

HERD space mission

Probing the Galactic Cosmic Ray frontier

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on behalf of the GSSI HE-EXP group

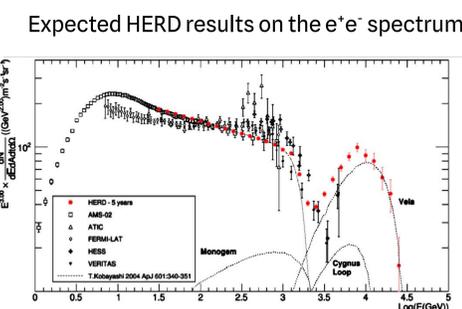
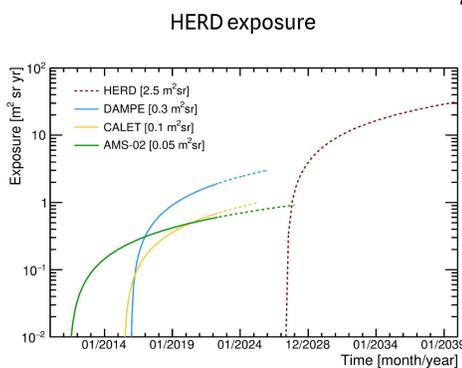
The space mission

- Launch scheduled for 2027
- On board of the Chinese Space Station (CSS):
 - circular LEO orbit inclined at 42°
 - altitude of ~ 340 - 450 km
 - lifetime >10 y

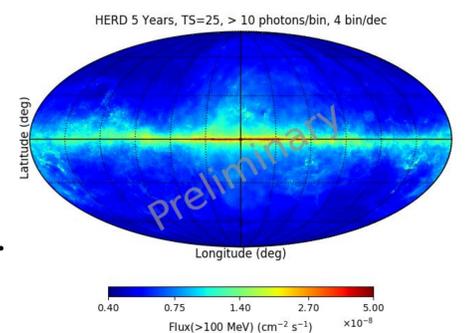
Calorimeter	55 X ₀ (~ 3 λ _I)
Geometric acceptance	~ 3 m ² sr
FOV	± 70°
Energy resolution	1% at 200 GeV (e/γ) ~20% at 100 GeV - 1 PeV (nuclei)
Detection	0.5 GeV - 100 TeV (γ) 10 GeV - 100 TeV (e) 30 GeV - 3 PeV (p/nuclei)

Research goals

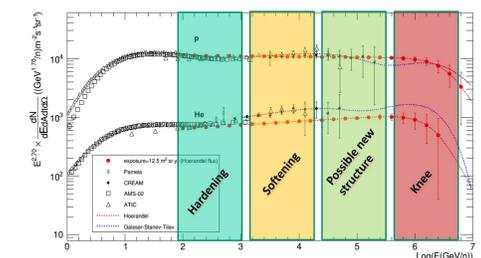
- Indirect dark matter search.
- γ-ray astronomy & transient studies.
- Electron spectra up to tens of TeV.
- CR spectra and composition up to the knee.



Expected HERD 5-year-sky-map



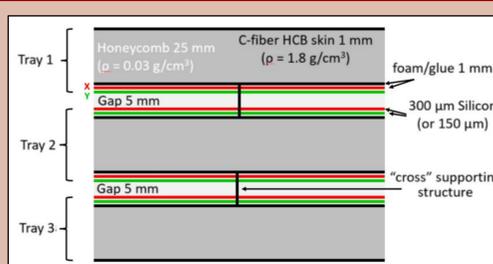
Expected HERD results on the p and He spectra



SCD

- For charge measurement up to Z = 28
- Outermost detector
- Highly segmented

Design



PSD

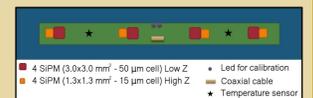
- For γ-rays ID (in anti-coincidence) and charge measurement up to Z = 26
- Requirements
 - High detection efficiency (>99.98%)
 - Wide dynamic range in nuclei ID
 - Highly segmented

Design

Sector: 2 double X-Y layers of scintillating tiles



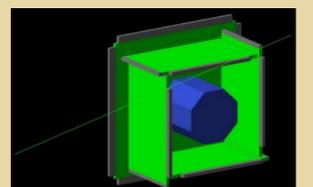
Read-out system: Printed Circuit Board housing 8 SiPMs



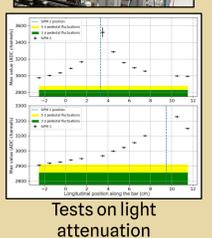
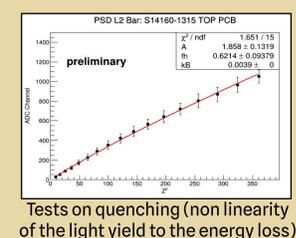
GSSI activities

- Simulations and software development

e.g. GEANT4 simulation of full-scale PSD and CALO detectors to test the hermeticity



- Hardware
 - Test beam campaigns at CERN and CNAO
 - Prototype assembling
 - Single components testings

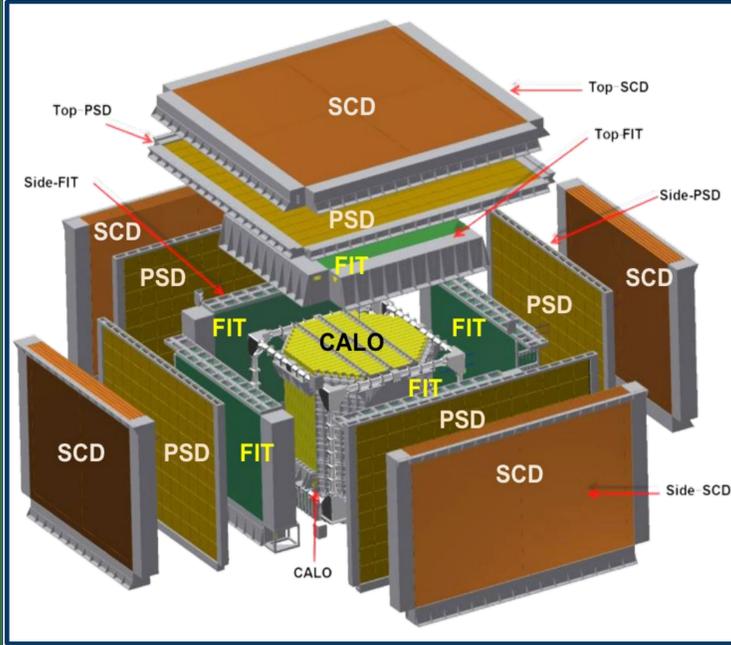


FIT

- For charged particles track reconstruction and γ-ray conversion in e+e- pairs

Design

- Sector: 7 X-Y planes
- Side plane: 6X + 10Y modules
- Top plane: 10X + 10Y modules
- Module: 1 fiber mat + 3 SiPM arrays

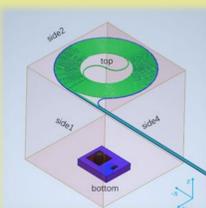


CALOrimeter

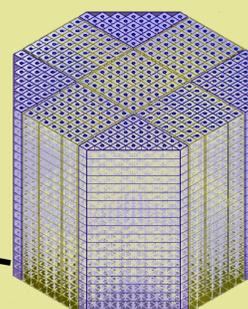
- 3D imaging calorimeter
- Isotropic & homogeneous
- Highly segmented
- Double read-out system

Design

Top read-out: Wavelength shifting fibers (WLS) coupled to image Intensified scientific CMOS



Bottom read-out: Photo-diode connected to custom electronics chips



7500 LYSO crystals