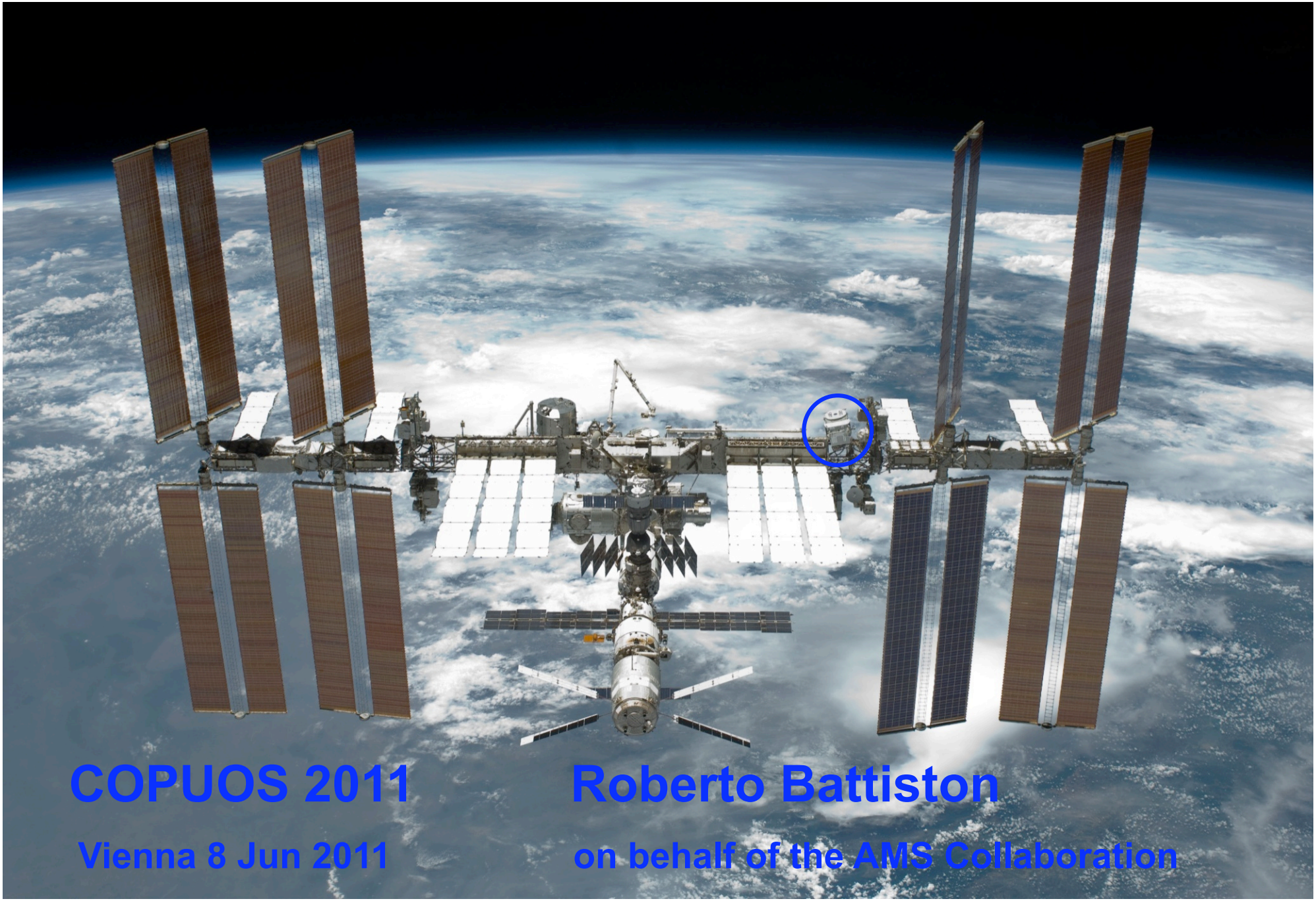
The Alpha Magnetic Spectrometer (AMS) Experiment

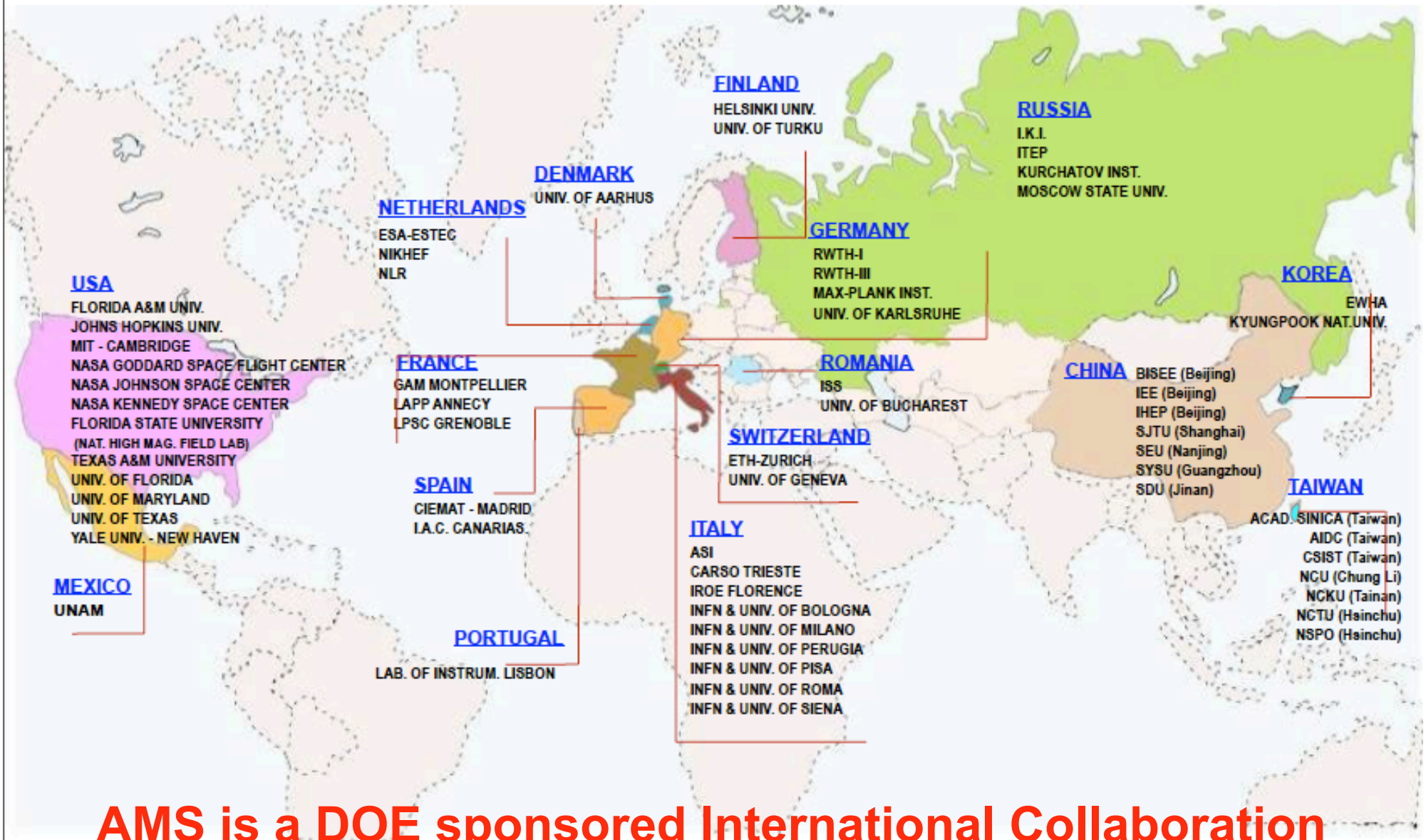


COPUOS 2011

Vienna 8 Jun 2011

Roberto Battiston

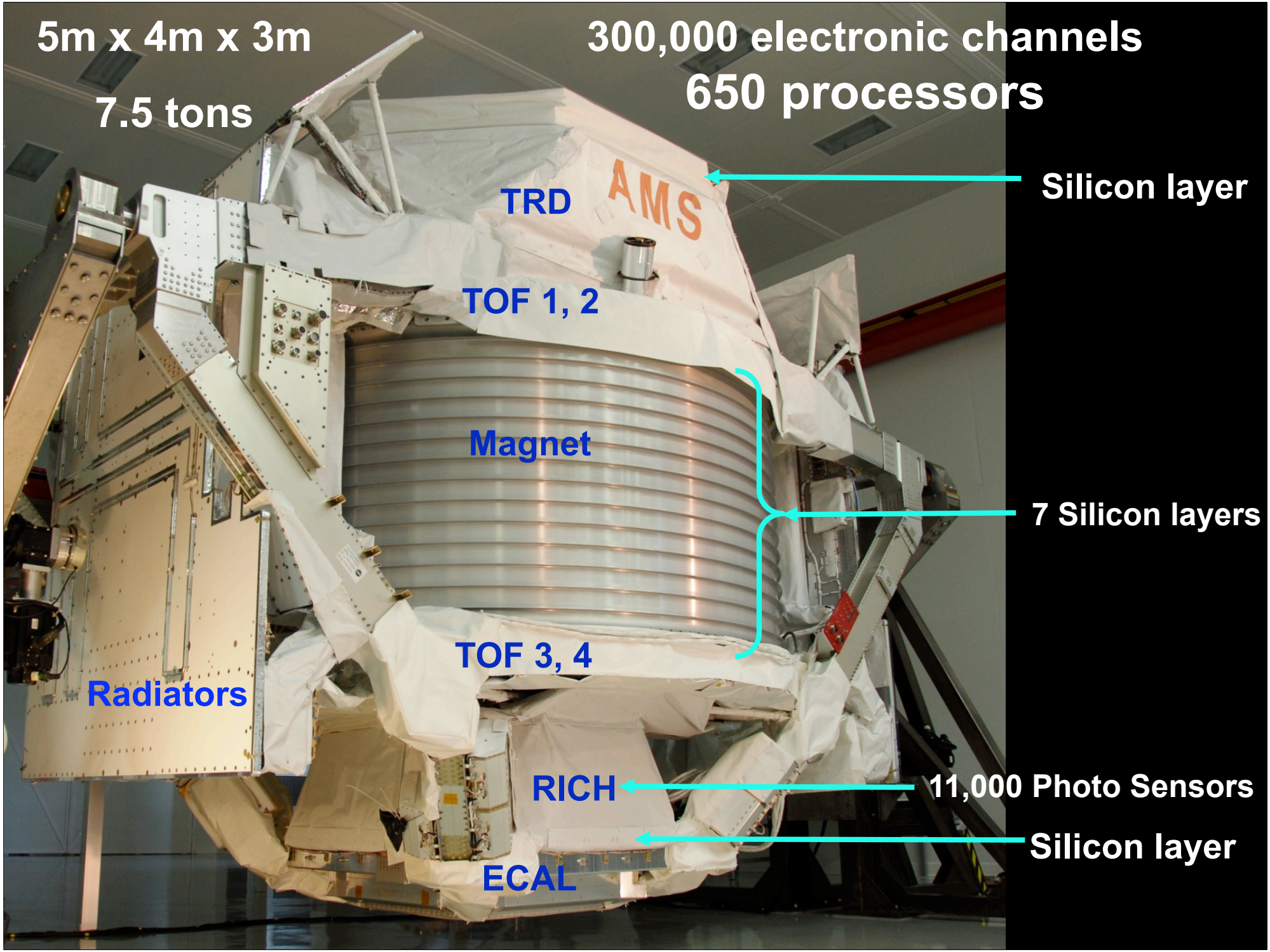
on behalf of the AMS Collaboration



AMS is a DOE sponsored International Collaboration

AMS: 16 Years, 16 Countries, 60 Institutes, 500 Physicists

DOE-NASA agreement to deploy and operate AMS on the ISS

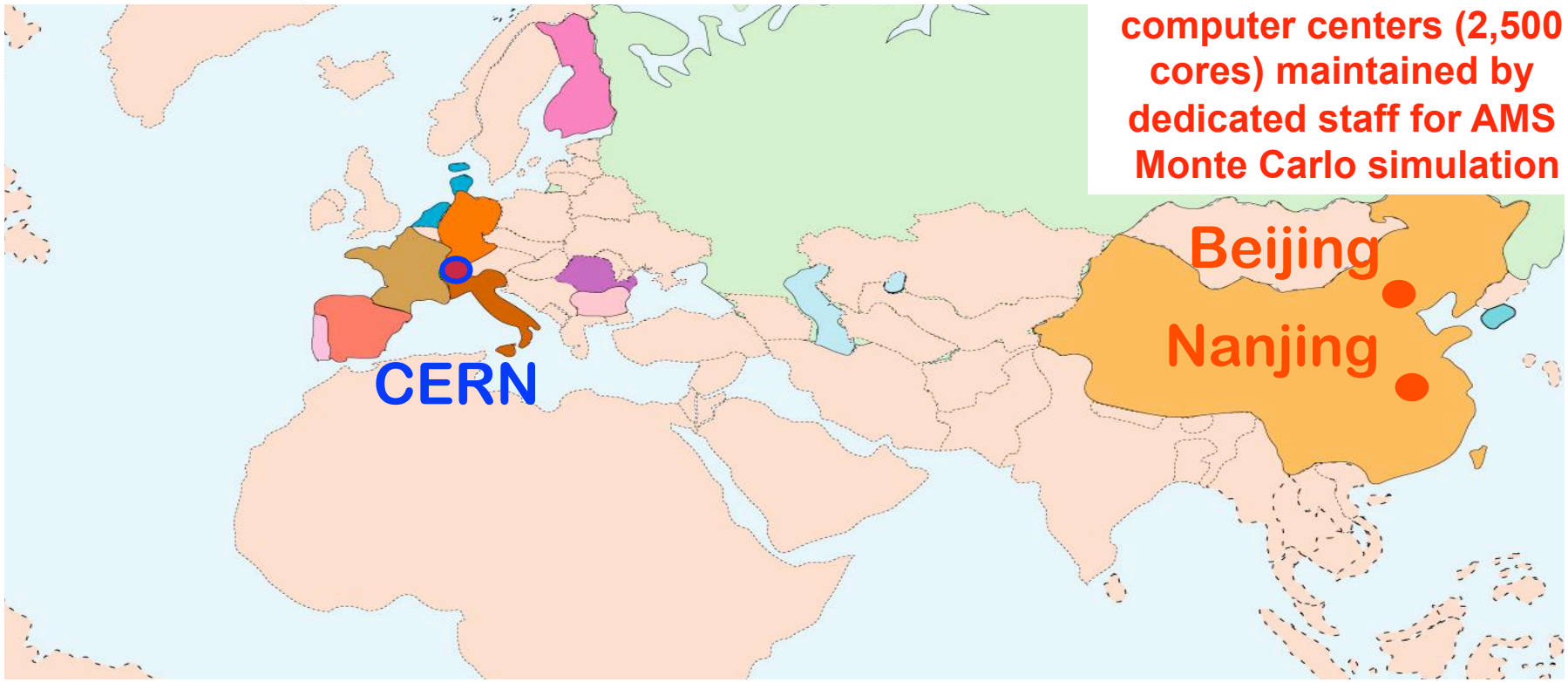

5m x 4m x 3m
7.5 tons
300,000 electronic channels
650 processors
AMS
TRD
TOF 1, 2
Magnet
TOF 3, 4
Radiators
RICH
ECAL
Silicon layer
7 Silicon layers
11,000 Photo Sensors
Silicon layer

陈求发 (Chen Qiufa)

Director

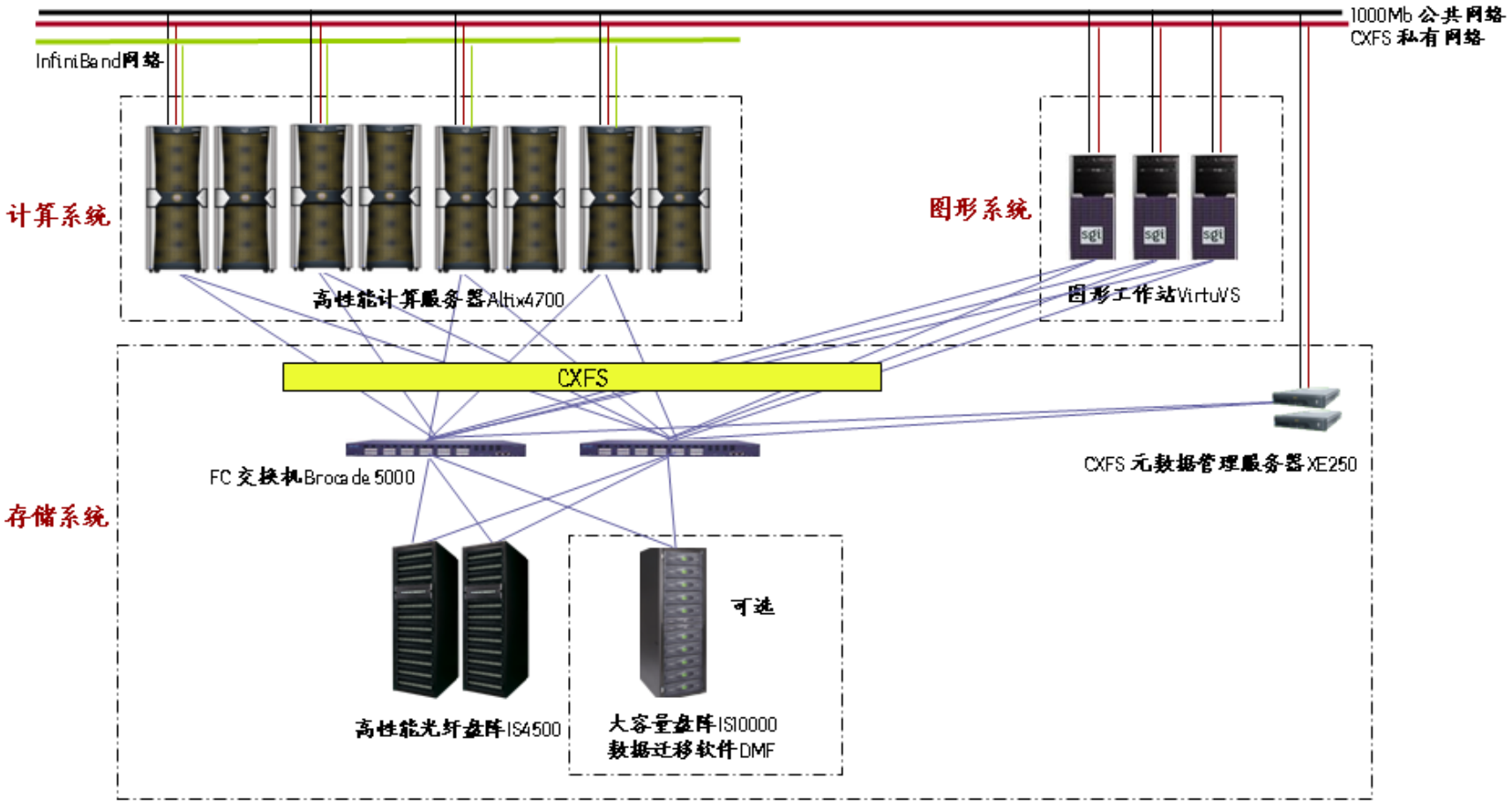
China National Space Administration

CNSA



China has two super computer centers (2,500 cores) maintained by dedicated staff for AMS Monte Carlo simulation

AMS Center at NLAA, Beijing, China



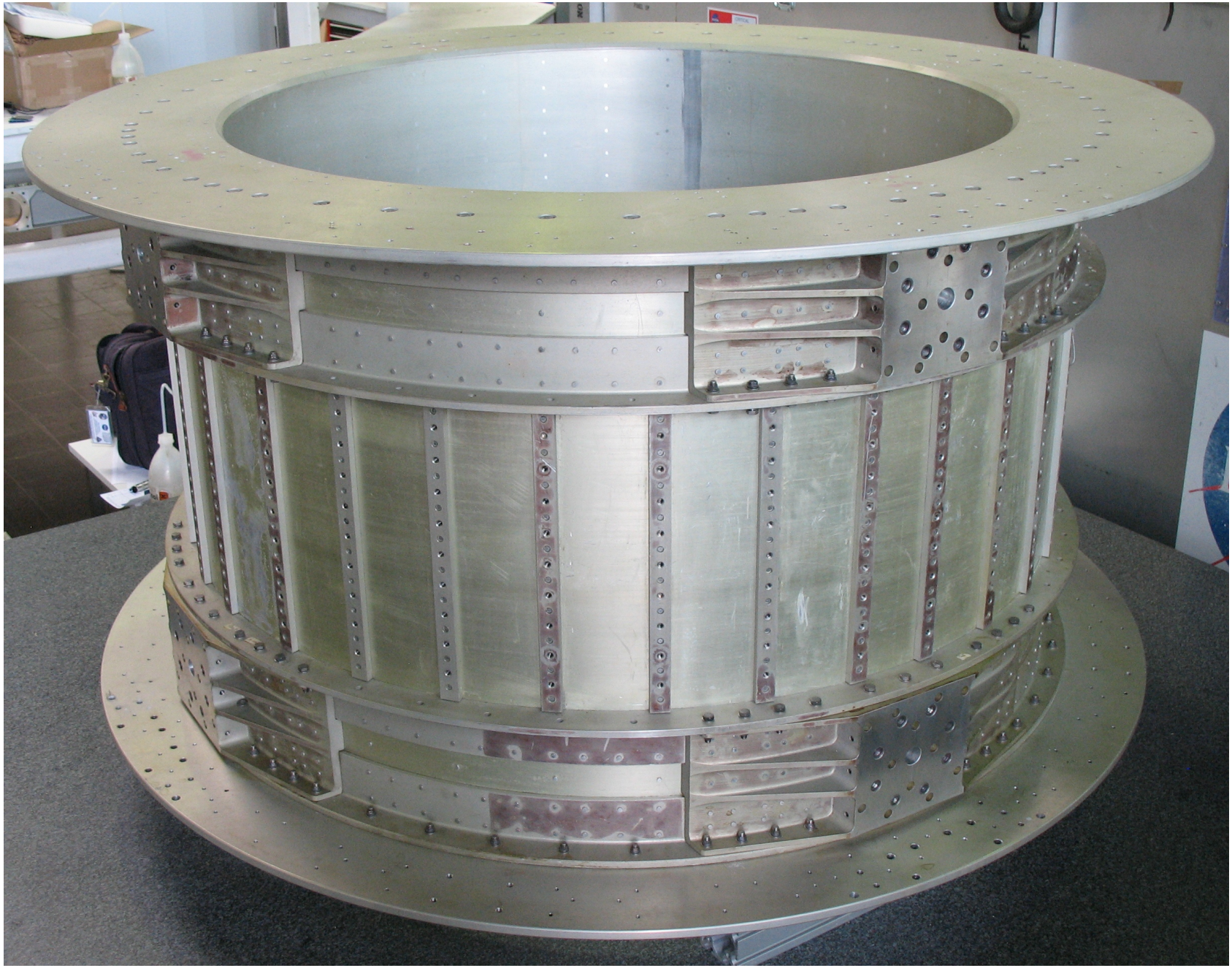
Hon. Enrico Saggese

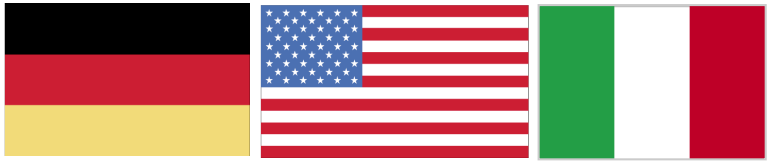
President
Agenzia Spaziale Italiana (ASI)

ASI has supported AMS since the beginning (1994) in collaboration with
the Italian Insitute for Nuclear Physics (INFN).

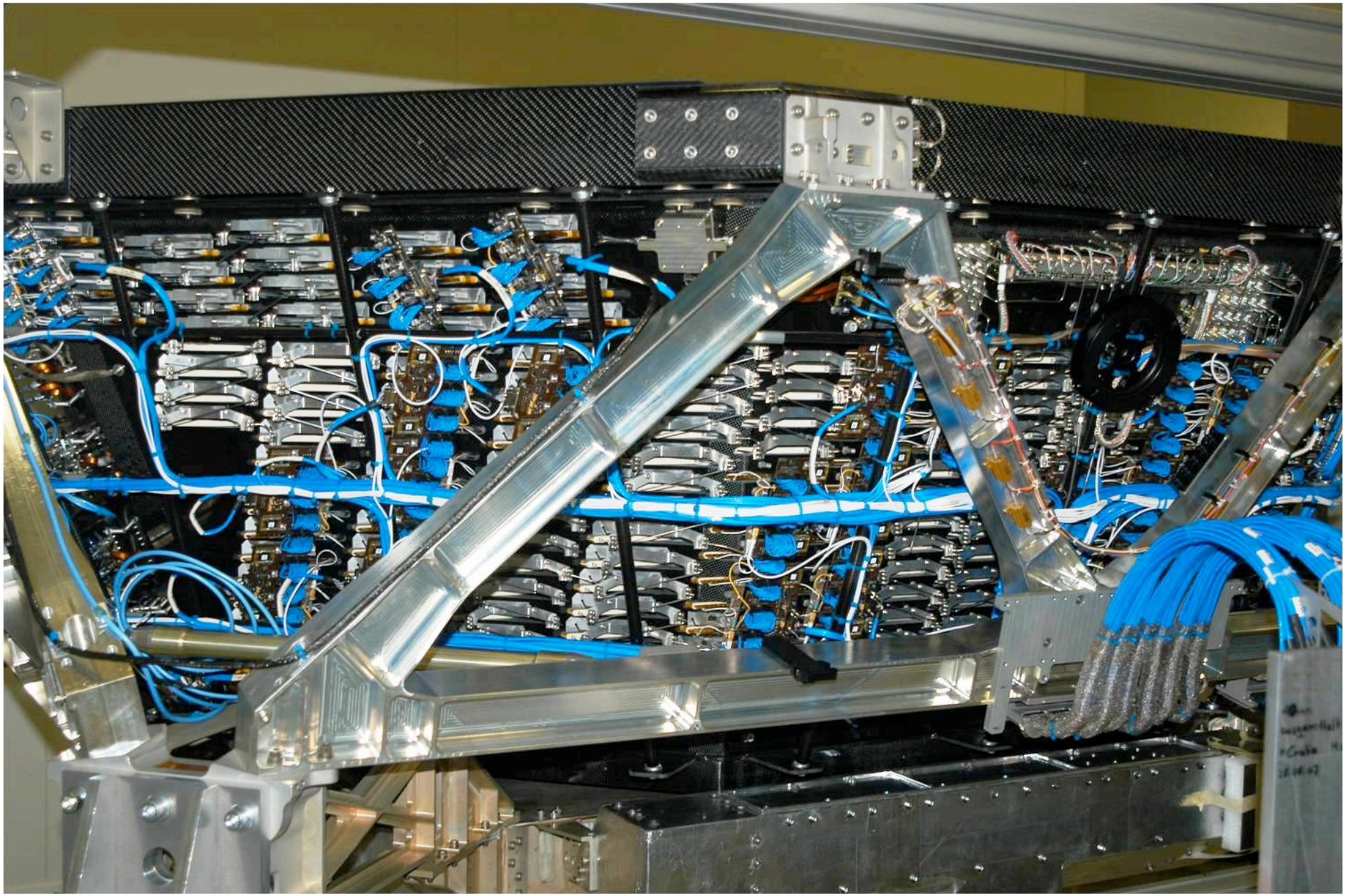
AMS is the largest Italian partecipation to an experiment on the International Space Station

The Permanent Magnet: on the Shuttle - AMS-01 and on ISS – AMS-02

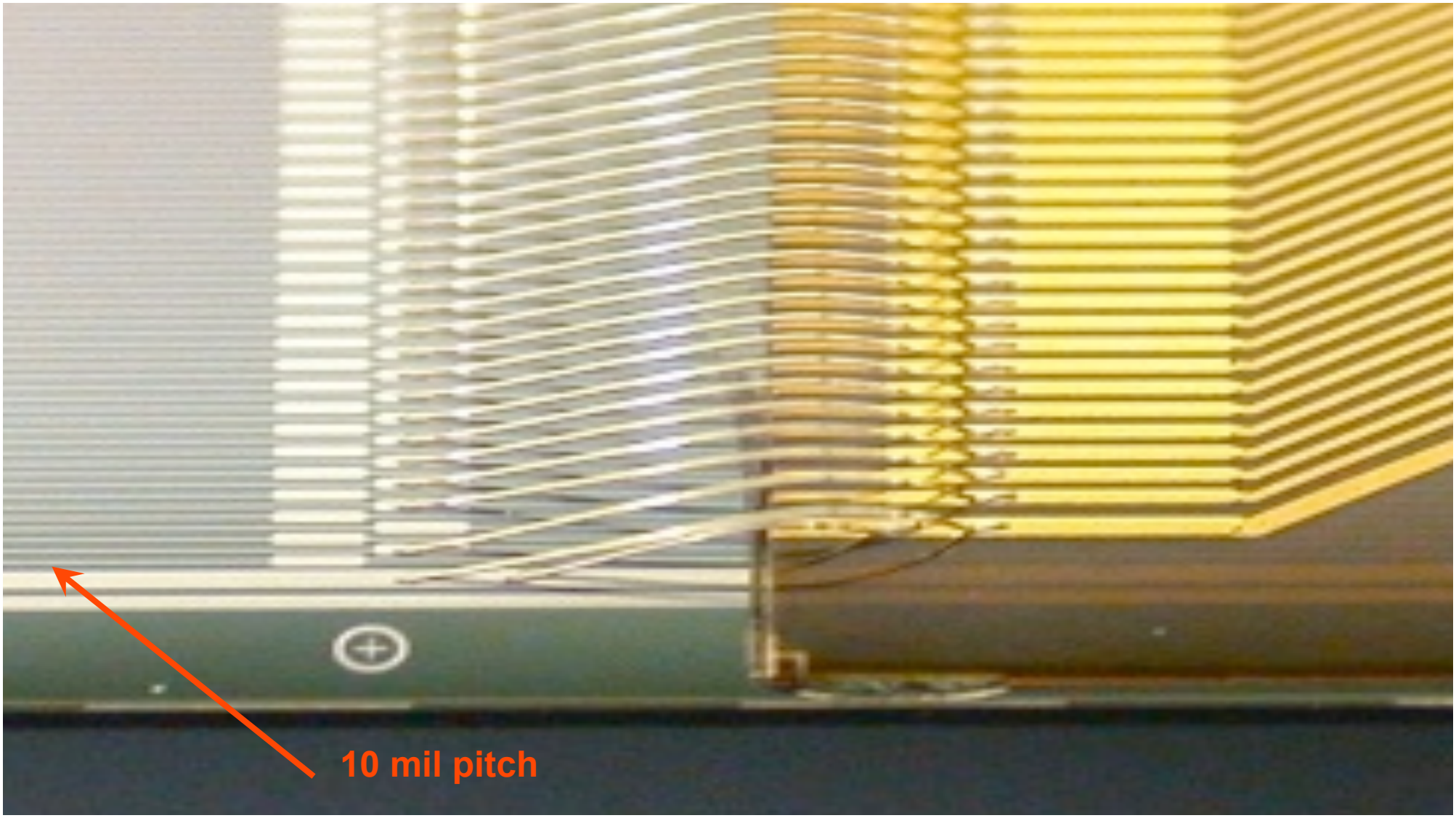




Transition Radiation Detector: TRD



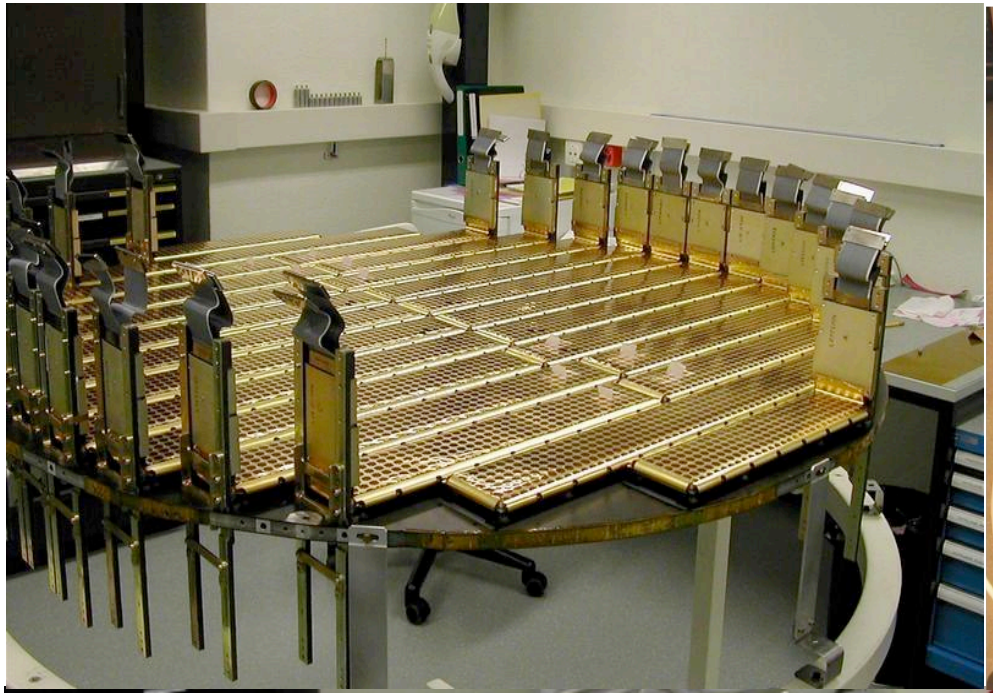
Silicon Tracker

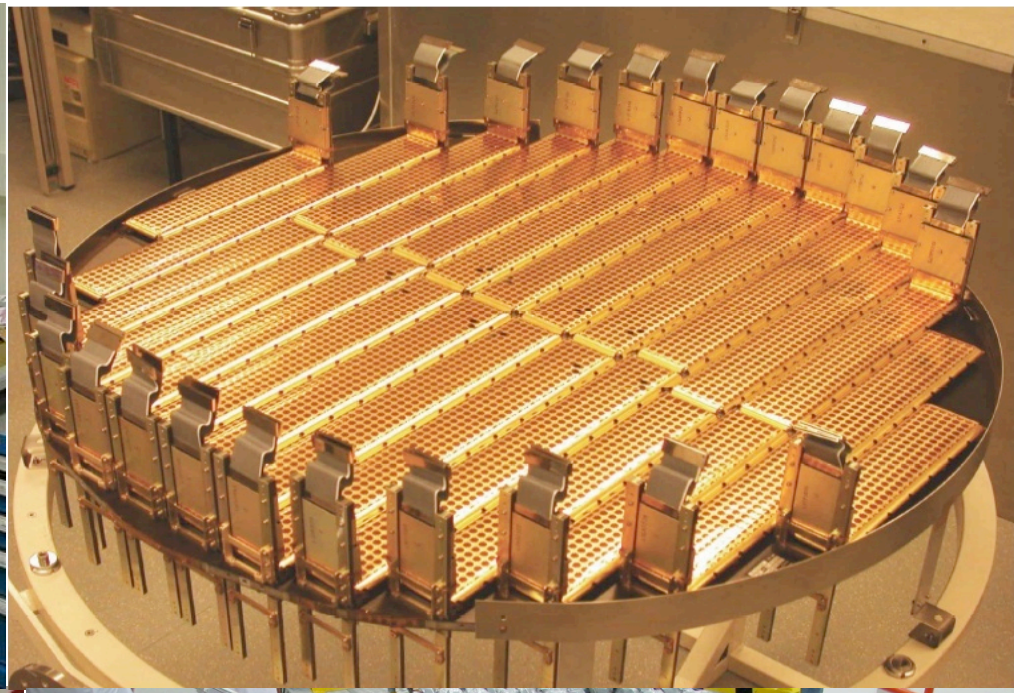


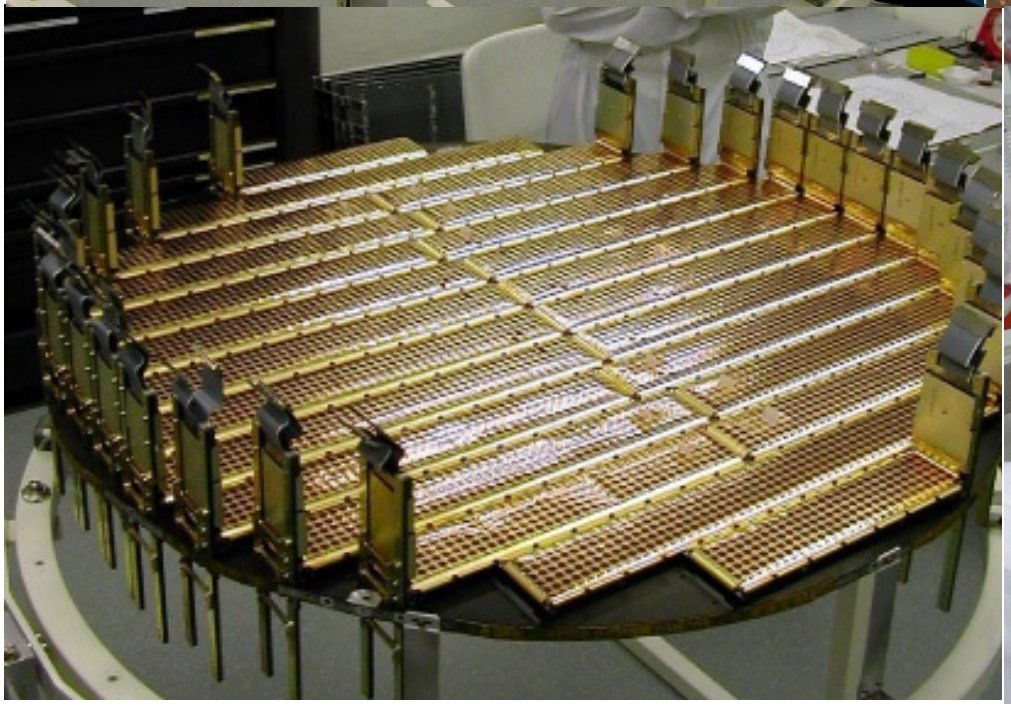
The coordinate resolution is 10 micron

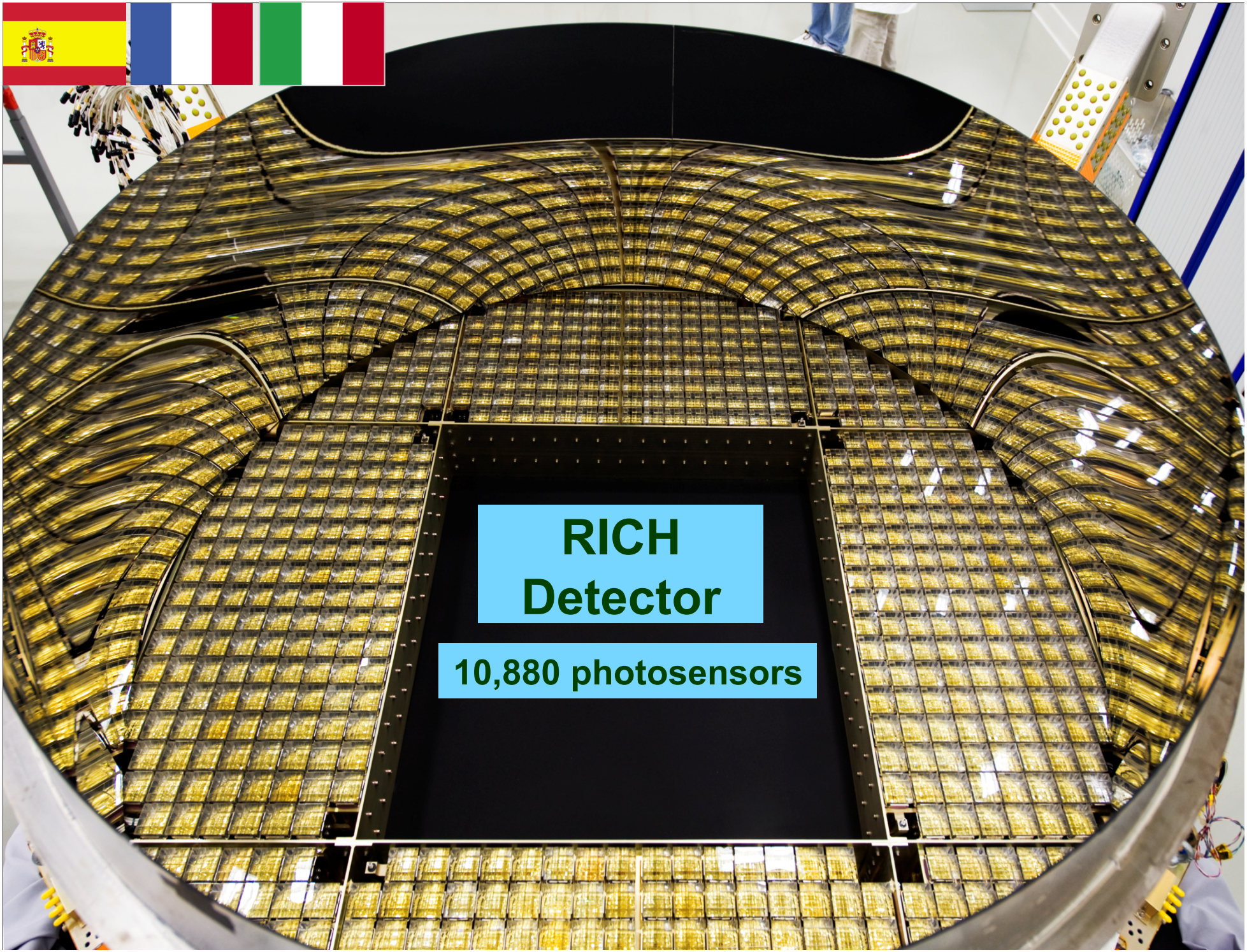
It has taken 50 engineers to complete the detector

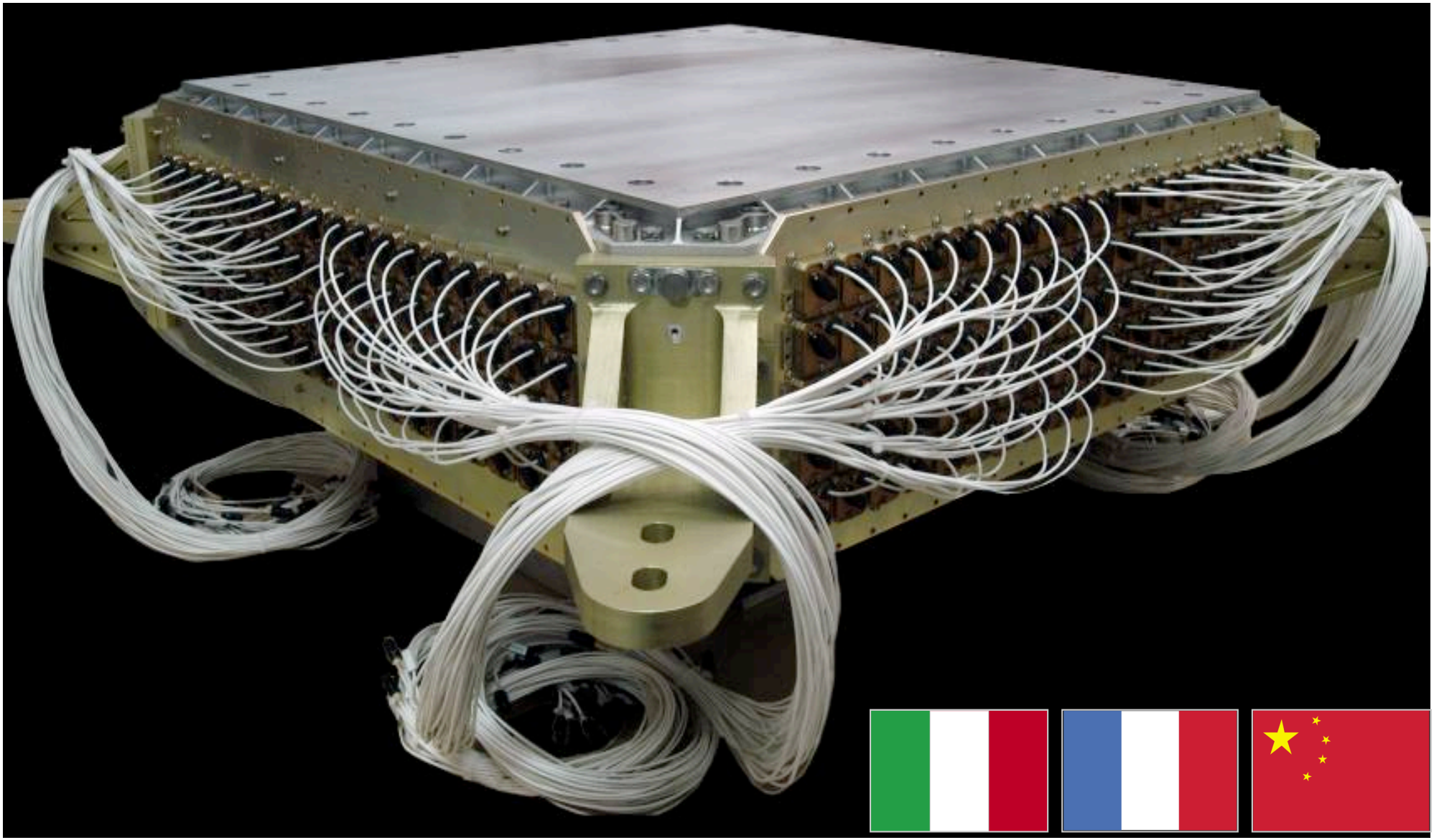
There are 9 planes with 200,000 channels aligned to 3 microns



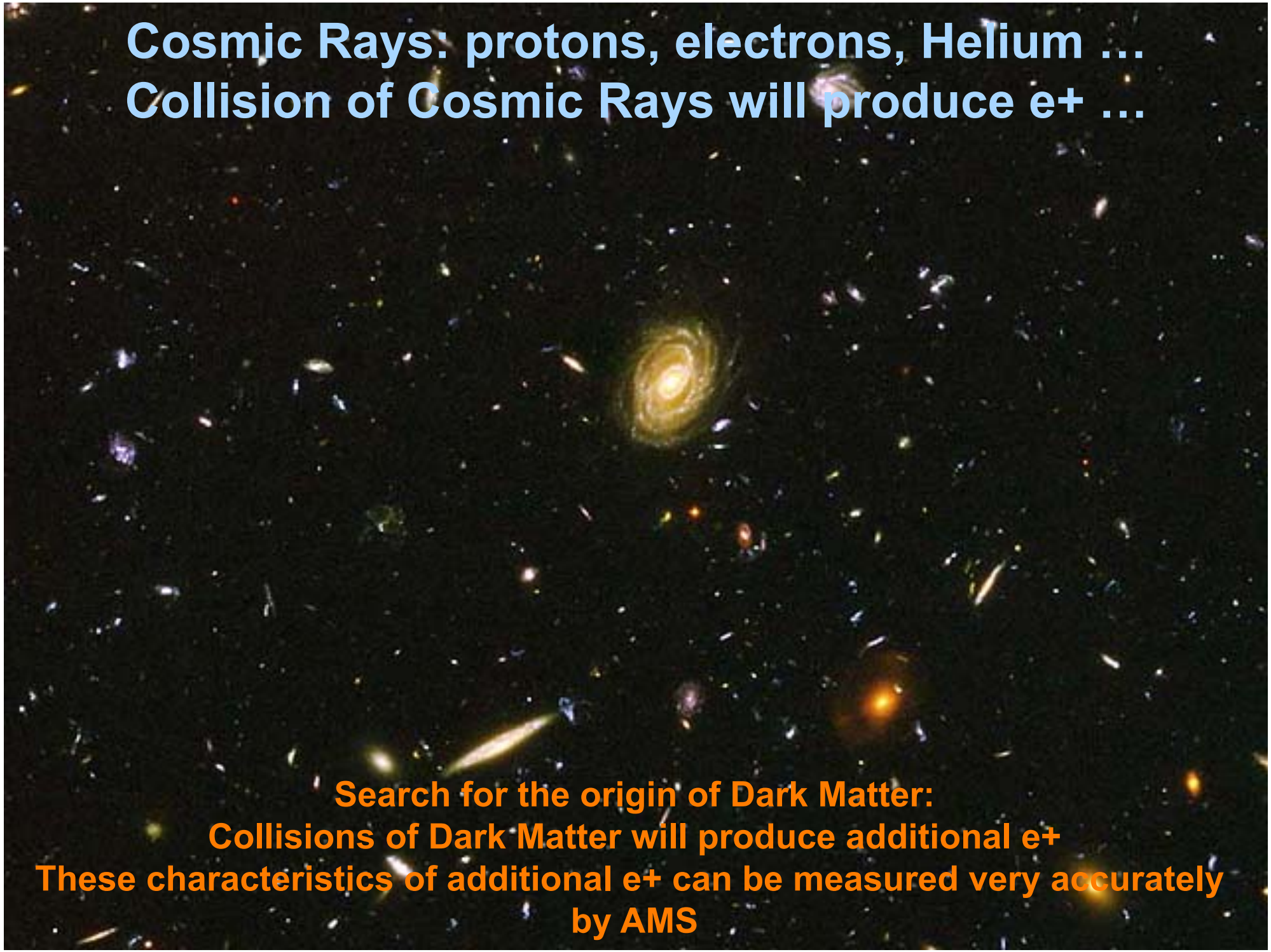





RICH
Detector
10,880 photosensors

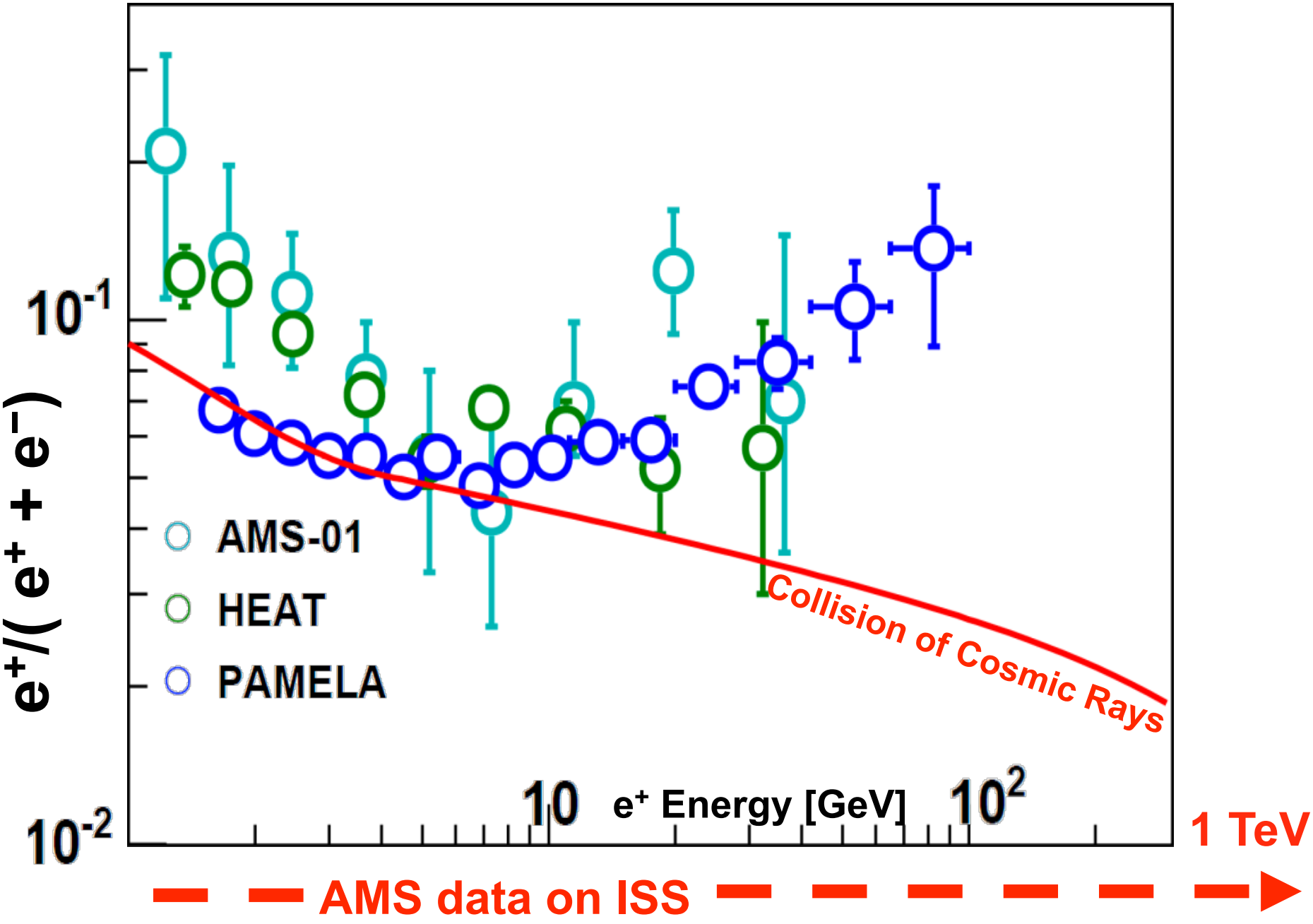


50,000 fibers, ϕ =1mm, distributed uniformly inside 1,200 lb of lead which provides a precision, 3-dimensional, 17X_0 measurement of the directions and energies of light rays and electrons up to 1 TeV


Cosmic Rays: protons, electrons, Helium …
Collision of Cosmic Rays will produce e+ …
Search for the origin of Dark Matter:
Collisions of Dark Matter will produce additional e+
These characteristics of additional e+ can be measured very accurately
by AMS

The leading candidate for Dark Matter is a SUSY neutralino (χ^0)

Collisions of χ^0 will produce excess in the spectra of e^+ different from known cosmic ray collisions



May 19: AMS installed on ISS 5:15 CDT, start taking data 9:35 CDT

During the first week, we collected 100 million cosmic rays

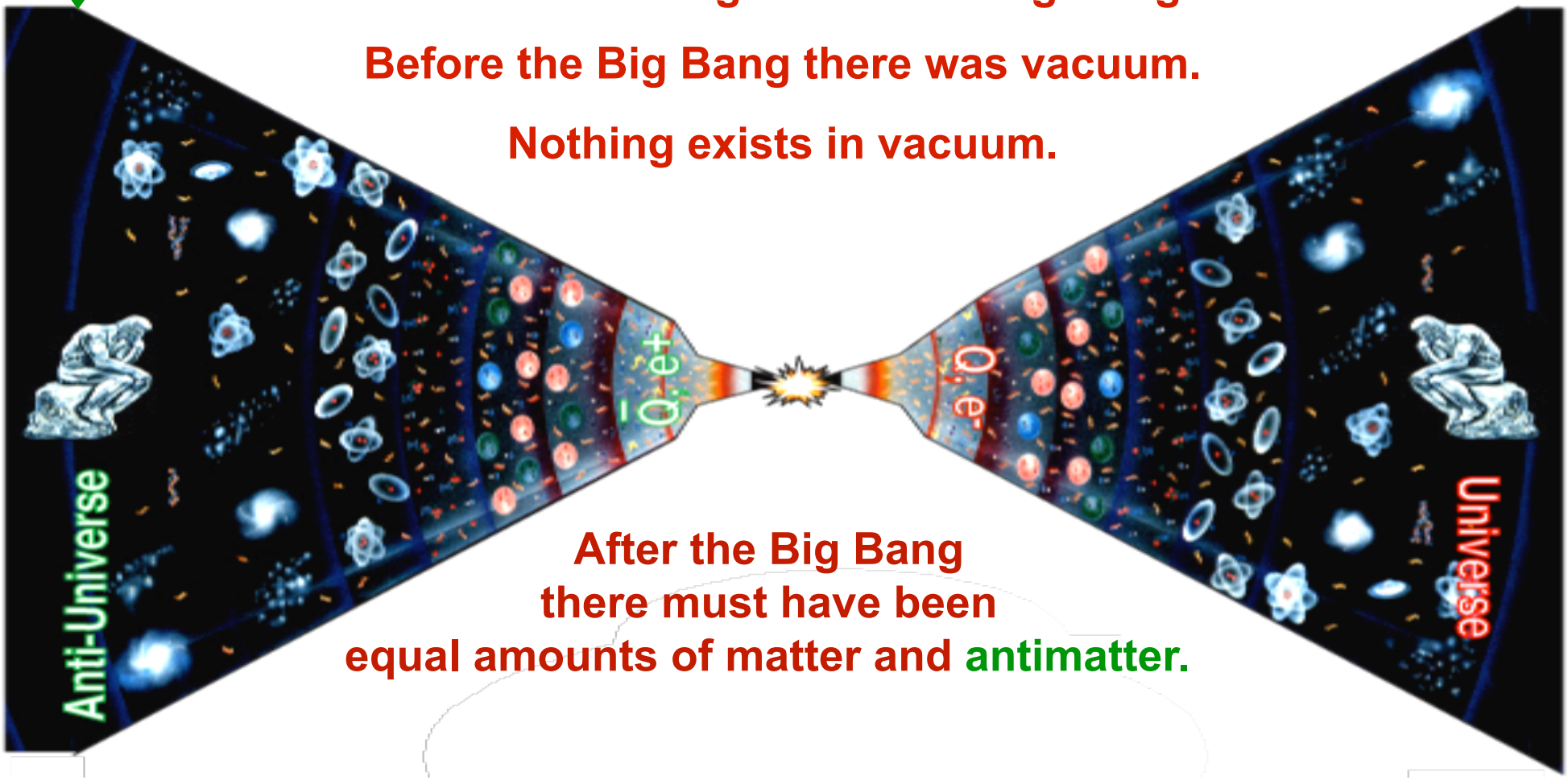
Physics of AMS: Search for Antimatter Universe

AMS on ISS

The Universe began with the Big Bang.

Before the Big Bang there was vacuum.

Nothing exists in vacuum.



After the Big Bang
there must have been
equal amounts of matter and antimatter.

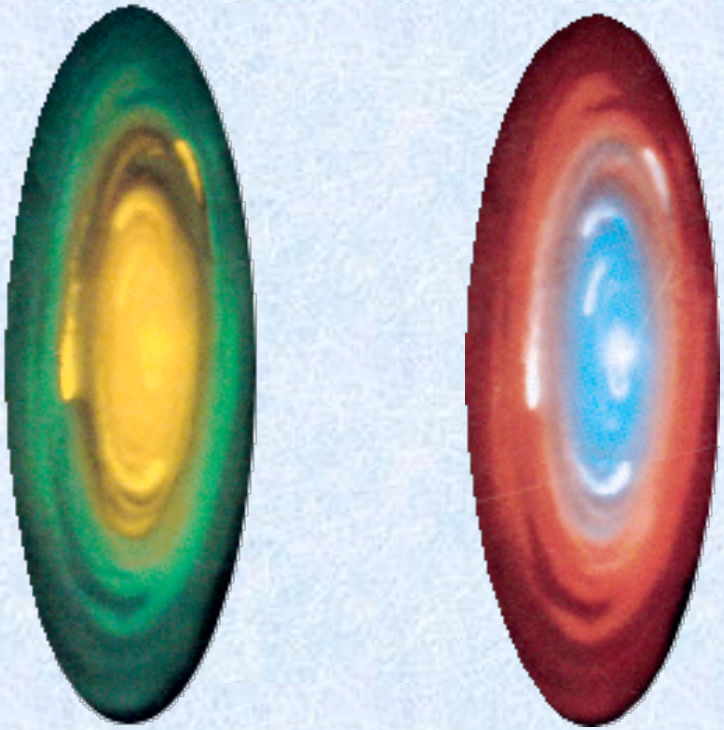
AMS on the Space Station for 20 years will search for the existence of antimatter to the edge of the universe

Question

Universe

$^{4}_{2}He$

$^{12}_{6}C$



Anti universe ?

$^{\overline{4}}_{\overline{2}}\overline{He}$

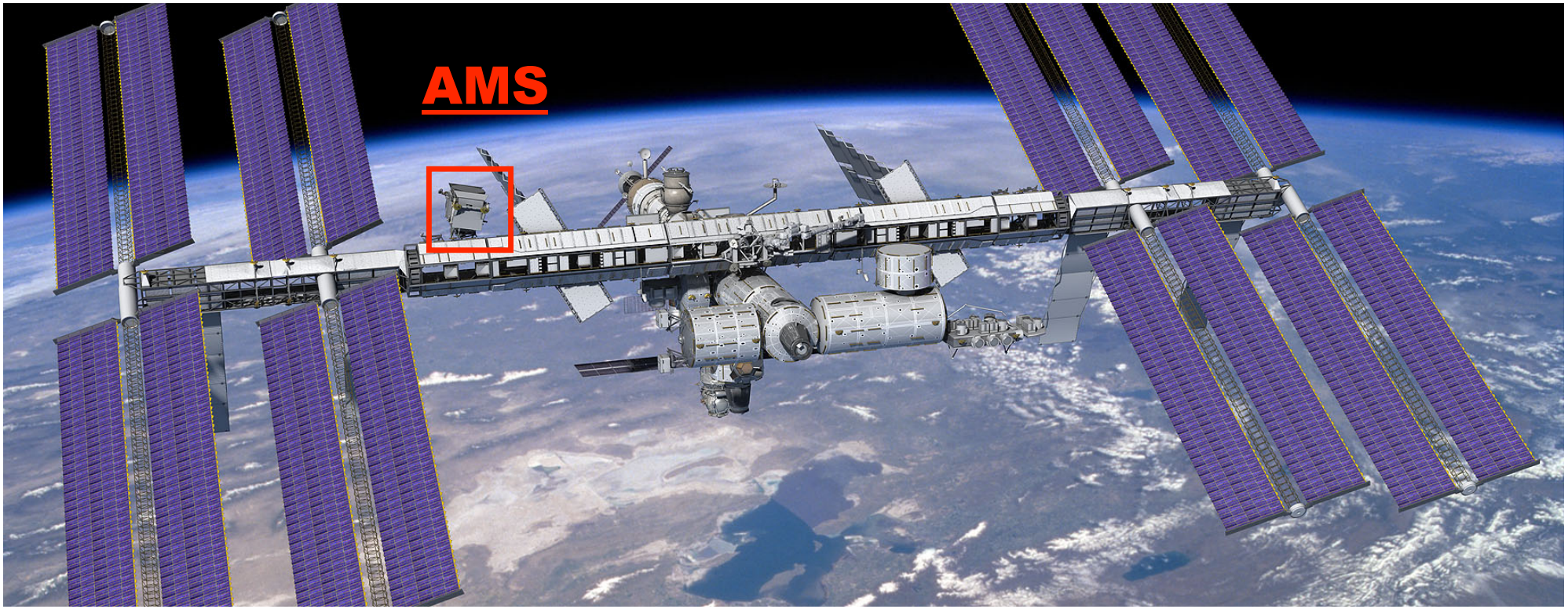
$^{\overline{12}}_{\overline{6}}\overline{C}$

Cosmic antimatter cannot be detected on Earth because matter and antimatter will annihilate each other in the atmosphere

The Cosmos is the Ultimate Laboratory.

Cosmic rays can be observed at energies higher than any accelerator.

The issues of antimatter in the universe and the origin of Dark Matter probe the foundations of modern physics.



AMS is the only large scientific experiment to study these issues directly in space.

The first data on the ISS shows large amount of electrons and positrons at very high energies.

AMS is functioning smoothly on the ISS. AMS provides a unique way to probe the fundamental properties of the Universe.

Thank You