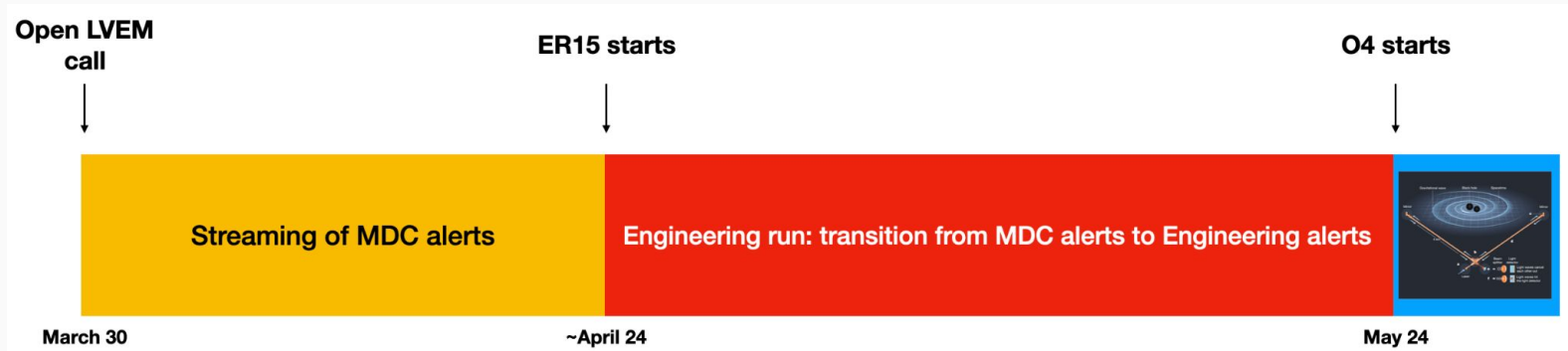# Low Latency Alerts Update

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TIMELINE to the start of 04

- Streaming of MDC alert (including Early-warning) with the full content in Production.
- Start of the Engineering Run - Approx April 24
- Start of the observation period - May 24

Released today

- The latest release of the userguide (v18) is at
  - https://emfollow.docs.ligo.org/userguide/index.html

- The latest release of low-latency alert infrastructure
  - Deployed today with final alert formats, more later.
  - Hourly MDC events with new alert format

New Threshold for alerts.

Updated Public Alert Threshold for O4*

The false alarm rate threshold for public alerts will be lowered to **2/day** starting in O4. There will therefore be two classes of alerts:

Low Significance **("*Subthreshold*" in O3) gravitational-wave alerts** with false alarm rate greater than 1/month for CBC and 1/year for Burst

Significant gravitational-wave alerts with false alarm rate less than 1/month and 1/year for Burst that pass automated and manual verification tests.

*May be tuned slightly during the engineering run.

Alert summary for O4

Early warning (pre-merger) alerts will be provided

Multiple distribution channels for alerts:

GCN Notices and Circulars as in O3.

Kafka based alerts with embedded skymap via SCiMMA and GCN

EM-Bright probabilities (`HasNS` and `HasRemnant`) marginalized over large number of equation of neutron star models.

Mass-gap moved from p_astro to source-properties section of GCN. Called `HasMassGap`.

New "`significant`" field introduced in the notices.

The O4 system - new 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 will be lowered to **2/day** starting in O4. 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.

Time relative to gravitational-wave merger

Merger time
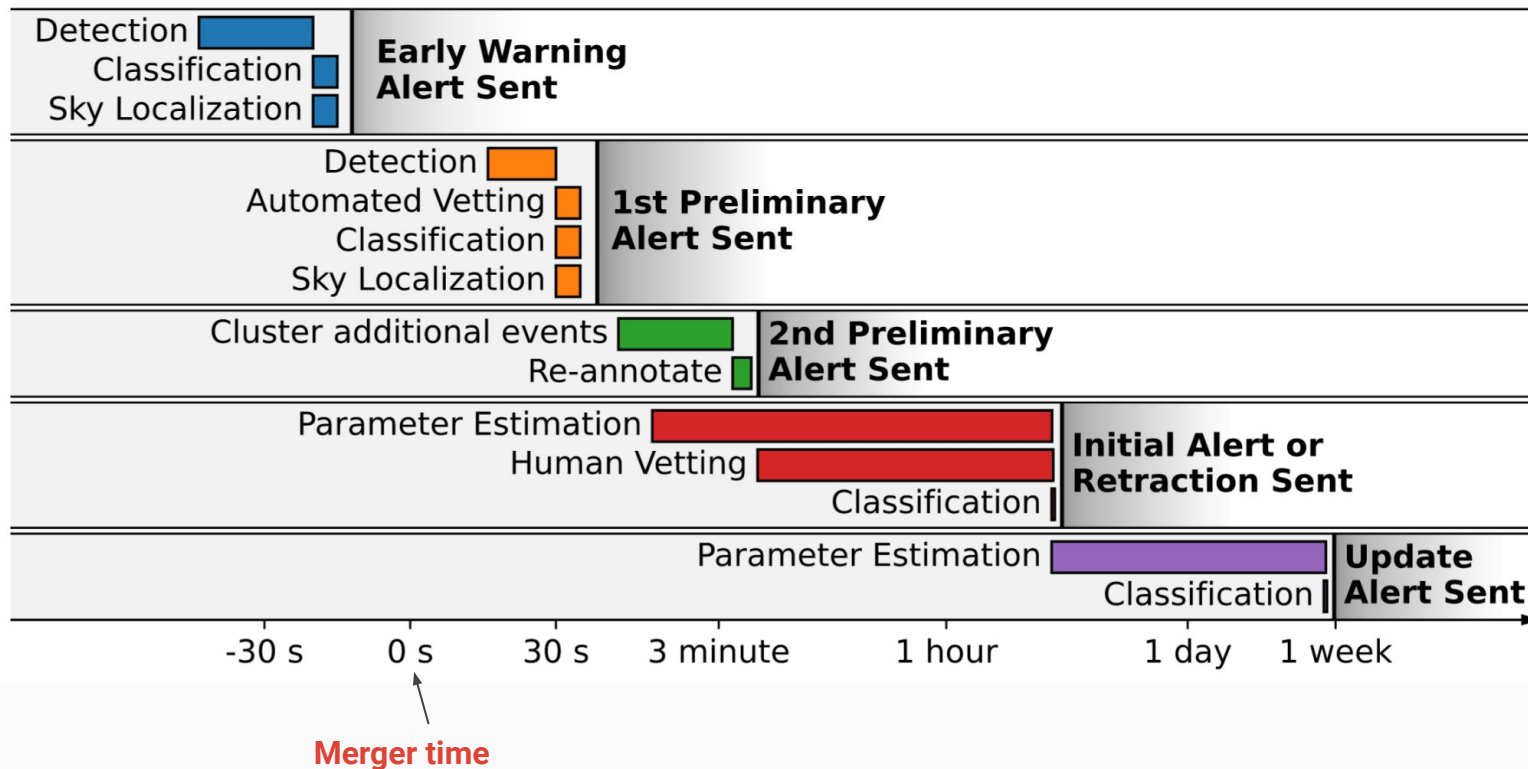
Example alert

```json
{    "alert_type": "Preliminary",
     "time_created": "2018-11-01T22:34:49Z",
     "superevent_id": "MS181101ab",
     "urls": { "gracedb": "https://example.org/superevents/MS181101ab/view/" },
     "event": {
         "time": "2018-11-01T22:22:46.654Z",
         "far": 9.11069936486e-14,  # FAR < (2/day)
         "significant": False      # FAR > 1/month CBC and 1/year BURST
                          True      # FAR < 1/month CBC and 1/year BURST
         "instruments": [ "H1", "L1", "V1"],
         "group": "CBC",
         "pipeline": "gstlal",
         "search": "MDC",
         "classification": { "BNS": 0.95, "NSBH": 0.01, "BBH": 0.03, "Terrestrial": 0.01},
         "properties": { "HasNS": 0.95, "HasRemnant": 0.91, "HasMassGap": 0.01},
         "skymap": "U0lNUExFICA9ICAgICAgICAgICAgICAgICBUIC8gY29uZm..."
          },
     "external_coinc": null }
```

Hourly MDC events on the production has the new schema

Conclusion

- We will provide public alerts for:

    * Compact binary coalescences (CBC) and gravitational wave burst events

    * pre-merger (negative time) **early warning** alerts for CBC events.

    * alerts based on a **coincident external public trigger**.

- We **will** provide public alerts using the GCN Classic (VOEvent over VOEvent Transport Protocol) infrastructure as well as on the alternative alert channels provided by avro over Kafka (SCiMMA) and GCN Kafka.

- Detail on the format and procedure is in: https://emfollow.docs.ligo.org/userguide/.

- **You should expect public alerts with a rate of:**

    - one per day (Significant gravitational-wave alerts) - based on expected rate of real GW alerts

    - two per day (Low Significance gravitational-wave alerts) - based on new threshold

- Instructions to receive notices: https://emfollow.docs.ligo.org/userguide/tutorial/receiving/index.html