# S4/S5 Calibration Status

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For the Calibration Committee

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# Calibration Committee

- "The Calibration Committee is responsible for organizing, delivering, and documenting the calibration information for the detectors in the Collaboration":
  - Frequency Domain
  - Time Domain
  - High Frequency
  - Photon Calibrator
  - Regular bi-weekly meetings.
- A. Dietz, S. Giampanis, G. González, E. Hirose, P. Kalmus, B. O'Reilly, M. Landry, R. Savage, M. Sung, X. Siemens.
- Contributions from J. Garofoli, H. Radkins, L. Matone and many others.
- Minutes etc. at http://www.ligo-la.caltech.edu/~irish/Work/Calibration/ this page is "lsc cheerleader™" protected.
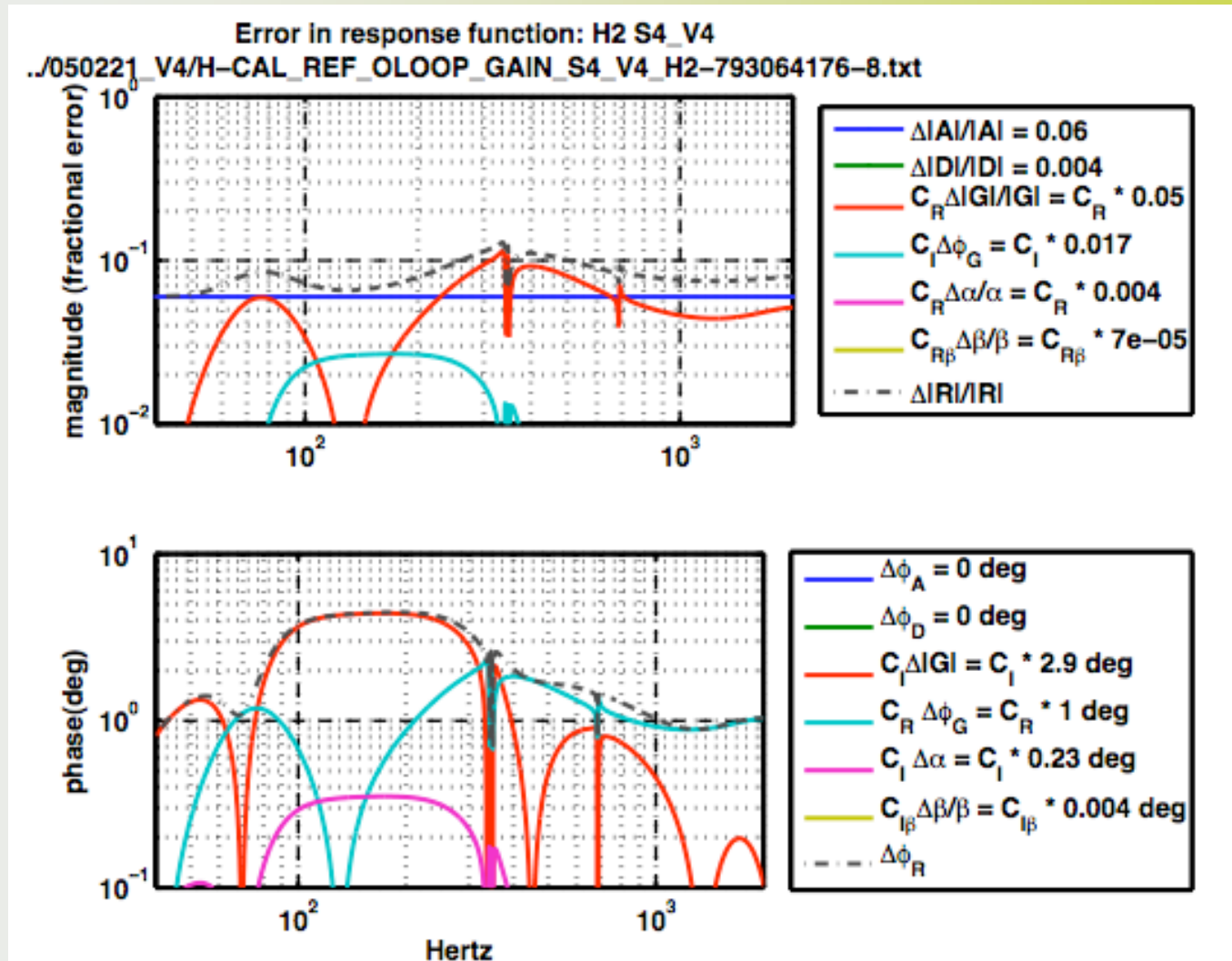
# S4 Status

- Final S4 Calibration released 12/18/05
    - V4 had some significant differences from V3.
    - Search groups are approaching this in different ways.
- Final S4 uncertainties released 3/13/06.
    - Uncertainties in response function both as a function of frequency and "recommended" frequency independent values.
- S4 Calibration document **T050262** being finalized. A draft version exists.
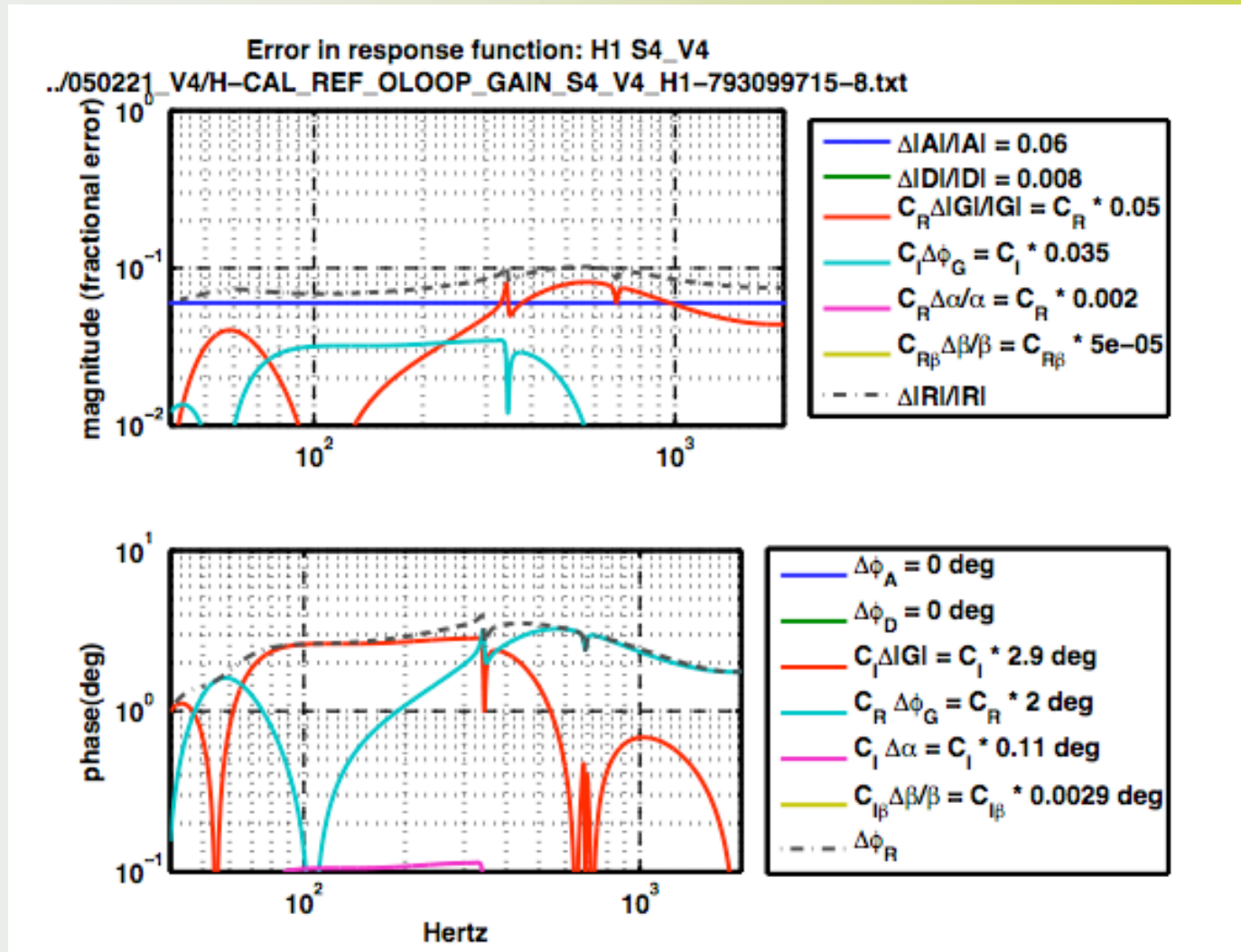
# H2: 8% in Magnitude, 4° in phase

Error in response function: H2 S4_V4
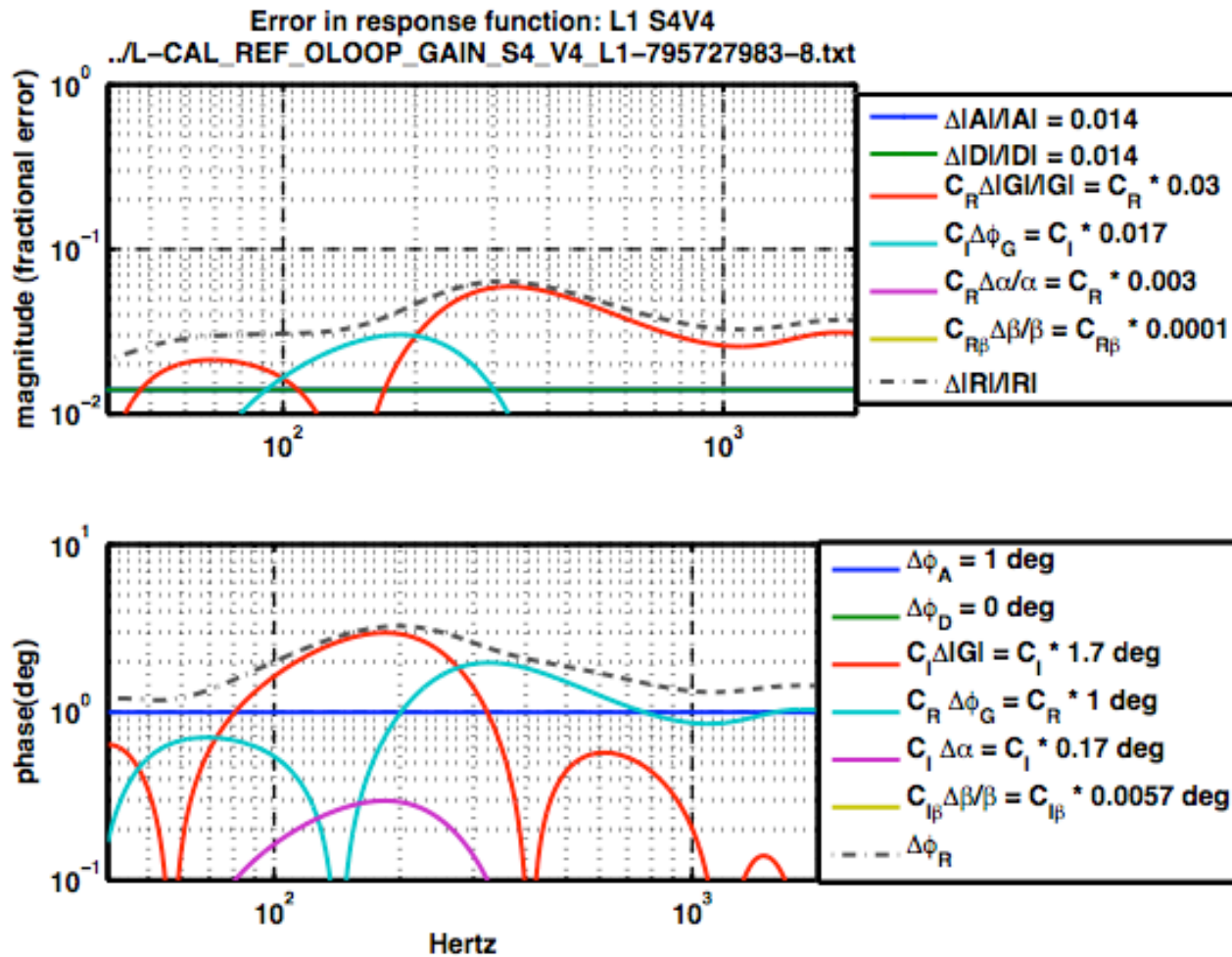../050221_V4/H-CAL_REF_OLOOP_GAIN_S4_V4_H2-793064176-8.txt

# H1: 8% in Magnitude, 3° in phase

# L1: 5% in Magnitude, 2° in phase



Error in response function: L1 S4V4
../L–CAL_REF_OLOOP_GAIN_S4_V4_L1–795727983–8.txt

# S4 Status

- There was a problem with the S4 V4 Calibration which only affected the calibration frame files.

- $\alpha$ and $\gamma$ were switched

- Improved validation procedures to avoid problems like this in the future.

- Calibration review committee:
  - Albert Lazzarini(chair), Dennis Coyne, Vuk Mandic, John Zweizig.
  - Will read final document and decide if additional review meeting(s?) are warranted.

# S5 Frequency Domain

- We started S5 with a calibration which we feel is already quite accurate, similar to final S4 errors for L1.

- All three IFOs used the same technique and obtained similar accuracy.

- Calibration coefficients are being generated in close to real-time. However, we have only released non-unity coefficients up to Jan-31-06.

- We are still validating the later values (see G. González's talk later in this session).

# S5 Frequency Domain

- We have once again had to change how we store the data, filenames etc.

- Specification document **T040175** has been updated to reflect changes.

- ASCII file names:

  "H-H1_CAL_REF_RESPONSE_DARM_ERR_S5_V2-815155213-9540480.txt"

  - More closely matches naming convention for frames.

- The "V" now has a different meaning. The highest "V" number will now contain the latest calibration for all times during S5.

  - This means some duplication, but greater simplicity for searches.

- Frame files being rewritten to accommodate different epochs (J. Creighton).

# S5 Frequency Domain

- We are already at V2 for S5, thanks to the commissioning break at LHO.

- Period of instability, mainly affecting H2, which might necessitate some smaller epochs later on.

- The V1 and V2 calibrations are the same for L1, changes during commissioning were minor.

- Expect V3 calibration after LLO break.

# S5 Time Domain

- **Now generating h(t) using only DARM_ERR (not DARM_CTRL)**
- **Have switched to all FIR method   (simplifies book-keeping immensely)**
- **Have final S4 v4 h(t)**
  - **Systematic differences with 40Hz-5000Hz**
  - **in amplitude < 3%**
  - **in phase < $3^o$**
  - **In use by CW Group and Philip Charlton (maybe others?)**
- **For S5 have been generating h(t) on-line (same systematic differences as with S4)**

# S5 Time Domain

- **To do list:**
  - **Have whitened DARM_CTRL which we can use to get back to systematic differences in amplitude < 1%, in phase < 1°**
  - **Finish catching up with 1st month of S5, L1 done, H1 H2 in a couple more days**
  - **Performing a validation suggested by S. Klimenko, involving inverse calibrating a signal in the frequency domain adding it to real detector noise and forward calibrating in time domain**
  - **More validations would be nice, ideas?**

# S5 Time Domain

- The pulsar group has used both $h(f)$ and $h(t)$ calibrations in preliminary analyses of S5 data.

- $h(f)$ has been used for the time domain search

- $h(t)$ has been used for F-stat (frequency domain search)

- Results are consistent to within the calibration uncertainties.

- It is important for other groups to start using $h(t)$, it is probably the main means by which we will share data with VIRGO.

# Other Activities

- Photon Calibrator (P. Kalmus):
    - Draft document in the works.
    - Has written a DMT monitor, which is running on Fortress at present.
- High Frequency Calibration (R. Savage, S. Giampanis):
    - See next talk.
- Review issues:
    - Approval of S5 numbers
    - Validating calibrations from other detectors
    - h(t)
- We also have in mind to publish a technical paper on the S5 calibration.