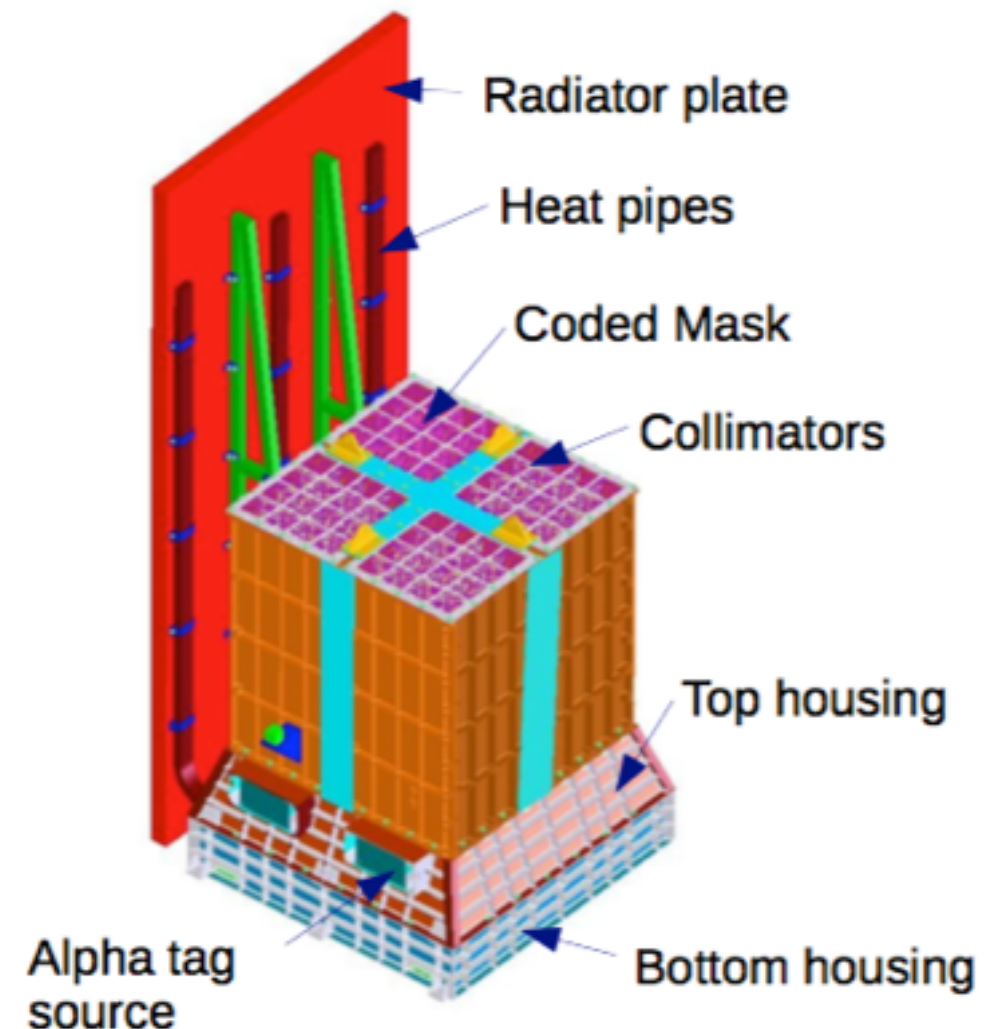


# Machine Learning Technique to Search GRB in CZTI

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# Cadmium Zinc Telluride Imager (CZTI)

- Four independent quadrants: 16 modules of 256 elements in each. Collimator slats around each module
- Indirect imaging and simultaneous background measurement with Coded Aperture Mask (CAM)
- Imaging and spectroscopy in 20 - 150 keV within FOV
- Acts as open detector at higher energies
- Alpha tagged  $^{241}\text{Am}$  source to monitor detector gain



# Methodology

- Data Cleaning
- Peak Identification
- Peak Verification

# Data Cleaning

In data cleaning process, removed following events

- All charged particle bunches
- Events from noisy and flickering pixels
- Events belonging to on board alpha source
- Events between (SAAStart - Threshold) and (SAAEnd + Threshold)  
Where Threshold is configurable
- Events below 60 KeV

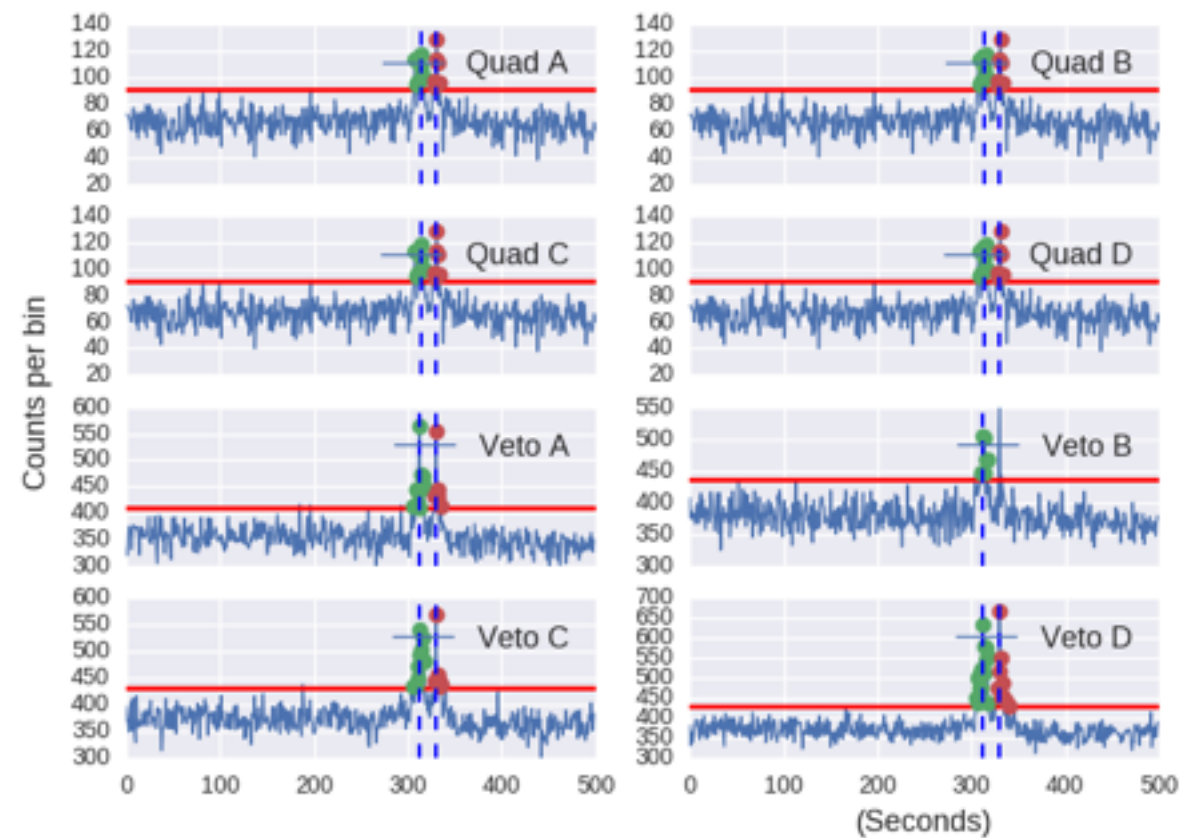
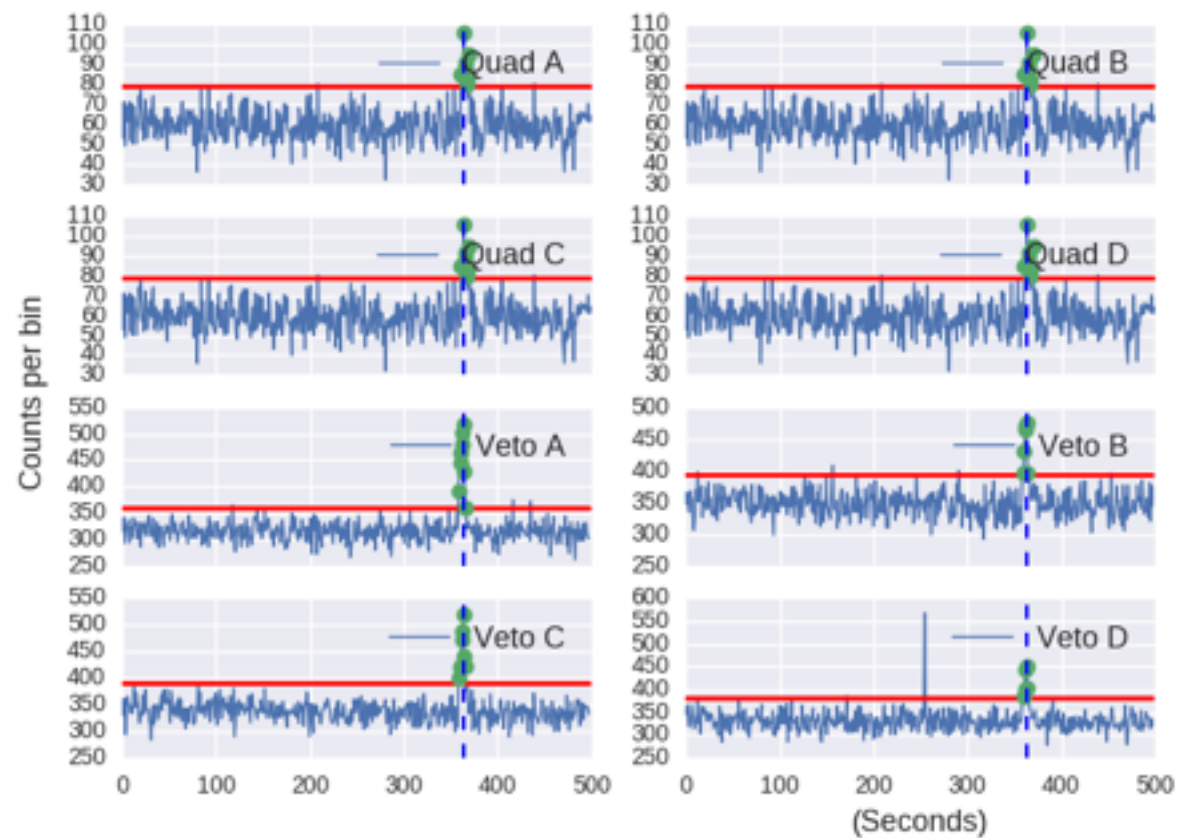
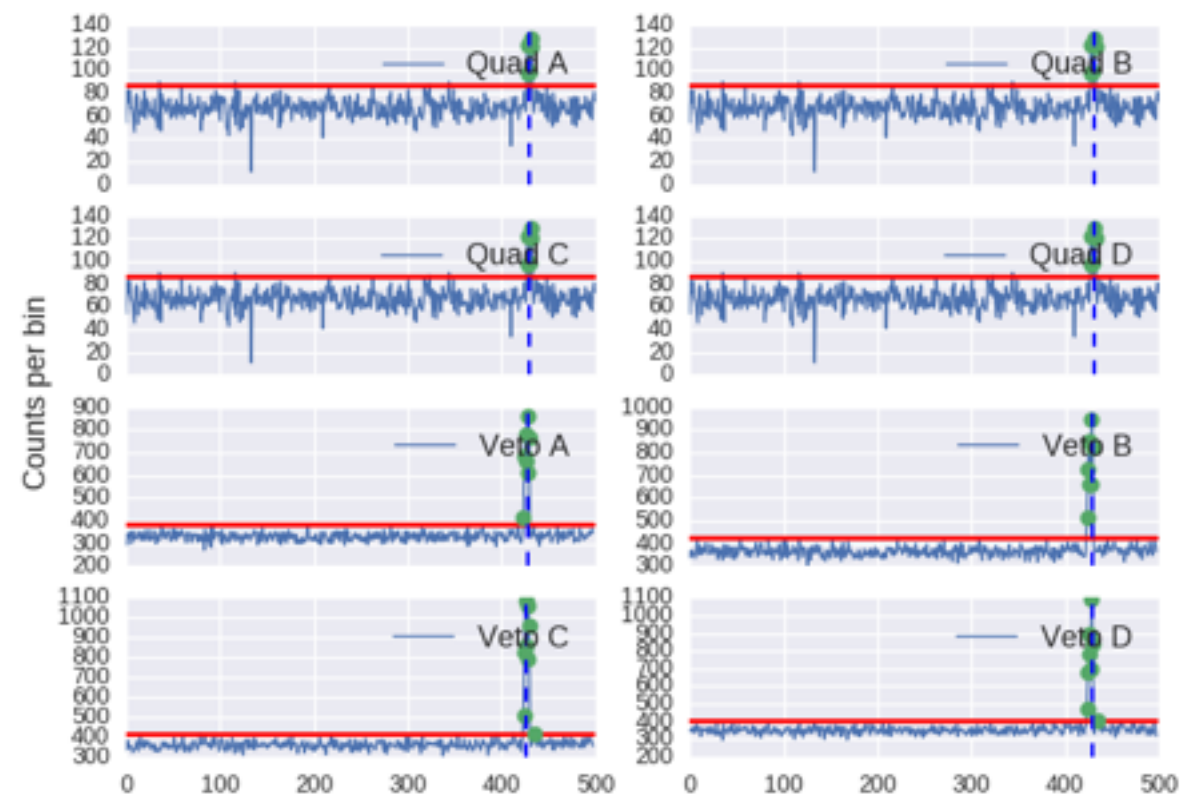
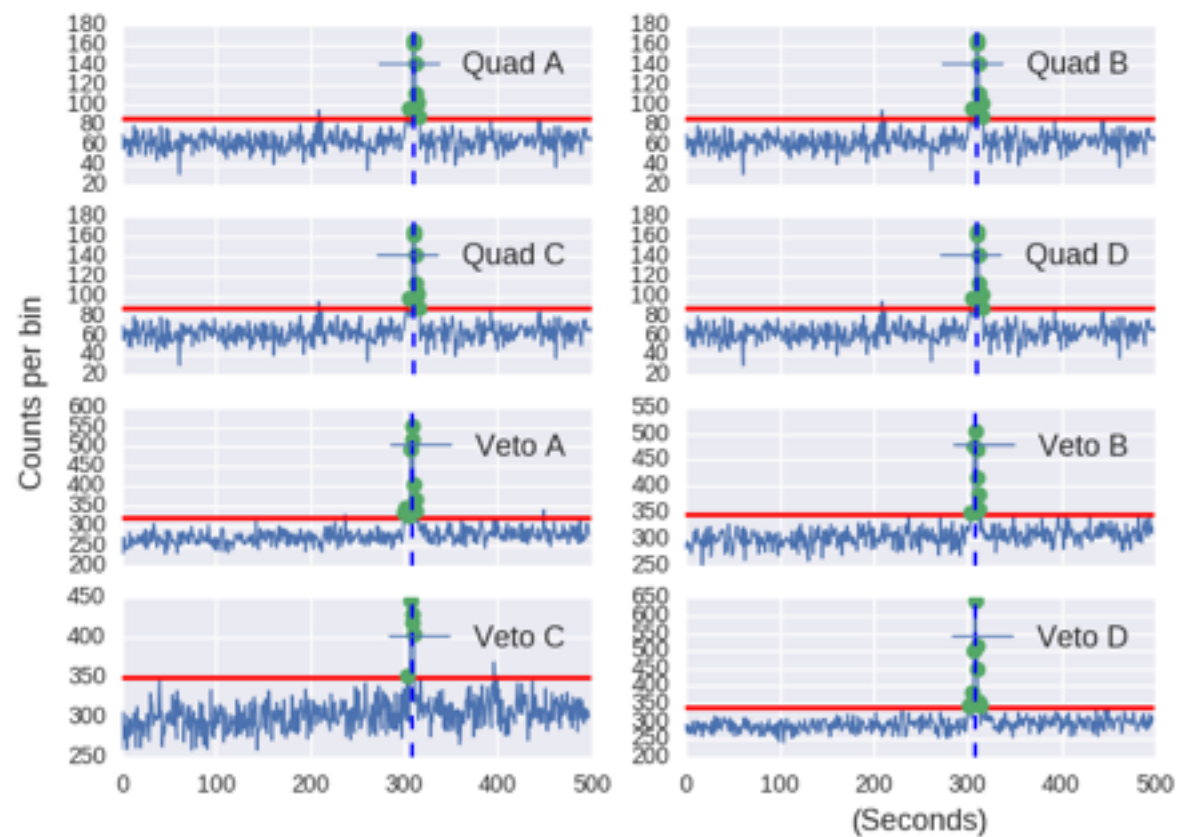
# Peak Identification and verification

- Divide event file into chunk of 500 seconds
- Repeat following steps for all chunks
  - Generate a light-curve
  - Calculated Median (M) and MAD (D) for the light-curve
  - Select all bins  $> M + (\text{Threshold} * D)$
  - Identify the clusters in the light-curve using Density-based spatial clustering of applications with noise (DBSCAN)
  - Select clusters with minimum 3 points in it

# Peak Identification and verification

- Match each selected cluster with the templates in template database using Dynamic Time Wrapping algorithm
- Select all clusters which match with at least with one template.
- Finally for all selected clusters check coincidence with other CZTI quadrants or Veto

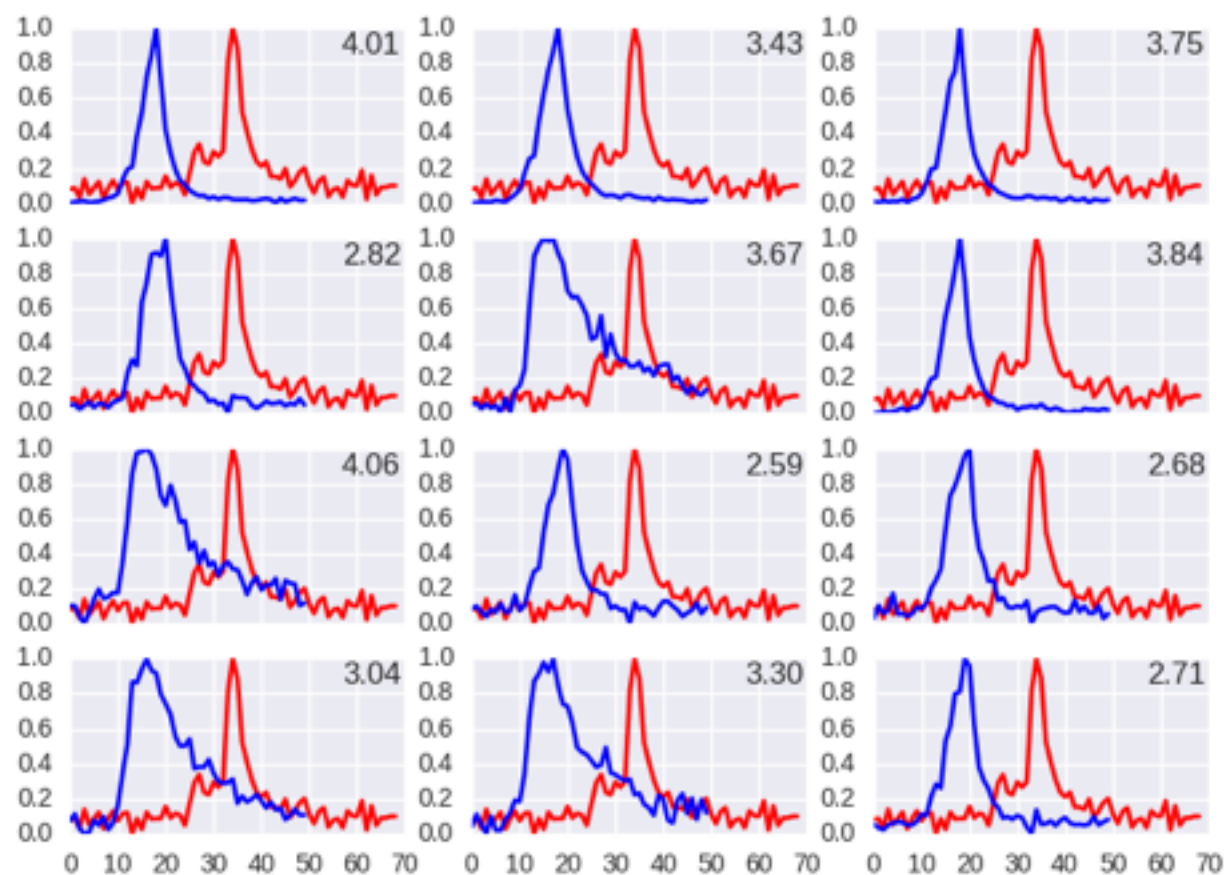
# Results: Clustering



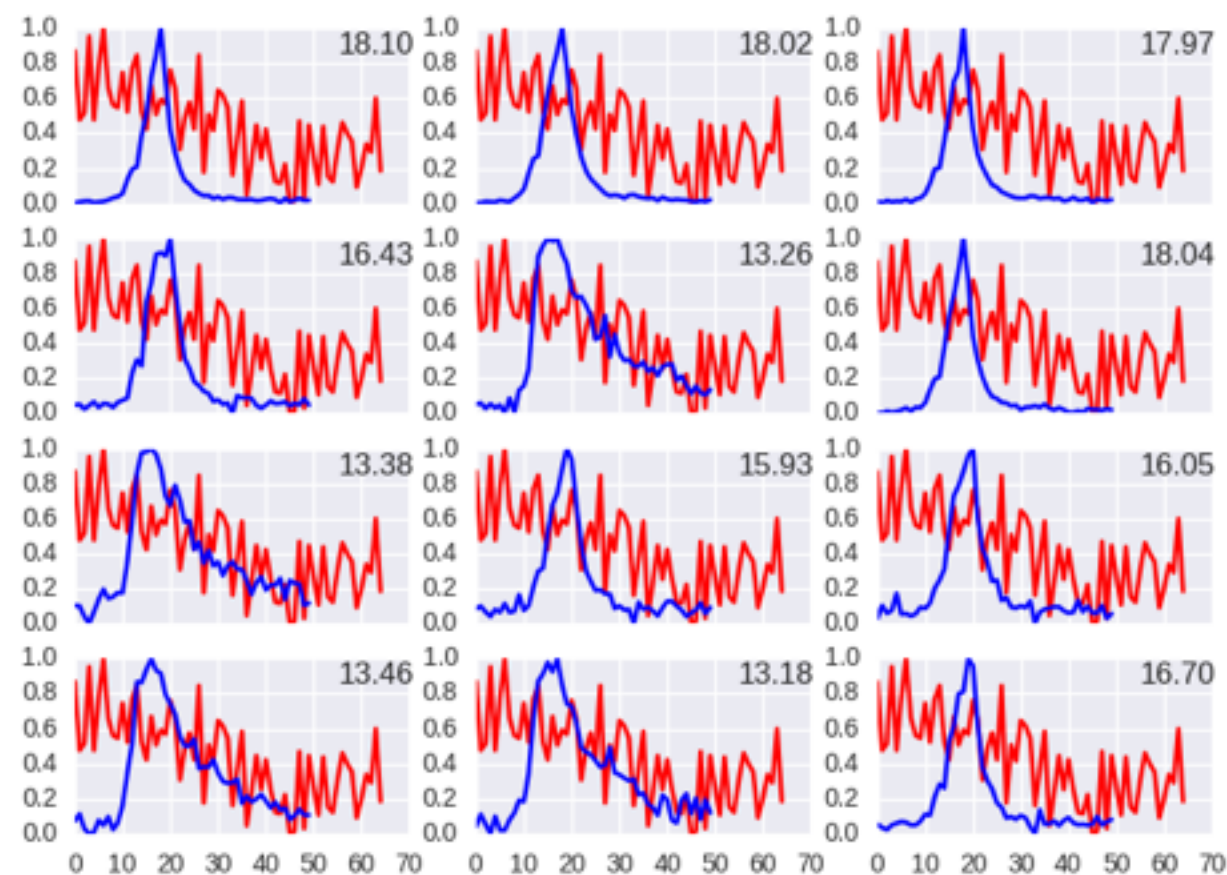


# Results: Templates

Veto A : 309

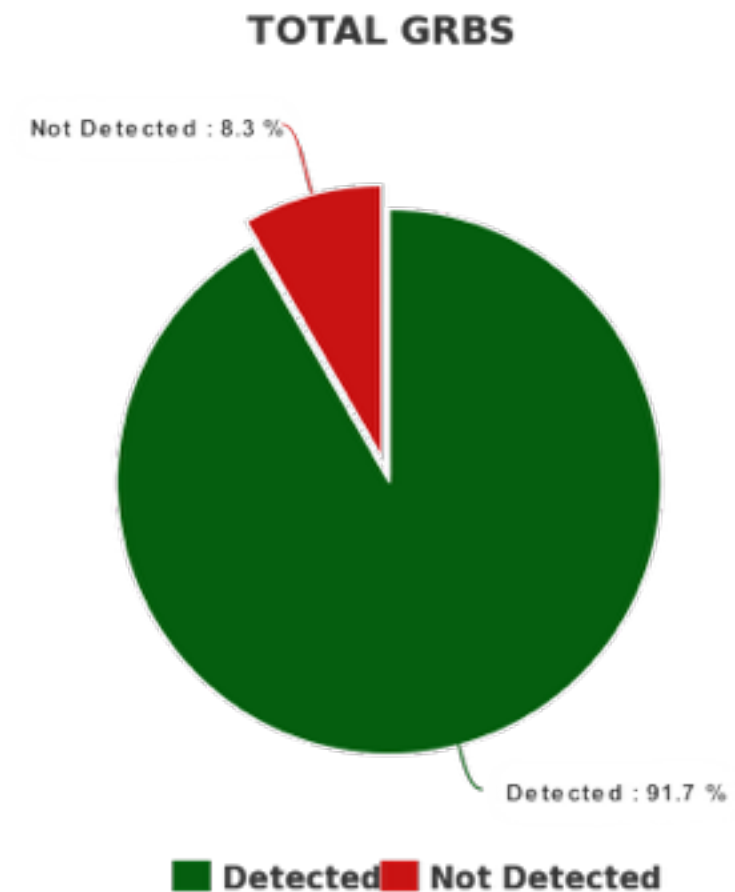
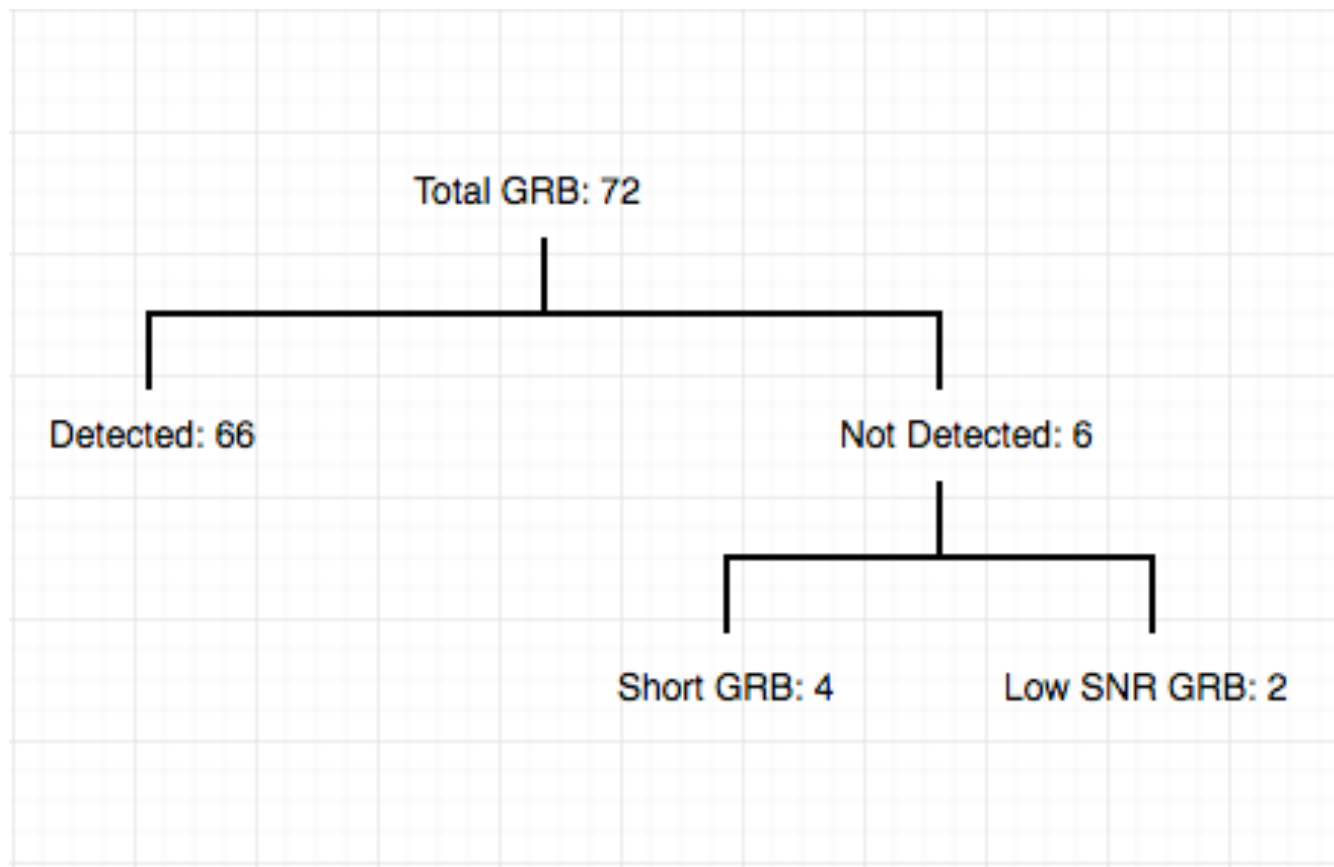


Veto A : 6





# Results: Execution on known GRBS



meta-chart.com

False trigger rate is 8.33%

# Results from Blind Run

- Performed a blind search on czti data,
  - Found 71 already reported triggers
  - Found 26 unreported triggers (35 - 40 unreported triggers are expected)

Thank You !!!