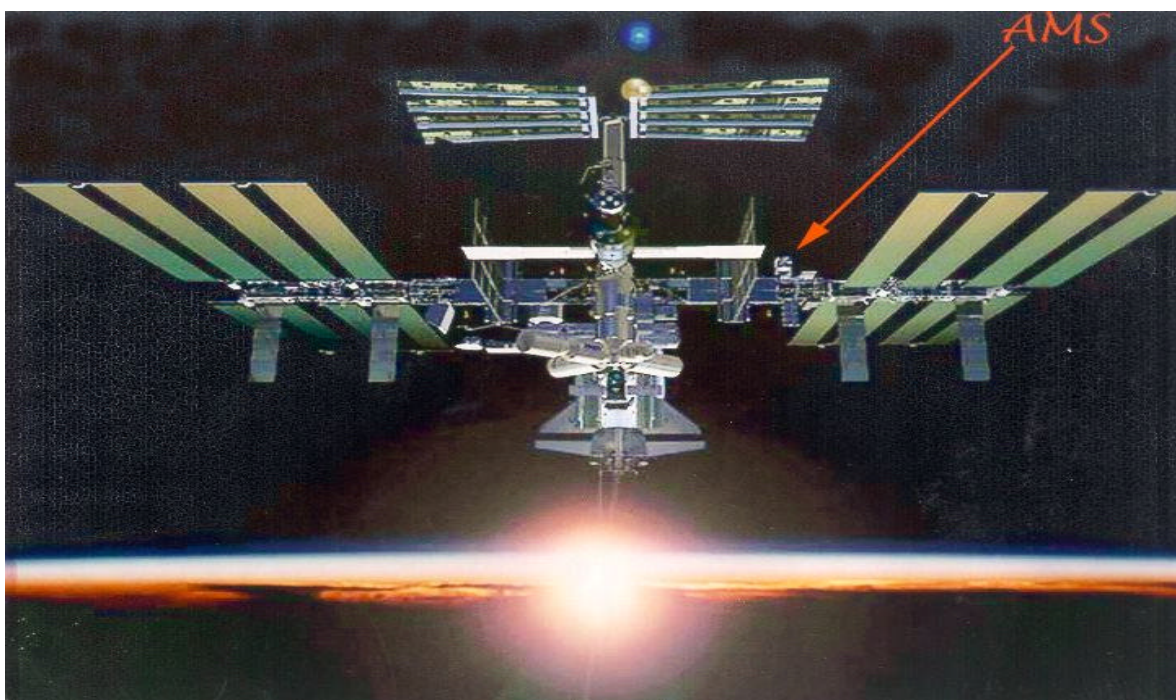


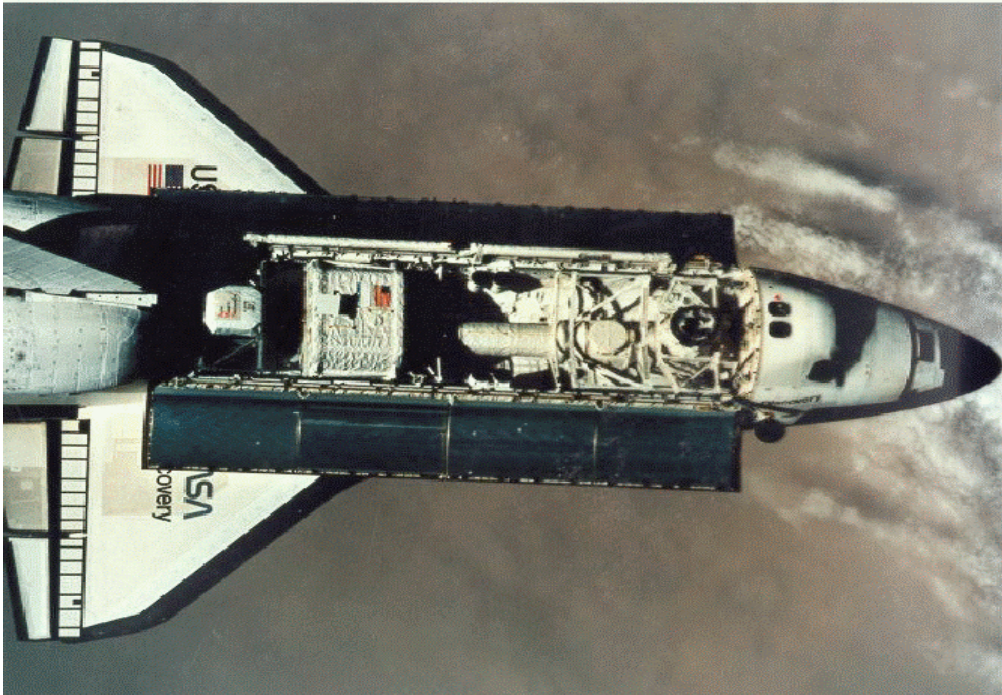
## AMS-02 nella ISS



## AMS / ISS

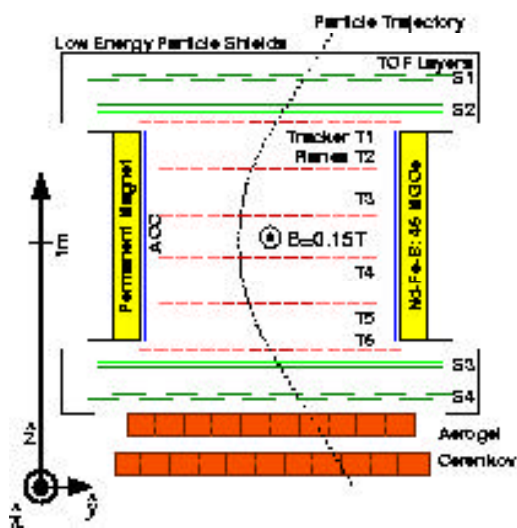
- \* Il volo precursore nel 1998
- \* Gli obiettivi di fisica
- \* L'apparato sperimentale
- \* L'attività del gruppo di Roma
- \* Conclusione

## AMS-01 on Discovery during STS-91 Flight



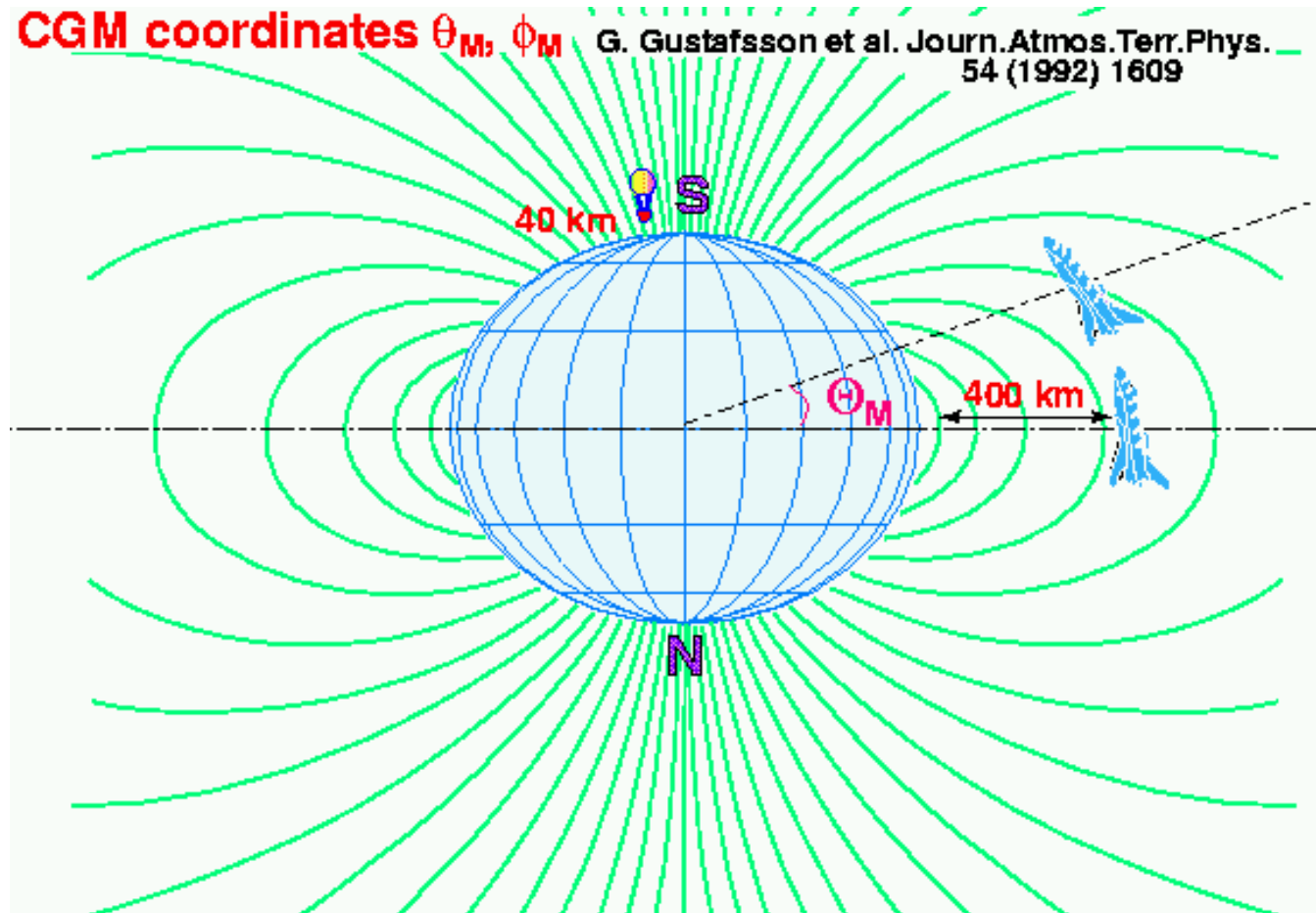
# AMS-01 Configuration on STS-91 Flight

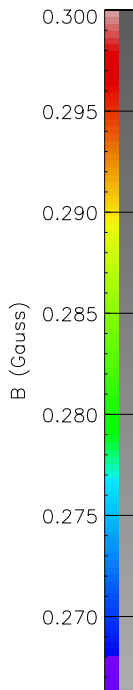
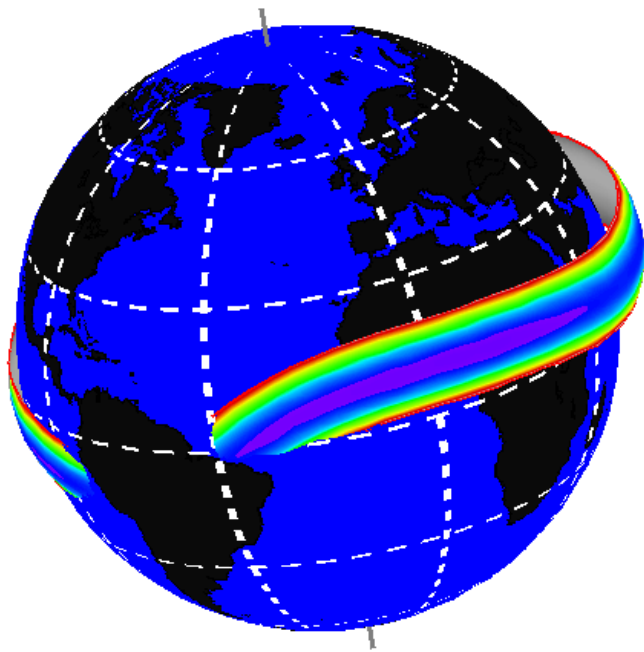
STS-91 Flight, June 2-12<sup>th</sup>, 1998



- **Magnet:**  $Nd_2Fe_{14}B$ ,  $BL^2= 0.15 TM^2$
- **T.o.F:** Four planes of scintillators; and Z measurements, up/down separation
- **Tracker:** Six planes of ds silicon detectors; Charge sign,  $dE/dX$  up to  $Z=8$ , Rigidity ( $p/Z$ )
- **Anticounters:** Veto stray trajectories and bckgnd particles from magnet walls
- **Aerogel Threshold Cerenkov:** measurements ( $1 \div 3 GeV/c$ ) for better e/p separation
- **Low Energy Particle Shielding (LEPS):** Carbon fibre, shield from low energy ( $<5MeV$ ) particles

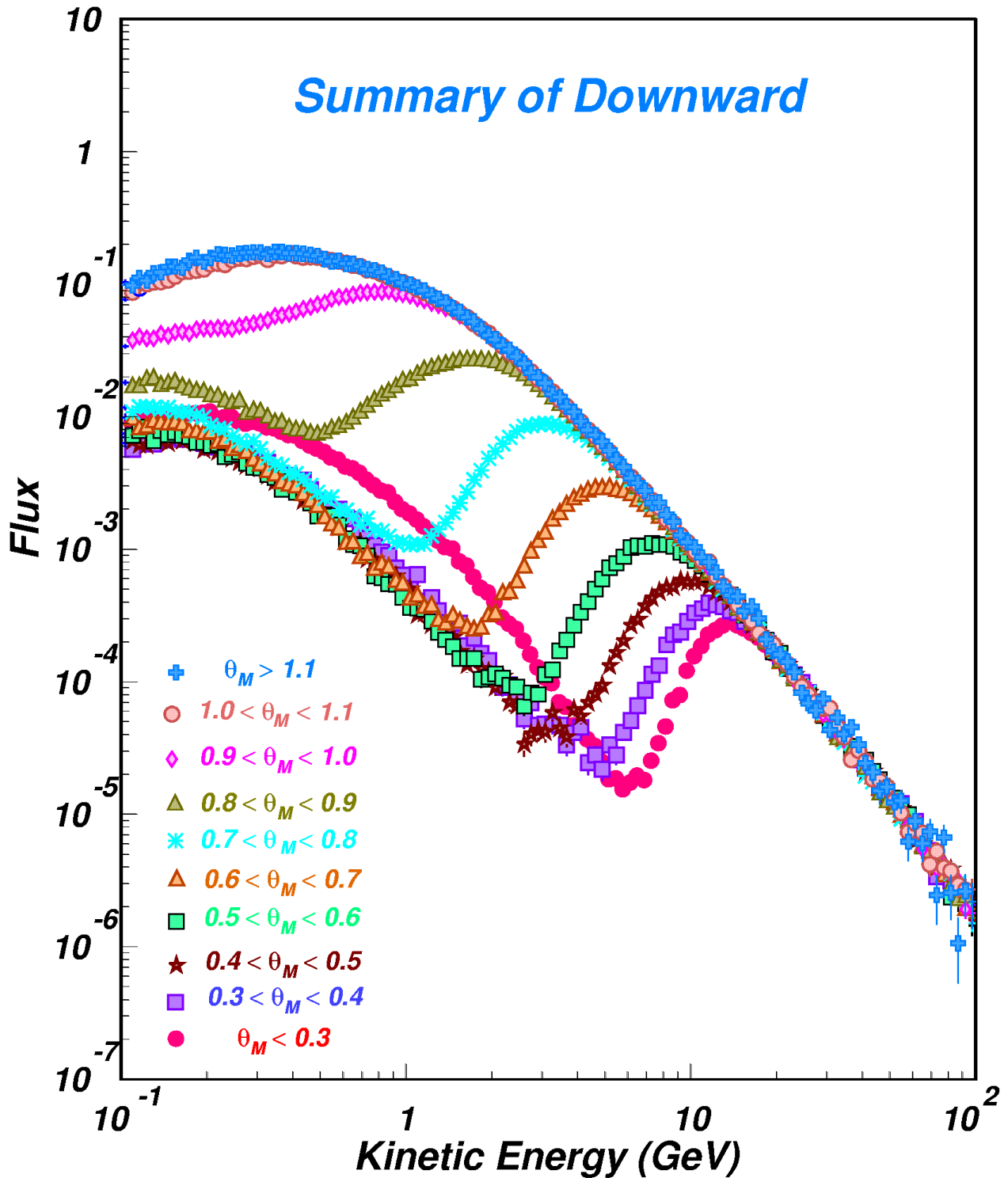
# Earth Magnetic Field vs shuttle orbit





# Primary Proton Spectrum

## Proton Flux



y99181c\_AllPsumDown

## AMS 01- Le fasce

	Fasce di Van Allen	Fasce AMS
Energia	1 – 100 Mev	1 – 10 Gev
Composizione	$e^-$ p	$e^+$ $e^-$ p $^3\text{He}$
Posizione	alta quota 1000-3000 Km	bassa quota 400 Km
Vita media	anni	secondi
Origine	decadimenti neutroni	secondari x atmosfera



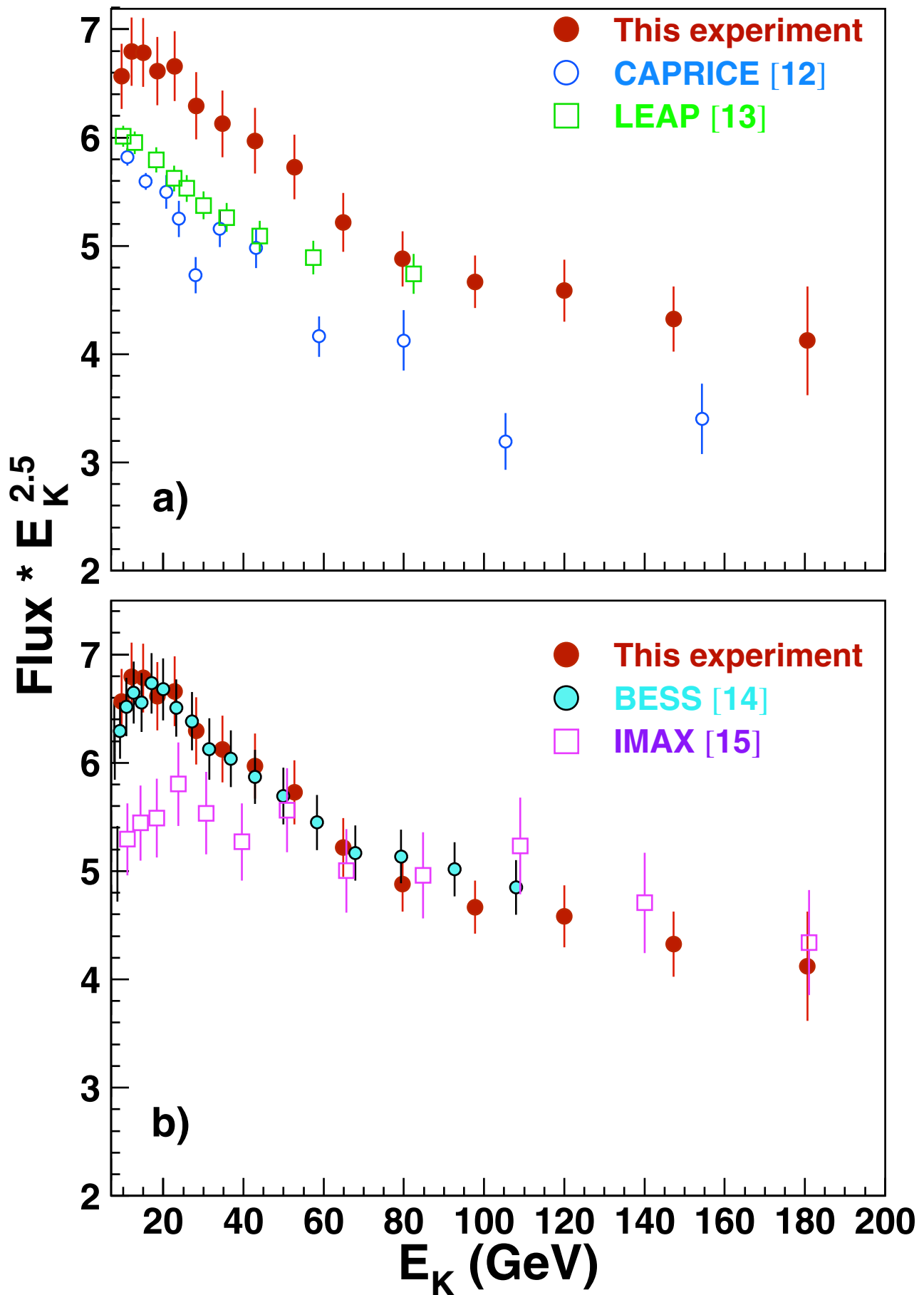


Figure 8: The primary proton spectrum multiplied by  $E_K^{2.5}$  in units of  $\text{GeV}^{2.5}/(\text{m}^2 \text{ sec sr MeV})$  as measured by this experiment (total errors shown) in comparison with some recent balloon based measurements.

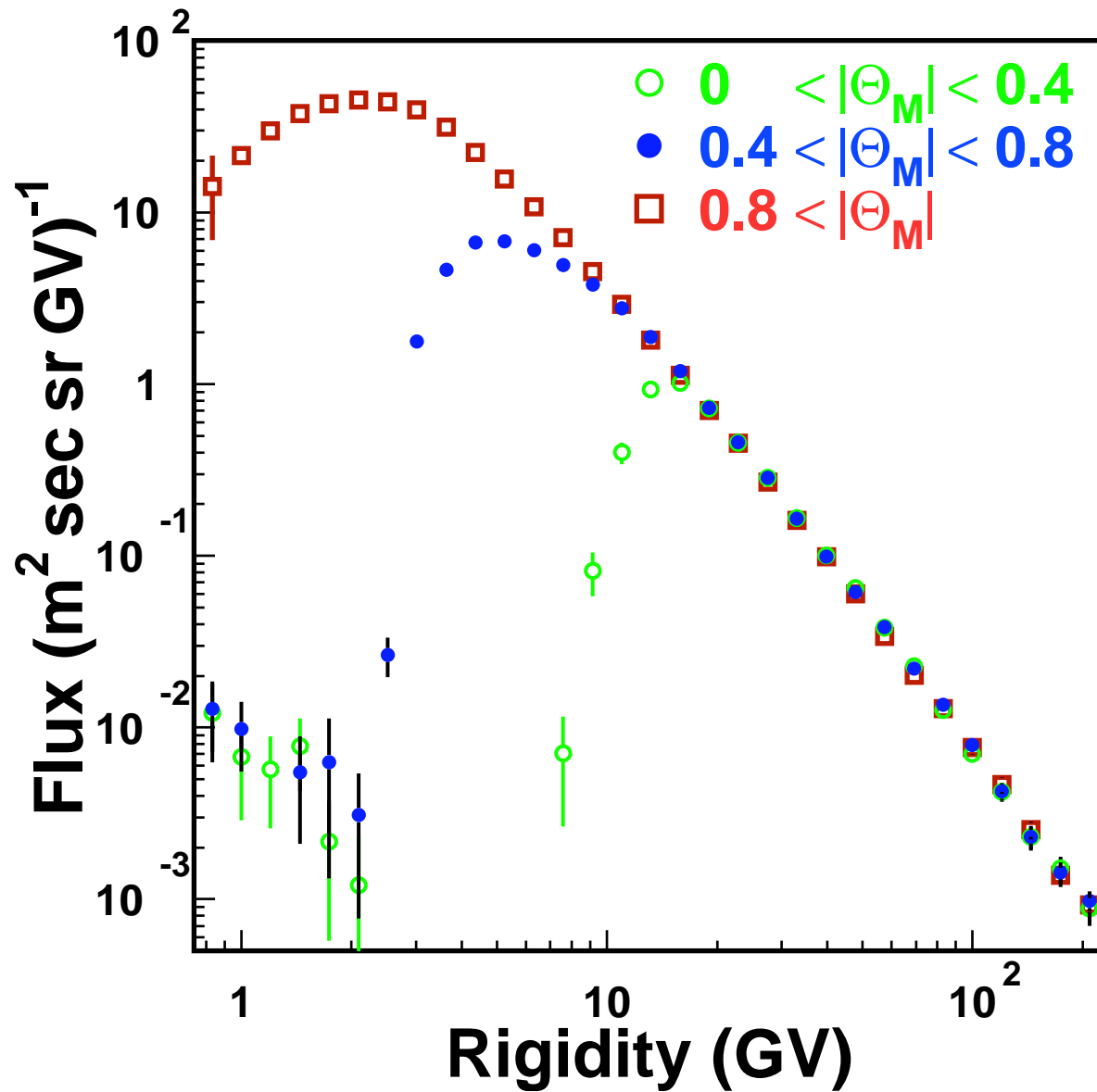
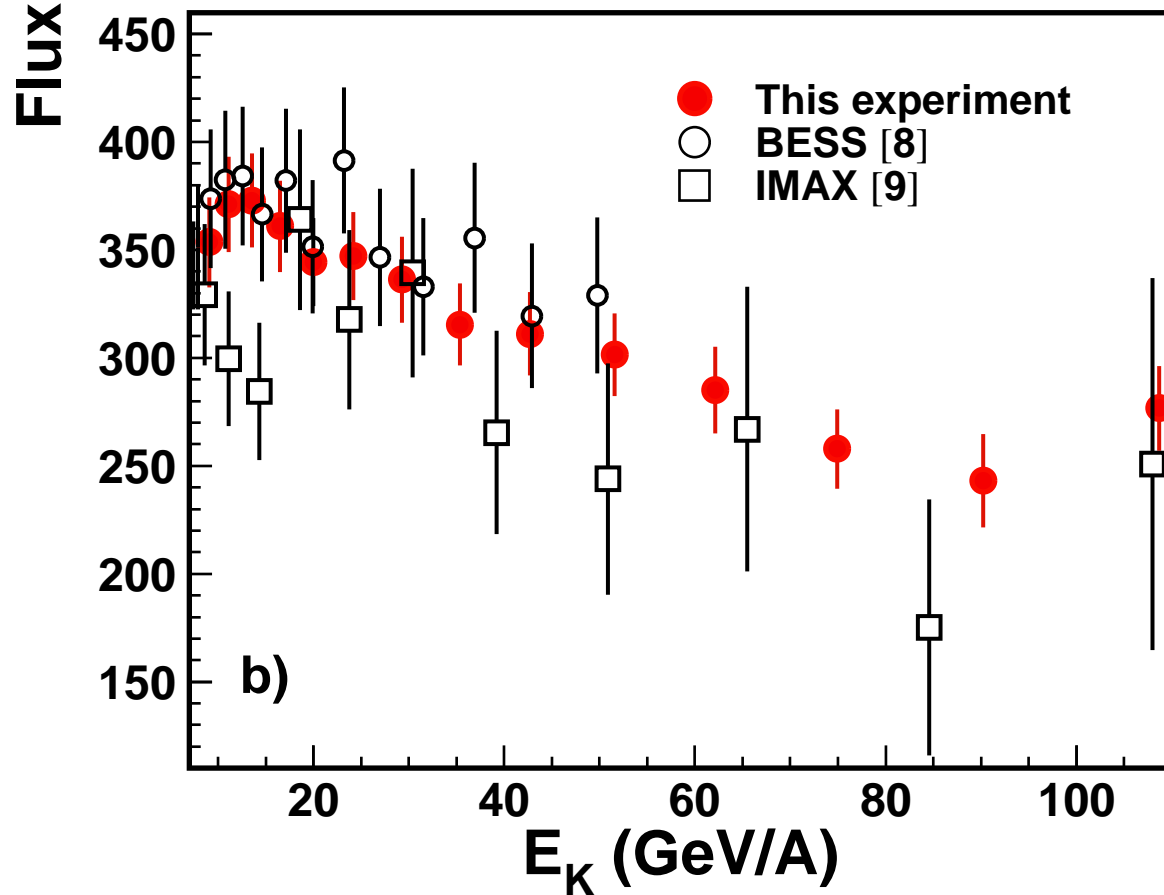
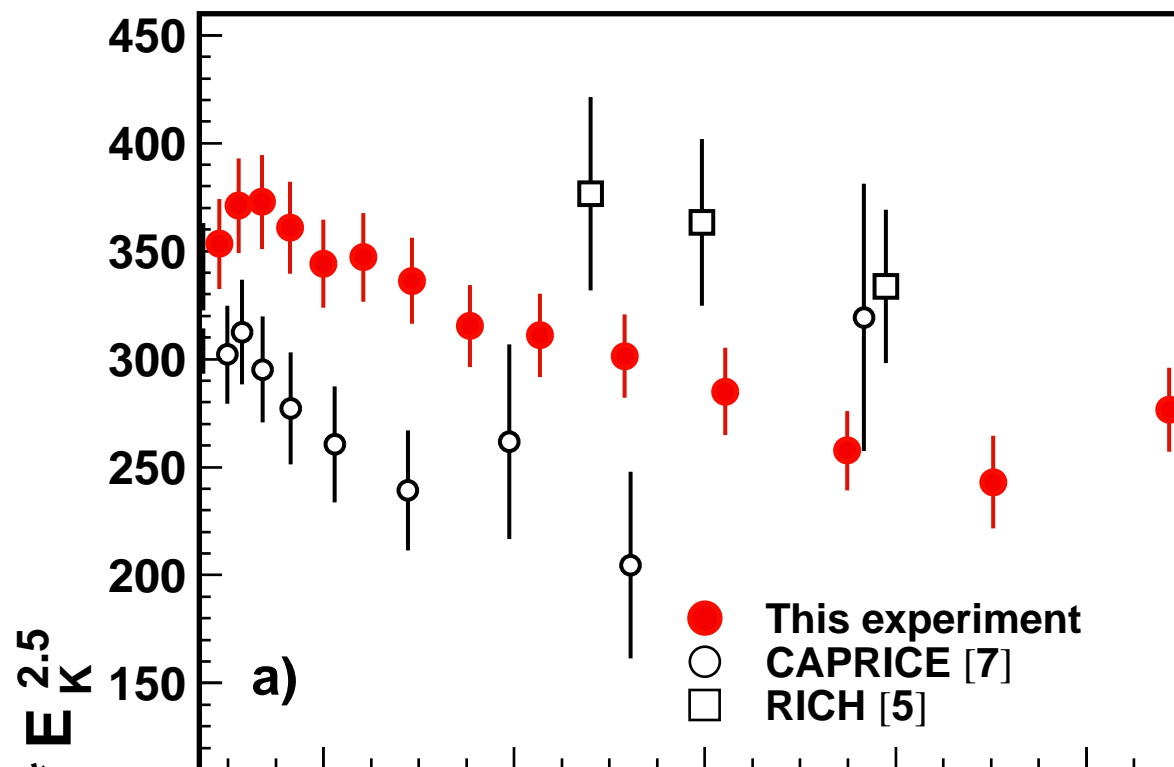


Figure 1: Helium flux spectra for the zenith pointing separated according to the geomagnetic latitude,  $|\Theta_M|$ , at which they were detected.



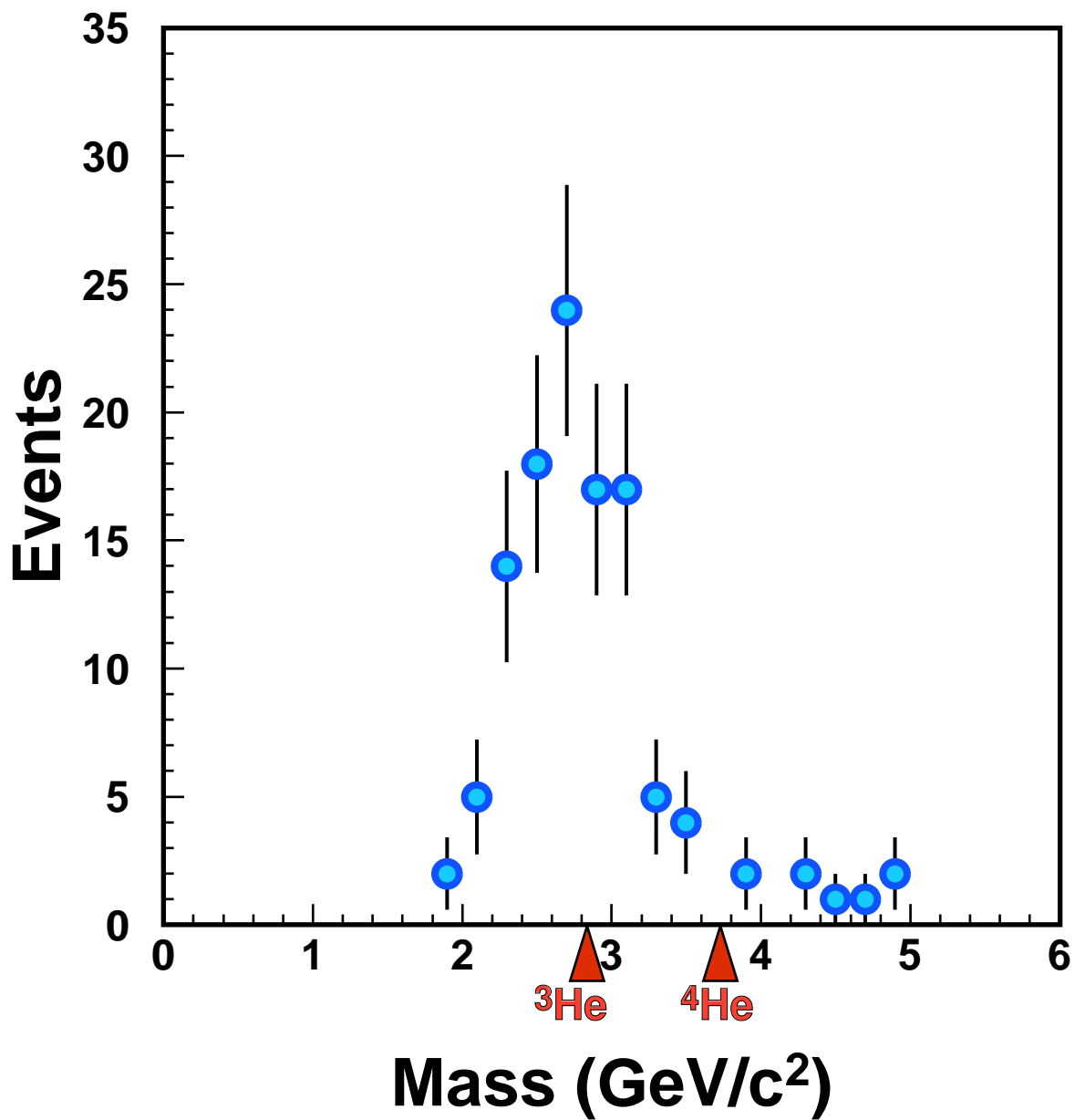
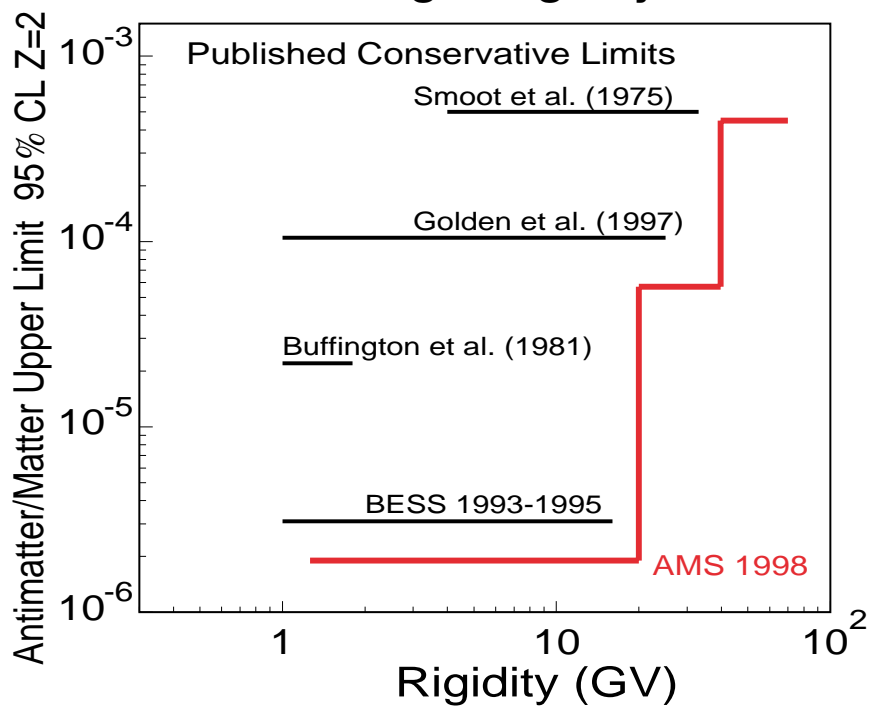
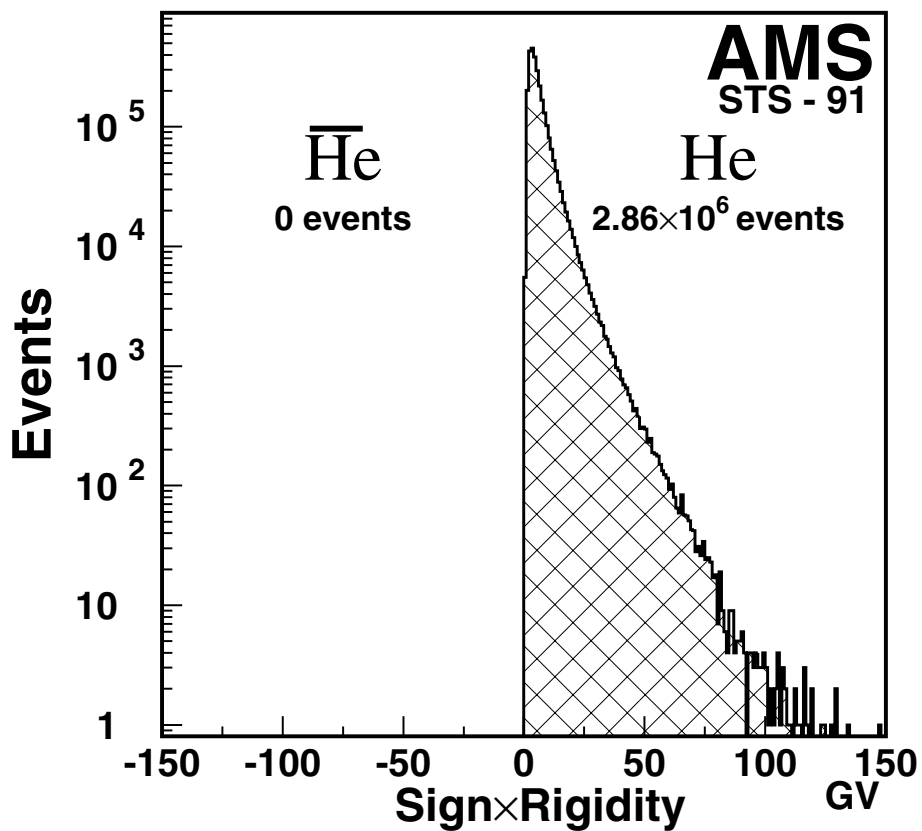
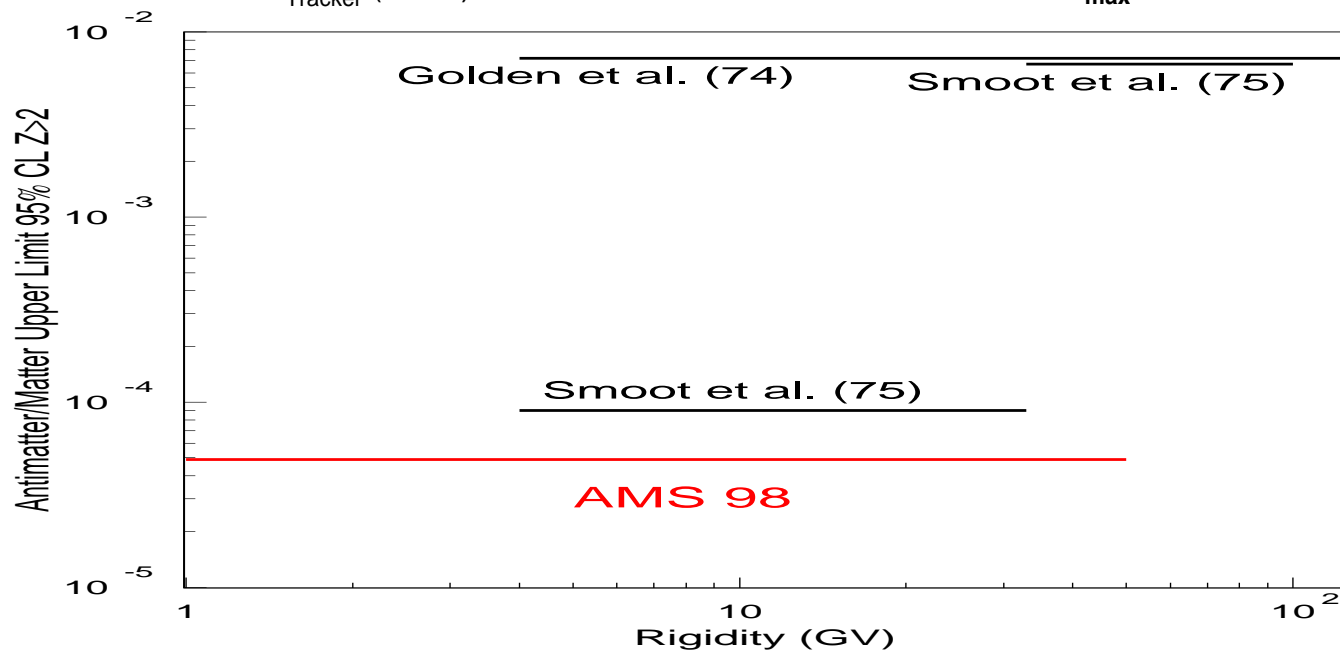
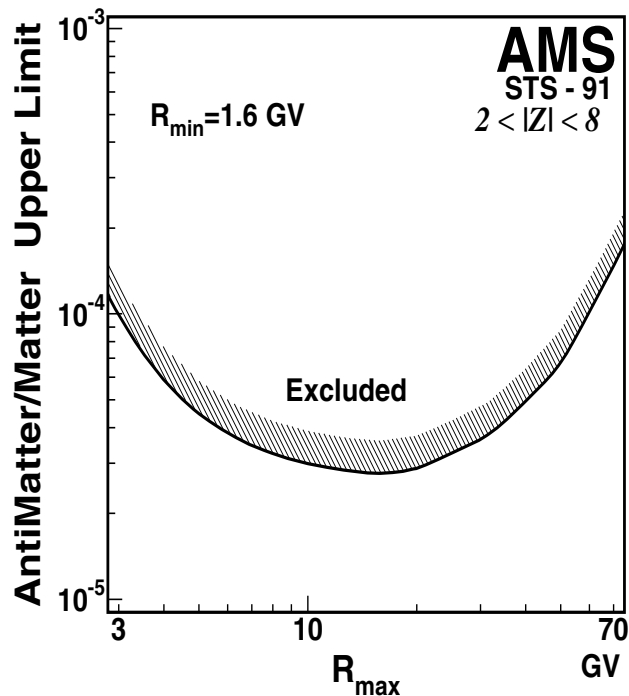
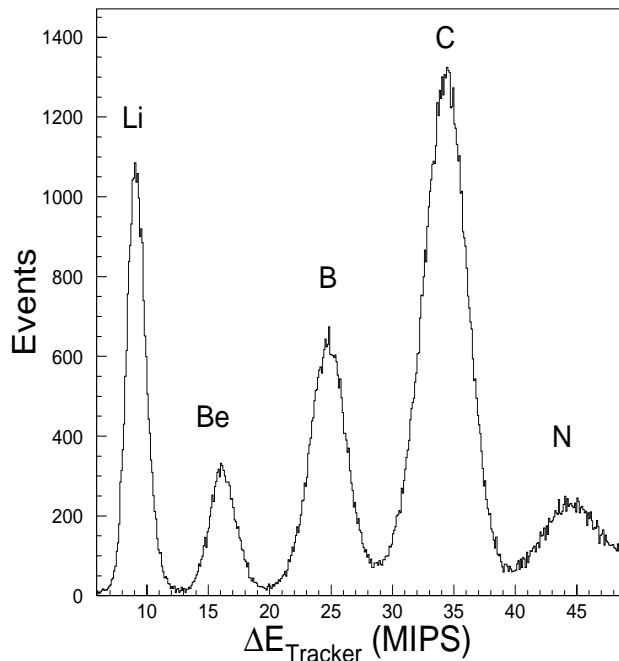


Figure 7: Reconstructed mass distribution for the second spectrum helium for  $|\Theta_M| < 0.6$  compared with the masses of  ${}^3\text{He}$  and  ${}^4\text{He}$ .

# AMS01 Results

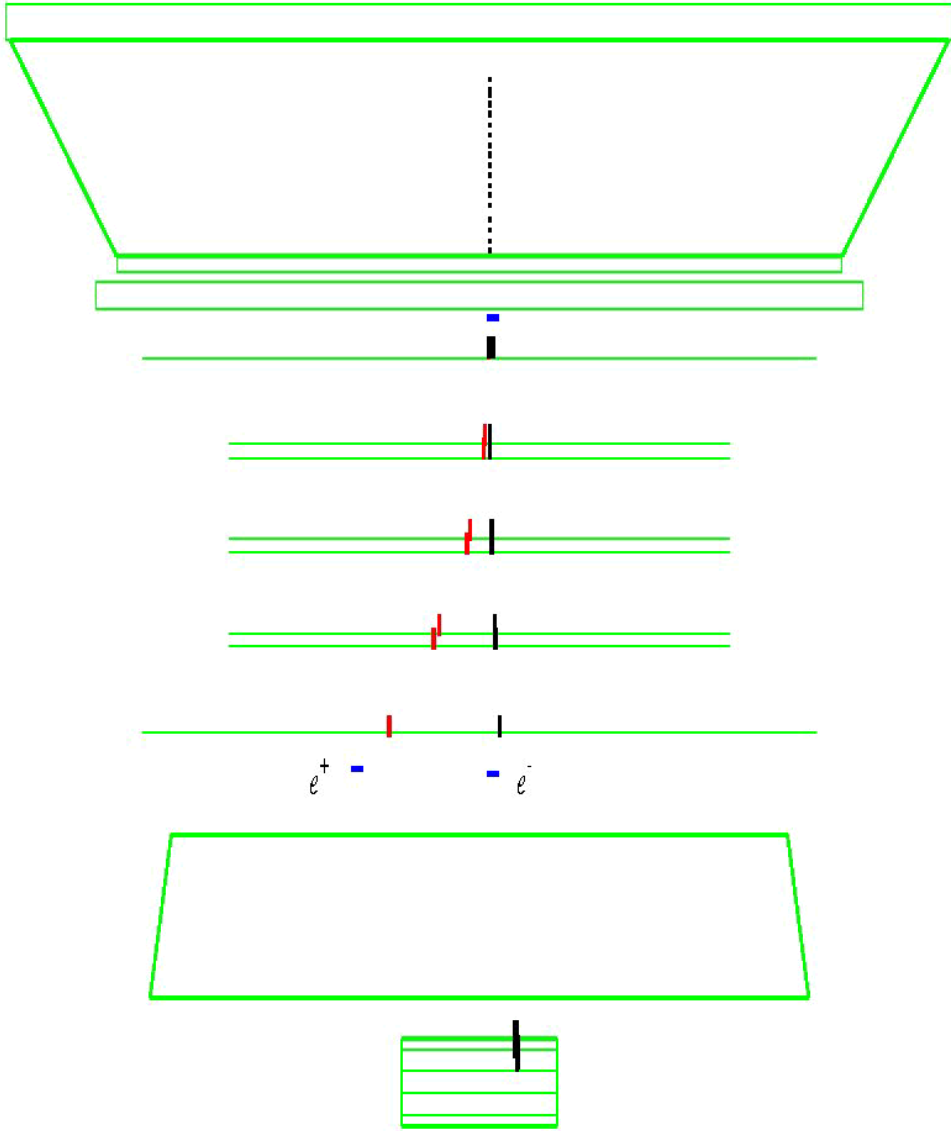


# AMS01 Results



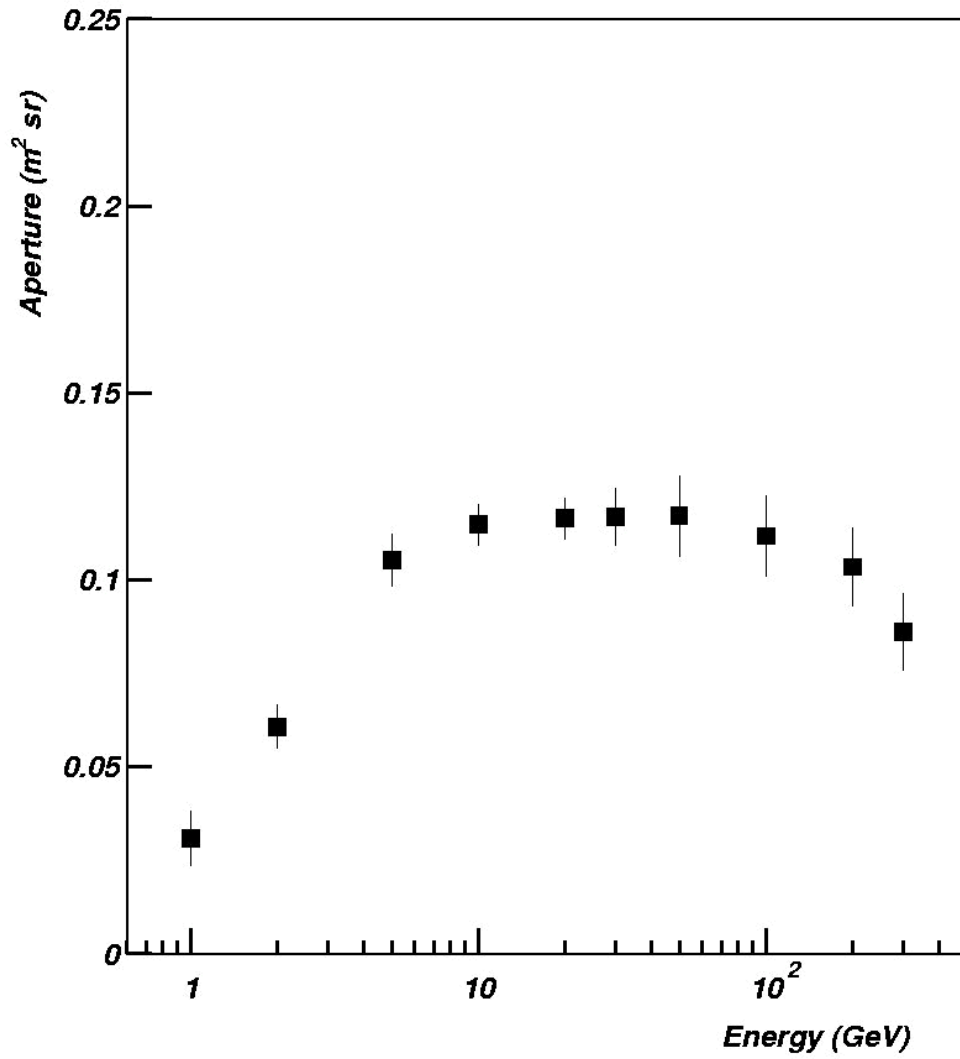
## La fisica di AMS

- ricerca antimateria nucleare con sensibilità  $10^{-9}$
- ricerca materia oscura via  $\chi + \chi \rightarrow e^+ e^- ; \chi + X; p.....$
- sorgenti , burst
- origine e propagazione dei CR  $\rightarrow {}^{10}\text{Be}/{}^9\text{Be}$





## AMS 02 GAMMA APERTURE



# AMS / ISS

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L'apparato sperimentale

La collaborazione

Il magnete

Il tracker

Il transition radiation detector

Il cerenkov ad immagine

Il tempo di volo

Il calorimetro elettromagnetico

# AMS-02 Europe



European Participation in AMS-02 construction.

## AMS-02 Superconducting Magnet

**Nominal Bending Power:** 0.85 Tm<sup>2</sup>

**Peak Field in coil:** 6.6 T

**N. of Coils:** 2 Dipoles, 20 racetracks

**Magnetic Torque:** 0.272 Nm

**Conductor:** NbTi wire, Aluminum stabilized

**Operating Temperature:** 1.8K @ 20 mbar (2600 lt superfluid Helium)

**Operating Current:** 450 A

**Power:** 1.5 kW (peak, during ramp), 400 W (maintenance)

**Endurance:** 27 to 33 months (w cryocoolers)

**Weight:** about 3 tons

**Dimensions:** 2.7 m of diameter and 1.5 m of max height

## AMS-02 Tracker

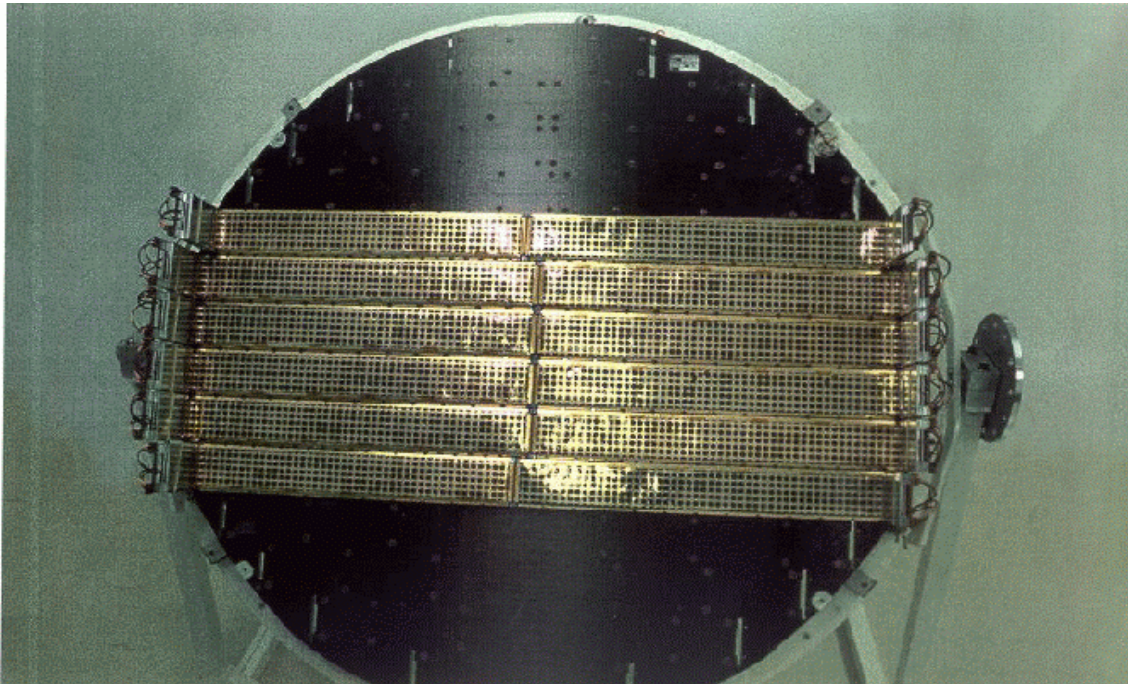
### ⌘ Scopo:

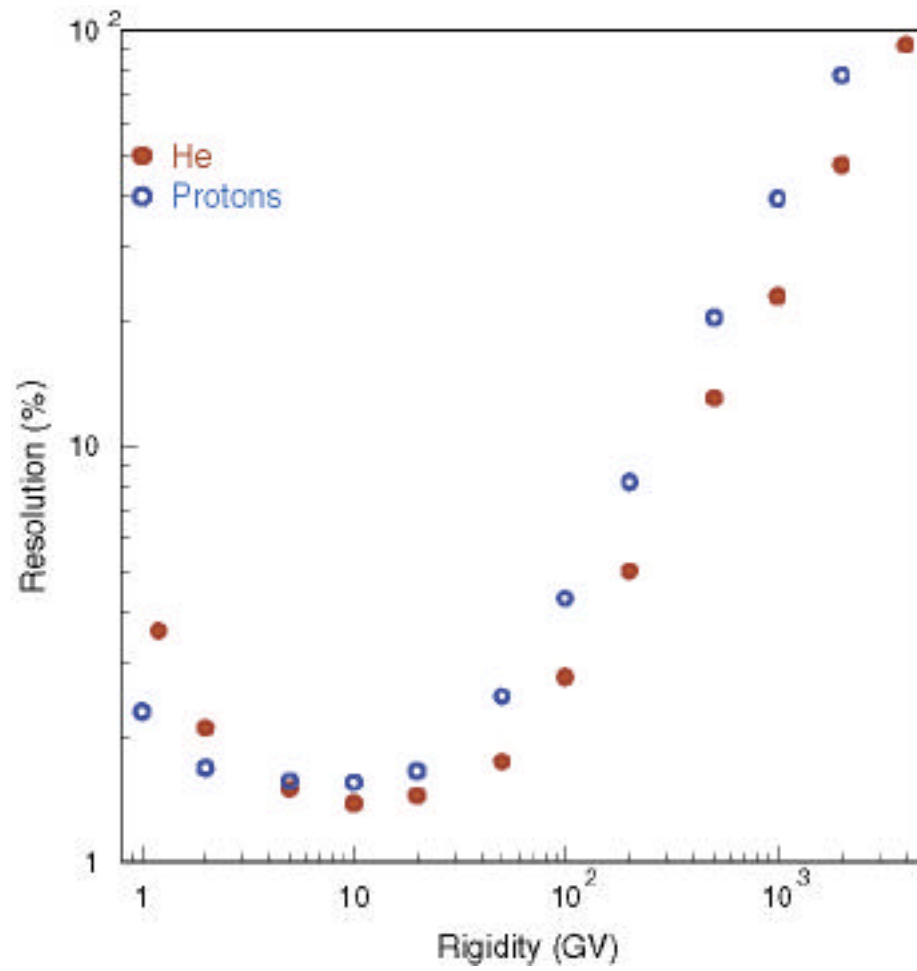
- ❖ Rigidity (P/Ze)
- ❖ Segno della carica

### ⌘ 8 piani sottili di microstrips Si doppio strato, risoluzione spaziale $< 10 \mu\text{m}$ , 200.000 canali, potenza 800 W.

6 m<sup>2</sup> di superficie attiva, il più esteso costruito prima di LHC @ CERN.

## AMS-02 Tracker (da AMS-01)





**Rigidity Resolution of P and He in AMS-02**

# AMS-02 Transition Radiation Detector

- ⌘ Scopo:
  - ❖ Identificazione di particelle  
p elettroni
    - ★ Reiezione e/p  $1.5 - 4 \cdot 10^{-3}$  @ 90%÷95% e
- ⌘ 6 mm diameter, 1.3 to 2 m long straw tubes
- ⌘ Radiatore: Foam (Airex)
- ⌘ Miscela Gas : Xe/CO<sub>2</sub> 80/20, guadagno  $2.5 \cdot 10^4$
- ⌘ Operating temperature interval: +10° C to + 25° C (gradient  $\pm 1$  K)
- ⌘ Peso: 484 kg (350 kg rivelatore)
- ⌘ Test beam e<sup>±</sup> p (3.5 - 15 GeV)



## AMS-02 Ring Imaging Cerenkov Detector

### ⌘ Scopo:

#### ❖ Velocità delle particelle, determinazione della massa

★  $dM/M = dP/P - 2 d /$

★  $d /$  0.1 %,  $p=1.7$  to  $7.3$  GeV/c/amu (for  $n=1.15$ )

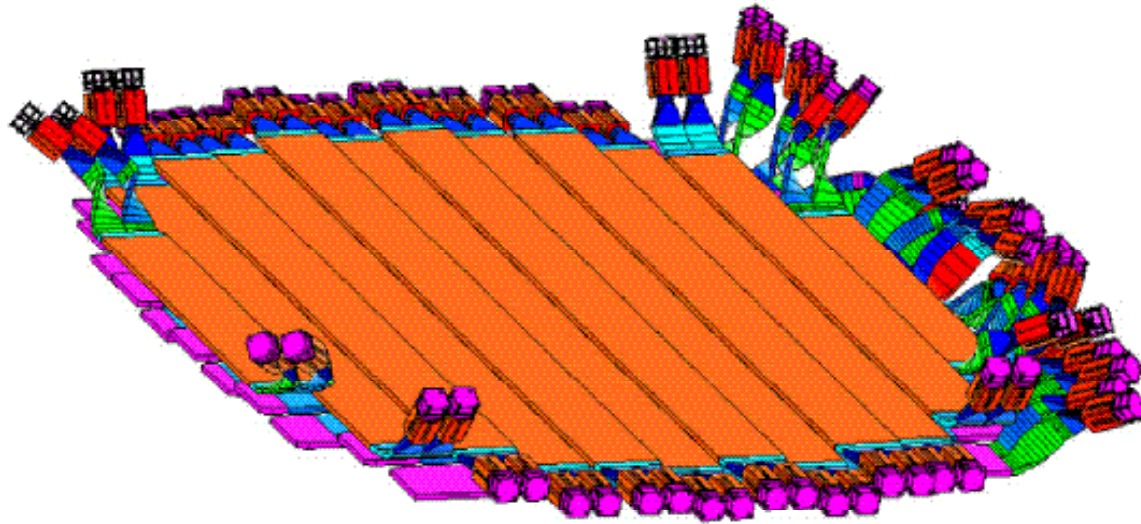
#### ❖ identificazione isotopi $A < 25$ ( $^{10}\text{Be}/^9\text{Be}$ , $^3\text{He}/^4\text{He}$ etc.)

$m/m$  0.2 % up to 10 GeV

### ⌘ Radiatore (NaF) : $n=1.15$ (2 cm) / $n=1.34$ (1 cm)

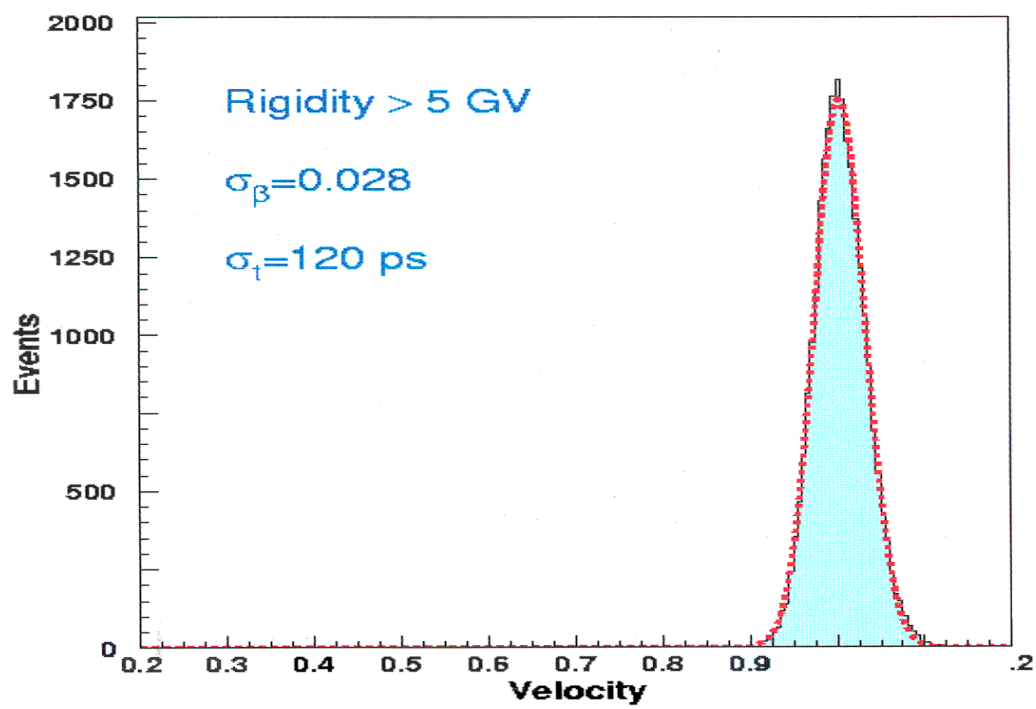
### ⌘ Light Yield (N) : 50

### ⌘ PMT Hamamatsu R5900 pixel (16 pixels, $0.45 \times 0.45$ cm<sup>2</sup> each)



Counters and PMs in planes 1 and 2 of the TOF system.  
Note that the PMs of plane 1 are shown on one side only

## AMS-02 Time of Flight System (T.o.F. risoluzione da AMS 01)



## AMS-02 Electromagnetic Calorimeter (1)

### ⌘ Scopo:

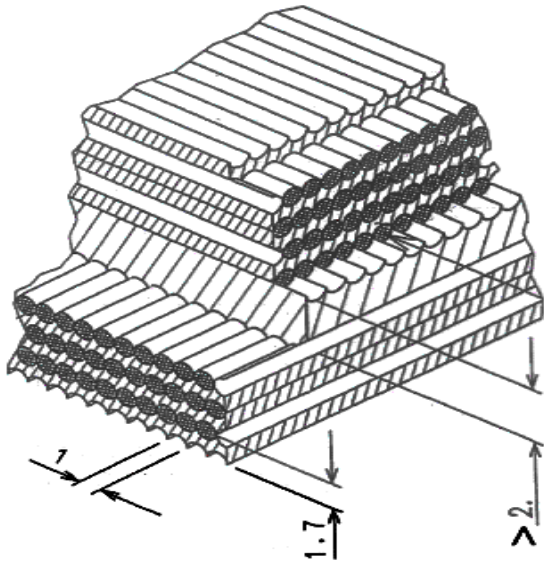
- ❖ separazione e/h @  $10^{-4}$  intervallo 1 ÷ 1000 GeV  
Rivelazione con risoluzione angolare e di energia
- ❖ Misura albedo neutro ( $\gamma, n$ )

### ⌘ Risoluzione in energia

6.1 % ± 3.1 % @	1 GeV
4.4 % ± 1.2 % @	10 GeV
1.46 % ± 0.2 % @	100 GeV

# AMS-02 Electromagnetic Calorimeter

## Active detector characteristics

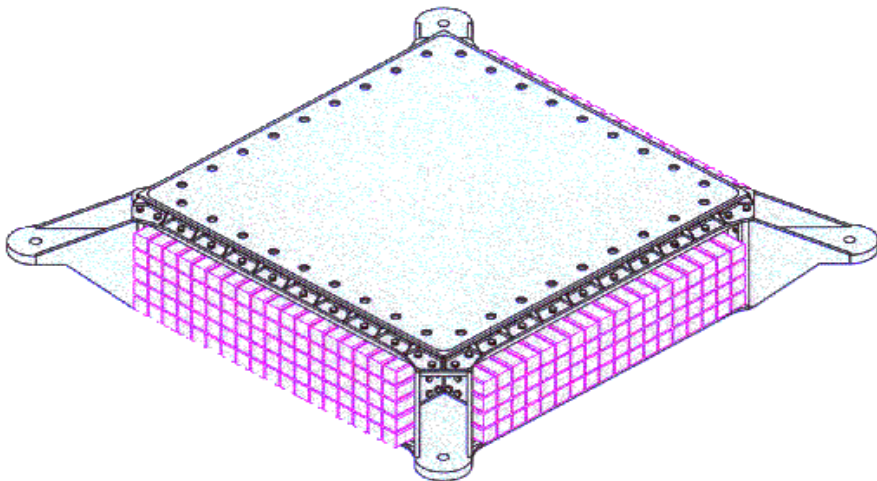


y2K087a

- ◆ **Pankake characteristics:**
  - Density:  $6.95 + .05 - .15 \text{ g/cm}^3$
  - Radiation Length:  
 $X_0 = .98 \pm .01 \text{ cm}$
- ◆ **Superlayer:**
  - 10 Scintillating fiber planes
  - Thickness:  $18.2 \pm 0.3 \text{ mm}$
- ◆ **Active Detector:**
  - dimensions:  
 $658 \times 658 \times 163.8 \text{ mm}^2$
  - weight: 482 kg
  - 10 Scifi planes/Superlayer
  - Total Rad Length:  $16.5 X_0$

# AMS-02 Electromagnetic Calorimeter

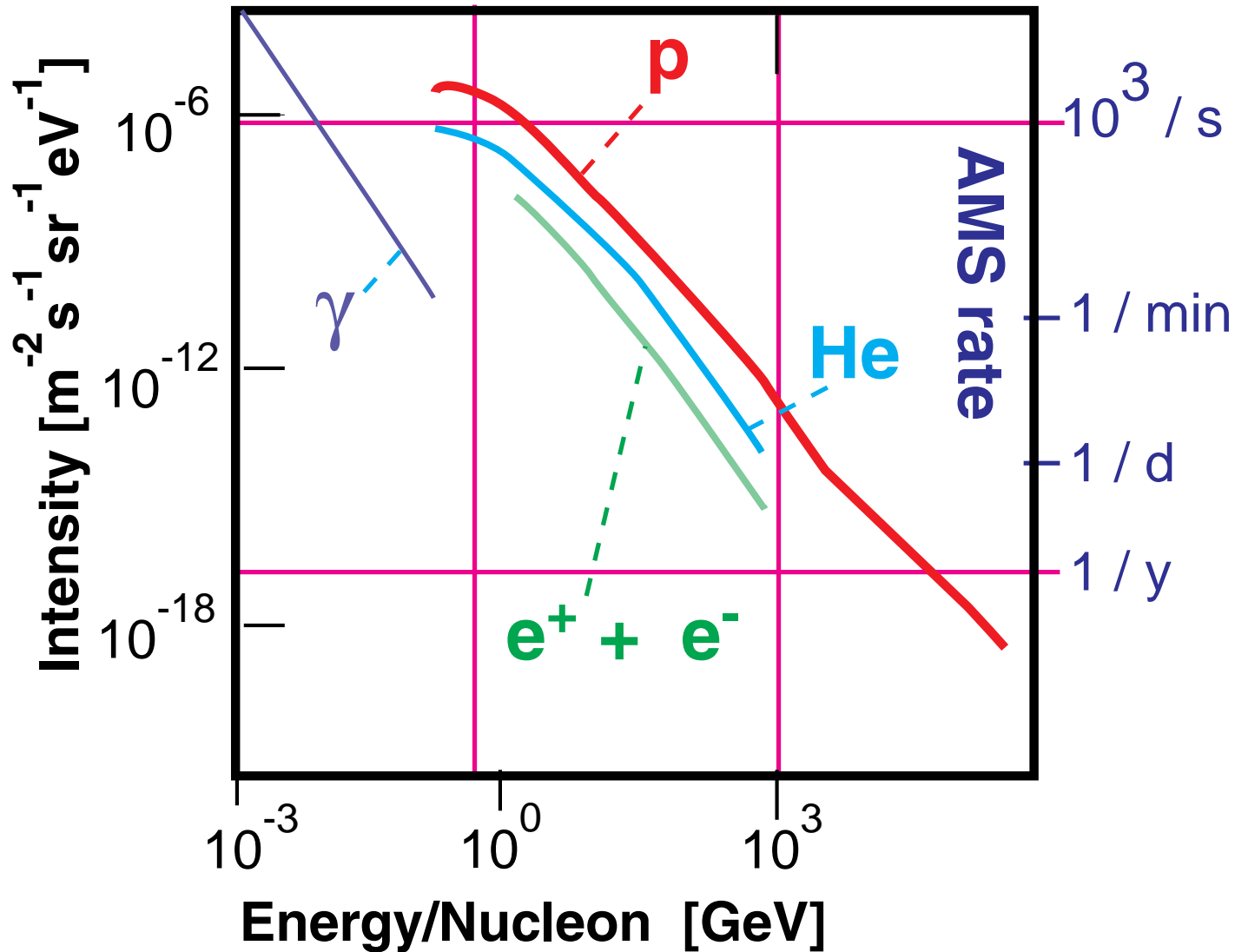
ECAL Mechanical Structure After Assembly with PMT



QZYK04ECAL

Designed by	Tai Cheng	24/01/00	Ecal Structure with PMT	File No.	CA-00-0
Checked by	C Wang	31/08/00		Scale	1:5
Reviewed by	H. Zhuang	03/02/00			
Approved by	<b>IHEP, Beijing</b>				AMS-02

# Cosmic Particle Spectrum



## AMS02 - Acquisizione dati

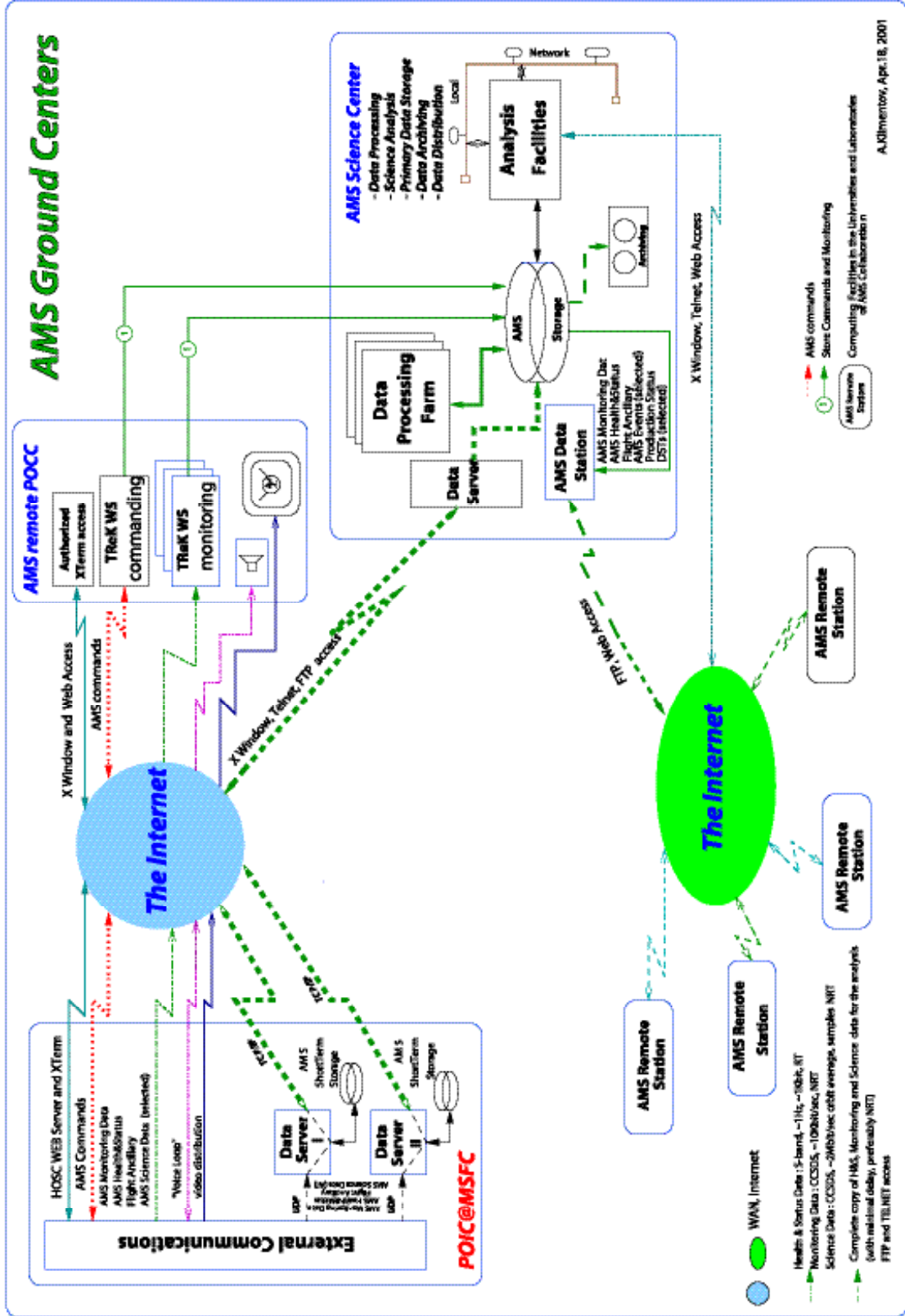
### # canali/ rivelatore

★ Tracker	196600
★ TOF + ACC	384
★ RICH	33800
★ TRD	6200
★ ECAL	2600

⌘ Dimensione evento	5 Mbit
⌘ Trigger rate	200-2000 Hz
⌘ Raw Data rate	1-10 Gbit/s
⌘ Reduced Data rate	<2 Mbit/s>



# AMS Ground Centers



# AMS / ISS

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L'attività del gruppo di Roma

## AMS Roma

- ⌘ Alessandro Agneni Dip. Ingegneria Aerospaziale
- ⌘ Stefania Baccaro ENEA/Casaccia
- ⌘ Alessandro Bartoloni INFN Roma 1
- ⌘ Bruno Borgia Dip. Fisica
- ⌘ Carlo Bosio INFN Roma 1
- ⌘ Corrado Gargiulo INFN Roma 1
- ⌘ Simonetta Gentile Dip. Fisica
- ⌘ Giovanni Laneve Dip. Ingegneria Aerospaziale
- ⌘ Marco Montecchi ENEA/Casaccia
- ⌘ Giovanni Vittorio Pallottino Dip. Fisica
- ⌘ Antonio Paolozzi Dip. Ingegneria Aerospaziale
- ⌘ Piero Rapagnani Dip. Fisica
- ⌘ Corinne Rossi Dip. Fisica
- ⌘ Enzo Valente INFN Roma 1
- ⌘ M.Di Ruscio, U.Ponzi, C. Olivieri Centro Progetto S.Marco

## AMS Roma

- ⌘ **Elettronica di controllo sistema gas del TRD**
  - ❖ progettazione ed ingegnerizzazione elettronica
  - ❖ qualificazione dei componenti per radiazione
  - ❖ qualificazione moduli termo-vuoto, vibrazione
  - ❖ produzione sistema di controllo
- ⌘ **Meccanica sistema gas del TRD**
  - ❖ calcolo strutturale box S
- ⌘ **Test sul fascio del TRD completo di controlli**
- ⌘ **Calcolo**
  - ❖ *sviluppo del sistema di data storage e computer farm*
  - ❖ *simulazione montecarlo eventi nel TRD*
  - ❖ *simulazione eventi*
- ⌘ **Analisi dei dati**