Multi-wavelength study of the Blazar 3C 454.3: *Swift* & AGILE

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&

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Outline

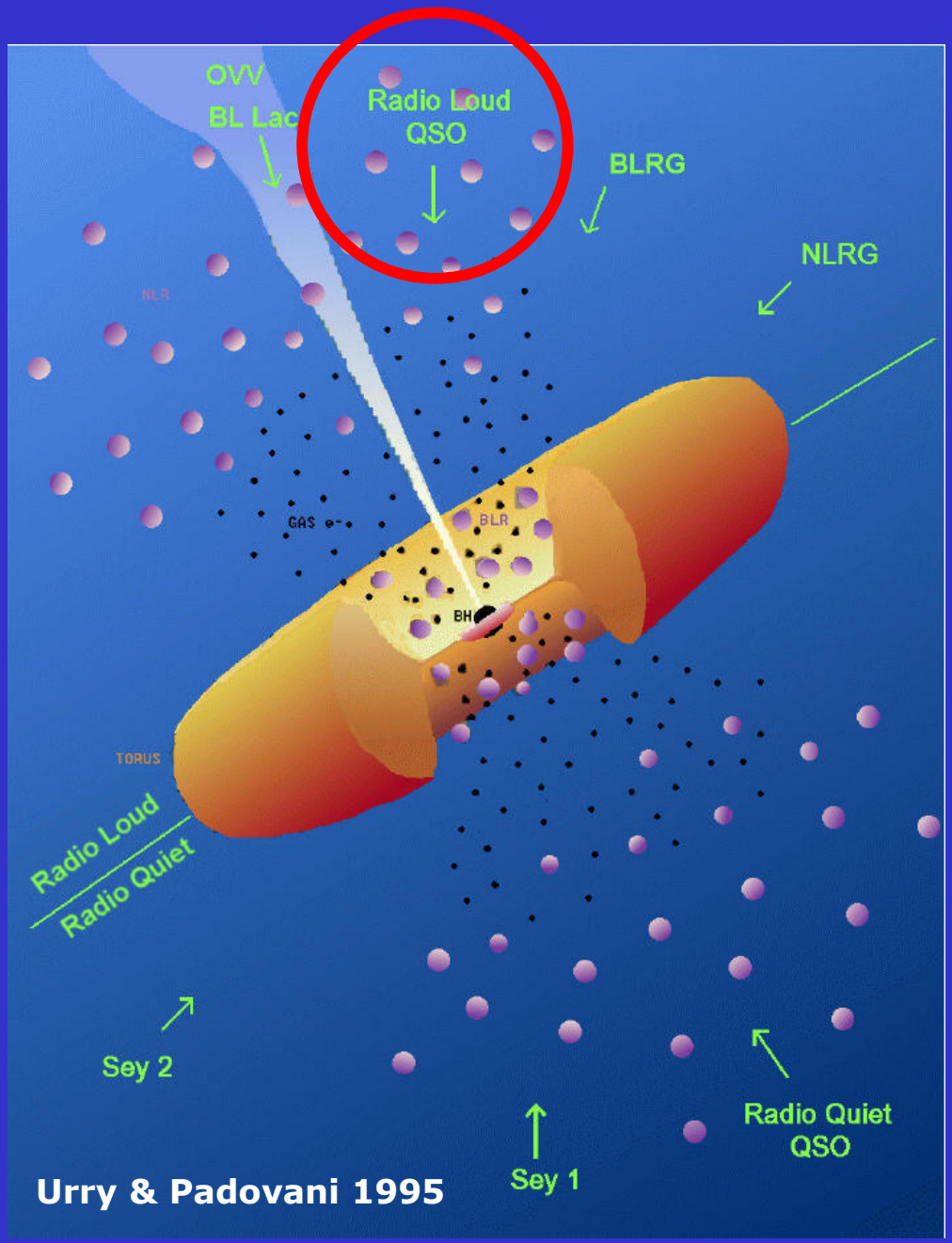
Blazars' multi-wavelength study

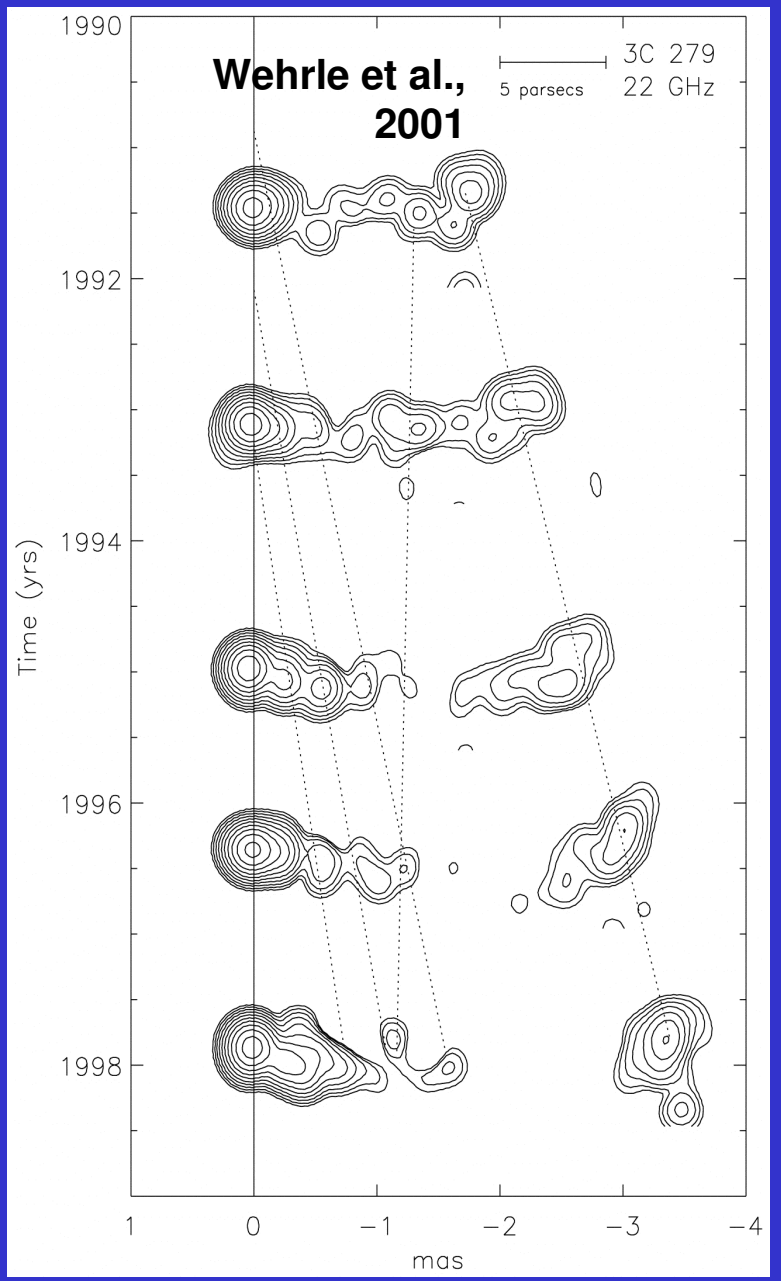
AGILE Mission

***Swift* Mission**

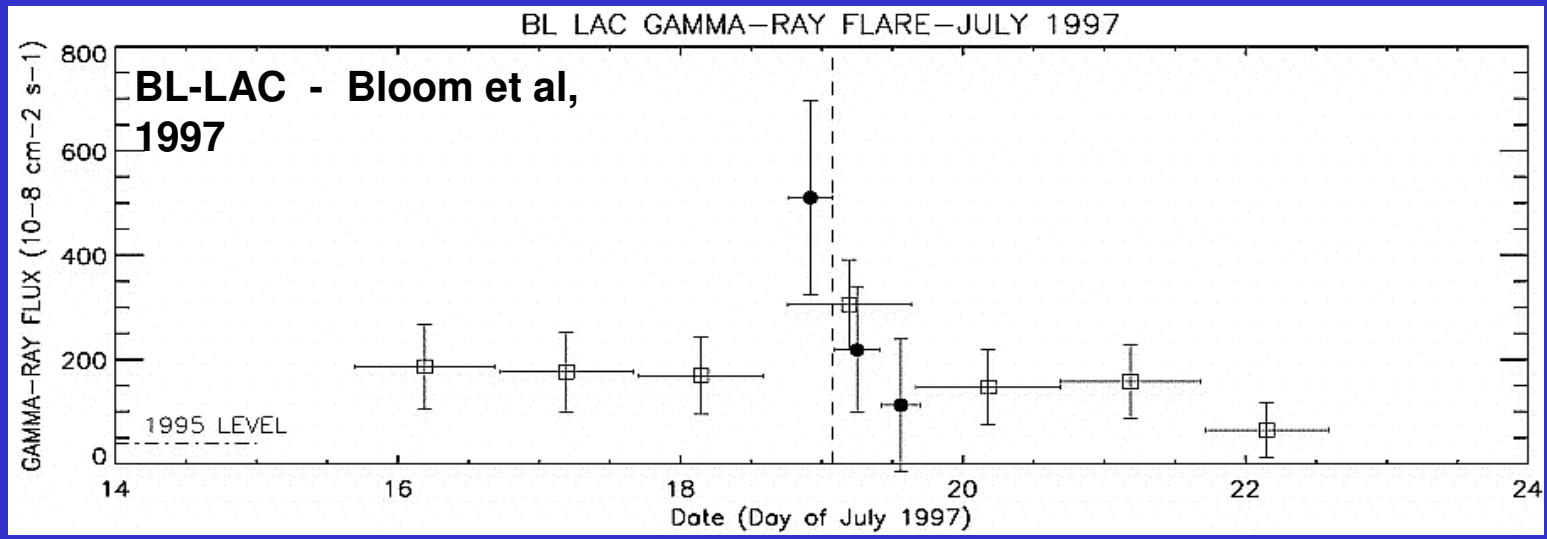
3C 454.3 and data analysis

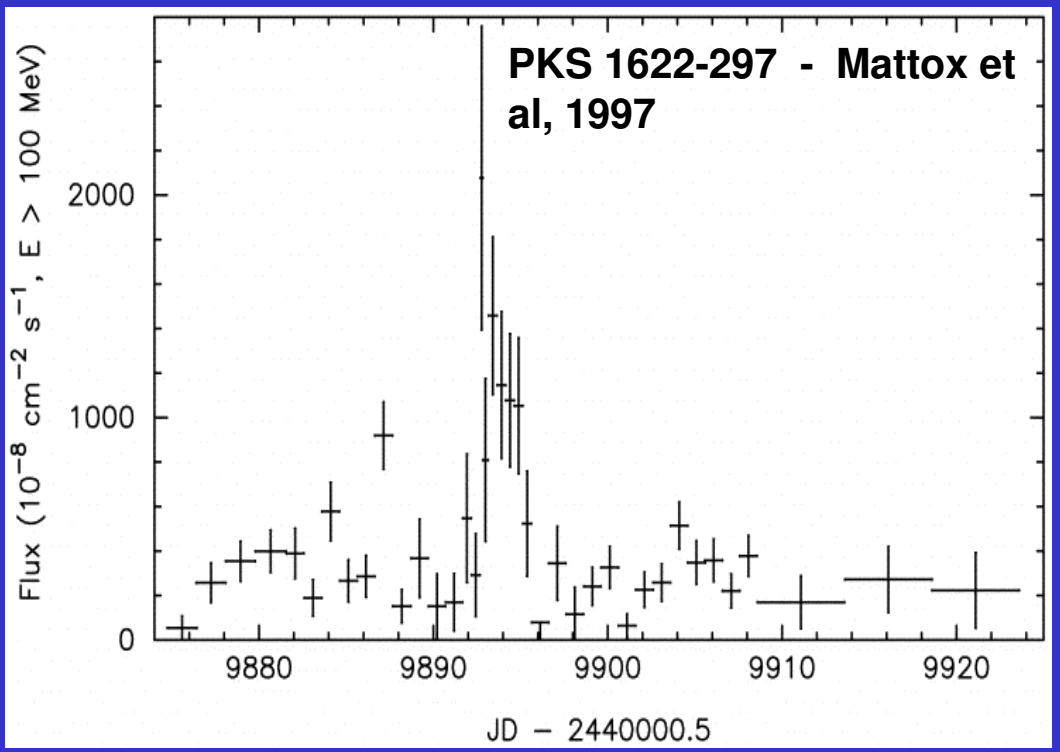
AGNs & Blazars

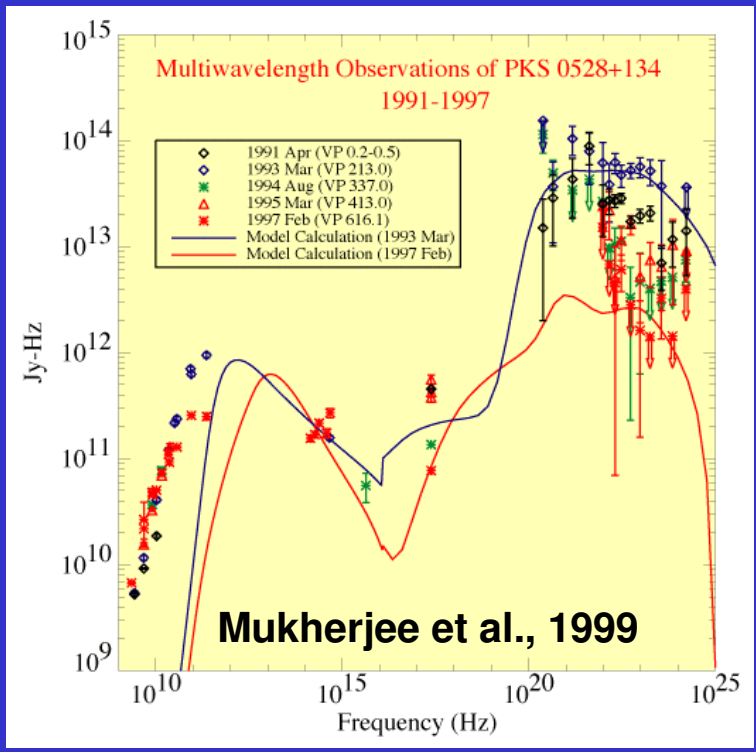




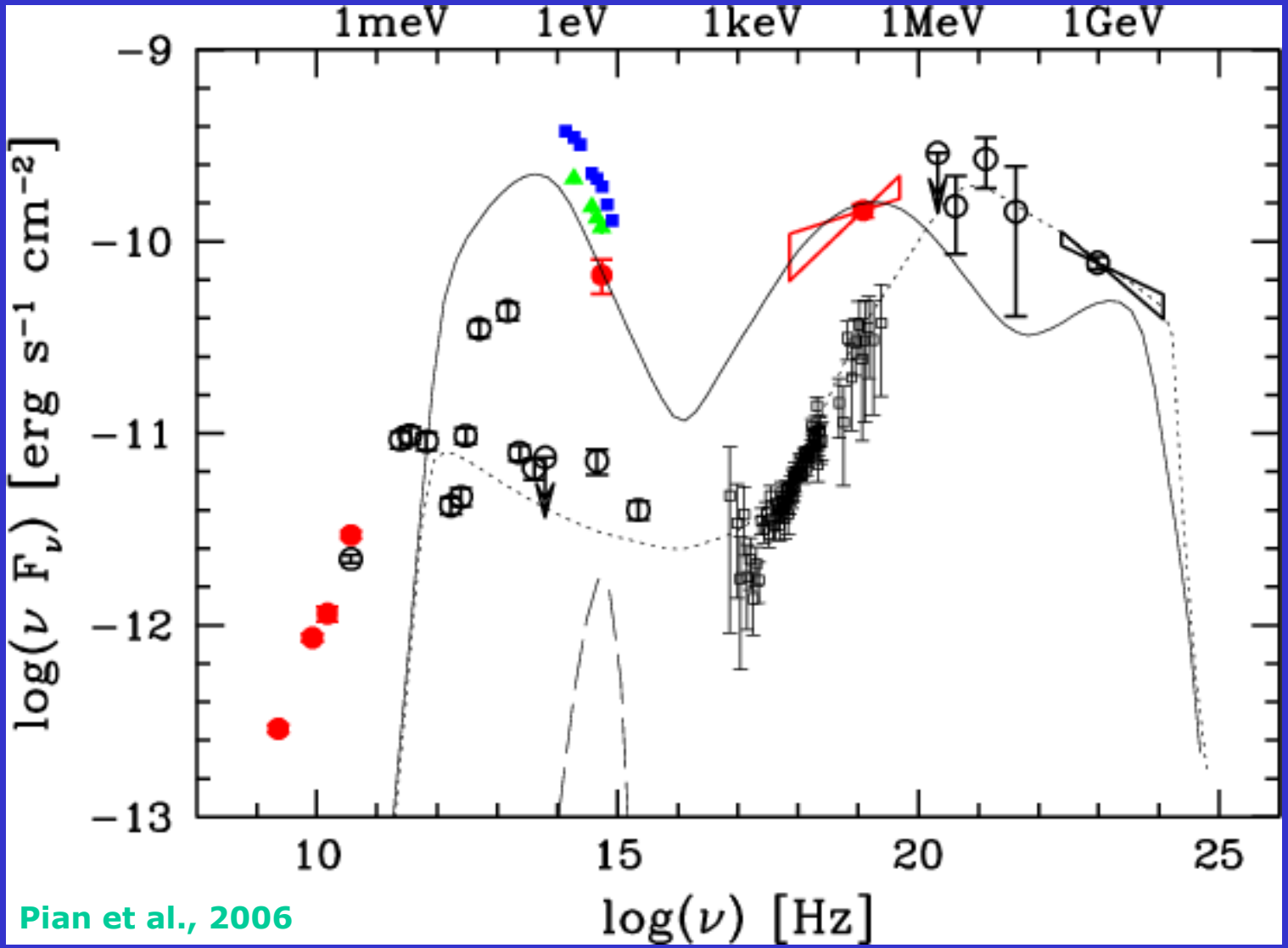
Gamma-ray Blazars







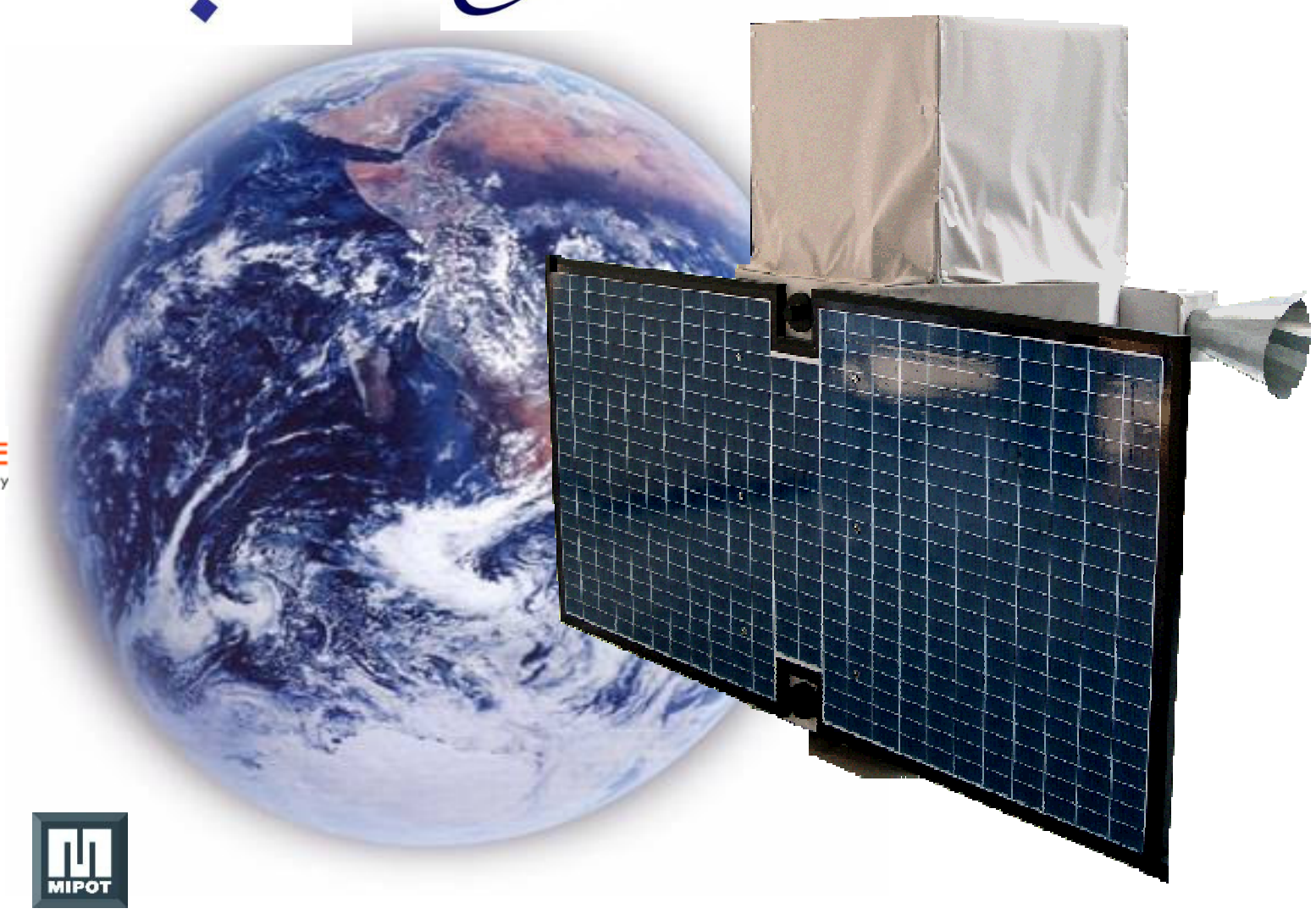
14 decades in energy



Pian et al., 2006

AGILE Mission

AGILE Partners



AGILE in a nutshell

The AGILE Payload: the **most compact instrument** for high-energy astrophysics

For the first time it combines a **gamma-ray imager (30 MeV- 30 GeV)** with a **hard X-ray imager (18-60 keV)** with large FOVs (3 - 1 sr) and optimal angular resolution

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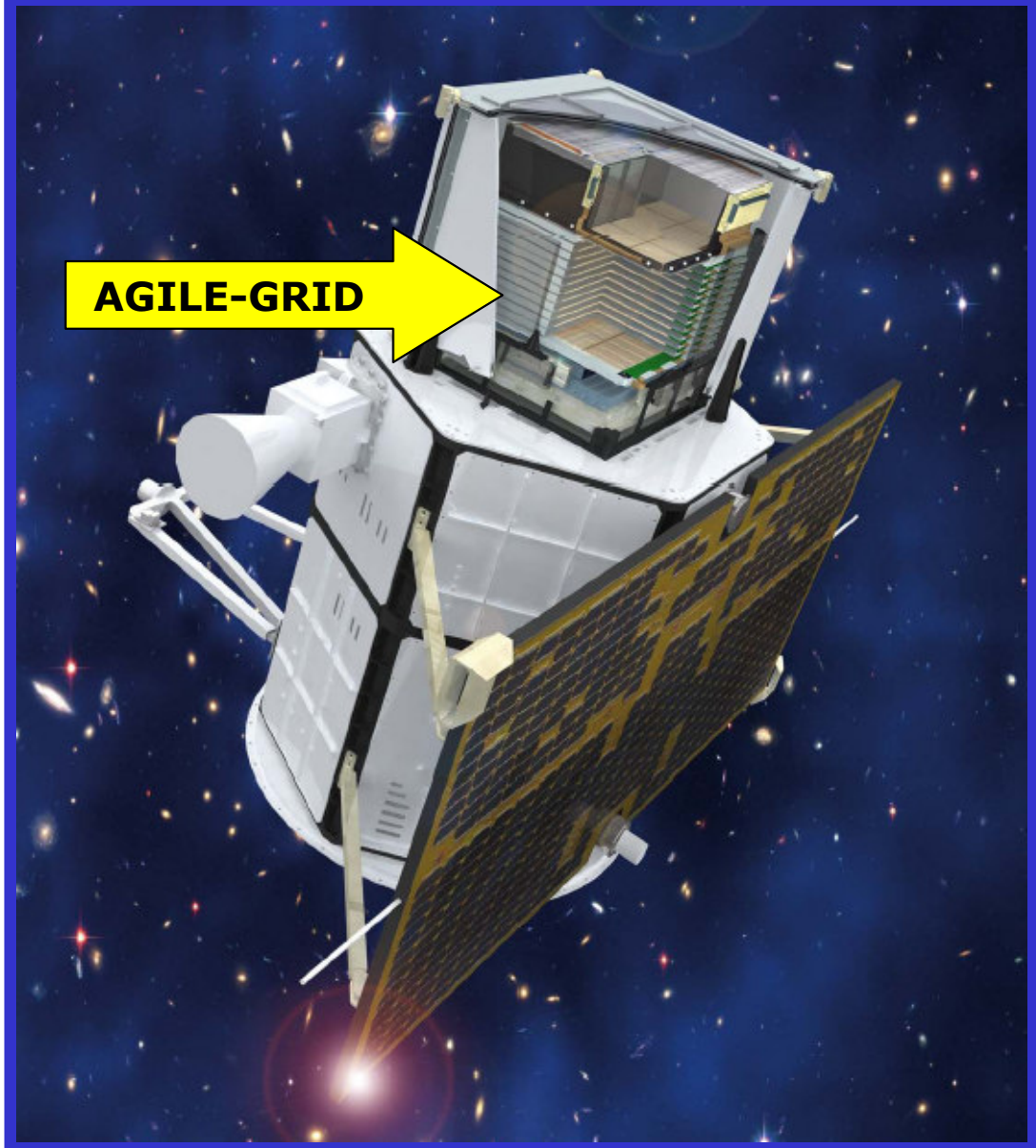

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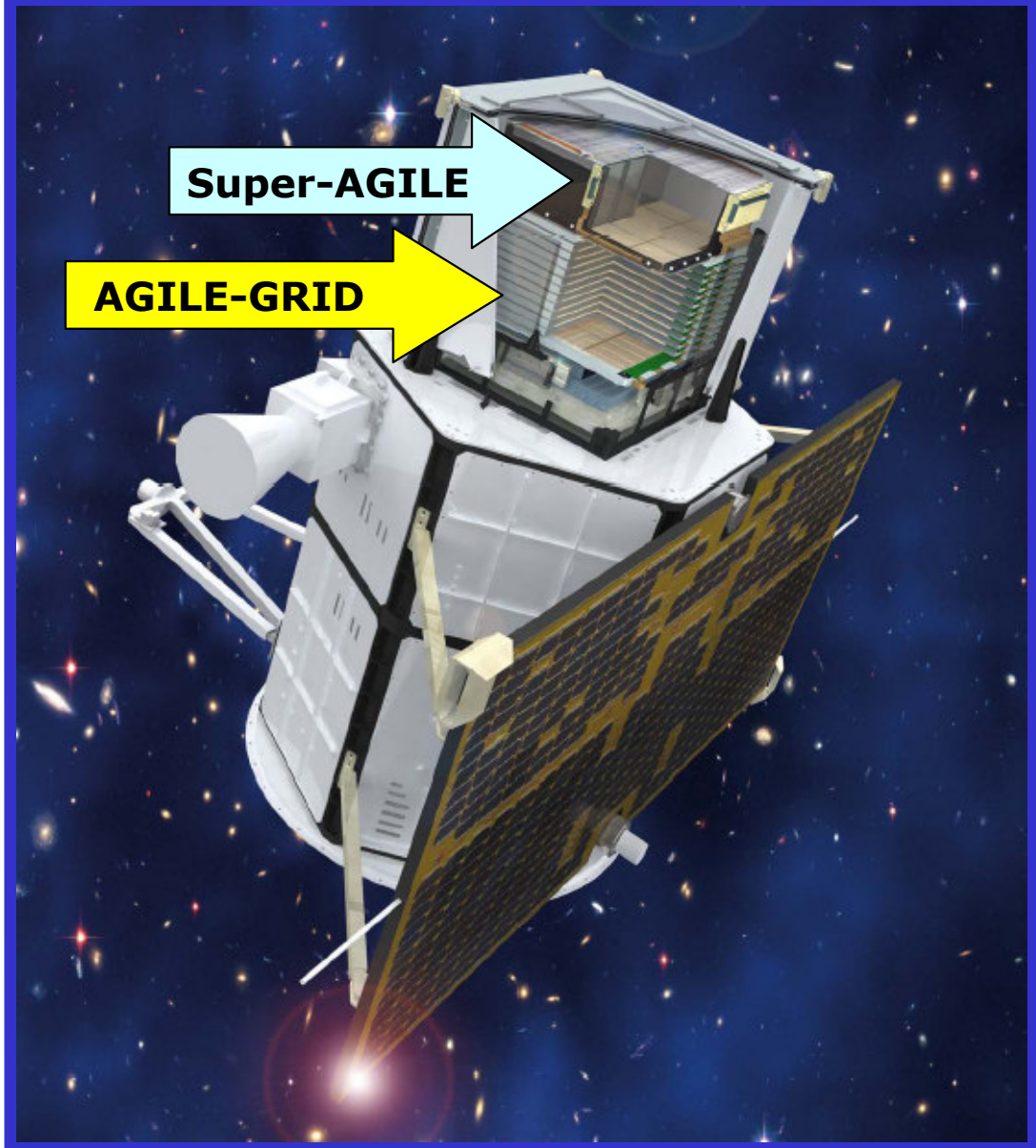

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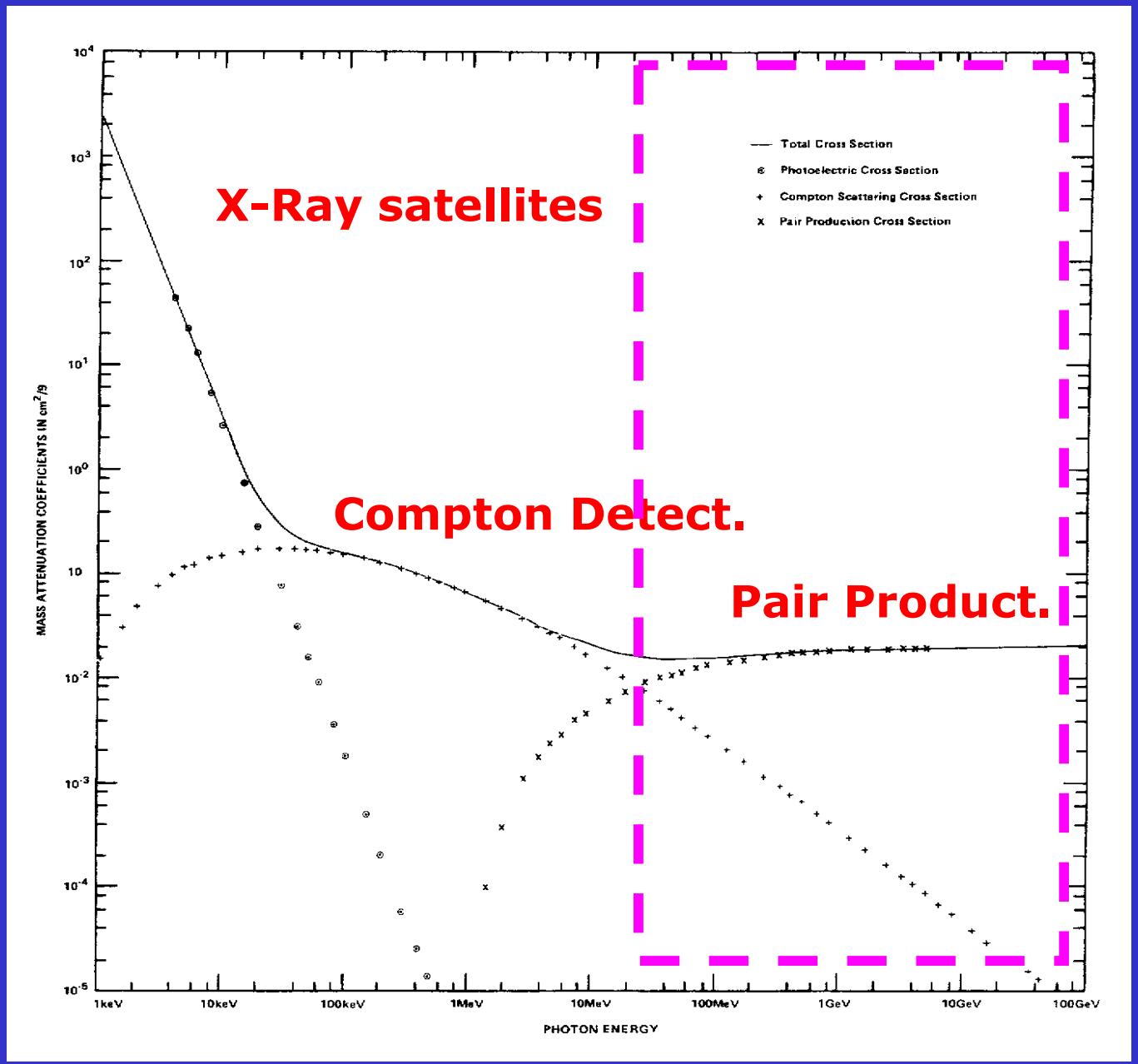
Gamma-ray detectors



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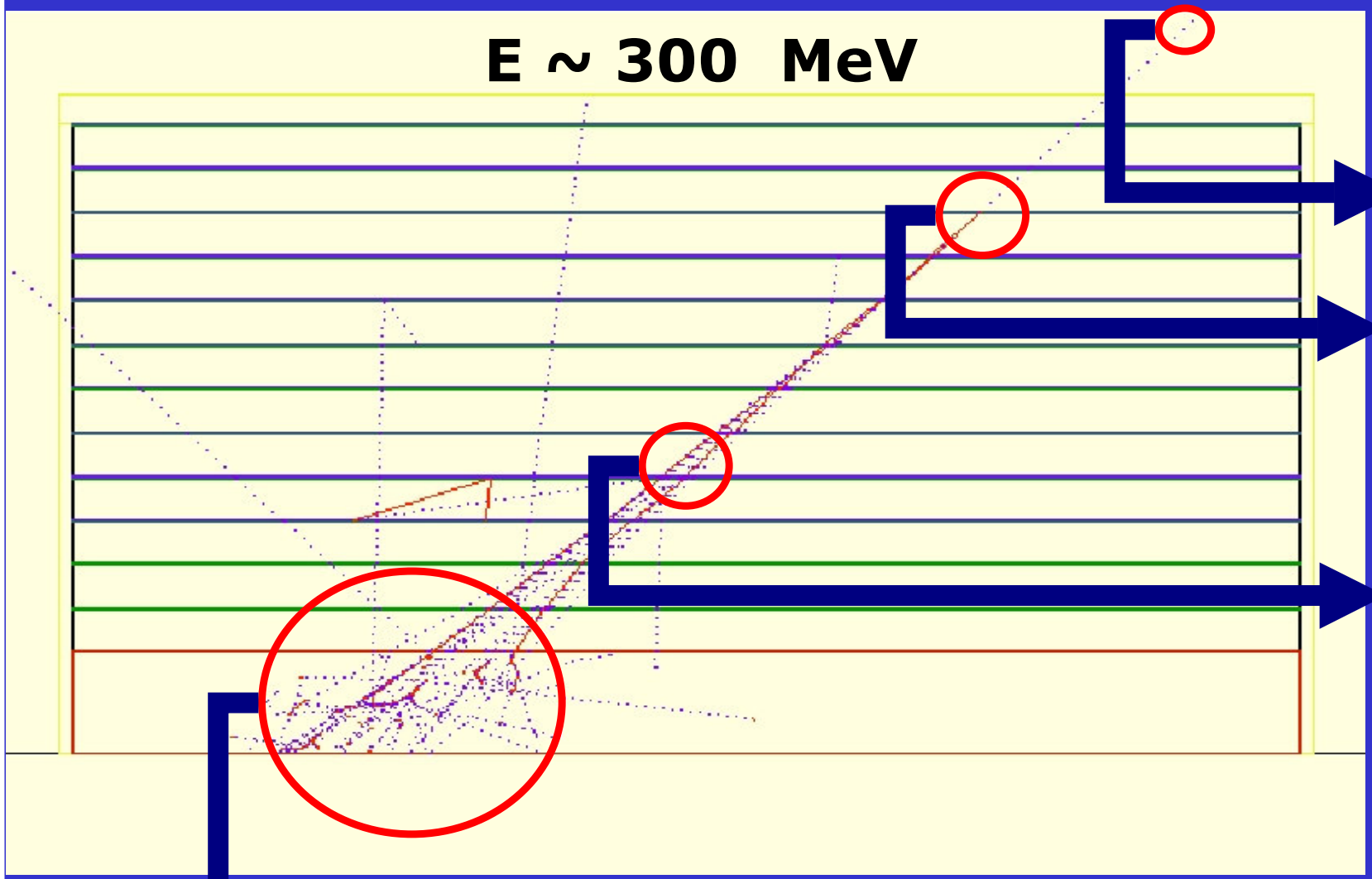


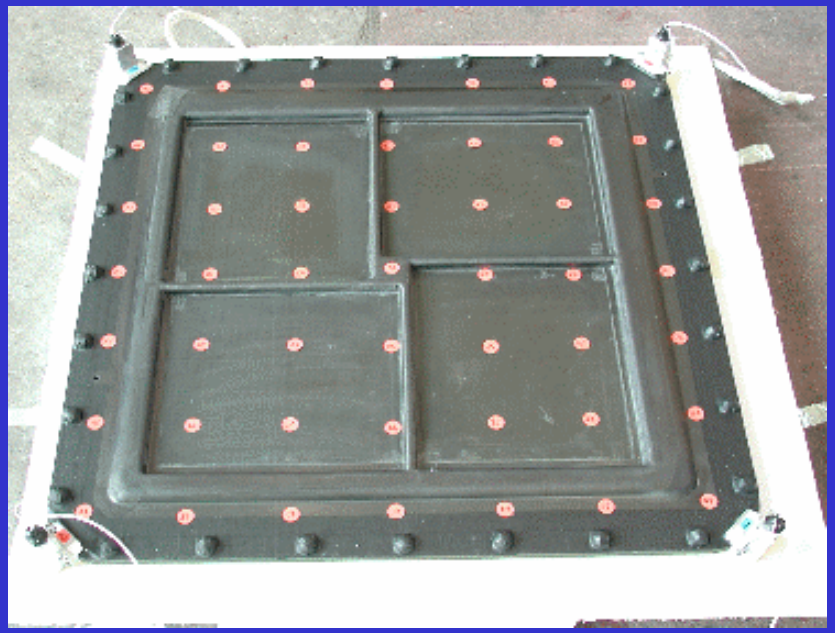
γ-ray photon

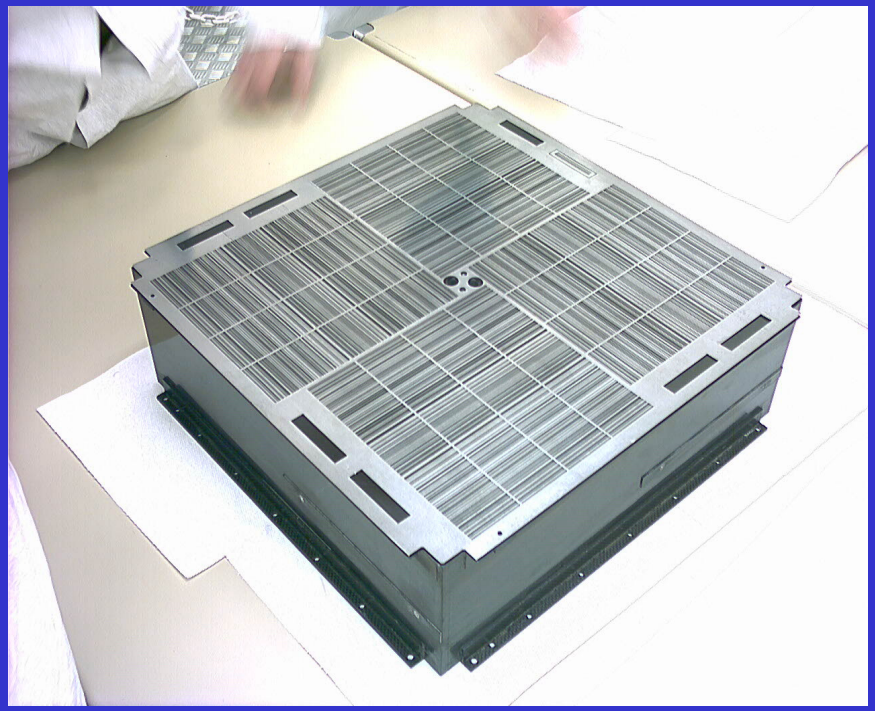
γ → e^+-e^-

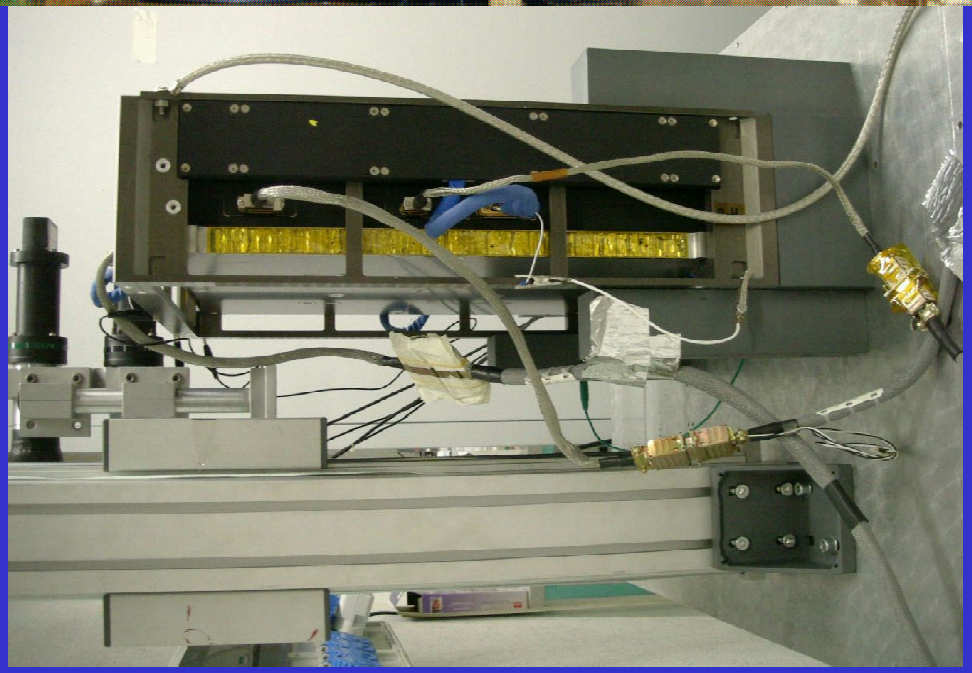
γ-ray direction from e^+-e^- tracks

γ-ray energy from the MCAL

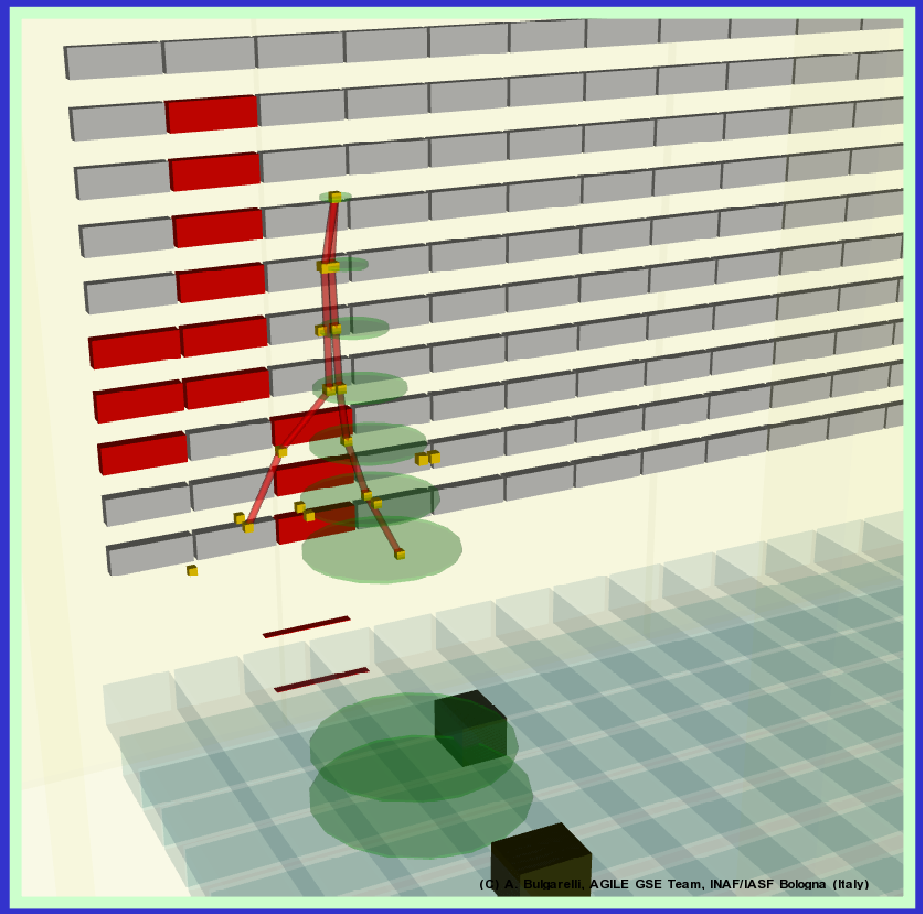
AGILE detectors





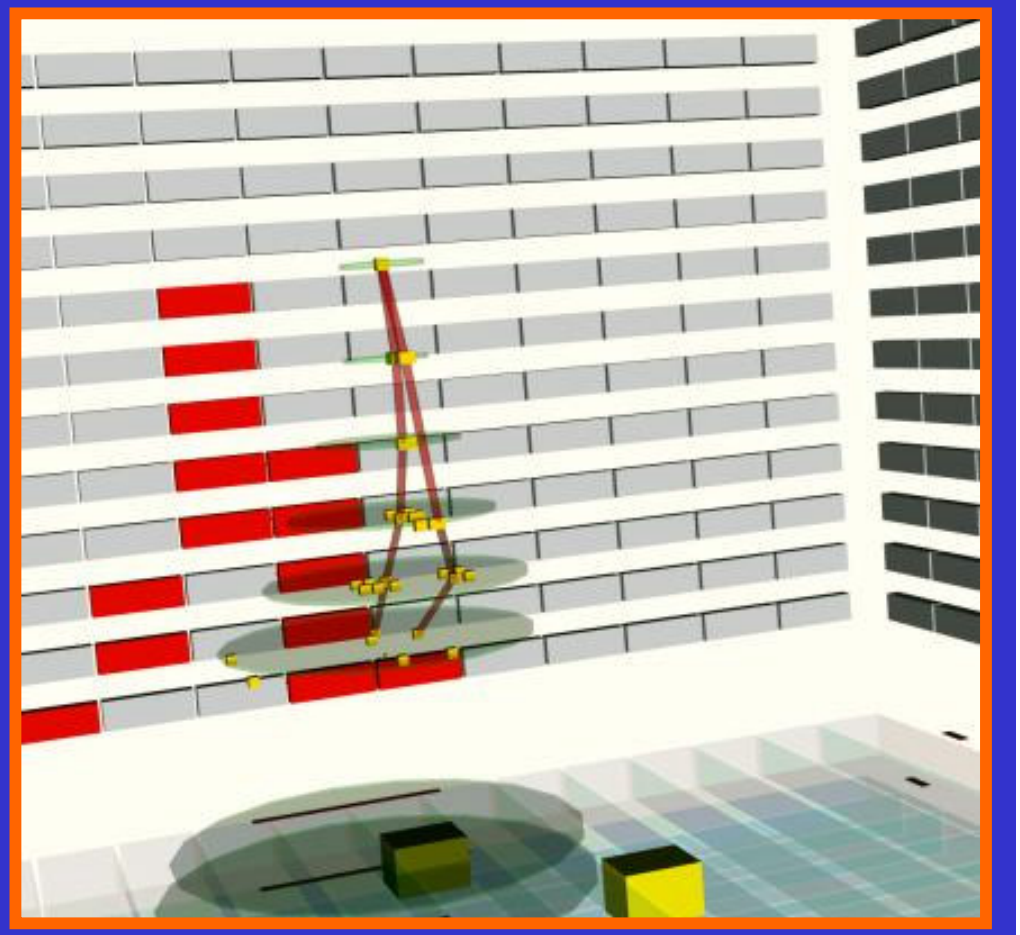


AGILE photons



First γ-ray in-flight photon detected by the AGILE-GRID on 2007, May 09

AGILE last photon on Earth

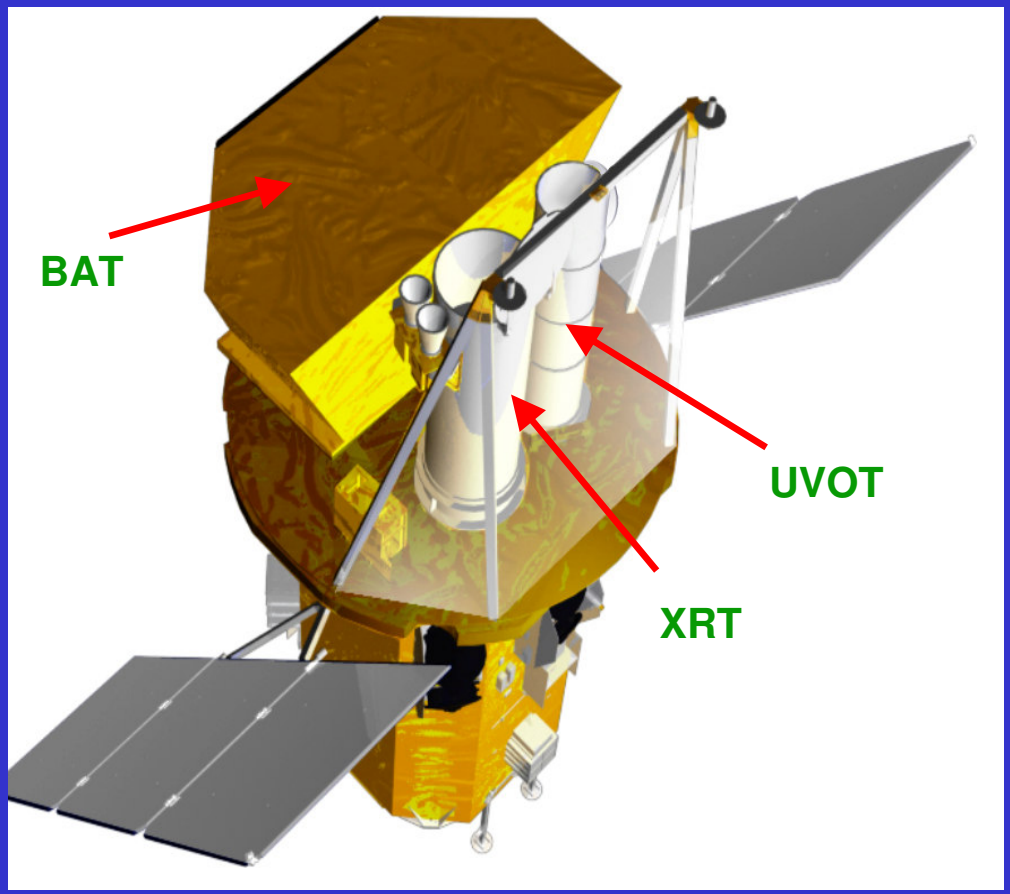


Swift Mission

Swift Instruments

Spacecraft

- Autonomous re-pointing, <70 s
- Onboard and ground triggers



Burst Alert Telescope (BAT)

- Imaging: 15-150 keV
- Centroid accuracy: 1-4′
- Field of view: 1/6 sky
- Energy resolution 7keV

X-Ray Telescope (XRT)

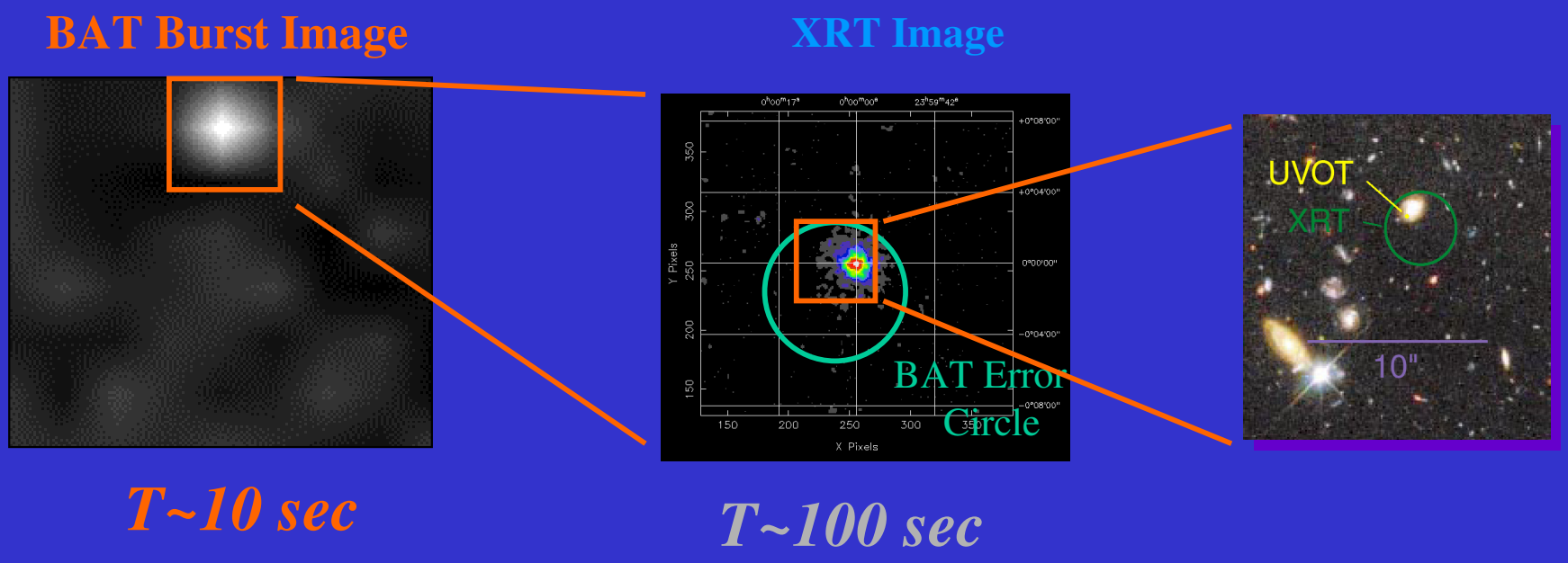
- CCD spectroscopy
- Imaging in 0.2–10 keV
- res 140ev @ 5.9keV
- Centroid accuracy: 3”
- FOV 23.6′x23.6′

UV/Optical Telescope (UVOT)

- 30cm telescope
- FOV 17′x17′
- 6 filters:1700 – 6500 Å
- Centroiding accuracy: 0.5"
- 24 mag sensitivity (wh 1000s)

GRB Observing Strategy

1. BAT triggers on GRB, calculates position to ~ 3 arcmin
2. Spacecraft autonomously slews to GRB position in <70 s
3. X-ray Telescope determines position to ~ 3 arcseconds
4. UVOT images field, transmits finding chart to ground



Data analysis requirements

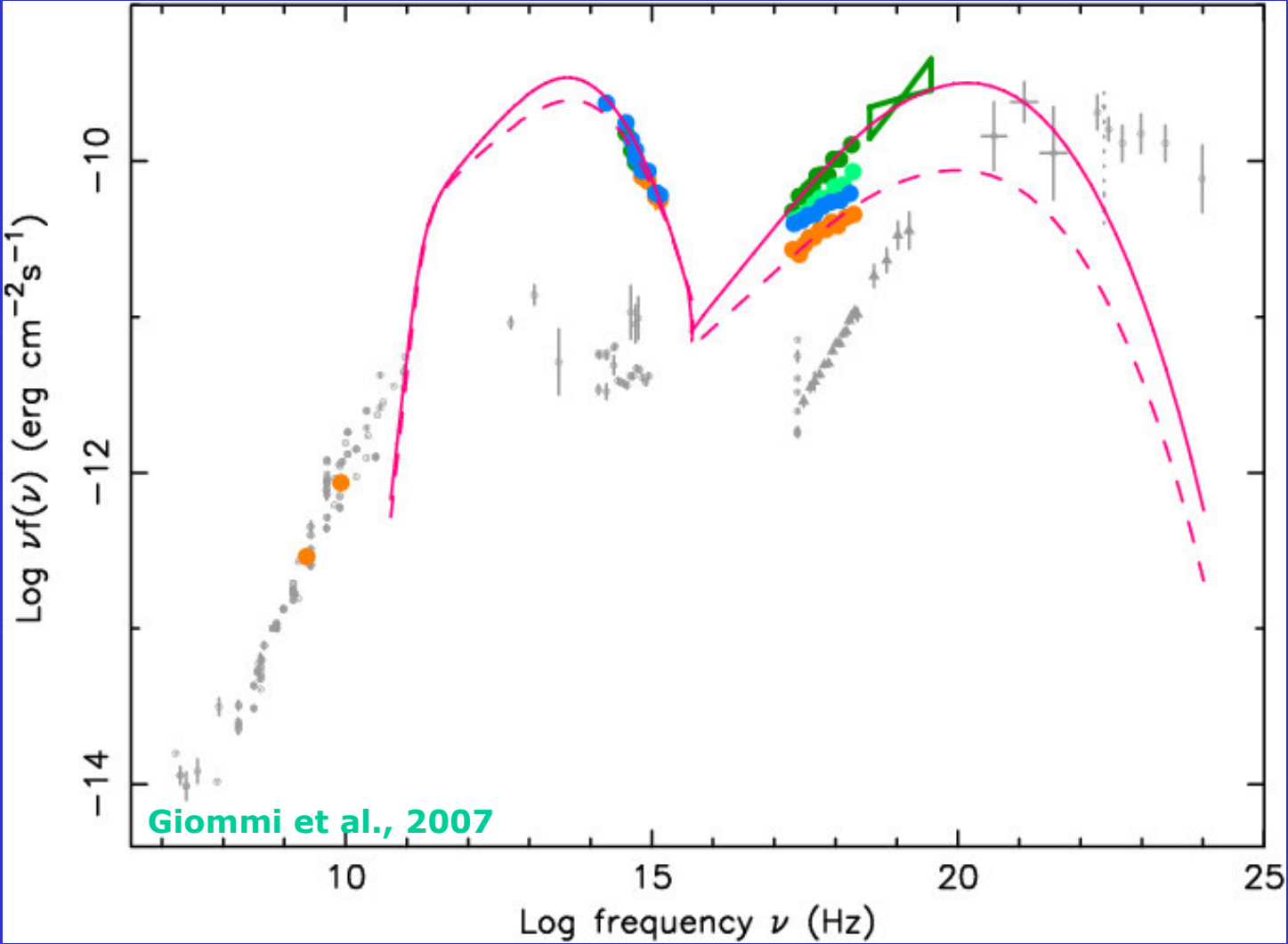
1. Data downloaded from the *Swift* Archive
2. Responses (ARF & RMF) from CALDB
3. FTOOLS

3C 454.3: the source

May 2005

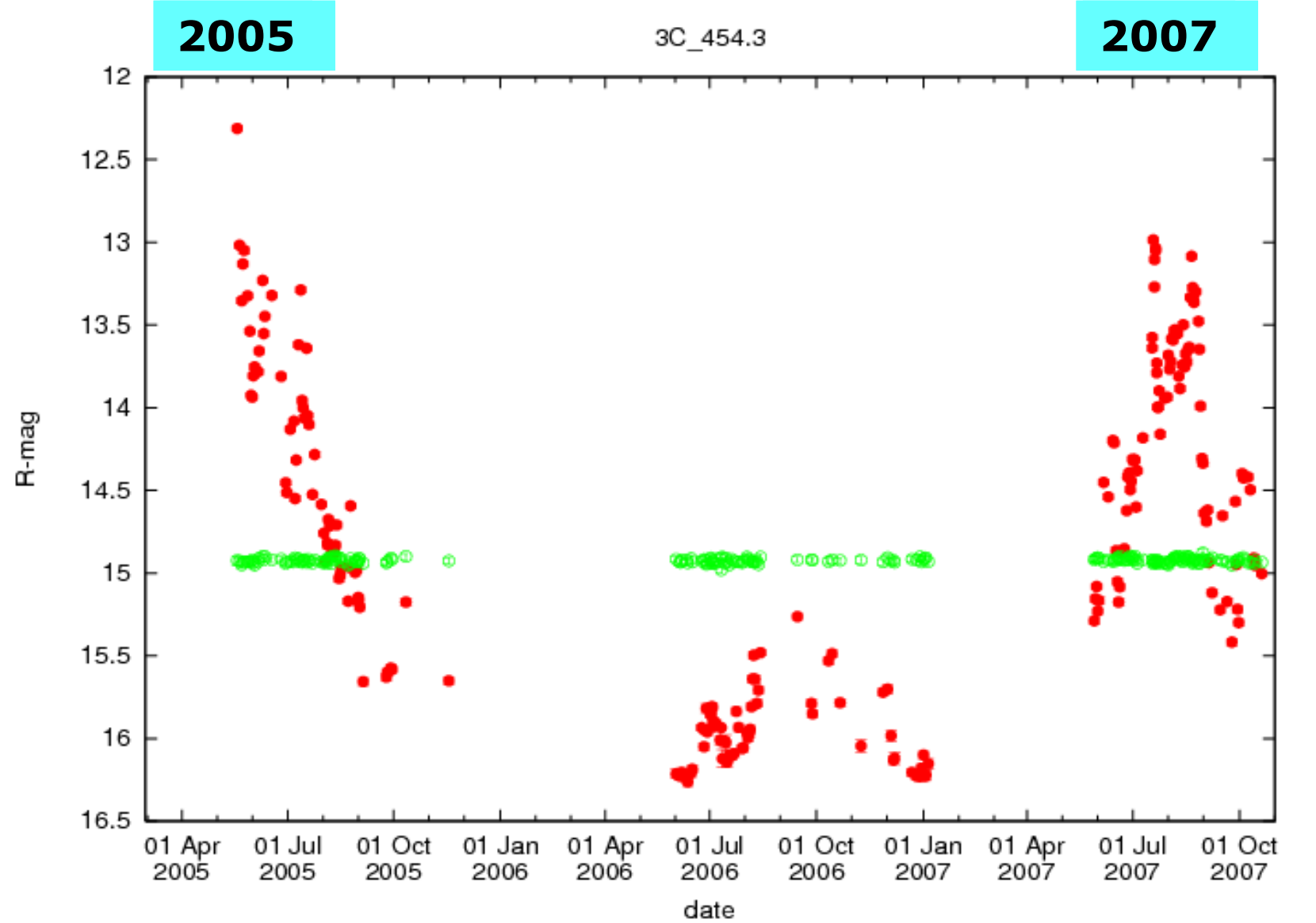
2005: Optical and X-ray flare

→ NO γ-RAY SATELLITE IN ORBIT !

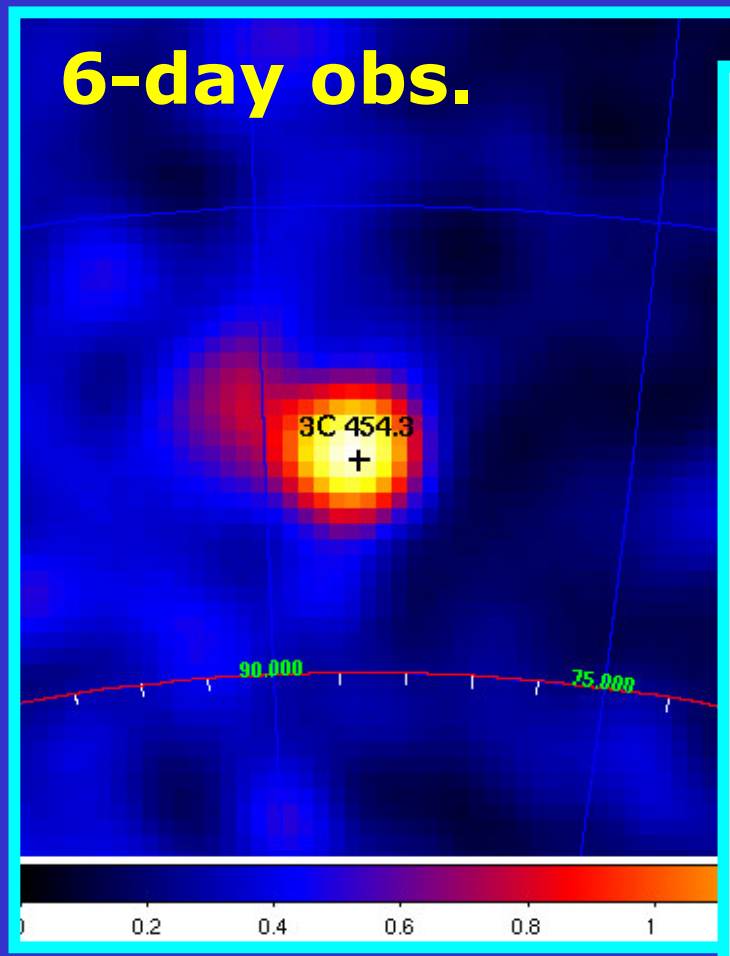


Flaring again

2007: Optical flare

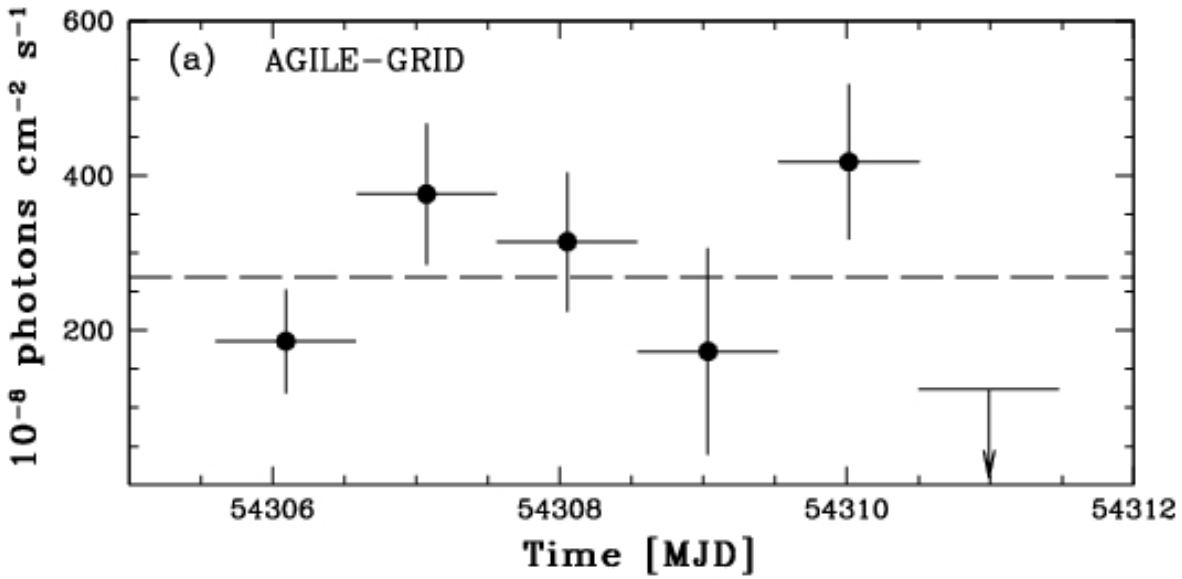


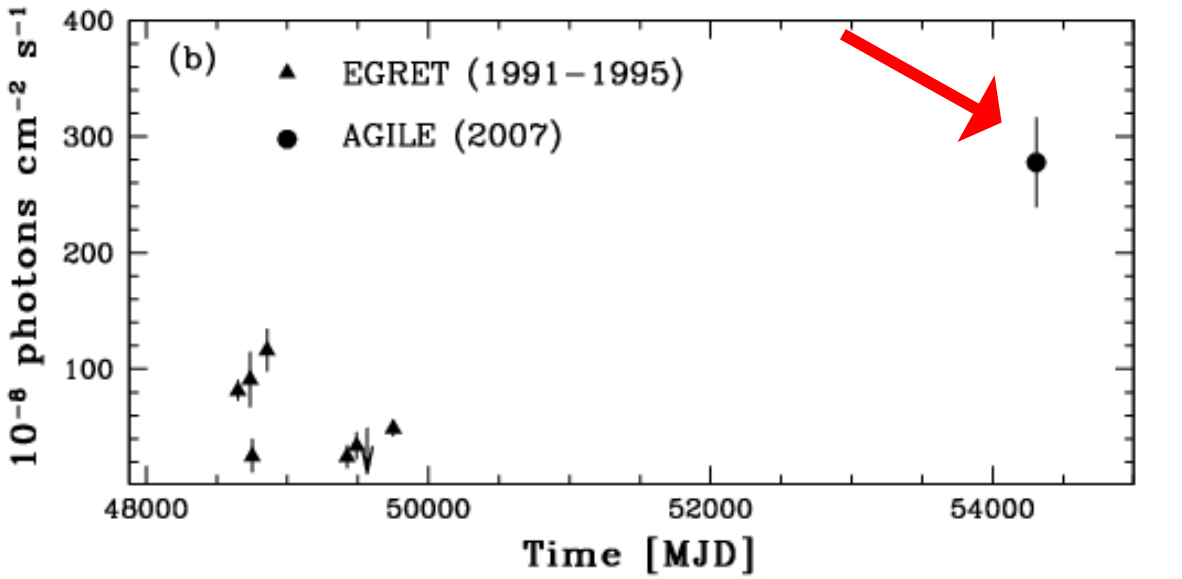
July 2007



1st published AGILE γ-ray map !

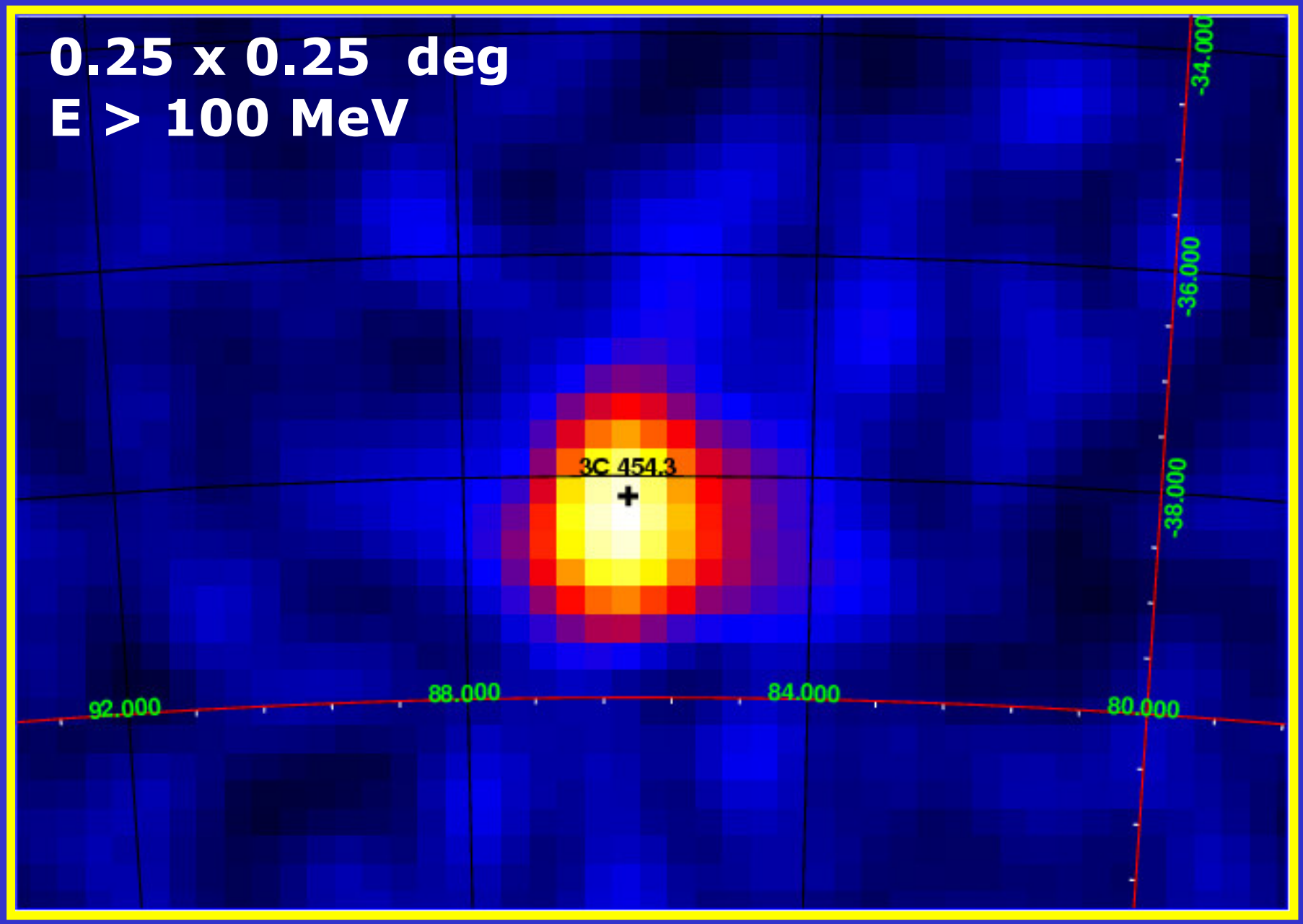
Vercellone et al. 2008, ApJL, 676, 13





3C 454.3: our data

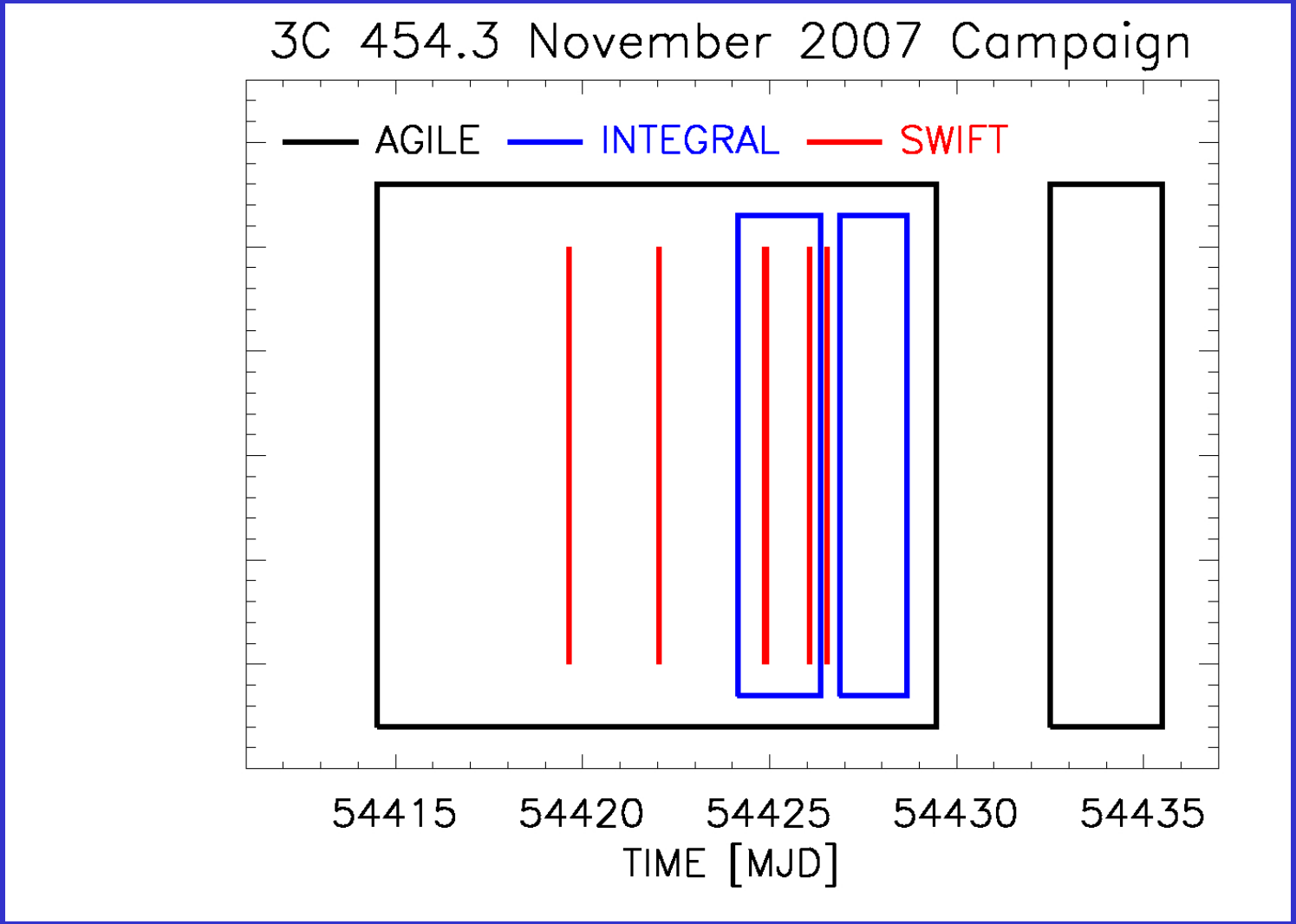
November 2007



The November Campaign

True simultaneous multiwavelength coverage

Opt. monitoring (WEBT+REM) along the whole period



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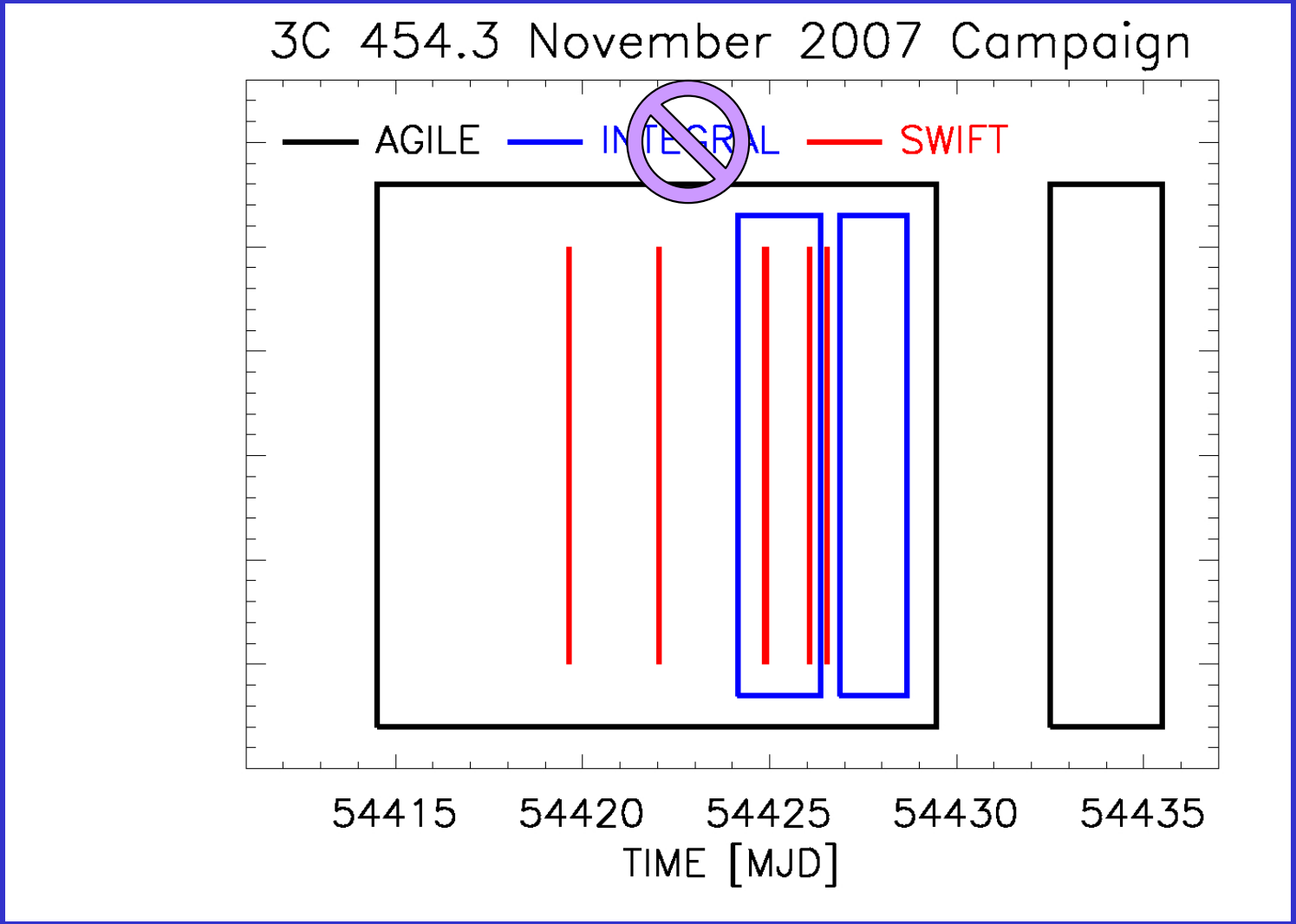

AGILE data

About 21 days of monitoring

AGILE Team data kindly packed and provided by the ASDC personnel (C. Pittori et al.)

Data analysis steps:

1. `counts`, `exposure` and `diffuse gas` map generation
2. gamma-ray spectrum computation
3. gamma-ray light—curve generation

Swift data

All the data (six segments) were obtained by means of a pre—approved G.I. Program of the AGILE Team.

All data are publicly available at the URL

`http://heasarc.gsfc.nasa.gov/docs/archive.html`

Data analysis steps:

1. `xrtpipeline` **events extraction**
2. **0.3—10 keV spectrum computation**
3. **0.3—10 keV light—curve generation**

Our Goal

Build—up the high—energy (keV—GeV) portion of the spectral energy distribution of 3C 454.3