

Stochastic Background Detection Correlation Techniques Between Bar & Interferometer Data

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Outline

I Background and Motivation (Whelan)

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- Review of Cross-Correlation Technique
- Motivations for Bar-IFO (e.g. ALLEGRO-LLO) Correlations

II Implementation and Technical Challenges (McHugh)

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ALLEGRO data during E7

Presenter: Martin McHugh

Orientation	GPS	UTC
IGEC alignment (48° CCW from N)	694248422 – 694310432 694483231 – 694734091	05-Jan-2002 06:46:49 - 06-Jan-2002 00:00:19 08-Jan-2002 00:00:18 - 10-Jan-2002 21:41:18
Aligned with Y-arm (18° CCW from N)	694737691 - 694903471	10-Jan-2002 22:41:18 - 12-Jan-2002 20:44:18
Null alignment (63° CCW from N)	694910671 - 695171763	12-Jan-2002 22:44:18 - 15-Jan-2002 23:15:50

Recent/current activities

- Stochastic DSO handles both ifo-ifo and bar-ifo cross correlations
- Frames of E7 data have been made using code written by Ed Daw
- ALLEGRO undergoing transducer upgrade
- will NOT take data during S1
- aiming for S2

Complications

- Heterodyning – bar data is in-phase and quadrature output of a lock-in amplifier with reference frequency 907 Hz
- sampling rate – 250Hz
- dynamic range – raw output is 2 sharp lines at the bar resonant frequencies

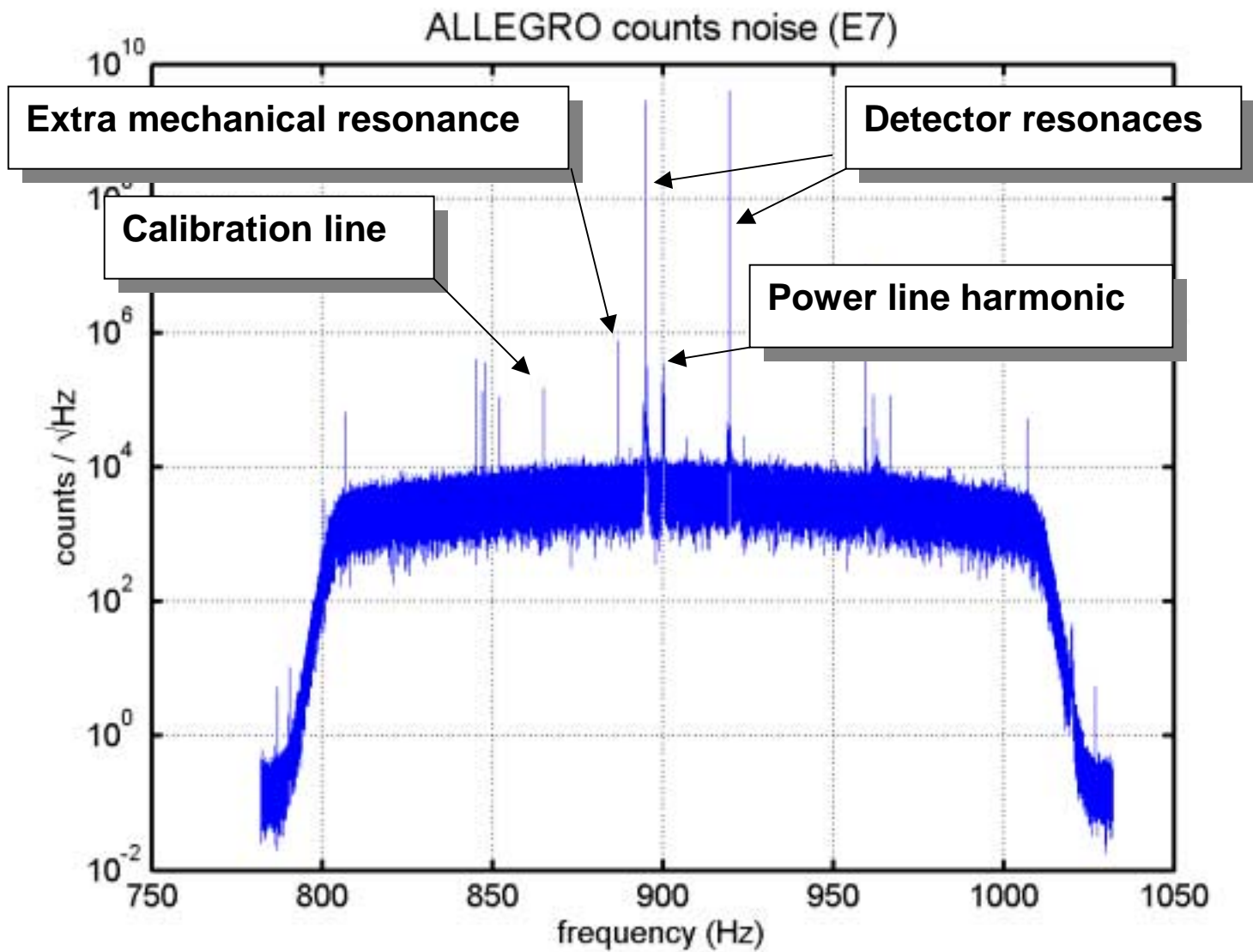
Bar–ifo Stochastic Analysis Chain

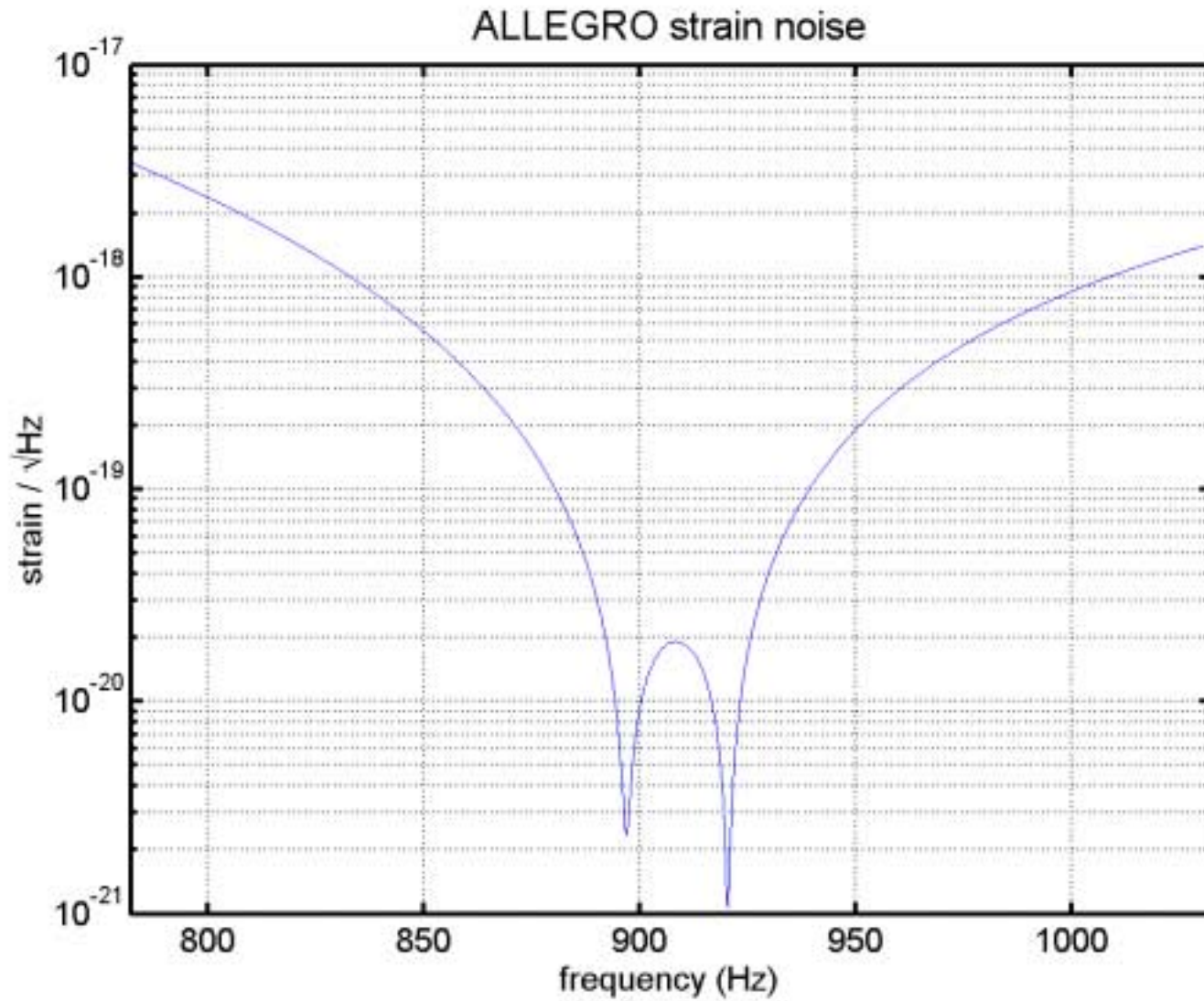
Bar:

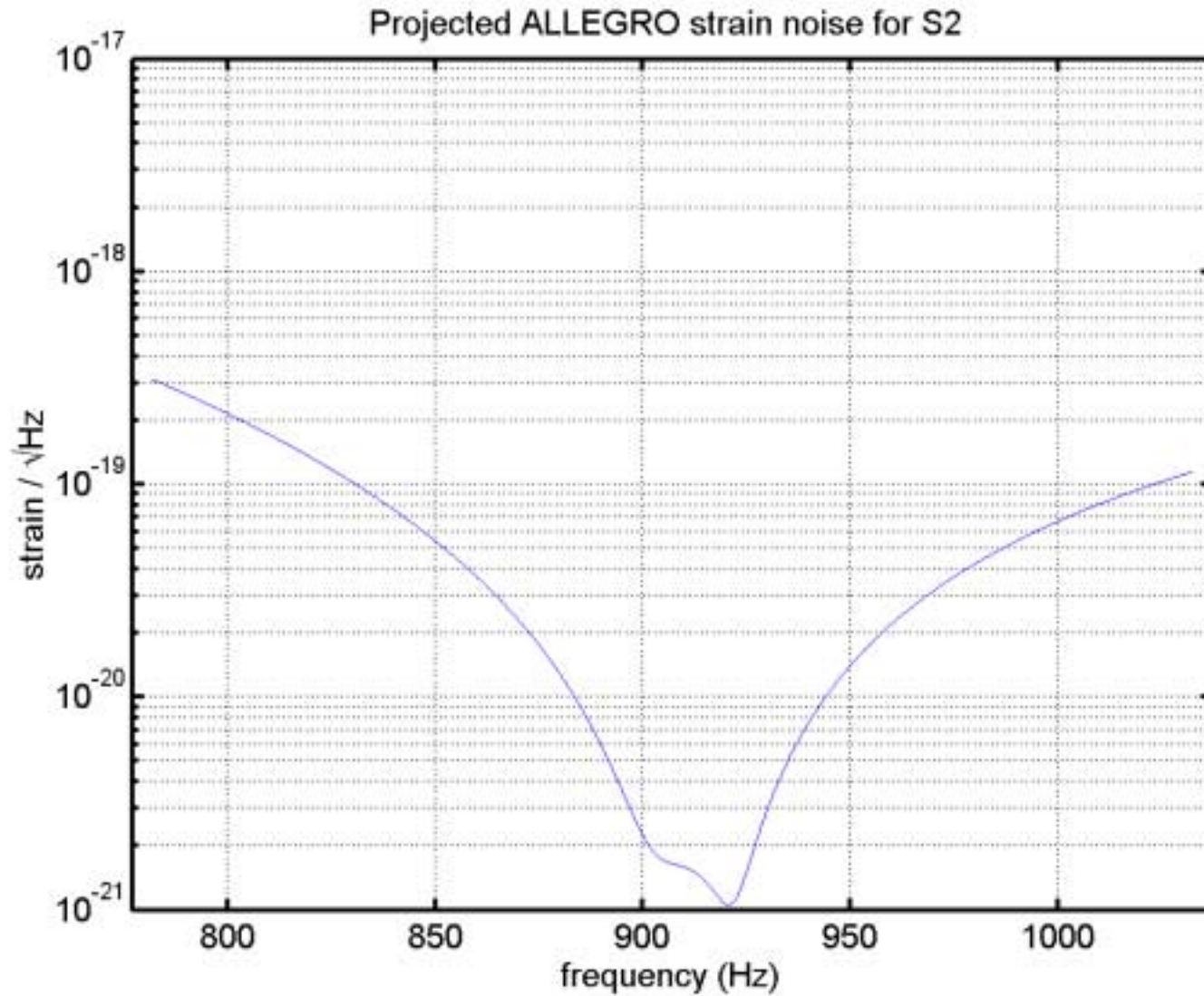
- Whiten data (response function alone leaves spectrum with big ‘dips’) – frequency domain or time domain ?
- Form response – de-whitening function
- Two-sided psd of result
- Pass data to DSO

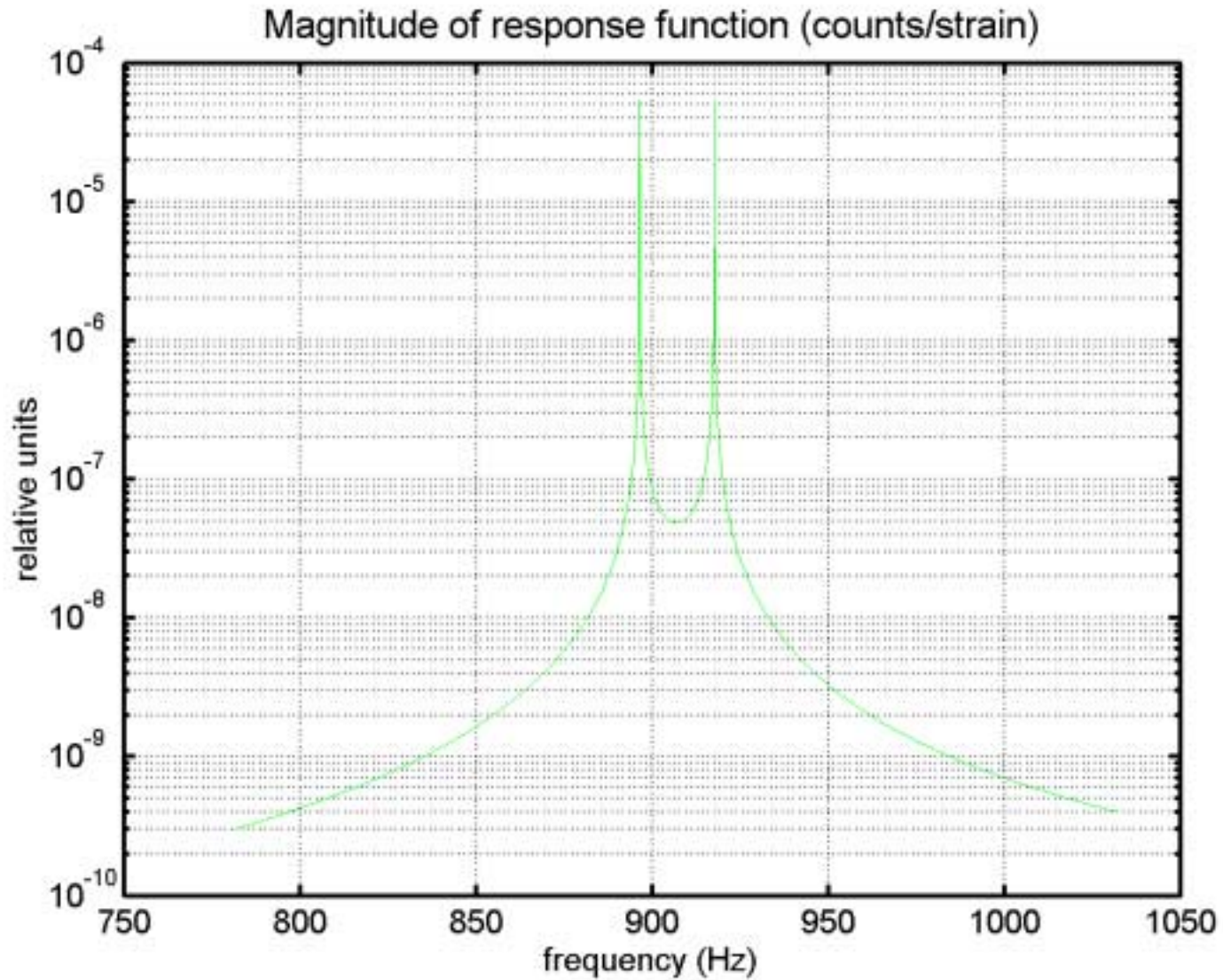
Interferometer:

- mix with reference of appropriate frequency (907Hz) and phase
- resample complex times series 16384Hz to 250Hz
- take 2-sided psd
- pass data to DSO









Questions

- Rotating the bar between X-arm alignment and Y-arm alignment flips the sign of the GW correlation – allows cancellation of correlated noise
- Null orientation gives measure of correlated noise
- What's the optimal amount of time in each of these orientations?