

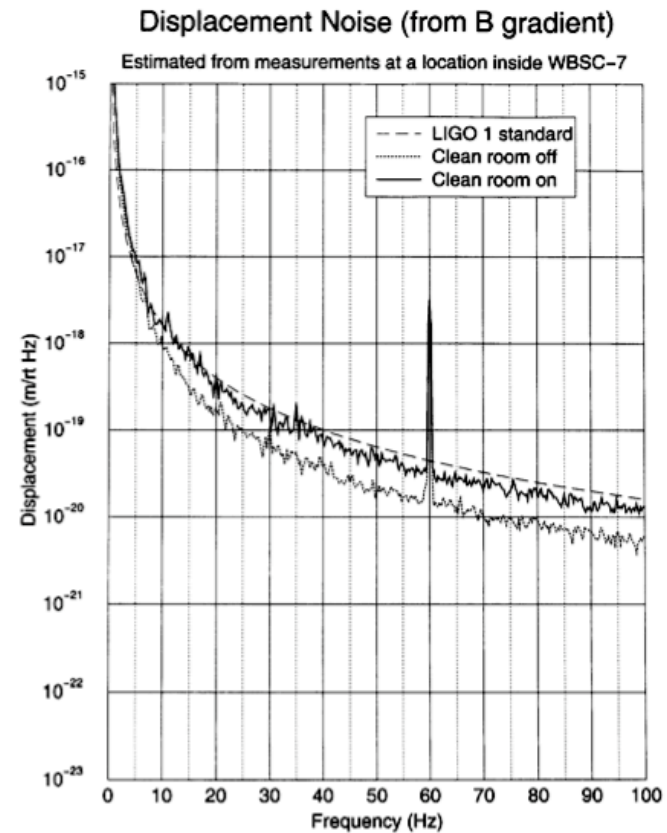
Inter-site Magnetic Correlations

Bernard F Whiting
with support from
Shourov Chatterji, Vuk Mandic
and
Robert Schofield

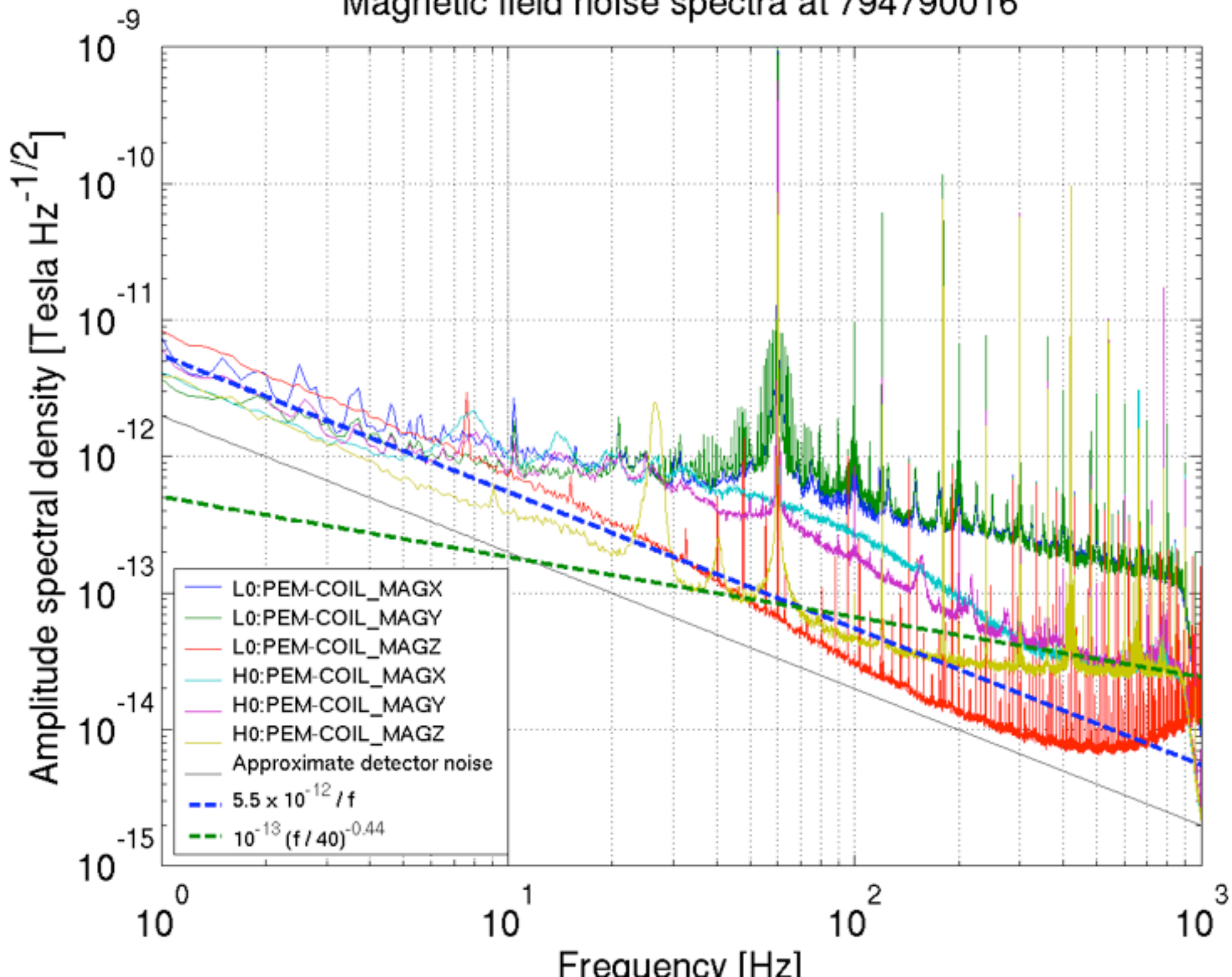
LIGO DCC number: G060147-00-Z

Magnetic field dependence

- Observed from the beginning of construction
- Quiet mode sought during science runs
- Critical because of reliance on coil drivers for suspended mirrors

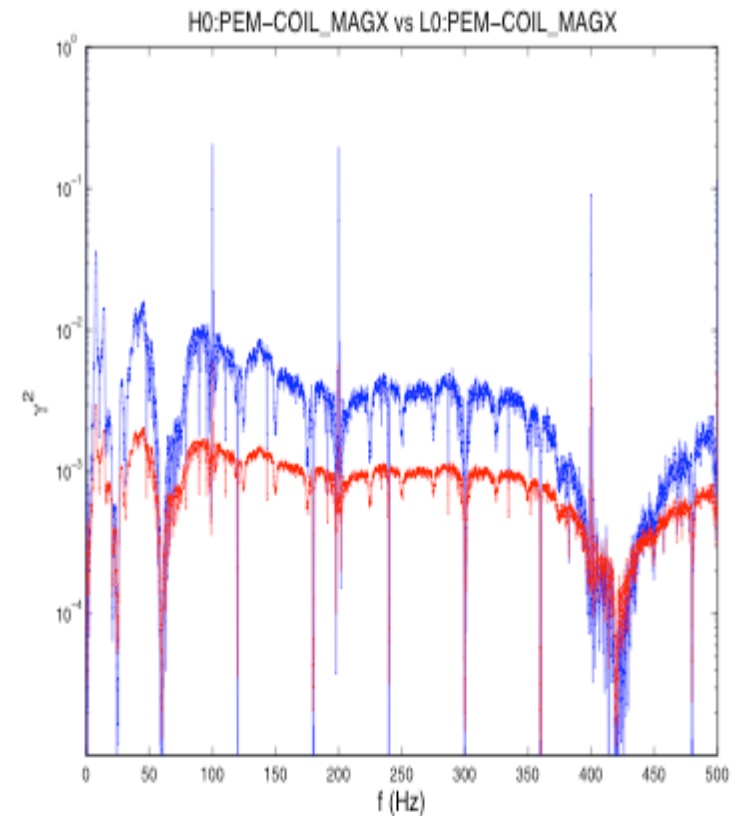


Magnetic field noise spectra at 794790016



Inter-site magnetometer coherence

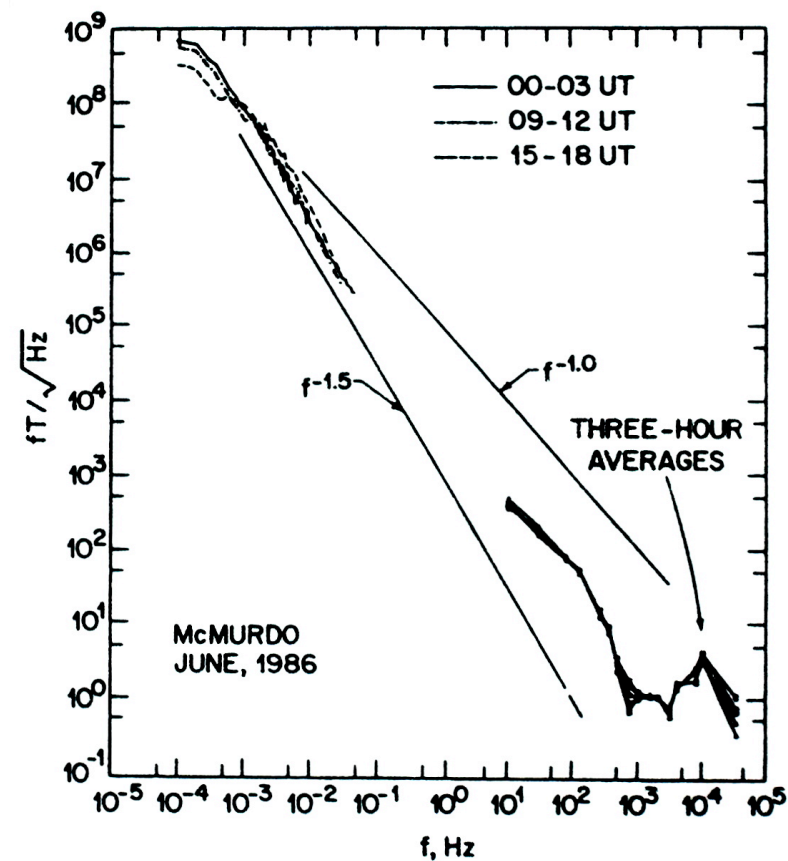
- Vuk found inter-site coherence of .003 - .01 in the frequency range 50-350 Hz
- The coil magnetometers give 10^{-13} - 10^{-12} T/rt Hz at 50 Hz for the two sites (previous transparency)
- => source of 70 fT/rt Hz for observed coherence



Coherence over all of S4 is shown in blue, $4\sigma_{\gamma^2}$ is shown in red.

The terrestrial cavity

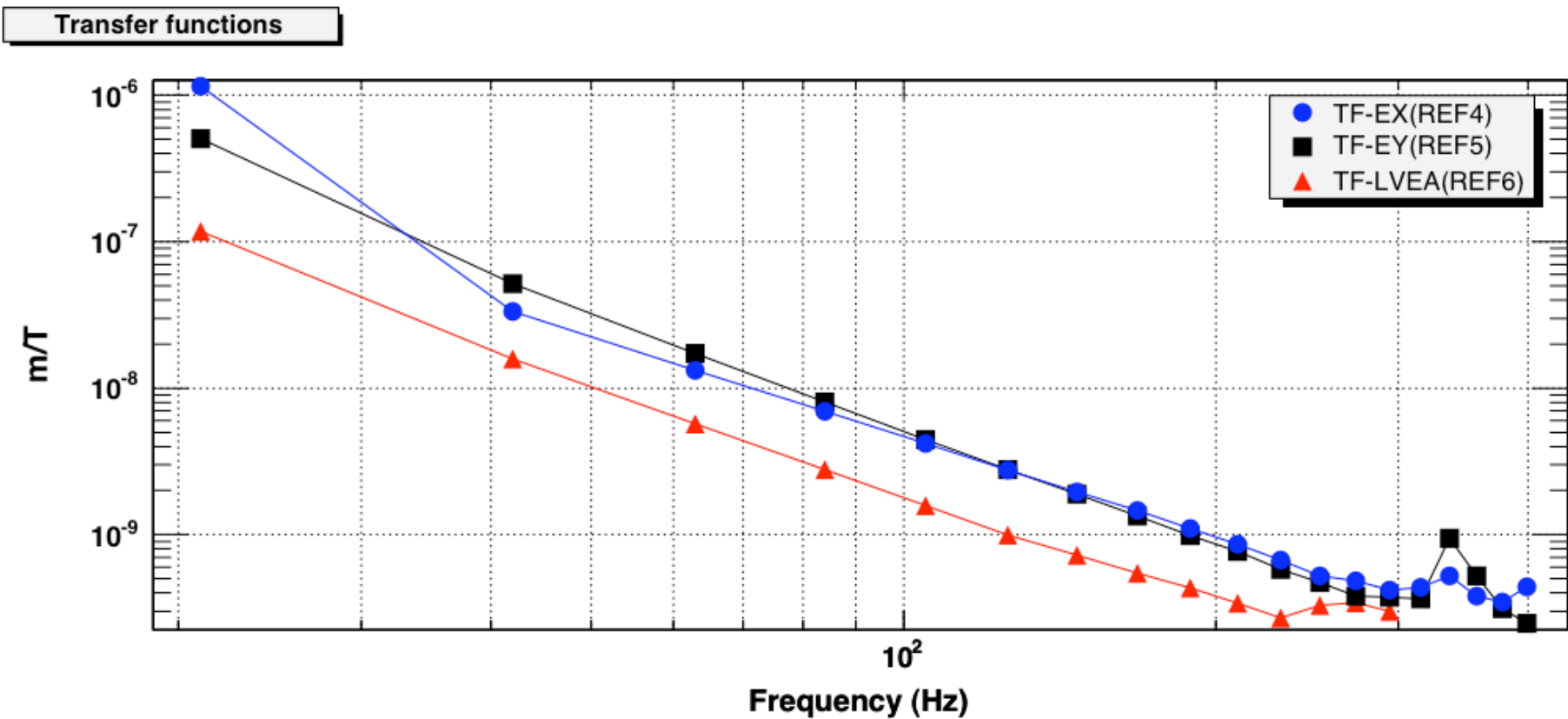
- Compare with measurements of non-anthropogenic fields in far away Antarctica
- Fold in expected long range correlation ~ 0.75 (see next transparency)
- Consistent with observed coherence during S4



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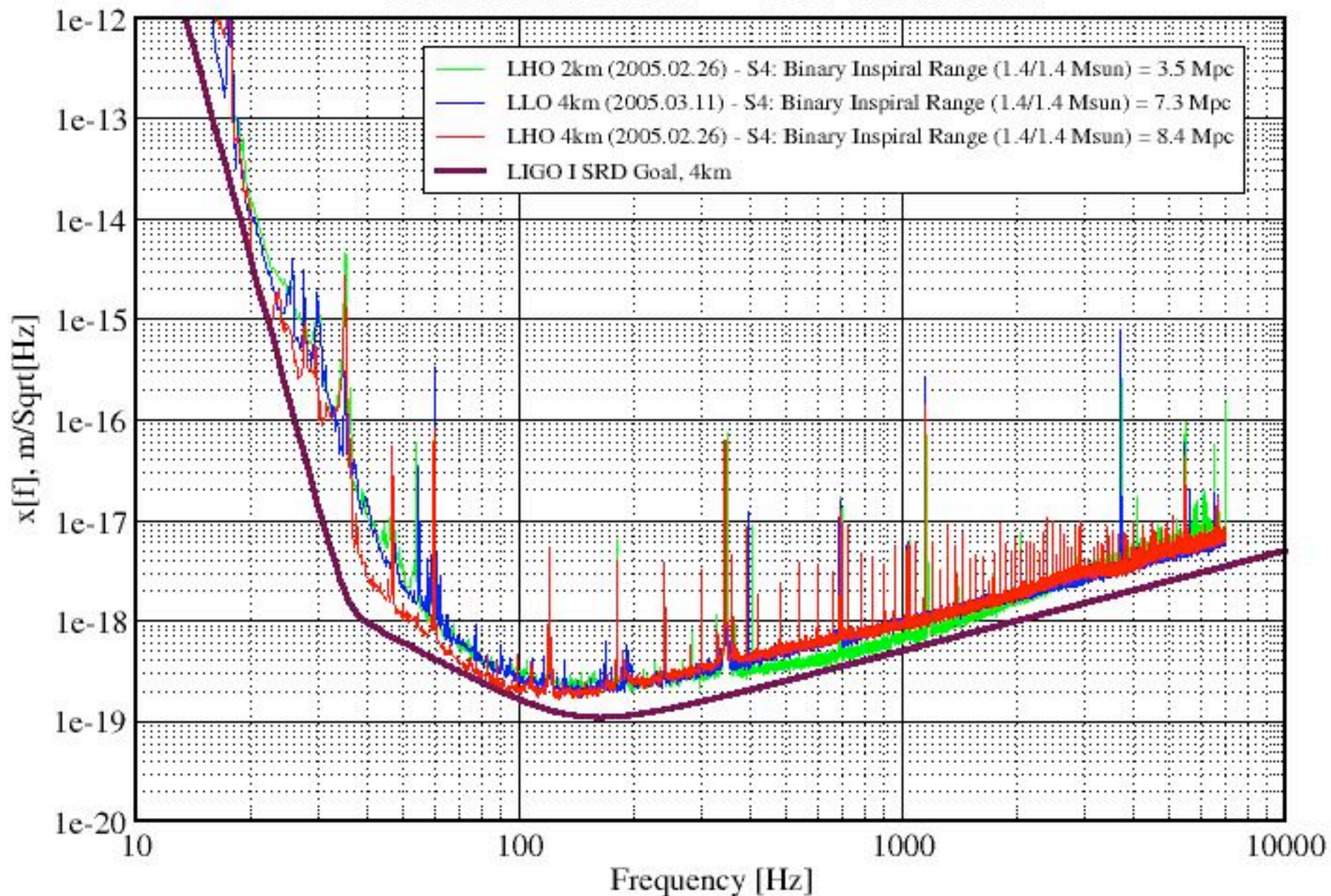
- Presents observations of the horizontal magnetic component of Schumann resonance intensities as simultaneously measured in California and Western Australia during two separate intervals September 2-17 1989, and April 14-21 1990.
- When corrected for local *D* region height, detailed diurnal intensity profiles over the two intervals display inter-station correlation coefficients of 0.70 and 0.82, respectively.

Use transfer functions from Robert for S4



Displacement Sensitivities for the LIGO Interferometers

Best Performance for S4 LIGO-G050231-02-E



Doing the math for a stochastic background

- $70 \text{ fT/rt Hz} * 30 \text{ nm/T} = 2.1 \times 10^{-21} \text{ m/rt Hz}$.
- cf $1-2 \times 10^{-18} \text{ m/rt Hz}$ for S4 at 50 Hz. Use:

$$S_{\text{gw}}^{1/2}(f) = 4.0 \times 10^{-22} \left(\frac{100 \text{ Hz}}{f} \right)^{3/2} \sqrt{\frac{\Omega_0}{\text{Hz}}}$$

- $\Rightarrow 2 \times 10^{-7}$ for Ω_0 at 50 Hz (1×10^{-9} at 200 Hz)
- Ultimate effect on LIGO | stochastic search?