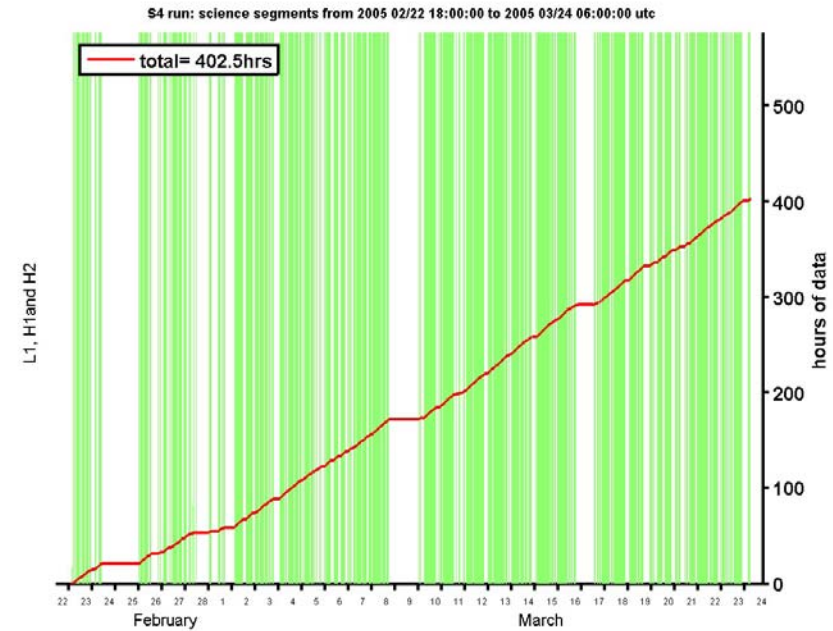
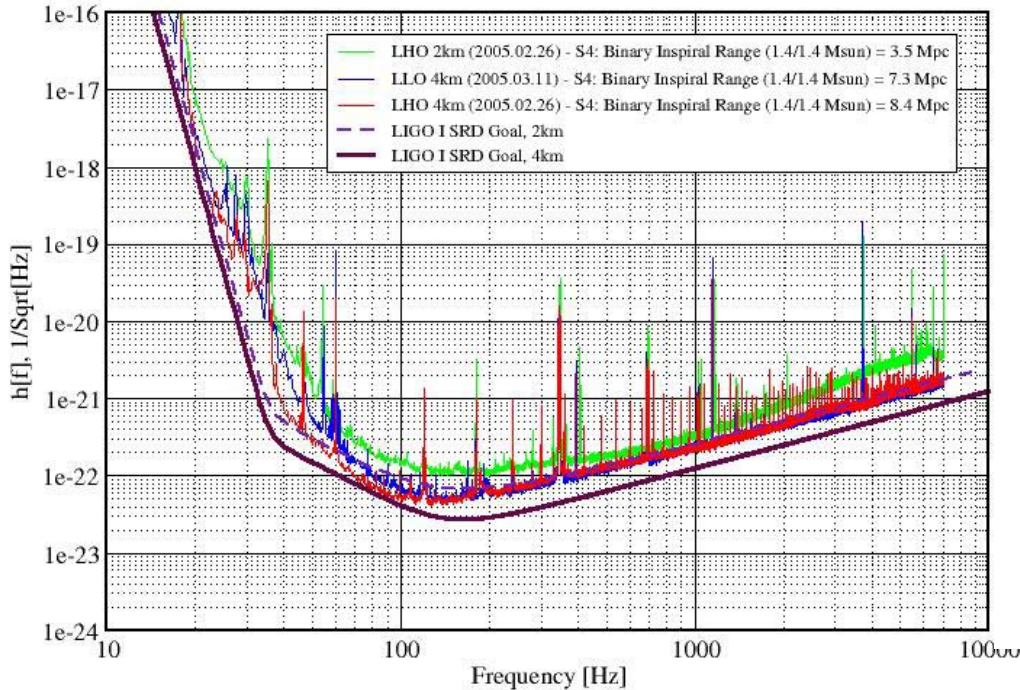


S5 Run Performance Goals

Strain Sensivities for the LIGO Interferometers

Best Performance for S4 LIGO-G050230-01-E



Peter Fritschel & Michael Zucker

PAC18 meeting
LIGO Livingston Observatory
18 May 2005

- S4 a success
 - » Sensitivity good (and *astrophysically relevant*)
 - » Machines reliable and well characterized
 - » Commissioning, operations, analysis teams in top form
- What are our expectations for S5?
- What are the principal challenges?

Interferometer Duty Factor

Run	S2	S3	S4	S5 Target (proposed)	SRD goal
L1	37%	22%	75%	85%	90%
H1	74%	69%	81%	85%	90%
H2	58%	63%	81%	85%	90%
3-way	22%	16%	57%	70%	75%

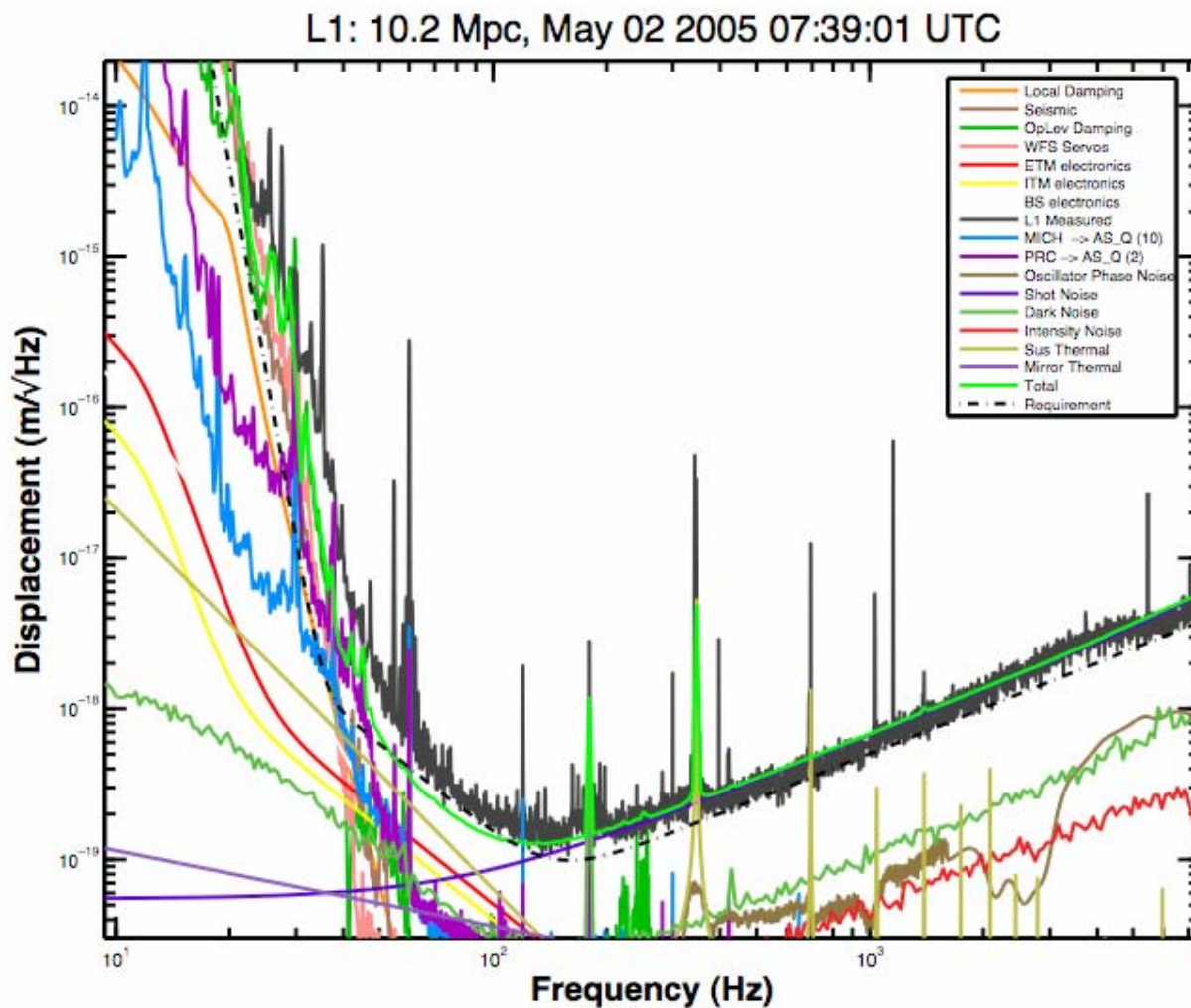
- HEPI works; L1 no longer vulnerable to logging, μ seism
- What's the remaining background of downtime?
 - » H1, H2: high winds *uncorrelated with L1*, ~ 10% uptime loss
 - » L1: extreme weather *uncorrelated*, ~ 1-3% loss
 - » All 3: global earthquakes (magnitude > 5) *correlated*, ~ 1-3%
 - » All 3: equipment maintenance *correlated*, ~ 7-10%
 - e.g., liquid nitrogen deliveries, HVAC maintenance
 - current experience bottoms at about 1/2 day per week
 - » All 3: hardware & software failure *uncorrelated, high @ run start*
 - Latter 1/4 of S4 uptimes averaged 87% (L1), 86% (H1), 90% (H2)
- What are realistic goals?
 - » 3 x 85% @ 70% triple looks achievable without heroic investments
 - » Approaching 3 x 90% @ 75% triple goal may require a wind noise solution, near 100% equipment reliability, and *much more experience*



S4 Sensitivity

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

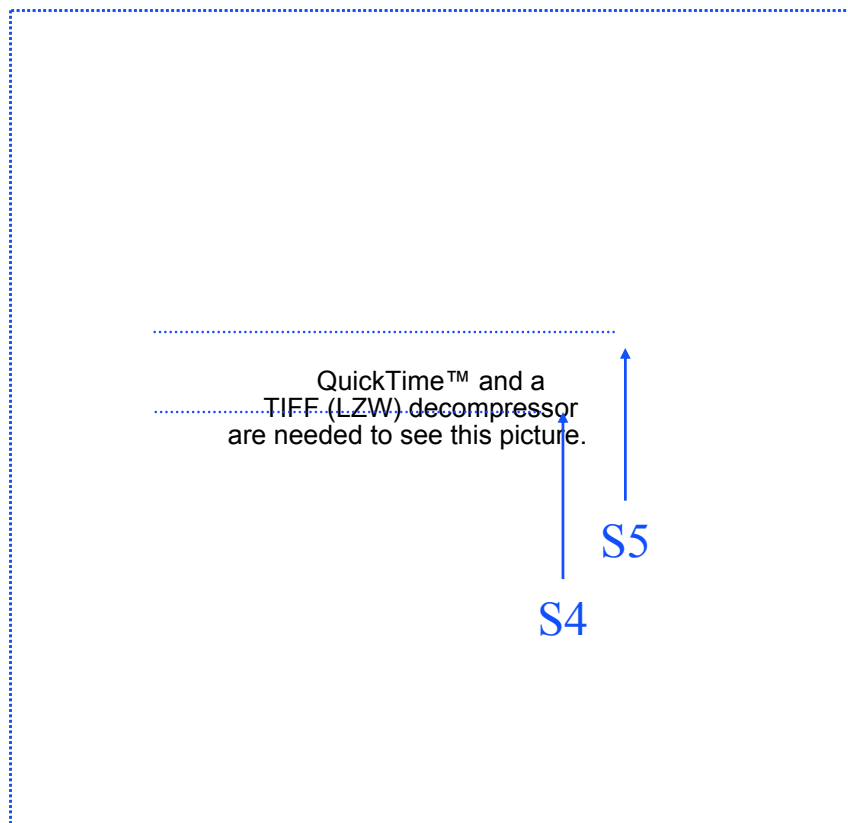
L1 Noise Budget 5/2/05



- At this writing we are largely through our post-S4 upgrade lists
- Main remaining tasks:
 - » *Optic replacement* on H1
 - » (and/or) TCS boost to handle anomalous TM heating
 - » May need other upgrades (e.g., more PD's) depending on results
- Power up req'd on all three machines
 - » Still running at 2-4 W vs. design goal of 6 W
- After resolution of H1 optics:
 - » principal effort is to get comfortable with high power and work ancillary noise issues

- Technical:
 - » H1 lossy optic R&R and/or TCS upgrade critical for high P operation
 - » High power operation not yet fully demonstrated
 - » Low-frequency noise not understood
 - » 60 Hz spikes still an issue
- Schedule:
 - » LLO Science Education Center construction starting September!
 - Wait for earthmoving & concrete to finish, or start run at diminished duty factor?
 - Post-steelwork construction activity not expected to interfere as much
- Operations:
 - » Site and interferometer reliability, maintenance in “steady state”
 - » Insufficient ops staff to maintain watch (except in “burst mode”)
- LSC Community:
 - » Science monitoring model not viable for long run
 - » Are we ready to drink from the data firehose?

- BNS inspiral: well into VIRGO cluster



Nutzman et al., arXiv:astro-ph/0402091 v2, 28 Jun 2004

- Tasks in progress should net about a factor of 1.4 in strain sensitivity with respect to 'S4 best' (~ 10-12 Mpc binary inspiral range for H1 and L1, ~ 5-6 Mpc for H2)
- Assuming no new surprises, we think we know how to get ~70% triple coincidence uptime
- => Current (preliminary) strain and duty factor performance already look sufficient to achieve primary S5 science objectives
- New "Run Planning" protocol affords reasonable structure for managing controlled improvements during an extended run

but....

- Some challenges remain (not all technical)