Alerts and APPs

A. Bulgarelli

INAF/IASF Bologna (Italy), ASI/ASDC
University of Modena and Reggio Emilia

on behalf of AGILE Team

11th AGILE Science Workshop May 16-17, 2013, ASI Headquarters, Rome
**ALERTS?**

- Transient discoveries from gamma-ray sources during the AGILE observations is possible given the large Field of View and the AGILE sensitivity.
- A quick reaction time enable us to follow the evolution of a flaring event.
- The search for γ-ray transients (Galactic and extra-Galactic) detectable on timescales of 1-2 days is one of the main daily activities performed by the AGILE Team.
Two independent pipelines

- The Science Alert System (SAS) pipeline running at INAF/IASF Bologna (IASFBO)
- The Quick-Look Scientific (QLS) pipeline running at the AGILE Data Center (ADC)

Automated scientific analysis systems

Cross check of scientific results
<table>
<thead>
<tr>
<th><strong>QLS@ADC</strong></th>
<th><strong>SAS@IASFBO</strong></th>
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</thead>
<tbody>
<tr>
<td>It performs an accurate data processing</td>
<td>It performs a raw data processing</td>
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<tr>
<td>It generates daily REPORTS</td>
<td>It generates ALERTS immediately</td>
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<td></td>
<td>It works with a <strong>continuous integration of data</strong>: the data are analyzed for each orbit</td>
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To react in the shortest time

Science Alert System

To access the results with a mobile phone

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The daily gamma-ray sky

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ALERTS within 2-3 hours!

[Image of a smartphone screen showing a red alert symbol with text:

```
gridalert] ALERT LEVEL
4.95 386.7 +/-136.6 (195.6, 4.6, 105) -
AGL_30634+1748 -
FM3.119_2.SPO5_100_02
3442.023469.B6EXT.002.txt
```

10/nov/2011 18:27

```
gridalert] ALERT LEVEL
4.86 512.0 +/-148.6 (79.5, 1.8, 201) -
FM3.119_2.SPO5_100_02
3439.023467.B6EXT.002.txt
```

10/nov/2011 18:27

SAS@IASFB0

2013, ASI Headquarters, Rome
THE FASTEST GAMMA-RAY GROUND SEGMENT OF THE WORLD
THE AGILE GROUND SEGMENT
Who is involved?
Every 96 minutes...

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Nominal chain, L0 (raw), L1 (FITS) and auxiliary data flow

Backup chain, L0 (raw) data flow (manual)

AGILE Data Centre @ASDC, Rome

AGILE Team @INAF/IASF Bologna

AGILE Team @INAF/IAPS Rome

Telespazio @Fucino (Italy)

To AGILE Team for manual analysis

QLS

Daily report

SAS

SMS

email

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A manual analysis starts when an alert is generated above a well defined threshold (with $V(T_s) \geq 4.5$)
Who is involved?

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IASFMI

INAF - IASF BOLOGNA

Istituto Nazionale di Fisica Nucleare
Sezione di Trieste

IAFPa

ASDC

Ariane 5 intersatellite data relay
The key point of the overall system: the AGILE Team can start with the manual analysis within 2-3 hours (SAS@IASFBO)

During this “quick-look” analysis the data are consolidated by a more accurate data processing (QLS@ADC)

Both pipelines work with a common goal to produce scientific results in the shortest possible time and with the best quality of data.
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For the first time
- An App is integrated into a scientific ground segment
- The App is used for scientific activities

In addition
- Some step of the monitoring activities become ‘mobile’
SAS@IASFBO
Put all together!

The gamma-ray sky now
"AGILE: from Black Holes to the Earth"

AGILE is a satellite of the Italian Space Agency (ASI) dedicated to unveiling the most exciting mysteries of our Universe. Black holes, neutron stars, stellar explosions, very far galaxies from deep space and other exotic cosmic sources emit very radiation (gamma-rays) that AGILE detect in orbit.

Launched in 2007, the satellite is observing the Universe with not only APPS.
Technicalities

• Scripting in Ruby
• About 64 cpu cores for overall processing
• The system works with different integration time windows: (1-2-7 days)
• A binned maximum likelihood estimator (developed @IASFMI) is used as analysis tool

• The selection of candidate flares is performed with
  - transient blind search methods ("spotfinder")
  - transient search from a list of known sources
The "2010 Crab flare" case
The first alert received from Crab with a flux level that exceed 1-sigma mean flux level was received at 2010-09-20T02:04:04 UTC. The Crab reach its maximum flux for E>100 MeV in AGILE data between 2010-09-19T01:54:43 and 2010-09-20T23:47:51 UTC in the continuous integration procedure with 2 days integration time. The alert was generated via email and SMS at 2010-09-21T02:00:54 UTC.
Conclusions

• Key factors:
  – IASF Bologna pipeline that react within 2 hours
  – Two independent pipelines
  – Cross check with consolidated data.

• The effectiveness of the monitoring system is demonstrated on a daily basis and by the great number of ATel (90 in 6 years) published by AGILE Team; very important discoveries were started from this system.

• This allows an effective follow-up of flaring sources, enabling AGILE to maximize the scientific return of the mission.
THANKS FOR YOUR ATTENTION!