

中國科學院高能物理研究所
Institute of High Energy Physics, Chinese Academy of Sciences

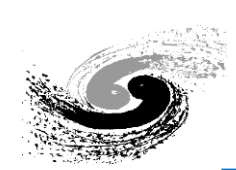
Key Laboratory of Particle Astrophysics

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Understanding the energetic universe



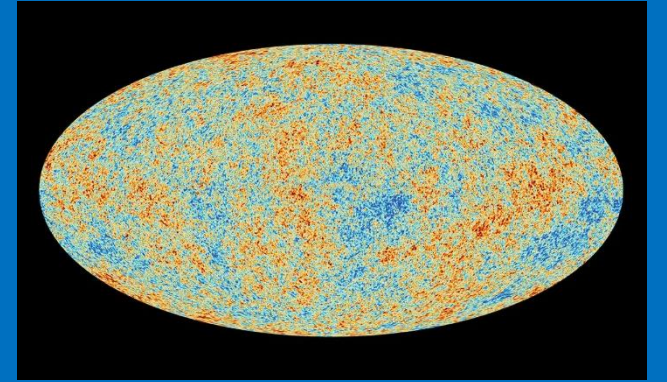
**Origin, acceleration
and propagation of
cosmic rays**

**LHAASO
LACT, HUNT, HERD**



**Law of physics under
extreme gravity, density,
and magnetism**

**HXMT, GECAM, EP-FXT
eXTP, CATCH, POLAR-2**



**What is the nature of
inflation and Hubble
tension**

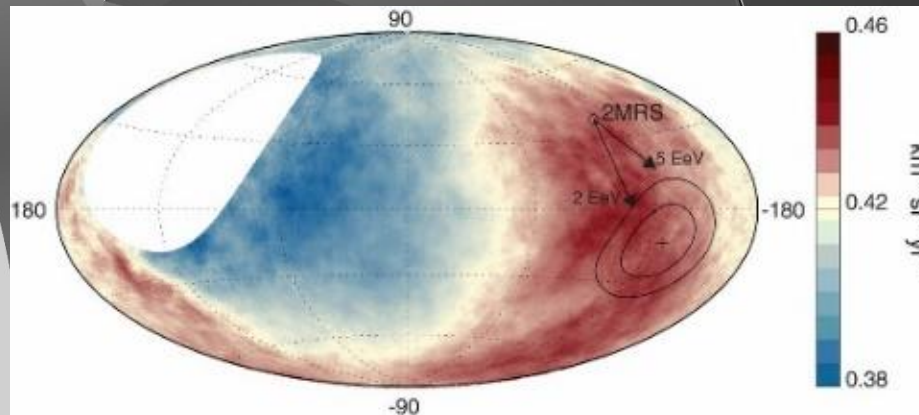
**SARM
AliCPT**

HERD: High Energy cosmic-Ray Detection facility

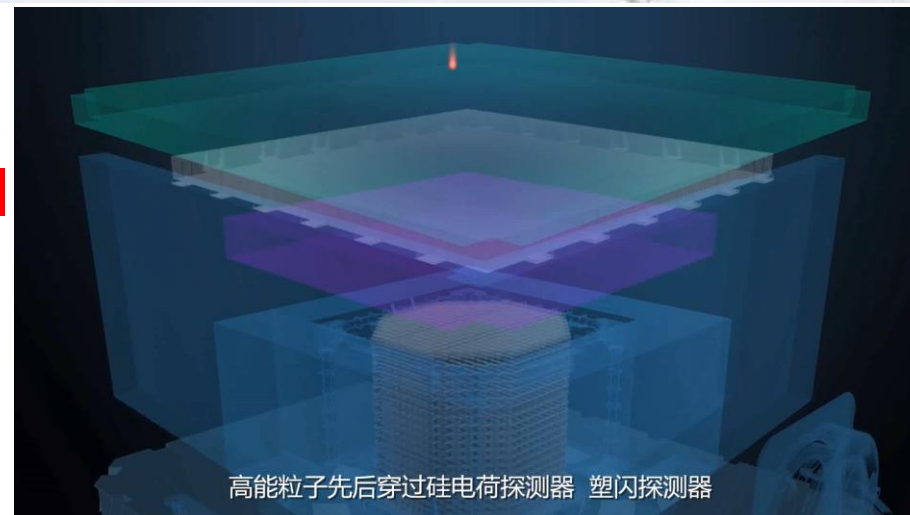
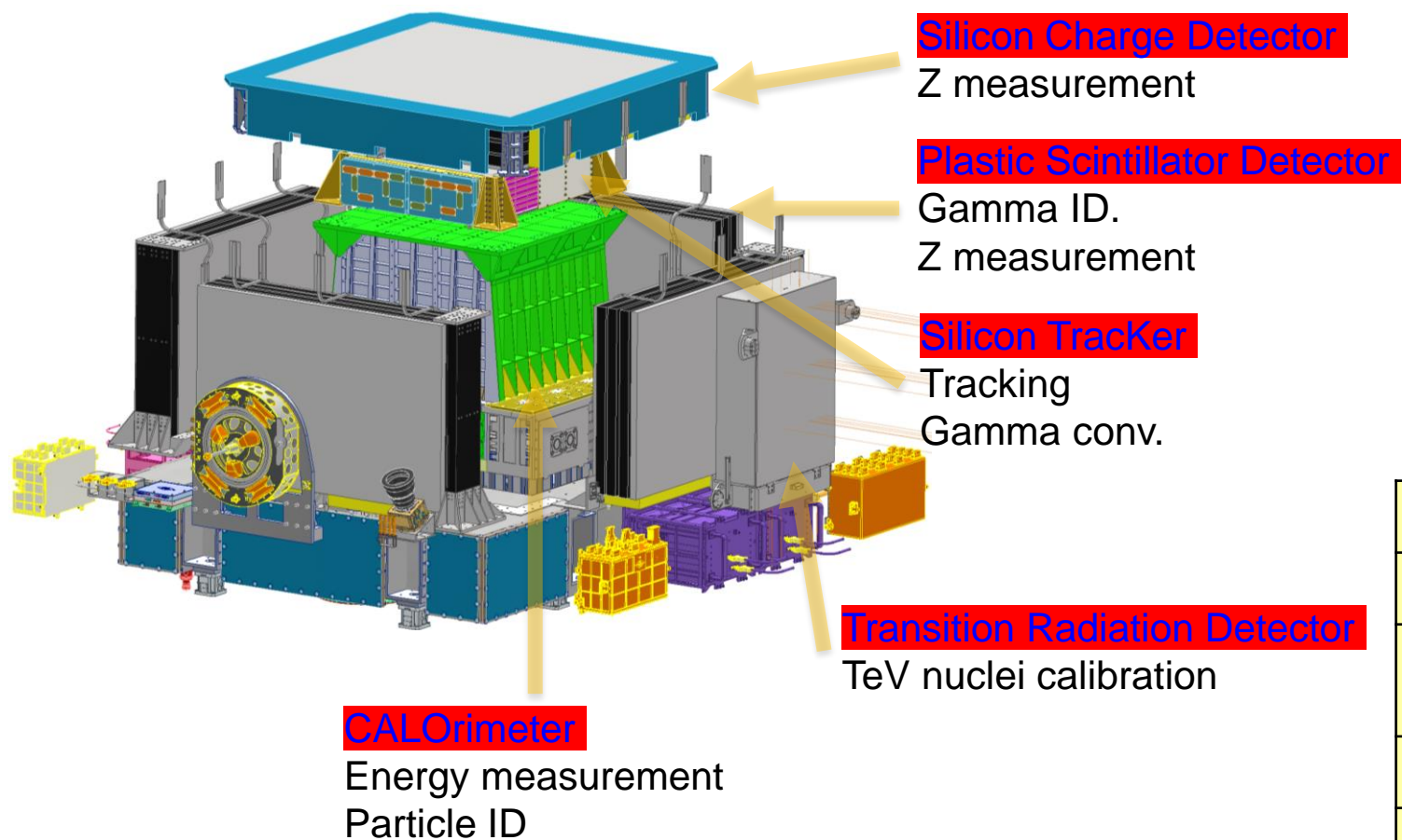
- HERD, as a space particle experiment and gamma ray observatory, is one of the two flagship scientific experiments onboard China Space Station

- Main Sciences

- **Dark matter:** Indirect dark matter search with unprecedented sensitivity
- **Cosmic-ray:** Precise & direct cosmic ray spectrum and composition measurements up to the PeV energy
- **Gamma-ray:** Gamma-ray monitoring and full sky survey



HERD payload

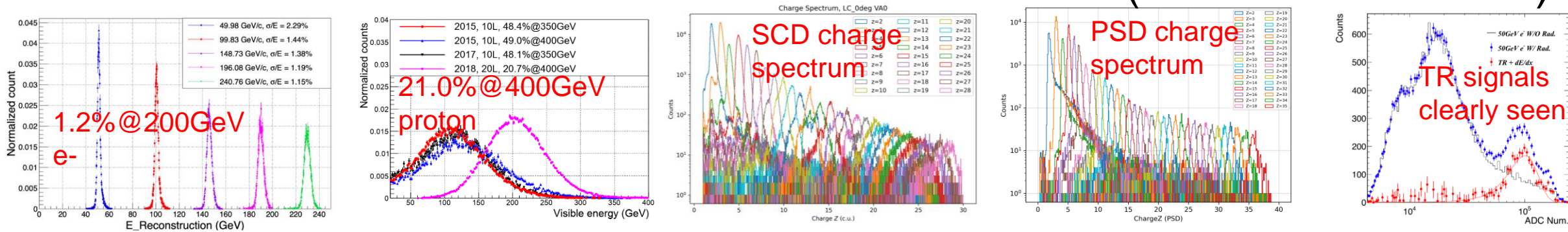


HERD is a next generation experiment, following AMS-02 and DAMPE, with much better performance on direct high energy e, p, gamma-ray detection.

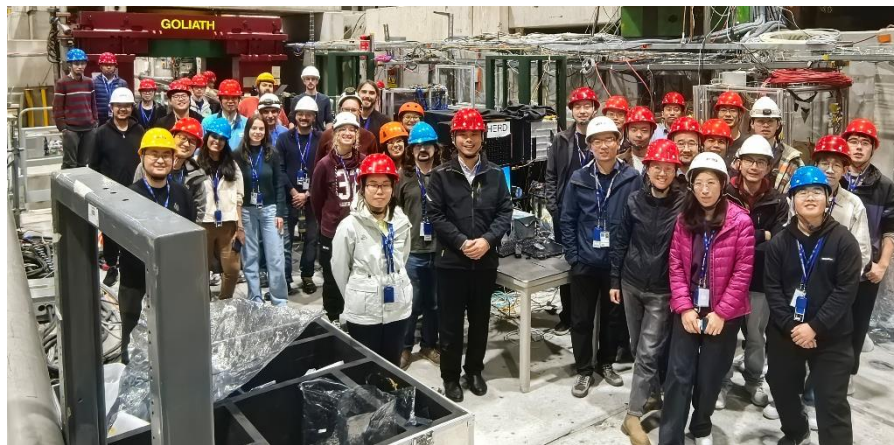
G.F. (e)	>3 m ² sr@200 GeV
G.F. (p)	>2 m ² sr@100 TeV
Energy range (e/γ)	10 GeV - 100 TeV (e); 0.5 GeV - 100 TeV (γ)
Energy range (p)	30 GeV - 5 PeV
Charge meas.	Z=1-28; <0.15 c.u. @Z=1
Energy resolution (e)	1%@200 GeV
Energy resolution (p)	<25%@100 GeV – PeV
e/p separation	>3*10 ⁵ (90% eff. @100GeV)
Angular resolution	0.1 deg. @10 GeV

Joint beam test with European collaborators at CERN

- 7 rounds of CERN beam tests were carried out (from 2015 to 2024).

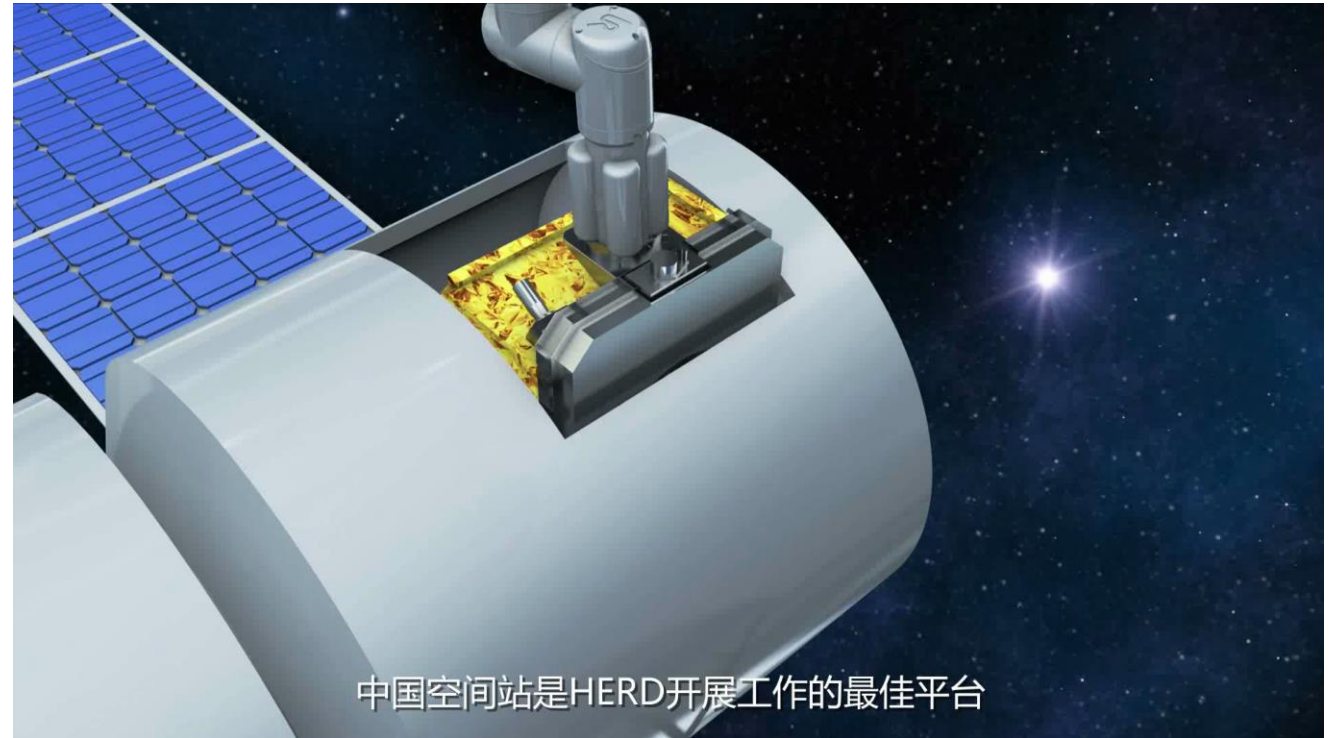
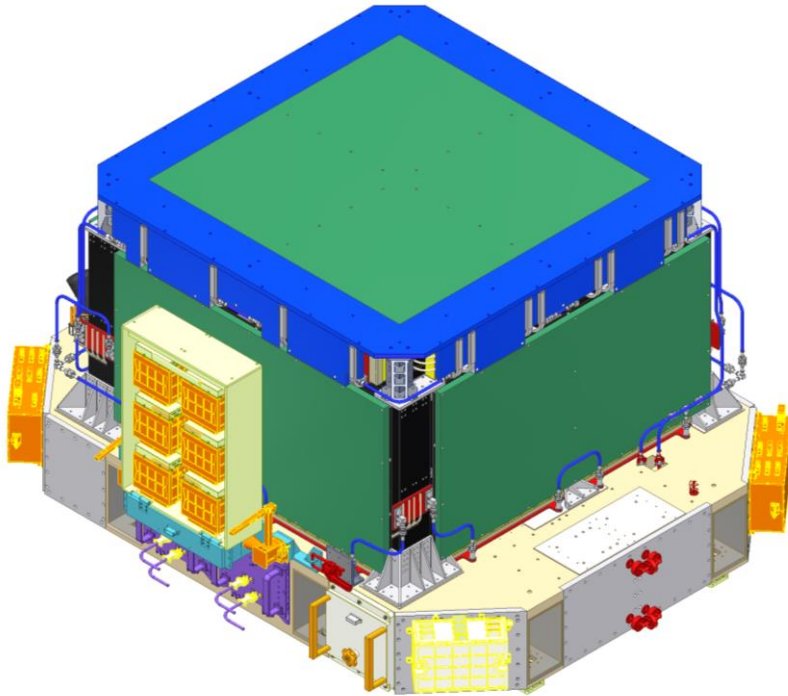


All key technology and key performances of subdetectors are validated.



General status of HERD

- HERD will be carried to CSS with the MFM Module, transported by Robotic Arm and installed on top of the Module
- Development of payload Electrical Model (EM) is ongoing
- Deep international collaboration
 - >200 scientists from China and Europe (mainly Italy, Spain, Switzerland)
 - Joint design on subdetectors and trigger; beam test; payload integration, etc.
 - Science, data analysis, software framework, etc.



AMS-02: a space version of a precision detector used in accelerators

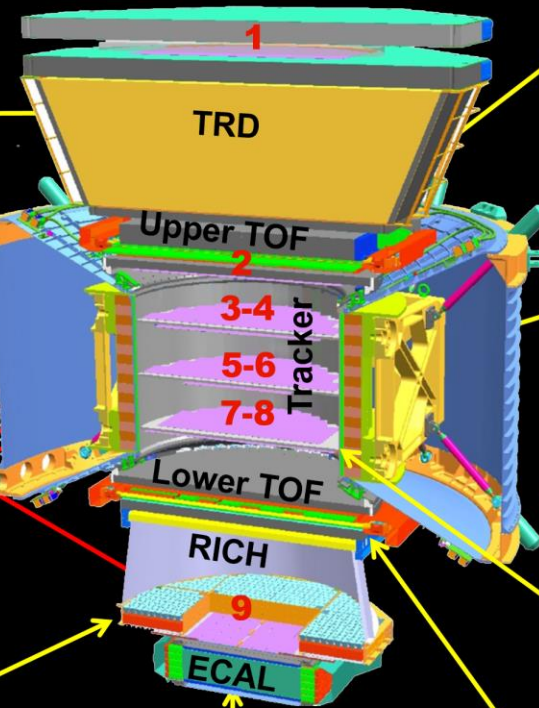
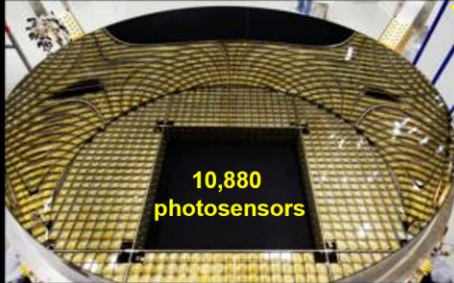
Transition Radiation Detector (TRD)
identify e^+ , e^-



Silicon Tracker
measure Z, P



Ring Imaging Cerenkov (RICH)
measure Z, E



Electromagnetic Calorimeter (ECAL)
measure E of e^+ , e^-



Upper TOF measure Z, E



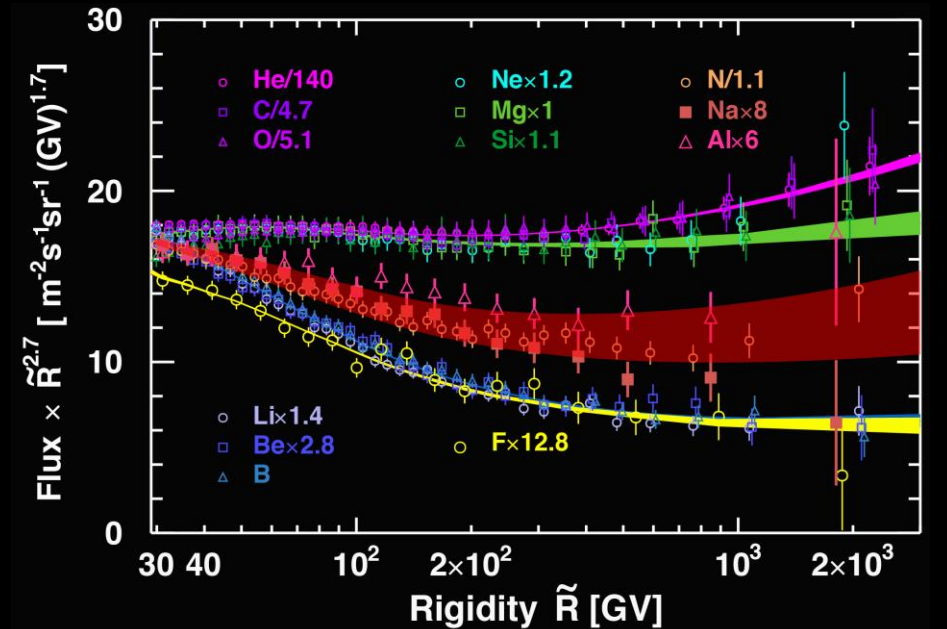
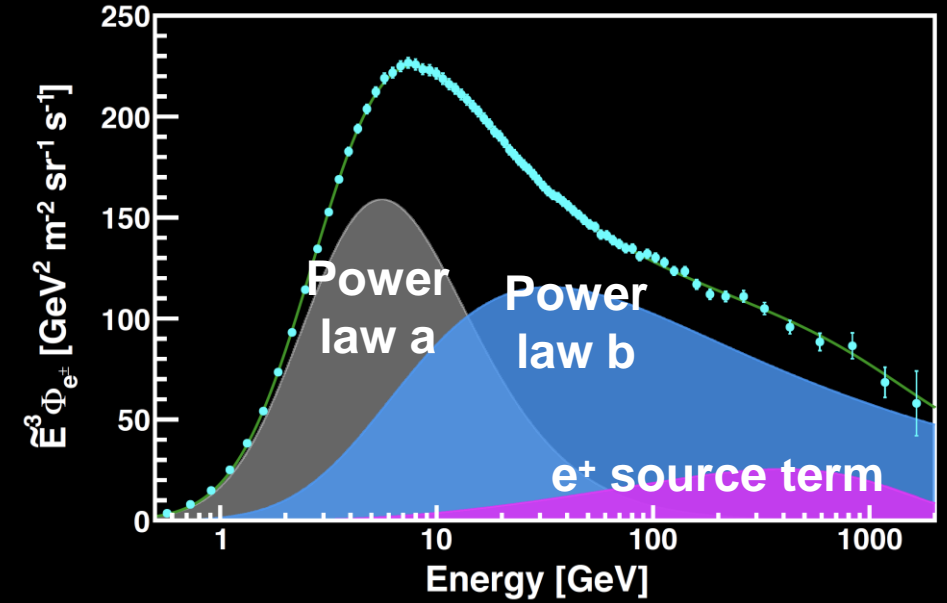
Magnet identify $\pm Z, P$



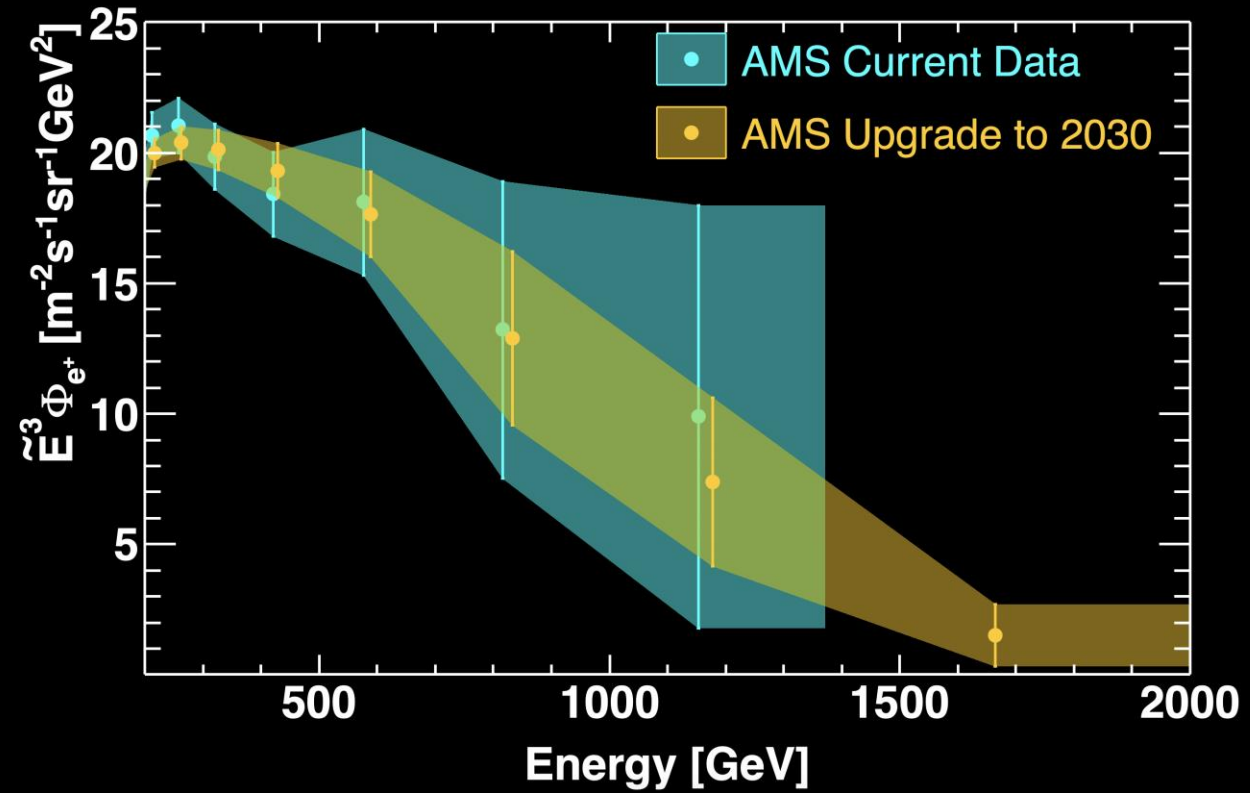
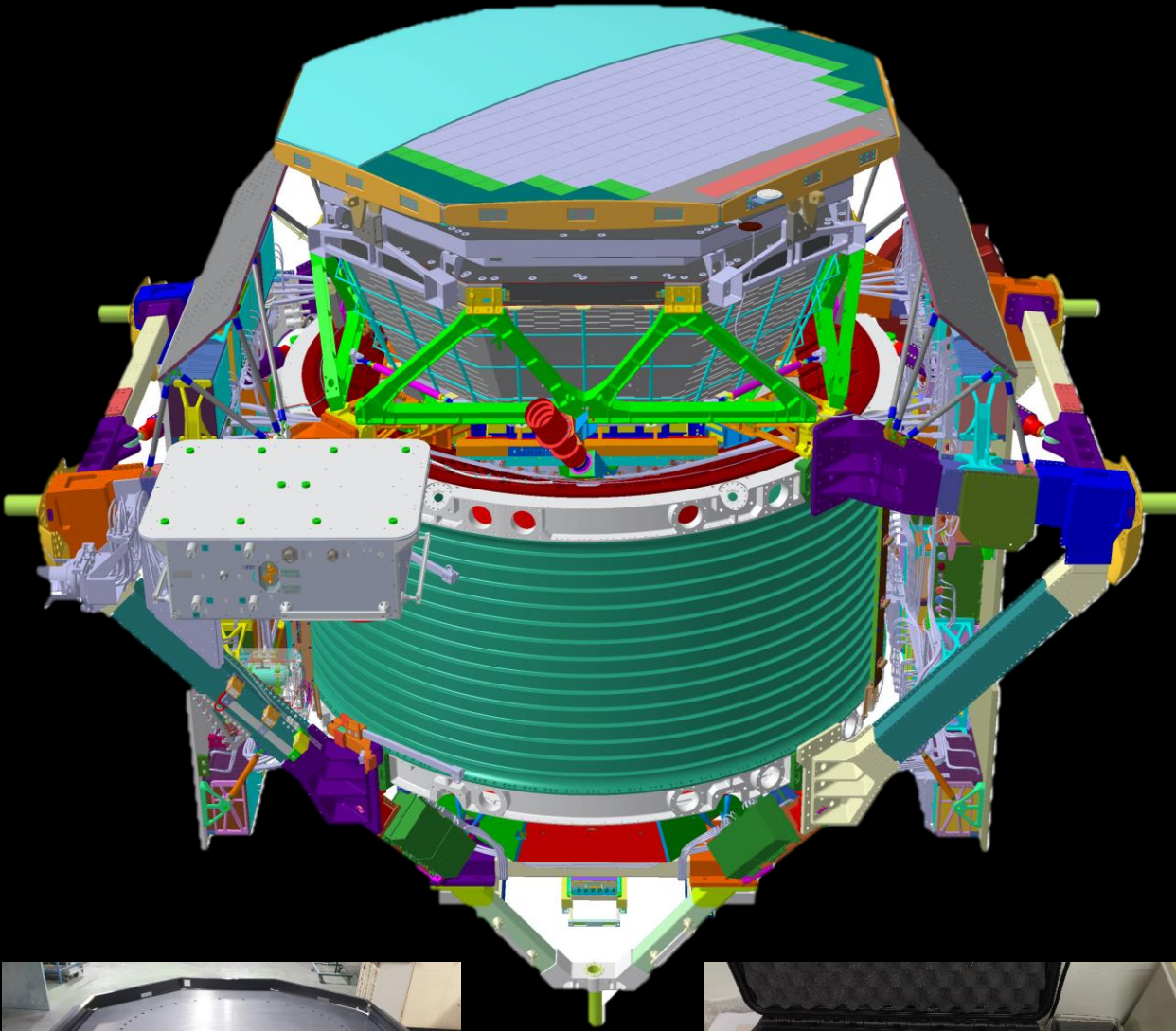
Anticoincidence Counters (ACC)
reject particles from the side



Lower TOF measure Z, E

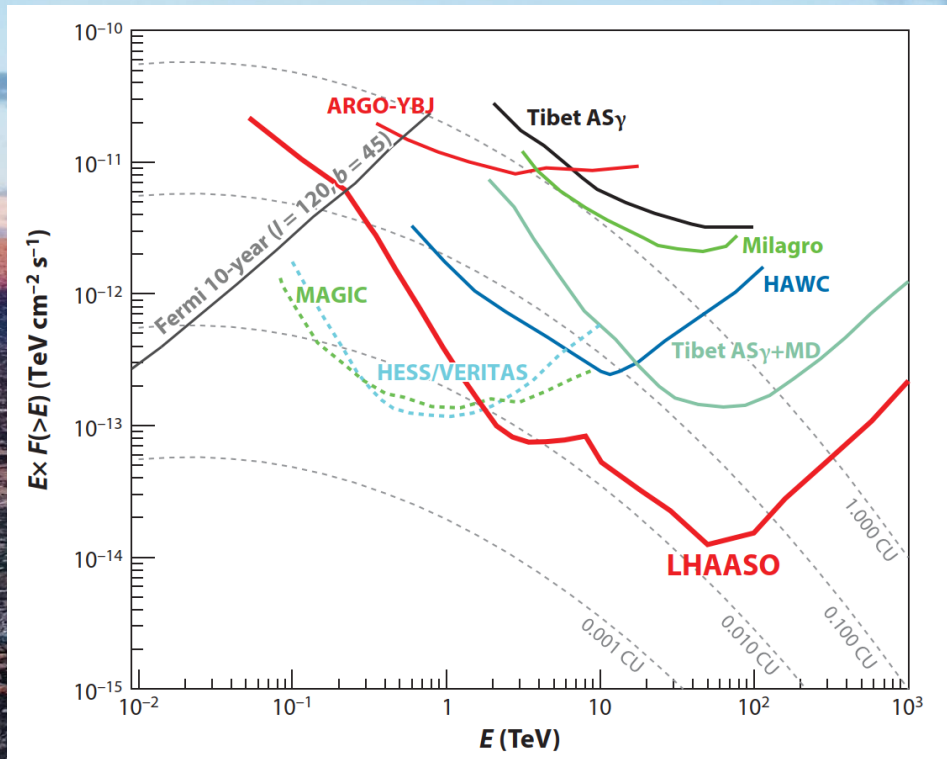


AMS with Layer 0



The upgrade will extend the energy range of the positron flux measurement from 1.4 to 2 TeV

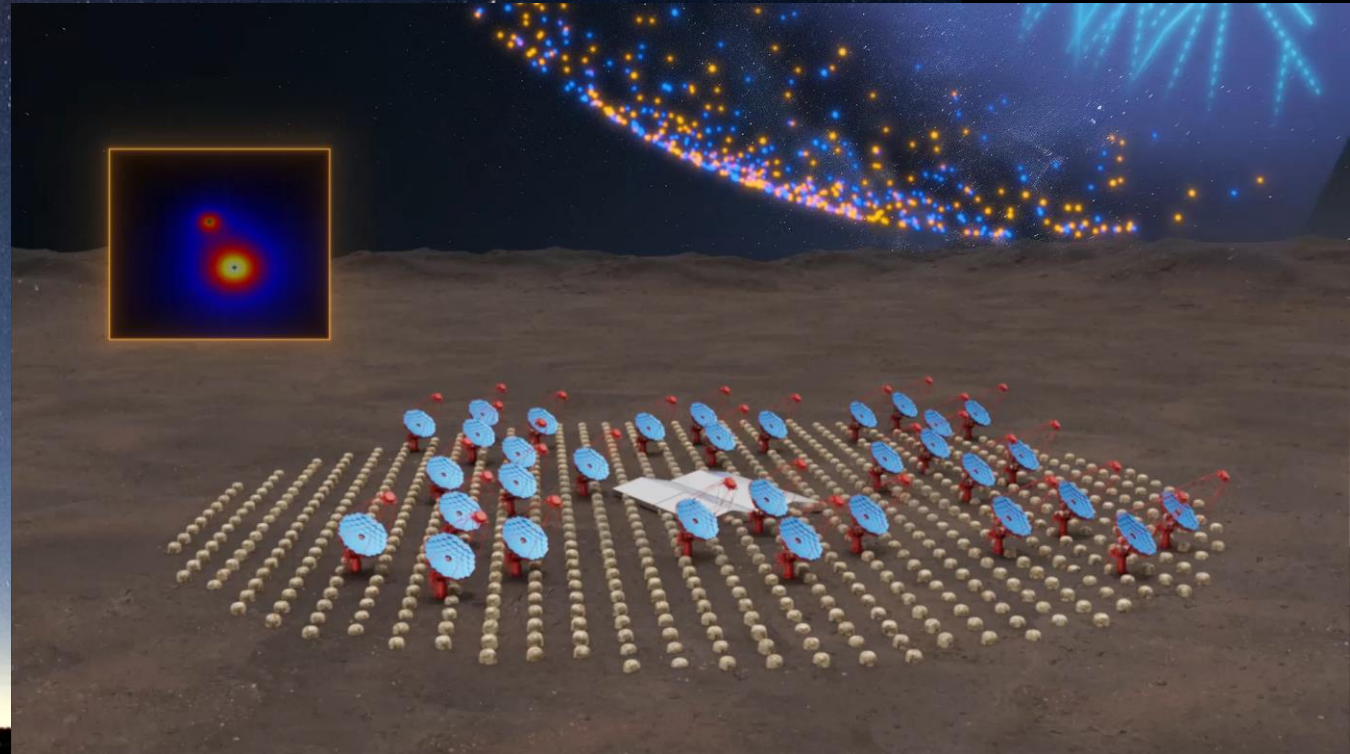
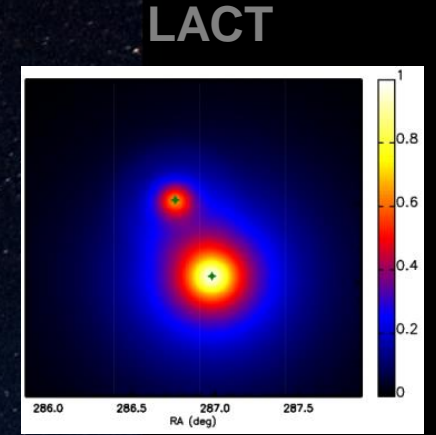
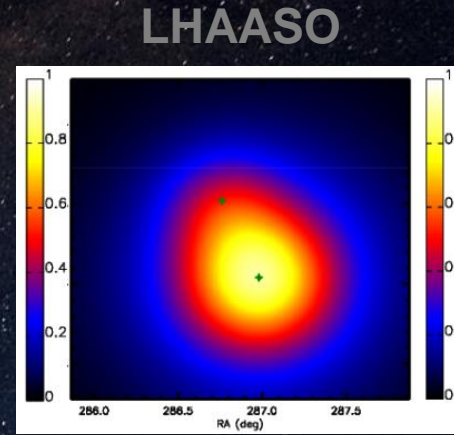
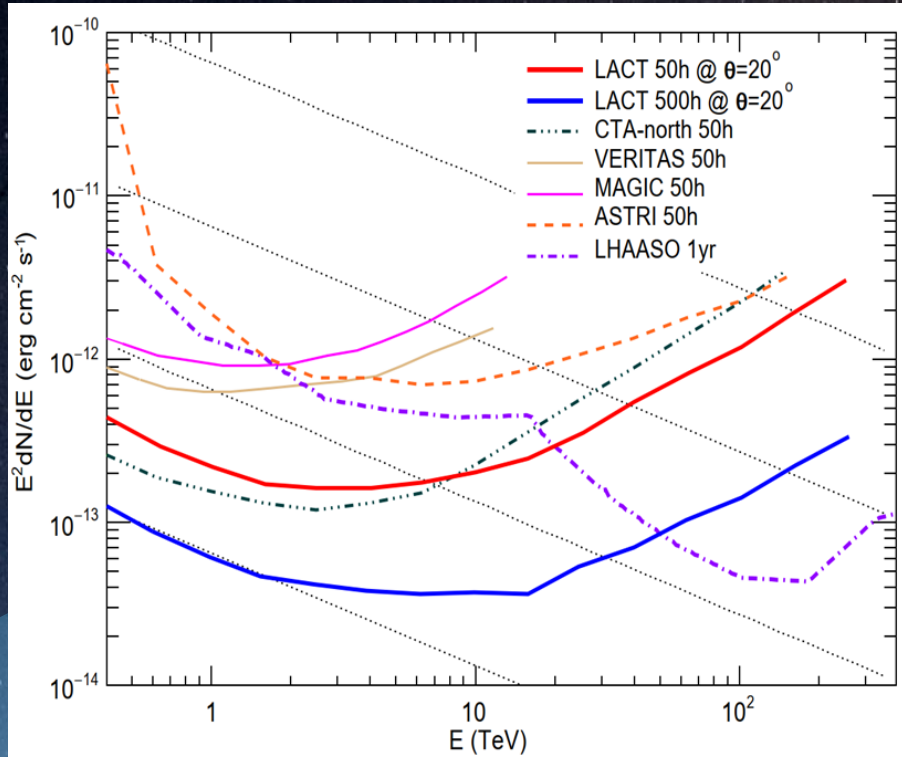
Large High Altitude Air Shower Observatory (LHAASO)



- Altitude 4410 m
- Diameter 1.3 km - Started observations since 2019.04
- Area 1.3 km²

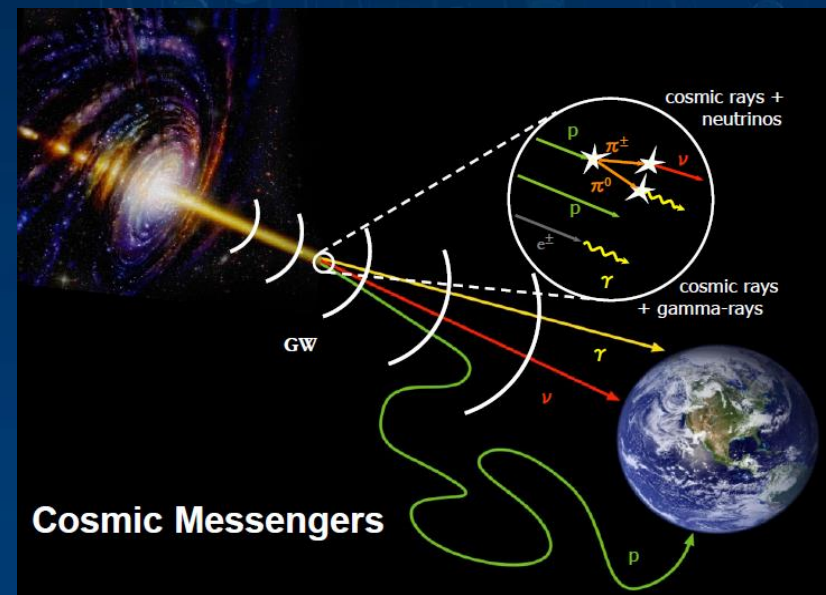
Large Array of imaging atmospheric Cherenkov Telescopes

LACT



High-energy Underwater Neutrino Telescope

HUNT



MAJOR FACILITIES IN LABORATORY

Near Future



eXTP



CATCH



HERD / POLAR-2

Today



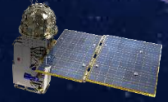
EP-FXT
(2024)



SVOM-GRM
(2024)



HXMT(2017~)



GECAM(2020~)

Theory
Software/algorithm
Instrumentation

Primordial
Gravitational Wave



X-ray

Gamma-ray

UHE gamma-ray

LACT

Under development

LHAASO

AIICPT

Under development