

# ISS second loop update

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# Why we needed a new one:

## Shortcomings of the original 2<sup>nd</sup> loop

- Didn't allow us to change power after it is engaged.
  - Need AC coupling.
- Horrible ad-hoc hack job for the 3<sup>rd</sup> loop against  $dP/d\theta$  instability.
  - Need for a proper built-in support for the 3<sup>rd</sup> loop.
- Design document for a new one by Gabrielle:  
[T1600064](#)

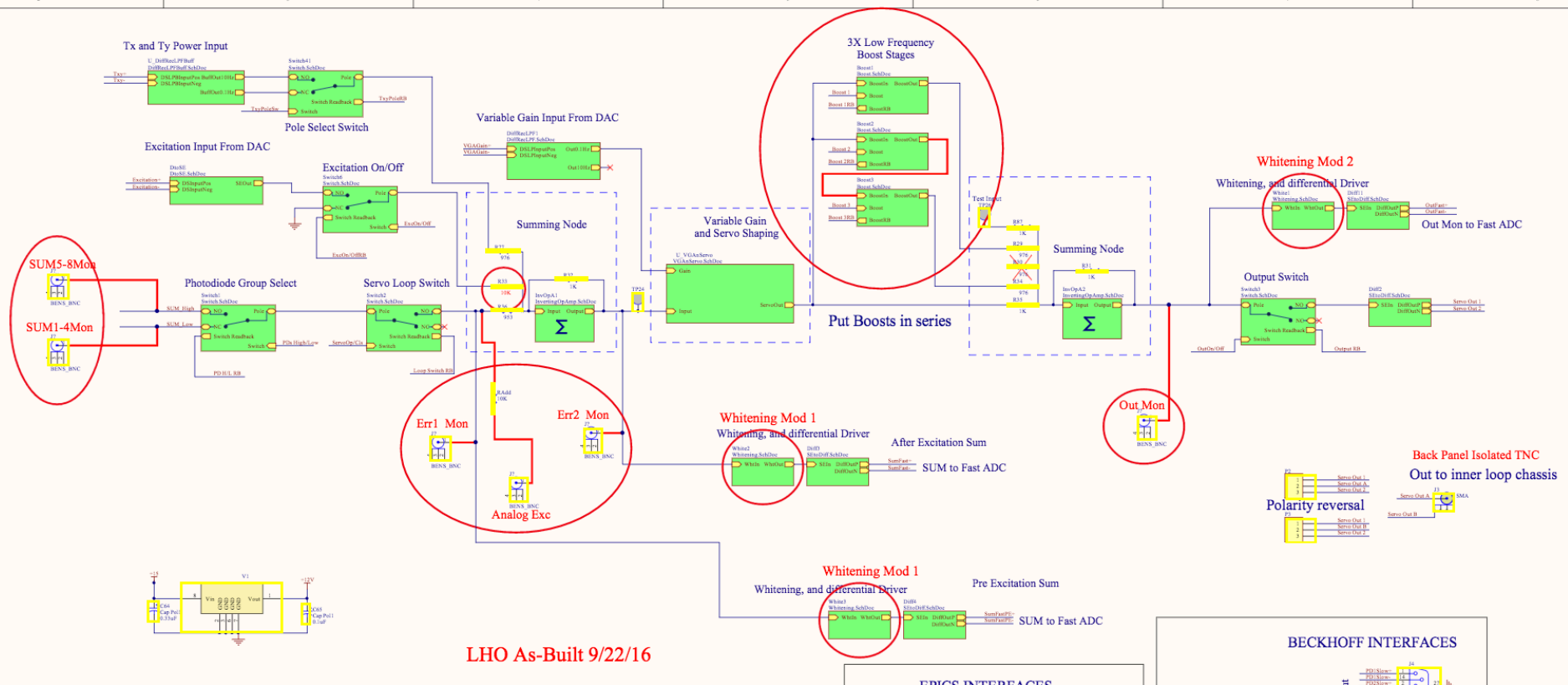
# New board (after LOTS of mods)

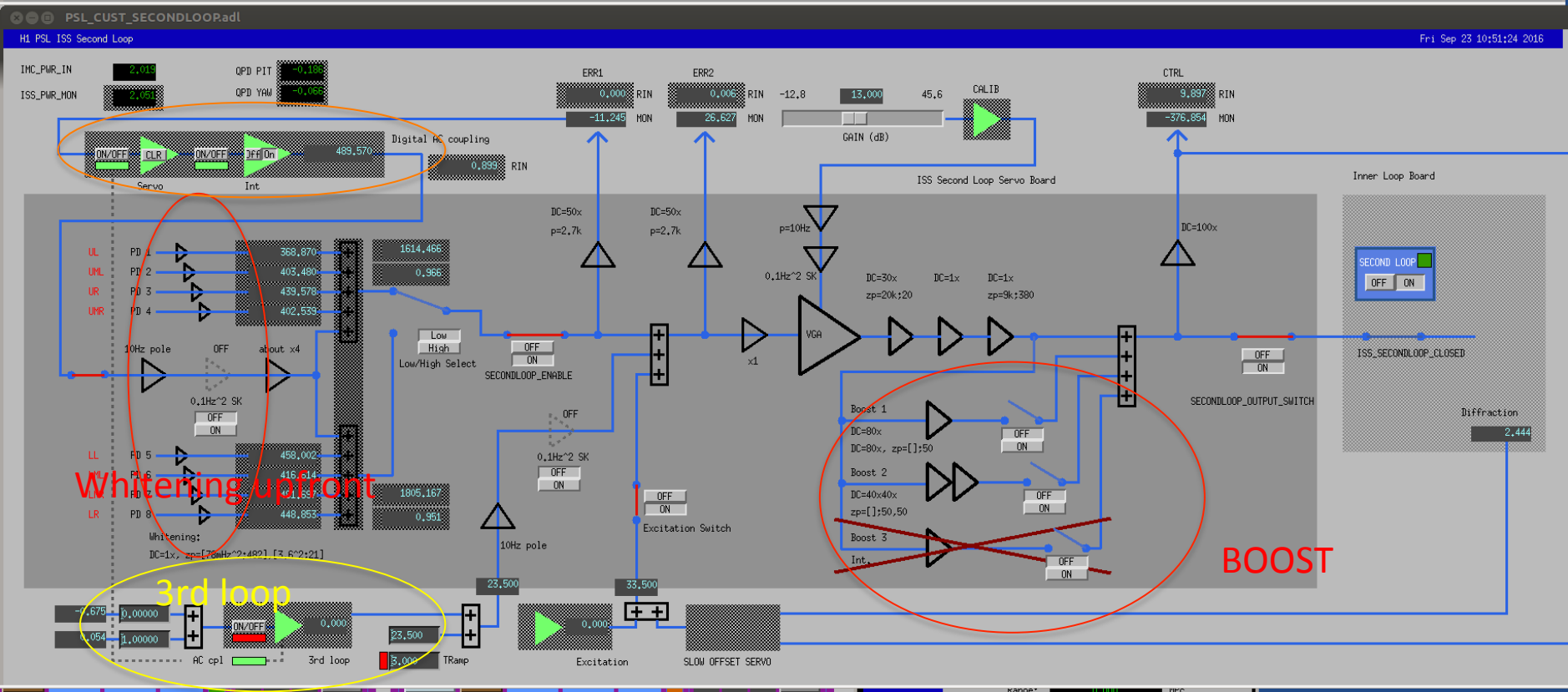
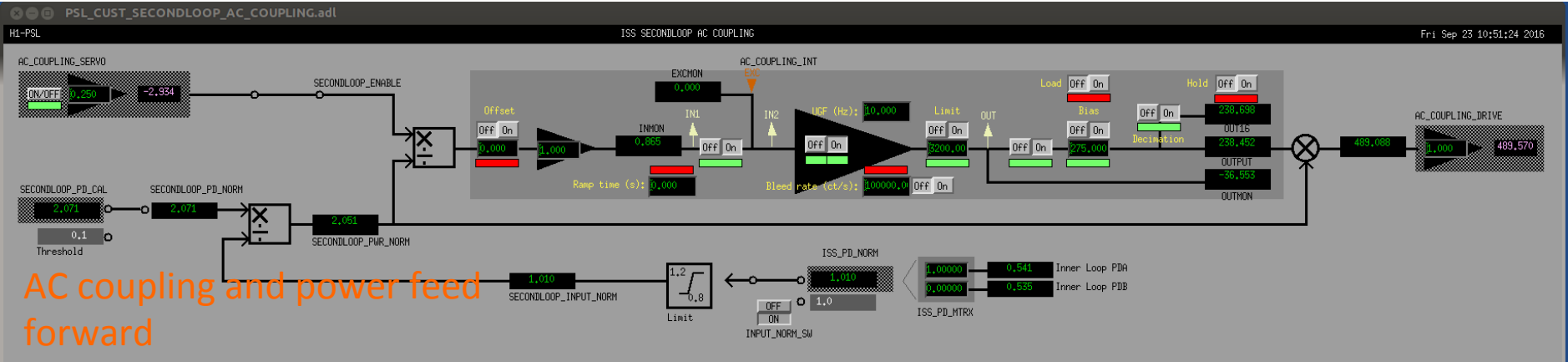
- Drawings updated by Ben: [D1600298](#) and [D1600193](#)
- AD797 shall not be used
- 1<sup>st</sup>-loop style whitening upfront in 2<sup>nd</sup> loop PD,  $zp=[78\text{mHz};482],[3.6^2;21]$
- Some gain reshuffling so nothing saturate.
- Usable boosts.
- Test points available on the front panel.
- 40dB suppression at 1kHz, UGF~20kHz.



## Servo board mod:

- Add lots of analog test points on the front panel
- Reshuffle gains, zeros and poles for noise and saturation reasons
- Usable boost
- No “whitening” on the monitor point whitening because the signals are already whitened.
- Diff out should go to isolated connector.

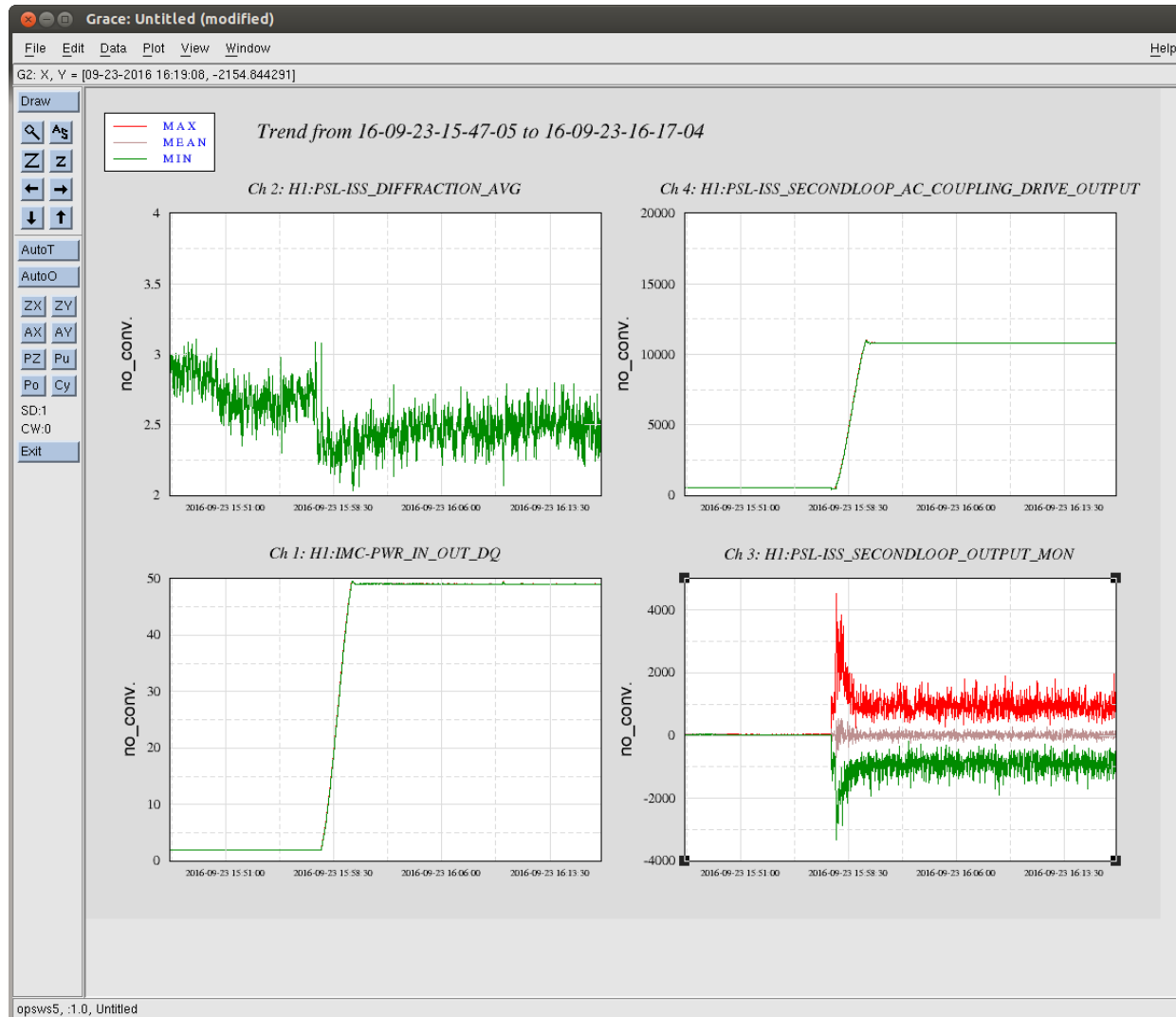




2<sup>nd</sup> loop is always ON after MC is locked.

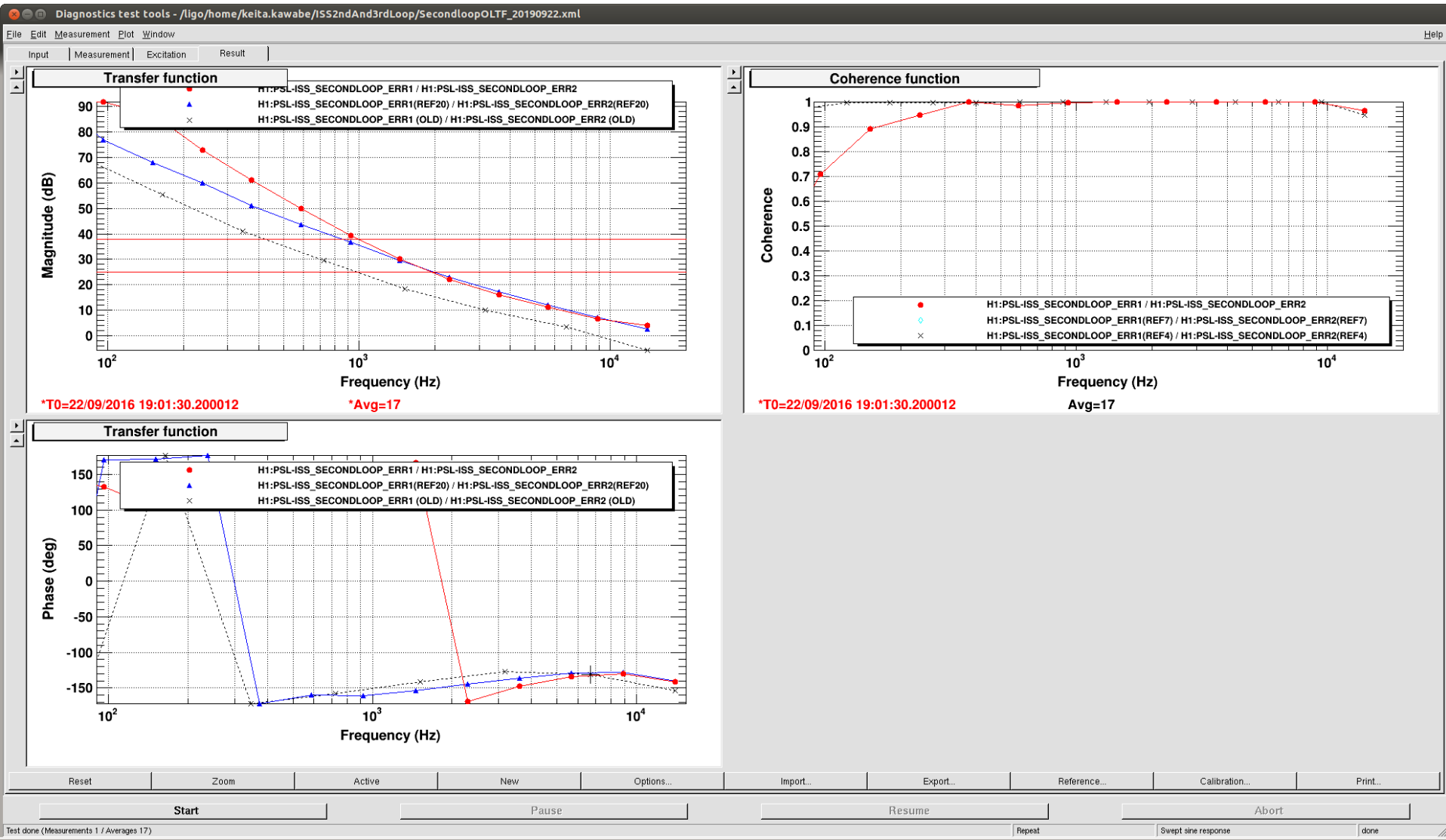
- No modification for auto-locker.
- Guardian(s) should do the following:
  - Switch off 2<sup>nd</sup> loop, disable boosts, and enable AC coupling when MC unlocks.
  - Enable 2<sup>nd</sup> loop and make sure that AC coupling is ON when MC locks.
  - At the end of power up process, should disable the AC coupling, turn off power scaling FF, and turn boosts on.

# Powering up with 2<sup>nd</sup> loop AC coupled

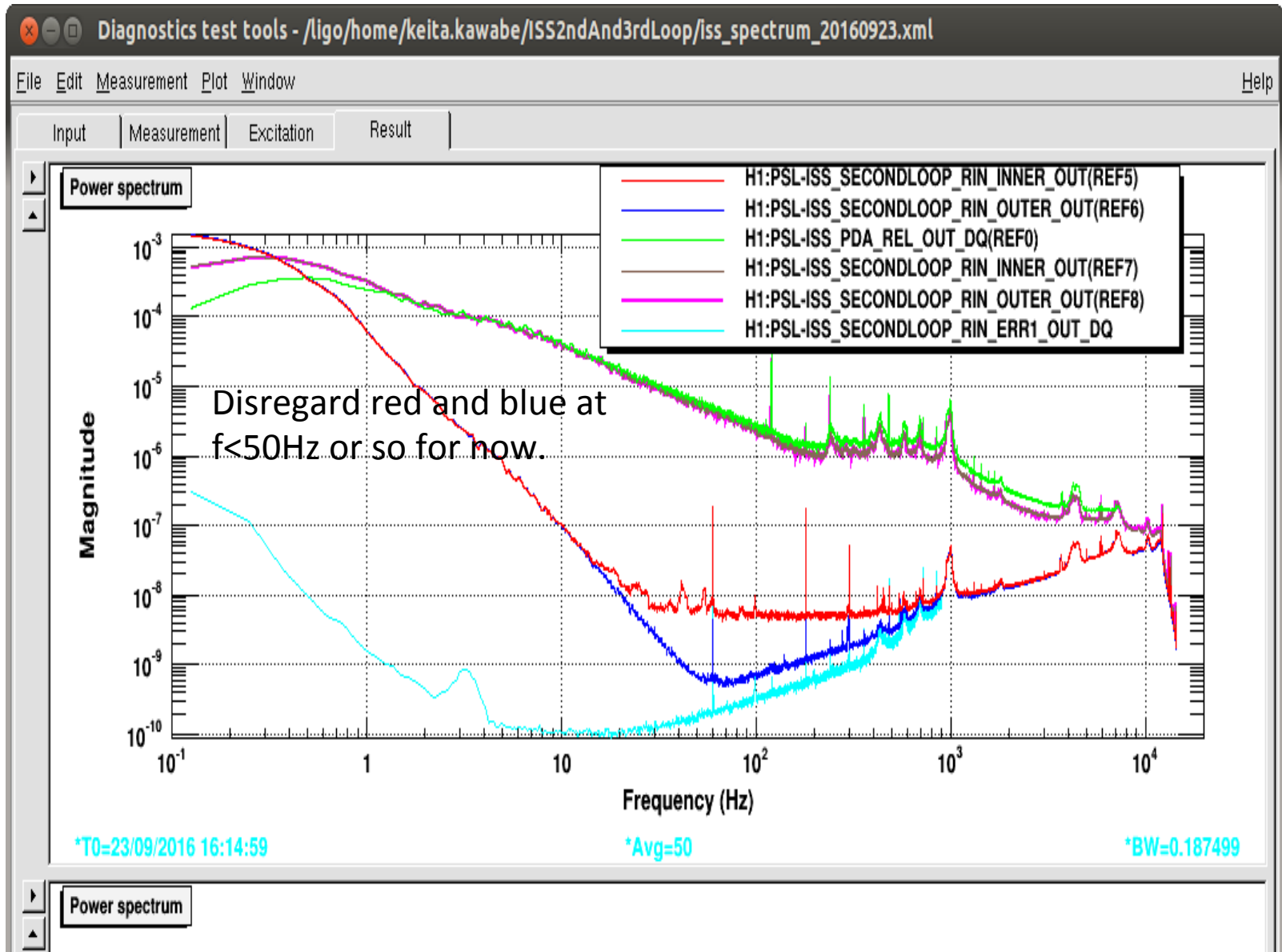




# OLTF



# Noise at 50W

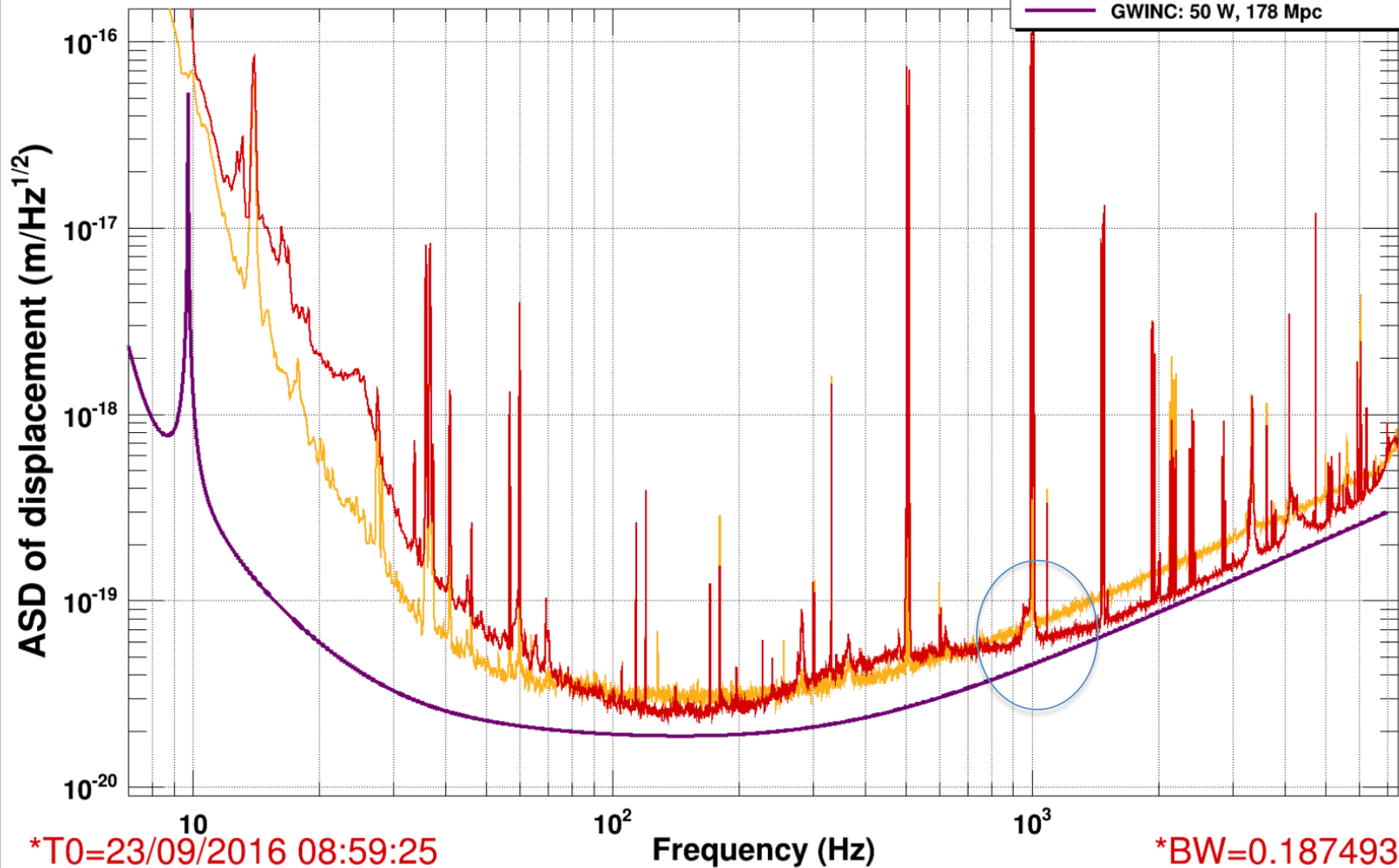


# Changes in the iss model

- ISS, second loop, and third loop are all common library parts.
- Some channel assignment change.
- Inner loop ISS parameters that only represent binary status (ON/OFF) are now binary (0 or 1) instead of 16bit integer (-32000 etc.)
  - [E1600204](#)
  - Needs some change in guardian as well as medm (done at LHO).

# ISS Summary

- ISS performance is probably already adequate.
- Jitter is totally different but related problem.
- Some of the major structures come from HPO itself, not in intensity but in jitter.
  - TBD: See if the measured jitter at various QPD sensors are compatible with DBB measurements for HPO.

**aLIGO DARM**

Reset Zoom Active New Options... Import... Export... Reference... Calibration... Print...

Start

Pause

Resume

Abort

# DBB – relative pointing noise

noisereport

