Engineering Run ER15 (LIGO Plans)

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An *Engineering Run,* generally several days to several weeks in duration, is used for several purposes: Some aspects of the calibration, data quality and analysis pipelines require live and/or simultaneous data from the observatories for testing. The operational team needs dedicated time relatively free of configuration change to practice running the detector. The commissioning team may need to make some final adjustments to the detector operating state and automation. And all of these groups may need to make adjustments in response to recent changes by the other groups.

ER15

- Will begin ~4 weeks before the start of the Observing Run
  - Exact date/time still TBD
- LIGO Observatories will transition from Commissioning Phase to an Engineering Phase.
- At the LIGO Observatories the head of the Detector Engineering Groups takes charge of scheduling and approving activities on-site.
- The goal is to have a smooth transition to Observations with stable, calibrated instruments.

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ER Activities

- **P**hysical **E**nvironment **M**onitoring Injections
  - Acoustic, Magnetic, Vibrational, RF etc. injections are performed at many different locations around the detector.
  - The goal is to measure the coupling of environmental noise sources to the gravitational wave strain channel.
  - Each site will spend approximately 60 hours on these tests.
  - Injections will happen during the week 1 of ER15 at LLO, week 3 at LHO

- Calibration
  - The goal for O4 is to produce the final calibration in near real-time instead of several months as in past Observing Runs.
  - Requires careful initial measurements and regular checks throughout O4.
  - Will be prioritized at each site during Week 2. Budget of ~40 hours total.

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ER Activities

- Automation
  - In O4 our goal is to have automated operation of the instrument, with the ability to have remote monitoring and intervention if needed.
  - LLO will budget ~20 hours/week to this effort. LHO budgets ~5 hours/week

- Detector Characterization Safety Injections
  - Loud injections delivered through the Photon Calibrator are used to assess the safety of channels used as vetoes by the analyses.
  - Will use a few hours of time at each site. Can be done opportunistically.

- Commissioning
  - Efforts to understand the noise and improve the sensitivity and reliability of the instruments will continue during the ER.
  - We are budgeting ~20 hours/week to this activity.
  - Some commissioning can happen in parallel with other investigations.

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ER Activities

- Tuning of Detector subsystems and displays by Detector Engineers.
  - Hardware fixes
  - Final alignment of auxiliary lasers
  - Transfer function measurements
  - Making our status boards green

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ER Activities

- Testing of the Low-Latency Alert Infrastructure
  - We will have significant amounts of low noise data during the Engineering Run.
  - Low-Latency analysis pipelines will generate gravitational event candidates.
  - Towards the latter half of the run we expect to issue public alerts.
  - These alerts **will not** be followed up unless the candidate is deemed to be exceptional.
  - We will make a complete end-to-end test of the alert infrastructure.
  - The final week of the ER will focus on providing Observing quality data so that online analyses will be able to estimate their backgrounds.

On to O4!

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