Fermi

Gamma-ray Space Telescope

The first 100 LAT Gamma-ray Bursts:

a new detection algorithm and pass 8

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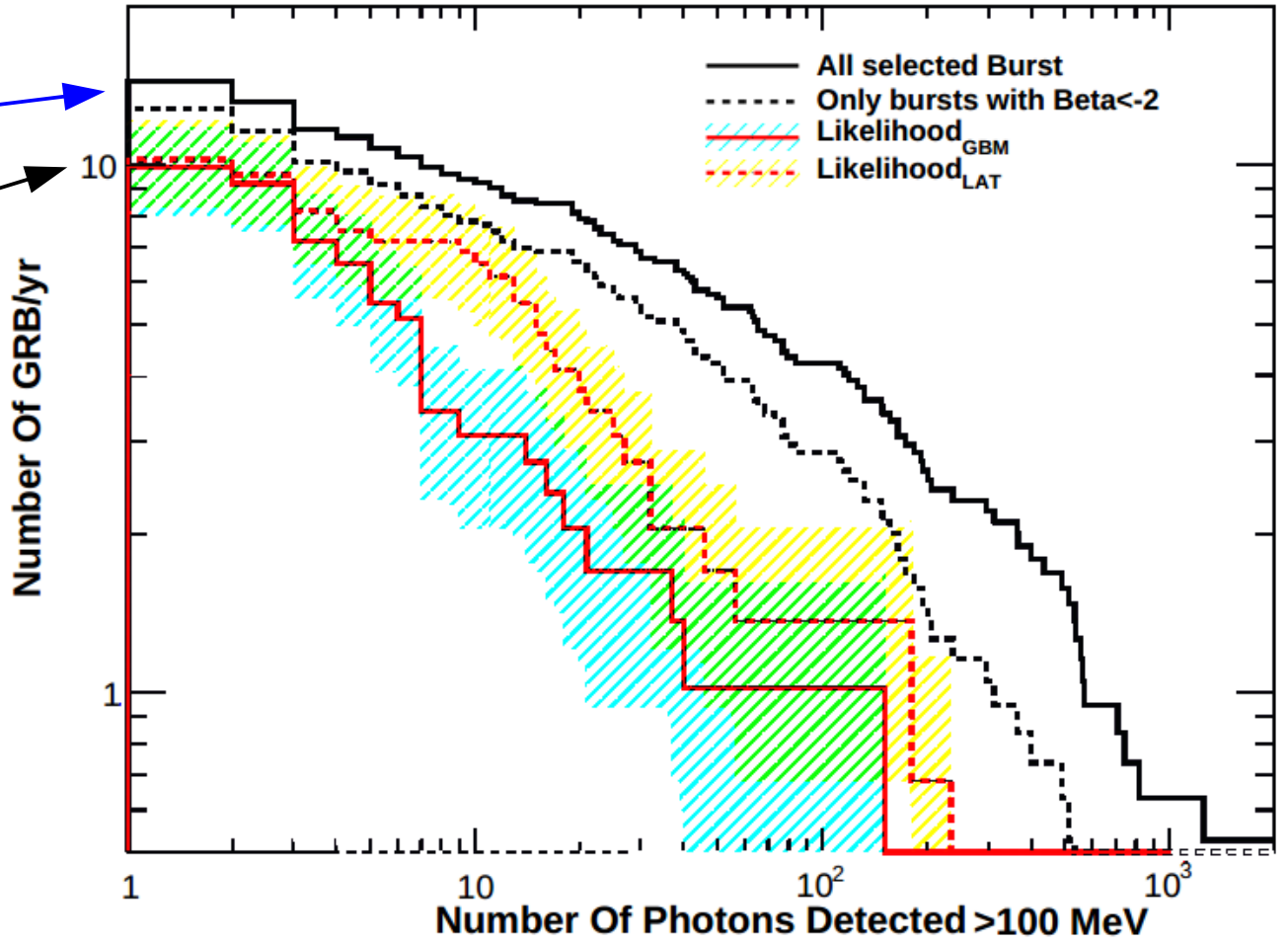
on behalf of the Fermi/LAT collaboration

The mystery of the missing GRBs:

Optimistic predictions?
New GRB physics?

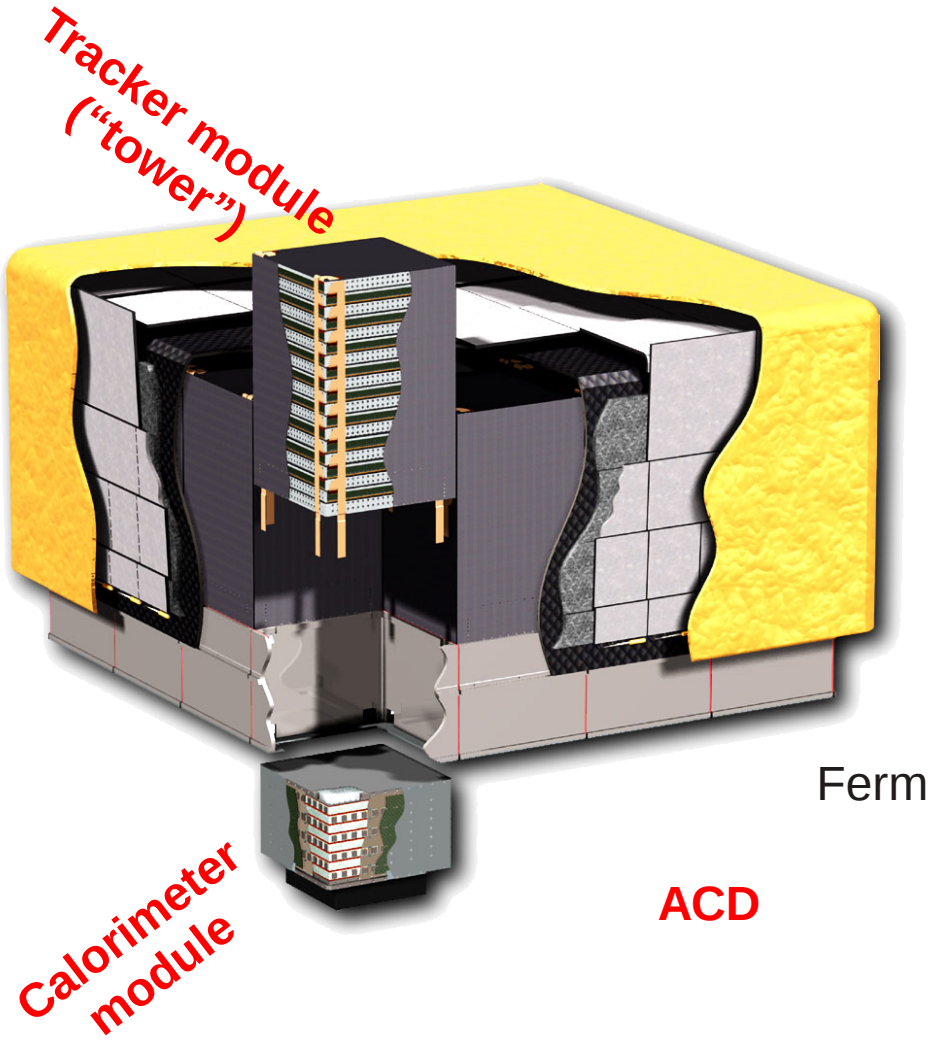
Expected: 12 GRB/y

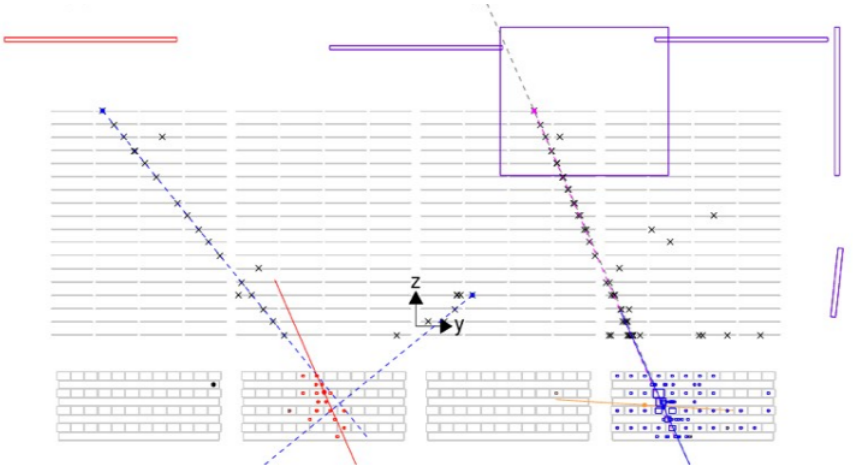
Observed: 9.5 GRB/year



(1st GRB catalog, Ackerman et al., 2013)

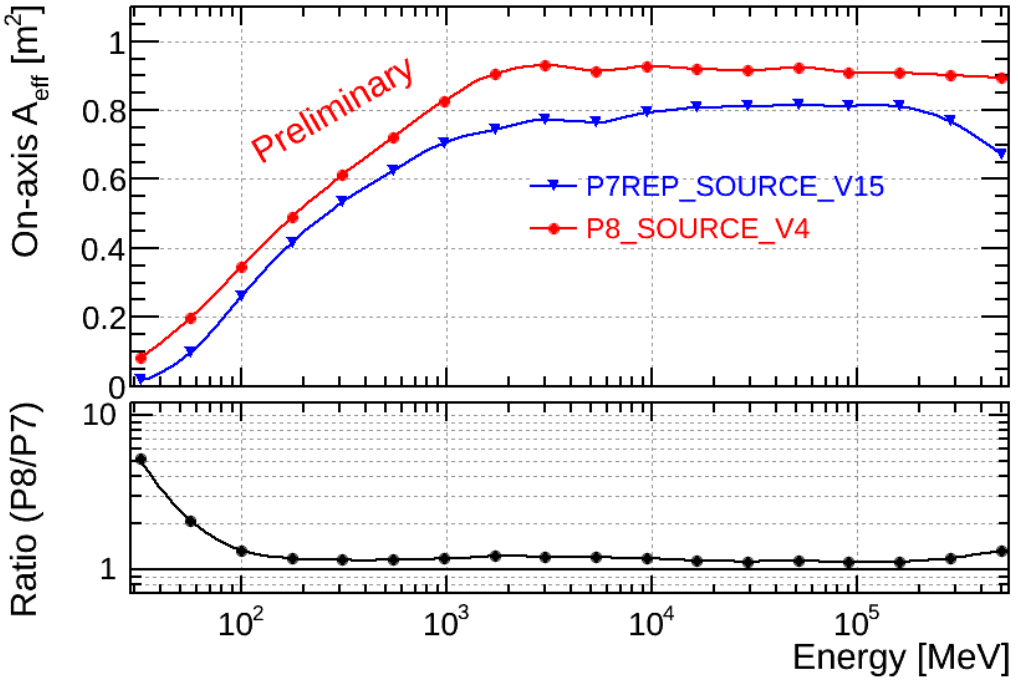
Pass 8 is a major review of the event analysis

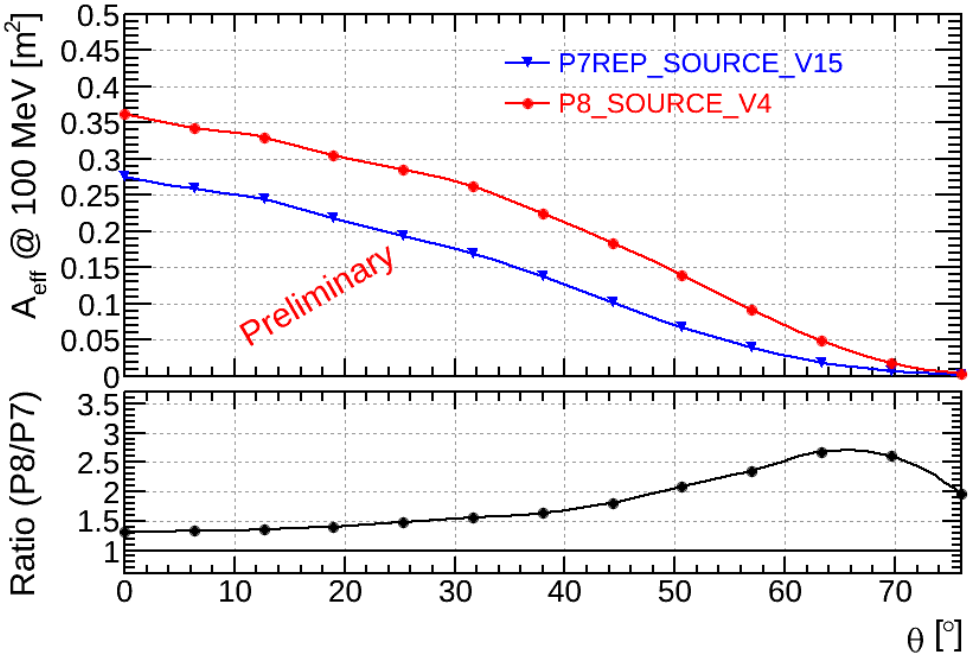




Fermi/LAT

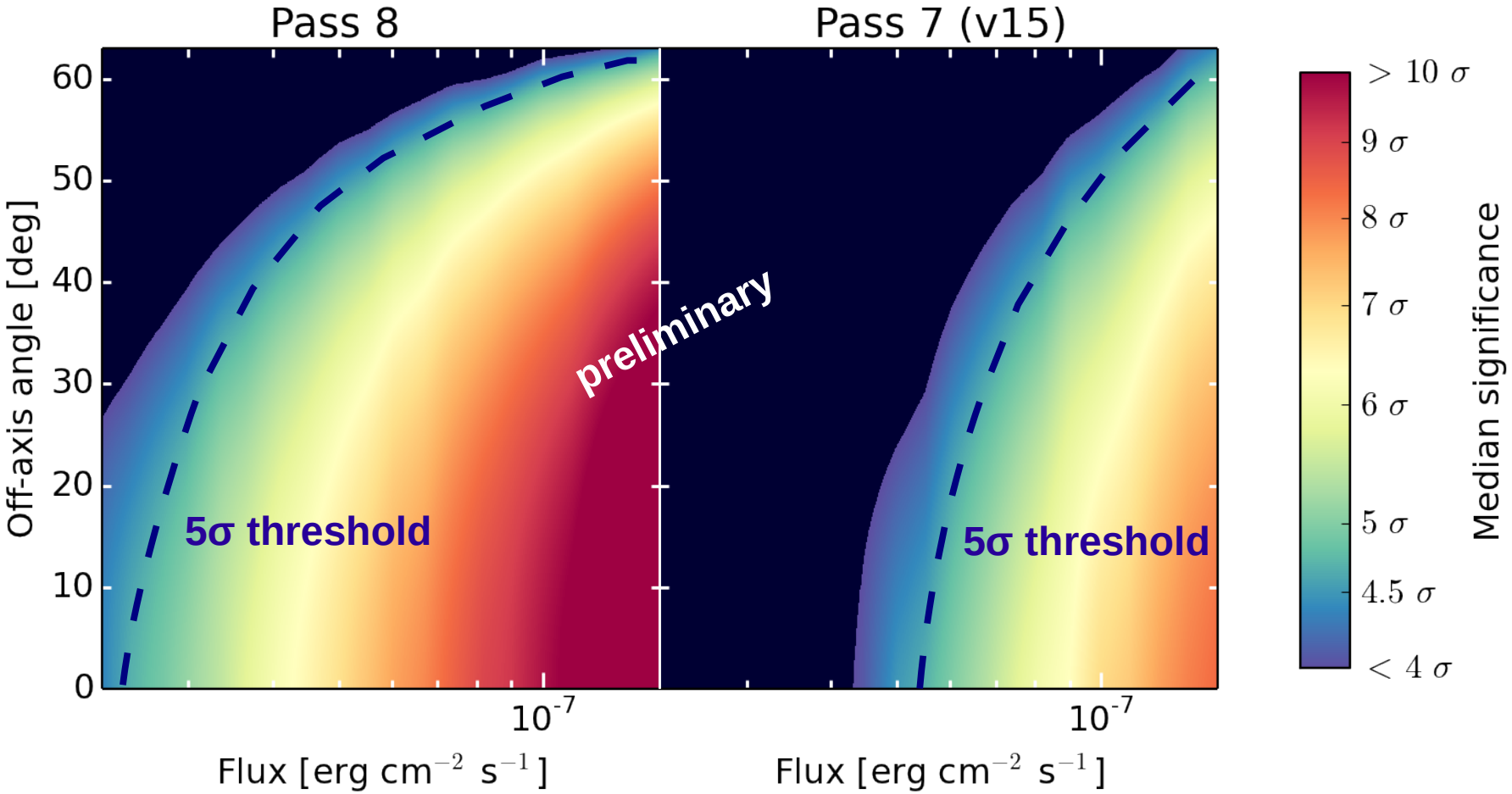
Pass 8: much improved science performance





See P. Bruel talk in the Analysis splinter

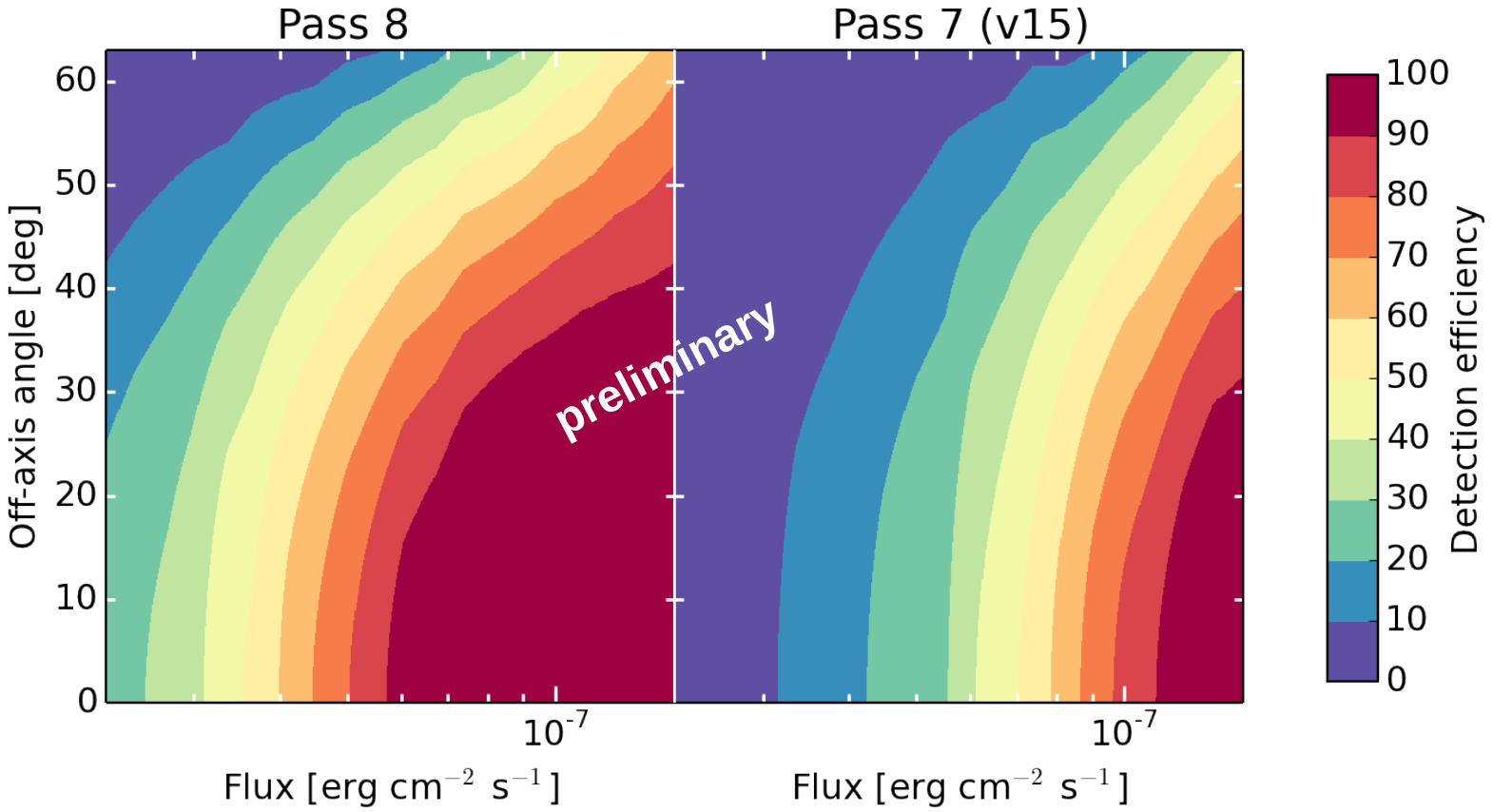
GRBs & Pass 8: lower flux threshold



(simulated 100 s GRBs on true background, Transient classes)

GRBs & Pass 8: more detections

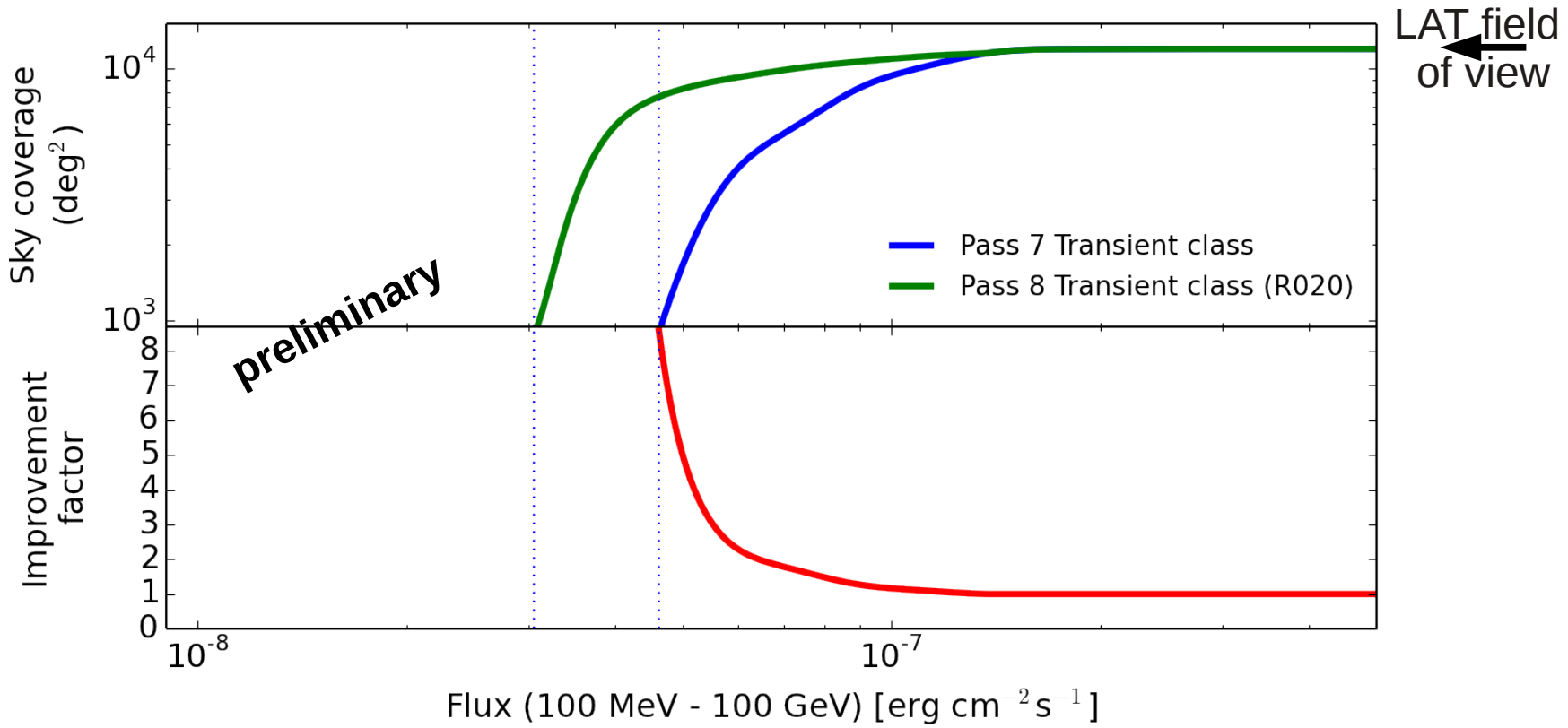
Which fraction of GRBs with a given flux are we able to detect at a given off-axis angle?



(simulated GRBs on true background, Transient classes)

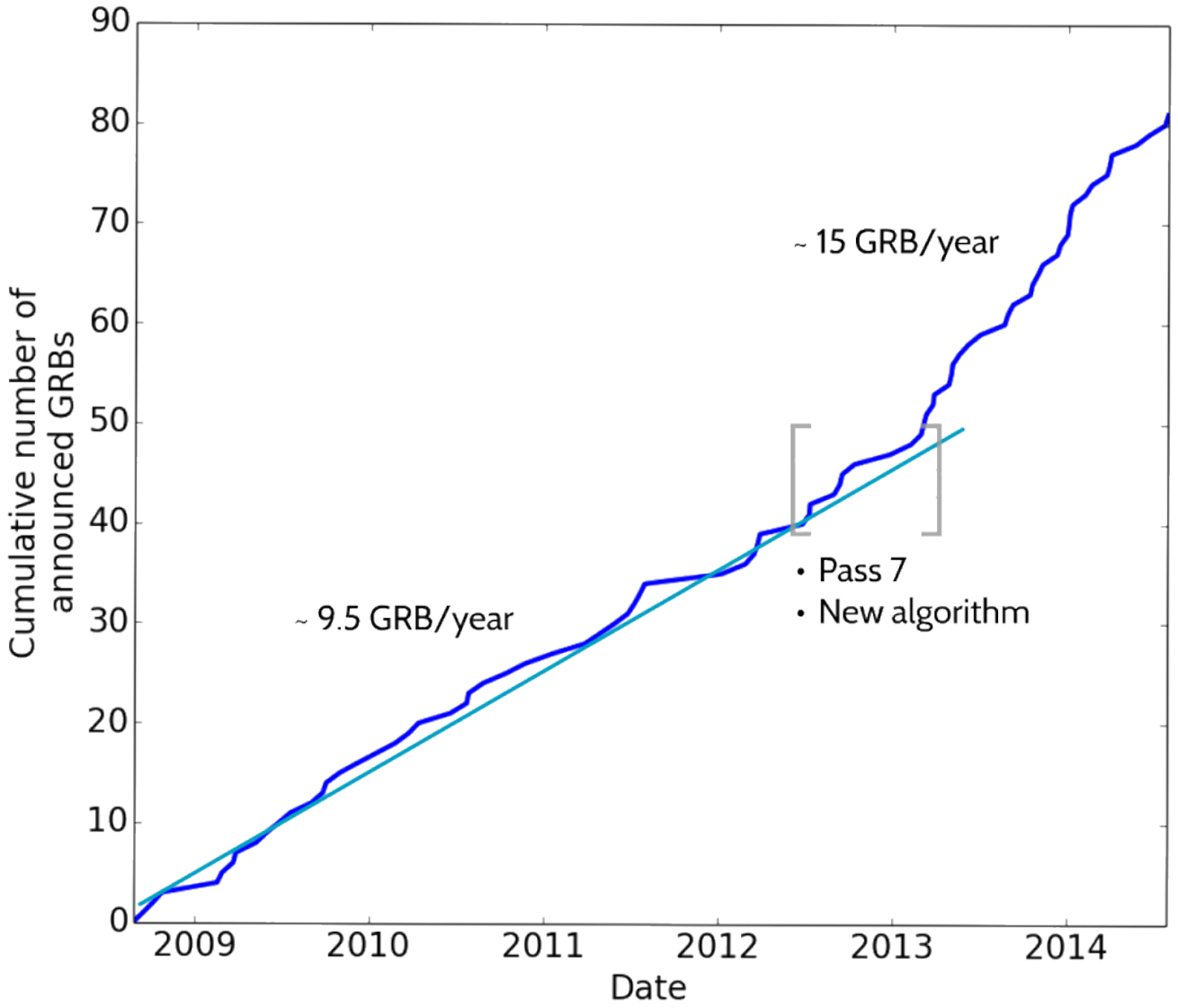
GRBs & Pass 8: better sky coverage

What is the solid angle within which we have a 50 % detection efficiency for a GRB with a given flux?



(simulated GRBs on true background, Transient classes)

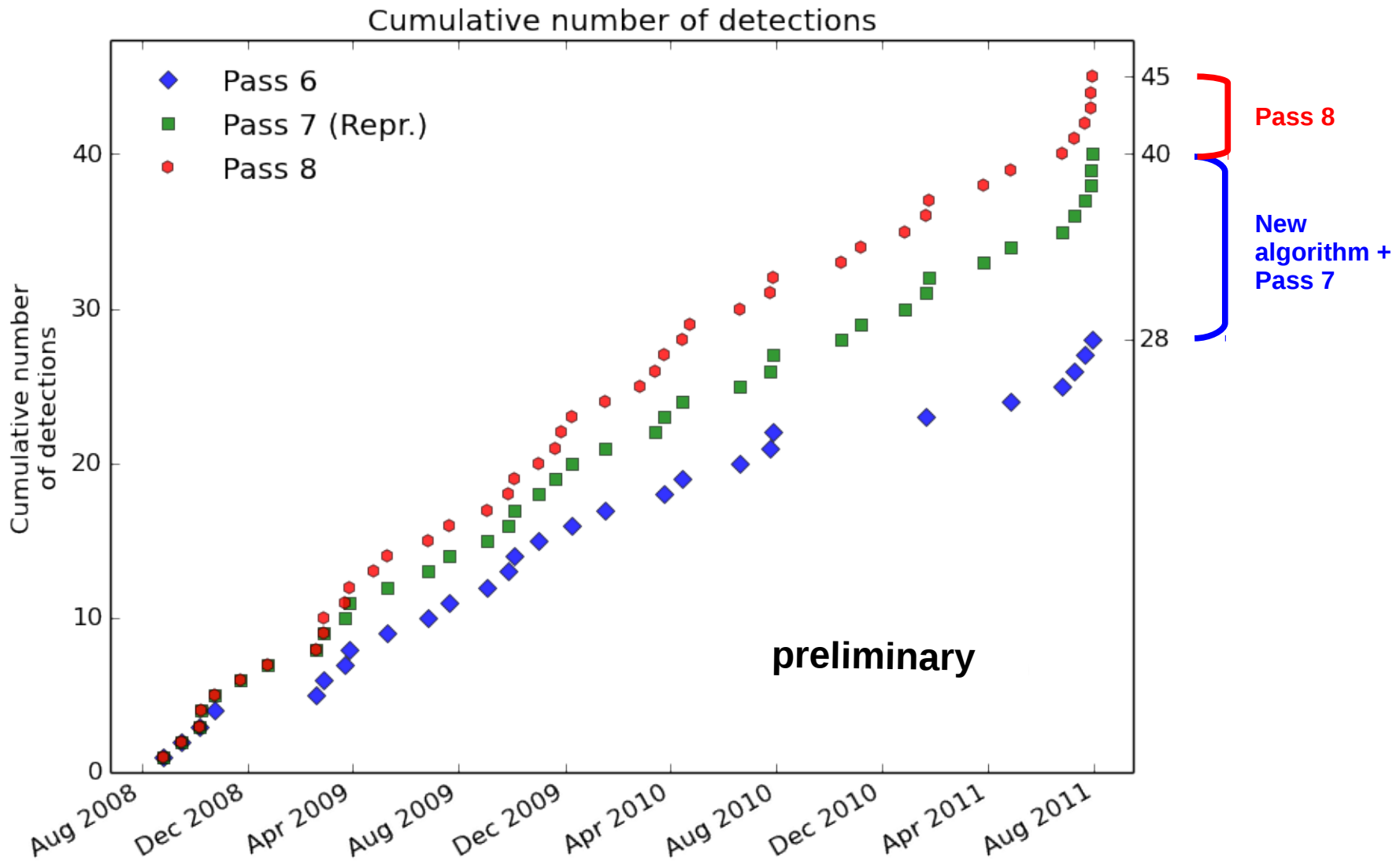
Another recent development: new GRB detection algorithm



(GCN circulars, no Pass 8 here!)

Put the two together:

→ 50% increase in detections



New algorithm + Pass 8

86 detections* (Pass 8 dataset, from 08/08 to 04/14)

\+ > 6 detections (predictions, based on Pass 7 analysis between April and today)

\+ > 15 LAT Low-Energy (LLE) detections

(counting analysis between ~20 MeV and 100 MeV)

> 100 LAT detected GRBs!

* for likelihood detections, TS threshold of 28

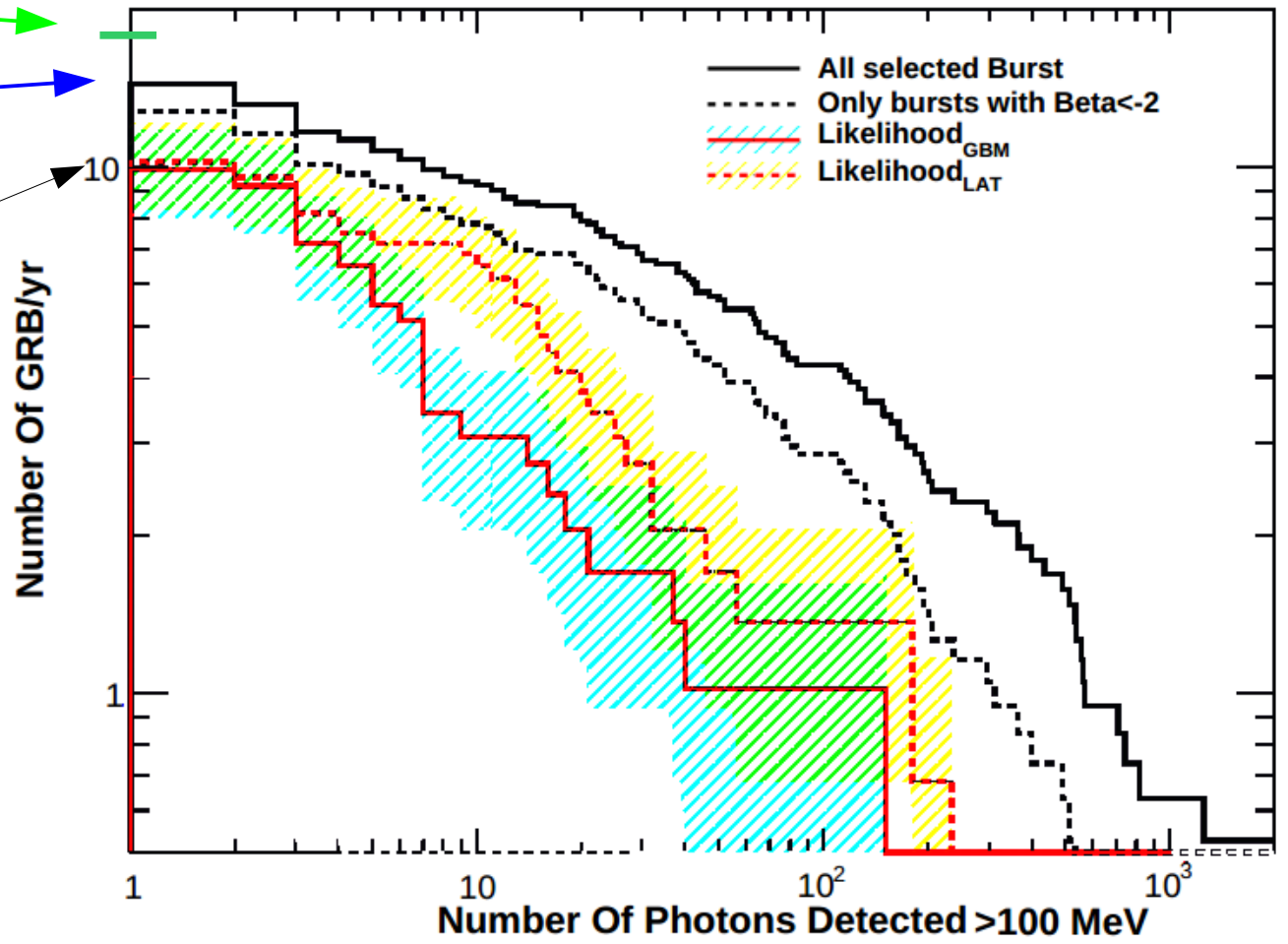
Now exceeding expectations

(Standard likelihood detections, no LLE)

Observed: 16 GRB/y

Expected: 12 GRB/y

Old catalog: 9.5 GRB/year

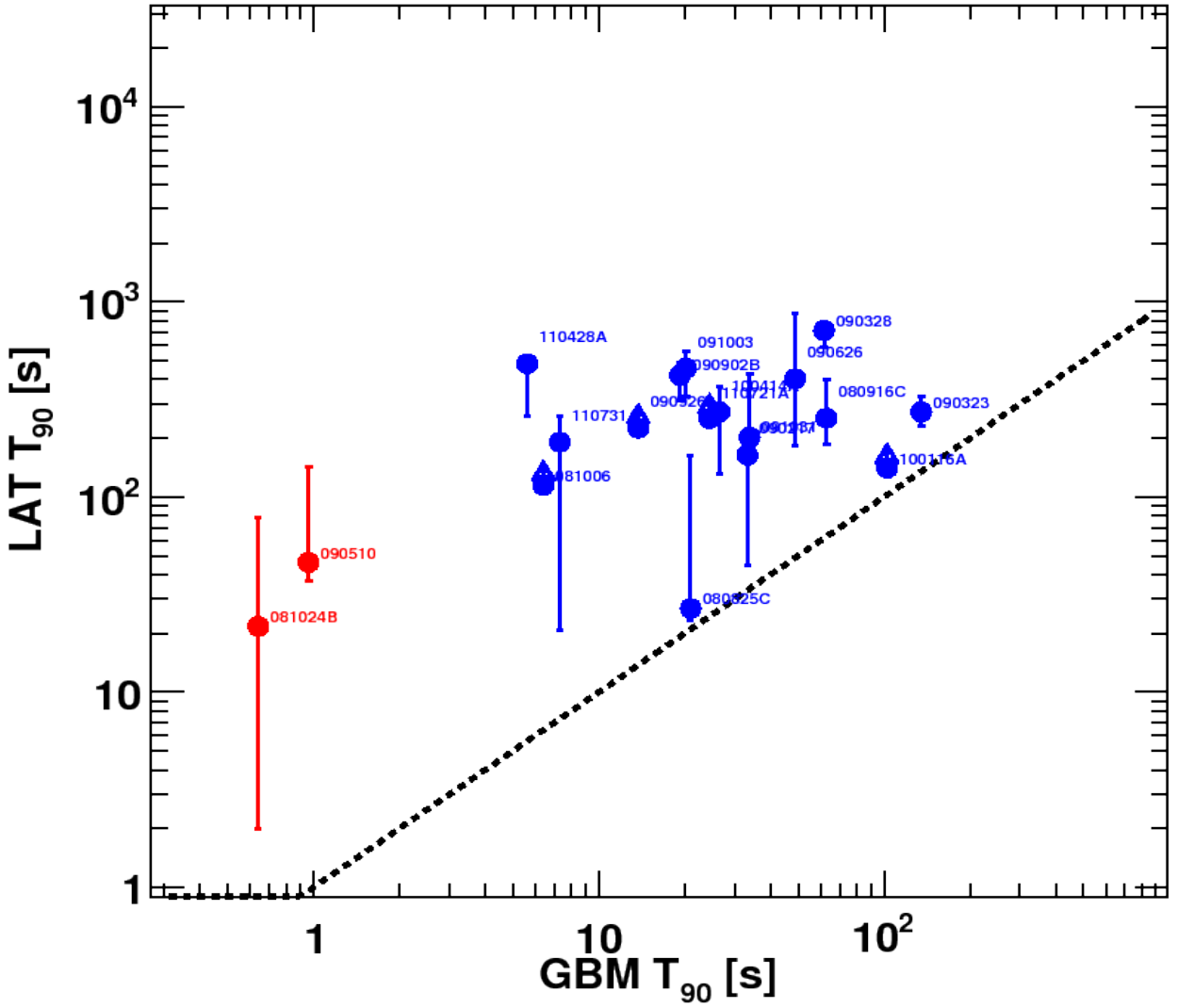


(1st GRB catalog, Ackerman et al. 2013)

What's new in the algorithm?

Lesson 1, from 1st GRB catalog:

LAT signal duration >> prompt emission

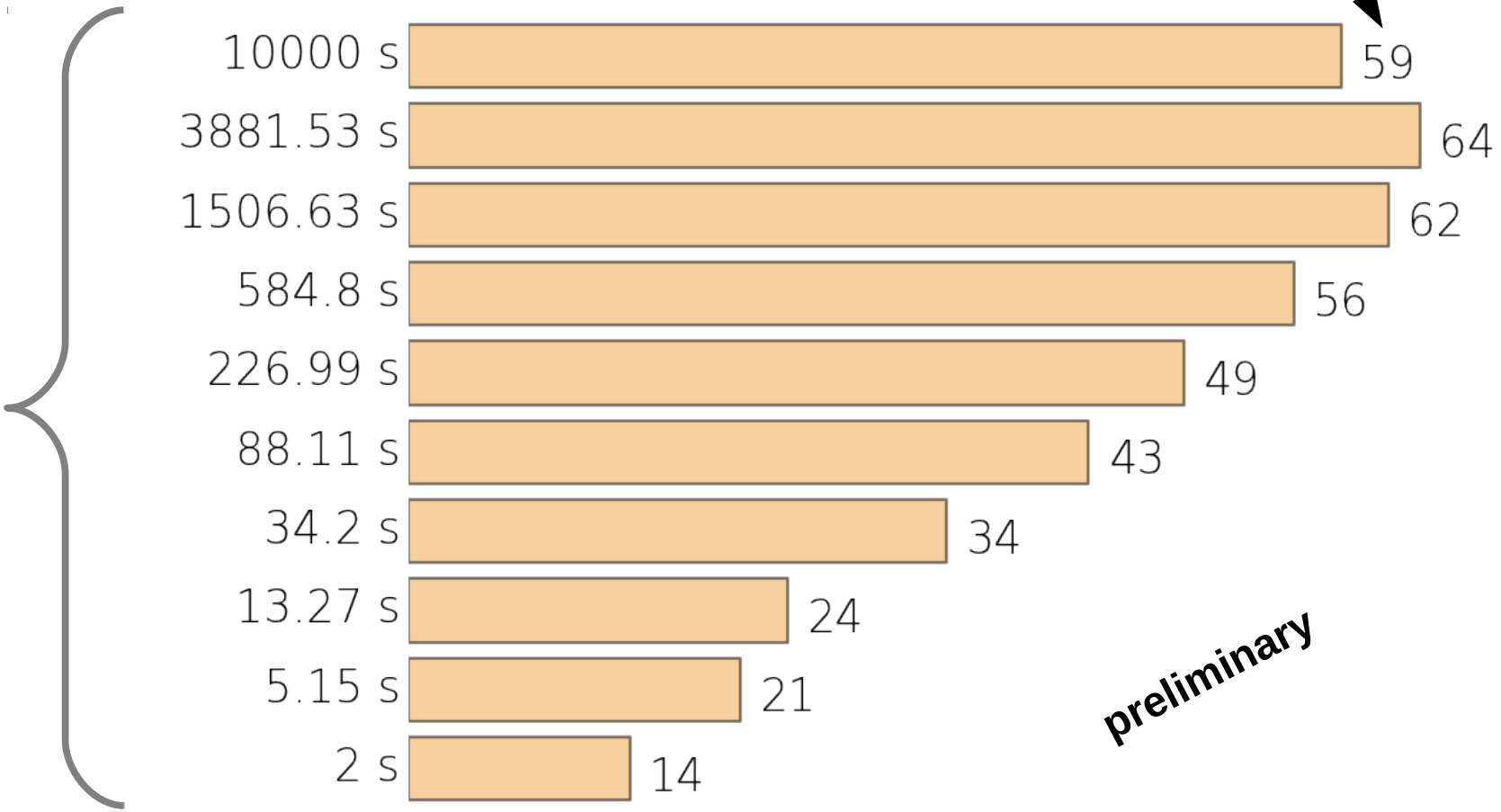


(First LAT GRB Catalog, Ackermann et al. 2013)

Lesson 1 learned:

10 time scales

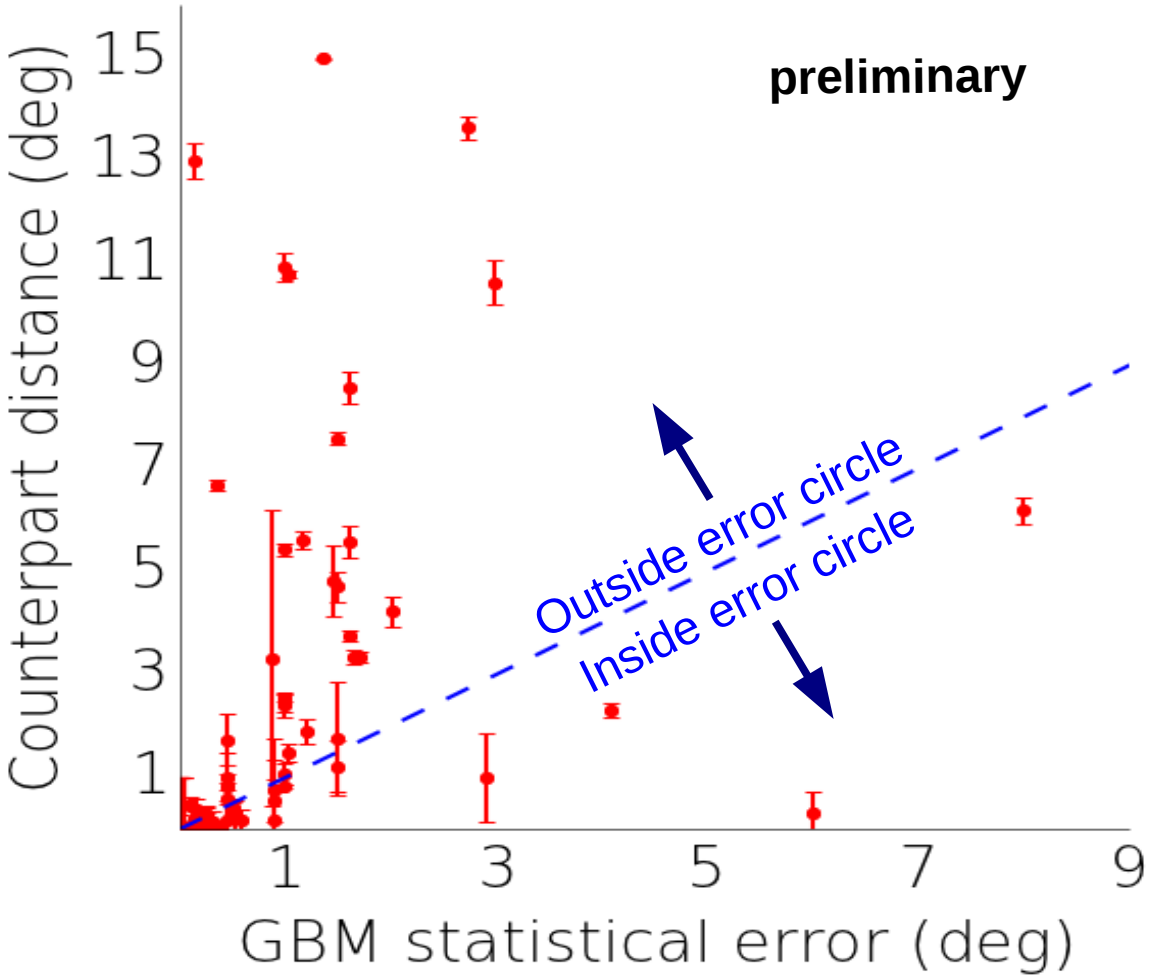
This is the number of bursts above the TS threshold for this time scale, among the 86 detections



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

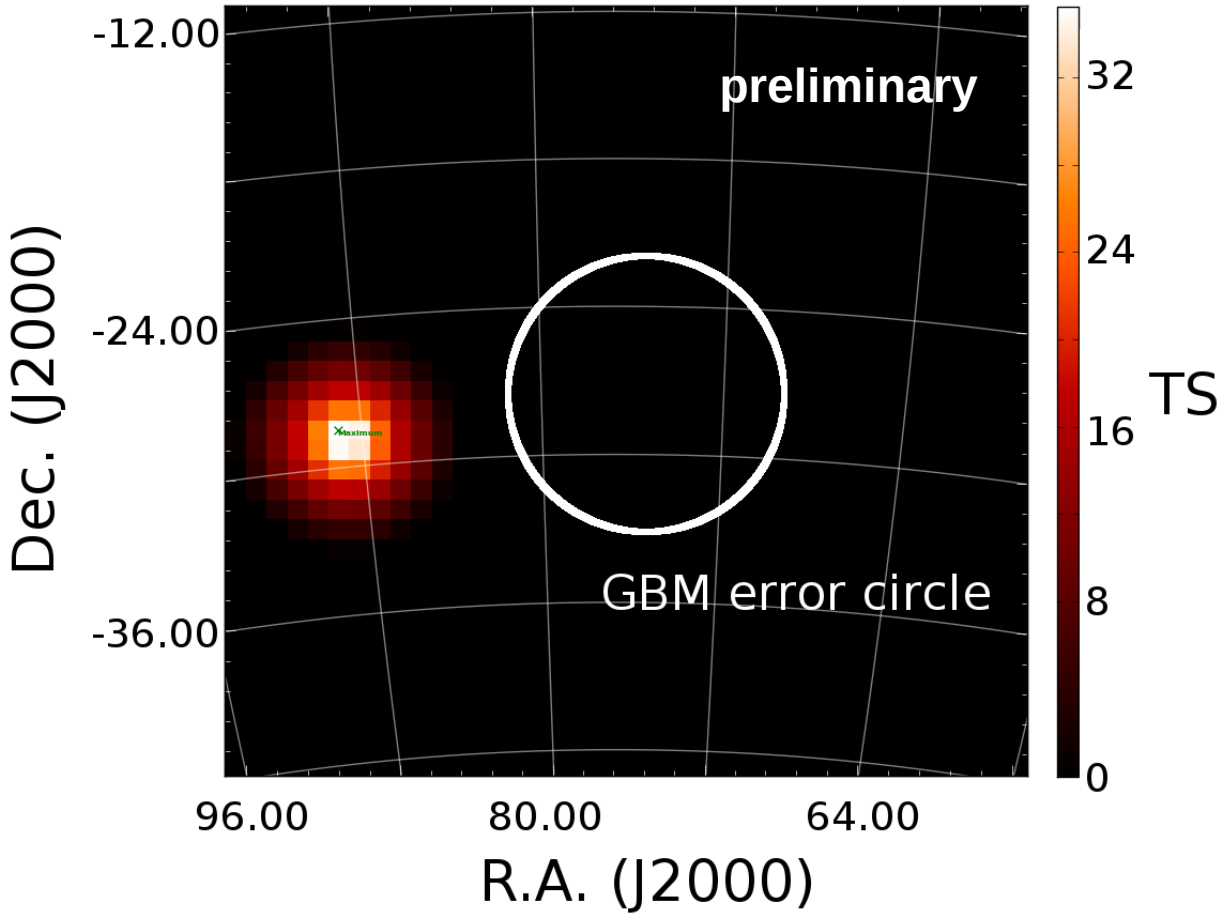
Lesson 2, from the GBM team:

systematic error in GBM localizations



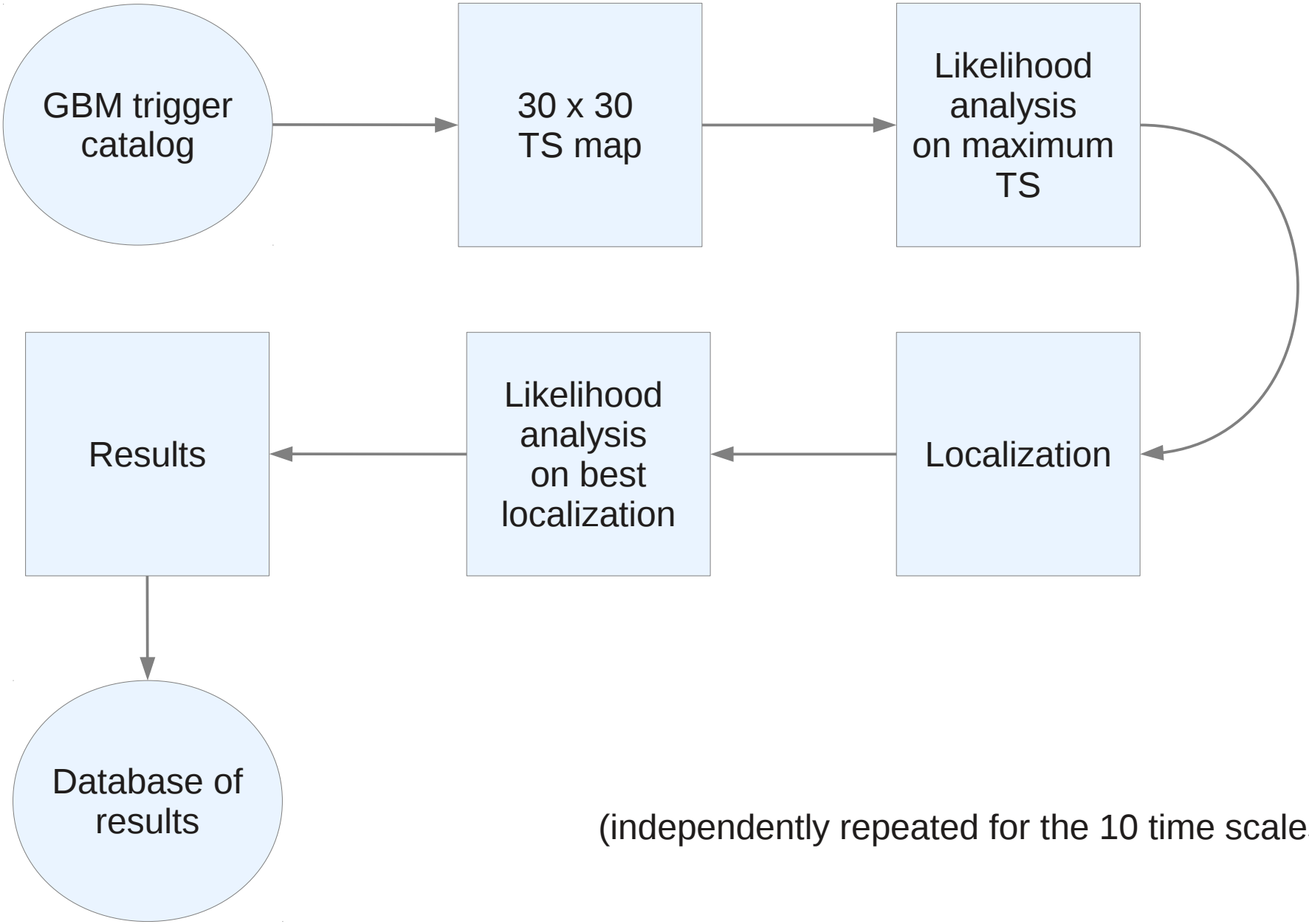
Lesson 2 learned:

30° x 30° finding map (TS map)



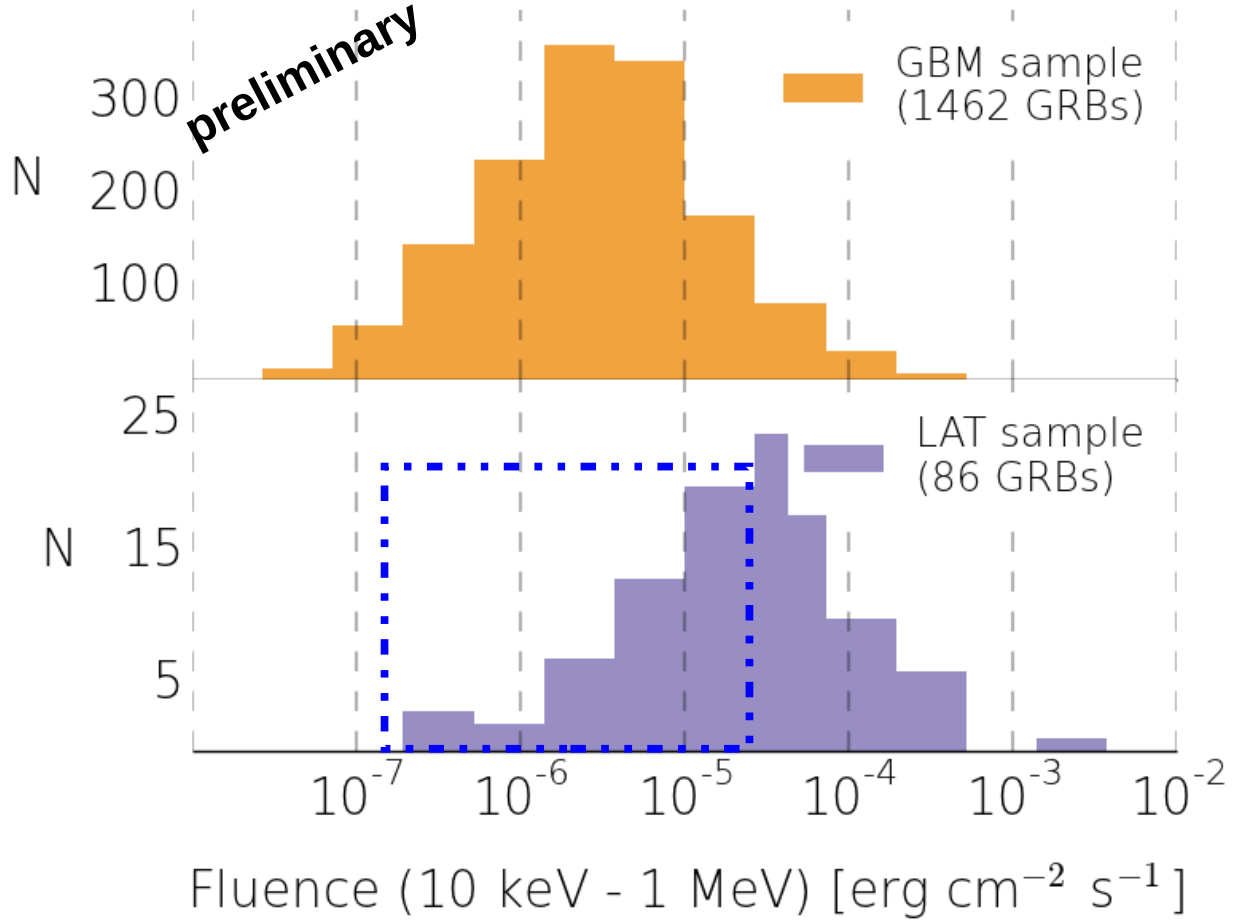
NOTE: now the GBM team releases localization contours which take into account systematic errors

The algorithm

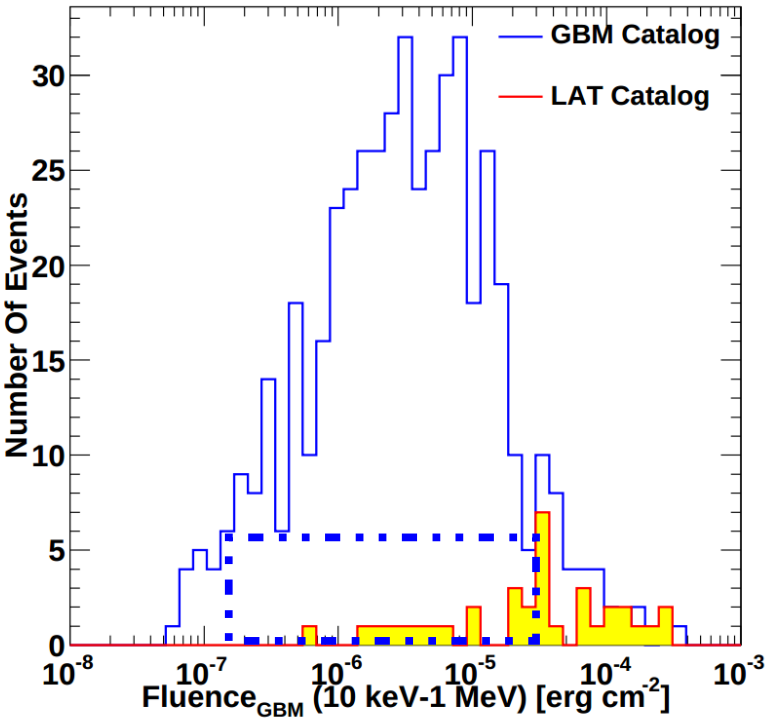


(independently repeated for the 10 time scales)

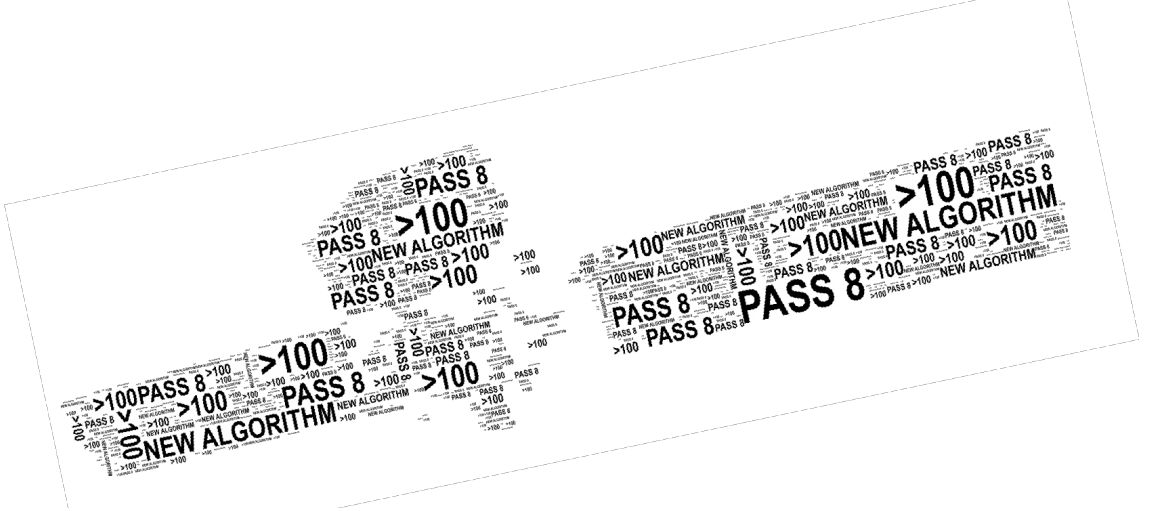
More sensitive:
more mid- and low-flux GRBs



(this work)



(Ackerman et al. 2013)



Pass8

newDetectionAlgorithm

First 100 GRBs

~~missing GRBs mystery~~

More GCNs

change Predictions For VHE