LLO aLOG

2015/01/06

- 12/15頃からのLLO alogを見ていきました。
- ER6のreportが多い
- ISCのreportが多い
- HW injection testが行われた。
- その他ノイズを着実に減らしているみたい。

ISC : interferometer sensing and control

PSL : Pre-Stabilized Laser

PZT : piezoelectric transducer(圧電振動子)

WFS : wave front sensor

L1 ISC Link

denis.martynov@LIGO.ORG - posted 10:49, Sunday 04 January 2015 (16265)

PSL PZT TF

Few days ago Valera and I measured PSL PZT YAW TF to suppress 256Hz jitter peak in DARM (alog 16240). Since driver was low-passed at 0.2Hz, we did not have enough range for an accurate TF measurement. We went on the PSL and removed the low-pass filter. When IMC was locked we could see in WFS signals broadband noise from 10 to 100Hz factor of ~30 higher compared to the state when PZT driver is low-passed. For that reason we installed low-pass filter back after the measurement.

PZT YAW TF (IMC WFS / PZT EXC) is shown on the attached plot and implies a resonance at 256 Hz probably due to PZT mount (LHO 15818). We designed a servo to suppress 256Hz peak but could reduce it only by factor of 2 due to small range of low-passed PZT around this frequency. For this reason we think we should mount PZT on the table of shift the mount resonance towards higher frequencies as discussed by Robert.

Non-image files attached to this report

PZT_YAW_TF.pdf

ISC : interferometer sensing and control

ETMY : End test mass yarm

HAM : Horizontal access module

L1 ISC Link

denis.martynov@LIGO.ORG - posted 00:26, Tuesday 30 December 2014 - last comment - 09:19, Tuesday 30 December 2014(16255)

scattering tests

Valera, Den

Today we have investigated scattering noise from end stations and vertex chambers. For the test we have turned on fans by ETMY, ETMX, HAM2, HAM3, HAM4 and HAM6 chambers and looked at DARM dispalcement signal. We estimated acoustic excitation by looking at signals from accelerometers located on the chambers. All beam diverters were closed during the measurement.

Attached plots show DARM noise, accelerometer signals and power fluctuations at arm transmission or POP in quiet and excited states. According to our estimations, most significant scattering comes from HAM6 (alog 15863). We saw scatering noise from all chambers and most significant contribution after HAM6 comes from Y end. This could be related to ETMY CP loss of 1000ppm.

We think that our current DARM noise might be limited by scattering from HAM6 while noise from other chambers projects below by factor of 3-10 but is higher than SRD at some frequencies.

We have also moved CPs in angle and could clearly see scattering shelves in the DARM spectrum. We plan to continue investigations.

Images attached to this report

Comments related to this report

valery.frolov@LIGO.ORG - 09:19, Tuesday 30 December 2014 (16256) Link

ETM CP -> ERM

LLO General (Detchar) Link

guillermo.valdes@LIGO.ORG - posted 11:08, Sunday 21 December 2014 (16229)

ER6 Data Quality Shift - Monday 15th Dec 00:00 UTC - Wednesday 17th Dec 23:59 UTC

DQ Shifters:
Marie Kasprzack, mkasprzack@lsu.edu
Guillermo Valdes, gvaldes@phys.utb.edu

Detchar Mentor:
Duncan Macleod, duncan.macleod@ligo.org

DQ Shift full report:

https://wiki.ligo.org/DetChar/DataQuality/DQShift_20141215

Summary

- Duty cycle: Obs. Intent 30.2%
- ER6 ended on Monday 17th (9am LLO local)

December 15th

- During the Monday 15th locks, hardware injections test were made.
- Lock was lost with the last hardware injection.
- Long lock very noisy, identified as dying PSL PMC (pre-mode-cleaner)
- Lock loss probably due to an earthquake.

December 16th

- Lock started around 06:00 UTC, duration about 10h.
- Range relatively stable at 35 Mpc with 2 major glitches around 8:30 and 14:30 UTC.
- First glitch coincident with an excess at the 1-3 Hz seismic band
- Second glitch coincident with activity of a truck on site.
- Lock loss coincident with peak in Earthquake band at 15:30 UTC

December 17th

- Continuation of lock of December 16 that started around 21:00 UTC.
- Range around 47 Mpc.
- Range glitchy part when the chilled water line (HAM6 noise source) was valved off at 21:00 UTC on Dec 16th.
- Range dropped to 38 Mpc at 00:15 UTC coincident with excess in the seismic bands 1-3 Hz, 3-10 Hz, and 10-30 Hz.

L1 ISC Link

denis.martynov@LIGO.ORG - posted 23:54, Friday 19 December 2014 - last comment - 02:55, Sunday 21 December 2014(16220)

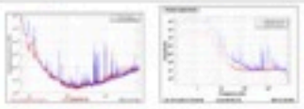
PMC HV control coupling to DARM

Valera, Den

Today we have verified that bumps around 1.5kHz and 4kHz disappered from DARM spectrum after PMC swap. At the same time 250Hz peak is now higher than before. Attached plots show comparison of DARM noise with old and new PMC.

Maximum power we can get through IMC is 18W. We left interferometer in the undisturbed mode at this power starting at ~23.50 UTC

Images attached to this report



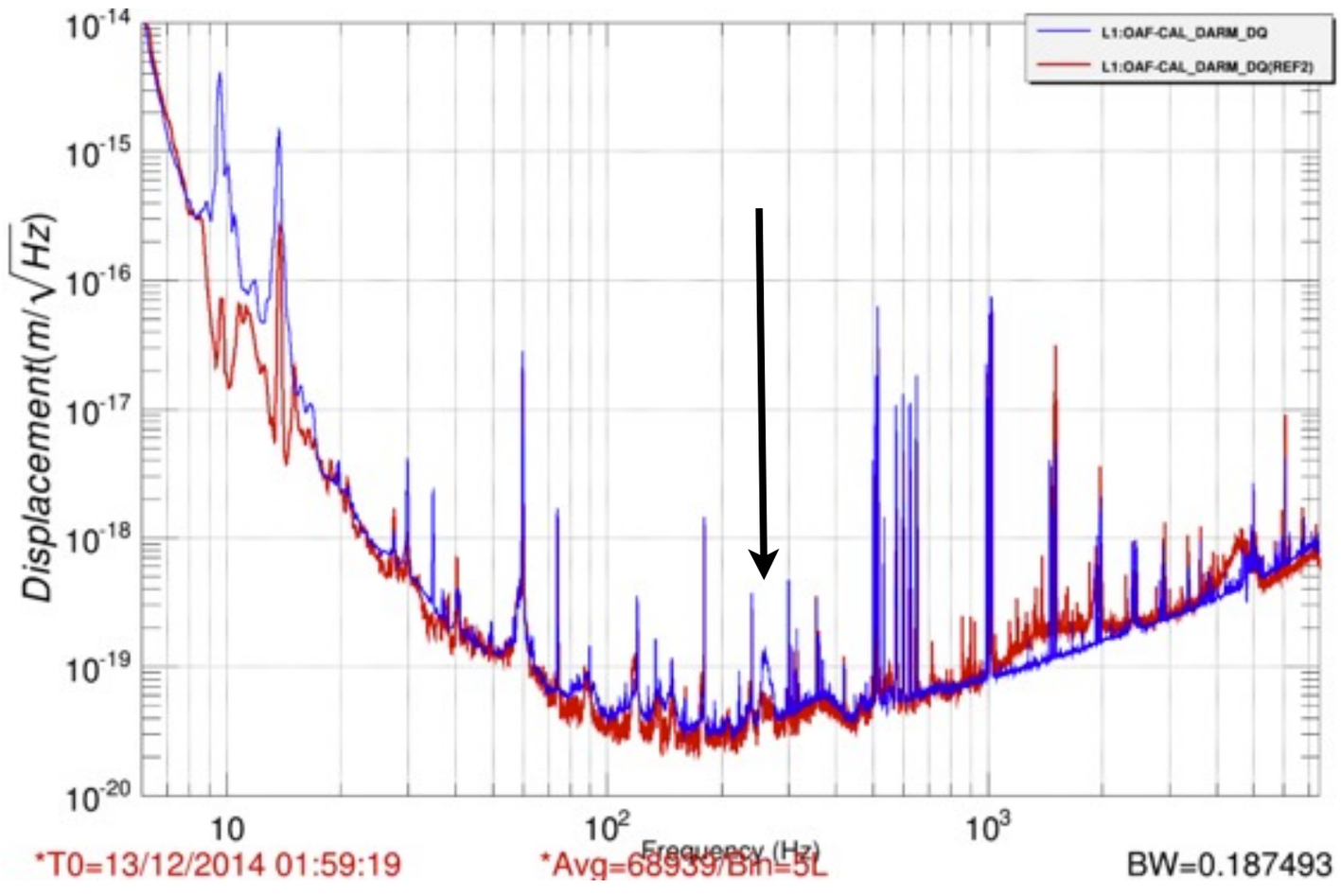
Comments related to this report

gabriele.vajente@LIGO.ORG - 00:06, Saturday 20 December 2014 (16221) Link

The increase of the 250 Hz peak might be due to a non optimal alignment of the IMC. Have you tried to find the best IMC WFS offsets and MC2 trans beam position?

denis.martynov@LIGO.ORG - 02:55, Sunday 21 December 2014 (16228) Link

alog 16227



AS : anti symmetric

General (Detchar, ISC) Link

joshua.smith@LIGO.ORG - posted 18:36, Friday 19 December 2014 (16219)

Pulse energy at AS port in ER6 lock losses

Conclusion: If the calibration used by Matt for the AS port LF signal in 15540 is still correct, during ER6 some lock losses had more than 50 W peak and averaged powers greater than ~10W for ~100ms so >1J (max 3 J) of energy at the AS port.

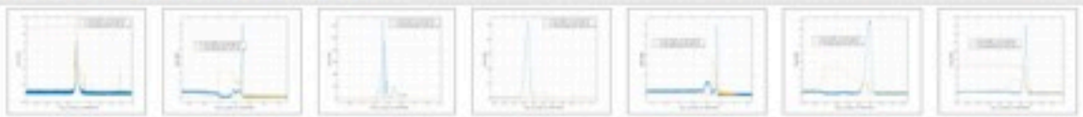
Peter Fritschel asked if Detchar could check the pulse energy that comes out of the AS port during lock losses, as a follow up to earlier entries by Matt in alogs 15540 and 15563, and to get more statistics. I grabbed lock loss times from the summary pages and data using ligodv-web and created a matlab script to calibrate the AS port diode according to 15540. If anyone is aware of an update to this calibration, which comes from Valera using a Thorlabs power meter in 15525, please let me know. The energy is at times higher than that reported by Matt, but so was the input power (ranging from 10-20W into IMC, compared to 8 W into IMC for Matt's time). The energy below is calculated multiplying the average power over some hand-chosen time by that duration, e_pulse = P_avg*T.

The figures are:

1. Nov 8, 08:16 UTC, re-creating Matt's image for the lock loss to test the script (8 W into IMC, according to summary page for PSL) [0.15 J]
2. 2014-12-17 04:23:06 (1102825402) 20 W into IMC [0.20 J]
3. 2014-12-16 15:30:44 (1102779060) 10 W into IMC [1.53 J]
4. 2014-12-09 01:33:35 (1102124031) 16 W into IMC **[2.98 J]**
5. 2014-12-11 01:37:18 (1102297054) 10 W into IMC [0.32 J]
6. 2014-12-14 06:43:19 (1102574615) 10 W into IMC [0.26 J]
7. 2014-12-15 01:29:46 (1102642202) 10 W into IMC [0.47 J]

We're still grabbing other lock loss times and will calculate the energy better, but I wanted to post this early in case anyone spots anything wrong with the analysis.

Images attached to this report



ER : engineering run

General (Detchar) Link

keith.riles@LIGO.ORG - posted 16:55, Friday 19 December 2014 (16218)

First look at narrow lines in ER6 data

Here is a first look at narrow lines in ER6 data before the holidays. I am using calibrated 30-minute Hann-windowed SFTs of OAF-CAL_DARM generated by the daily automated FScans here. Some SFTs were discarded manually if their entries in the FScan spectrogram indicated high broadband noise. The spectra from the SFTs were averaged together with an inverse-noise weighting (similar to a harmonic mean) that mimics the weighting used in continuous waves searches like PowerFlux, i.e., lower-noise SFTs are weighted more heavily in the average. In this report only the band below 1000 Hz is examined.

Bottom line:
The noise floor is substantially below where it was in late summer and early fall, as expected, and as a nice bonus, the sharp spectral artifacts have been greatly mitigated. The data, for the most part, is just lovely. Congratulations to everyone.

Details:
99 half-hour SFTs (49.5 hours) of DC-readout data were combined into nine sets, where the following UTC-day labels apply, and different letters correspond to different lock stretches. In some cases short lock stretches of comparable noise levels are aggregated together:
dec11A - 1 hour
dec11B - 11 hours
dec12A - 5 hours
dec12B-E - 5.5 hours
dec13 - 3.5 hours
dec14 - 2.5 hours
dec15A-C - 6.5 hours
dec16A - 9.5 hours
dec16B - 5 hours

Figures 1-2 show the separate displacement spectra (0-1000 Hz) for the first five sets and the last four sets.

Figure 3 shows the displacement spectrum (0-1000 Hz) for all nine sets averaged together, along with labels for individual spectral lines and for some combs (labels defined below).

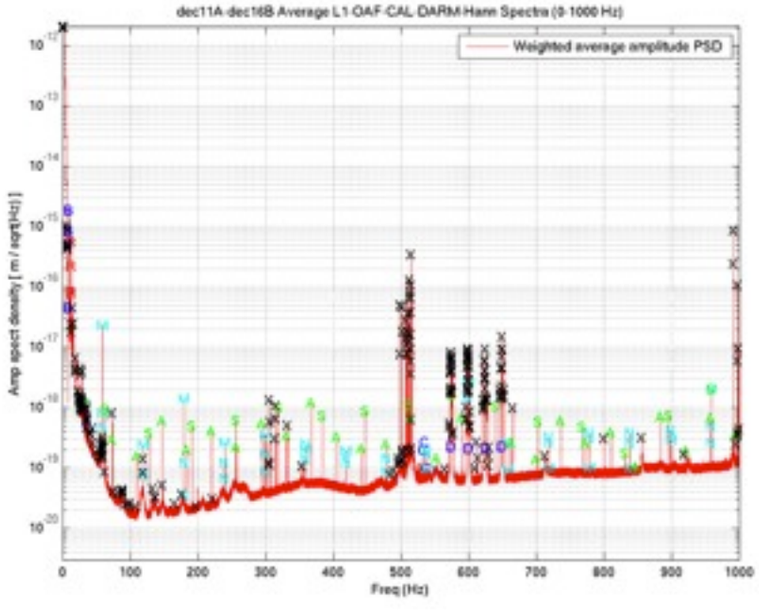
Figures 4-5 compares the *strain* spectrum for the ER6 data with the spectrum (21.5 hours) from August (alog entry) for 10-1000 Hz and 300-1000 Hz, respectively.

Comments:
* The 4-Hz comb seen previously is gone, but there remains a strong 64-Hz comb
* In addition to a power mains comb at 60 Hz, there are two other strong combs pervasive to high frequencies with slightly lower fundamental frequencies (59.9390 and 59.9406 Hz) - motors?
* Another pervasive comb has a fundamental frequency of 36.8636 Hz
* Violin modes were generally not nearly as rung up in ER6 as in the summer data
* Bounce and roll modes don't show much beyond the fundamental
* The crud seen previously in the mid 200-Hz range has been suppressed dramatically, but a residual remains
* A forest of lines seen in August data in the 910-930 Hz band is nearly gone
* The four OMC alignment dithers at 575.1, 600.1, 625.1 and 650.1 Hz still produce much upconversion around them, although some sideband features are different (fewer distinct peaks).
* I have not made as much effort this round to identify all of the upconverted sidebands around power mains and violin modes, in part because it's extremely tedious and in part because the structures are less distinct in this data.

The attached plaintext file contains a list of all of the lines marked on the graphs. Note that some "combs" are listed that have only the fundamental frequency visible (bounce/roll modes, calibration lines).

Legend for Figure 3
x = Individual line (note that violin modes are labeled this way, although some harmonics can be seen just below 1000 Hz)
C = Calibration line
M = Power mains harmonic
N = Other sub-60-Hz harmonic (motors?)
S = 64-Hz harmonic
A = 36.8636-Hz harmonic
B = Bounce mode
R = Roll mode
D = OMC alignment dither

That's a first look - more later...



ESD : electro static driver

L1 INJ (CAL, Detchar, ER) Link

duncan.brown@LIGO.ORG - posted 02:09, Monday 15 December 2014 - last comment - 10:47, Thursday 18 December 2014(16130)

CBC Hardware Injections: Round 2

[Chris B, Adam M, Mike F, Duncan B]

Joe, Mike, and Adam relocked the detector and turned off the ESD completely at 06:06 UTC. The spectrum is stable and the sensemon range is at ~ 45 Mpc (corresponding to a horizon distance of ~ 45 Mpc * 2.26 = 102 Mpc for 1.4,1.4 at SNR 8), so we tried another round of hardware injections. The signal is the same 45 Mpc BNS used earlier.

The first plot shows the omicron triggers from the summary page when we started the injections. The data looks clean (appart from the big glitch when Adam turned off the ESD). We listened to the data and didn't hear any of the clicks and whistles heard in the last lock.

First injection: Scaled the waveform down by a factor of two and injected starting at 1102660100. The SNR should be around 9, if we have the calibration correct (but we may be off by a factor of a few). The last ~16 second of the injection are clearly visible in the attached spectrogram (inj-0100).

awgstream L1:CAL-INJ_HARDWARE_EXC 16384 injection.txt 0.5 -d -d
SIStrOpen: Current time is 1102660089.977015000
SIStrOpen: Assigning start time = 1102660100.000000000
SIStrOpen: Waveform starts at GPS=1102660100, epoch=0, sample=0

Second injection: Scaled the waveform down by a factor of four and injected starting at 1102661847. This should be low SNR (around 4.5). No sign of the signal in the attached spectrogram (inj-1847).

awgstream L1:CAL-INJ_HARDWARE_EXC 16384 injection.txt 0.25 -d -d
SIStrOpen: Current time is 1102661836.190781000
SIStrOpen: Assigning start time = 1102661847.000000000
SIStrOpen: Waveform starts at GPS=1102661847, epoch=0, sample=0

Third injection: No waveform scaling (distance of 45 Mpc, optimally oriented) injected starting at 1102662974. Should be SNR around 18. Nice clean signal in the attached spectrogram (inj-2974).

awgstream L1:CAL-INJ_HARDWARE_EXC 16384 injection.txt 1.0 -d -d
SIStrOpen: Current time is 1102662963.040441000
SIStrOpen: Assigning start time = 1102662974.000000000
SIStrOpen: Waveform starts at GPS=1102662974, epoch=0, sample=0

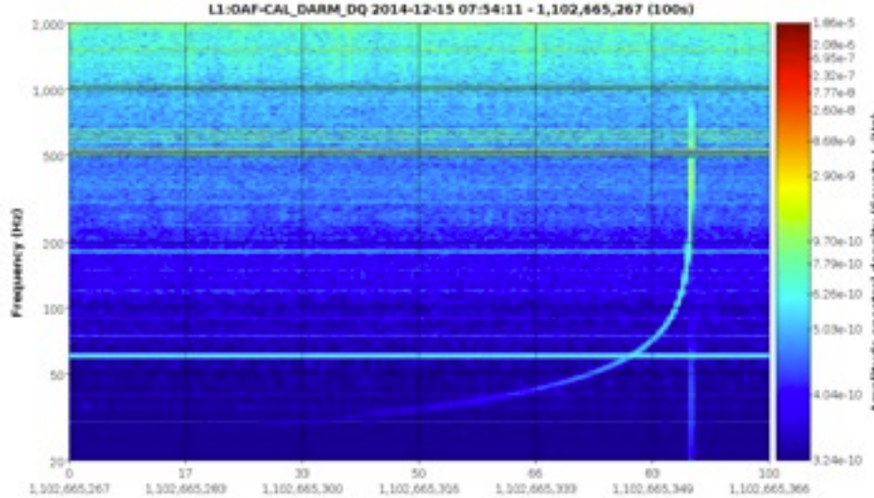
Fourth injection: Waveform scaled up by a factor of two injected starting at 1102664224. Should be SNR around 36. Corking signal in the spectrogram (inj-4224).

awgstream L1:CAL-INJ_HARDWARE_EXC 16384 injection.txt 2.0 -d -d
SIStrOpen: Current time is 1102664213.470361000
SIStrOpen: Assigning start time = 1102664224.000000000
SIStrOpen: Waveform starts at GPS=1102664224, epoch=0, sample=0

Now we're going to decrease the time between the injections and increase the amplitude for veto safety studies.

Fifth injection: Waveform scaled up by a factor of four injected starting at 1102664819. Should be SNR ~ 70.

awgstream L1:CAL-INJ_HARDWARE_EXC 16384 injection.txt 4.0 -d -d
SIStrOpen: Current time is 1102664808.753682000
SIStrOpen: Assigning start time = 1102664819.000000000
SIStrOpen: Waveform starts at GPS=1102664819, epoch=0, sample=0



Sixth injection: Waveform scaled up by a factor of six injected starting at 112665267. Can the detector take SNR ~ 100? Yes! (inj-5267). Notice that in the spectrogram you can start to see the burst of power at the coalescnece time when the waveform turns off. It may be that the fast ringdown on an EOB waveform in the BNS mass range is too fast at this SNR and a more gentle turn off is needed.

awgstream L1:CAL-INJ_HARDWARE_EXC 16384 injection.txt 6.0 -d -d
SIStrOpen: Current time is 1102665256.801458000
SIStrOpen: Assigning start time = 1102665267.000000000
SIStrOpen: Waveform starts at GPS=1102665267, epoch=0, sample=0

We are going to call it a night now, rather than pushing it further. Any louder and we may knock the detector out of lock and we won't learn much by doing that. We are going to leave the detector undistrurbed for the rest of the night.

The final attached plot shows the omicron triggers for the data while we were doing the injections. By the time we finished the injection sequence, the nasty glitching had back. You can hear clearly hear whistles in OAF-CAL_DARM. DetChar, any idea what this glitching is? The violin modes are still high, but they have been high all evening.

https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=16130

LLO General (Detchar, ER, General) Link

christopher.buchanan@LIGO.ORG - posted 01:29, Wednesday 17 December 2014 - last comment - 01:40, Wednesday 17 December 2014(16174)

ER6 DetChar Late Shift Report

Lock Information:

	GPS	UTC
Start:	1102796870.94	2014-12-16 20:27:34
Stop:	1102816201.19	2014-12-17 01:49:45
Duration:	Approximately 5.5 hours	

The range for the full lock time is shown in Figure 1. This shift began at 22:00 UTC, about 1.5 hours into the lock. During the first 1.5 hours, the range was stable, but with many dips. Nobody in the control room when I came in had a good explanation for it. However, after the first 1.5 hours, the 1-3Hz region settled down (because loggers quit work for the day), and the range settled out. Below are listed some interesting times for which I was present during the lock.

"THE ADVENTURES OF THE LIQUID NITROGEN TRUCK" (See its activity in Figures 2&3 (3-10Hz & 10-30Hz); direct effect on range in Figure 4)

UTC	Event
22:28:00	18-Wheeler Liquid Nitrogen Truck Enters Gate
22:46:30	Truck stops at Y-End to fill tank 3; range drops to 39 Mpc
22:49:00	Truck moves back and forth to back up to tank 3; range dips
22:49:25	Truck moves back and forth to back up to tank 3; range dips
22:49:50	Truck moves back and forth to back up to tank 3, range dips; starts filling tank leading to wide, large dip in range about halfway through lock
23:57:40	Truck is done unloading, backs up to drive back to gate; range dips
00:17:00-00:19:00	Truck stops to exit gate, range drops to 38 Mpc; multiple strong peaks in 10-30Hz band as truck stops multiple times on inside and outside of gate.

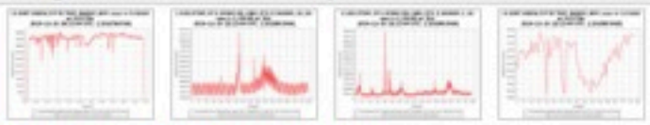
Microseism continues to increase throughout the day and evening, affecting range:

00:27:30	Peak in HPI STSB (0.1-0.3)Hz band, range drops to 40 Mpc
00:29:50	Peak in HPI STSB (0.1-0.3)Hz band, range drops to 34 Mpc
01:21:30	Observed visual pulsing of light in ITMY and ITMX, with ~2sec frequency. Not seen in ETMY or ETMX, Adam suspects it's just camera saturation.
01:49:45	Lock Lost, no clear reason

Microseism has increased steadily, and is making it difficult to obtain lock again tonight. As a final observation, I've noticed that there are drops in range associated with microseism peaks in L1:HPI-STSB_BLRMS_X_100M_300M, but not with peaks in L1:HPI-STSB_BLRMS_Y_100M_300M. Any idea why this would be the case?

Happy ER6, everyone!
Chris Buchanan

Images attached to this report



Comments related to this report

christopher.buchanan@LIGO.ORG - 01:40, Wednesday 17 December 2014 (16175) Link

And, as of 07:40 UTC, we've had an earthquake for the last hour (which also showed up in the train band and some in the microseism).

L1 General (Detchar, ER) Link

shivaraj.kandhasamy@LIGO.ORG - posted 08:45, Tuesday 16 December 2014 - last comment - 18:07, Tuesday 16 December 2014(16160)

Early Morning shift

We are having a long nice lock. At this point, it is stretching back to past ~9 hrs with ~37 Mpc. From the range plot and summary pages it looks to be relativiely clean lock, with exception of one glitch during which the range dropped to 20 Mpc. I wasn't at the control room at the time of the glitch (it was before my shift), so not sure what triggered it. Omicron reports the glitch to be around 400 Hz with SNR of ~250. Coincidentely the train-band (1-3 Hz seismic band) also reports an excess at that time (the rain likely flag was triggered for the first time in the last 8 hrs a the time of the glitch, so it mayn't be a pure coincidence). During the last hour and half, we are seeing excess noise in 1-10 Hz due to logging. Hope the lock beats it.

Comments related to this report

max.isi@LIGO.ORG - 18:07, Tuesday 16 December 2014 (16172) Link

I was on site when this long lock stretch started, around 11.50 PM local time. A couple of minutes after lock was acquired, it started to rain very hard and the wind was strong. This presumably increased noise at low frequencies, but it lasted only a few minutes. The glitch mentioned took place after I left the site. It is maybe worth mentioning that, before this long lock, there was a ~15min lock starting a little before 10.00 PM local time; this lock was lost quickly.

L1 CAL (ER) Link

madeline.wade@LIGO.ORG - posted 21:07, Monday 15 December 2014 (16073)

ER6 GDS Calibration Filters and Information

A detailed discussion of the time domain calibration can be found in DCC-T1400256. Briefly here I will say that the external differential arm length is constructed by:

Delta L = DARM_ERR / (gamma(t) * C) + A * DARM_CTRL

where gamma(t) is the time dependent gain of the sensing function, C is the sensing function, and A is the actuation function. For ER6, gamma(t)=1 at all times. The inverse sensing function (1/C) and the actuation function are modeled with FIR filters, and the calibration pipeline performs direct convolution to filter DARM_ERR and DARM_CTRL through the relevant filters. The pipeline does divide by the detector arm length, so the output (GDS-CALIB_STRAIN) has units of strain.

Input channel names:

CAL-DARM_CTRL_WHITEN_OUT_DQ
CAL-DARM_ERR_WHITEN_OUT_DQ

Output channel names:

GDS-CALIB_STRAIN 16384 Hz (contains h(t) with units of strain)
GDS-CALIB_STATE_VECTOR 16 Hz (contains calibration state information)
ODC-MASTER_CHANNEL_OUT_DQ 32768 HZ (ODC-MASTER state vector copied from input to the pipeline)

Instructions for running the calibration pipeline can be found here: https://wiki.ligo.org/Calibration/TDCalibReviewO1
Instructions for creating the FIR filters can be found in aLOG #15925.

The official filters file used for GDS calibration during ER6 is checked into the calibration SVN (https://svn.ligo.caltech.edu/svn/aligocalibration/trunk/Runs/ER6/L1/GDSFilters/). The actuation and inverse sensing FIR filters are based off of the OAF calibration models on Dec 8th, 22:00 UTC. Attached are figures showing the errors associated with converting the frequency domain OAF models to digital FIR filters. The frequency response of the OAF models are the blue curves, and the frequency response of the digital FIR filters are the red curves.

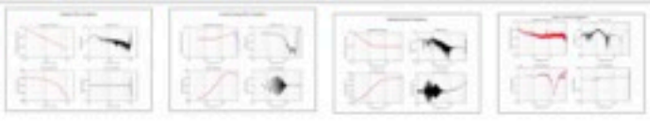
Actuation: The actuation FIR filter has errors in amplitude that are less than 10^(-3) and errors in phase less than a degree. The actuation filter has built into it a high pass filter up to 10 Hz.

Inverse Sensing: The inverse sensing FIR filter has errors in amplitude that are less than 1% above a few hundred Hz and errors in phase less than a degree. The inverse sensing filter has a built into it a high pass filter up to 5 Hz.

Dewhitening: In addition to the above filters, DARM_CTRL and DARM_ERR are also dewhitened with 5 zeros at 100 Hz and 5 poles at 1 Hz. The dewhitening FIR filter has errors in amplitude that are less than 10% up to 200 Hz and less than 1% above 200 Hz. The errors in phase are below 4 degrees. However, the phase error indicates a small delay in the filter that needs to be found and corrected. This filter will be improved in both amplitude and phase for future runs.

I have also attached a plot of the comparison between the GDS calibration (red) and the front-end OAF calibration (blue). The biggest errors (unfortunately) appear around 100 Hz. We believe these errors are largely due to the dewhitening filter. We will focus on improving this filter and investigate if that is the cause for the large bucket errors.

Images attached to this report



L1 General (ER) Link

janeen.romie@LIGO.ORG - posted 16:44, Monday 15 December 2014 (16151)

ER6 Daily Status Notes from meeting 15 Dec, 3pm CT

Chad reported that the low latency gstLAL CBC search is running ok. He said that the failure rate is about once a day. He received at least 1 hardware injection. The one ending in 0188 made it through. They're not throttling the false alarm rate.

Dipongkar said that they've had no GRB trigger so they're going to make a false GRB trigger after this call.

Duncan, Chris and Adam did some hardware injections last night. They got 5 injections in at low noise with a SNR from 17 to 400.

Stuart Anderson reported on the computing infrastructure. The bulk Virgo data transferring is still troublesome, but they'll get that sorted out.

Patrick Brady reported that Branson showed pathways to GCN and GRB networks.

Janeen talked about the proposal to end the run early, and that Valera is preparing a proposal tonight that he'll send to Fred and Nicolas on the technical reasons supporting the request. Chad will talk about this on the CBC call tomorrow and report back. LLO detector engineers and operators had many challenges over the weekend that were very good learning tools with respect to aligning, locking, moving from RF to DC and determining reasons for lock loss.

L1 General (Detchar) Link

alan.weinstein@LIGO.ORG - posted 16:03, Monday 15 December 2014 (16149)

ER6 Data Quality Shift - Thursday 11th Dec 00:00 UTC - Sunday 14th Dec 23:59 UTC

DQ Shifters: Nairwita Mazumder, Alan Weinstein
Email: nairwita.mazumder@wsu.edu ajw@ligo.caltech.edu
Detchar mentor: TJ Massinger- tjmassin@syr.edu

Full report on DetChar wiki

Summary

- Total Duty Cycle of the second DQ shift (Thurs 00:00 UTC - Monday 00:00 UTC): 25.0% (86041.0 seconds).
  - The total duty cycle contains four major locked stretches : nearly 12 hours lock on 11th and 12th December at the range of ~42Mpc, nearly 5 hours lock on 12th December at the range of ~29Mpc, 3hours lock on 13th at the range of ~59Mpc and nearly 2.9 hours lock on 14th December at the range of ~42 Mpc
- 1st lock summary (Thursday, GPS 1102347552 to 1102380800 (33248s, Thursday only), ~42 Mpc, alog entry 16058)
  - Other than few momentary dips in the inspiral range the 12 hour lock was a stable one. The pattern of glitches are same as the previous DQ shift, i.e., noise occurring throughout the lock particularly at ~260Hz and in the region between 1kHz - 2 kHz . Apart from these, there was a series of glitches found on integer seconds near ~73Hz (for details look at Andy's alog entry) which were observed in S6 data as well. But these glitches were not being seen in the other future locks.
  - The glitches around 1-2kHz seem to be associated with PMC (alog entry related to these PMC glitches can be found here). Some PSL intensity stabilization issues can be seen during this lock which might have changed the rate of glitches near 18:00 UTC in the frequency range 1-2kHz.
  - The line of ~260 Hz triggers is likely due to the PSL periscope resonance
- 2nd lock summary (Friday, GPS times: 1102398675 - 1102416264 (17589s), ~29 Mpc, alog entry 16071)
  - The spectrogram of the 5 hour lock seems to show a fairly clean lock. But the range of this lock was ~29Mpc which is noticeably low compared to the previous lock which had the same input power. The possible reason of which is the residual noise from ESD even after actuation is moved to ETMX PUM stage.
  - There were no noticeable dips in inspiral range during this lock and the lock-loss reason was probably due to a communication problem with the Beckhoff computer.
  - One interesting feature noticed during this lock was the appearance of a set of glitches during 8a.m. to 9a.m. UTC in this lock at the range of roughly 30 to 100 Hz and the reason behind this could be the glitches in vertex magnetometers. The high SNR (=>8) glitch rate goes down as compared to the previous lock.
- 3rd lock summary (Saturday, GPS Times 1102472452- 1102483279 (10827s), ~58 MPC. alog 16087.)
  - 13th December's 3hrs lock had the highest sensitivity, peaking at **59.5 Mpc!**
  - This lock was lost because of an earthquake in Northern Mid-Atlantic ridge. Looking at the timing of the ground motion BLRMS, the first earthquake must have created the second glitch at ~4:20 UTC and the second earthquake is likely cause of lock loss at 5:20 UTC
  - Though we do not know the reason behind the first glitch, there are some glitches can be observed in the omegascan result at the same time in L1:ASC-AS_B_RF45_Q_PIT_OUT_DQ and L1:ASC-Y_TR_B_NSUM_OUT_DQ. Likely alignment related.
  - The 2nd glitch, due to the earthquake, shows up in the Daily CBC result, but the first glitch doesn't have much affect.
  - We do see one feature that hasn't been noticed up until now: a line of triggers at ~ 600 Hz that is noticeable both by eye and as a small bump in the frequency vs SNR plot. This peak seems to have moderate coherence with MC2 motion and PSL accelerometers.
- 4th lock summary (Sunday, GPS time 1102564818- 1102574632 (9814s) , ~41Mpc, alog entry 16104)
  - This ~3 hrs locked stretch is a very clean one at 40 Mpc. We see only two small dips in the inspiral range.
  - Some strong individual lines of glitches between 1kHz - 2kHz (believed to be from a glitchy PMC) seem to have decreased dramatically in this lock. PCAT confirms that the glitch rate in this band has decreased.
  - The frequency-snr plot looks extremely clean and the high SNR trigger rate goes below 0.01 per second. The correction of some ISS stability issues has improved the overall stability.
- CBC
  - Aside from the glitch caused by the large earthquake on December 13th, these lock stretches were considered generally clean in newSNR
  - Duncan Brown found that the 508 Hz violin mode is causing excess triggers in the CBC pipeline
- Hveto
  - Regular Hveto:The most common winner throughout these lock stretches was PSL-PMC_HV_MON_OUT_DQ, one of the channels listed by Valera and Den as indicative of the PMC intensity noise fluctuations.
  - DAC MCT Hveto: we have not, so far, found any immediate evidence that major carry transitions in the DACs were causing systematic glitching the IFO during these locks. The Omicron triggers look relatively clean in the MCT glitch range and DAC Hveto did not find any significant vetoes using MCT triggers.
- Other noise features
  - These lock stretches brought up another interesting noise pattern - extremely slow amplitude modulation of DARM and SRCL (0.06Hz in DARM!) see alog 16110
  - Immediate guess was that the seismic isolation blend filters might have been detuned at the crossover point and created a very low frequency beat note (have seen this before in the oplevs on even slower time scales, ~0.005 Hz)

L1 General (ER) Link

stuart.aston@LIGO.ORG - posted 18:55, Sunday 14 December 2014 - last comment - 01:28, Monday 15 December 2014(16121)

Locking Status Update - DC Locked at 10W at 18:45pm (CT)

[Stuart A, Adam M, Joe H, Danny S]

After losing lock earlier this morning, Operators had reported not being able to lock and successfully transition to DC read-out (see LLO aLOG entries 16111, 16112 and 16119).

Firstly, I discovered a large calibration error in the PSL output power, above 20%, so I tweaked some of the calibration factors to bring this below 5%. This helped DRMI lock and allowed us to proceed.

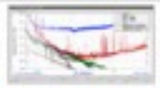
Running the alignment script and manually fine tuning TMSX & TMSY in yaw improved the green cavity power in each arm, and enabled us to lock at RF without failing at WFS. However, RF locks lasted only for a short period, most likely due to some extremely rung up QUAD bounce modes (most notably ETMX). The automated damping script was ringing these modes up even further, so we set about manually tuning damping phases and gains (which needed to be reduced for such large rung up modes).

After another round of alignment, eventually we were able to reach RF lock and damp the bounce, roll, and violin modes. During one attempt we were able to reach RF lock and damp the suspension modes, but noticed an odd large 10Hz feature in MICH (see attached plots), lock was lost during powering up to 10W.

Finally, we were able to lock in RF at 10W and transition to DC read-out at ~18:45 [CT] (00:45 [UTC]).

n.b. HAM6-ISI trips persisted throughout the day and observed that these were coincident with the DRMI locking and arming (not moving?) the shutter.

Images attached to this report

Comments related to this report

https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=16121

General (Detchar, ISC) Link

joshua.smith@LIGO.ORG - posted 10:22, Sunday 14 December 2014 - last comment - 08:41, Monday 15 December 2014(16110)

Noise jumps in DARM appear with double frequency in SRCL

Josh, Andy, TJ, (conversations with Peter Saulson),

Peter Saulson commented previously that the noise in DARM "bounced" on timescales of ~10 seconds in the Dec 9 lock. Back then, we noticed that there appeared to be a correlation between the noise jumps in DARM and similar noise jumps in SRCL, but at double the frequency (see attached PDF). Lately, this effect has been weaker at most times. However, In the recent Dec 13 lock there were some bad DQ periods, e.g. around 04:27 UTC when **the double frequency relationship was particularly clear (see attached PNG)**. We don't think this means that SRCL is coupling to DARM, because the frequency is too high, according to the latest noise budget (see report 14163). But could it mean whatever is modulating DARM noise is modulating SRCL noise at double the frequency, for example, by a squaring process or some absolute value? As a side note, we do not see this noise modulation at either frequency clearly in PRCL, MICH, or CARM.

Images attached to this report

Non-image files attached to this report

dec9-darm-srcl.pdf

Comments related to this report

joshua.smith@LIGO.ORG - 08:41, Monday 15 December 2014 (16139)Detchar, ISC Link

Whether there's a curious relationship between DARM and SRCL noise modulation as above, probably DARM noise is driven by seismic motion. During these times, there is a large 0.06Hz peak in low frequency DARM (fig 1), that corresponds to a 16.7 Hz period, which matches roughly with the above plots. The 0.06 Hz peak looks peakier in DARM than in ground seismic (fig 2). For reference, low frequnency SRCL is also shown (fig 3).

ISS : Intensity stabilization servo

General (Detchar, ER) Link

thomas.massinger@LIGO.ORG - posted 06:00, Sunday 14 December 2014 - last comment - 04:30, Monday 15 December 2014(16106)

PMC glitching seems to have improved after ISS stability improvement

ER6

During the DC readout lock described in alog 16104 there was a reduction in both the population and SNR of glitches in the 1kHz - 2kHz band that has lately been populated with PMC glitches. In earlier locks, we have been able to see the PMC lines in DARM between 1 - 2 kHz increase in amplitude during times of higher intensity noise [see attachment 3]. In alog 16093 Stuart mentioned that they had stabilized the ISS while trying to achieve lock - it looks like this stabilization has helped settle down the glitching between 1 - 2 kHz.

Attachments:

[1,2] Omicron glitchgrams comparing lock from alog 16104 to the 12 hour lock on Dec 11, 2014 with similar sensitivity. Note that the Dec 11th lock has a higher density of glitches in the 1 - 2 kHz range.

[3] Example of DARM before and after a shift in intensity noise that occured during the Dec 11th lock. There's a broadband effect on the 1 - 2 kHz region and the individual peaks from the PMC increase in amplitude.

[4,5] Omicron glitchgrams on daily time scales that allow for an easy eye test of glitch data quality between 16 UTC onward on Dec 11th and now - both of these locks had an inspiral range of ~40 Mpc. Many of the glitches showing up in specific frequency bands (~260 Hz, ~600 Hz, 1-2 kHz) have decreased in SNR.

Images attached to this report

L1 General (Detchar, ER) Link

alex.nitz@LIGO.ORG - posted 00:51, Sunday 14 December 2014 - last comment - 05:27, Monday 15 December 2014(16104)

ER6 Detchar Lateshift Report

Alex Nitz, Christopher Biwer

Detchar Late Shift Report Dec 13, 2014 02:00 UTC to Dec 13, 2014 06:00 UTC

Locks:

Lock was attained at ~04:00 UTC with a range of 42 Mpc and lost at 06:44 UTC.

Details:

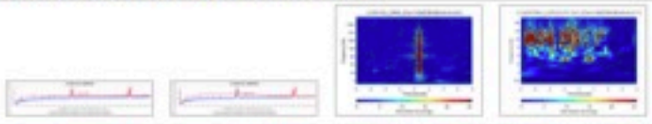
There were two significant drops in range during this time:

- GPS time 1102567394.5 range drops to 4 Mpc
- GPS time 1102570996 range drops to 6 Mpc

We have attached two plots showing the spectrum for each of the range drops. The red trace is around the time of the range drop, while the blue trace is 40 seconds later.

We looked at omega scan plots at the time of the first drop and notice that there was a lot of noise in L1:SUS-ETMX_L3_OPLEV_PIT_OUT_DQ just before. Plot attached.

Images attached to this report



Comments related to this report

matthew.evans@LIGO.ORG - 15:24, Sunday 14 December 2014 (16118) Link

This is a ~2ms glitch in the time series. The DARM loop can't respond this fast, so the glitch shape should not be too much modified by the loop.

L1 INJ (Detchar, ER) Link

christopher.biwer@LIGO.ORG - posted 13:44, Sunday 14 December 2014 - last comment - 17:01, Sunday 14 December 2014(16114)

Planning CBC waveform injections for ER6

Chris B., Duncan, B.

The hardware injection subgroup had suggested using gstlal_fake_frames to make CBC signals for hardware injections. We compared the output of this code to the lalapps_coinj code used to make hardware injections in S6. While the inspirals look correct the waveforms are not tapered at the start and the end. [See attached images.]

lalapps_coinj can generate injections in frame format as needed by tinj, as well as ASCII files for awgstream. So we will use lalapps_coinj for the testing today with Adam.

Images attached to this report

Comments related to this report

General (Detchar) Link

andrew.lundgren@LIGO.ORG - posted 17:09, Saturday 13 December 2014 - last comment - 14:21, Sunday 14 December 2014(16096)

Scattering arches during earthquake

There were some beautiful scattering arches in DARM during the first earthquake of the lock earlier, reported in this alog. The arches hit their peak every 10 seconds, and the bottom arch goes up to 20 Hz. The arches reach all the way up to the fifth harmonic (100 Hz). They're clearly due to the earthquake. In the second plot, you can clearly see the arches start at 4:21:30 UTC. Although this scattering was driven by the earthquake, it might be a useful time to study to understand other scattering. Burst and CBC should also look at this time to see how staying locked through an earthquake affect the searches.

L1 General (Detchar) Link

duncan.brown@LIGO.ORG - posted 21:25, Saturday 13 December 2014 (16101)

Violin modes appear to be causing high trigger rates in CBC search

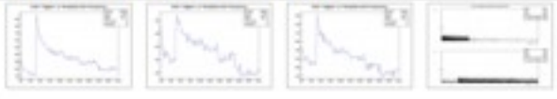
Duncan B, Chris B, Alex N

There appears to be a significant increase in trigger rates in the CBC search for inspiral templates that sweep through the violin modes at 508 Hz (templates with total mass below 8.66 solar masses). The attached histograms show the trigger rate as a function of coalescence frequency for the 55 Mpc lock on Dec 12, the 5 hour 30 Mpc lock on Dec 12, and the 12 hour 40 Mpc lock on Dec 11. In each plot, there is a large increase in the trigger rate for coalescence frequencies above 508 Hz (larger than would be expected just looking at the density of the template bank). This is also clearly seen in the attached scatter plot from the 55 Mpc lock which shows SNR vs total mass and SNR vs coalescence frequency for the first 90 mins of the lock (to avoid the time around the earthquake).

The daily CBC detchar search runs a bank of the CBC templates with component masses between 1 and 12.5 solar masses. The filter start frequency in ER6 is set to 30 Hz and the templates sweep up through the detector band to a coalescence frequency determined by the template's innermost stable ircular orbit (ISCO) given by c^3/(6 * sqrt(6) * G * M). This means that in the ER6 analysis, a 1.4,1.4 solar mass BNS signal sweeps from 30 Hz to 1520 Hz in 55 seconds, and a 7,7 solar mass BBH signal sweeps from 30 Hz to 314 Hz in 37 seconds.

We are re-running the analysis to try and exclude the forest of violin modes around 508 Hz, but it would be good if detchar can also take a look for non-stationarity and/or upconversion around these lines, especially in the 55 Mpc lock.

Images attached to this report



General (Detchar, PSL) Link

andrew.lundgren@LIGO.ORG - posted 17:01, Friday 12 December 2014 (16082)

Glitches associated with PMC HV

Josh and Andy (and discussion with TJ)

The Dec 11 hVeto page shows PSL-PMC_HV_MON as a very significant veto during the long lock stretch. The same glitches are associated with PMC_MIXER, the LVEA vertex magnetometers, and possibly also LVEA radio (though we haven't looked carefully into that one).

Looking at several of the glitches, they are all sharp short glitches in the 1200 to 1600 Hz band. The glitches in DARM, PMC_MIXER, and PMC_HV_MON match each other very well. The glitches seen by the LVEA magnetometers are low frequency but large (and in all three degrees of freedom). There are similar glitches in the magnetometers that aren't associated with the glitches in PMC/DARM.

My theory is that the HV supply for the PMC PZT is glitching (maybe sparking or the like), and that causes glitches in the PMC that make it to DARM. I think the magnetometers are too far away to see the HV glitches, but maybe they're picking up transients or dirty power on the power line that cause the HV supply to glitch.

Here are some custom Omega scans aimed at DARM, PMC, and the LVEA mag. The glitches are at high frequency and very short so they are hard to see, but the SNRs are from 12 to 24.

Scan1 Scan 2 Scan 3 Scan 4

General (Detchar) Link

peter.saulson@LIGO.ORG - posted 09:44, Thursday 11 December 2014 (16045)

Slightly better noise stability in last night's 37 Mpc lock

In this past evening's 37 Mpc lock, "bouncing" of the DARM noise spectrum is qualitatively similar to that of a few nights ago (8-9 Dec). Low frequency bouncing looks very similar. High frequency bouncing has similar timescale and frequency structure, but a bit lower amplitude. See attached normalized 1 hour spectrograms for comparison. (First figure is this past evening's lock, second figure is from a couple of nights ago.)

Images attached to this report