

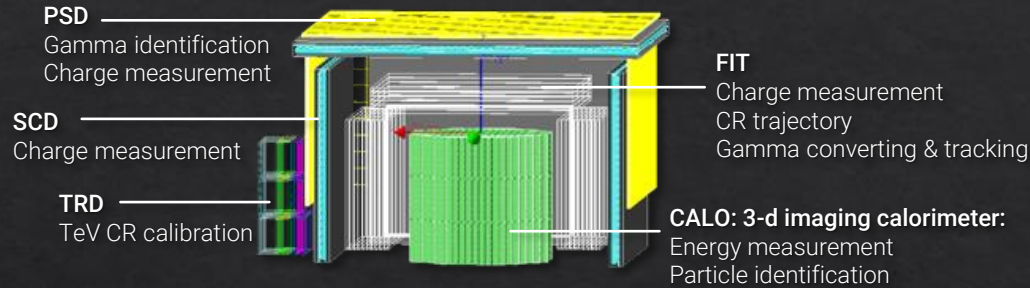
THE HIGH ENERGY COSMIC RADIATION DETECTOR (HERD) TRIGGER SYSTEM

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THE HERD DETECTOR

The High Energy cosmic Radiation Detector (HERD) is a future cosmic ray experiment planned to be installed onboard the Chinese Space Station (CSS) for a 10-year mission.



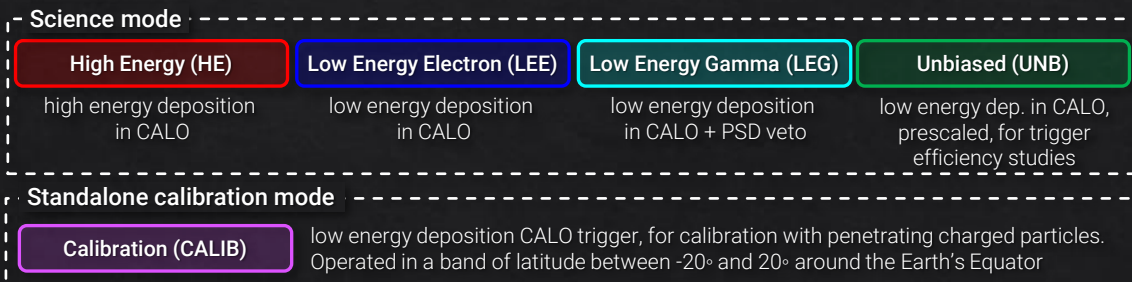
- Orbit inclination: $\sim 41.5^\circ$
- Orbit altitude: 340 - 450 km
- Mass: < 4 t
- FOV: $\sim 70^\circ$

Scientific goals:

- Precise measurement of the CR spectra and composition up to knee
- Measurement of the electron spectra up to tens of TeV
- Indirect searches for DM
- Gamma ray astronomy and transients

BASELINE TRIGGER DEFINITIONS

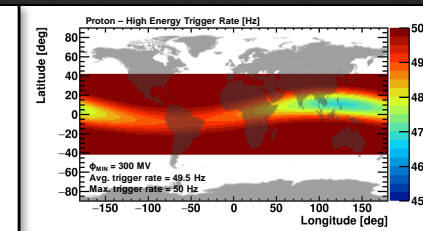
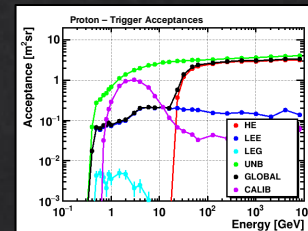
The trigger strategy is defined to fulfill the scientific goals of the HERD mission.



STUDY OF THE TRIGGER PERFORMANCES

The performances of the sub-trigger definitions have been evaluated using Monte Carlo samples simulated and processed with the HerdSoftware framework based on Geant4 using a compact geometry of HERD detector. The generated samples include different particle species (protons, electrons, helium, carbon and gammas) and energy points.

The trigger acceptances and expected trigger rates for down-going particles are calculated.



Expected proton trigger rates

	$\Phi_{MIN}=300$ MV Avg. [Hz]	Max. [Hz]
HE	49.5	50.0
LEE	72.5	311.2
LEG	0.5	8.1
UNB	0.9	3.6
GLOBAL	123.1	372.5
CALIB	26.4	94.3

FEASIBILITY OF A TOPOLOGICAL TRIGGER

The photodiode readout of the CALO LYSO crystals provides topological trigger capabilities that may complement the baseline sub-triggers based on the energy deposition in CALO.

A simple programmable logic (based on the total multiplicity or x,y,z-projection multiplicities) built from individual PD self-trigger signals provides enhanced particle identification as long as a low threshold (~ 1 MIP) can be set. Based on this, different sub-triggers have been investigated:

- Low Energy Electron Topological (LEET):** low energy electrons either for science/calibration
- High Energy Topological (HET):** high energy CRs
- High Energy Electron Topological (HEET):** for electrons at intermediate energies
- MIP Topological (MIPT):** for MIP calibration

