*Calibration/validation of the **AS_Q_FAST** channels*

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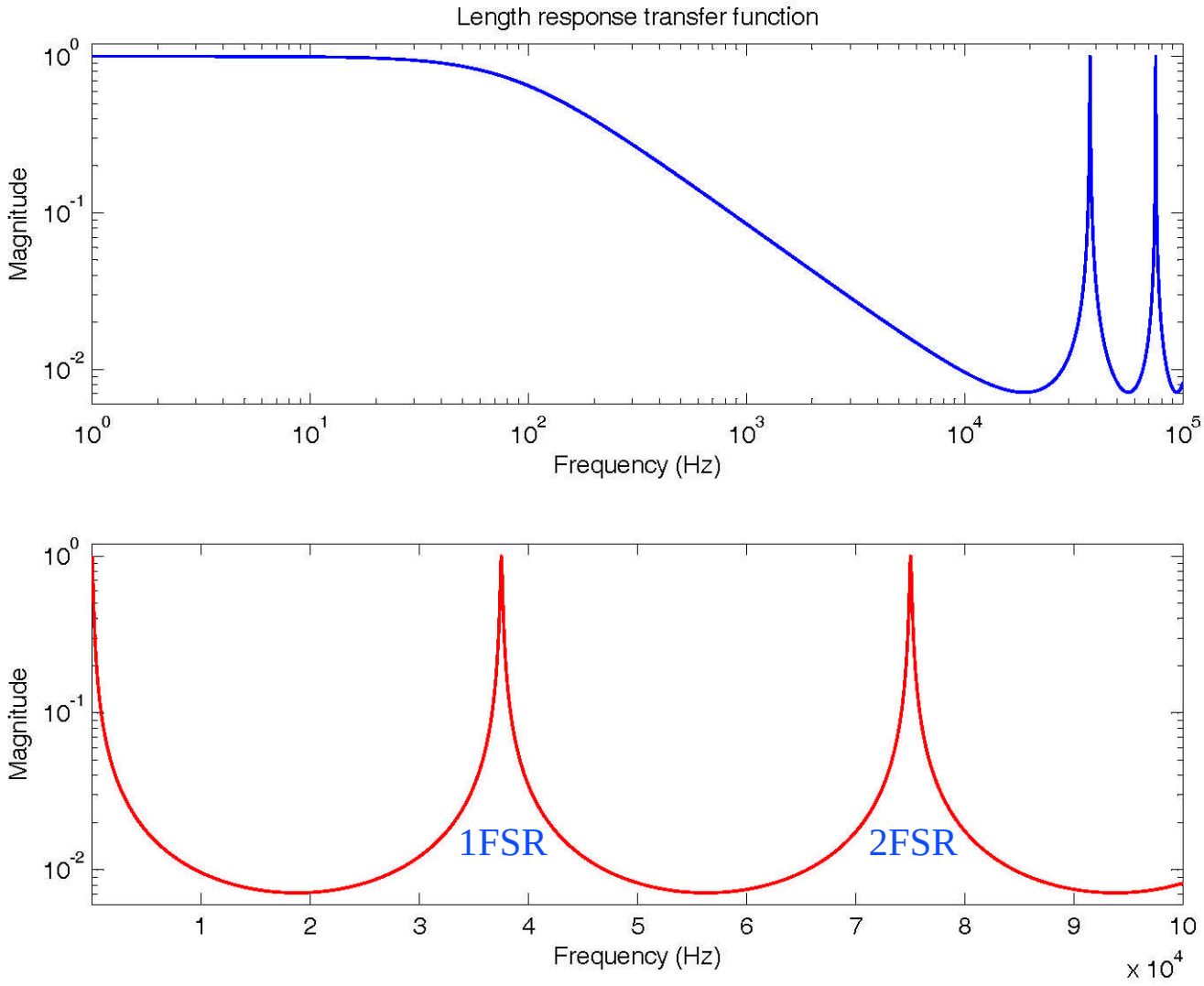
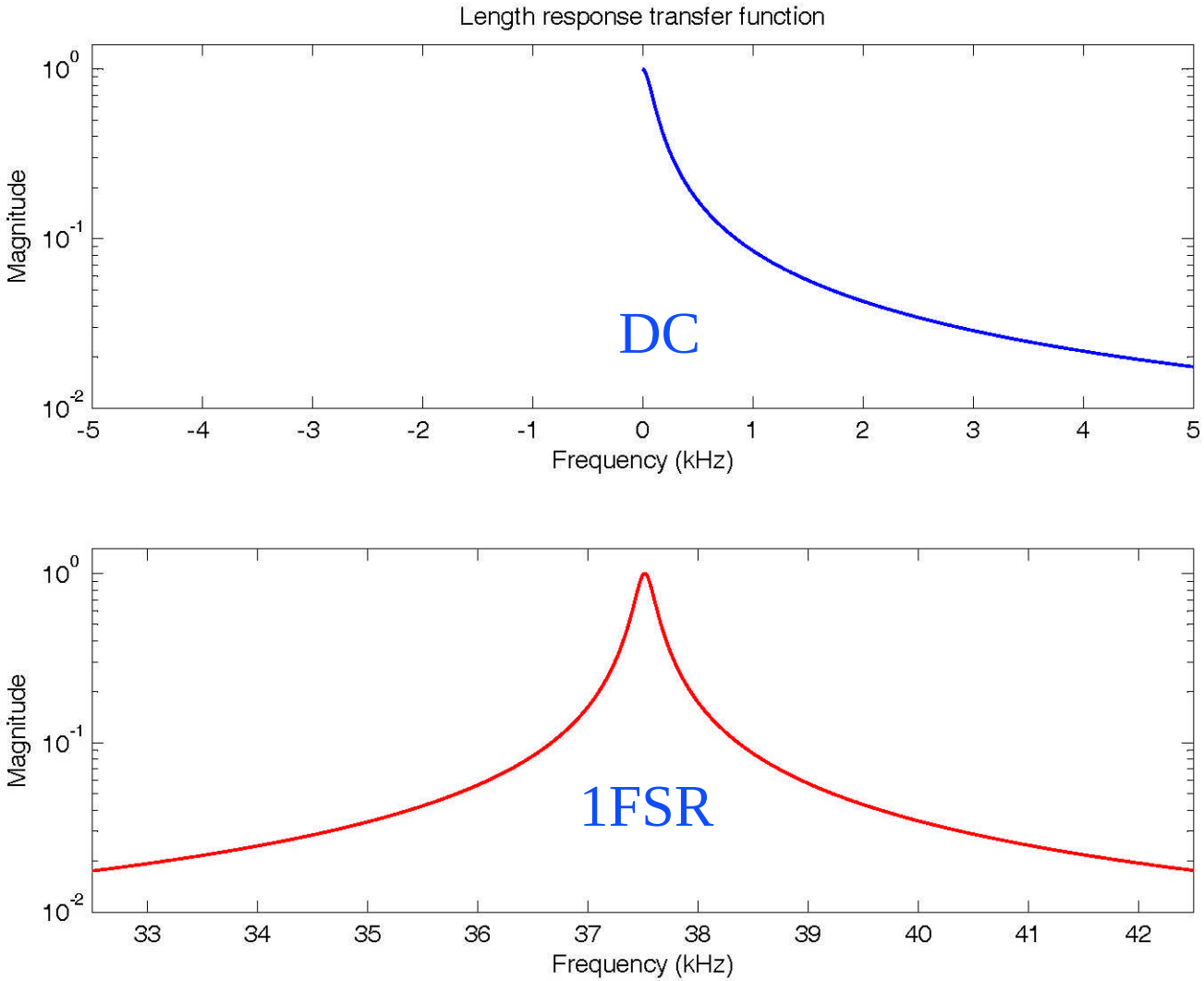
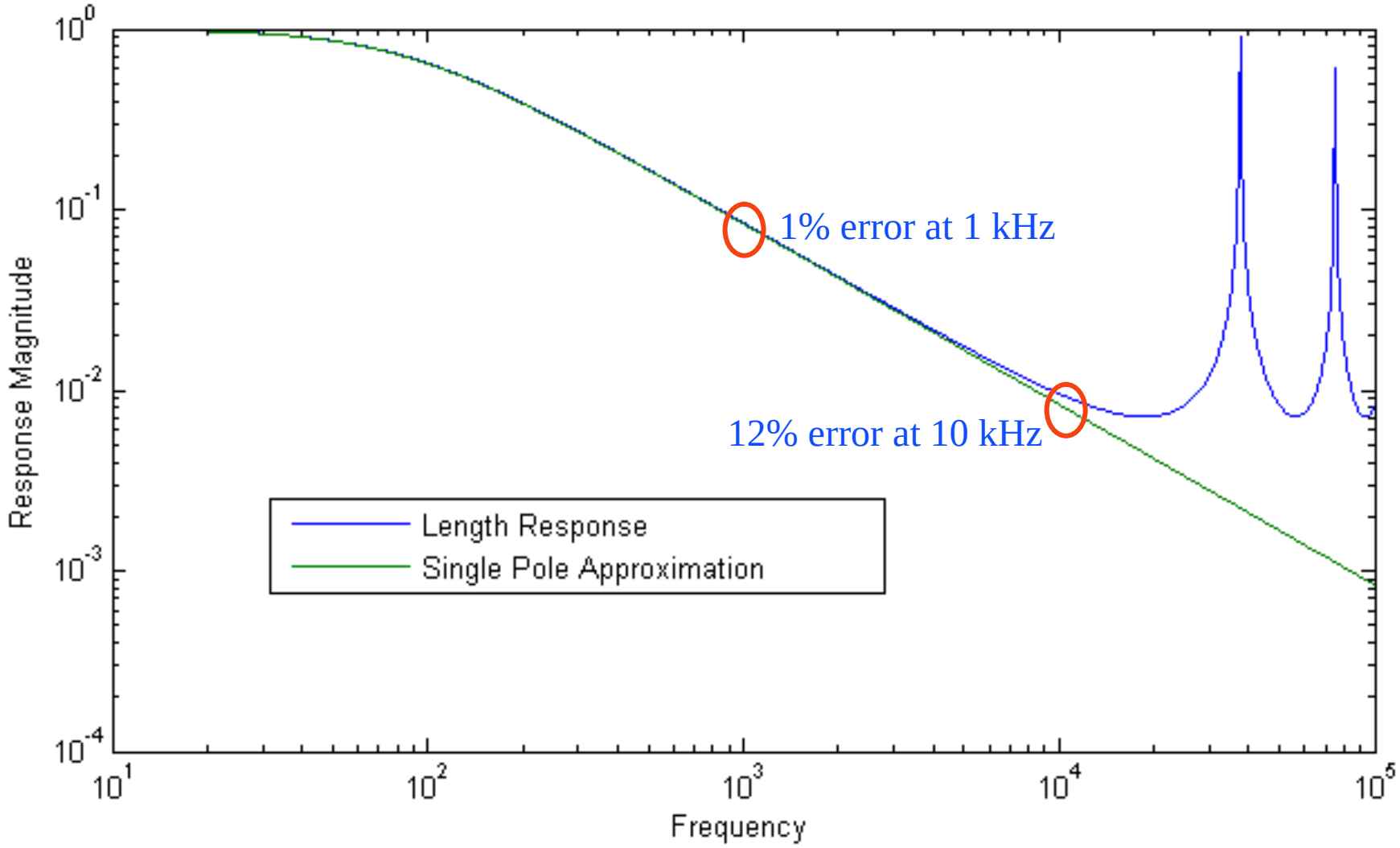
High frequency length response



Length response TF detail



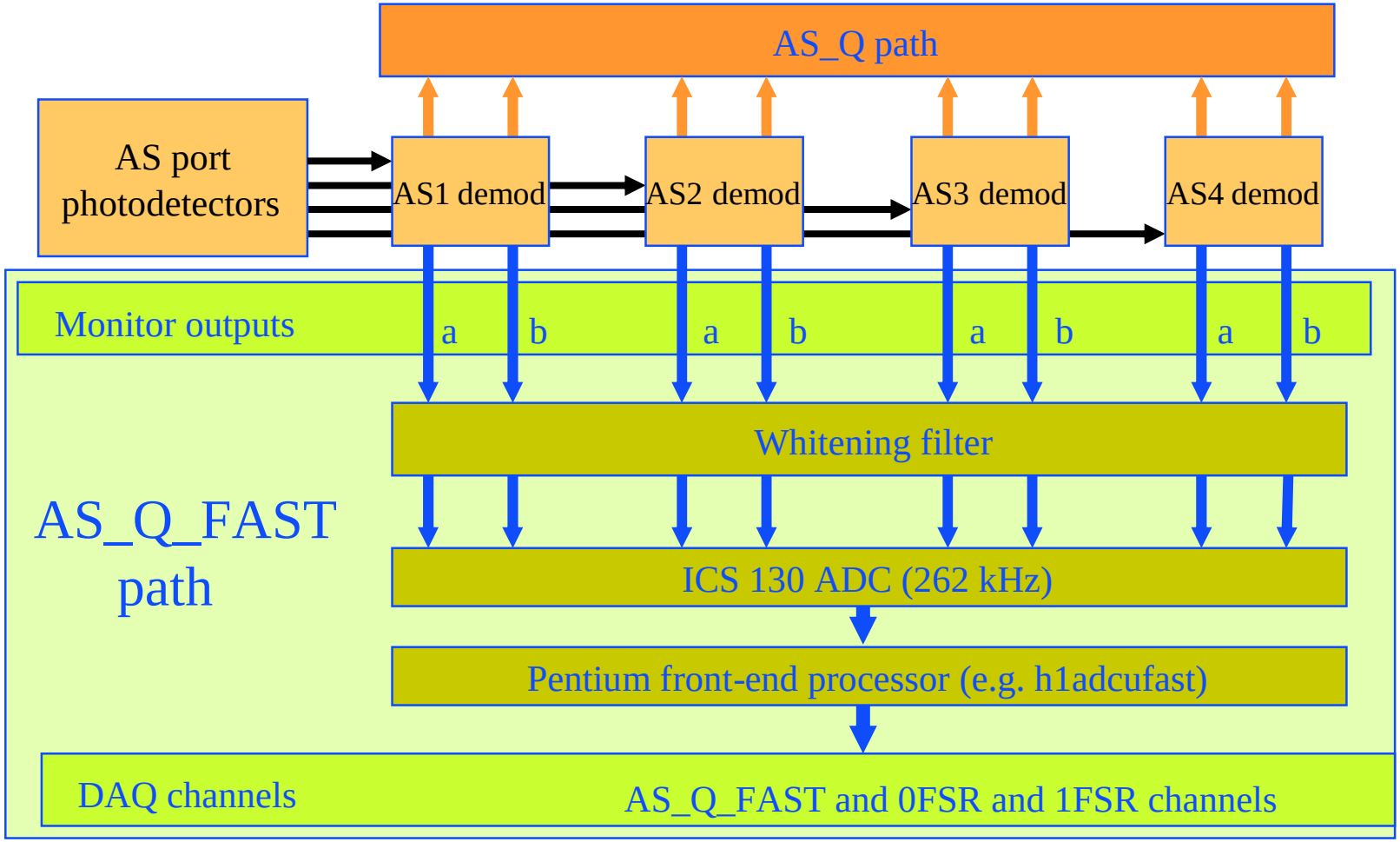
Comparison with single pole approximation



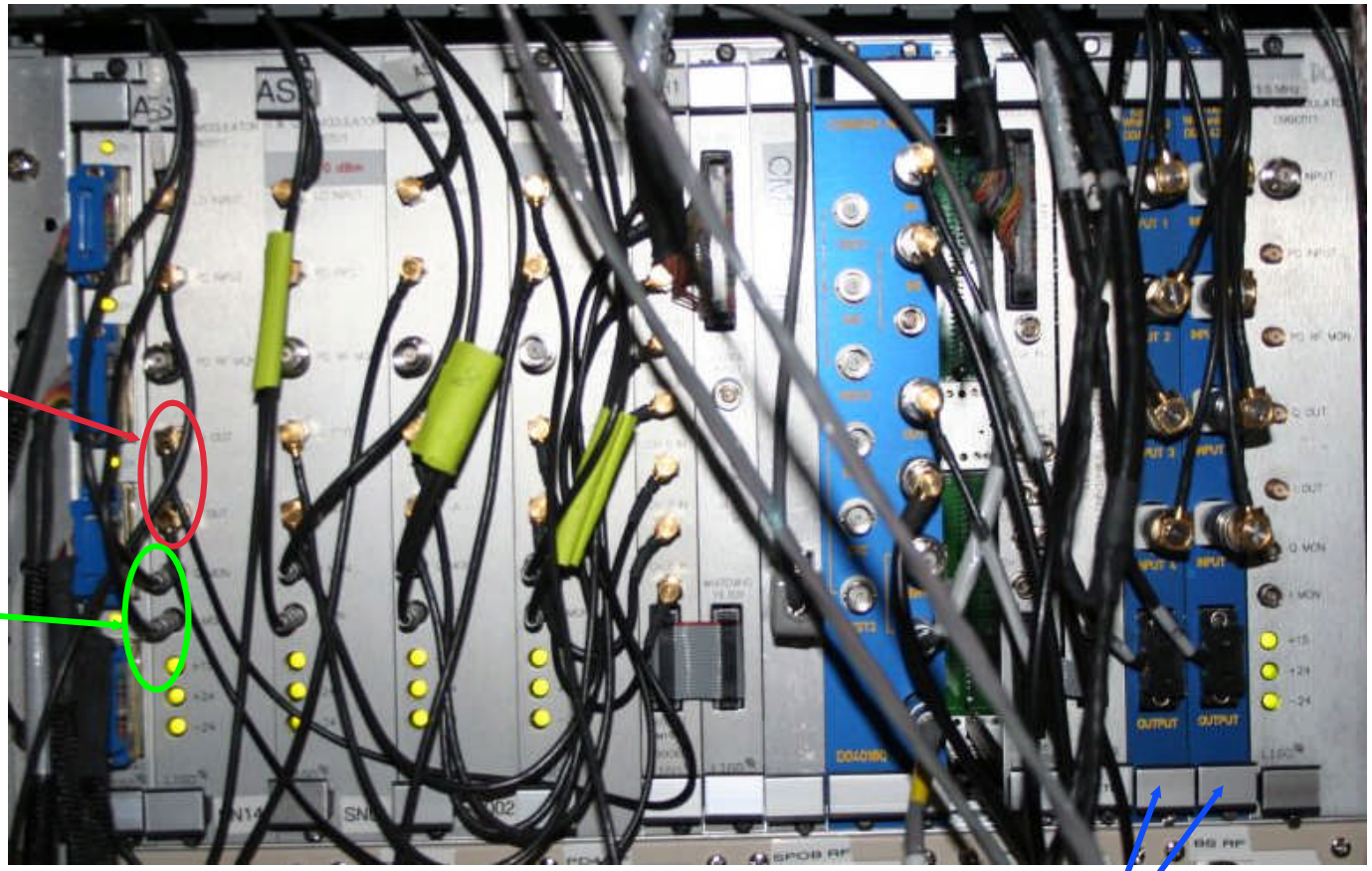
"FAST" channels

- All three interferometers have FAST (262 kHz) data acquisition systems generating AS_Q_FAST signals with 100 kHz bandwidths
- The signals are also digitally heterodyned at 1024 Hz and 37.504 kHz and downsampled to 2048 Hz to generate the 0FSR and 1FSR channels
  - » AS_Q_0FSR.mag AS_Q_1FSR.mag
  - » AS_Q_0FSR.phs AS_Q_1FSR.phs
  - » AS_Q_0FSR.real AS_Q_1FSR.real
  - » AS_Q_0FSR.img AS_Q_1FSR.img
- At LHO the full 262 kHz AS_Q_FAST channels are written to the frames. Not yet implemented at LLO.

AS signal flow



Hardware – AS demod end

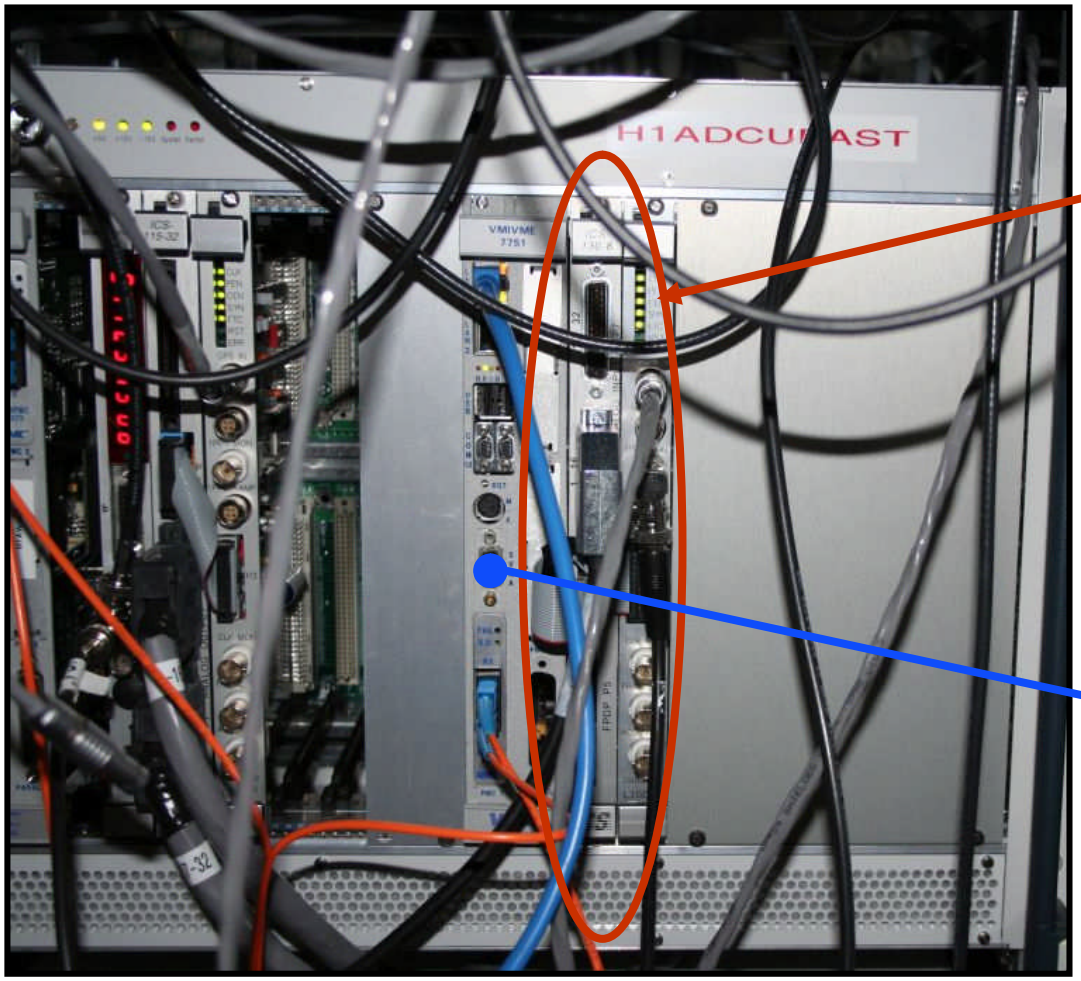


ASn outputs

ASn-**mon** outputs (x 2 gain)

whitening filters for ICS 130

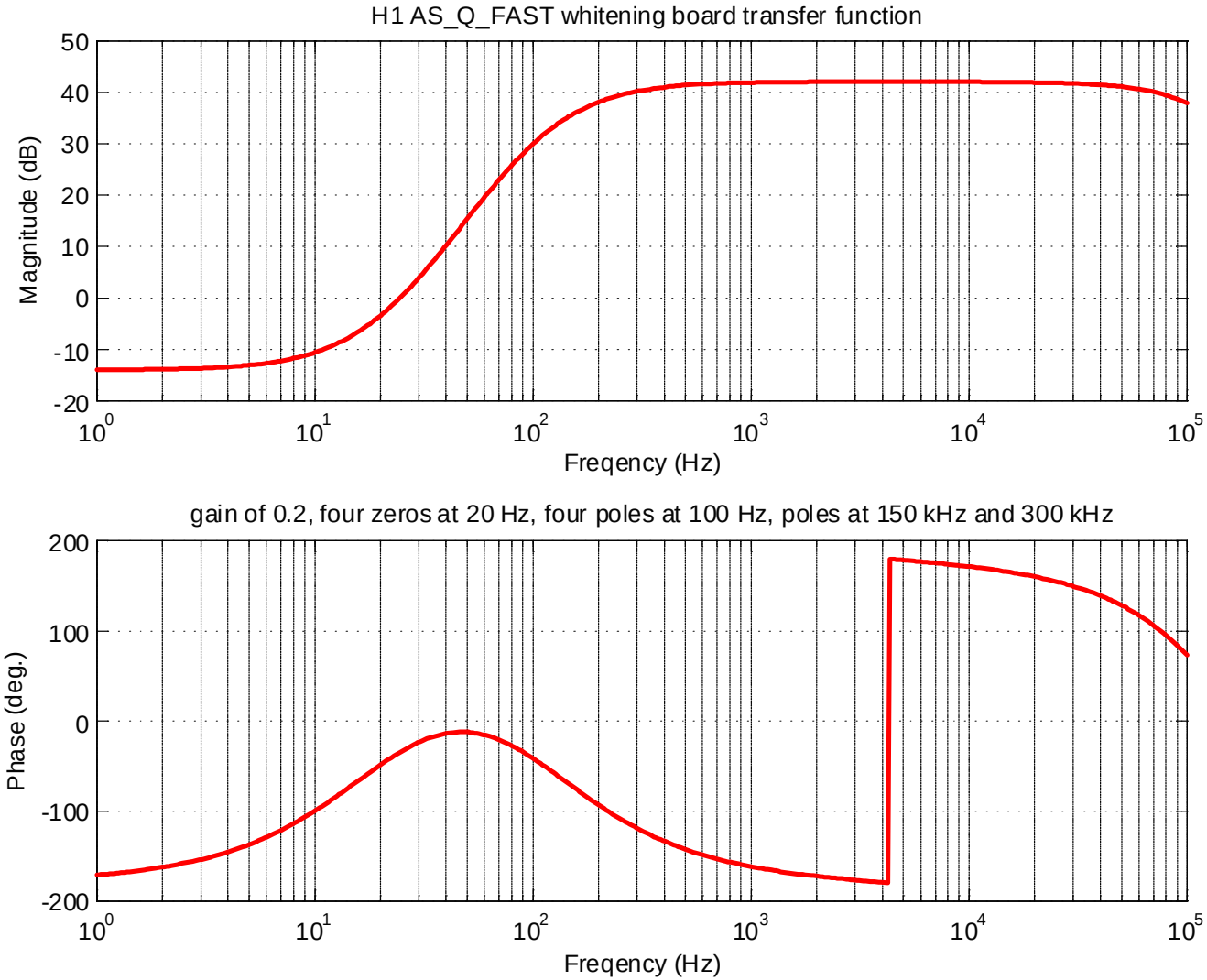
Hardware – ADC end



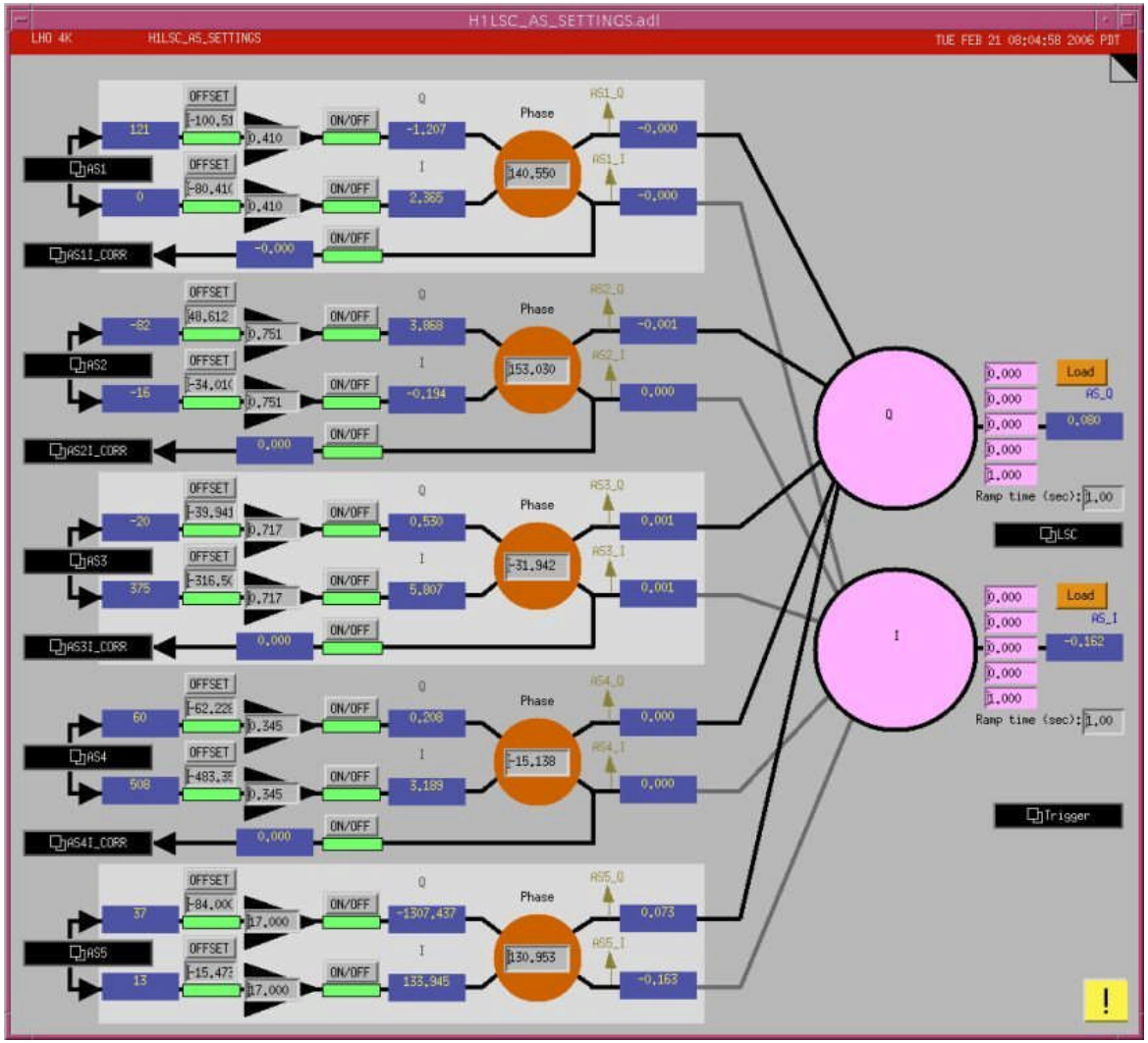
ICS 130 – 8 channels running at 262,144 Hz

Pentek code generates the AS_Q_FAST and hetrodyned channels

Whitening filter transfer function

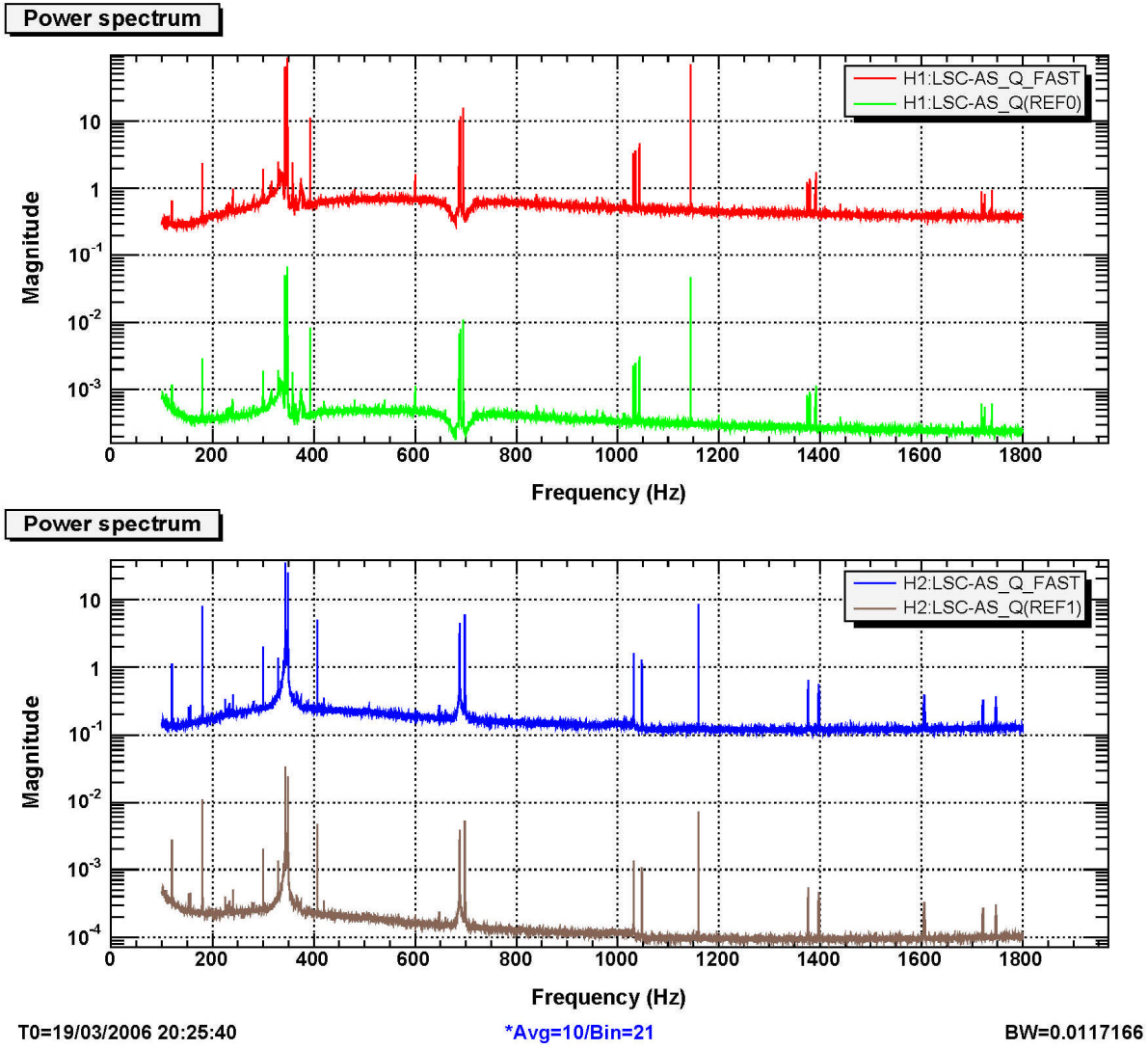


ASPD summation for AS_Q and AS_Q_FAST

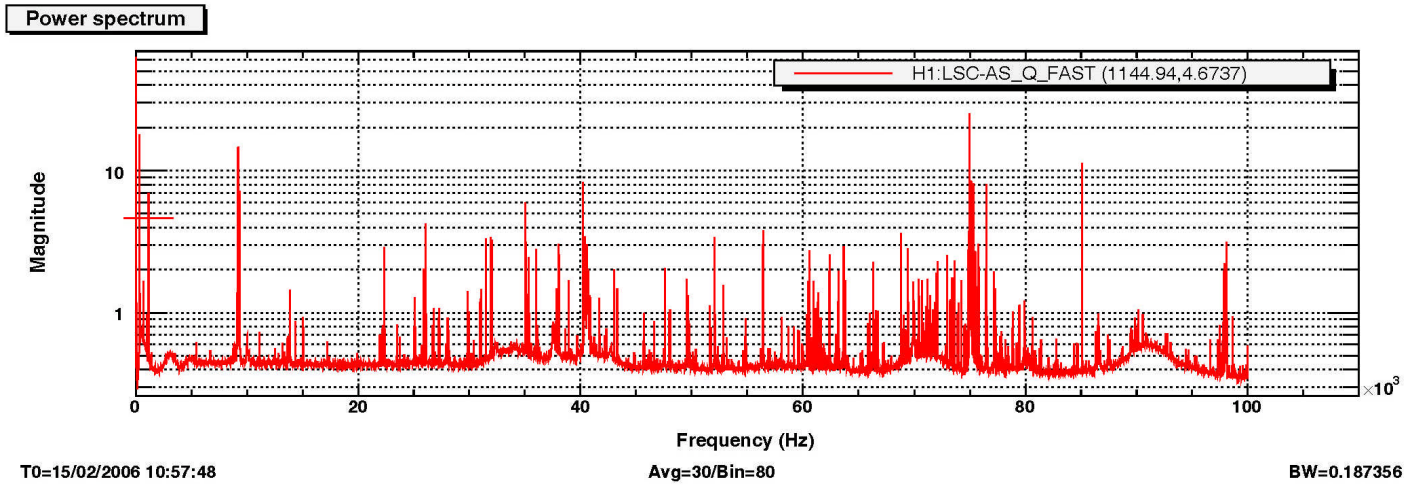


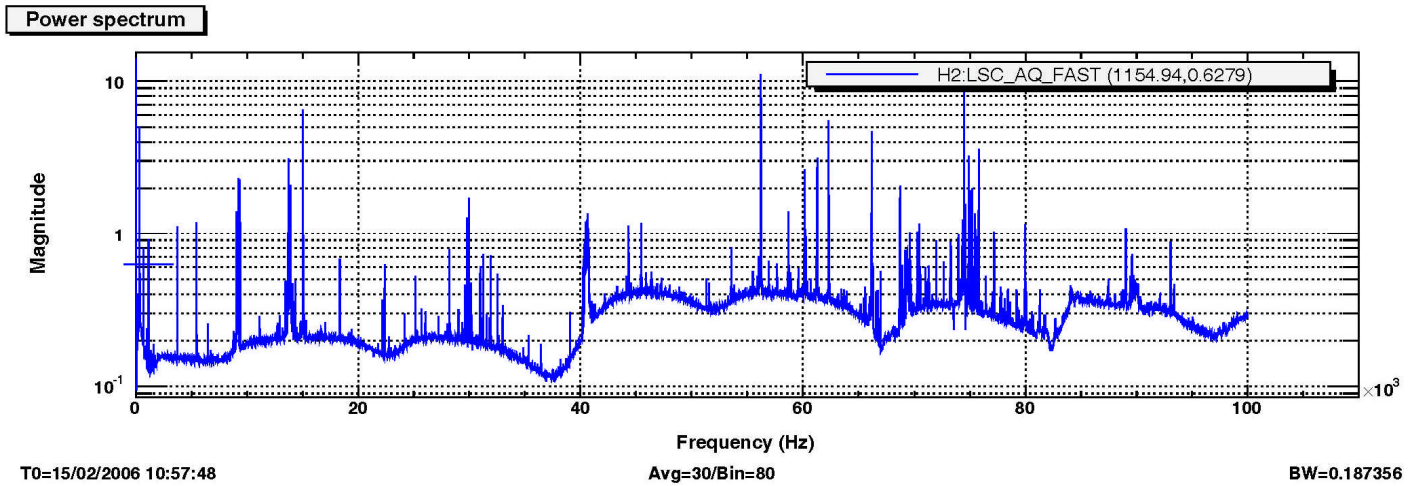
- Similar calculation done in adcufast
- Presently, startup.cmd must be updated manually every time medm settings are changed
- LLO adjusts ASPD matrix coefficients for each lock stretch
- Working toward reading epics settings on the fly.

AS_Q : AS_Q_FAST comparison

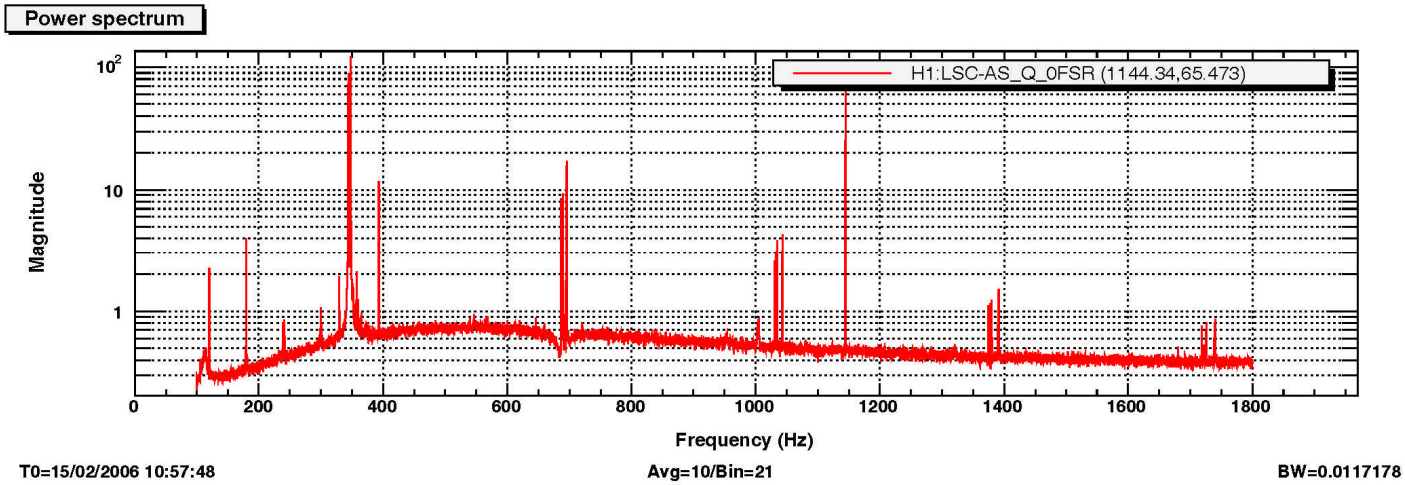


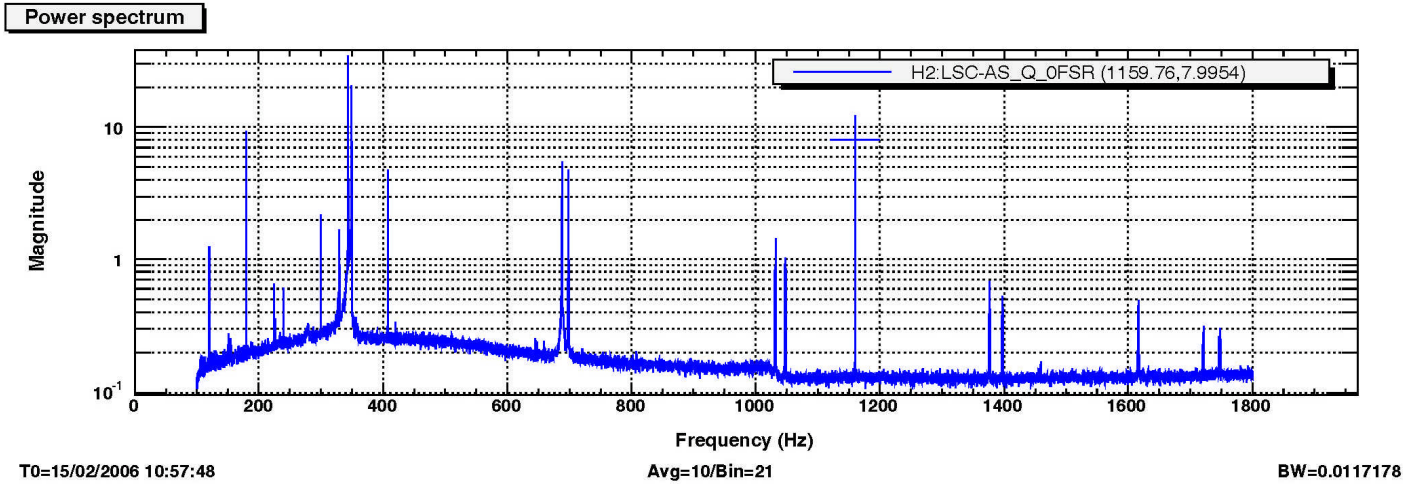
AS_Q_FAST signals during full ifo. lock



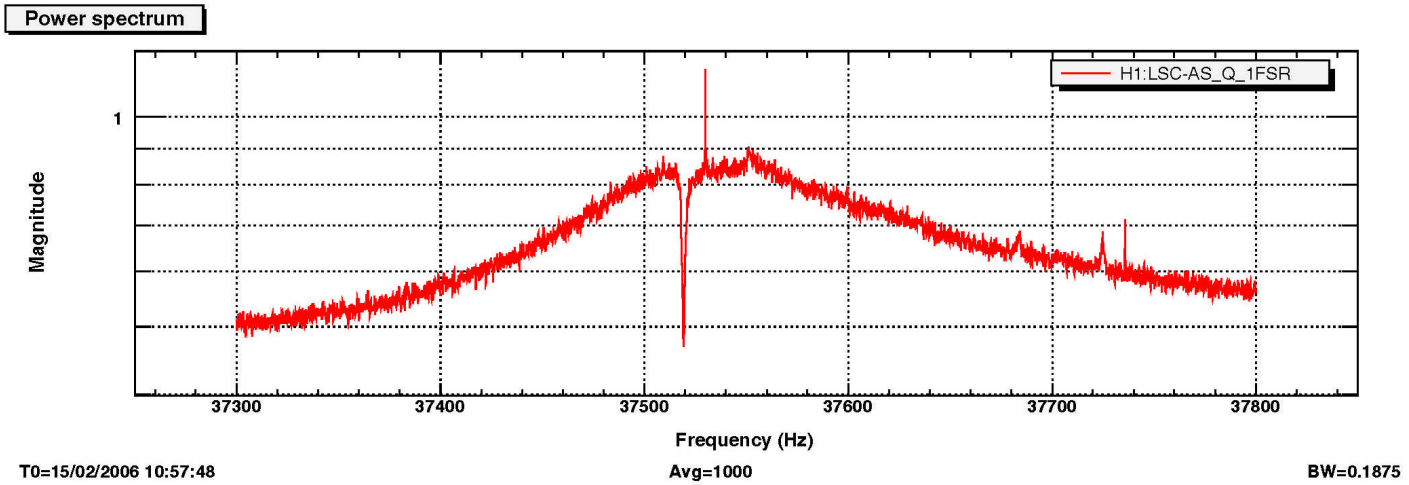


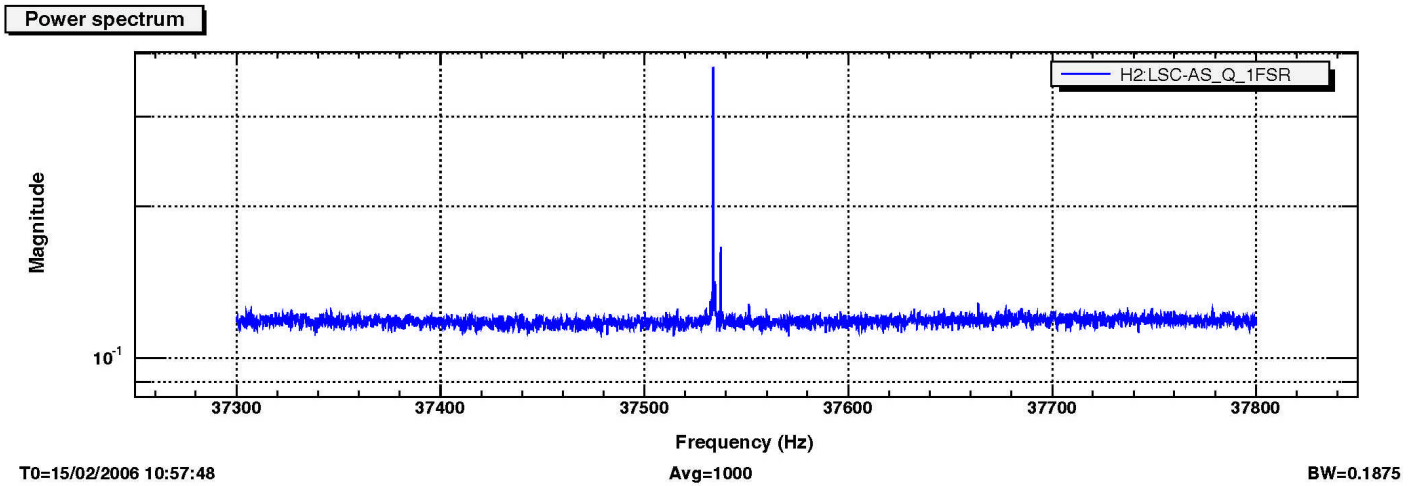
0FSR signals





1FSR signals





Calibration options

- Drive test mass at 37.5 kHz
  - » Attempted during Oct. 2005
    - – Factor of five larger value than expected
    - – Electronics not designed to be driven at this frequency
    - – Uncertainty in force/displacement too high
- Photon calibrator
  - » Now driving at ~ 1600 Hz
    - – To resolve peak in ASD factor at the level of a factor of a few above the background requires hundreds of seconds of integration
    - – At 37.5 kHz one data point would require ~ one year integration time
- Thermally-excited TM internal mode vibrations
  - » Modeling (and more thought) required

"Blind" extrapolation of low-freq. calibration

- Use cal line at ~1150 Hz
- Replace cavity pole approximation with length response given by $H_L(f)$
- Extrapolate to 100 kHz <u>without HF measurement</u>
  - » Analytic model used to date for single FP cavity - probably gets differential mode right , but not leakage of common mode effects into AS port – doesn't model noise floor.
  - » Use full interferometer model such as Finesse to study noise couplings at high frequencies.
- Effort underway to implement "blind" calibration