Calibration: S2 update, S3 preliminaries

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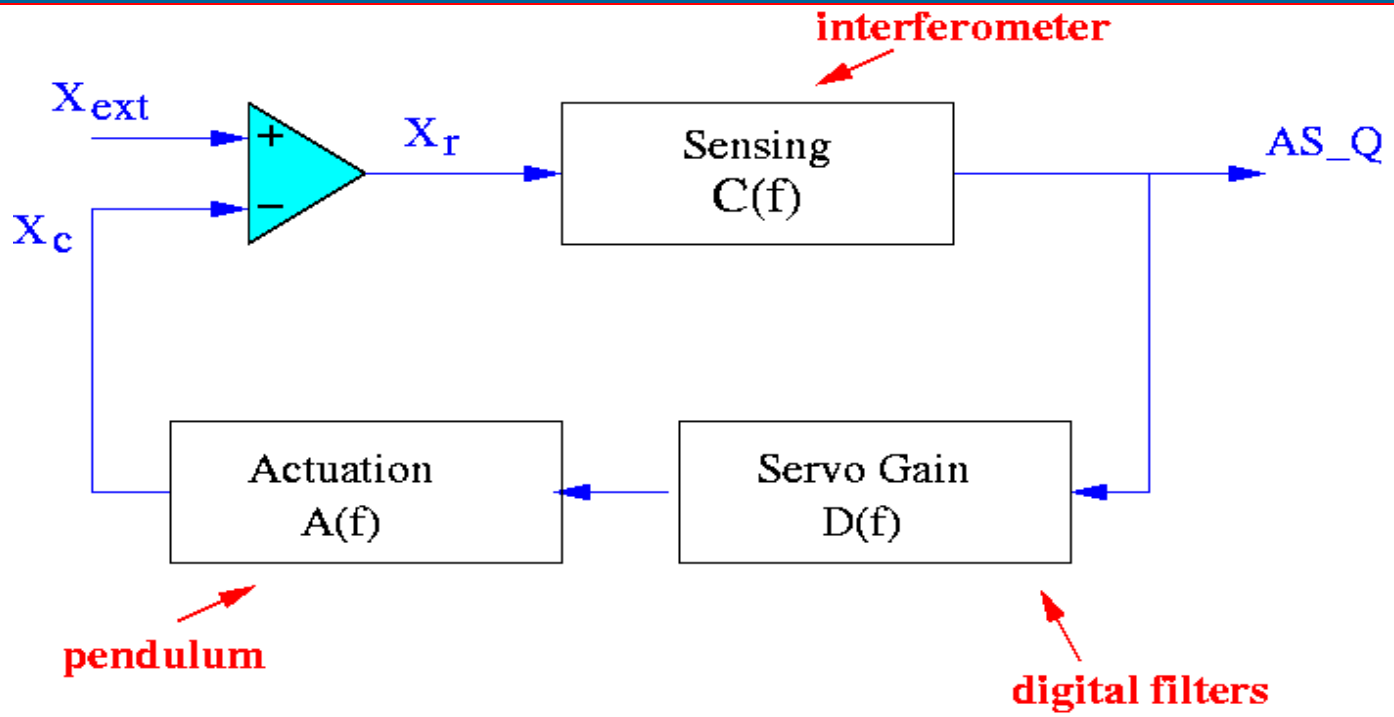
Calibration Basics I



$$X_i = AS\_Q(f_i,t) \cdot R(f_i,t)$$

$$X_i / AS\_Q(f_i,t) = R(f_i,t) = [1 + a(t)\, b(t)\, G(f_i)] \;/\; a(t)\, C(f_i)$$

R(f): Response Function α: Scale Factor (from Calibration Line)
G(f): Open Loop Gain = C(f)•D(f)•A(f)

Calibration Basics II

- We choose a time $\mathbf{t_0}$ and measure $\boldsymbol{a_0}$, $\boldsymbol{G_0}$ and $\boldsymbol{R_0}$.
- This allows us to extrapolate to any time **t** using the amplitude of the calibration line (or lines).
- The amplitude **a(t)** is a function of the alignment, dependent on the carrier power in the arms and the sideband power in the recycling cavity.
- **a(t)** is tracked throughout the science segments.

$$R(f_i,t) = [\, 1 + a(t)\, b\,(t)\, G(f_i)\,] \;/\; a(t)\, C(f_i)$$

S2 calibration status

- Online calibration with accuracy of ~20% was available with 1 hour latency
- Interim calibration (V2) issued with corrected DC calibration for LHO
- Final calibration (V3) released ~2 weeks after Hanover LSC, included correction to LLO DC calibration
- Information for data quality flags completed
- Additional Wednesday talks relating to calibration include two from Xavier Siemens

S3 calibration status

- Online calibration available with 1 hour latency, based on E10 preliminary calibration
- accuracy varies between IFOs (H1 opened S3 in best-known state, H2 less so, L1 calibration postponed until Nov 7th)
- Opening calibration run performed, analysis is being performed at LLO, awaits at LHO
- Consistent model for all IFOs in hand
- Hardware measurements complete at LLO, only representative ones made at LHO
- Cross-coupling measurements obtained for noise budget

S3 calibration status, contd.

- Input matrix being dynamically calculated (Sensemon monitors this)
- Sensemon and autocals on NS-NS inspiral range with high precision (few percent) at LHO, however, some uncertainty remains regarding agreement at LLO: being sorted by Gaby/Brian/Patrick/Rana.
- Amplitude of calibration lines being analyzed
- E10 cal frame conversion done by Duncan; we will try and do this conversion using tagged version of LAL for S3
- Actuation functions now produced by model. UL groups should use these for injections. Analysis using Vn S3 cals should account for this systematic, i.e. if they employed simple pendulum
- Target date: S3 V1 calibration in two weeks
- Target date: S3 Vfinal calibration Feb 1st

DC calibrations

Mike's NYT nightmare: Stan comes to me and says, we missed a galactic SN because you were doing %!&!* DC calibrations?

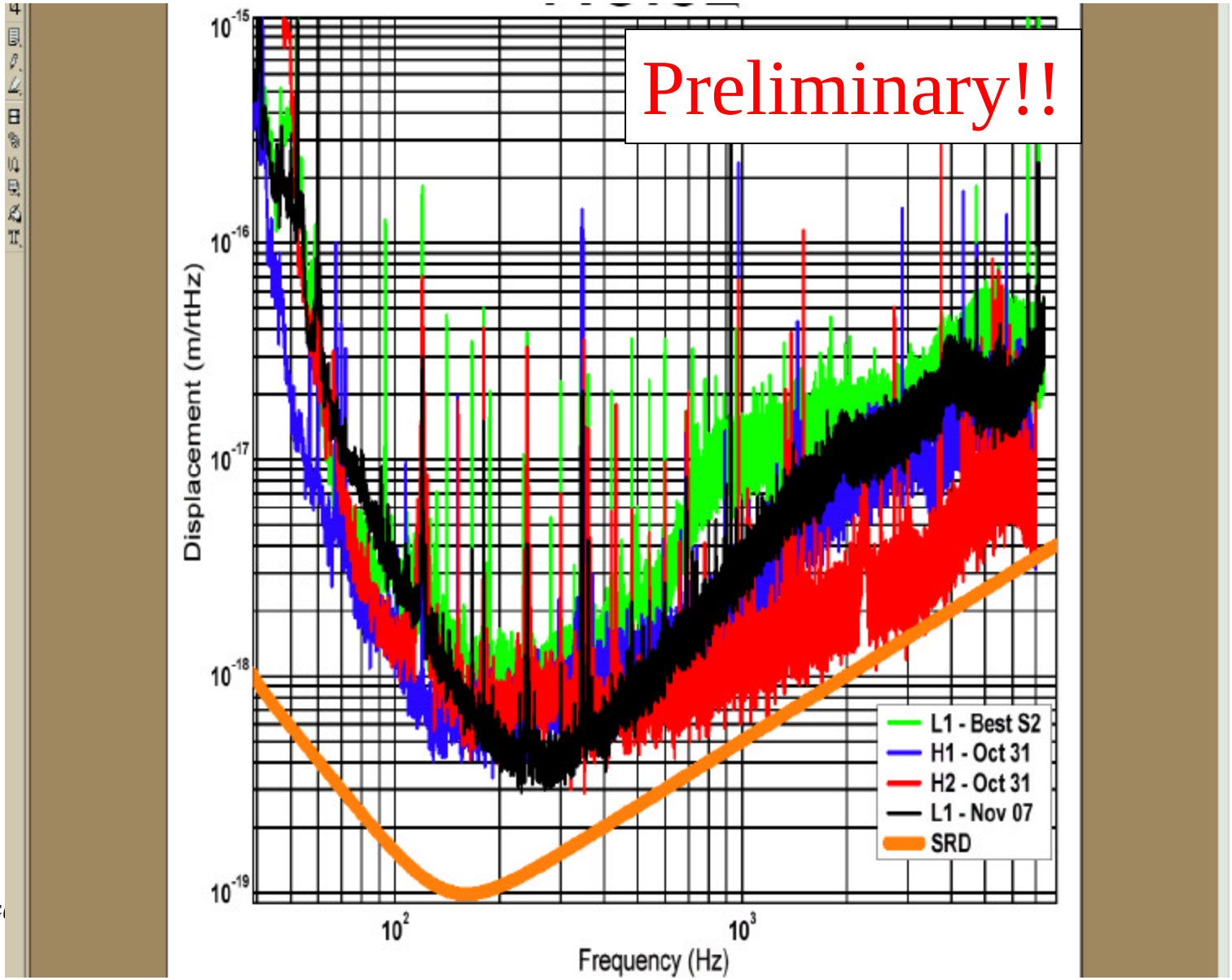
Hanover:

- *Have redundant measurements, including sign toggling, fringe counting, free-swinging and PZT fine actuator*
- *Will limit the number of redundant measurements during the S3 run; making some of these beforehand*

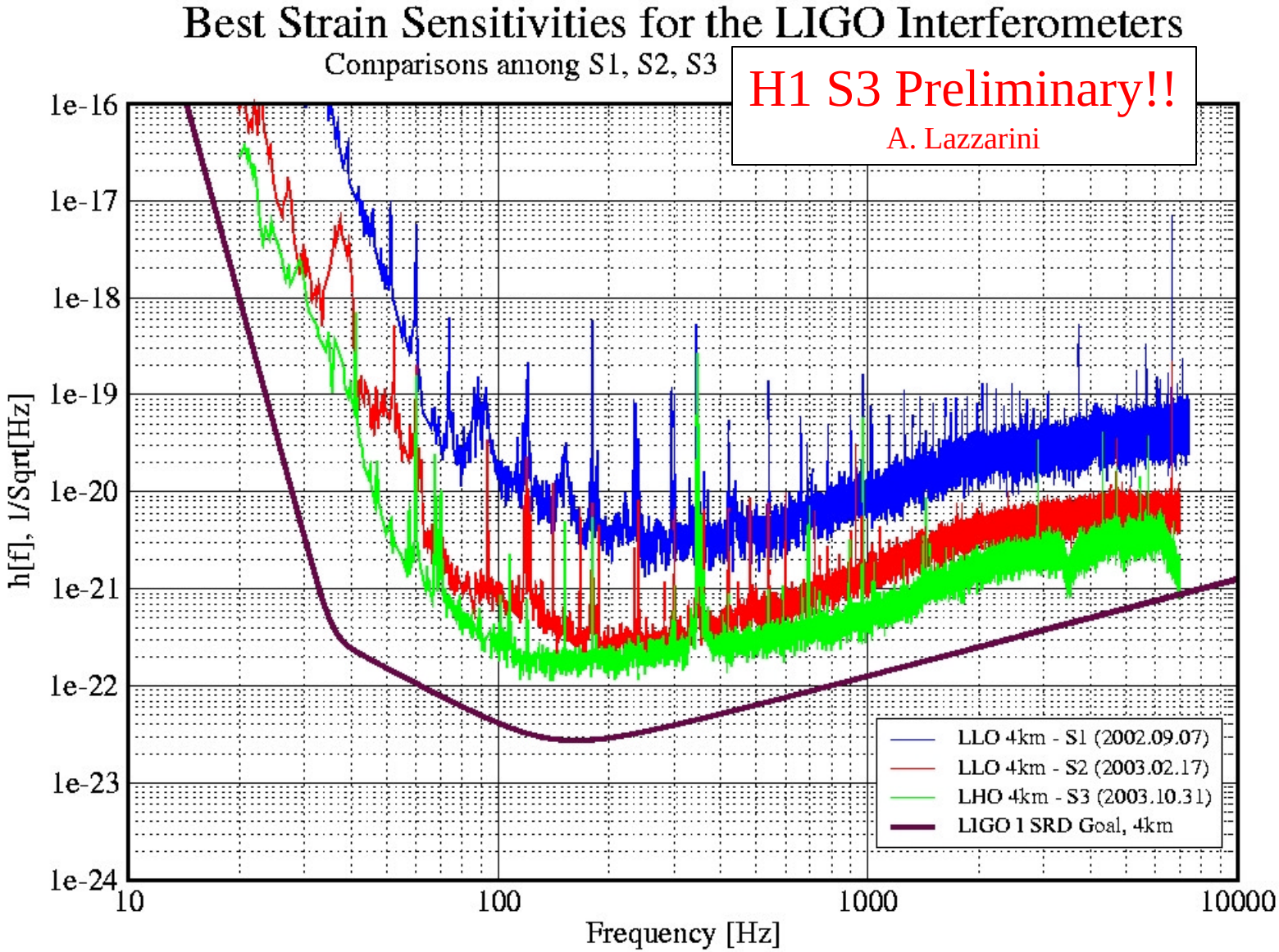
S3:

- LLO completed measurements Nov 7. Most of this done before the run at LHO, quick check on Monday Nov 3 (see nightmare above)
- DC calibrations in various states: Good on H1 (<6%), poor on H2 (~20%), and I'm not sure about LLO just yet
- All data in hand however, Brian and I just need to analyze them

S3 strain comparison



S1-2-3 strain comparison



Conclusions

- V3 (final) calibration available. S2 calibration errors very late (haven't been pushed by anyone); ready by Dec 10th
- S3: calibration status staggered with H1 most mature, H2 less so, L1 analysis underway. We had promised S2 V3-like calibration for the start of S3, we should meet this goal in 1-2 weeks