ASC Noise Budgeting for LLO

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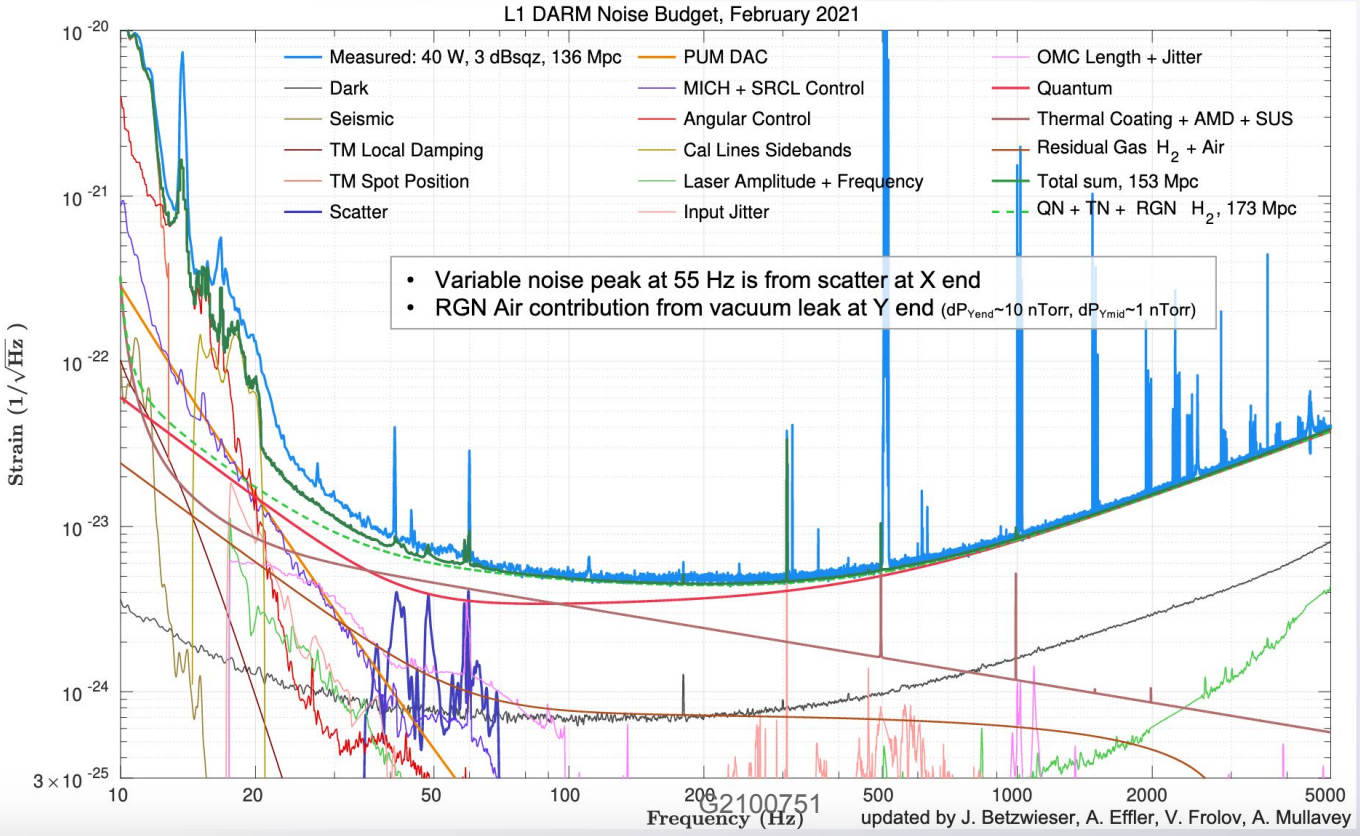
LF workshop, April 6 2021

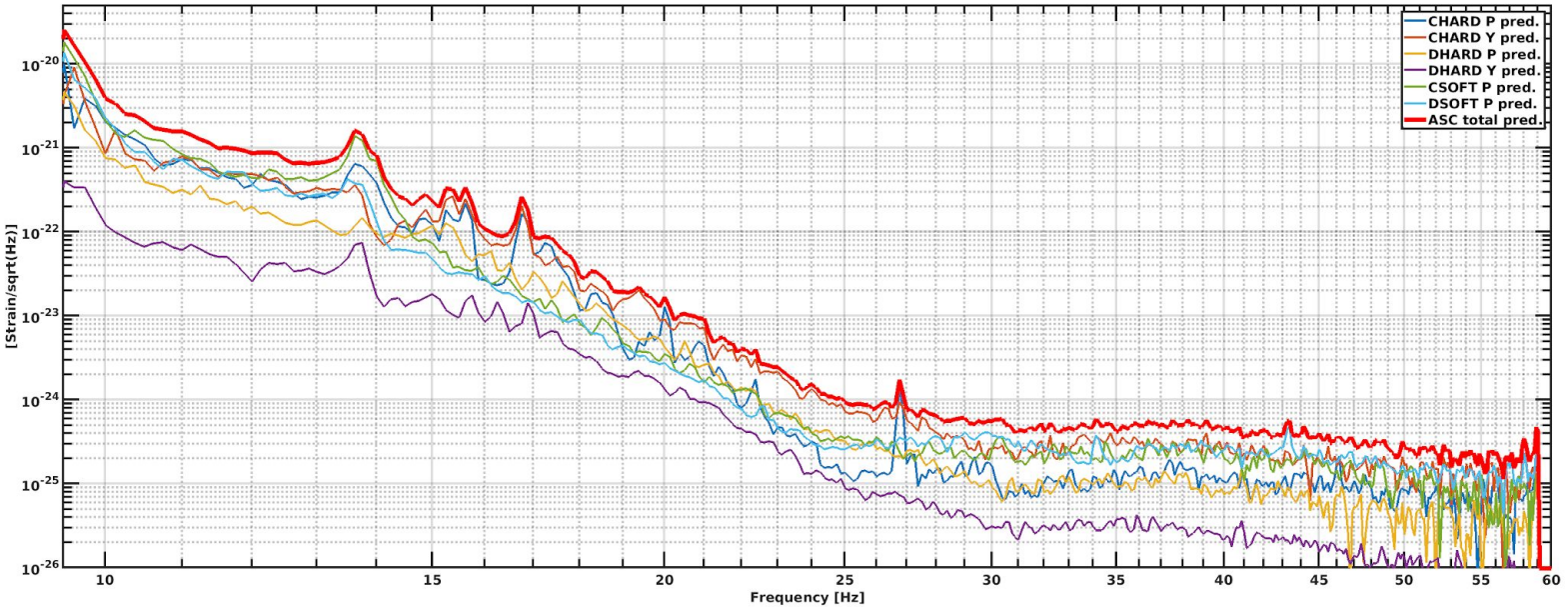
ASC contribution to DARM

L1 Noise Budget



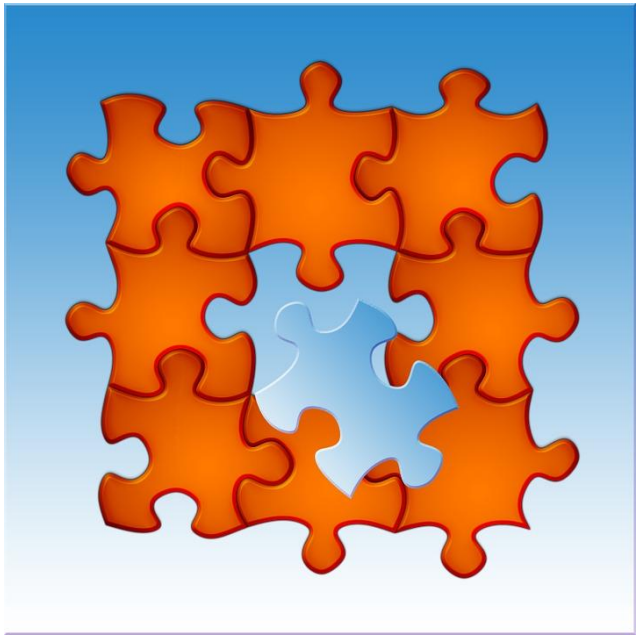
ASC to DARM

From last Noise Budget February 2021



ASC Noise Budget new version!

- No Simulink model, all matlab scripts
- More flexible, easier to fix!

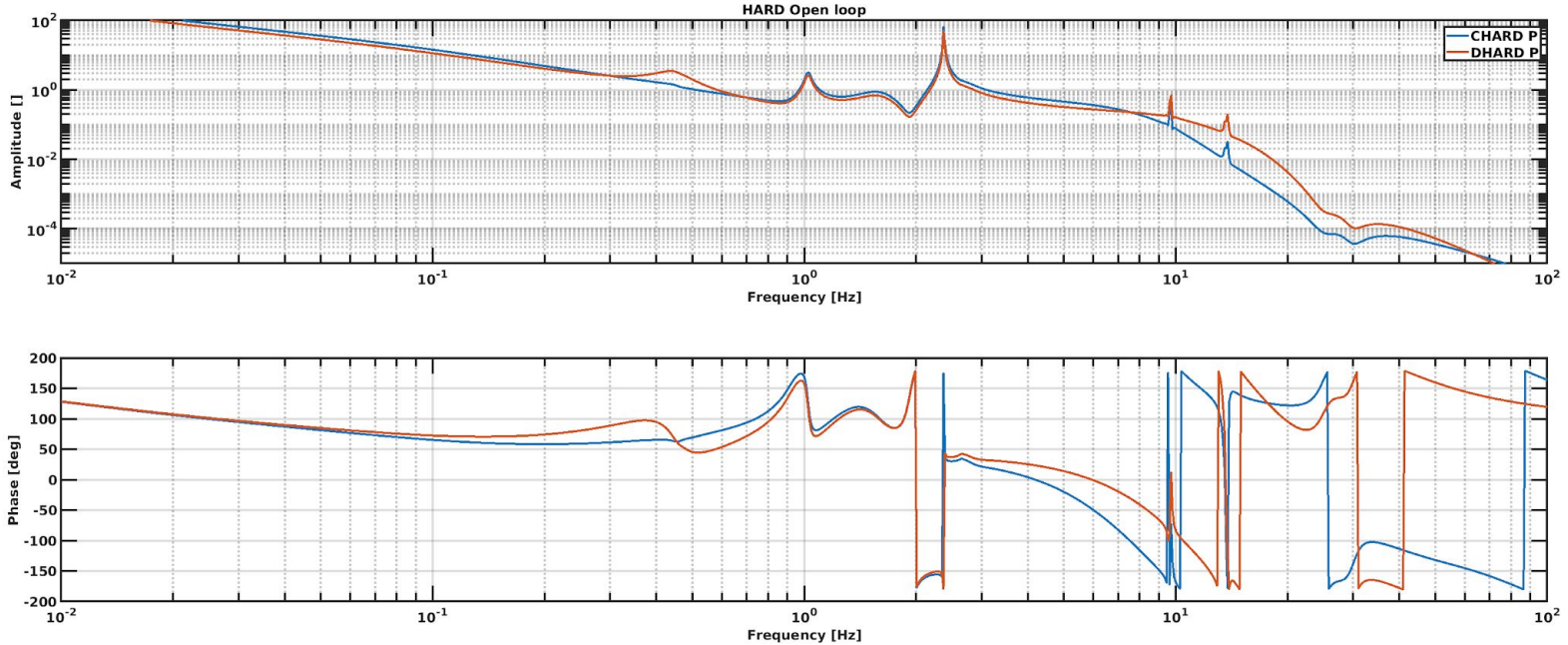


- Use Wiener filtering to get ideas of coupling
- Then include the couplings into the NB

- Today focus on CHARD P and DHARD P
- Others DOF should be “easy” to integrate now :-)

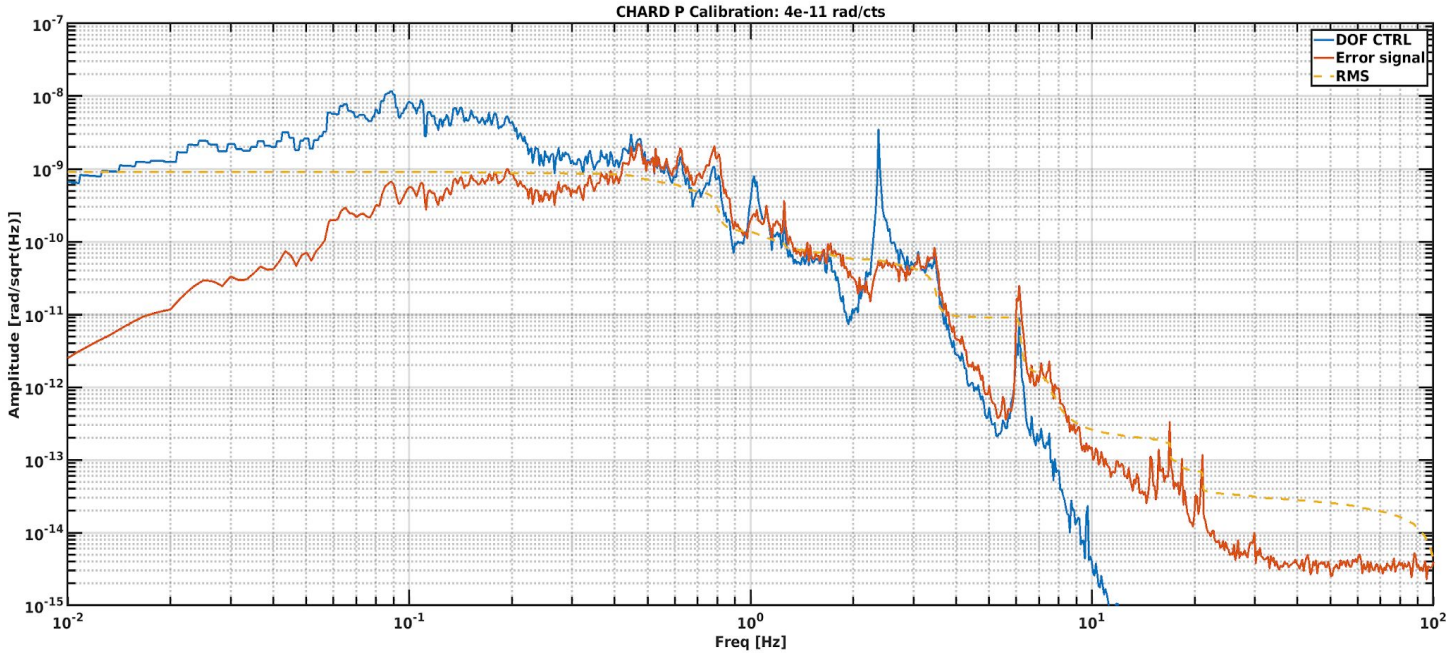
Open Loop Gains

Pin = 40W
Parms = 230 kW



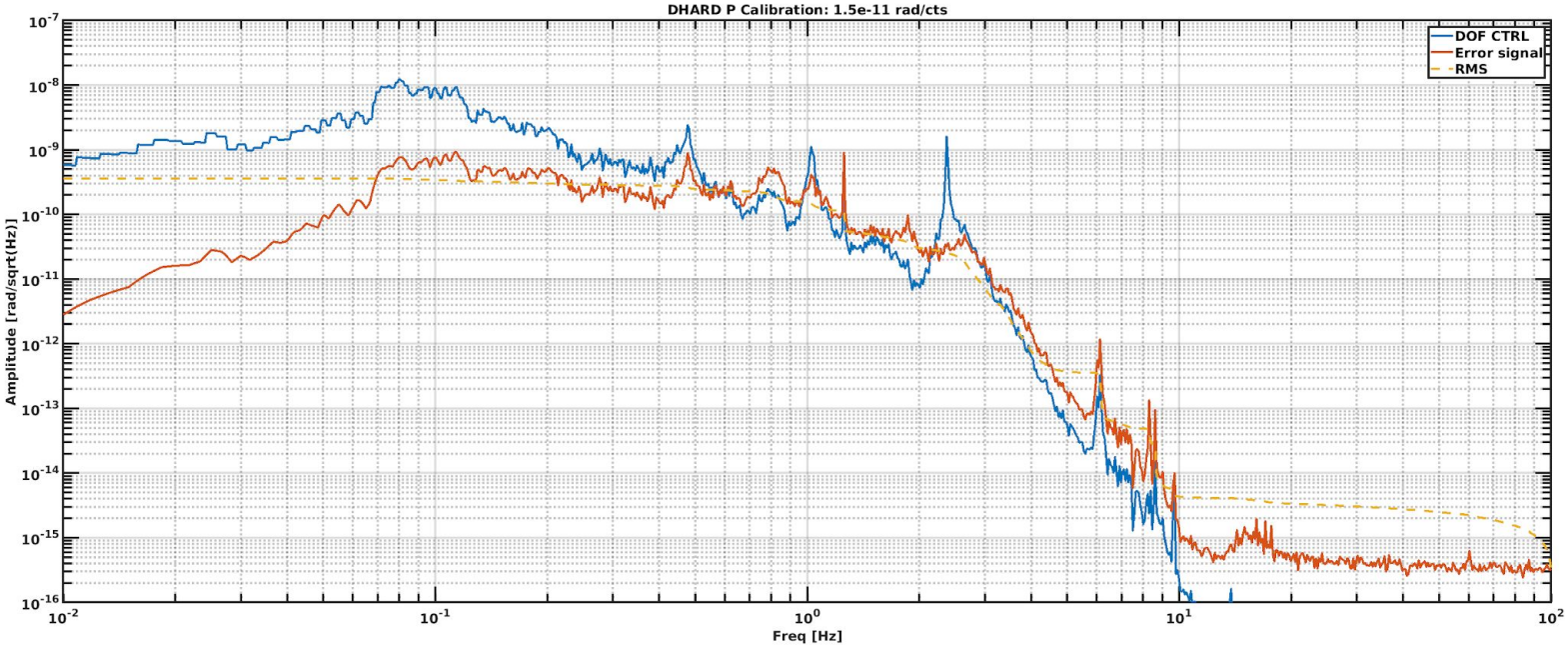
- The UGF is around 3 Hz for both loops.
- CHARD phase margin is 22 deg
- DHARD P is 35 deg

Calibration of ASC signals



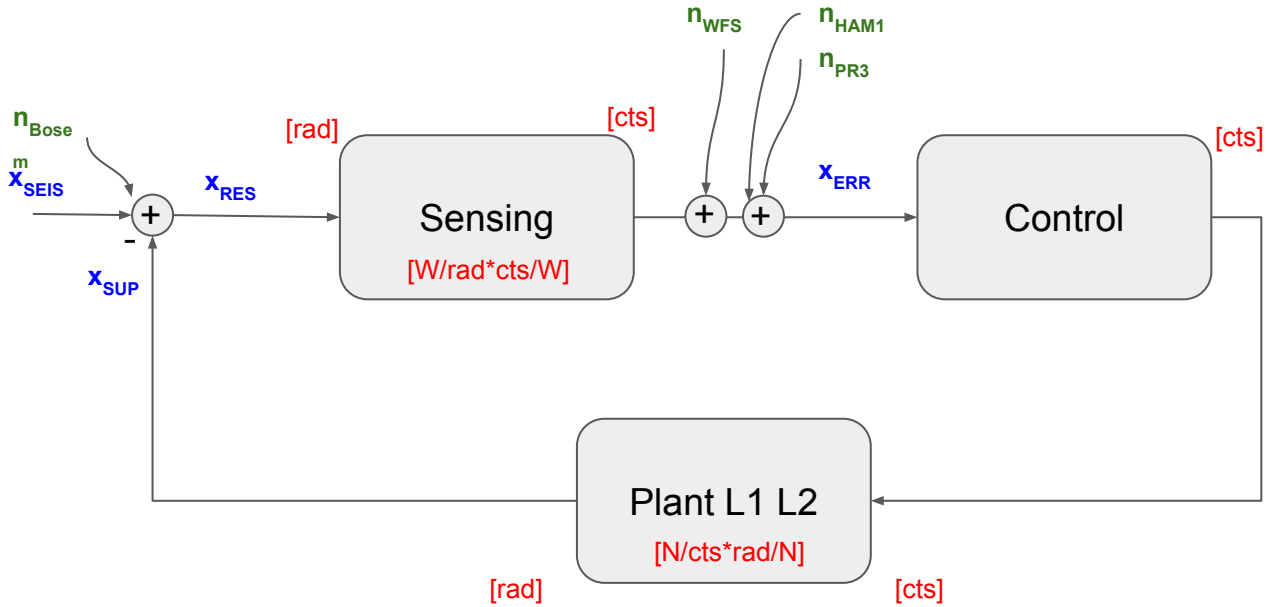
Cumulated RMS of error signal = 1 nrad

Calibration of ASC signals



Cumulated RMS of error signal = 0.4 nrad

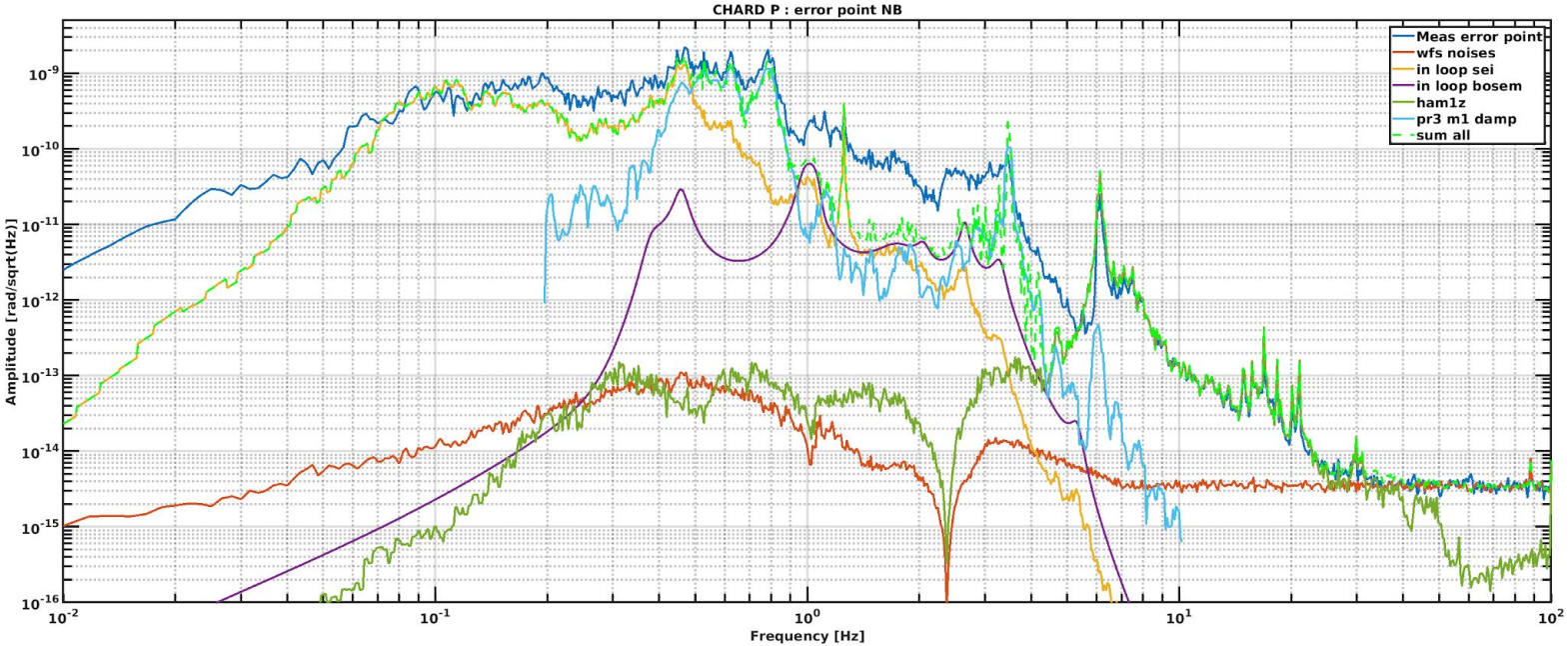
Closed Loop description



Error signal: $X_{ERR} = 1/(1+SCP)[S*X_{SEI} + S*n_{BOSEM} + (n_{WFS} + n_{HAM1} + n_{PR3})]$

Residual motion: $X_{RES} = 1/(1+SCP)[X_{SEI} + n_{BOSEM} - (n_{WFS} + n_{HAM1} + n_{PR3})*CP]$

CHARD Noise Budget

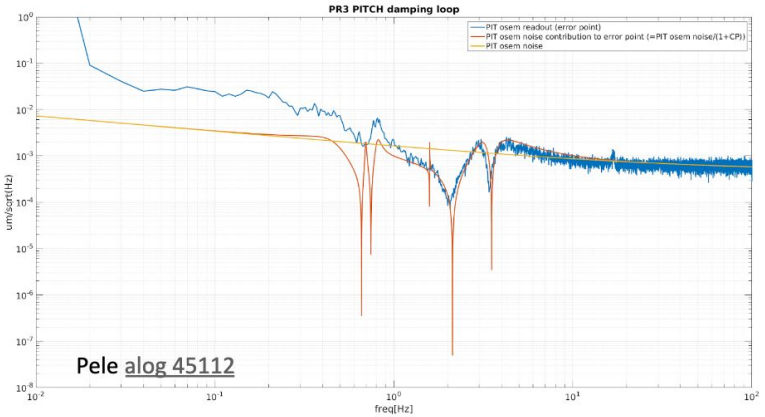


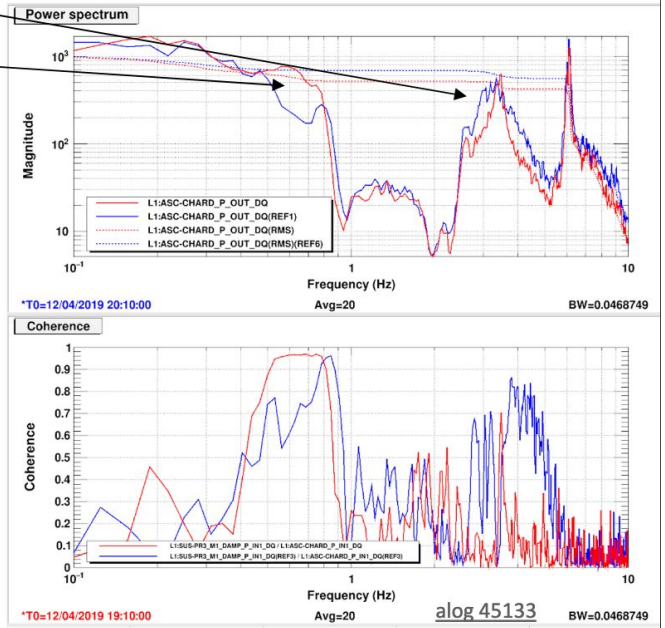
- HAM1 Z is making noise in REFL WFS from 6 to 30 Hz
- PR3 damping makes noise at 3.5 Hz and 0.5-0.8 Hz
- Unexplained noise source between 1 and 3 Hz

PR3 damping

Reducing the P gain reduces noise impressed on CHARD

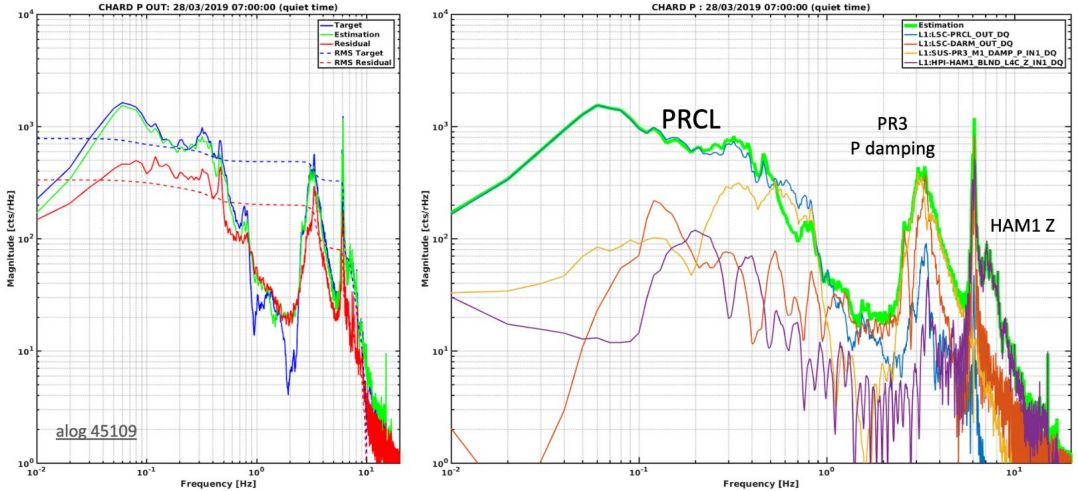
Need to tune the damping filter to avoid reinjection <1Hz



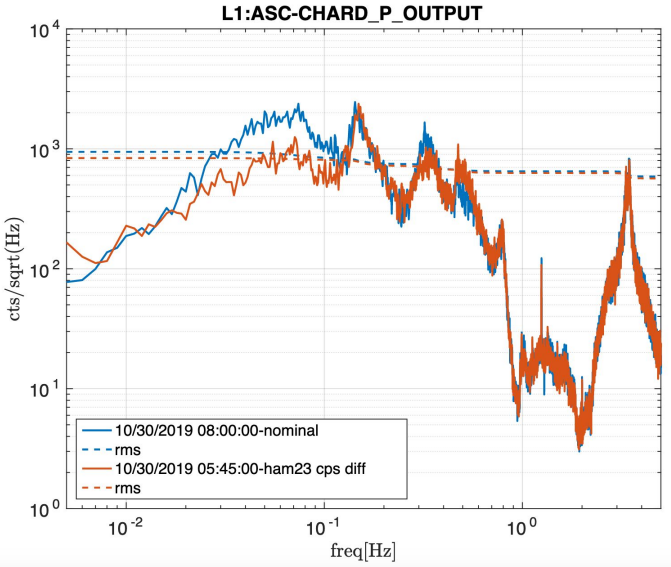


STILL ON THE TO DO LIST!

PRCL noise reduced by HAM23 CPS diff

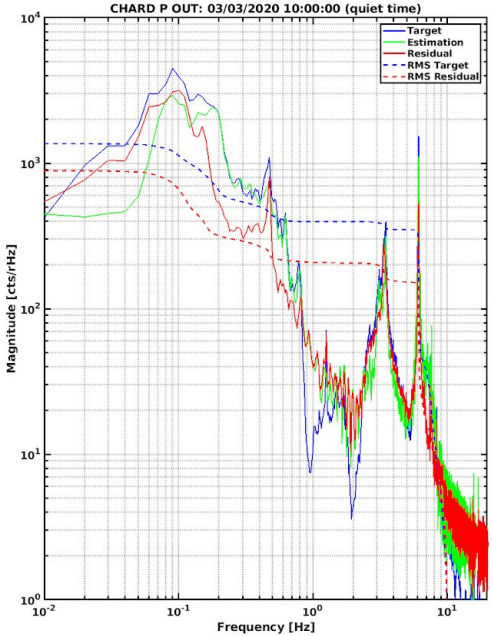


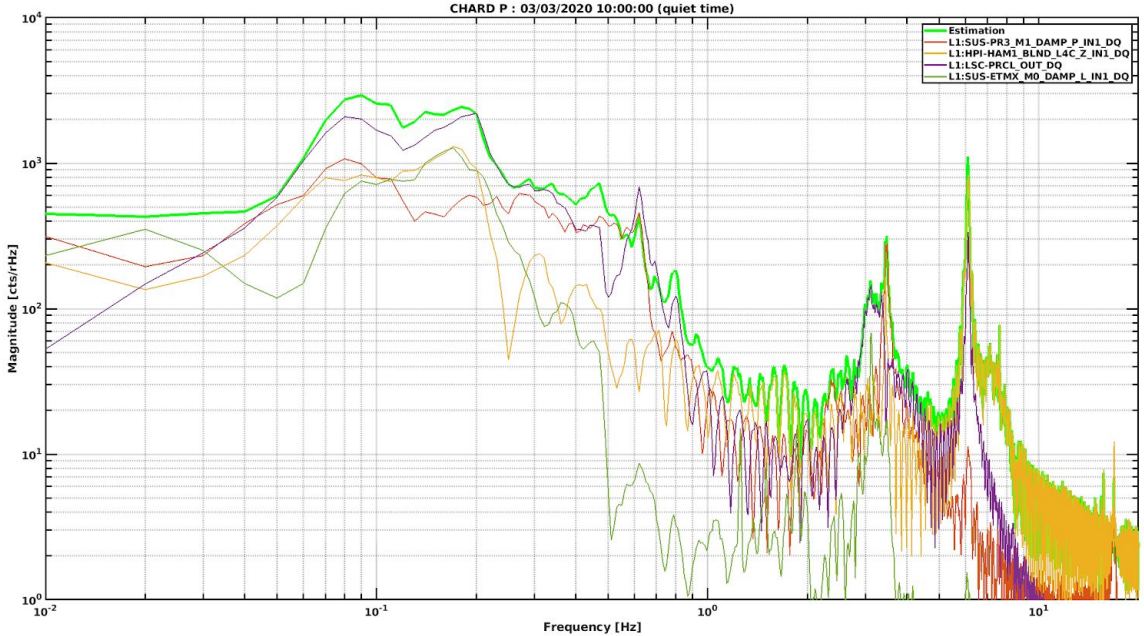
alog 49728



HAM3 is locked with HAM2 at low frequencies:
→ length noise into CHARD P reduced

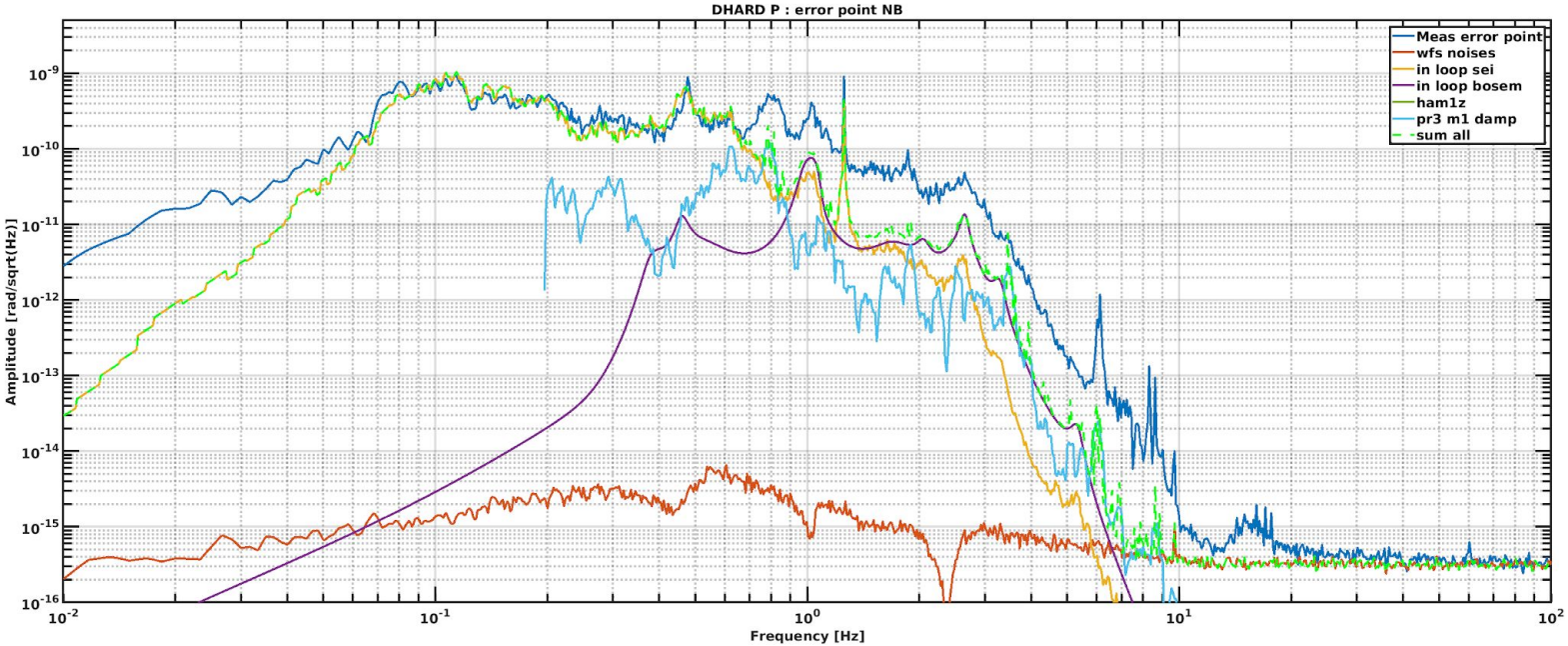
Wiener Filter CHARD P





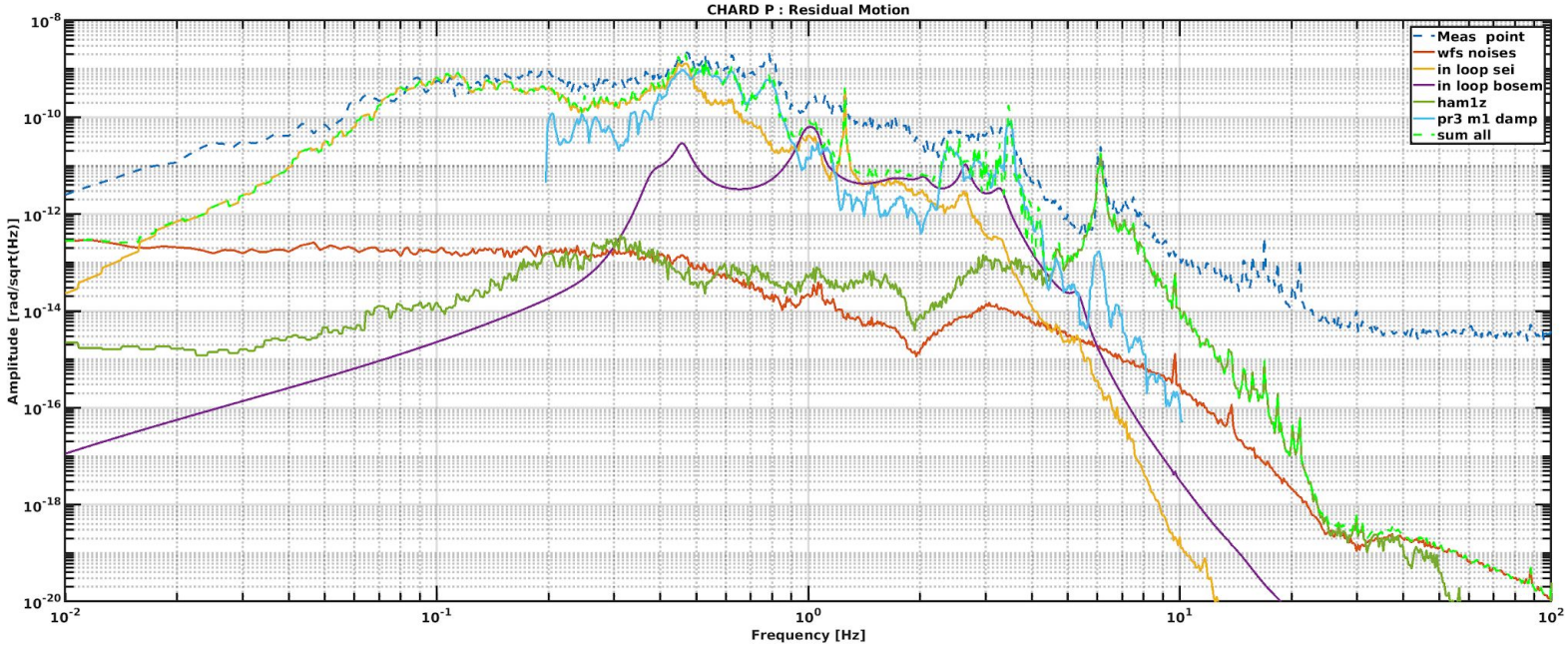
PRCL is not a good estimator anymore of CHARD P below 0.5 Hz

DHARD Noise Budget



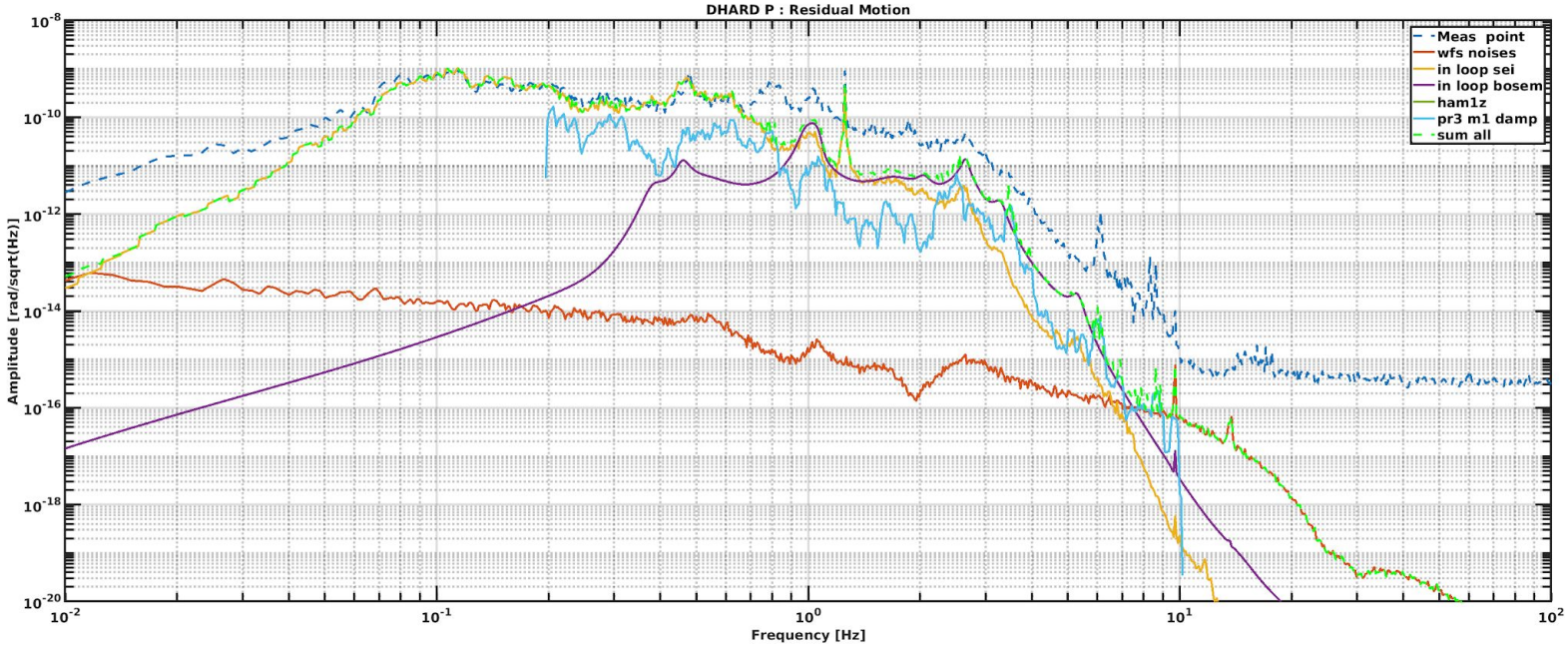
- SUS point of the quad explains the signal below 0.6 Hz
- WFS Sensor noise above 20 Hz
- Bosem noise is not quite at the level of error signal between 1 and 10 Hz

CHARD Noise Budget



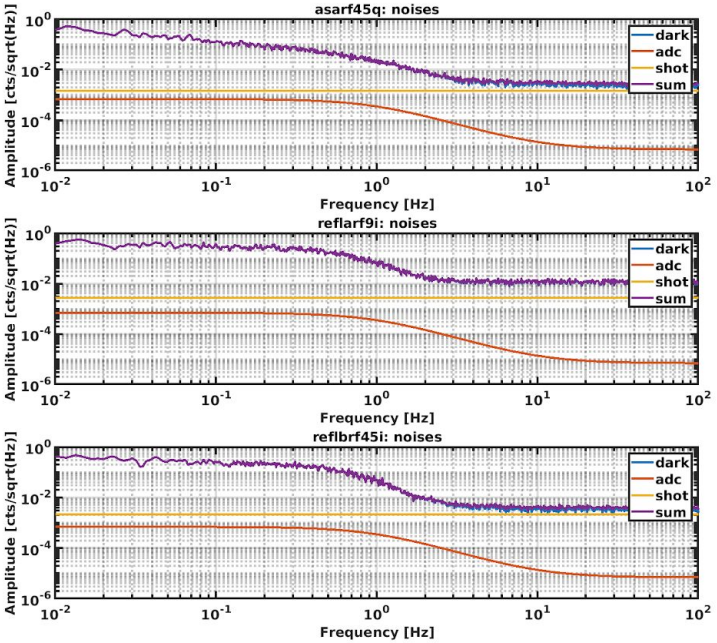
We can reduce CHARD motion by working on HAM1 motion coupling above 10 Hz

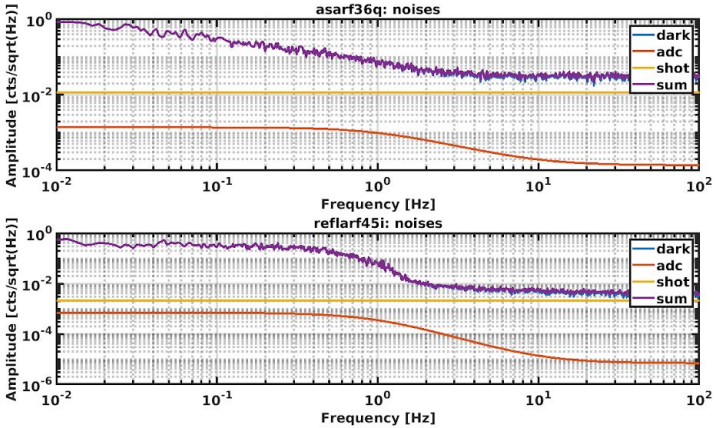
DHARD Noise Budget



We can reduce DHARD motion by using lower noise sensors?

WFS Noises contribution

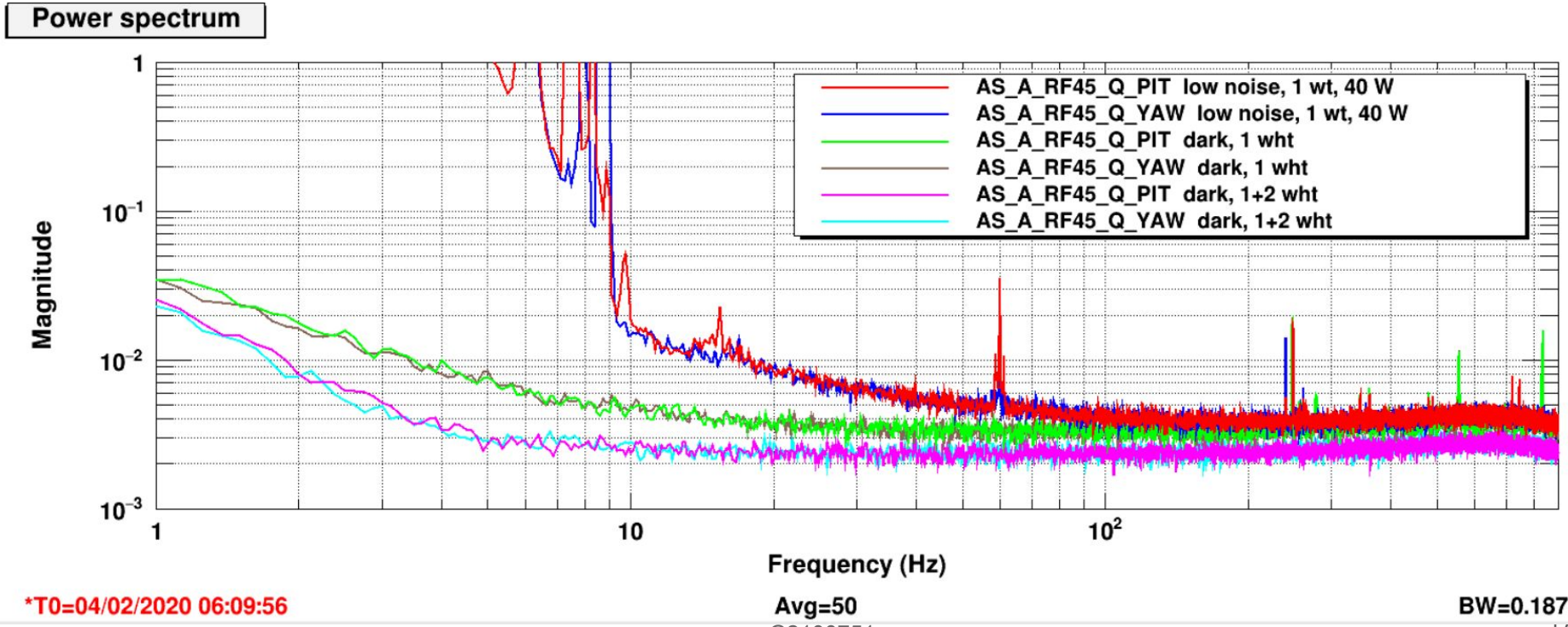




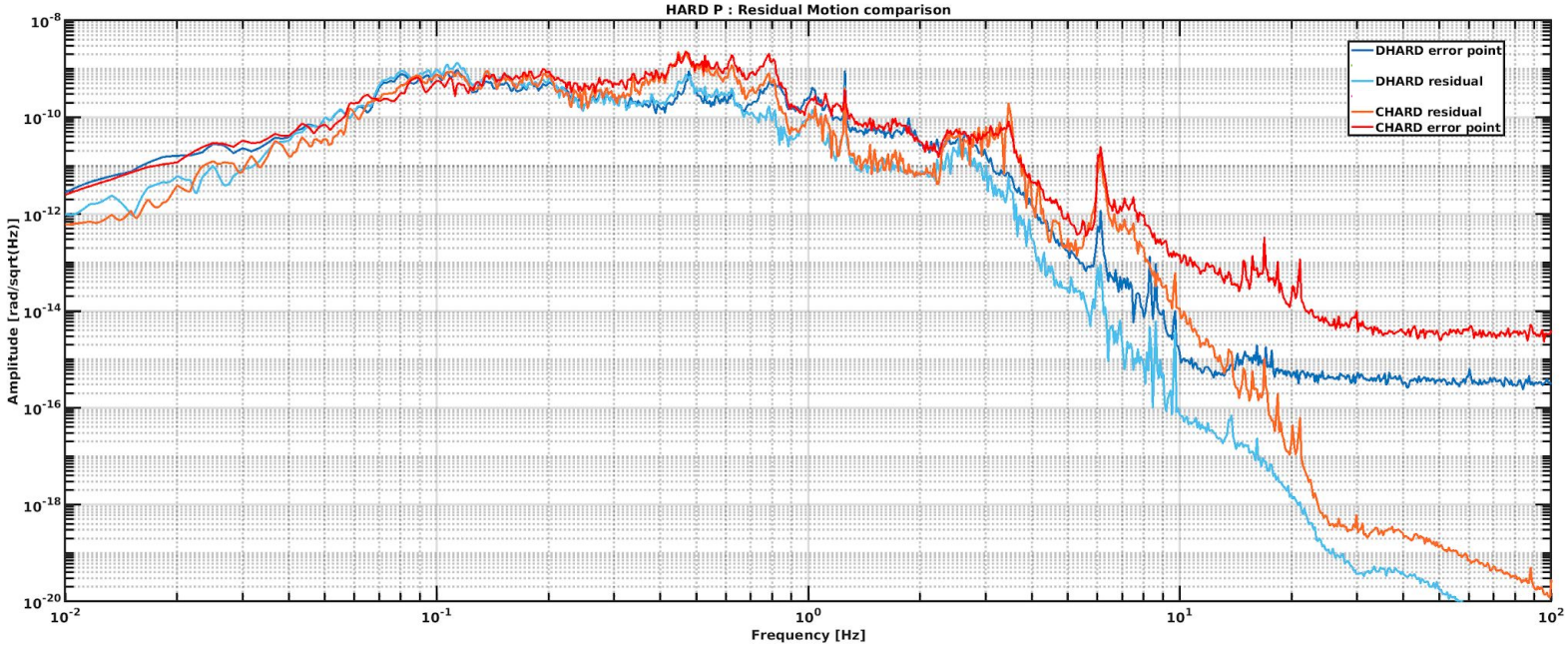
Limited by dark noises

WFS noise contribution

Change of wfs whitening : alog 51444
Factor 2 lower?

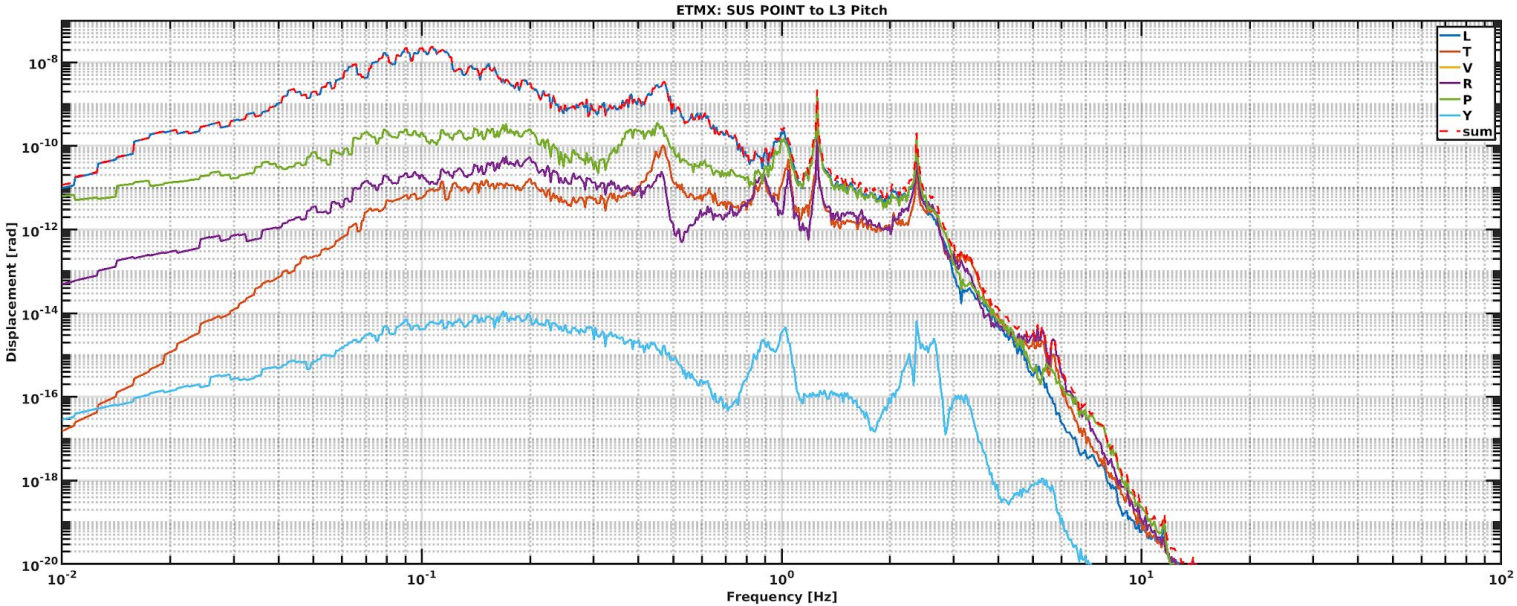


Comparison of calibrated signals



Coupling into DARM still to model

Extra slides : Seismic noise = SUS point → L3



Extra slides : damping noise = M0 bosem noise→ L3