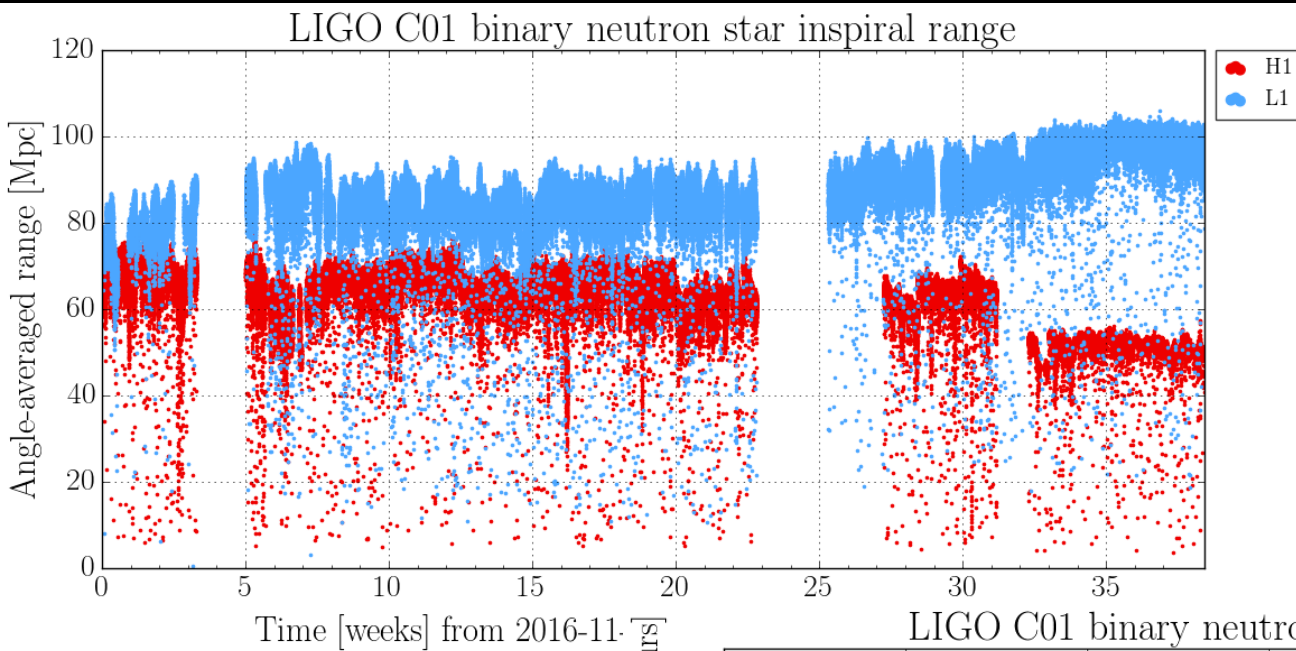


LIGO and Virgo instrument status and timeline of ER13, ER14 and O3

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for the LIGO-VIRGO
Joint Run Planning Committee

LIGO-G1802174

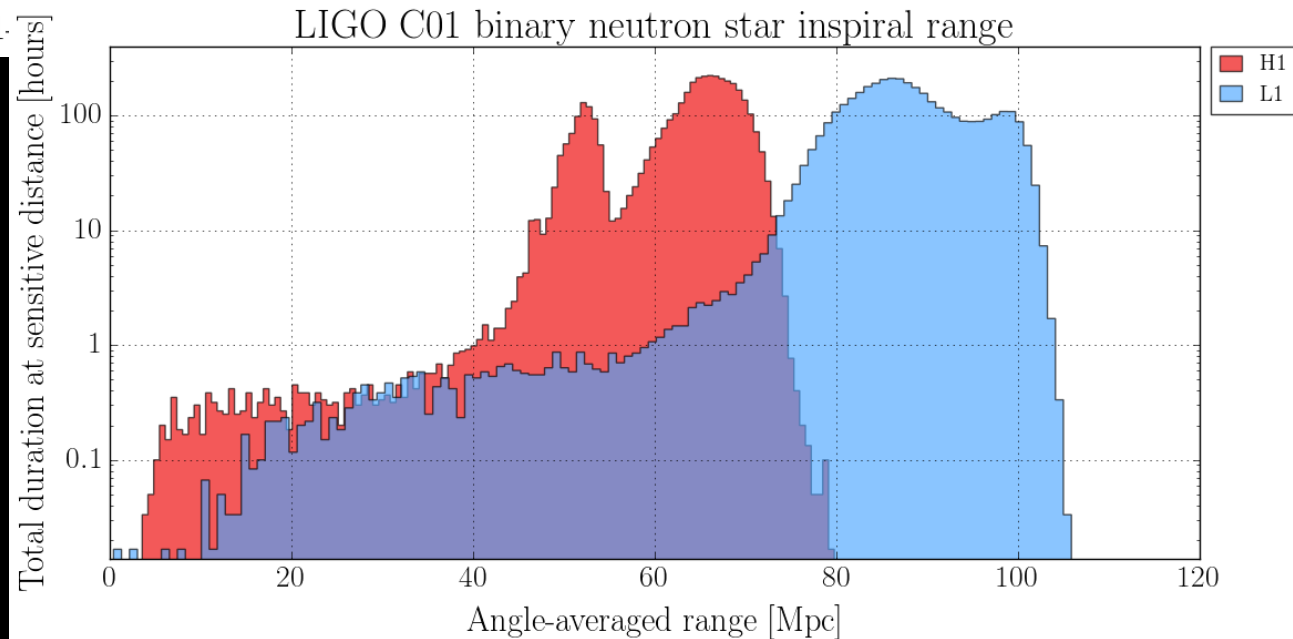
BNS Range in O2: LIGO L1 and H1



LIGO-LIVINGSTON:
100 Mpc towards the
end of O2, best
sensitivity ever

LIGO-HANFORD:
noise performance
degraded during O2, some
instrumental noise
removed offline
("data cleaning")

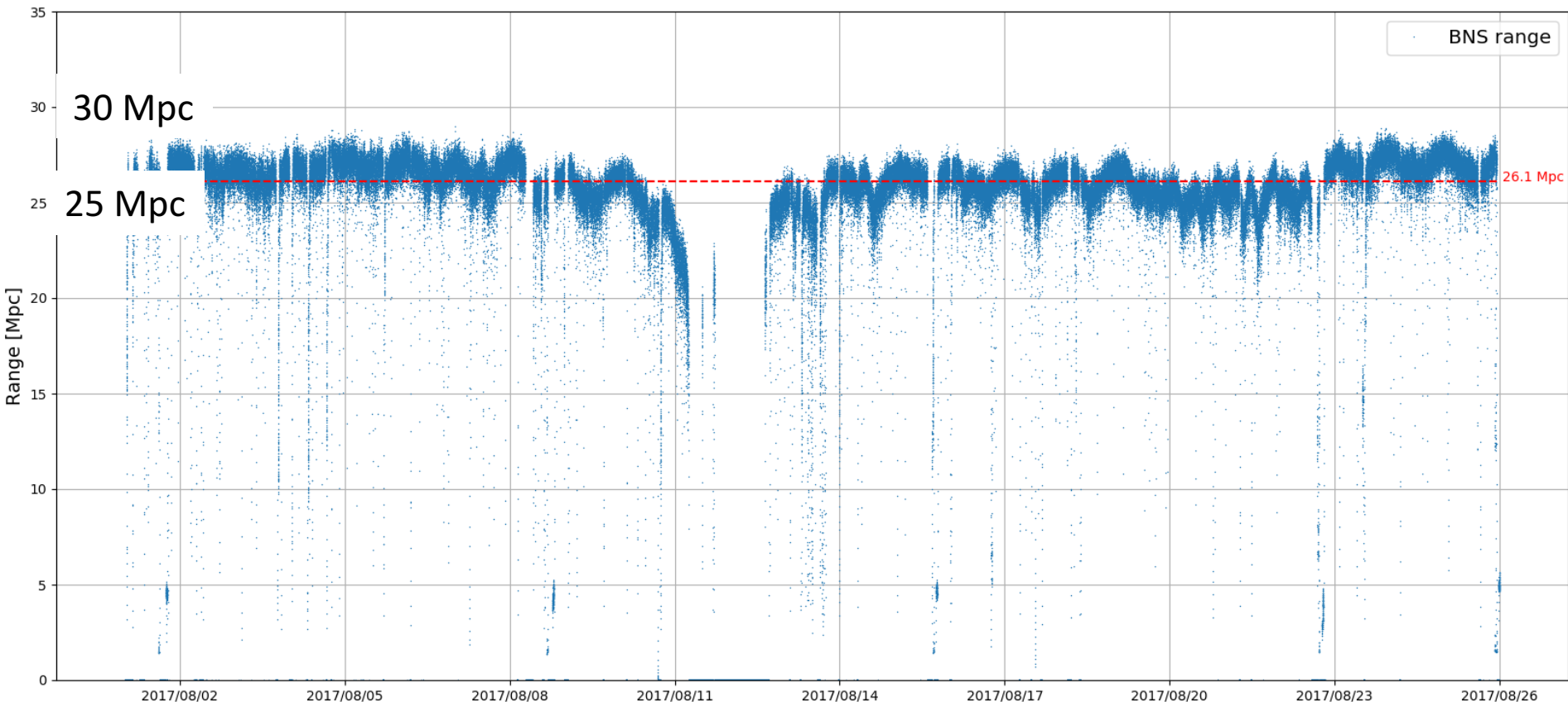
Nov 15, 2018



BNS Range in O2: VIRGO

- First lock in March 2017, joined O2 in August with **25-30 Mpc** BNS (only 3 months of “noise hunting”!)

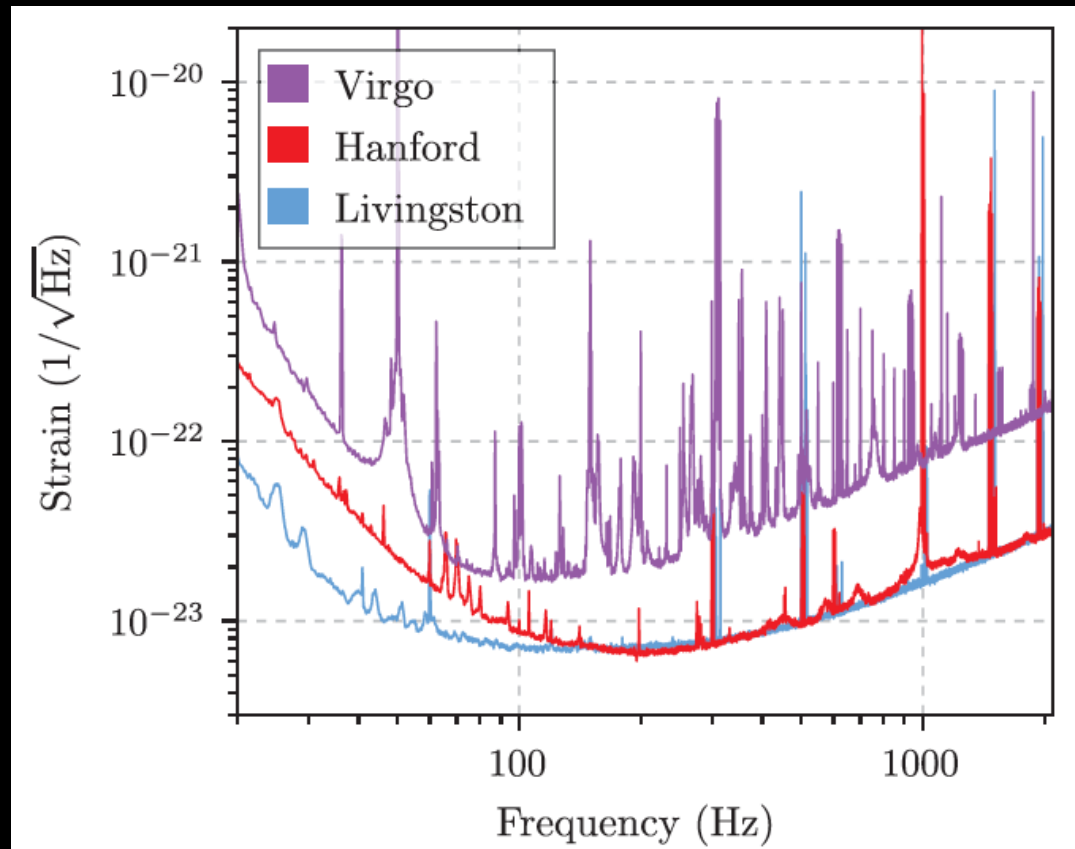
Virgo BNS range: 2017/08/01 -> 2017/08/25 -- now: 2017/10/05 22:24:04 UTC



Instrument work after O2

(O3 goals: 120+Mpc LIGO, 60+ Mpc Virgo)

Noise performance in August 2017



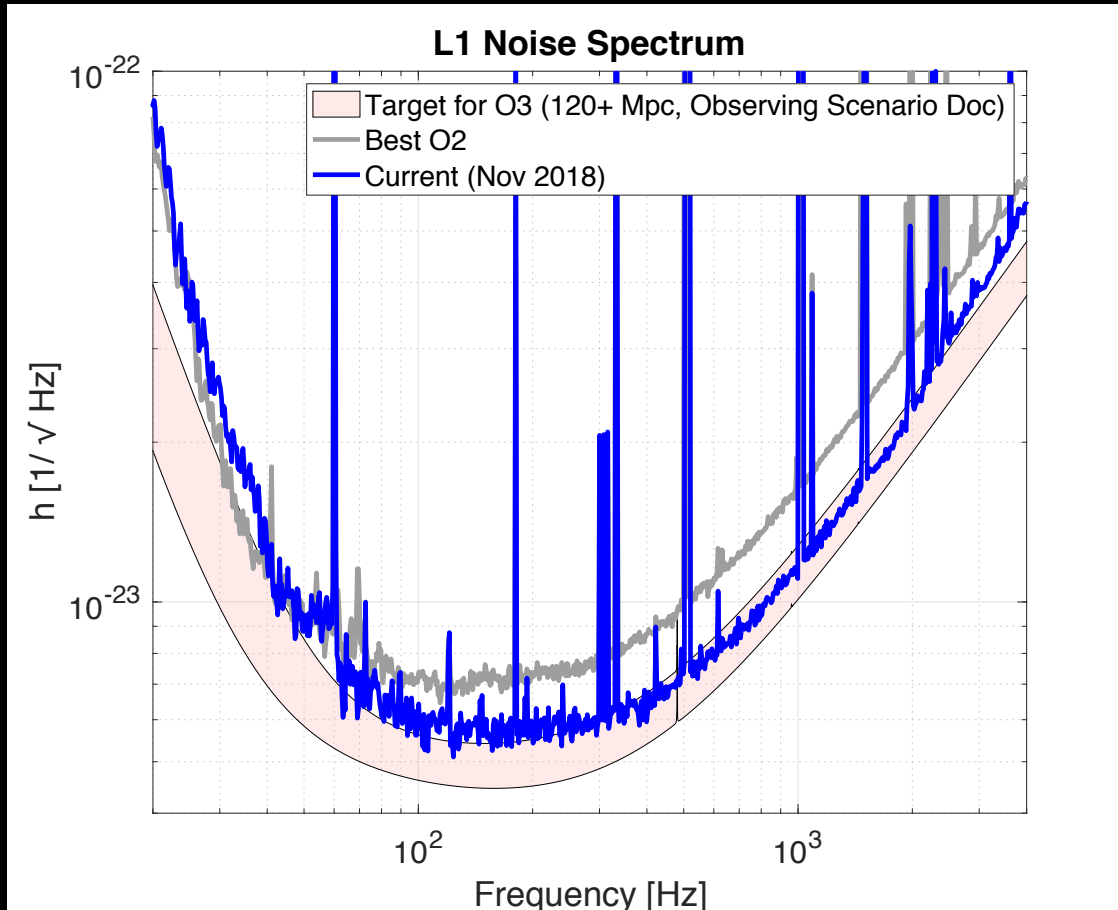
Basic plan at all sites:

- Improve the high frequency performance by increasing the amount of circulating laser power + squeezed light injection
- Mitigate back scattered light
- Identify and reduce other technical noises at low frequency

Some specific interventions:

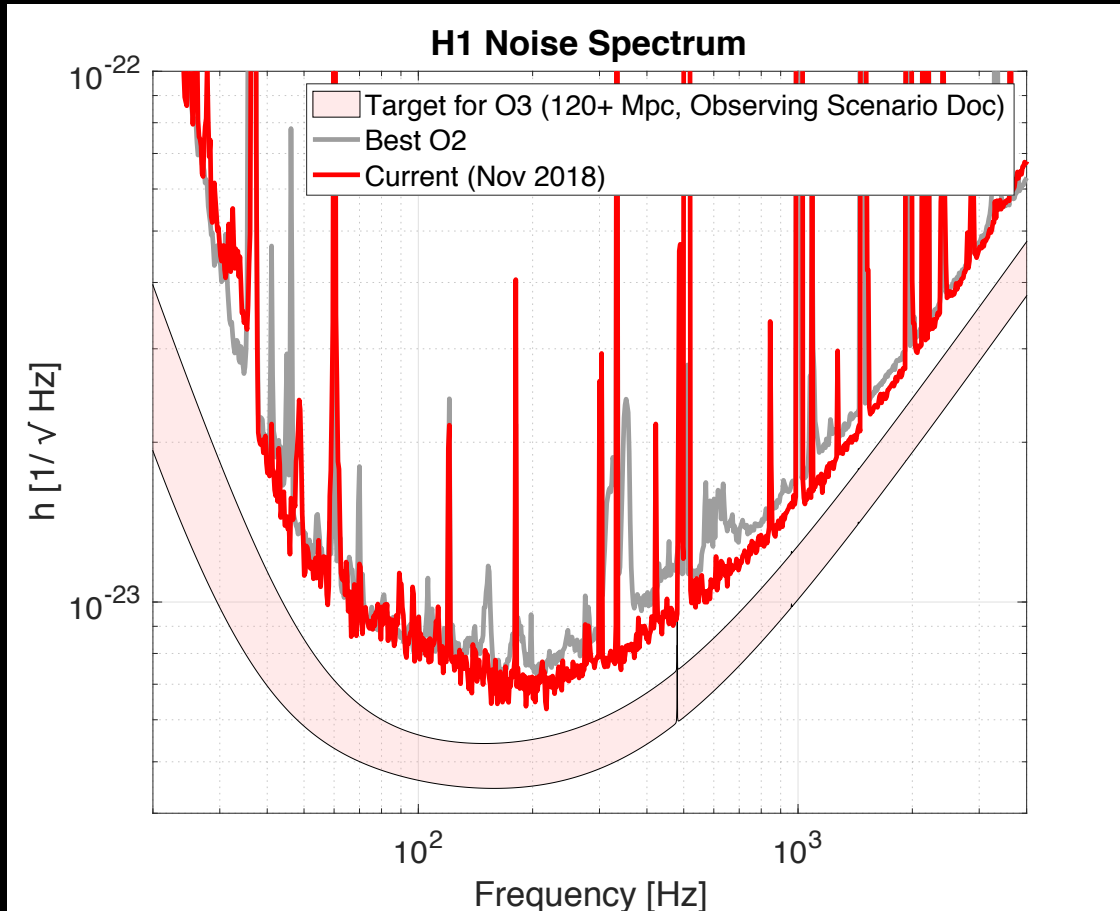
- Virgo: replace mirror suspension steel wires with fibers
- Hanford: track the origin of excess noise at both high and low frequency

Current Status: L1 (Nov 2018)



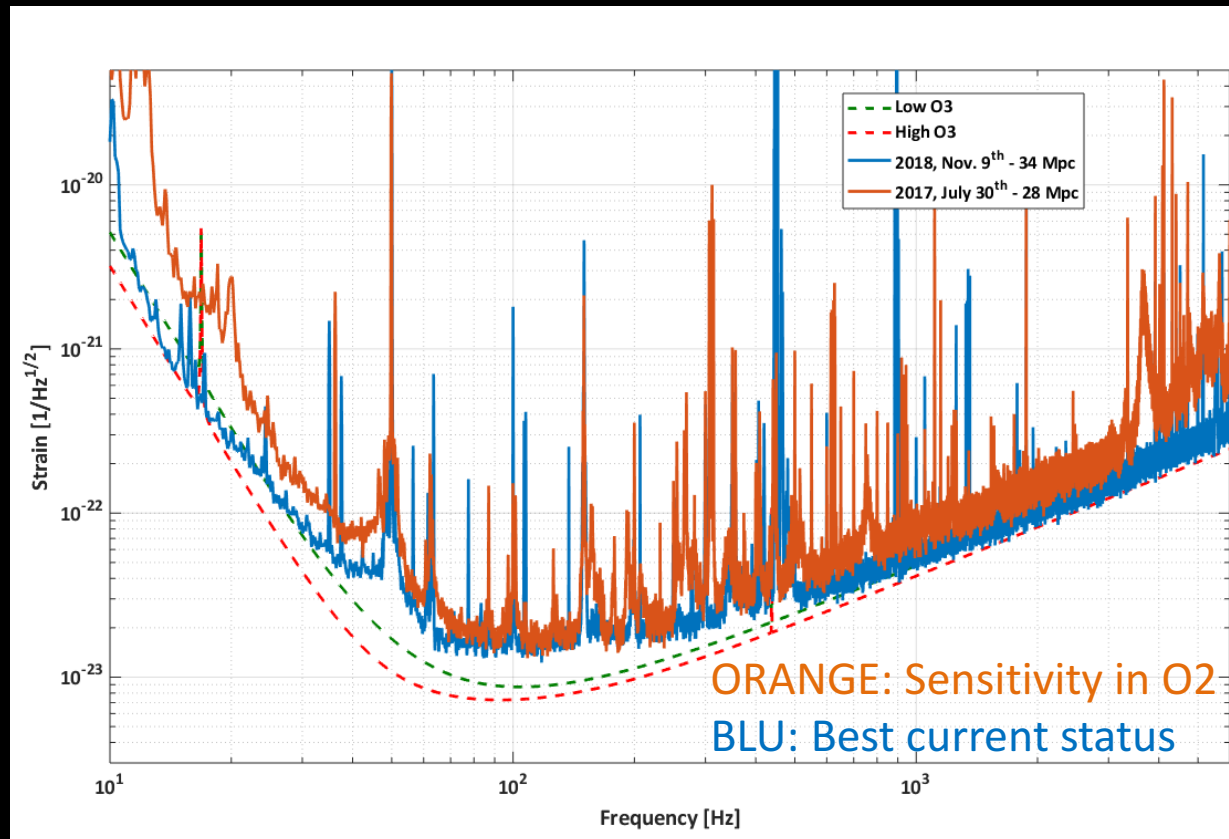
- Best range observed so far close to **115 Mpc**
- Modest increase in laser power so far, plus 25% shot-noise reduction with squeezed light injection
- Some successful mitigation of technical noises
- Work still in progress on all fronts (more power, higher levels of squeezing, noise hunting)
- In parallel: data quality improvements and interferometer robustness

Current Status: H1 (Nov 2018)



- Recovered from late O2 noise excess, improved over best O1 performance
- Best range observed so far close to **90 Mpc**
- Modest increase in laser power so far, squeezing not yet injected
- Work still in progress on all fronts (more power, squeezing, noise hunting)
- In parallel: data quality improvements and interferometer robustness

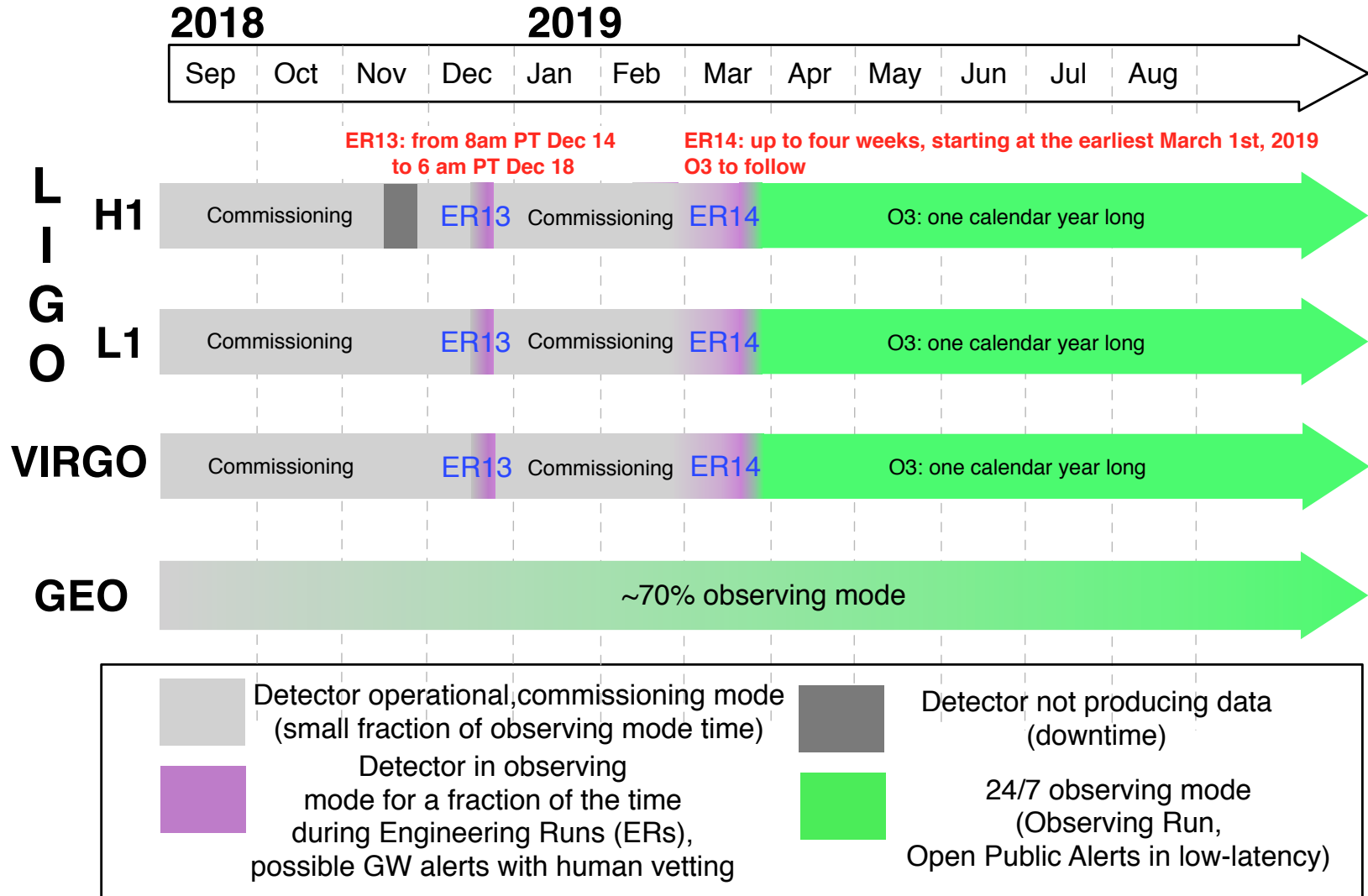
Current Status: VIRGO



- Successfully replaced steel fibers with fused silica fibers
- Exposed low frequency noise, some fixed
- Power doubled wrt O2, squeezing not yet injected
- Best range observed so far close to **35 Mpc**
- In parallel: data quality improvements and interferometer robustness

Working schedule for O3

(Public document G1801056-v4, based on G1800889-v7)



O3 Observing Strategy

- **24/7 operation**, with **planned downtime** for maintenance and (minimal) commissioning:
 - of the weekly 168h, loss up to 21h (12%) of triple coincidence (21h → 12h double coincidence, 9h Virgo only)
- **Unplanned downtime**: environmental disturbances, some of which are simultaneous (large earthquakes), some are local (storms, power outage) → up to 10% downtime in O2 for single interferometer
- **Extraordinary downtime**: if major problem is observed during the run and need immediate fix, or major noise/data quality problem is identified and we think we can quickly fix it (example in O2: cleaning of one of the input arm mirrors in H1)

Conclusions

- Intense hardware changes at all of the three sites after O2
 - some delays, but good progress
 - all of the instruments have now surpassed previous best noise performance
 - Target is: 120Mpc+ for LIGO, 60+ Mpc for VIRGO
- ER13 schedule established:
 - **8amPT Dec 14, 2018 – 6amPT Dec 18, 2018**
- ER14+O3 schedule shifted by 6 weeks:
 - ER14 (up to 4 weeks) starting around March 1st, then transitioning into O3 late March/early April
 - Change necessary to further improve noise, data quality, robustness