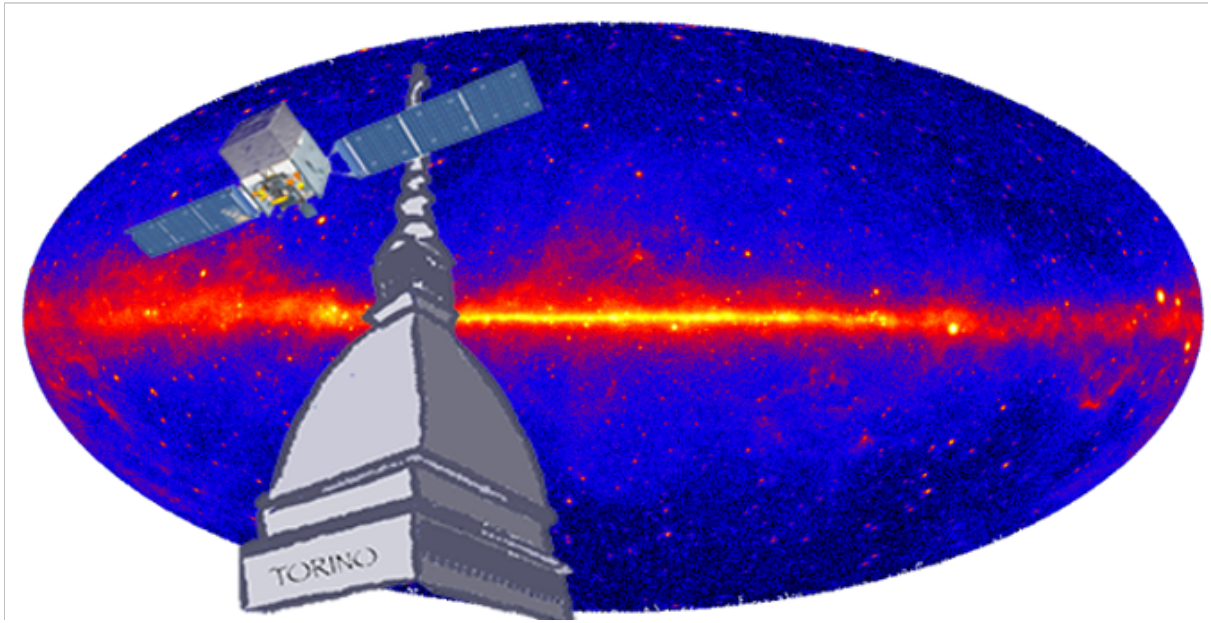
Dai segnali nei rivelatori… alla mappa del cielo gamma



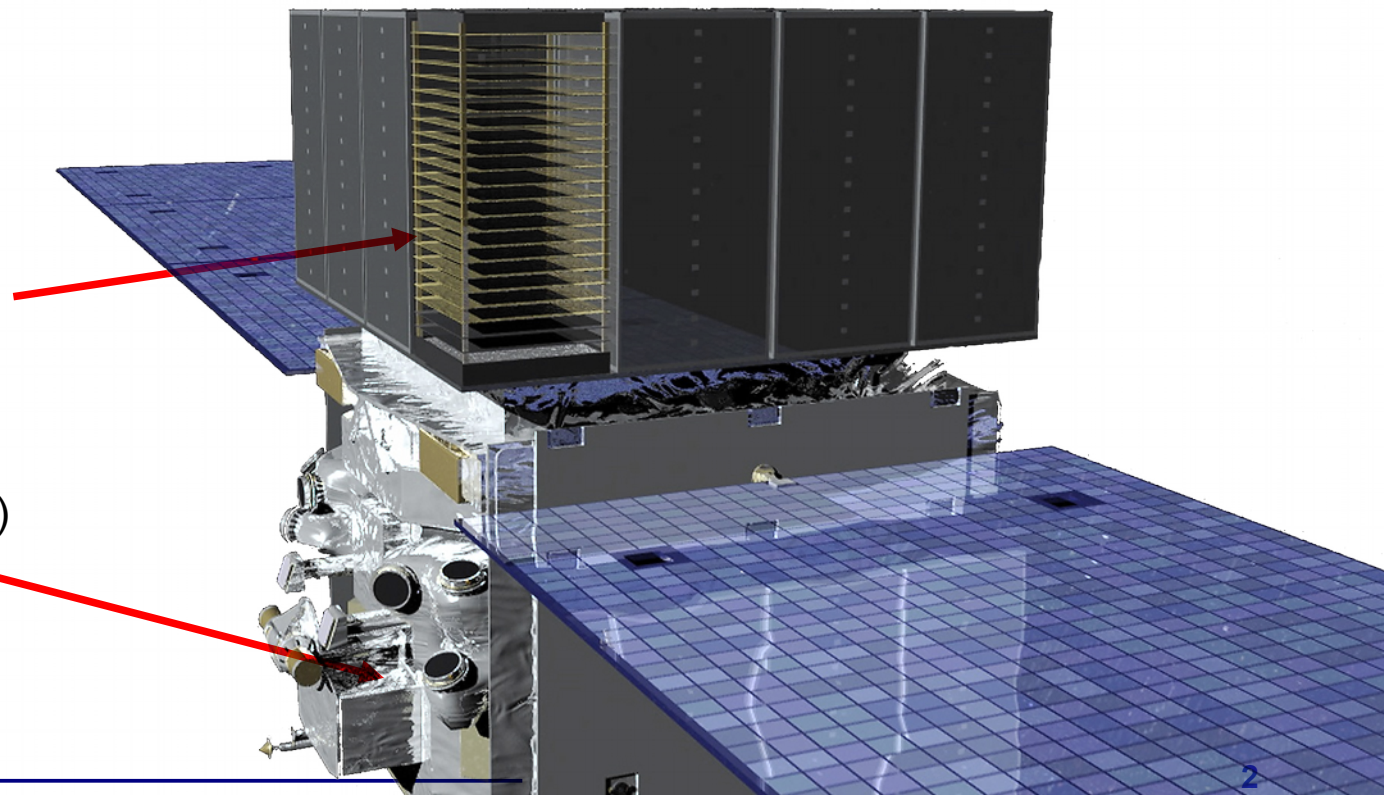
S. Maldera
INFN - Torino

The Fermi satellite

- **The Fermi Gamma-Ray Space Telescope is an international Science Mission exploring the gamma-ray sky by means of its two main instruments:**
  - **Gamma-ray Burst Monitor (GBM): 8 keV - 40 MeV**
  - **Large Area Telescope (LAT): 20 MeV - ~1TeV**

Almost circular orbit, at 565 km altitude and 25.6 deg inclination

Orbit period= ~90'



The Fermi LAT

Precision Si-strip Tracker (TKR)

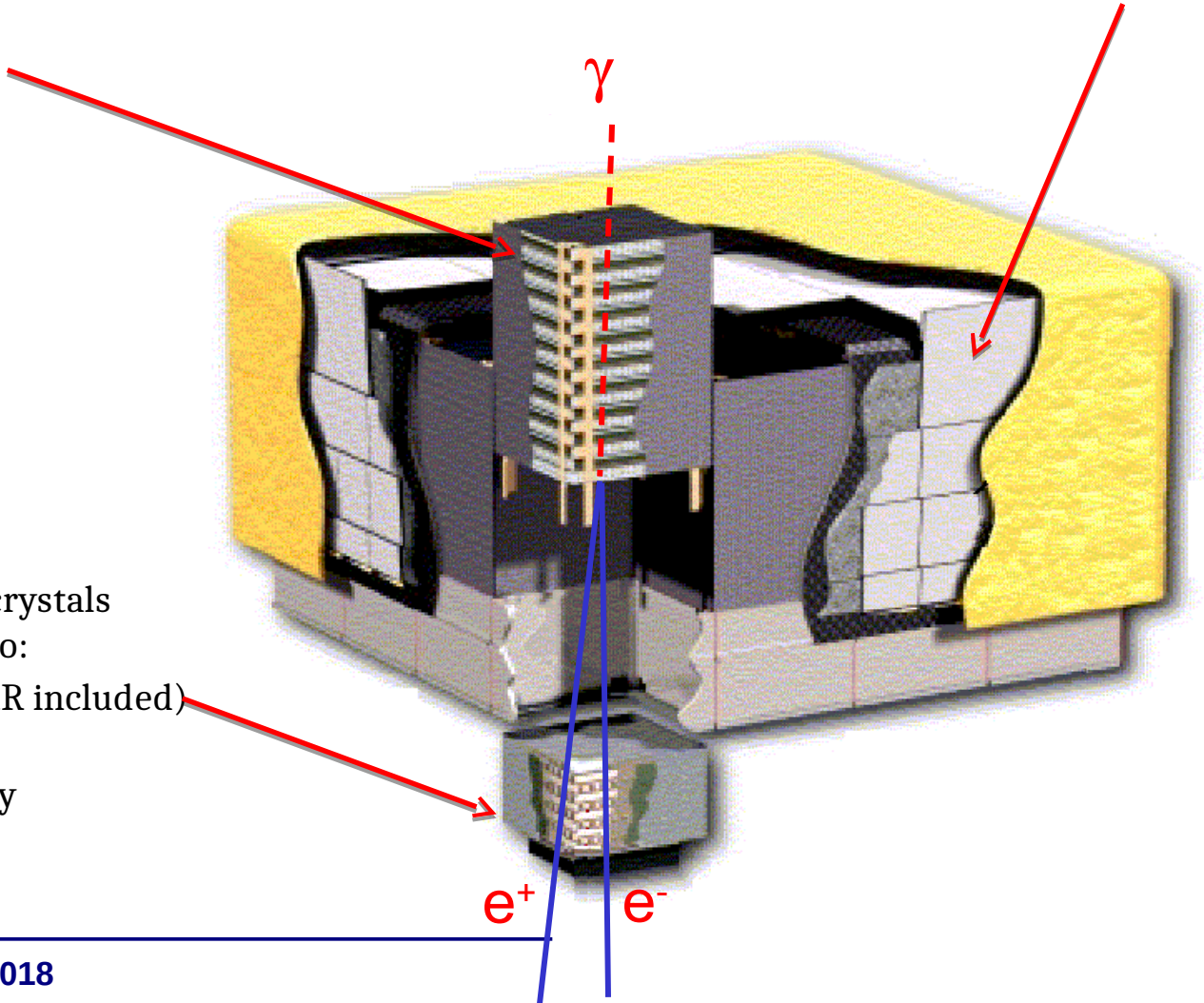
- Measures incident γ-ray direction
- 18 XY tracking planes: 228 μm strip pitch
- High efficiency. Good position resolution
- 12x 0.03 X_0 front end: reduce multiple scattering
- 4x 0.18X_0 back-end: increase sensitivity >1 GeV

Anticoincidence Detector (ACD)

- 89 scintillator tiles
- First step in the reduction of large charged cosmic ray background
- Segmentation reduces self-veto at high energy

Overall LAT Design:

- 4x4 array of identical towers
- 3000 kg, 650 W (allocation)
- 1.8 m × 1.8 m × 1.0 m
- 20% sky in any instant
- All sky for 30' every 3 hours



Hodoscopic CsI Calorimeter

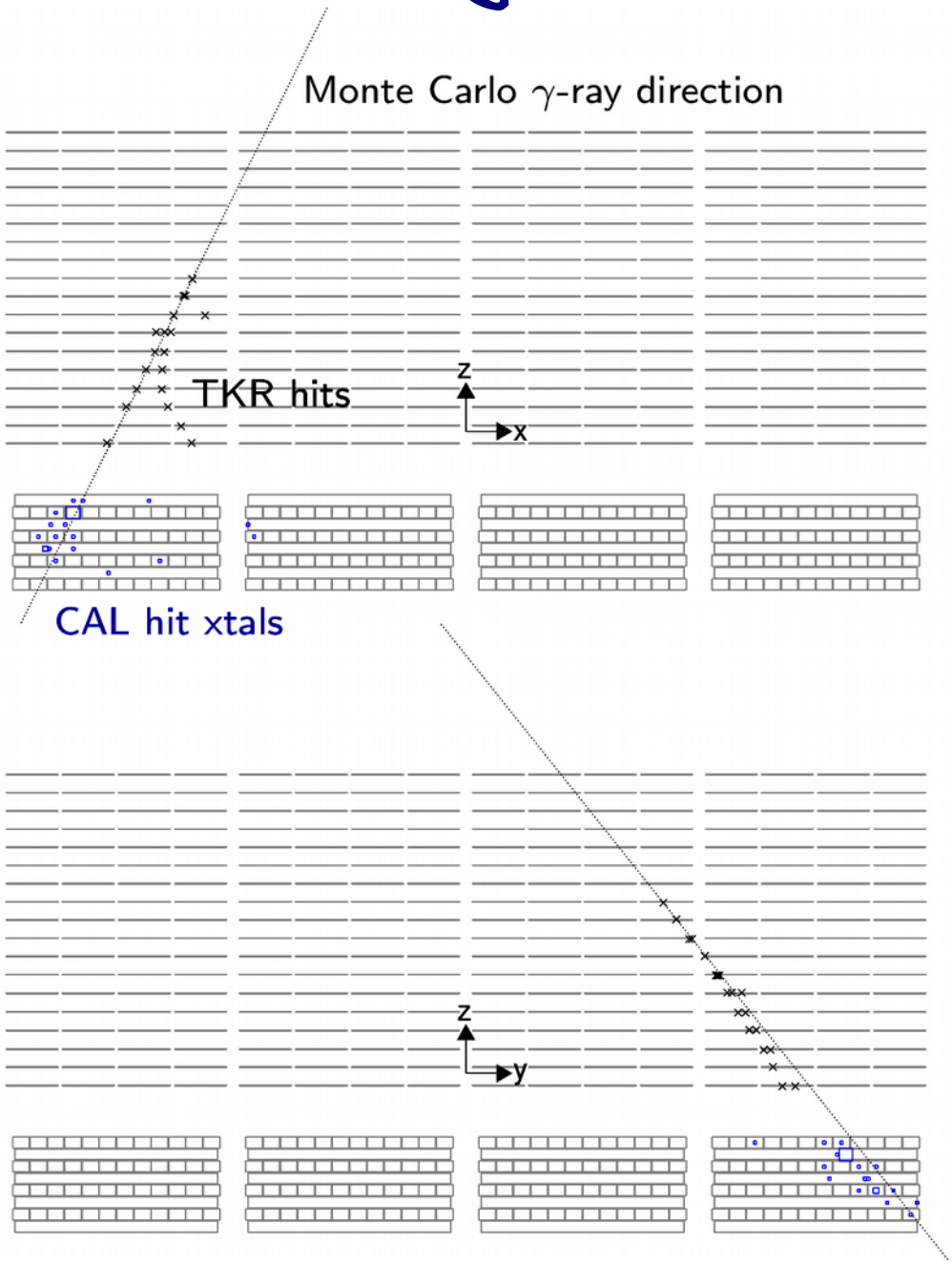
- Segmented array of 1536 CsI(Tl) crystals
- 8.6 X_0: shower max contained up to:
  - ~ 200 GeV normal (1.5X_0 from TKR included)
  - ~ 1TeV @ 40° (CAL-only)
- Measures the incident γ-ray energy
- Rejects cosmic-ray background

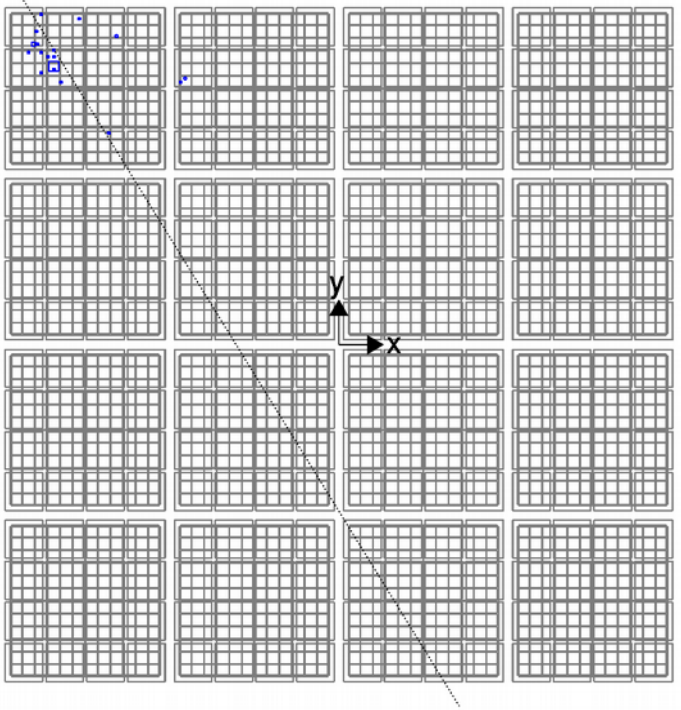
Ricostruzione degli eventi

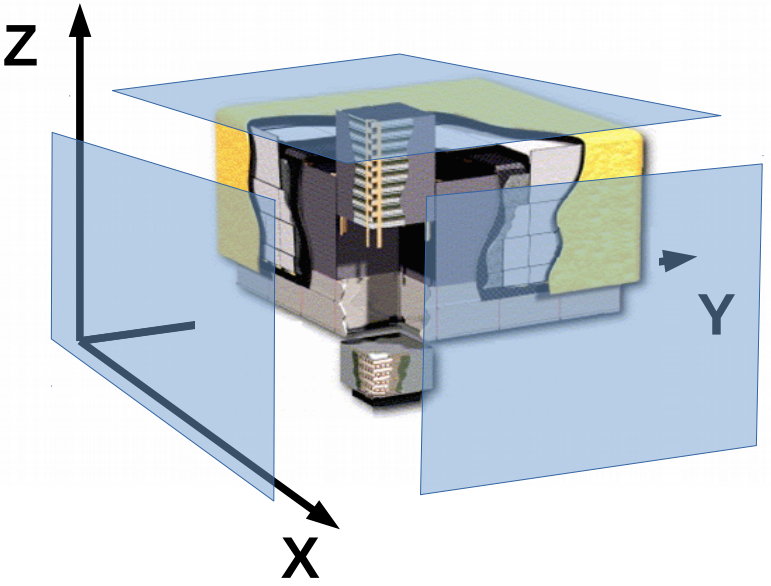
A partire dai segnali nei rivelatori vogliamo:

- eliminare (o studiare) le particelle cariche (background)
- ricostruire la direzione di arrivo
- ricostruire l'energia

Fotone gamma nel LAT

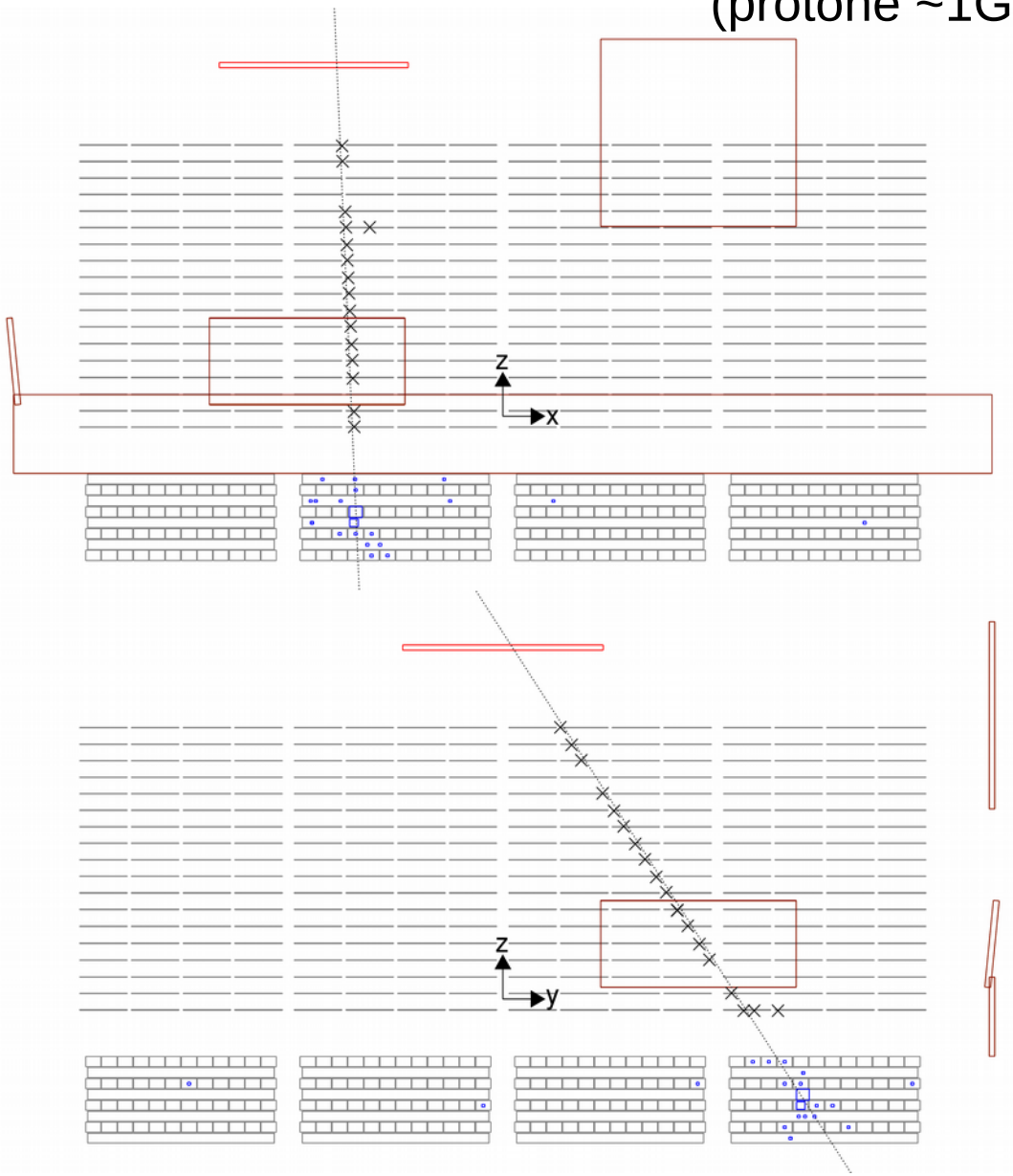


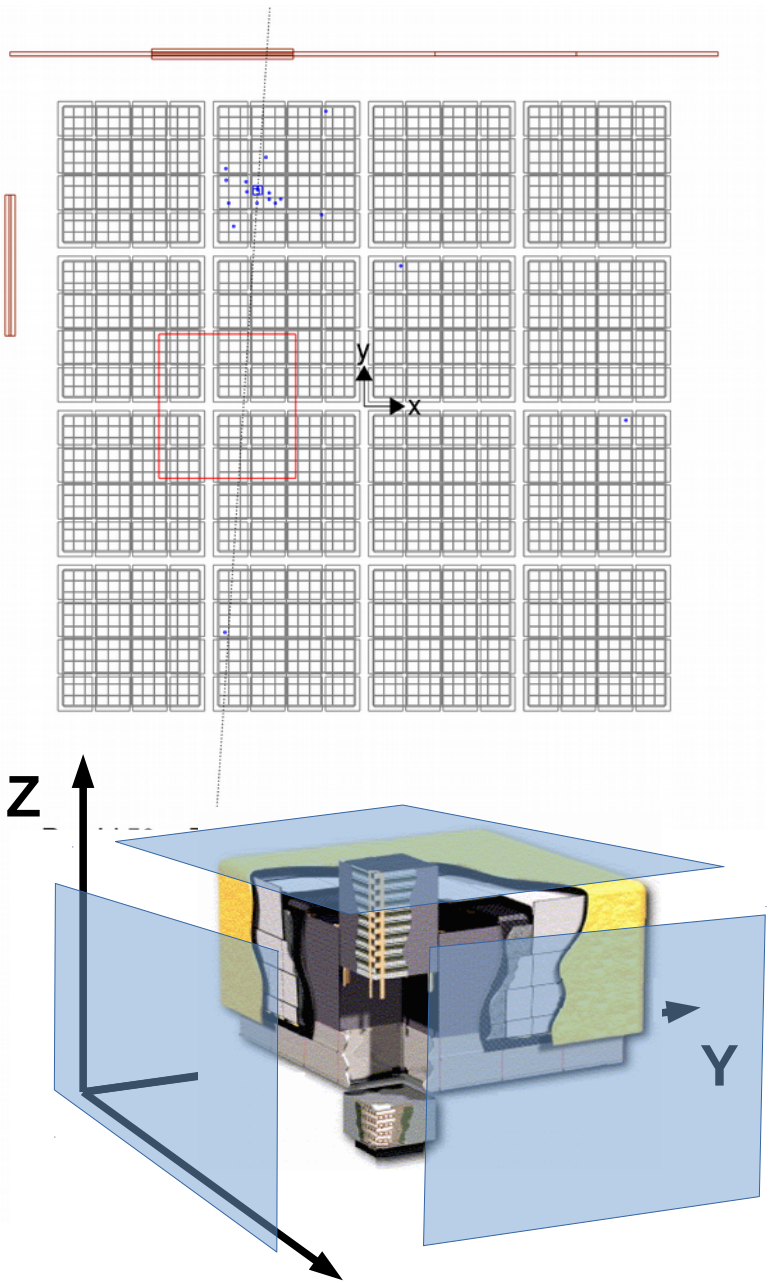




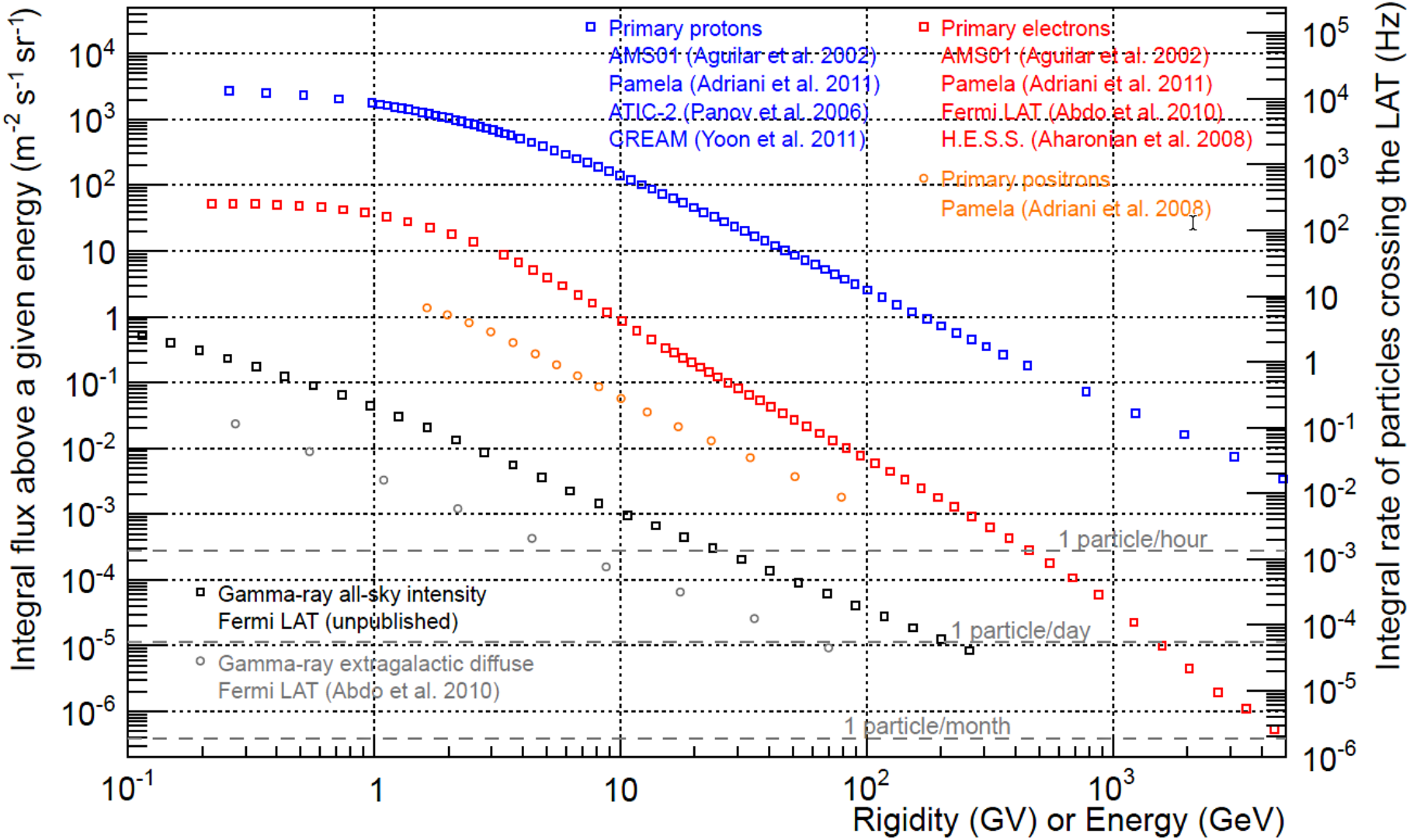
Evento background nel LAT

(protone ~1GeV)





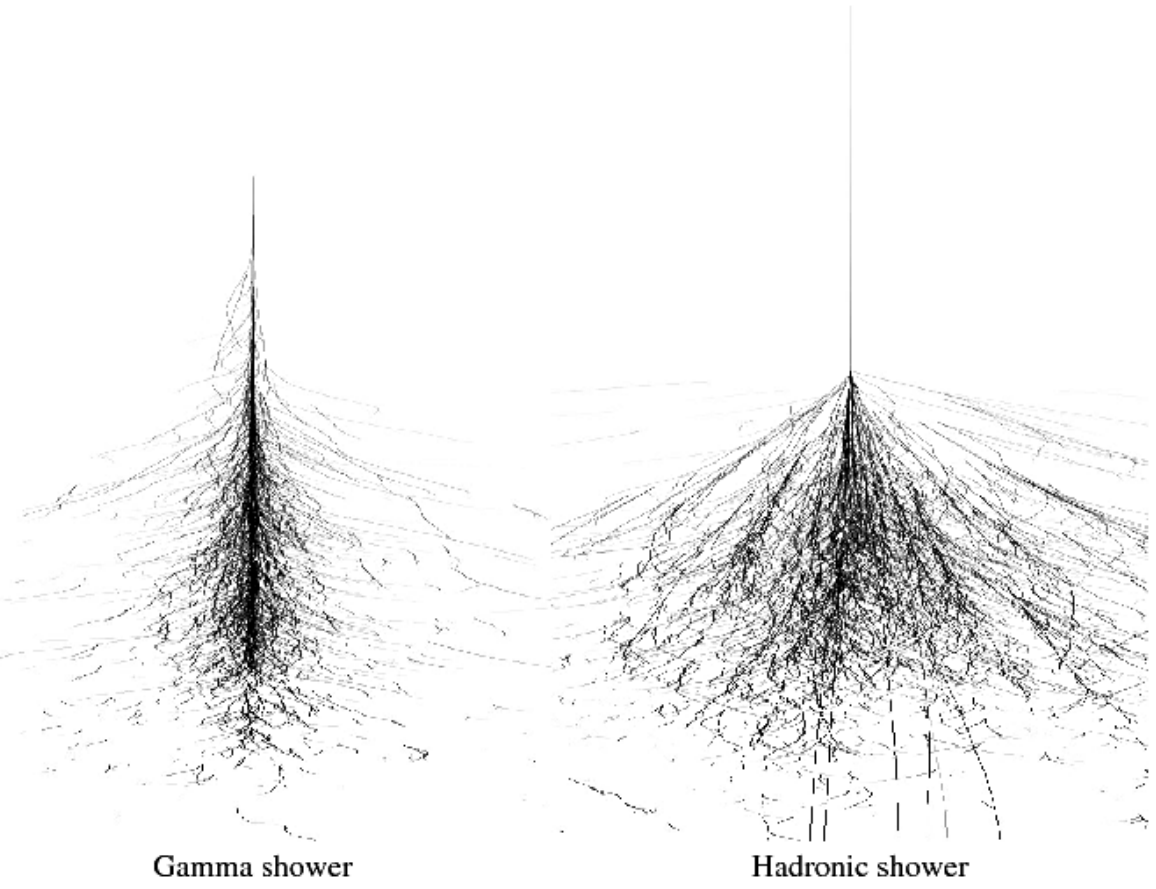
Flussi all'orbita di Fermi

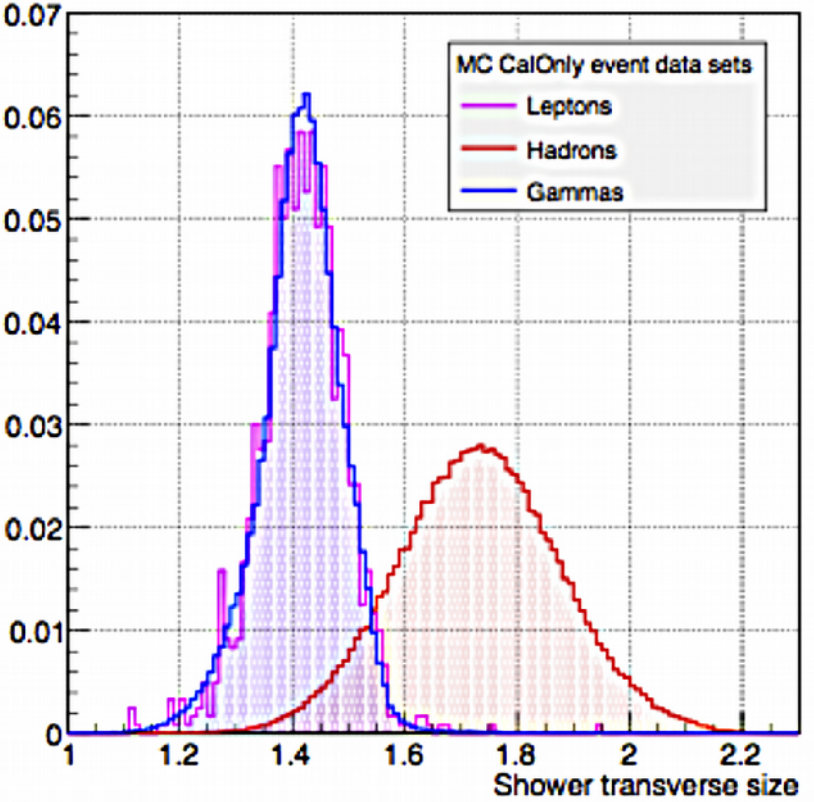


necessaria una riduzione del background di un fattore ~ 10^6

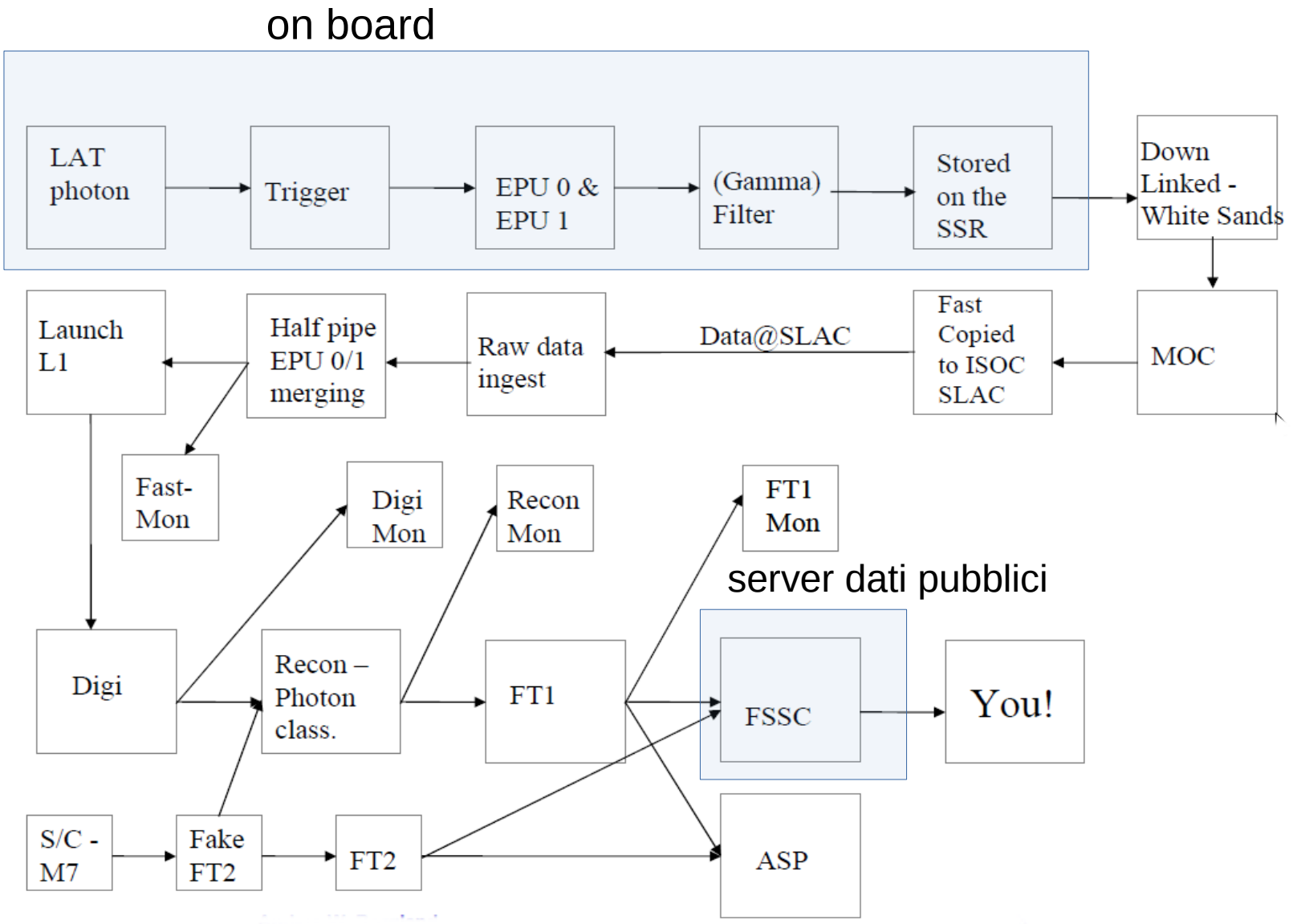
ACD + "forma" dello sciame nel calorimetro

Sciame elettromagnetico vs sciame 'adronico'

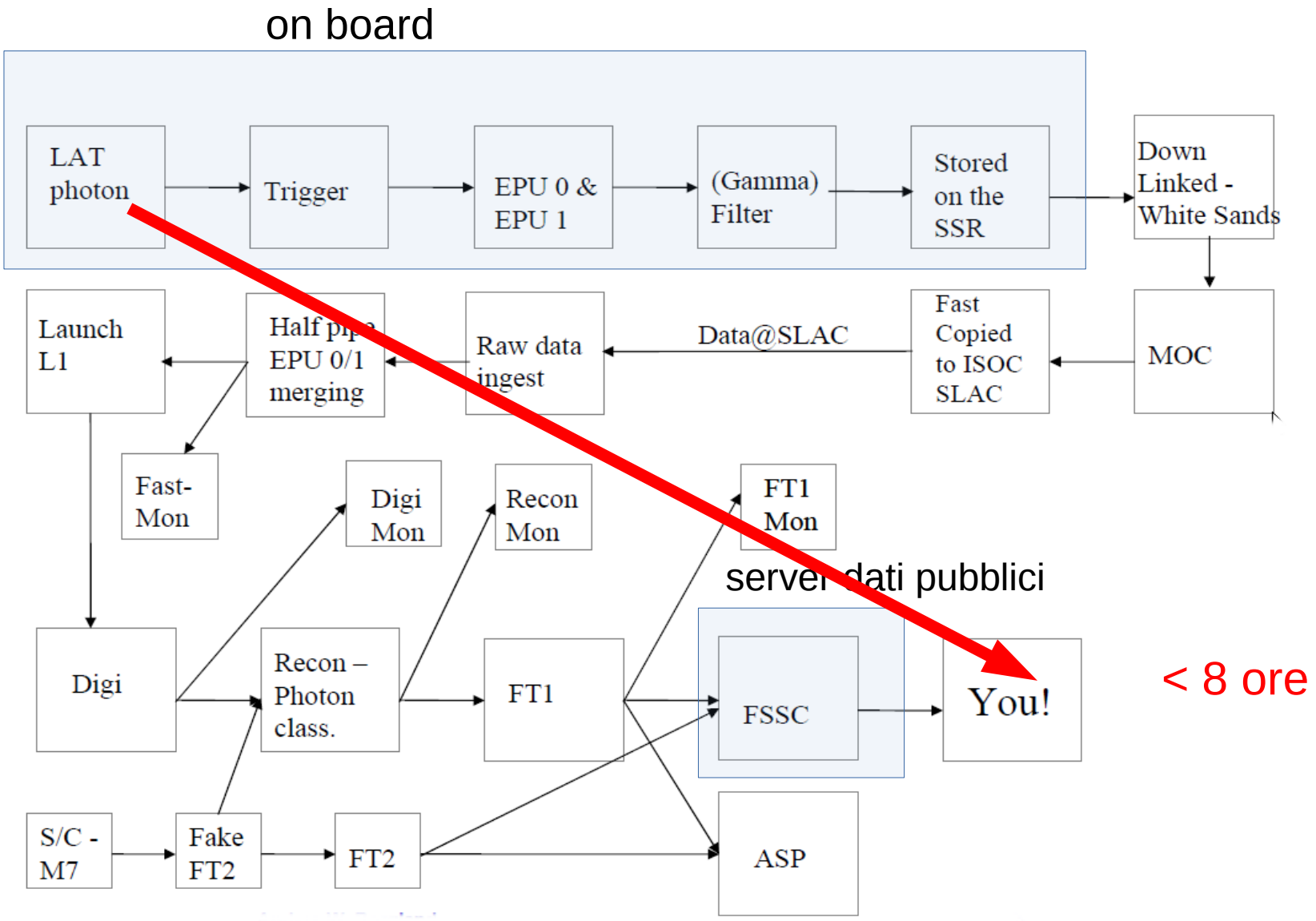




Data Processing



Data Processing



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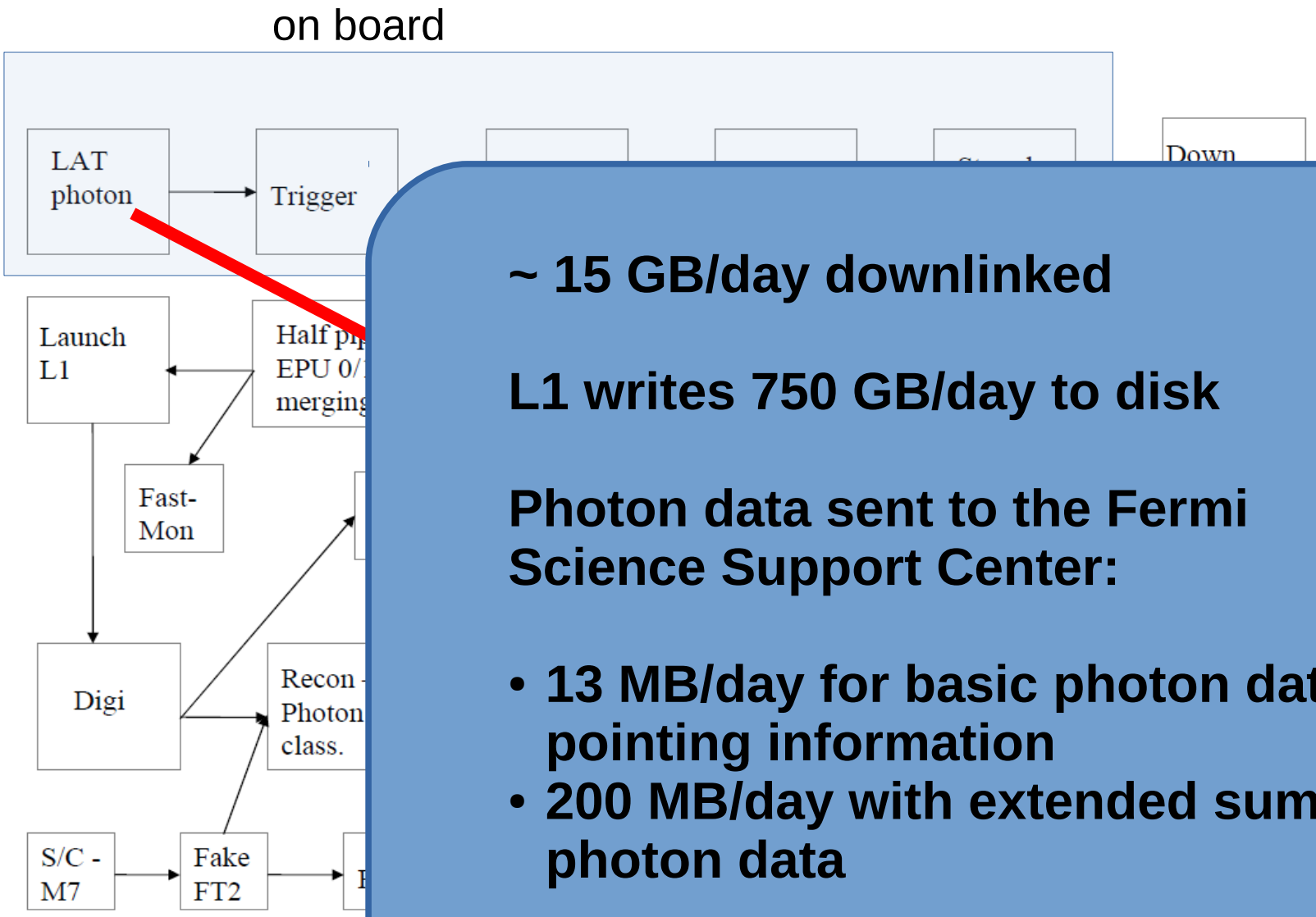
Data Processing

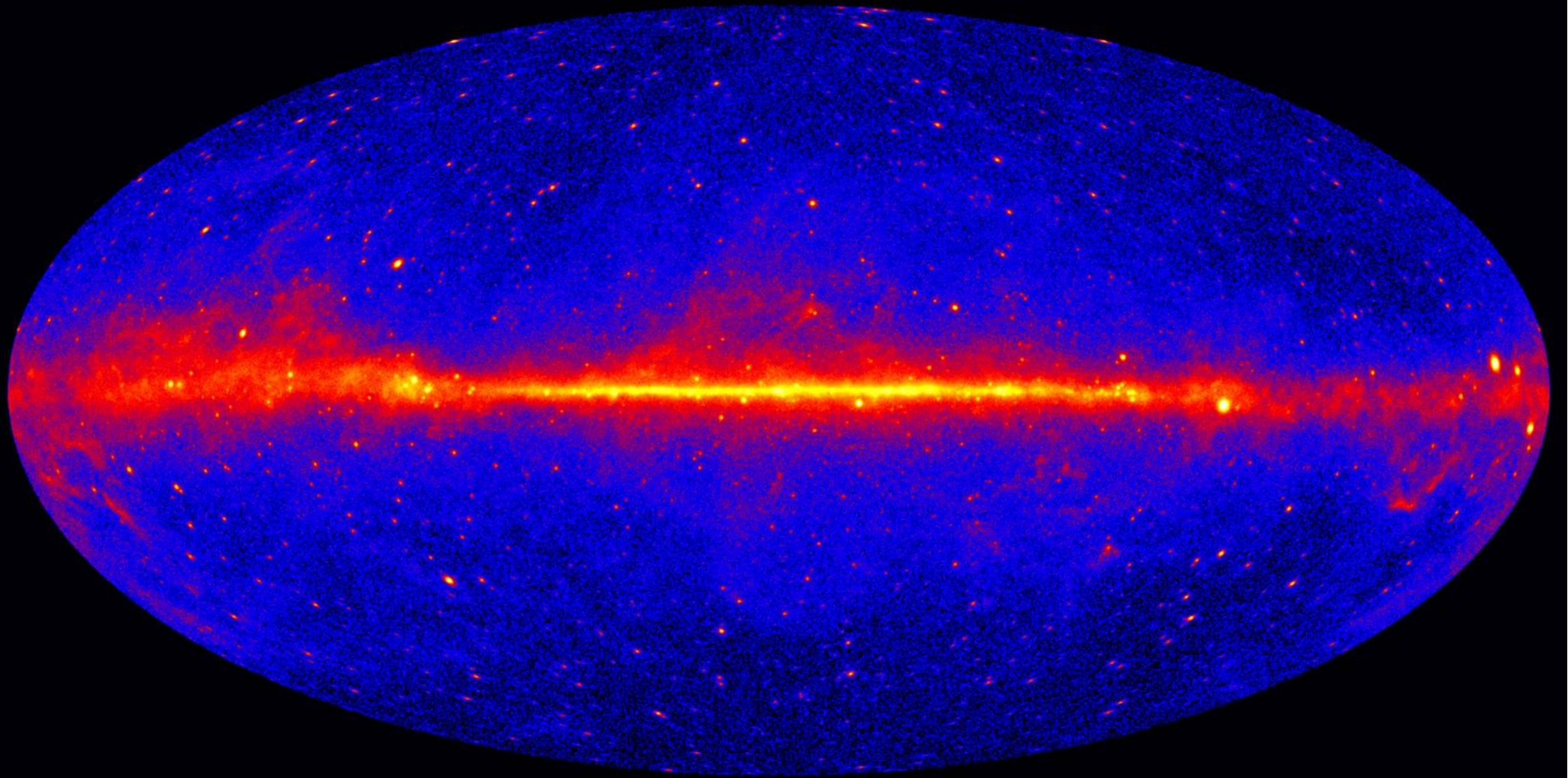


~ 15 GB/day downlinked

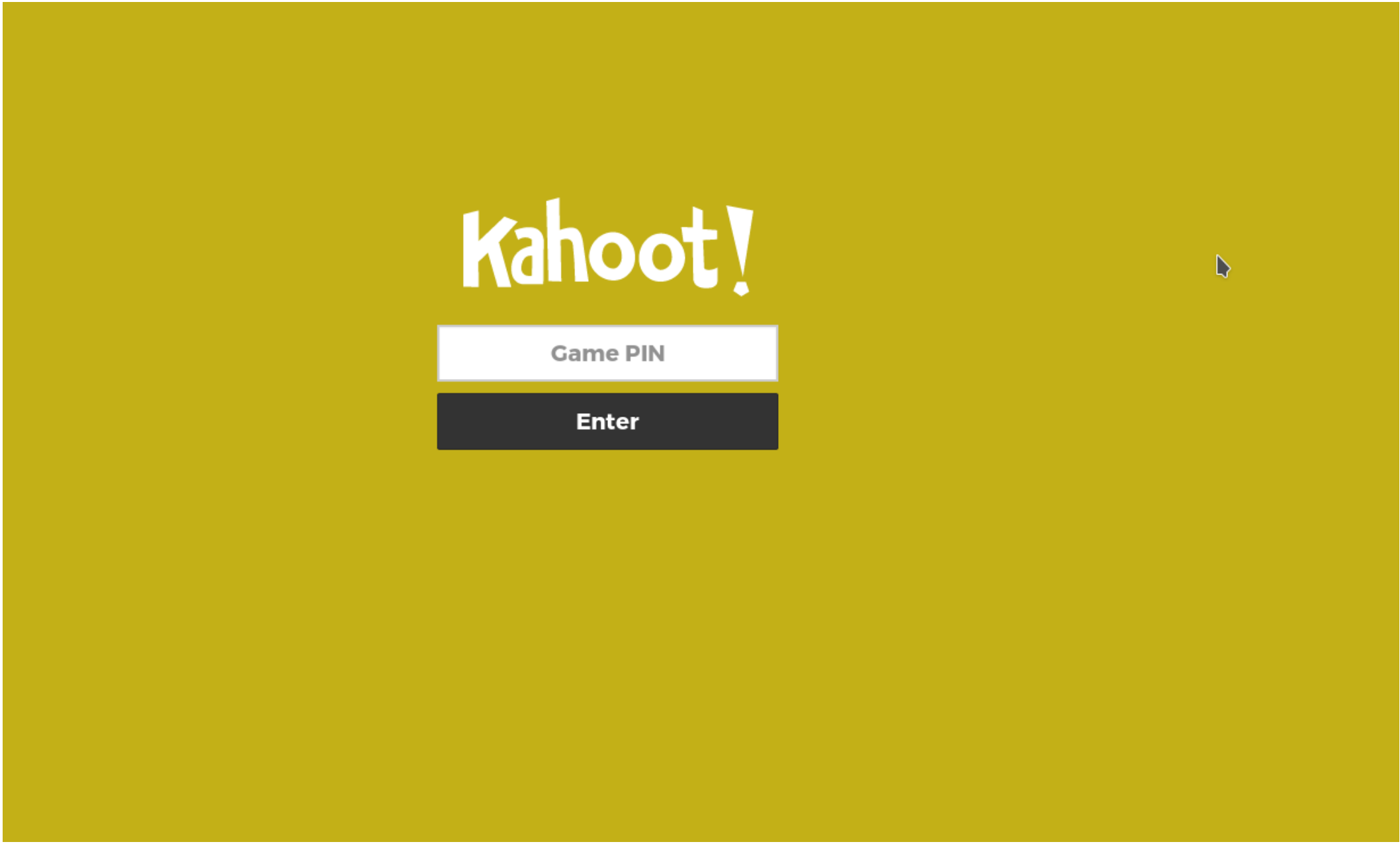
L1 writes 750 GB/day to disk

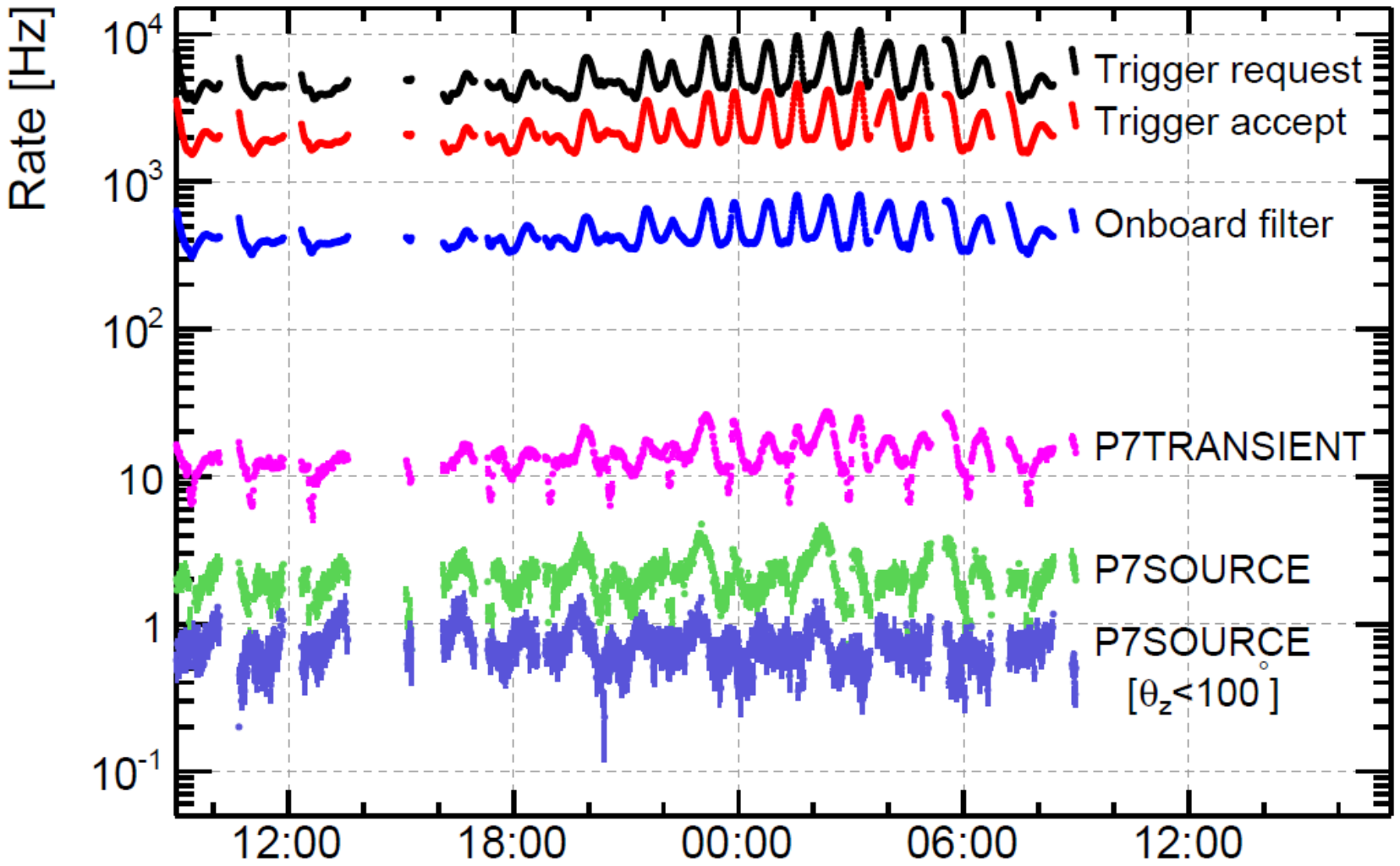
Photon data sent to the Fermi Science Support Center:

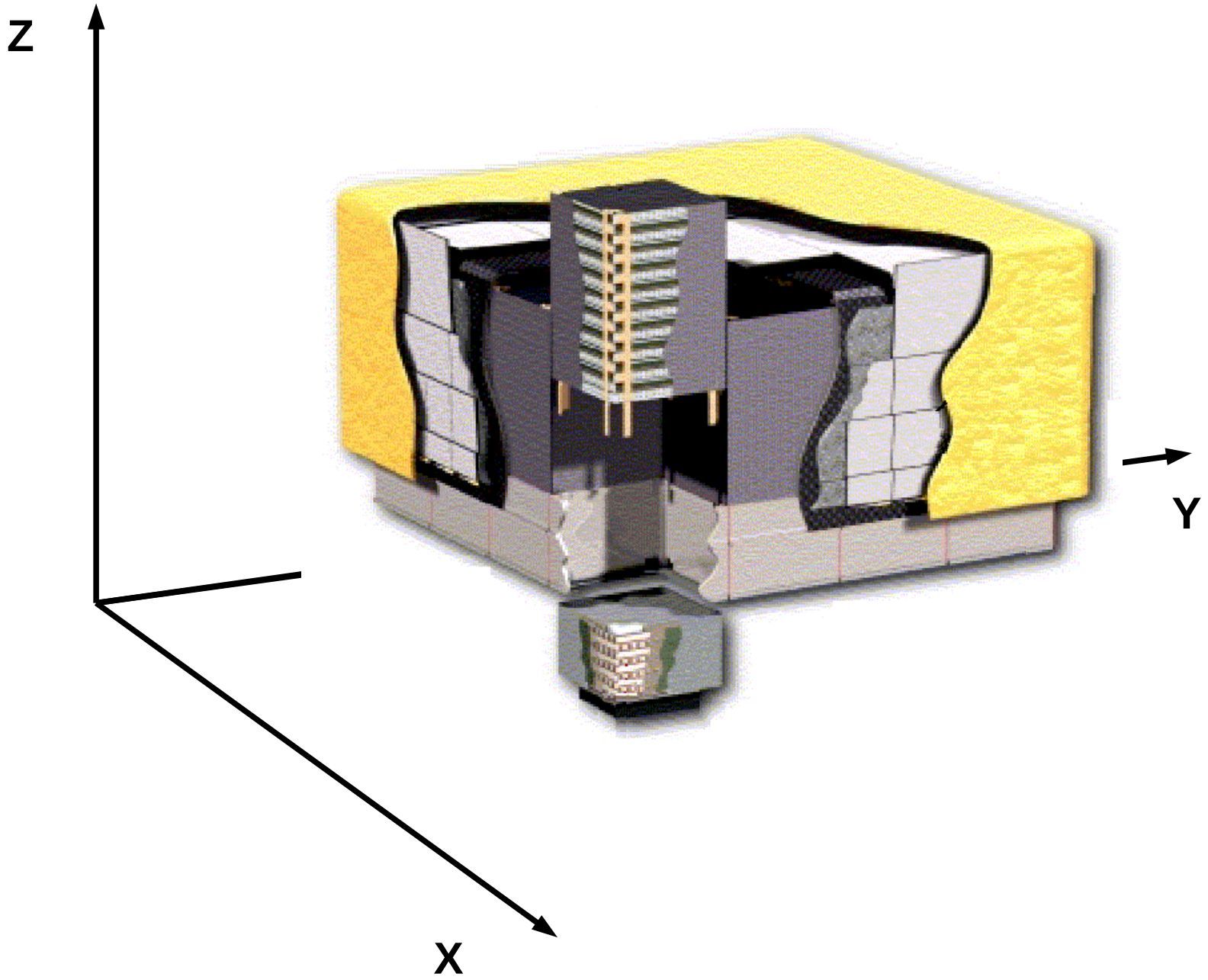
- **13 MB/day for basic photon data and pointing information**
- **200 MB/day with extended summary photon data**



www.kahoot.it




Rate [Hz]
10^4
10^3
10^2
10
1
10^{-1}
12:00
18:00
00:00
06:00
12:00
Trigger request
Trigger accept
Onboard filter
P7TRANSIENT
P7SOURCE
P7SOURCE
[θ_z<100°]


Z
Y
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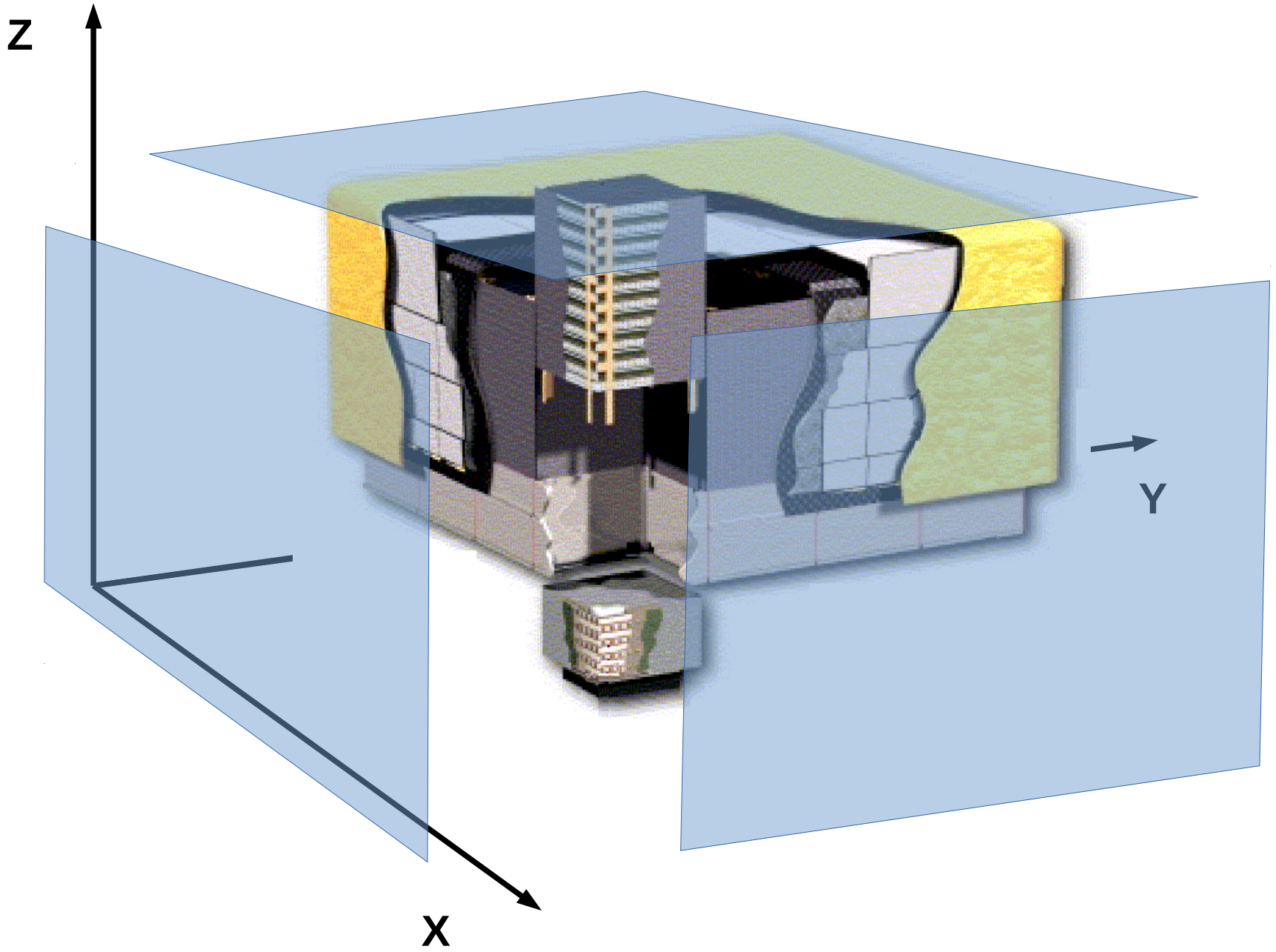
Z
Y
X