DAMPE

Bi Sheng

March 23, 2018 THCA
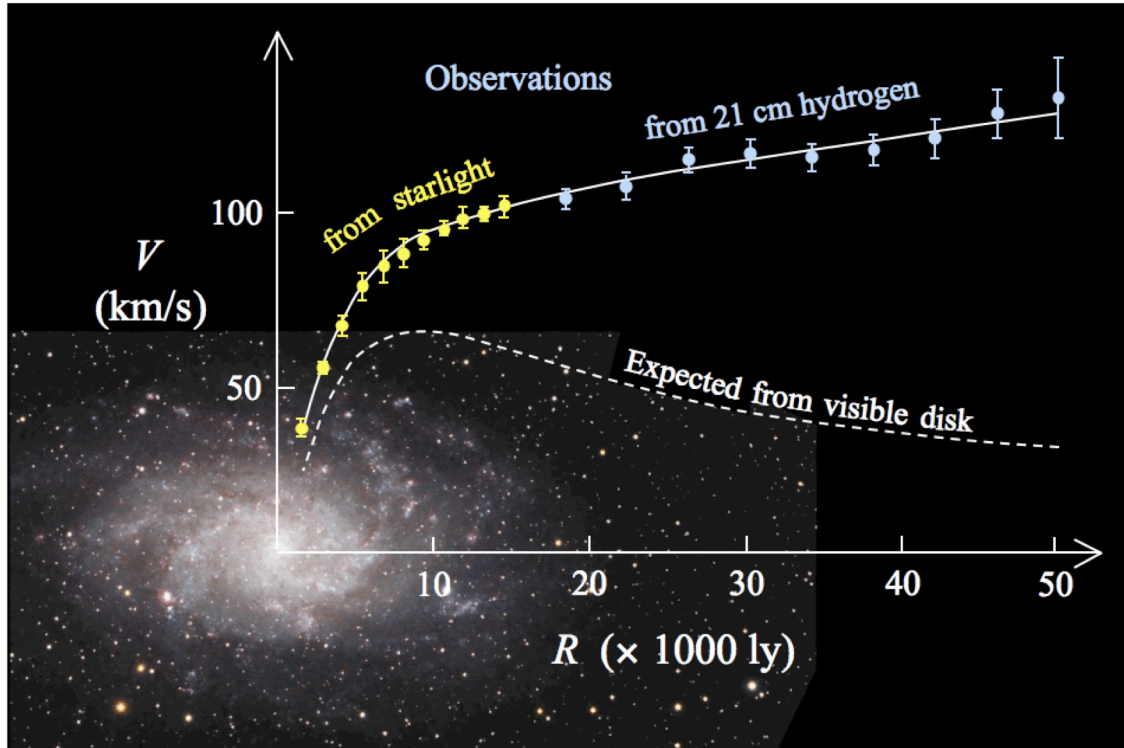
Seminar Mentor: Prof. Mao Shude & Prof. Cui Wei
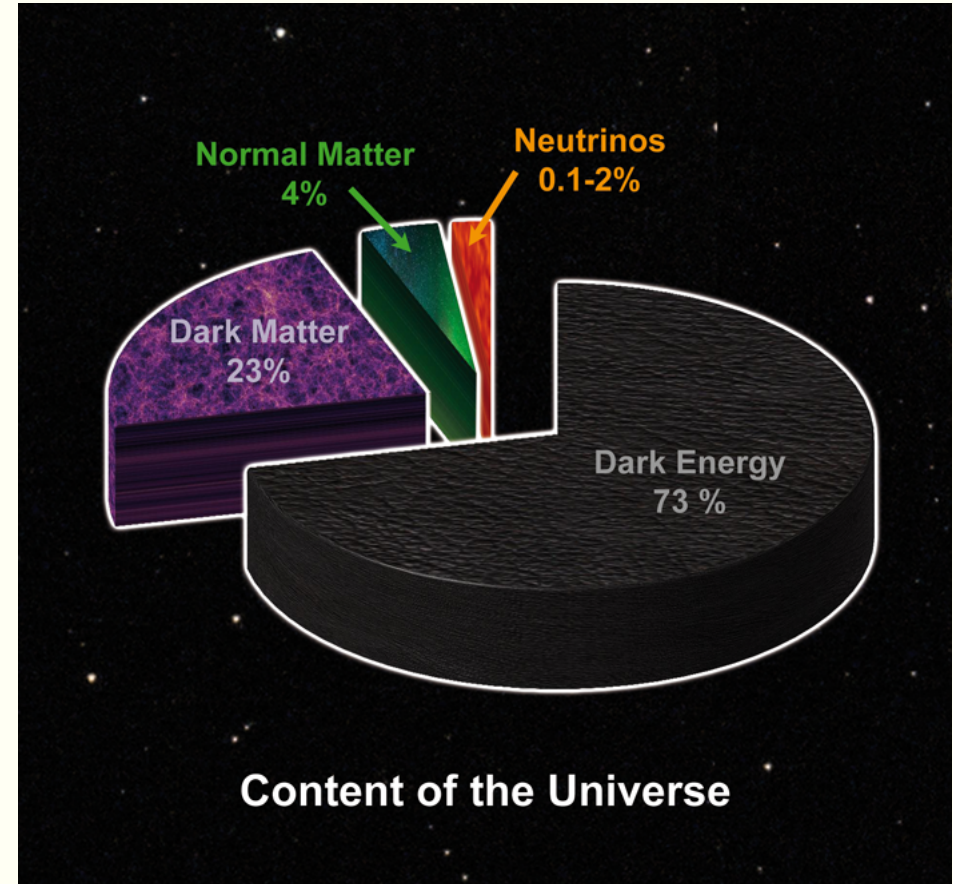
Outline

- ***Scientific Objectives***

- Layout

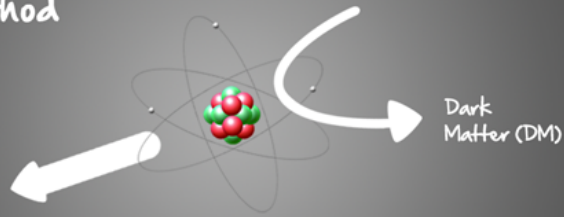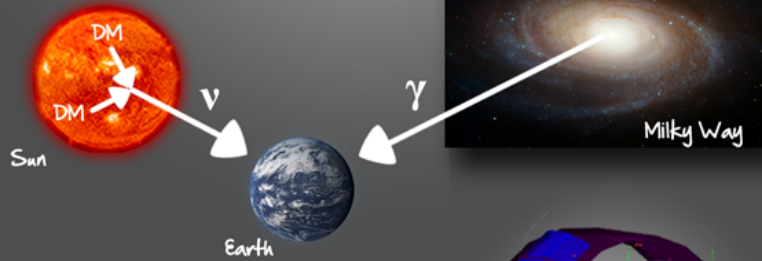- Big News

- Summary

Dark universe

M33

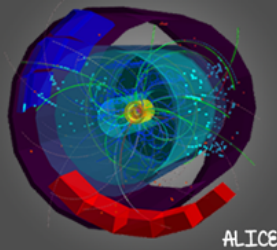Content of the Universe

Explore dark matter

HAP / A. Chantelauze
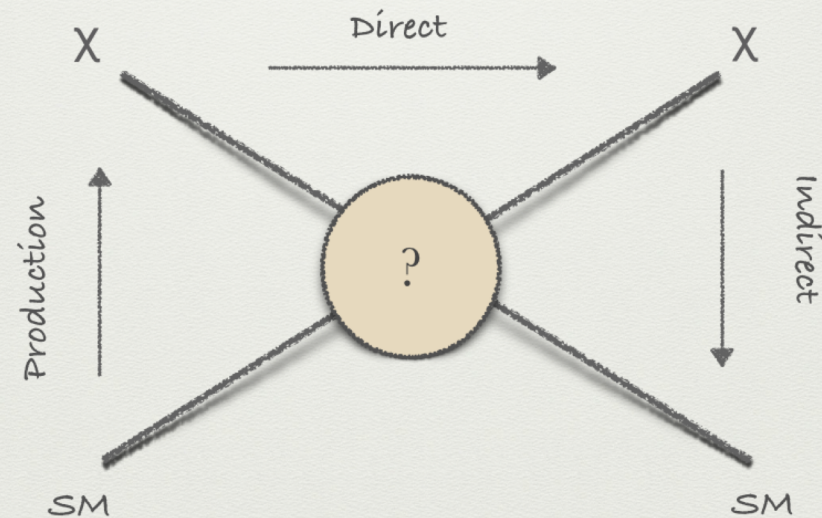
LHC...DAMPE...PandaX

Find origin of cosmic rays

Cosmic Ray Spectra of Various Experiments
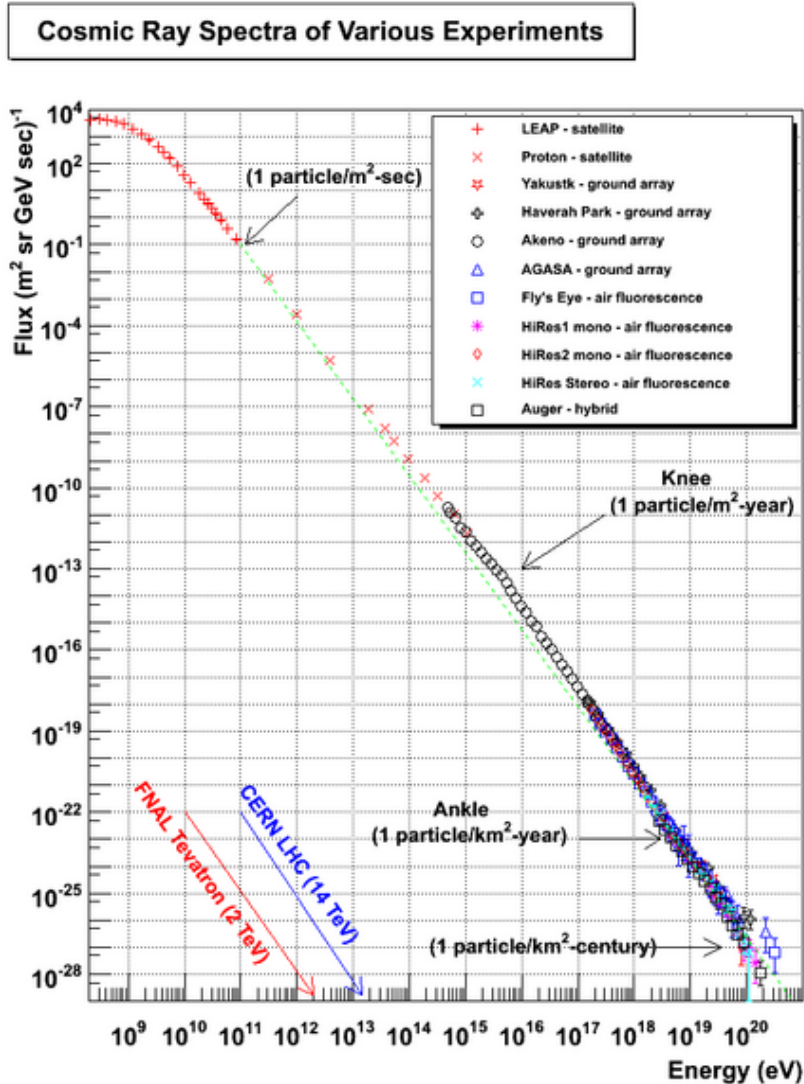
DAMPE:

Electron/positron: GeV to 10 TeV

Protons, helium or hevier nuclei: 10GeV to 100 TeV

Composition of Cosmic Rays
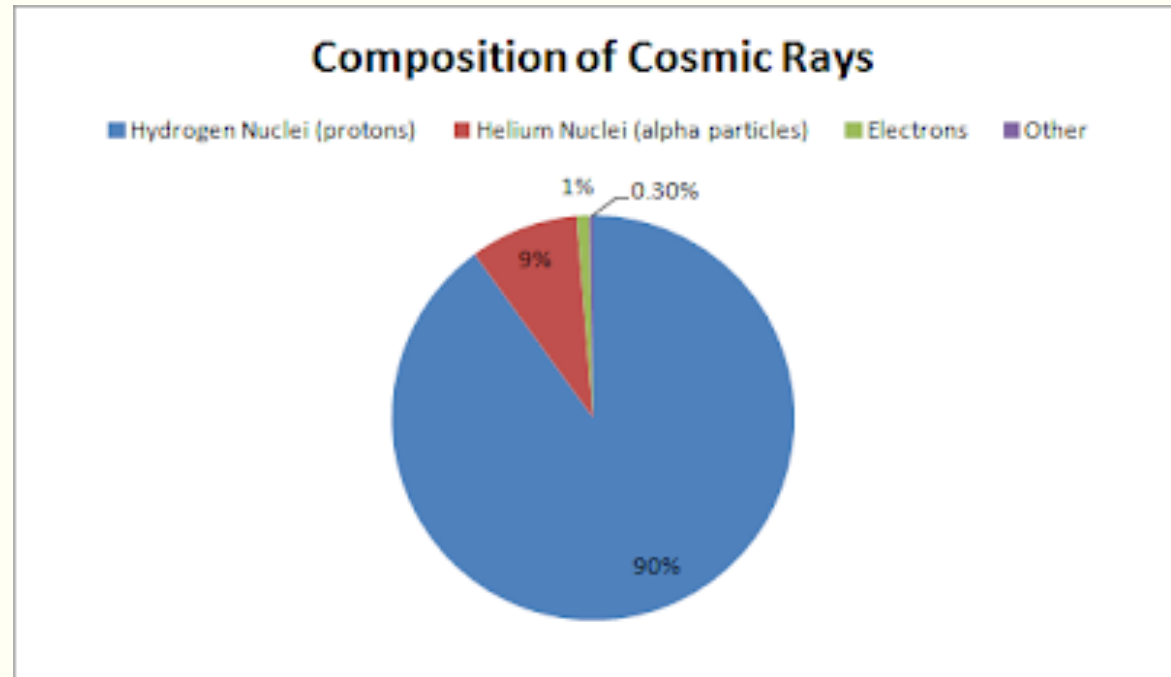
Study the gamma-ray emission

Fermi data reveal giant gamma-ray bubbles
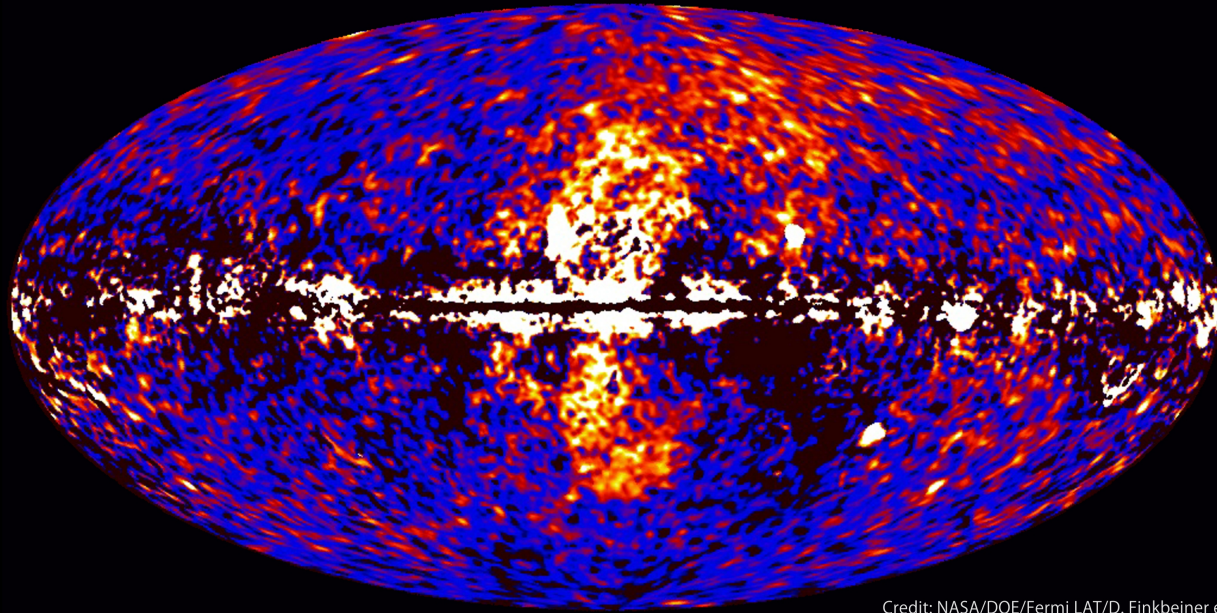
Credit: NASA/DOE/Fermi LAT/D. Finkbeiner et al.

- DAMPE: 10 GeV to TeV and above with very high energy resolution
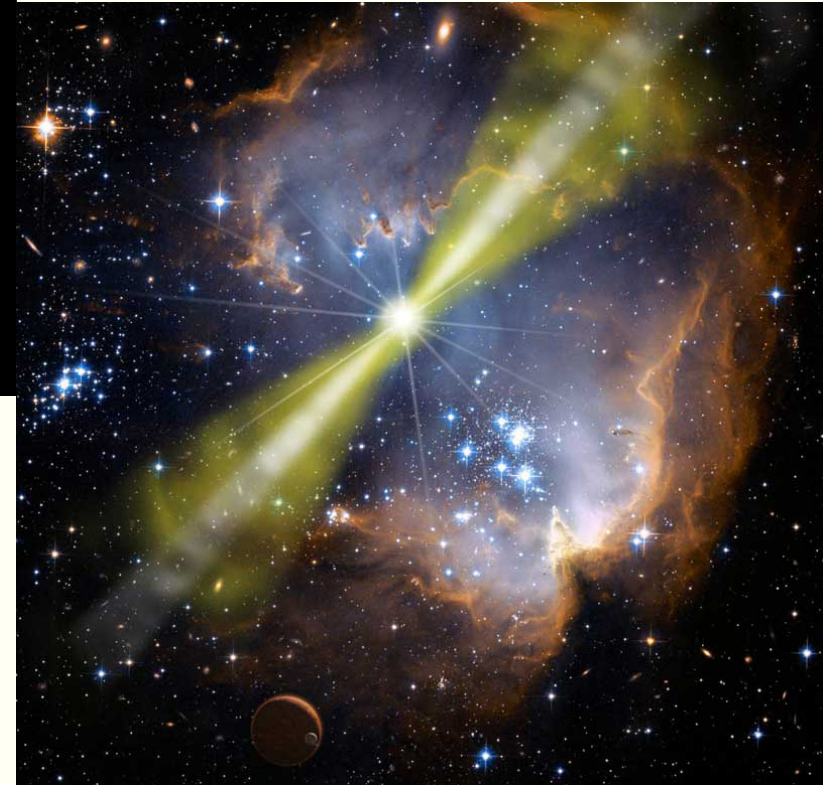- Fermi-LAT 20MeV to 300 GeV

Outline

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- Big News

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Layout

The plastic scintillator detector (PSD)

The silicon tracker (STK)

The BGO calorimeter (BGO)

The neutron detector (NUD)
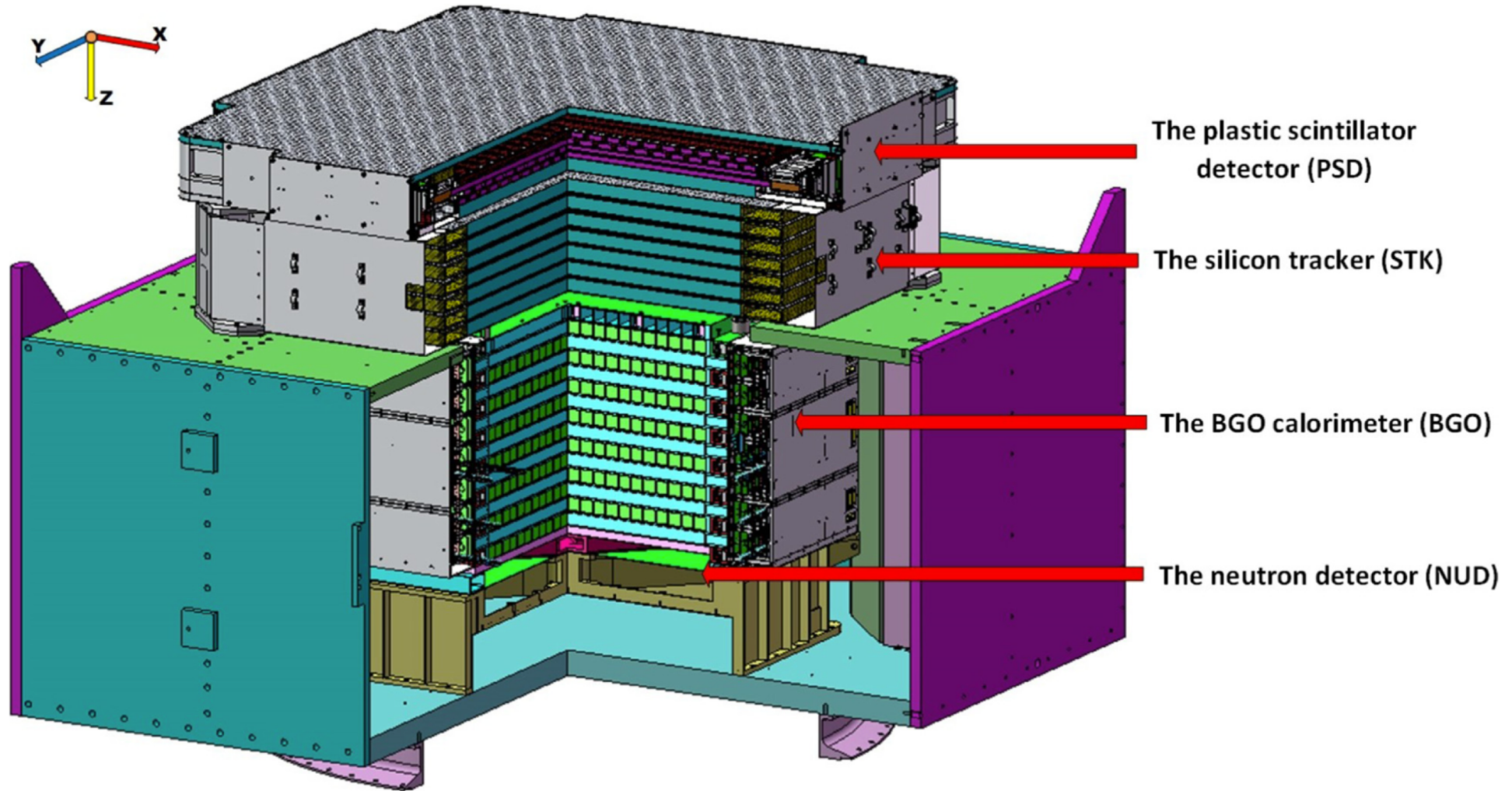
Plastic Scintillator Detector(塑料闪烁体探测器)

- provide charged-particle background rejection for gamma rays
- measure the charge of incident particles
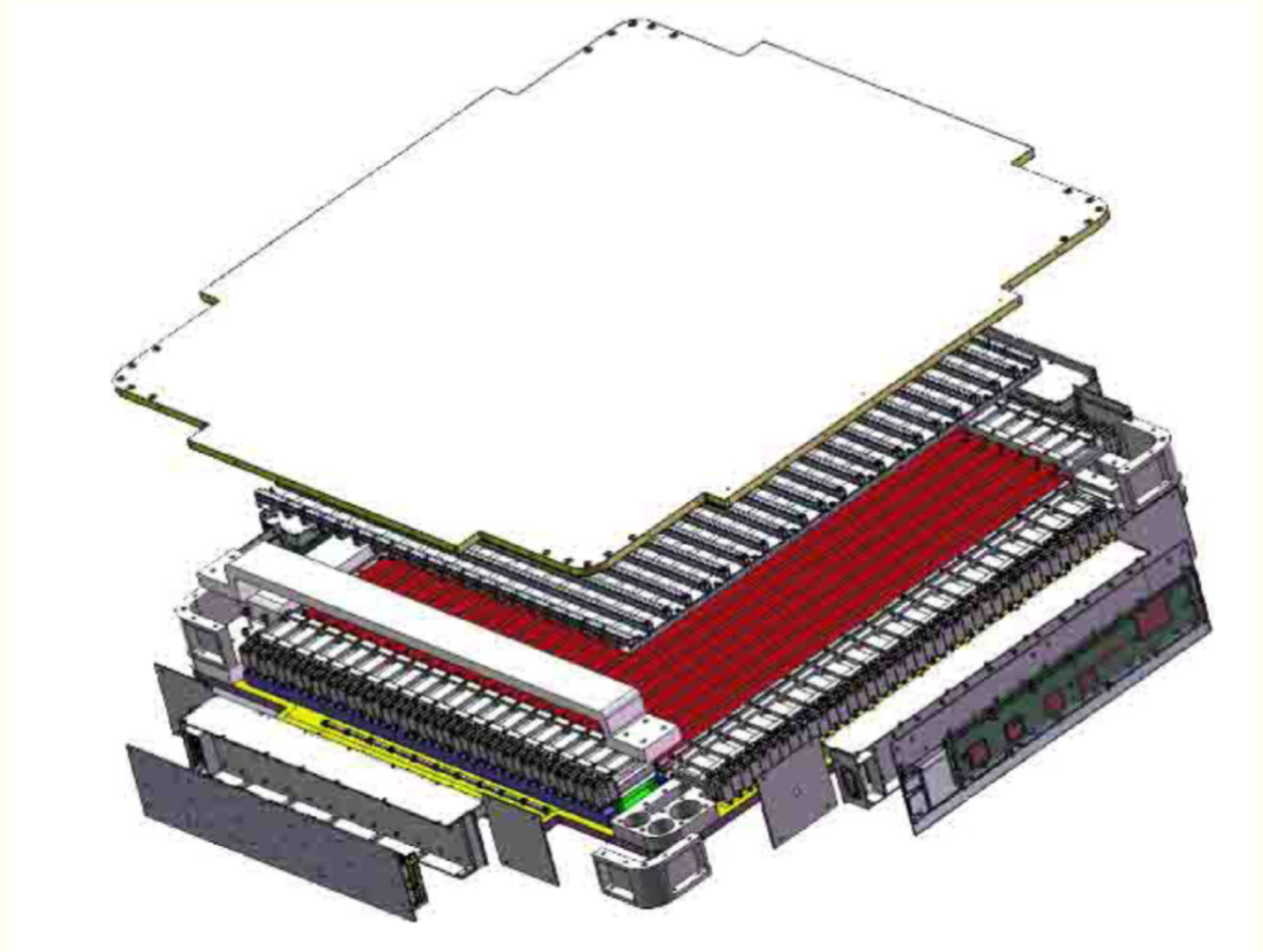
Plastic Scintillator Detector(塑料闪烁体探测器)

Parameter	Value
Active area	$\geq 82cm \times 82cm$
Number of layers	2
Dynamic range	Electrons, ions(Z < 26)
Charge resolution	$\leq 25\%$ for Z=1
Detector efficiency of single module	≥ 0.95 for MIPs
Position resolution	≤ 2 cm
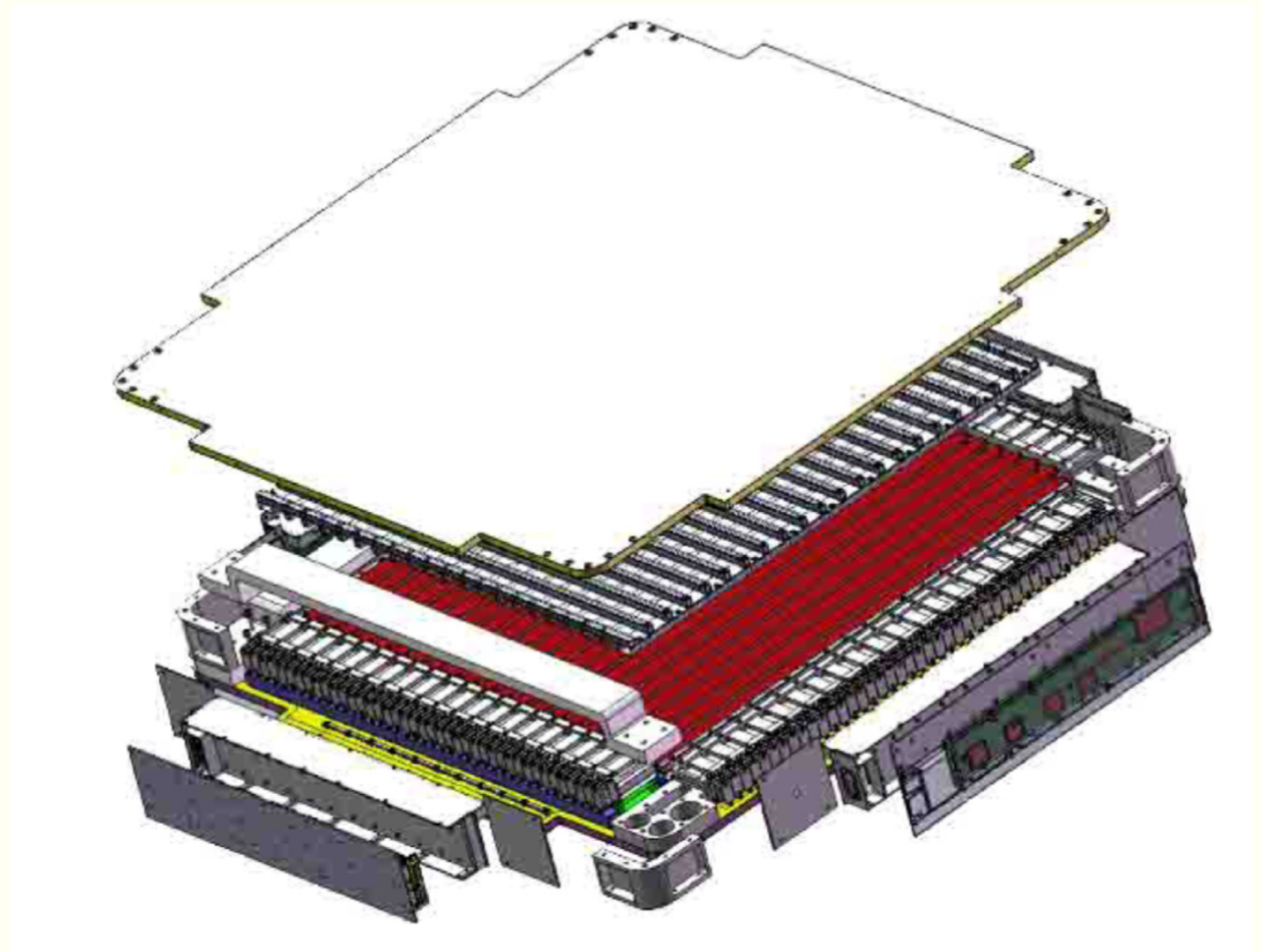

J. Chang et al./Astroparticle Physics 95 (2017) 6–24

Silicon-Tungsten(钨) tracker-convertor

- precise particle track reconstruction
- measurement of the electrical charge of incoming cosmic rays
- photon conversion to electron-positron pairs
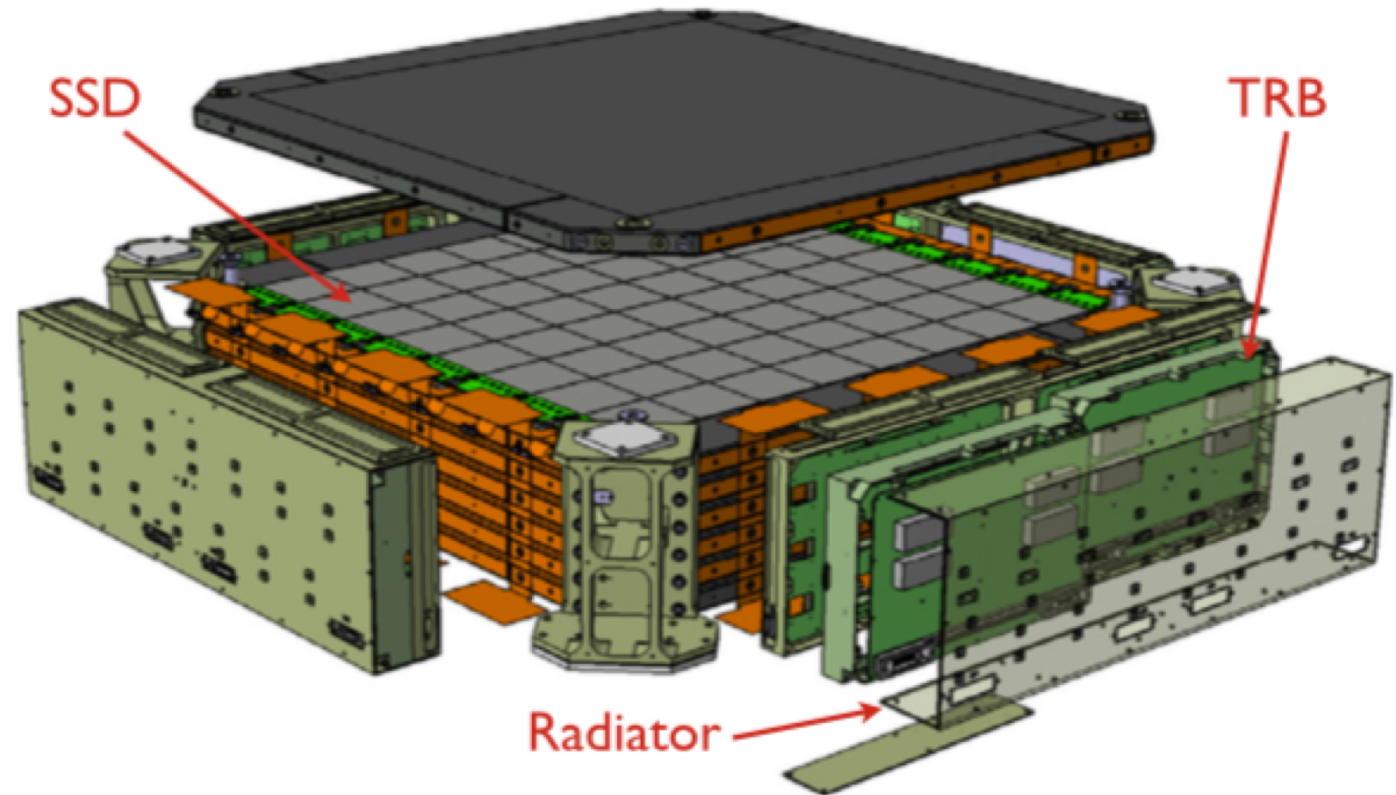
Silicon-Tungsten(钨) tracker-convertor

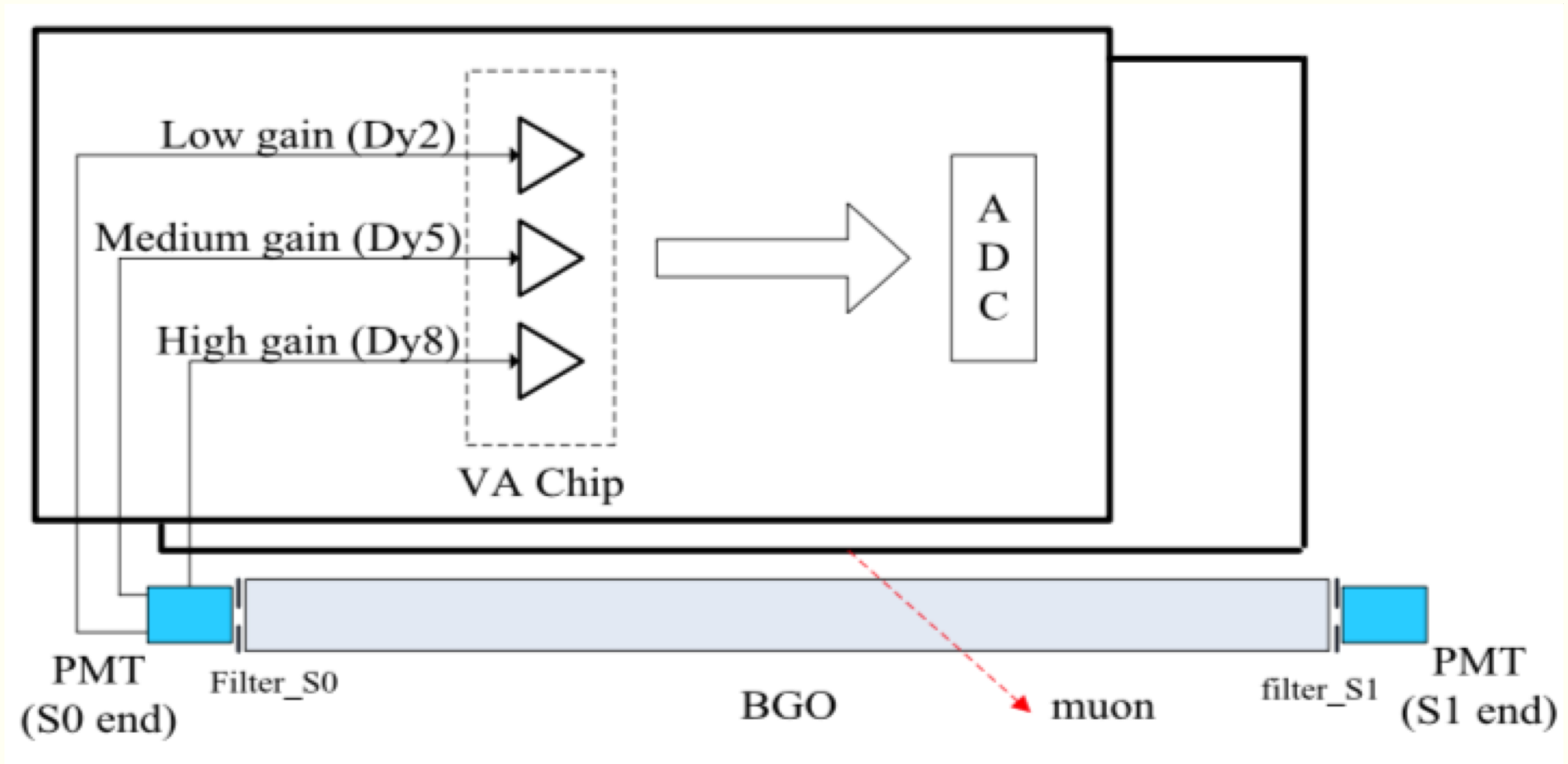| Parameter	Value
Active area of silicon detectors	0.55 m2 × 12 layers
Thickness of each silicon layer	320 μm
Silicon strip pitch	121 μm
Thickness of tungsten layers	3x1mm
Total radiation length	0.976（X0）
Spatial resolution (68% extension range)	<80 μm within 60° incidence
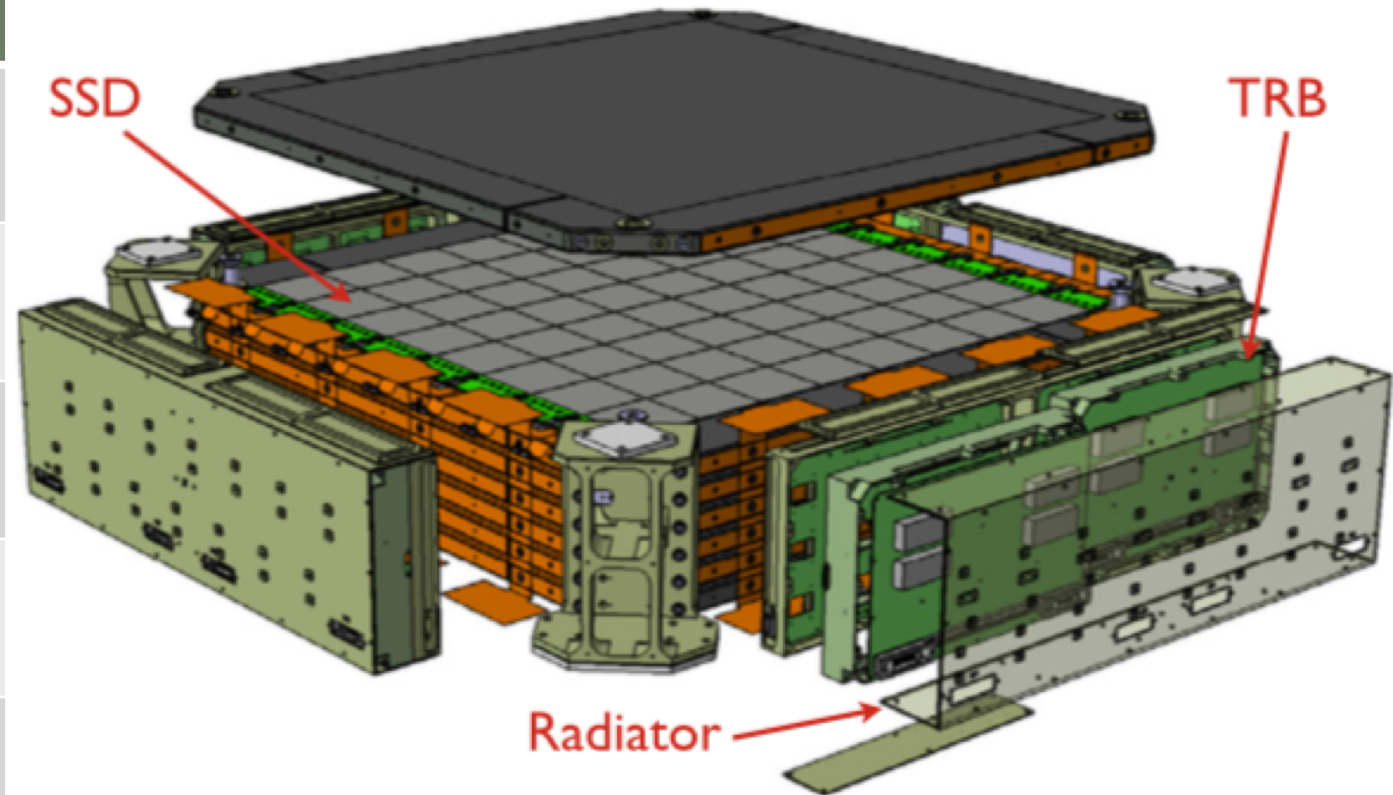
BGO(铋锗氧化物) calorimeter

- measure the energy of incident particles
- provide efficient CRE identification
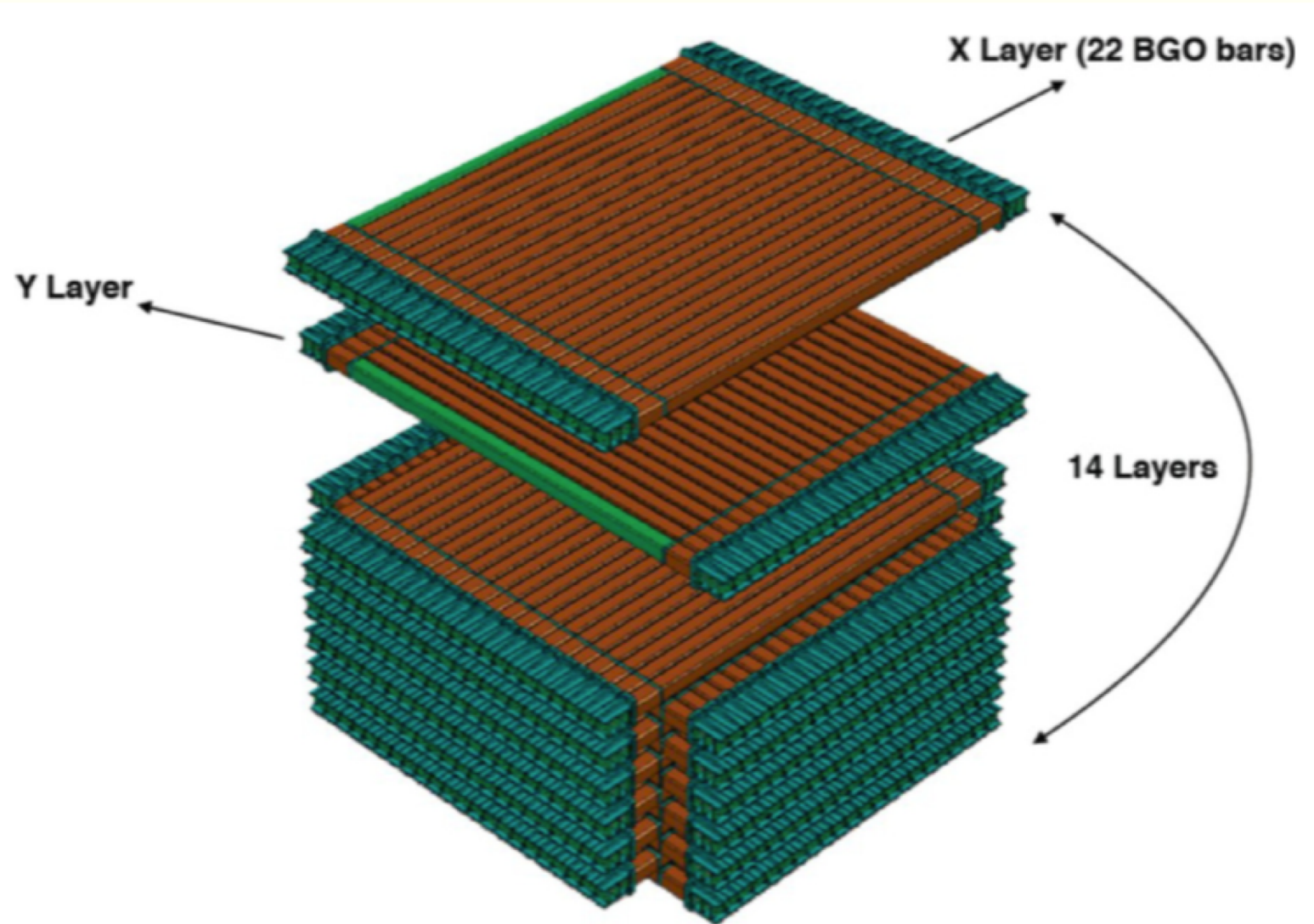
BGO calorimeter

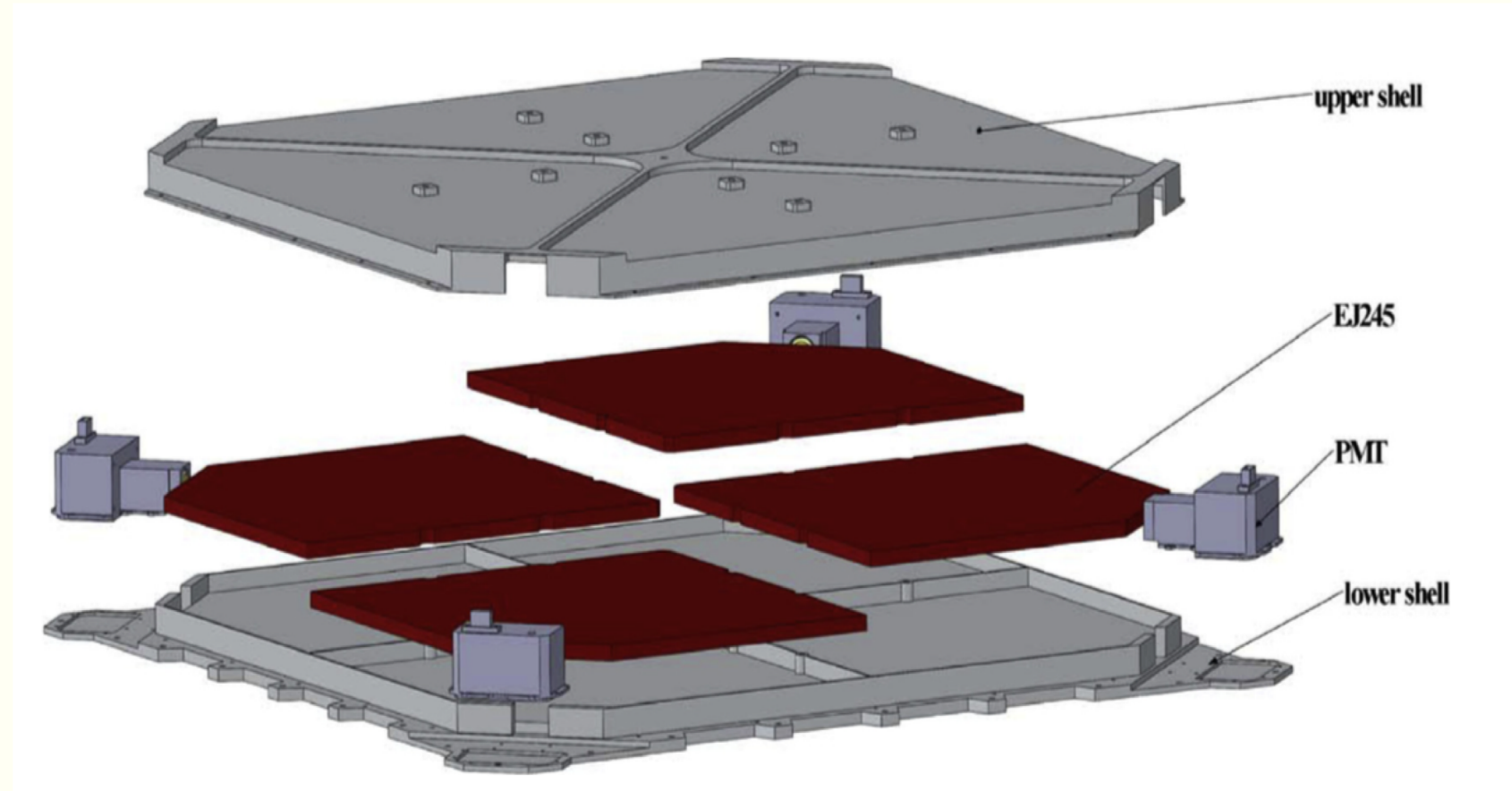# BGO(铋锗氧化物) calorimeter

| Parameter	Value
Active area	60 cm × 60 cm (on-axis)
Depth (radiaton length)	32
Sampling	≥ 90%
Longitudinal segmentation	14 layers (2.3 rad. lengths each)
Lateral segmentation	~1 Molière radius
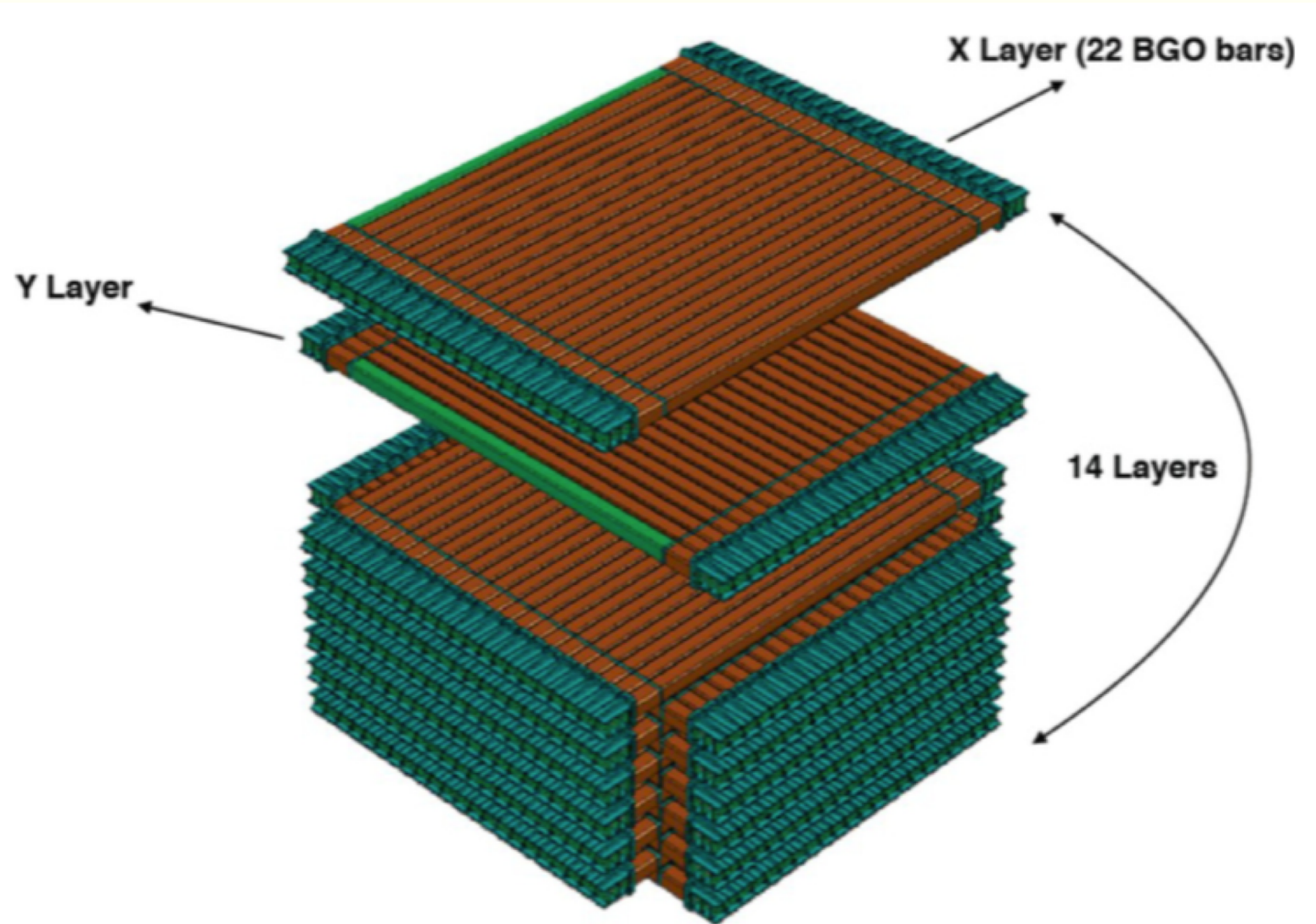
Neutron Detector

perform electron/hadron(强子）identification
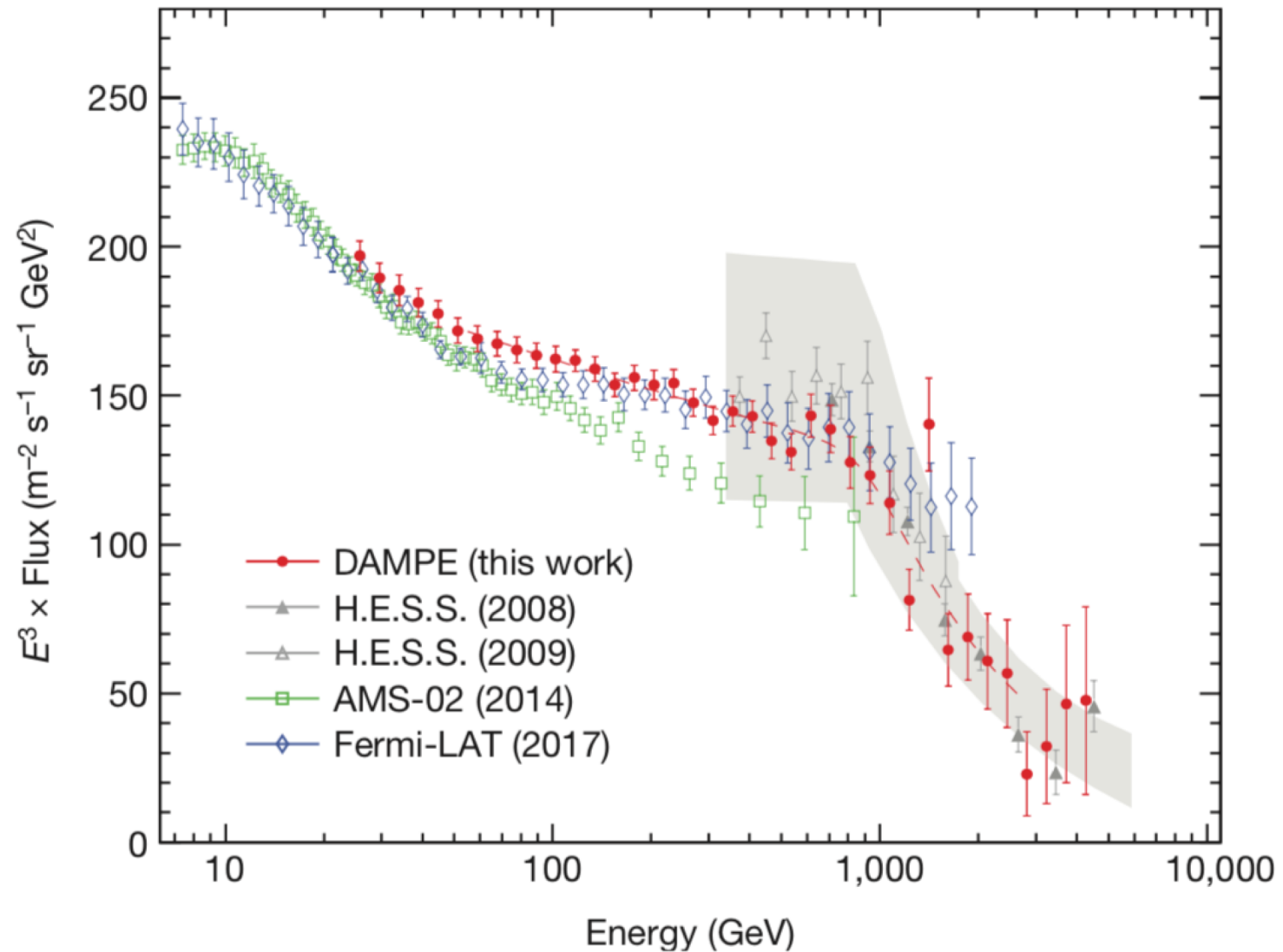
Neutron Detector

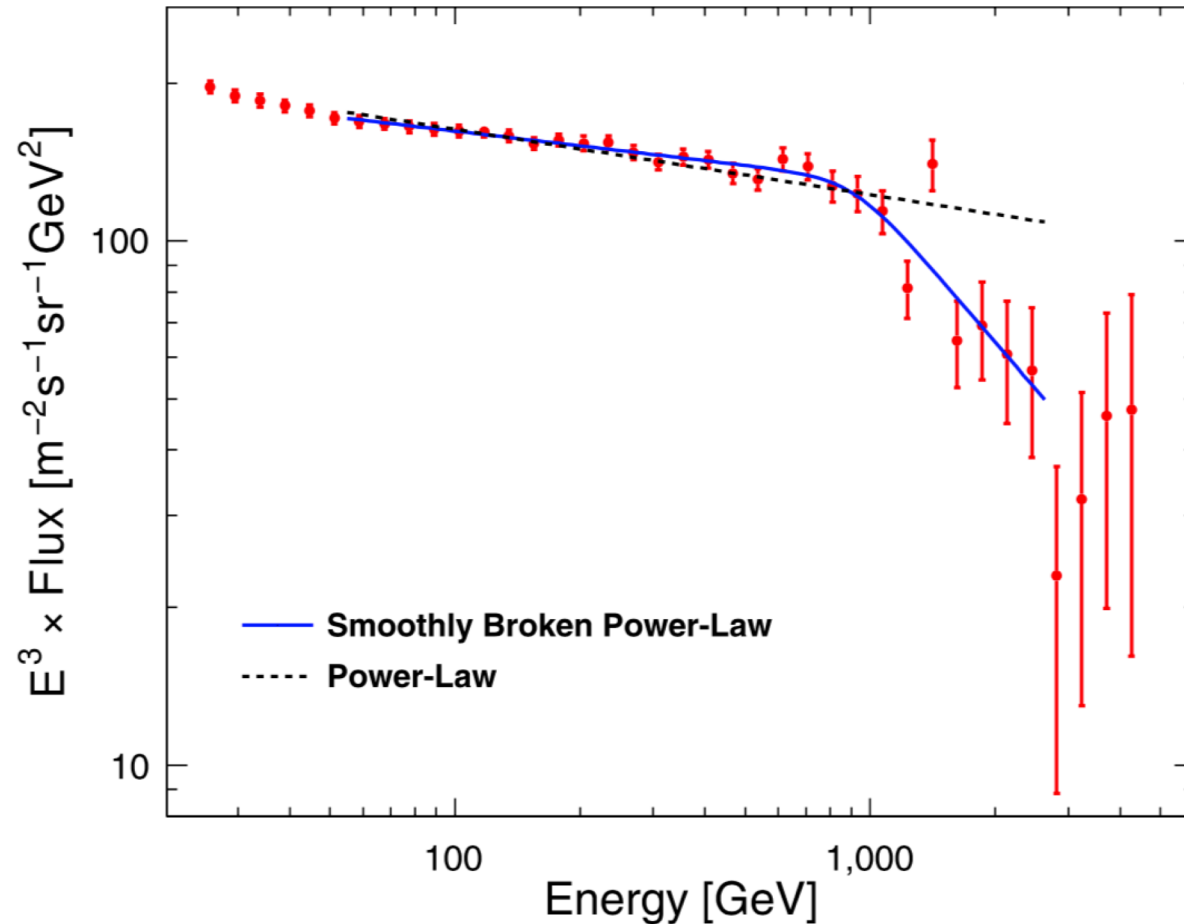| parameter	value
Active area	61cm x 61cm
Energy range	2 – 60 MeV for single detector
Energy resolution	≤10% at 30 MeV
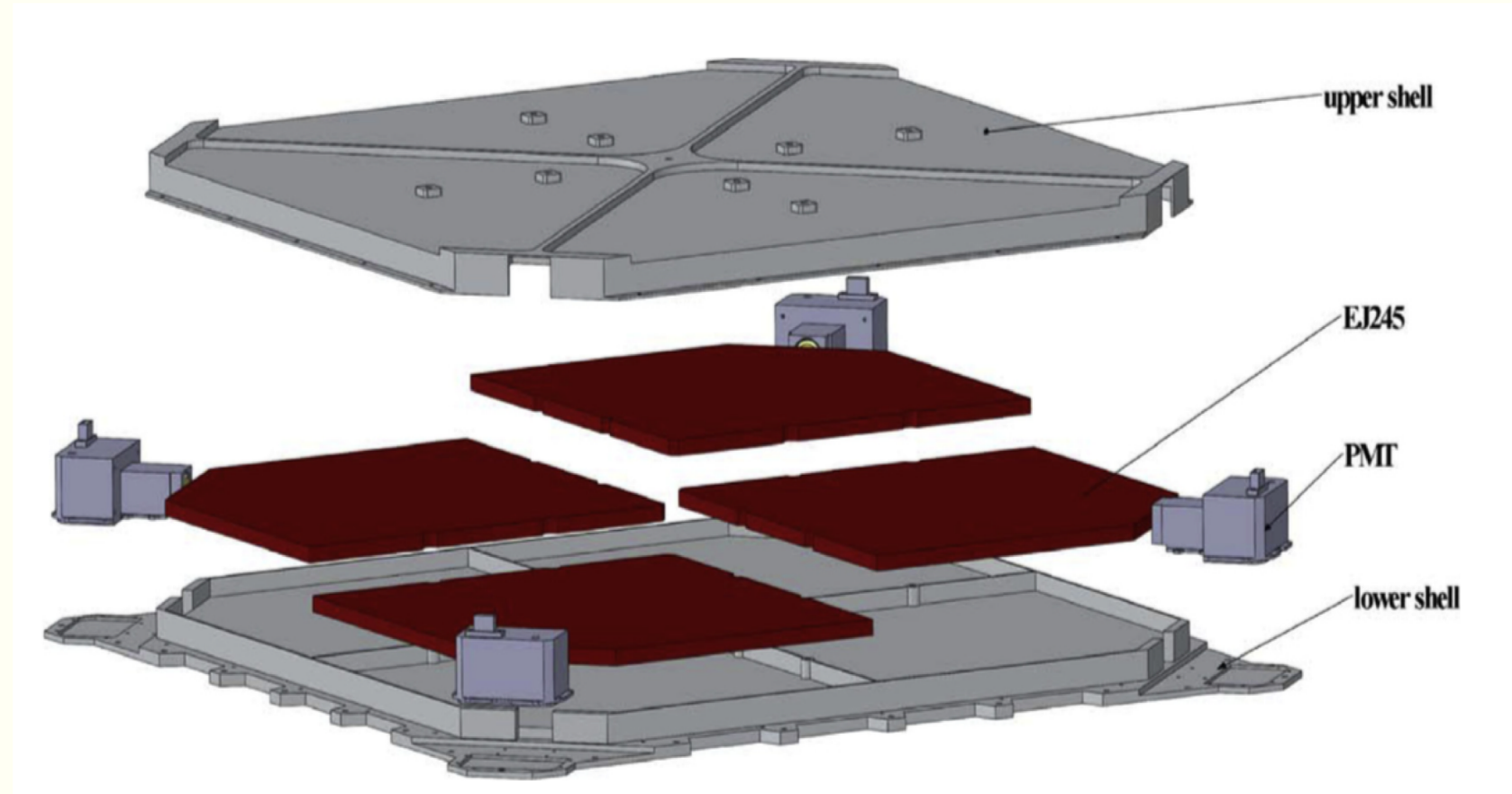
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'Breaking' News

More data, more Nature

- Pulsar?

- Supernova-remnants?

- Dark matter annihilation?

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Summary

- Scientific Objectives

  - Explore dark matter indirectly

  - Find origins of CR

  - Study Gamma-ray astronomy

- Big News

  - Direct detection of a break in the spectrum of CREs

That's all, thanks for coming!