

The AURIGA-LIGO Joint Burst Search

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Scientific Motivation for Joint Analyses



- suppress false alarm rates
- increase effective observation times
 - » i.e. 3 out of 4 detectors
- increase sky coverage
- increase detection confidence (source parameters?)

AU1 run: Dec 24 2003 – Jan 14 2004

S3 run: Oct 31 2003 – Jan 9 2004

92 hours 4-fold coincidence

175 hours 3-fold coincidence

AURIGA-LIGO

First Coincidence Run



AU1 run: Dec 24 2003 – Jan 14 2004

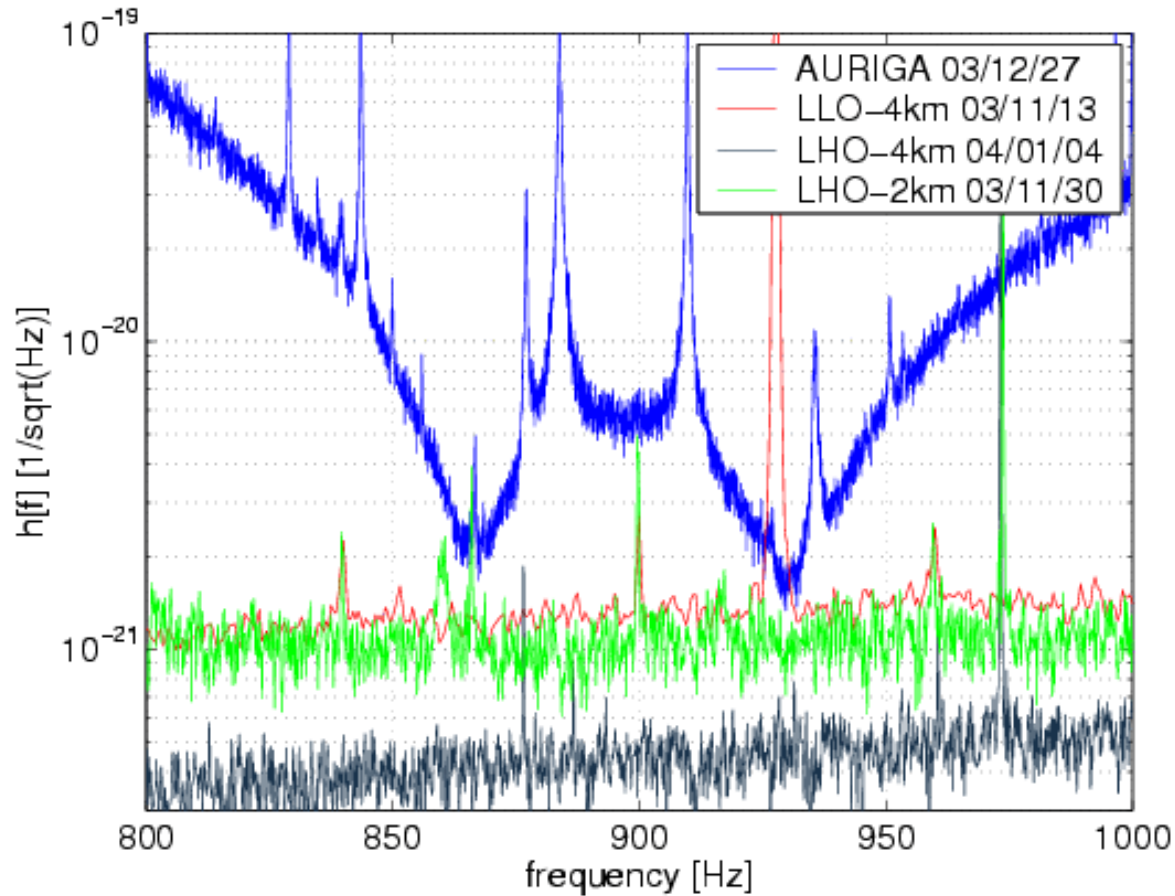
S3 run: Oct 31 2003 – Jan 9 2004

92 hours 4-fold coincidence

175 hours 3-fold coincidence

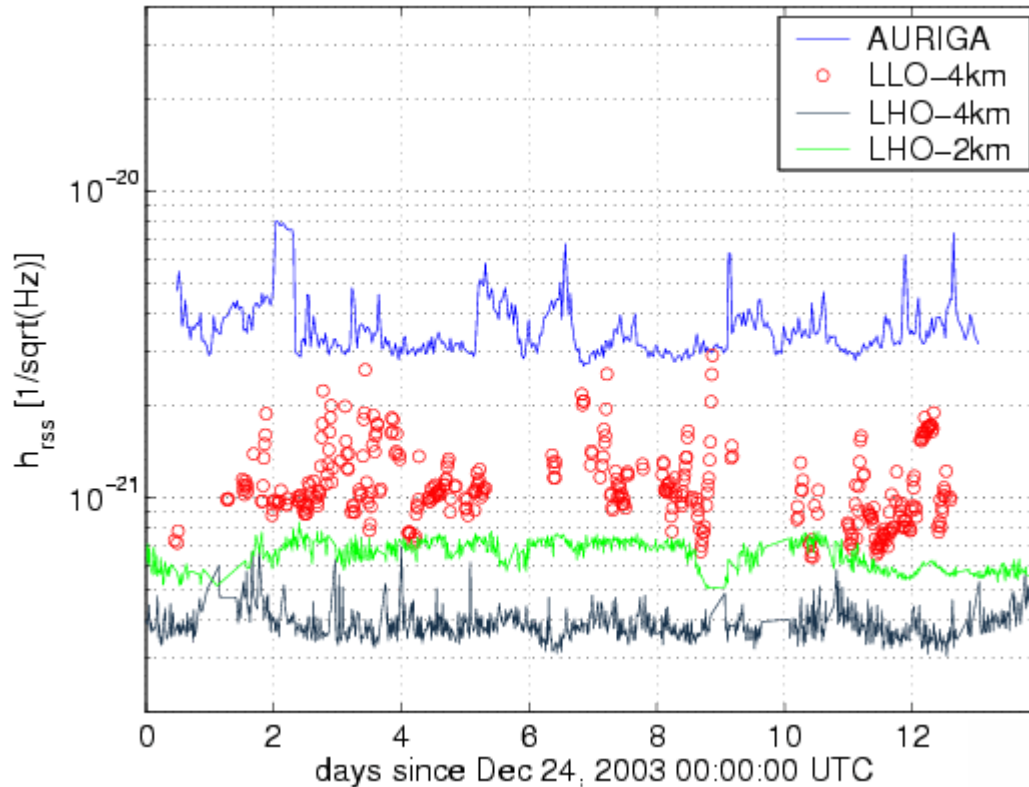
- MOU for S3/AU1 burst analysis signed in July 2004
- Joint Working Group composition:
 - » AURIGA: G. Prodi, L. Baggio, A. Mion, A. Ortolan, S. Poggi, F. Salemi, G. Vedovato
 - » LSC: L. Cadonati, S. Heng, W. Johnson, P. Sutton, M. Zanolin
- Target analysis completion: spring 2005

Performance (1)



LLO 2-3 times worse at times

Performance (2)



h_{rss} with SNR=1
for
SG 900Hz Q=9

$$\rho = \left[4 \int_0^{\infty} df \frac{|\tilde{h}(f)|^2}{S(f)} \right]^{1/2}$$

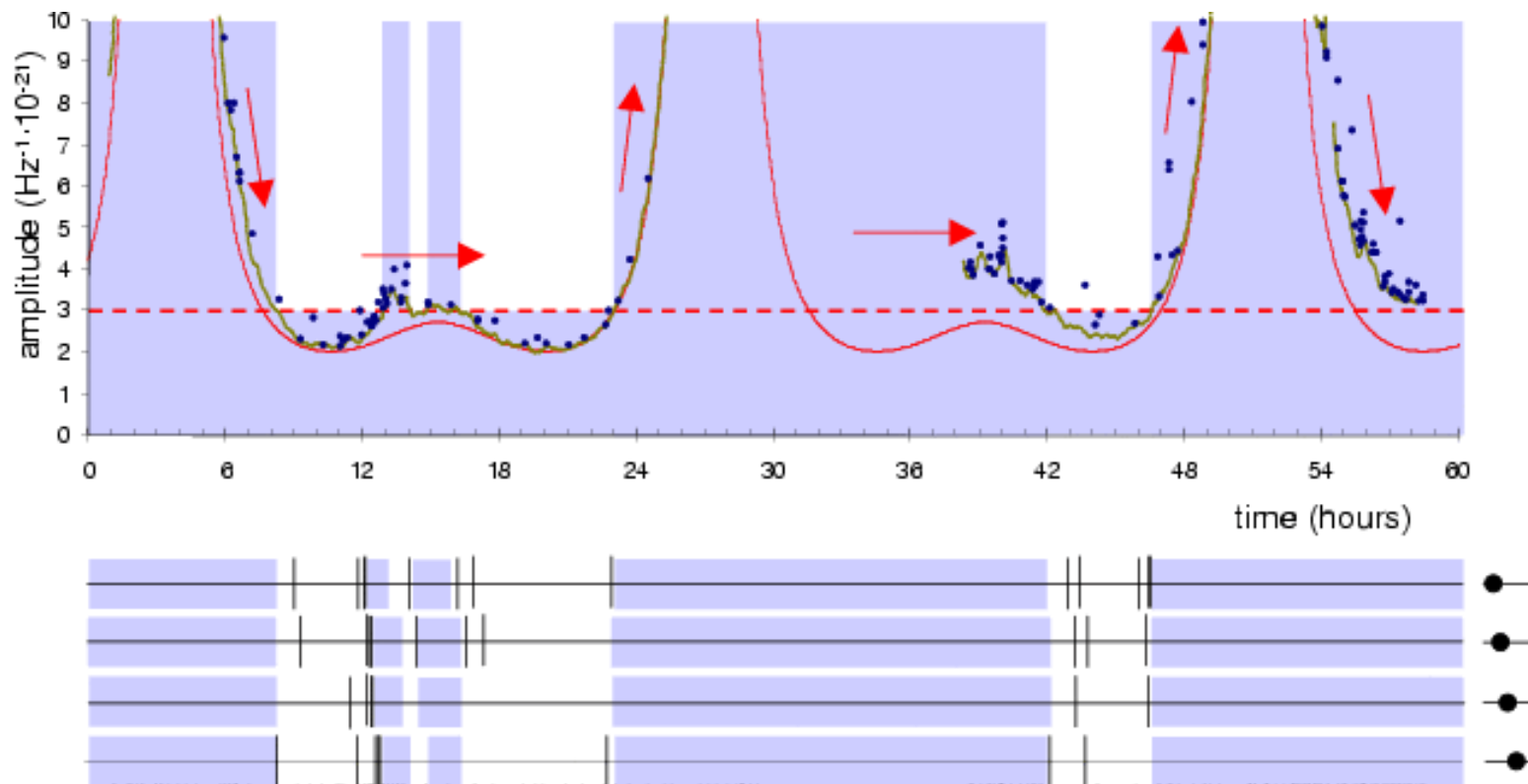
General Strategy for a Trigger-based Analysis



- Data quality and veto done “at home”
- Exchange SINGLE INTERFEROMETER triggers
 - » peak time and its error
 - » amplitude A (BW 850-950Hz and broadband) and its error
- Exchange A_T (minimum detectable) versus time

- Blind analysis
 - » Playground or time-shifted data?
- Compare measured “test statistic” to its background distribution
 - » Background measured with time-lags
- Result interpretation
 - » directional analysis (optimized)
 - » all-sky search (using montecarlo for source position distribution)

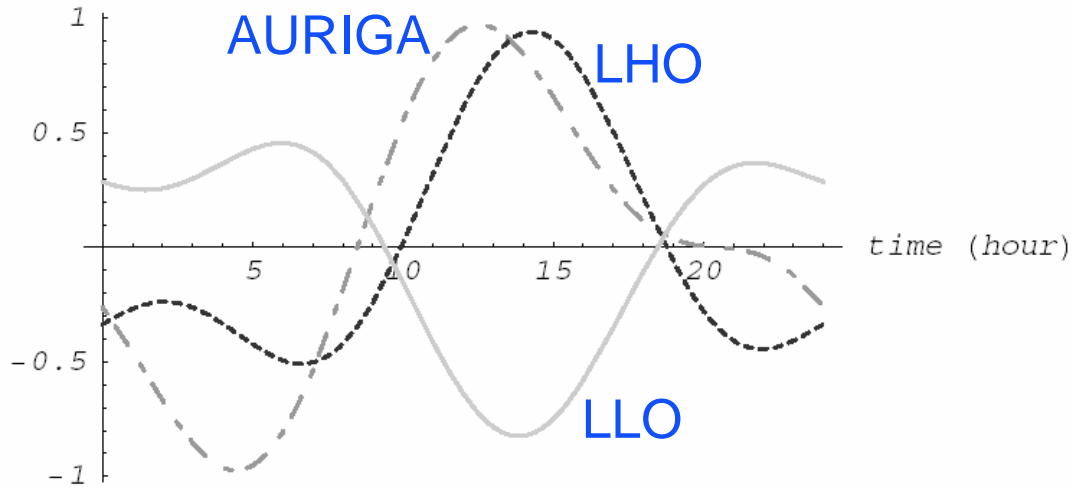
Method 1: Directional Analysis



Antenna Patterns for Galactic Center

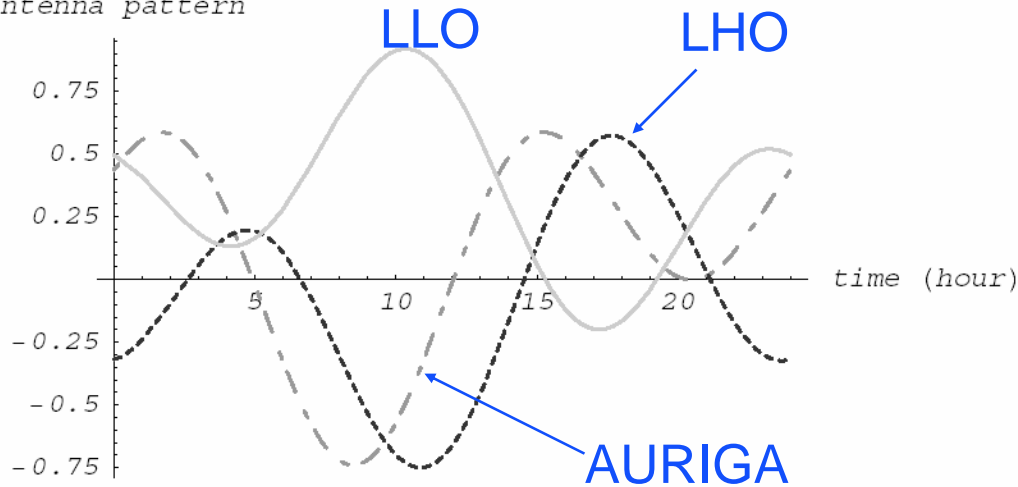


antenna pattern

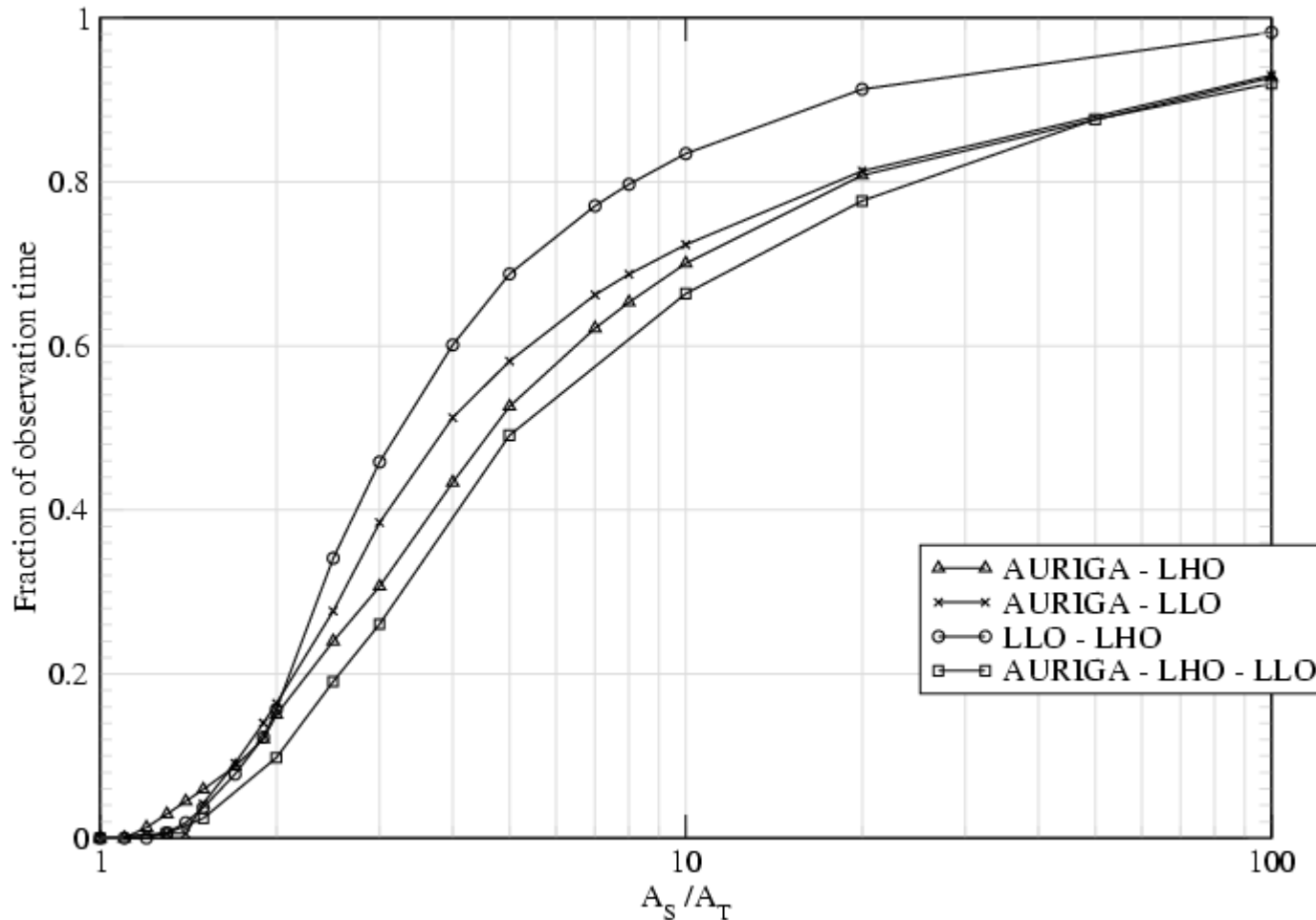


cross

antenna pattern

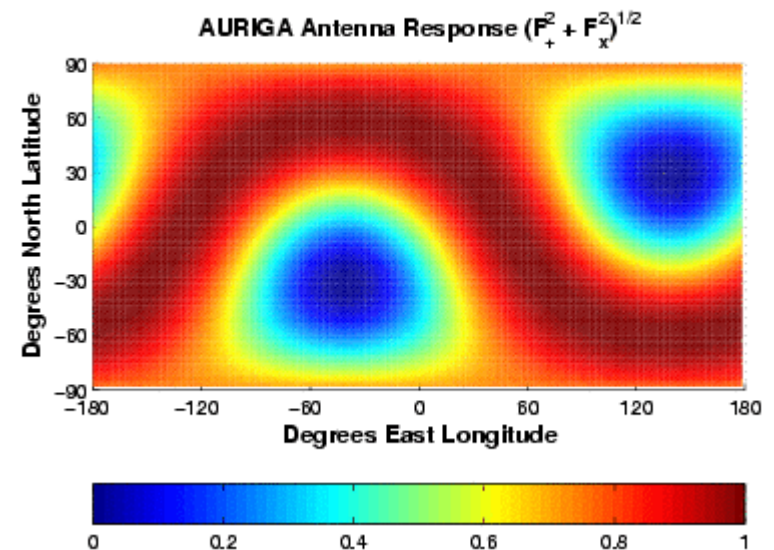
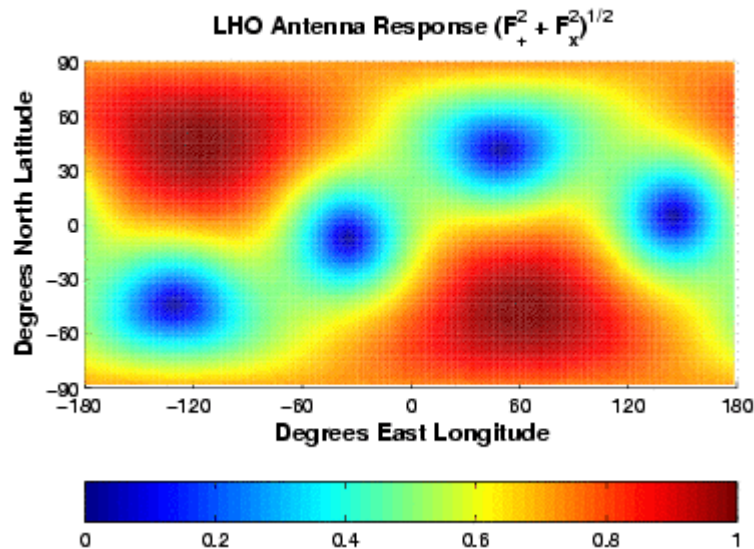


plus



Method 2: “Eyes Wide Open”

- CorrPower events around the times of AURIGA triggers



Method 2: “Eyes Wide Open”

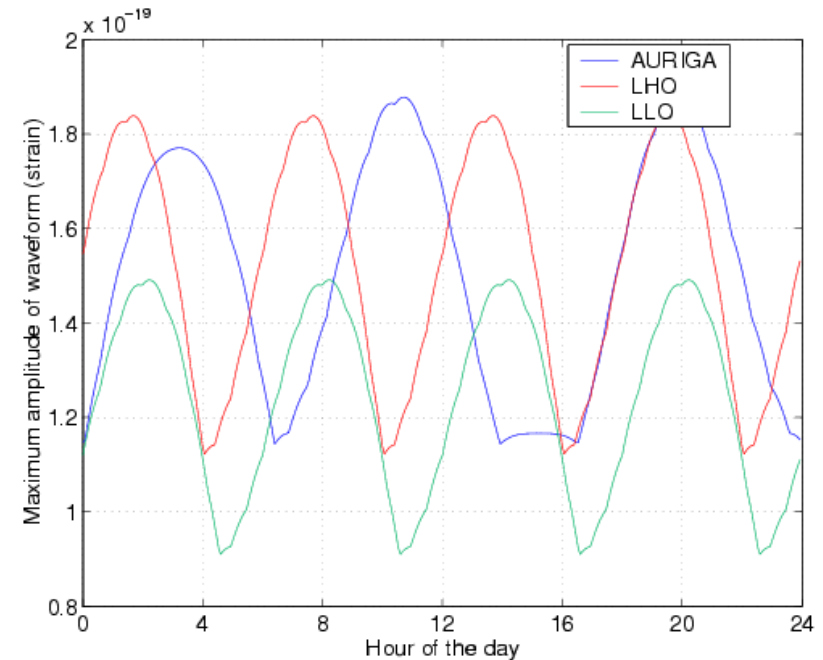
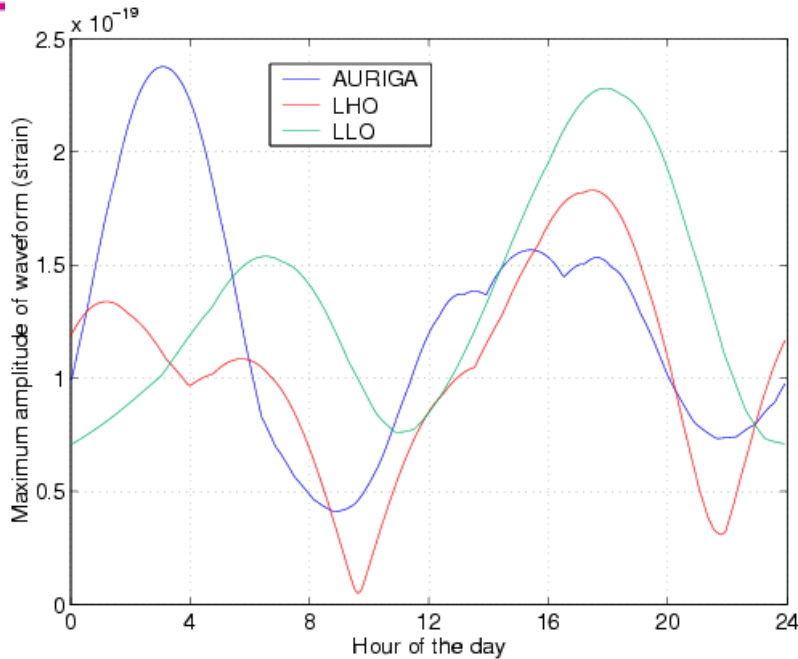


Figure 7: The peak signal amplitude observed by AURIGA, LHO and LLO for a Lazarus black hole merger waveforms for a pair of 15 solar mass black holes, with polarization angle of 45 degrees, at a distance of 1 megaparsec. Figure *a* shows the detector responses for a source location with a polarization angle of 180 degrees (south pole) where AURIGA observes a larger peak response than LLO for 80% of the day. Figure *b* shows the detector response for a source location with a polarisation angle of 85 degrees (near equator) where AURIGA observes a larger peak response than LHO for 62% of the day.

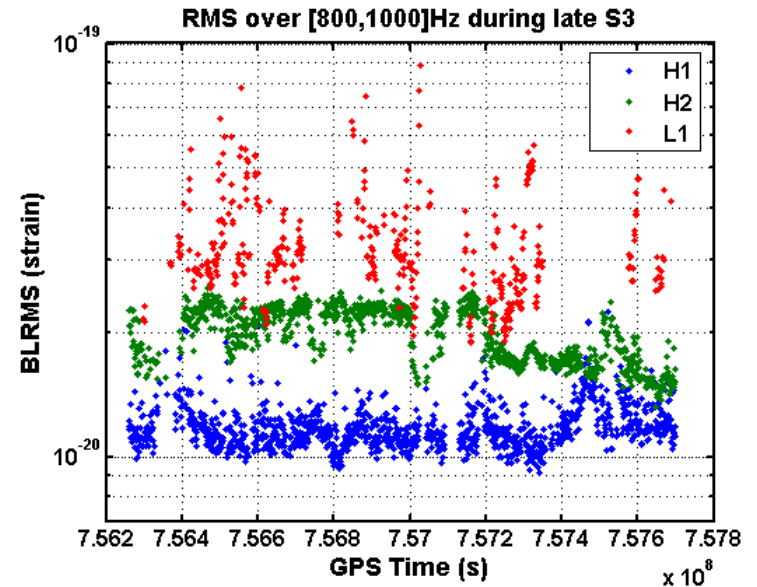
Simulations for method 2

LIGO:

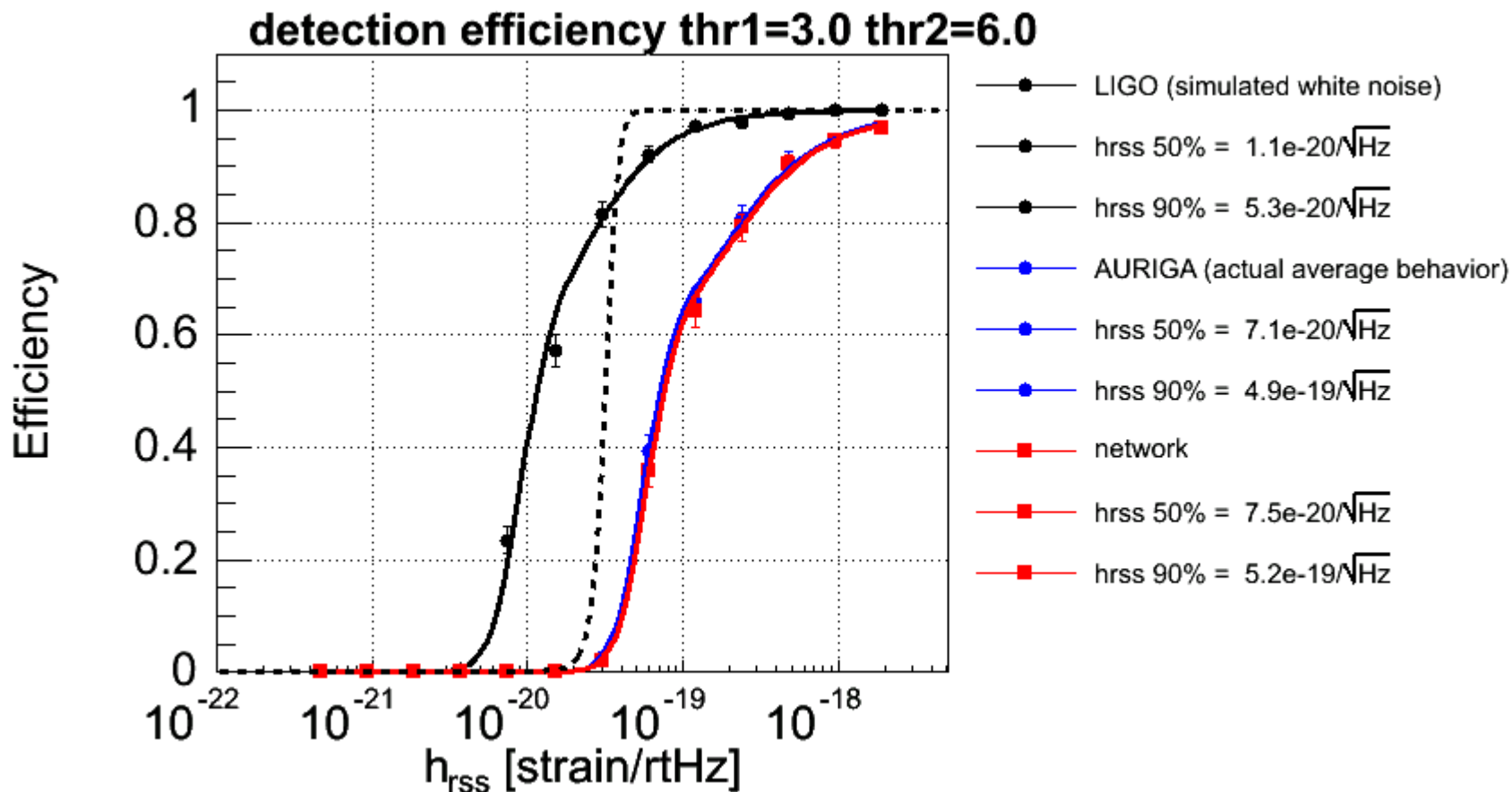
white gaussian noise
matching median BLRMS during
the AURIGA-LIGO coincidence run

AURIGA:

montecarlo average detection
efficiency using delta-filter and
SNR>6 (???)



Sine-Gaussians 900 Hz Q=9



Template Waveforms

- Gaussian, Sine Gaussian (900 Hz central frequency)
- Damped sinusoids
- Lazarus waveforms for BH-BH mergers (10-20 M_{\odot})

Summary and Outlook

