



Detection Confidence Discussion: S2/S3 Scenarios

Stan Whitcomb
LIGO Caltech

LSC Meeting
Joint ASIS/DetChar Session
20 August 2003
Hannover

- S2
 - » Possible signal at an h of $3e-24$ at a frequency of 380 Hz in L1
 - » Confidence level 80% in L1
 - » H1/H2 consistent, but do not add significantly to confidence
 - » If \dot{f} is due to slowing due to gravitational waves, the distance to the (presumed) neutron star source is 300 pc
- S3
 - » Template with previous observed f and \dot{f} shows no signal.
 - » If the same \dot{f} and an f which is increased by 0.7 mHz are used. L1 sees a signal of $2e-24$ at a confidence level of 90%.
 - » H1 sees a signal of $1.5e-24$ at a confidence level of 85%.
 - » H2 consistent, but do not add significantly to confidence

- S2 result:
 - » L1-H1 $\Omega = 0.3 \pm 0.2$ (error bars are 90% confidence)
 - » L1-H2 $\Omega = 0.2 \pm 0.3$
- S3 result:
 - » L1-H1 $\Omega = 0.2 \pm 0.15$
 - » L1-H2 $\Omega = 0.0 \pm 0.2$
- In both runs:
 - » H1-H2 dominated by clear instrumental correlations
- One deviation from the "expected" result
 - » Spectrum of $\Omega(f)$ not consistent with flat,
 - » Fits power law between $f^{(0.7 - 1.4)}$

- Nothing in the S2, but S3 has the following "event"
 - » Strongest L1 trigger $\rho = 18$ event.
 - » Highest ρ in 6.6 - 4.8 solar mass BH template
 - » Distance estimate is 8 Mpc.
 - » It passes the χ^2 test with flying colors
 - » The next highest ρ during the two runs is 13
- H1 and GEO were down.
- H2 sees the event but it is much less gold-plated than L1.
 - » It shows a $\rho = 7$ in the same template as the L1 event,
 - » Maximum ρ comes in a different template, with 7.8 - 6.2 solar masses.
 - » Both just barely pass the χ^2 test
 - » The time delay between the H2 and L1 events is between +130 ms and -60 ms depending on which template in H2 you use for the coincidence
 - » The amplitude as measured by H2 is 1.25 times that measured by L1

- S2 event:
 - » One coincident event observed in H1, H2, and TAMA; L1 down
 - » H1 and H2 have good cross-correlation
 - » A duration of ~15 ms and a central frequency of 750 Hz
 - » H1H2 amplitudes consistent, TAMA sees at 60% of the LHO amplitude
 - » Time delay to TAMA is ~12 ms; H1/H2 delay -0.3 ms or -1.6 ms
 - » Location circle crosses galactic plane at 20° and 35° from galactic center
 - » Accidental coincidences estimated by time shifting (TAMA against LHO)
 - Out of 100 time shifts, only 2 show an event like the zero time lag one
- S3 event:
 - » One coincident event observed in H1, H2, and L1; GEO600, TAMA down
 - » H1/H2 and H1/L1 show good cross-correlation
 - » H1H2 amplitude ratio 0.8 ± 0.15 , H1/L1 ratio 1.1 ± 0.1
 - » A duration of ~20 ms and a central frequency of 550 Hz
 - » Time delay LHO/LLO is ~8 ms; H1/H2 delay -0.3 ms or $+1.8$ ms
 - » Location circle does not cross galactic plane
 - » Accidental coincidences estimated by time shifting (LLO against LHO)
 - Out of 100 time shifts, only 13 show an event like the zero time lag one

- S2 event:
 - » One coincident event observed in H1, H2, and TAMA; L1 down
 - » H1 and H2 have good cross-correlation
 - » A duration of ~15 ms and a central frequency of 750 Hz
 - » H1H2 amplitudes consistent, TAMA sees at 60% of the LHO amplitude
 - » Time delay to TAMA is ~12 ms; H1/H2 delay -0.3 ms or -1.6 ms
 - » Location circle crosses galactic plane at 20° and 35° from galactic center
 - » Accidental coincidences estimated by time shifting (TAMA against LHO)
 - Out of 100 time shifts, only 2 show an event like the zero time lag one
- S3 event:
 - » One coincident event observed in H1, H2, and L1; GEO600, TAMA down
 - » H1/H2 and H1/L1 show good cross-correlation
 - » H1H2 amplitude ratio 0.8 ± 0.15 , H1/L1 ratio 1.1 ± 0.1
 - » A duration of ~20 ms and a central frequency of 550 Hz
 - » Time delay LHO/LLO is ~8 ms; H1/H2 delay -0.3 ms or $+1.8$ ms
 - » Location circle does not cross galactic plane
 - » Accidental coincidences estimated by time shifting (LLO against LHO)
 - Out of 100 time shifts, only 13 show an event like the zero time lag one