Search for GeV counterparts of TeV sources in the AGILE-GRID data

LONGO, F. , **LUCARELLI, F.,** PITTORI, C., RAPPOLDI, A., VERRECCHIA,F.
(presented by F. Verrecchia)

Two "lifes" of AGILE

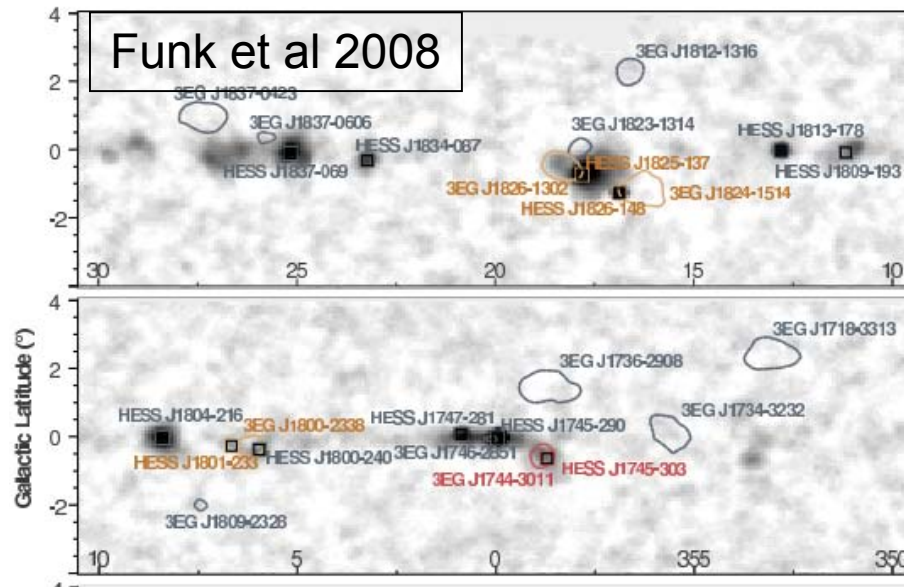|	AGILE-POINT	AGILE-SPIN
time period	Jul.07 – Oct.09	Nov. 2009 - today
attitude	fixed	variable (spinning ~ 1°/sec)
sky coverage	1/5	~ 70-80 %
1-day exposure (≤ 30 deg off-axis, @ 100 MeV)	~ 2×10^7 $(cm^2 \ sec)$	$(0.5-1) \times 10^7$ $(cm^2 \ sec)$

1-yr Flux sensitivity in spinning (E>100 MeV):
$1 \div 8 \times 10^{-7}$ ph cm^{-2} s^{-1}

GeV-TeV correlation

HESS-EGRET correlation

Funk et al 2008

TeV-0FGL/1FGL correlation

Tam et al 2010, 2011

- Spatial correlation.
- SED studies => emission mechanisms.
- Identification of UNID TeV sources.
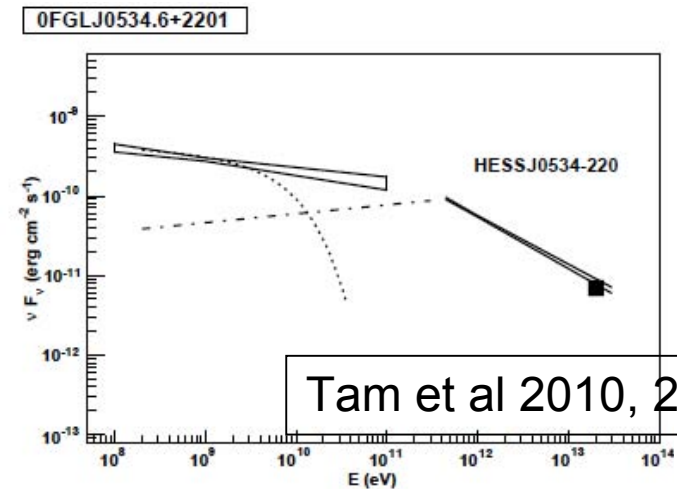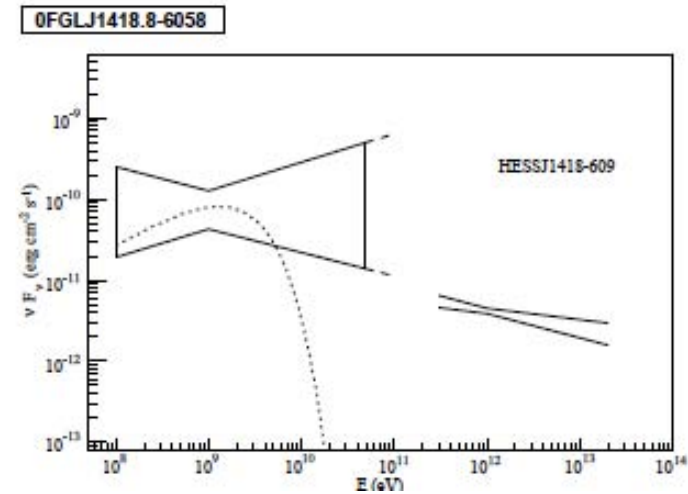
AGILE results on specific TeV sources

- **Extra-galactic:**
  - Mkn 421 (Donnarumma et al. 2009, ApJ 691)
  - S5 0716+714 (Giommi et al. 2008 A&A 487, Chen et al. 2008 A&A 489)
  - W Comae (Acciari et al. 2009, ApJ 707)
  - PG 1553+113 (Aleksic et al. 2010, A&A 515)
  - PKS 1510-089 (Pucella et al. 2008, A&A 491, D'Ammando et al. 2009, A&A 508)
- **Galactic:**
  - IC 443 (Tavani et al. 2010, ApJL 710)
  - SNR W28 (Giuliani et al. 2010, ApJL …)
  - Cygnus X-1 (Sabatini et al. 2010, Del Monte et al 2010)
  - Vela X (Pellizzoni et al 2010, Science 327)
  - Crab Nebula (Tavani et al. 2011, Science 311)

Systematic Search for TeV counterparts

Rappoldi et al. (2009), Lucarelli et al.(2011)

- **Complete automated search for E>100 MeV sources spatially correlated with known TeV sources.**

- **Using AGILE-GRID <u>pointing period</u> of 2.3 yrs**

- **Official GRID public data archive provided by ASDC.**

- **Data analysis criteria: multi-source Maximum Likelihood (ML) analysis around the TeV position (Mattox et al. 1996, Chen et al. 2010)**

TeV source input list

http://tevcat.uchicago.edu/

The TeV sky up to Apr.'11
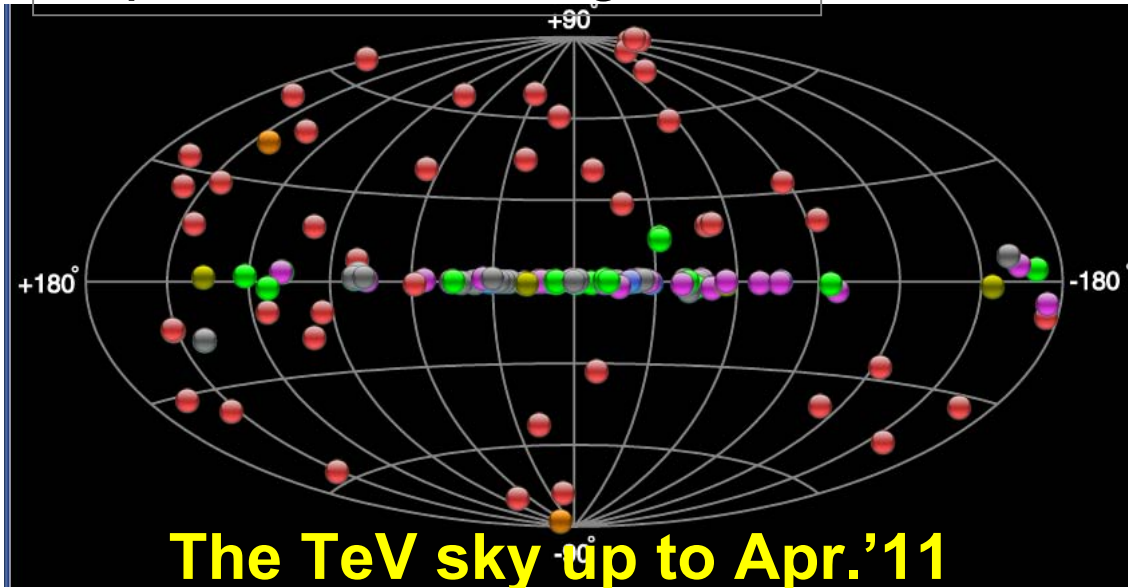
PWN 24
Starburst 2
AGN 45 (HBL 29)
Other Galact 3
SNR /MC   14
UNID   25
PSR, XRB 3
__Total: 116 sources__

Revision of all TeV positions made at @ ASDC
(Carosi, Lucarelli, Antonelli and Capalbi)

**New TeV source catalog now available at the ASDC
interactive web pages (**http://www.asdc.asi.it/tgevcat/**)**

Preliminary Results

Source Class	TeV Catalog	Detections sqrt(TS>4)
AGN (HBL, LBL, …)	45	10
Starburst	2	--
PWN	24	8
SNR	14	5
XRB	3	1
UNID	25	6
Other Galactic	3	1

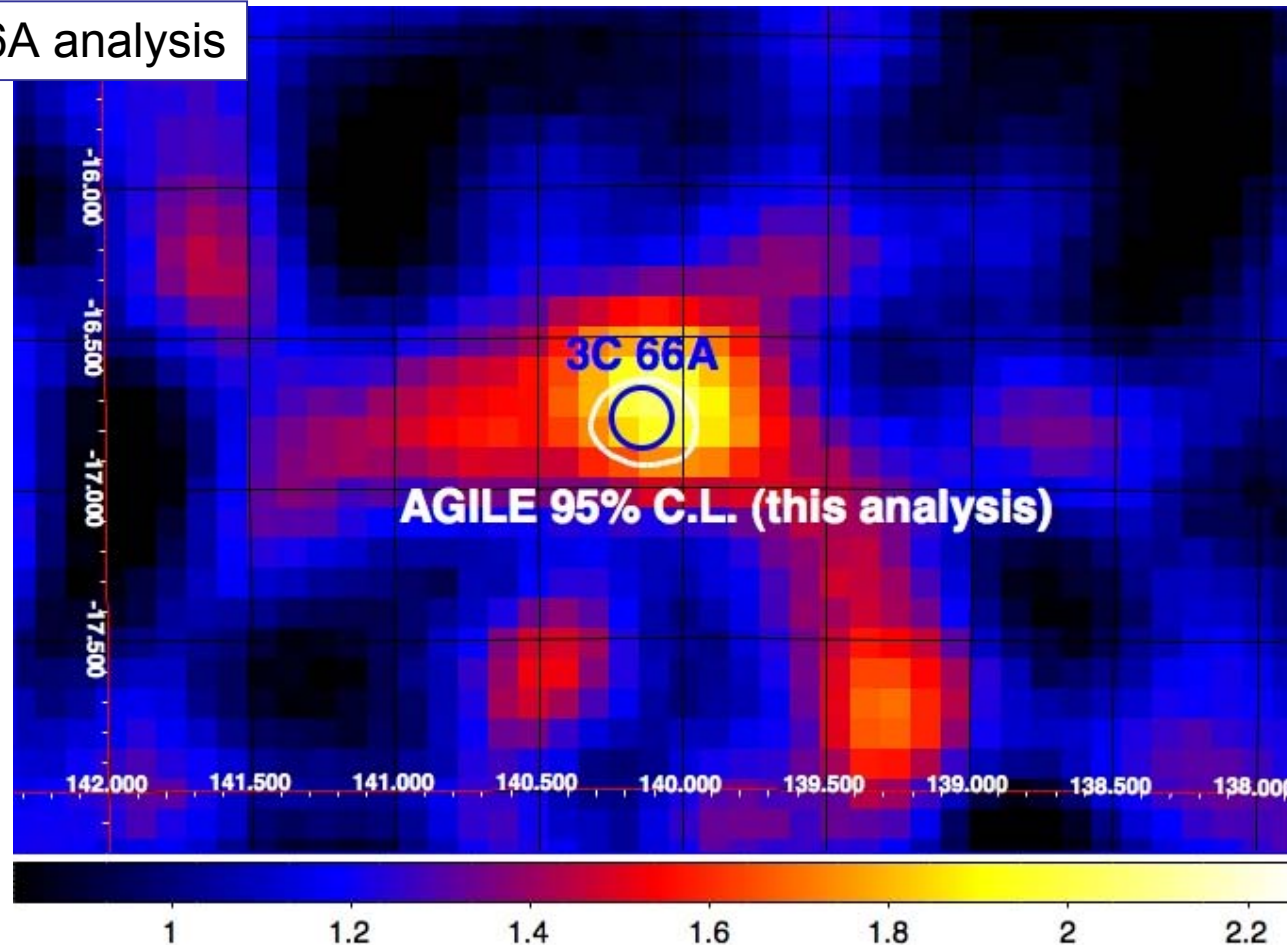~30% of TeV sources show counterparts in AGILE first 2.3yrs data

Preliminary Results

Example: 3C 66A analysis

Source included and detected in a variability analysis of the full Pointing OB archive, on an updated source list

(Verrecchia et al. to be submitted)

A few GRID detections (1-2 HBL, few Galactic) not in 2FGL Cat.

AGILE-GRID lightcurves (E>100 MeV)

- **GRID Level 3 Archive: 1-day integration EXP, COUNTS and GAS maps produce from the official LV2STD AGILE archive, covering the whole AGILE data.**

- **Using GRID L3 archive, we can investigate the behaviour of the TeV AGN sources at GeV energies over ~6 years (July 2007 -- Aug. 08 not covered by Fermi-LAT), producing lightcurves with different binning (7- and 28-days).**

Comparison with the Pointing OB analysis source sample lightcurves

MWL campaign on TeV sources

- **1ES2344+514 (Rugamer et al., arXiv:1211.2608v1)**
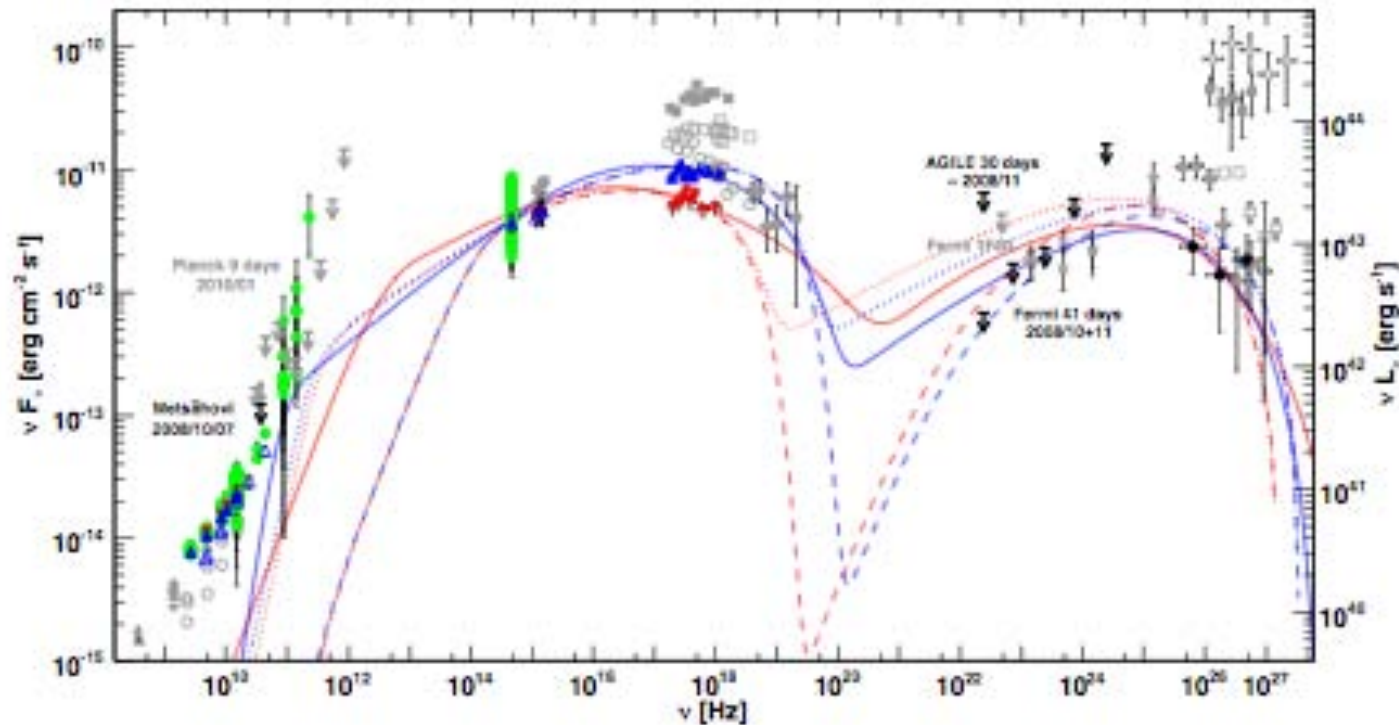
More to come: PKS1510 (Feb. 12 flare), Mrk180, 1ES1011+496.

Summary

- A systematic search of MeV-GeV counterparts of TeV sources in the AGILE first 2.3 yrs of data has been performed.

- The preliminary results show E>100 MeV counterparts for ~30% of the 116 TeV sources analysed.

- Detailed analysis is ongoing.

- Upgrade of the analysis using latest calibration matrices (I0023) and updated TeV source catalog is ongoing.

- GRID Level 3 Archive helps to investigate flaring activity over more than 5 years of data in a very short computing time.