A Common “Core” alert?

GNN Data Formats WG

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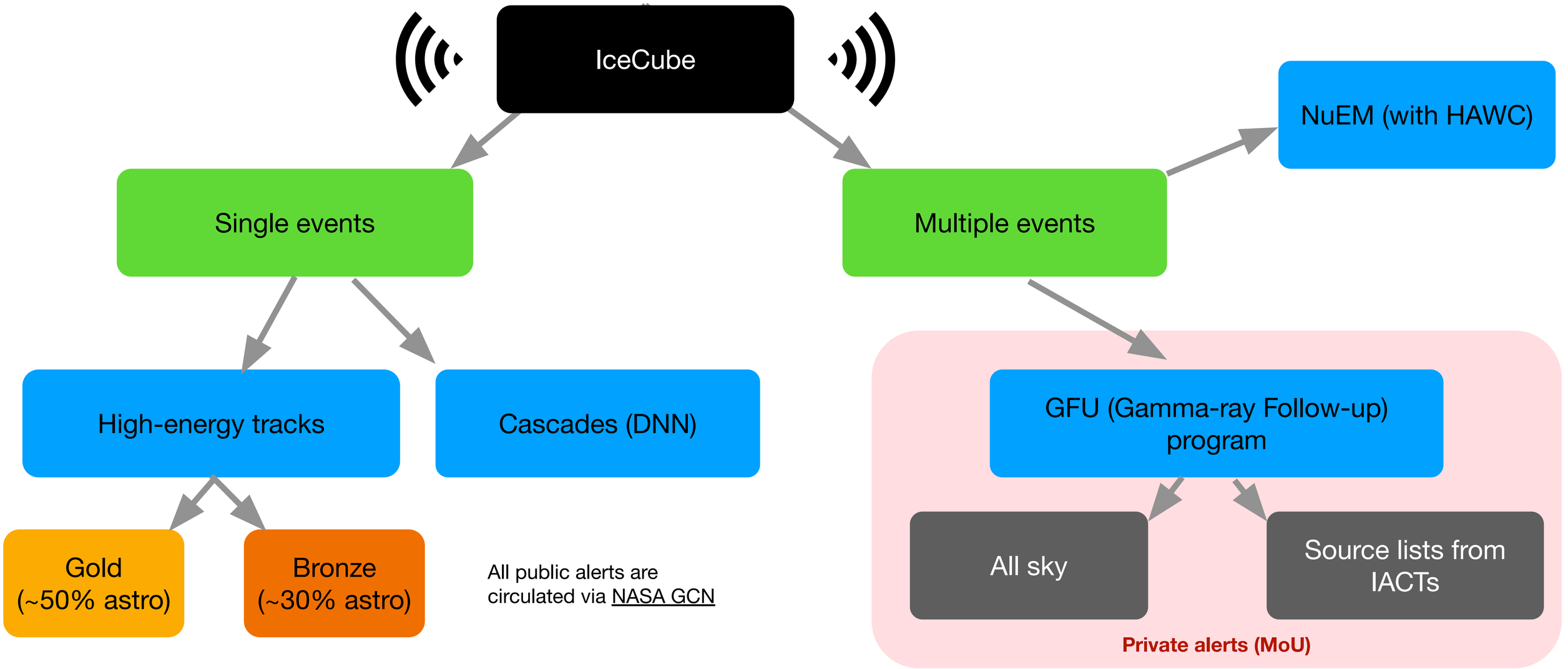
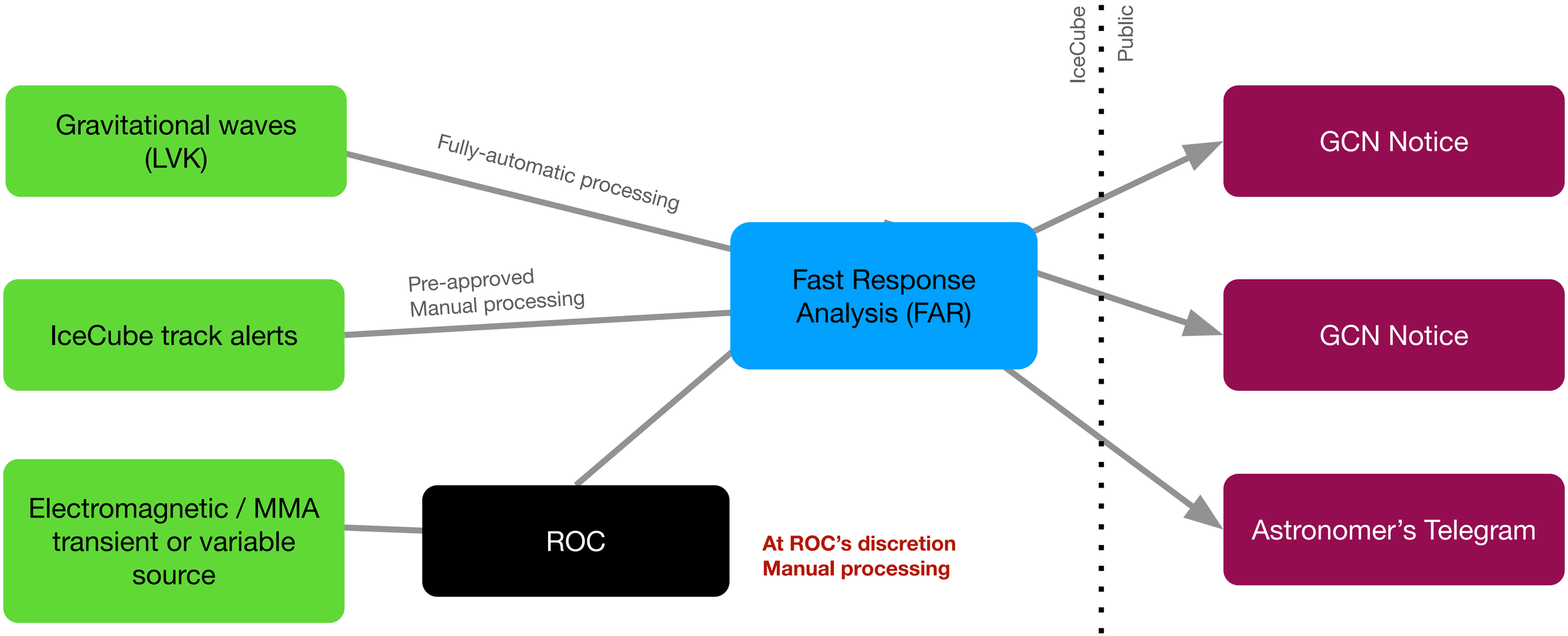
IceCube Generated Alerts

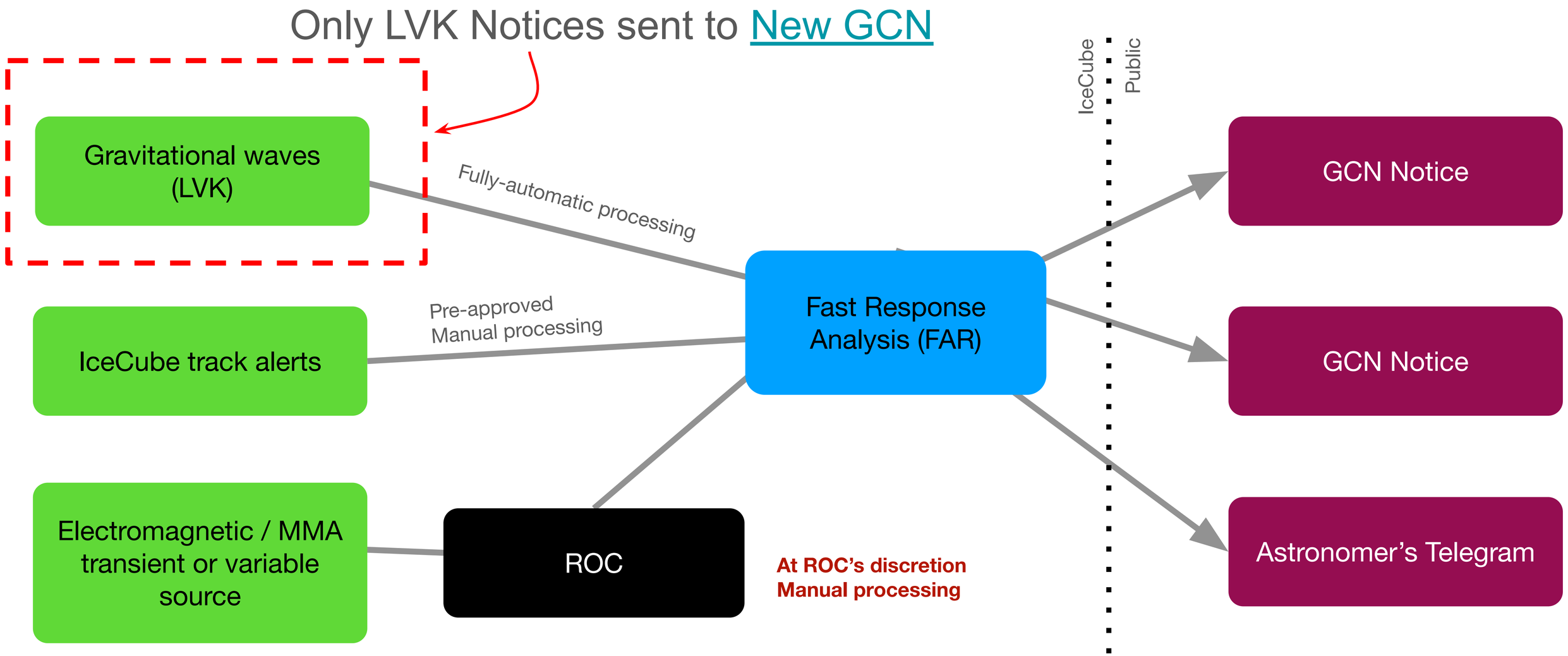


All public alerts are circulated via NASA GCN

IceCube responses to external triggers



IceCube responses to external triggers



Upcoming updates

For the IceCube issued alerts, we're working to get these updated with several technical improvements

- Improved event selections and event classifications (increased number of alert from starting events,...)
- Applying new reconstruction tools
  - Cascade and follow-up track reconstructions (rev 1 updates) improved significantly over the past years
- Per-event p-value maps in addition to error boxes.

Unfortunately, we can no longer make updates to our "GCN classic alert" stream format

- Nor do we want to; we want to move these to the new GCN-over-Kafka systems
  - Trivial to copy other Kafka-based brokers such as SCiMMA as well

Common alert structure?

Since we're redoing our alert structure for the new GCN system, it's a good time to think about our overall structure.

Structure is set by the JSON schema used in your alert, built from established GCN "core" schema classes

Namely: Can we find a common set of "core" alert contents that both KM3Net and IceCube can promise to send with each alert?

- Simplify job for downstream consumers if we're including the same information, with the common definitions on what these values mean.
  - Still OK to add detector specific information on TOP of this core structure.

IceCube has a start of a draft version for our track alerts on GCN Schema GitHub but we are happy to modify/update/scrap based on discussions.

Our Draft Gold and Bronze track GCN-Kafka alerts.


```
{
 "$schema": "https://gcn.nasa.gov/schema/main/gcn/notices/icecube/test/gold_bronze_track_alerts.schema.json",
 "additional_info": "IceCube Bronze Neutrino Track Alert",
 "event_name": ["IceCube-230416A"],
 "id": ["137840", "57034692"],
 "alert_datetime": "2023-04-16T05:42:00.0Z",
 "alert_type": "update",
 "ra": 345.82,
 "dec": 9.01,
 "ra_dec_error": 0.5,
 "containment_probability": 0.9,
 "systematic_included": false,
 "healpix_url": "https://roc.icecube.wisc.edu/public/",
 "trigger_time": "2023-04-16T05:22:26.150574Z",
 "nu_energy": 127.29,
 "signalness": 0.34064,
 "far": 8.029e-8

}
```


This is largely a direct translation with some additions of our GCN Classic Notice

A common core?

There are many items that could constitute a common core structure:

```
"event_name": ["IceCube-230416A"],          #Name of alert (or KM240901A)
"id": ["137840", "57034692"],               # A unique event ID (Run, Event# for us)
"alert_datetime": "2023-04-16T05:42:00.0Z",
"alert_type": "update-1",                   # can be “initial”, “update-2”...
"ra": 345.82,                               # direction, url and time info
"dec": 9.01,
"ra_dec_error": 0.5,
"containment_probability": 0.9,
"systematic_included": false,
"healpix_url": "https://roc.icecube.wisc.edu/public/",
"trigger_time": "2023-04-16T05:22:26.150574Z",
"nu_energy": 127.29,                        # Estimated Neutrino Energy (Tev)
"p_astro": 0.34064,                         # Estimated probability of being astrophysical (“signalness”)
"far": 8.029e-8,                            # False alarm rate (Hz…)
```

A common core (2)

Other potential items?

```
"medal_rank": "gold”,                                          #  Enumerated type (gold/bronze/silver(?))
"analysis_pipeline": “IceCube Bronze Track alert”,  # A search ID?  Cascade alert, etc?
```

Other considerations:

- Same notice schema for all alerts?
  - In IceCube - I think we can do this for our single alert events (tracks and showers)
  - Nominally planning a potentially different format for multiplet alerts
    - GFU time dependent catalog and all-sky point source searches
  - Dedicate follow-ups of higher rate alerts (currently LVK only) already get dedicated alert notice format.
- Move away from “always send a GCN Circular”?
  - Just use to highlight very interesting alerts (high p_astro, interesting correlations?)
  - Some discussions about doing this in Icecube (no conclusion yet)
  - Already doing this for LVK alerts due to high rate.

Moving forward

Happy to help coordinate a “common” neutrino telescope schema into GCN

- Strong, well established base of neutrino telescope specific values with common definitions.
- Each collaboration could then build onto this with per-detector specific information

Discussion?