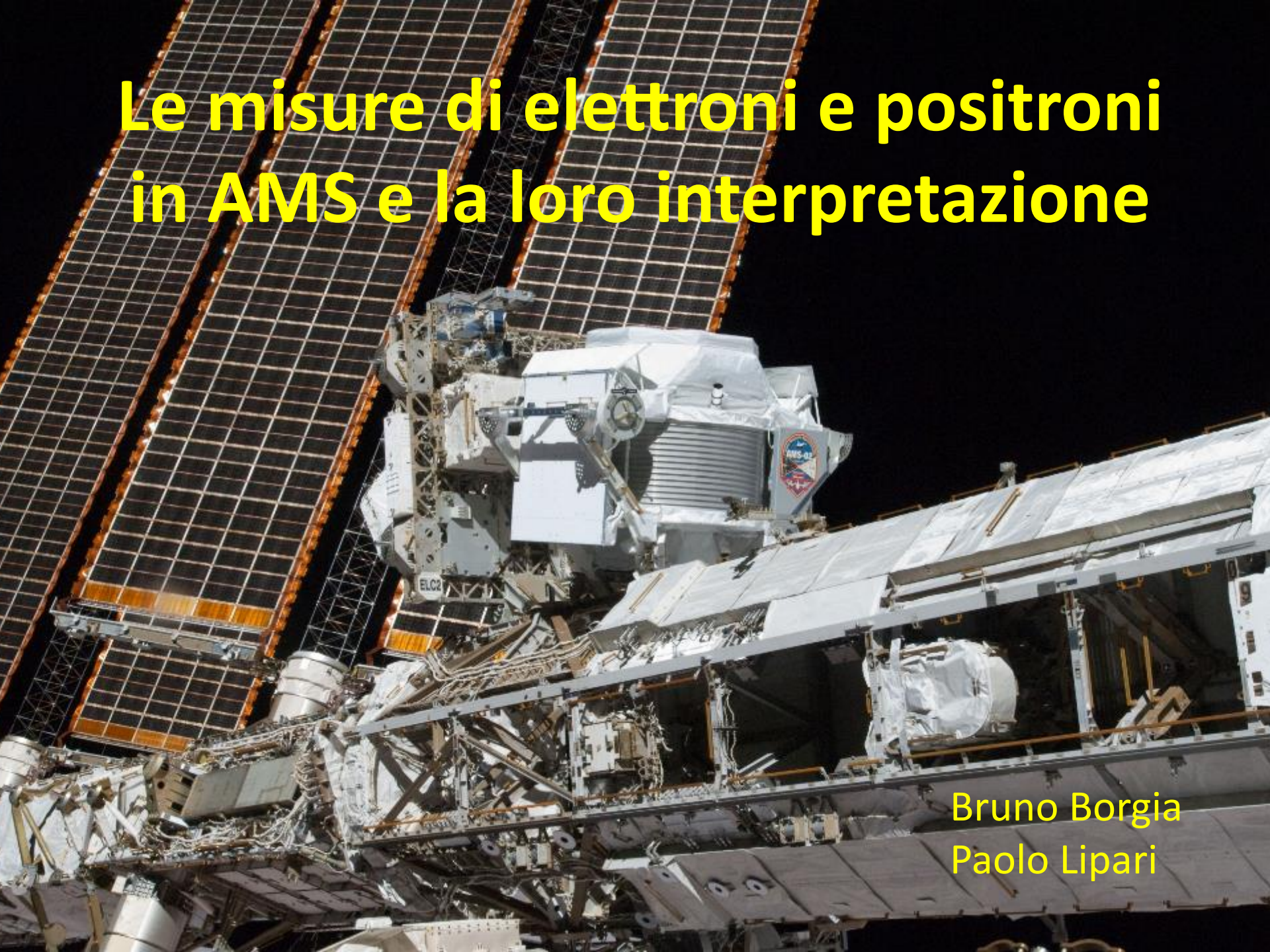
Le misure di elettroni e positroni in AMS e la loro interpretazione

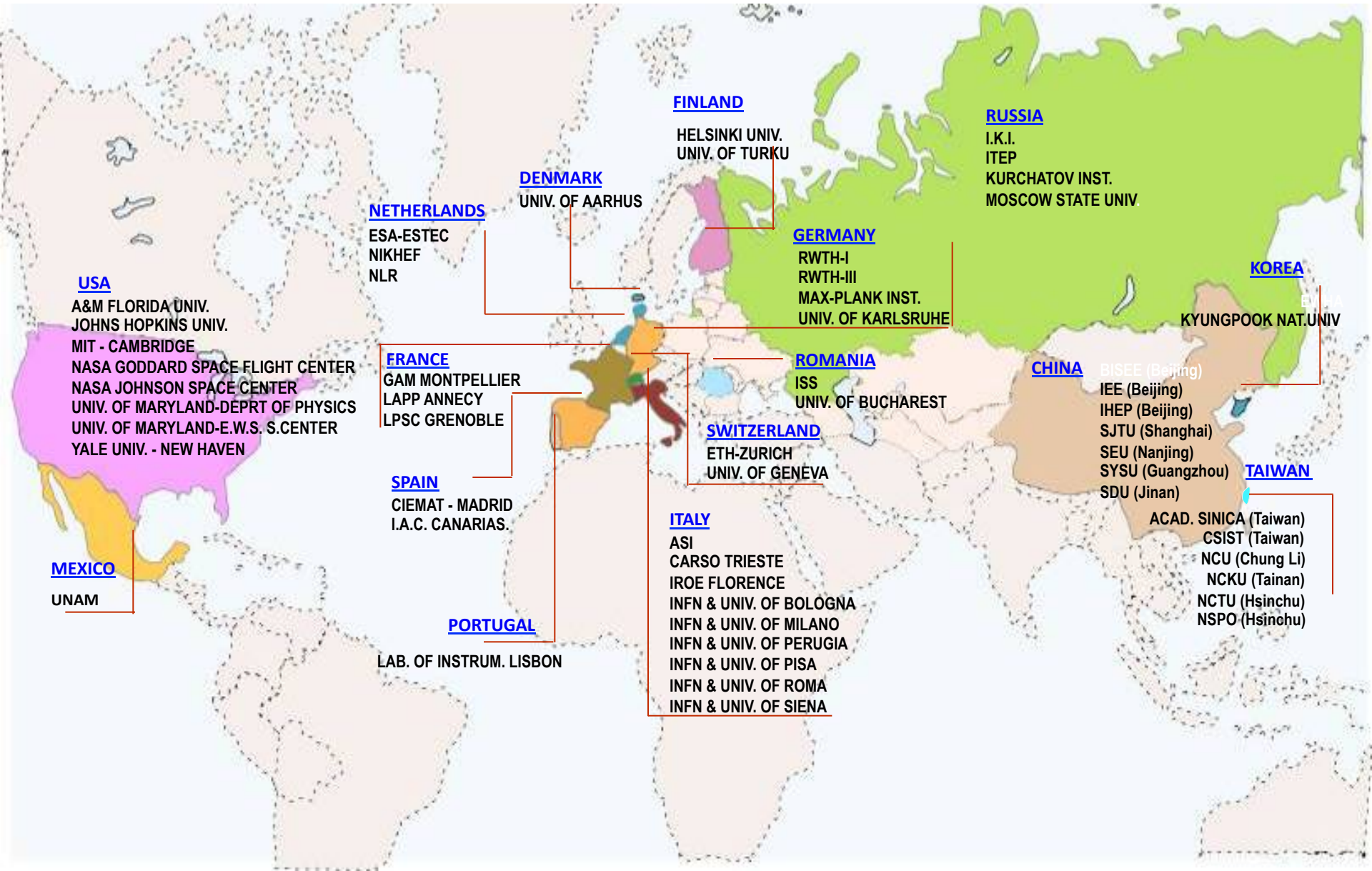


Bruno Borgia
Paolo Lipari

15ft x 12ft x 9ft
5m x 4m x 3m
7.5 tons

AMS is designed with the same precisions as the CERN LHC detectors
the technology has been miniaturized and upgraded to work on space

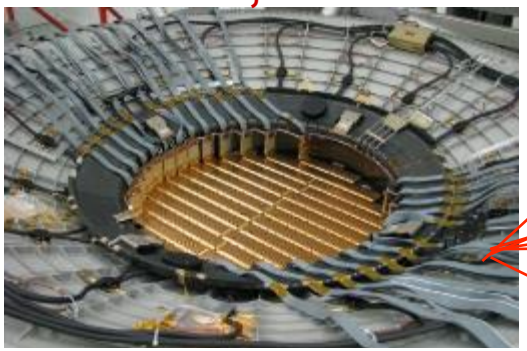
16 Paesi 60 Istituti 500 ingegneri ricercatori e tecnici



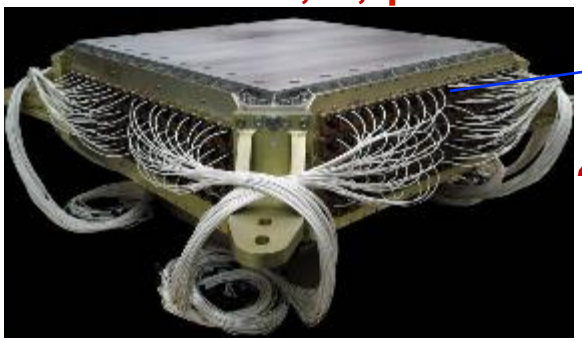
AMS: A TeV precision, multipurpose spectrometer

TRD
Identify e^+, e^-, Z

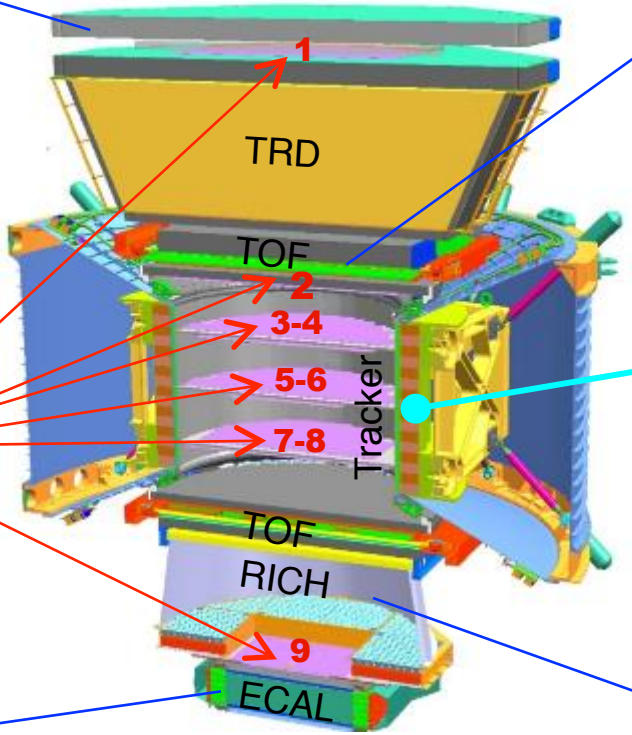
Silicon Tracker
Z, P



ECAL
E of e^+, e^-, γ



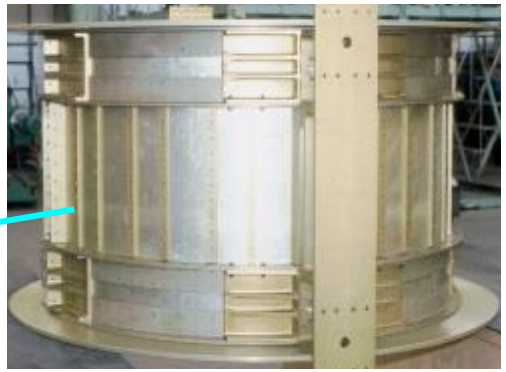
Particles and nuclei are defined by their charge (**Z**) and energy (**E ~ P**)



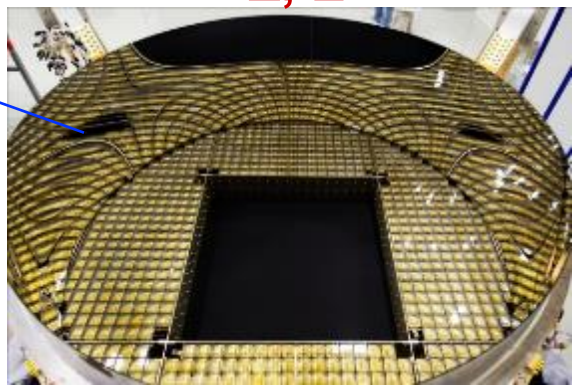
***Z, P** are measured independently by the Tracker, RICH, TOF and ECAL*

TOF
Z, E

Magnet
±Z



RICH
Z, E



Dimensioni: 5 x 4 x 3 m^3

Massa: 7 500 kg

Potenza: 2 500 W

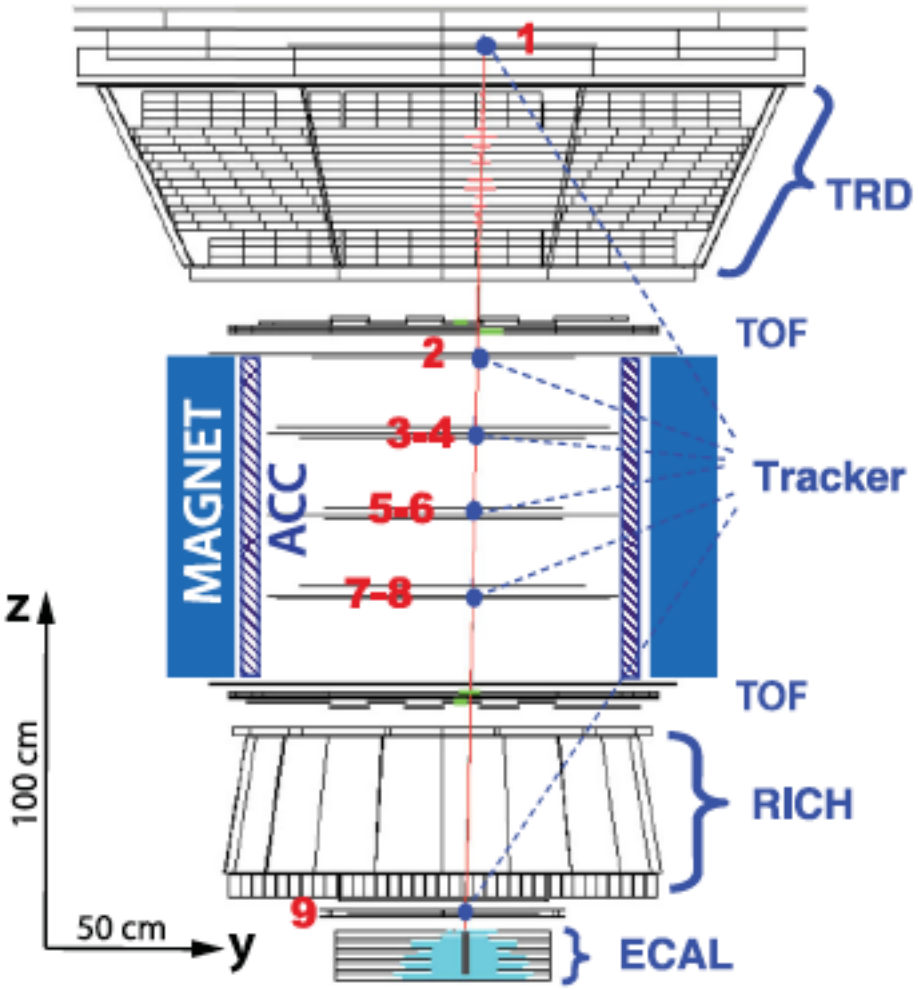
Canali di elettronica: 300 000

Microprocessori: 650

Data rate a terra: 10 Mbit/s

Durata della missione: 10 - 18 anni

Campo magnetico: 0.15 T
Magnete permanente 1200 kg $Nd_2 Fe_{14} B$



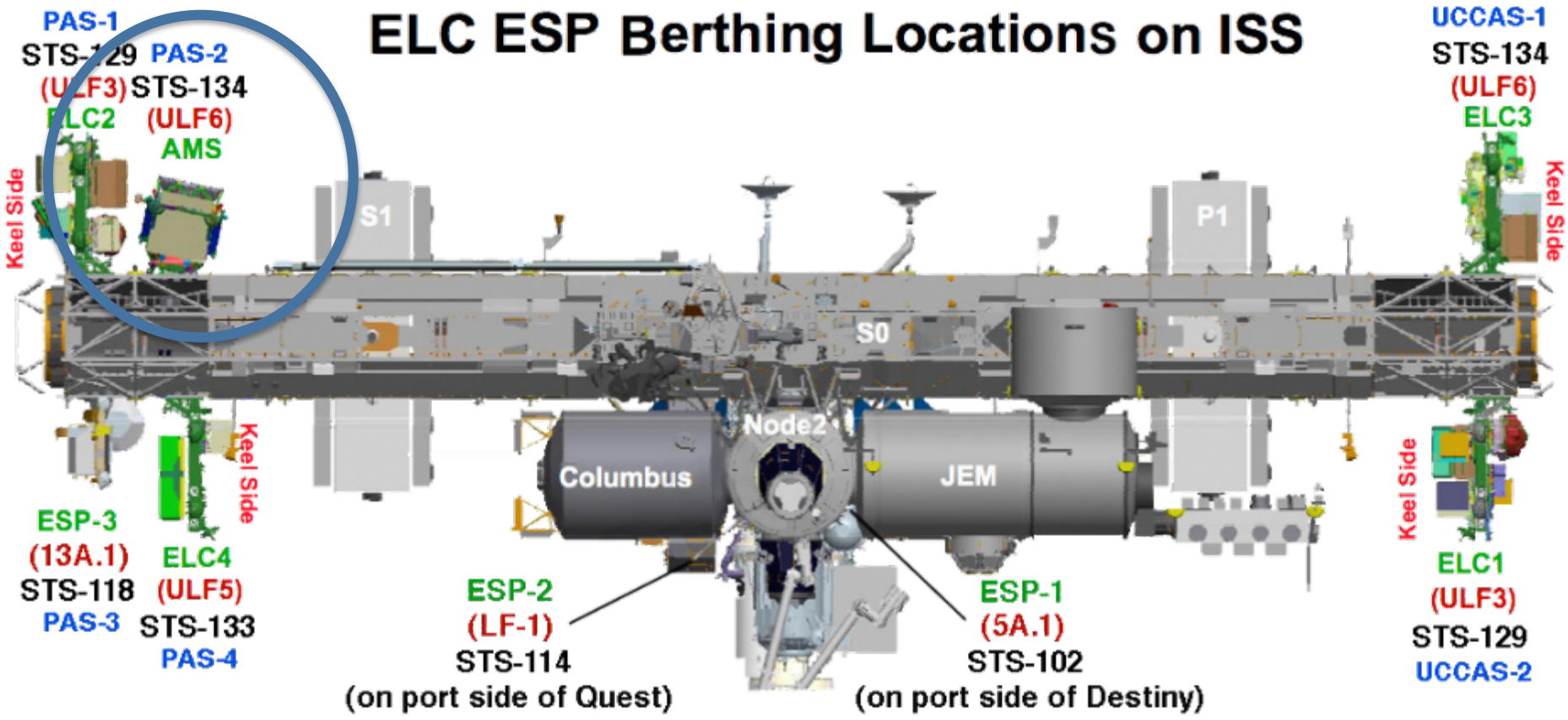
Transition Radiation Detector (TRD):

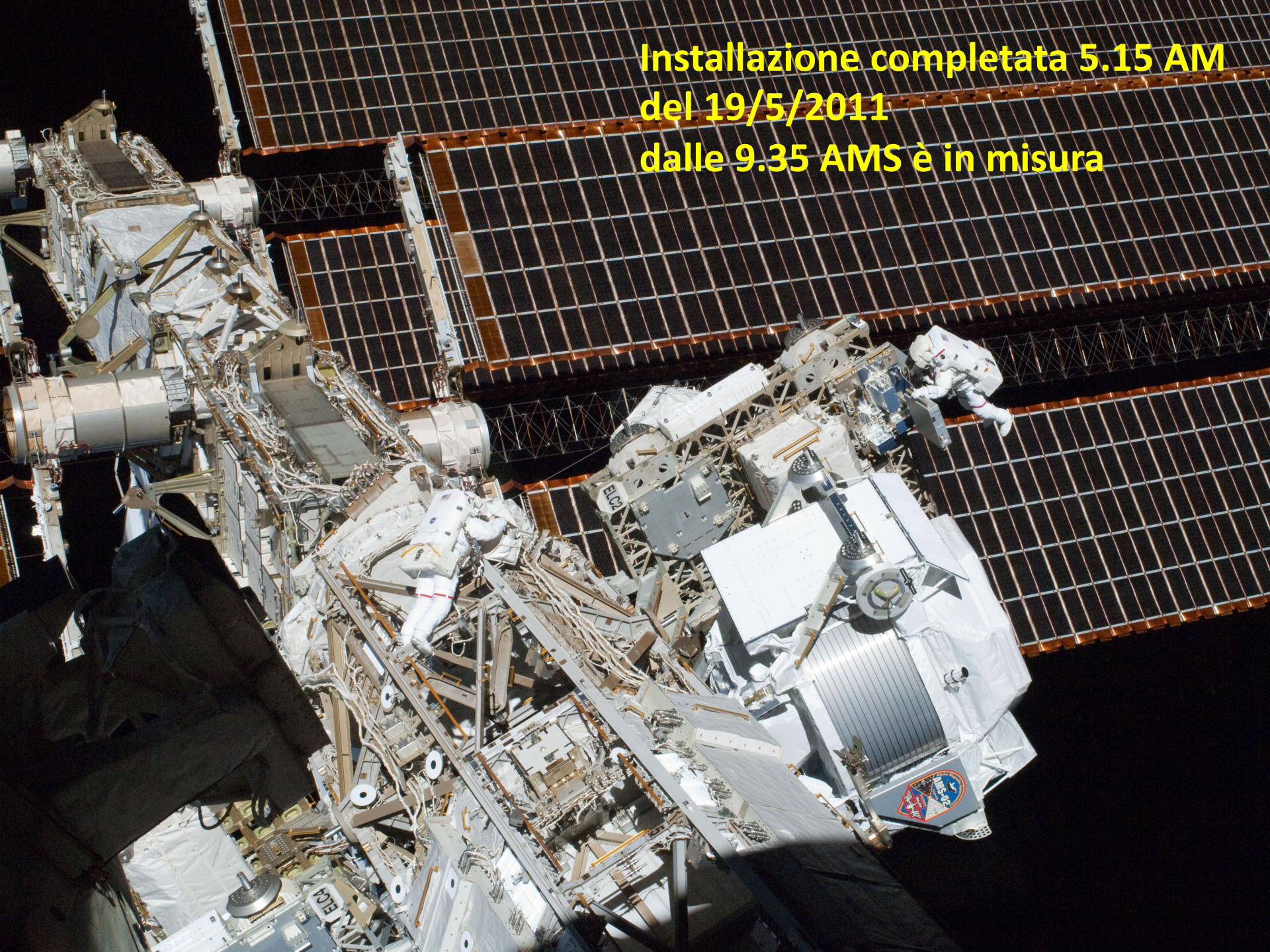
identifies Positrons, Electrons by transition radiation and Nuclei by dE/dX

May 16, 2011, 08:56 AM

Total weight: 2008 t
AMS weight: 7.5 t

2,5 ore dopo il lancio, i primi a funzionare sono i controlli del TRD


ELC ESP Berthing Locations on ISS
PAS-1
STS-129
(ULF3)
ELC2
PAS-2
STS-134
(ULF6)
AMS
UCCAS-1
STS-134
(ULF6)
ELC3
Keel Side
Keel Side
S1
P1
S0
Node2
Columbus
JEM
Keel Side
Keel Side
ESP-3
(13A.1)
STS-118
PAS-3
ELC4
(ULF5)
STS-133
PAS-4
ESP-2
(LF-1)
STS-114
(on port side of Quest)
ESP-1
(5A.1)
STS-102
(on port side of Destiny)
ELC1
(ULF3)
STS-129
UCCAS-2


Installazione completata 5.15 AM
del 19/5/2011
dalle 9.35 AMS è in misura

AMS Payload Operation Control Center POCC al CERN

24h/24 365 d/y ≈ 1200 days data taking ≈ 50x10^9 events

Space Shuttle Mission is not what they told you! They plan to blow it up on reentry!

Posted By: Mr.Ed [Send E-Mail]
Date: Monday, 16-May-2011 20:14:27

Monday, May 16, 2011
CABAL'S AMS-02 STAR WARS WEAPON
Submitted by Dick R. - Thanks

CABAL'S AMS-02 STAR WARS WEAPON

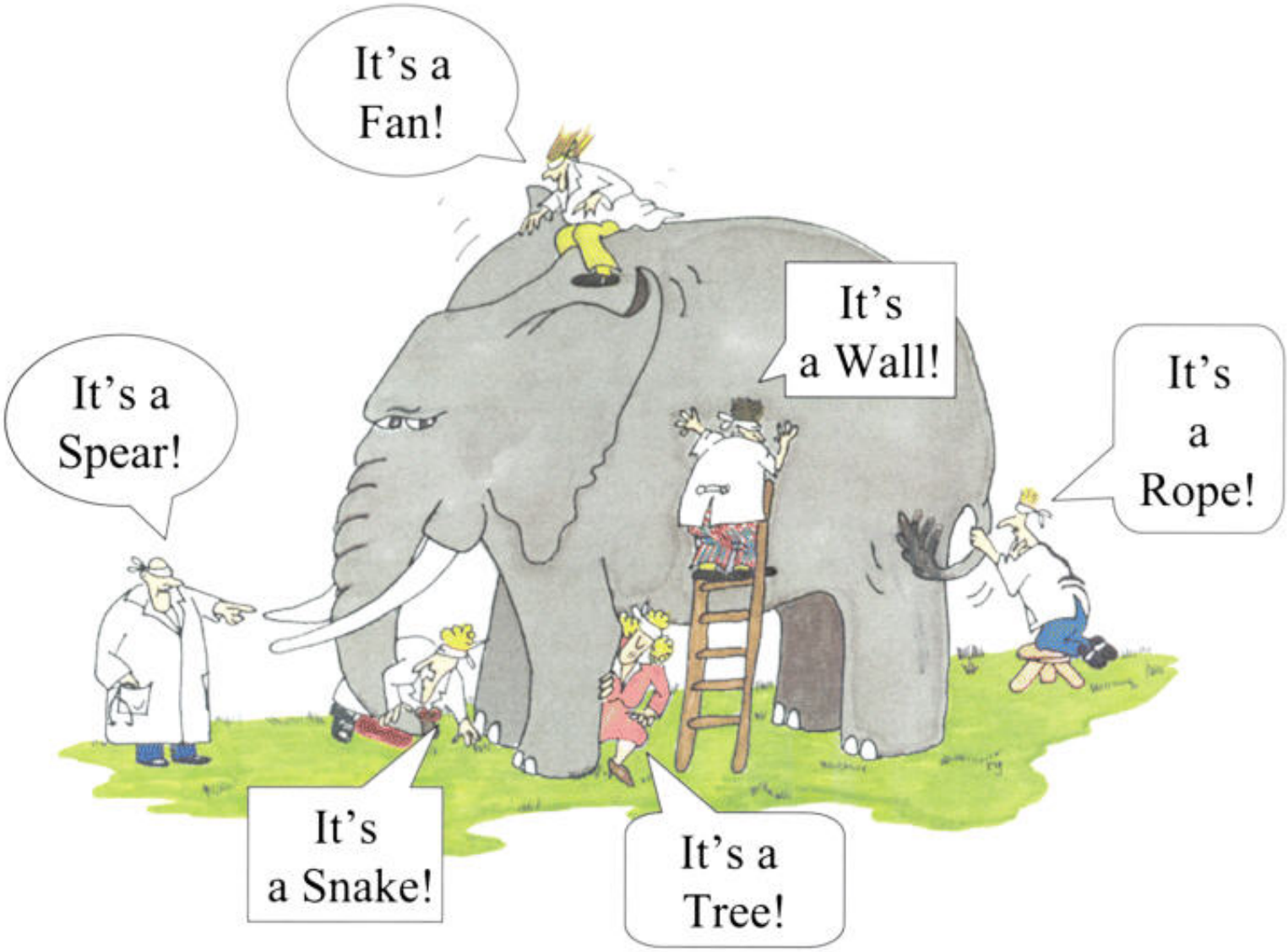
Dr. Richard Boylan

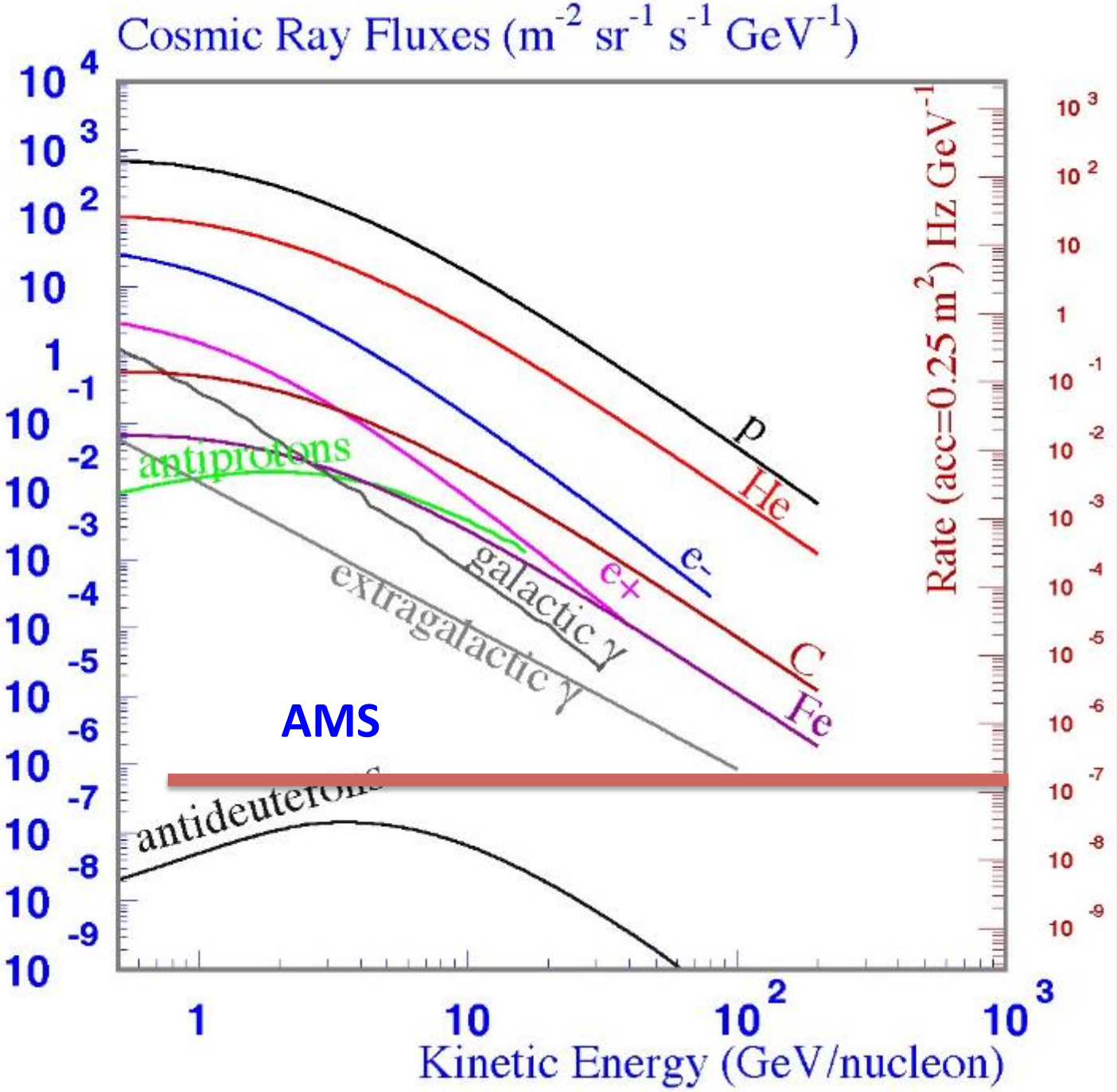
Now, three months later, the Cabal plan to use the Space Shuttle Endeavor, (launch rescheduled to Monday, May 16, 8:56 am EDT/12:56 Greenwich Mean Time/UTC), to place a different Star Wars anti-UFO weapons system into orbit, set to kill.

Shuttle Endeavor's official mission is to haul a deliberately-mislabeled "Alpha Magnetic Spectrometer" (AMS-02) to the International Space Station and install it. NASA claims that the AMS-02 is a state-of-the-art particle physics detector. In actuality the AMS-02 is an advanced extreme-energy neutral-particle-beam space weapon intended to shoot down Star Visitor craft (UFOs). And instead of the International Space Station, Shuttle Endeavor will deliver the AMS-02 Star Wars weapon to a secret military space station, also in orbit.

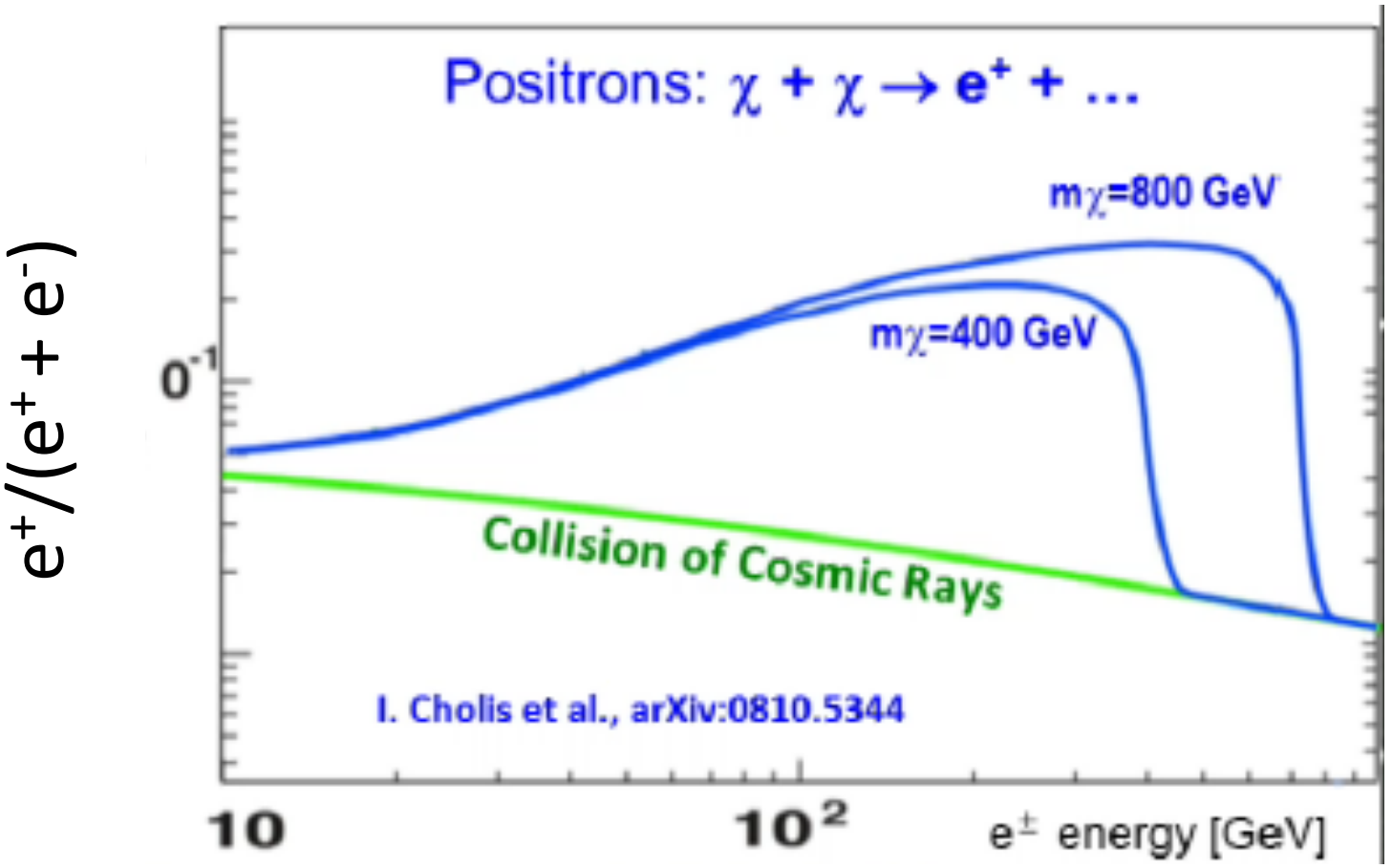
Obiettivi

- **Ricerca di antimateria primordiale:**
  - Anti-nuclei: $\overline{\text{He}}$, $\overline{\text{C}}$, …
- **RICERCA DI MATERIA OSCURA:**
  - annichilazione dei neutralini ⟶ e+ , e± , $\bar{p}$, …
- **Ricerca di nuovi tipi di materia:**
  - strangelets, …
- **Misura degli spettri dei RC**
- **Sorgenti locali di fotoni di alta energia (~TeV):**
  - SNR, Pulsars, PBH, …
- **Effetti della modulazione solare (ciclo 11a)**
- **Fenomeni inaspettati**

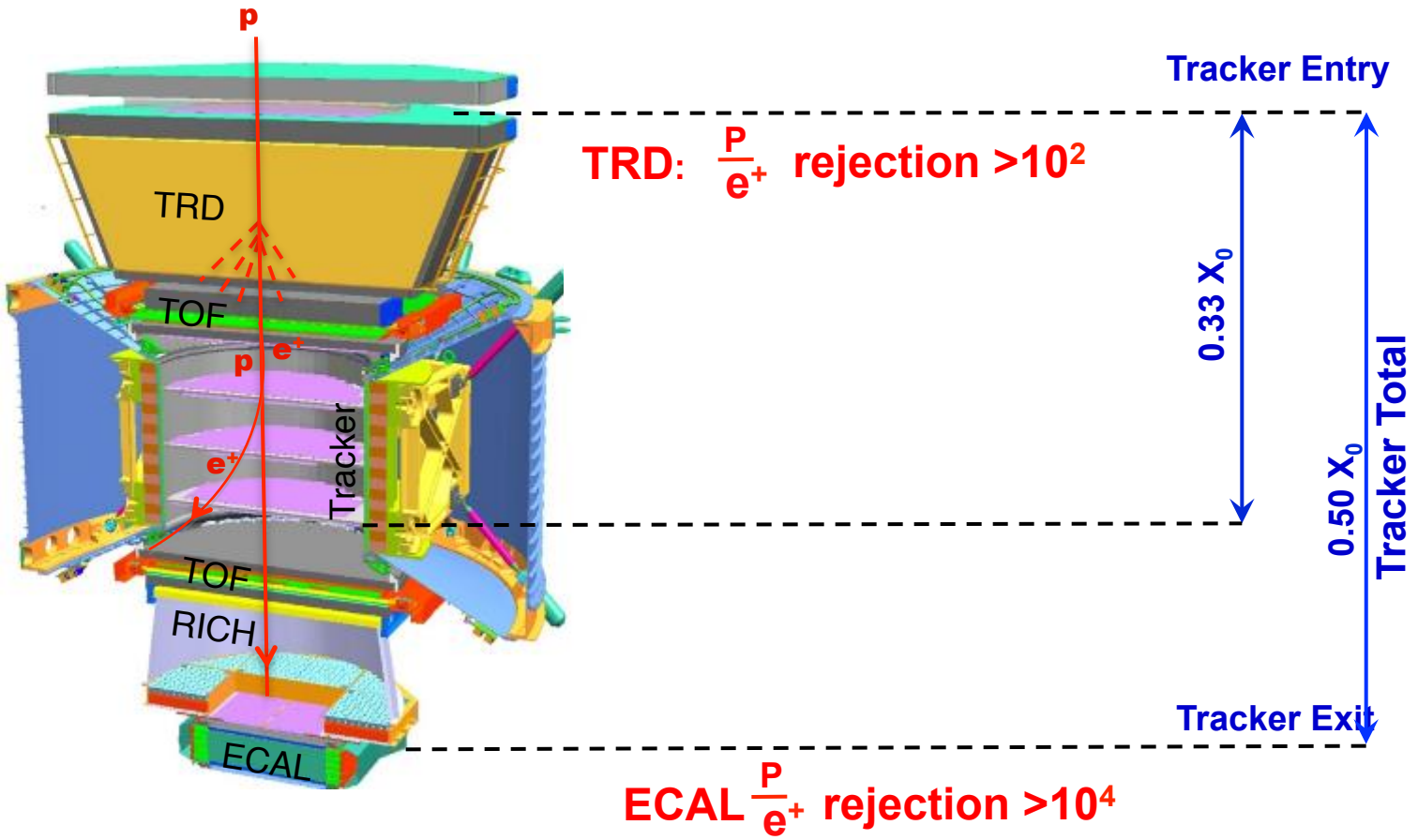

It's a Fan!
It's a Spear!
It's a Wall!
It's a Rope!
It's a Snake!
It's a Tree!


Cosmic Ray Fluxes (m^{-2} sr^{-1} s^{-1} GeV^{-1})
Rate (acc=0.25 m^2) Hz GeV^{-1}
p
He
e-
e+
C
Fe
antiprotons
galactic γ
extragalactic γ
antideuterons
AMS
Kinetic Energy (GeV/nucleon)

$X+X \longrightarrow e^{+}.....$



Positron identification + flux with $p/e^+ > 10^6$

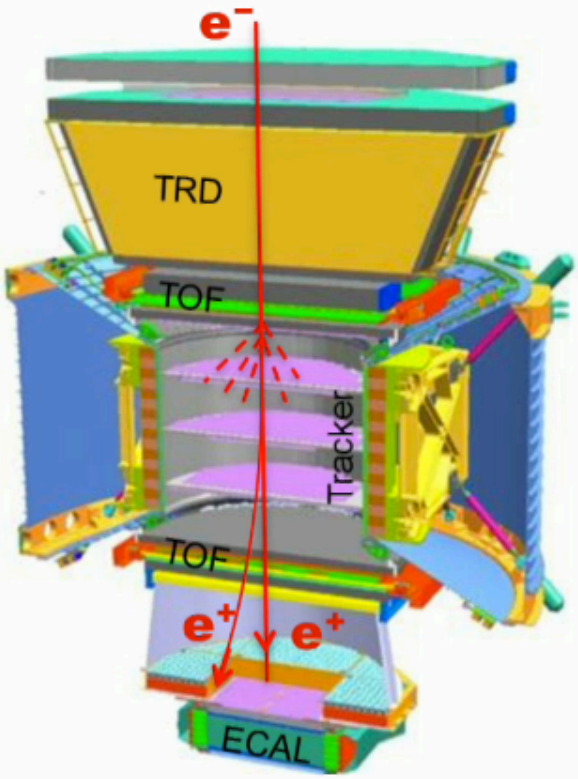


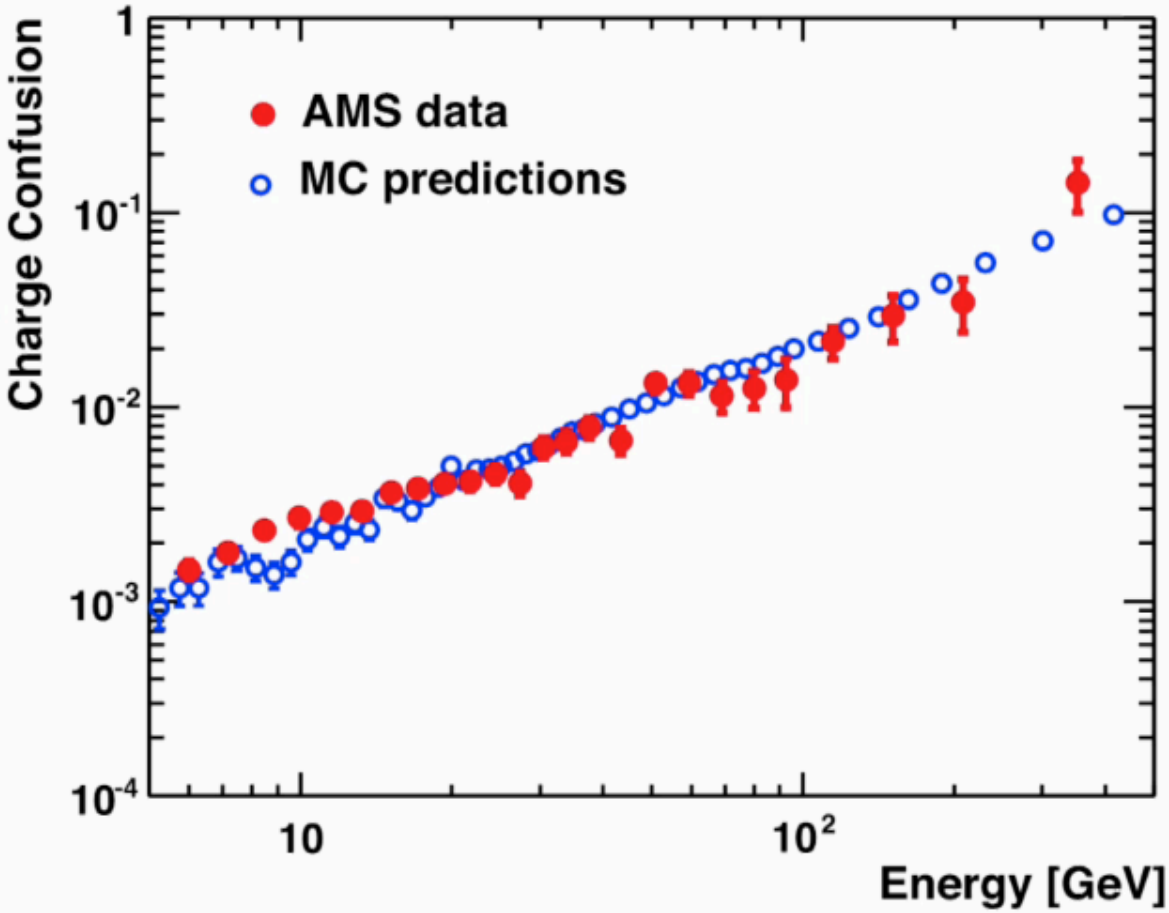
a) Minimal material in the TRD and TOF :
So that the detector does not become a source of e^+.

b) A magnet separates TRD and ECAL so that e^+ produced in TRD will be swept away and not enter ECAL
In this way the rejection power of TRD and ECAL are independent

c) Matching momentum of 9 tracker planes with ECAL energy measurements

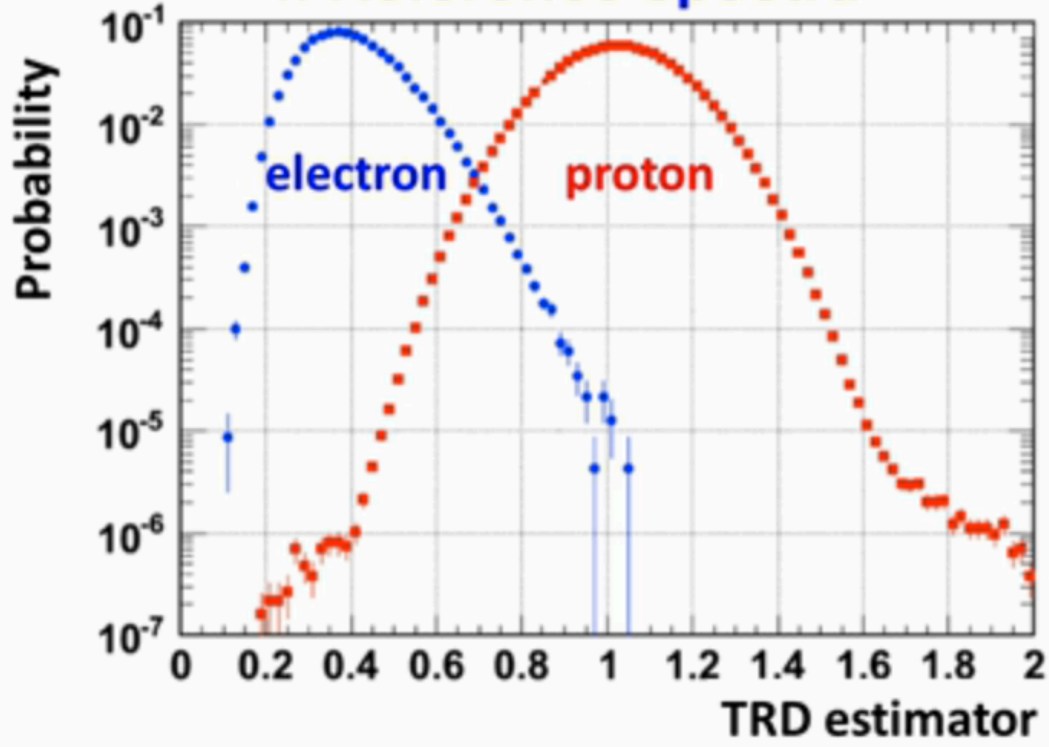
Systematic error on the positron fraction: 5. Charge confusion





Two sources: 1) large angle scattering and 2) production of secondary tracks along the path of the primary track. Both are well reproduced by MC. Systematic errors correspond to variations of these effects within their statistical limits and comparing the results with the Monte Carlo simulation

Systematic error on the positron fraction: 4. Reference spectra



Definition of the reference spectra is based on pure samples of electrons and protons of finite statistics.

TABLE I. Representative bins of the positron fraction as a function of energy. Errors due to *stat.*, statistical error; *acc.*, acceptance asymmetry; *sel.*, event selection; *mig.*, bin-to-bin migration; *ref.*, reference spectra; *c.c.*, charge confusion; and *syst.*, total systematic error. For the complete table, see [13].

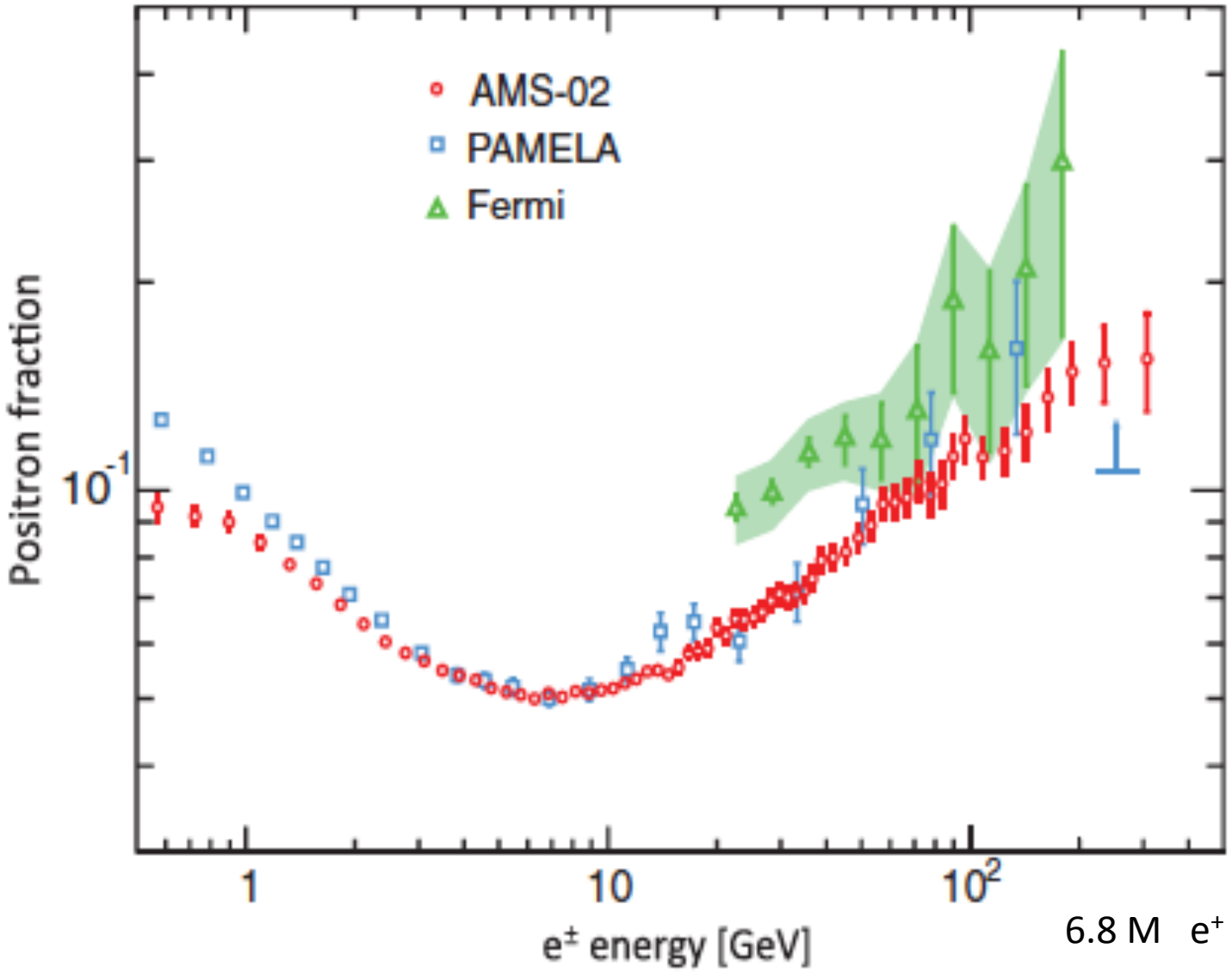
Energy[GeV]	N_{e^+}	Fraction	σ_{stat}	σ_{acc}	σ_{sel}	σ_{mig}	σ_{ref}	$\sigma_{c.c.}$	σ_{syst}
1.00–1.21	9335	0.0842	0.0008	0.0005	0.0009	0.0008	0.0001	0.0005	0.0014
1.97–2.28	23 893	0.0642	0.0004	0.0002	0.0005	0.0002	0.0001	0.0002	0.0006
3.30–3.70	20 707	0.0550	0.0004	0.0001	0.0003	0.0000	0.0001	0.0002	0.0004
6.56–7.16	13 153	0.0510	0.0004	0.0001	0.0000	0.0000	0.0001	0.0002	0.0002
09.95–10.73	7161	0.0519	0.0006	0.0001	0.0000	0.0000	0.0001	0.0002	0.0002
19.37–20.54	2322	0.0634	0.0013	0.0001	0.0001	0.0000	0.0001	0.0002	0.0003
30.45–32.10	1094	0.0701	0.0022	0.0001	0.0002	0.0000	0.0001	0.0003	0.0004
40.00–43.39	976	0.0802	0.0026	0.0002	0.0005	0.0000	0.0001	0.0004	0.0007
50.87–54.98	605	0.0891	0.0038	0.0002	0.0006	0.0000	0.0001	0.0004	0.0008
64.03–69.00	392	0.0978	0.0050	0.0002	0.0010	0.0000	0.0002	0.0007	0.0013
74.30–80.00	276	0.0985	0.0062	0.0002	0.0010	0.0000	0.0002	0.0010	0.0014
86.00–92.50	240	0.1120	0.0075	0.0002	0.0010	0.0000	0.0003	0.0011	0.0015
100.0–115.1	304	0.1118	0.0066	0.0002	0.0015	0.0000	0.0003	0.0015	0.0022
115.1–132.1	223	0.1142	0.0080	0.0002	0.0019	0.0000	0.0004	0.0019	0.0027
132.1–151.5	156	0.1215	0.0100	0.0002	0.0021	0.0000	0.0005	0.0024	0.0032
151.5–173.5	144	0.1364	0.0121	0.0002	0.0026	0.0000	0.0006	0.0045	0.0052
173.5–206.0	134	0.1485	0.0133	0.0002	0.0031	0.0000	0.0009	0.0050	0.0060
206.0–260.0	101	0.1530	0.0160	0.0003	0.0031	0.0000	0.0013	0.0095	0.0101
260.0–350.0	72	0.1550	0.0200	0.0003	0.0056	0.0000	0.0018	0.0140	0.0152

PRL 110, 141102 (2013)

6.8 M $e^+ + e^-$

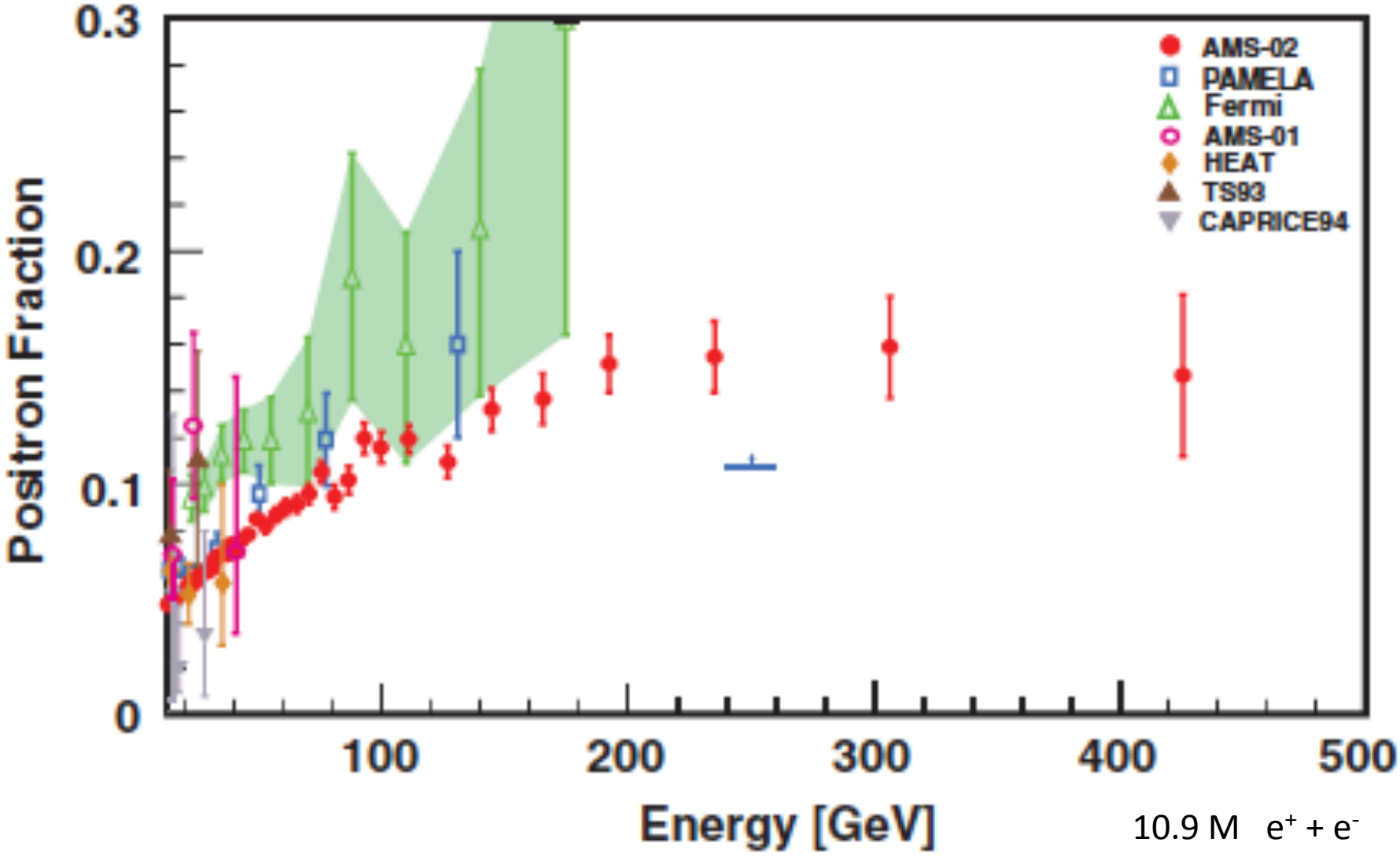
$e^+/(e^+ + e^-)$

2013

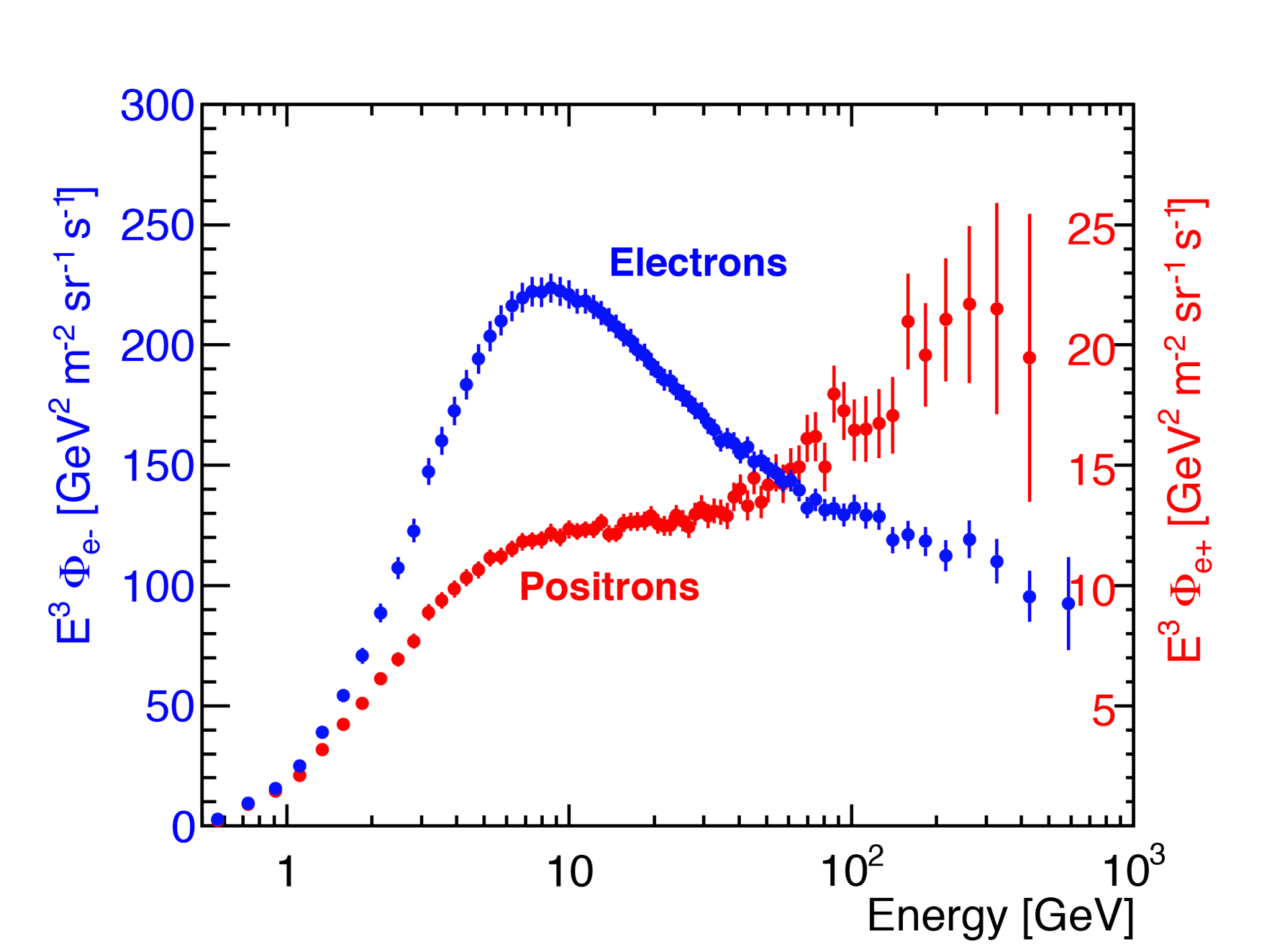


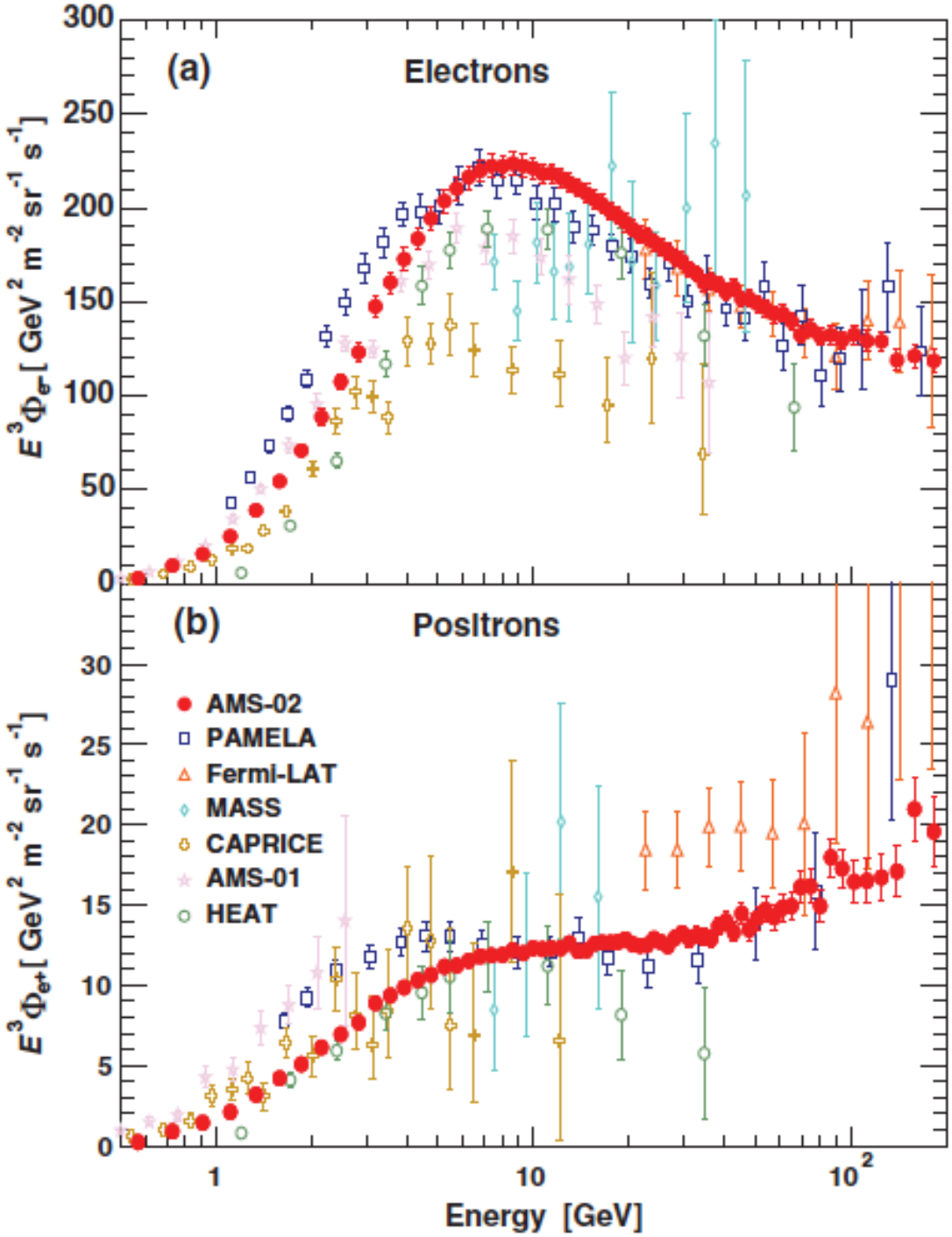
6.8 M $e^+ + e^-$

$e^+/(e^+ + e^-)$

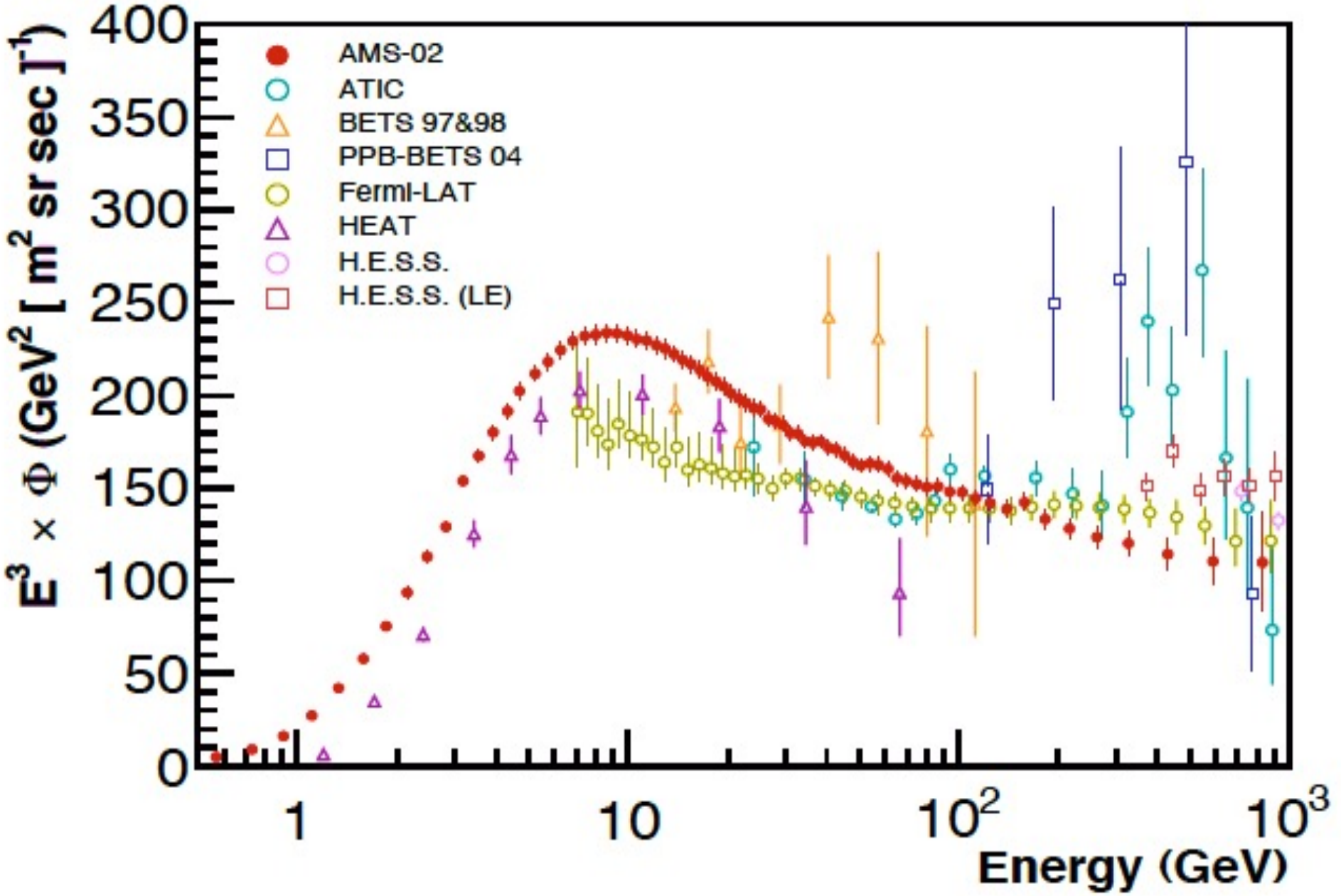

AMS-02
PAMELA
Fermi
AMS-01
HEAT
TS93
CAPRICE94
Positron Fraction
0.3
0.2
0.1
0
100
200
300
400
500
Energy [GeV]

10.9 M $e^+ + e^-$


Electrons
Positrons
$E^3 \Phi_{e-}$ [GeV^2 m^{-2} sr^{-1} s^{-1}]
$E^3 \Phi_{e+}$ [GeV^2 m^{-2} sr^{-1} s^{-1}]
Energy [GeV]
0
50
100
150
200
250
300
5
10
15
20
25
1
10
10^2
10^3


(a)
Electrons
(b)
Positrons
AMS-02
PAMELA
Fermi-LAT
MASS
CAPRICE
AMS-01
HEAT
$E^3\Phi_{e^-}$ [GeV^2 m^{-2} sr^{-1} s^{-1}]
$E^3\Phi_{e^+}$ [GeV^2 m^{-2} sr^{-1} s^{-1}]
Energy [GeV]
0
50
100
150
200
250
300
5
10
15
20
25
30
1
10
10^2

Spettro $e^+ + e^-$


AMS-02
ATIC
BETS 97&98
PPB-BETS 04
Fermi-LAT
HEAT
H.E.S.S.
H.E.S.S. (LE)
$E^3 \times \Phi$ (GeV^2 [m^2 sr sec]$^{-1}$)
400
350
300
250
200
150
100
50
0
1
10
10^2
10^3
Energy (GeV)

PRL 110, 141102 (2013) PHYSICAL REVIEW LETTERS week ending 5 APRIL 2013

First Result from the Alpha Magnetic Spectrometer on the International Space Station: Precision Measurement of the Positron Fraction in Primary Cosmic Rays of 0.5–350 GeV

PRL 113, 121101 (2014) PHYSICAL REVIEW LETTERS week ending 19 SEPTEMBER 2014

High Statistics Measurement of the Positron Fraction in Primary Cosmic Rays of 0.5–500 GeV with the Alpha Magnetic Spectrometer on the International Space Station

PRL 113, 121102 (2014) PHYSICAL REVIEW LETTERS week ending 19 SEPTEMBER 2014

Electron and Positron Fluxes in Primary Cosmic Rays Measured with the Alpha Magnetic Spectrometer on the International Space Station

Precision Measurement of the $(e^+ + e^-)$ Flux in Primary Cosmic Rays from 0.5 GeV to 1 TeV with the Alpha Magnetic Spectrometer on the International Space Station

(accepted, in press November 8th)