UNIVERSITÉ DE GENÈVE

AMS-02 Tracker Performance

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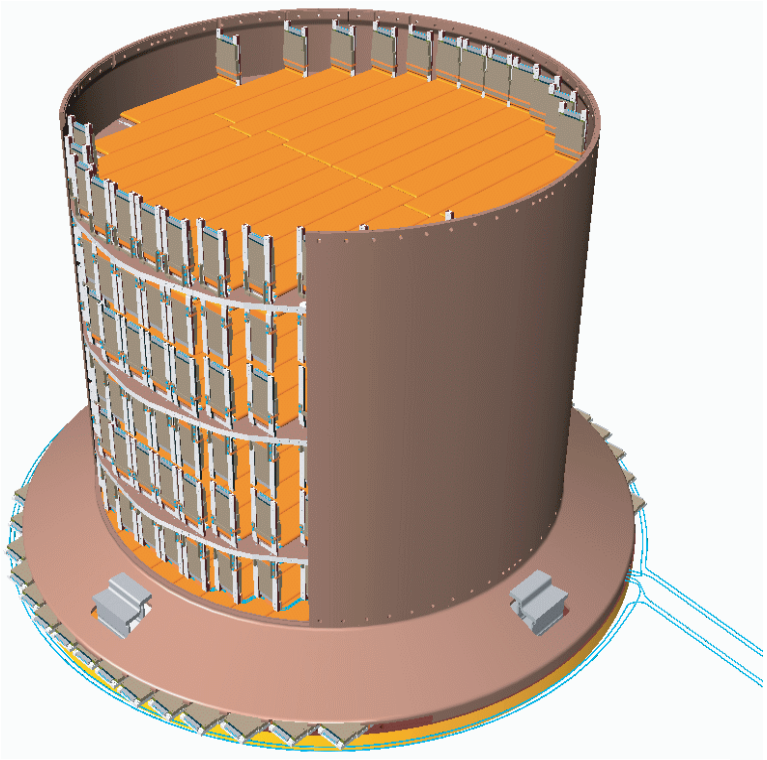
- Introduction
- Test Beam setups
- Spatial Resolution
- Identification Capabilities
- Summary & Conclusions

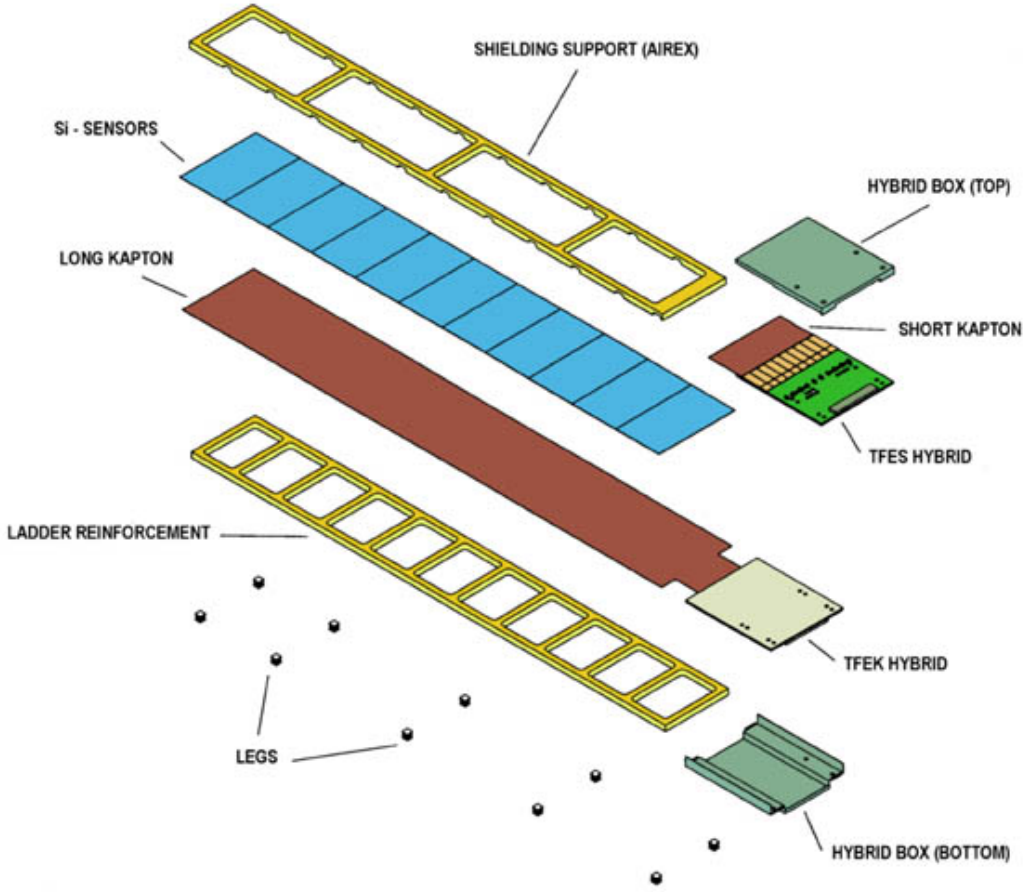
Introduction

- AMS-02 is a magnetic spectrometer → See talk from S. Gentile (OG 1.5-10)
- The core of the spectrometer is composed by:
  - Superconducting magnet (0.87 T) → See talk from B. Blau (OG 1.5-12)
  - Silicon tracker → This talk and poster 2-P-297

- 8 layers arranged in 5 planes.
  - 2 external layers (2 planes) on top and botton the magnet
  - 6 internal layers (3 planes) inside the magnet
- 192 elements called *ladders*



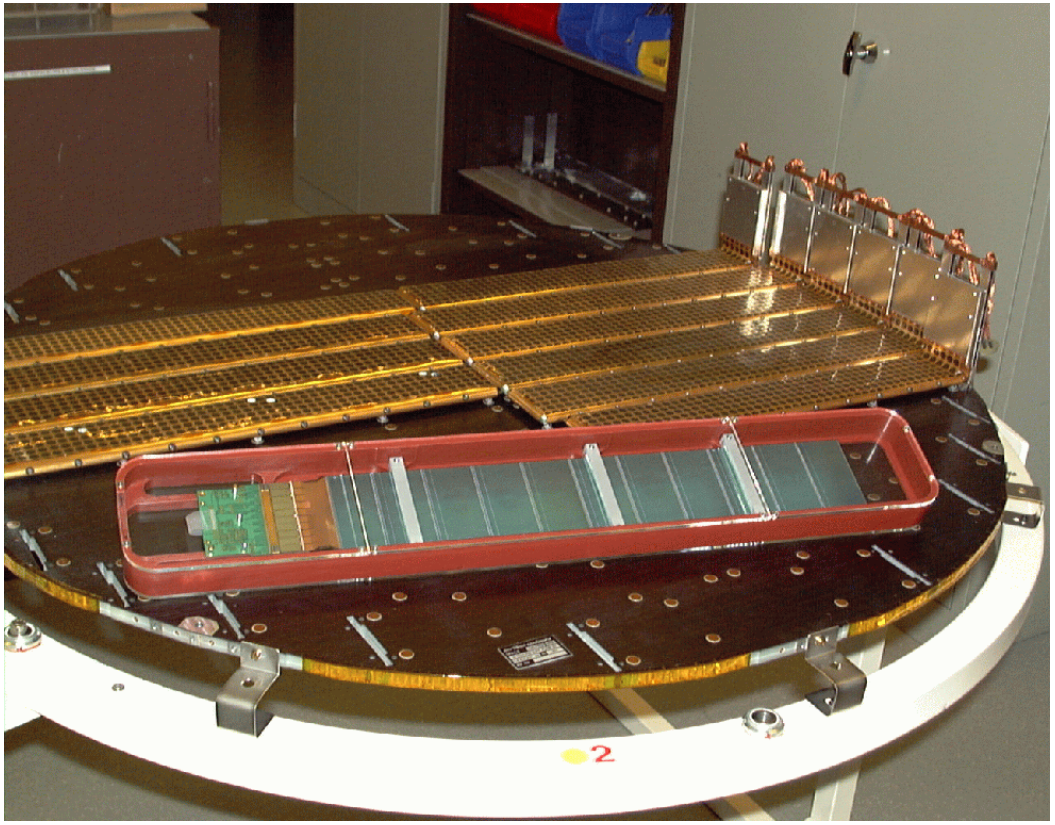
What's a ladder?



- 7-15 double sided silicon sensors (300 μm width)
  - S-side = p-side
  - K-side = n-side
- 8200-16500 microbonds per ladder
- Sensor relative position known better than 4μm

Pitch	p-side	n-side
Implantation	27.5μm	104μm
Readout	110μm	208μm

Plane structure

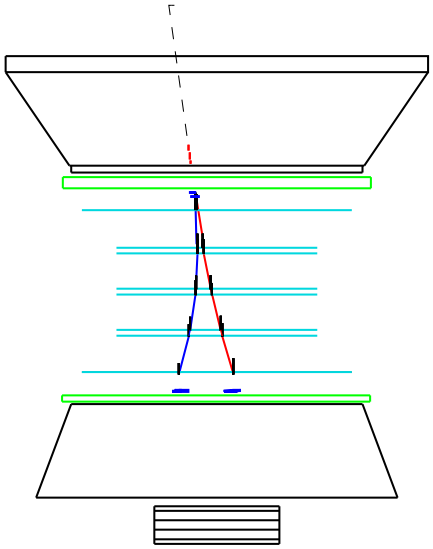


- Carbon fiber and aluminum honeycomb sandwich
- Same planes used for AMS-01
  - Inner planes modified to attach ladders on both sides
  - Bags for laser diodes on external planes.
- Layers 2 and 3 ready to be installed on Plane 2

P1	P2		P3		P4		P5
L1	L2	L3	L4	L5	L6	L7	L8
30	24	22	20	22	22	24	30

Measurements

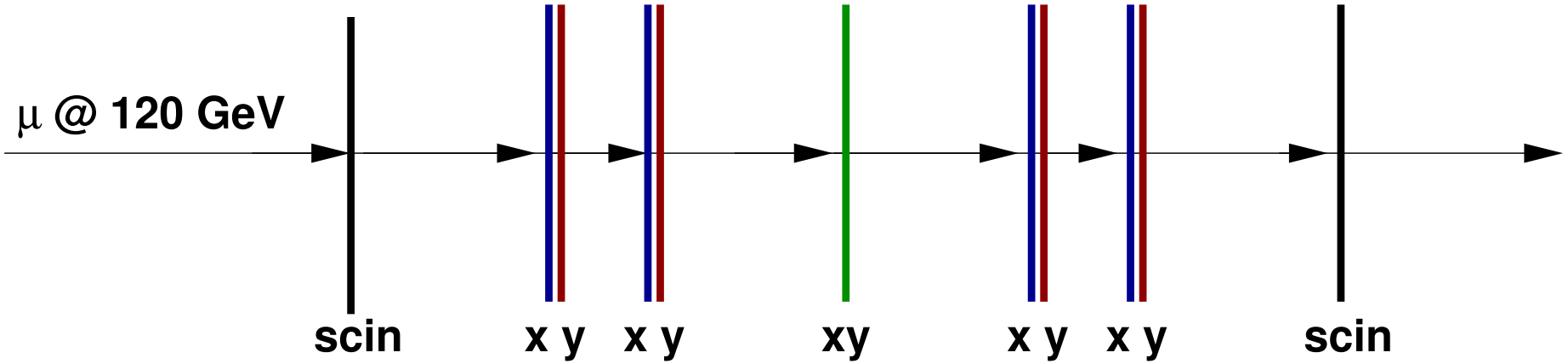
- Together with the magnet will allow 3D reconstruction of particle trajectories.
  - Two position measurements per hit.
  - Measurement of the momentum
  - Measurement of the sign of the charge
- Each hit in a sensor will provide two measurements of the energy deposition.
  - Determination of particle charge.



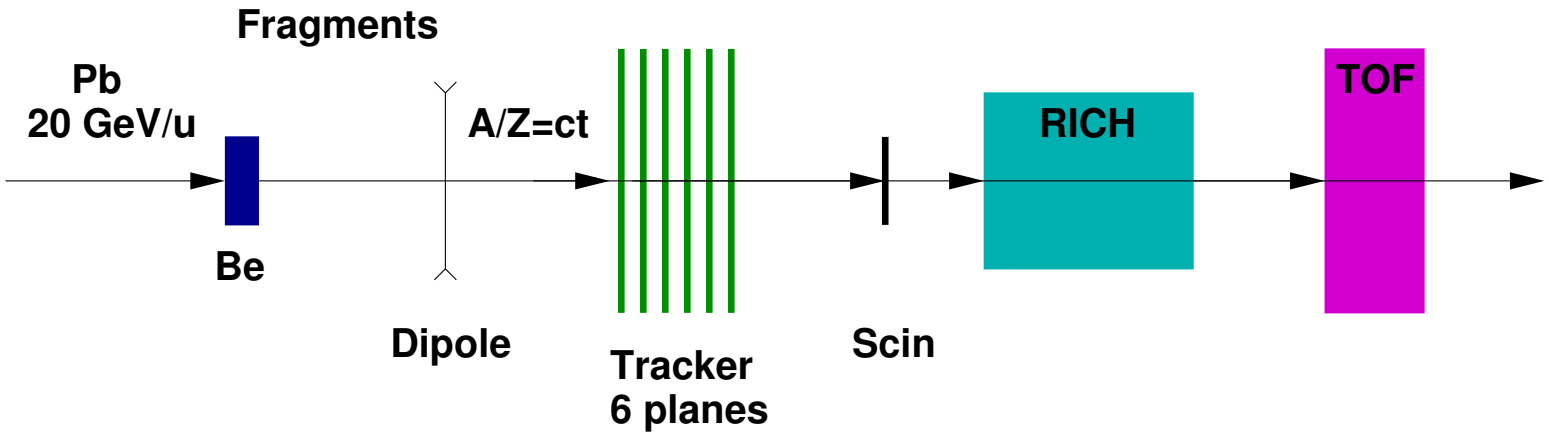
- Possibility to measure converted photons (MC studies)
  - 1 GeV-400 GeV. Limited by double track resolution
  - Energy resolution modest (bremsstrahlung)
  - 0.6^{o} @ 1 GeV - 0.12 mrad @ 300 GeV
- Method tested in AMS-01. Limited by rate and geometry.

Test Beam setups

120 GeV muons SPS (CERN)



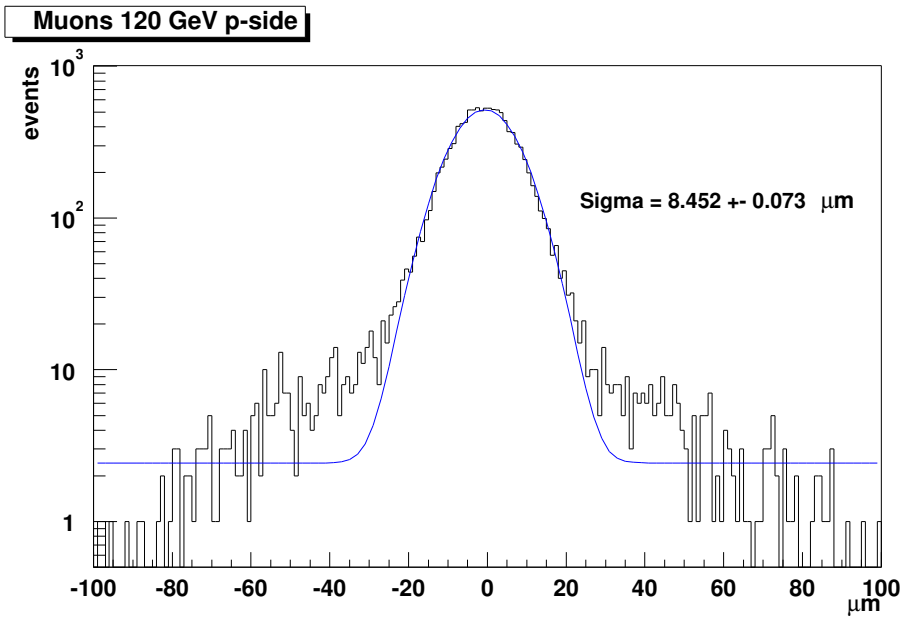
20 GeV/u Pb+Be SPS (CERN)

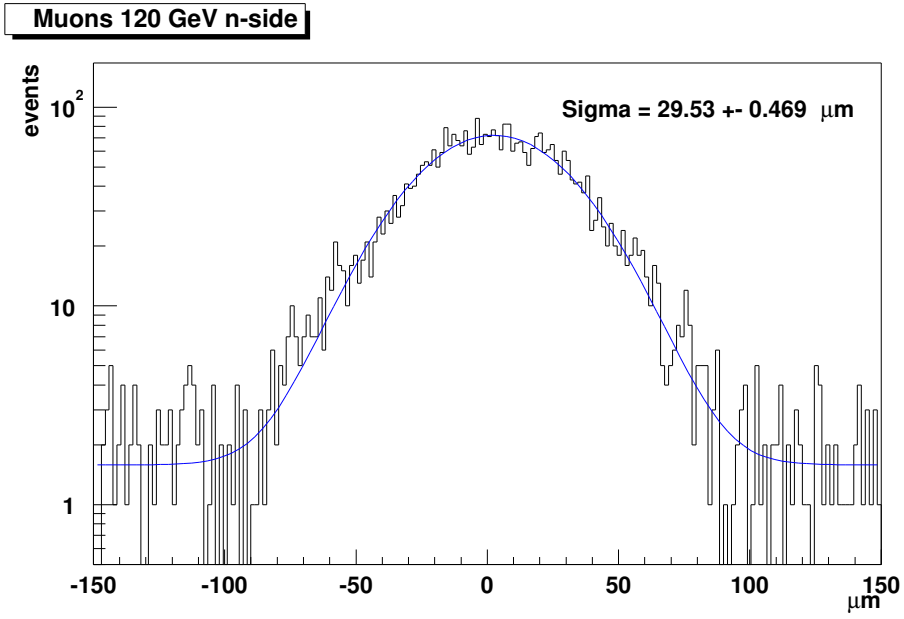


Spatial Resolution

- Precise alignment performed prior to compute residuals
- S/N ratios $\sim$10 for both sides

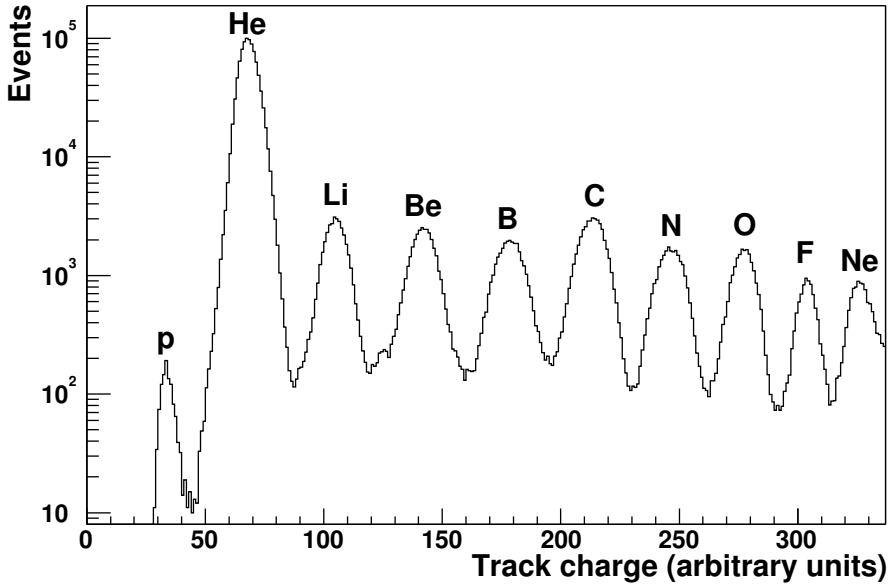
Particle	p-side	n-side
μ 120 GeV	$8.5\mu m$	$29.5\mu m$
p 20 GeV	$11.6\mu m$	$29.2\mu m$
He 20 GeV/A	$7.1\mu m$	$22.1\mu m$

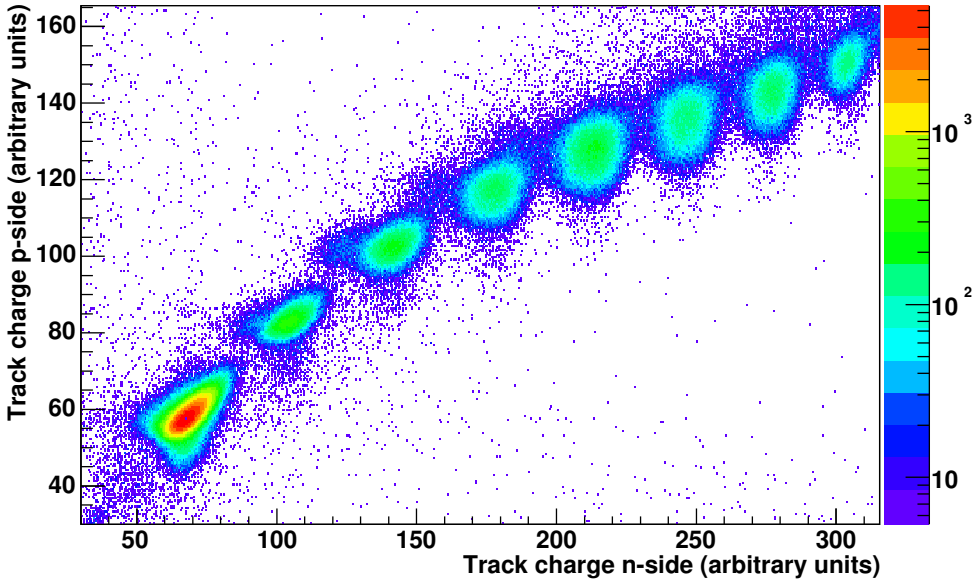




Identification Capabilities

- Each plane provides two measurements of energy deposition
- 6 planes in test beam (8 planes in AMS-02)
- Up to Z=10 if only one side used
- Up to Z=13 combining informations from both sides.





Conclusions

- A Silicon Tracker composed by 192 ladders with 6.4 m^2 is being constructed.
- The detector has been tested in two test beams at the CERN SPS with MIPS and heavy ions
- Spatial resolution of 8.5 μm on p-side and 30μm on n-side have been obtained
- Allow to identify up to Z=13 (Z=10 using only one side)
- New tests foreseen during 2003 and 2004.
  - 10 GeV p @ PS (CERN). June 2003
  - 20 GeV/u In @ SPS (CERN). October 2003
  - 800 MeV/u C @ FRS (GSI). November 2003
  - Electron or photon beam. 2004.