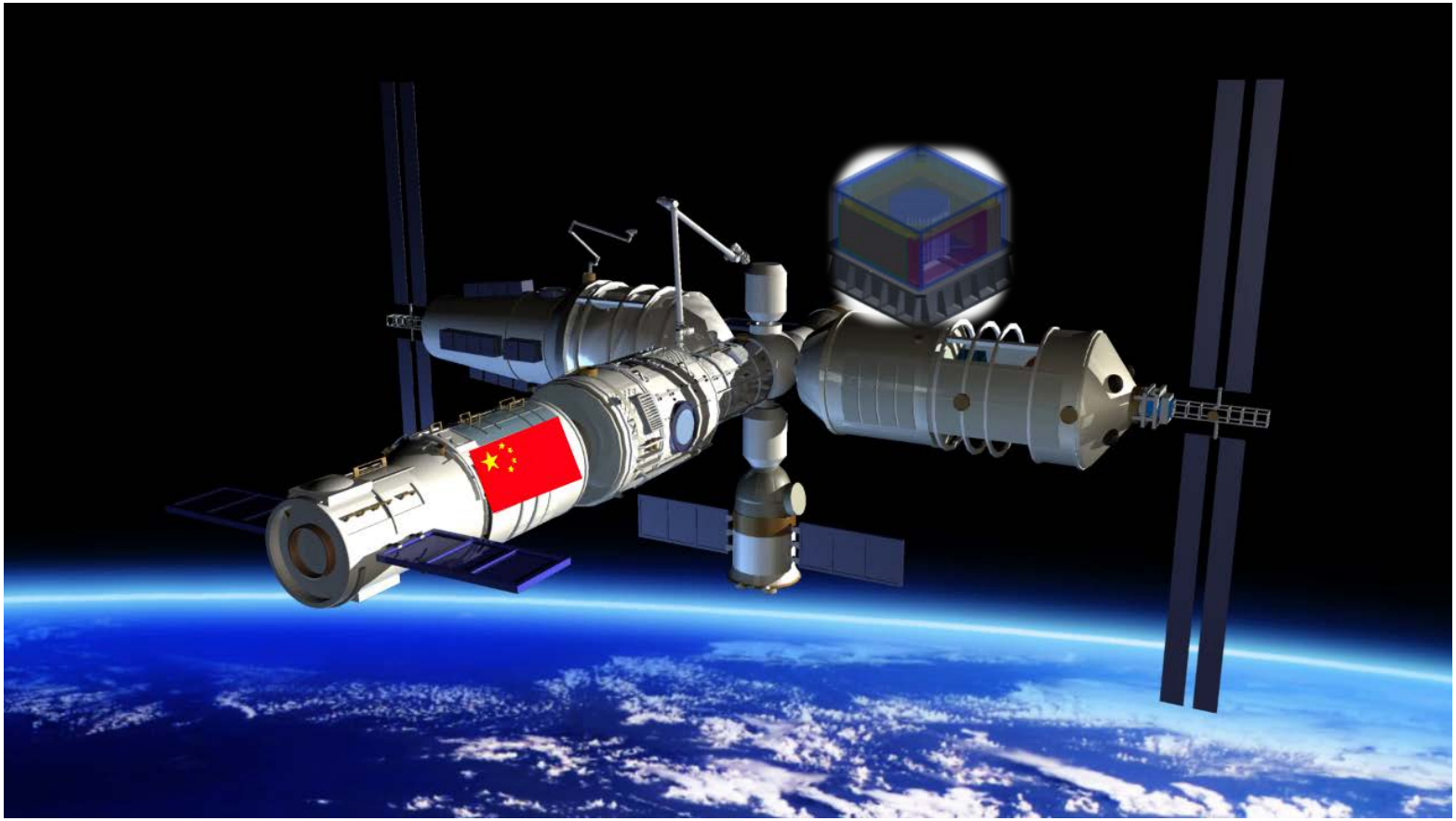
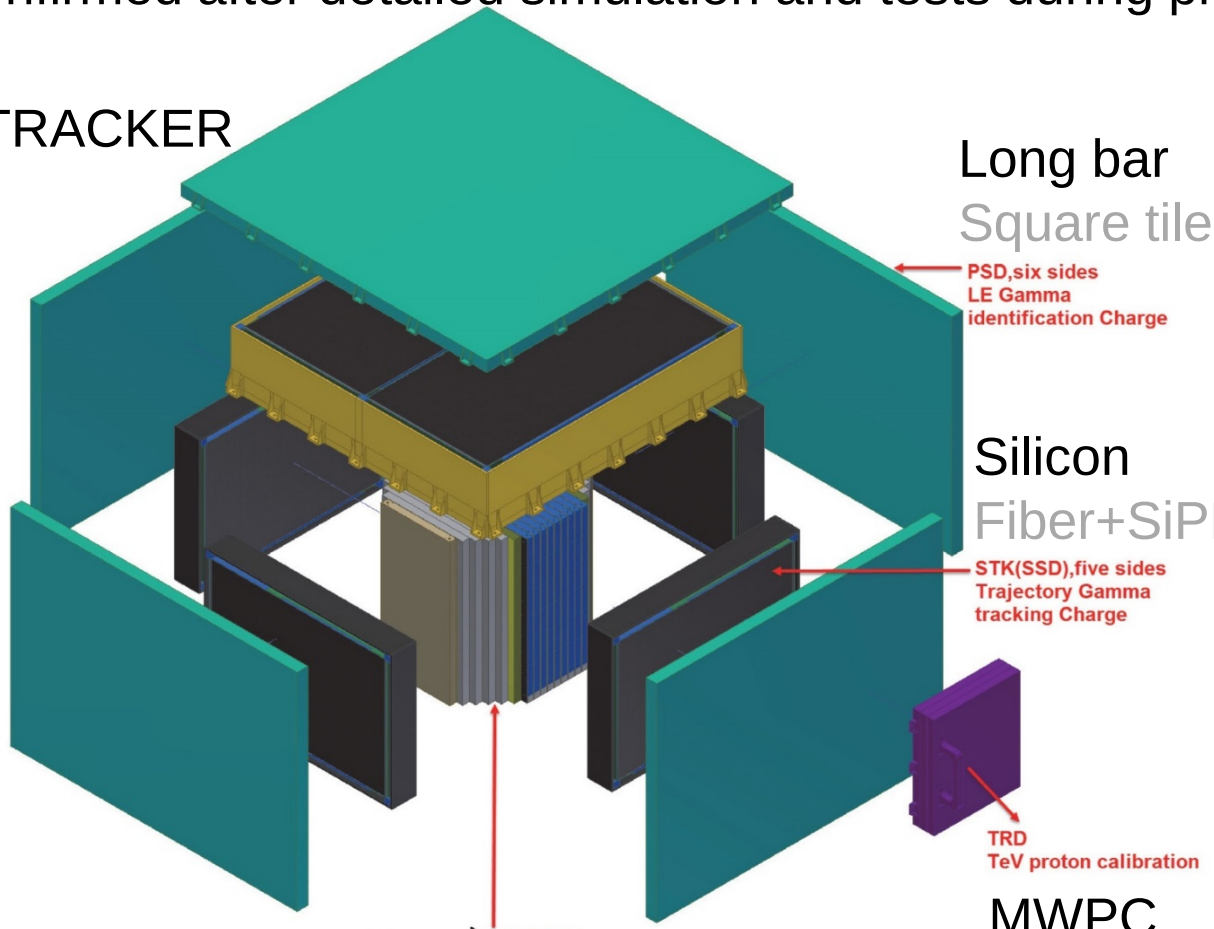
The High Energy cosmic-Radiation Detection (HERD) Facility onboard China's Future Space Station



HERD payload configuration (baseline)

- All candidates of technical approaches are clearly demonstrated to RB.
- To be confirmed after detailed simulation and tests during phase B.

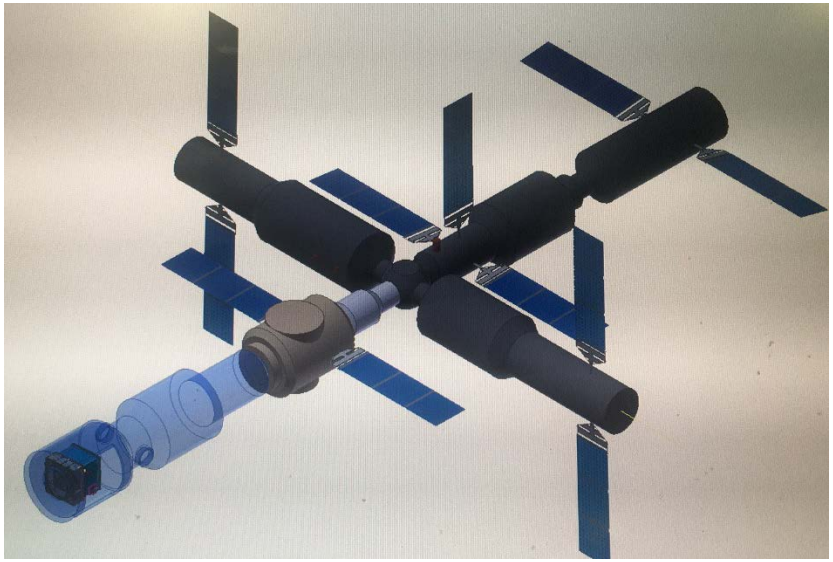


HERD specifications

Item	Value
Energy range (e/γ)	10 GeV-100 TeV(e); 0.5 GeV-100 TeV (γ)
Energy range (CR)	30 GeV－3 PeV
Angle resolution	0.1 deg.@10 GeV
Charge meas.	0.1-0.15 c.u
Energy resolution (e)	1%@200 GeV
Energy resolution (p)	20%@100 GeV - PeV
e/p separation	~10^{-6}
G.F. (e)	>3 m^2sr@200 GeV
G.F. (p)	>2 m^2sr@100 TeV
Pointing	Zenith
Field of View	+/-70 deg (targeting +/-90 deg)
Measure accuracy of attitude	<0.1 deg
Measure accuracy of angular speed	<0.005 deg/s
Lifetime	>10 years

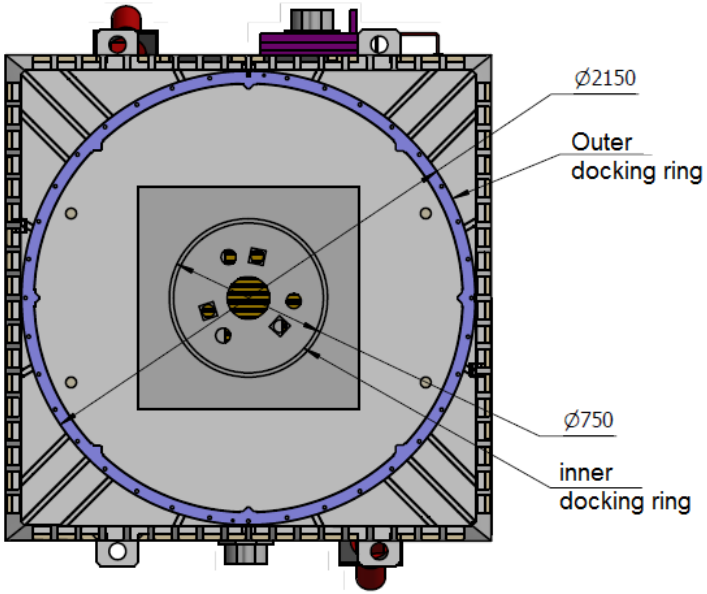
HERD onboard Italian Module

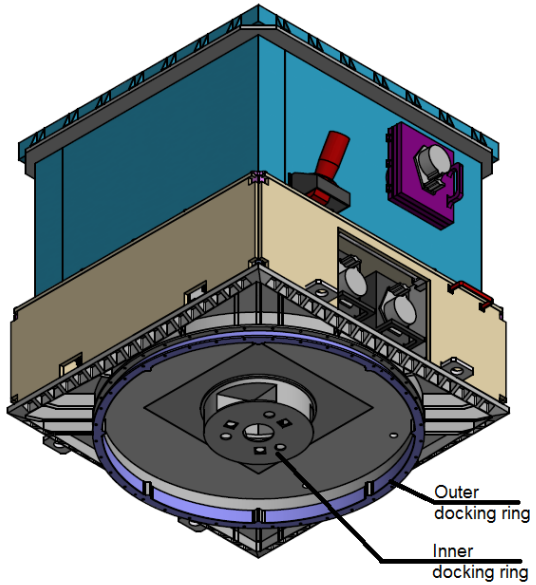
- Launch, Transfer & Installation
  - To launch Italian Module and HERD together, with HERD hiding inside the service module
  - To dock Italian Module on CSS
  - To open lateral wall of service module and move out HERD by using robotic arm
  - To install HERD on top of Italian Module



New interfaces based on Italian Module

- Overall mass: ≤ 4 T
- Overall power: ≯1400 W
- Dimension (main body): 2300 * 2300 *2300 mm^3。
- Dimension (envelope): 3000 * 2300 * 2300 mm^3（X*Y*Z）
  - Replaceable IsCMOS cameras, TRD and one STR are on –X.
  - The adapter, another STR is on +X.

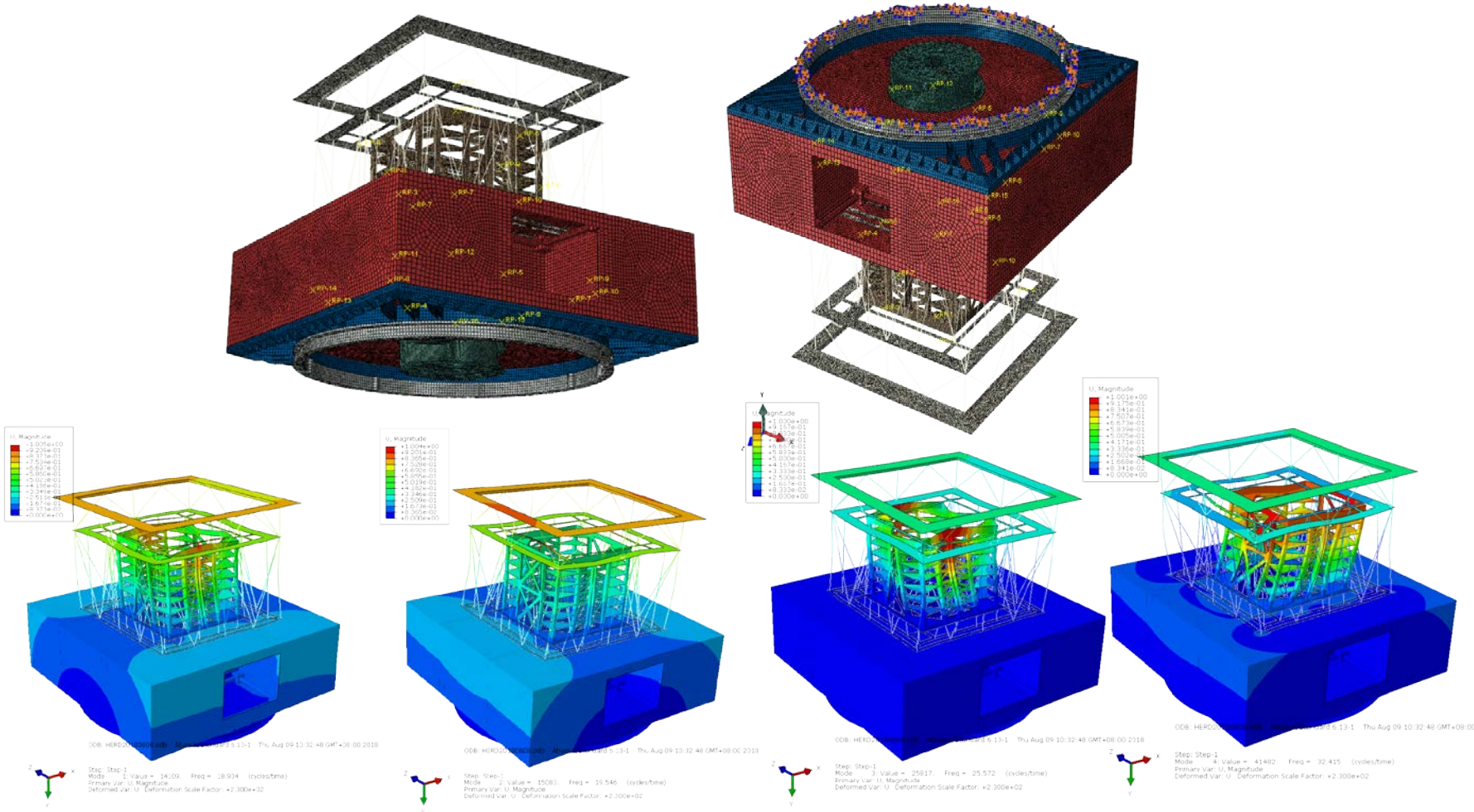




- Outer docking ring is for connection with service module during launch.
- Inner docking ring is for final installation on Italian module, i.e. the adapter including mechanical, electrical, thermal, data interfaces.

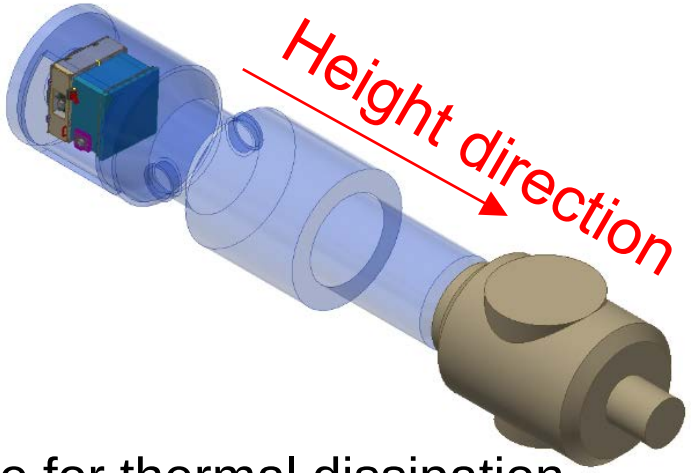
Preliminary modal analysis

- Fundamental frequencies are 18.9, 19.5, 25.6, 32.4 Hz respectively.



Some TBCs

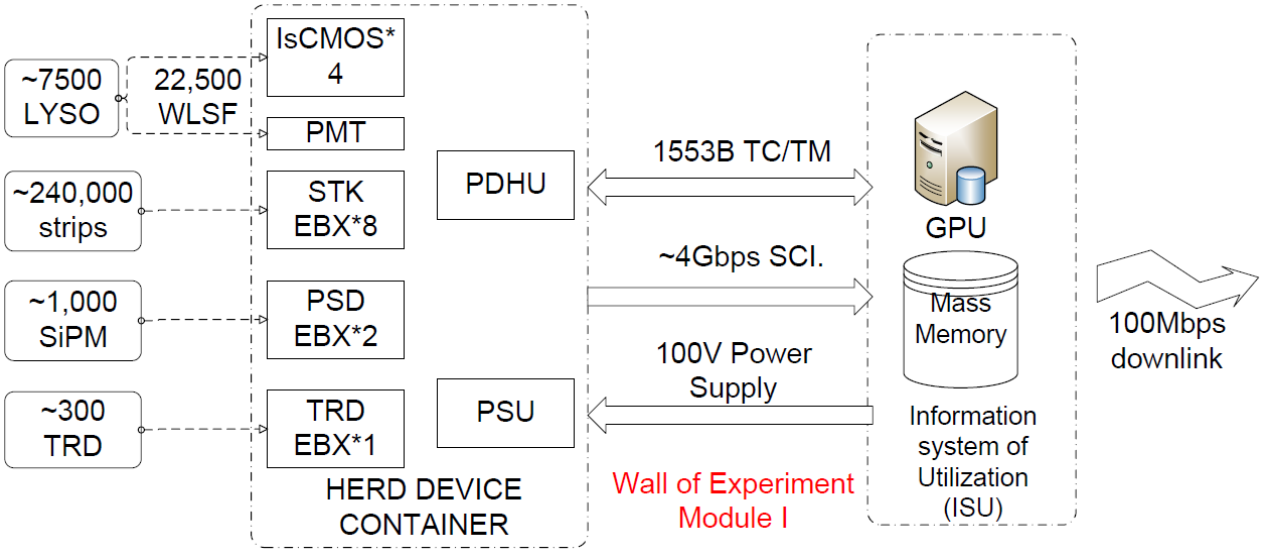
- Height constraint
  - Constraints from CAST using info. of developed Modules provided by TAS-I is below 2m.
  - Height of HERD ~2.2-2.3 m.
  - TAS-I: Module could be optimized.



- HERD needs cooling tank inside Module for thermal dissipation.
- HERD will send raw data to the information system (ISU) inside CSS.
- Adapter interfaces
  - Proposal to be discussed with CSU & CAST.
  - Feasibility to be checked between CAST & TAS-I.
  - Decision to be made between CMSA & ASI.

DAQ concepts (1)

- (Based on docking on Experimental Module I)
- Primary power supply from CSS is 100 V.
  - HERD PSU could distribute 1-2 kinds of secondary power supplies to all instruments.
- Data transfer protocol between HERD & CSS is FE-AE-1553 bus.
  - ISU provides huge MM and GPU; Small CPUs in HERD PDHU.
  - Almost all raw data could go to ISU. Periodic calibration, data selection, pre-process could be done by GPU.
- TC/TM protocol between HERD & CSS is 1553B bus.



DAQ concept (2)

- Trigger rate
  - ~150 cps in normal mode
  - ~350 cps in calibration Mode
- Dead time
  - <2ms (foreseen 1.2ms) for IsCMOS

- Science data taking mode
  - HE trigger
    - 110 Hz trigger rate
    - Trigger efficiency > 90%, for proton > 50 GeV
  - HE + Low energy electron threshold
    - 130 Hz trigger rate
    - Trigger efficiency > 90%, for electron > 30 GeV
  - LE trigger with CALO shell threshold beyond 0.35 GeV and AND PSD veto
    - Trigger rate depends on veto efficiency
    - Trigger efficiency > 80%, for photon > 0.5 GeV
  - Unbiased with pre-scale
    - < 10Hz
- Calibration mode
  - CALO core trigger threshold > 0.5 GeV and CALO shell threshold to discard shower events
  - 300 Hz trigger rate near earth equator (-20^{o} , 20^{o}) and SAA exclude

Protocol between instruments and PSU & PDHU could be discussed in splinter meetings.