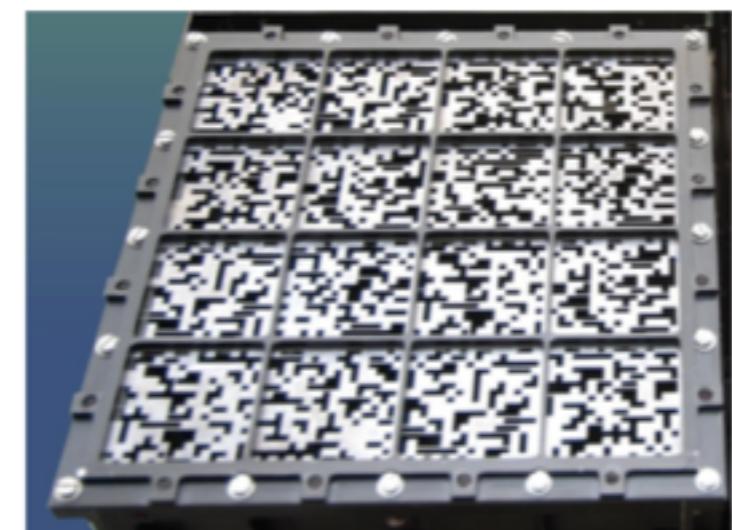
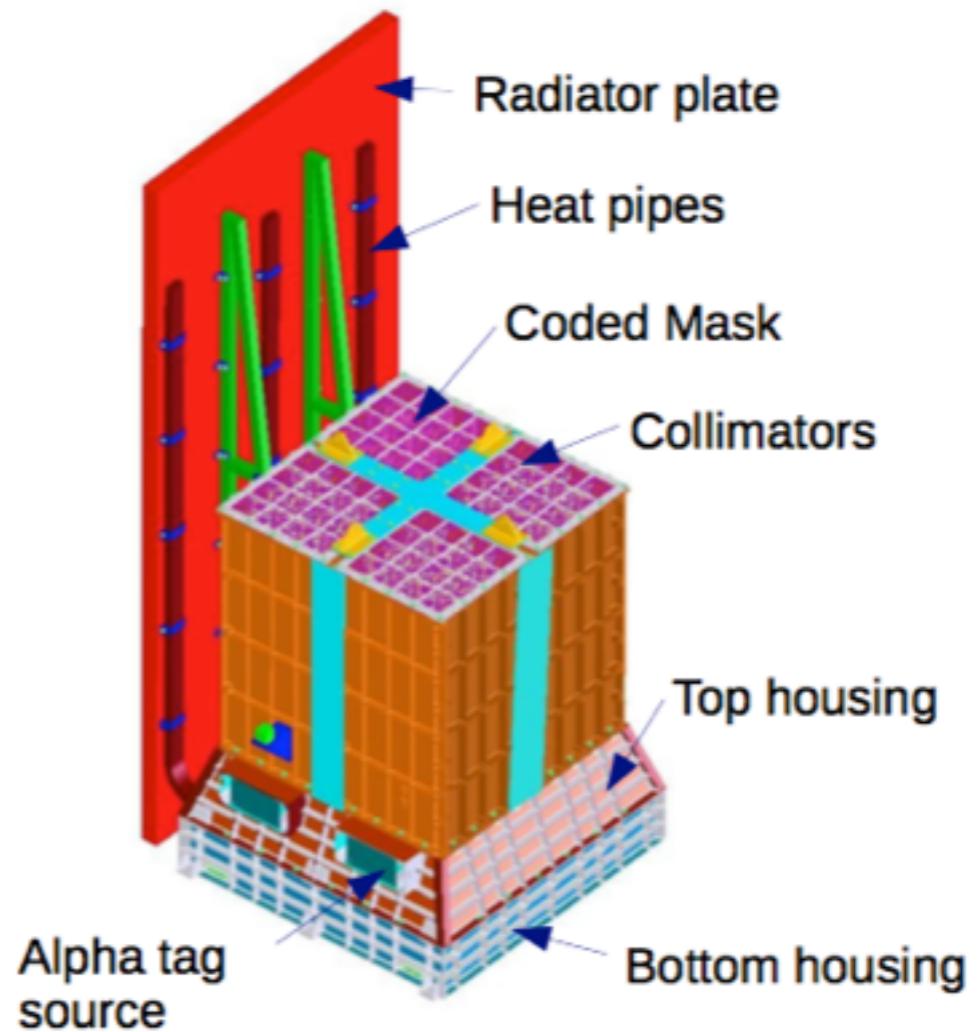


Machine Learning Technique to Search GRB in CZTI

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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}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

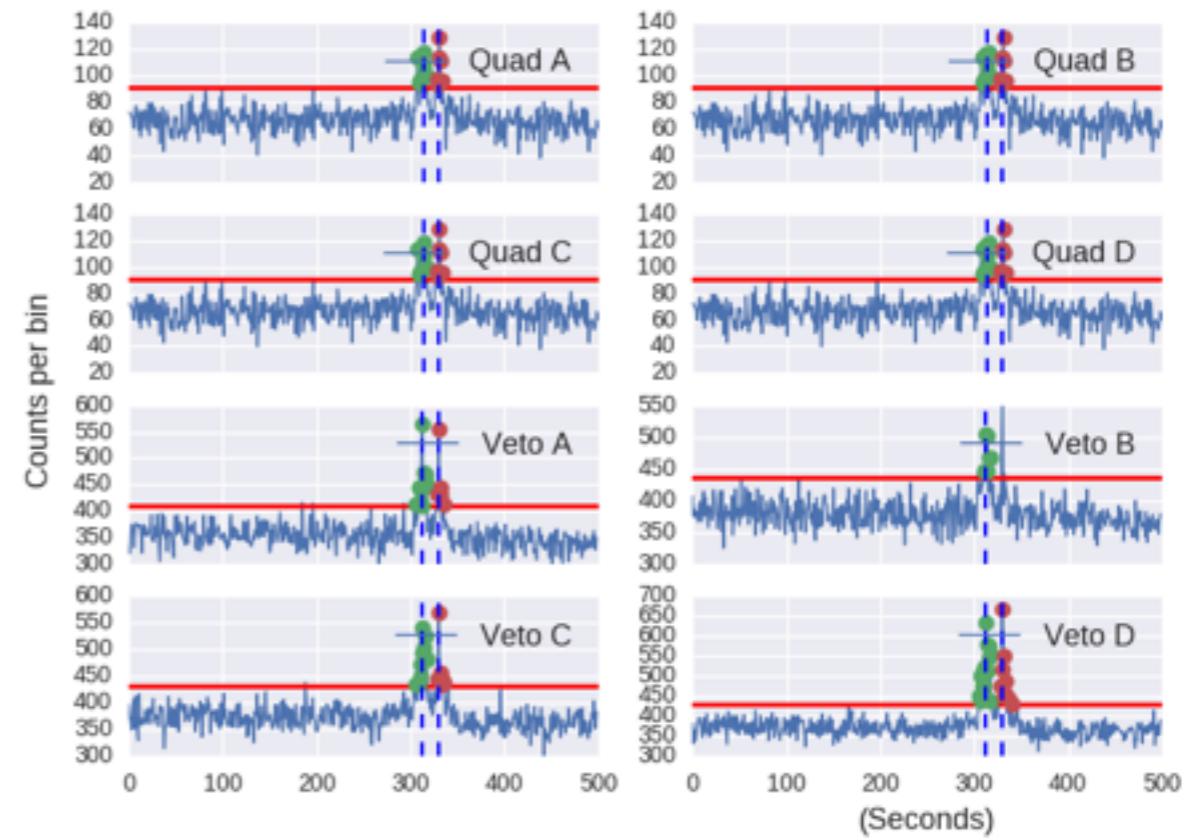
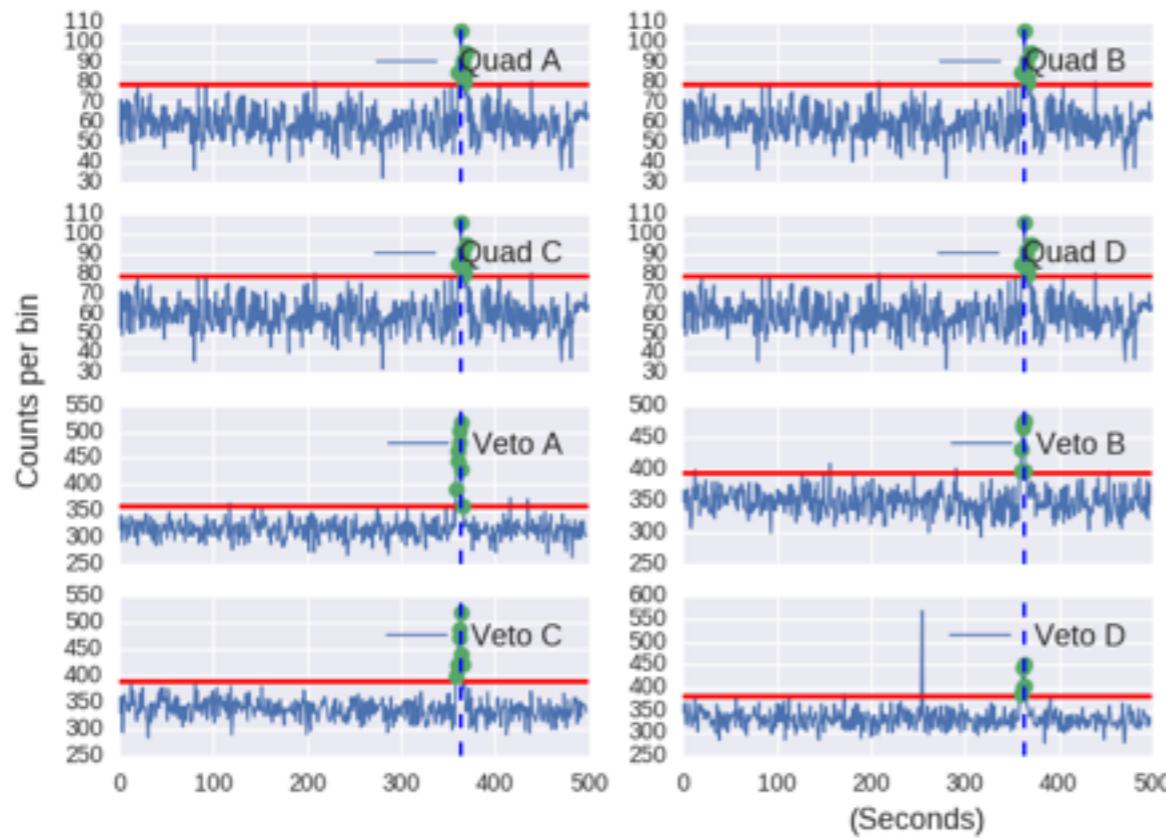
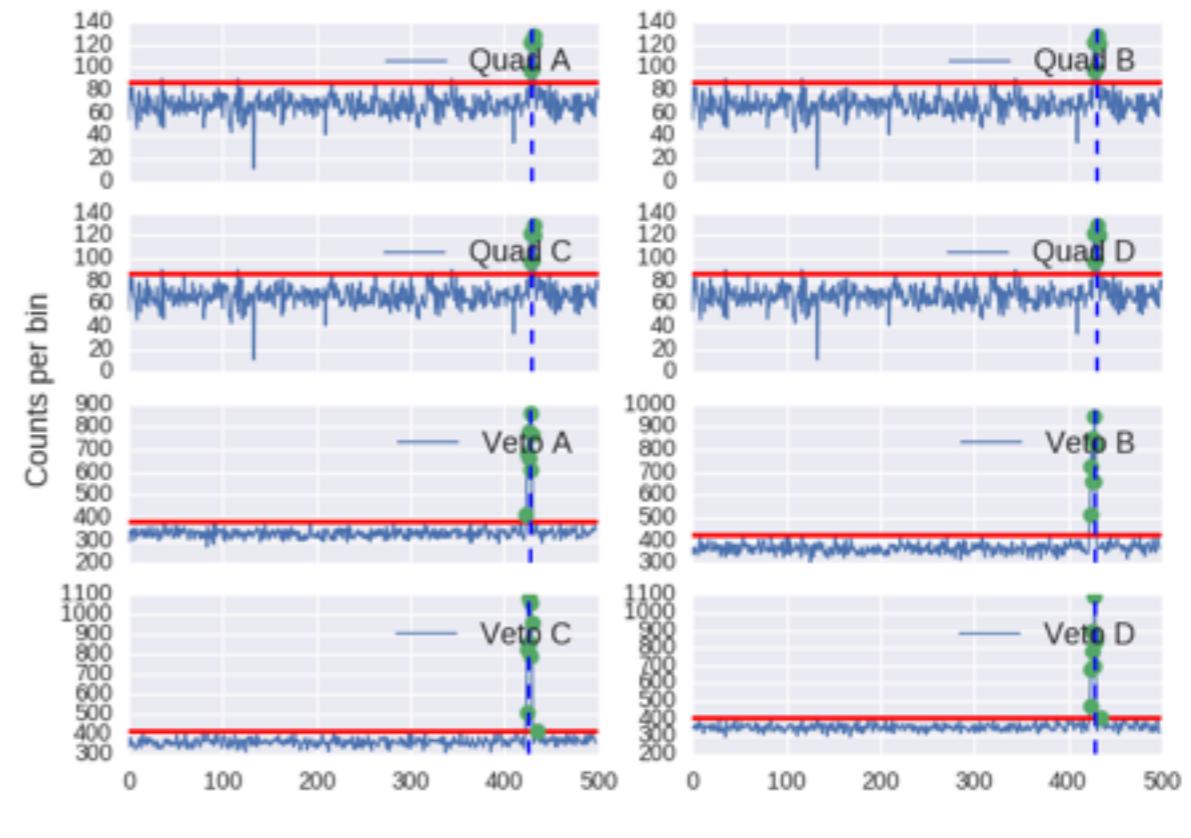
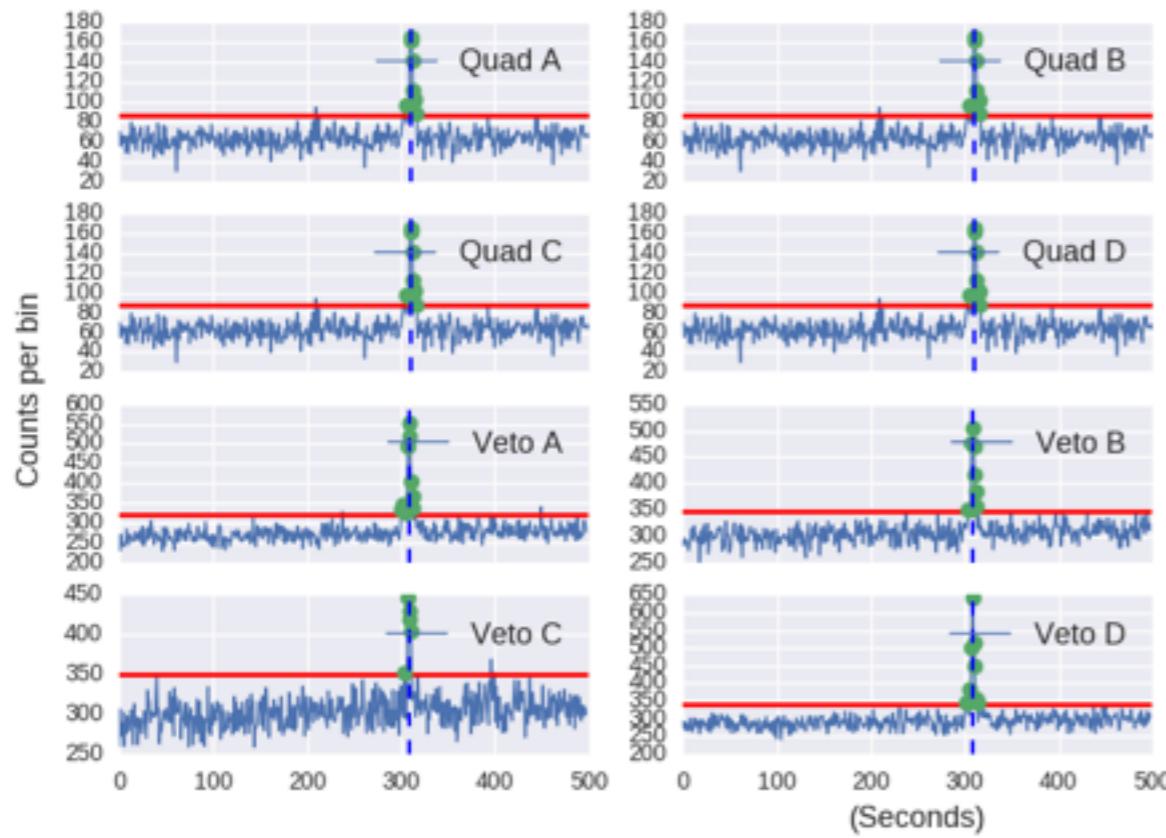
Peak Identification and verification

- 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

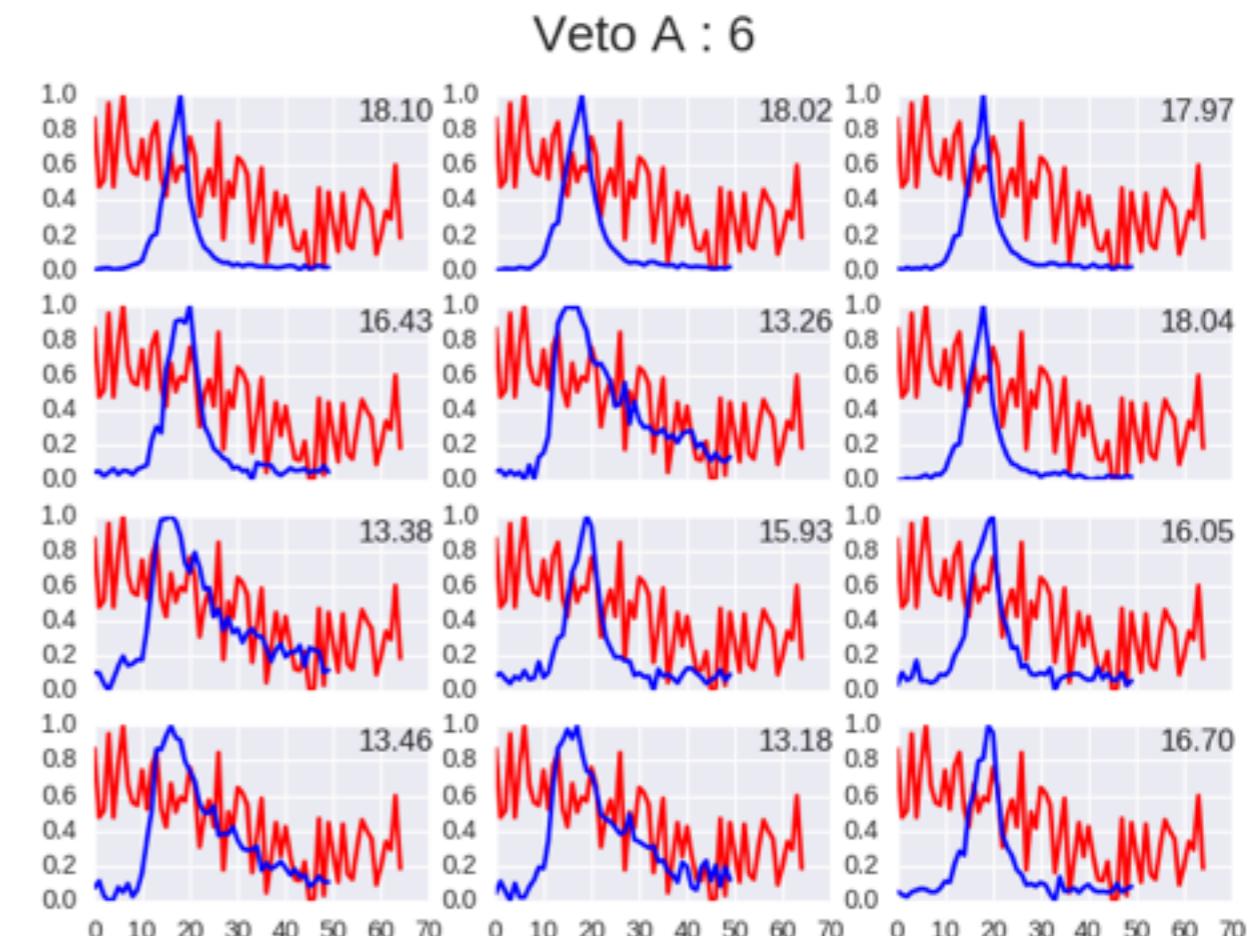
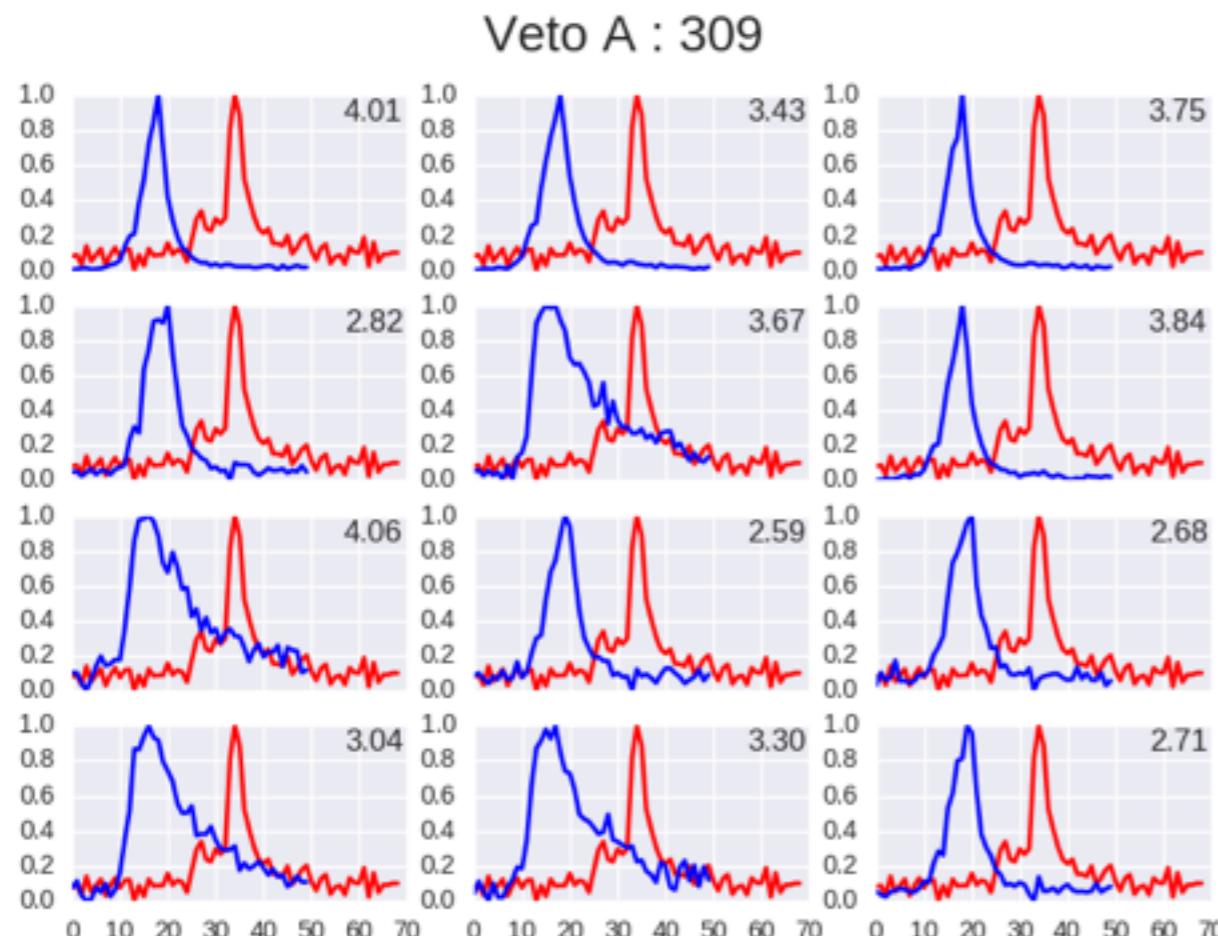
Peak Identification and verification

- 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

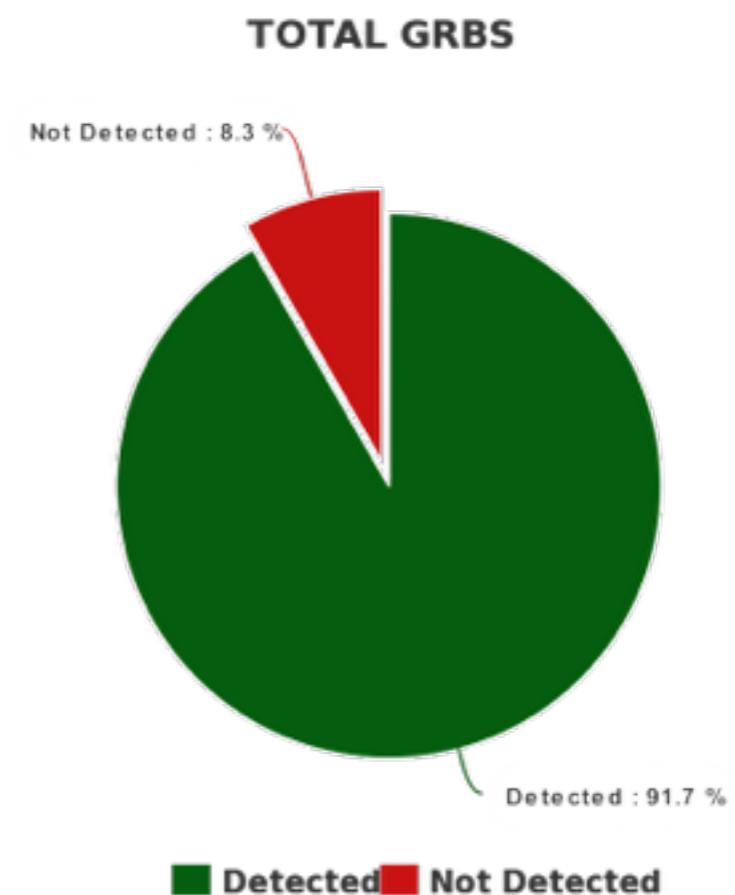
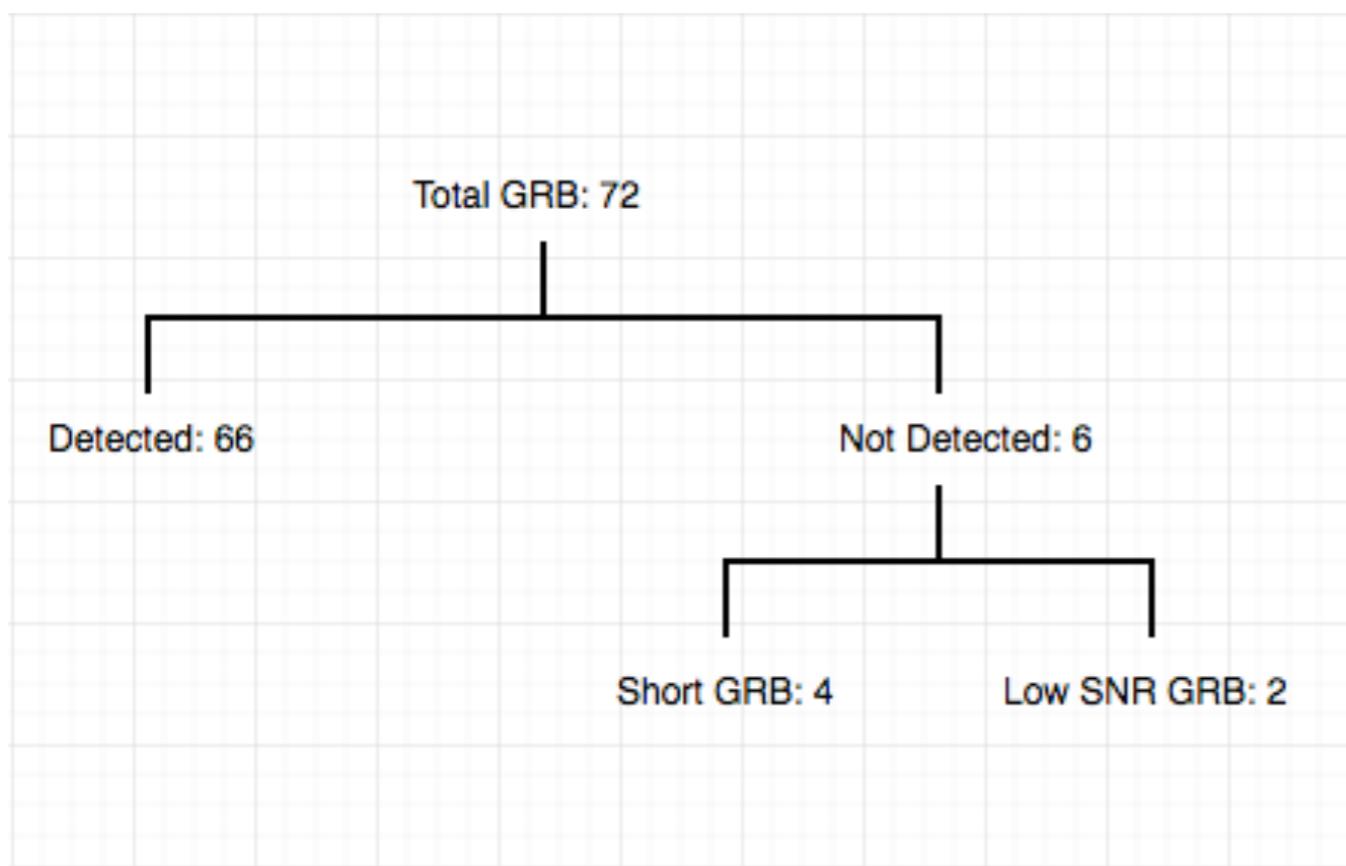
Results: Clustering



Results:Templates



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 !!!