

V. Formato - INFN Sezione di Tor Vergata - 10/02/2025

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# AMS-02: ALPHA MAGNETIC SPECTROMETER

# AMS-02

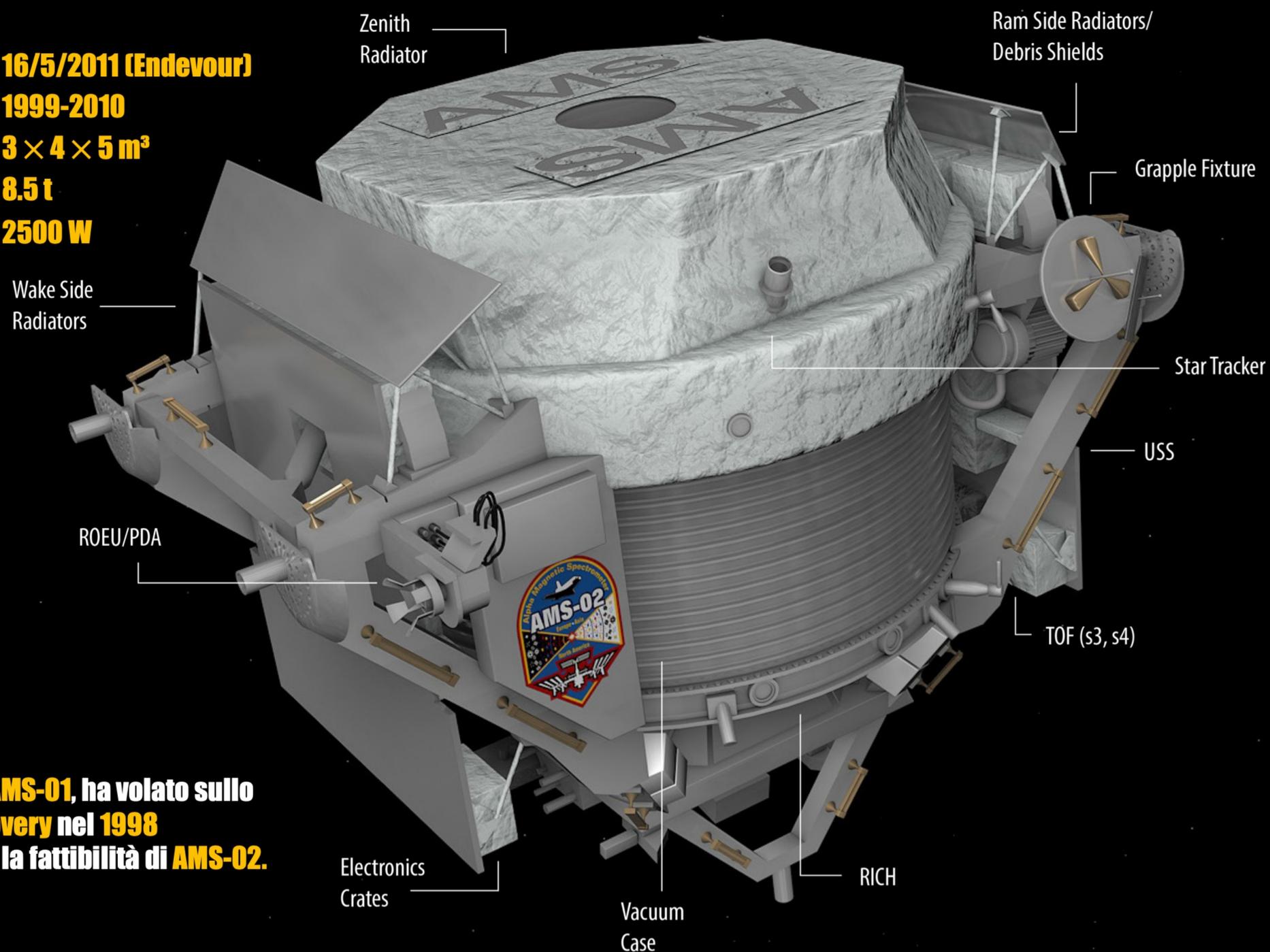
**AMS-02** è uno **spettrometro magnetico** a larga accettazione in grado di misurare accuratamente il passaggio di particelle nel range di energia **GeV-TeV**. Dal 19 Maggio **2011** AMS-02 è in operazione a bordo della Stazione Spaziale Internazionale (ISS), raccogliendo **>230 miliardi di raggi cosmici**.



AMS dovrebbe prendere dati per l'intera durata della ISS (estesa al 2030)

# AMS-02: ALPHA MAGNETIC SPECTROMETER

**Lancio** 16/5/2011 (Endeavour)  
**Costruzione** 1999-2010  
**Dimensioni** 3 × 4 × 5 m<sup>3</sup>  
**Peso** 8.5 t  
**Potenza** 2500 W



300'000 canali di lettura

650 processori

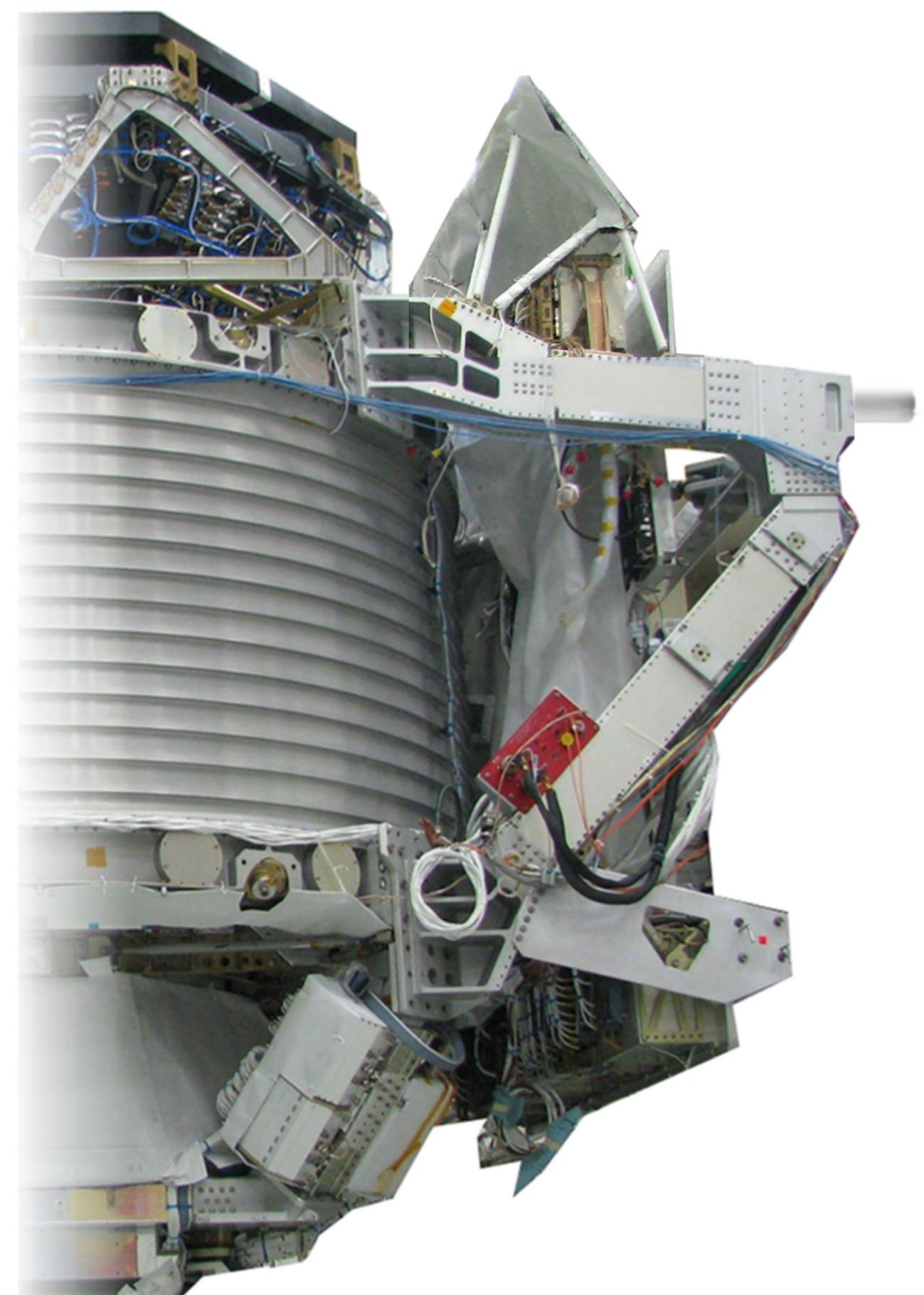
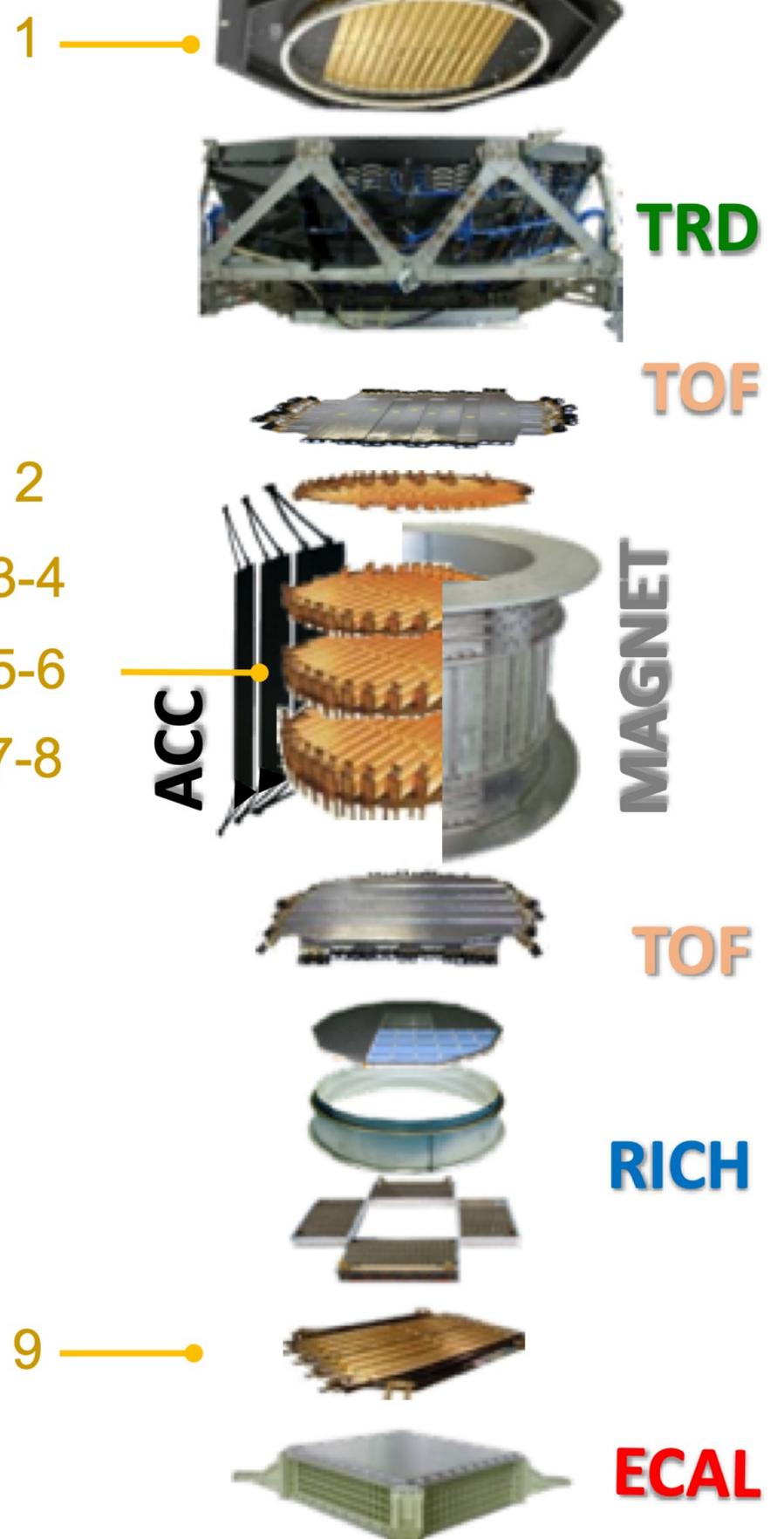
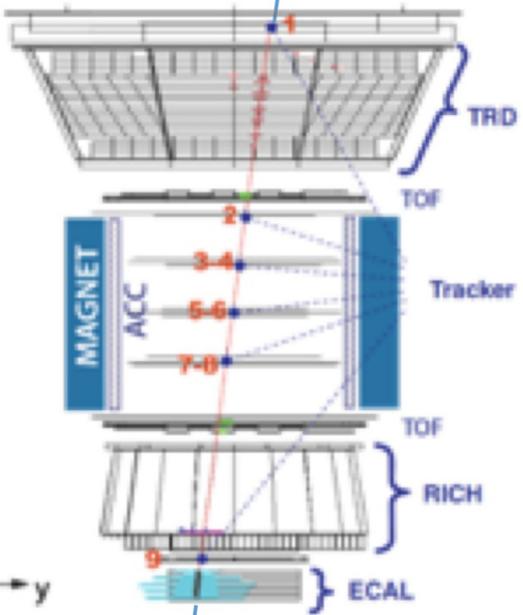
Dimensioni: 3m x 4m x 5m

Peso: 8.5 tonnellate

In operazione 24h su 24, 7 giorni su 7, 365 giorni all'anno

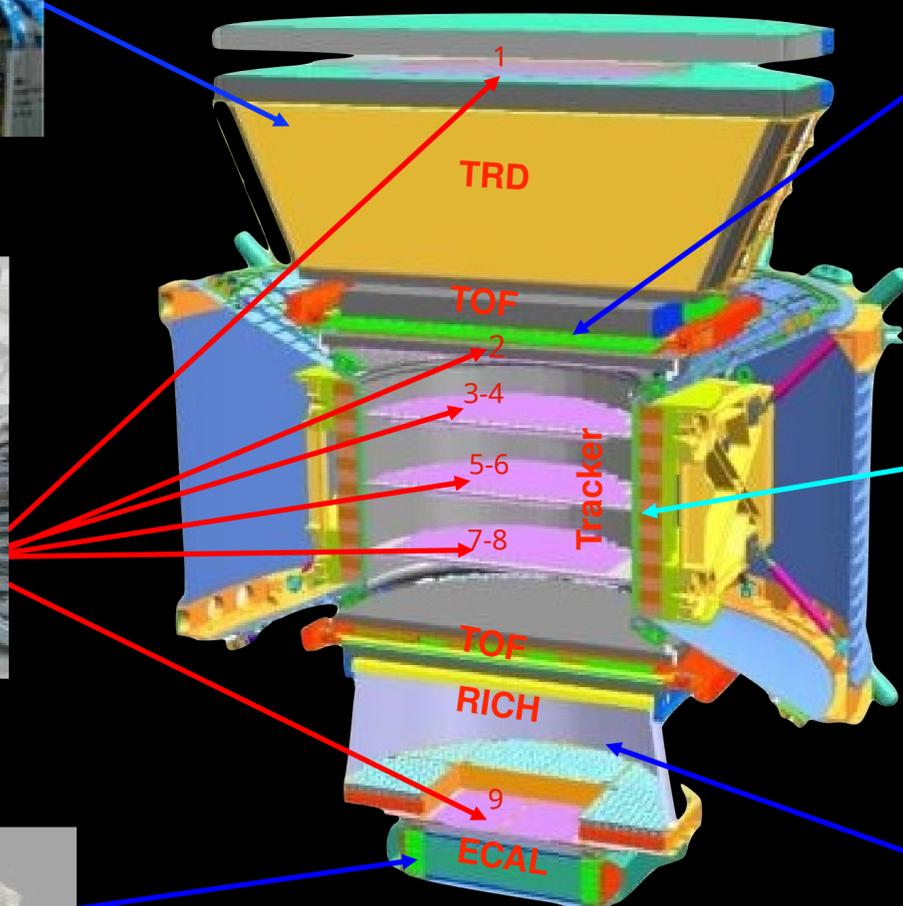
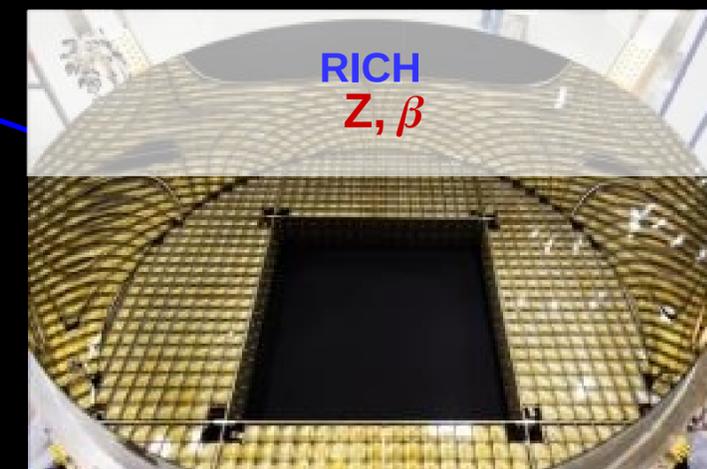
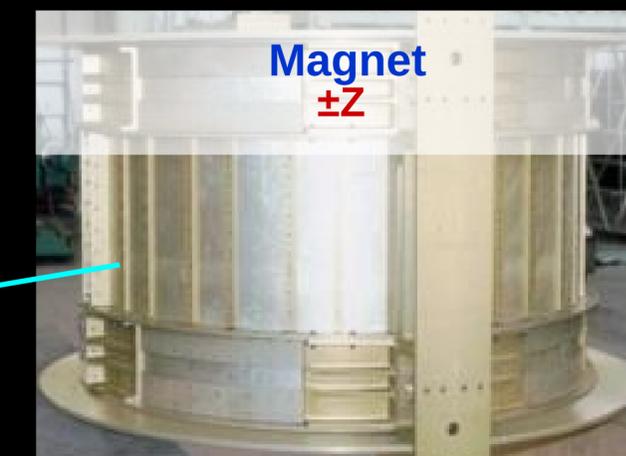
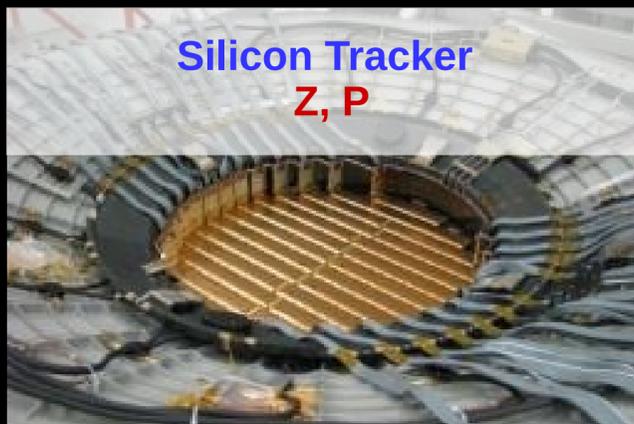
Il prototipo, **AMS-01**, ha volato sullo shuttle **Discovery** nel **1998** dimostrando la fattibilità di **AMS-02**.

**Tracker**  
planes

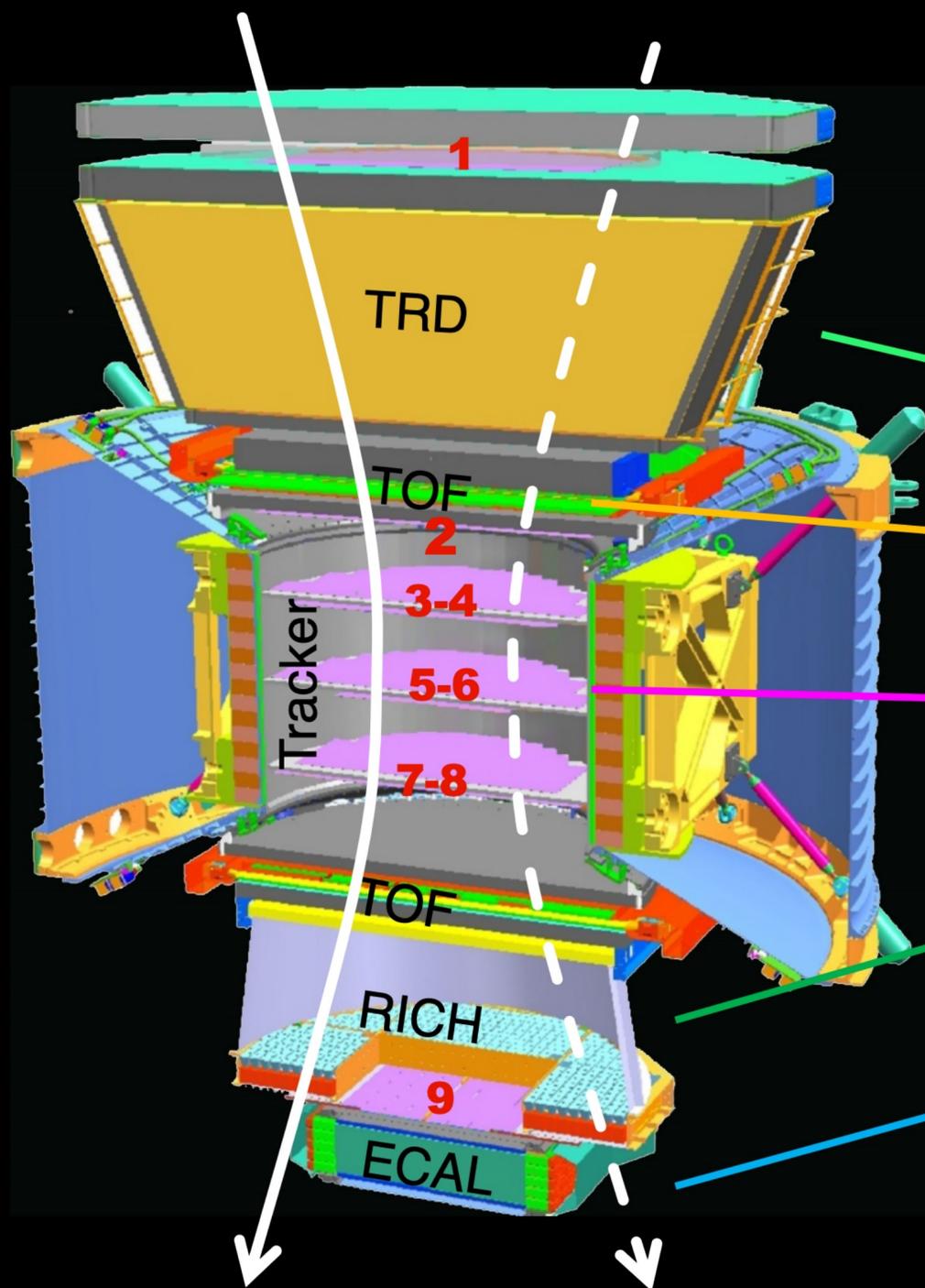


# AMS-02

Per raggiungere una elevata precisione nella misura di raggi cosmici una caratteristica chiave è la ridondanza nella misura di caratteristiche come **carica elettrica, momento, velocità e, in generale, particle ID.**



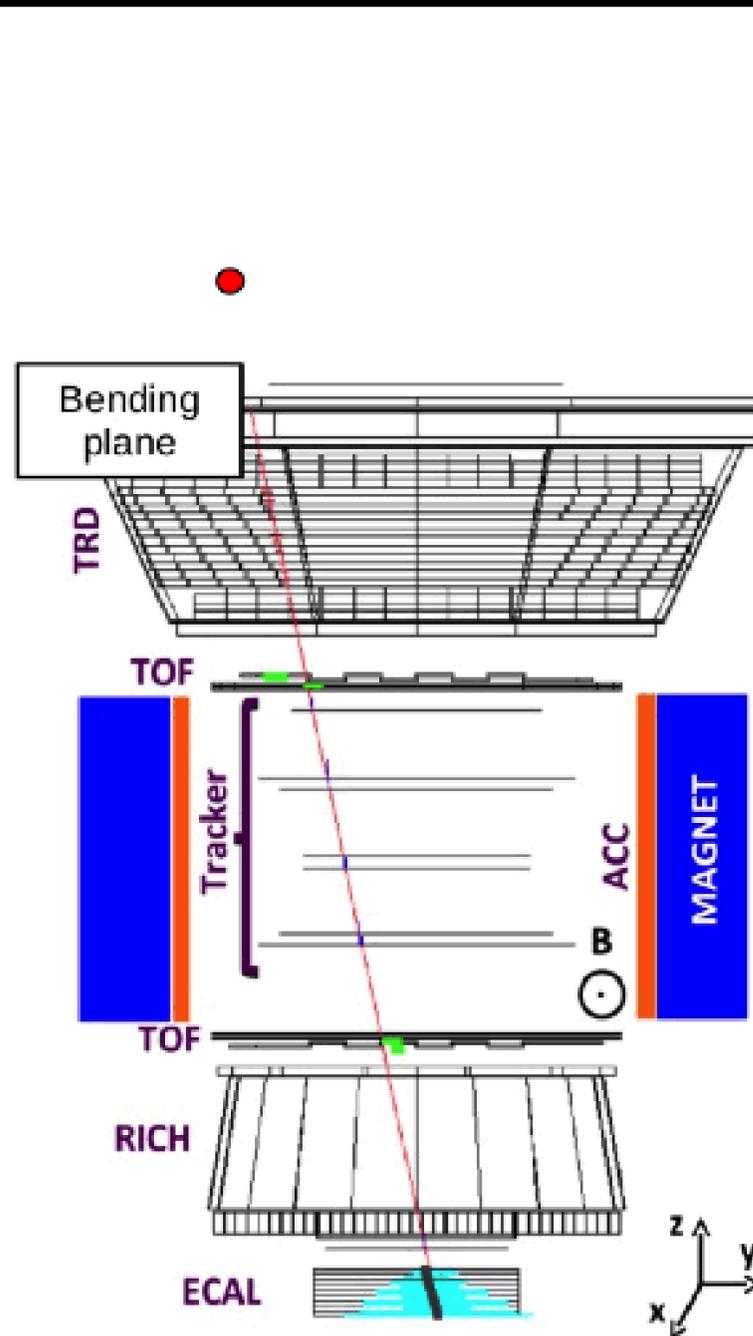
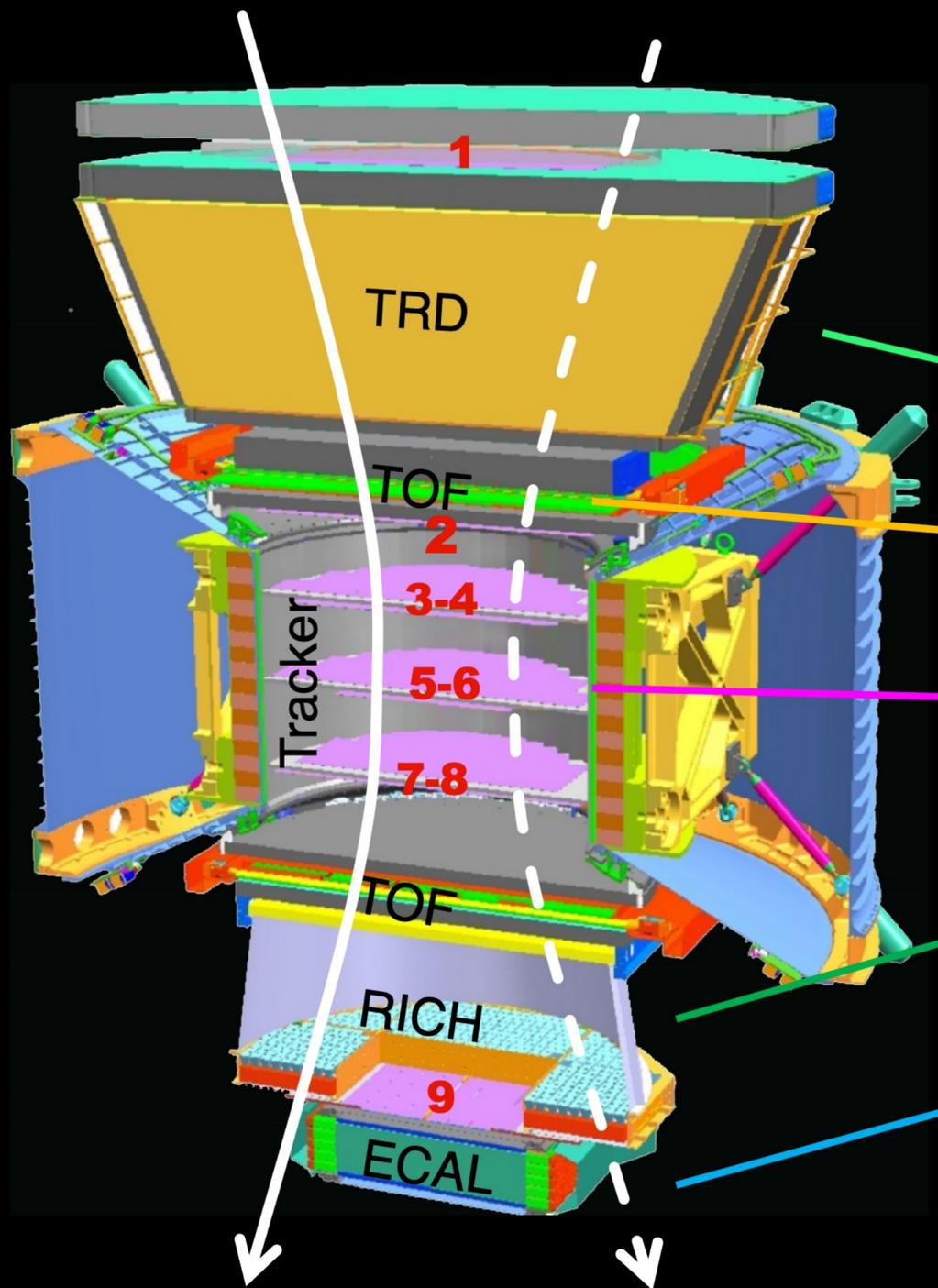
# AMS-02: UNO SPETTROMETRO POLIVALENTE



**Materia**      **Anti-materia**

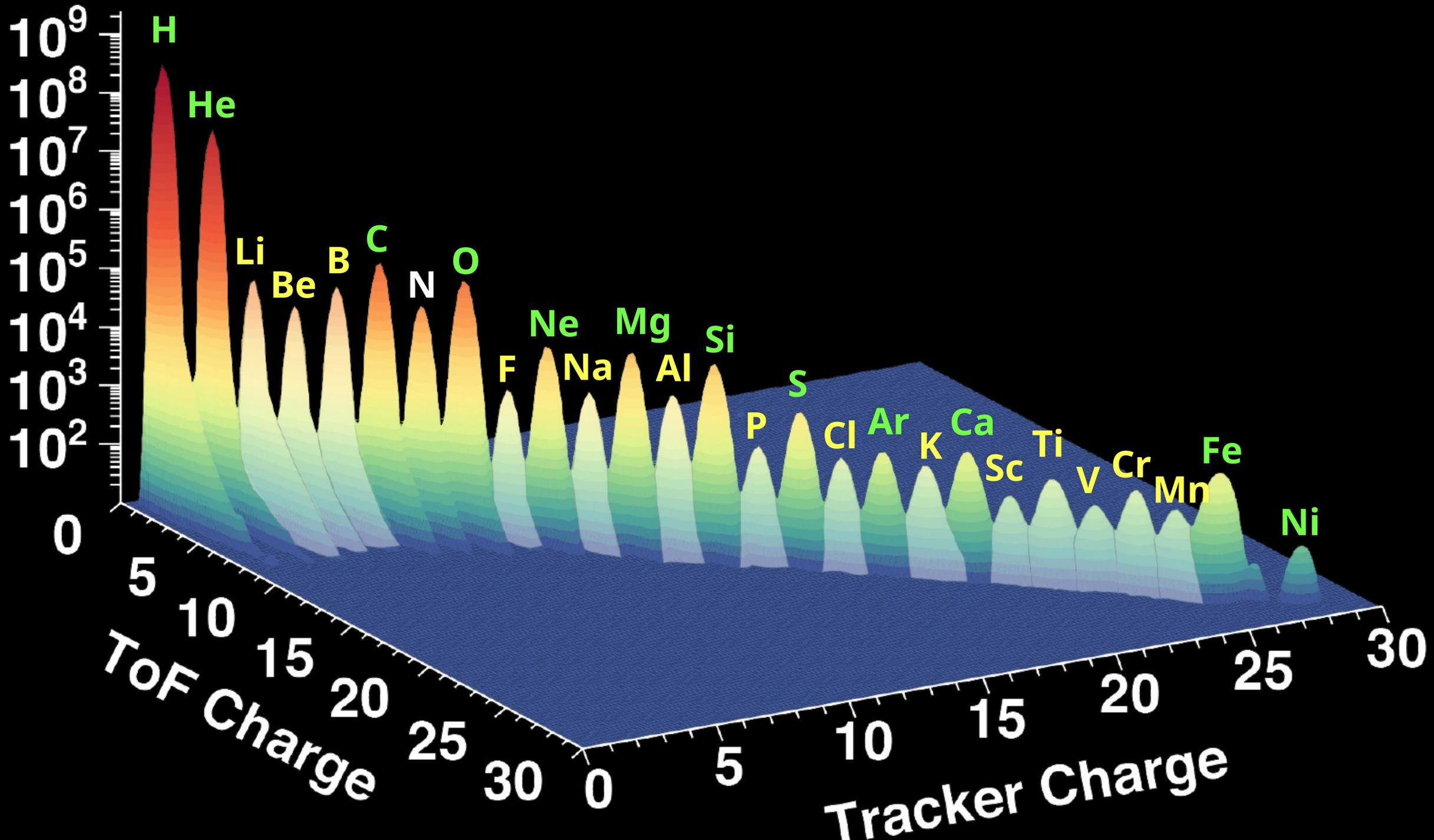
	$e^-$	P	Fe	$e^+$	$\bar{P}$	$\bar{He}$
TRD						
TOF						
Tracker + Magnet						
RICH						
ECAL						

# AMS-02: UNO SPETTROMETRO POLIVALENTE



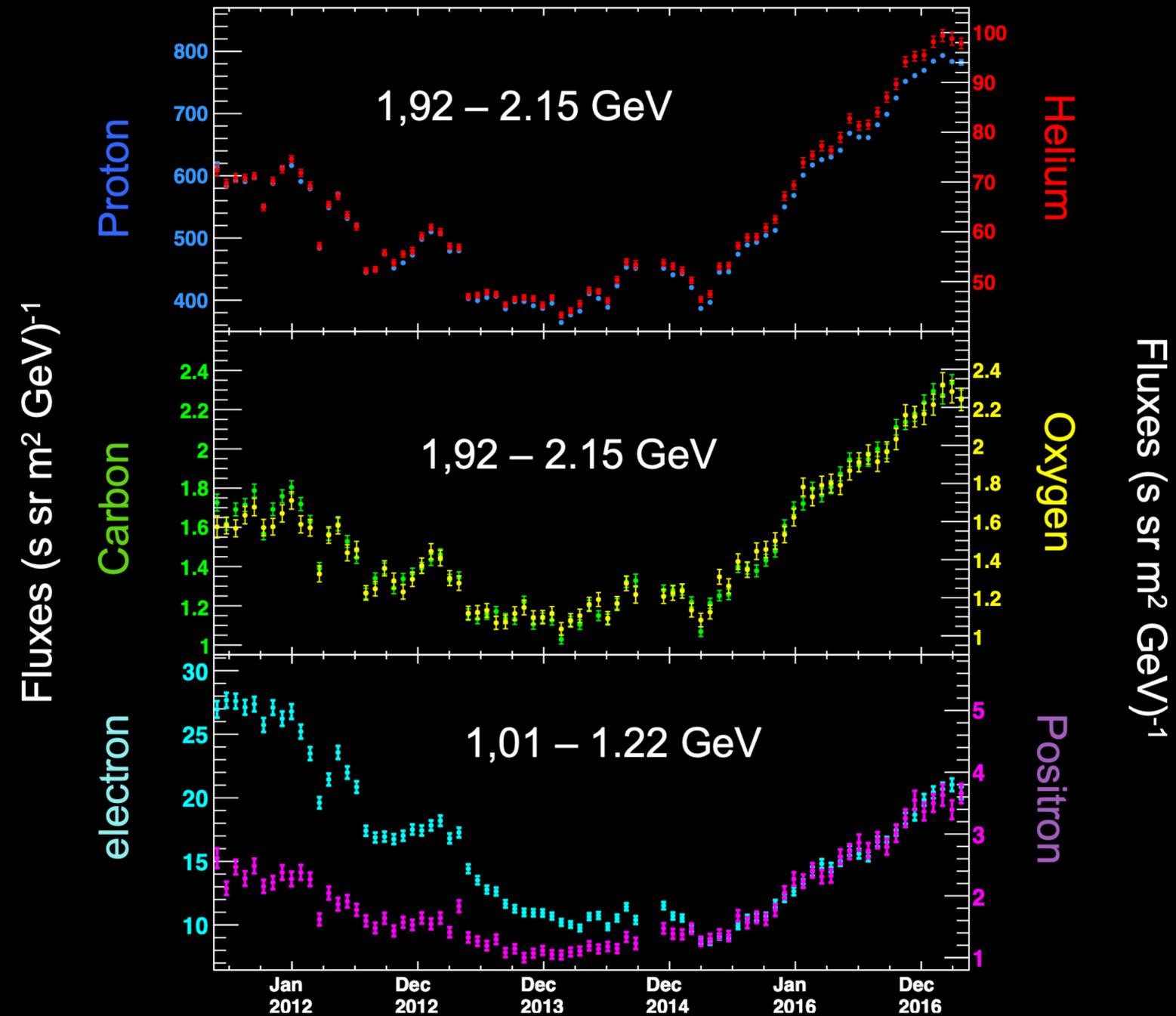
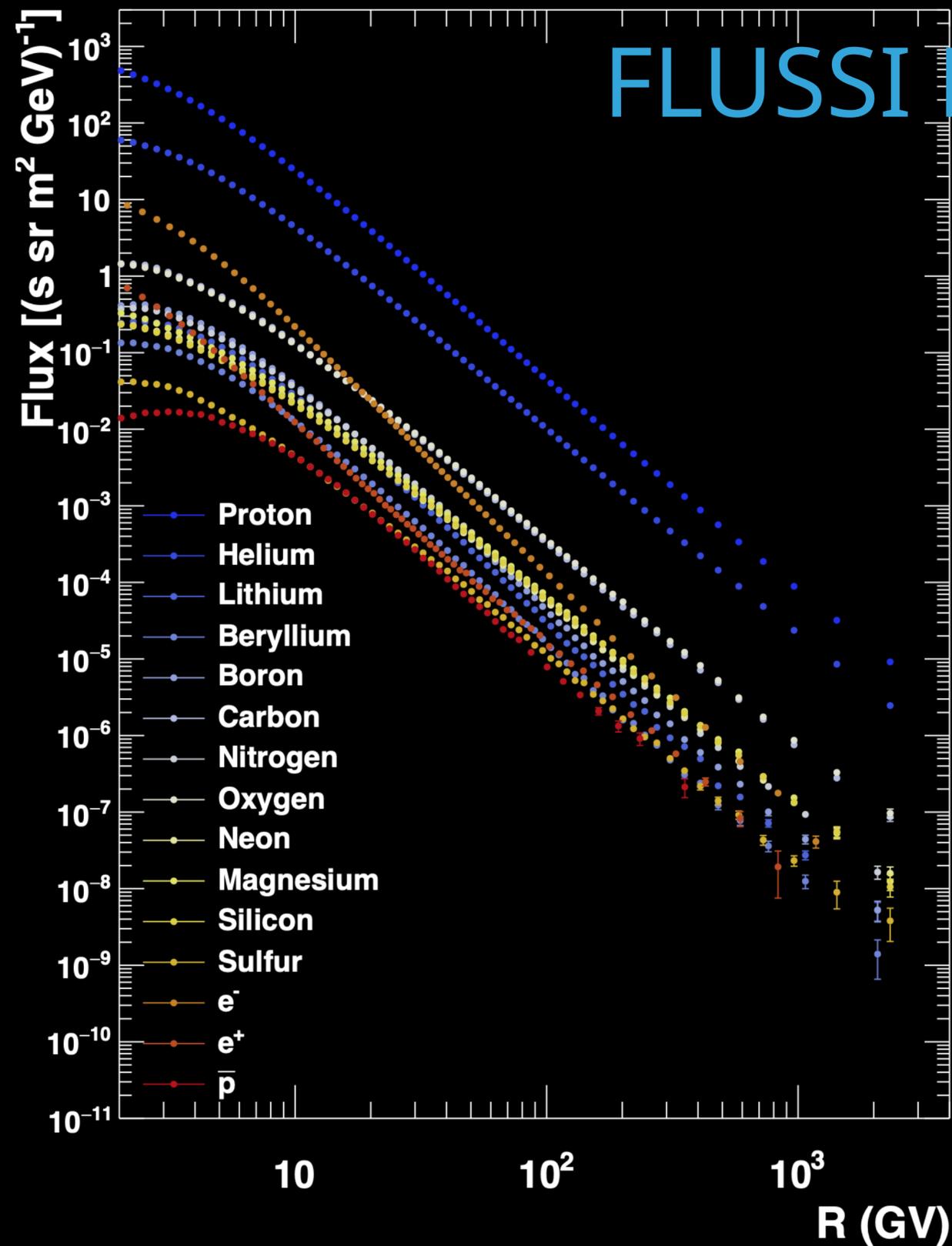
	$e^-$	p	He
<b>TRD</b> 20 layers	=====	=====	=====
<b>TOF</b> 4 layers	=====	=====	=====
<b>TRK</b> 9 layers	=====	=====	=====
<b>RICH</b>	=====	=====	=====
<b>ECAL</b> 20 layers	=====	=====	=====

# LA TAVOLA PERIODICA DI AMS

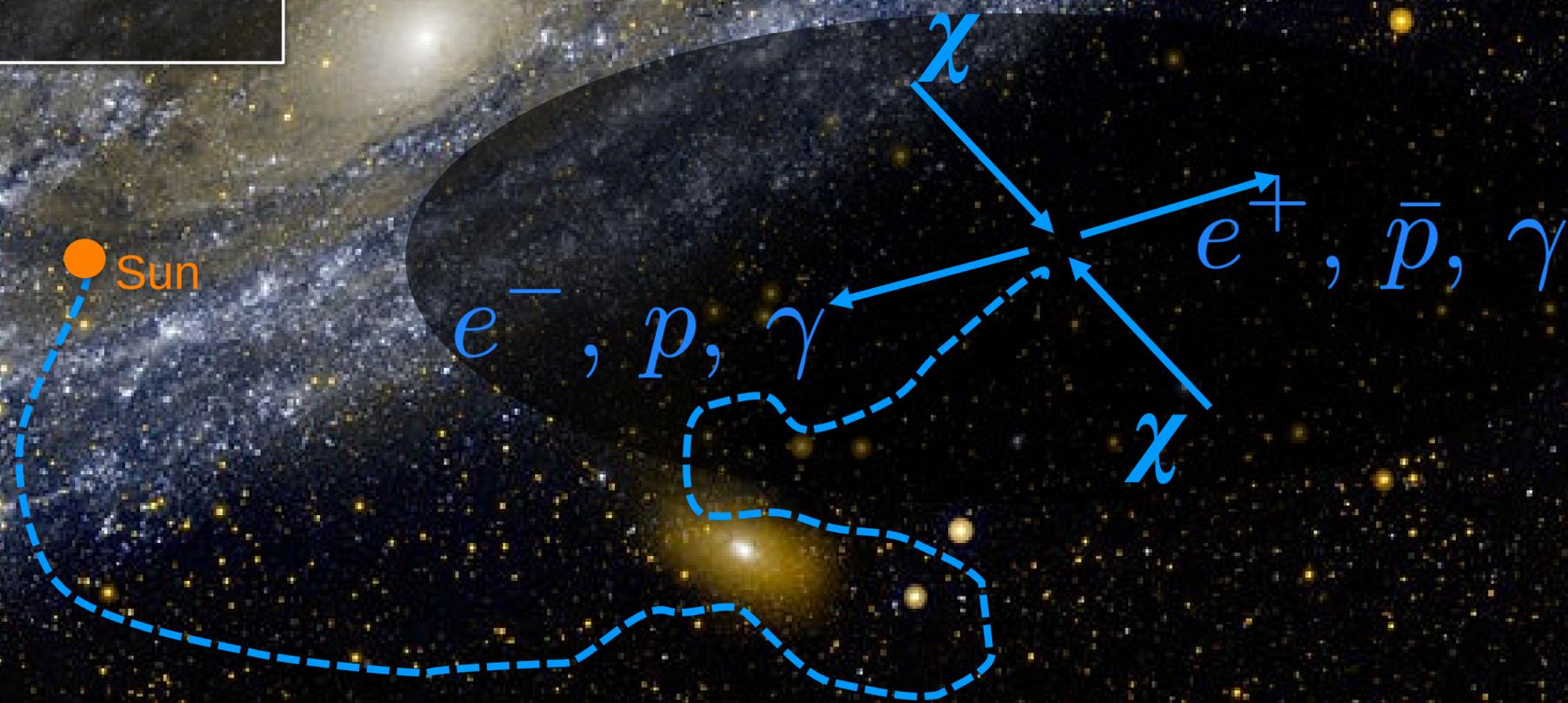
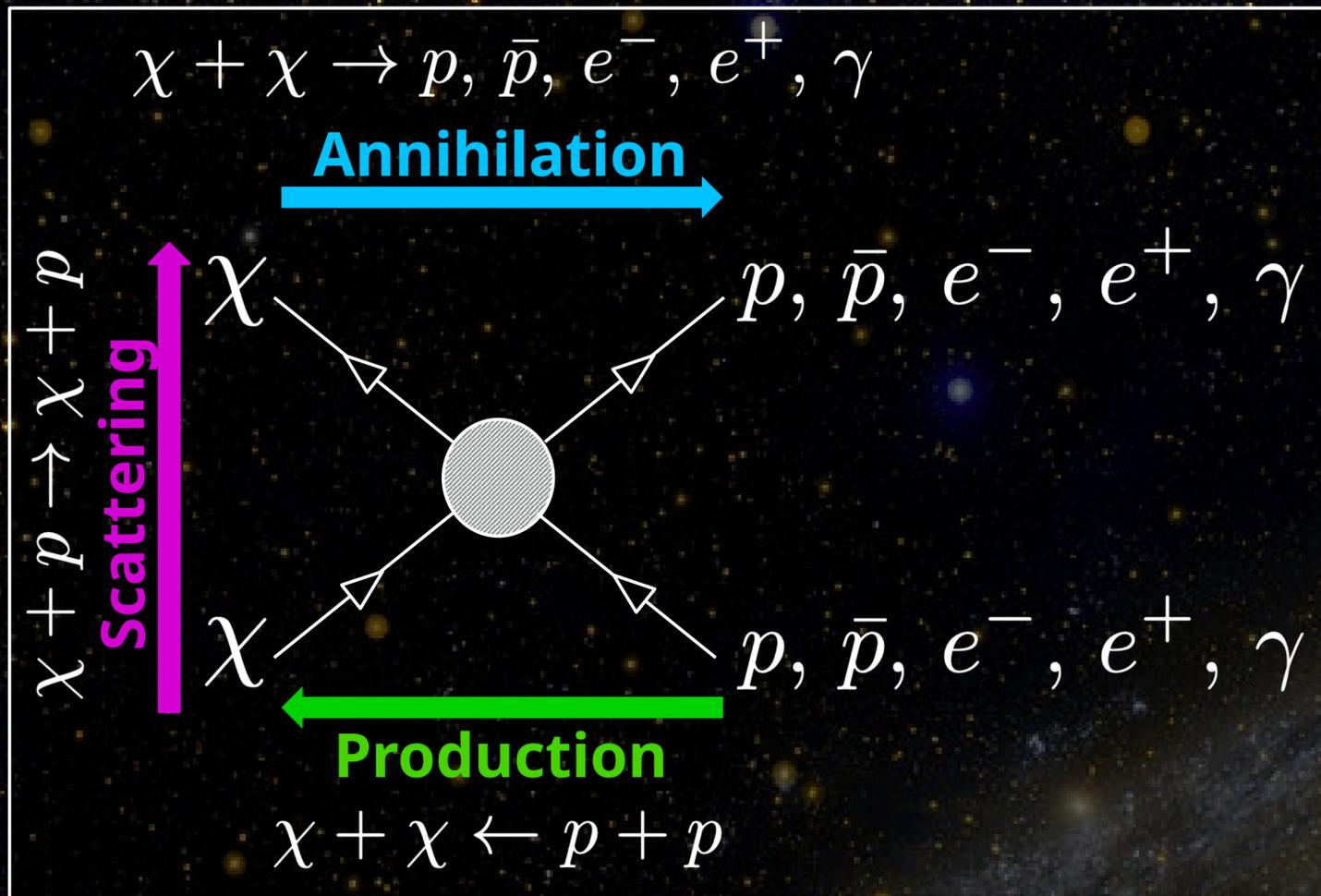


Primari  
Secondari

# FLUSSI DI RAGGI COSMICI: IN PRATICA

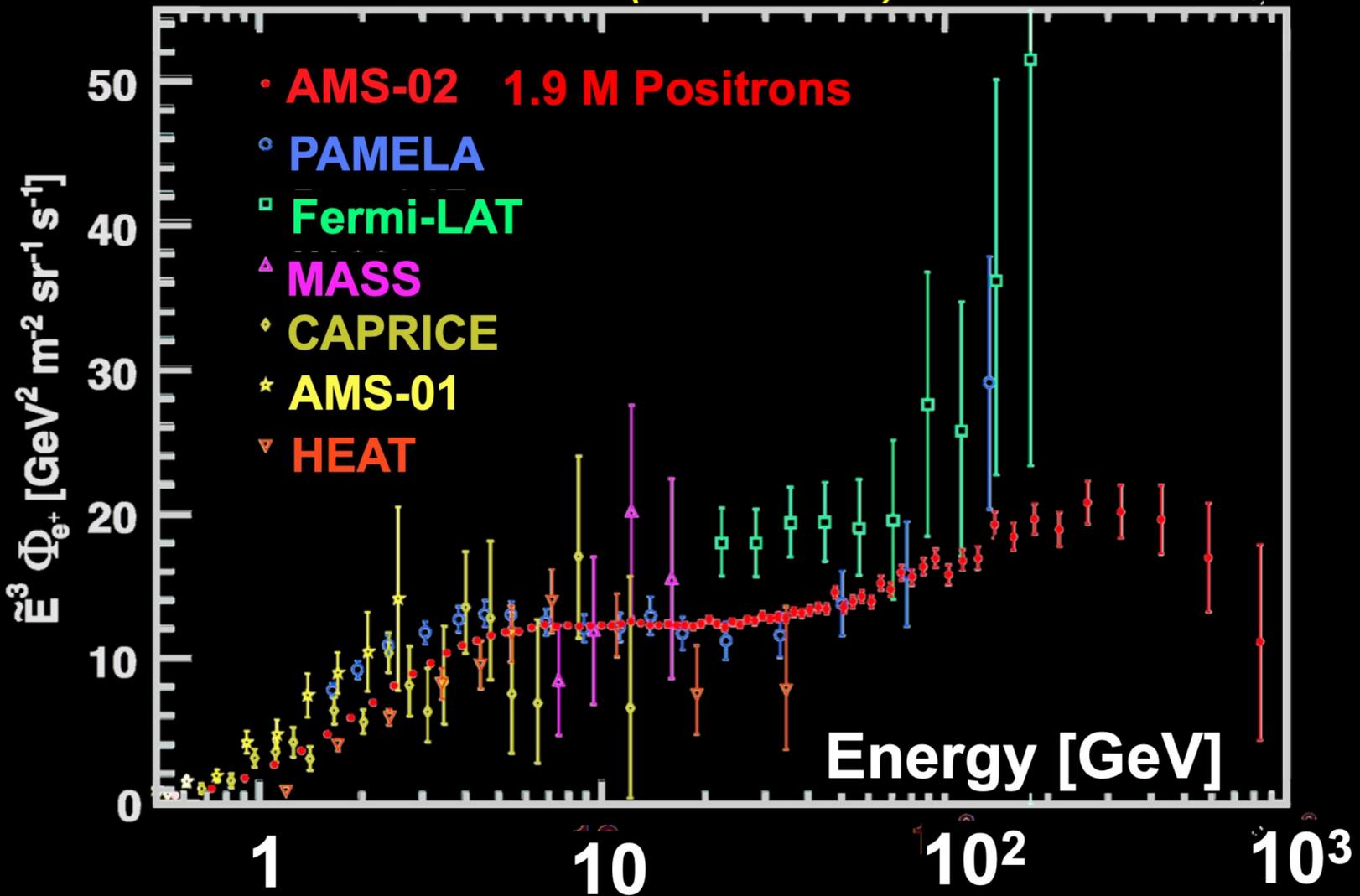


# RICERCA DI NUOVA FISICA

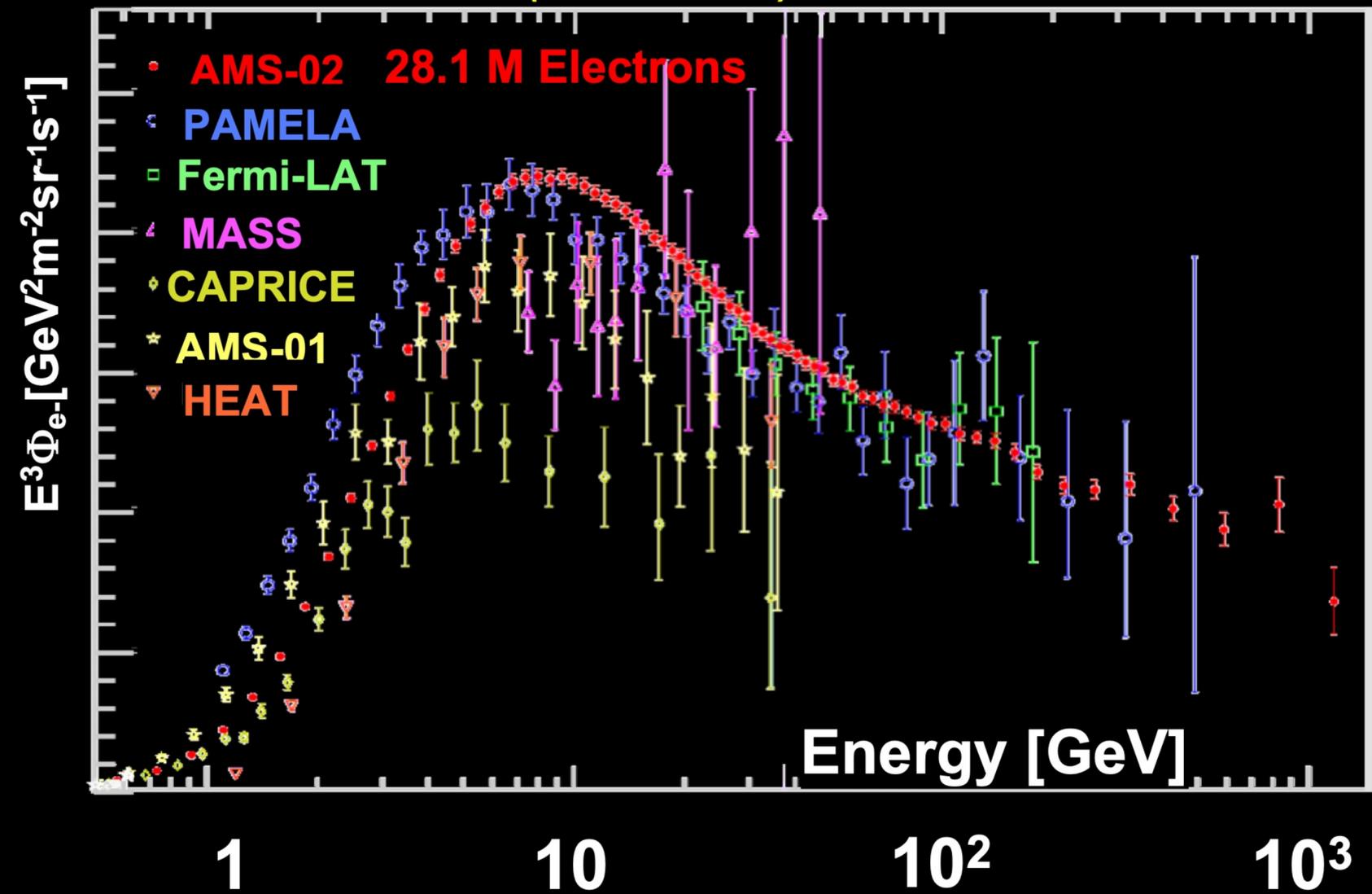


# ELETTRONI E POSITRONI

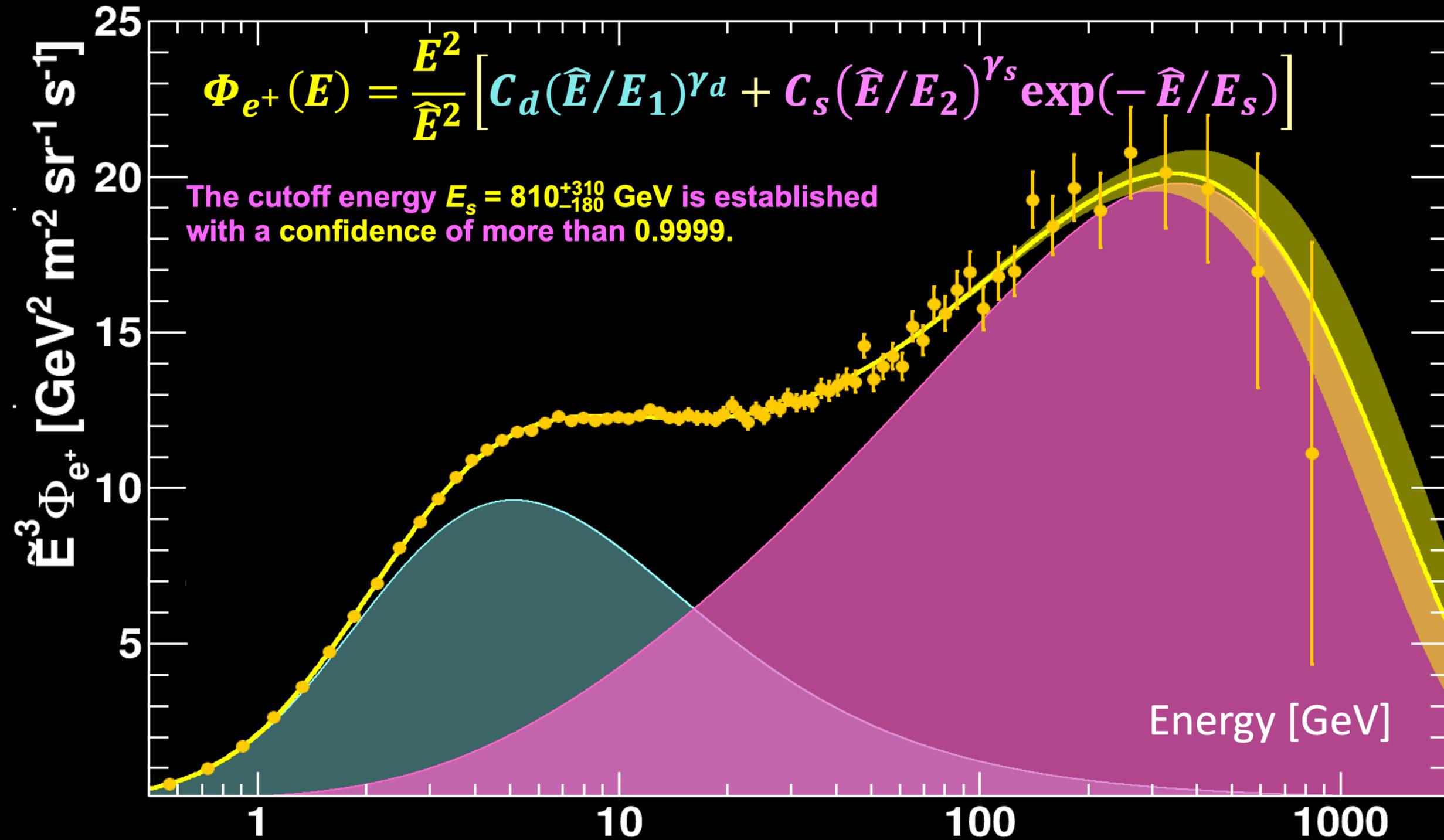
*PRL 122, 041102 (Jan. 2019)*

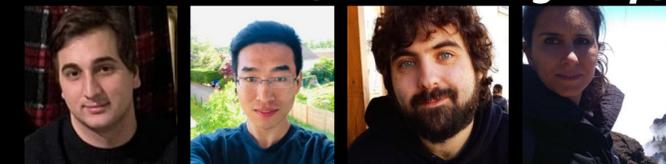


*PRL 122, 101101 (Mar. 2019)*



# FLUSSO DI POSITRONI

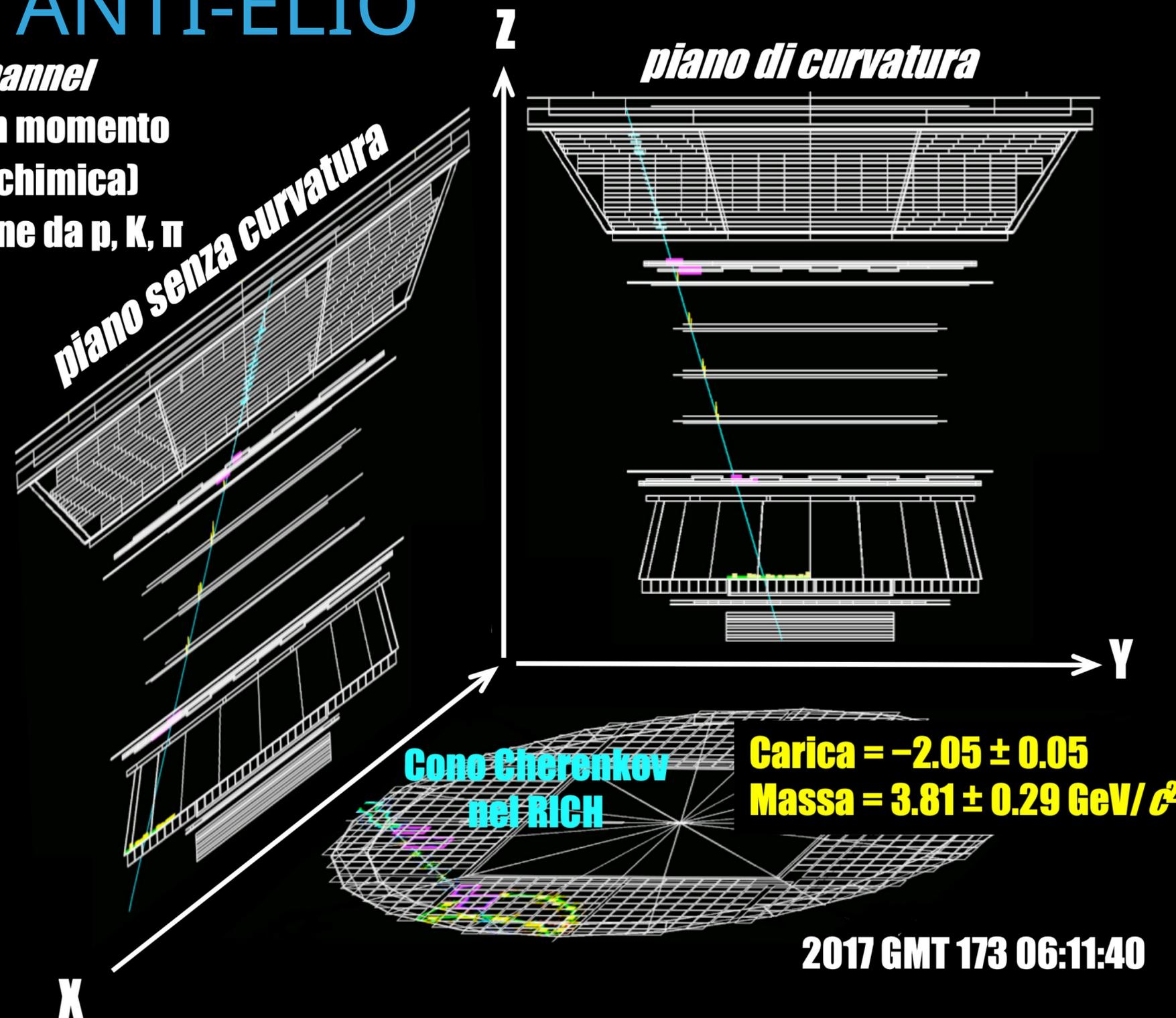




# RICERCA DI ANTI-ELIO

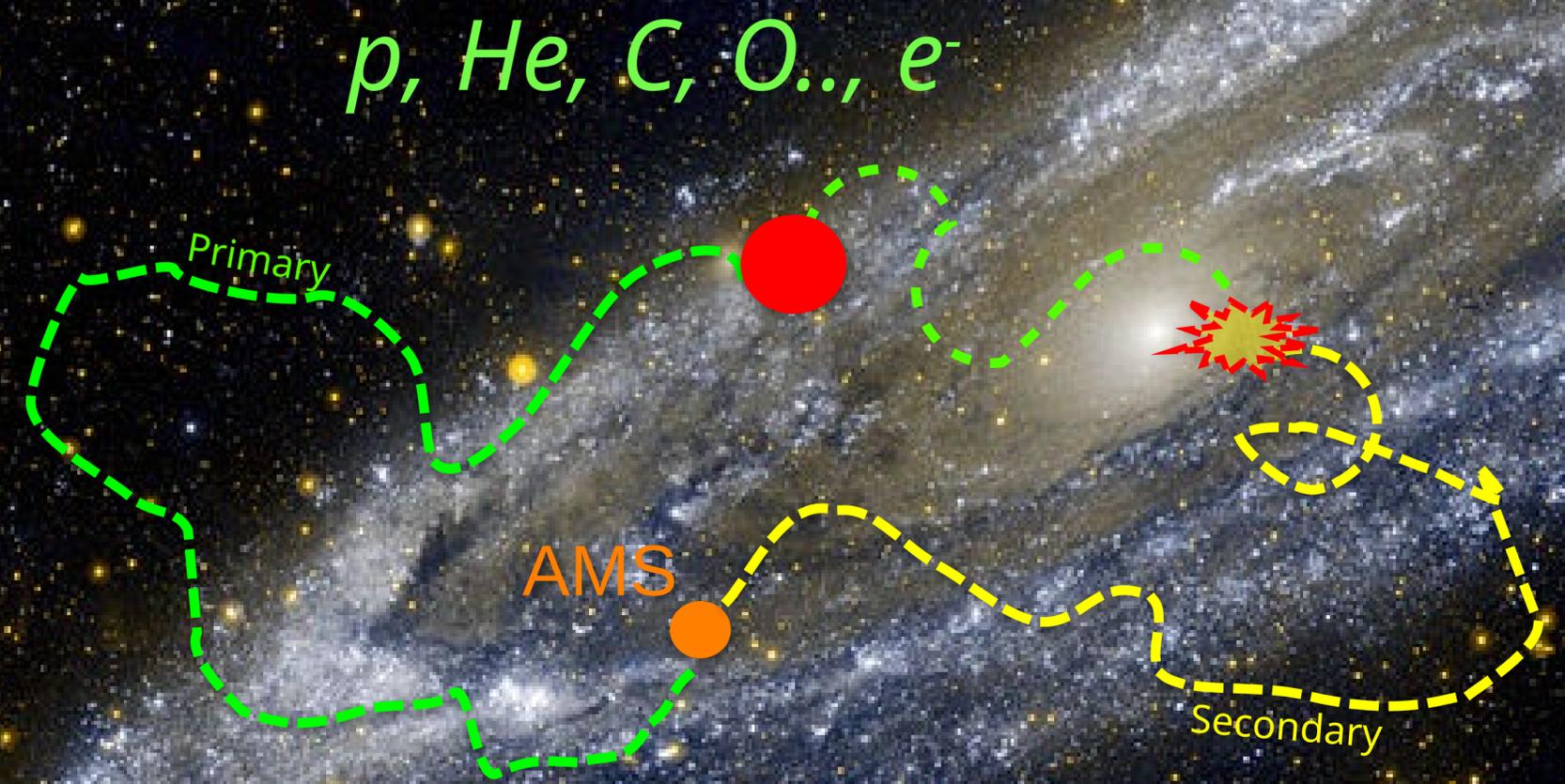
L'anti-elio è un *golden-channel*

- Migliore risoluzione in momento
- Migliore separazione chimica)
- Non c'è contaminazione da p, K,  $\pi$



**Carica =  $-2.05 \pm 0.05$**   
**Massa =  $3.81 \pm 0.29 \text{ GeV}/c^2$**

# I RAGGI COSMICI NELLA GALASSIA

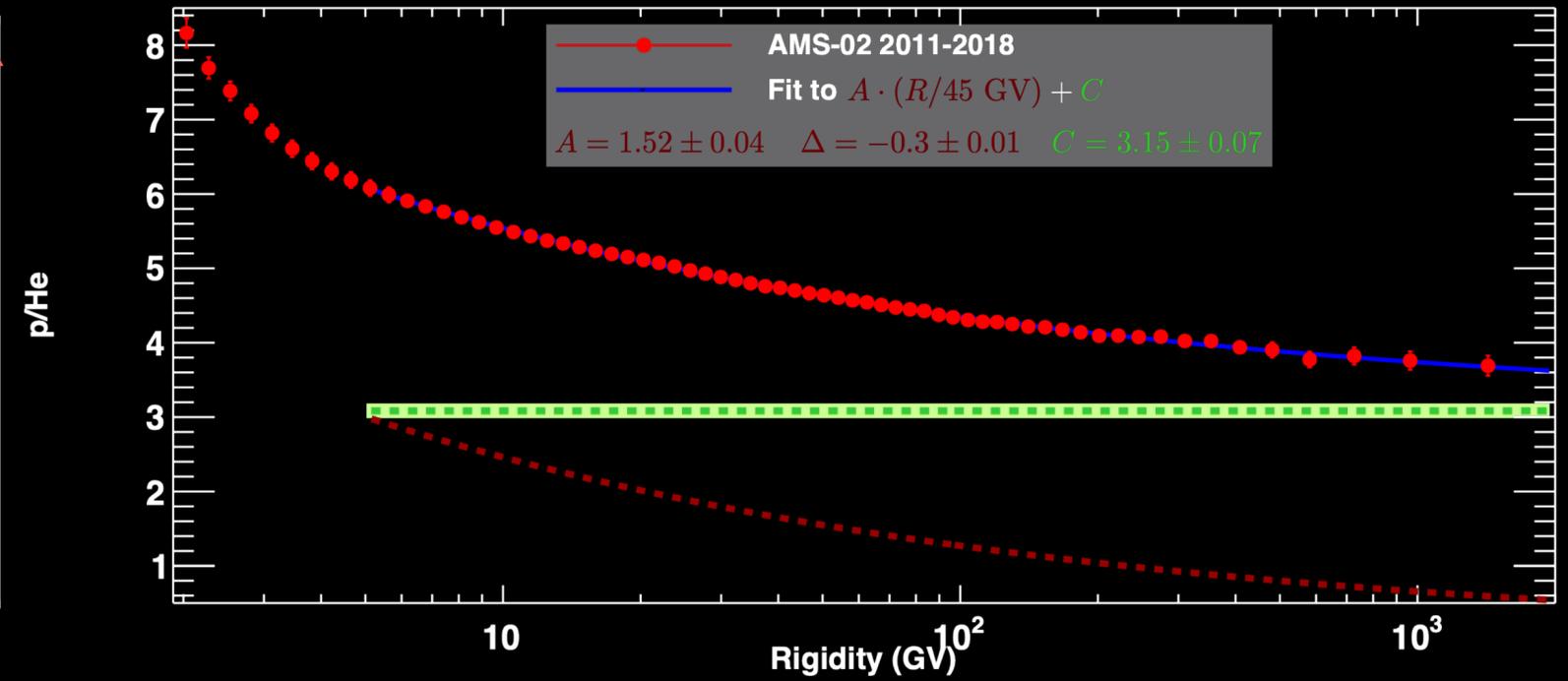
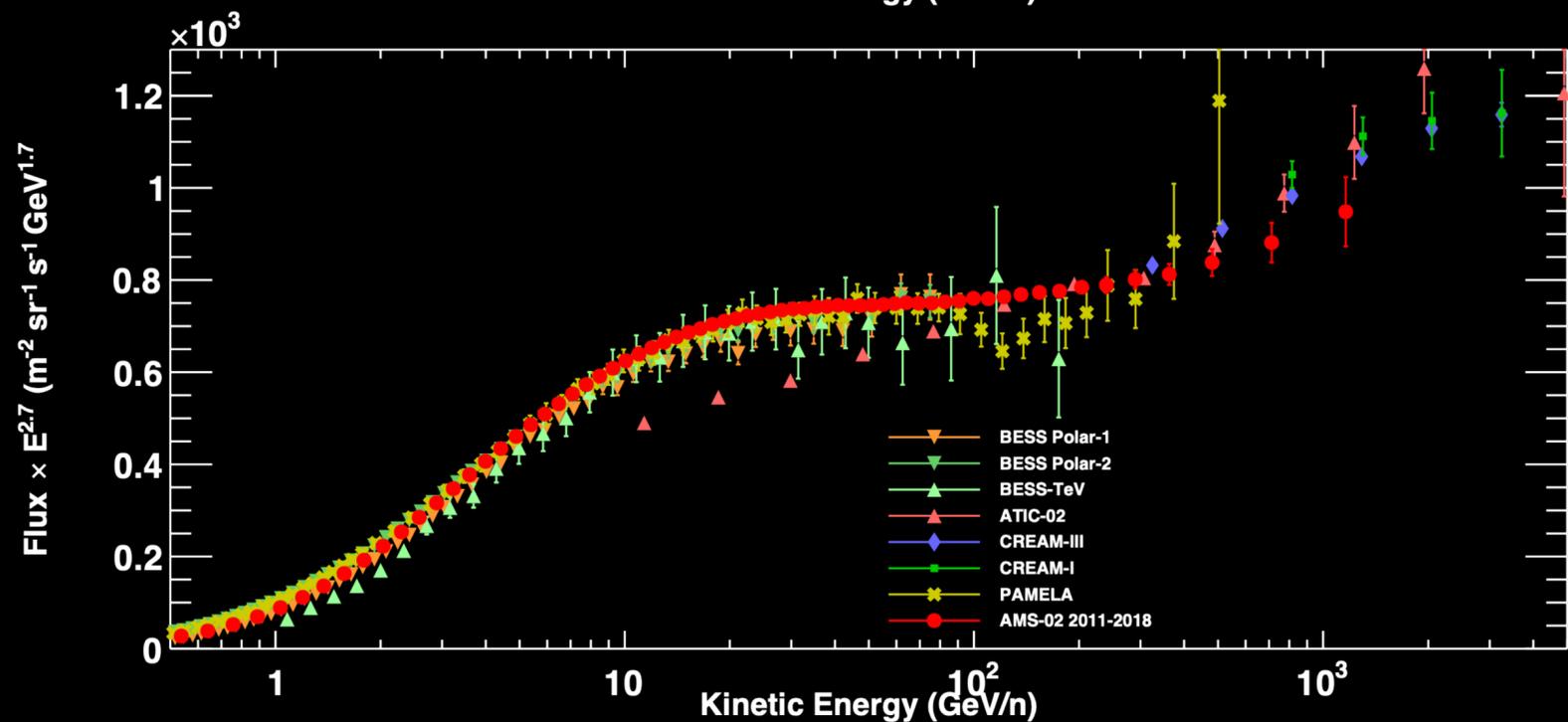
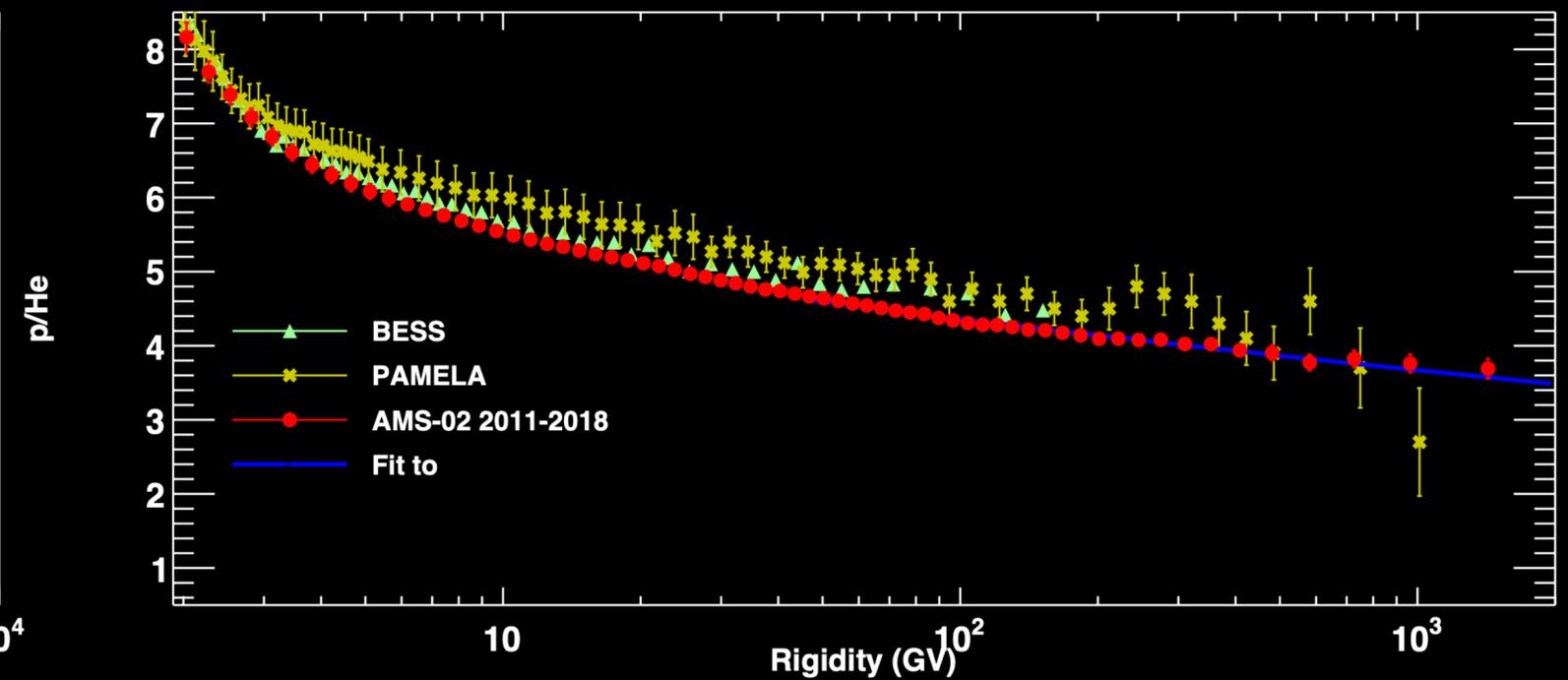
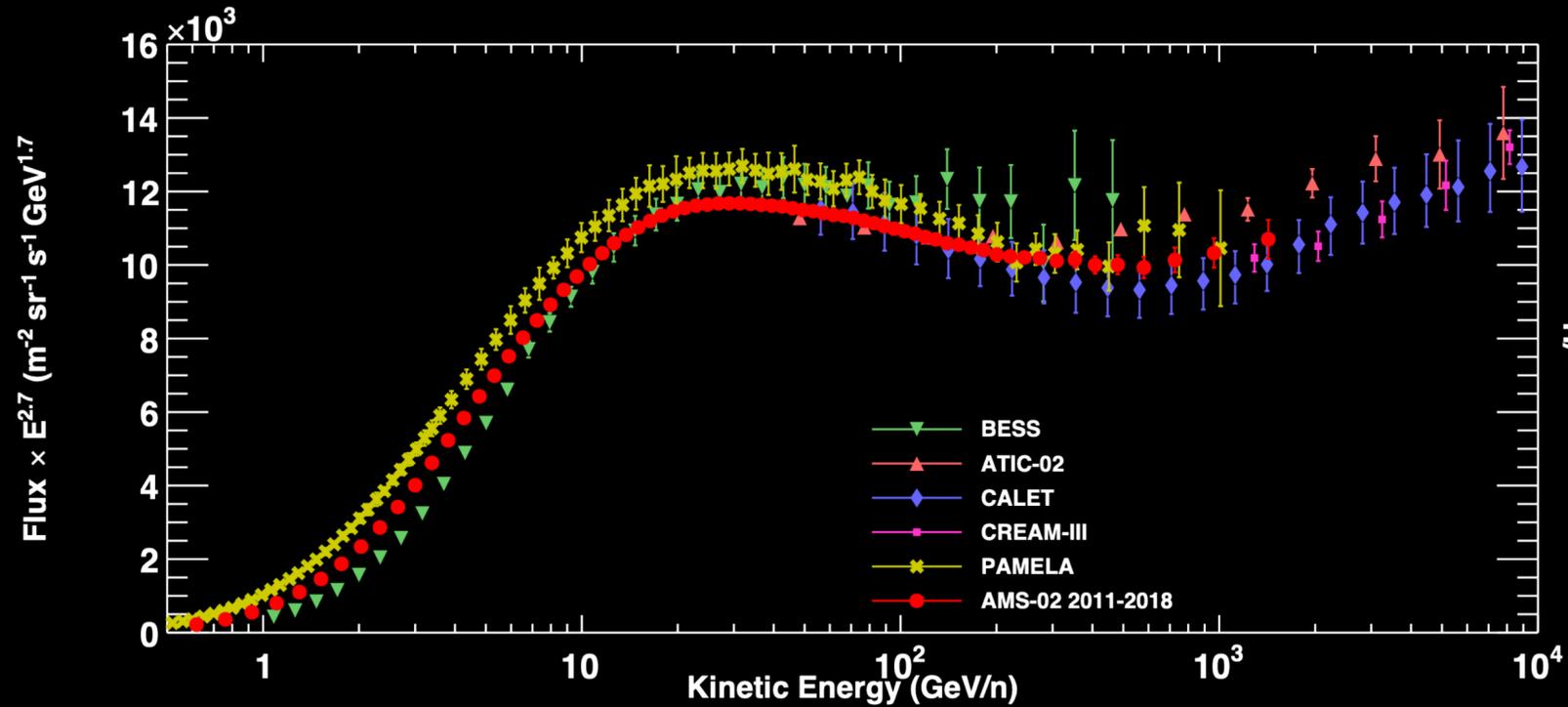


$p, He, C, O.., e^-$

$Li, Be, B...$

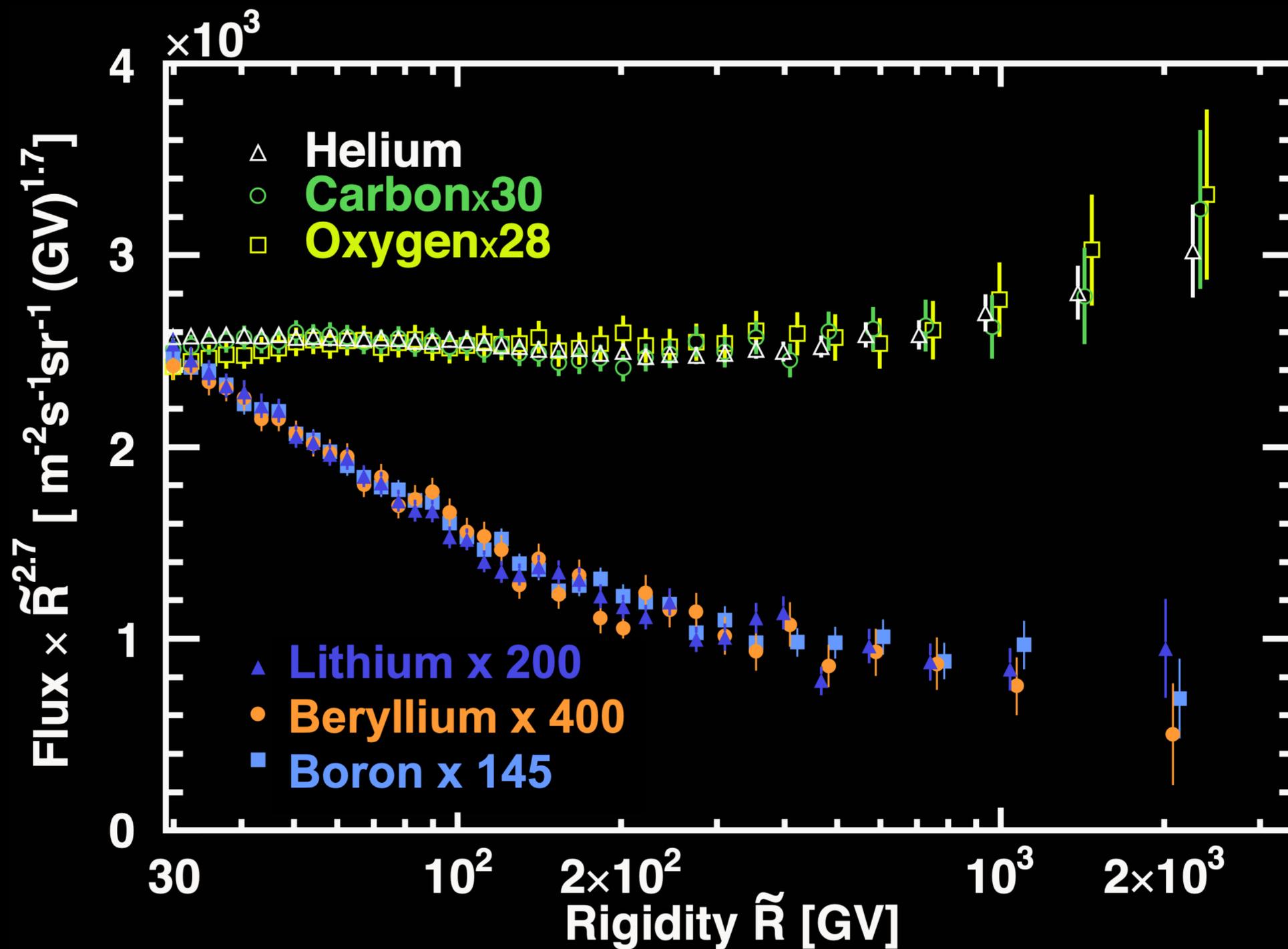
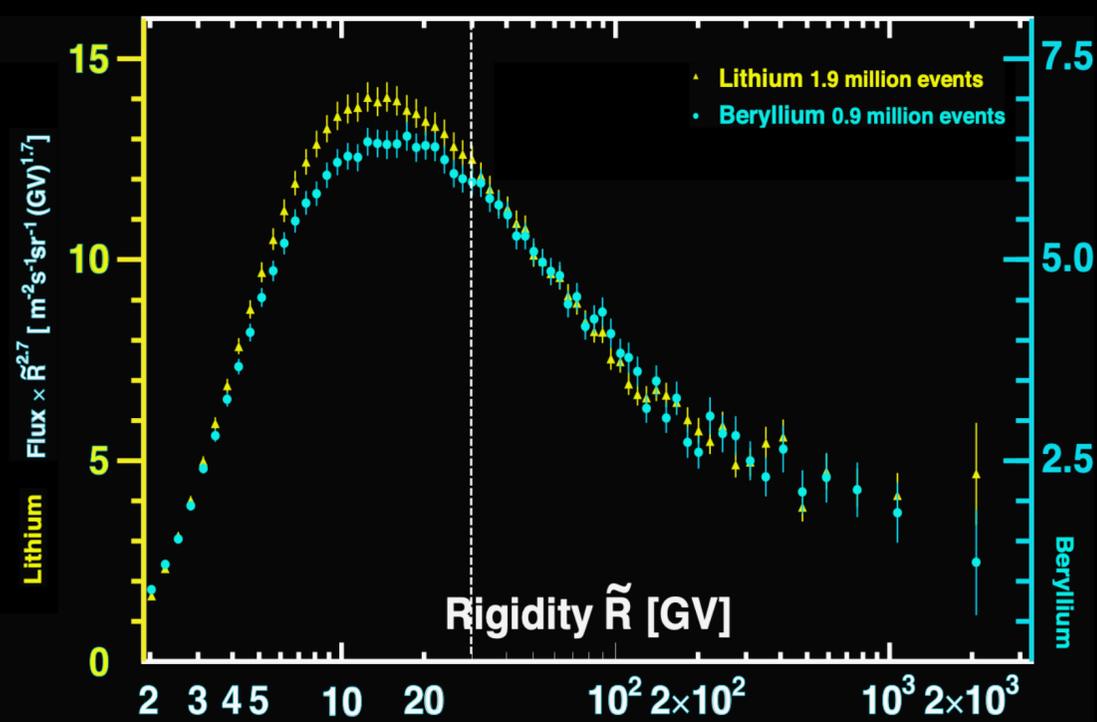
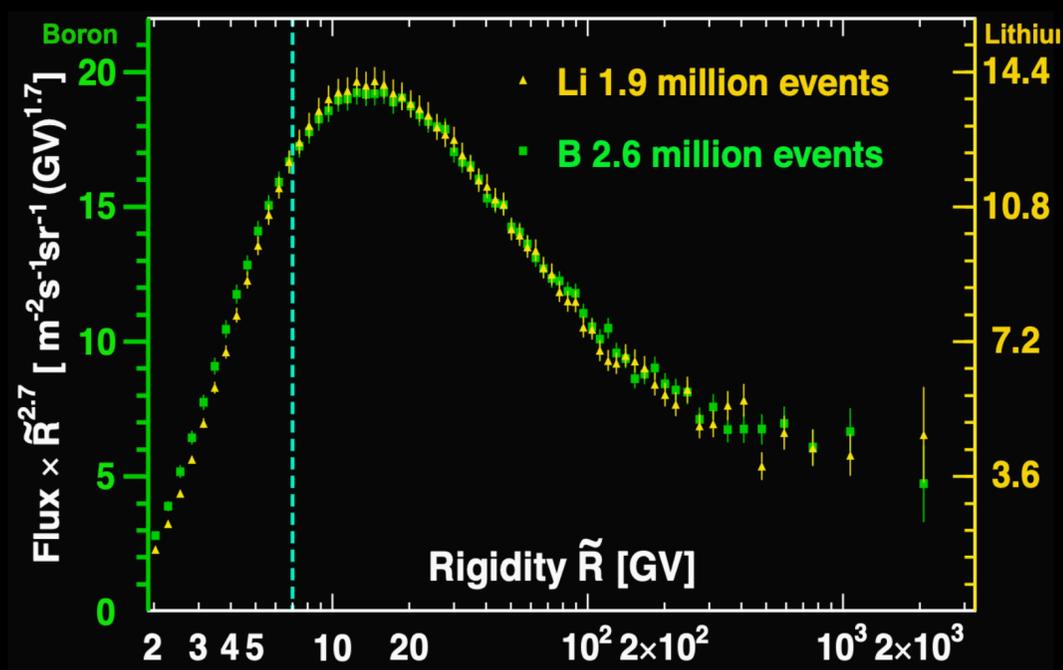
(but also other stuff like)  $\pi^\pm \rightarrow \mu^\pm \rightarrow e^\pm$   
 $p + p \rightarrow p + \bar{p} + \dots$

# FLUSSI DI PROTONI E ELIO





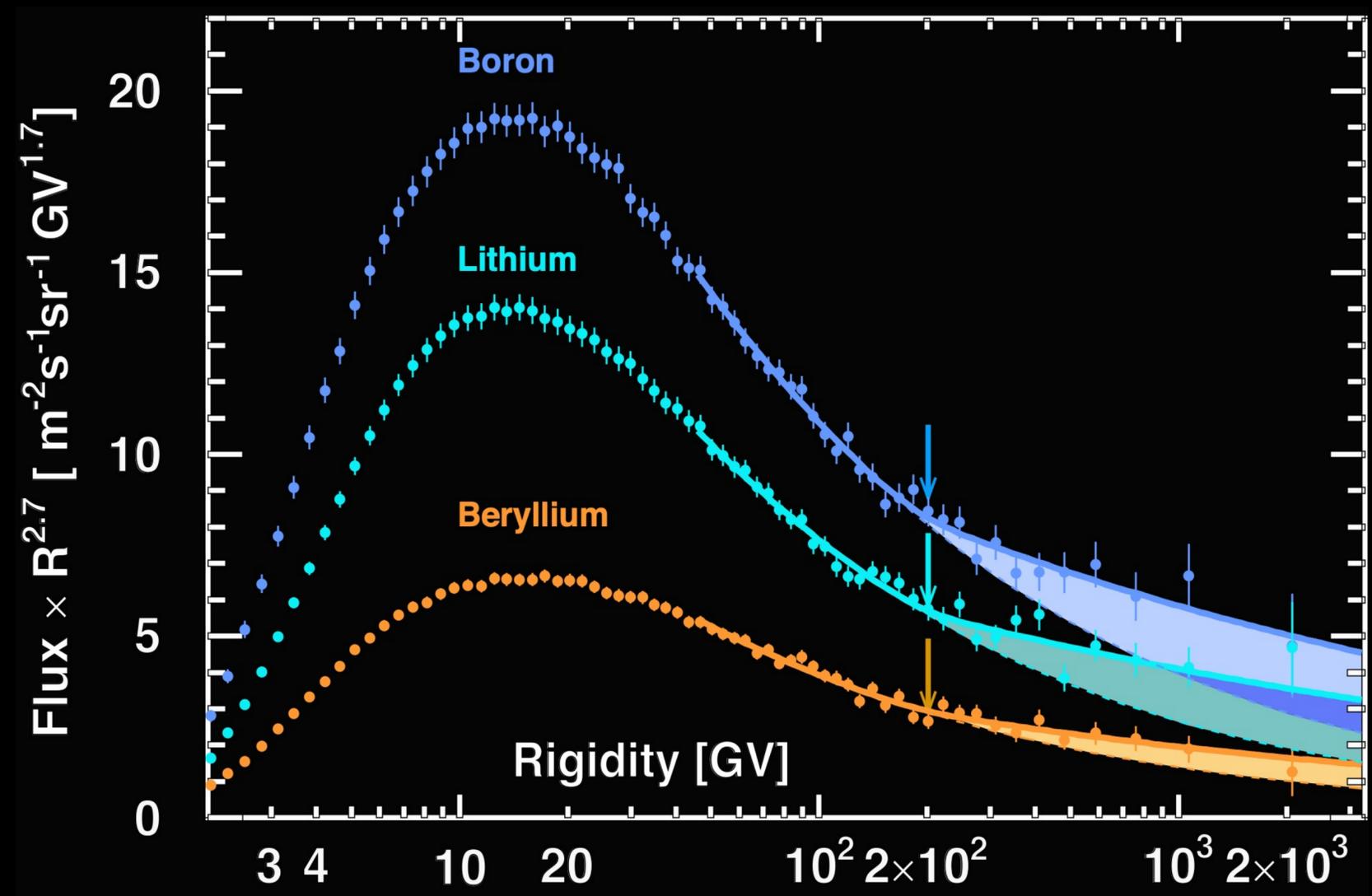
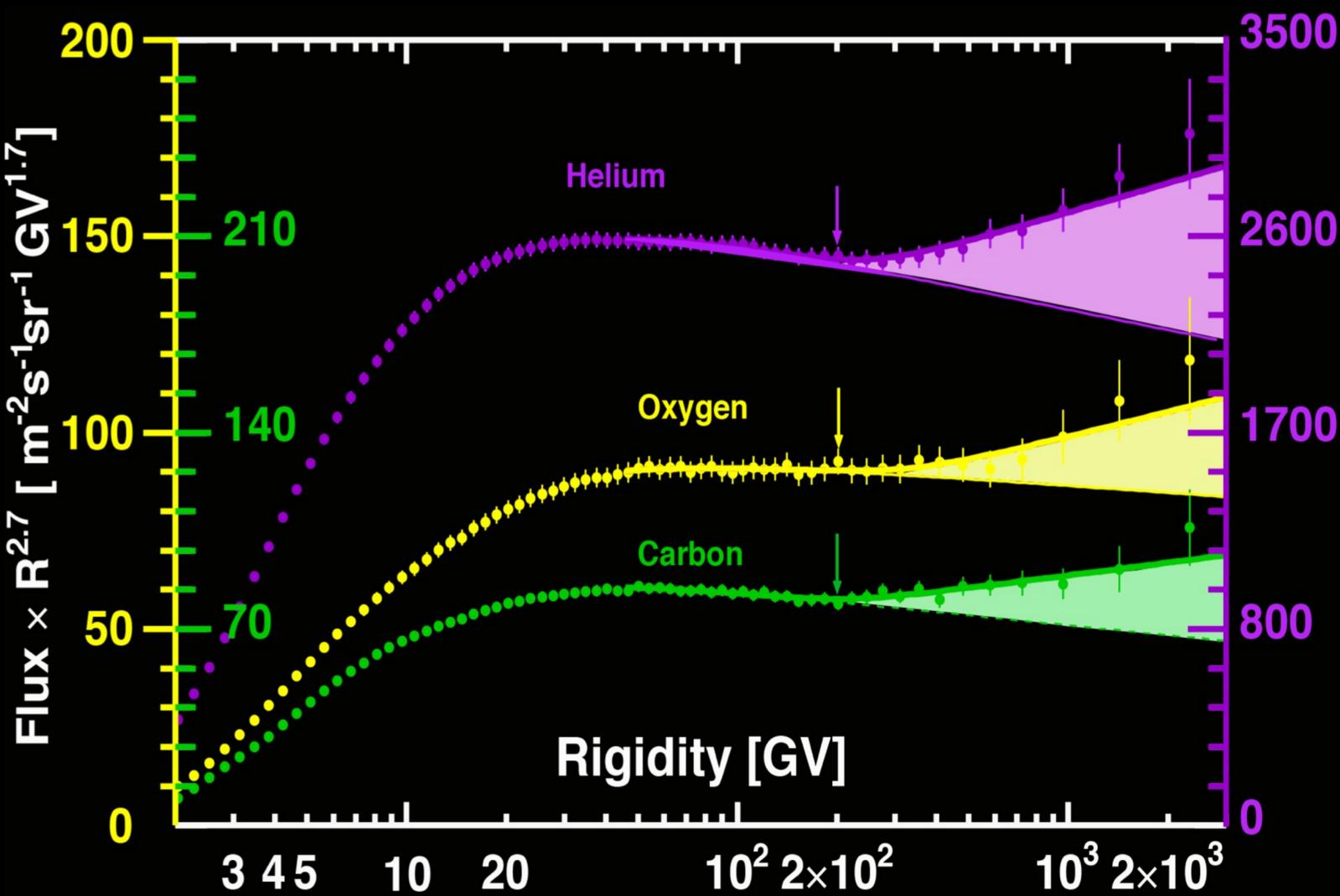
# FLUSSI DI NUCLEI LEGGERI



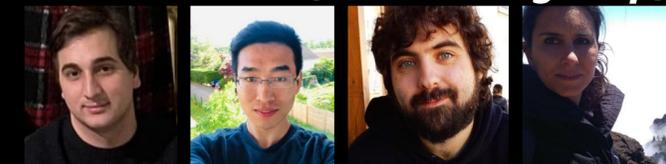
(AMS RM2 group)



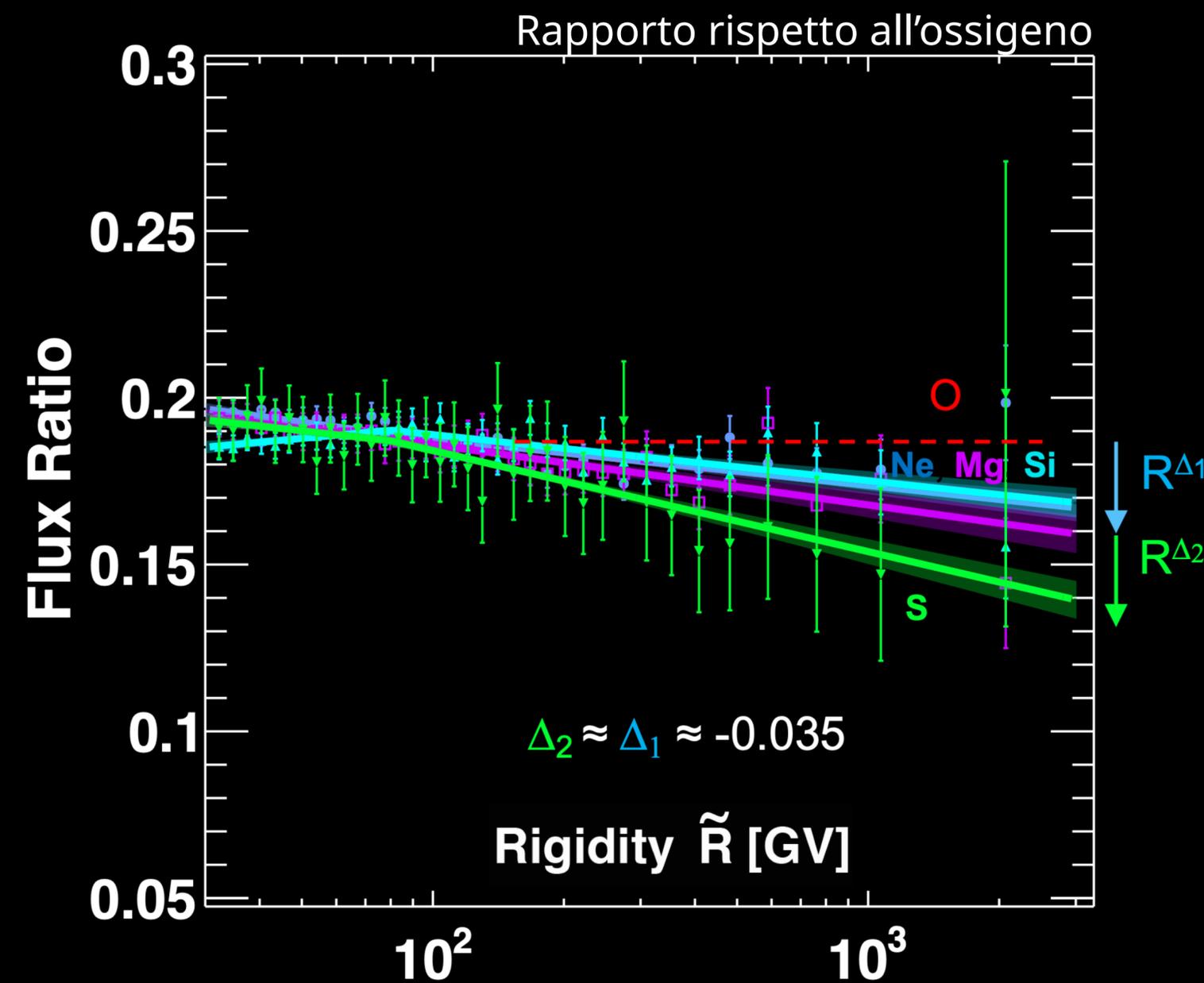
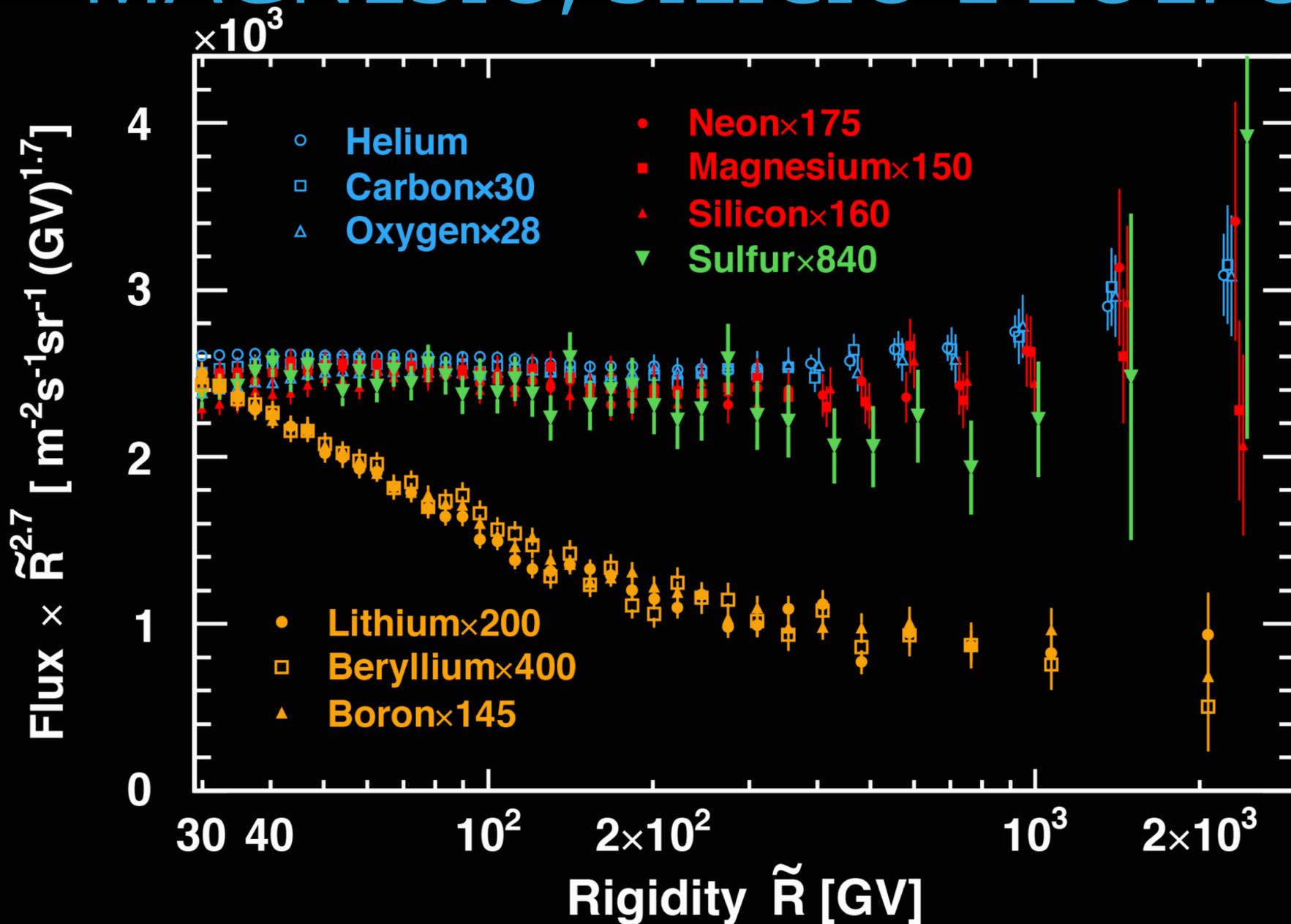
# FLUSSI DI NUCLEI LEGGERI: CARATTERISTICHE SPETTRALI



(AMS RM2 group)



# VERSO NUCLEI PIÙ PESANTI: NEON, MAGNESIO, SILICIO E ZOLFO

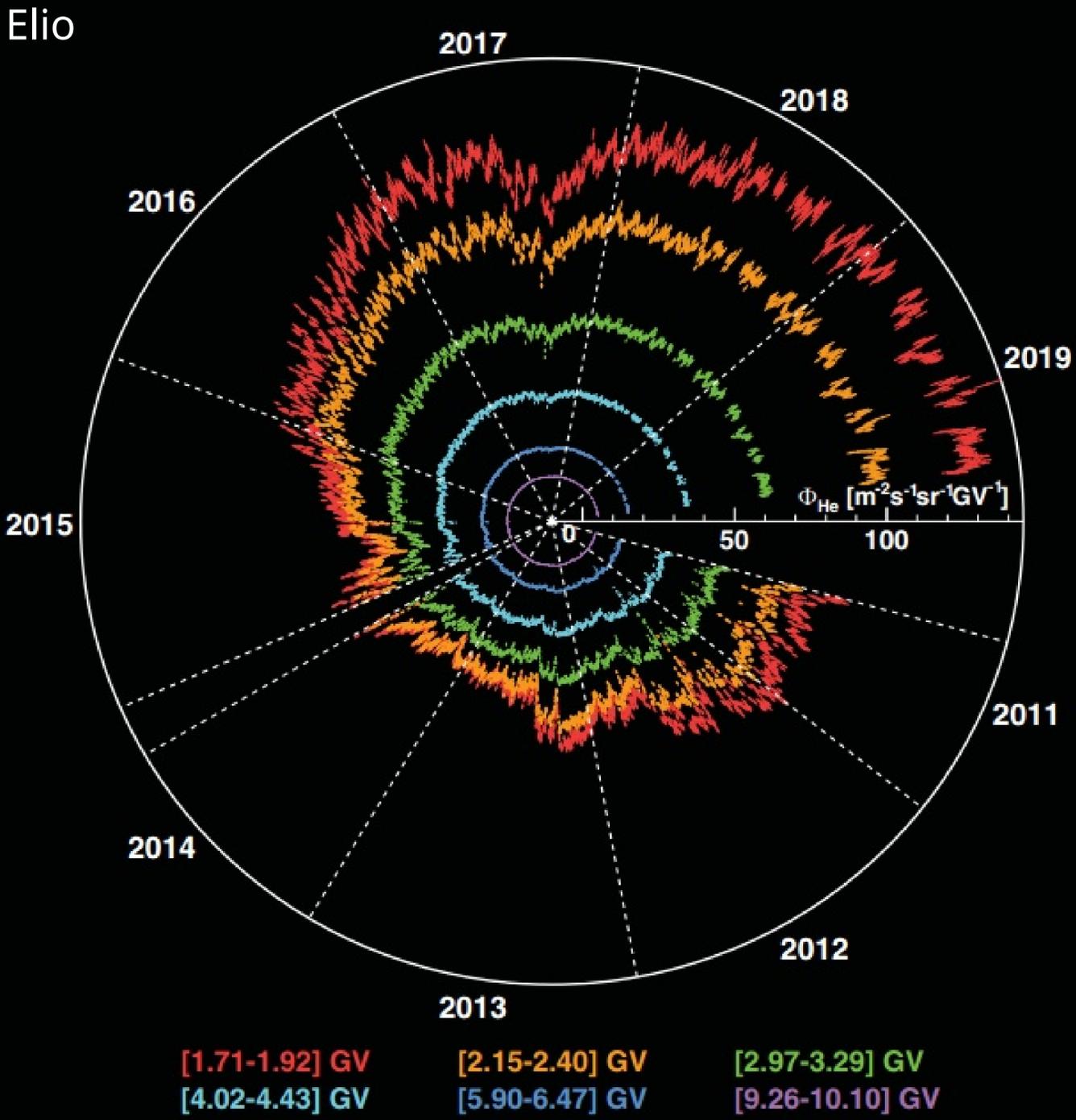
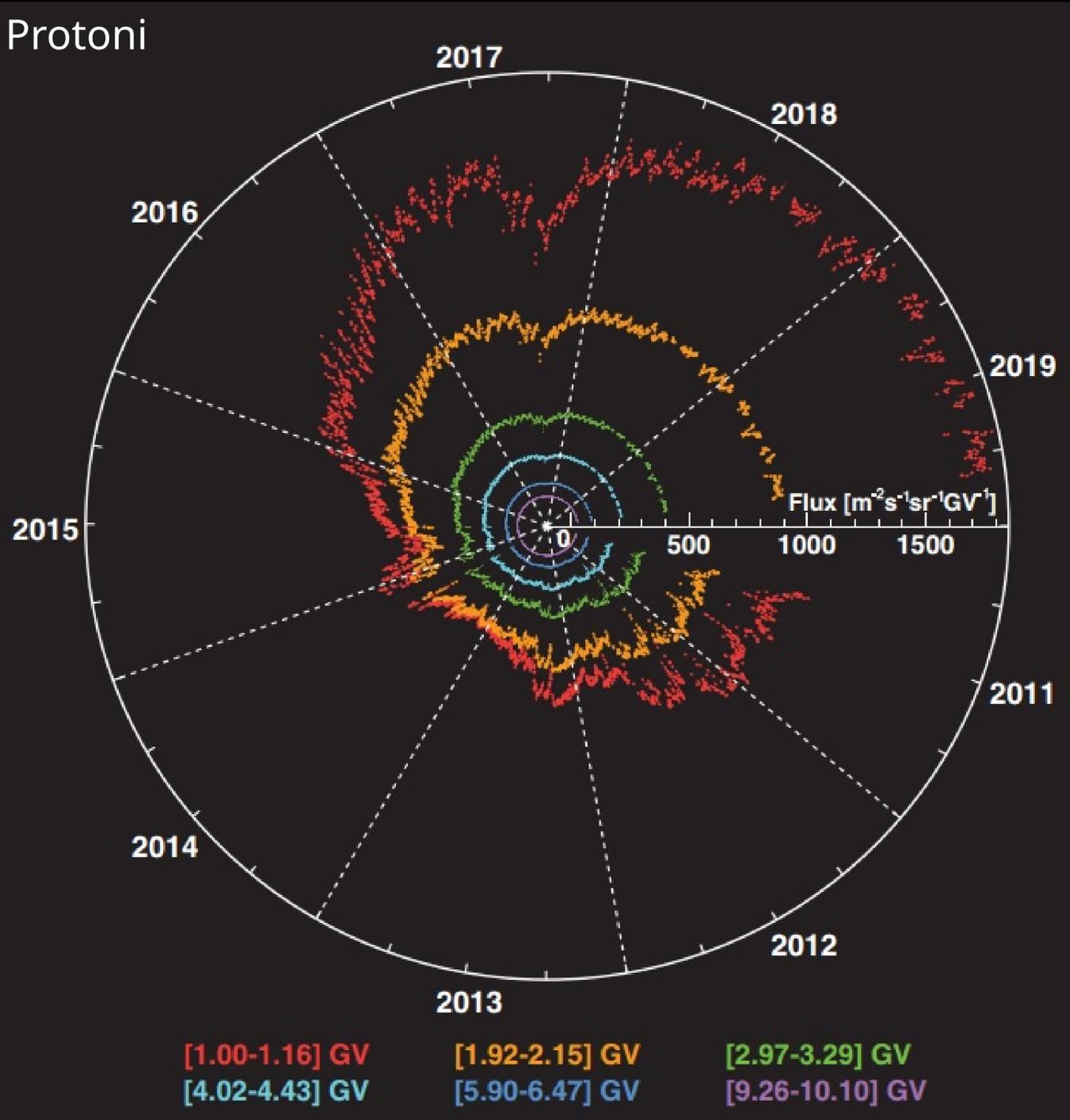


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# RAGGI COSMICI NELL'ELIOSFERA

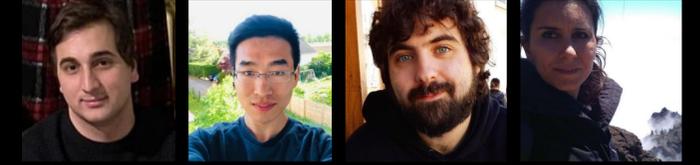


# RAGGI COSMICI NELL'ELIOSFERA

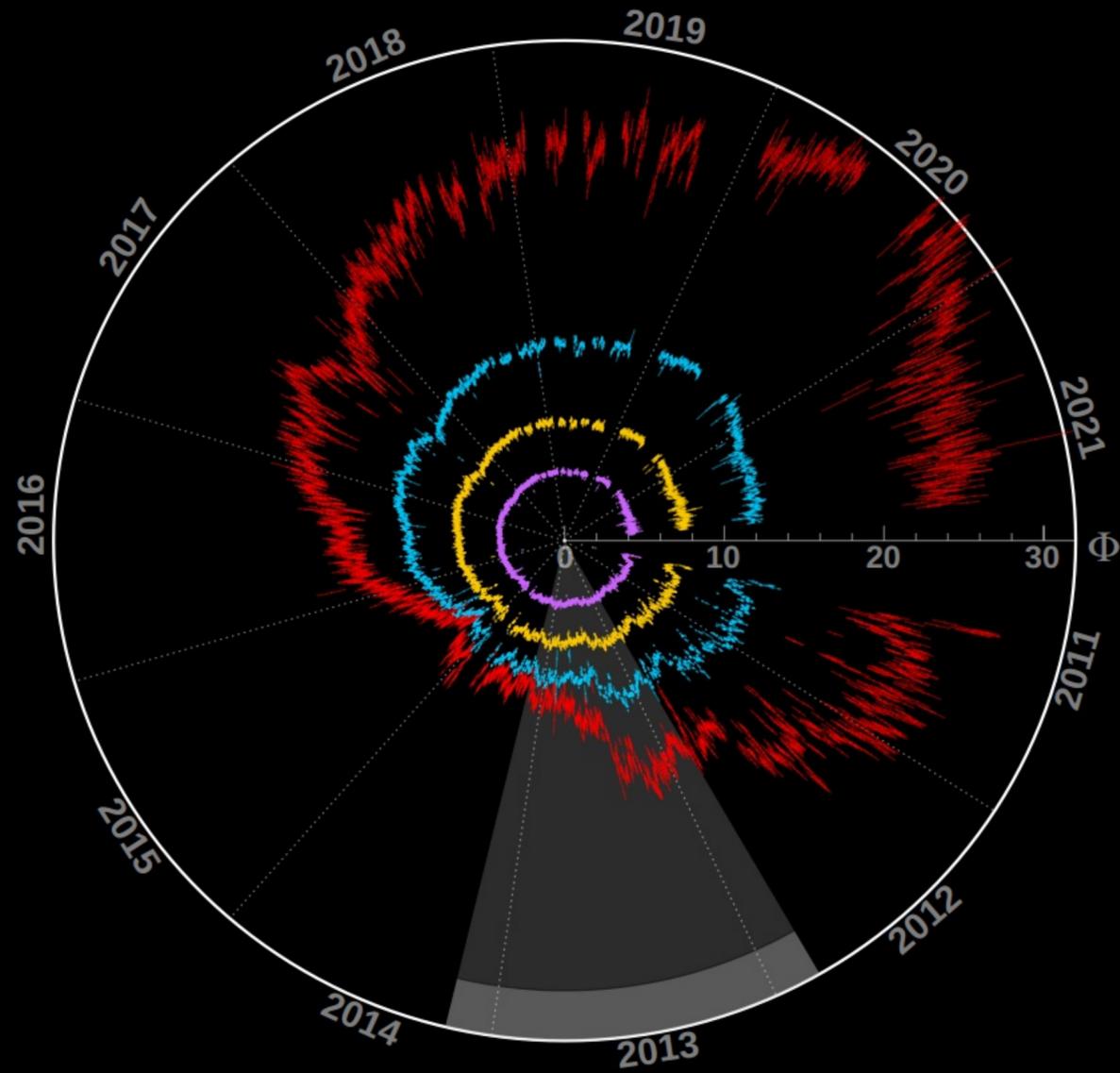


# RAGGI COSMICI NELL'ELIOSFERA

(AMS RM2 group)



Elettroni



[1.00 - 1.71] GV  $\Phi_{e^-}$

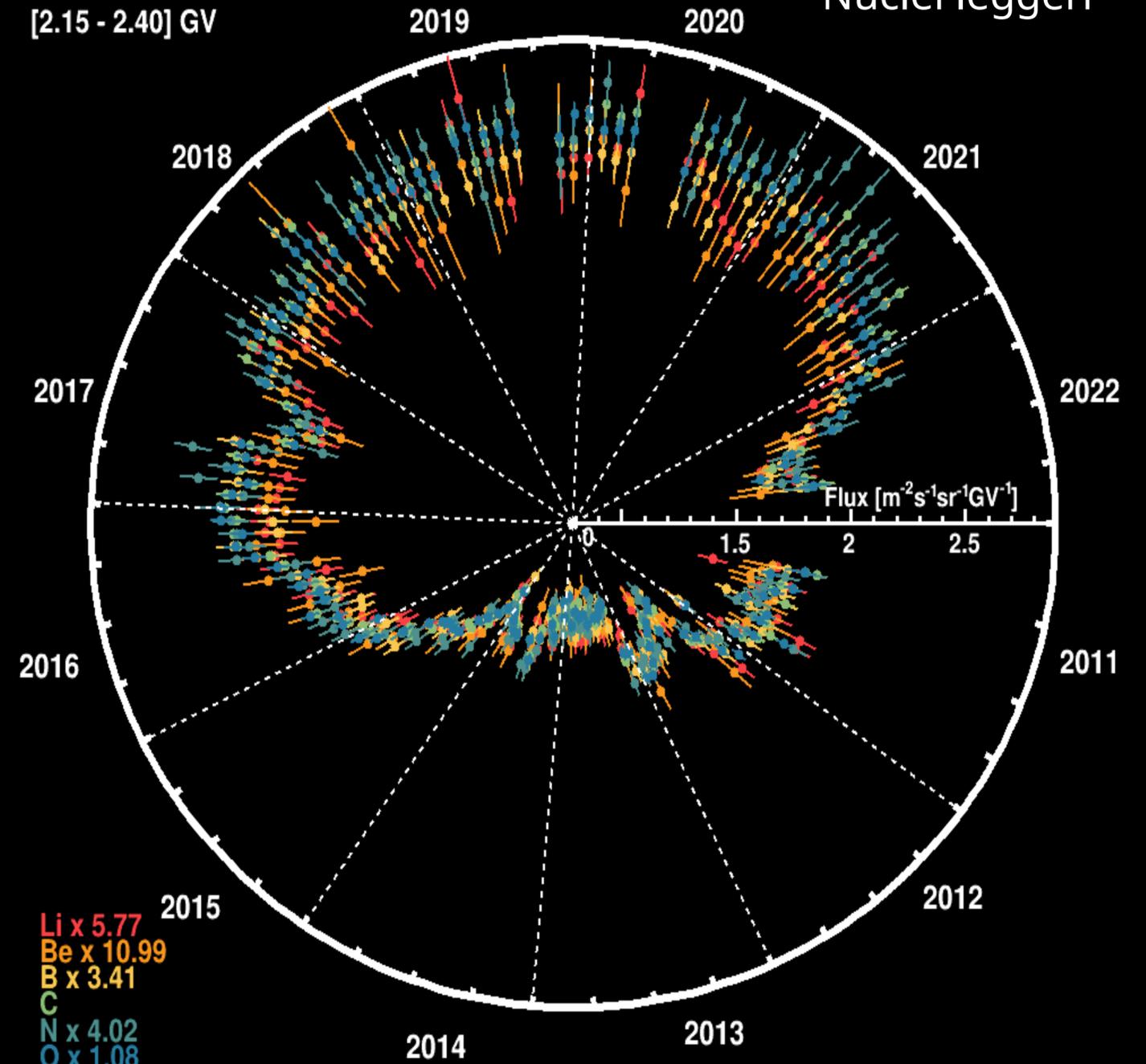
[5.90 - 7.1] GV  $\Phi_{e^-} \times 8$

[2.97 - 4.02] GV  $\Phi_{e^-} \times 2.5$

[8.48-11.0] GV  $\Phi_{e^-} \times 16$

[2.15 - 2.40] GV

Nuclei leggeri



Li x 5.77  
 Be x 10.99  
 B x 3.41  
 C  
 N x 4.02  
 O x 1.08

# PAYLOAD OPERATION CONTROL CENTER (POCC)



DATA/LEAD

(PM)  
TOF/ECAL/RICH

(TEE)  
TRACKER/TRD

THERMAL