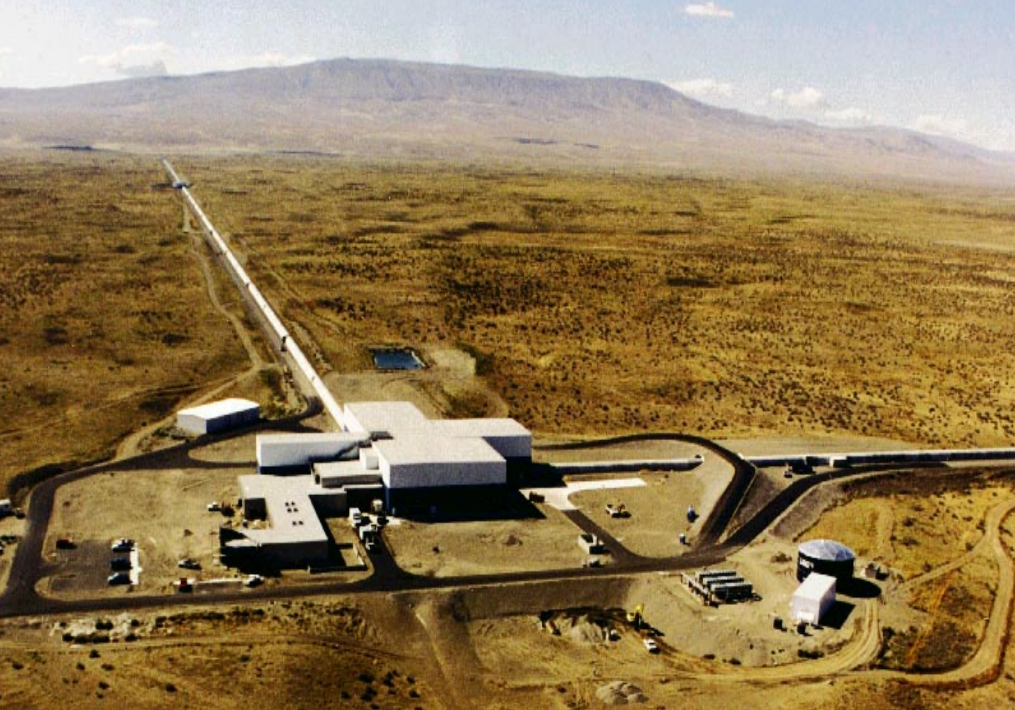


Status of LIGO

Peter R. Saulson
for the LIGO Scientific Collaboration

1. LIGO and the LIGO Scientific Collaboration (LSC)
2. Performance of LIGO interferometers
3. The S5 Run
4. Performance during the S5 run
5. Highlights of data analysis results
6. A look toward the future



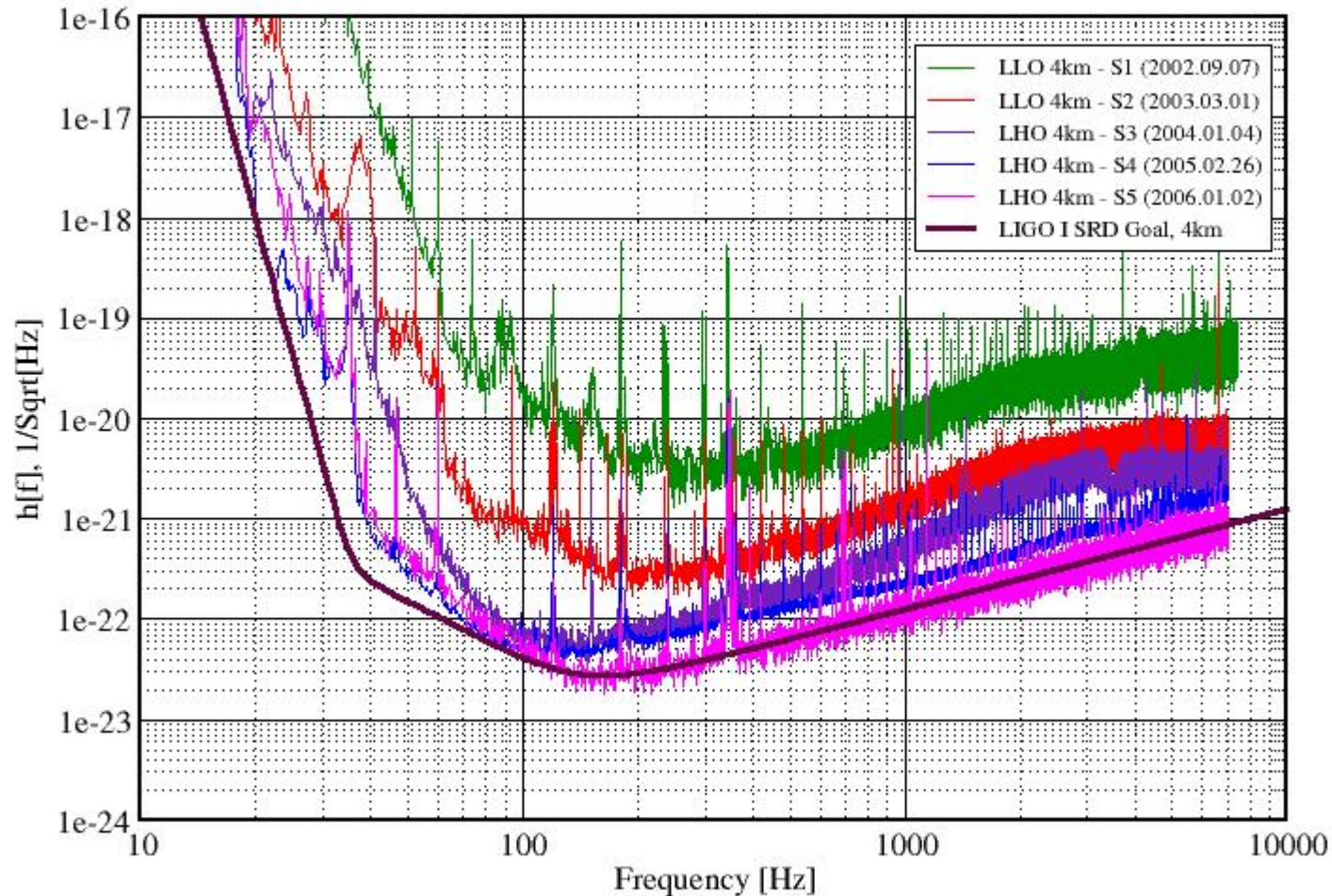
- The LSC carries out the scientific program of LIGO.
- Approximately **540** members
- ~ **35** institutions plus the LIGO Laboratory.
- International participation from Australia, Germany, India, Italy, Japan, Russia, Spain and the U.K.
- All members of GEO are members of the LSC. GEO data and LIGO data are analyzed as one data set.



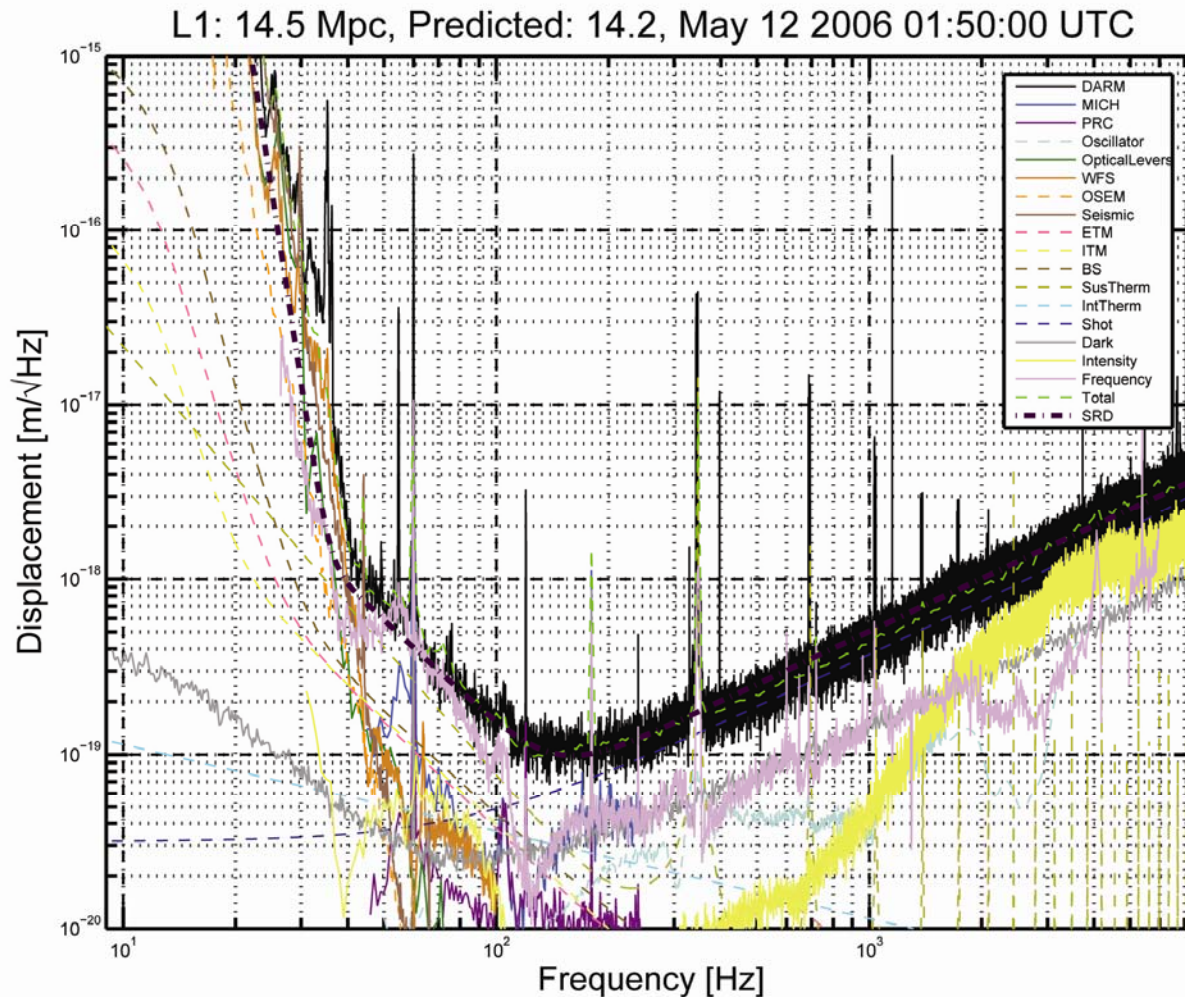
Sensitivity over time

Best Strain Sensivities for the LIGO Interferometers

Comparisons among S1 - S5 Runs LIGO-G060009-01-Z



Recent noise budget, Livingston



Now, that LIGO has reached design sensitivity, we are collecting data.

Previous science runs had durations of only one or two months.

S5 is intended to collect one year of integrated coincident data at design sensitivity.

S5 began in November 2005.

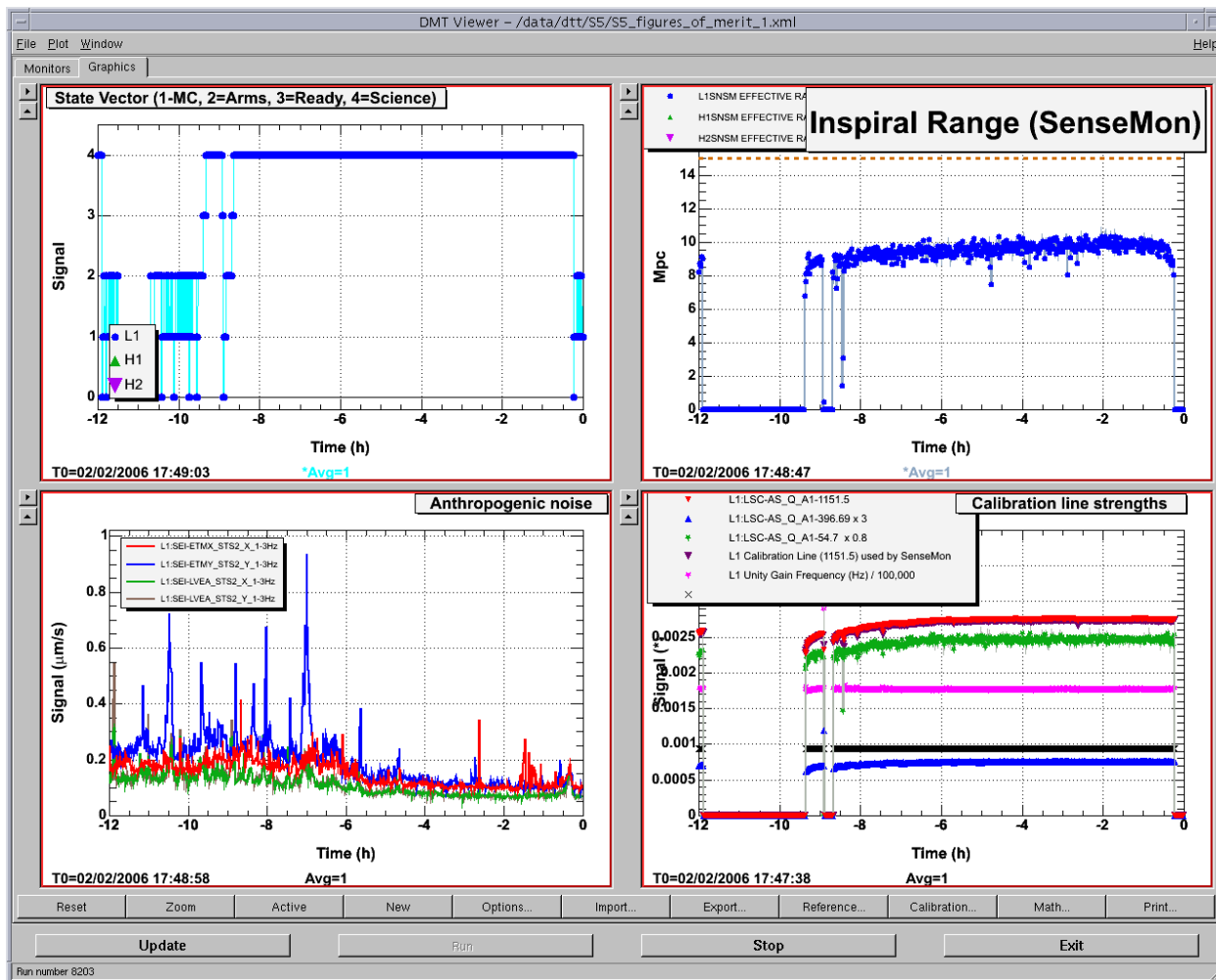
Calendar duration depends on duty cycle.

Duty cycle goal is ~70% for triple coincidence.

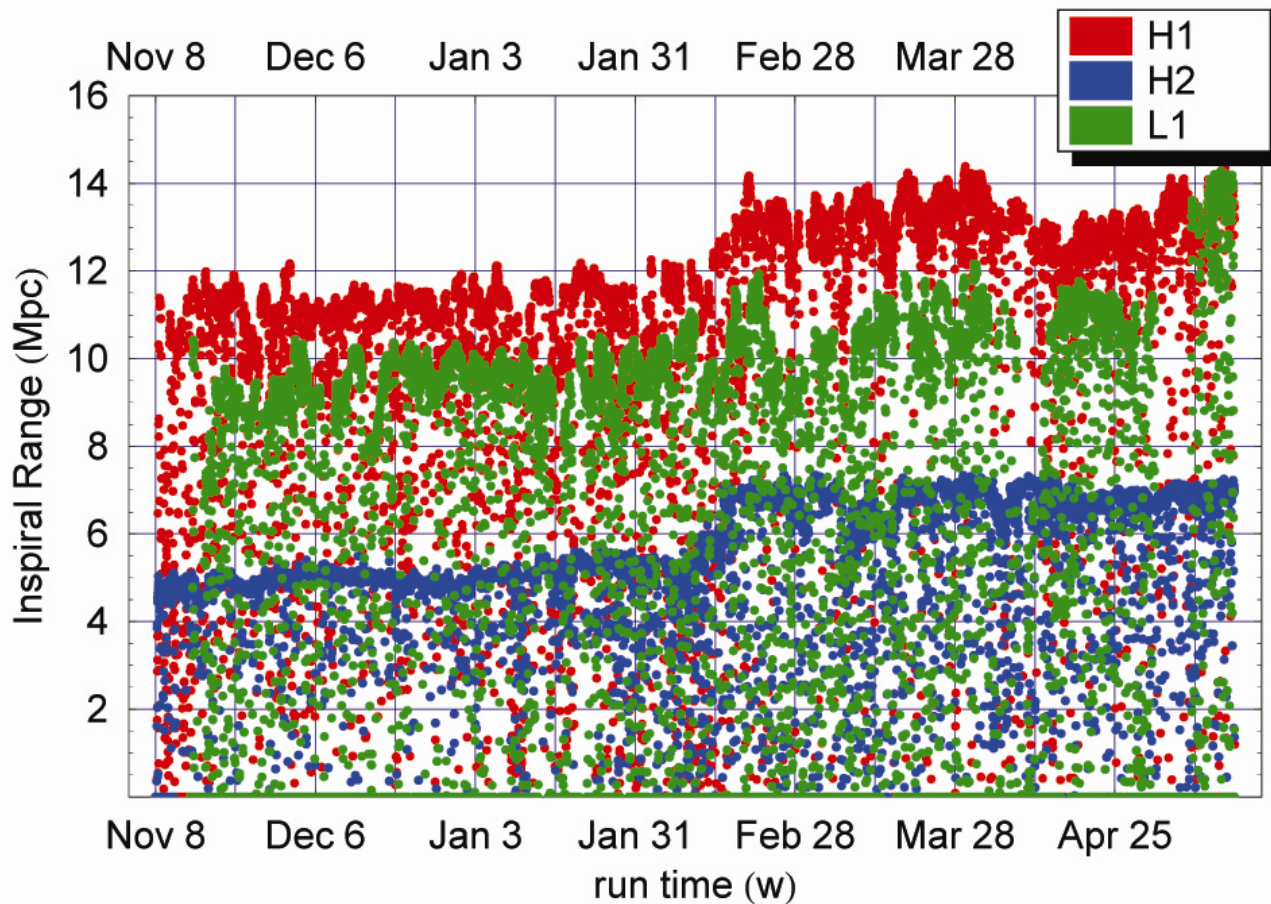
So far, we have achieved about 45%.

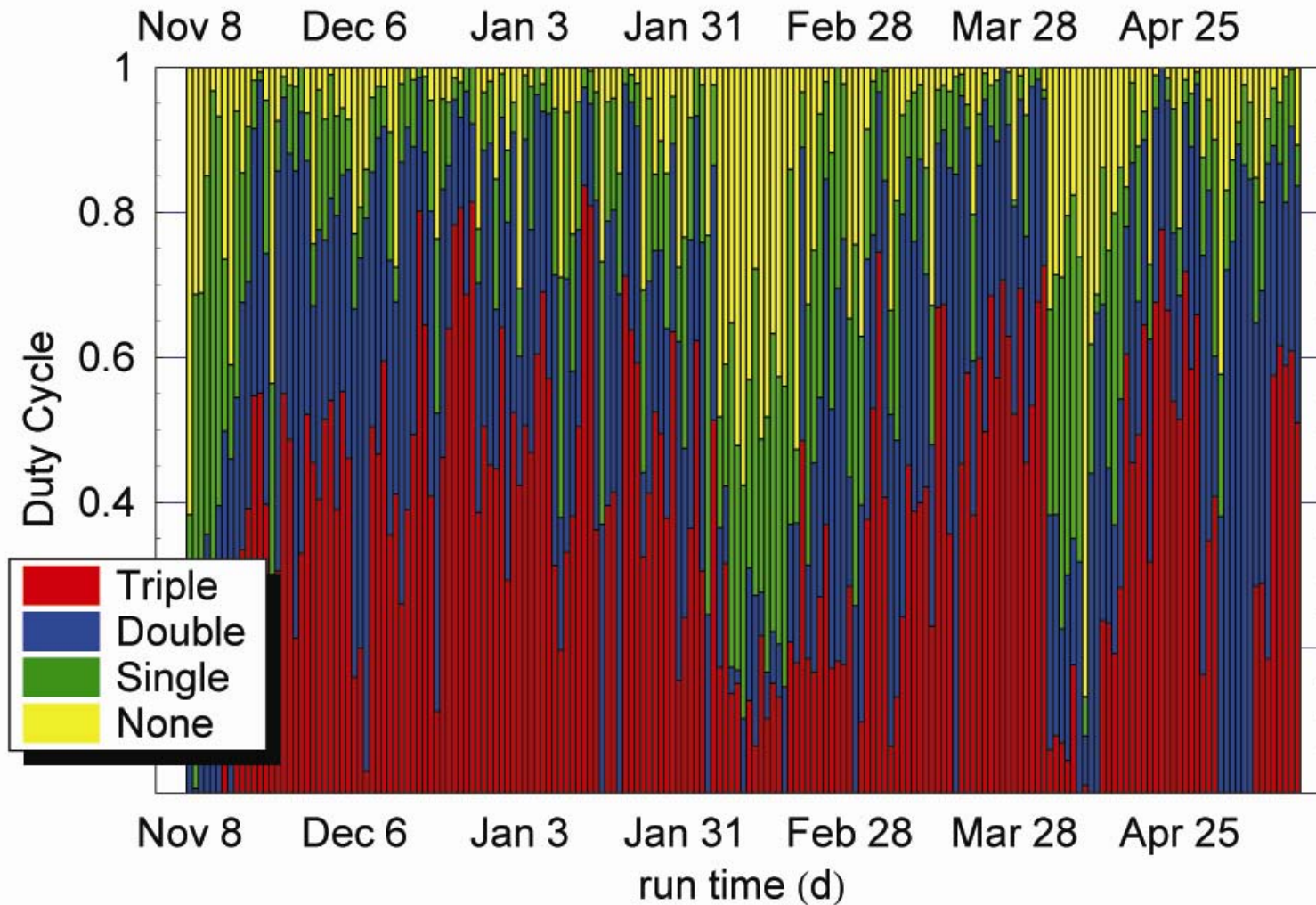
GEO has recently joined S5 full time, after commissioning and evening/weekend running.

See John Zweizig's talk, up next, on LIGO data quality.



Neutron star binary inspiral range vs. date





Some highlights of data analysis results

... as reported at the April APS meeting.

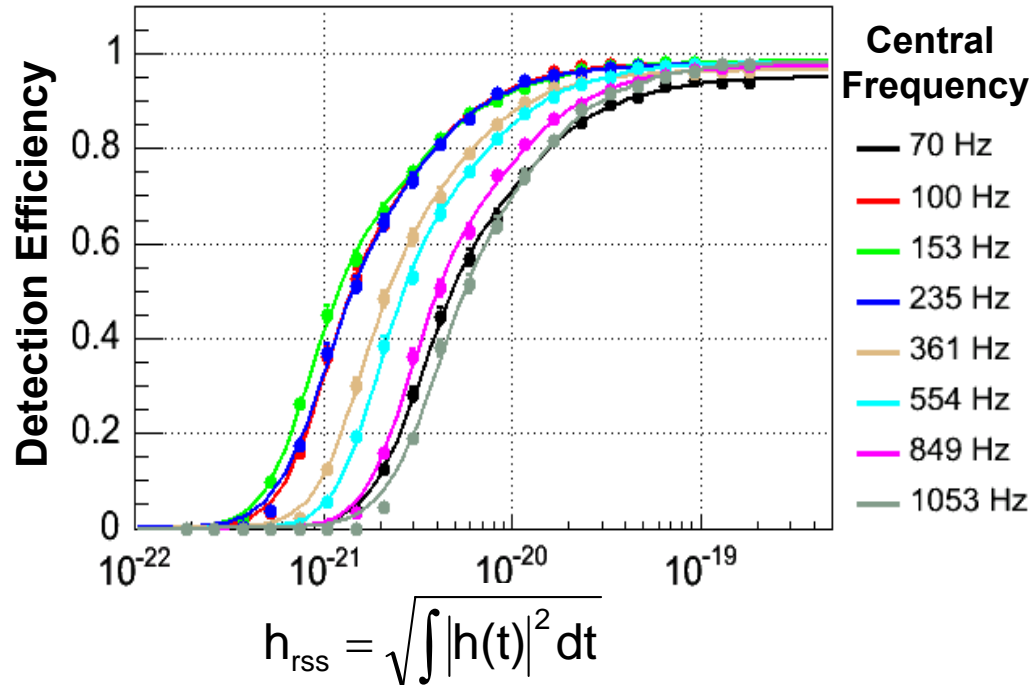
Note:

- All data analysis done by unified teams that include GEO members as full partners, with LIGO and GEO data as a unified data set.
- The past year has seen intensive data analysis exercises between the LSC and Virgo, as preparation for joint data analysis that we hope to commence in the near future.

No gravitational wave bursts detected during S1, S2, S3, and S4.

Upper limits set on burst rate and strength from S1, S2, and S4.

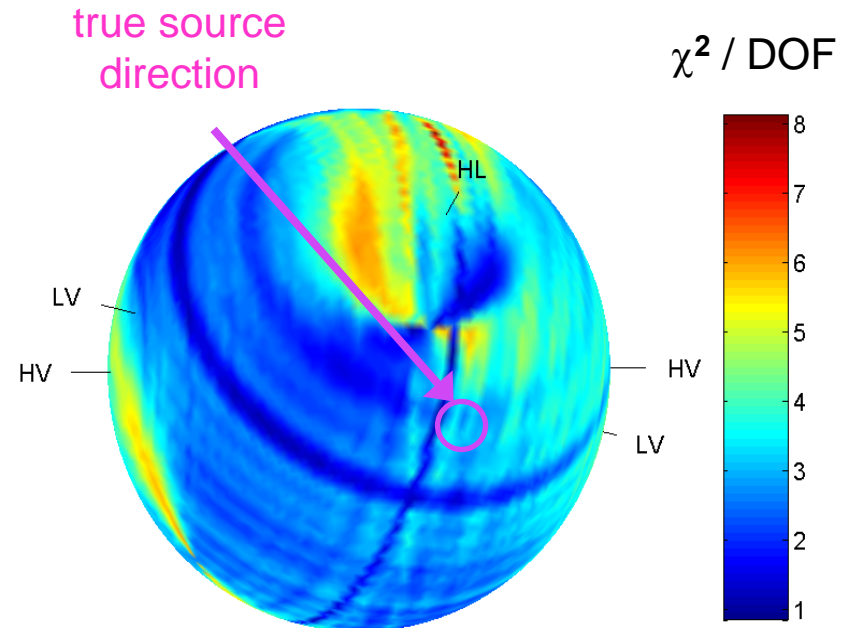
Science Run 4



Rapid (high threshold) analysis of first few months of S5 has also not yielded any detections of gravitational wave bursts.

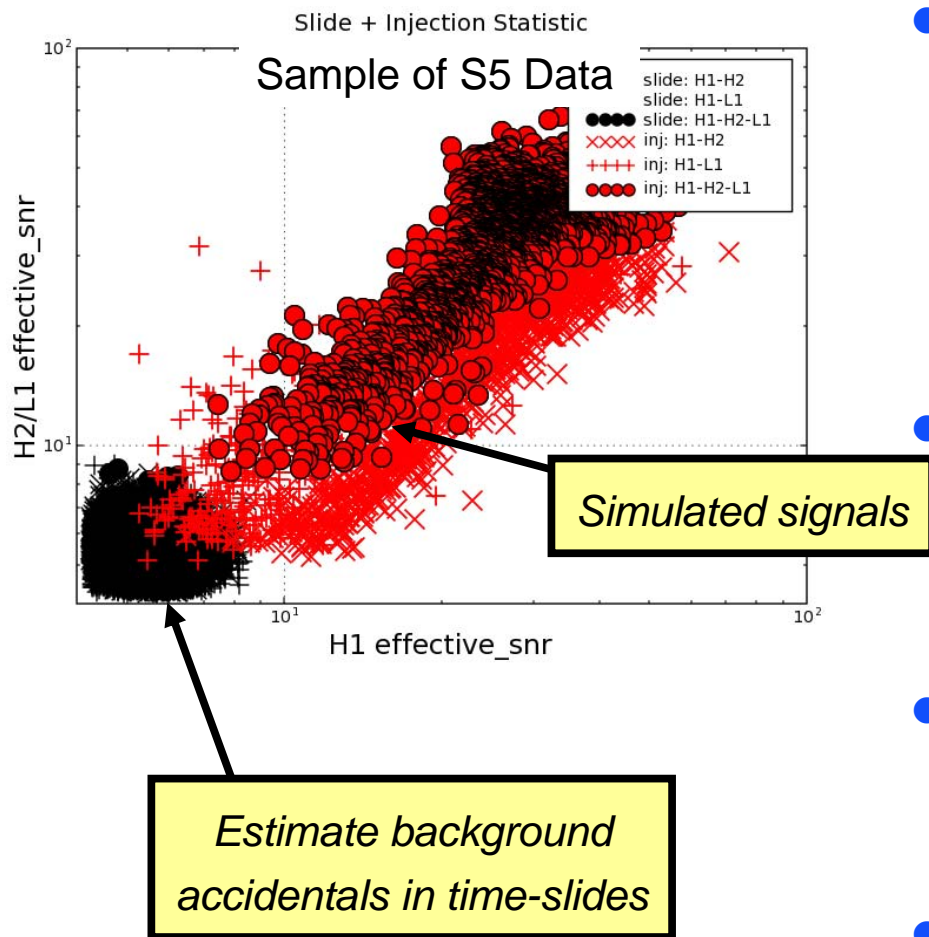
Coherent analysis with the global network (under development):

- » for GWB detection, source location, waveform extraction
- » Several methods being developed in parallel
- » Especially valuable in context of LIGO/GEO joint data analysis and, soon, Virgo/LIGO/GEO



χ^2 consistency with a GWB as a function of direction: simulated LIGO-Virgo data containing a simulated supernova GWB

See talks Wednesday after dinner by Wen, Chassande-Mottin, and Sutton.

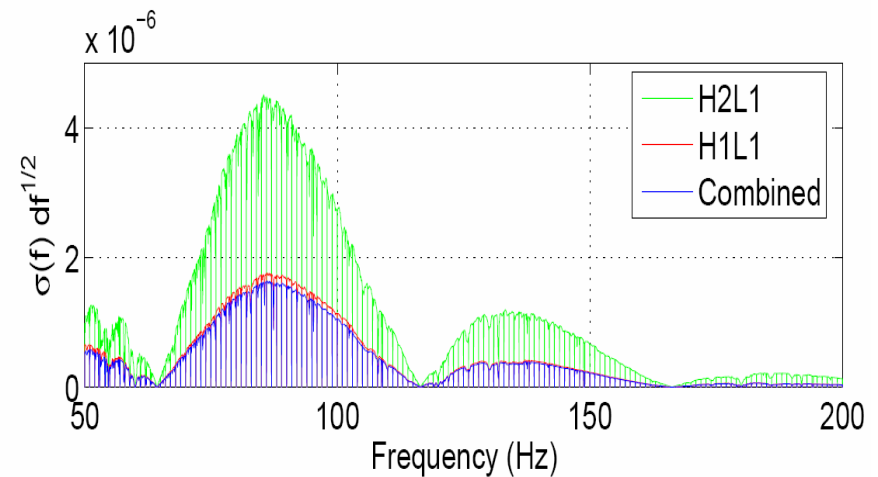
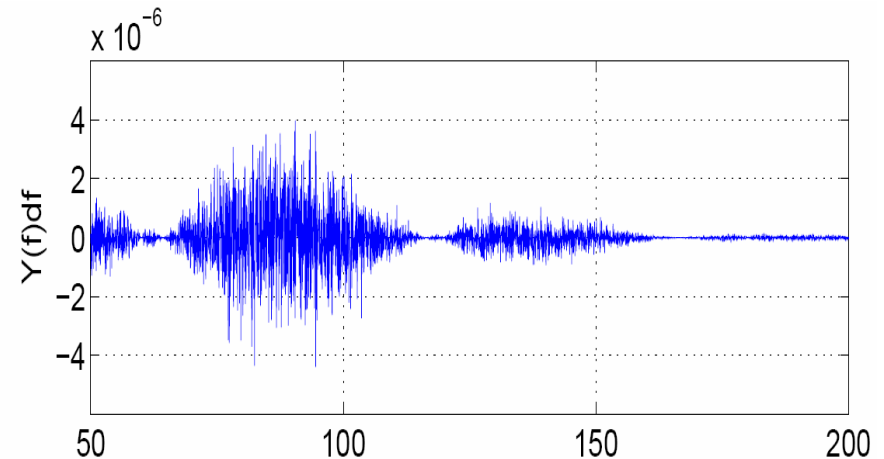


- All S3 and S4 data has been analyzed for BNS
 - » “Box opened” on S3 data: no detections
 - » Final checks being performed on S4; result under internal review
- S5 data from first epoch (Nov 4 to Feb 6) analyzed
 - » Feb 6 is start of mid-run commissioning at Hanford
- Currently finalizing tuning of S5 instrumental vetoes
 - » Box will be opened shortly
- Expect first S5 result (upper limit or detection) soon!

- Weighted average of H1-L1 and H2-L1 measurements:

$$\Omega \pm \sigma_{\Omega} = (-0.8 \pm 4.3) \times 10^{-5}$$
- Bayesian 90% UL:
 - » Use S3 posterior distribution for S4 prior.
 - » Marginalized over calibration uncertainty with Gaussian prior (5% for L1, 8% for H1 and H2).

$$\Omega_{90\%} = 6.5 \times 10^{-5}$$



S5 upper limits on signals from known pulsars

Closest to spin-down upper limit:

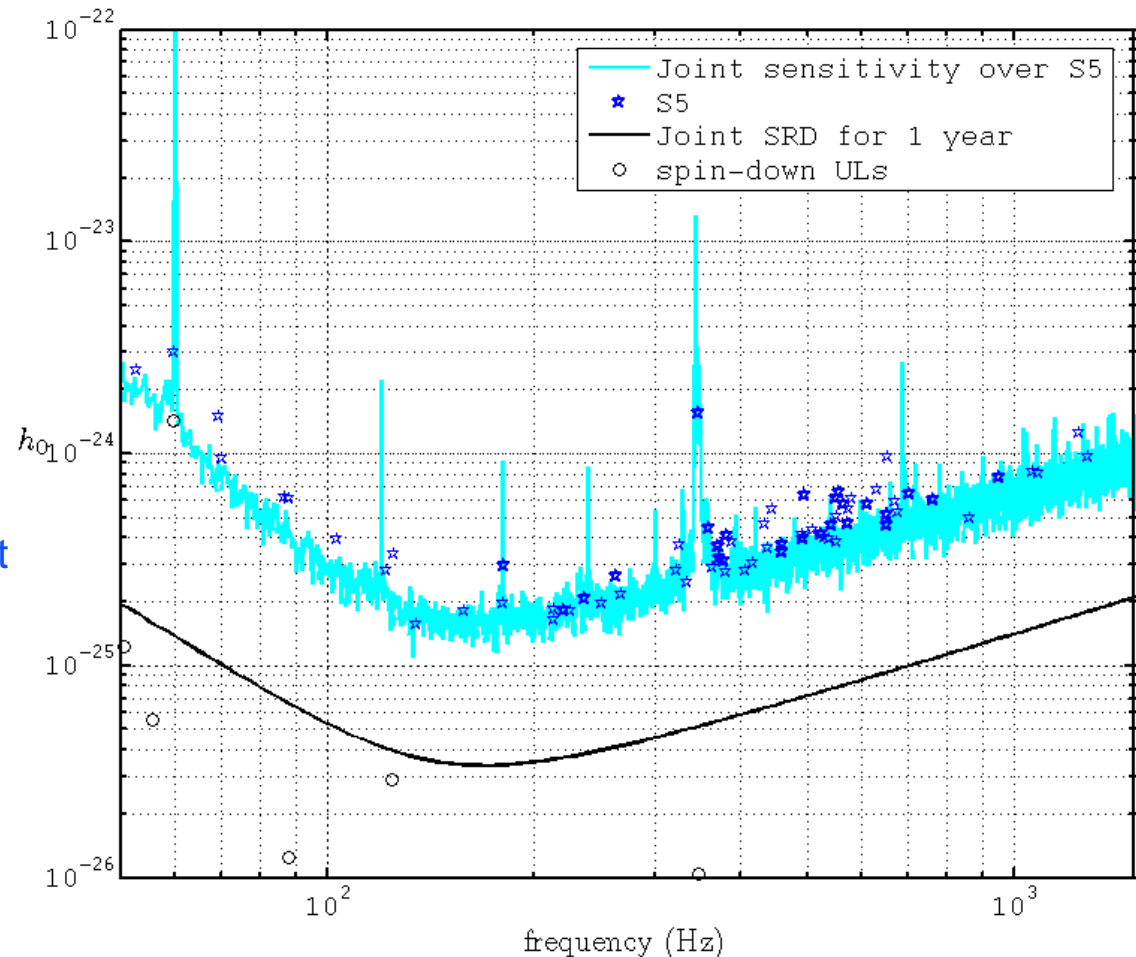
Crab pulsar, only ~ 2.1 times greater than spin-down

$$h_0 = 3.0 \times 10^{-24},$$

$$\square \varepsilon = 1.6 \times 10^{-3}$$

($f_{\text{gw}} = 59.6$ Hz, dist = 2.0 kpc)

We should have sensitivity below spin-down limit on the Crab pulsar before S5 is over.



- GEO has now joined S5, with good performance. (As you heard in Harald Lueck's talk.)
- LSC and Virgo are almost ready to sign an agreement to carry out joint data analysis in the future, starting (we hope) very soon. (The global network is starting to come together!)
- After S5, a new commissioning period to bring up some modest performance enhancements.
- We hope to hear within the next year that Advanced LIGO will be funded.
- Outstanding prospects for success on all fronts.