



# Open Data: What do You Want?

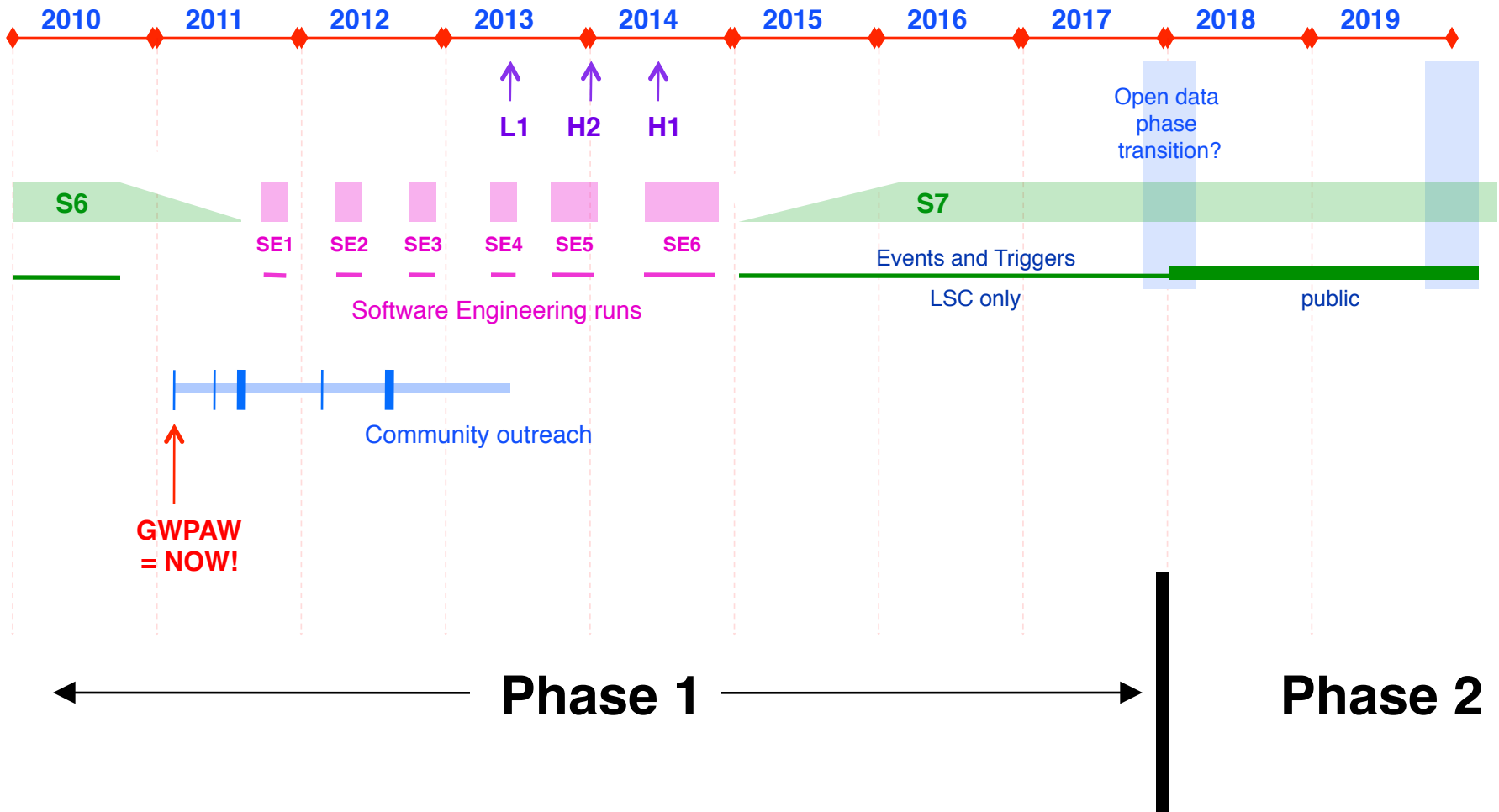
Roy Williams  
California Institute of Technology

GWPAW January 2011

**LIGO-G1100104**



# Possible Timeline





## Open Data Phase 1

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- 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

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

- **Volume** trigger
  - Based on rate estimates (LIGO-T1000414)
    - $3 \times 10^7$  Mpc<sup>3</sup>-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

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- **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

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- 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”)

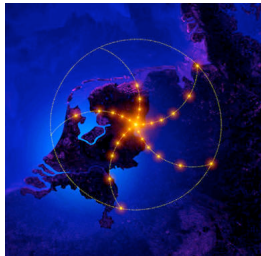


SkysAlert.org GraceDB2

Authors



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



Events and annotation  
disseminated to  
subscribers in real time  
with intelligence

Software  
followup

Subscribers



Astronomers  
Amateurs  
Students

EM  
Followup



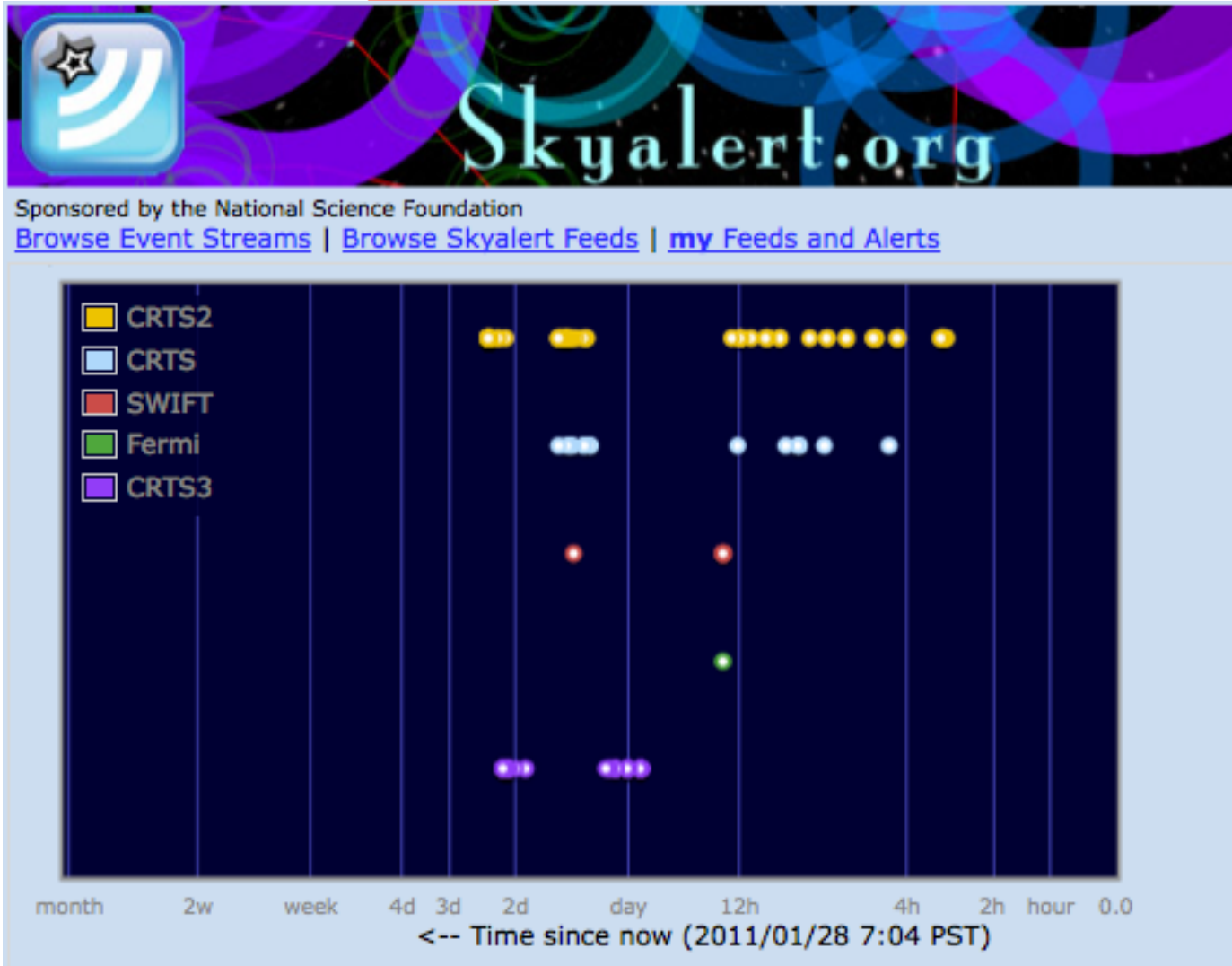
LSST

Follow-up  
Scheduler

Telescope  
Telescope  
Telescope



Skyaalert.org GraceDB2









# VOEvent

## International Interoperability for Rapid Transients

<http://hotwireduniverse.org>  
**Free download!**

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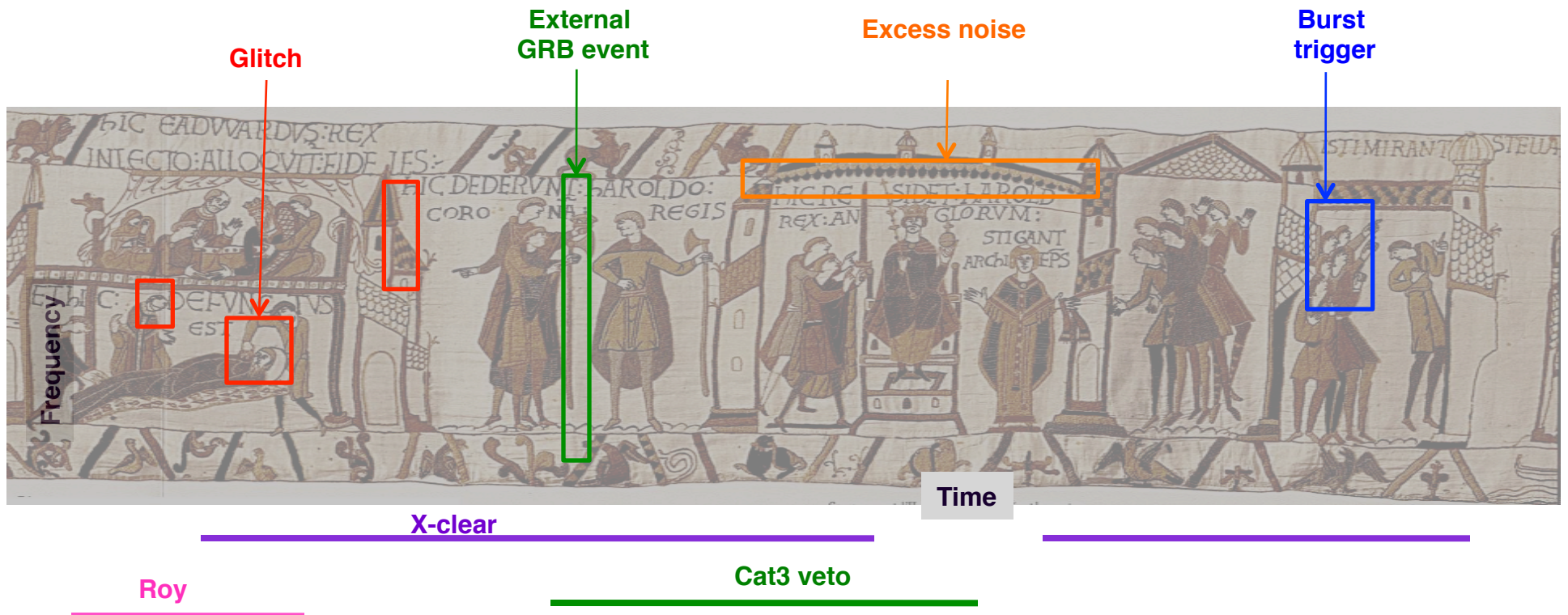
*Since time domain astronomy is a moving target, planning is already underway for a 2nd edition*





# LSC knowledge for the broader community

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





## Tools for the broader community

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- 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

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- 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

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- **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