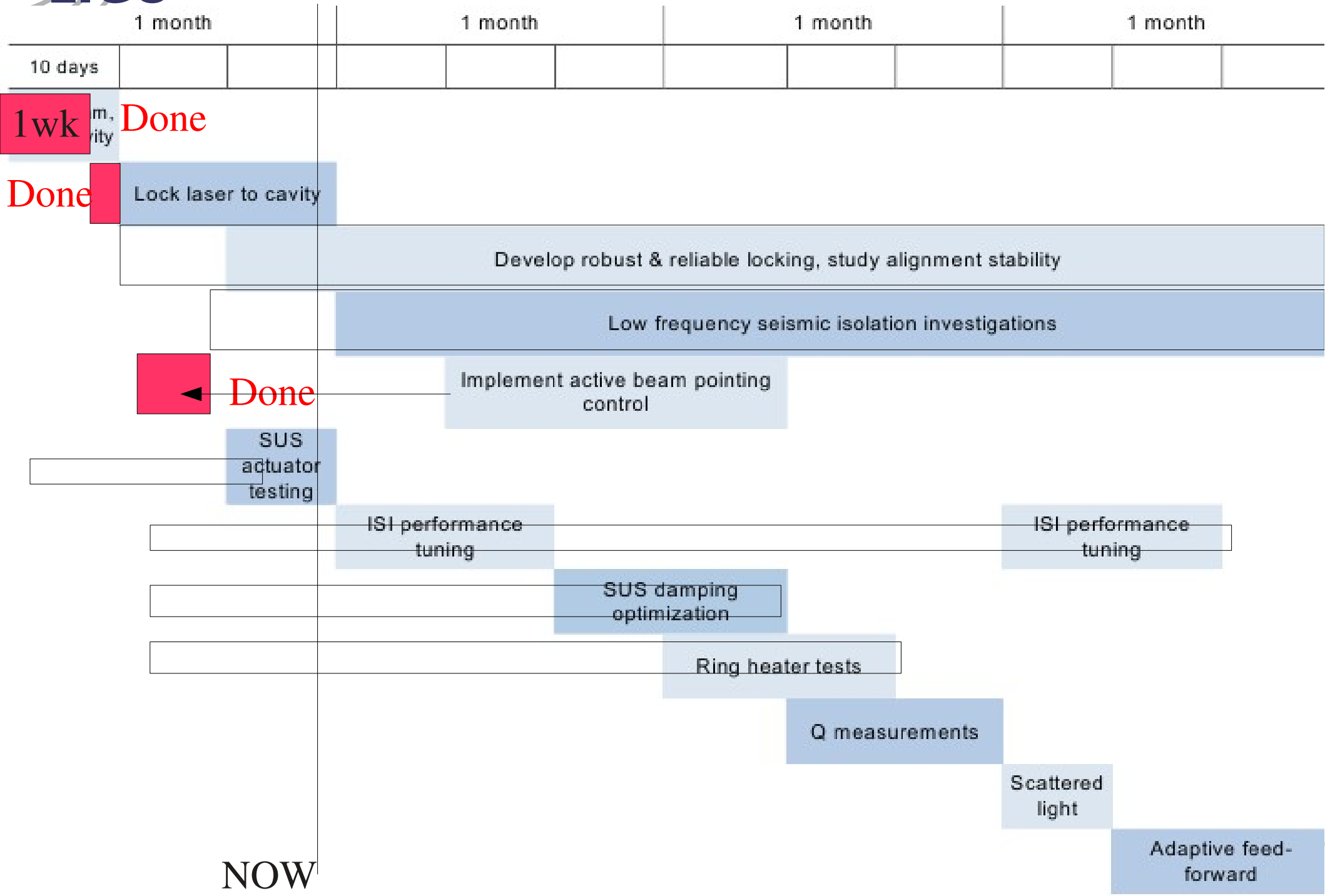
aLIGO One Arm Test Commissioning Update: So far, so good.

Kawabe + many people

Initially Proposed Straw Man (T1100080)



Reality

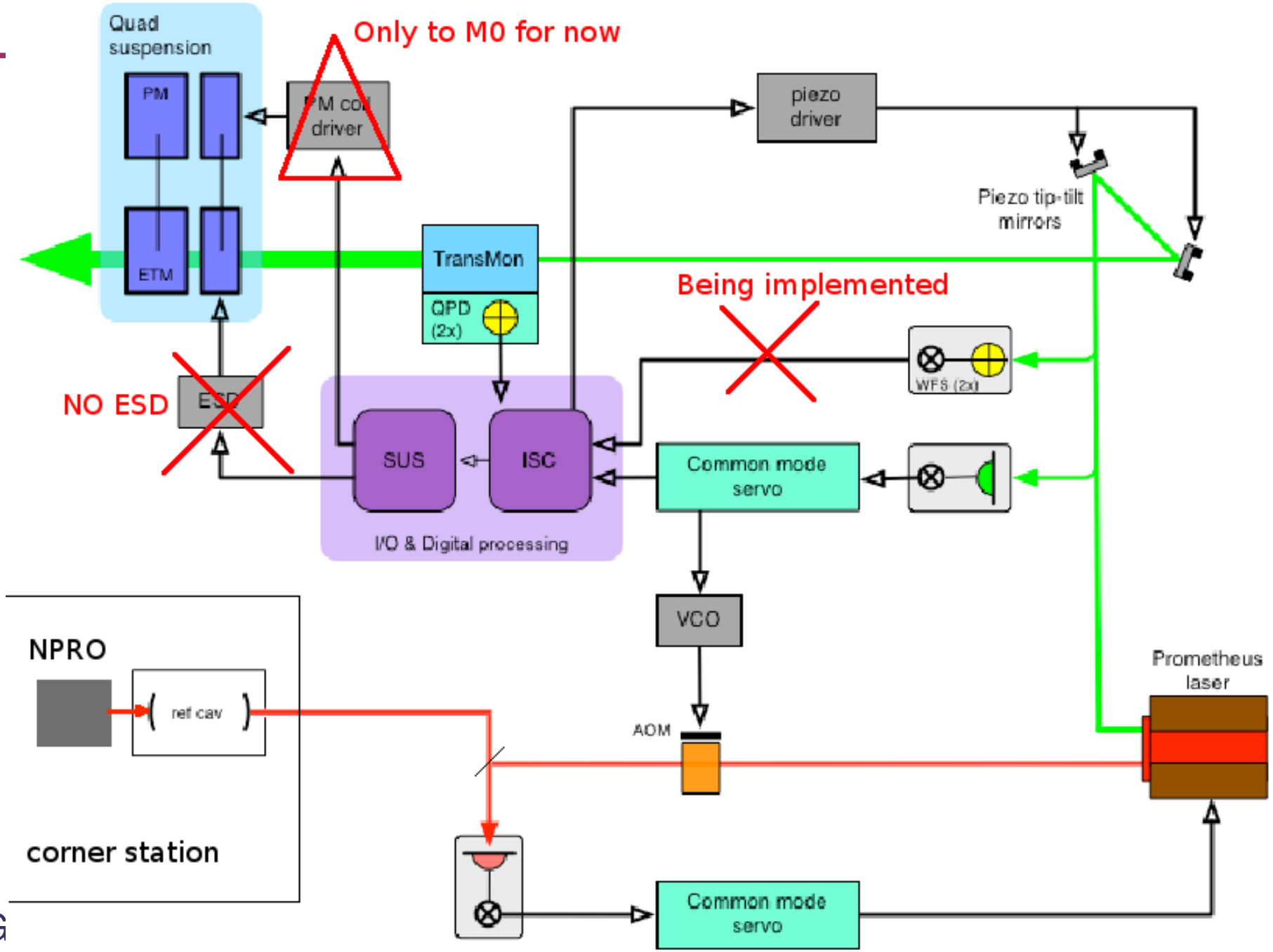

1 month
1 month
1 month
1 month
10 days
1wk
Done
Done
Lock laser to cavity
Develop robust & reliable locking, study alignment stability
Low frequency seismic isolation investigations
Done
Implement active beam pointing control
SUS actuator testing
ISI performance tuning
ISI performance tuning
SUS damping optimization
Ring heater tests
Q measurements
Scattered light
Adaptive feed-forward
NOW

LIGO

Initial alignment

- 2 days to shoot the beam down through the tube
- 5 additional days until the first lock
- Both baffle diodes and ccds are essential for alignment.
- Working PDH diode and demod are essential for alignment.
  - Use it instead of looking at the video for flashing, as you can't see it “flashing” until the laser is half-locked to the cavity.
- Working PLL is essential for alignment.
  - Free running freq. noise is large enough to make the PDH error blurry.

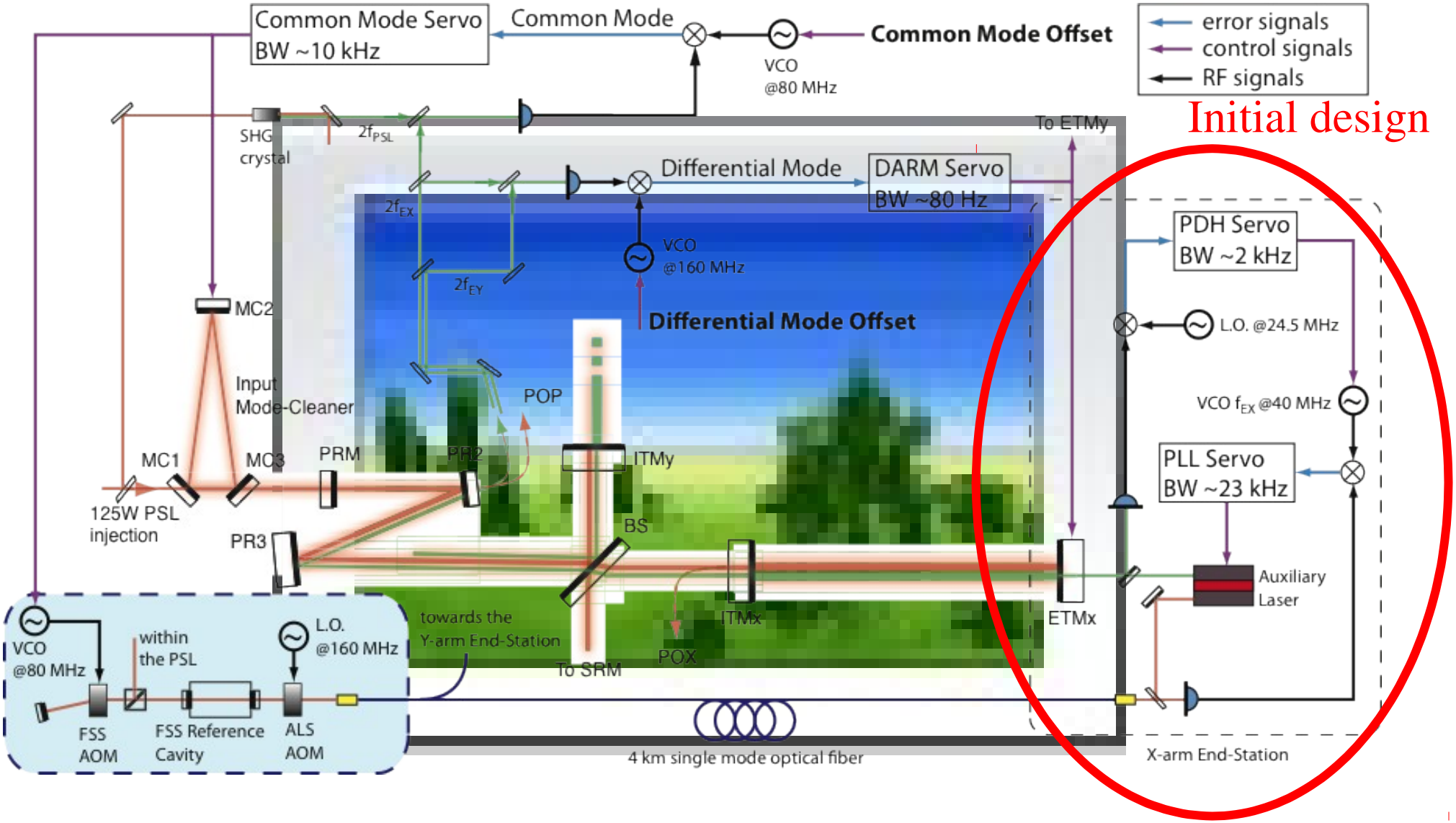
ISC: Almost everything works



LIGO

ISC Status

- PLL UGF: 22kHz (about the same as design)
- PDH UGF: about 12kHz (as opposed to 2kHz design)
- Cavity lock lasts for hours
- VCO offloading to ETM path for “slowing” cavity (M0-only and BW very small for now)
- Calibrated spectrum (more on this later, G1200752)
  - Very good length calibration using VCO
  - Noise dominated by TM vibration f<1.2 Hz or so (as opposed to f<0.5Hz initial estimate)



- PDH performance (BW~12kHz) better than design
- Gives more headroom for ALS comm and diff feedback

Quad Feedback

- ETMY Longitudinal-to-Pitch coupling mitigation.
- Longitudinal feedback (at the TOP) couples into small Pitch signal (inherent in the mechanical suspension).
- Filter design to reduce this coupling
  - Model shows 76 pole-zero pairs, this is to hard to implement.
  - Reducing pairs which cancel, less then 10% different and above ~3.5 Hz.
- Work in progress.

LIGO

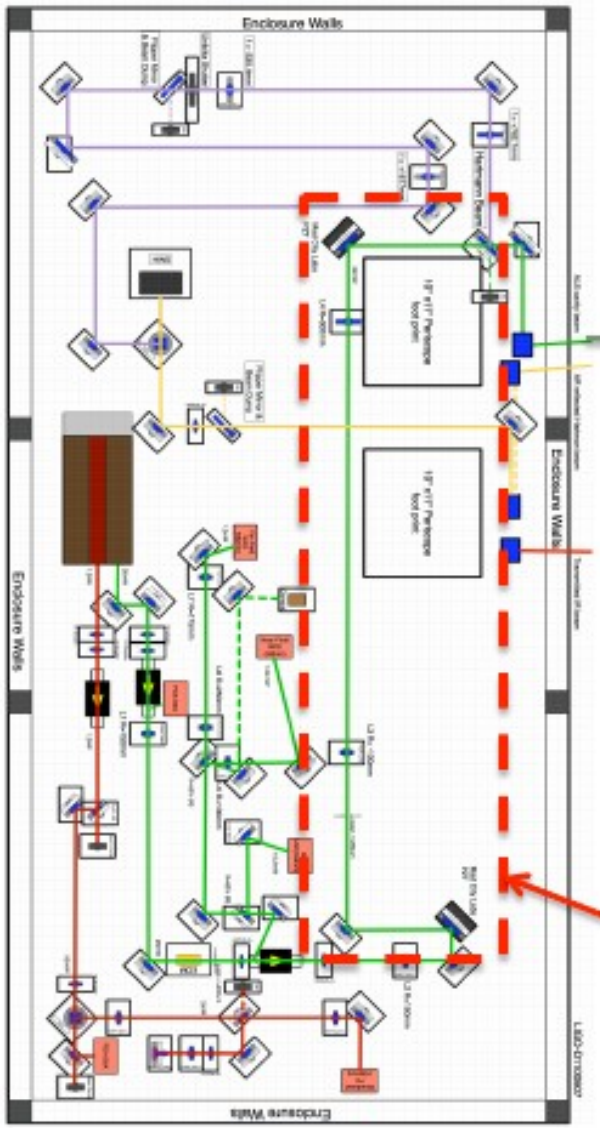
ISC Status 2

- Active pointing control was implemented
  - Open loop pointing error meets the spec (Stochino)
- Fringe visibility of REFL 50-60%
- WFS as a sensor is being implemented
  - Gouy telescope redone (initial design produced tiny beam)
  - Possibility of control later
- Slow control (Beckhoff, OPC)
  - Most of the things work
  - No automation yet (auto locker for PLL and PDH)
  - OPC-EPICS translation issues being investigated

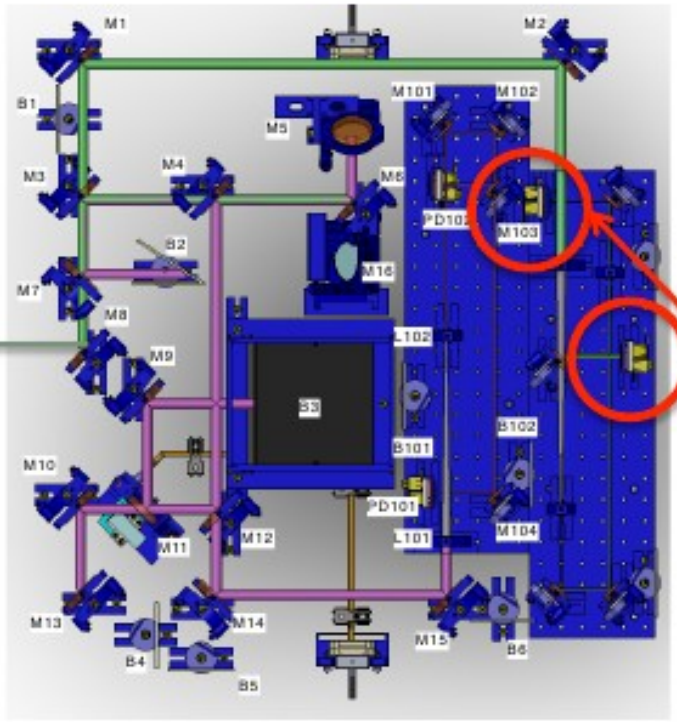
TMS table displacement with respect to ALS beam

Australian National University

ALS Table

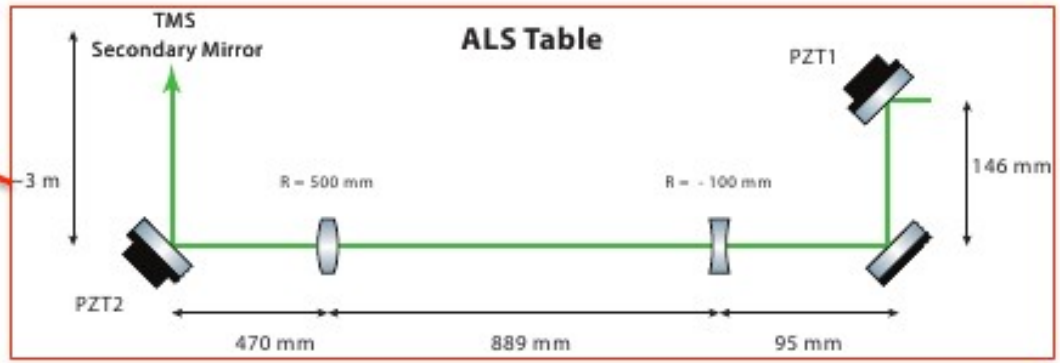


TMS Table

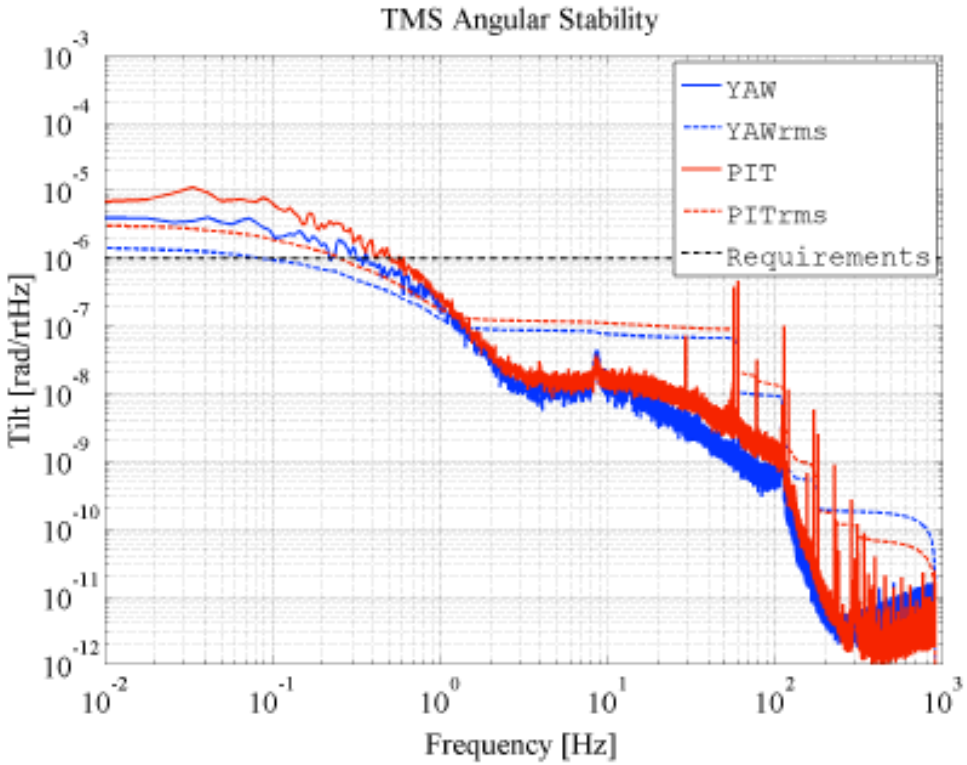


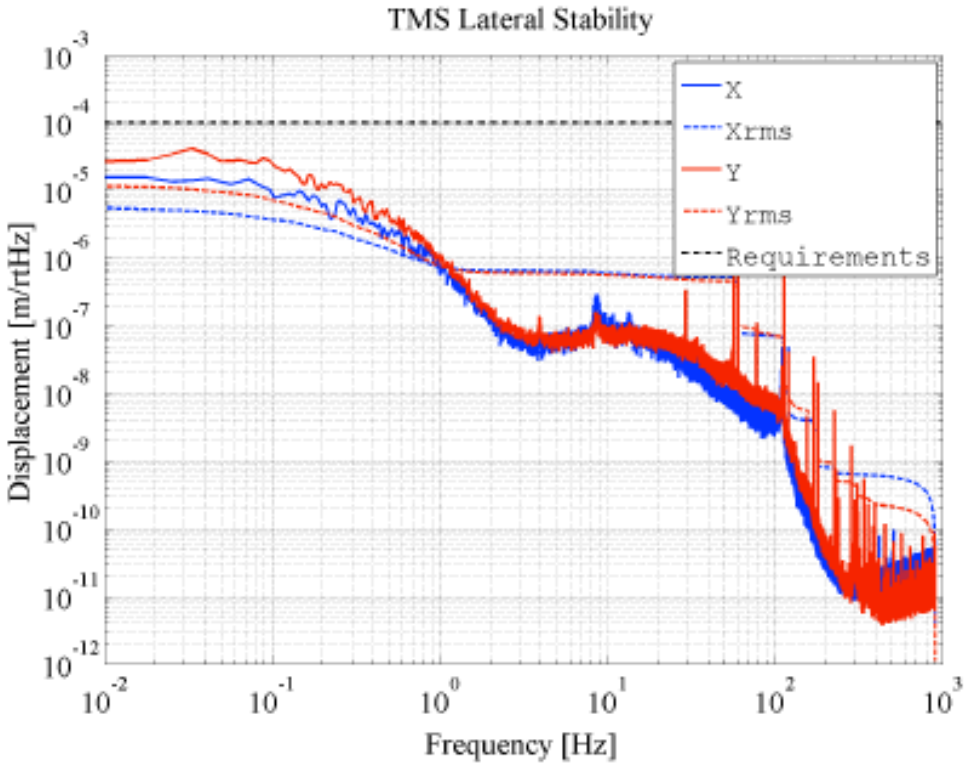
- QPD-PZT loops closed (UGF ~ 10 Hz)
- Measured PZT displacement
- Derived table-beam relative displacements through ALS table ABCD matrix

QPDS



Australian National University





Note: data is the equivalent OPEN LOOP ERROR, and the requirement is for CLOSED LOOP. UGF=10Hz, so it looks like both angle and displacement already meets the requirements.

LIGO

SUS

- Damping characterization/optimization effort.
  - Plot by Kissel
  - Spec-wise, long way to go: IY-EY < 10nm rms for f<0.5Hz with slow signal from PDH offloaded to EY
- Length-PIT actuation decoupling effort.
- Sensing diagonalization effort.

SEI

- Some trouble in ISI isolation.
  - Need a better high freq. (e.g. 1Hz) performance
- See Vincent/Fabrice's presentation.
- Despite these, we're already close to low frequency spec (IY-EY<250 nm rms w/o global feedback).

TCS

- See Aidan's presentation.