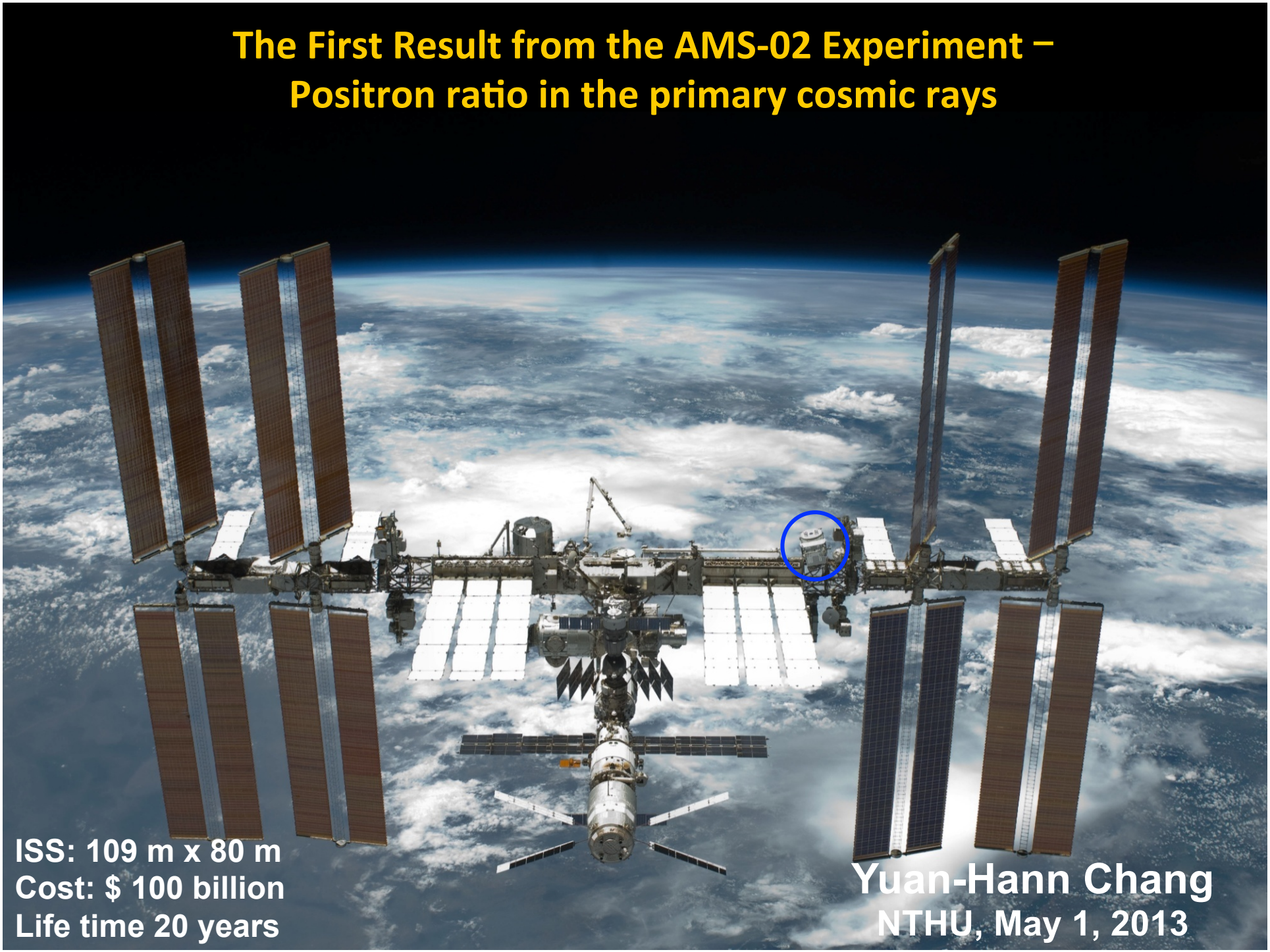
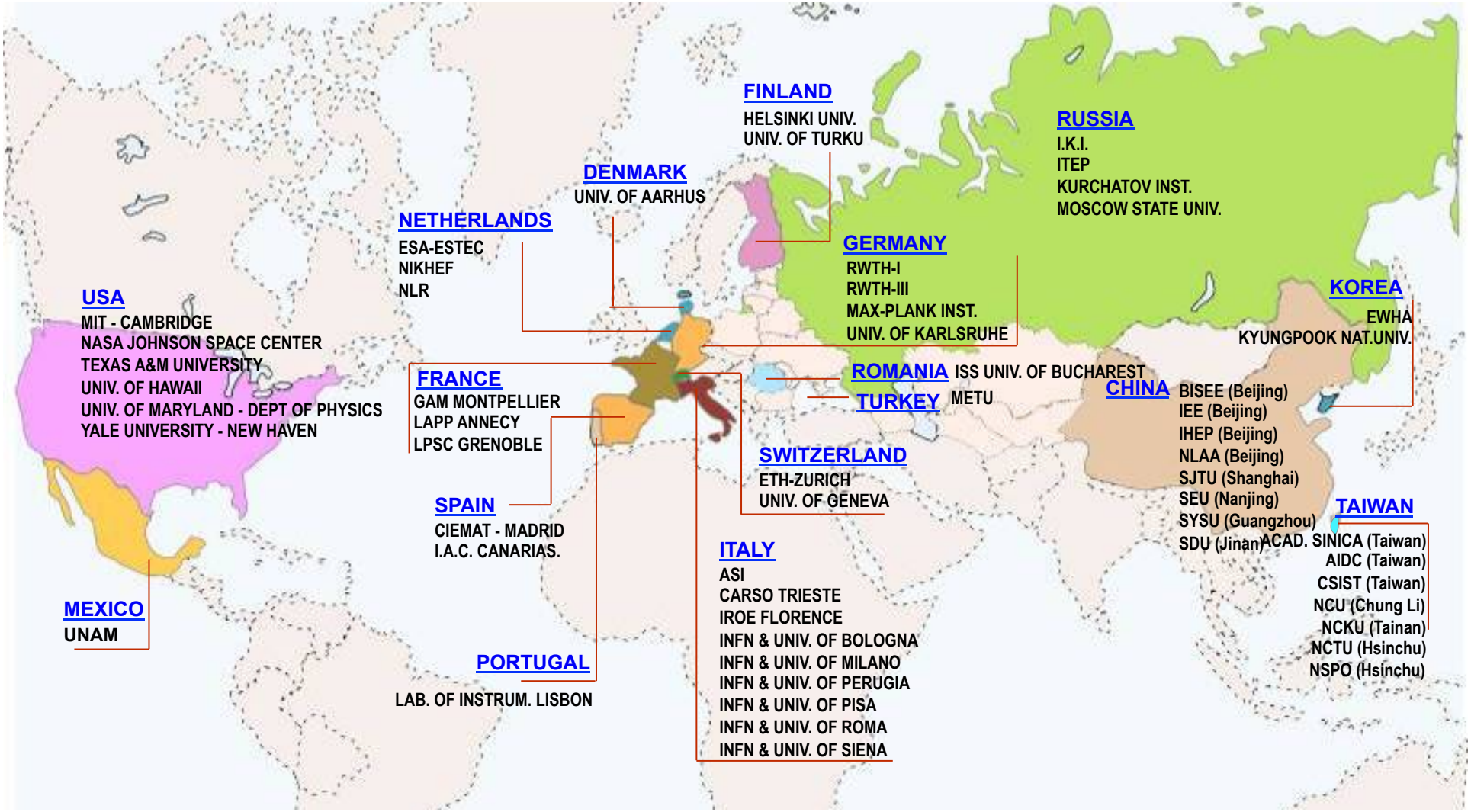
The First Result from the AMS-02 Experiment – Positron ratio in the primary cosmic rays



ISS: 109 m x 80 m
Cost: $ 100 billion
Life time 20 years

Yuan-Hann Chang
NTHU, May 1, 2013

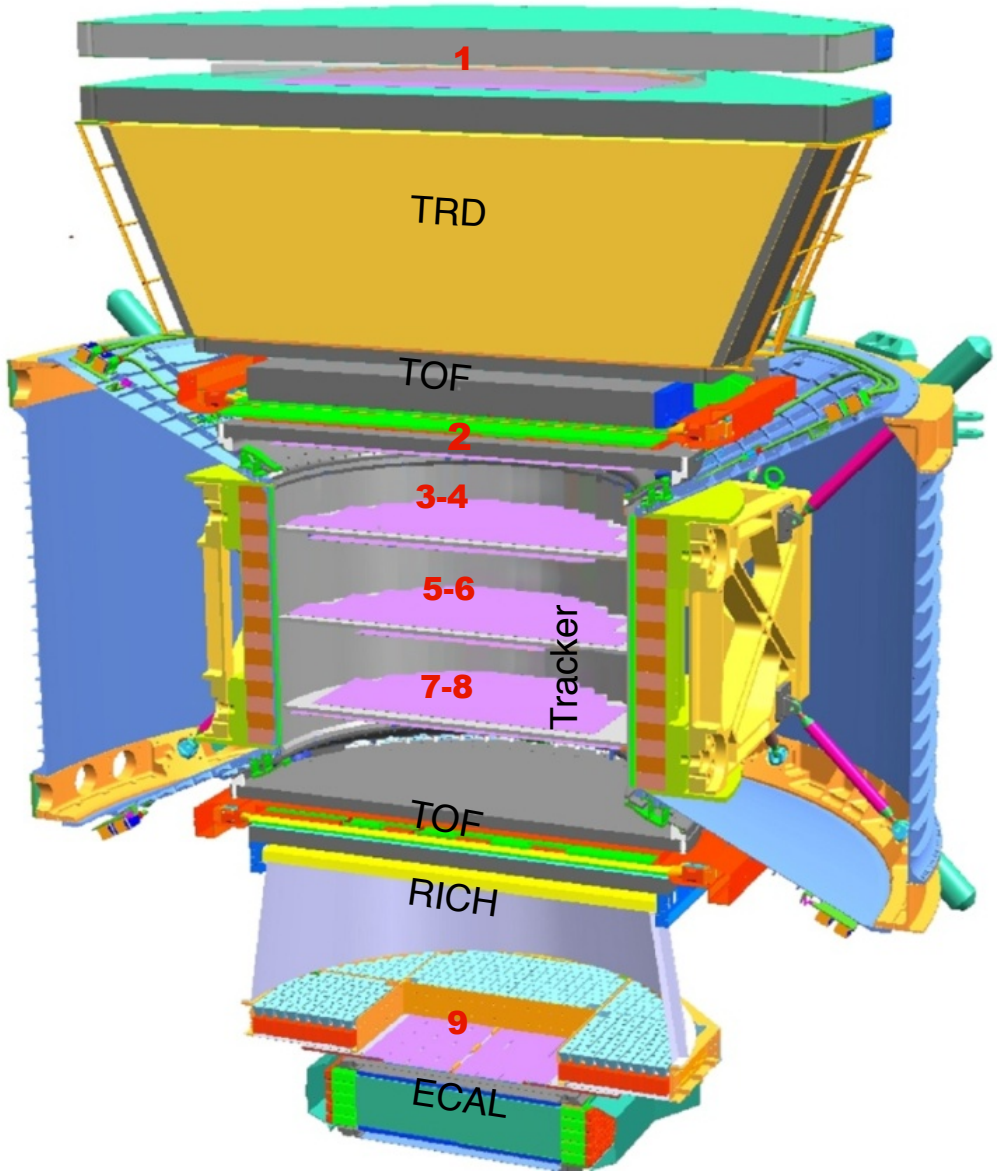
The AMS collaboration



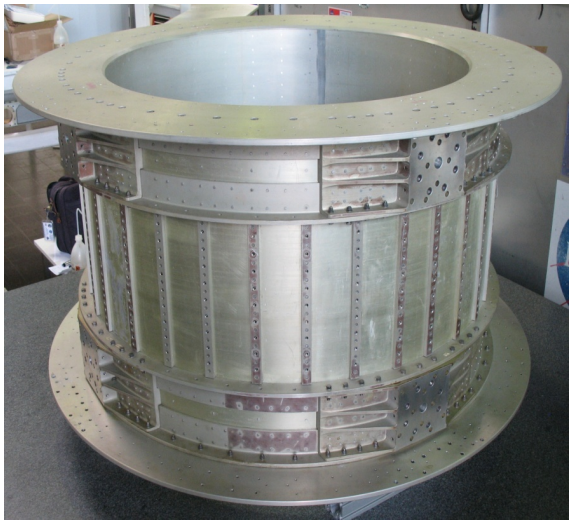
Strong support from

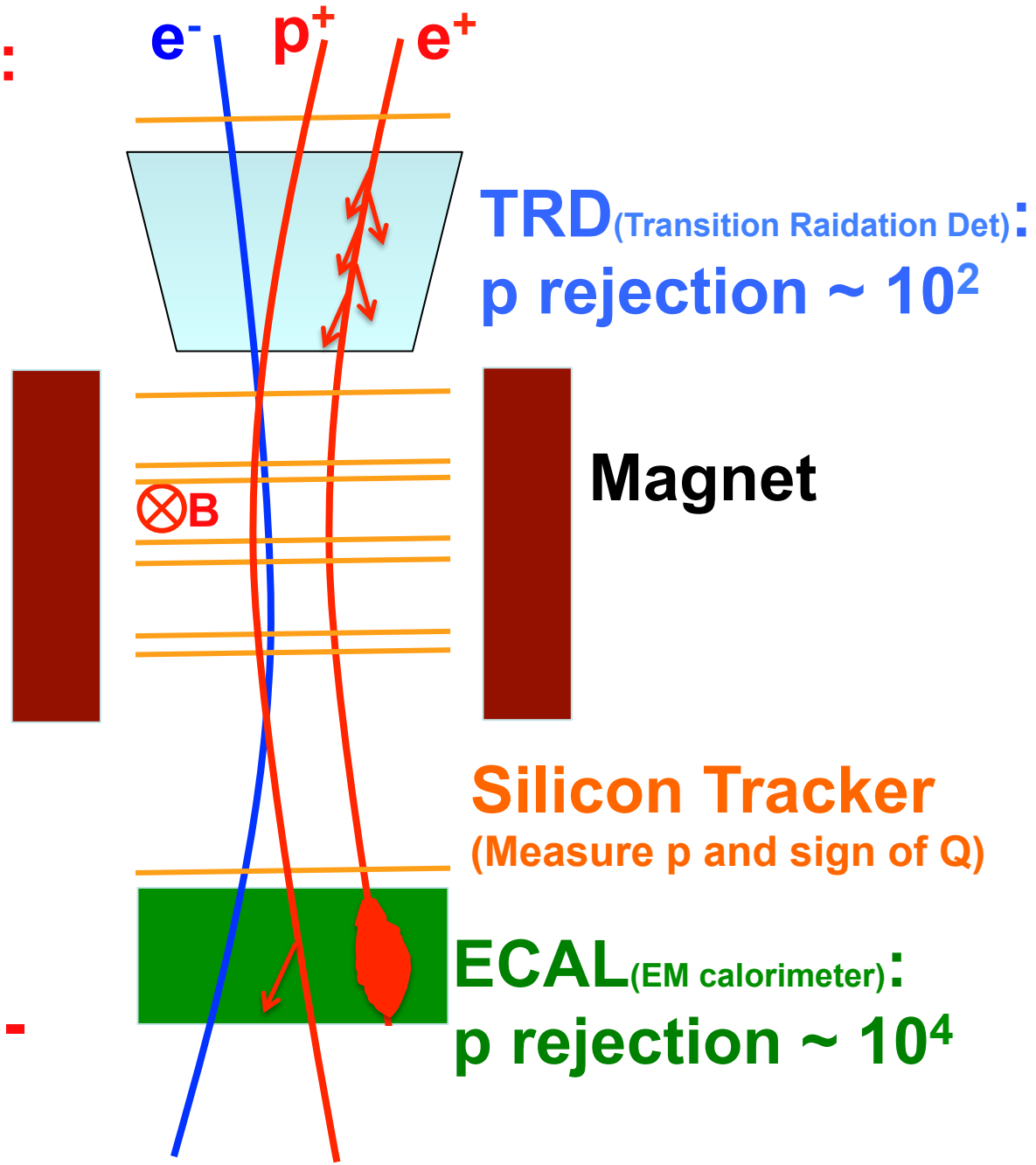
NASA (D. Goldin, C. Bolden, L. Garver, G. Abbey, W. Gerstenmaier, M. Sistilli, T. Martin, K. Bollweg, …)

The AMS Detector



Cosmic rays:
$p/e^+ \sim 10^4$





TRD(Transition Raidation Det):
p rejection ~ 10^2

Magnet

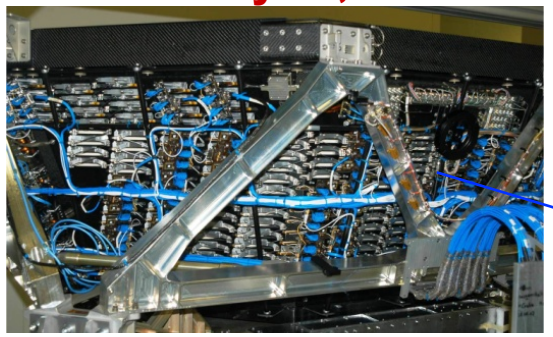
Silicon Tracker
(Measure p and sign of Q)

ECAL(EM calorimeter):
p rejection ~ 10^4

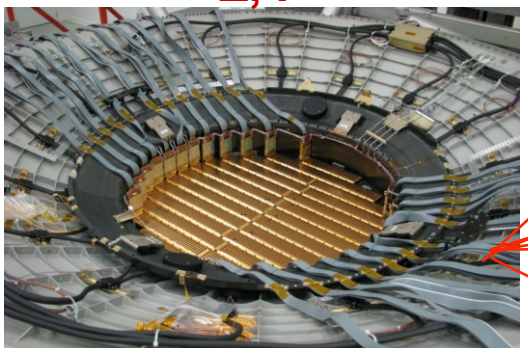
Principle of AMS Detector for e+/e- measurement

AMS: A TeV precision, multipurpose spectrometer

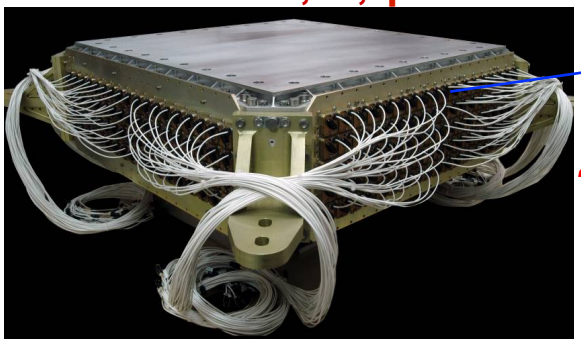
TRD
Identify e^+, e^-



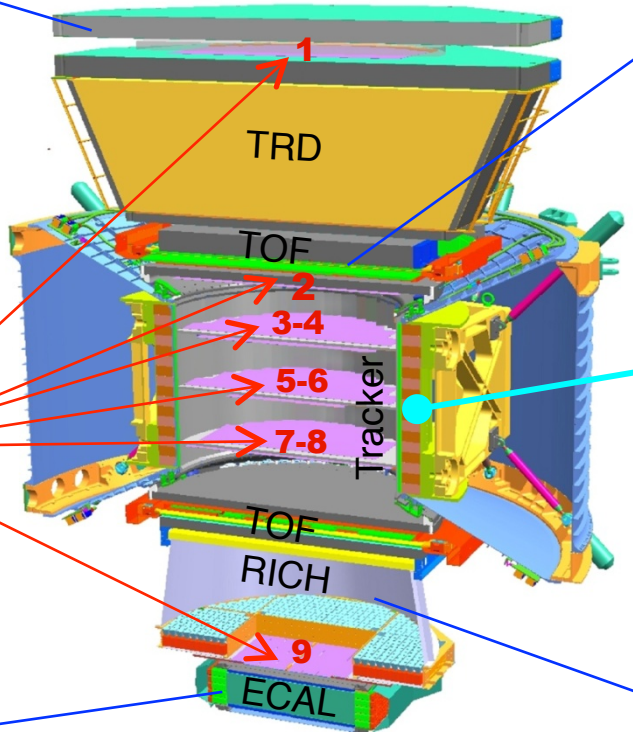
Silicon Tracker
Z, P



ECAL
E of e^+, e^-, γ



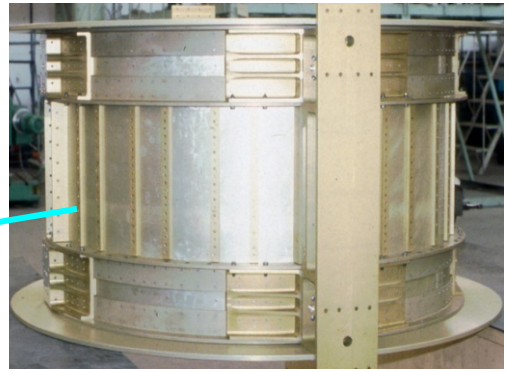
Particles and nuclei are defined by their charge (**Z**) and energy (**E ~ P**)



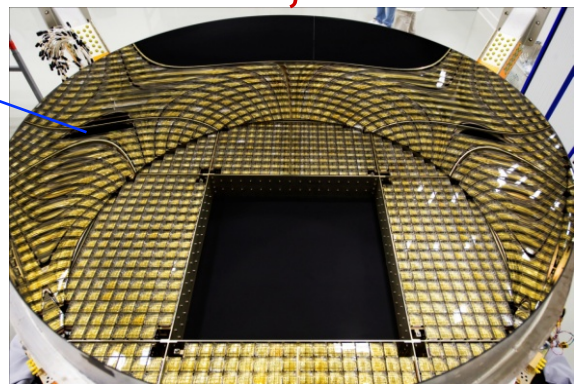
***Z, P** are measured independently by the Tracker, RICH, TOF and ECAL*

TOF
Z, v

Magnet
±Z



RICH
Z, v



AMS Electronics

(and detectors)

Reliability: operational for 20 years.

Same spec. as the best ground experiment.

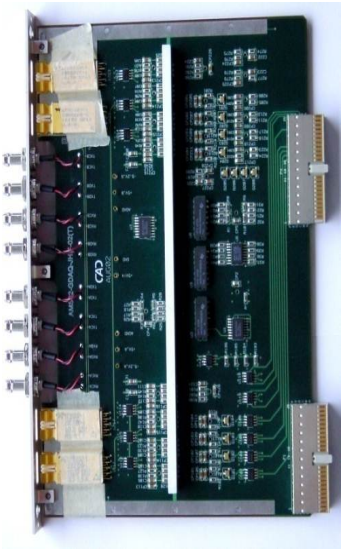
However:

- Strong radiation
- Extreme temperature variation
- Vacuum
- Vibration during launch
- No Maintenance

AMS Space qualification:

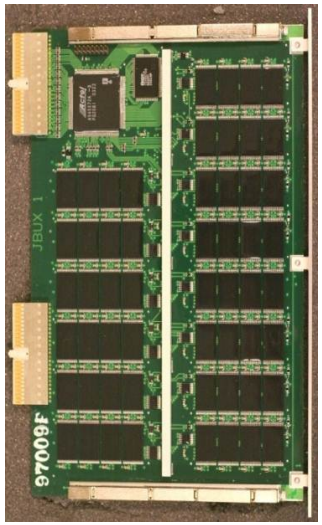
- Redundant design (2x in general, 4x for main CPU)
- Radiation hardness (component selection)
- Thermal cycling
- Thermal vacuum test
- Vibration test

AMS Main Data Computers, each with:



High Rate Interface

400 MHz Processor



112 GB Flash Memory

CAN bus interface

AMSWire & Low Rate Interfaces

DAQ Computers

AMSWire
100 MBit/s

- Collect data, format, compress reconstruct, buffer, send to POCC
- On-board buffer for ~1 day of data
- Interface to ISS Avionics
- Execute commands from the POCC
- Collect monitoring data, analyze, respond, buffer, send to POCC

HRDL
100 MBit/s
LRDL

ISS Avionics

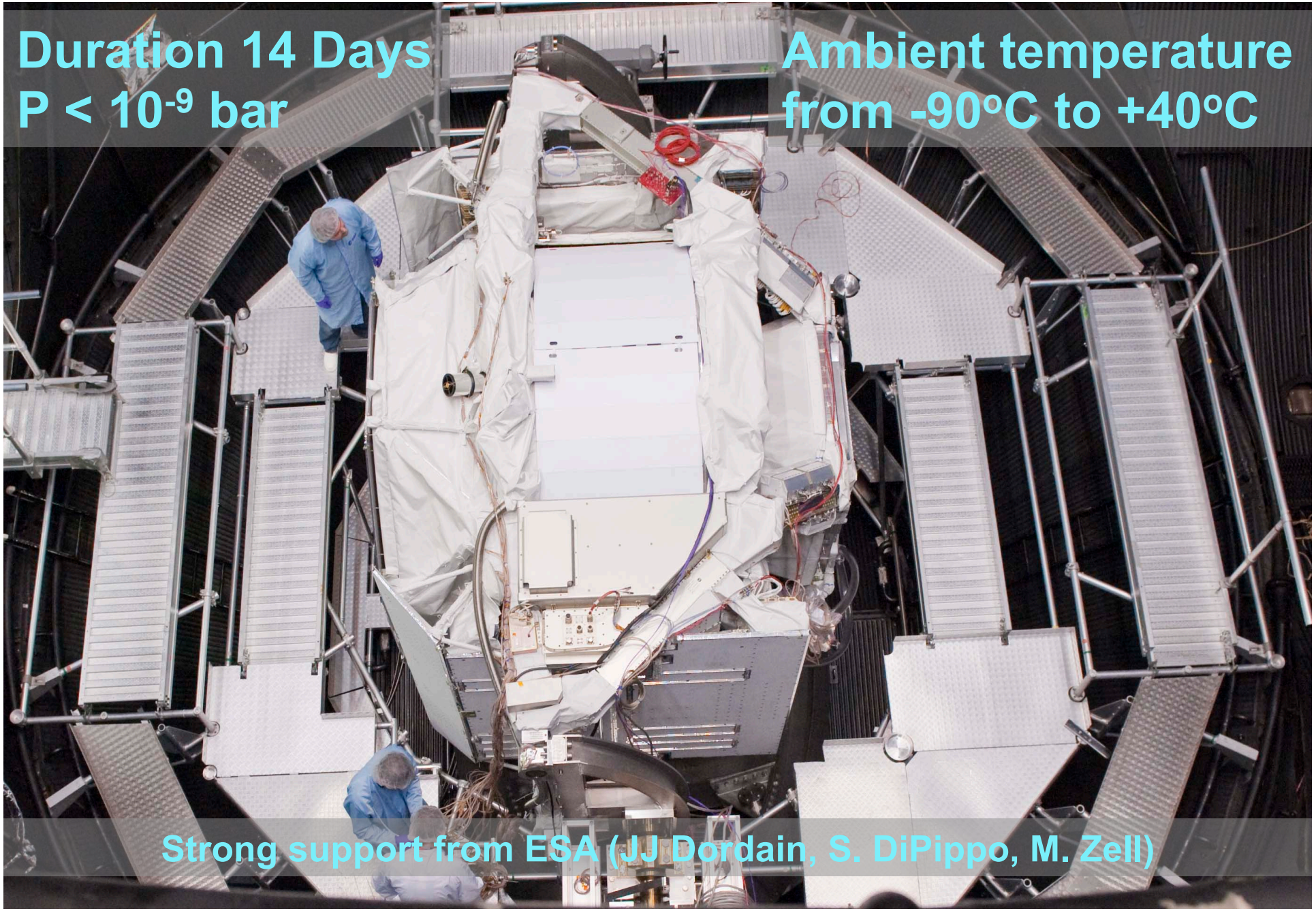
AMS CAN Buses

Main Computer Power	Monitoring (TAS, GPS, Star Tracker)	TRD Gas, Temperature	Tracker Thermal Control	Power Distribution
USCM-J	USCM-M	UGSCM	TTCE	PDS

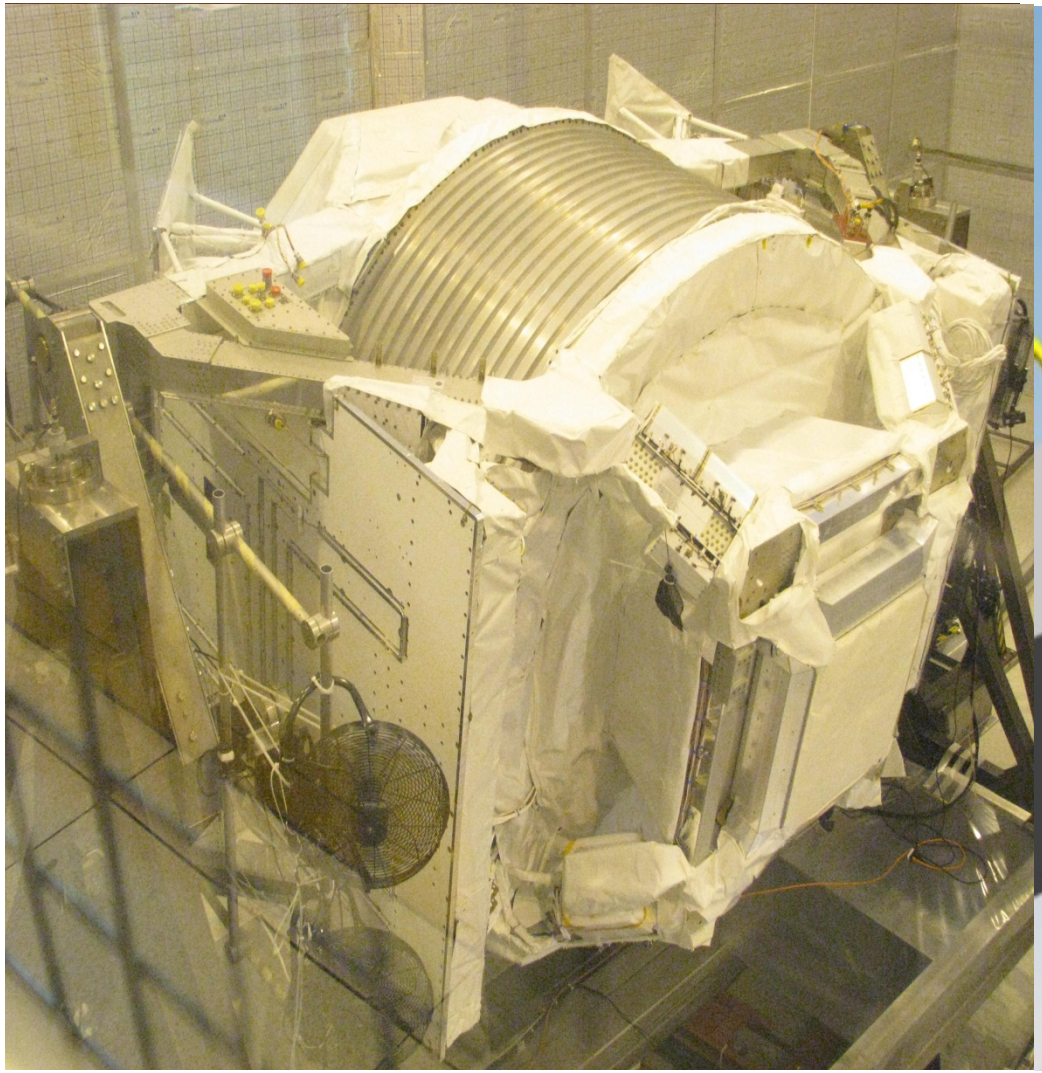
Design, produce, and space qualified in Taiwan
CSIST/NSPO/AS/NCU

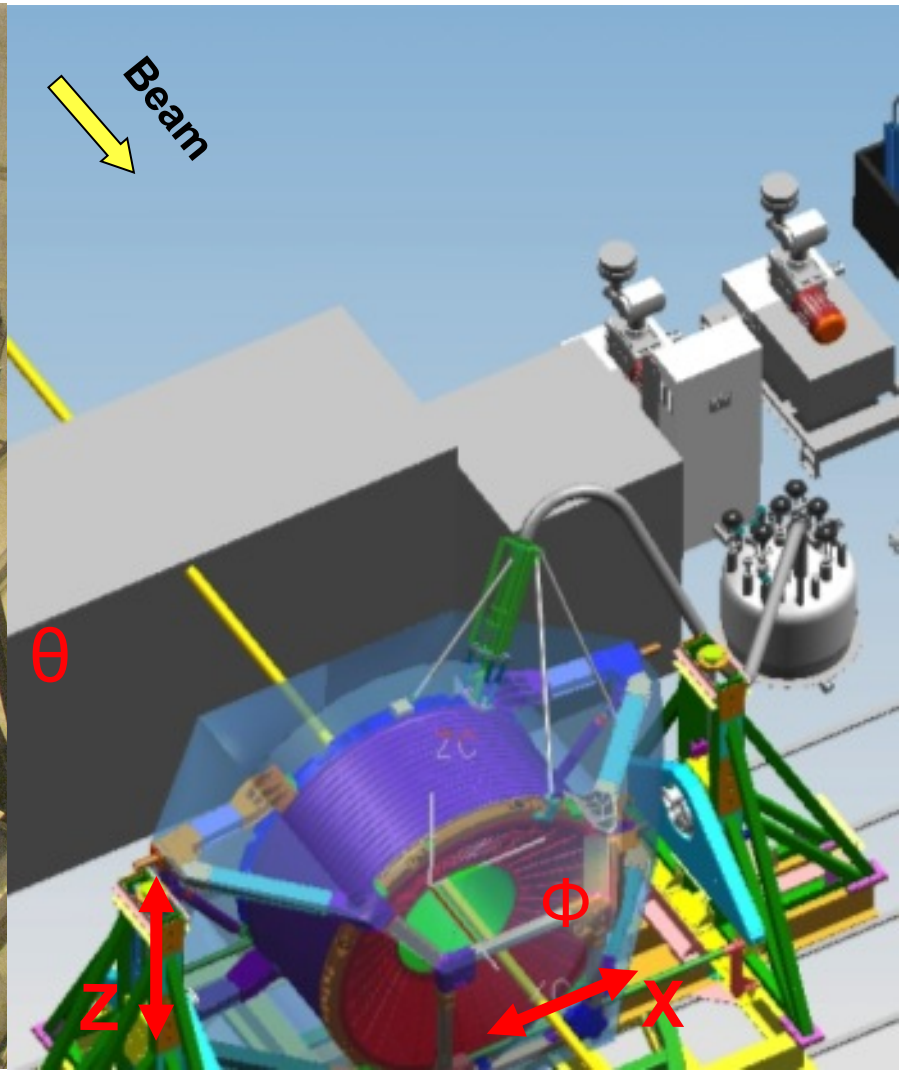

5m x 4m x 3m
7.5 tons
AMS

AMS in the ESA Thermal Vacuum Chamber, April 2010



Intensive Tests at CERN





Strong support from CERN (R. Heuer, A. Siemko, S. Meyers, C. Garguilo)