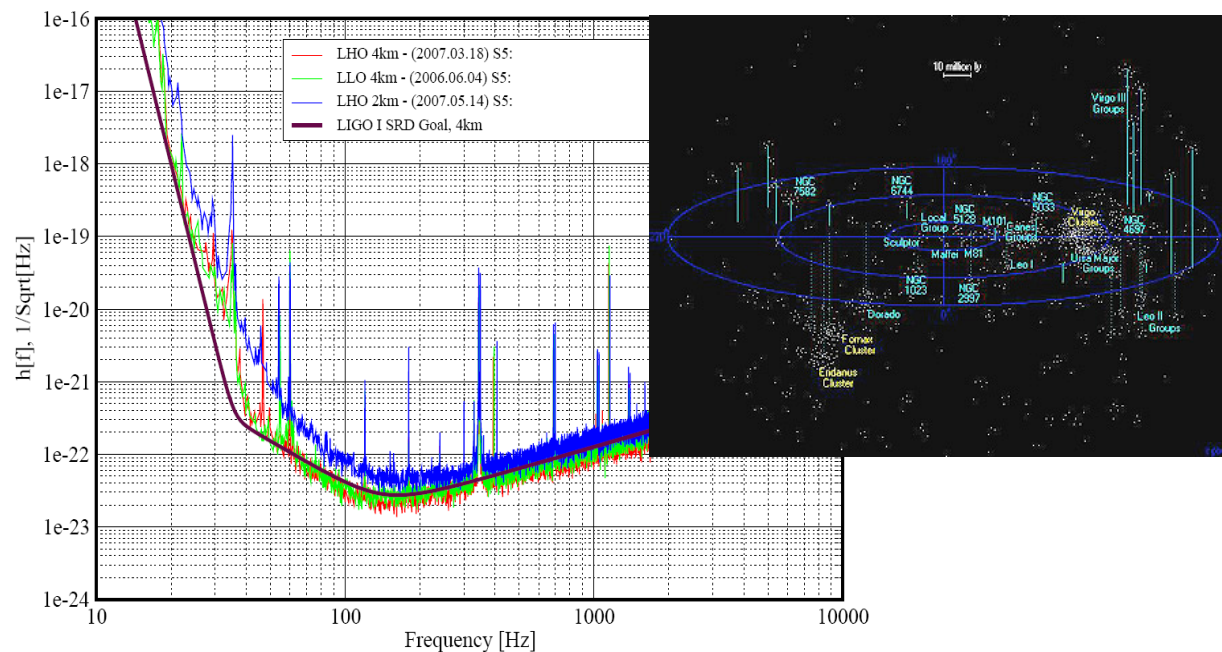


Calibration of the LIGO detectors

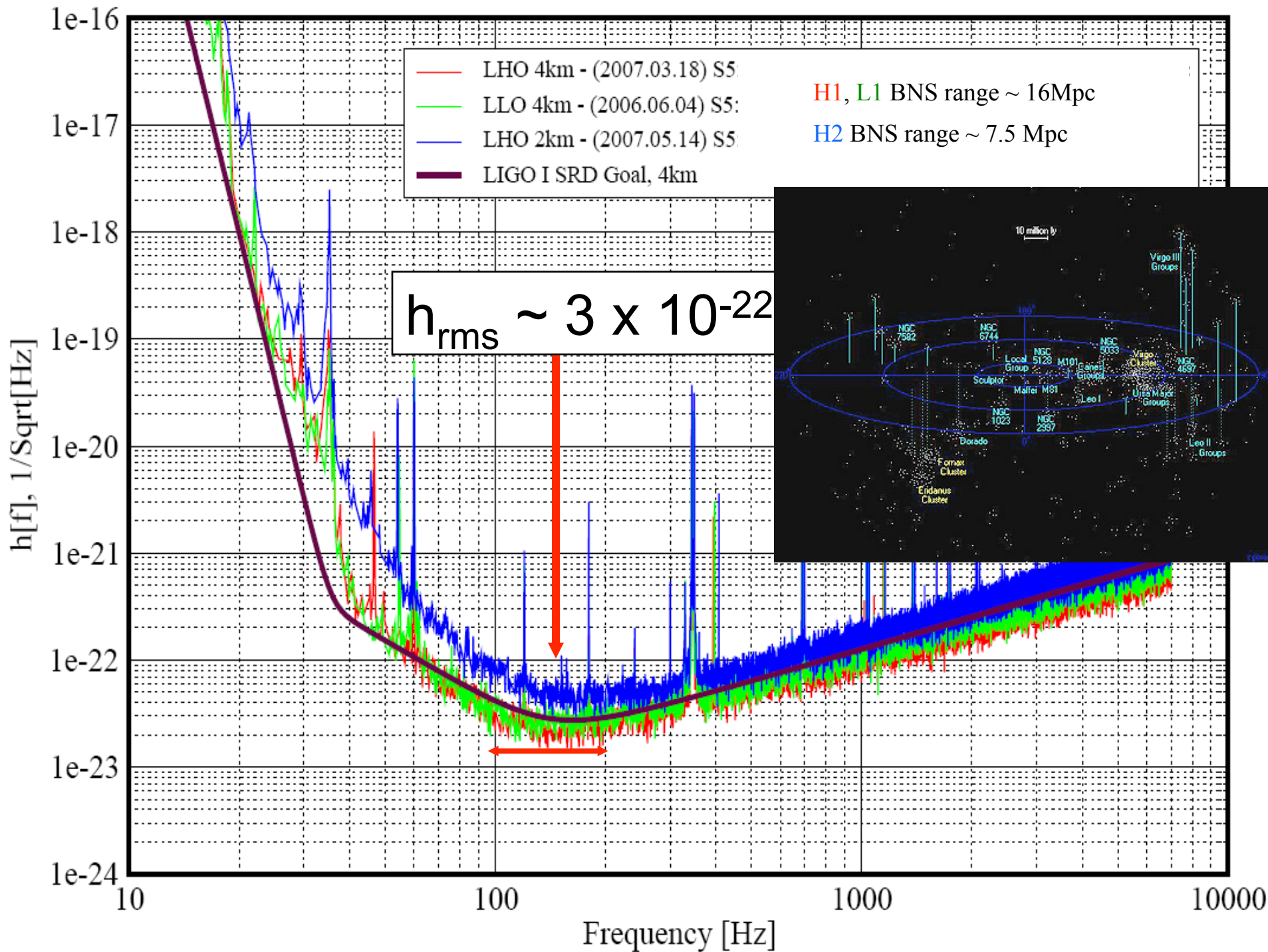


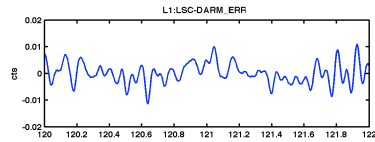
Gabriela González
Louisiana State University

For the LIGO Scientific Collaboration

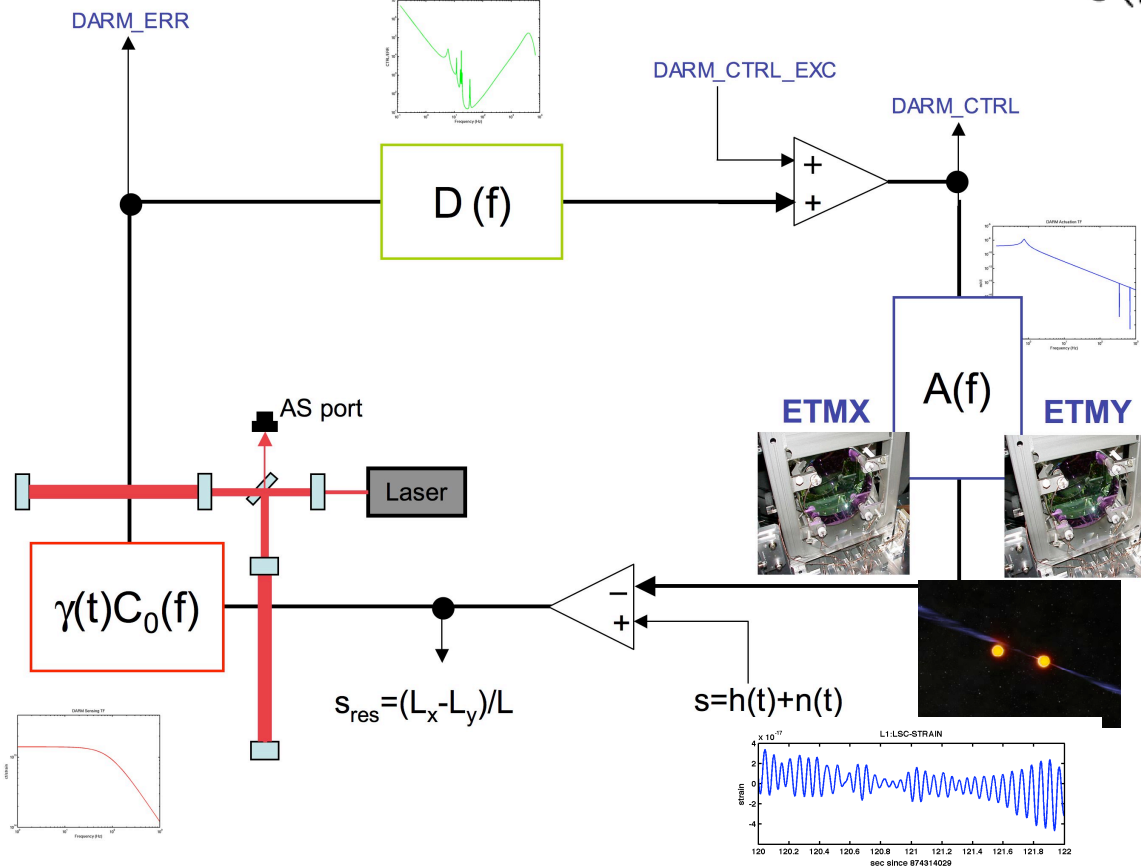


Gulf Coast Gravity Meeting, Baton Rouge, LA
April 17, 2009





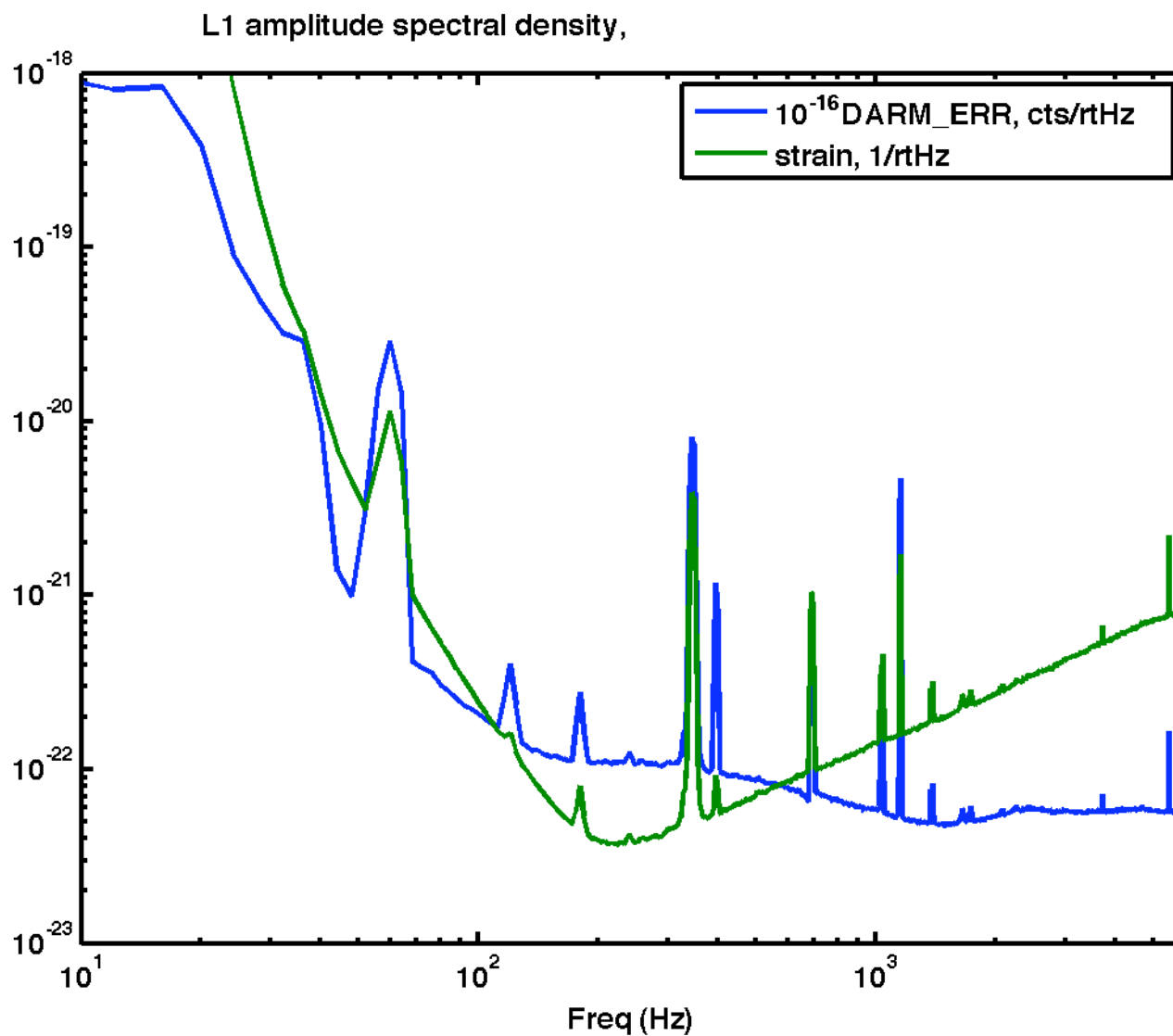
$$G_0(f) = A(f)D(f)C_0(f)$$

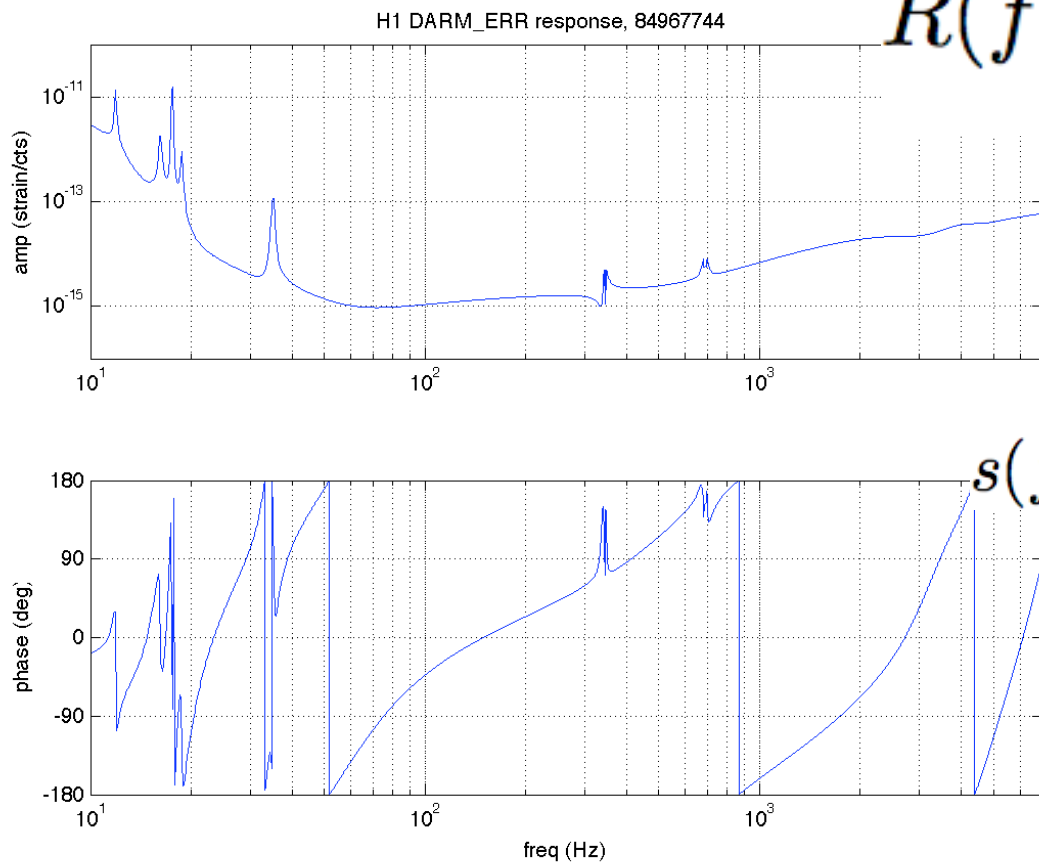


$$R(f) = \frac{1 + \gamma(t)G_0(f)}{\gamma(t)C_0(f)}$$

$$s(f) = R(f)DARM_ERR(f)$$

“Raw” and calibrated signals: average spectral densities





$$R(f) = \frac{1 + \gamma(t)G_0(f)}{\gamma(t)C_0(f)}$$

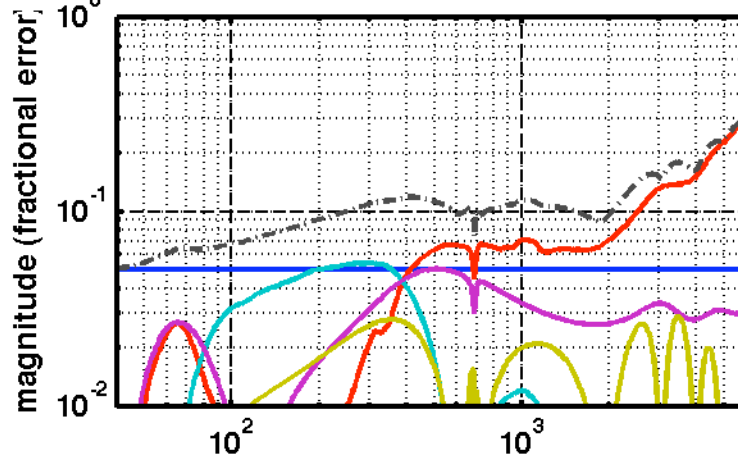
(from model)

(from ifo)

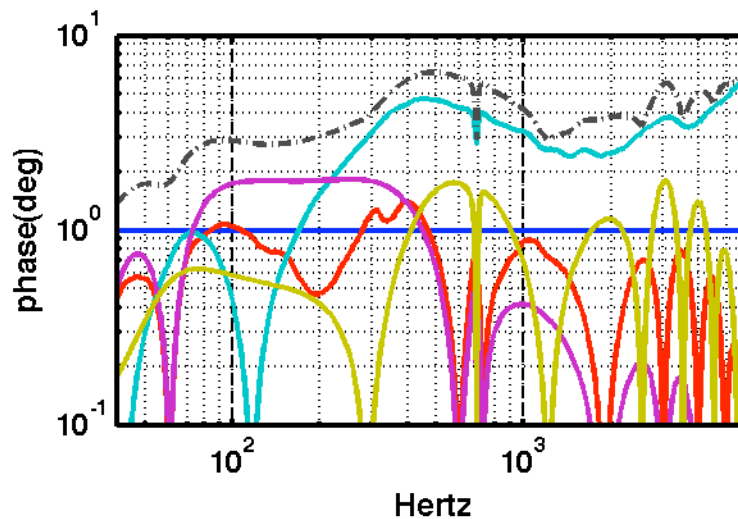
$$s(f) = R(f)DARM_ERR(f)$$

$$h(t) = \int R(t - \tau)DARM(\tau)d\tau$$

Error in response function: H1 S5_V
 H-H1_CAL_REF_OLOOP_GAIN_S5_V4-815155213-9540481.tx

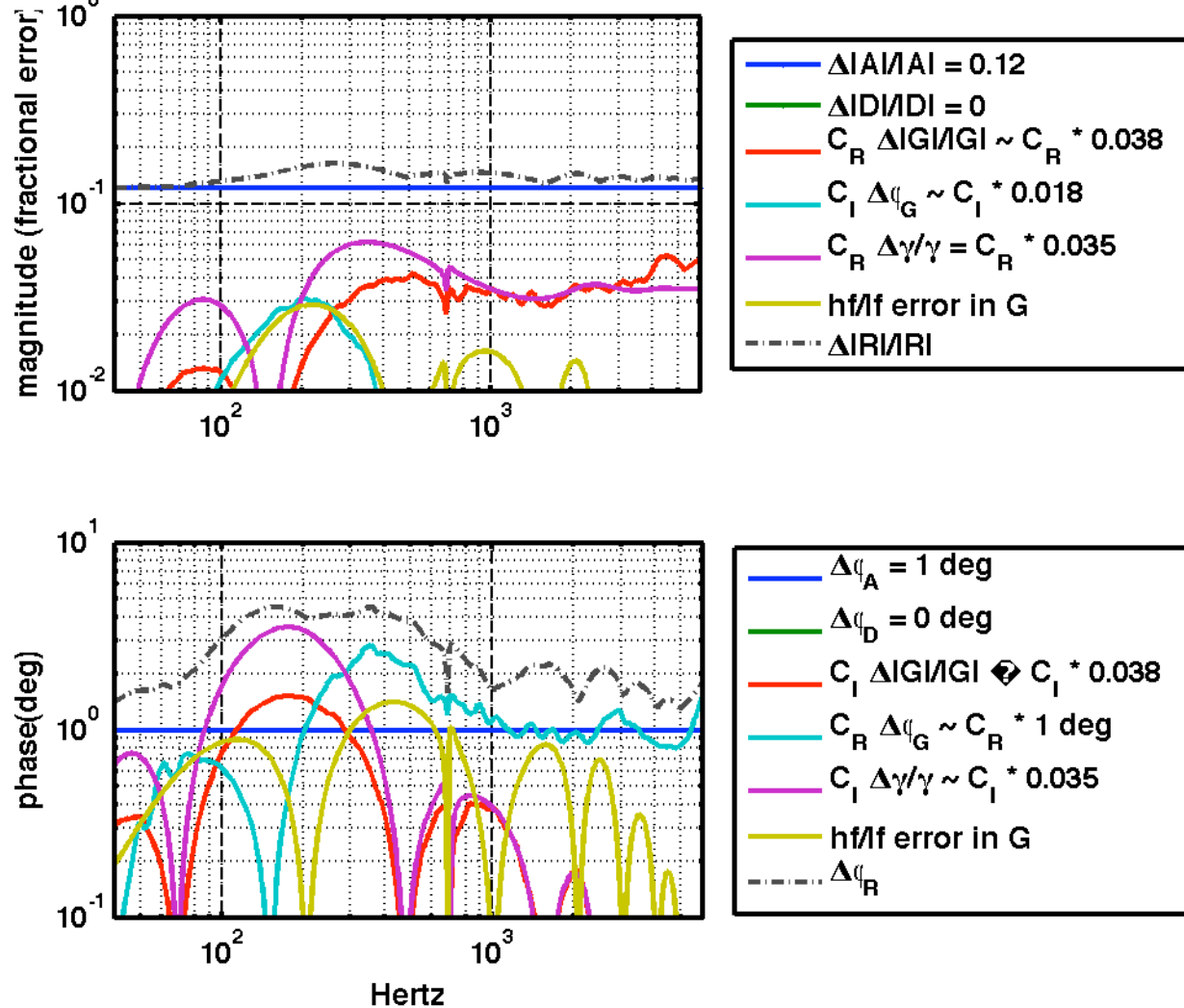


- $\Delta|A|/|A| = 0.05$
- $\Delta|D|/|D| = 0$
- $C_R \Delta|G|/|G| \sim C_R * 0.13$
- $C_I \Delta\phi_G \sim C_I * 0.064$
- $C_R \Delta\gamma/\gamma = C_R * 0.03$
- hf/f error in G
- - - $\Delta|R|/|R|$



- $\Delta\phi_A = 1 \text{ deg}$
- $\Delta\phi_D = 0 \text{ deg}$
- $C_I \Delta|G|/|G| \sim C_I * 0.13$
- $C_R \Delta\phi_G \sim C_R * 3.7 \text{ deg}$
- $C_I \Delta\gamma/\gamma \sim C_I * 0.03$
- hf/f error in G
- - - $\Delta\phi_R$

Error in response function: L1 S5_V
 L-L1_CAL_REF_OLOOP_GAIN_S5_V4-816019213-8478614.txt



- How good is current calibration?
 - ~ 10%, few degrees ...

- How good can calibration be?
 - » At what frequency?
 - » In magnitude or phase?
 - » Statistical or systematic errors?

- How good does calibration need to be?
 - » Good enough for discovery
 - » Good enough for doing astrophysics

