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Report on the S2 Run

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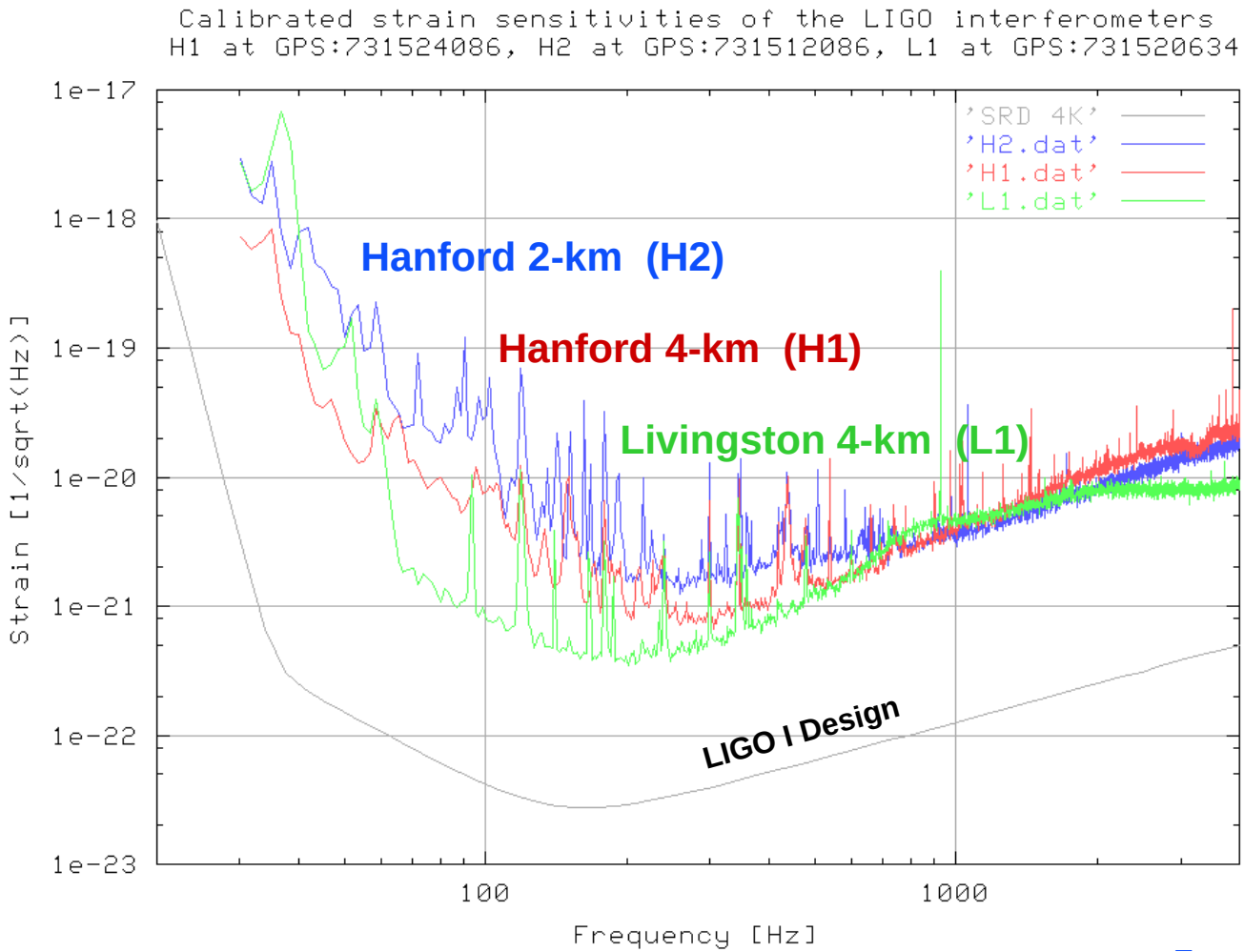
LIGO Scientific Collaboration Meeting
LIGO Livingston Observatory
March 18, 2003

LIGO-G030055-00-00-Z

Interferometer Performance

"Typical" Sensitivities (sampling from S2 web page)



P. Sutton

S. Marka

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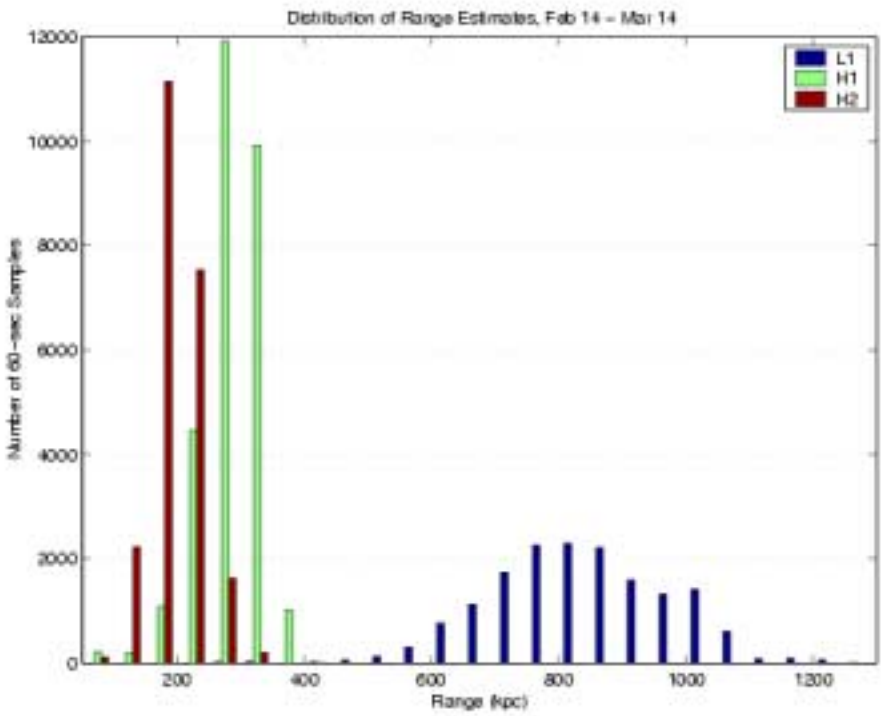
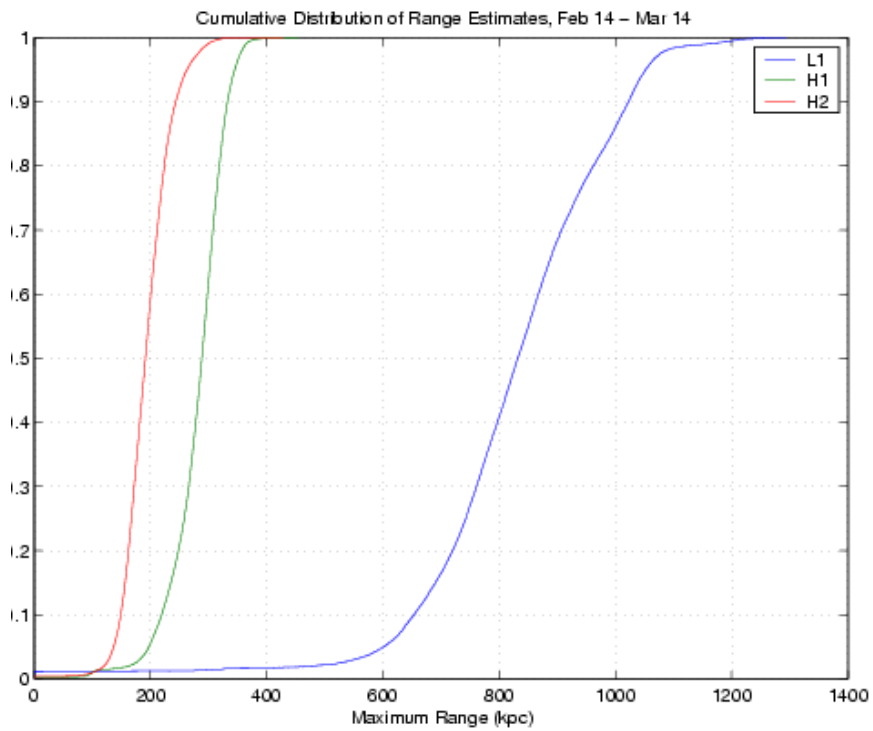
"Inspiral Range" [to see $1.4M_{sun}$-$1.4\ M_{sun}$ NS-NS Coalescence with SNR=8, average orientation/direction]

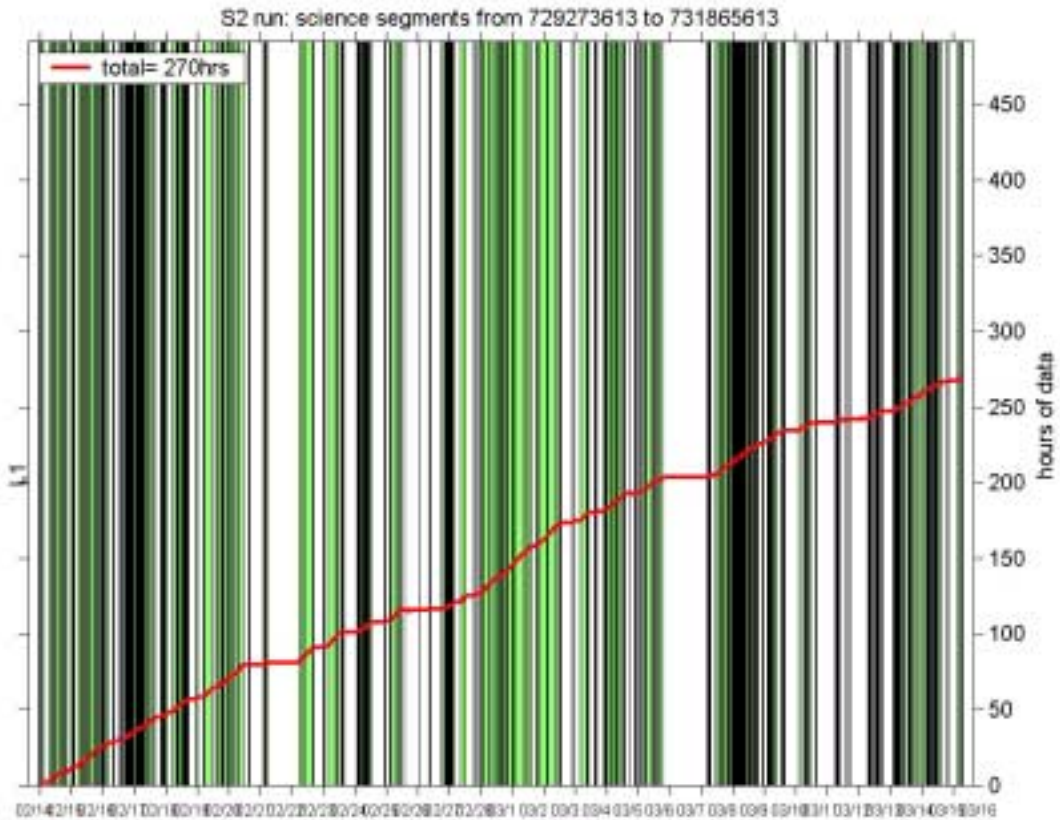
Histograms and cumulative distributions of inspiral range for The three interferometers (first month)

P. Sutton





Interferometer Livetimes (first month)



L1 – 270 hours (38% duty cycle)

Troubles

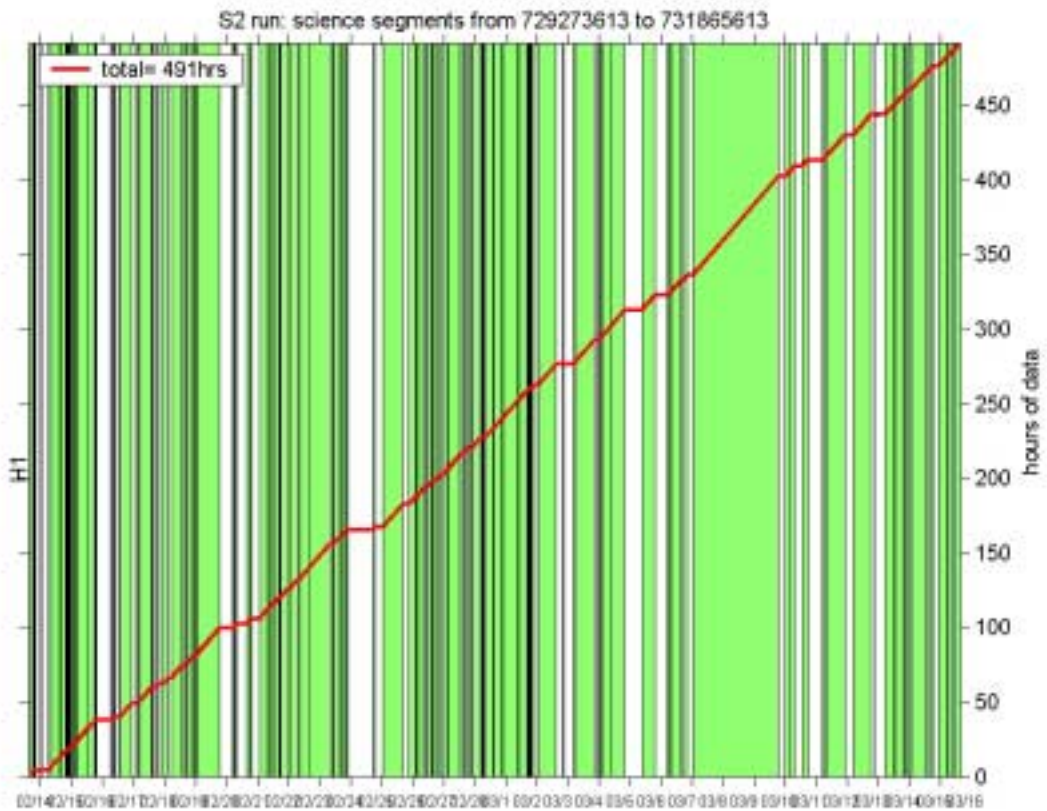
Anthropogenic noise, mostly logging

Site-wide power outage recovery

Storms in the Gulf (μseismic)

G. Gonzalez

Interferometer Livetimes (first month)



H1 – 491 hours (68% duty cycle)

Troubles

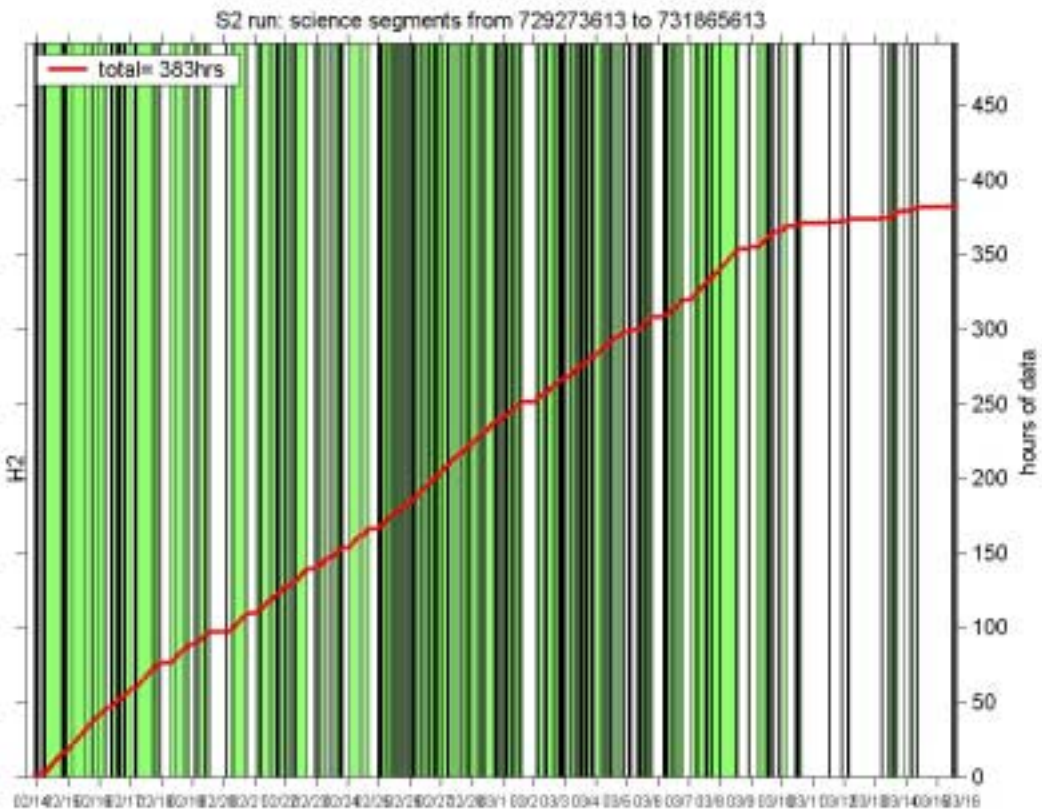
High winds

LHO server crash

Digital servo communications

G. Gonzalez

Interferometer Livetimes (first month)



H2 – 383 hours (53% duty cycle)

Troubles

High winds

LHO server crash

Unstable sensitivity, glitches

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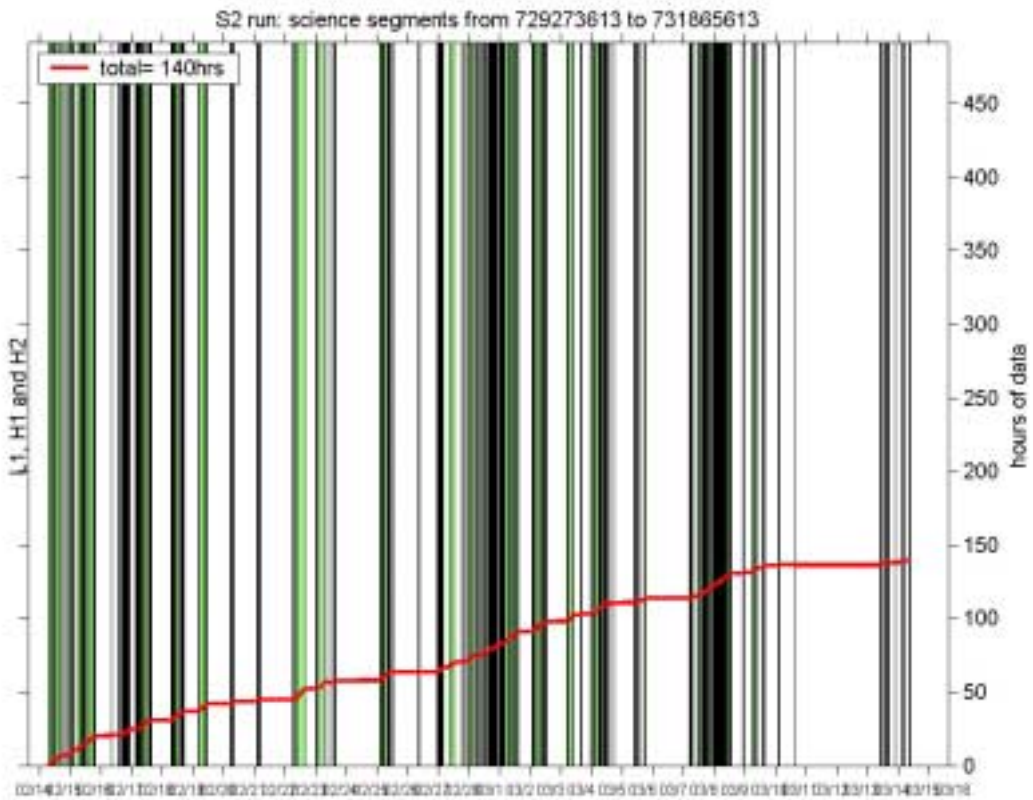
Interferometer Livetimes (first month)



Triple Concidence for 140 hours

(19% duty cycle)

Double Concidence L1/H1 for 206 hours

(29% duty cycle)

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Remarks on IFO stability:

- L1 about as stable (unstable) as in the S1 run
- H1 remarkably stable (thanks to 8/10 closed WFS loops)
  - Long locks (record: 66 hours!)
  - Occasional long downtimes
- H2 unstable (short and long time scales)

Operations

Data products:

- **Raw frames written to tape, stored in circular buffer on disks at sites (9.5 MB/s)**
- **Reduced data sets (1.9 MB/s) written to disk**
- **Second / minute DAQ channel trends stored locally and transferred over network to CIT**
- **DMT minute trends stored on disk locally and transferred to CIT**

Operations

Data pipeline reliability

LHO: ~0.3% data lost:

- LDAS disk failure
- DAQ reflective memory failure

LLO: ~3% data lost:

- Controller/DAQ recovery from power outage

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Operations

Calibrations:

Full-up calibrations performed at start of run, mid-run and at end of run, with additional daily "auto-calibrations".

Occasionally generated reference functions and once-per-minute drift corrections (based on injected lines) provided for downstream astrophysical analysis → Online calibration!

(See special Calibrations Session this afternoon)

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Operations

Signal Injections:

- Elaborate suite of signal injections performed in week preceding run (inspiral, burst, stochastic)
- Twelve half-hour injections scheduled during 59-day run to track stability
- Environmental injections also performed in tandem

(See special Injections Session Wednesday afternoon)

Operations

S2 Web Page serves as central bulletin board:

http://blue.ligo-wa.caltech.edu/scirun/S2/

Link Highlights:

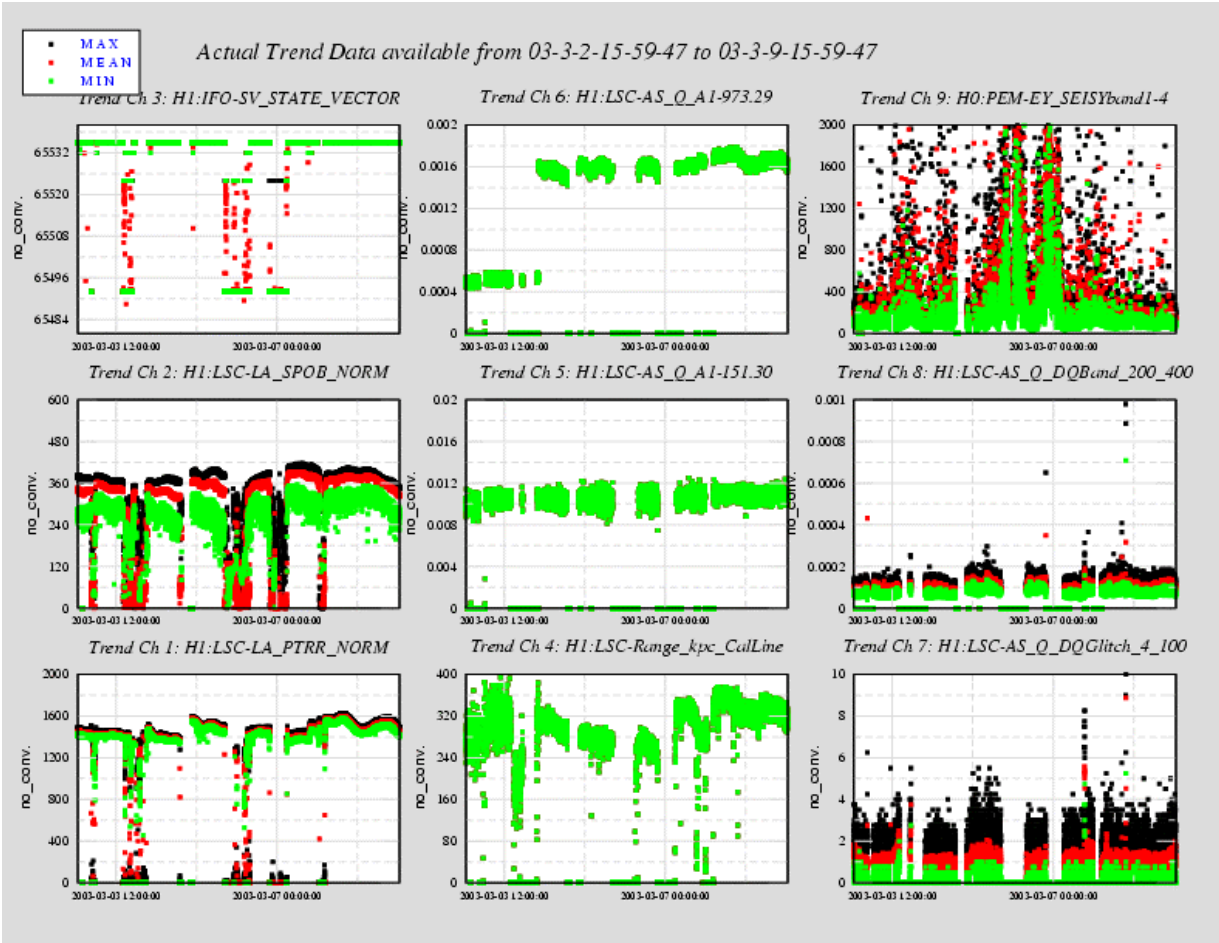
- **Nearly real-time calibrated spectra, with drift corrections.**
- **Links to DMT monitor / LDAS status pages & alarms**
- **Scientific Monitor (scimon) instruction sheets**
- **Summary plots, livetime statistics, and figures of merit**
- **Information on S2 investigations (see reports at this meeting – Tuesday afternoon, Wednesday morning)**

Daily & Weekly Summary Plots

("Bird's Eye" View of Performance)

One week of H1 performance

(includes part of record-breaking 66-hour lock)



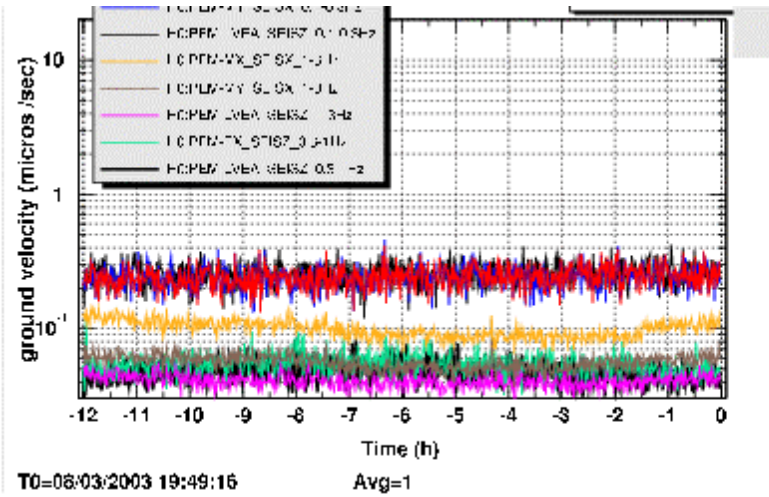
DMT and DTT Figures of Merit

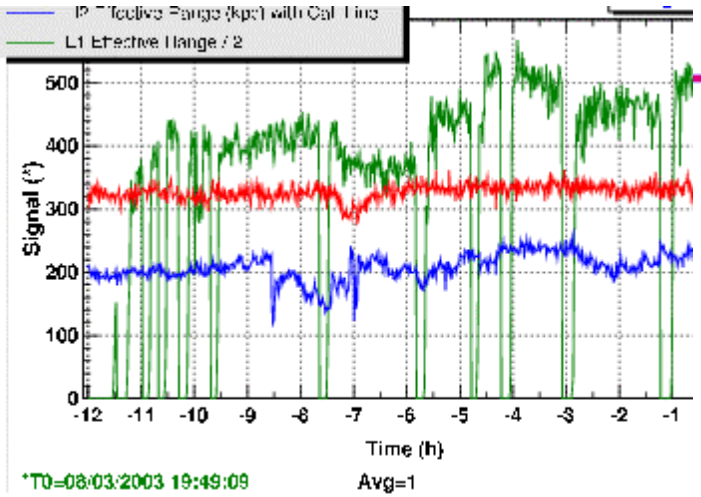
Hanford Control Room

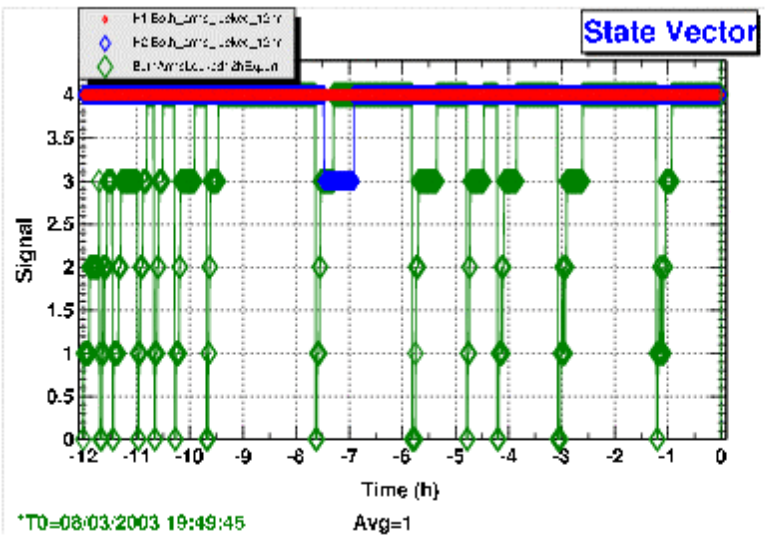
(Feb 22)

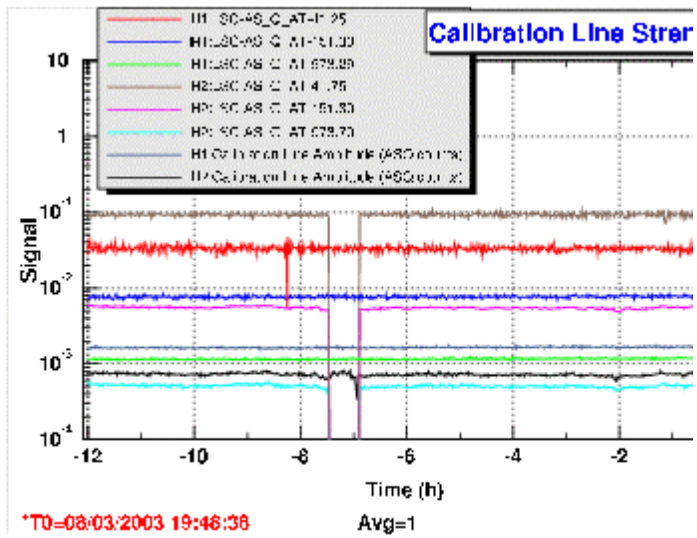
Sample 12-hour “Figure of Merit 1” at Hanford

Mar 8



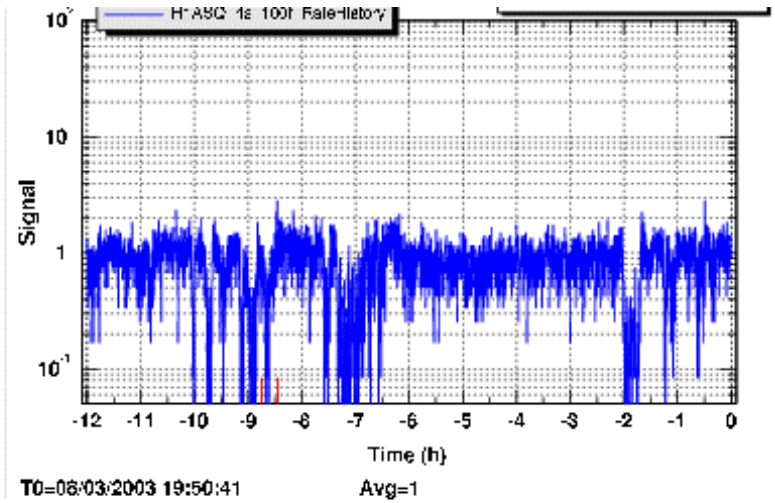


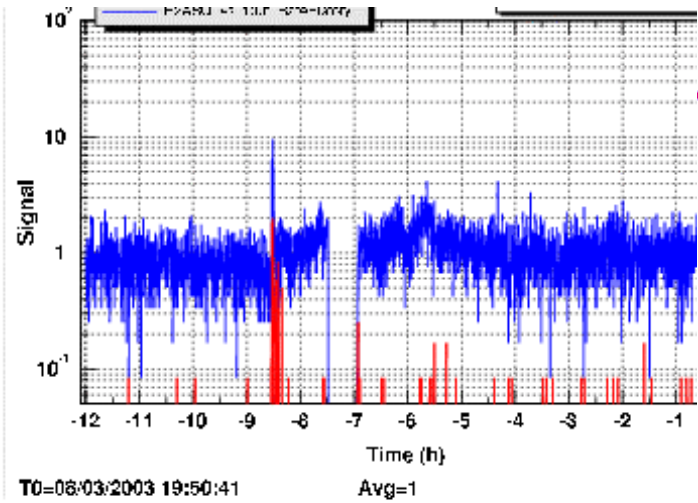


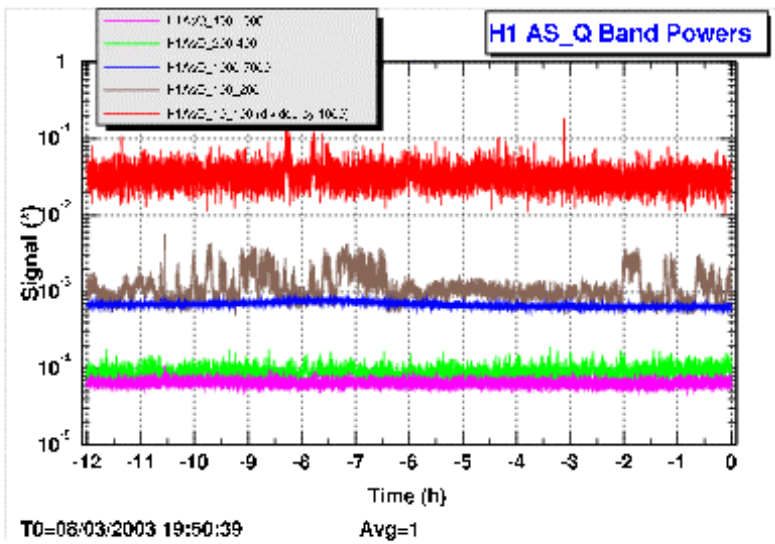


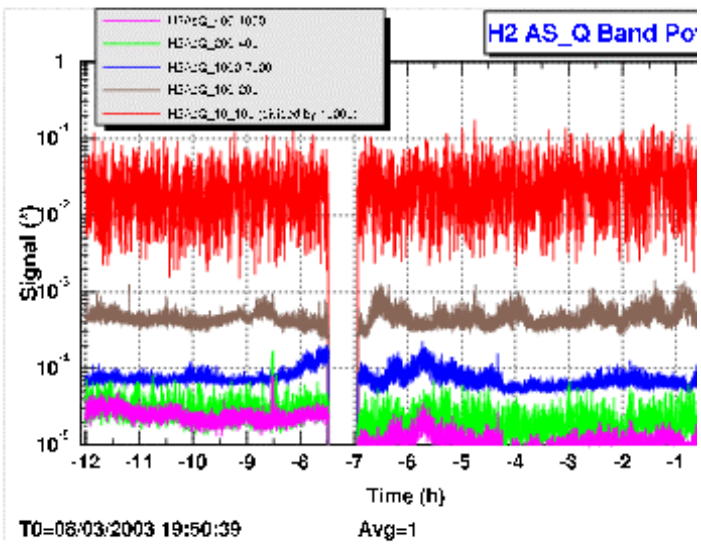
Sample 12-hour “Figure of Merit 2” at Hanford

Mar 8





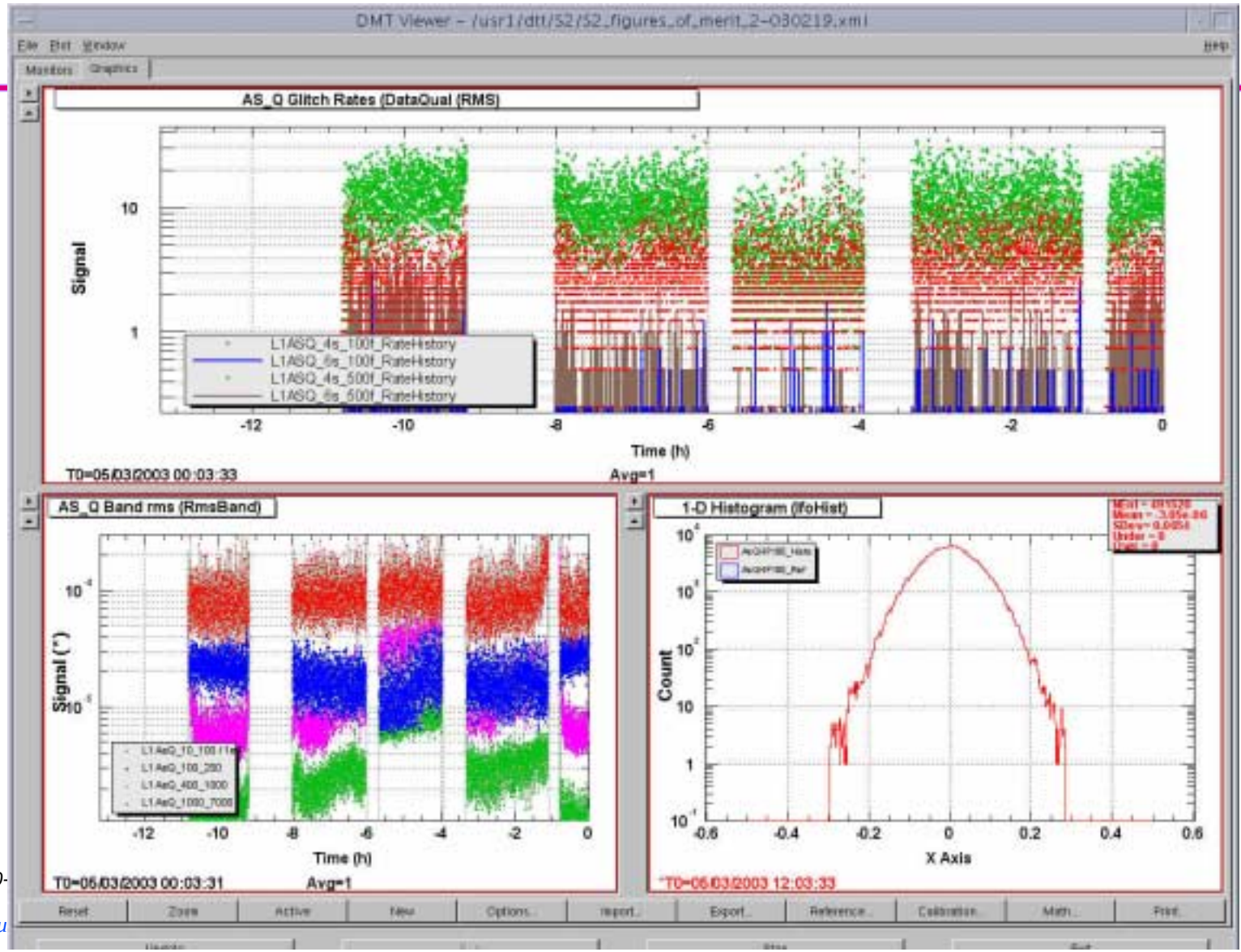




Sample “Figure of Merit 2” from Livingston

(12 hour history and current AS_Q histogram)

Mar 4



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Scimon Shift Staffing

Needed to fill 354 expert scimon shifts
(59 days x 3 shift/day x 2 sites)

Nominal scimon allocations by (non-GEO) LIGO I FTE counts:

Total of 126 FTE's → ~3 shifts / FTE

But not all groups could provide ready experts:

Total of ~70 experts → ~5 shifts / expert

Used hybrid allocation scheme for expert / trainee shifts:

115 scimons staffing: **354 expert shifts**

(sample schedule) **198 trainee shifts**

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Remarks

S2 going well, on the whole

- **Better IFO sensitivity, stationarity than in S1**
- **High-duty-cycle data acquisition & archiving**
- **Online data analysis being exercised**
- **Reasonable calibration info available in near real-time**
- **Better diagnostics, more confidence in data quality**

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Remarks

But…

- **L1 livetime still poor (logging, storms)**
- **H1 inspiral range 3-4 times worse than L1**
  - → **Lesson: pay attention to inspiral range before run**
  - → **More generally: science-mode figures of merit relevant during commissioning too**
- **H2 so far unstable**
- **Despite improved diagnostics, more automation and more systematic cataloguing of artifacts needed**

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Thanks!

Thanks to DMT & DSO authors for the useful new control room IFO diagnostics

Thanks to operators for keeping the IFO's happy

Thanks to scimons for slogging through the damn checklists to make sure the IFO's really are happy

Many, many thanks to commissioners, observatory scientists/staff, & lab engineers, for long hours in bringing IFO's to a qualitatively new performance level!