

AMS-Pisa Preventivi 2016

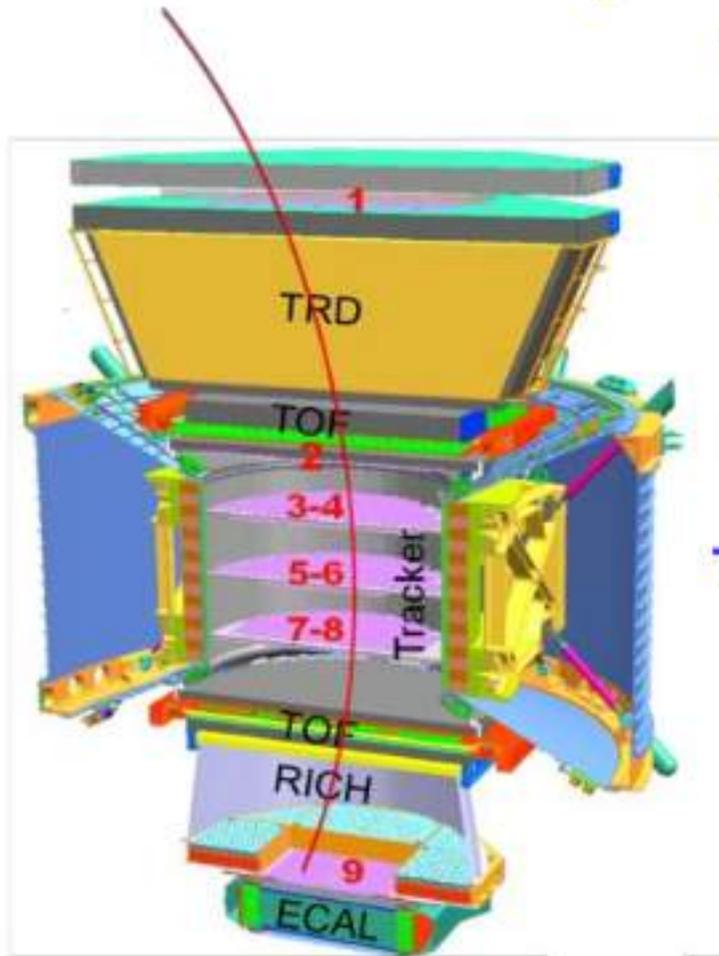
M. Incagli -10 luglio 2015

AMS02 highlights

- Presa dati iniziata 19 maggio 2011 (dati utilizzabili a partire da 1 luglio 2011)
- analisi presentate agli AMS days basate sui dati raccolti fino a settembre 2014 (~40 mesi di dati)
- pubblicati risultati su:
 - frazione di positroni
 - flusso di elettroni e positroni
 - flusso di protoni
- presentati risultati su:
 - flusso di elio
 - rapporto antiprotoni/protoni
 - nuclei leggeri (Li, B, C)

rivelazione e^\pm : ruolo di ECAL

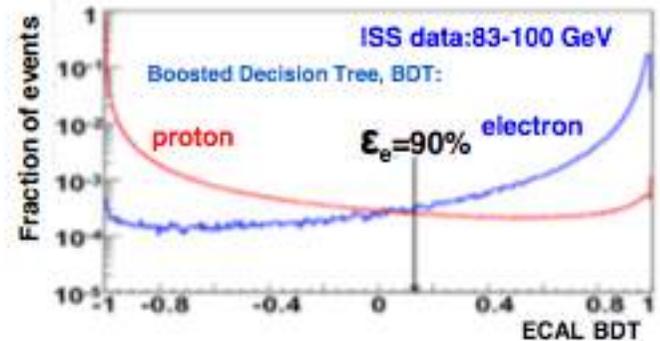
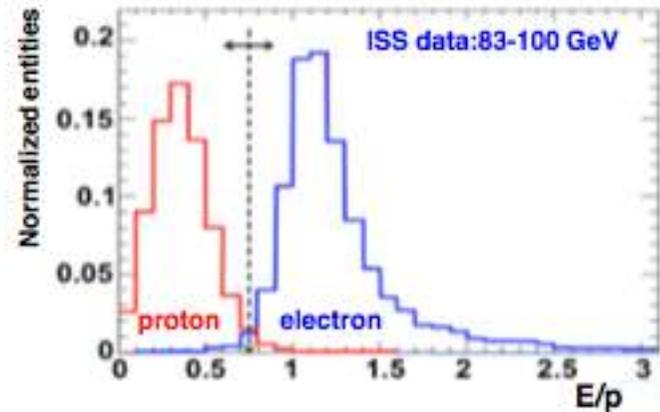
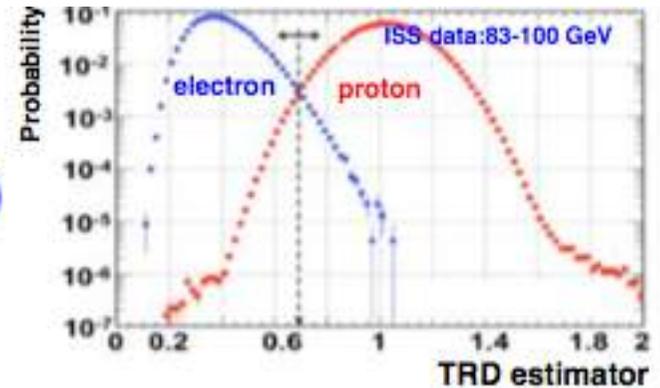
Measuring electrons and positrons



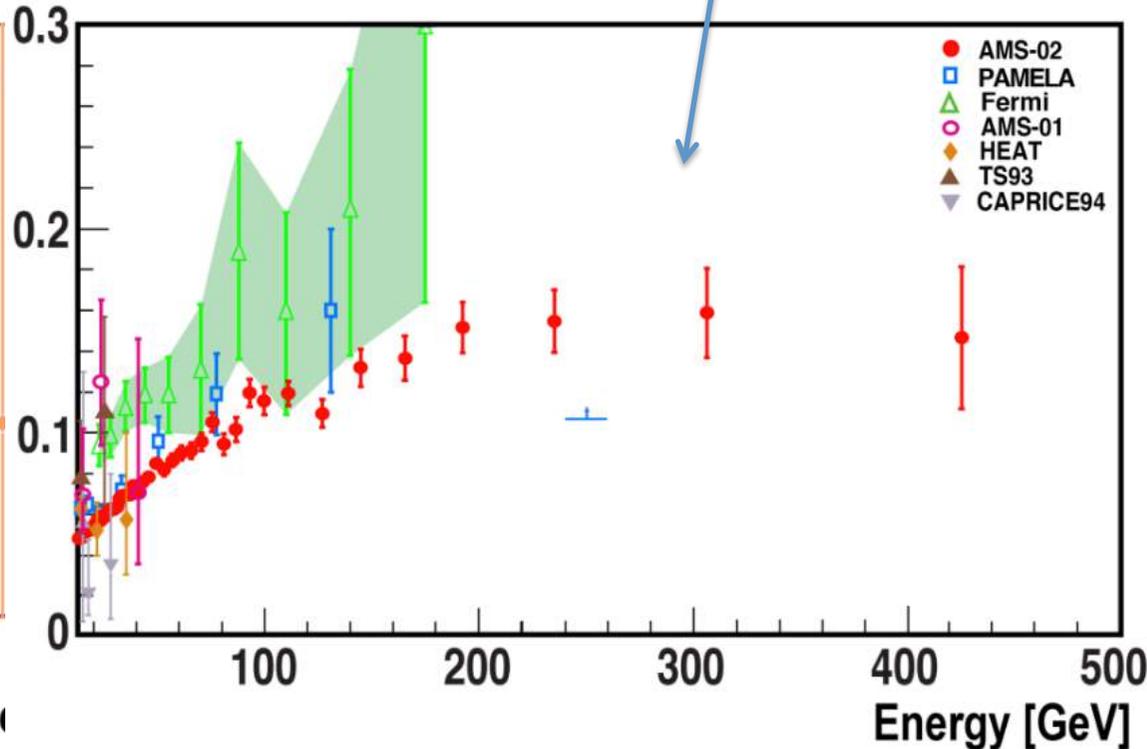
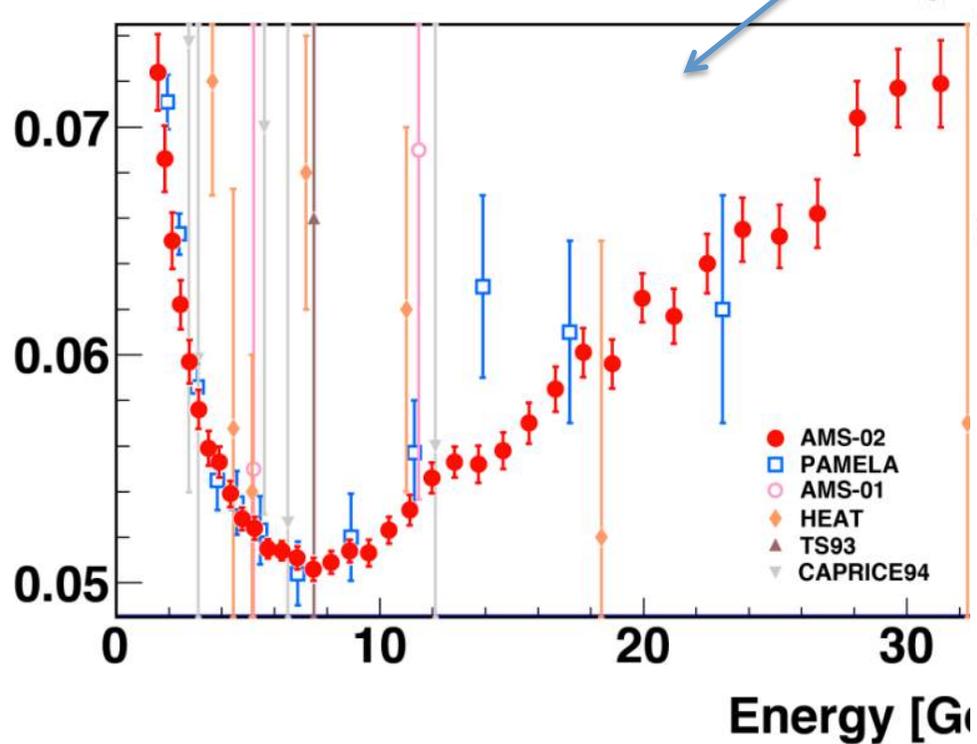
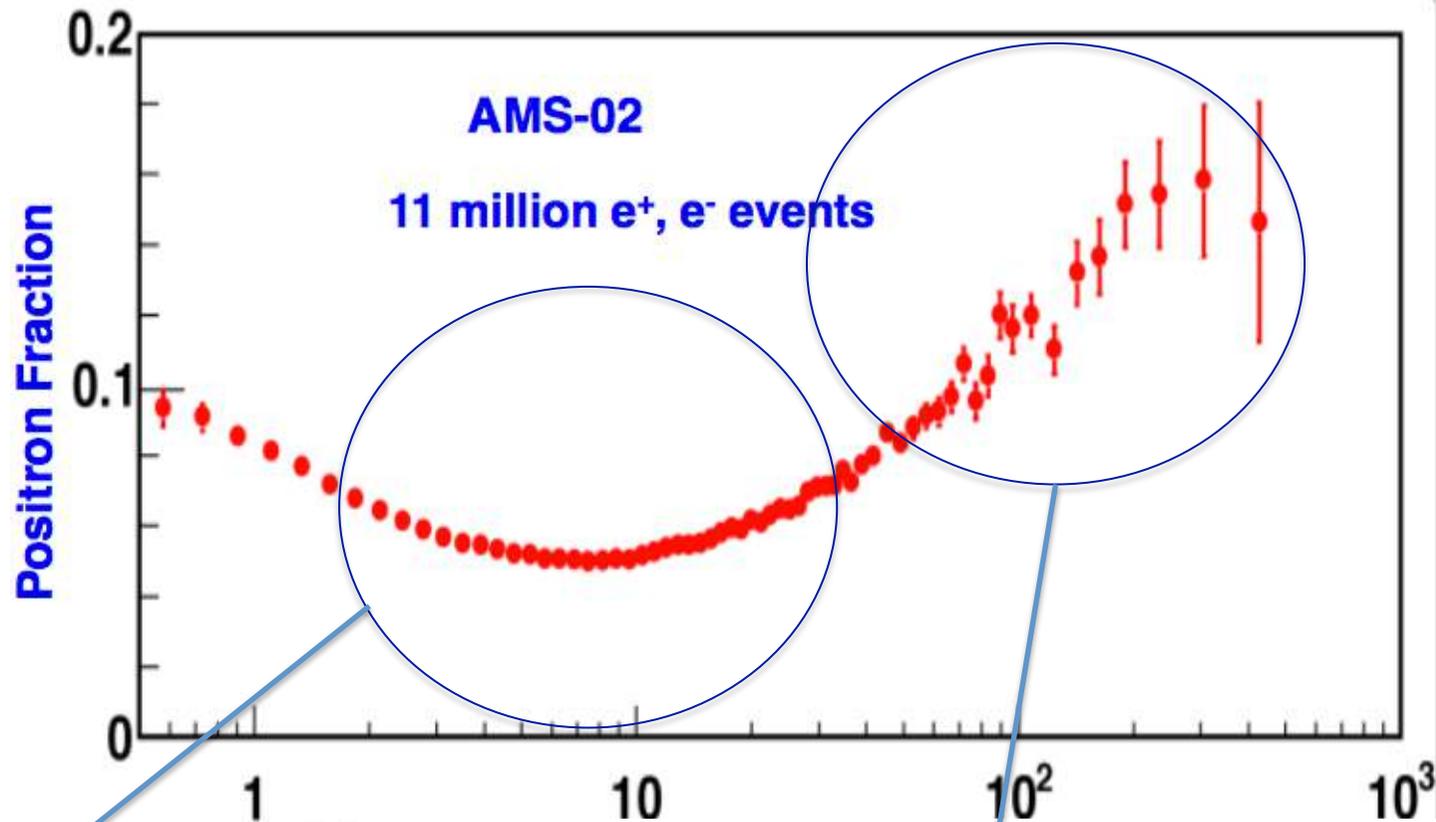
TRD
(transition radiation)
to identify e^\pm

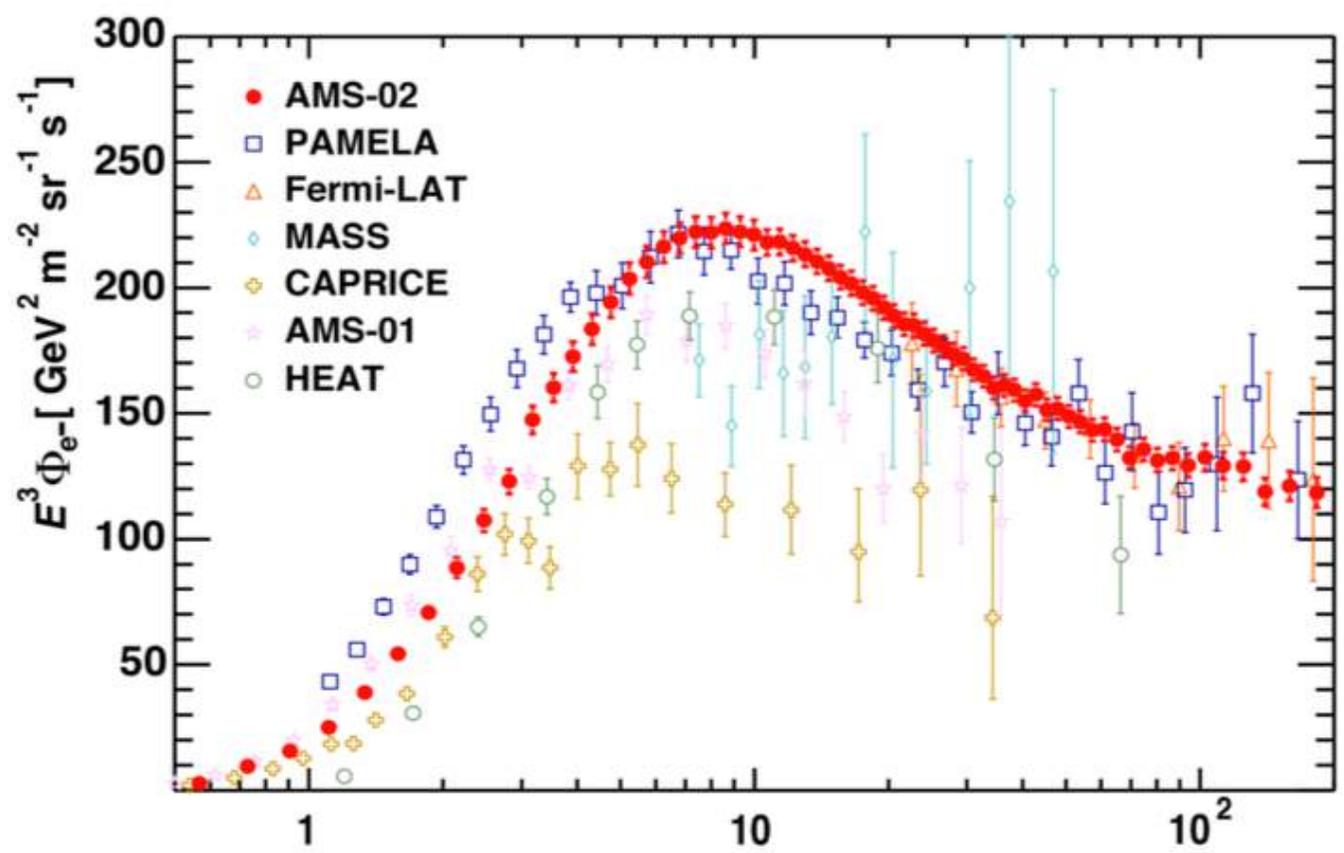
ECAL measures E
Tracker measures p
 e^\pm : $E=p$
proton: $E < p$

ECAL
(shower shape)
to separate e^\pm
from protons

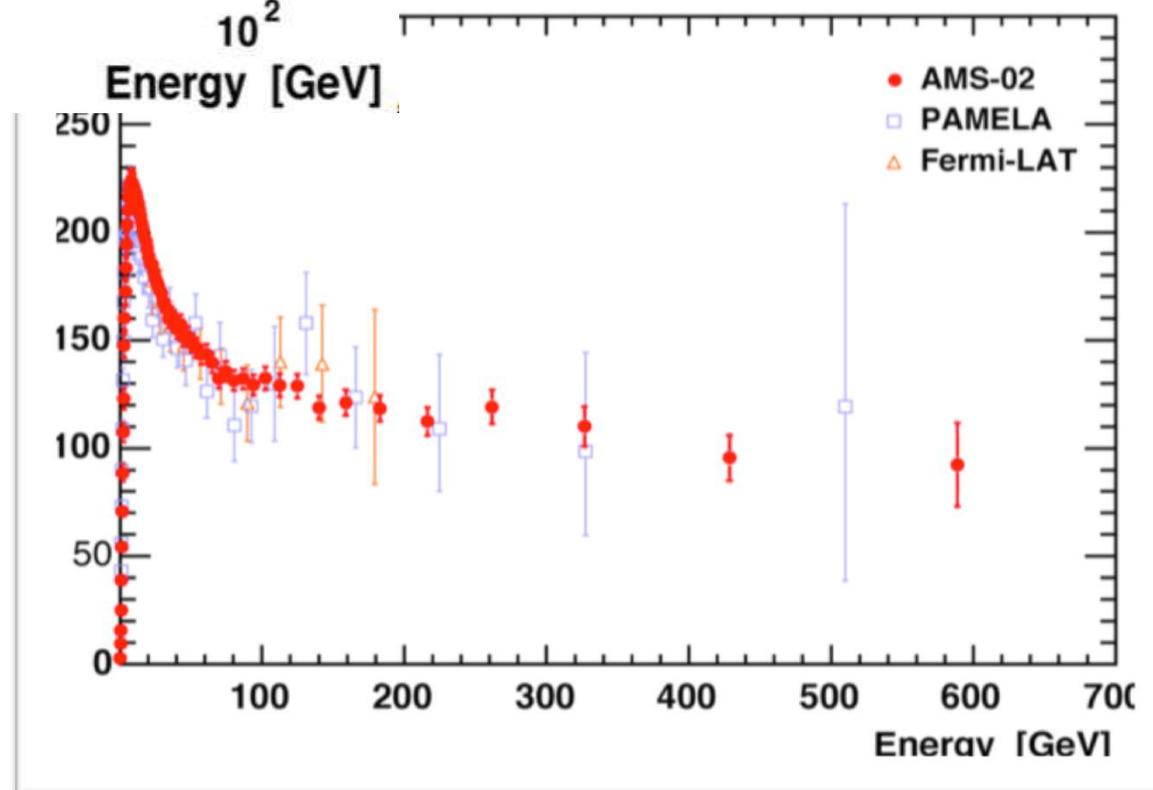


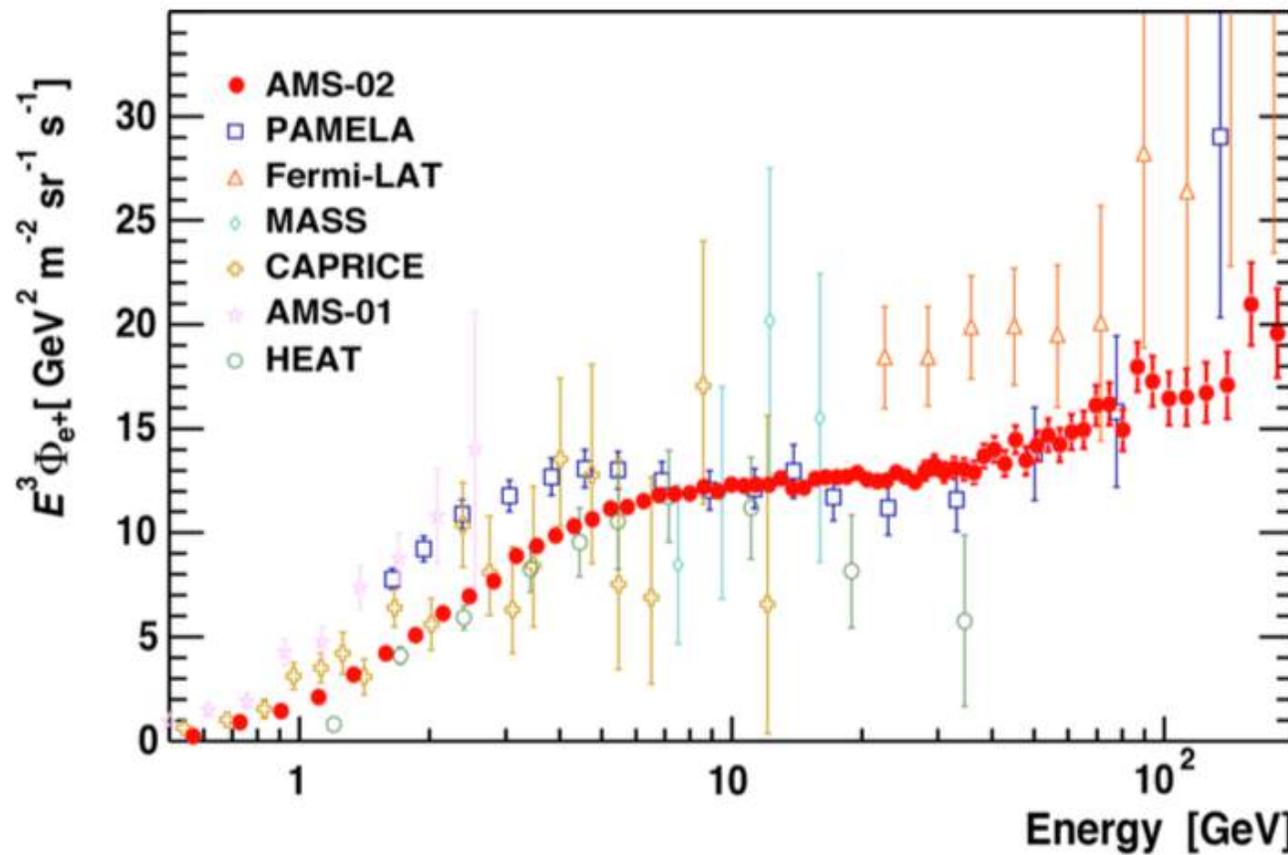
positron
fraction



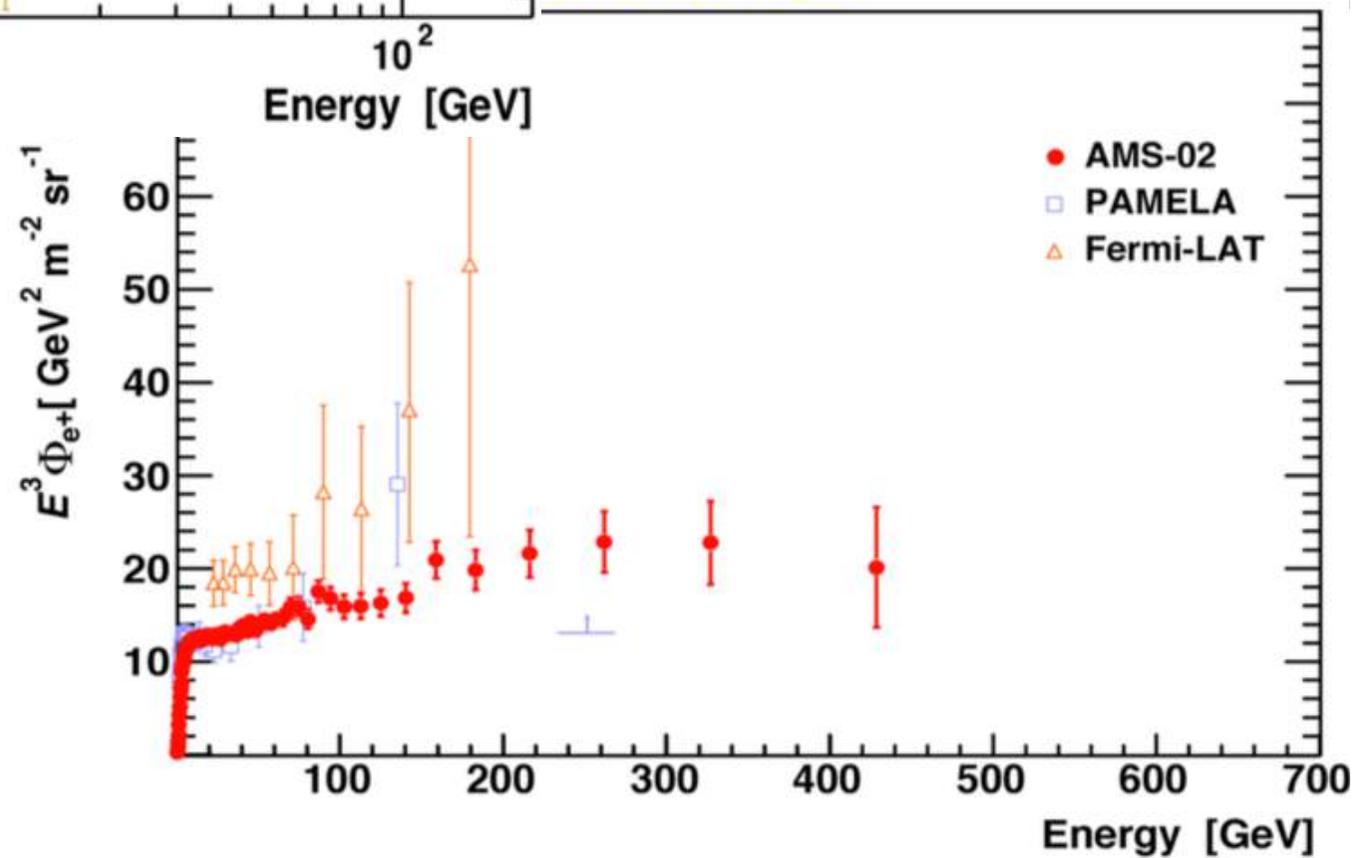


flusso di
elettroni

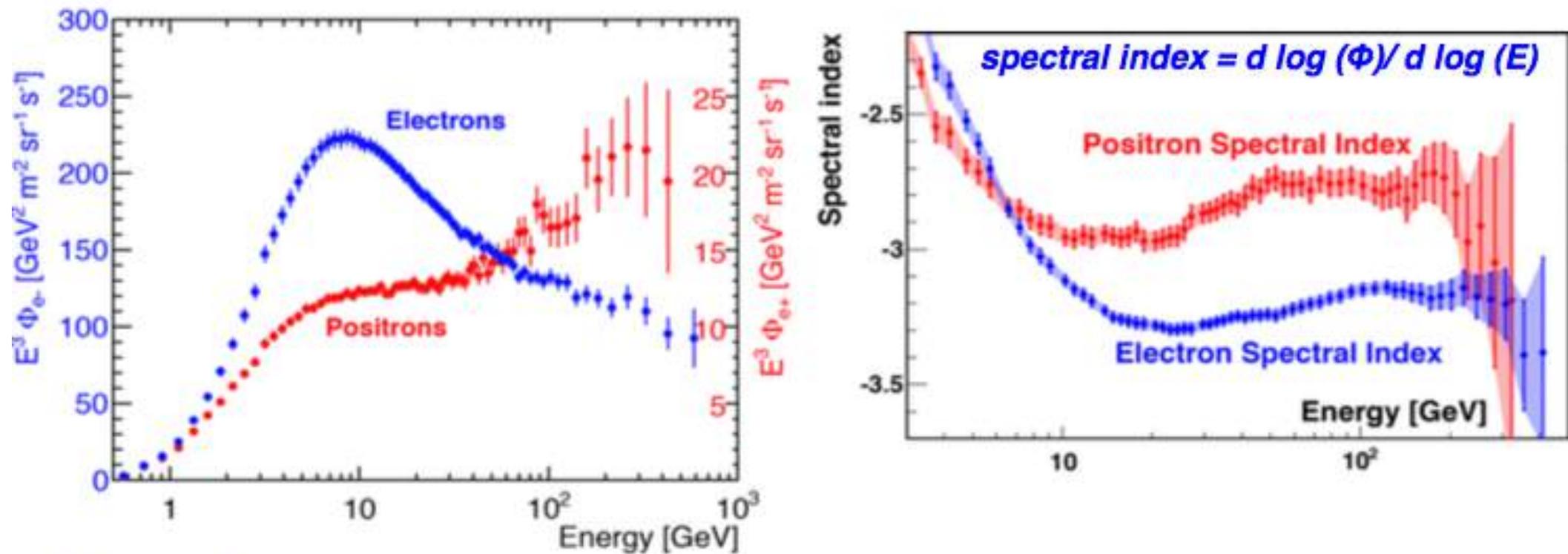




flusso di
positroni



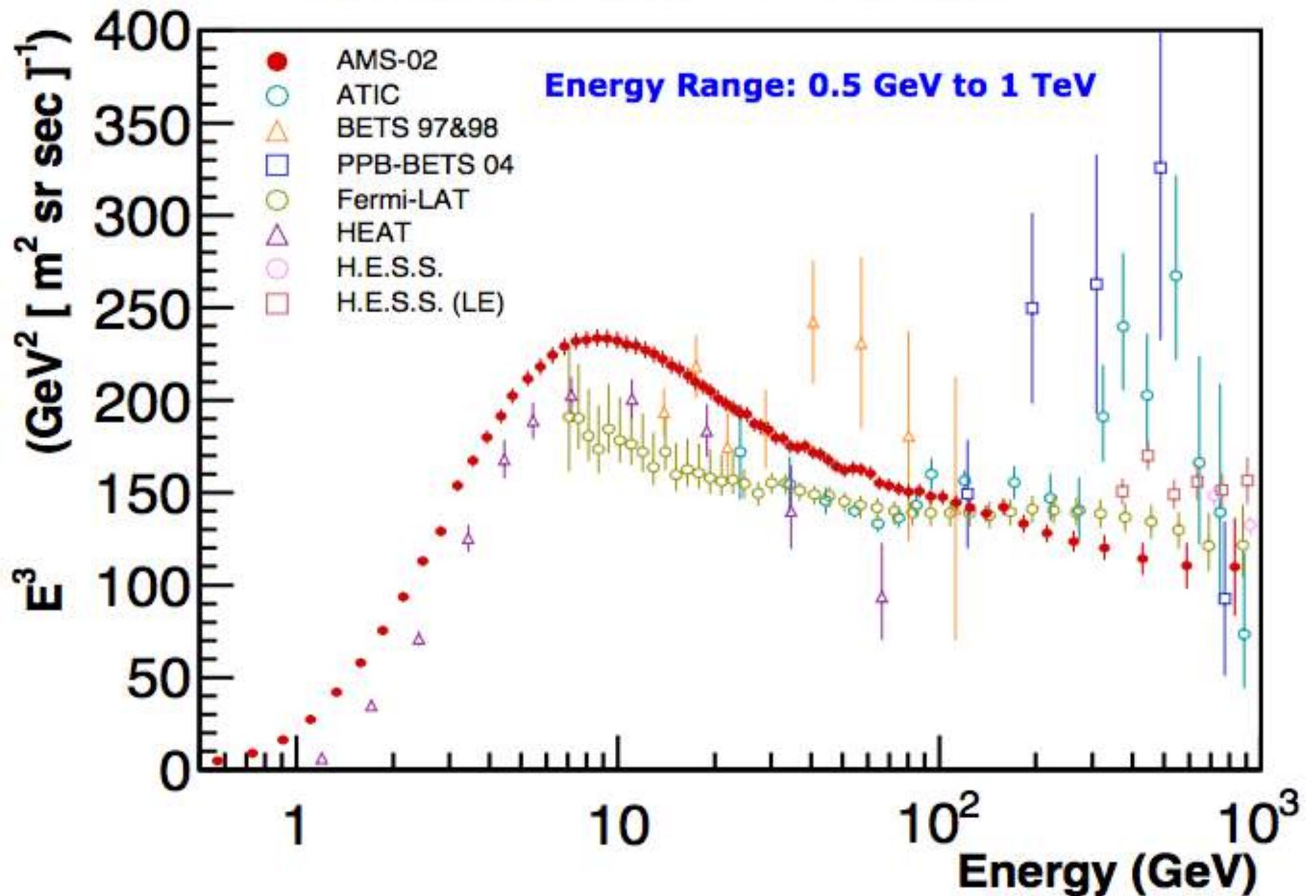
The Electron Flux and the Positron Flux



Observations:

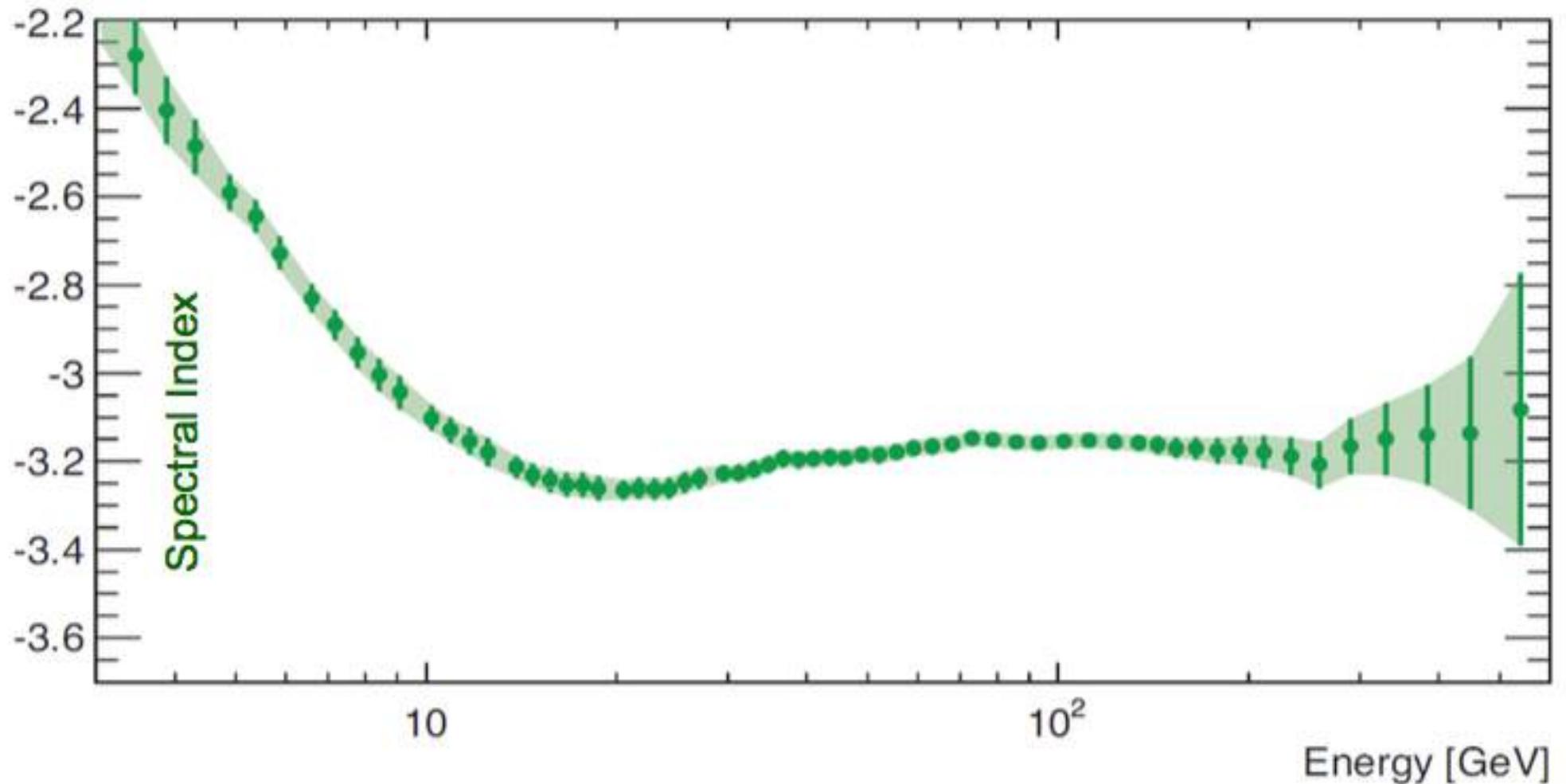
1. The electron flux and the positron flux are different in their magnitude and energy dependence.
2. Both spectra cannot be described by single power laws.
3. The spectral indices of electrons and positrons are different.
4. Both change their behavior at $\sim 30\text{GeV}$.
5. The rise in the positron fraction from 20 GeV is due to an excess of positrons, not the loss of electrons (the positron flux is harder).

AMS Results: ($e^+ + e^-$) flux

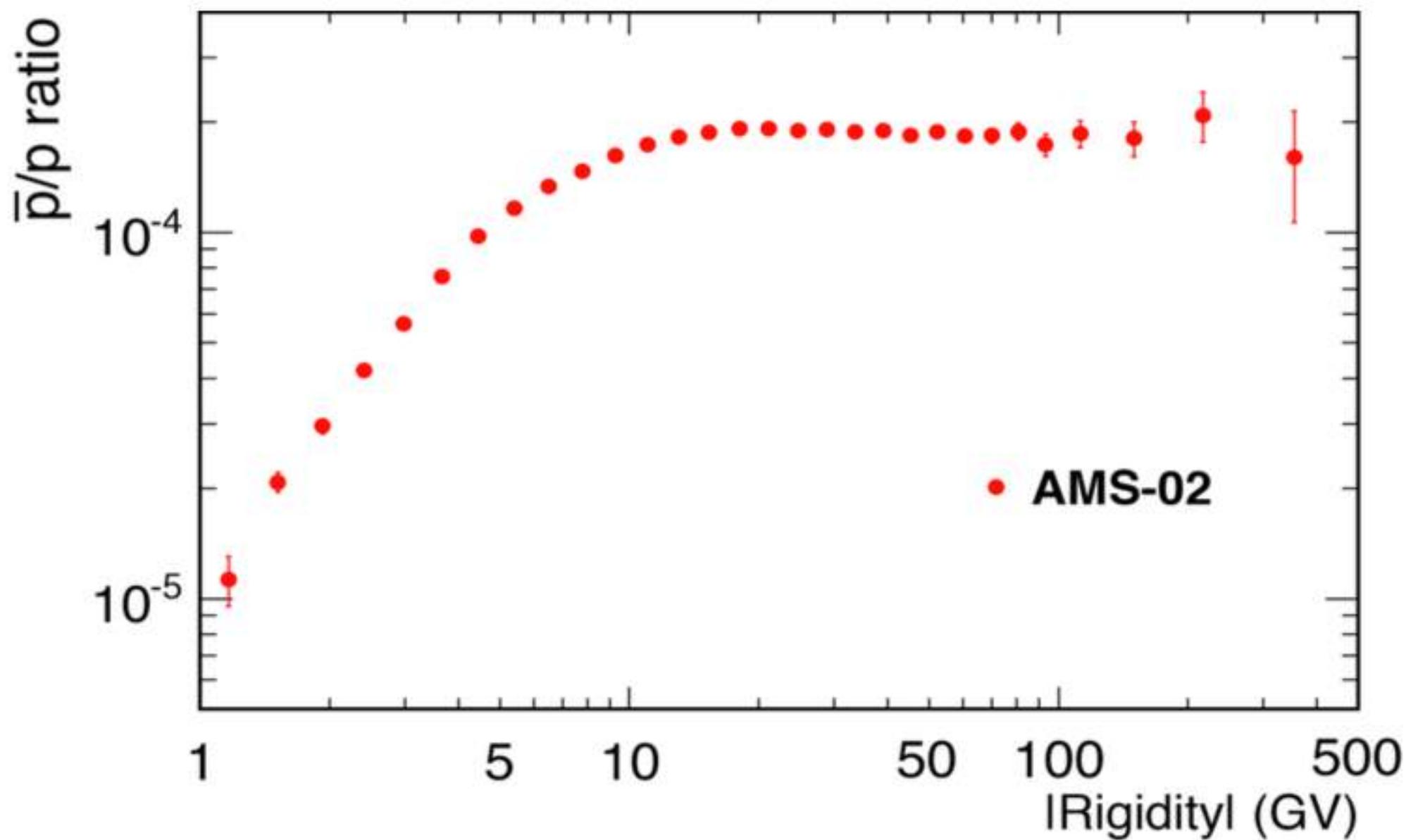


L'indice spettrale della somma $e^+e^- e'$ ~piatto sopra 30 GeV, a differenza degli spettri singoli.

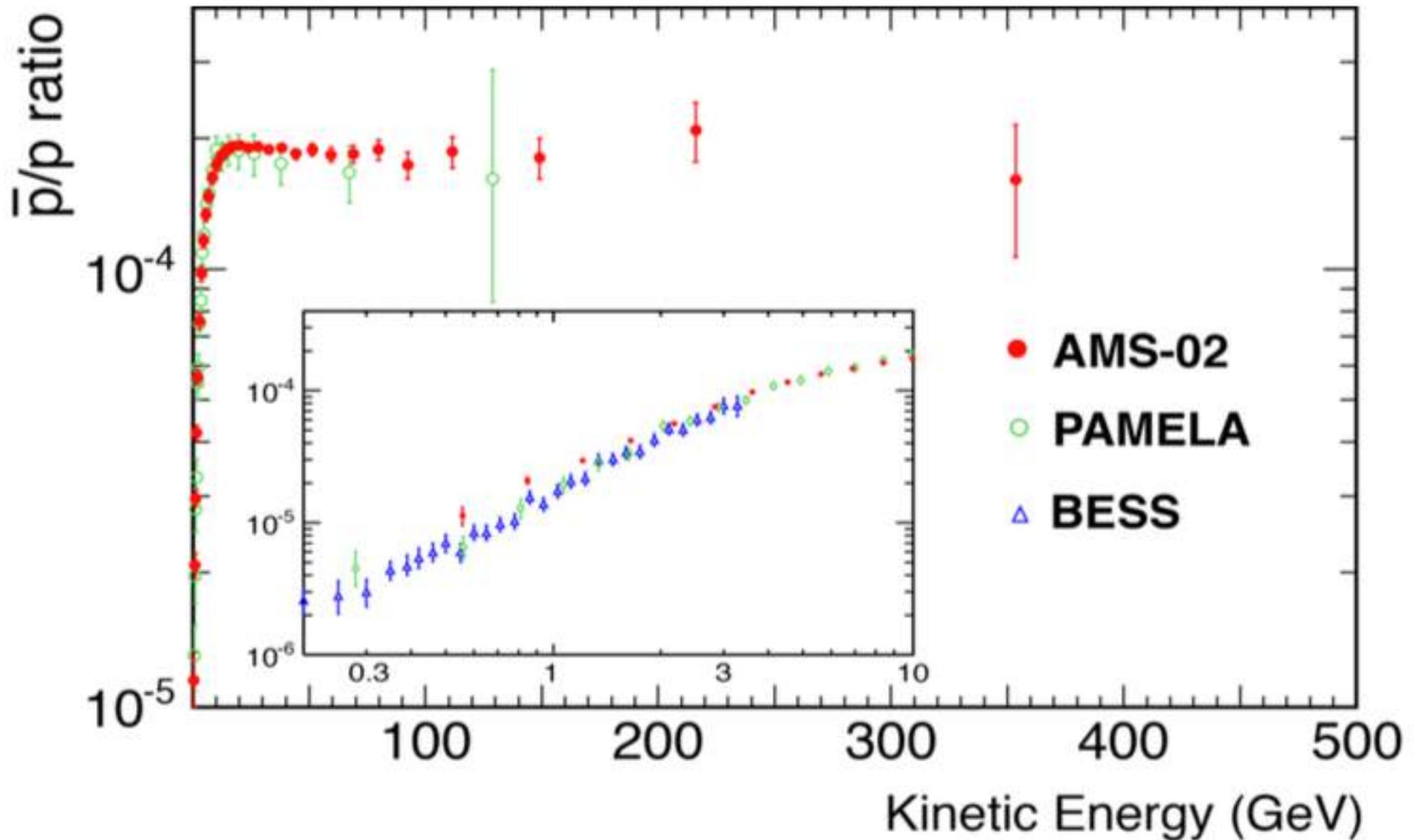
$$\gamma = d \log (\Phi) / d \log (E)$$



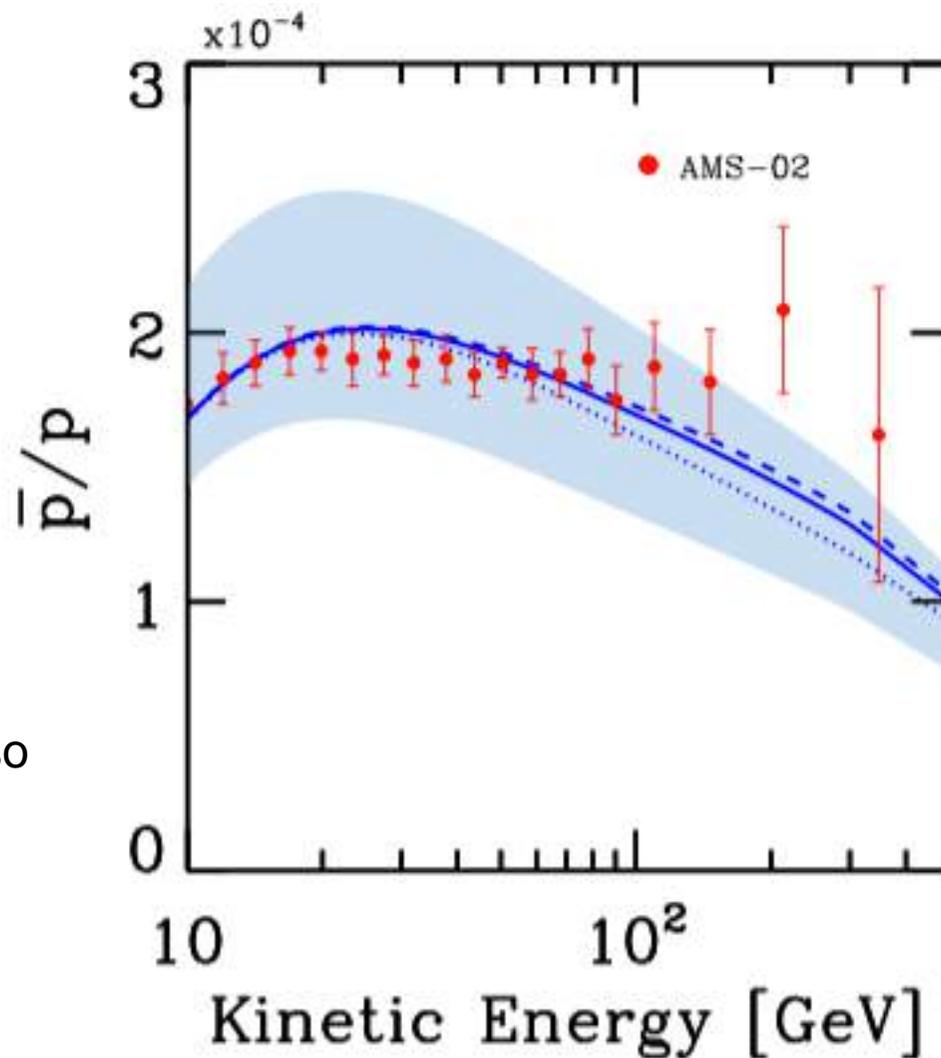
AMS \bar{p}/p results



AMS \bar{p}/p results



Interpretazioni?



arXiv:1504.05175v2

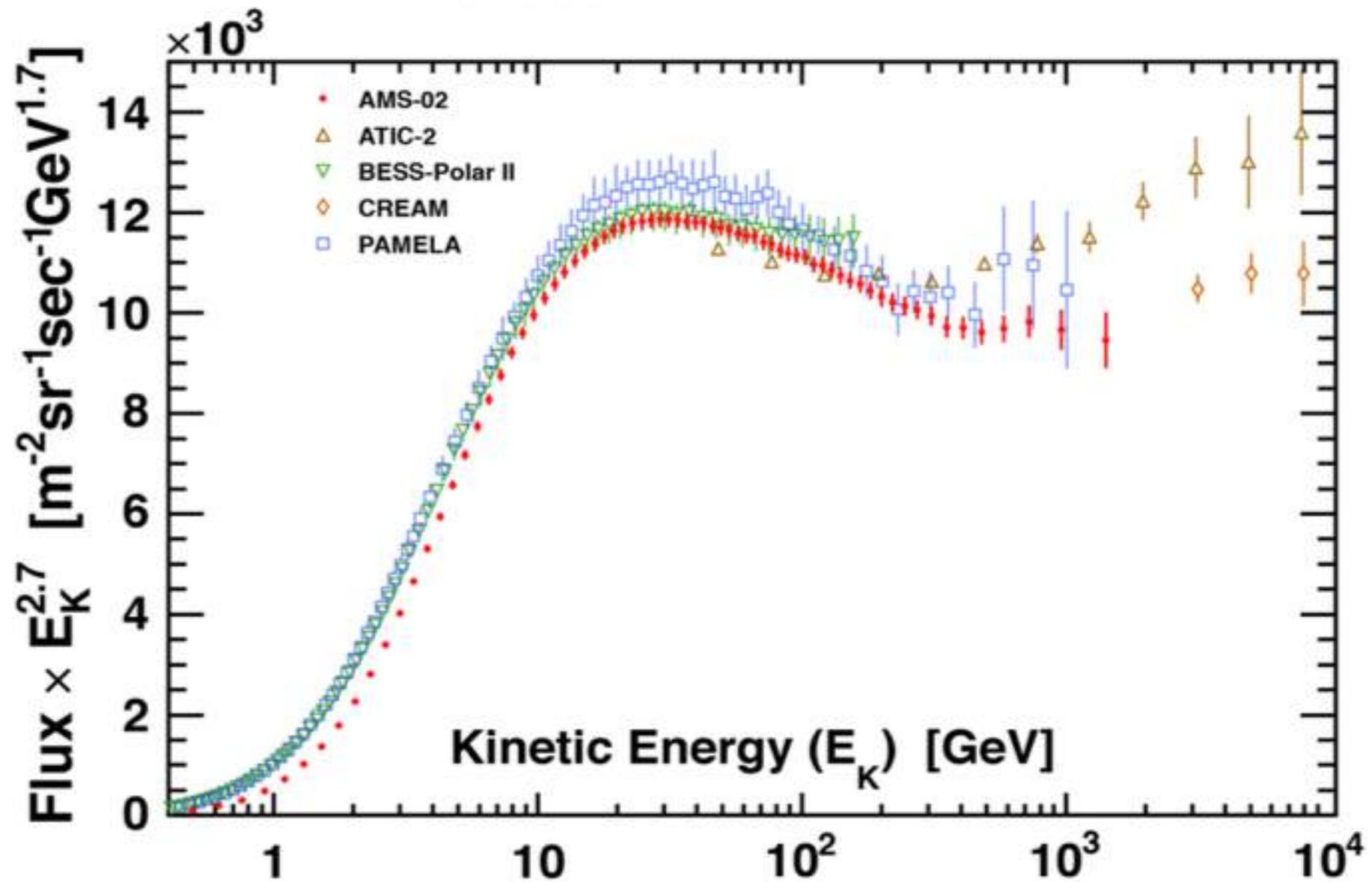
Evoli, Gaggero, Grasso

Figure 10. Our reference model compared to AMS-02 preliminary \bar{p}/p data. Blue solid line: the \bar{p}/p spectrum computed with the fiducial cross sections from [14], with the optimal hardening in the proton and helium injection spectra. Dotted and dashed lines: the \bar{p}/p spectrum computed with the minimal and maximal hardening in the proton spectrum as in Fig. 8. The blue band reports the uncertainty associated to the production cross sections.

Interpretazioni?

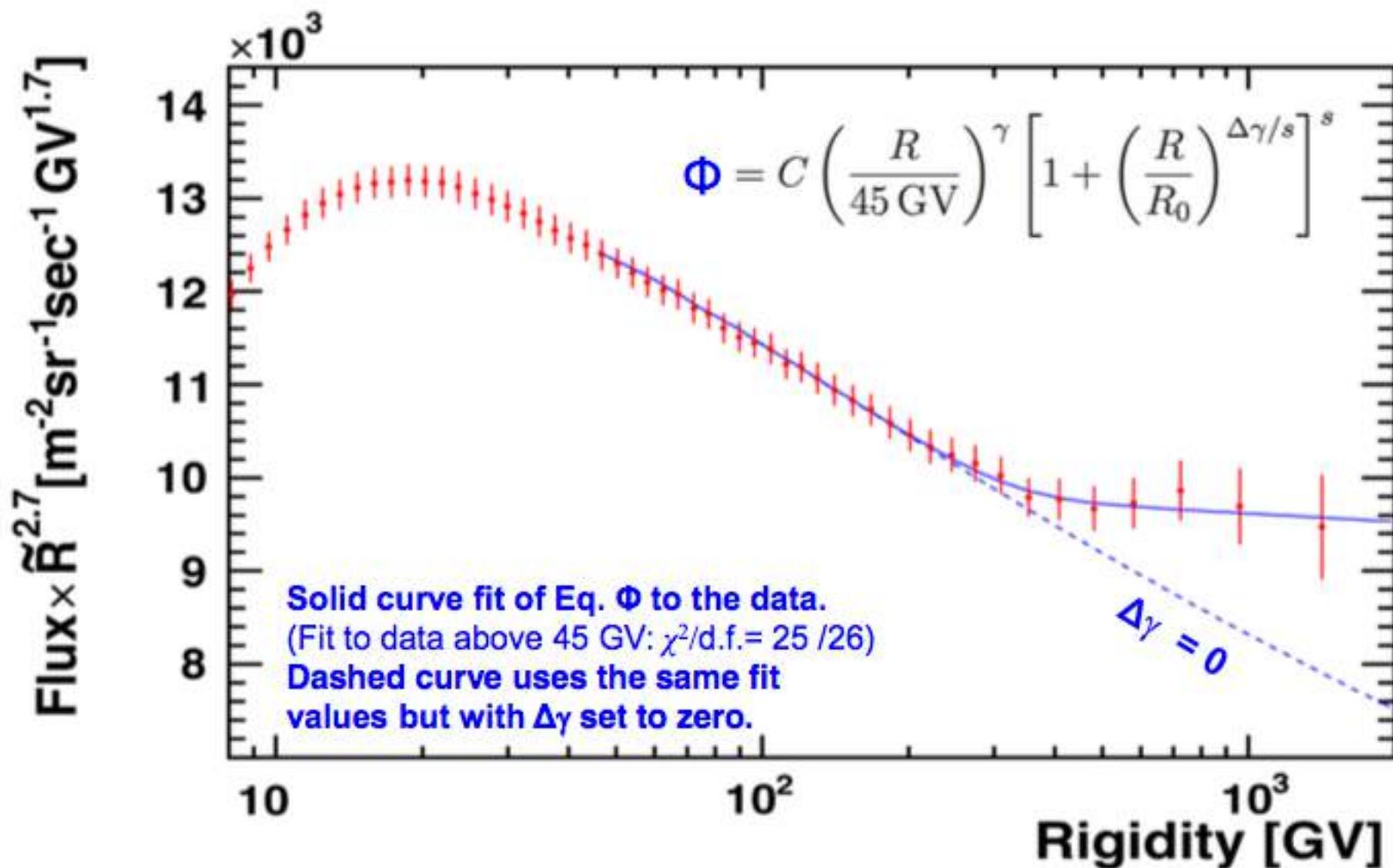
- Per interpretare i risultati e' fondamentale misurare non solamente la zona dove si spera di trovare un eventuale segnale di materia oscura, ma anche la radiazione cosmica "standard" che ne costituisce il fondo
- AMS permette di misurare contemporaneamente i nuclei primari e secondari per mettere "vincoli" sul background

AMS proton flux

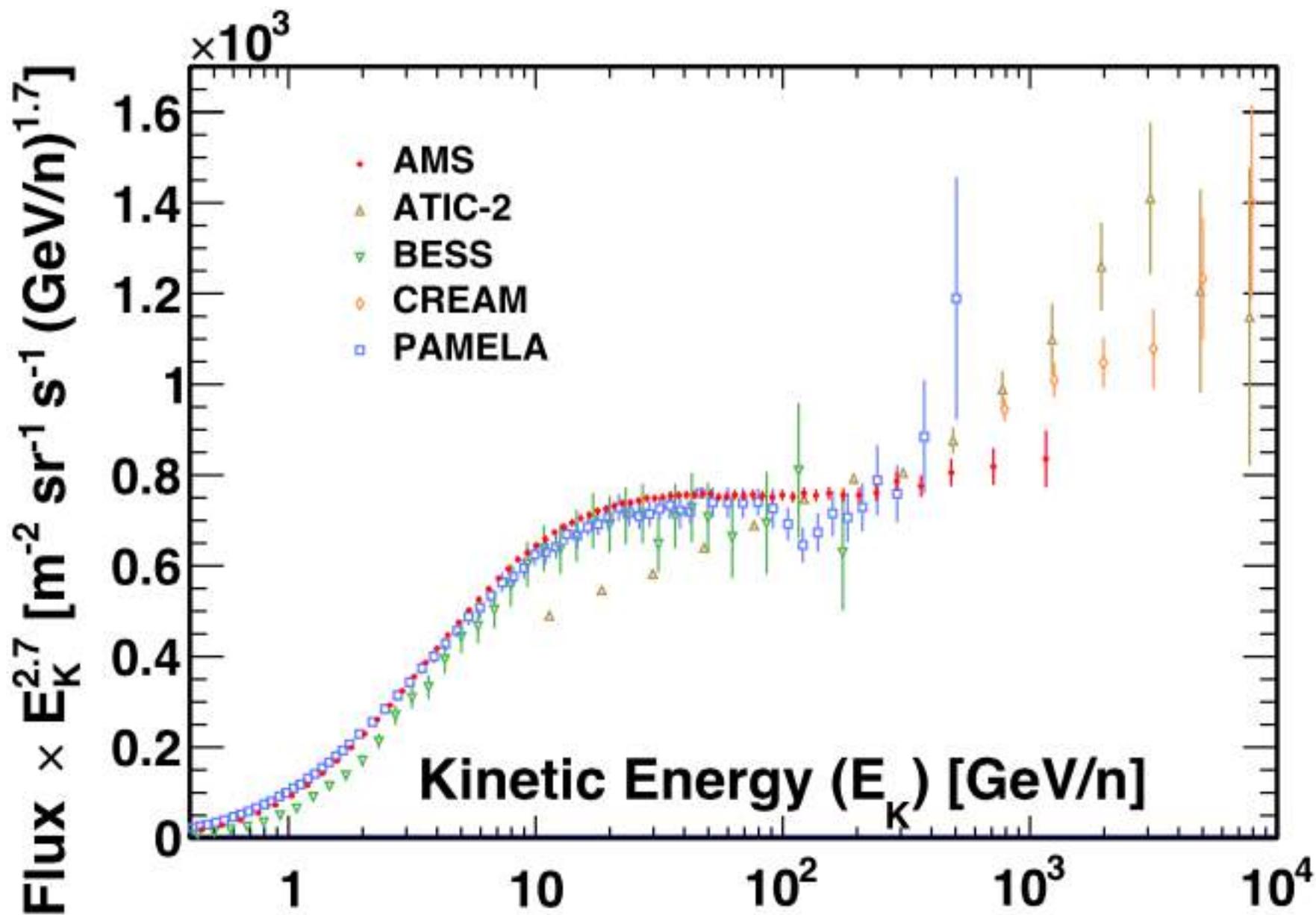


AMS proton flux fit with two power laws:

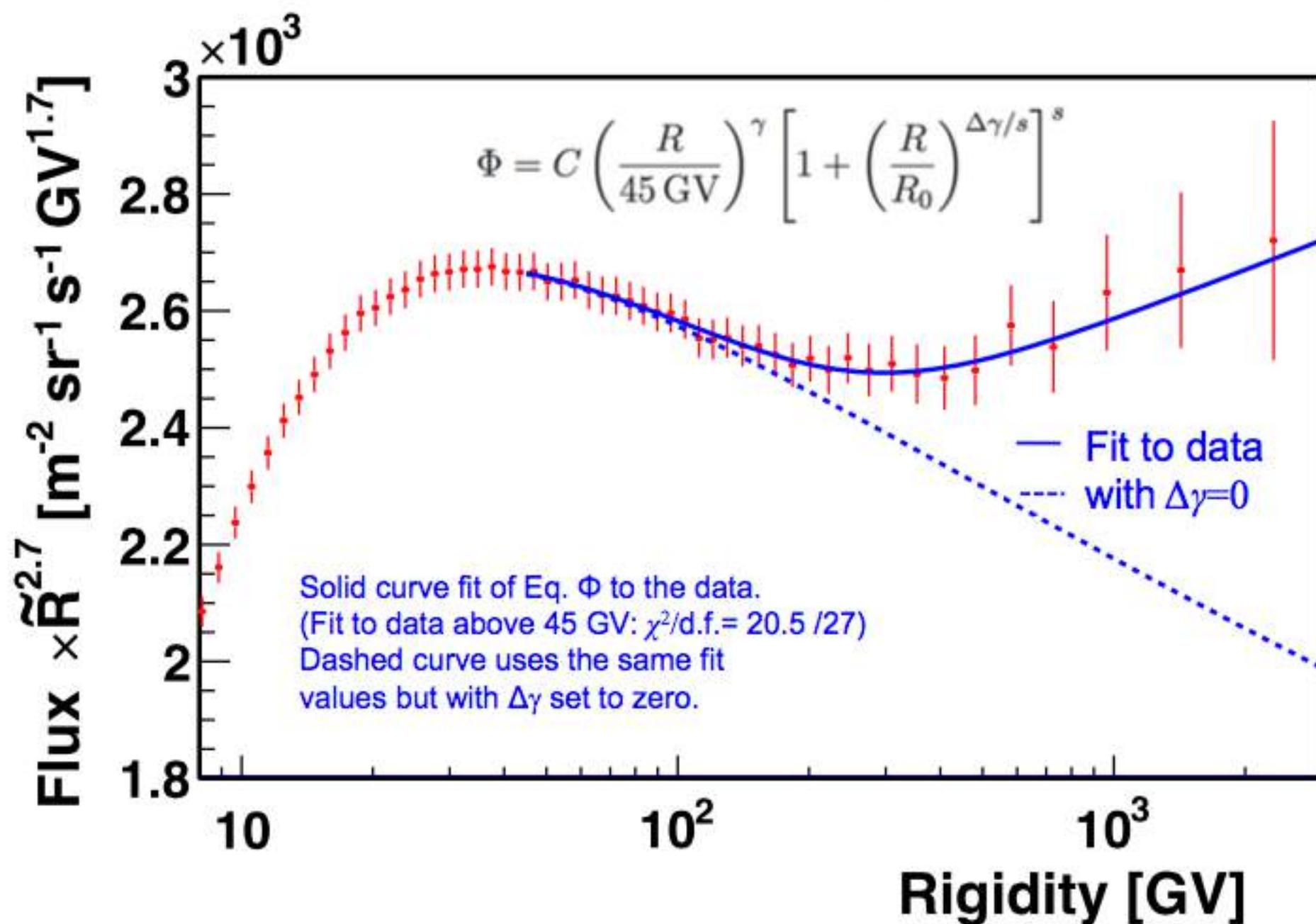
$R^\gamma, R^{\gamma+\Delta\gamma}$ with a characteristic transition rigidity R_0 and smoothness s



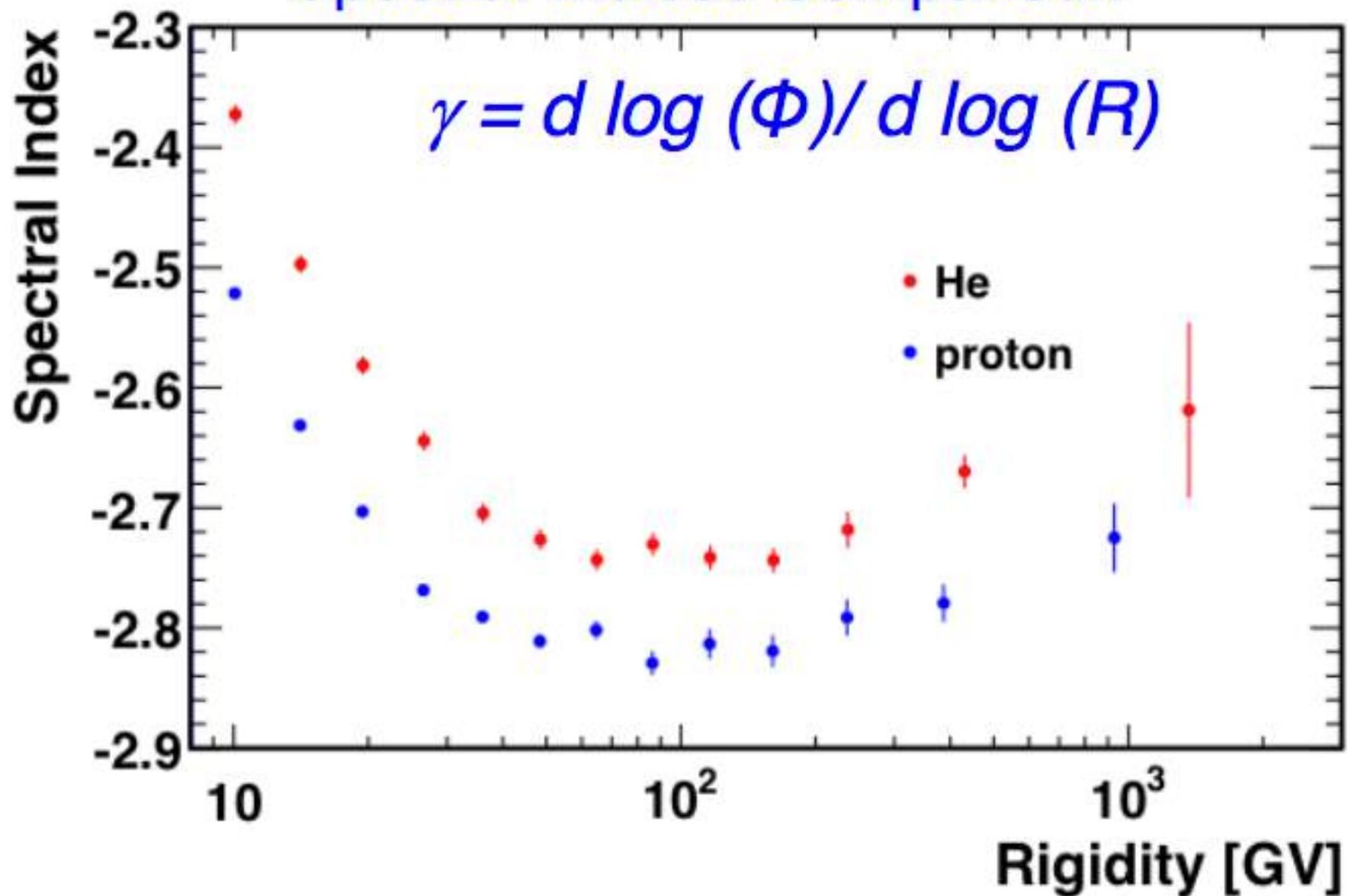
AMS Helium Flux



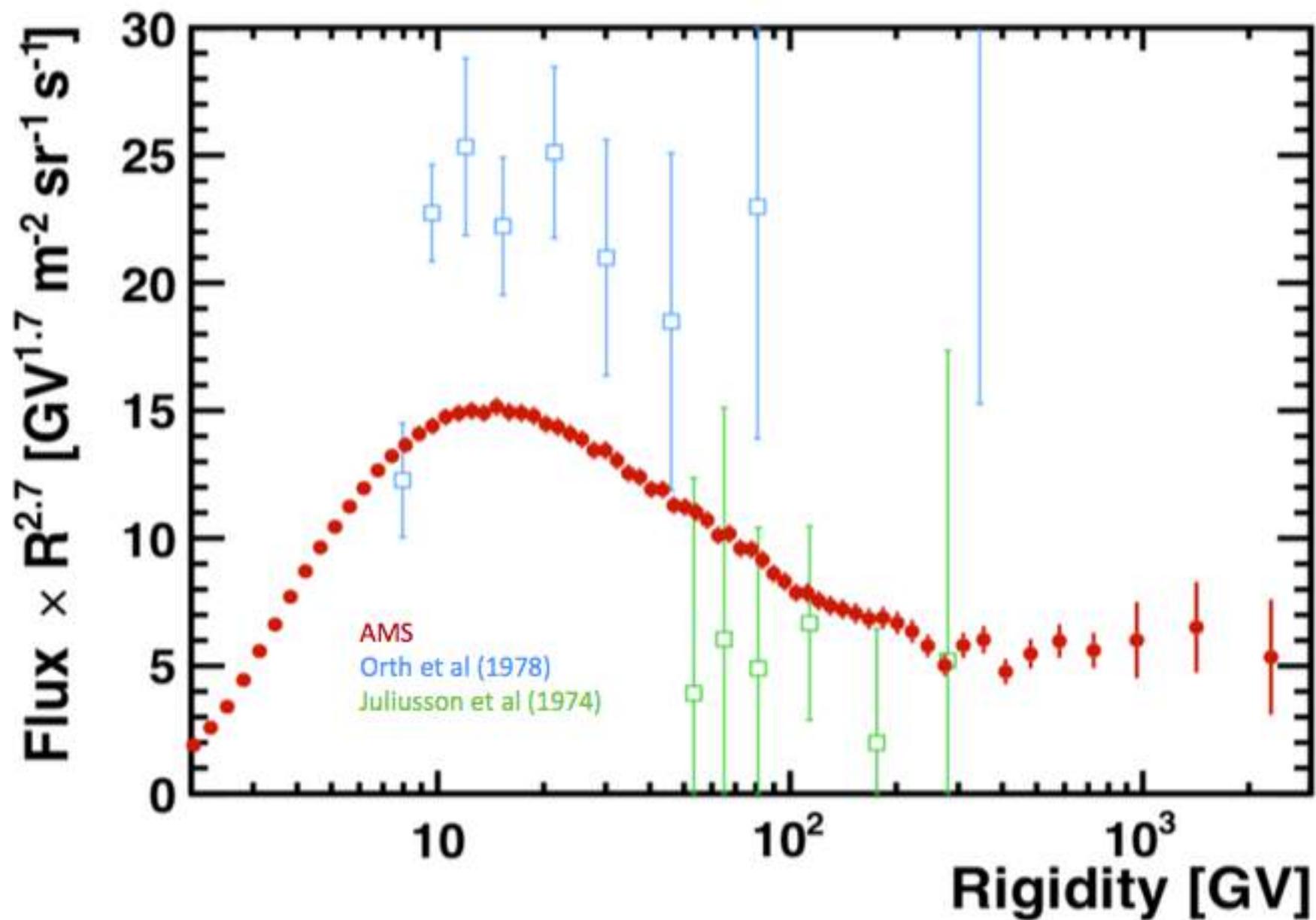
AMS Helium Flux



Model Independent Spectral Indices Comparison

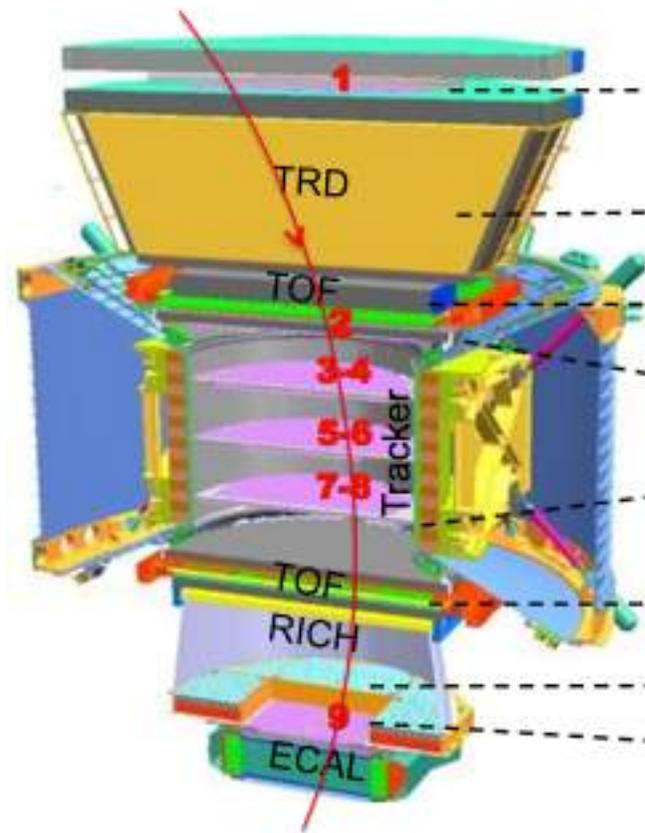


AMS Lithium flux – current status



Measurement of Nuclei with AMS

AMS: Multiple Independent Measurements of the Charge (**IZI**)



Carbon ($Z=6$)

ΔZ (cu)

1. Tracker Plane 1

0.30

2. TRD

0.33

3. Upper TOF (1 counter)

0.16

4. Tracker Planes 2-8

0.12

5. Lower TOF (1 counter)

0.16

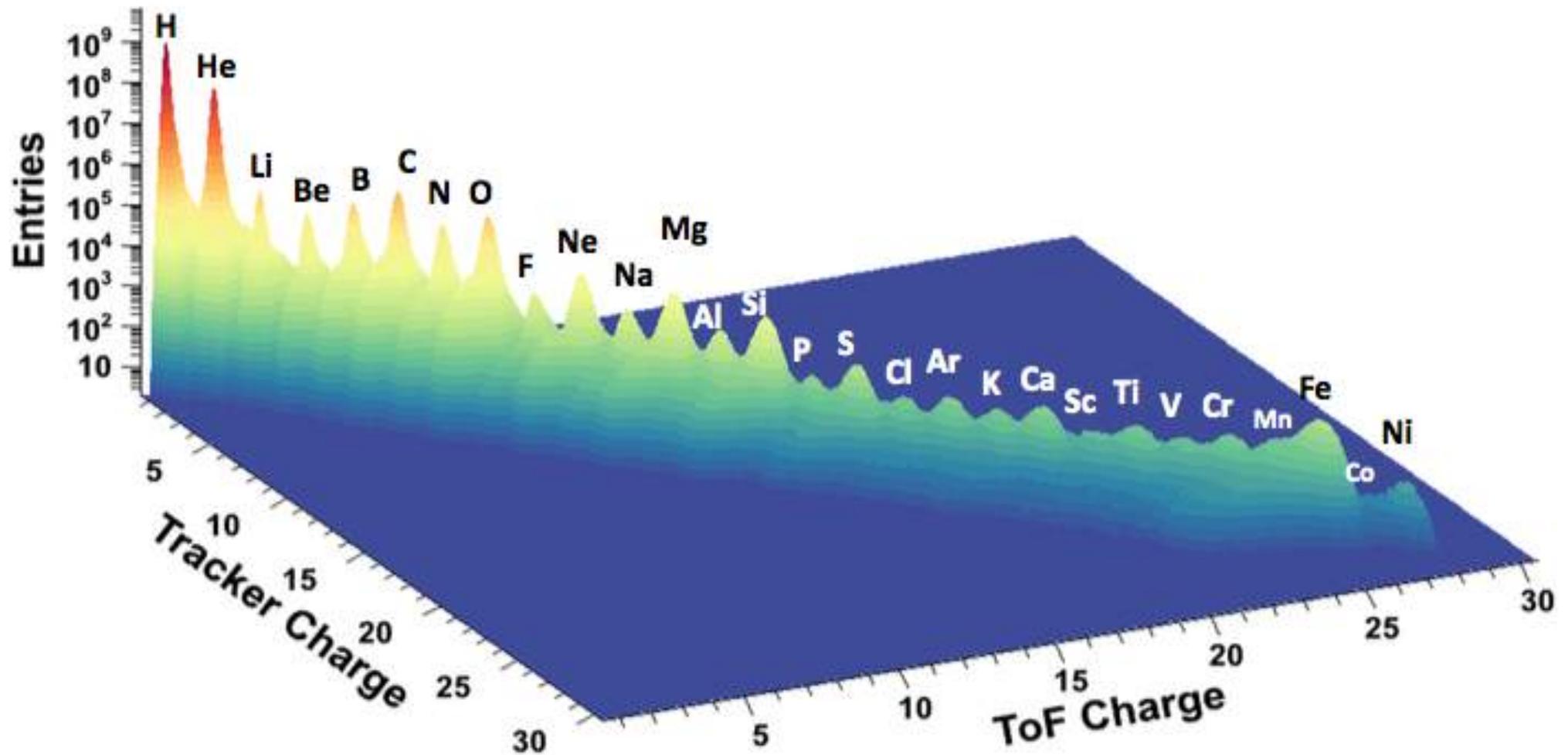
6. RICH

0.32

7. Tracker Plane 9

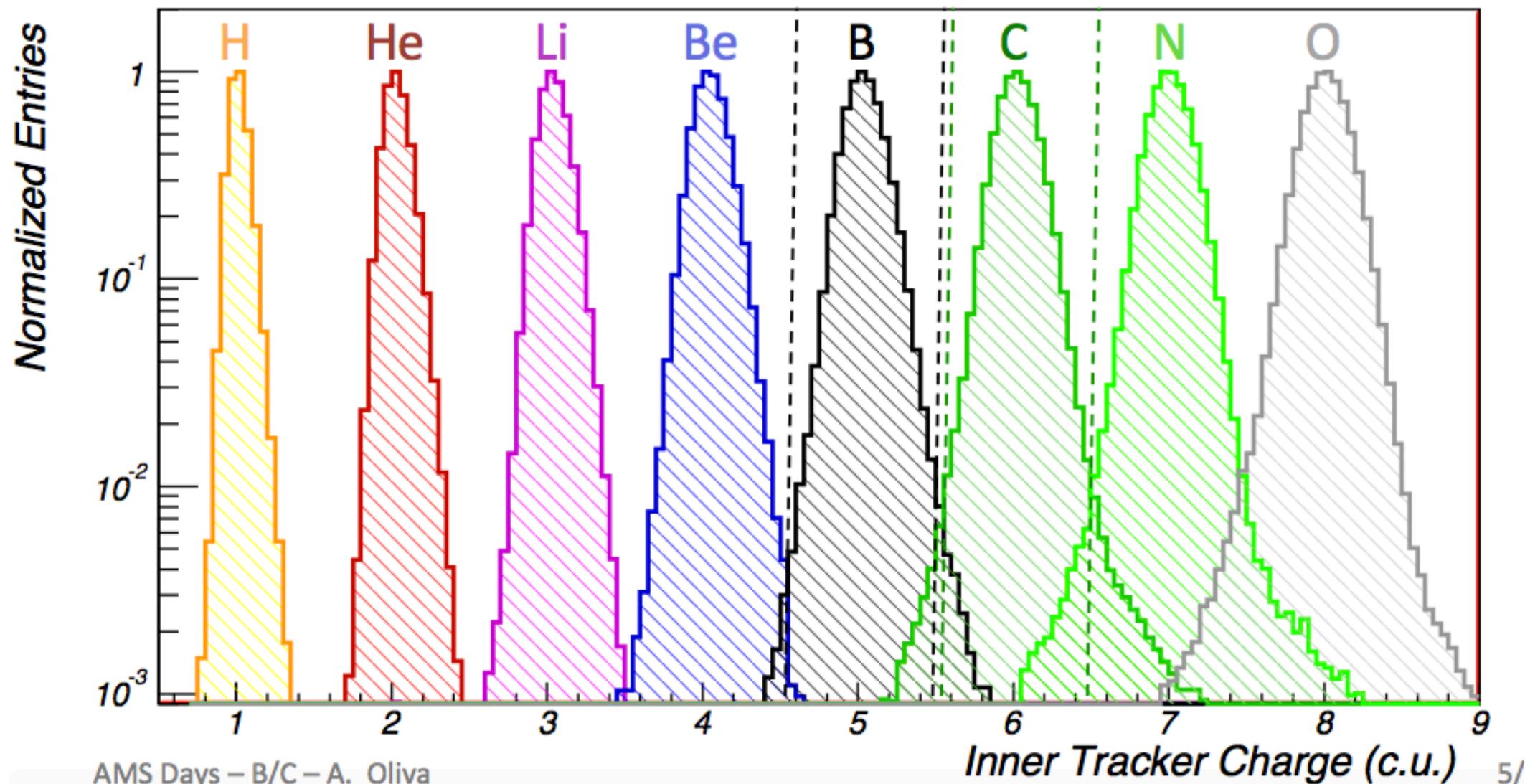
0.30

AMS Nuclei Measurement on ISS

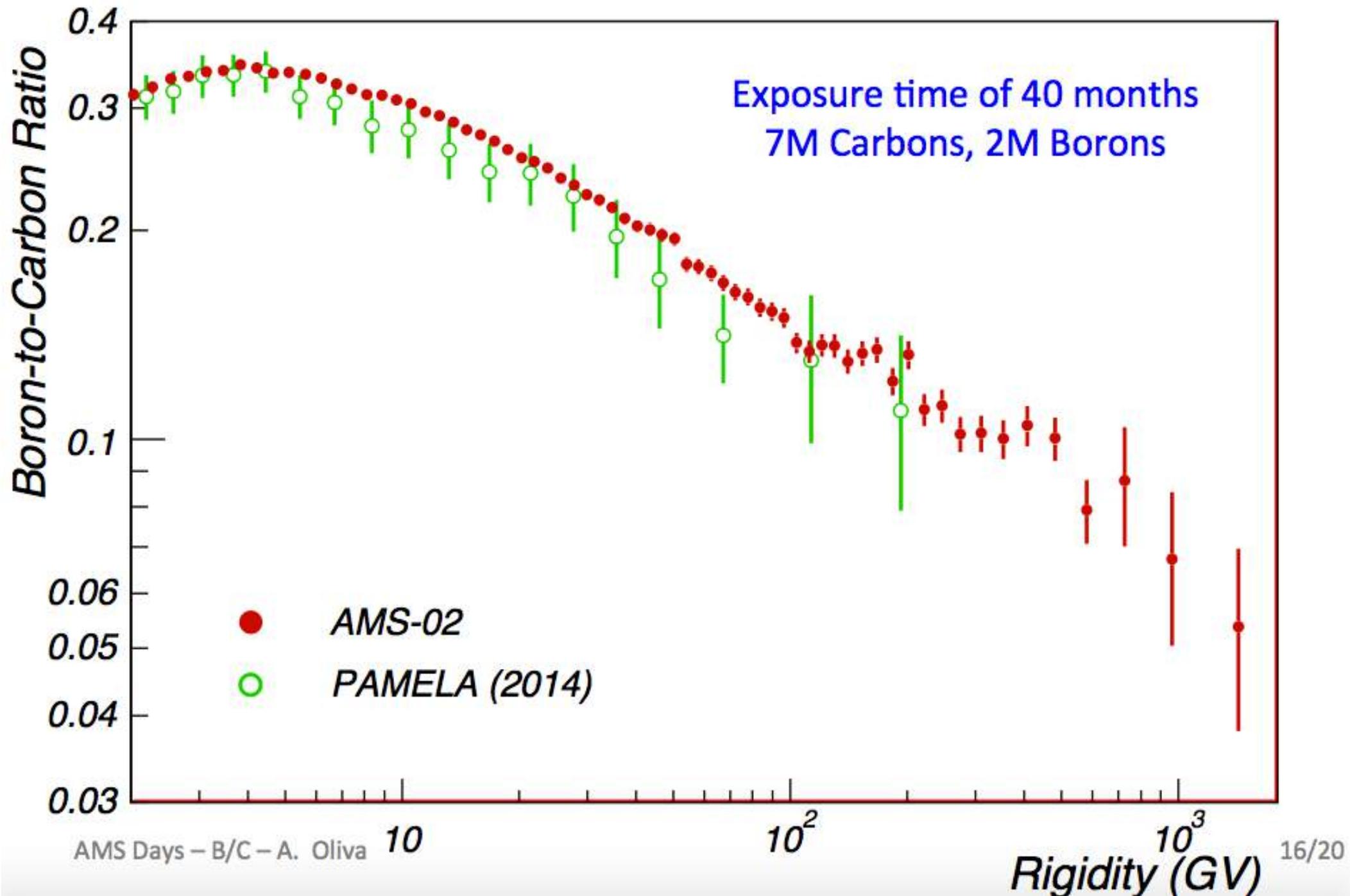


B/C Event Selection with Inner Tracker

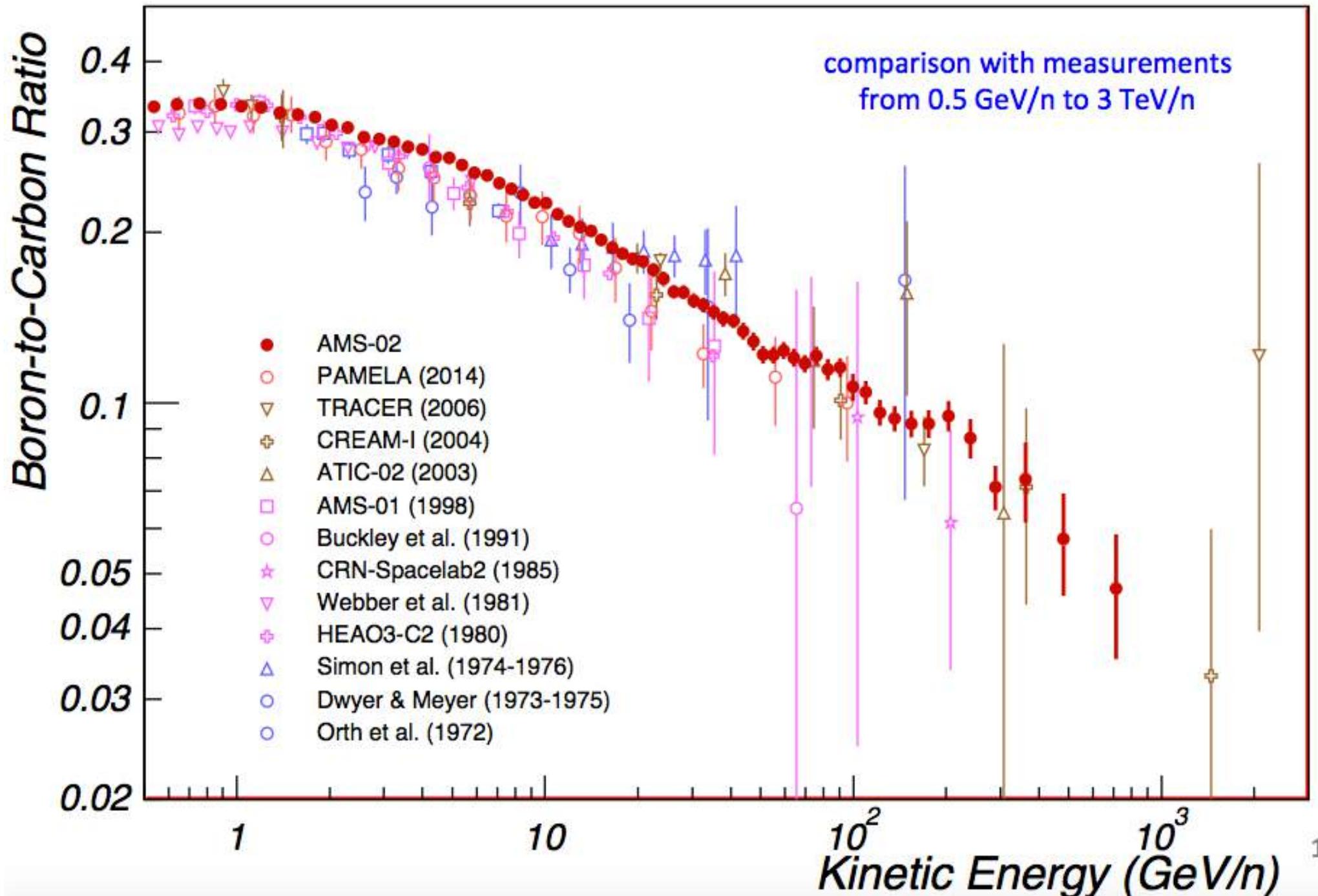
Misidentification from neighboring charges is $< 10^{-3}$.
Identification efficiency is $> 98\%$.



B/C Ratio



B/C Ratio converted in Kinetic Energy



Il calorimetro elettromagnetico (ECAL) di AMS-02

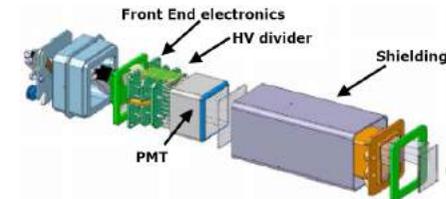
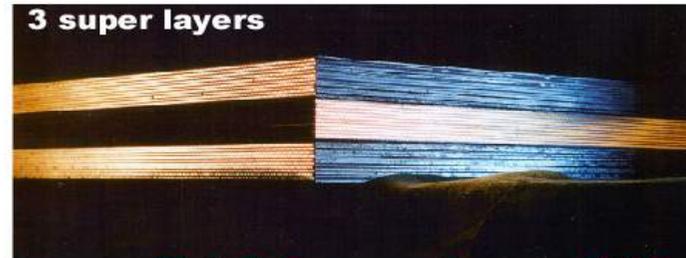
9 superlayers (18 layers)
with lead and scintillating fibers

65.4 cm

1 anode =
9x9 mm²

328 PMT
with 4 anodes

Stereo reading



Il gruppo AMS-Pisa ha costruito sia la meccanica che l'elettronica del calorimetro (occupandosi dei relativi test di qualifica spaziale), è responsabile della sua calibrazione e del software relativo alla sua simulazione e ricostruzione (attraverso l'analisi dei dati dei test beam e di quelli raccolti in volo). E' coinvolto in tutte le analisi che utilizzano ECAL (frazione di positroni e antiprotoni, flusso di elettroni e fotoni)

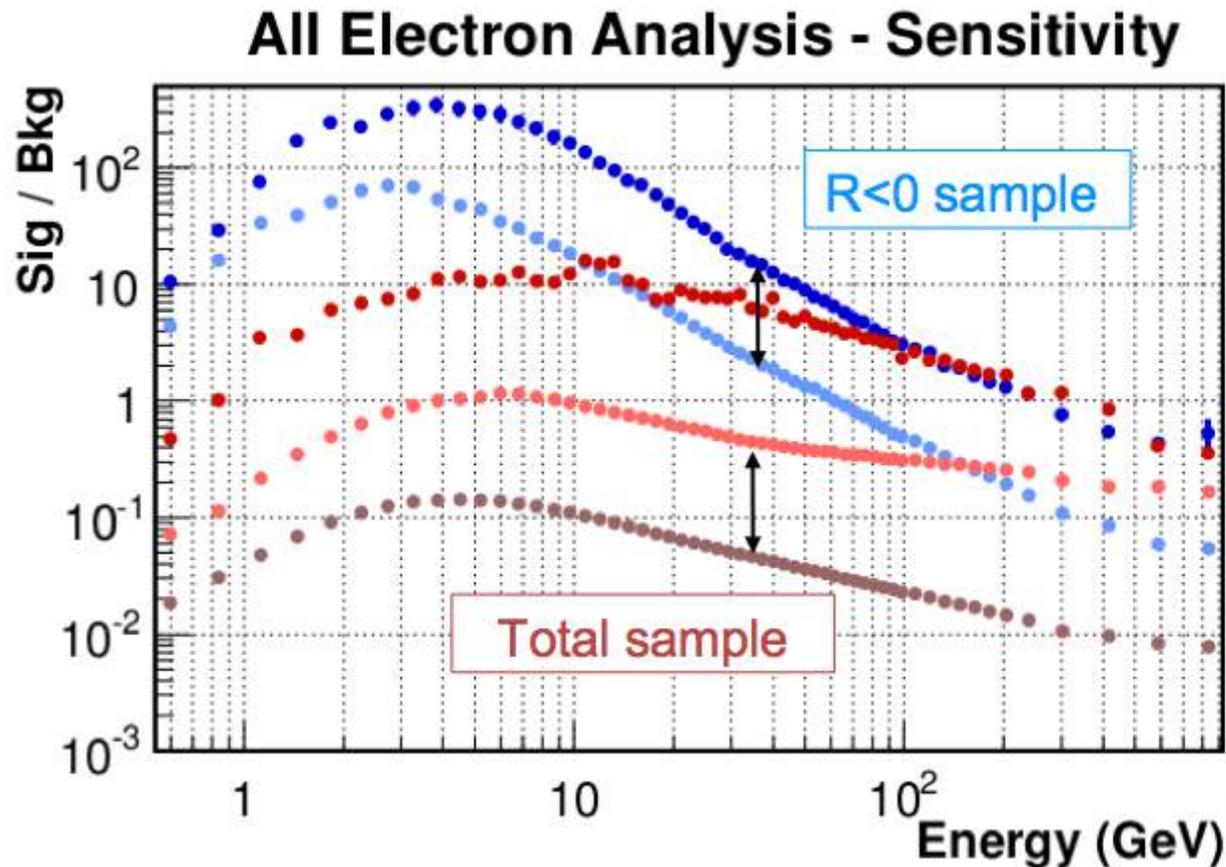
Sala Controllo: impegno nei turni del gruppo AMS-Pisa



- Turni di monitoraggio del corretto funzionamento del calorimetro: 2/mese
- Turni di shift leader (run control e comunicazioni con la Nasa): 0.5/mese
- Turni ECAL on call expert: ≥ 15 giorni/mese
- Responsabile ECAL daq e monitoring:
M.Incagli, S.DiFalco, F.Pilo



IDENTIFICAZIONE DI ELETTRONI vs PROTONI



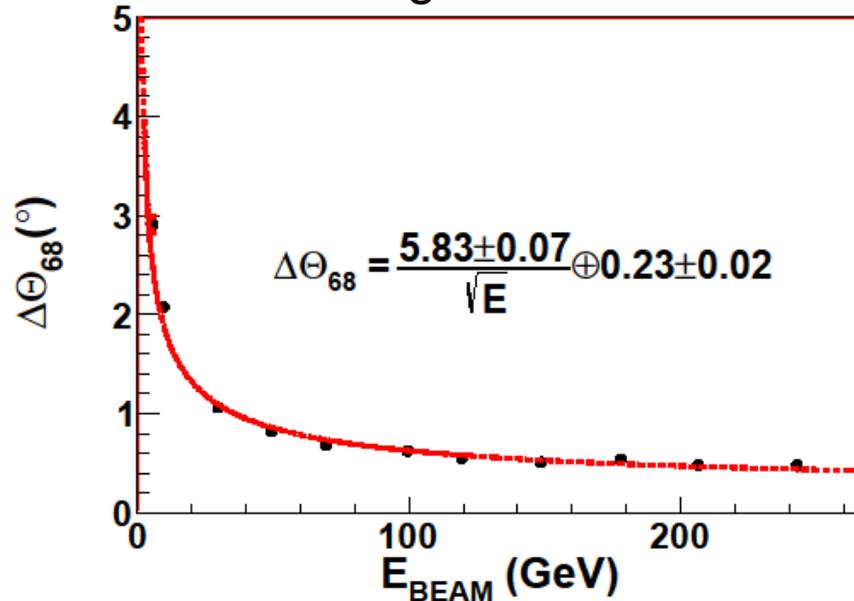
- Rapporto **elettroni/protoni** misurato dai dati a 300 GeV:
- **1/10** dopo tagli su forma longitudinale sciame
- **1/1** dopo tagli su forma longitudinale e laterale
- **Potere di reiezione ECAL a 300 GeV: $>10^3$**
- **N.B.:** Total sample dopo preselezione

Coordinatore del gruppo di analisi per la **separazione tra elettroni e protoni: M. Incagli**

Tesi di Laurea: “Identification of positrons and electrons with AMS ECAL”, V. Vagelli (3/2011)
“Measurement of positron fraction in cosmic rays with AMS-02”, C.Corti (3/2012)
“Misura della frazione di positroni con AMS”, F. Gagliardi (3/2013)

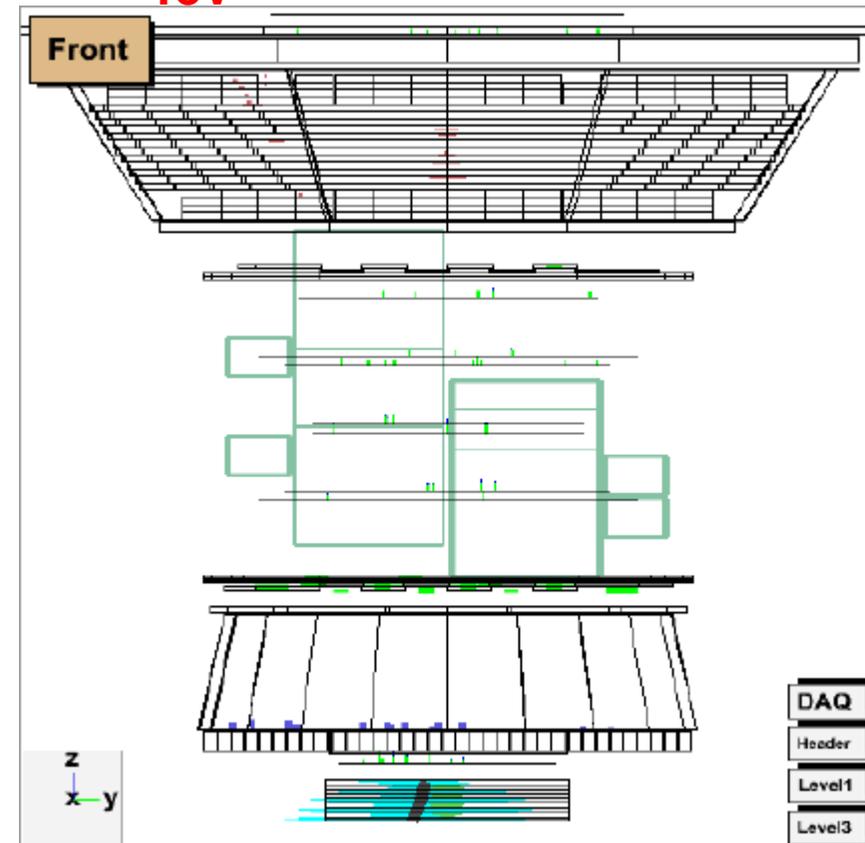
RIVELAZIONE DI FOTONI

Risoluzione angolare del calorimetro



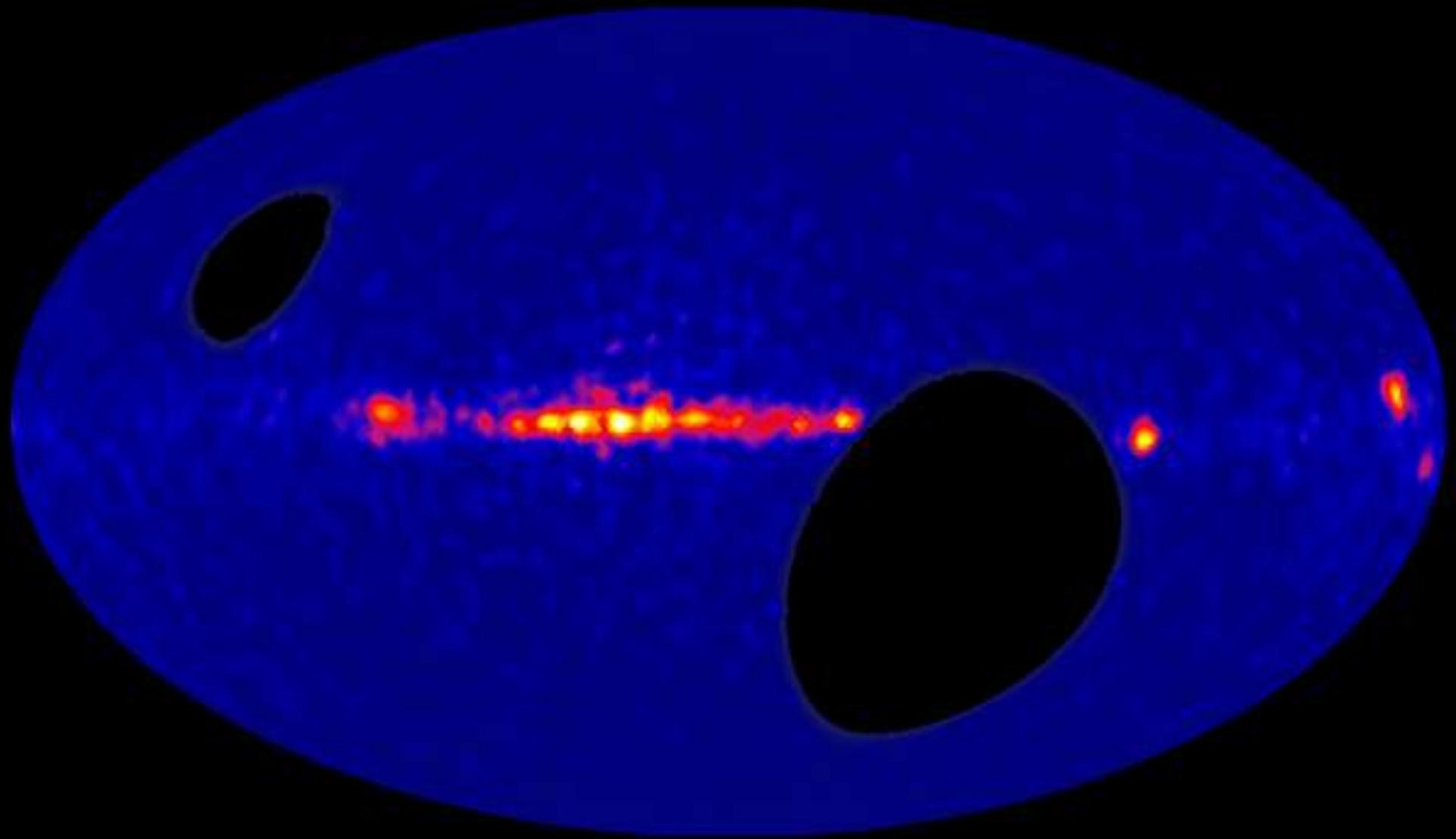
Coordinatore del gruppo di analisi sui fotoni: **S. Di Falco**

FOTONE DA **1.6 TeV**



Tesi di Laurea: “Misura della frazione γ nei raggi cosmici con AMS-02”, I. Guerri (7/2012)
“Misura del flusso di fotoni nei raggi cosmici con AMS-02”, L.Morescalchi (10/2013)
“Association of high energy γ to known sources with AMS-02”, S. Vitillo (3/2014)

AMS ECAL gamma sky ($E > 5$ GeV)



Cigno

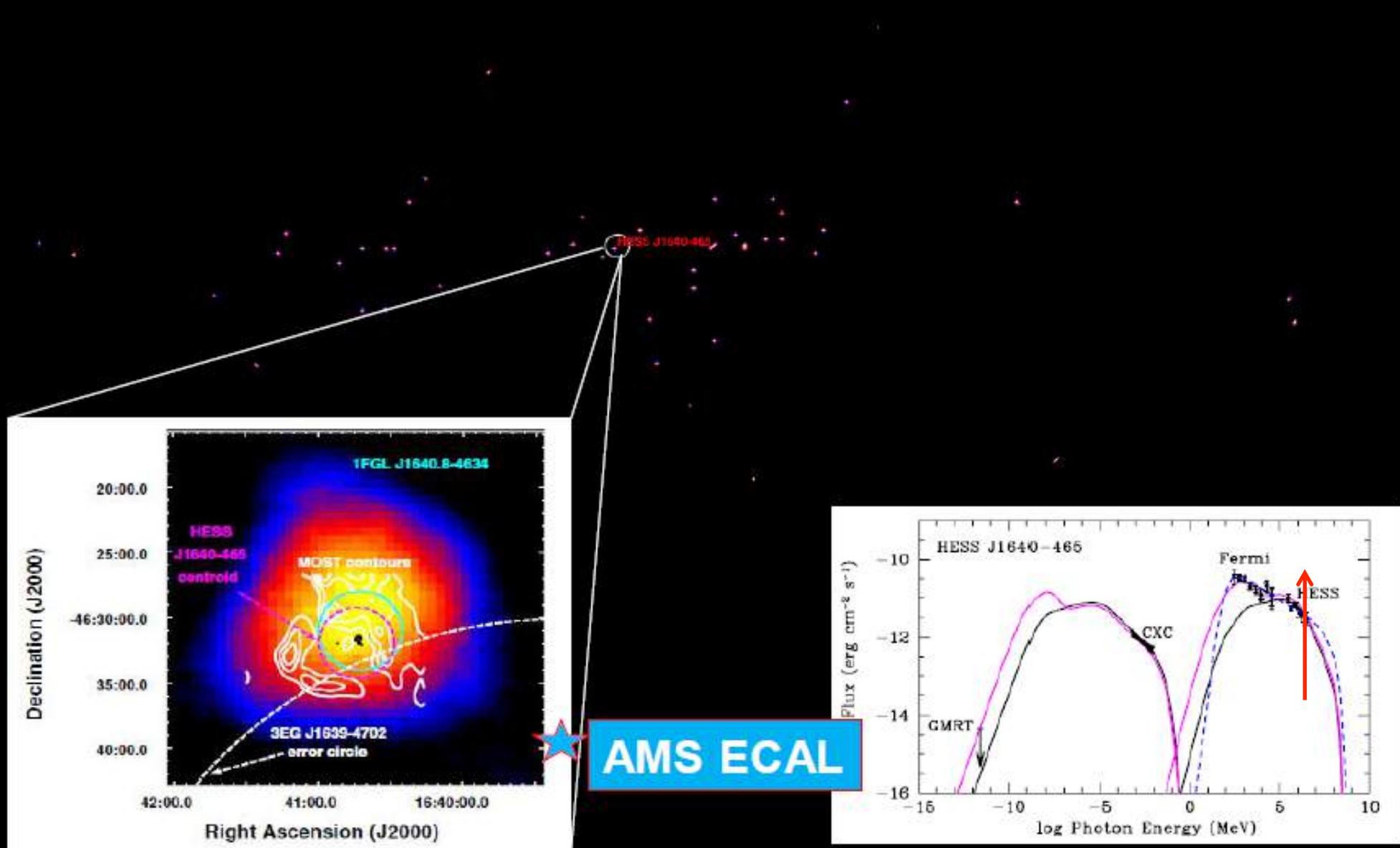
Vela

Geminga
Granchio

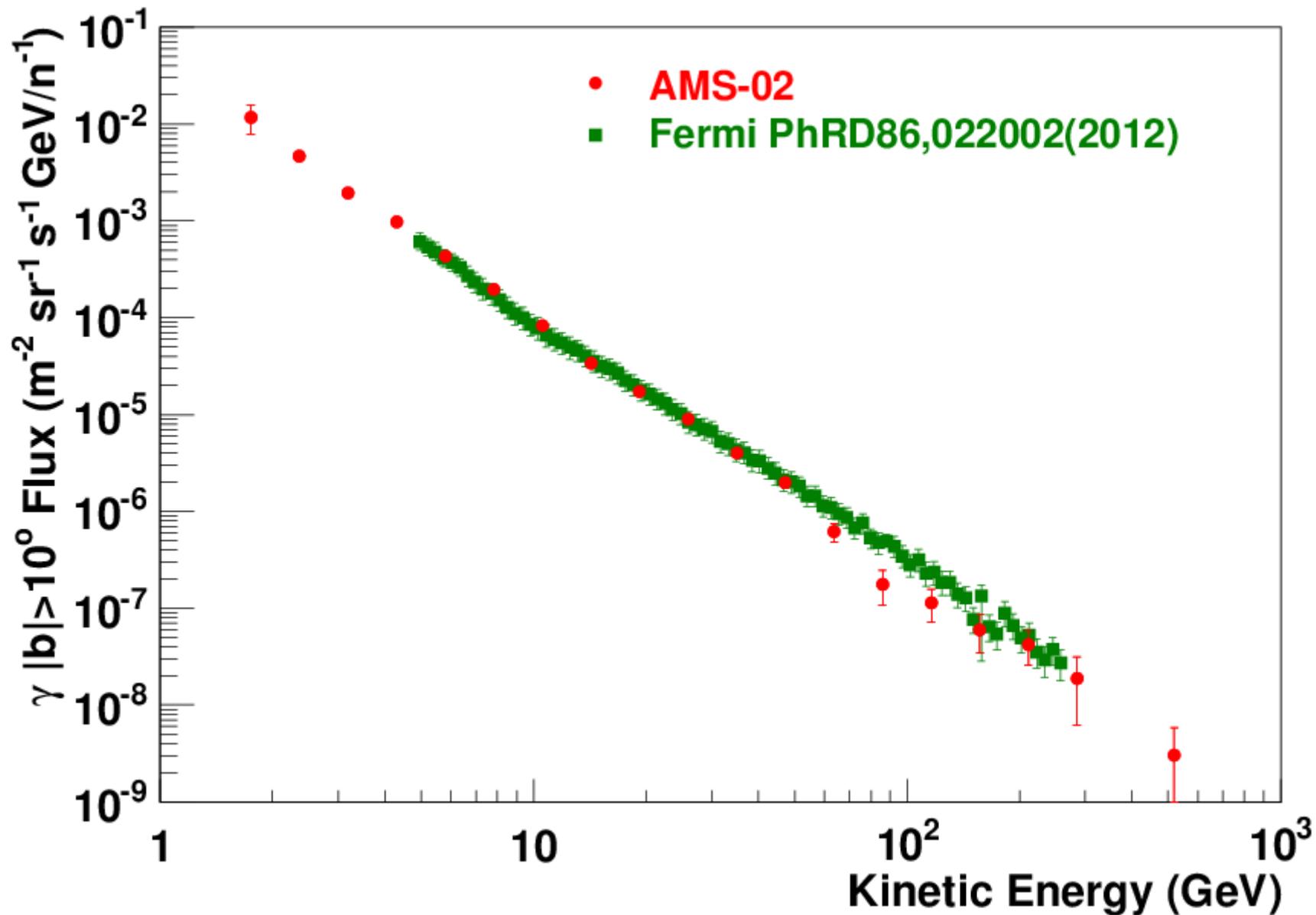
The highest energy AMS-ECAL photon: 1.6 TeV

AMS: $l=338.4 \pm 0.5$ $b=0.05 \pm 0.5$ RA=16h 39m 27s Decl=-46° 40' 18"

HESS: $l=338.316 \pm 0.007$ $b=-0.021 \pm 0.007$ RA=16h 40m 48s Decl=-46° 34' 06"



Flusso di fotoni fuori del piano galattico (preliminary)



I membri del gruppo di AMS-Pisa

cervelli	0.5	dir ric	
di falco	0.5	ric	resp MC ecal
incagli	0.7	1 ric	resp ecal particle ID
pilo	1	<i>art.36</i>	
vannini	0.5	1 ric	
TOTALE	3.2		

+ 1 laureato (Mar '11) PhD a Karlsruhe
+ 1 laureato (Giu '12) PhD alle Hawaii
+ 1 laureato (Mar '13) nell'industria
+ 1 laureata (Mar '14)
+ 1 laureato (Nov '14)

- FTE passati da 6.0 a 3.2 per
 - inizio attivita' MU2E (Cervelli+DiFalco+Vannini: 0.5/each)
 - inizio attivita' LSPE (Incagli: 0.3)
 - scadenza contratto ASI (Giovanni Gallucci: 1)
- Nuovo contratto ASI in partenza nella prima meta' del 2016 → assegno di ricerca a Pisa

Richieste finanziarie 2016

Missioni								45	k€
ALTRI CONSUMI								5.5	k€
SPESE SERVIZI								5	k€
INVENTARIABILE		spazio disco locale						1	k€
TOTALE								56.5	k€

- Richieste in sezione:
se necessario F.Spinella 10gg al Cern per verifiche di elettronica su simulatore
supporto minimo per il calcolo