

AGILE Data Center 2017

C. Pittori (coord), F. Lucrelli, F. Verrecchia (INAF), G. Fanari (TPZ/Serco)

“AGILE is 10”
15th AGILE WS, May 23-24, 2017

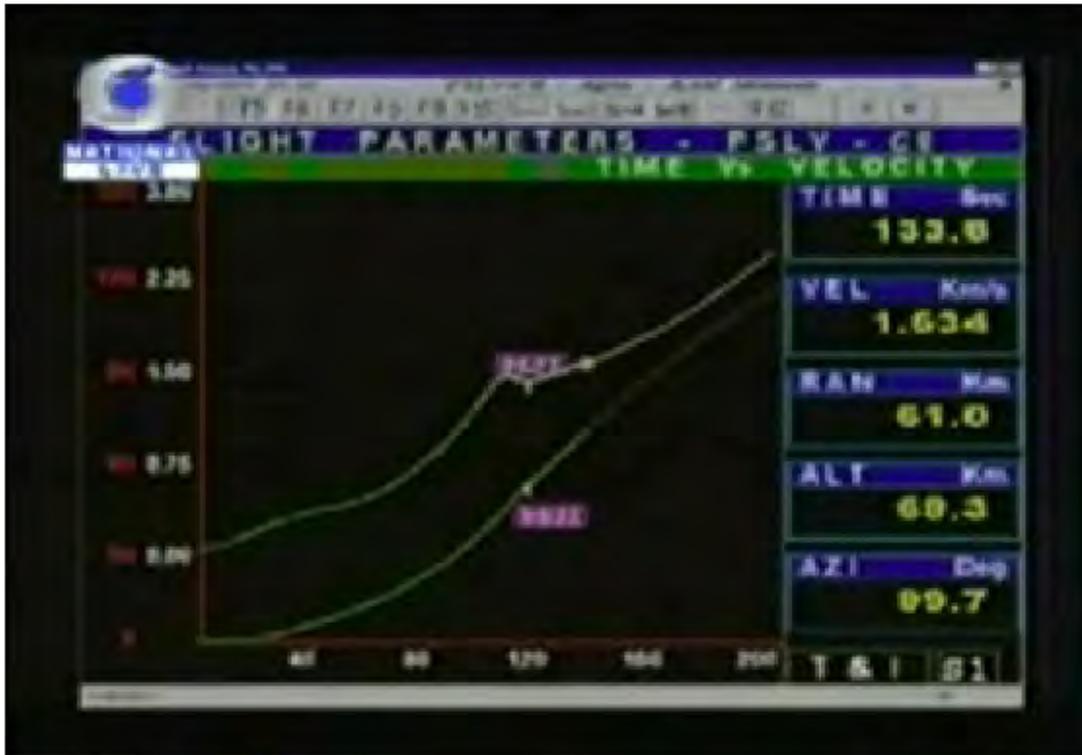


2007-2017: AGILE is 10!

India April 23, 2007: Launch



550 Km, $< 3^\circ$ inclination angle



AGILE launch event
as seen **live** in
Telespazio Control
Center in Fucino

Personal though:
1999-2007: more
than 8 years of
work hanged on a
two-hour show...





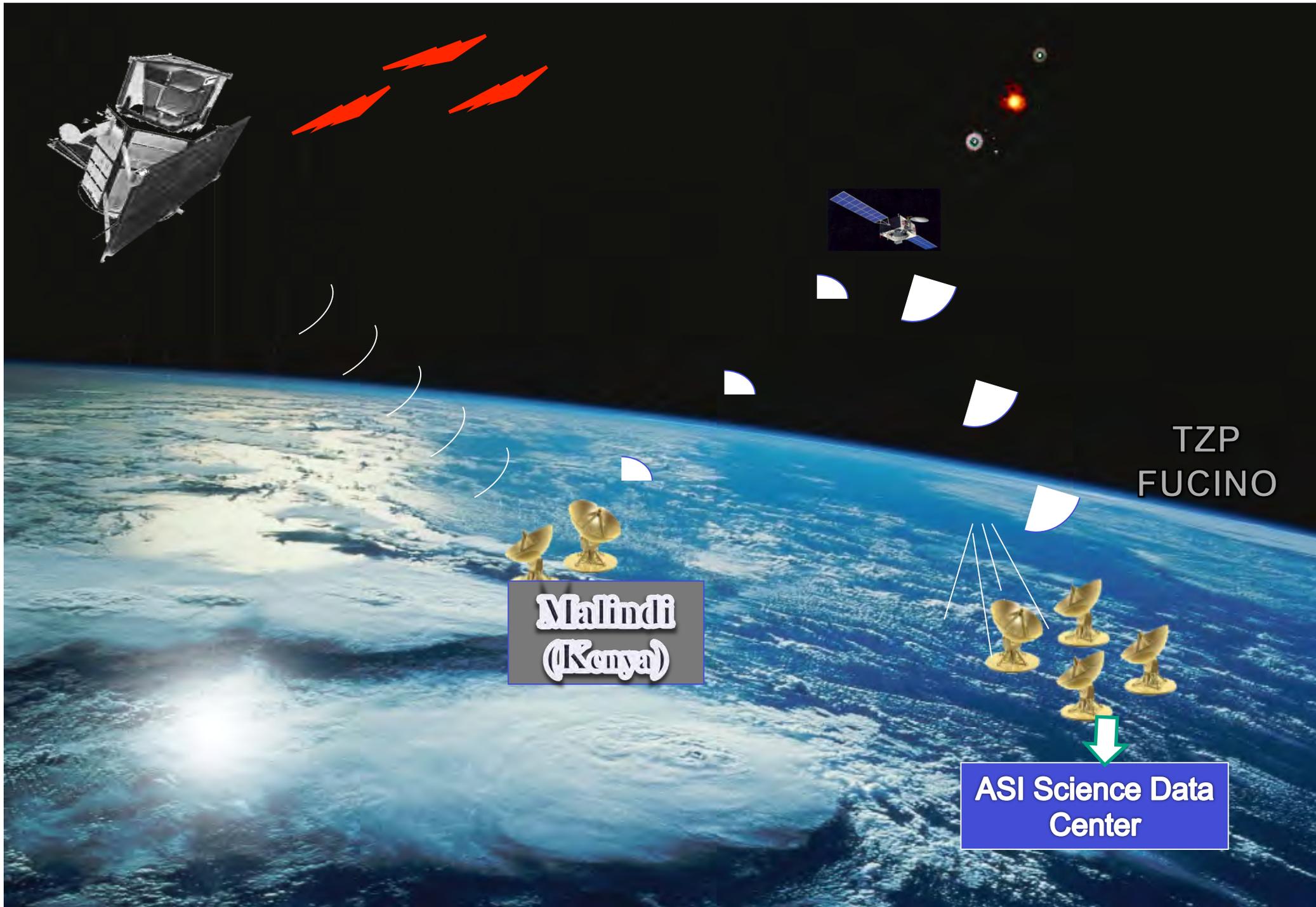
“La sofisticata macchina è partita alle 12 (ora italiana) dalla base di Shriharikota in India, ventitre minuti dopo è entrata in orbita a circa 550 Km di altezza sull’ Equatore e **alle 13,30 ha mandato a Terra i primi impulsi!**”

E’ fatta!

From Italian press release:

“Il satellite AGILE ora sta girando attorno all’ equatore terrestre e passa sopra la stazione di terra ASI a Malindi circa **ogni ora e mezza**. Fin dal primo “contatto” invia i suoi dati ogni ora e mezza al Fucino e da lì **all’ ASI Science Data Center (ASDC)**”





Malindi
(Kenya)

TZP
FUCINO

ASI Science Data
Center

THE WAY WE WERE:

Gruppo AGILE ad ASDC (2007/2008)



A. Antonelli, G. Fanari, B. Preger, C. Pittori, F. Verrecchia, D. Gasparrini, F. Acerra, S. Stellato

M. E. Pennisi, S. Cutini, P. Santolamazza, R. Primavera (assente)

(ASDC-INAF + DATASPAZIO)



Paolo Giommi
ASDC Director



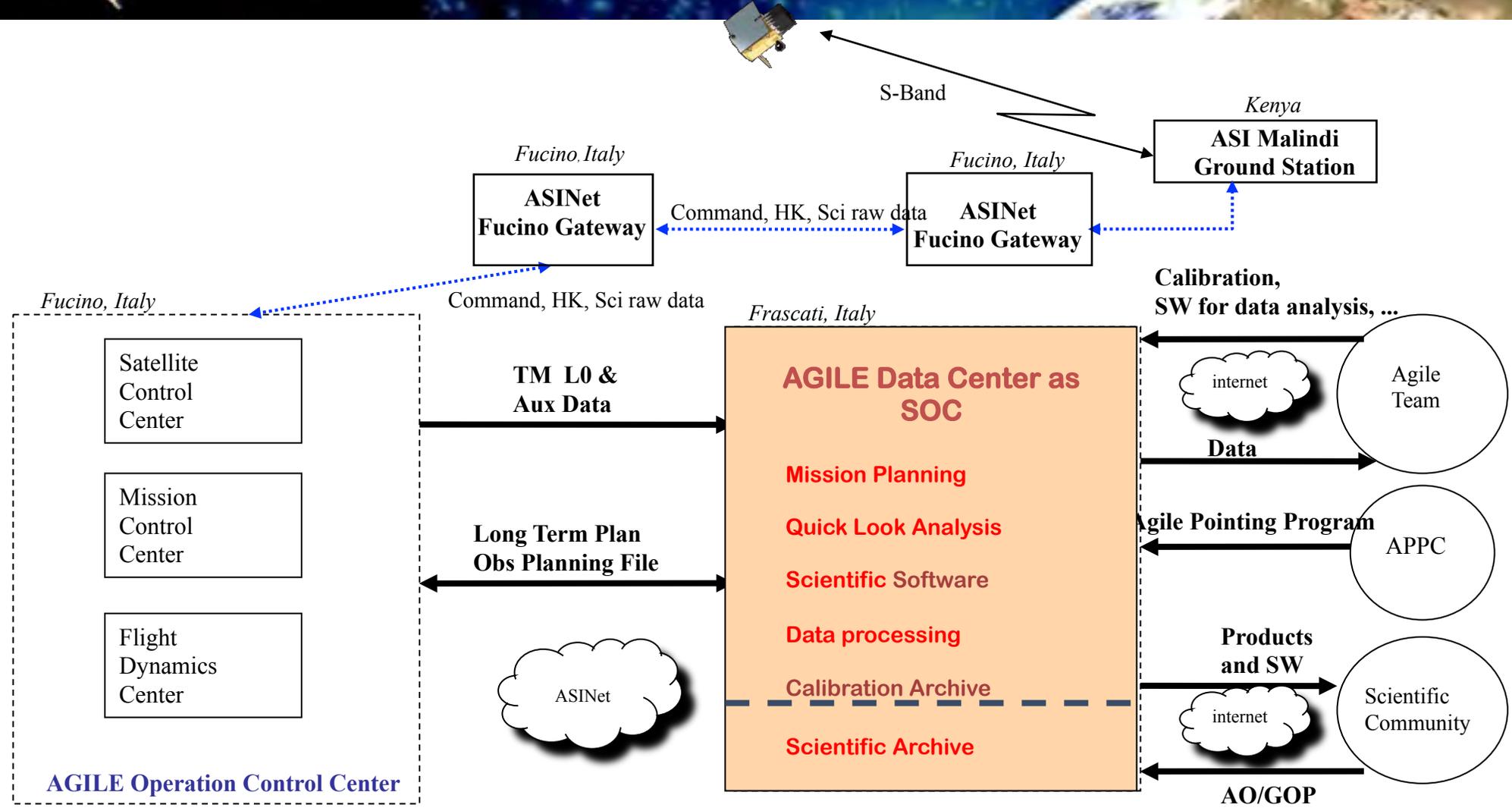
Francesca Tamburelli

(AGILE in calibrazione @ LNF)

AGILE Data Center team at ASDC in 2012:

Carlotta Pittori *coordinator*, Patrizia Santolamazza,
Fabrizio Lucarelli (since dec 2009), **Francesco Verrecchia**
(INAF and CIFS), **Giorgio Fanari**, Sandra Stellato (TPZ)







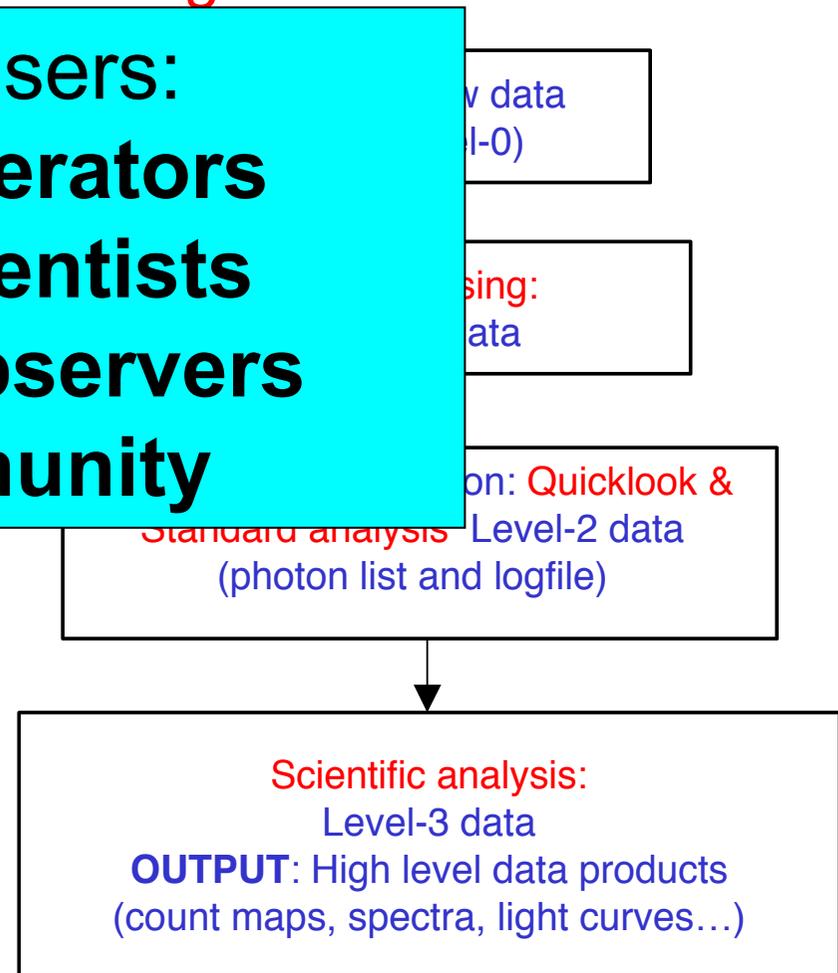
- The ADC, based at ASDC, is in charge of **all the scientific oriented activities related to the analysis and archiving** of AGILE data:

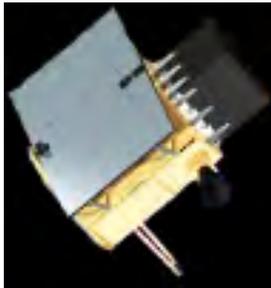
Different kinds of users:

- **Internal ADC operators**
- **AGILE Team scientists**
- **AGILE Guest Observers**
- **Scientific Community**

From scientific

- ✓ Preprocess
- ✓ Quick-Look
- ✓ Standard analysis (photon list)
- ✓ Scientific analysis (source detection, diffuse gamma-ray background)
- ✓ Archiving and distributing **all scientific AGILE data**





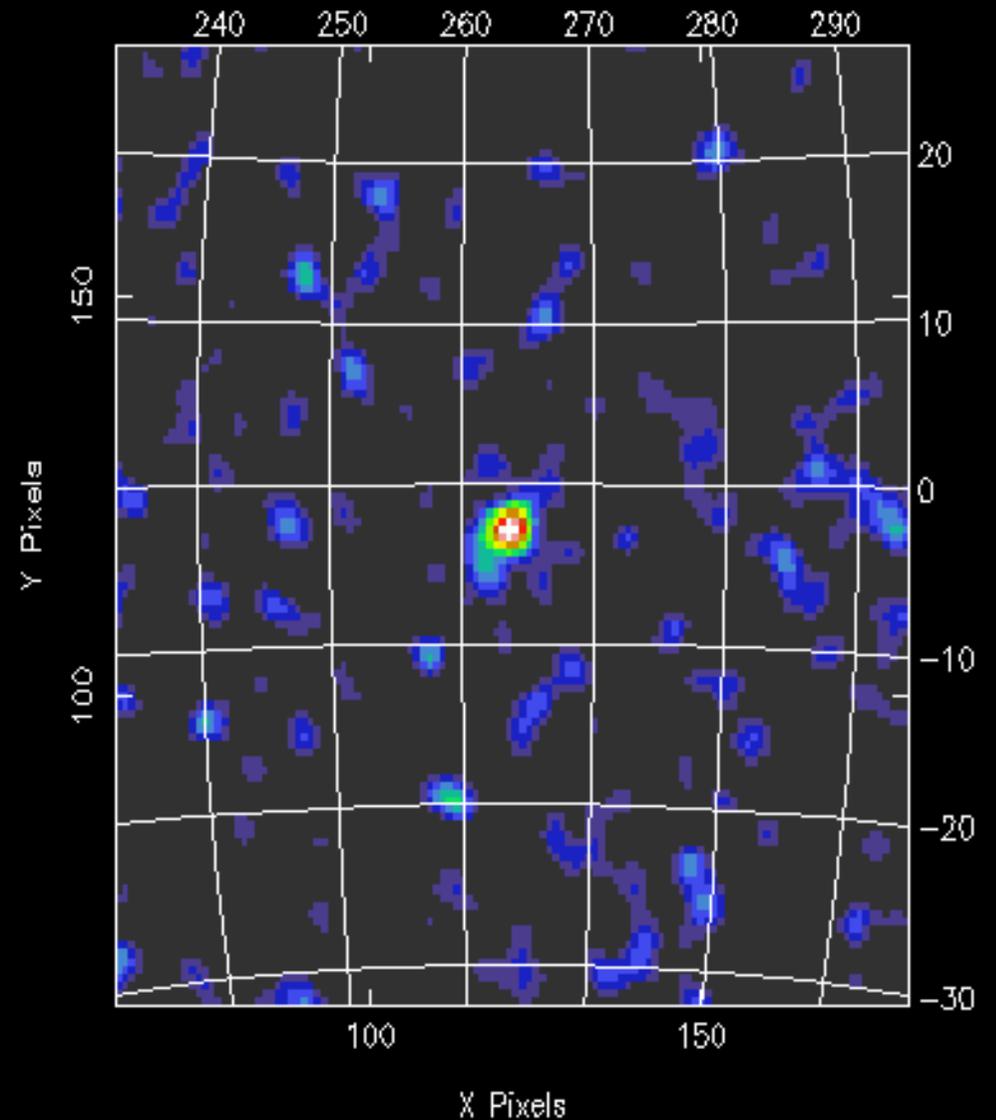
AGILE

Science Data Center

First AGILE GRID light ADC 24/5/2007

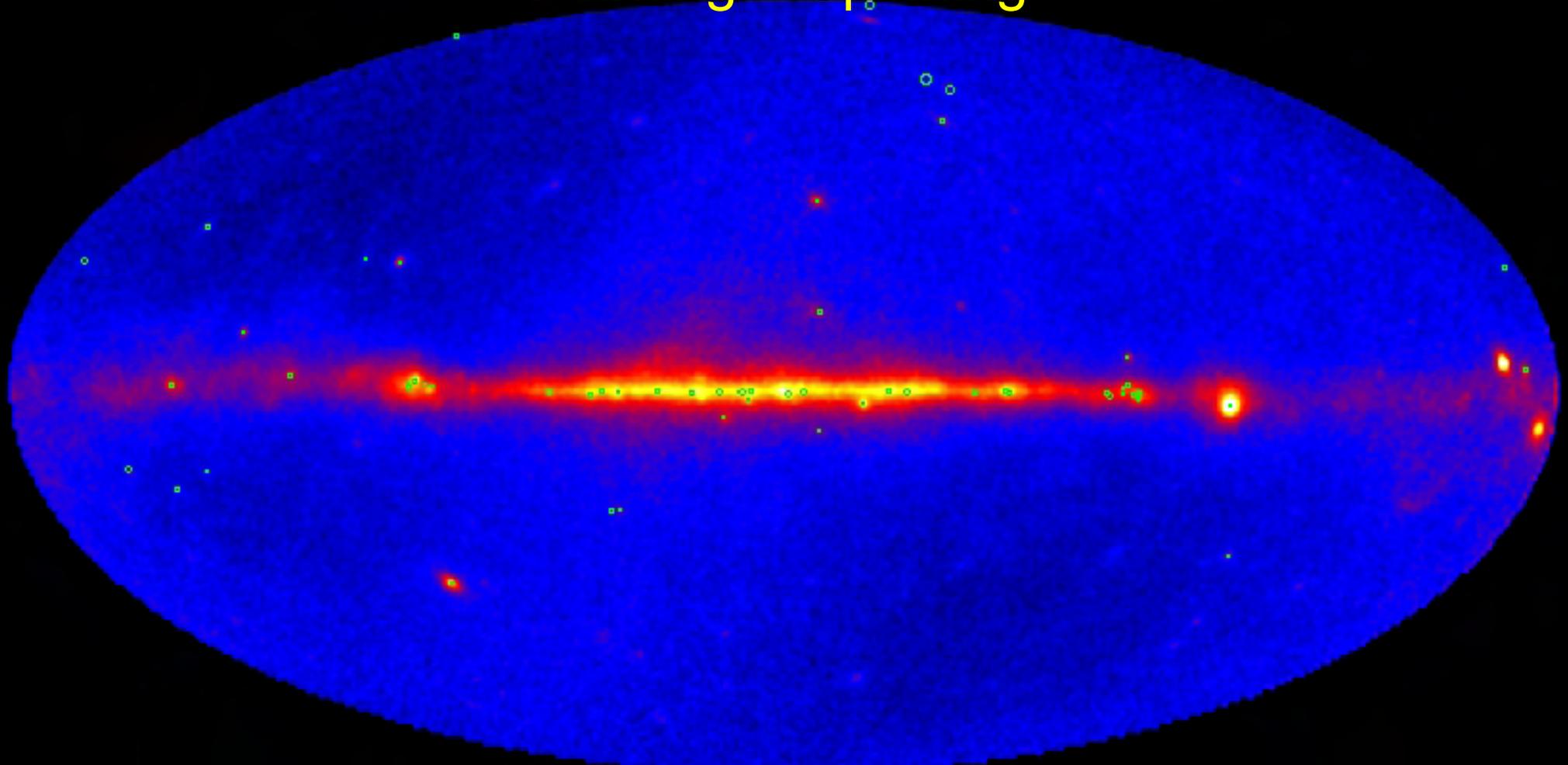
Commissioning Phase:
AGILE Vela PSR Count Map

(~ 20000 s)



AGILE Total Intensity Map ($E > 100$ MeV)

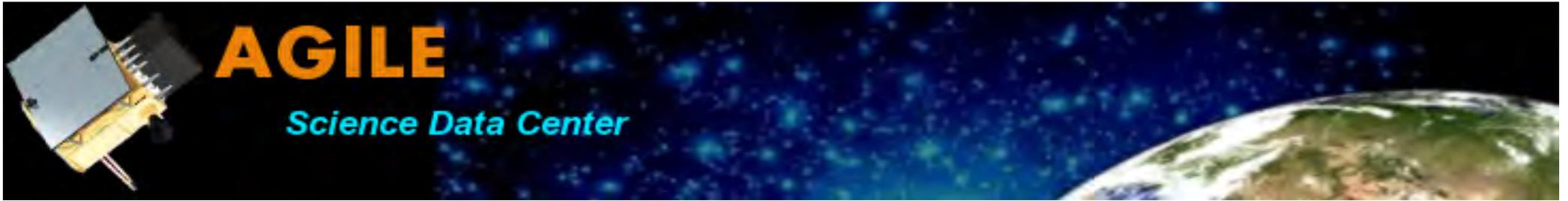
Pointing + Spinning



(green circles: AGILE sources, first year of operations)

“The First AGILE-GRID Catalog of High Confidence Gamma-Ray Sources”, C. Pittori et al., A&A 506, 2009 and

“An updated list of AGILE bright γ -ray sources and their variability in pointing mode”, F. Verrecchia et al., A&A 558, 2013



AGILE two "lives": pointing and spinning

| AGILE | POINTING | SPINNING |
|--|--|--|
| time period | Jul.07 – Oct.09 | Nov. 2009 - today |
| attitude | fixed | variable (rotation ~ 0.8°/sec) |
| sky coverage | 1/5 | ~ 70-80 % |
| 1-day exposure (≤ 30 deg off-axis, @ 100 MeV) | ~ 2 x 10⁷ (cm² sec) | (0.5 - 1) x 10⁷ (cm² sec) |

AGILE: 10th year in orbit

- **Pointing observation** mode up to October 18, 2009 and **spinning observation mode** since October 2009, surveying a large fraction (~80%) of the whole sky each day.
- **All AGILE functions are NOMINAL: 52205 orbits around the Earth completed on 22/5/2017 07:42 UTC. Mission operations extended at least till 2018 (next ASI CdA).**
- **Guest Observer Program open to the scientific community up to 2011: 4 ASI Announcements of Opportunity from Cycle-1 to Cycle-4 (Dec. 1, 2007– Nov. 30, 2011).**
- **Cycles 5-9 completed. Public data (Dec.1, 2011 – Nov. 30 2016)
Cycle-10: on-going data taking**



Current AGILE Data Publication Policy:

The AGILE Mission Board suggested in 2015 to eliminate the one year proprietary period

The public AGILE archive now contains all data from Dec 2007 up to Dec 2016 (from Cycle-1 to Cycle-9).

New Cycle-10 data will become public in early September

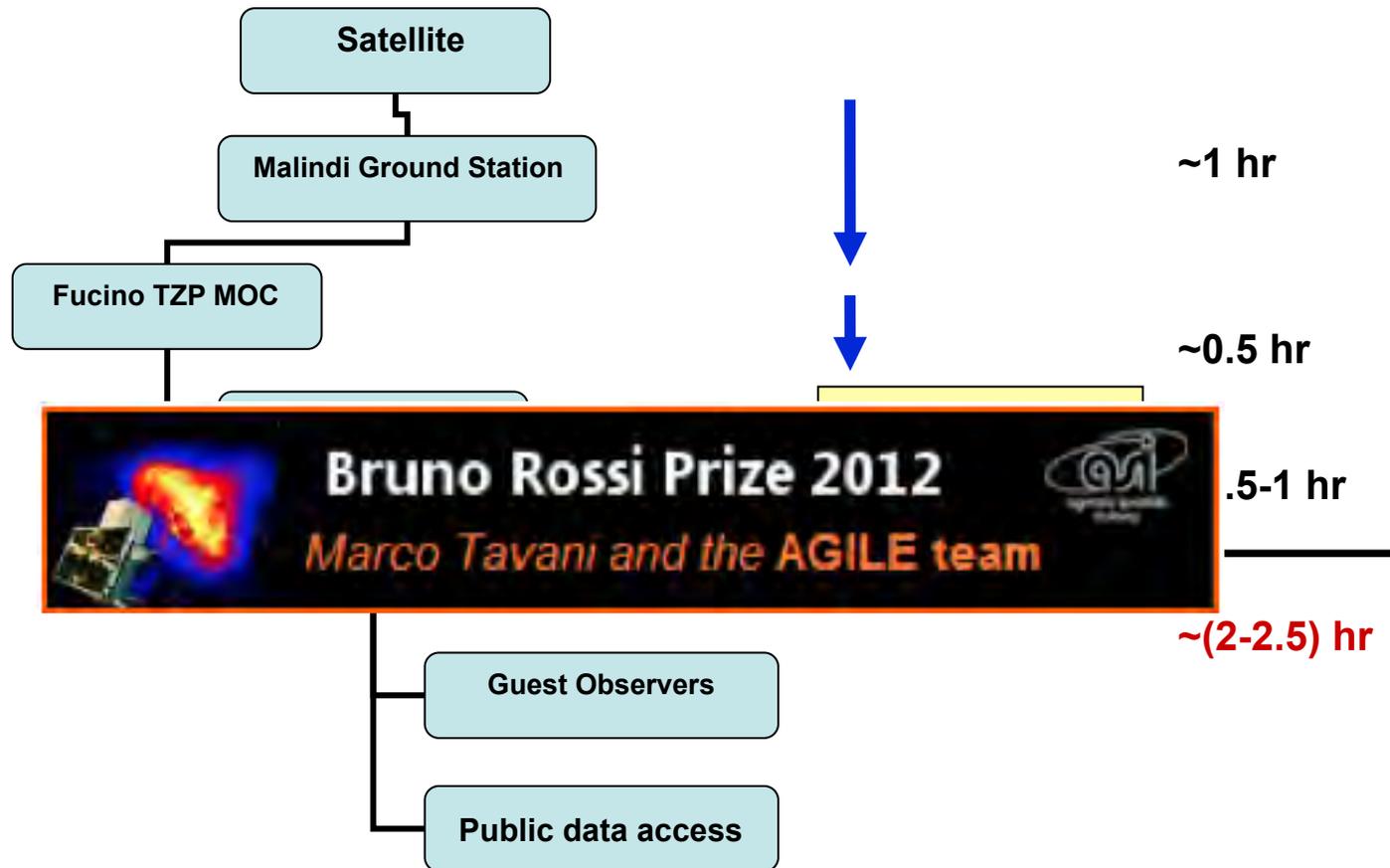
The AGILE Science Alert System

Variable sources and transients:

- The system is distributed among the ADC @ ASDC and the AGILE Team Institutes (**see also Bulgarelli talk**).
- **GRID Alerts are sent via email (and sms) both on a contact-by-contact basis and on a daily timescale**
- **Refined manual analysis on most interesting alerts performed every day (Flare Advocate daily monitoring)**
- **163 ATel** (48 in pointing + 115 in spinning) and **47 GCN** published up to May, 2017: **recently** several transient sources, record Y-ray flares from blazar **CTA 102**, and **new** Cyg X-3 flares.
(+ several AGILE GCN **internal** to the GW Ligo-Virgo Collaboration)

THE WAY WE WERE: (up to 2015/2016)

AGILE: “very fast” Ground Segment (with contained costs)

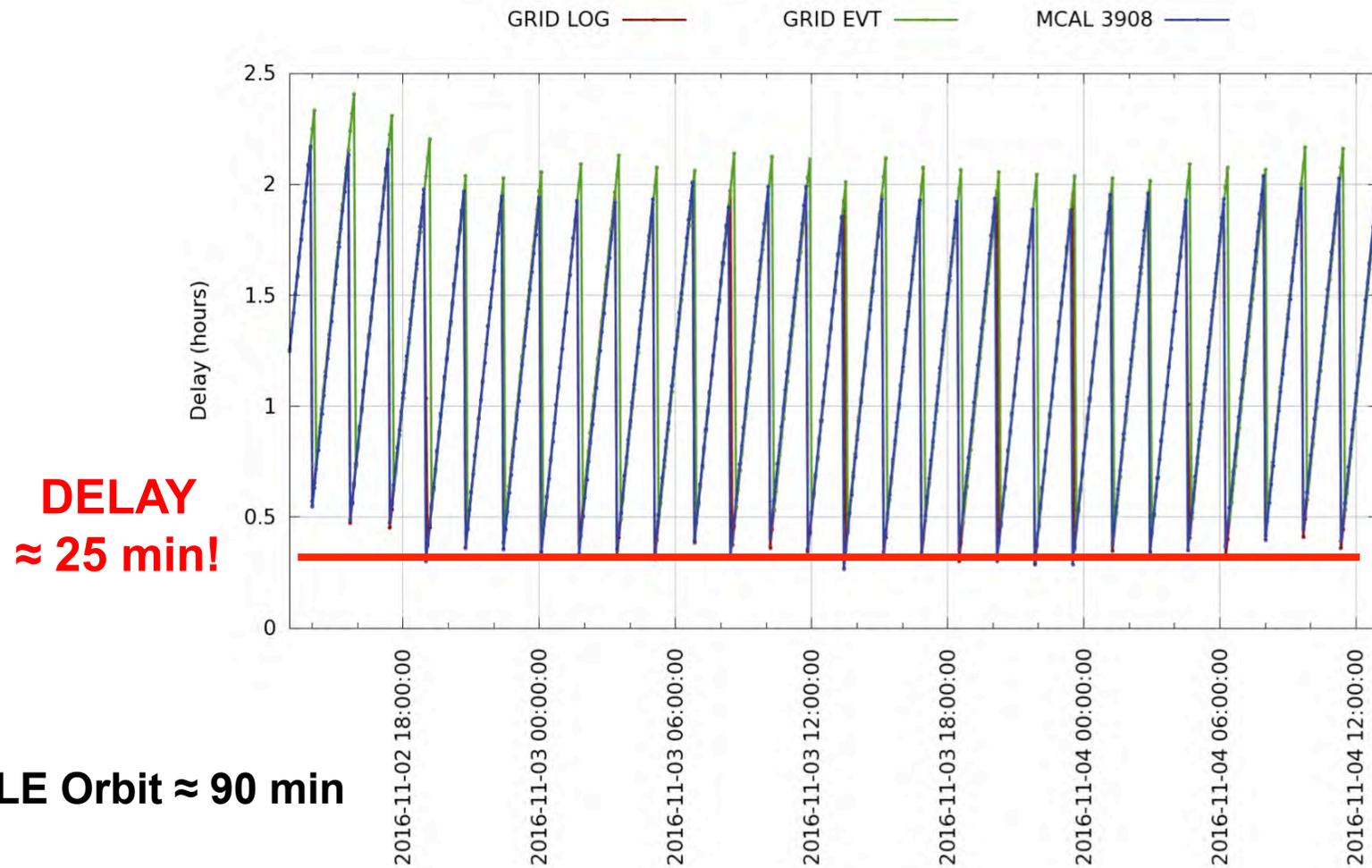


Record for a gamma-ray mission!

**APP (iPhone, Android): AGILEScience
(Bulgarelli, Parmiggiani)**

THE WAVE WE ARE:

AGILE and GW Counterpart Searches: an even faster Ground Segment!!





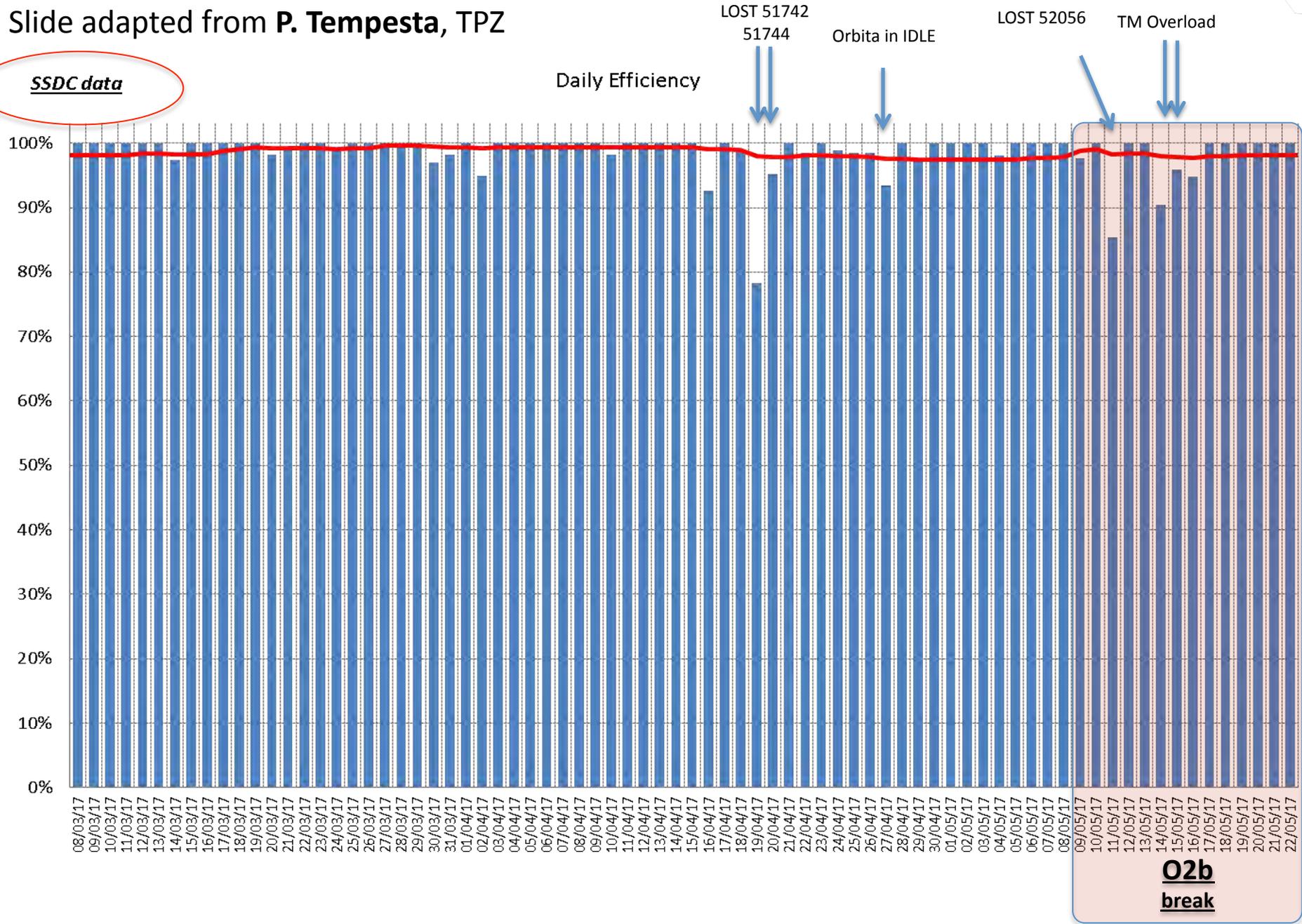
AGILE Data Center and Gravitational Waves

- **New on-board Payload configuration** optimized for GW electromagnetic counterparts hunt and **improved ASI Ground Station daily efficiency for AGILE.**
- **Improved ASINet connection between MOC (Fucino) and SOC (ASDC),** and reduced polling times for external connections.
- **ADC new optimized** automatic data processing to **reduce latency** in view of the O2 **GW LIGO-Virgo** run. **New MCAL and GRID QL pipelines active since Aug 3, 2016.**
- Now: **less than 25 min** (on average) between the satellite data acquisition at **Malindi Ground Station** and the availability of first reconstructed gamma-ray event files (**it was approx 2 hours** before).



Slide adapted from **P. Tempesta, TPZ**

SSDC data





AGILE and GW astrophysics

- **new operational mode for AGILE**
- **very fast reaction to external GW trigger**
- **new processing pipelines**
- **great potential for fast discovery of gamma-ray transients associated with NS-NS, NS-BH, and BH-BH coalescences (see Verrecchia talk)**
- **AGILE GW-Team monitoring shifts (24/7)** during the ongoing GW LIGO-Virgo observing run (O2)

NEW ASDC/SSDC MMIA 2.0:

Not only Astrophysics, but also Terrestrial Physics with AGILE (TGF!)

Astrophysics/Cosmology

all missions

Radio-Micro wave

Planck

IR-Optic-UV

Herschel

Swift-UVOT

X ray

ASCA

BeppoSAX

Einstein

Exosat

NuSTAR

ROSAT

Swift-XRT

Gamma ray

Agile

Egret

Fermi

Swift-BAT

Exploration of the Solar System

all missions

Rosetta

Dawn

Chang'E 1

Chang'E 2

Messenger

Particle Astrophysics Cosmic rays

all missions

Pamela

AMS-02

AMS-01 (soon available)

Fermi-LAT (soon available)

Chang'E 1 (soon available)

Chang'E 2 (soon available)

Atmospheric Physics TGF

all missions

Agile

Spectral band (Energy (keV)): from $1e^{-7}$ (1.00e-7 keV) to $1e^8$ (1.00e+8 keV)

Submit

Source name: CYGX-3

(e.g. CYGX-1)

Name Resolver: ASDC Name Server SIMBAD NED

Coordinate: 308.1074, 40.95775

RA, DEC L, B Lon, Lat

(e.g. 19 58 21.7, +35 12 05.8 or 299.590333, 35.201611 or 71.334960, 3.066917)

Properties of Terrestrial Gamma-Ray Flashes detected by AGILE MCAL below 30 MeV

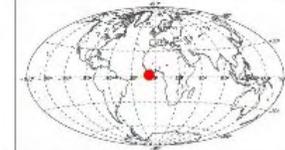
TGF (5 < 30 MeV) observed from March 2009 to July 2012



MCAL TGF Catalogs
ASDC interactive webpages:
www.asdc.asi.it/mcaltgf



Entry 090315
GeoLong. = -8.08
GeoLat. = 1.73



AGILE MCAL Data Products **Source Details**

This is the online version of the AGILE Terrestrial Gamma-ray (TGF) catalog below 30 MeV detected by the Minicalorimeter.

The interactive web table includes 308 TGFs. Thanks to its very low inclination...

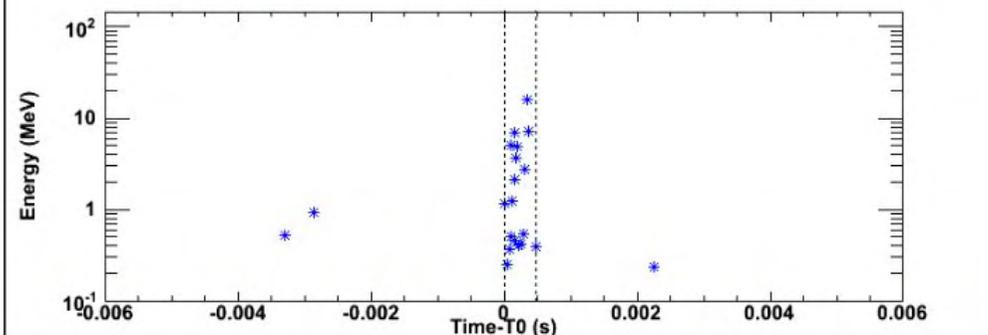
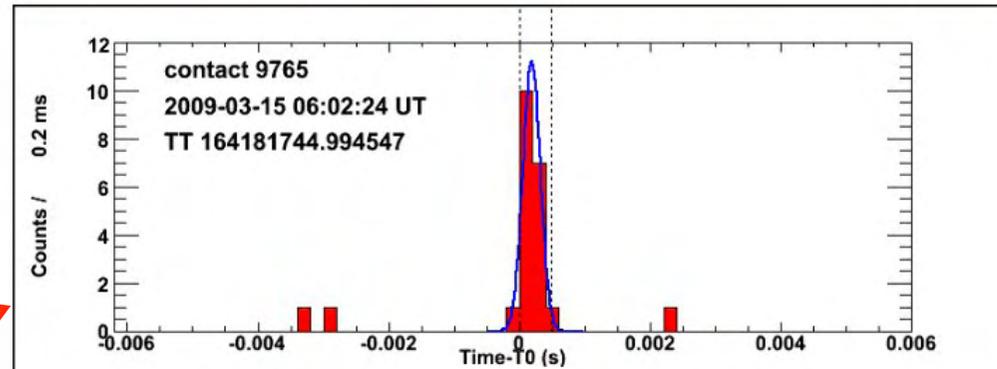
M. Marisaldi et al. 2013, Journal of Geophysical Research

Previous Page

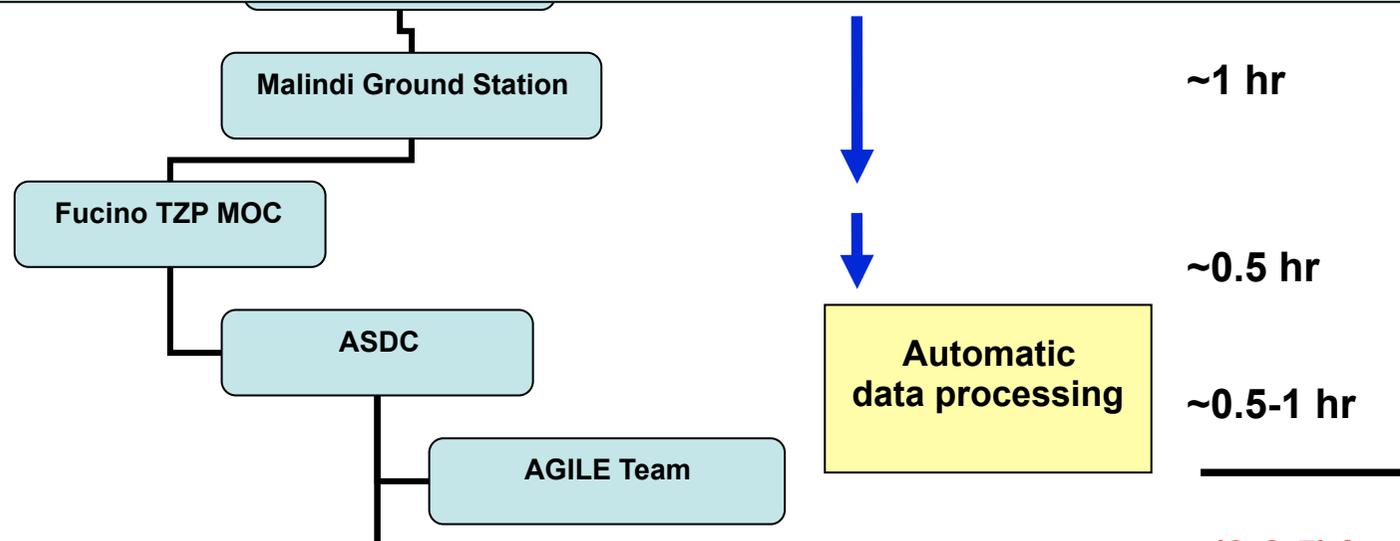
| Entry number | TGF ID | GeoLon | GeoLat |
|--------------|---------------------|--------|--------|
| 1 | TGF LC 090302.71821 | 17.42 | -1.73 |
| 2 | TGF LC 090308.40378 | 110.96 | -2.15 |
| 3 | TGF LC 090308.61530 | 106.13 | -1.73 |
| 4 | TGF LC 090309.25894 | 136.68 | -1.73 |
| 5 | TGF LC 090309.37239 | -6.65 | 1.73 |
| 6 | TGF LC 090309.37239 | -6.65 | 1.73 |
| 7 | TGF LC 090315.25166 | -8.08 | 1.73 |
| 8 | TGF LC 090315.54770 | -78.80 | -1.73 |

Standard Products

Light Curve broader binning (200 microsec)



IN PROGRESS: A NEW Real Time Pipeline to Link Meteorological Information and TGFs Detected by AGILE



**Extend also to Terrestrial data
the ASDC expertise on web based
interactive tools and cross-correlations
among different DBs and archives**



NEW PUBLIC TOOL
interfaced with other ASDC tools

Mission Selected
AGILE-LV3

AGILE-LV3 tutorials:

• [pdf](#)

Enter source name or coordinates: RA, DEC L, B Lon, Lat
(e.g. CYGX-1 or 19 58 21.7, +35 12 05.8 or 299.590333, 35.201611 or 71.334960, 3.066917)

NEW TOOL: web interface for official interactive on-line ML analysis on AGILE data.

Tested also with students, some of them kindly provided brief video tutorials (see Credits).

Now open access!!!

AGILE-LV3 Data

Query results for: pks1510-089(ASDC)

ME with RA = 228.210417; DEC = -9.100000; L = 351.289081; B = 40.138799; Lon = 228.293839; Lat = 8.496066; EQUINOX = 2000; RADIUS = 30 degrees; Start date = 01-12-2007; End date = 22-05-2017; Duration = 28 day(s); Min EXP

Modify AGILE-LV3 query parameters

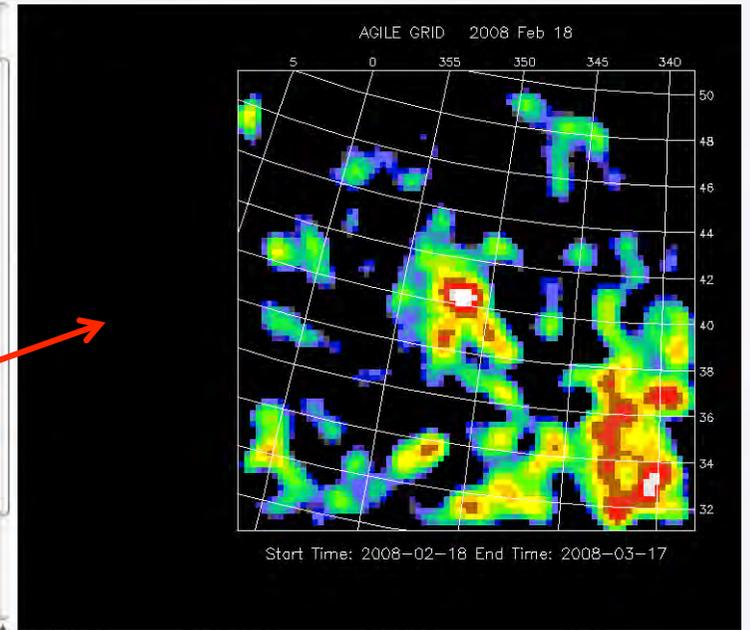
Make Light curve: **LC likelihood**

Export Current view of Table in:

Previous Page Next Page Page Size #Image Centered On:

RA (deg) 228.21 Dec (deg) -9.10
 LI (deg) 351.29 BI (deg) 40.14
 Source name: Search
 Image half size (deg) 10.00
 Emin (MeV) 1.00
 Emax (MeV) 50000

| Entry number | ASDC Data Explorer | GRID LV3 data retrieval | GRID Interactive Analysis | Source |
|--------------|-------------------------------------|-------------------------|---------------------------|----------------------|
| 1 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 2 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 3 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 4 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 5 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 6 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 7 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 8 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 9 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 10 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 11 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 12 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 13 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |
| 14 | <input checked="" type="checkbox"/> | ASDC Data Explorer | Data Access | Interactive Analysis |



Radio IR X-Ray Gamma Sources cats

AT20G
 ATCAPMN
 B3
 CRATES

Ximage display parameters:

Run (Ximage) Reset to default

GRID ML Interactive Analysis

Reference AGILE catalog aglall

Spectral index -2.1
 Galactic -999
 Isotropic -999

Source ML fixflag 1

Run GRID ML Reset GRID ML to default

Download GRID ML results

It does not require any locally installed software or calibrations. It takes from a few seconds up to a couple of minutes to analyse the entire archive (10 years of data)

AGILE-LV3 Data

Query results for: pks1510-089(ASDC)

Details: query by COORDINATE & TIME with RA = 228.210417; DEC = -9.100000; L = 351.289081; B = 40.138799; Lon = 228.293839; Lat = 8.496066; EQUINOX = 2000; RADIUS = 30 degrees; Start date = 01-12-2007; End date = 07-07-2008; Min EXP = 100 cm² s sr; sort by START DATE; max lines retrieved 1000;

You have selected N=101 time bins.
The run may take from a few seconds up to few minutes for large N (>10).
Do you want to continue?

Cancel

OK

Export Current view of table in: [LaTeX format](#) [HTML format](#) [Raw text format](#) [CSV text format](#) [Browse table](#)

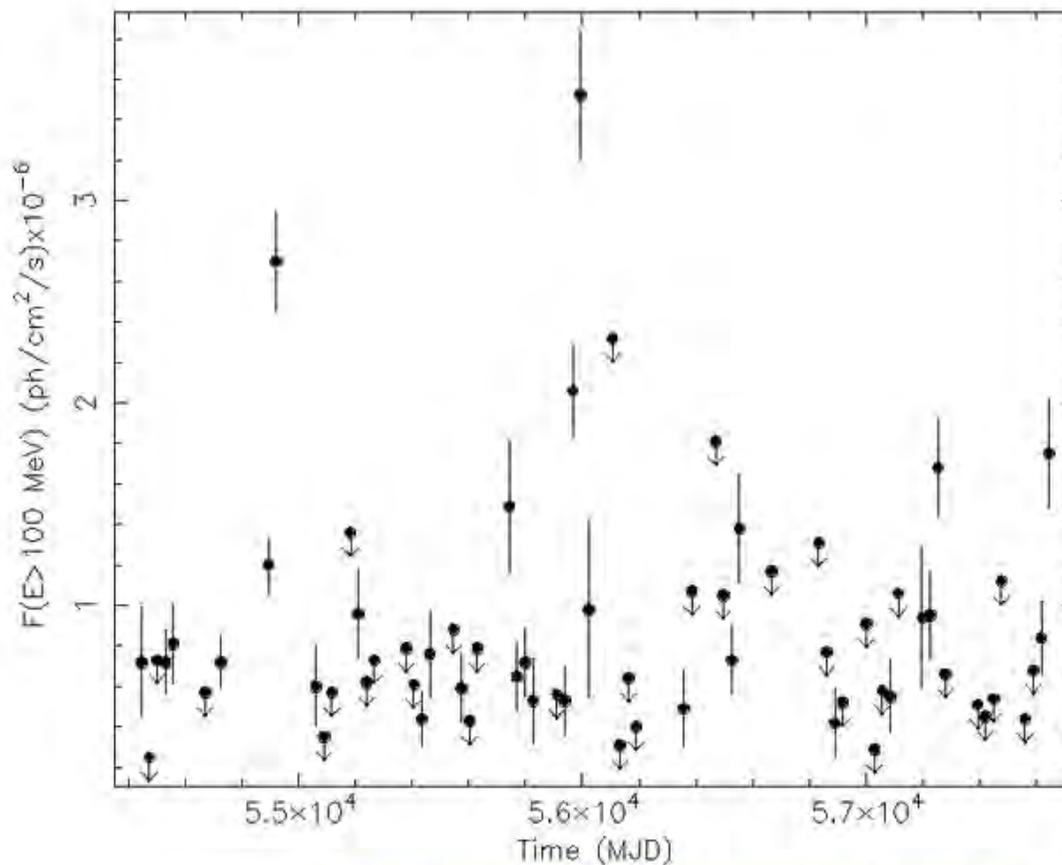
[Previous Page](#) [Next Page](#) Page Size (# of lines) [Reset all filters](#) [Show all entries](#)

| Entry number | Selection mode: <input type="button" value="Include"/> <input checked="" type="checkbox"/> All | GRID LV3 data retrieval | GRID Interactive Analysis | START DATE | STOP DATE | RA (J2000) | DEC (J2000) | MEAN EXP (cm ² s sr) | Dist. from searched position | |
|--------------|--|------------------------------------|-----------------------------|--------------------------------------|---------------------|---------------------|-------------|------------------------------------|---------------------------------|-------|
| | | | | | | hh mm ss.d | dd mm ss.d | | degrees | |
| 1 | <input checked="" type="checkbox"/> Select | ASDC Data Explorer | Data Access | Interactive Analysis | 2007-11-26 12:00:00 | 2007-12-24 12:00:00 | 14 34 48.23 | -14 01 10.92 | 908.27 | 10.53 |
| 2 | <input checked="" type="checkbox"/> Select | ASDC Data Explorer | Data Access | Interactive Analysis | 2007-12-24 12:00:00 | 2008-01-21 12:00:00 | 14 34 48.23 | -14 01 10.92 | 2643.62 | 10.53 |
| 3 | <input checked="" type="checkbox"/> Select | ASDC Data Explorer | Data Access | Interactive Analysis | 2008-01-21 12:00:00 | 2008-02-18 12:00:00 | 14 34 48.23 | -14 01 10.92 | 1125.36 | 10.53 |
| 4 | <input checked="" type="checkbox"/> Select | ASDC Data Explorer | Data Access | Interactive Analysis | 2008-02-18 12:00:00 | 2008-03-17 12:00:00 | 14 34 48.23 | -14 01 10.92 | 2589.95 | 10.53 |
| 5 | <input checked="" type="checkbox"/> Select | ASDC Data Explorer | Data Access | Interactive Analysis | 2008-03-17 12:00:00 | 2008-04-14 12:00:00 | 14 34 48.23 | -14 01 10.92 | 1033.45 | 10.53 |
| 6 | <input checked="" type="checkbox"/> Select | ASDC Data Explorer | Data Access | Interactive Analysis | 2008-04-14 12:00:00 | 2008-05-12 12:00:00 | 14 34 48.23 | -14 01 10.92 | 158.863 | 10.53 |
| 7 | <input checked="" type="checkbox"/> Select | ASDC Data Explorer | Data Access | Interactive Analysis | 2008-06-09 12:00:00 | 2008-07-07 12:00:00 | 14 34 48.23 | -14 01 10.92 | 1126.51 | 10.53 |

L: 351.29, B: 40.14, 28 day(s) Time binning

[lc_1AGLRJ1513-0906-ORIG_28dd-timebin.gdp](#)

1AGLRJ1513-0906-ORIG - 28 day(s) Time binning



DOWNLOAD: [1AGLRJ1513-0906-ORIG_28dd-timebin_input_for_SED.dat](#)

Total number of GOOD bins in the lightcurve: 65/101

[Download GRID ML results](#)

ASDC SED Builder access:

(click below to include SED data points)

[Add data to SED](#)

SED^(t) builder V 3.2

AGILE-LV3
results

A tool to build and handle Spectral Energy Distributions, time-resolved SEDs and multi-frequency light-curves



Version 3.2.6

[pittori \(Logout\)](#) [Feedback](#)

[Tutorial](#)

[DATA EXPLORER](#)

[User Data](#)

[Existing SEDs](#)

[Current SED](#)

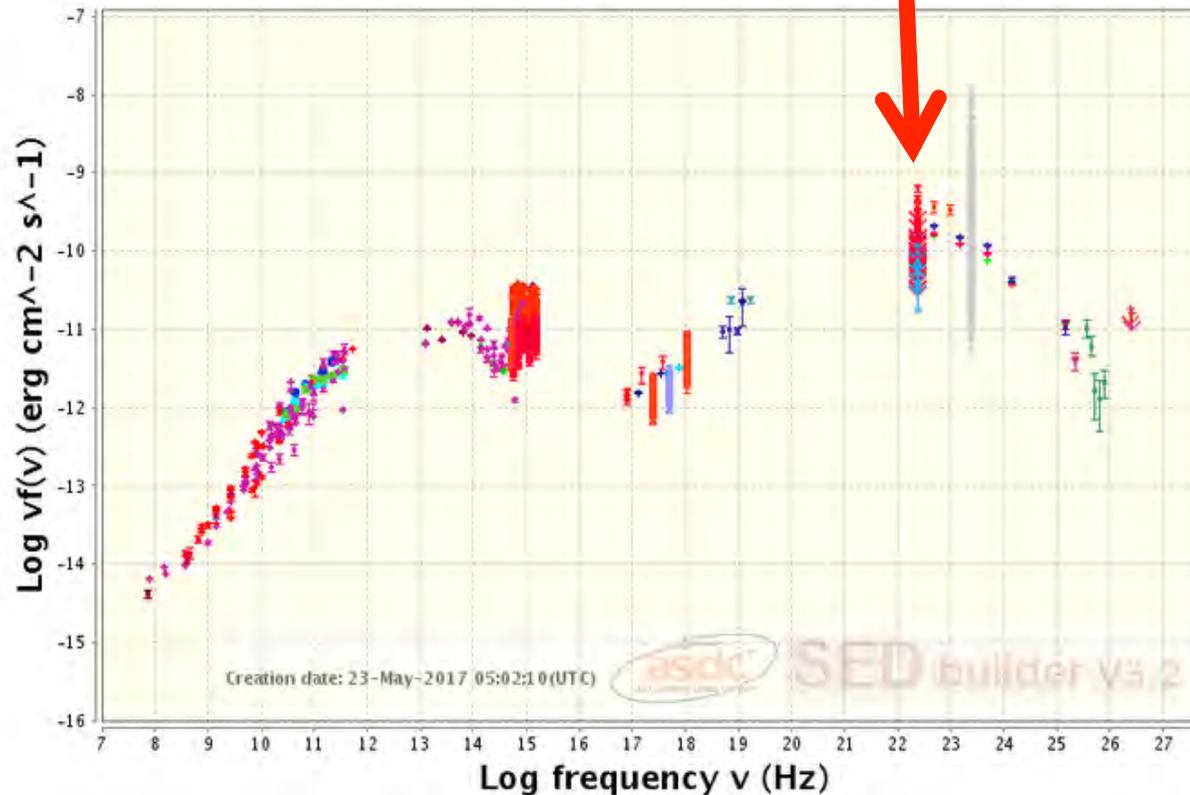
[Search and build new SEDs](#)

[Show source names](#)



[Data citation policy - pl](#)

sed1512m0906 Ra=228.21033 deg Dec=-9.10008 deg (NH=6.9E20 cm⁻²)



Load Data Show Data

Save Duplicate Sed

Bibliographic search

Redshift: Frame:

X Axis: Y Axis:

Plot Type:

Update Plot

Input Data Time Filtering Energy Filtering Mode

Fit Functions Templates Instr Sensitivity Plot opt

Existing SEDs Export VO Tools

ASDC-resident Catalogs [i](#)

[Expand all](#) [Collapse all](#)

| Energy Band / Catalog Name | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Options |
|----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|---------|
| ▶ Radio | <input checked="" type="checkbox"/> | | | |
| ▶ Infrared | <input checked="" type="checkbox"/> | | | |
| ▶ Optical UV | <input checked="" type="checkbox"/> | | | |
| ▶ Soft X Ray | <input checked="" type="checkbox"/> | | | |
| ▶ Hard X Ray | <input checked="" type="checkbox"/> | | | |
| ▶ Gamma Ray | <input checked="" type="checkbox"/> | | | |
| AGILE Grid | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | V S U |
| ... | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | V S U |

ENJOY!