



## **Search for TGFs in AGILE data using time correlation with ground-based lightning data**

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Terrestrial Gamma-ray Flashes (TGFs) are bursts of high energy photons associated with lightning flashes produced in thunderstorms. The Astro-Rivelatore Gamma a Immagini Leggero (AGILE) satellite is one of the few satellites capable of detecting these events.

Comparing gamma-ray measurements by AGILE and lightning detected by the World Wide Lightning Location Network (WWLLN), it is possible to find TGF candidates using only time correlation between AGILE and WWLLN data. This new algorithm is not biased by previous selection criteria, e.g. spectral hardness ratio, and can therefore find new candidates which have been overlooked before. Similar procedures have been already successfully applied to data from the Fermi and RHESSI satellites. The ultimate goal is to contribute to answering the question: how common are TGFs?

Using three different datasets collected by the Mini-Calorimeter (MCAL) instrument onboard AGILE a list of new TGF candidates has been obtained. The first dataset is from 2008 to 2015 when the anticoincidence (AC) shield was turned on. This system rejects signals from charged particles and makes it inefficient in the detection of TGFs.

The second dataset is from March-June 2015. In this time period the veto signal of the AC shield was disabled for the MCAL, reducing the instrument downtime, and resulting in a highly enhanced TGF detection rate and excellent TGF detection capability.

The third dataset starts from July 2015, when an issue with the onboard GPS caused a degradation of the AGILE microsecond timing performance. This third dataset could not be analyzed based only on time correlation between WWLLN and MCAL. A new method was developed allowing to find new TGF candidates by also taking into account the number of counts per time bin in the MCAL data. A threshold was selected to reject likely background fluctuations in order to enhance signal to noise ratio.

Moreover, assuming perfect time correlation between the WWLLN match and the TGF, these events may be used to further improve the timing accuracy of the AGILE data after July 2015.