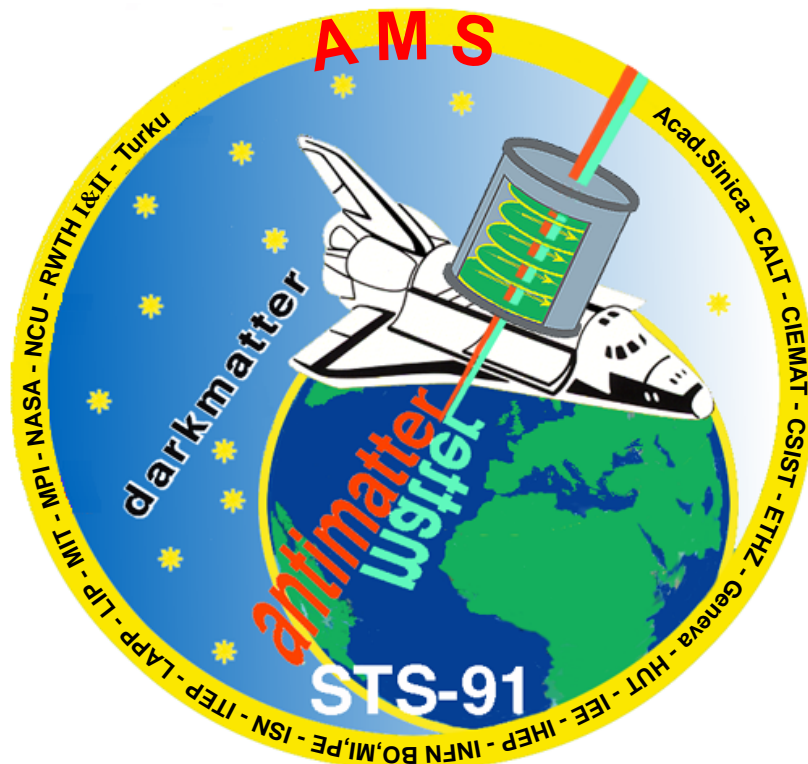


The AMS Microstrips Silicon Tracker



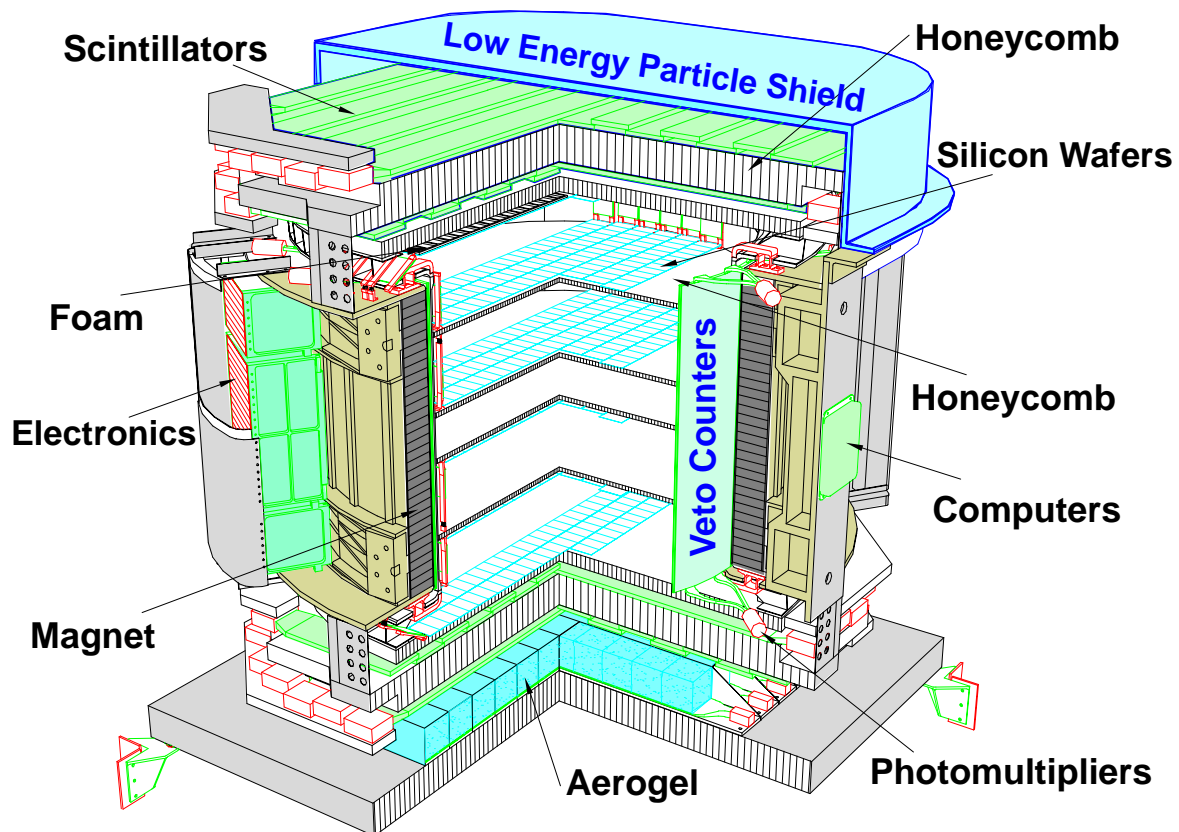
Divic Rapin
DPNC, University of Geneva
AMS Tracker Collaboration

The AMS Experiment

AMS is a particle physics experiment in space

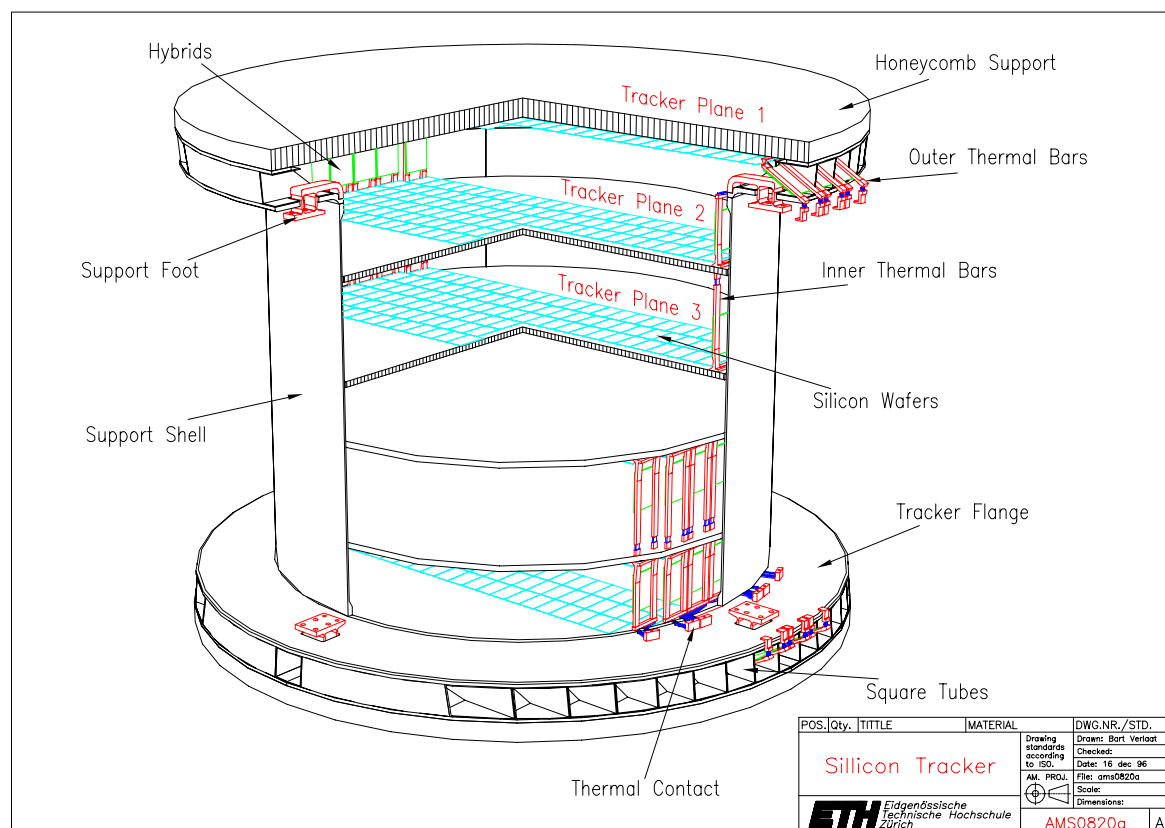
Measurement of Q , p , v and dE/dx of cosmic

- Qualification test flight in 1998 with Space Shuttle
- Installation on ISS scheduled for 2004
- Space operations constraints:
 - Radiation, extreme accelerations and temperature variations
 - Maximum weight ~ 2 t and power ~ 2 kW
 - Reliability for 3 years of operation



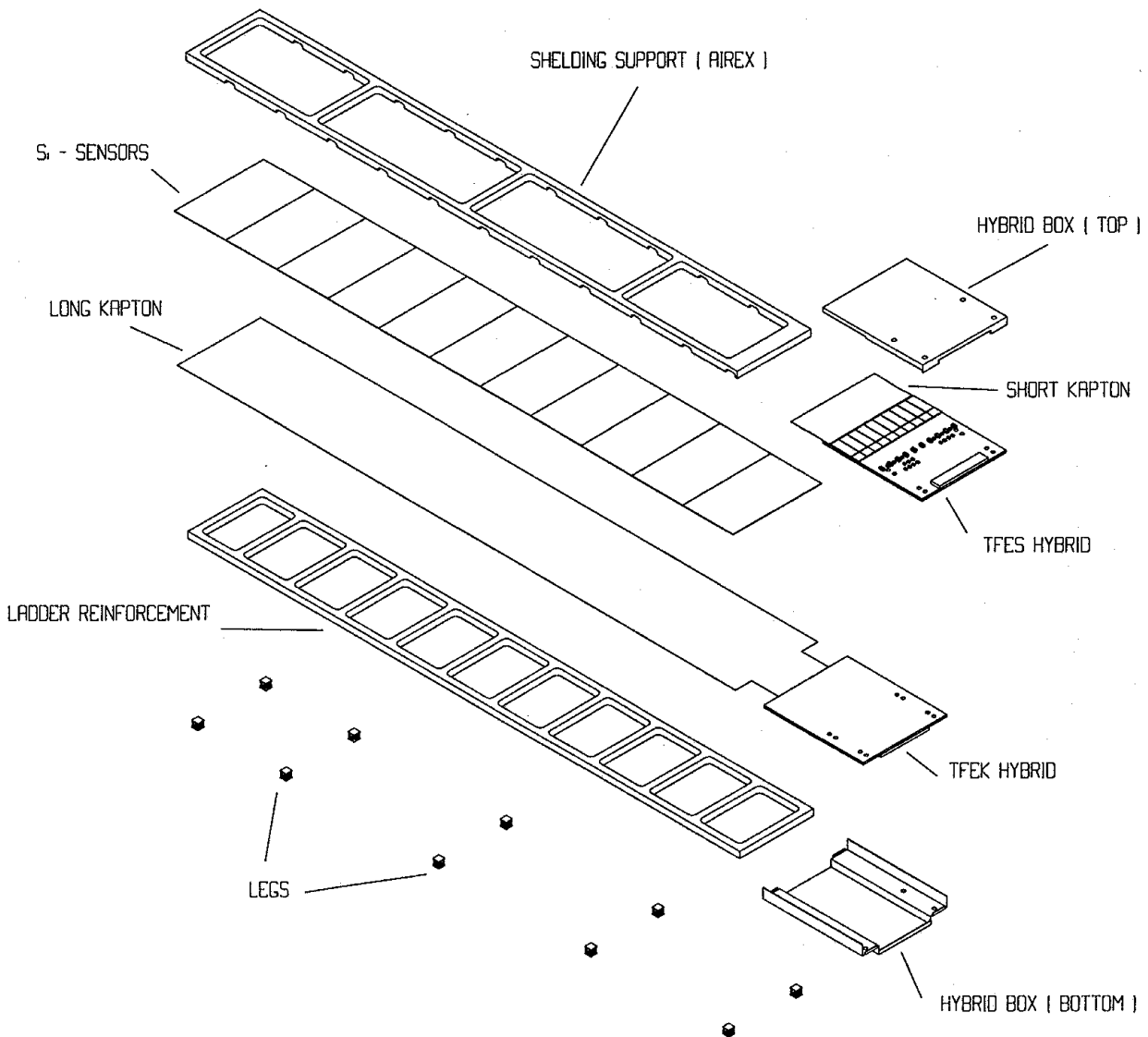
AMS Tracker Characteristics

- Resolution: $10\mu\text{m}$ bending, $30\mu\text{m}$ non-bending plane
- Large dynamic range for dE/dx : 1 to 100 MIP
- AMS01: 2 m^2 , 6 layers, 60k channels (57 ladders)
- AMS02: 7 m^2 , 8 layers, 200k channels (192 ladders)
- Ladders mounted on Al+C honeycomb support plane
 - ladder and support: $X_0 = 0.65\%$ per plane
- Planes supported by a Carbon fiber structure
- Heat evacuated by TPG inserts, $k=1700\text{ W/deg m}$



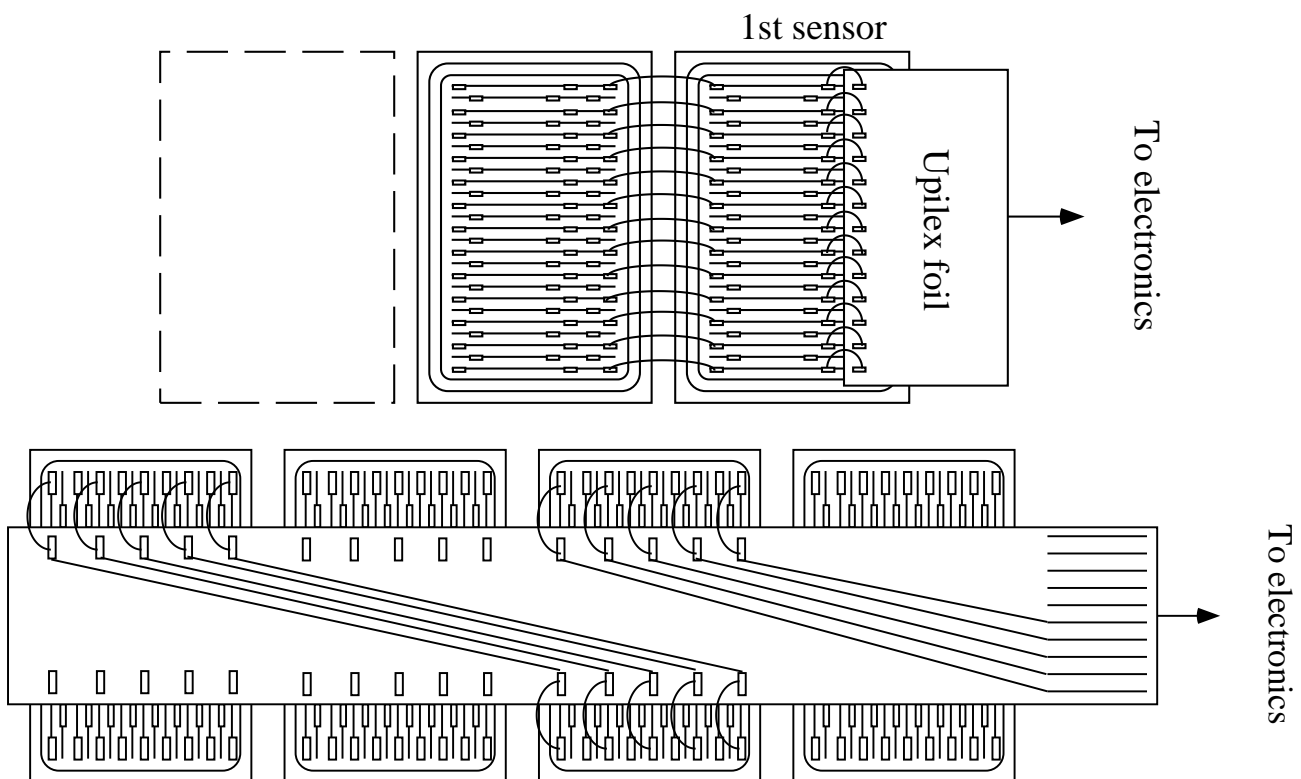
AMS Ladder Construction

- Wafers organised in long *ladders* (7 to 15 per ladder)
- Ladder rigidity provided by sandwich of AIREX foam (5 mm) and carbon fiber surface (0.1 mm)
- Thin EMI shielding wrapped around each ladder



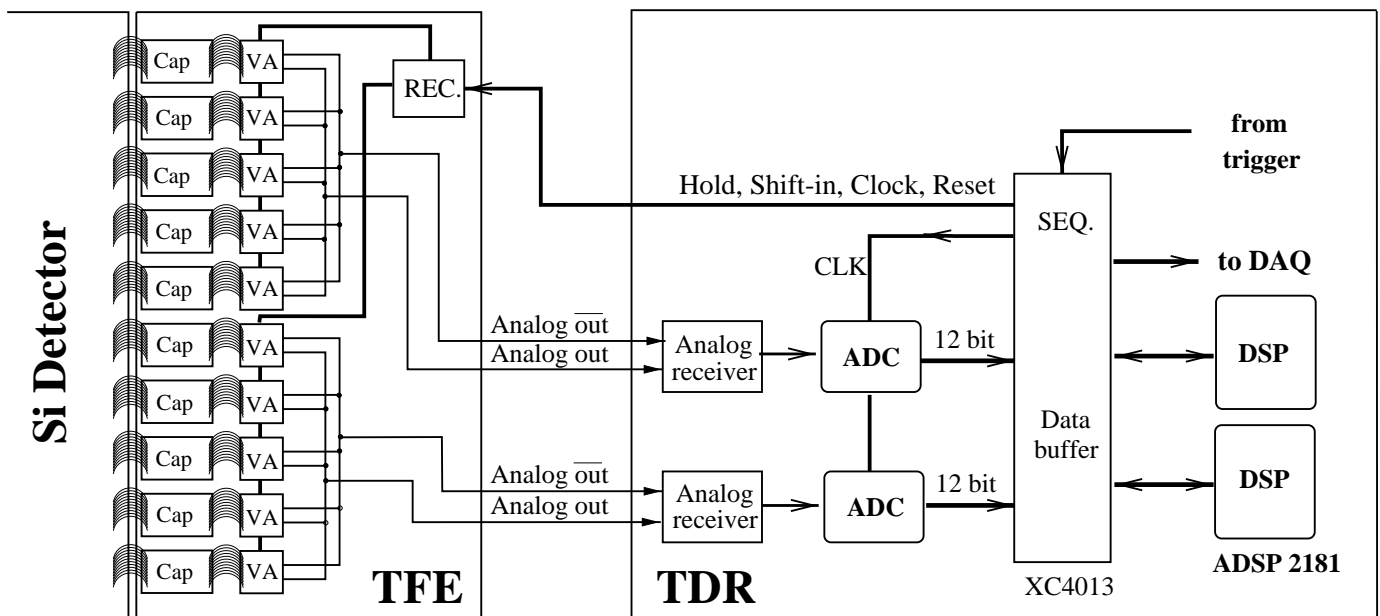
AMS Sensors and Bonding

- Double sided Silicon sensors: $40 \times 72 \times 0.3\text{mm}^3$
- Biasing (50 and 100 V) with punch-through and p^+ blocking strips on n-side
- Capacitive coupling with implantation strip pitches of:
 - for p-side: $27.5\mu\text{m}$, (110 for readout), 640 channels
 - for n-side: $26.0\mu\text{m}$, (208 for readout), 2×192 channels
- Connections between the wafers and to the front-end electronics with wire bonds and thin ($50\mu\text{m}$) flat flexible UPILEX (kapton) micro-circuits

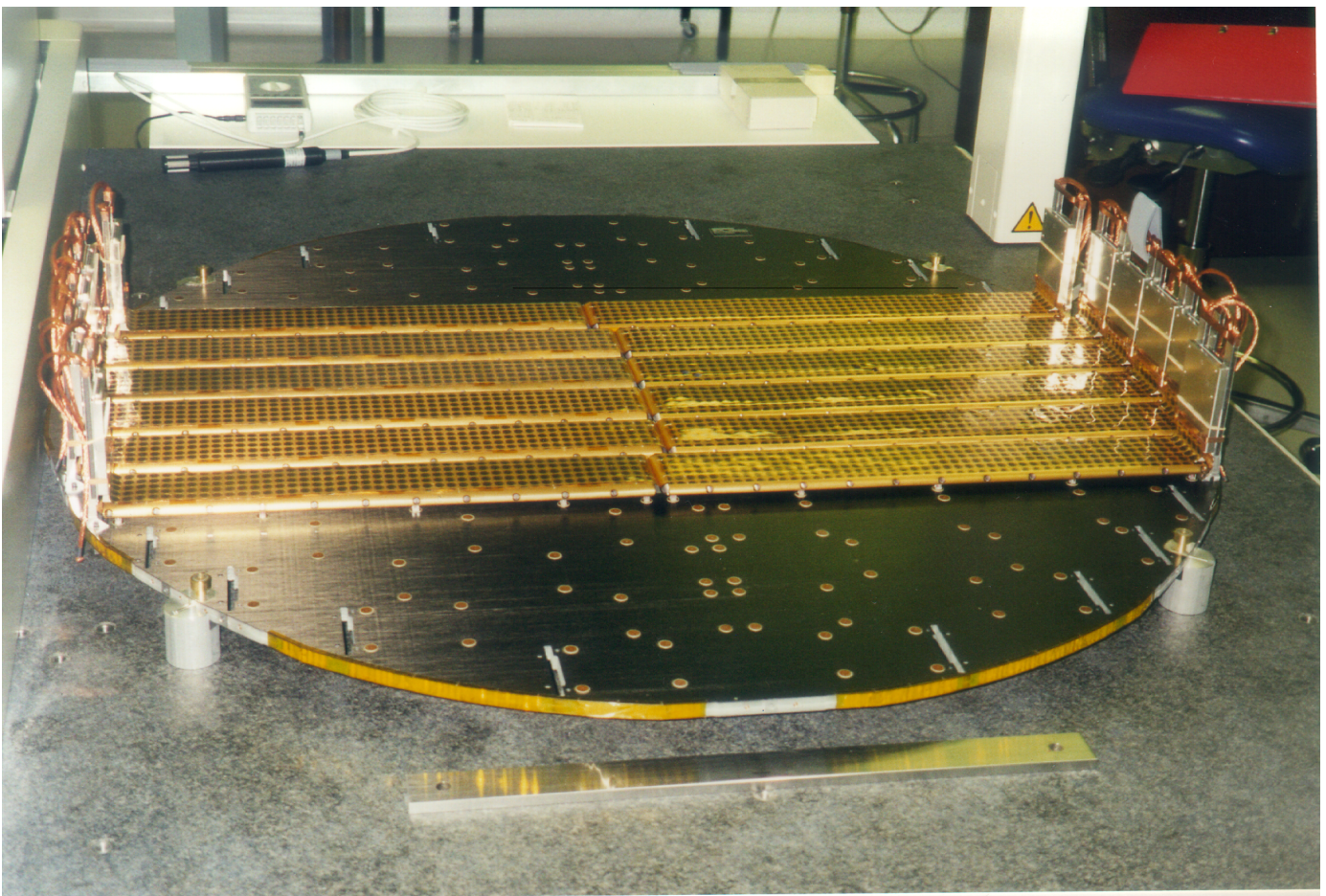


AMS Tracker Electronics

- Front-end electronics based on VA-hdr chip (preamp + memory)
- DSP processors for Tracker Data Reduction (TDR)



AMS Tracker Plane during Metrology

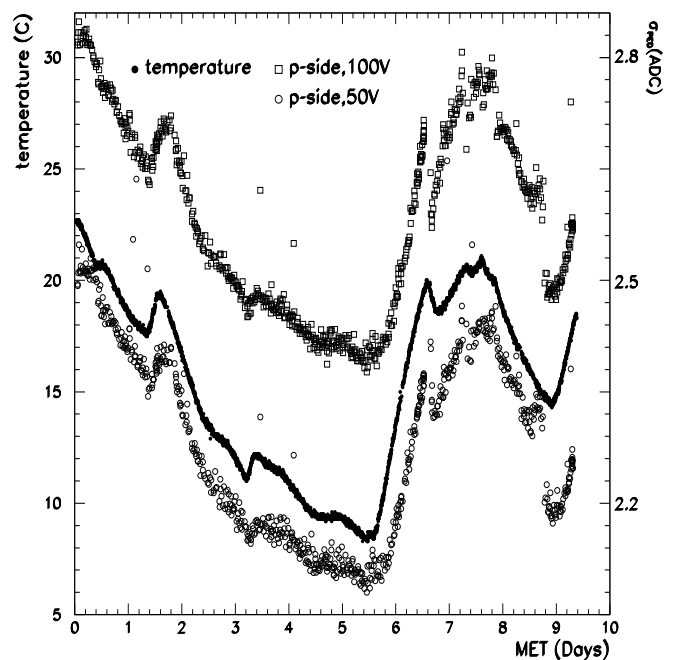
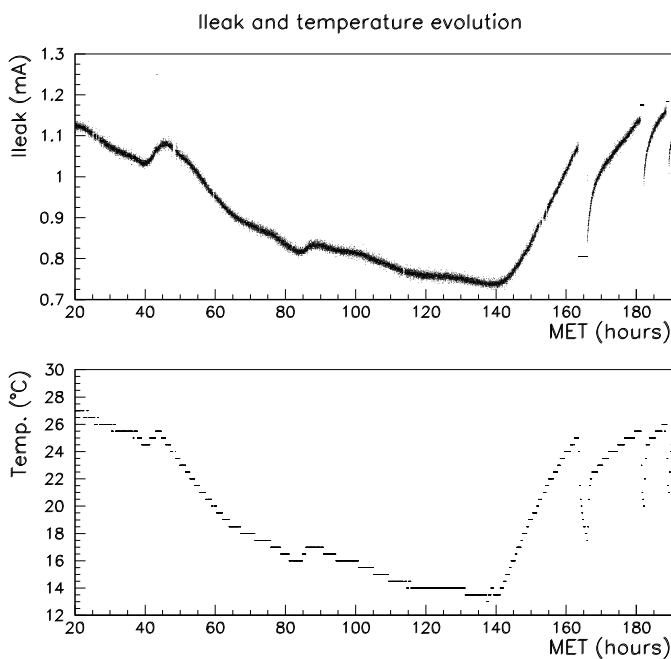


Performance

STS91 flight: June 2-12, 1998

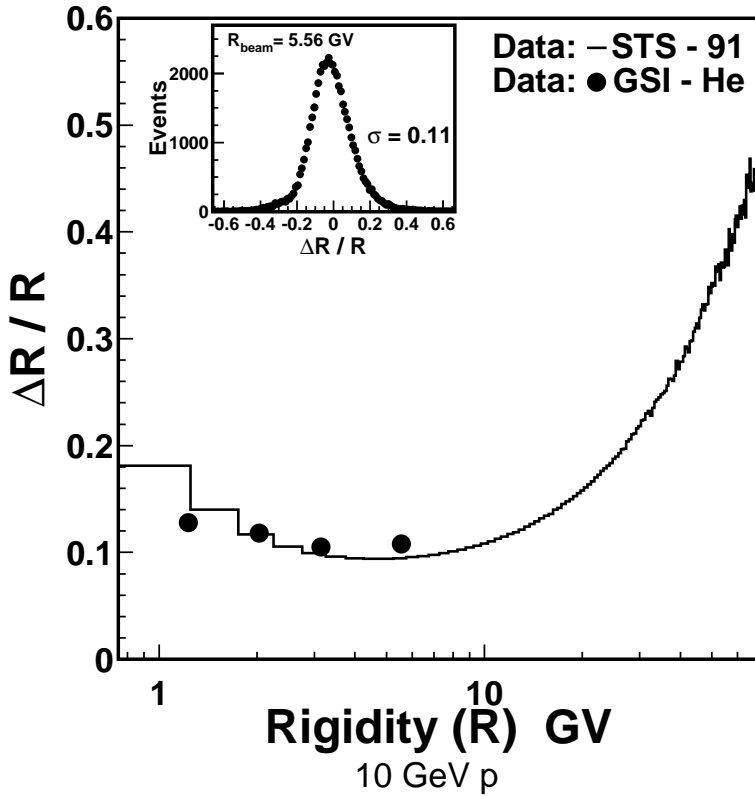
- AMS was secondary payload for test and qualification
- No failure, complete success
- 90 hours of dedicated data taking after MIR undocking
- Test beams at CERN (p) and at GSI (ions)
- Physics results at this conference (V. Choutko)

Tracker behaviour with temperature:

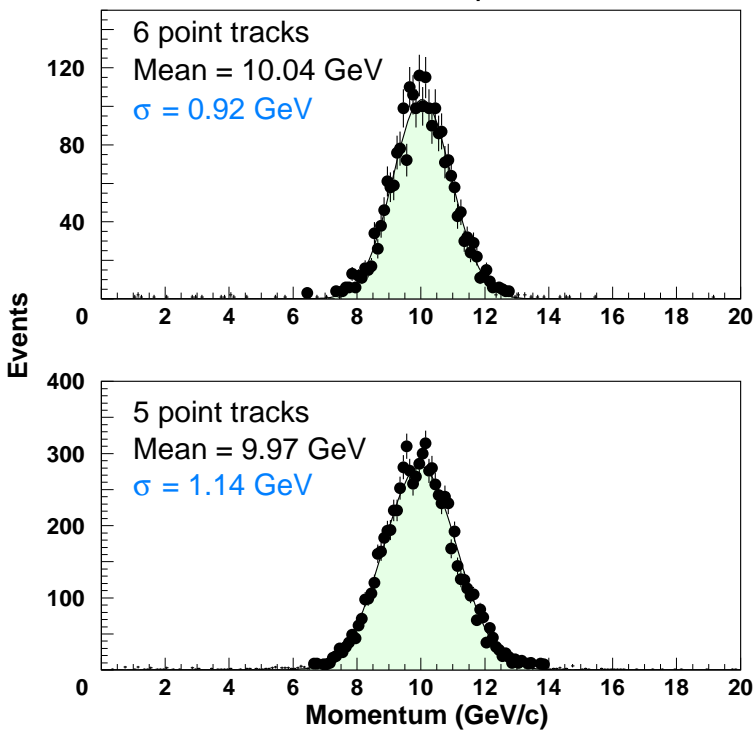


Resolution

Position resolution: $10\mu\text{m}$. Magnet: $BL^2 = 0.14 \text{ Tm}^2$



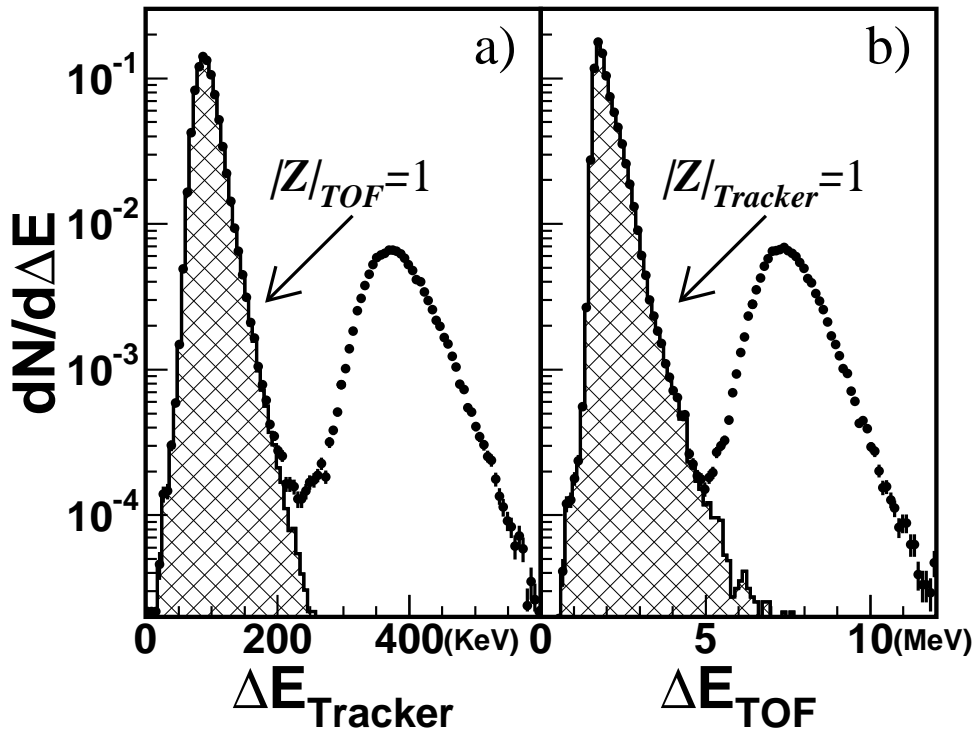
Rigidity resolution for ^4He



Momentum resolution for protons

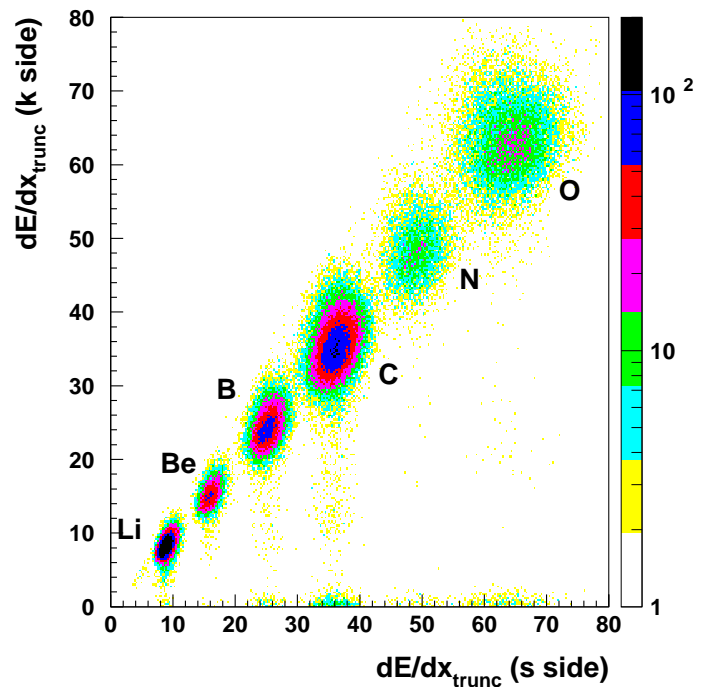
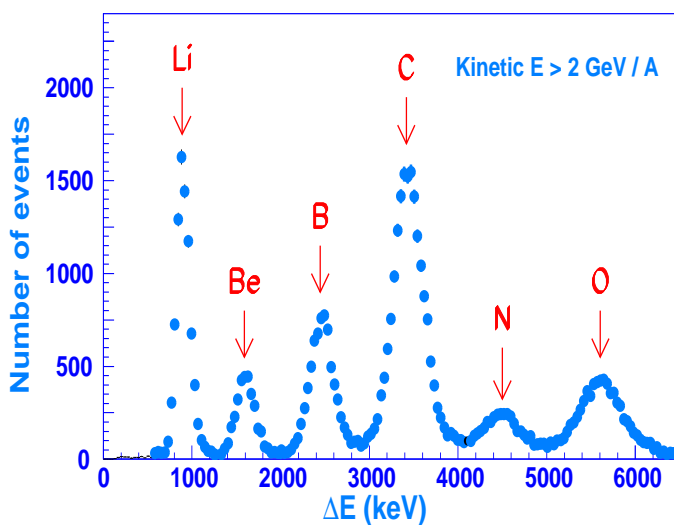
Charge identification with dE/dx

He-p separation (comparison with TOF scintillators)



Tracker charge identification

Ion Identification



Tracker for AMS2

AMS significantly upgraded

Next flight (for ISS) scheduled for early 2004

Tracker improved keeping the same concept:

- Full acceptance coverage (from 2 to 7 m², 192 ladders)
- 8 layers instead of 6 for better redundancy
- Better electronics and cooling
- Slight modifications of n-side strips, passivation of Si.

