Low Latency UPDATE

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New Threshold for alerts.

Updated Public Alert Threshold for O4 and beyond

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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/months for CBC and 1/year for BURST

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

The O4 system

```
{    "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,
         "significance": "low significance"   # 2/day > FAR > (1/month CBC and 1/year BURST)
                         "significant"         # (1/month CBC and 1/year BURST) > FAR
         "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": "U0lNUExFICA9ICAgICAgICAgICAgICAgICAgICBUIC8gY29uZm..."
          },
     "external_coinc": null }
```

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The O4 system - new OPA threshold **(2/day)**

We will provide (Open) alerts:	- the legacy GCN/TACH
	- avro of kafka (SCIMMA)
	- json over kafka (GCN).

- **EarlyWaning (1)**   **Associated to EW pipeline**

— Event time —

- **Preliminary (1)**   **latency < 20s with max 30s**
- **Preliminary (1a)**   **in case of new significance**
- **Preliminary (2)**   **final in less that 300s**

— 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**.

Low Significance (Subthreshold) gravitational-wave alerts with false alarm rate greater than 1/month and less than ~2/day.

```
{ "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,
    "significance": "marginal detection"  # 2/day > FAR > O3_limit (1/2month)
                    possible detection    # O3_limit > FAR > 1/(5 year)
                    probable detection    # 1/(5 year) > FAR
    "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": "UBlNUExFICA9ICAgICAgICAgICAgICAgICBUIC8gY29uZm..."
  },
  "external_coinc": null }
```

Conclusion

- We will provide open public alerts (OPA) also for:

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

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

- We **will** provide (Open) alerts using the legacy GCN/TACH infrastructure as well as on the alternative Alert channels provided by avro of kafka (SCIMMA) and json over kafka (GCN).

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

  Final version expected to be online for next openLVEM

- **You should expect OPA with a rate of:**

  - one per day (Significant gravitational-wave alerts)

  - two per day (Subthreshold gravitational-wave alerts).