

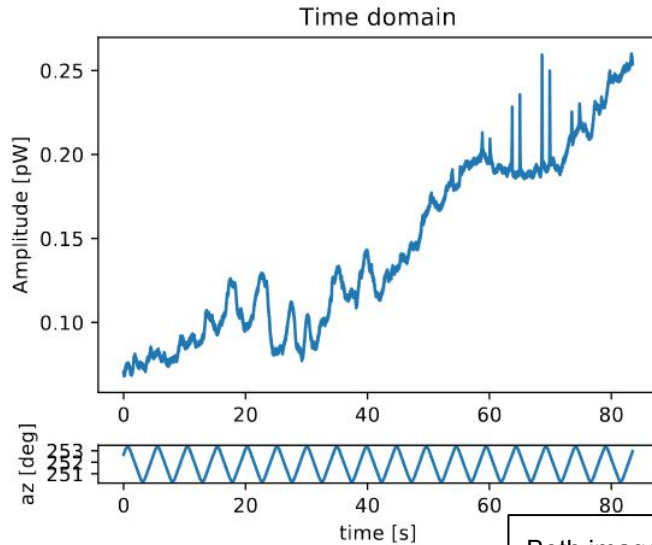
Transient Lessons from ACT

Cody J. Duell (Cornell)

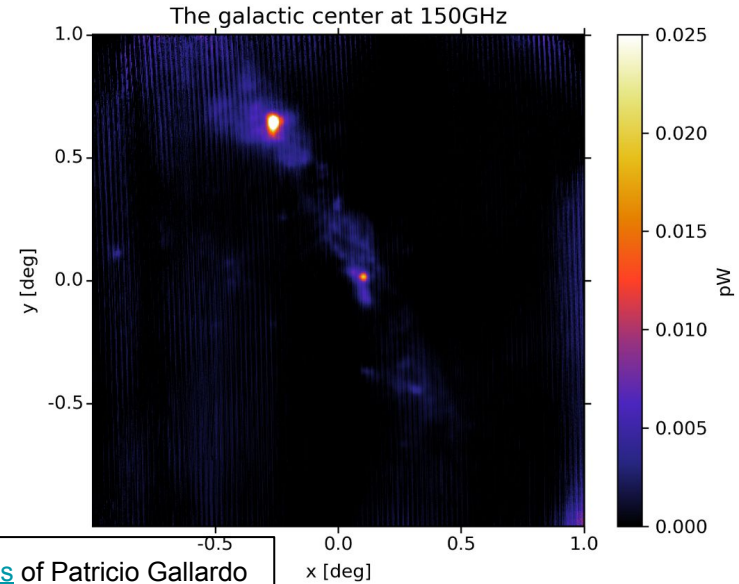
4/9/2020

Two Methods of Detection

Time Ordered Data-based (TOD)



Map-based



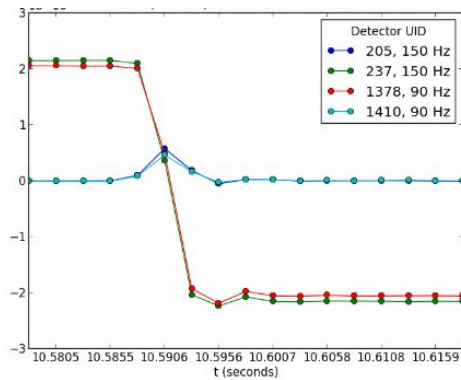
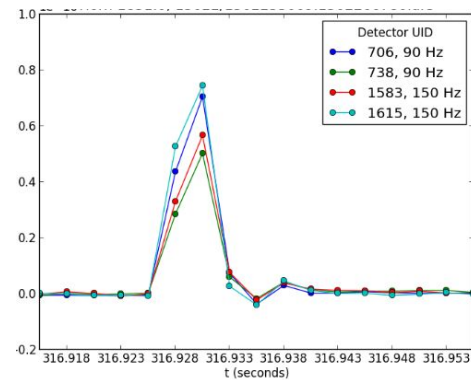
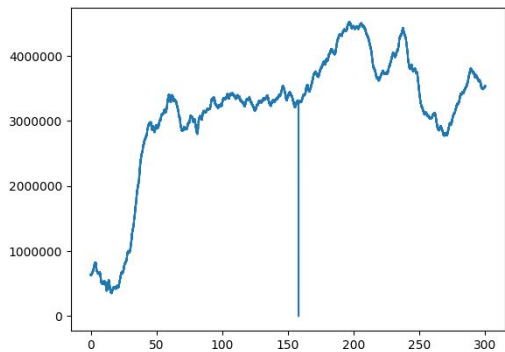
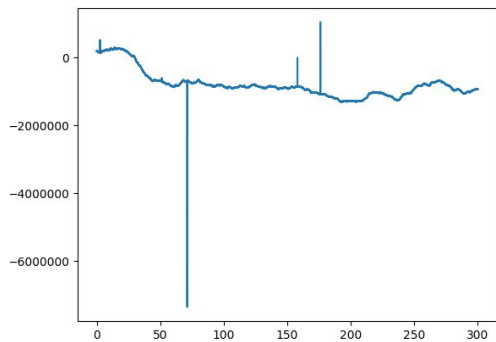
Both images from the [thesis](#) of Patricio Gallardo

Observations of the Galactic Center in the time stream for one detector with conversion to a map from several hundred detectors.

TOD-based Searches: Overview

- Good for looking at variability on very short time-scales (milliseconds to minutes, and yes sources can vary on these timescales)
- Easier to work with in some ways than maps, but...
 - Time streams are messy
 - Requires attention to calibrations and transient noise sources (e.g. electronic glitches, cosmic rays, satellites, etc.)
 - Lower sensitivity

TOD-based Searches: Examples



Map-based Searches

- Classic search strategy
- Good for looking at variability on longer time-scales (days to months)
- Higher sensitivity
- Some advanced strategies
 - Match-filtering
 - Reference image subtraction

Current Efforts by CMB Survey Instruments

Ad-hoc map-based studies

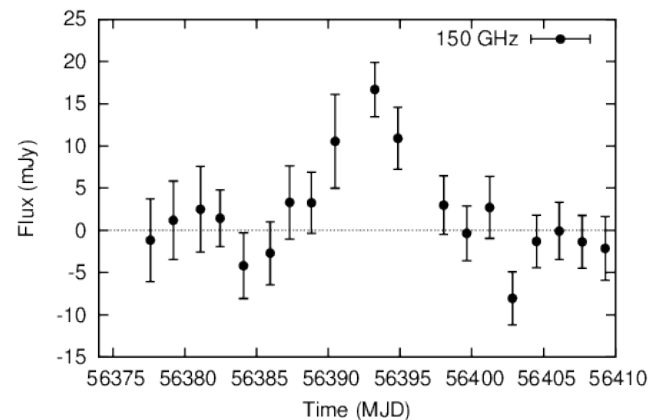
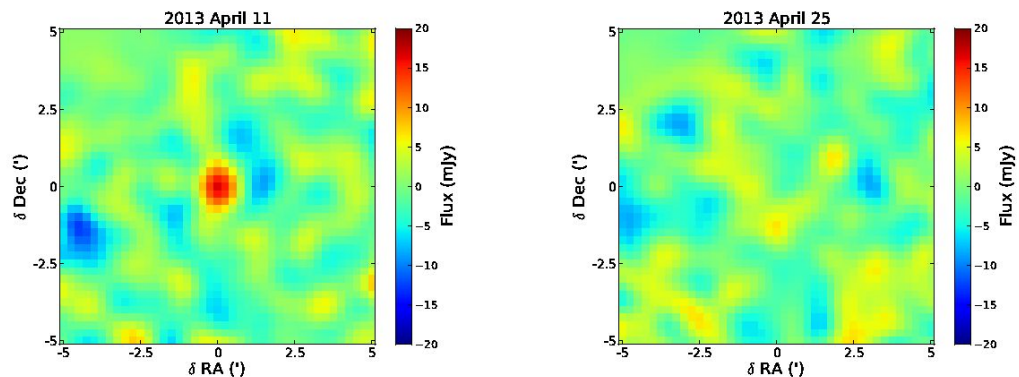
- ACT
 - [2019 identification of a strongly flaring blazar](#)
- SPTpol
 - Follow-up observations of [blazar observed by ACT](#)
 - [IceCube neutrino](#) event (non-detection)

Current Efforts by CMB Survey Instruments

ACT

- Systematic TOD-based search, looking for FRBs
- Advantage: dichroic, pol-sensitive pixels means 4 dets/feedhorn
- Sampling time (~ 2 ms) means impractical to distinguish between cosmic rays and FRBs even with 2 channels (unless helped by large dispersion measure)
 - We did find a lot of cosmic rays though!
- Also interested in using SGR J1725-2900 (magnetar) as test source, but high pulse variability and low intensity has made that difficult

Current Efforts by CMB Survey Instruments



SPTpol

- Systematic map-based search (Arxiv: [1604.03507](https://arxiv.org/abs/1604.03507), 2016)
 - 100 sq. deg. field (95-150 GHz) over 1 year nearly continuously
 - Used template map to identify transient events
 - ~ 10 mJy sensitivity on scales of days to weeks
 - Identified one potential source

Conclusion

- Multiple strategies for identifying sources on different time-scales
- Time-domain is faster but messier
- Map-based is slower but more powerful
- Some work has been done, but not much
- Large survey area and relatively little existing work mean we can add something