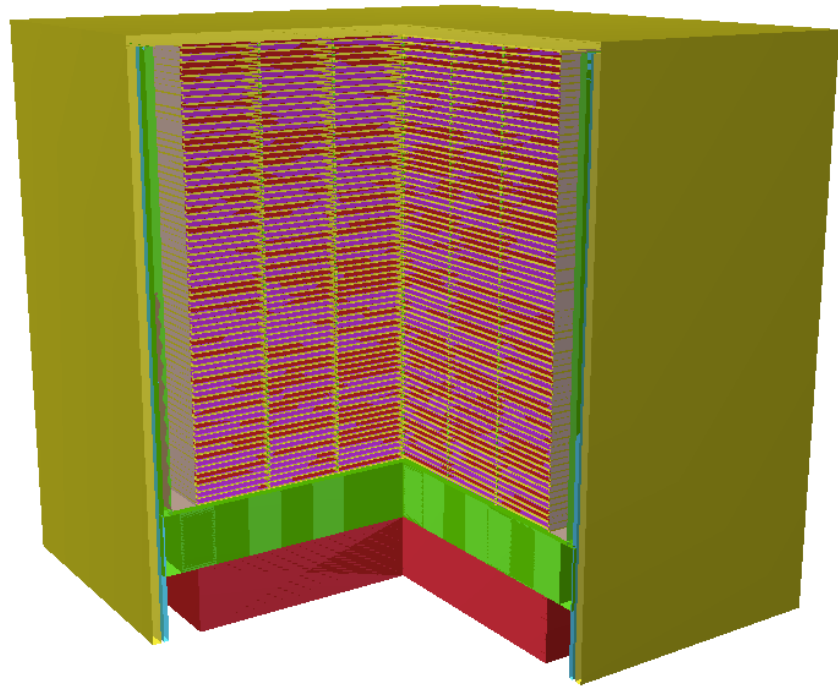


*Philippe Laurent
APC, Paris*

- Requirements
- Instrument design
- Open questions



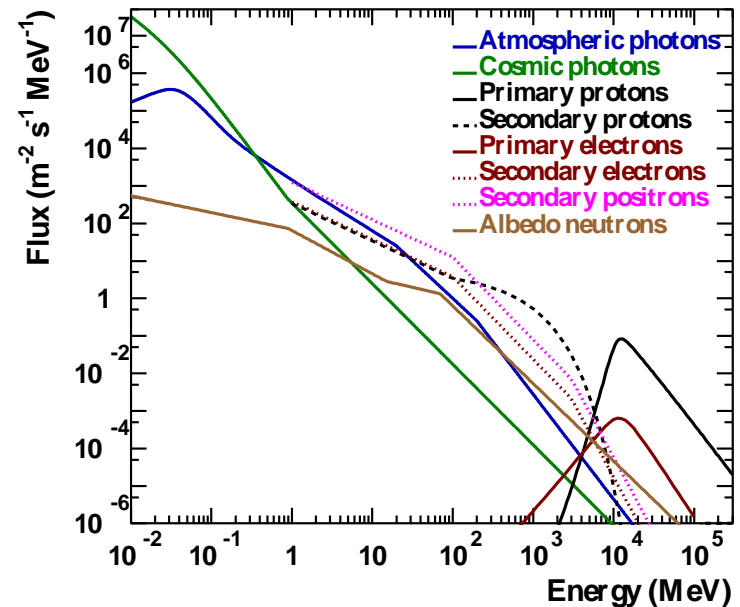
Requirements

ASTROGAM AC requirements

- **Orbit** – Equatorial ($i < 5^\circ$) low-Earth orbit (altitude in the range 550 - 600 km)
- **AC overall trigger rate** – around 60000 cts/s.
- **AC efficiency** – greater than 0.9999 (cf Agile).
- **AC mass** – less than 50 kg (TBC).
- **AC power** – less than 10 W (TBC).
- **AC lifetime** – more than 5 years (TBC).

⇒ we select **plastic scintillator** as it is light, and luminous.

⇒ we select **optical fibers** in order to facilitate the mechanical implementation.



Background environment in an ELEM

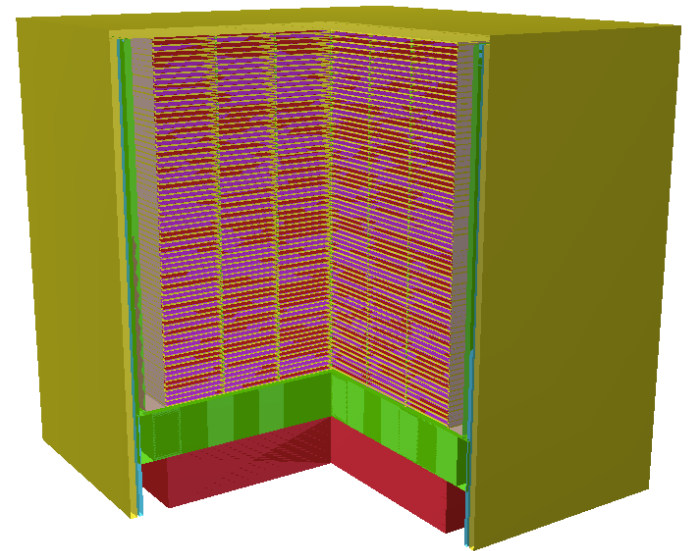
ASTROGAM AC requirements

- **Lower level requirements** – to be defined during next phases; values adapted from Fermi, Agile, and Simbol-X

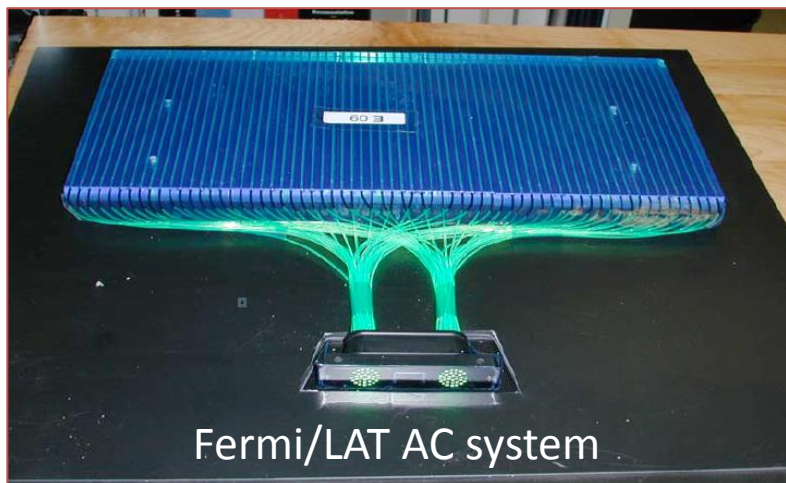
Parameter	Requirement
Detection of Charged Particles efficiency	No hole in the ACD system
Fast VETO signal	Datation 100 ns accuracy after passage of charged particle
PHA signal	Below 10 MIP, precision of <0.02 MIP or 5% Above 10 MIP, precision of < 1 MIP or 2% (whichever larger)
False VETO rate - noise	$< 1\%$ gamma-ray rejection from false VETO's due to electrical noise
High Threshold (Heavy Nuclei) Detection	Detection of highly-ionized particles (C-N-O or heavier) for calorimeter calibration.
Track reconstruction	Required ?

Instrument design

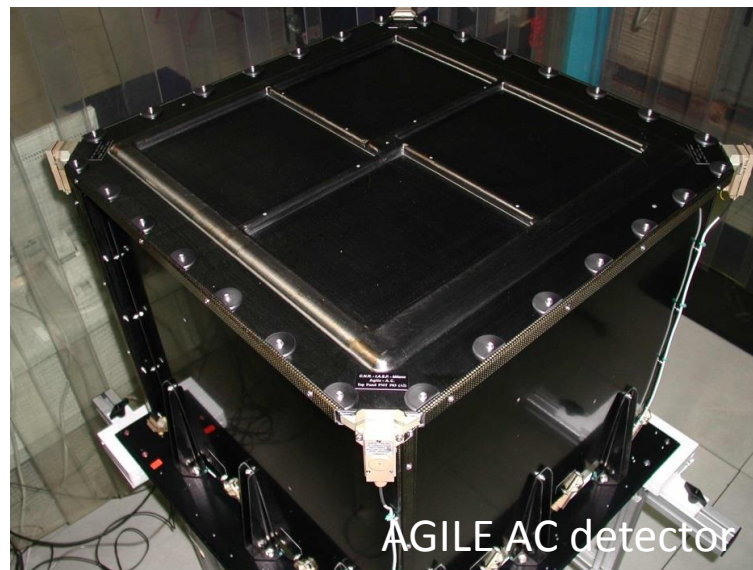
- AC system formed with large **1 cm thick plastic BC408 panels** covering 5 faces of the instrument. In each panel, **small optical fibers** buried in grooves convey the scintillation light to **SiPM** glued at the end of the fibers. The other is painted with a reflective material.
- With 72 fibers (70 cm long) for the top panel and 280 fibers (69 cm long) for the side panels, there are in total **352 fibers = 352 electronic channels**.
- Readout : ASICs (EASIROC, VATA).



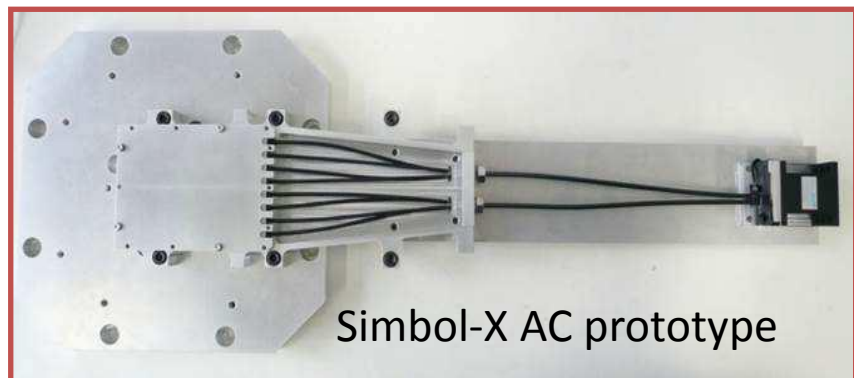
Heritage: FERMI/LAT, AGILE, Simbol-X



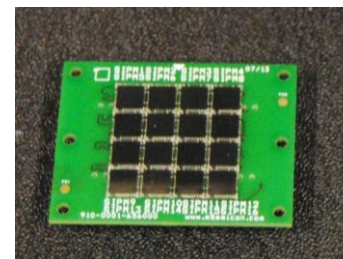
Fermi/LAT AC system



AGILE AC detector



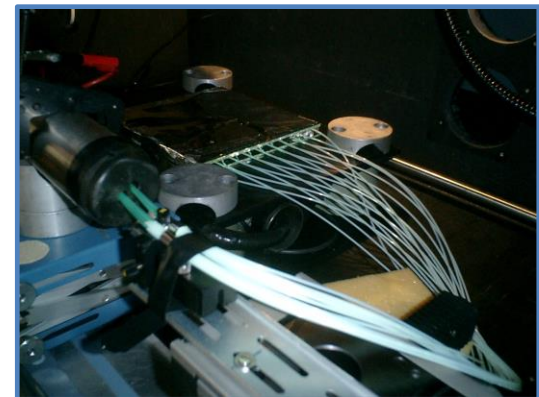
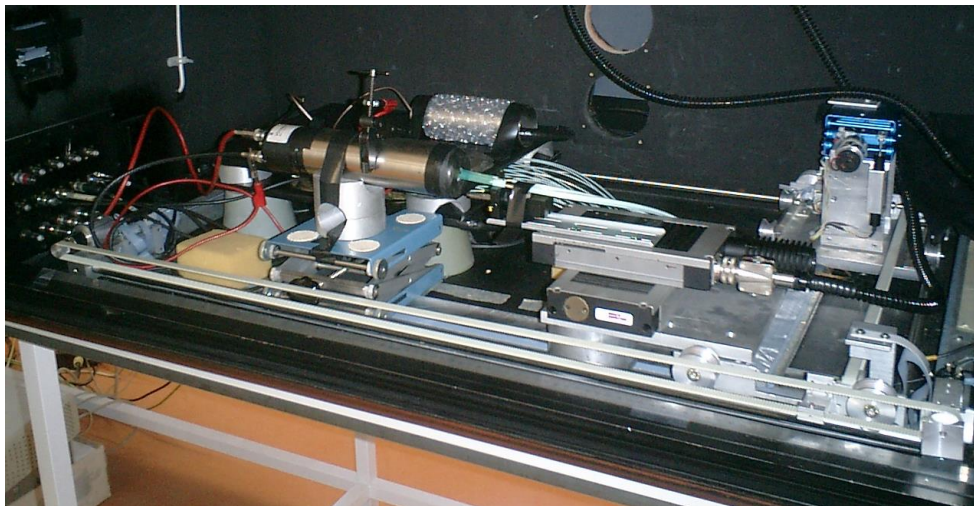
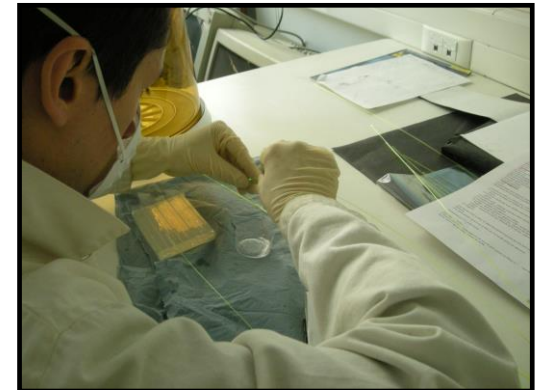
Simbol-X AC prototype



SensL SiPMs at/close to TRL6
(on-going program with ESA)

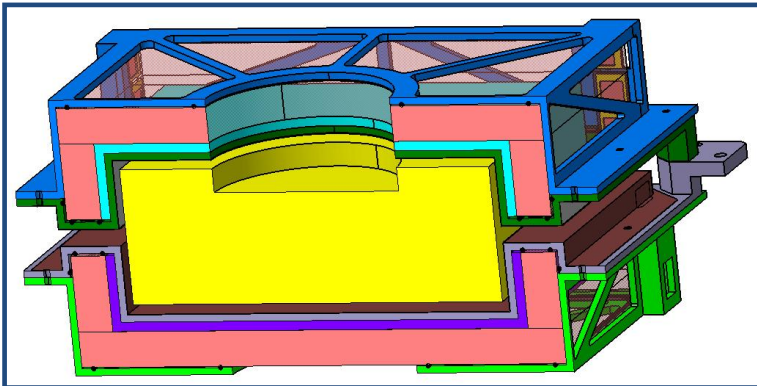
ASTROGAM Symbol-X AC @ APC

- Grooves in the AC plastic BC408 panels are first machined with a dedicated drill.
- Then the fibers are glued into the grooves with Bicon BC 600 optical cement.
- Then, we remove bubbles in a vacuum chamber.
- And the whole system was tested in a dedicated black box.

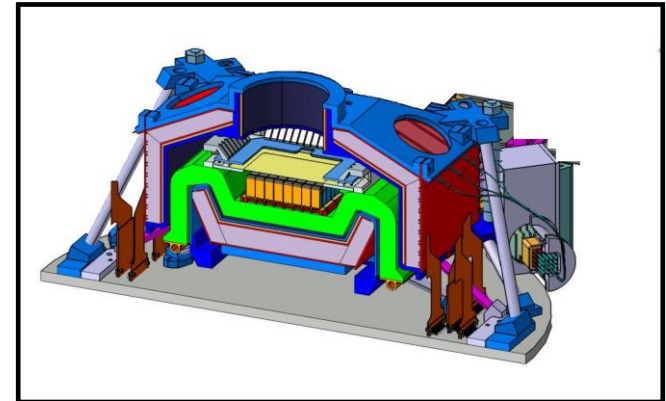


ASTROGAM 5 or 6 faces ?

- The possibility to put a plate below the main detector is open.
- With no plate below, it is easy to pass through the different cables and thermal connection keeping a rectangular geometry (as in Agile).
- At the system level, if a bottom plate is needed (to be evaluated with background computations), the AC system geometry should be optimized for the cable and drain passage without letting too much holes and without mass increase.



2006



2009

- **5 or 6 faces (with or without AC below) ?**
- **Photosensor: SiPM, PMT ?**
- **ASIC: EASIROC, VATA, other ?**
- **On-board data handling ?**
- **Telemetry ?**
- **...**

Thank you !