

O3 LIGO-Virgo-KAGRA update, February 2020

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2020/02/20

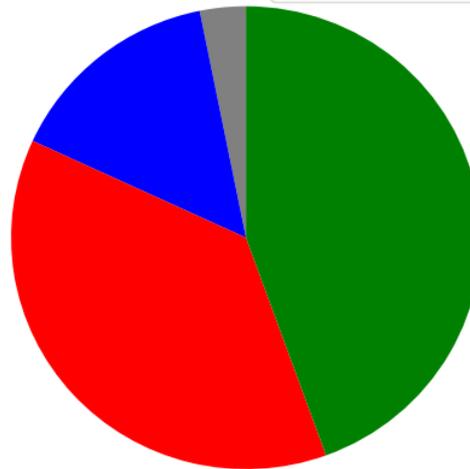
<https://wiki.gw-astronomy.org/OpenLVEM/Telecon20200220>

O3b Status

- 16th week of O3b
 - 3-IFO network: 49.8%
 - At least 2 IFOs: 84.4%
 - No IFO: 3.6%
- Downtime includes everything
 - Maintenance, calibration, commissioning, etc.
- Winter does not help for high duty cycle but **good performance overall**
- Single detector duty cycles

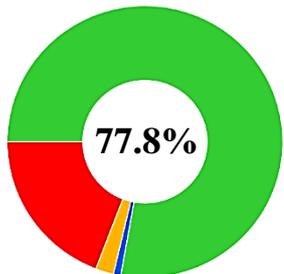
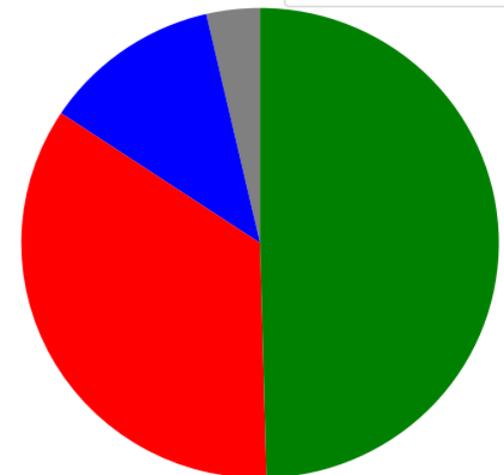
O3a

H1-L1-V1



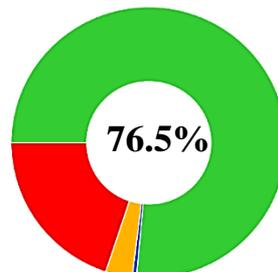
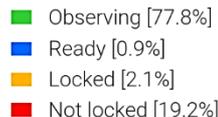
O3b

H1-L1-V1



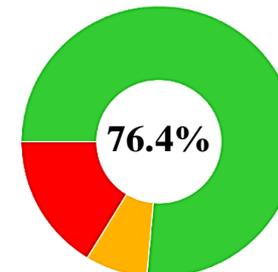
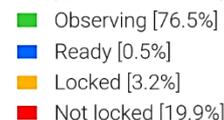
H1 operational state

[1256655618-1269788418, state: all]



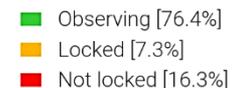
L1 operational state

[1256655618-1269788418, state: all]



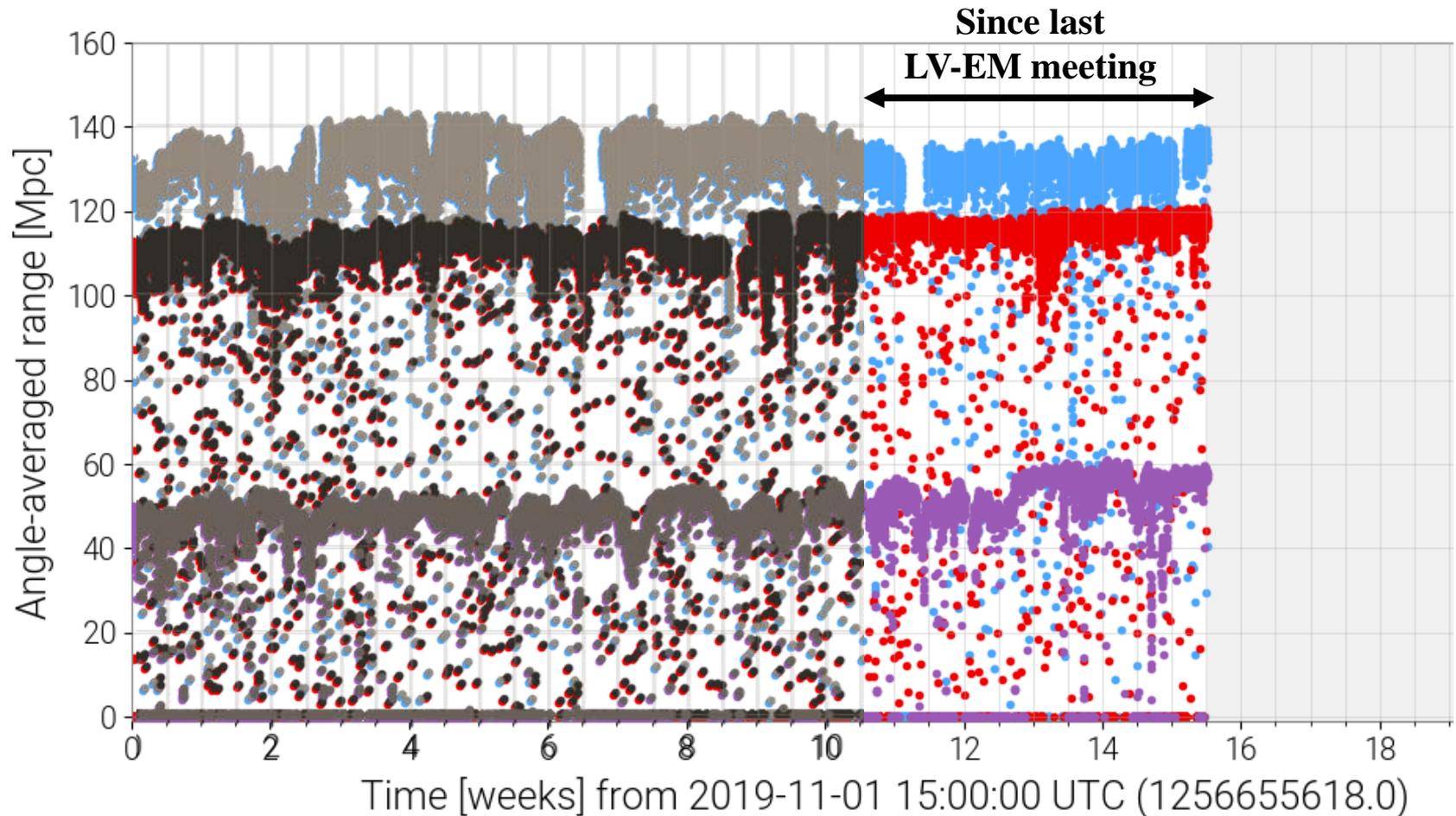
Virgo operational state

[1256655618-1269788418, state: all]



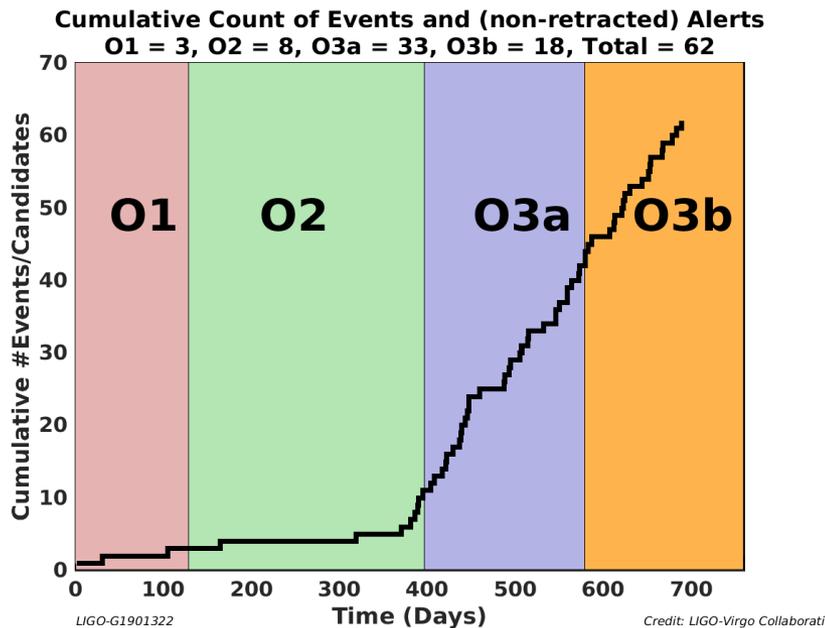
Binary neutron star inspiral range

- Steady BNS ranges
- Increase of the Virgo BNS range (~ 60 Mpc now)

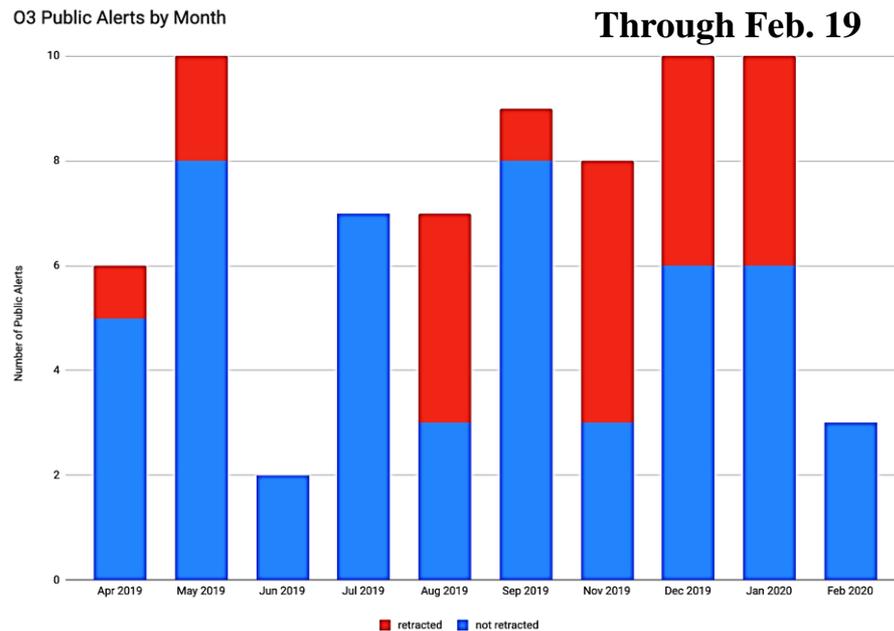


Public alerts

- **5 alerts, 0 retraction** since last open LVEM telecon on 2020/01/16
 - **4 likely BBH, 1 possible BNS** (significant probability of terrestrial origin)



<https://dcc.ligo.org/LIGO-G1901322/public>



■ retracted ■ not retracted

Bilby updated sky localization

- [Bilby: A User-friendly Bayesian Inference Library for Gravitational-wave Astronomy](#)
 - [arXiv:1811.02042](#)
 - Aim at **ultimately replacing LALInference**
- **S200213t potentially EM-bright**
 - **Bilby convergence faster than LALInference**
 - **Offline code reviewed**
 - Sky map sent out
- **Failure to communicate review status of pipeline**
 - **Online code being reviewed**
 - Outdated calibration envelopes
 - **Skymap quickly superceded by GCN 27096: LALInference**
- **LVEM observers will be notified in advance** if **further tests** are needed or when **Bilby takes over**
 - **Documentation will be updated accordingly**

```
TITLE:   GCN CIRCULAR
NUMBER:  27092
SUBJECT: LIGO/Virgo S200213t: Updated Sky Localization
DATE:    20/02/16 02:34:18 GMT
```

The LIGO Scientific Collaboration and the Virgo Collaboration report:

We have conducted further analysis of the LIGO Hanford Observatory (H1), LIGO Livingston Observatory (L1), and Virgo Observatory (V1) data around the time of the compact binary merger (CBC) candidate S200213t (GCN Circular 27042). **Parameter estimation has been performed using Bilby [1]** and a new sky map, `bilby.fits.gz,0`, distributed via GCN Notice, is available for retrieval from the GraceDB event page:

<https://gracedb.ligo.org/superevents/S200213t>

The preferred sky map at this time is `bilby.fits.gz,0`. For the `bilby.fits.gz,0` sky map, the 90% credible region is 282 deg². Marginalized over the whole sky, the a posteriori luminosity distance estimate is 141 ± 56 Mpc (a posteriori mean \pm standard deviation).

For further information about analysis methodology and the contents of this alert, refer to the LIGO/Virgo Public Alerts User Guide [<https://emfollow.docs.ligo.org/userguide/>](https://emfollow.docs.ligo.org/userguide/).

[1] Ashton et al. ApJS 241, 27 (2019)

Delayed S200219ac

```
TITLE:   GCN CIRCULAR
NUMBER:  27130
SUBJECT: LIGO/Virgo S200219ac: Identification of a GW compact binary merger candidate
DATE:    20/02/19 12:53:35 GMT
```

The LIGO Scientific Collaboration and the Virgo Collaboration report:

We identified the compact binary merger candidate S200219ac during real-time processing of data from LIGO Hanford Observatory (H1), LIGO Livingston Observatory (L1), and Virgo Observatory (V1) at **2020-02-19 09:44:15.195 UTC** (GPS time: 1266140673.195). The candidate was found by the PyCBC Live [1], CWB [2], MBTAOnline [3], SPIIR [4], and GstLAL [5] analysis pipelines.

The delay in issuing the alert was due to a software issue in the online system.

(...)

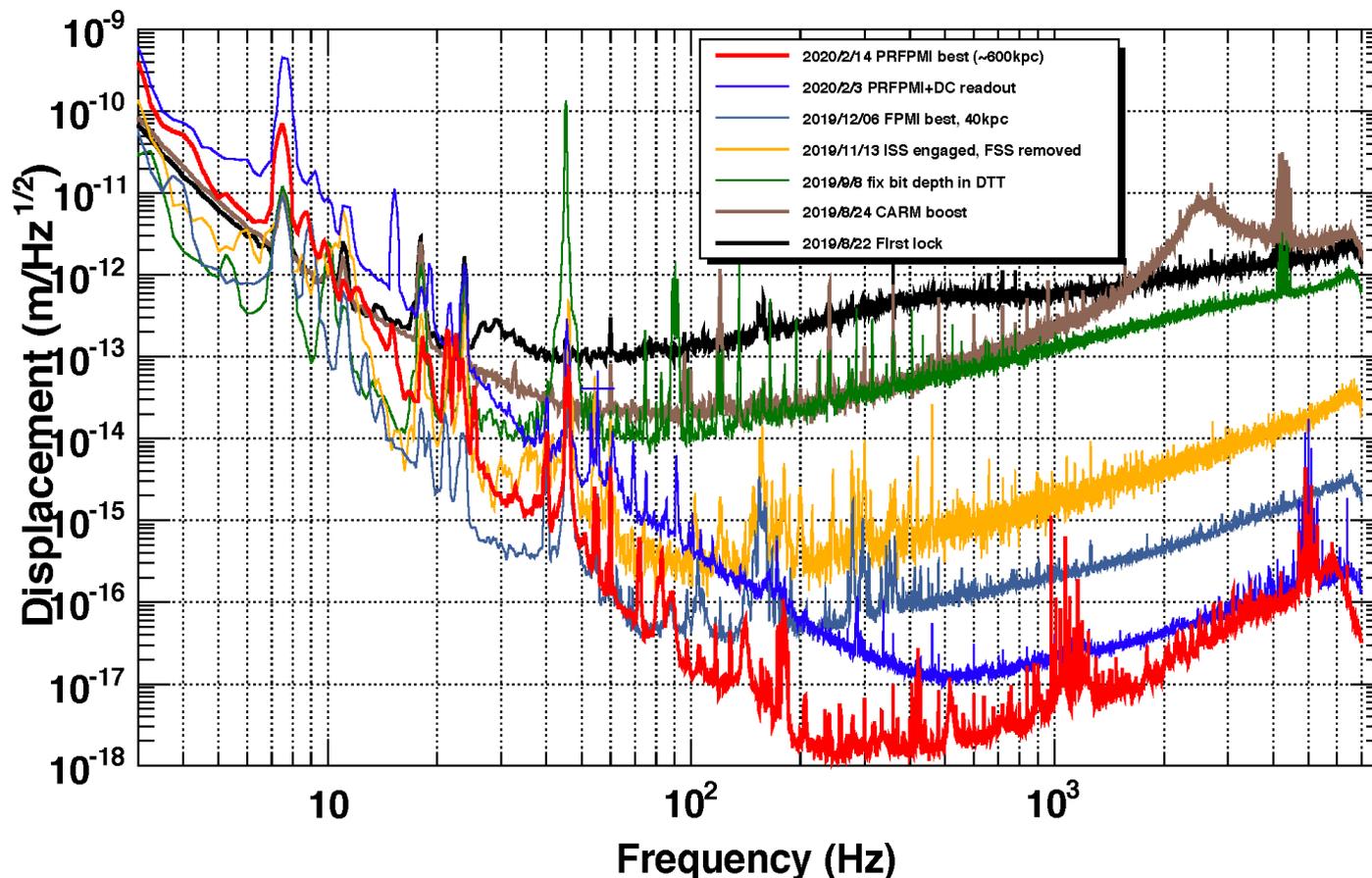
- **Technical problem to process this trigger**
 - Many automated steps had to be done manually
 - **No problem with the pipelines, nor with the quality of the data** for this event
- Low-latency framework quickly back to nominal state after GCN circular sent out
- Post-mortem analysis already done: **issue understood and fixed**

Future of O3

- O3b end date: confirmed to be April 30, 2020 @ 15:00 UTC
 - Upgrades will start on May 1st at all three sites
 - ◆ After possibly a few days of calibrations / noise injections
- Priority until then is data taking
 - Incremental improvements: noise reduction, stability improvement
- On Feb. 25th, LIGO-Hanford will start testing remote night shifts for two weeks
 - Automated procedures to relock interferometer and go to Observing mode
 - Operator on duty at home
 - ◆ Alerted in case of problem: trouble relocking, going to Observing, etc.
 - Low impact on duty cycle expected
 - More personpower to prepare upgrades and long O3-O4 shutdown
 - Assessment after test is completed; experience gained for future runs
- Similar test of remote operation planned for early March at Livingston
- Current plan is to start O4 after a 20-month shutdown
 - Tentative start date: January 13, 2022
- See update from KAGRA in the coming slides

KAGRA update

- Sensitivity curve evolution over the past 6 months

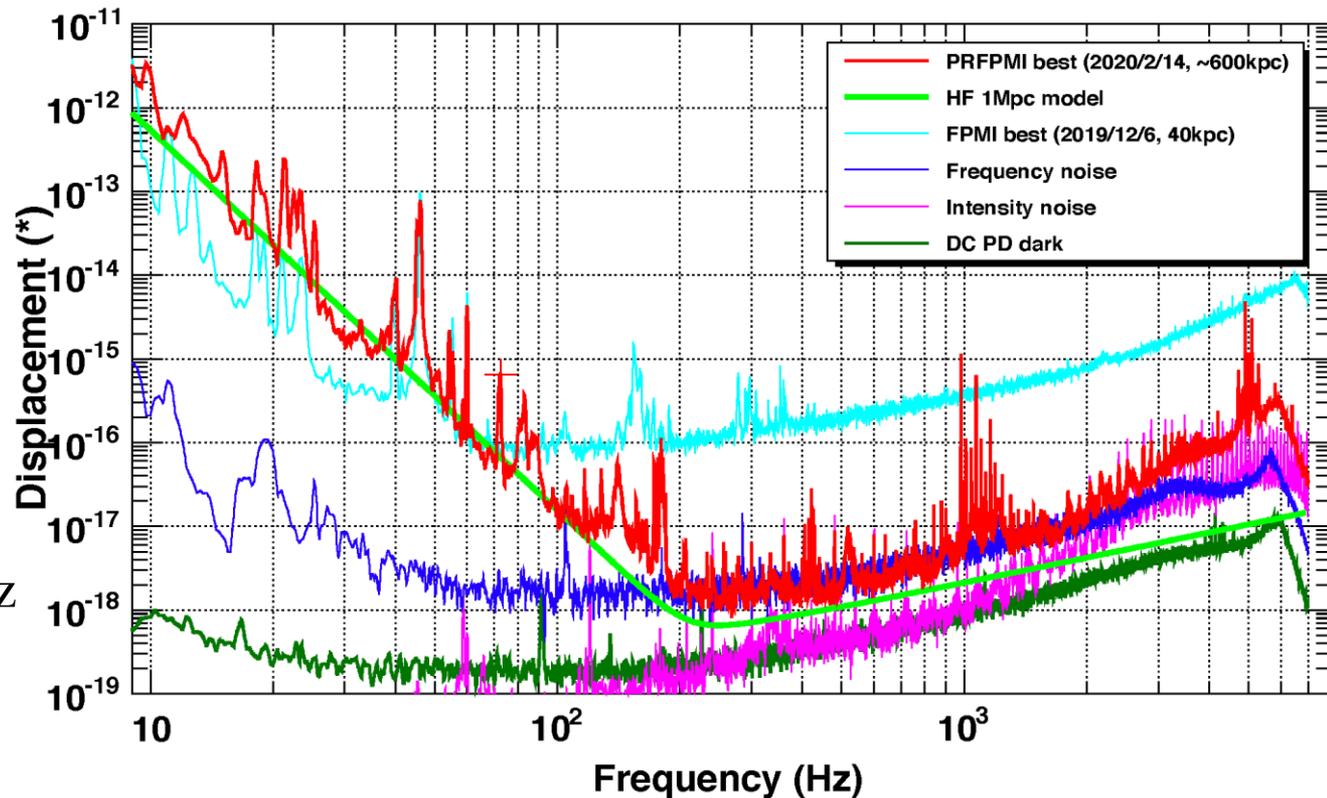


→ 5.5 orders of magnitude gained

- BNS range around 400 kpc in power-recycled Fabry-Perot Michelson config.
- ◆ Factor 2.5 more needed to reach the 1 Mpc milestone

KAGRA update

- Current sensitivity and noise budget
- Increasing laser power from 5W to 10W lead to some instabilities
- Frequency and intensity noises dominant above 200 Hz → Mitigation attempts
- Violin mode peaks around 180 Hz
- Middle frequency range limited by control noise of mirror vibration isolation or Michelson and Power Recycling Cavity Lengths
- Attempts to reduce low-frequency noise – moving from red curve back to cyan one
- Working on improving stability at best sensitivity
 - Winter sea activity hampering commissioning activities



GWADW 2020 cancelled

Dear all,

We regret to inform you that **GWADW 2020 has been cancelled** for a concern about the corona virus invasion. The SOC and LOC members have considered the seriousness of the issue and concluded that we cannot be sure if the situation be better by early May.

We are planning to have the GWADW 2021 in Hokkaido, shifting all the following GWADWs for one year. The detail is not fixed yet.

It is very sad not to have this great conference this year, but we hope to see you all in Japan next year.

In the end, we would like to express our sincere sympathies to people in Wuhan and surrounded areas. We hope the situation get better as soon as possible.

Best regards,

Kentaro Somiya,
On behalf of the GWADW 2020 LOC