Open Data: What do You Want?

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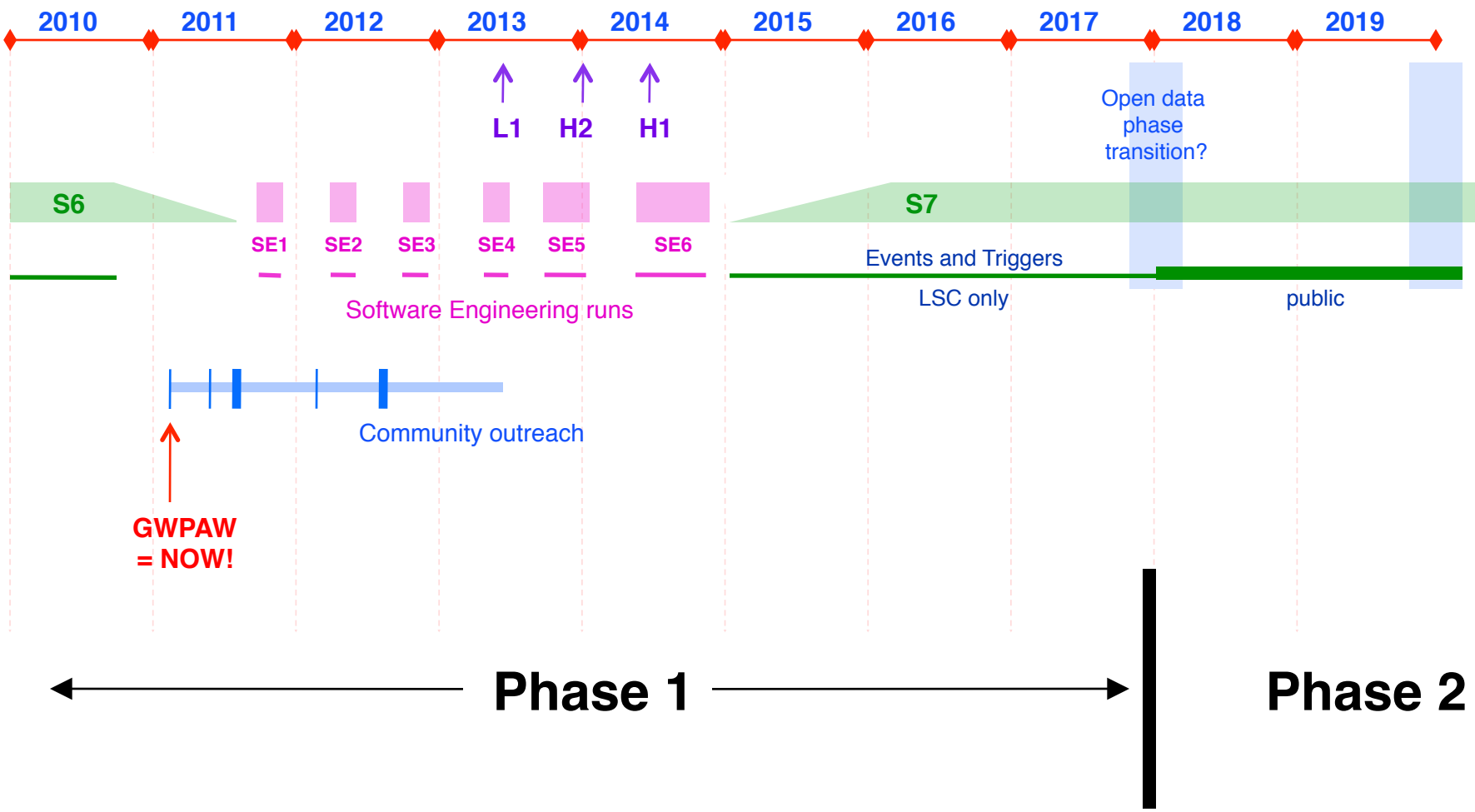
Possible Timeline



Open Data Phase 1

- Bringing instruments into most sensitive operation
- Can join LSC to see the data
- Few detections
  - All data meaningless without expert knowledge

- LIGO will release science data
  - with *published* detections and important non-detections
- LIGO real-time alerts
  - distributed immediately via MOU process

Transition to Phase 2

Transition to Open Data (phase-2) first of:

- Volume trigger
  - Based on rate estimates (LIGO-T1000414)
    - 3x10^7 Mpc^3-yr space-time-volume searched for coalescing double neutron-star systems at a specified false alarm level.
    - Translates to 0.9 years of running at aLIGO design sensitivity.
- Detection trigger
  - Plentiful detections: LIGO decides it's time
- Calendar trigger
  - Transition would occur a fixed amount of time after official aLIGO acceptance of all 3 interferometers.
  - Current proposal 2018 results in first bulk release c. 2020.

Open Data Phase 2

- Immediate open events
  - Interoperable with other event streams (VOEvent)
  - Follow-up of external triggers (and immediate release?)
- Release all h[t] with catalog of past events
  - 24 month proprietary period, 6 month releases
- PEM channels? Software?
  - Need to find out from external users

Five types of Real-time Event

- GW trigger
  - Followup result from GW trigger
- External trigger eg SWIFT, Icecube, MAXI, SVOM etc
  - LIGO pointed search from external trigger
- Presence events (“now in lock”)

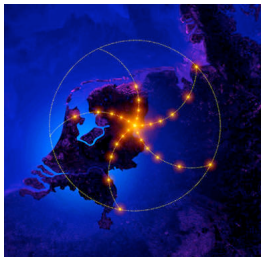
LIGO

Skyalert.org

GraceDB2

Authors

Voice of Cosmos
Optical transients
Radio transients
X-ray transients
Gamma transients



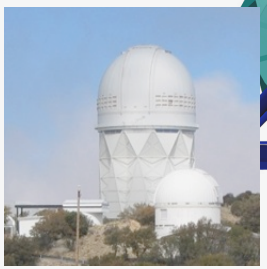
Software followup

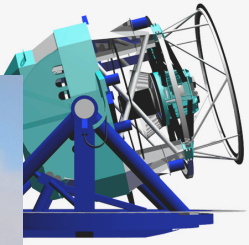
Events and annotation disseminated to subscribers in real time with intelligence

Subscribers

Astronomers
Amateurs
Students

EM Followup





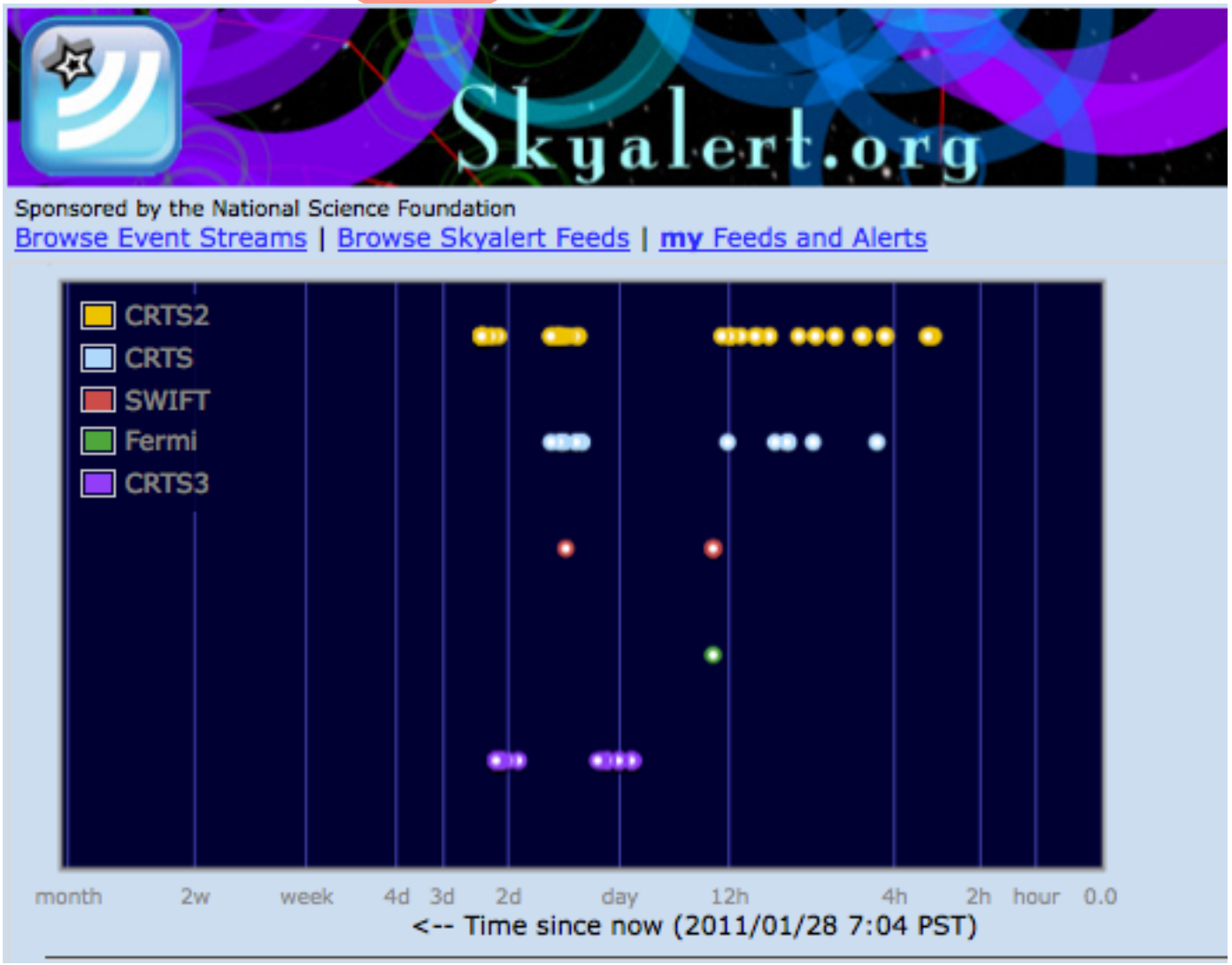
LSST

Follow-up Scheduler

Telescope
Telescope
Telescope

LIGO

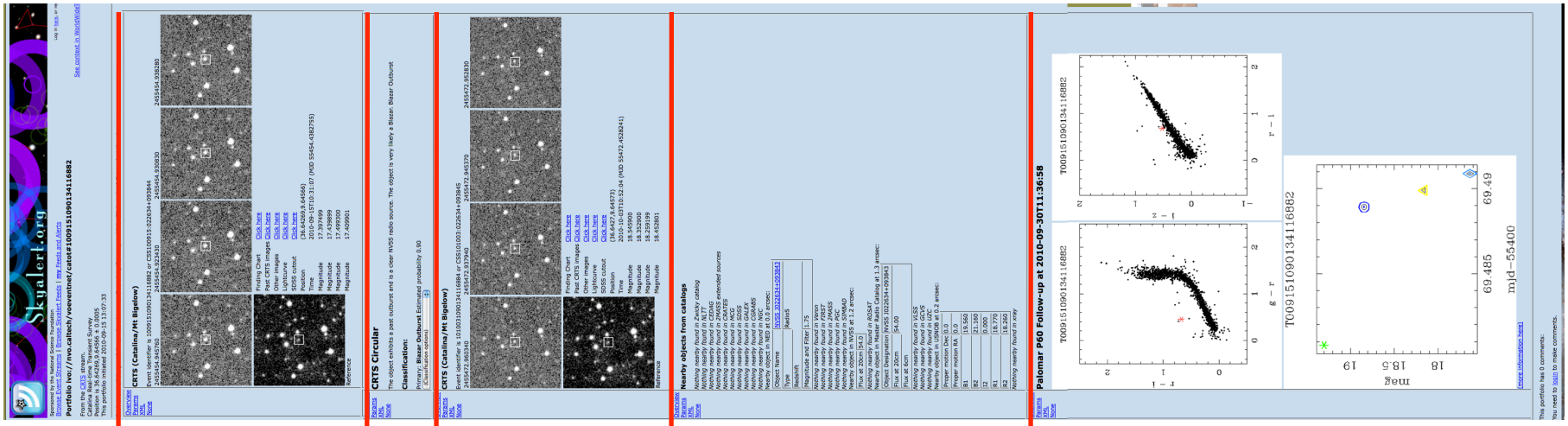
Skyalert.org GraceDB2



LIGO

Skyalert.org

GraceDB2



Data from many sources joined to initial event

Computer can understand it and make selection

VOEvent

International Interoperability for Rapid Transients

http://hotwireduniverse.org

Free download!

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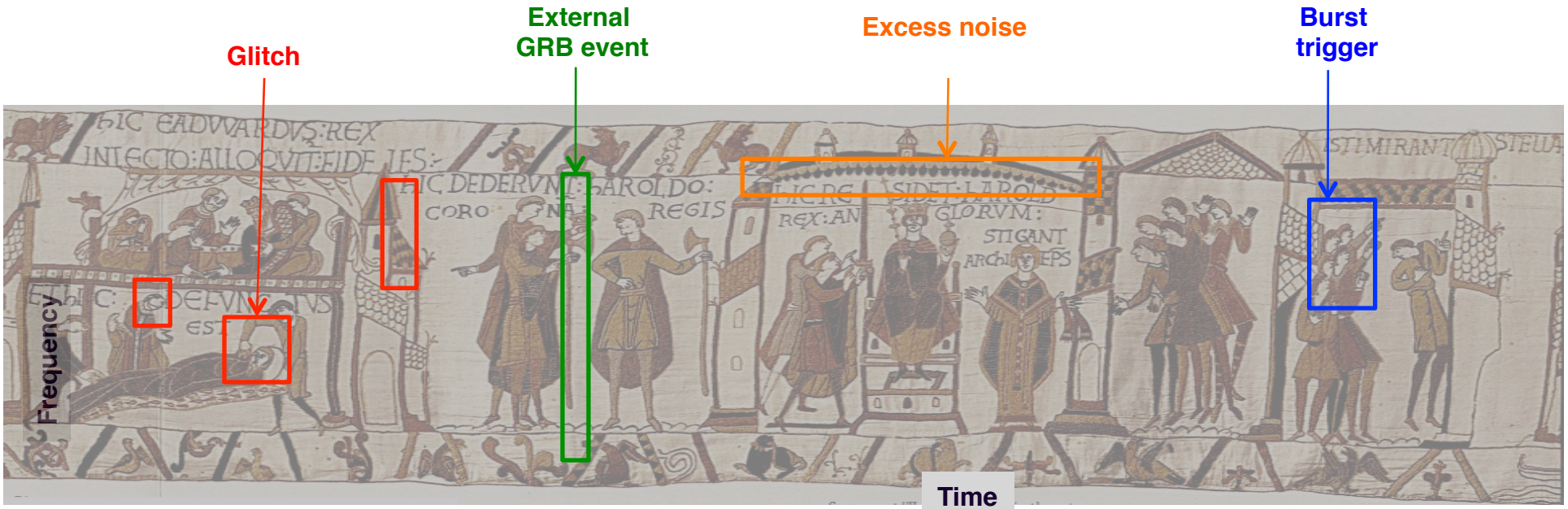
Since time domain astronomy is a moving target, planning is already underway for a 2nd editio

LSC knowledge for the broader community

h[t] is NOT changed, but annotated
Each annotation has rich metadata



Tools for the broader community

- Reader for data – Frame, HDF5, ….?
- Display and GUI in time and/or frequency
- GUI and API for metadata
  - Do you care if it is bad data or known glitch?
  - Masking bad data
- Specific functions
    - Computing power spectral density
    - Band limiting and heterodyning
    - Searching for non-Gaussianity
    - Computing trends in the data
    - Barycentering and space/time frames

Data for the broader community

- Immediate Events
  - Present: Event selection, event delivery
    - Building a plausible FAR for selection
    - Converting GW skymap to telescope schedule
    - Complex selections
- Past Events
  - Correlation of GW events with other data
  - What kind of queries on an event repository?

Data for the broader community

- Template matching
  - Strain data centered on validated detections
  - Relevant metadata, e.g., reconstructed astrophysical parameters
  - What is known already -- Segment, Glitch, Veto, Trigger
- Source Matching
  - Overlap of LIGO data with my favorites
    - eg blazars, SNe, galaxies, X-ray sources etc
- Not the GW channel
  - PEM channels for non-GW studies
- Not Scientists
  - Audio and pictures and EPO and press releases