



# Low-latency alerts update

Roberto De Pietri, Shaon Ghosh, Soichiro Morisaki

# Userguide

Userguide Version 20 was released on May 19 (small changes)

Run timeline updated based on new Virgo participation plans.

Deprecated dashboard link removed. Will be replaced by a new link in the future.

Update the GWIStat link to point to the new [Grafana dashboard](#).

MLy pipeline removed. It will be added back later in O4 when it is running.

# The O4 system - Public threshold (2/day)

We will provide public alerts:

- GCN classic
- Avro over kafka (SCIMMA)
- GCN kafka

- **EarlyWarning** Associated to EW pipeline

— Trigger time —

- **Preliminary (1)** median latency ~35s
- **Preliminary (1a)** in case of new significance
- **Preliminary (2)** final in ~350s

— Rapid Response team decision —

- **Initial/Retraction Alert**
- **Update (1)**
- ....
- **Update (n)**

The false alarm rate threshold for public alerts is 2/day accounting for 8 independent searches. We anticipate increasing this to 16/day in the coming weeks corresponding to a per pipeline false alarm rate of 2/day. There will therefore be two classes of alerts:

**Significant gravitational-wave alerts** with false alarm rate less than 1/month for CBC and 1/year for bursts that pass automated and **manual verification tests**. All other alerts have low-significance.

## O4 events:

S230525a 40s - 2 alerts (preliminaries) - low significance  
S230524x **-7s** - EARLY\_WARNING - **SIGNIFICANT** - RETRACT  
2 alerts (EarlyWarning + Retraction)

## ER15 – 6 events

S230524b 26s - 2 alerts (preliminaries)  
S230522n 31s - 2 alerts (preliminaries) - **SIGNIFICANT**  
S230522a 30s - 2 alerts (preliminaries) - **SIGNIFICANT** -  
S230521k **1 day** - 2 alerts (preliminaries) - ER15 config fix –  
S230520ae 32s 3 alerts (preliminaries, + **Initial**) - **SIGNIFICANT**  
**RRT E2E test to test procedure**  
S230518h - **NO AUTOMATIC ALERT ACTIVE** –  
3 alerts (preliminary, initial, and 1 update)

Issues with E-mail text notice: (i) not all VO fields translated; (ii) notices are duplicate on GCN server. Under investigation....

# Notice content of an event (S230522)

1. Time
2. FAR
3. Significance tag
4. instruments
5. pipeline-search
6. P-astro (**classification**)
7. EM-Bright (**properties**)
8. Skymap (embedded)
9. EM coincidence

```
{  
  "alert_type": "PRELIMINARY", "time_created": "2023-05-22T15:31:02Z",  
  "superevent_id": "S230522n",  
  "event": {  
    "time": "2023-05-22T15:30:33.391Z",  
    "far": 6.479128493829593e-09, "significant": true,  
    "instruments": ["L1"], "group": "CBC",  
    "pipeline": "gstlal", "search": "AllSky",  
    "classification": {  
      "BBH": 0.9931377623662752,  
      "BNS": 1.5857295164144167e-16,  
      "NSBH": 1.1696821003800253e-14,  
      "Terrestrial": 0.006862237633713075},  
    "properties": {"HasNS": 0.0, "HasRemnant": 0.0, "HasMassGap": 0.00410658...},  
    "duration": null, "central_f": null,  
    "Skymap": "..byte of multiorder.fits file.. embedded..."  
  },  
  "external_coinc": null,  
  "urls": {"gracedb": "https://gracedb.ligo.org/superevents/S230522n/view/"}
```

# S230524x

About the retracted EarlyWarning please note that:

- Early-warning searches produce a special class of (preliminary) notice.
- Make sure you are subscribed to the EarlyWarning channel on GCN/SCiMMA if you wish to receive them (see User Guide).
- There are 5 different: GCN notice types (**LVC\_EARLY\_WARNING**, **LVC\_PRELIMINARY**, **LVC\_INITIAL**, **LVC\_UDPATE** and **LVC\_RETRACTION**))\*

RRT was activated since it was a SIGNIFICANT alert and decided to retract

- There was no full-bandwidth **PRELIMINARY** alert associated with this superevent.

**Subject:**LIGO/Virgo/KAGRA S230524x: Retraction of GW compact binary merger candidate

**Date** 2023-05-24T20:50:40Z

**From** J. L. Wright at Australian National University <jennifer.wright@anu.edu.au>

The LIGO Scientific Collaboration, the Virgo Collaboration, and the KAGRA Collaboration report:

The trigger S230524x is no longer considered to be a candidate of interest. This candidate included at least one detection prior to the merger time but no significant detections that included the merger, which indicates this candidate is likely a noise transient.

\* names hardcoded in external codes and we decided not to change it even if we name LVK\_\* alerts

# Summary

- O4 started yesterday
- All 2-Burst and the 4-CBC pipeline uploading to production
- 6 events were sent out as public alerts during the engineering run
- 2 events already sent out for O4
  - 1 single detector, low significance event (23.7 per year)
  - 1 Early Warning with negative latency (However, a retraction)

Have a great O4!