

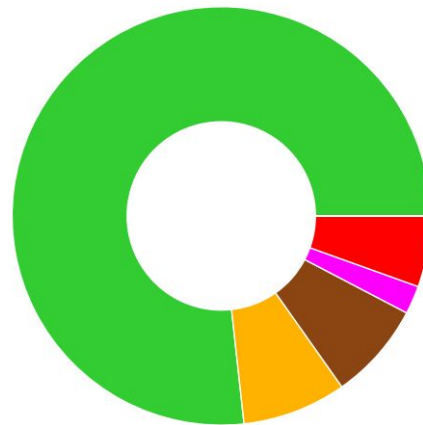
Assessing EQ Mode Impacts on LLO DQ

Robert M. Beda

July 20, 2020

Lockloss

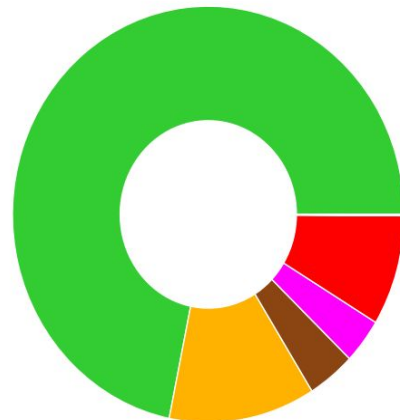
- Earthquakes at observatory sites can cause laser cavities to lose lock.
- Preventing lock loss helps to maximize useful observing time.



L1 operating mode overview

[1238166018-1253977218, state: all]

- Observing [76.7%]
- Locking [8.0%]
- Environmental [7.6%]
- Commissioning [2.2%]
- Maintenance [5.5%]
- Planned engineering [0.0%]
- Unknown [0.0%]
- Undefined [0.0%]



H1 operating mode overview

[1238166018-1253977218, state: all]

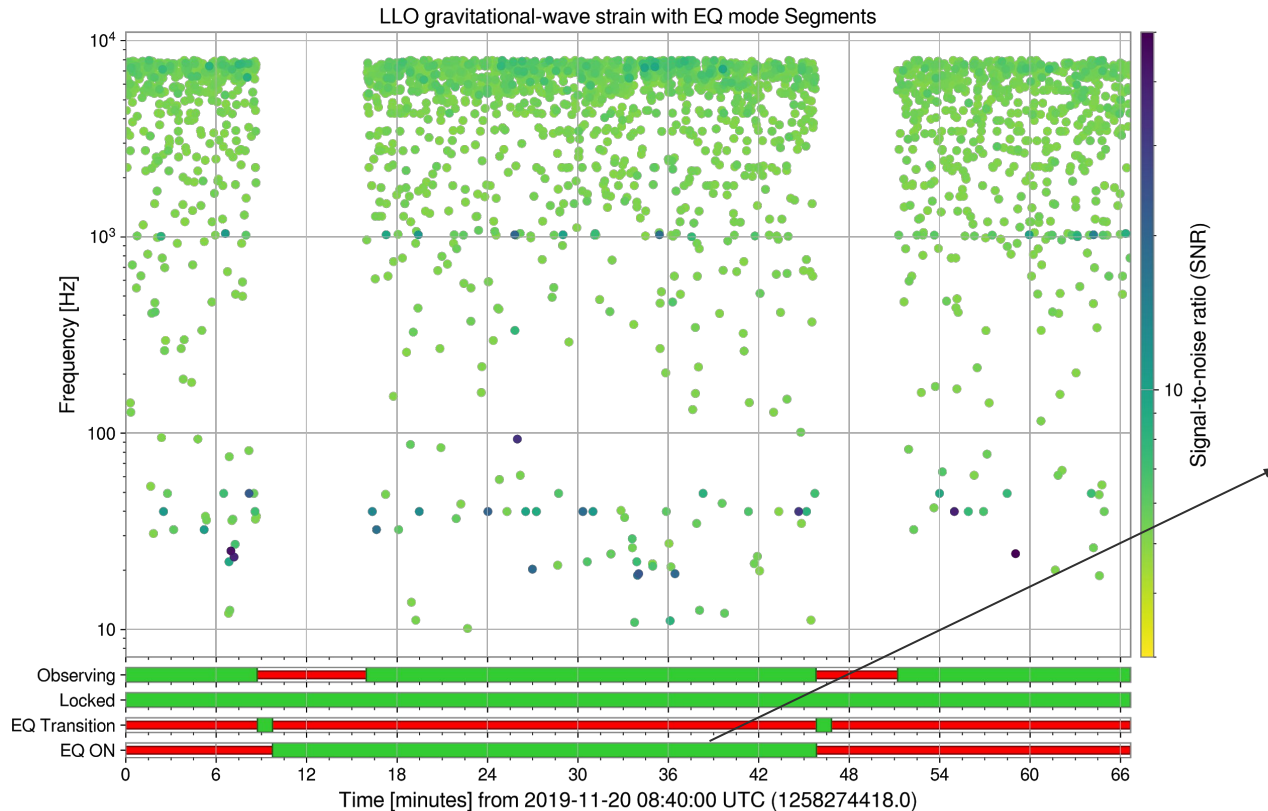
- Observing [71.8%]
- Locking [12.1%]
- Environmental [3.9%]
- Commissioning [3.5%]
- Maintenance [8.6%]
- Planned engineering [0.0%]
- Unknown [0.1%]
- Undefined [0.0%]

Observing time lost due to environmental factors and associated re-locking time during O3a.

(Figures taken from O3a summary pages)

Motivating Question: How do EQ Mode and its associated transitions influence data quality, if at all?

Should we stay in observing mode during transitions?



Nov 20 eg: Lock is maintained, but at what cost?

Building on Previous Work

We are building on a report concerning the effects on BNS range and glitch rates of transitions to and from LHO EQ Mode:

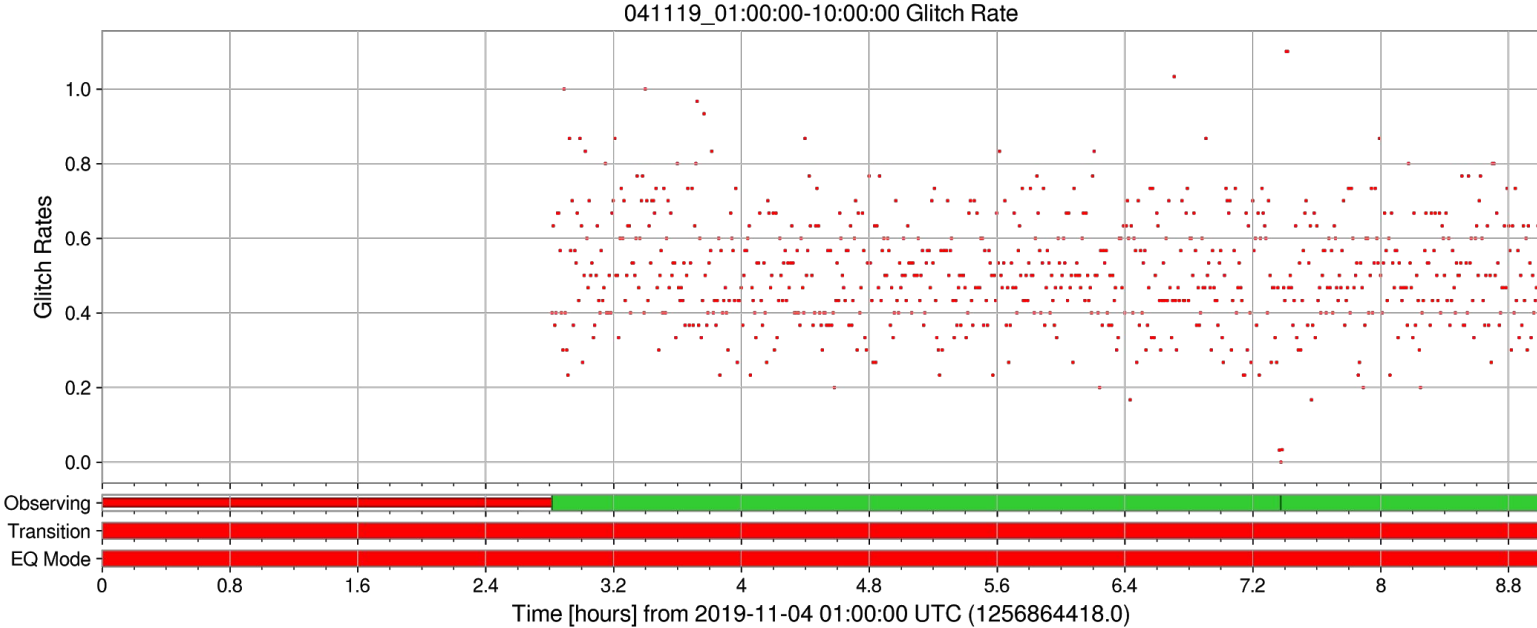
https://docs.google.com/document/d/1QRJjDHjEjjRVa_5cqBDLcwskDhnK2W

Document authors: Brennan Hughey, John Zweizig, Nicolas Arnaud, and Dripta Bhattacharjee

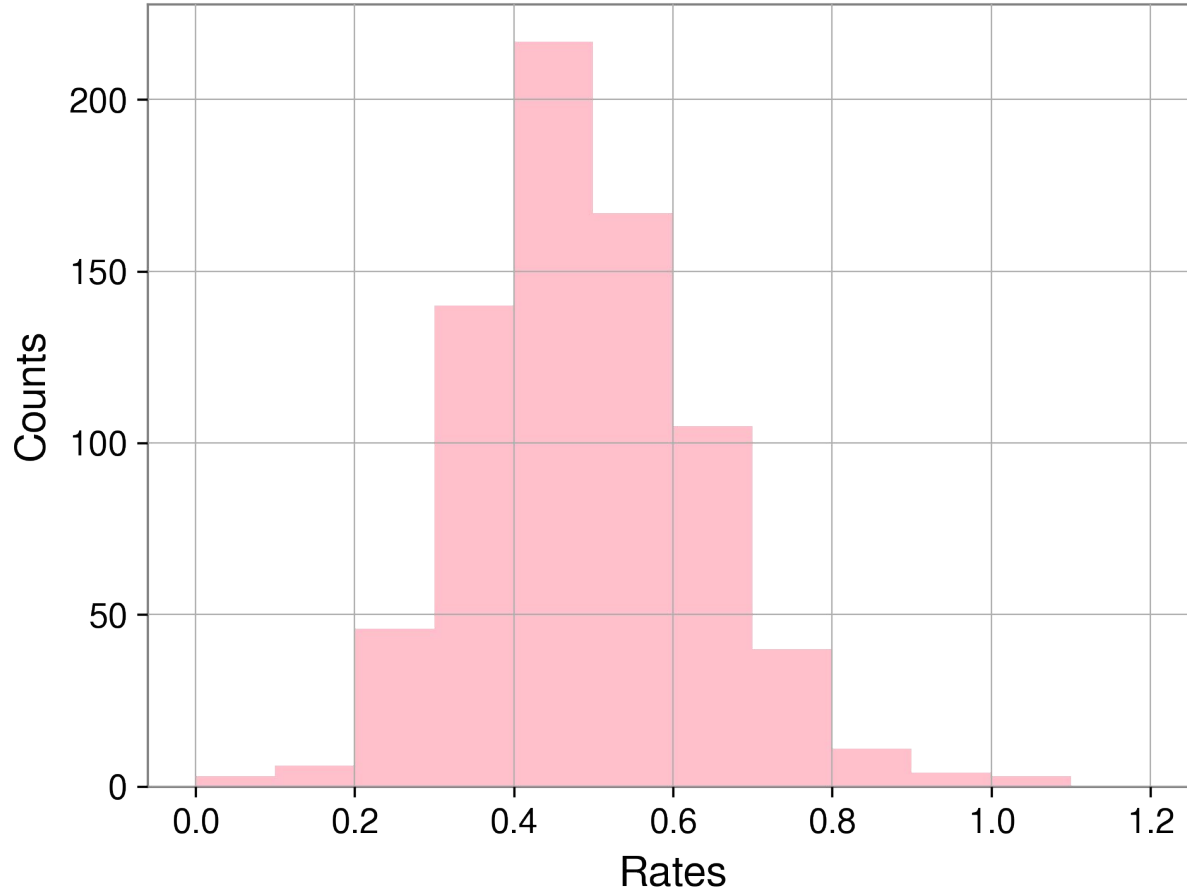
<u>SNR(>=)</u>	<u>Trans -8</u>	<u>Trans - 2</u>	<u>Trans</u>	<u>Tran + 2</u>	<u>Tran + 8</u>
<u>10</u>	0.00697	0.00935	0.00951	0.00539	0.00494

- We would like to get similar information about LLO

Taking Glitch Rate Averages



Distribution of Glitch Rates Averaged over ~30s intervals



Unwelcome Noise

These noise sources also influence glitch rates, and thus should be removed to isolate for observatory configuration effects.

- Wind

Potential solutions include removing wind speeds $\geq 5\text{m/s}$ and applying a cutoff to tilt motion channels - caveat concerning 'glitchy' behavior inconsistent with other SEI information.

- Anthropogenic Sources

Potential solutions include $\text{BLRMS}_{3_10} \leq 500 \text{ nm/s}$ and cutting known high-noise times out from data examined

- Microseism

Potential solutions include the fixed threshold $\text{BLRMS}_{100M_300M} \leq 1000 \text{ nm/s}$

Next Steps

- Streamline data reading to get glitch rate trends spanning larger periods of time
- Reduce the influence on the data set of any other non-seismic environmental factors that correlate with increased glitch rates.
- Use glitch rate distributions to compare data quality within different earthquake-related detector states

Noteworthy Contributions

- Project management: Jess McIver, Evan Goetz
- Seismic Expertise: Beverly Berger
- Coding Assistance: Arnaud Pele, Katie Rink