TRANSIENT HIGH-ENERGY GAMMA-RAY SKY

Searching for transients
in Fermi/LAT data

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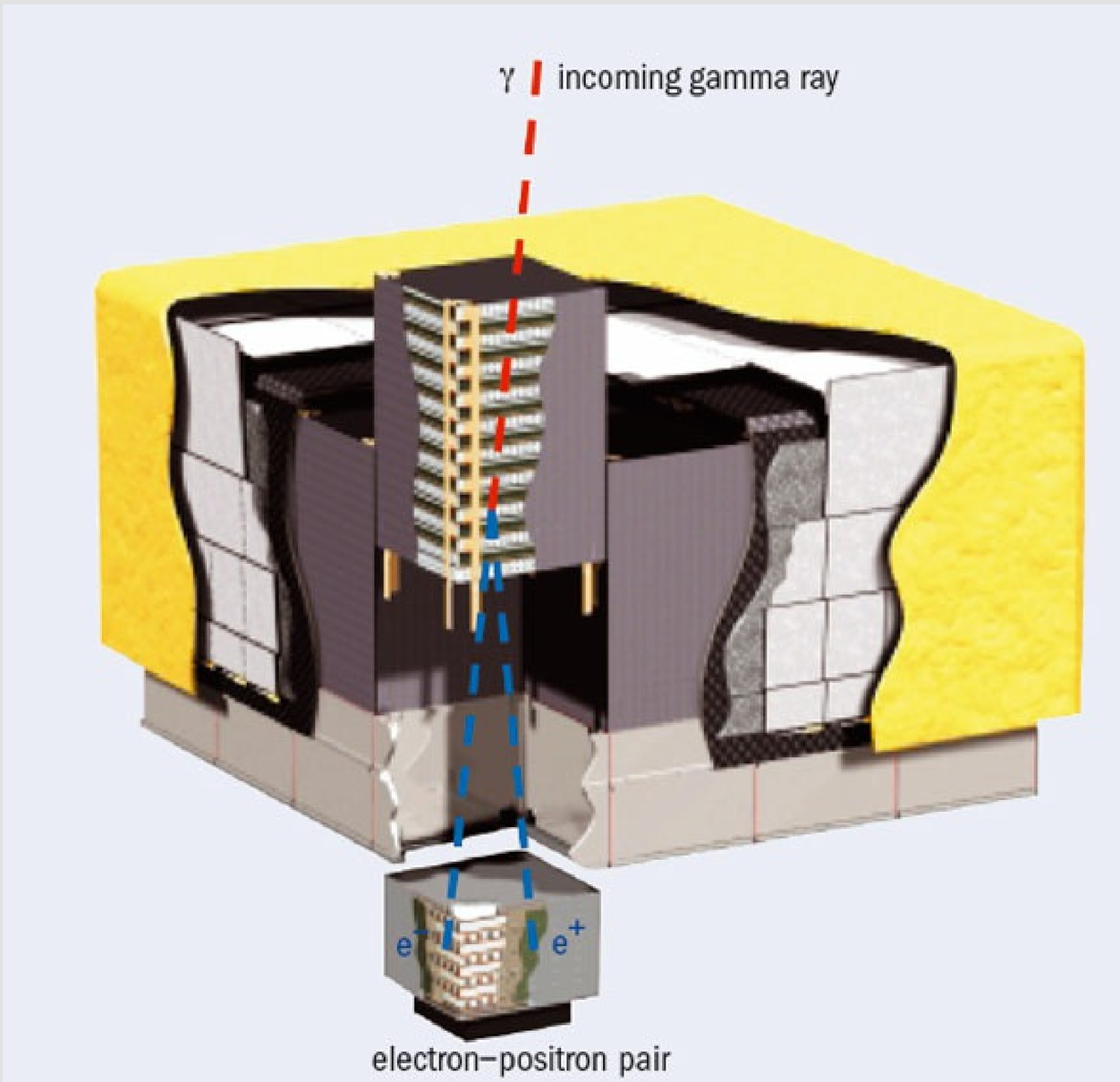
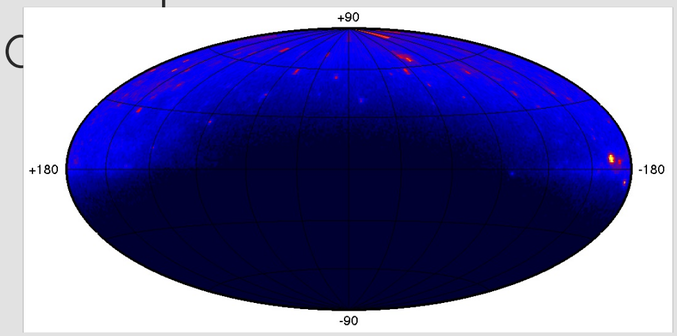
LARGE AREA TELESCOPE

- Pair conversion telescope
- 100 MeV - 300 GeV
- Field of view is ~1/3 of the sky
- Survey mode

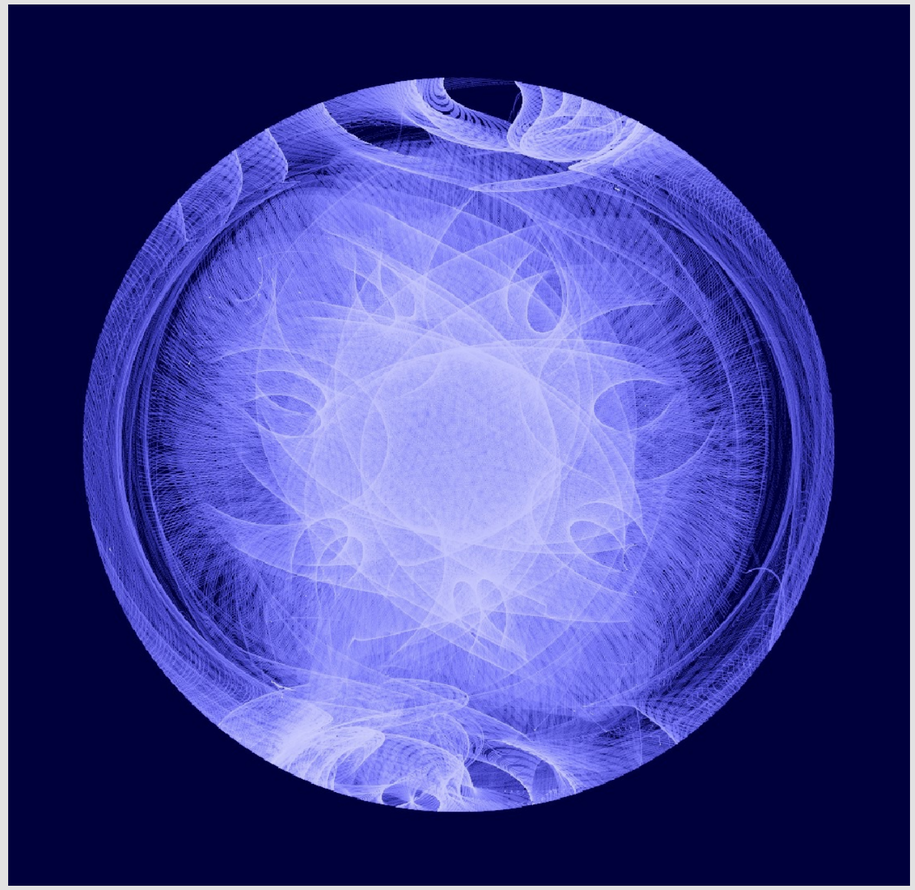


Survey mode

- Field of view is ~1/3 of the sky
- Full sky coverage every ~3.2 h
- Orbit precesses with a ~53.4 d

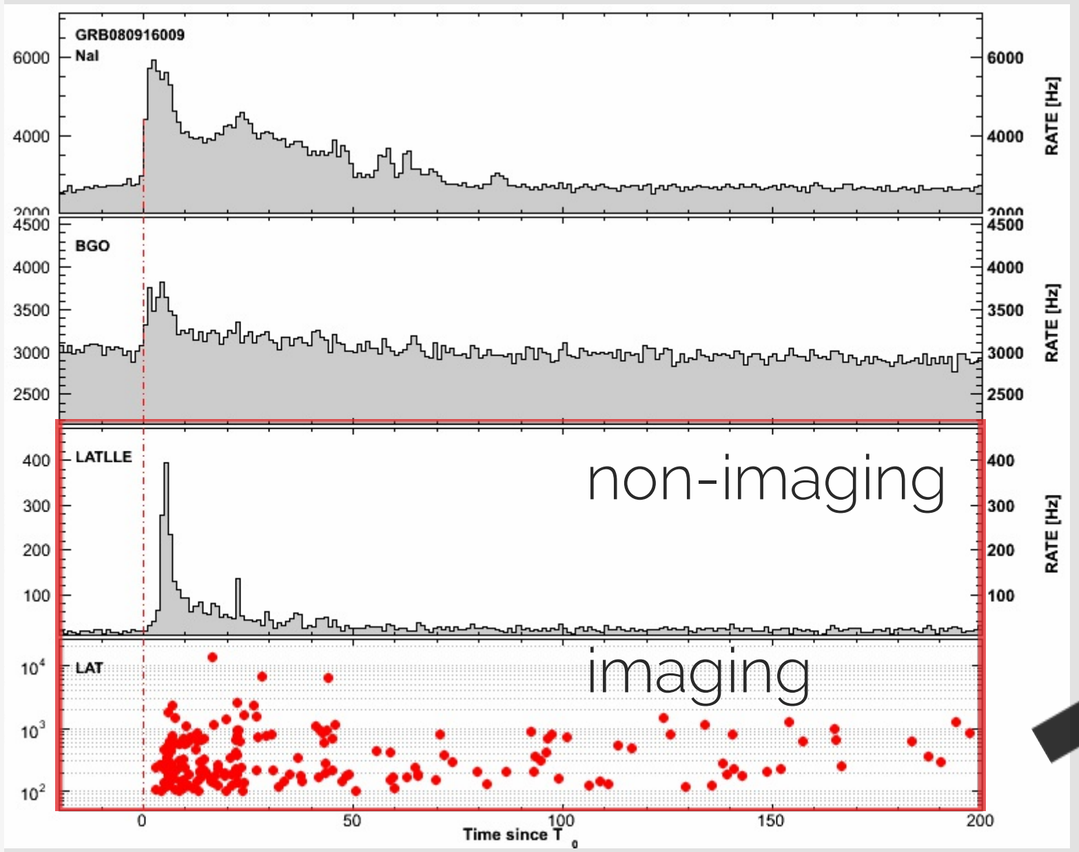


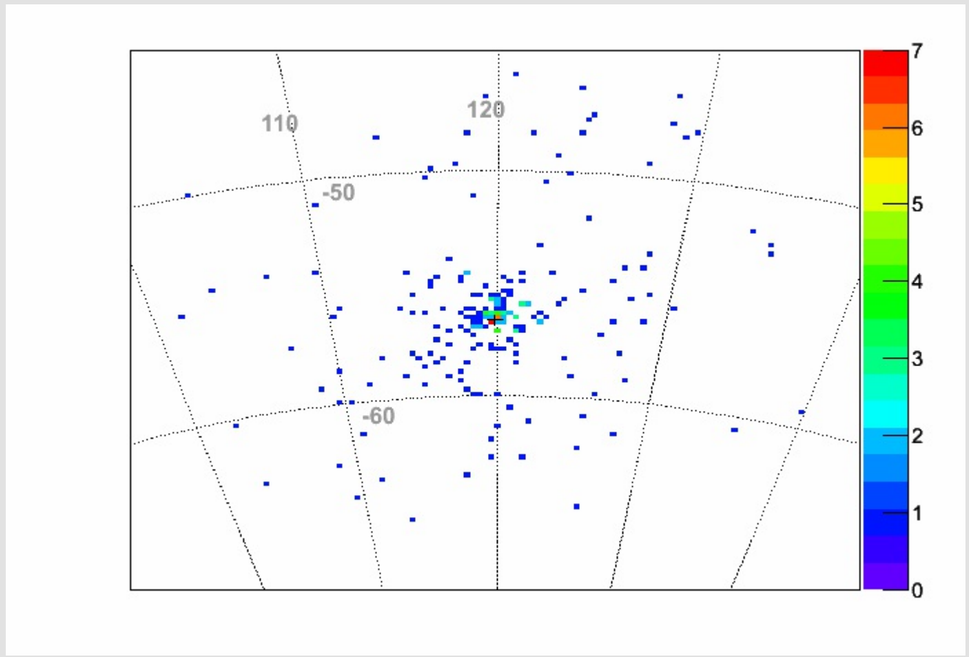
Exposure over ~3.5 hours, map in Galactic coordinates

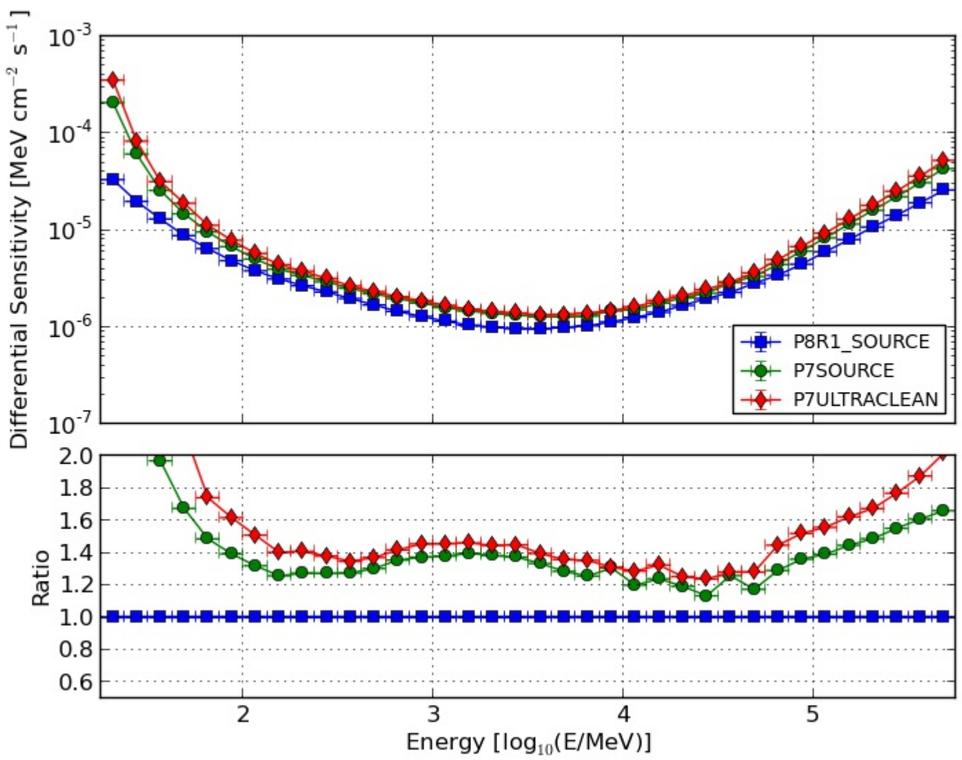


Path of the Vela pulsar in instrumental coordinates over 2 y of observations

LAT data


GRB080916009
NaI
BGO
LATLLE
LAT
RATE [Hz]
Time since T 0
non-imaging
imaging


110
120
-50
-60



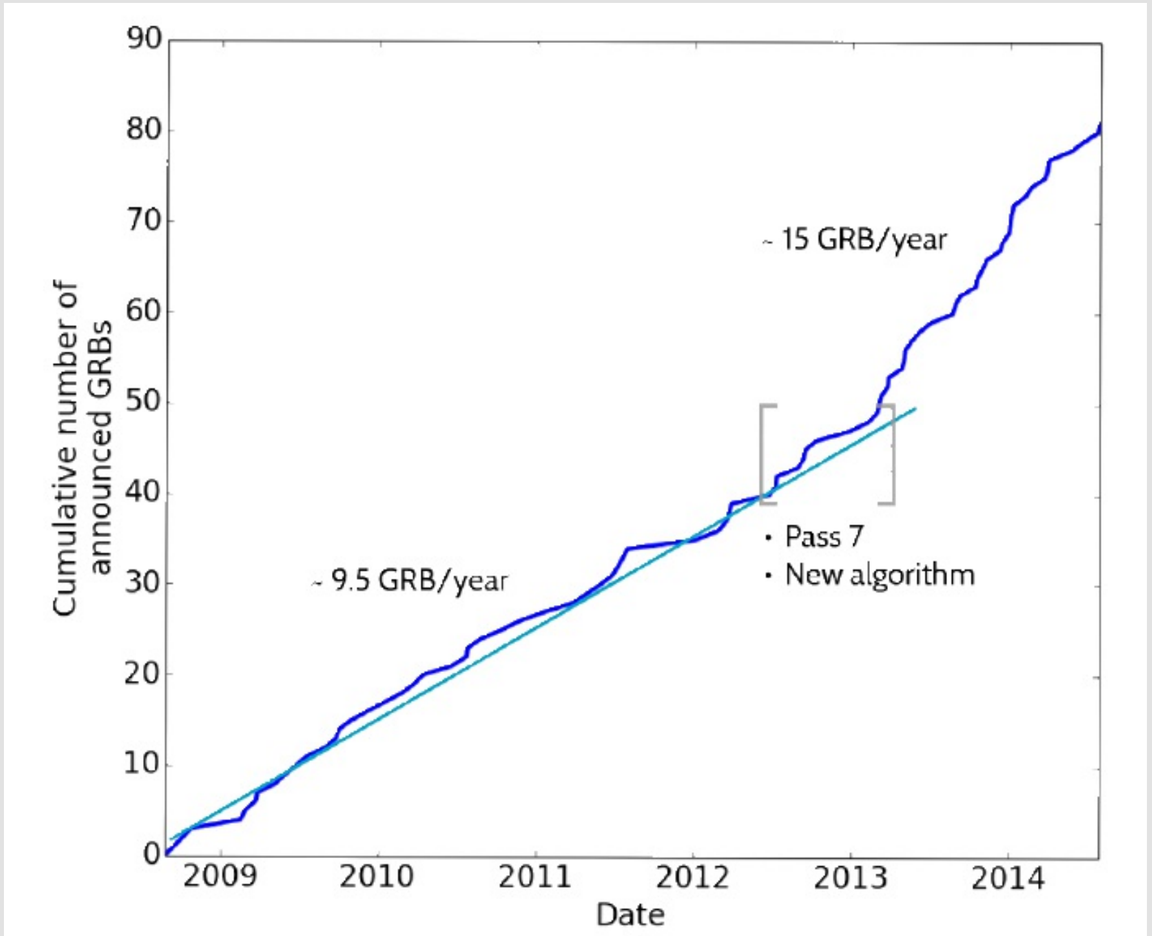
NEW EVENT ANALYSIS: PASS 8

- Direction and energy are reconstructed via software
- Track finding + machine learning + ...
- Pass 8 is a review "from scratch"
- Much improved performances

TRIGGERED SEARCH

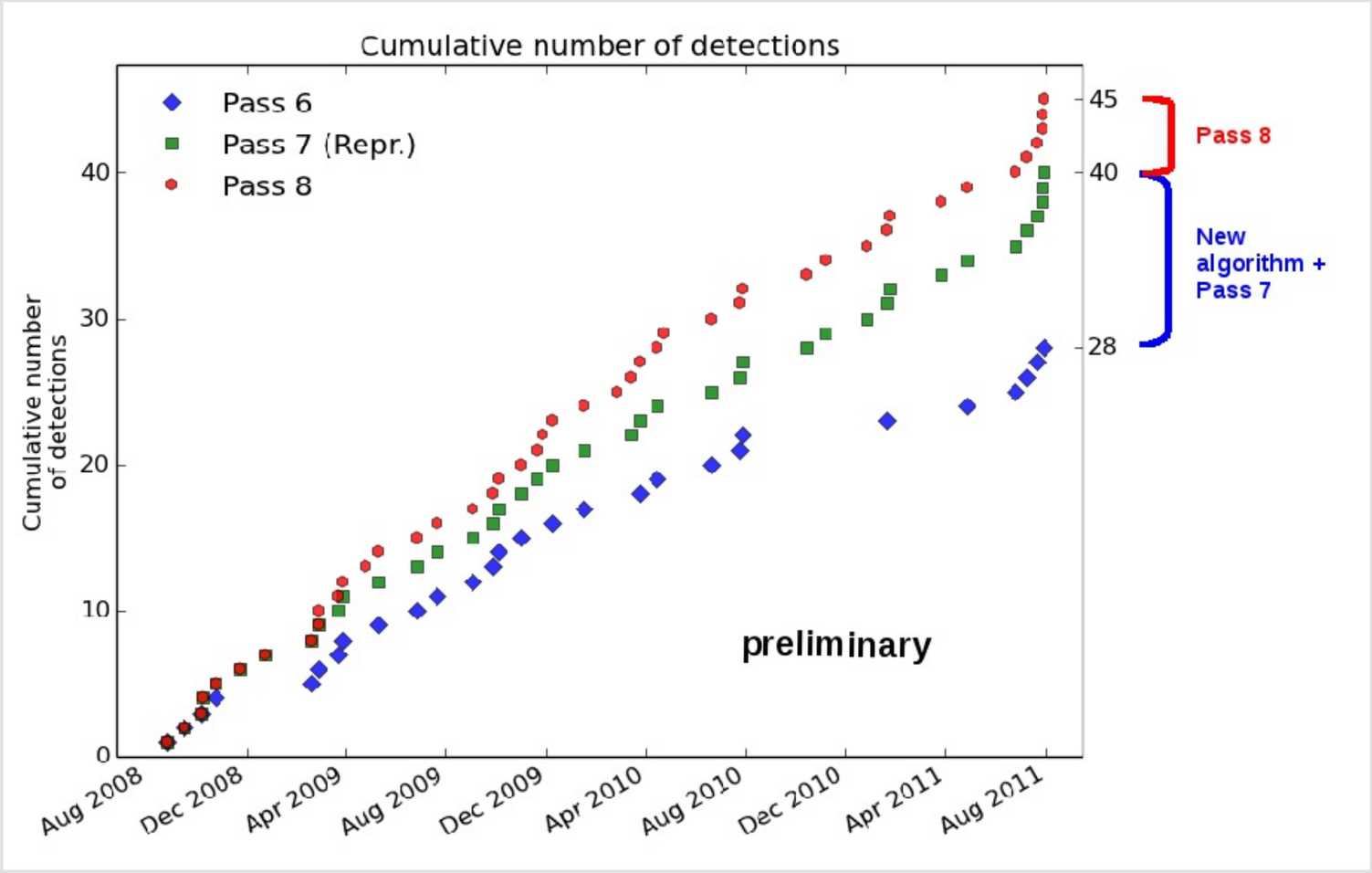
Search for counterparts of GRBs which triggered other instruments (GBM, INTEGRAL/ISGRI, Swift/BAT, MAXI...)

LTF triggered search performances 1



LOCALIZED AND NON-LOCALIZED GRBS

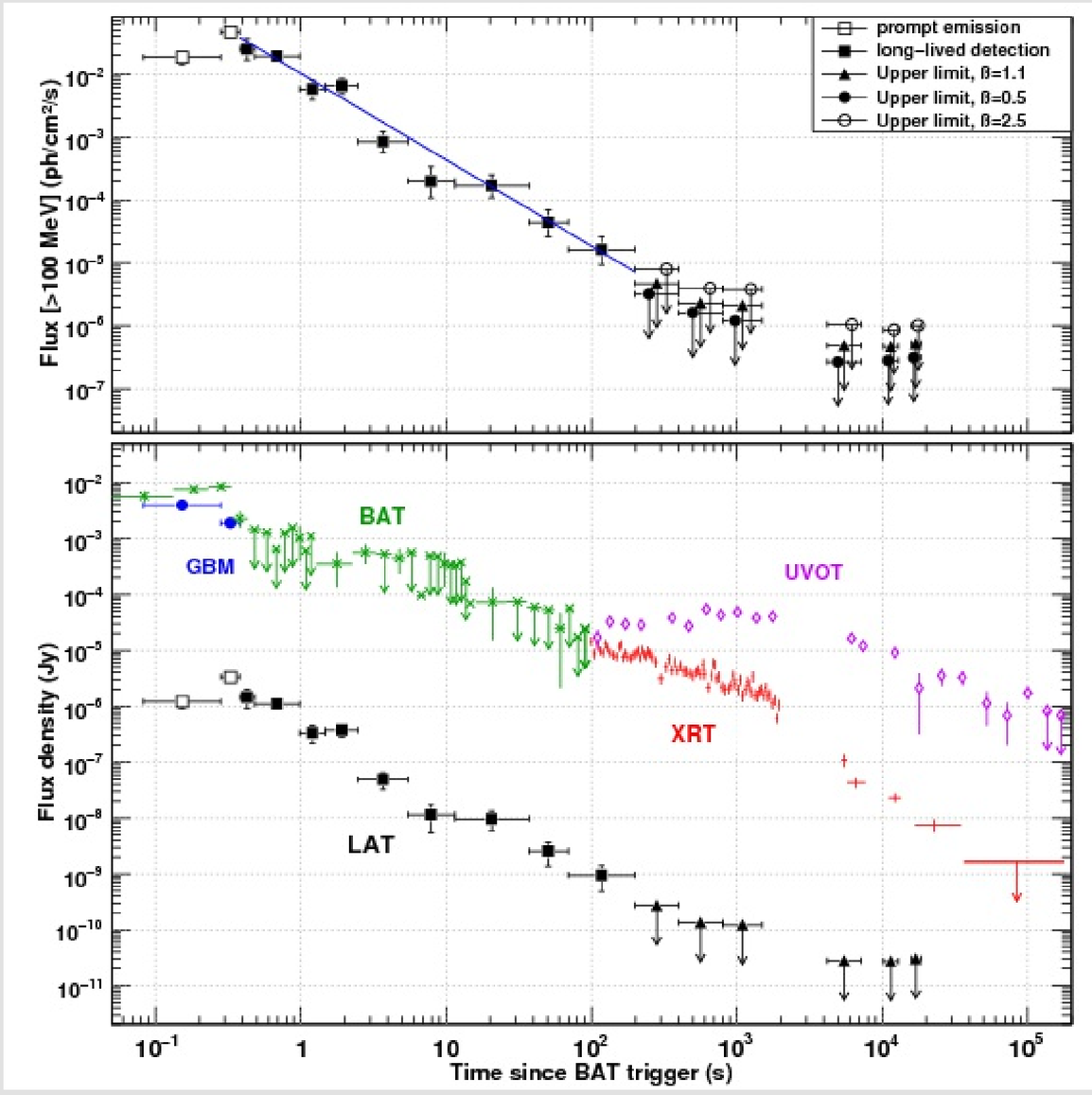
LTF triggered search performances 2

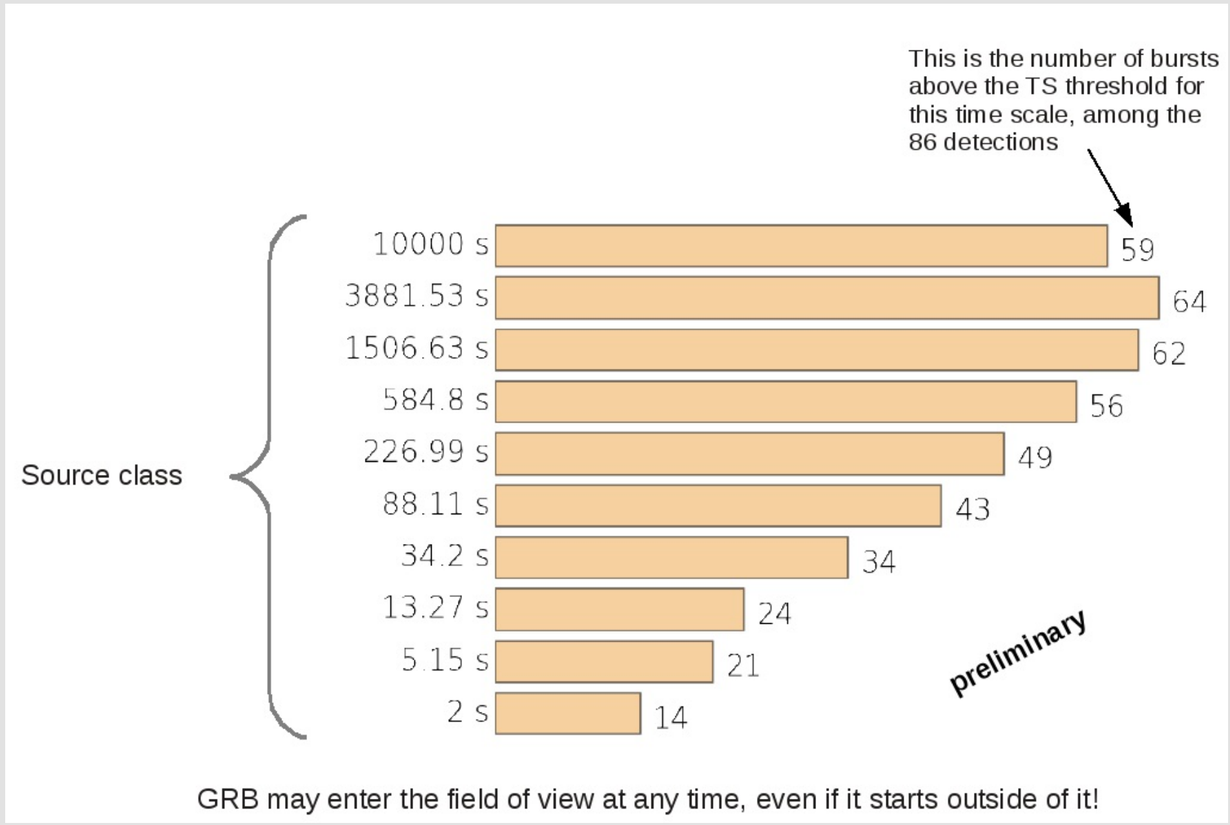


FERMI/LAT AND GW

- ~15 GRBs/year (with new algorithm)
- ~3 short GRBs/year
- Most GRBs are GBM-detected, but not Swift/BAT detected
- Localization < 0.5 deg (< 0.1 if bright) within ~10 hours
- Allow for follow-up from Swift
- Constraints/measure on Lorentz factor

sGRBs? not so short (for Fermi/LAT)



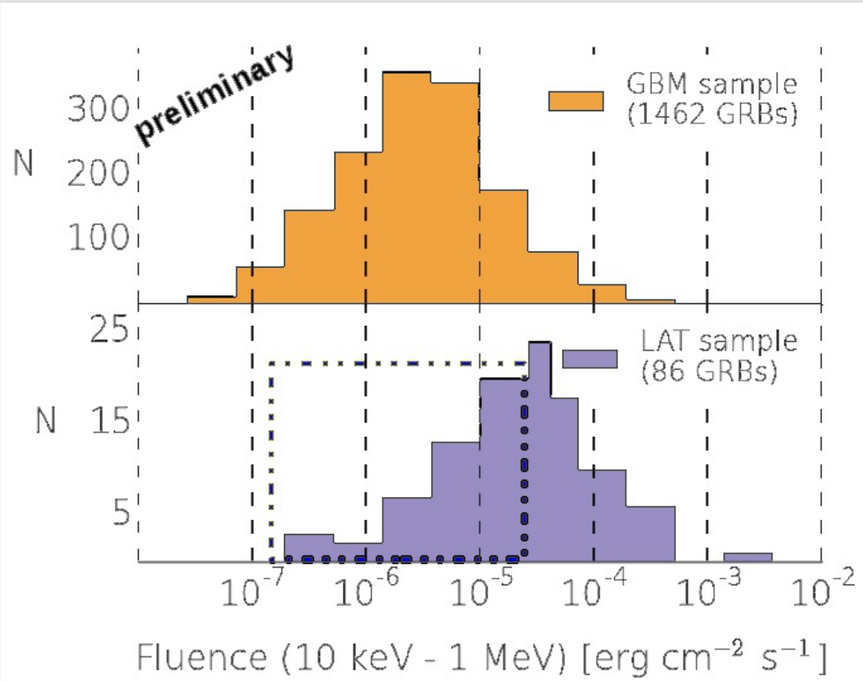


GRB may enter the field of view at any time, even if it starts outside of it!

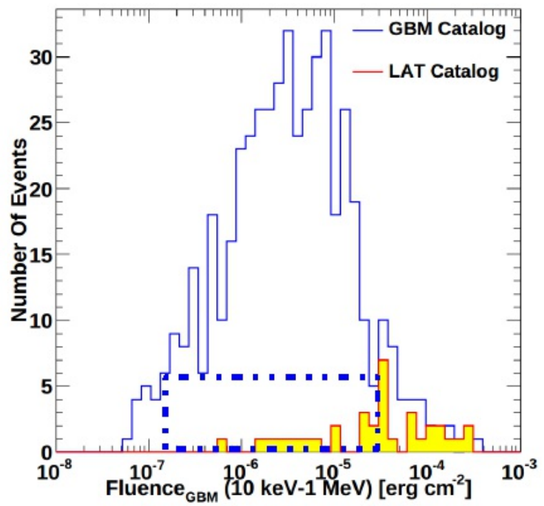
search on longer time scales

Better sensitivity

More mid- and low-fluence GRBs



(this work)



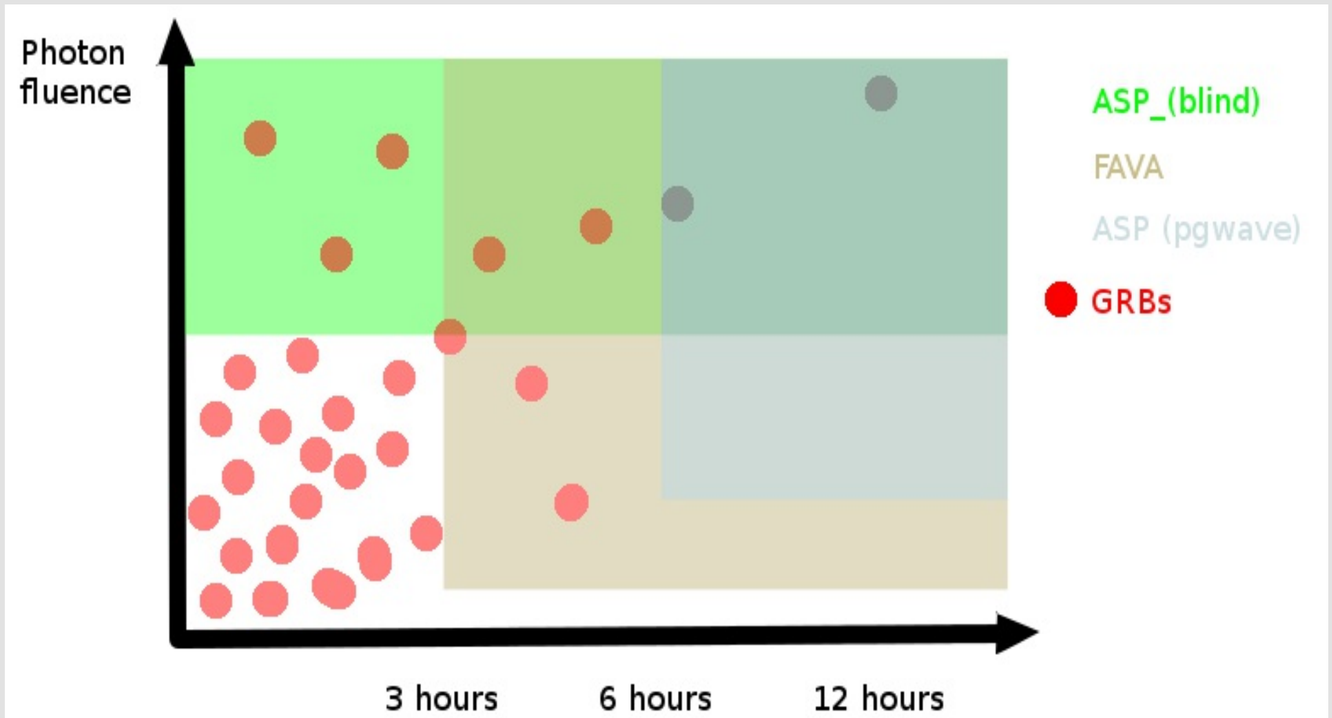
(Ackerman et al. 2013)

WE HAVE NOW >100 LOCALIZED GRBS (6.5 YEARS)

- ~15-20 short GRBs
- with pass 8 we will extend search below 100 MeV -> even more localized triggers

BLIND SEARCH

Look for transients in 6 years of data
(~500 millions events!)



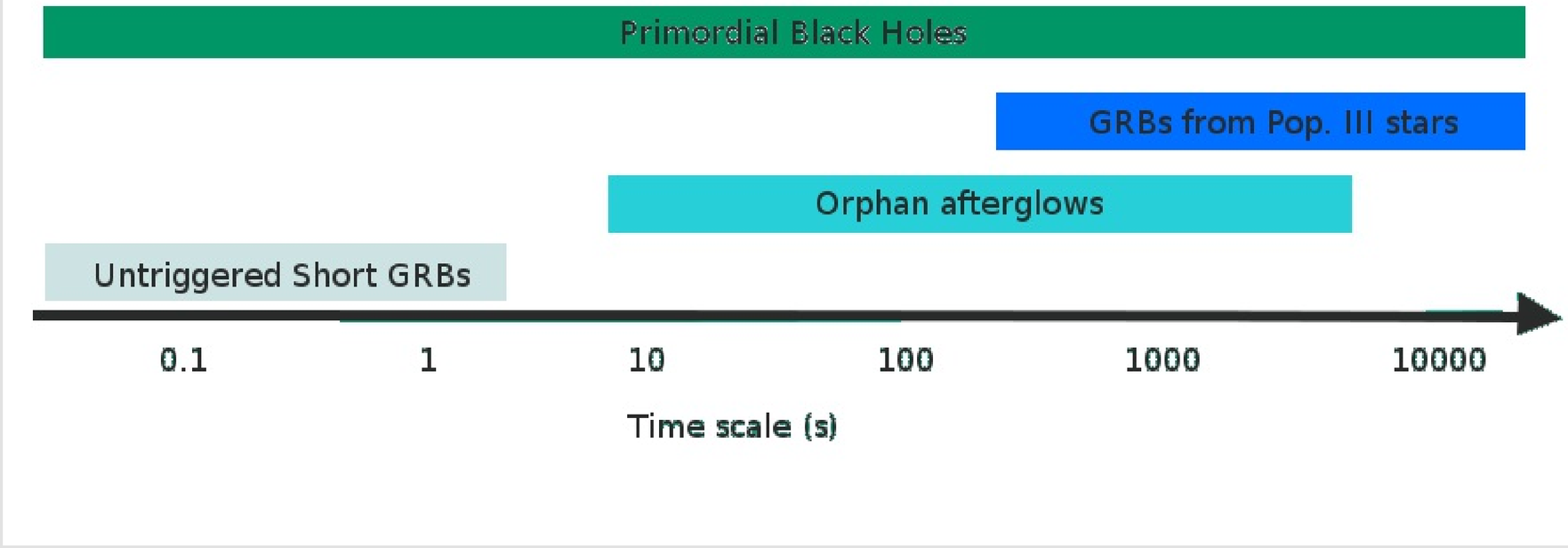
(illustration)

Room for discoveries

Current (blind) algorithms do not detect many GRBs that we detect with the triggered search.

Can we improve for short duration and not-very-bright transients?

IS THERE ANYBODY IN THERE?



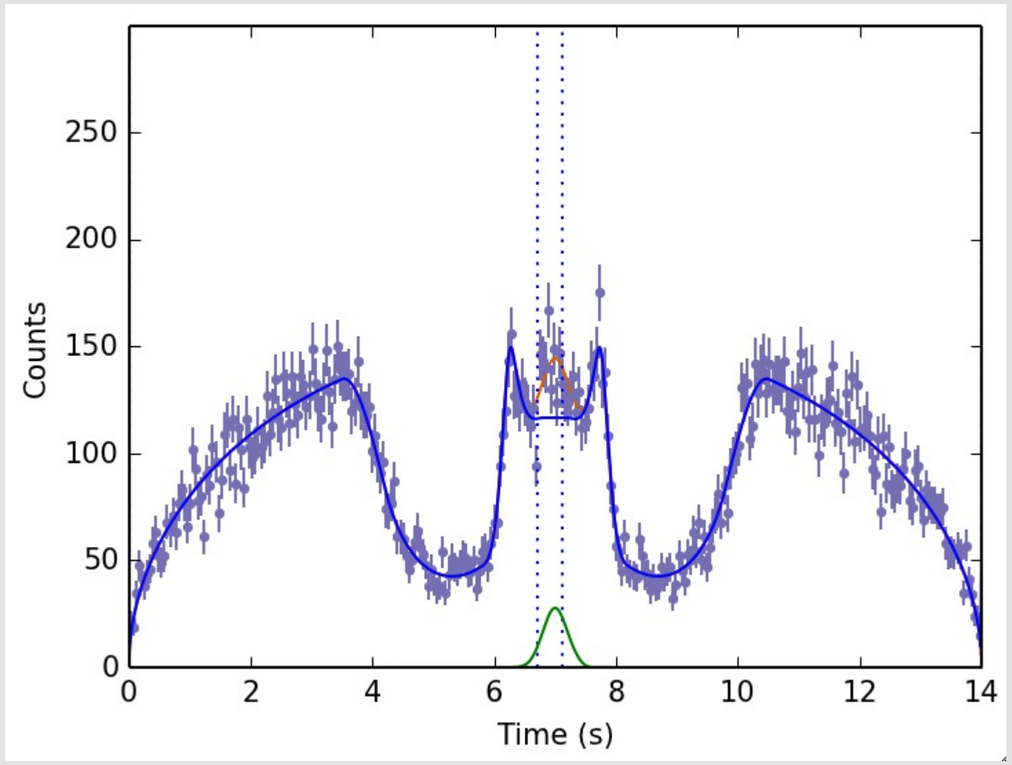
UNTRIGGERED SHORT

- GRB happened while GBM triggering was disabled (SAA, high McIlwain L...)
- GRB happened outside GBM FoV
- ...

LTF BLIND SEARCH

+ Scale-agnostic search

+ Exploit our knowledge about the gamma-ray sky



MODIFIED BB

+ Need to know the background distribution as function of time

+ Search for changes with respect to the background

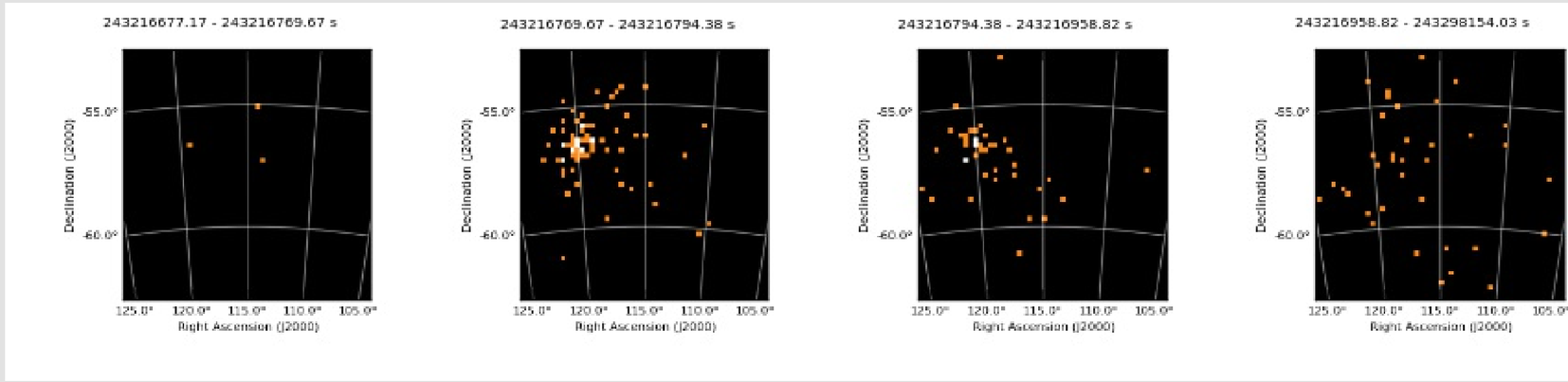
+ Automatically account also for data gaps (BTI) and variations in livetime

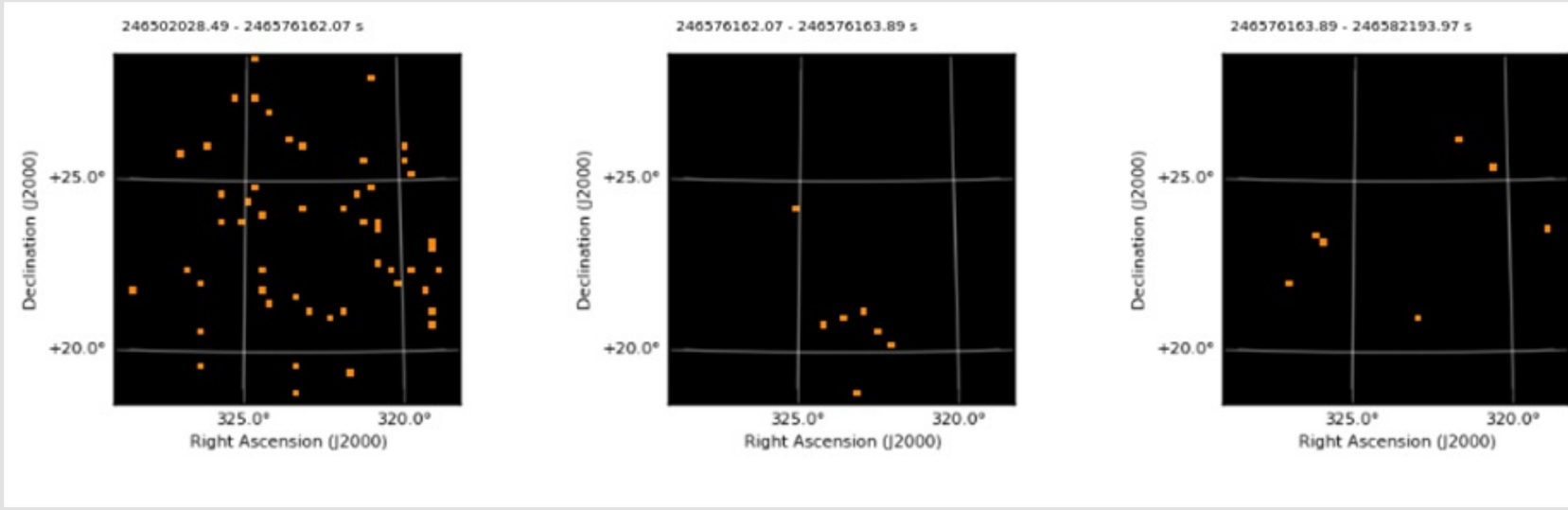
Transient above the Batman curve

(http://mathworld.wolfram.com/BatmanCurve.html)

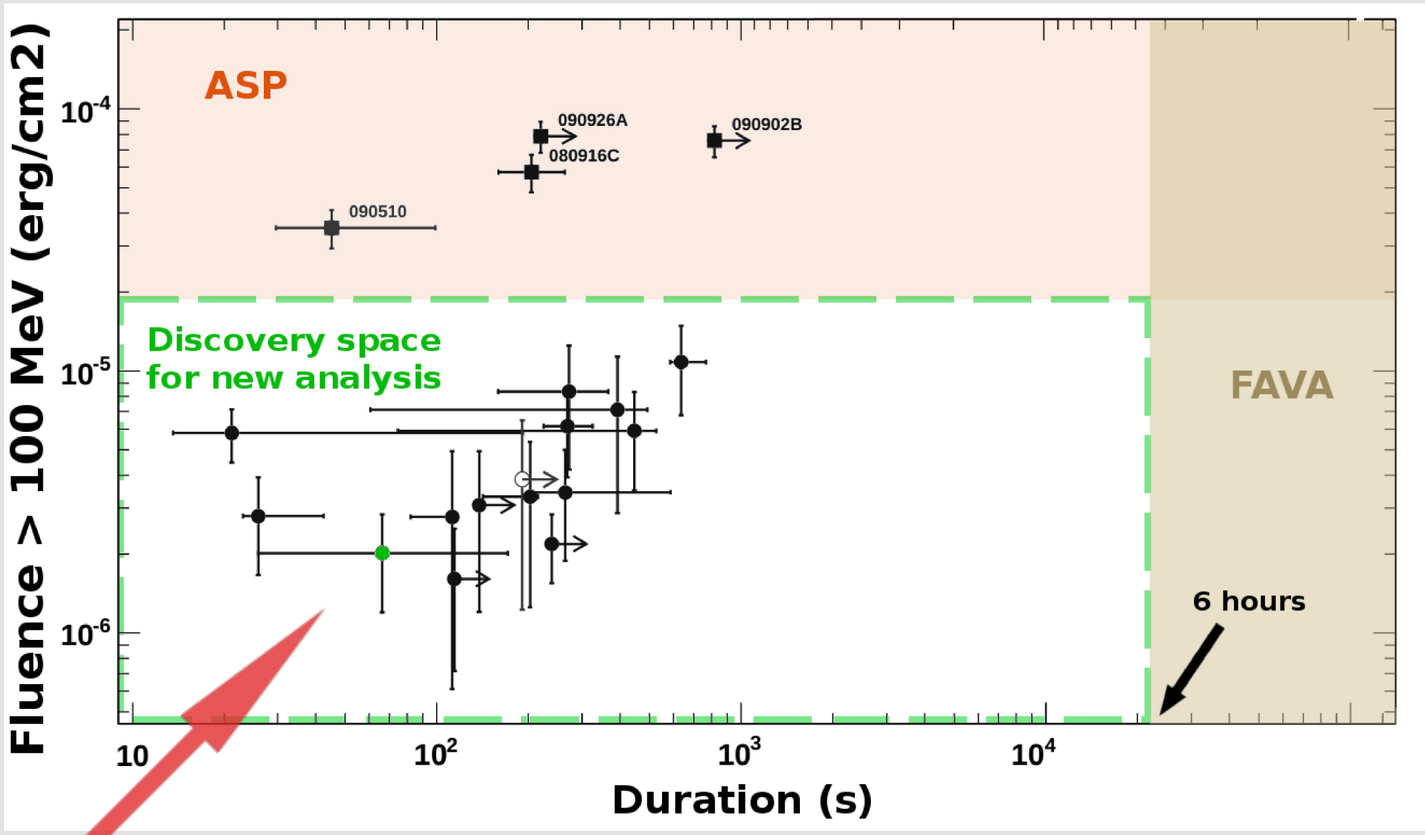
FIRST RUN

Two days with two known GRBs (a bright long one, and a faint short one not found by other algorithms)





Truly sampling a new discovery space



BOTTOM LINE

- LTF-blind is coming online: a scale-agnostic blind-search algorithm for short-duration transients
- Covers the parameter space which is no cover by currently running algorithms
- Stay tuned!