NASA Advisory Committee,
Human Exploration and Operations and Science Committees
NASA Headquarter, April 7, 2015

Emerging GCR Data from AMS-02

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AMS is a US DOE lead International Collaboration

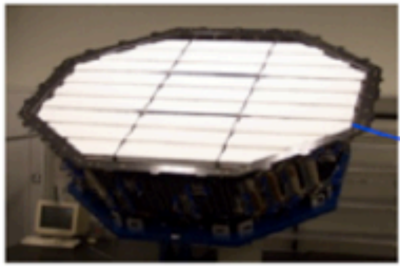
Spokesperson: Nobel laureate Prof. Dr. S. Ting from MIT

AMS-02 experiment has been installed
on the International Space Station on May 19^{th} 2011

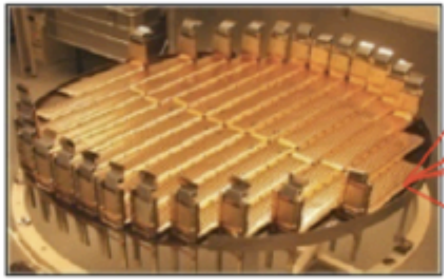
The AMS-02 is a cosmic ray detector

(Dimensions 5mx4mx3m; Weight ~7tons; B ~1.5KG)

TRD
Identify e+, e-

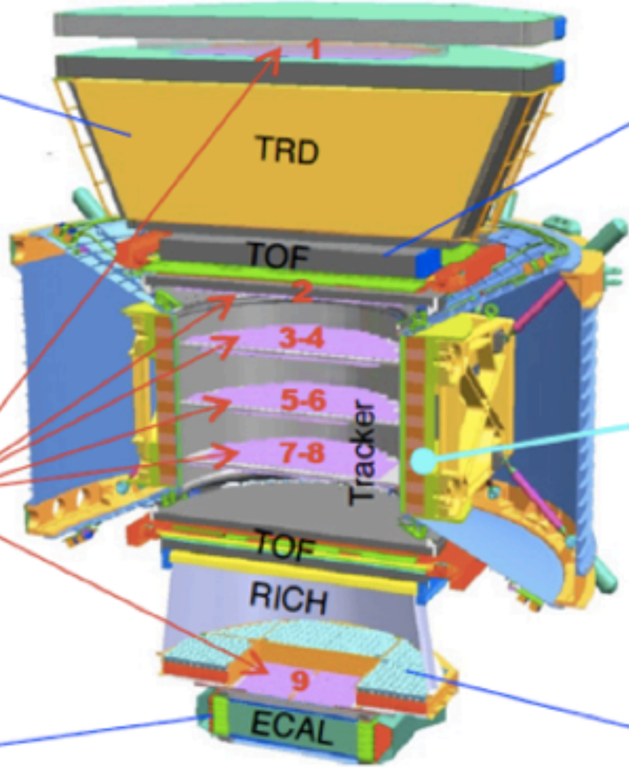


Silicon Tracker
Z, P



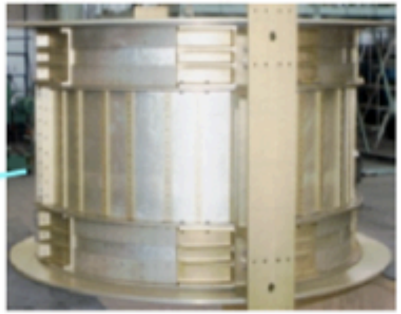
ECAL
E of e+, e-, γ

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

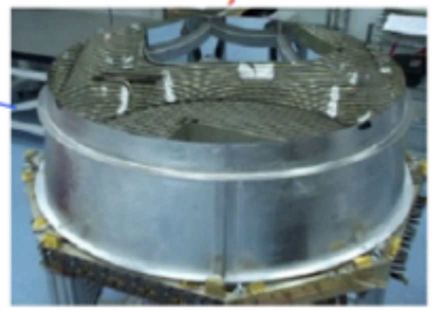


TOF
Z, V

Magnet
±Z



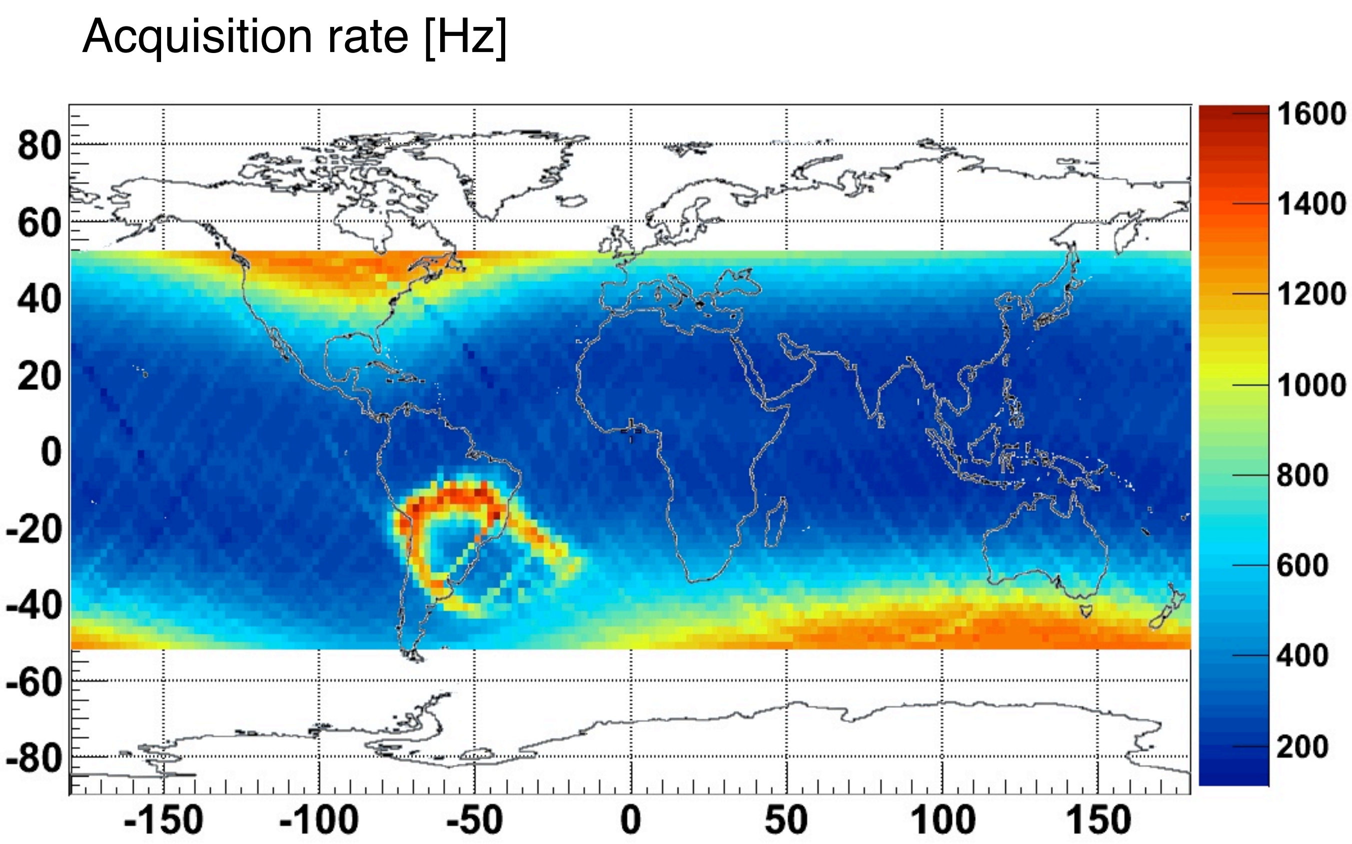
RICH
Z, V



Redundancy

AMS-02 data

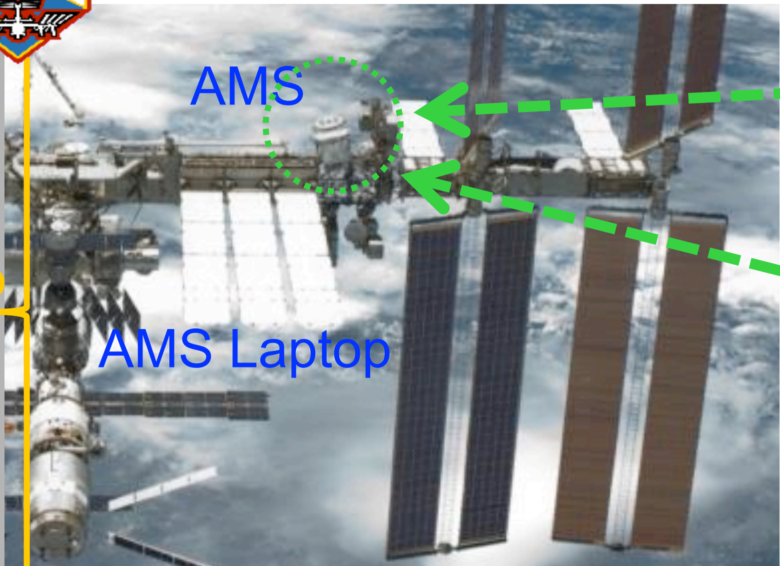
4 year of AMS correspond to 60 billion events



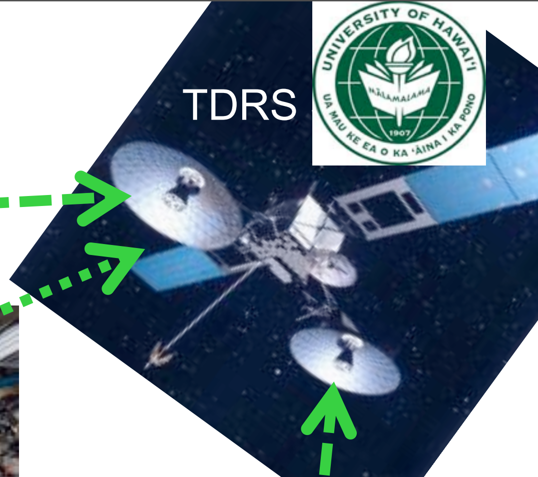
Particle rates vary from 200 to 2000 Hz per orbit

Flight and Ground Operations

Flight



ISS Astronaut with AMS Laptop



Ku-band High Rate (down):
Events <10Mbit/s>
Monitoring: 30 Kbit/s

S-band Low Rate:
Commanding: 1 Kbit/s (up)
No Ku: 10 bits/s (down)

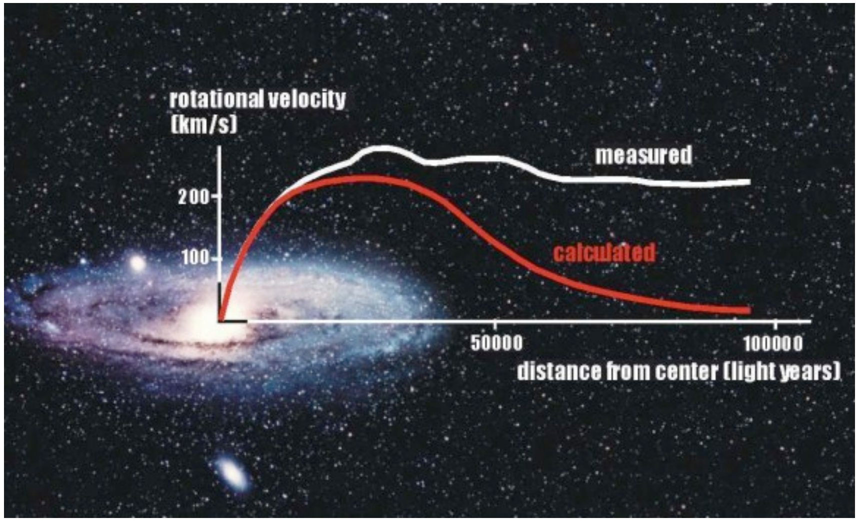
Ground

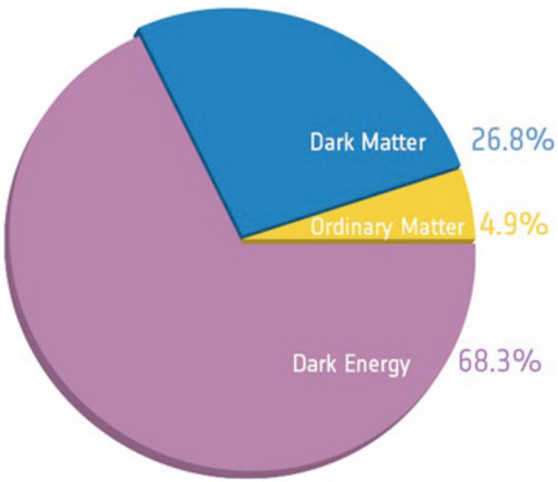
Payload Operations Control Centers (POCC) at CERN

AMS Computers at MSFC, AL

White Sands Ground Terminal, NM

AMS-02 in Space is looking for Dark Matter





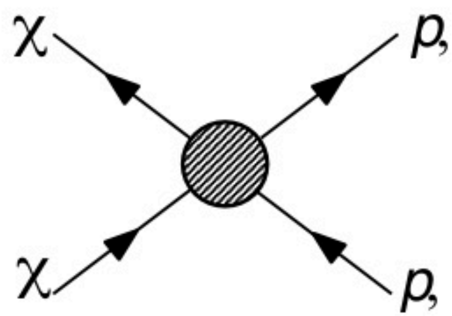
PAMELA
FERMI ...
AMS
Annihilation

$\chi + \chi \rightarrow e^{+}, \bar{p}, \gamma, \ldots$

LUX
DARKSIDE
XENON 100
CDMS II
...

Scattering

$\chi + p \rightarrow \chi + p$



$\chi + \chi \leftarrow p + p$

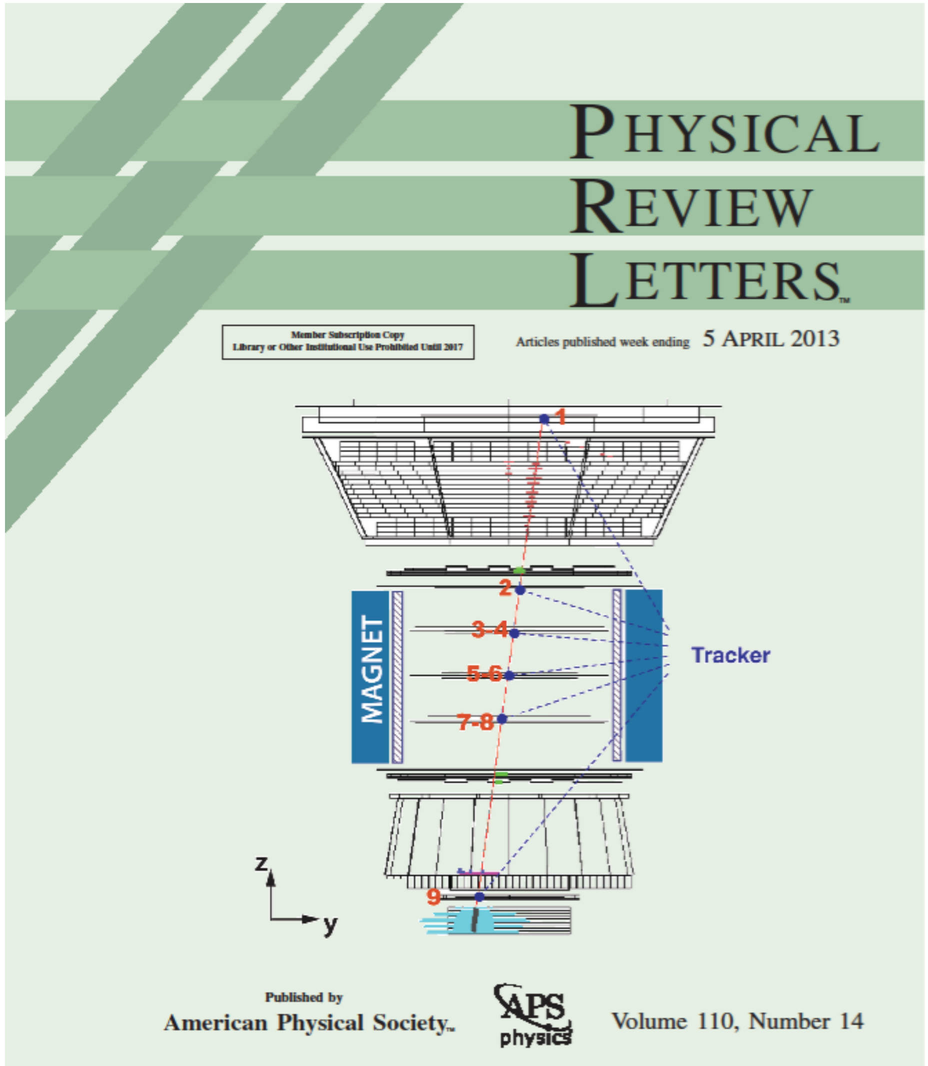
Production

LHC

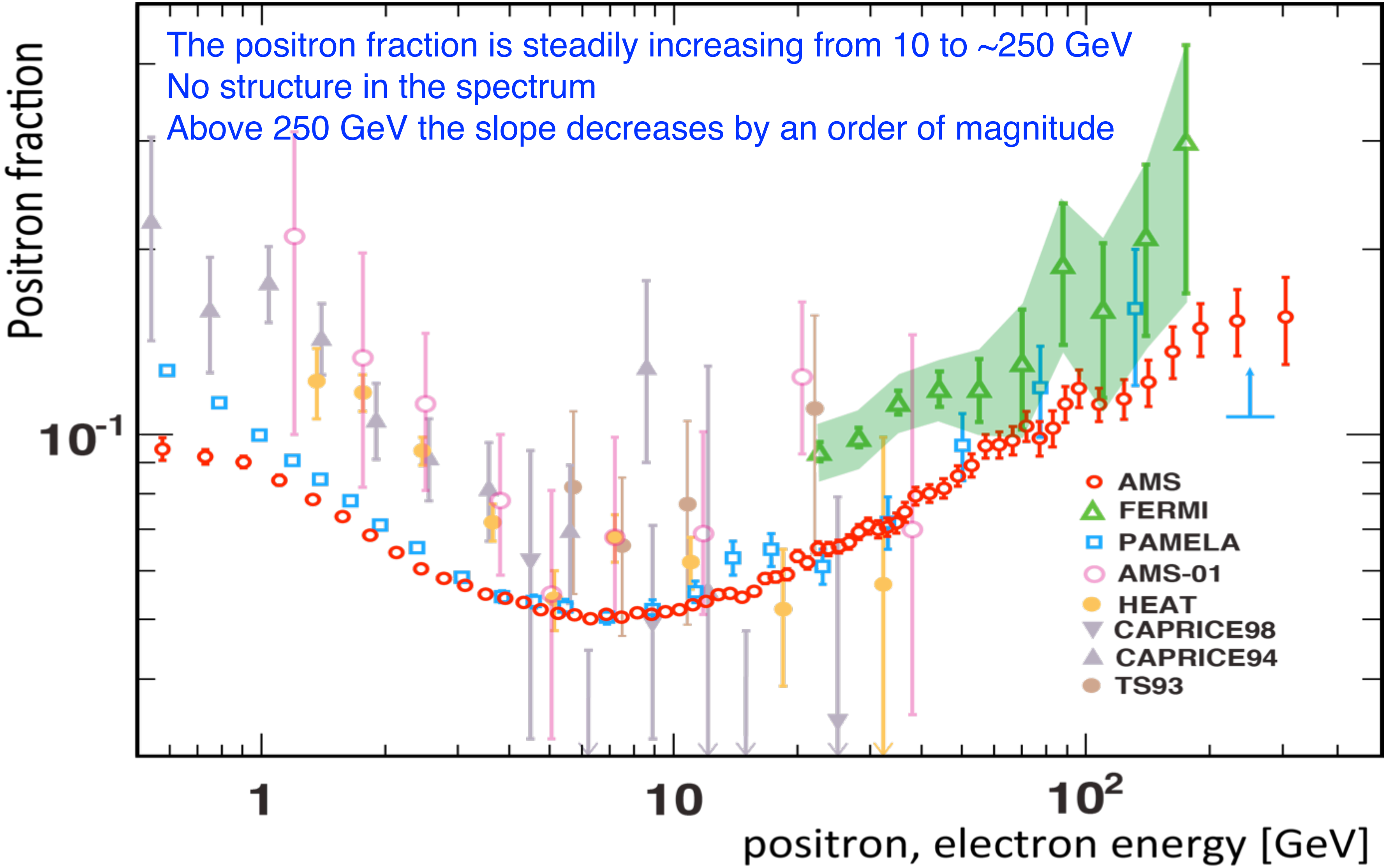
Precision Measurement of the Positron Fraction in Primary Cosmic Rays of 0.5-350 GeV

Aguilar,M. et al (AMS Collaboration) Phys. Rev. Lett. 110, 1411xx (2013)]

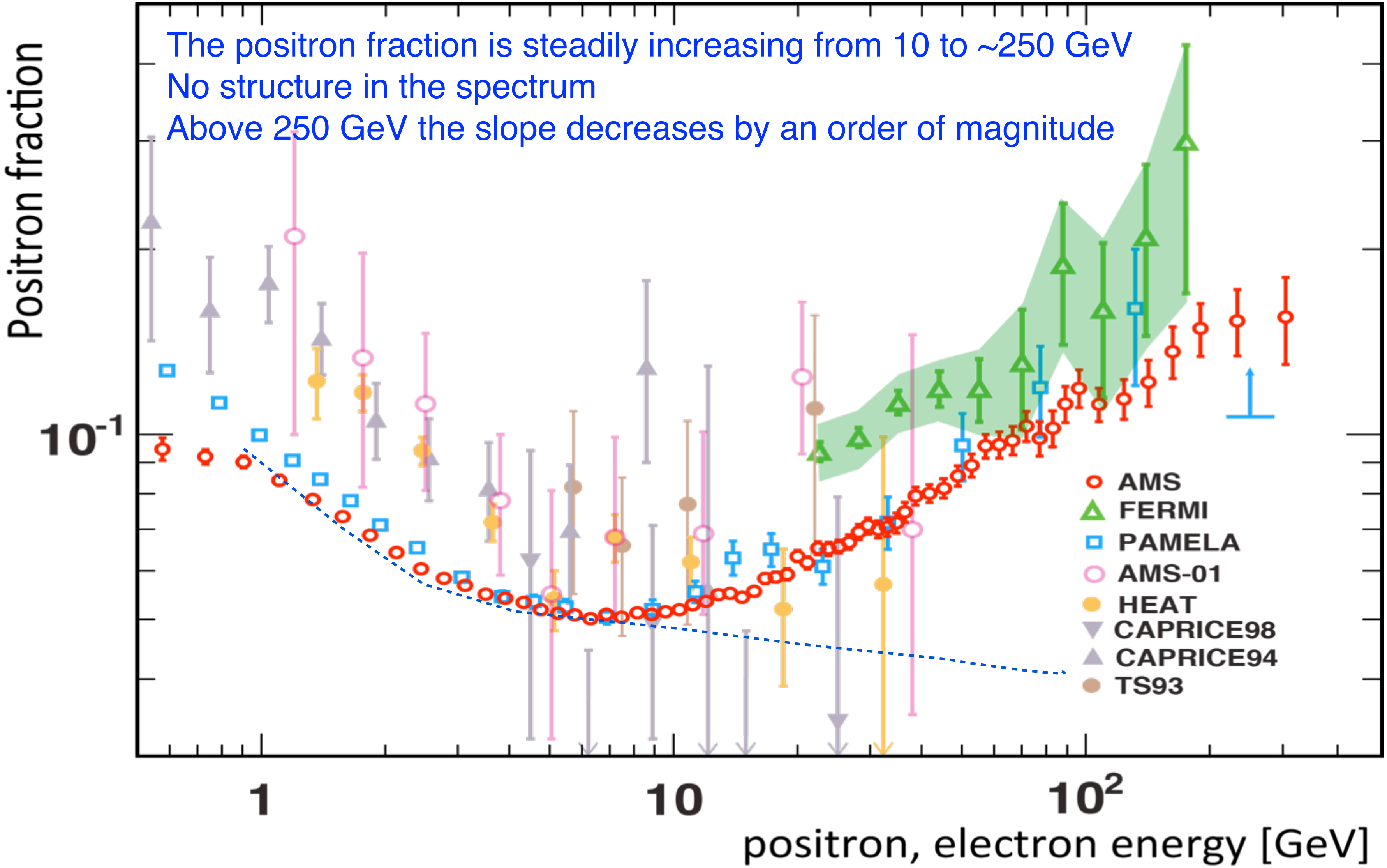
In the first 18 months in space, AMS has collected over 25 billion events. 6.8 million are electrons or positrons.



Positron Fraction



Positron Fraction



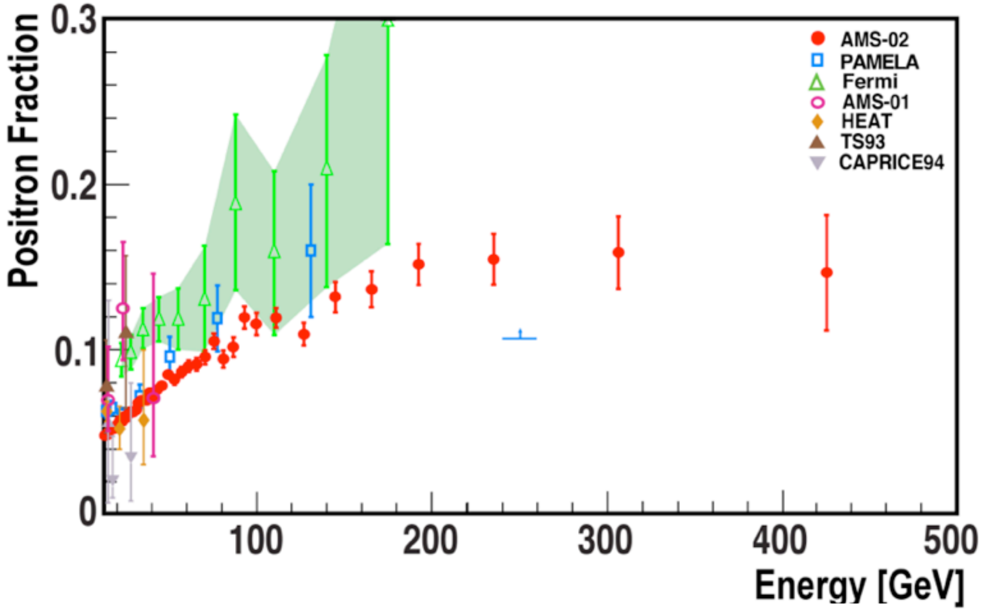
L 113, 121101 (2014) PHYSICAL REVIEW LETTERS week ending 19 SEPTEMBER 2

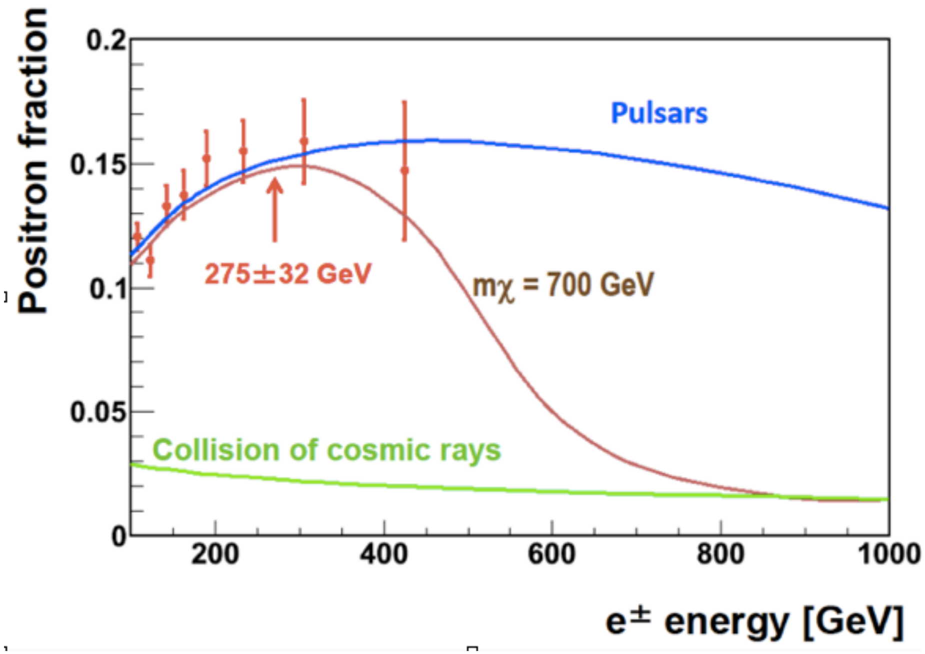
High Statistics Measurement of the Positron Fraction in Primary Cosmic Rays of 0.5–500 GeV with the Alpha Magnetic Spectrometer on the International Space Station

L. Accardo,[34] M. Aguilar,[26] D. Aisa,[34,35] B. Alpat,[34] A. Alvino,[34] G. Ambrosi,[34] K. Andeen,[22] L. Arruda,[24] N. Attig,[21] P. Azzarello,[34,16,a] A. Bachlechner,[1] F. Barao,[24] A. Barrau,[17] L. Barrin,[15] A. Bartoloni,[39] L. Basara,[3,38] M. Battarbee,[45] R. Battiston,[38,b] J. Bazo,[34,c] U. Becker,[9] M. Behlmann,[9] B. Beischer,[1] J. Berdugo,[26] B. Bertucci,[34,35] G. Bigongiari,[36,37] V. Bindi,[19] S. Bizzaglia,[34] M. Bizzarri,[34,35] G. Boella,[29,30] W. de Boer,[22] K. Bollweg,[20] V. Bonnivard,[17] B. Borgia,[39,40] S. Borsini,[34] M. J. Boschini,[29] M. Bourquin,[16] J. Burger,[9] F. Cadoux,[16] X. D. Cai,[9] M. Capell,[9] S. Caroff,[3] G. Carosi,[9,d] J. Casaus,[26] V. Cascioli,[34] G. Castellini,[14] I. Cernuda,[26] D. Cerreta,[34,35] F. Cervelli,[36] M. J. Chae,[41] Y. H. Chang,[10] A. I. Chen,[9] H. Chen,[9] G. M. Cheng,[6] H. S. Chen,[6] L. Cheng,[42] A. Chikanian,[33,e] H. Y. Chou,[10] E. Choumilov,[9] V. Choutko,[9] C. H. Chung,[1] F. Cindolo,[7,8] C. Clark,[20] R. Clavero,[23] G. Coignet,[3] C. Consolandi,[19] A. Contin,[7,8] C. Corti,[19] B. Coste,[38] Z. Cui,[42] M. Dai,[5] C. Delgado,[26] S. Della Torre,[29] M. B. Demirköz,[2] L. Derome,[17] S. Di Falco,[36] L. Di Masso,[34,35] F. Dimiccoli,[38] C. Díaz,[26] P. von Doetinchem,[19] W. J. Du,[42] M. Duranti,[34] D. D'Urso,[34] A. Eline,[9] F. J. Eppling,[9] T. Eronen,[45] Y. Y. Fan,[44,f] L. Farnesini,[34] J. Feng,[3,g] E. Fiandrini,[34,35] A. Fiasson,[3] E. Finch,[33] P. Fisher,[9] Y. Galaktionov,[9] G. Gallucci,[36,15] B. García,[26] R. García-López,[23] H. Gast,[1] I. Gebauer,[22] M. Gervasi,[29,30] A. Ghelfi,[17] W. Gillard,[10] F. Giovacchini,[26] P. Goglov,[9] J. Gong,[32] C. Goy,[3] V. Grabski,[27] D. Grandi,[29] M. Graziani,[34,15] C. Guandalini,[7,8] I. Guerri,[36,37] K. H. Guo,[18] D. Haas,[16,h] M. Habiby,[16] S. Haino,[10,44] K. C. Han,[25] Z. H. He,[18] M. Heil,[22,9] R. Henning,[9,i] J. Hoffman,[10] T. H. Hsieh,[9] Z. C. Huang,[18] C. Huh,[13] M. Incagli,[36] M. Ionica,[34] W. Y. Jang,[13] H. Jinchi,[25] K. Kanishev,[38] G. N. Kim,[13] K. S. Kim,[13] Th. Kirn,[1] R. Kossakowski,[3] O. Kounina,[9] A. Kounine,[9] V. Koutsenko,[9] M. S. Krafczyk,[9] S. Kunz,[22] G. La Vacca,[29,15] E. Laudi,[34,35,j] G. Laurenti,[7,8] I. Lazzizzera,[38] A. Lebedev,[9] H. T. Lee,[44] S. C. Lee,[44] C. Leluc,[16] G. Levi,[7,8] H. L. Li,[44,k] J. Q. Li,[32] Q. Li,[32] Q. Li,[9,l] T. X. Li,[18] W. Li,[4] Y. Li,[16,g] Z. H. Li,[6] Z. Y. Li,[44,g] S. Lim,[41] C. H. Lin,[44] P. Lipari,[39] T. Lippert,[21] D. Liu,[44] H. Liu,[32] M. Lolli,[7,8] T. Lomtadze,[36] M. J. Lu,[38,m] Y. S. Lu,[6] K. Luebelsmeyer,[1] F. Luo,[42] J. Z. Luo,[32] S. S. Lu,[18] R. Majka,[33] A. Malinin,[12] C. Mañá,[26] J. Marín,[26] T. Martin,[20] G. Martínez,[26] N. Masi,[7,8] F. Massera,[7,8]

This measurement extends the energy range of our previous observation and increases its precision.

AMS-02 positron fraction





The non-existence of sharp structures related to DM.

The energy beyond which it ceases to increase.

Next: Extend the measurement at higher energies and decrease the error bars.

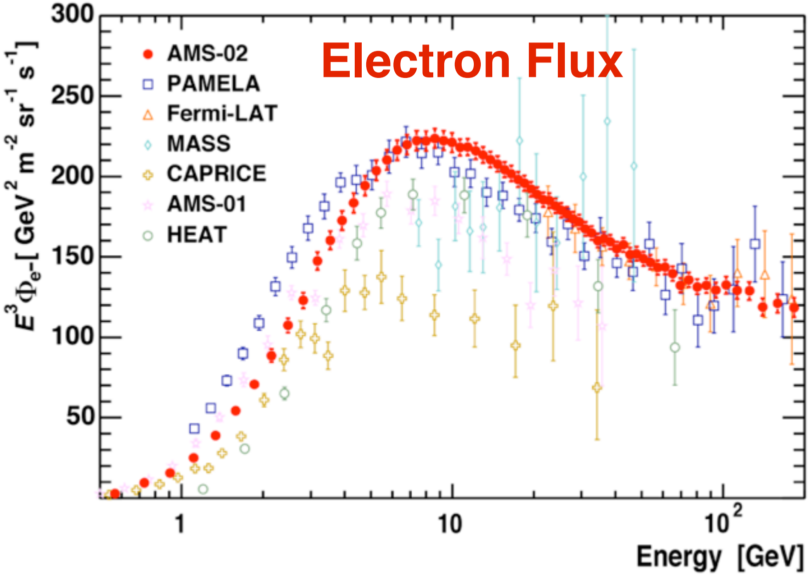
Electron and Positron Fluxes

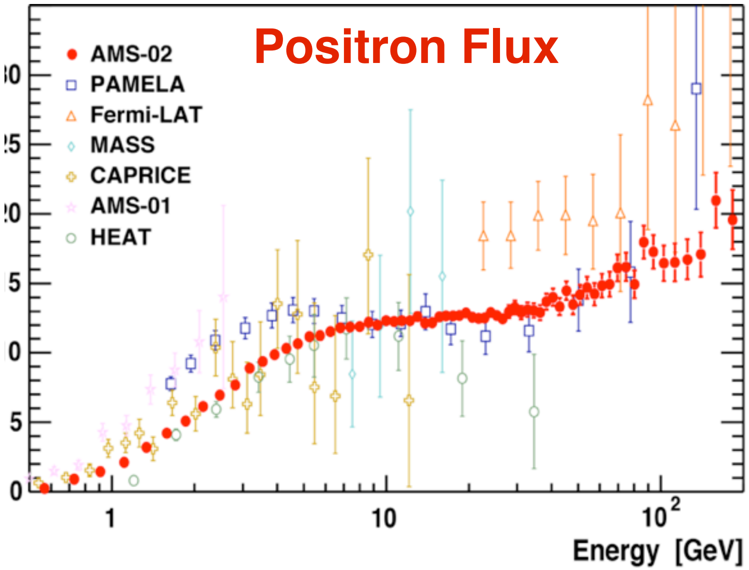
PRL **113,** 121102 (2014) PHYSICAL REVIEW LETTERS week ending 19 SEPTEMBER 2014

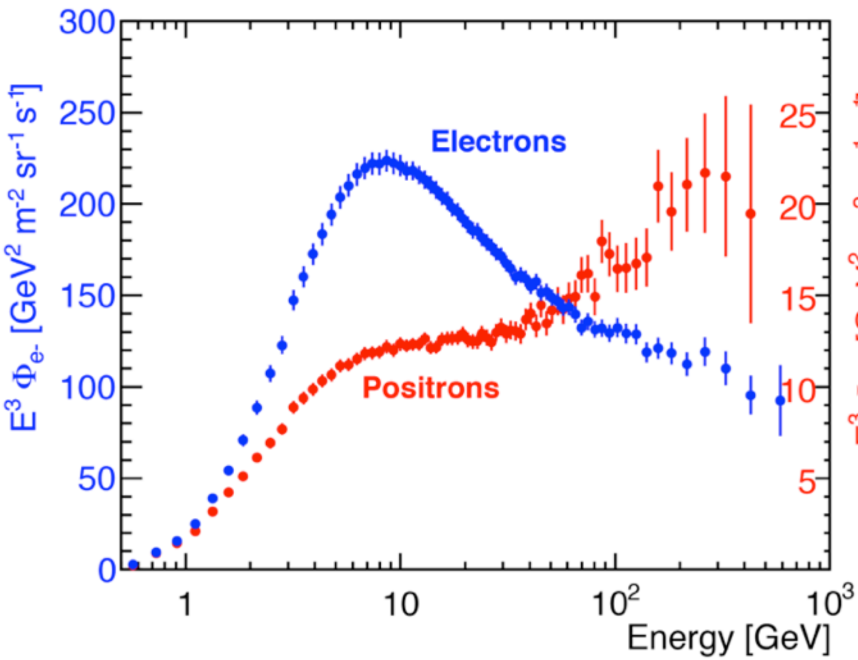
Electron and Positron Fluxes in Primary Cosmic Rays Measured with the Alpha Magnetic Spectrometer on the International Space Station

M. Aguilar,[26] D. Aisa,[33,34] A. Alvino,[33] G. Ambrosi,[33] K. Andeen,[22] L. Arruda,[24] N. Attig,[21] P. Azzarello,[33,16,†] A. Bachlechner,[1] F. Barao,[24] A. Barrau,[17] L. Barrin,[15] A. Bartoloni,[38] L. Basara,[3,37] M. Battarbee,[44] R. Battiston,[37,‡] J. Bazo,[33] U. Becker,[9] M. Behlmann,[9] B. Beischer,[1] J. Berdugo,[26] B. Bertucci,[33,34] G. Bigongiari,[35,36] V. Bindi,[19] S. Bizzaglia,[33] M. Bizzarri,[33,34] G. Boella,[28,29] W. de Boer,[22] K. Bollweg,[20] V. Bonnivard,[17] B. Borgia,[38,39] S. Borsini,[33] M. J. Boschini,[28] M. Bourquin,[16] J. Burger,[9] F. Cadoux,[16] X. D. Cai,[9] M. Capell,[9] S. Caroff,[3] J. Casaus,[26] V. Cascioli,[33] G. Castellini,[14] I. Cernuda,[26] F. Cervelli,[35] M. J. Chae,[40] Y. H. Chang,[10] A. I. Chen,[9] H. Chen,[9] G. M. Cheng,[6] H. S. Chen,[6] L. Cheng,[41] A. Chikanian,[32,*] H. Y. Chou,[10] E. Choumilov,[9] V. Choutko,[9] C. H. Chung,[1] C. Clark,[20] R. Clavero,[23] G. Coignet,[3] C. Consolandi,[19] A. Contin,[7,8] C. Corti,[19] B. Coste,[37] Z. Cui,[41] M. Dai,[5] C. Delgado,[26] S. Della Torre,[28] M. B. Demirköz,[2] L. Derome,[17] S. Di Falco,[35] L. Di Masso,[33,34] F. Dimiccoli,[37] C. Díaz,[26] P. von Doetinchem,[19] W. J. Du,[41] M. Duranti,[33] D. D'Urso,[33] A. Eline,[9] F. J. Eppling,[9] T. Eronen,[44] Y. Y. Fan,[43,§] L. Farnesini,[33] J. Feng,[3,‖] E. Fiandrini,[33,34] A. Fiasson,[3] E. Finch,[32] P. Fisher,[9] Y. Galaktionov,[9] G. Gallucci,[35,15] B. García,[26] R. García-López,[23] H. Gast,[1] I. Gebauer,[22] M. Gervasi,[28,29] A. Ghelfi,[17] W. Gillard,[10] F. Giovacchini,[26] P. Goglov,[9] J. Gong,[31] C. Goy,[3] V. Grabski,[27] D. Grandi,[28] M. Graziani,[33,15] C. Guandalini,[7,8] I. Guerri,[35,36] K. H. Guo,[18] M. Habiby,[16] S. Haino,[10,43] K. C. Han,[25] Z. H. He,[18] M. Heil,[22,9] J. Hoffman,[10] T. H. Hsieh,[9] Z. C. Huang,[18] C. Huh,[13] M. Incagli,[35] M. Ionica,[33] W. Y. Jang,[13] H. Jinchi,[25] K. Kanishev,[37] G. N. Kim,[13] K. S. Kim,[13] Th. Kirn,[1] R. Kossakowski,[3] O. Kounina,[9] A. Kounine,[9] V. Koutsenko,[9] M. S. Krafczyk,[9] S. Kunz,[22] G. La Vacca,[28,15] E. Laudi,[33,34,¶] G. Laurenti,[7,8] I. Lazzizzera,[37] A. Lebedev,[9] H. T. Lee,[43] S. C. Lee,[43] C. Leluc,[16] H. L. Li,[43,**] J. Q. Li,[31] Q. Li,[31] Q. Li,[9,††] T. X. Li,[18] W. Li,[4] Y. Li,[16,‖] Z. H. Li,[6] Z. Y. Li,[43,‖] S. Lim,[40] C. H. Lin,[43] P. Lipari,[38] T. Lippert,[21] D. Liu,[43] H. Liu,[31] T. Lomtadze,[35] M. J. Lu,[37,‡‡] Y. S. Lu,[6] K. Luebelsmeyer,[1] F. Luo,[41] J. Z. Luo,[31] S. S. Lv,[18] R. Majka,[32] A. Malinin,[12] C. Mañá,[26] J. Marín,[26] T. Martin,[20] G. Martínez,[26] N. Masi,[7,8] D. Maurin,[17] A. Menchaca-Rocha,[27] Q. Meng,[31] D. C. Mo,[18] L. Morescalchi,[35,§§] P. Mott,[20] M. Müller,[1] J. Q. Ni,[18] N. Nikonov,[22] F. Nozzoli,[33] P. Nunes,[24] A. Obermeier,[1] A. Oliva,[26] M. Orcinha,[24] F. Palmonari,[7,8] C. Palomares,[26] M. Paniccia,[16] A. Papi,[33,34] E. Pedreschi,[35] S. Pensotti,[28,29] R. Pereira,[24,19] F. Pilo,[35] A. Piluso,[33,34] C. Pizzolotto,[33] V. Plyaskin,[9] M. Pohl,[16] V. Poireau,[3] E. Postaci,[2] A. Putze,[3] L. Quadrani,[7,8] X. M. Qi,[18] P. G. Rancoita,[28] D. Rapin,[16] J. S. Ricol,[17] I. Rodríguez,[26] S. Rosier-Lees,[3] A. Rozhkov,[9] D. Rozza,[28] R. Sagdeev,[11] J. Sandweiss,[32] P. Saouter,[16] C. Sbarra,[7,8] S. Schael,[1] S. M. Schmidt,[21] D. Schuckardt,[22] A. Schulz von Dratzig,[1] G. Schwering,[1] G. Scolieri,[33] E. S. Seo,[12] B. S. Shan,[4]

Electron and Positron Fluxes







The electron flux and the positron flux are different in their magnitude and energy dependence.

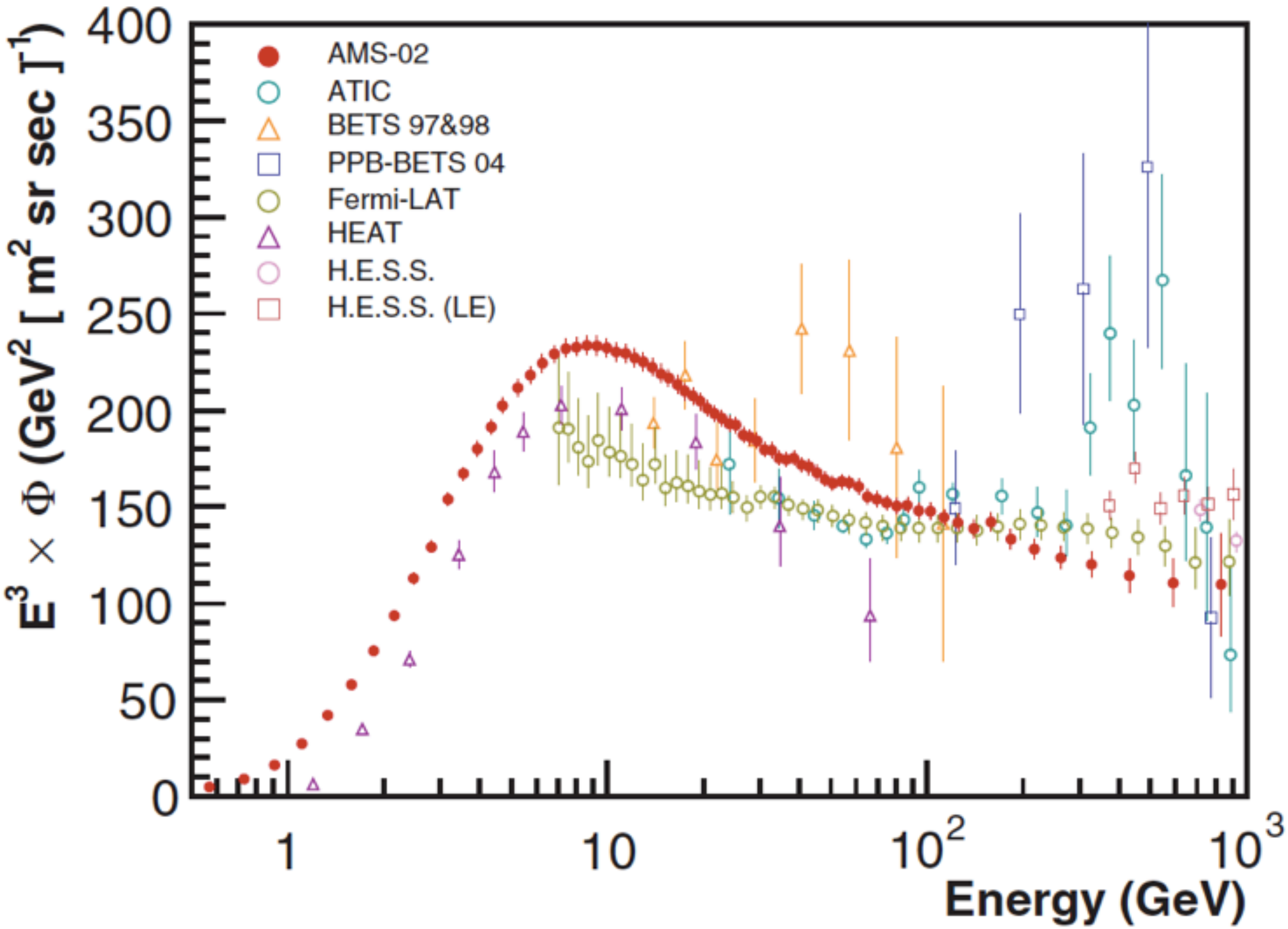
AMS-02 (e+ + e-) flux

PRL 113, 221102 (2014) PHYSICAL REVIEW LETTERS week ending 28 NOVEMBER 2014

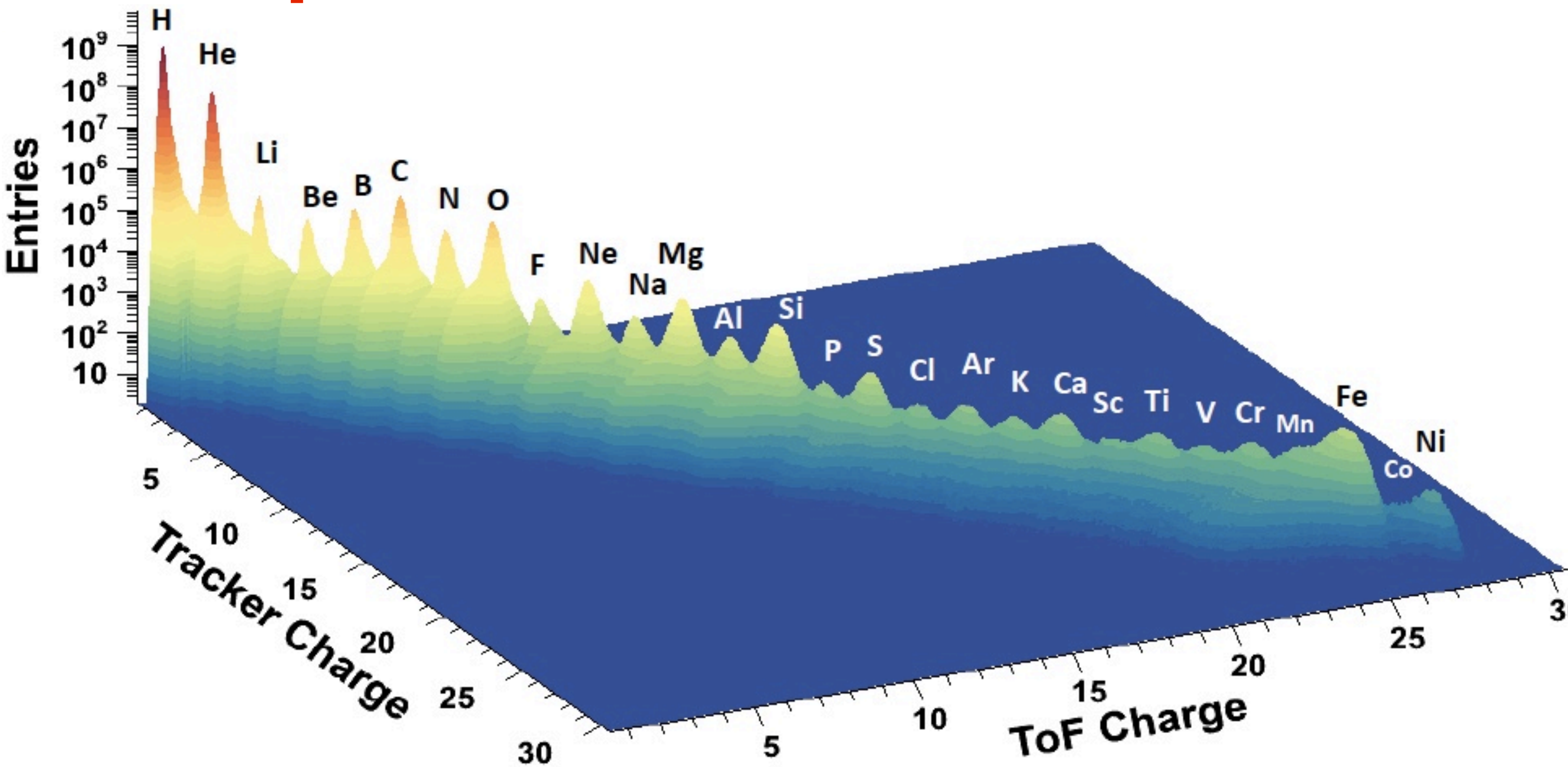
Precision Measurement of the $(e^+ + e^-)$ Flux in Primary Cosmic Rays from 0.5 GeV to 1 TeV with the Alpha Magnetic Spectrometer on the International Space Station

M. Aguilar,[26] D. Aisa,[33,34] B. Alpat,[33] A. Alvino,[33] G. Ambrosi,[33] K. Andeen,[22] L. Arruda,[24] N. Attig,[21] P. Azzarello,[33,16,a] A. Bachlechner,[1] F. Barao,[24] A. Barrau,[17] L. Barrin,[15] A. Bartoloni,[38] L. Basara,[3,37] M. Battarbee,[44] R. Battiston,[37,b] J. Bazo,[33] U. Becker,[9] M. Behlmann,[9] B. Beischer,[1] J. Berdugo,[26] B. Bertucci,[33,34] G. Bigongiari,[35,36] V. Bindi,[19] S. Bizzaglia,[33] M. Bizzarri,[33,34] G. Boella,[28,29] W. de Boer,[22] K. Bollweg,[20] V. Bonnivard,[17] B. Borgia,[38,39] S. Borsini,[33] M. J. Boschini,[28] M. Bourquin,[16] J. Burger,[9] F. Cadoux,[16] X. D. Cai,[9] M. Capell,[9] S. Caroff,[3] J. Casaus,[26] V. Cascioli,[33] G. Castellini,[14] I. Cernuda,[26] F. Cervelli,[35] M. J. Chae,[40] Y. H. Chang,[10] A. I. Chen,[9] H. Chen,[9] G. M. Cheng,[6] H. S. Chen,[6] L. Cheng,[41] A. Chikanian,[32,*] H. Y. Chou,[10] E. Choumilov,[9] V. Choutko,[9] C. H. Chung,[1] C. Clark,[20] R. Clavero,[23] G. Coignet,[3] C. Consolandi,[19] A. Contin,[7,8] C. Corti,[19] B. Coste,[37] M. Crispoltoni,[33,34] Z. Cui,[41] M. Dai,[5] C. Delgado,[26] S. Della Torre,[28] M. B. Demirköz,[2] L. Derome,[17] S. Di Falco,[35] L. Di Masso,[33,34] F. Dimiccoli,[37] C. Díaz,[26] P. von Doetinchem,[19] F. Donnini,[33,34] W. J. Du,[41] M. Duranti,[33] D. D'Urso,[33] A. Eline,[9] F. J. Eppling,[9] T. Eronen,[44] Y. Y. Fan,[43,c] L. Farnesini,[33] J. Feng,[3,d] E. Fiandrini,[33,34] A. Fiasson,[3] E. Finch,[32] P. Fisher,[9] Y. Galaktionov,[9] G. Gallucci,[35,15] B. García,[26] R. García-López,[23] C. Gargiulo,[15] H. Gast,[1] I. Gebauer,[22] M. Gervasi,[28,29] A. Ghelfi,[17] W. Gillard,[10] F. Giovacchini,[26] P. Goglov,[9] J. Gong,[31] C. Goy,[3] V. Grabski,[27] D. Grandi,[28] M. Graziani,[33,15] C. Guandalini,[7,8] I. Guerri,[35,36] K. H. Guo,[18] M. Habiby,[16] S. Haino,[10,43] K. C. Han,[25] Z. H. He,[18] M. Heil,[9] J. Hoffman,[10] T. H. Hsieh,[9] Z. C. Huang,[18] C. Huh,[13] M. Incagli,[35] M. Ionica,[33] W. Y. Jang,[13] H. Jinchi,[25] K. Kanishev,[37] G. N. Kim,[13] K. S. Kim,[13] Th. Kirn,[1] R. Kossakowski,[3] O. Kounina,[9] A. Kounine,[9] V. Koutsenko,[9] M. S. Krafczyk,[9] S. Kunz,[22] G. La Vacca,[28,15] E. Laudi,[33,34,e] G. Laurenti,[7,8] I. Lazzizzera,[37] A. Lebedev,[9] H. T. Lee,[43] S. C. Lee,[43] C. Leluc,[16] H. L. Li,[43,f] J. Q. Li,[31] Q. Li,[31] Q. Li,[9,g] T. X. Li,[18] W. Li,[4] Y. Li,[16,d] Z. H. Li,[6] Z. Y. Li,[43,d] S. Lim,[40] C. H. Lin,[43] P. Lipari,[38] T. Lippert,[21] D. Liu,[43] H. Liu,[31] T. Lomtadze,[35] M. J. Lu,[37,h] Y. S. Lu,[6] K. Luebelsmeyer,[1] F. Luo,[41] J. Z. Luo,[31] S. S. Lv,[18] R. Majka,[32] A. Malinin,[12] C. Mañá,[26] J. Marín,[26] T. Martin,[20] G. Martínez,[26] N. Masi,[7,8] D. Maurin,[17] A. Menchaca-Rocha,[27] Q. Meng,[31] D. C. Mo,[18] L. Morescalchi,[35,i] P. Mott,[20] M. Müller,[1] J. Q. Ni,[18] N. Nikonov,[22] F. Nozzoli,[33] P. Nunes,[24] A. Obermeier,[1] A. Oliva,[26] M. Orcinha,[24] F. Palmonari,[7,8] C. Palomares,[26] M. Paniccia,[16] A. Papi,[33] M. Pauluzzi,[33,34] E. Pedreschi,[35] S. Pensotti,[28,29] R. Pereira,[24,19] F. Pilo,[35] A. Piluso,[33,34] C. Pizzolotto,[33] V. Plyaskin,[9] M. Pohl,[16] V. Poireau,[3] E. Postaci,[2] A. Putze,[3] L. Quadrani,[7,8] X. M. Qi,[18] T. Räihä,[1] P. G. Rancoita,[28] D. Rapin,[16] J. S. Ricol,[17] I. Rodríguez,[26] S. Rosier-Lees,[3] A. Rozhkov,[9] D. Rozza,[28] R. Sagdeev,[11] J. Sandweiss,[32] P. Saouter,[16] C. Sbarra,[7,8] S. Schael,[1] S. M. Schmidt,[21]

AMS-02 (e+ + e-) flux

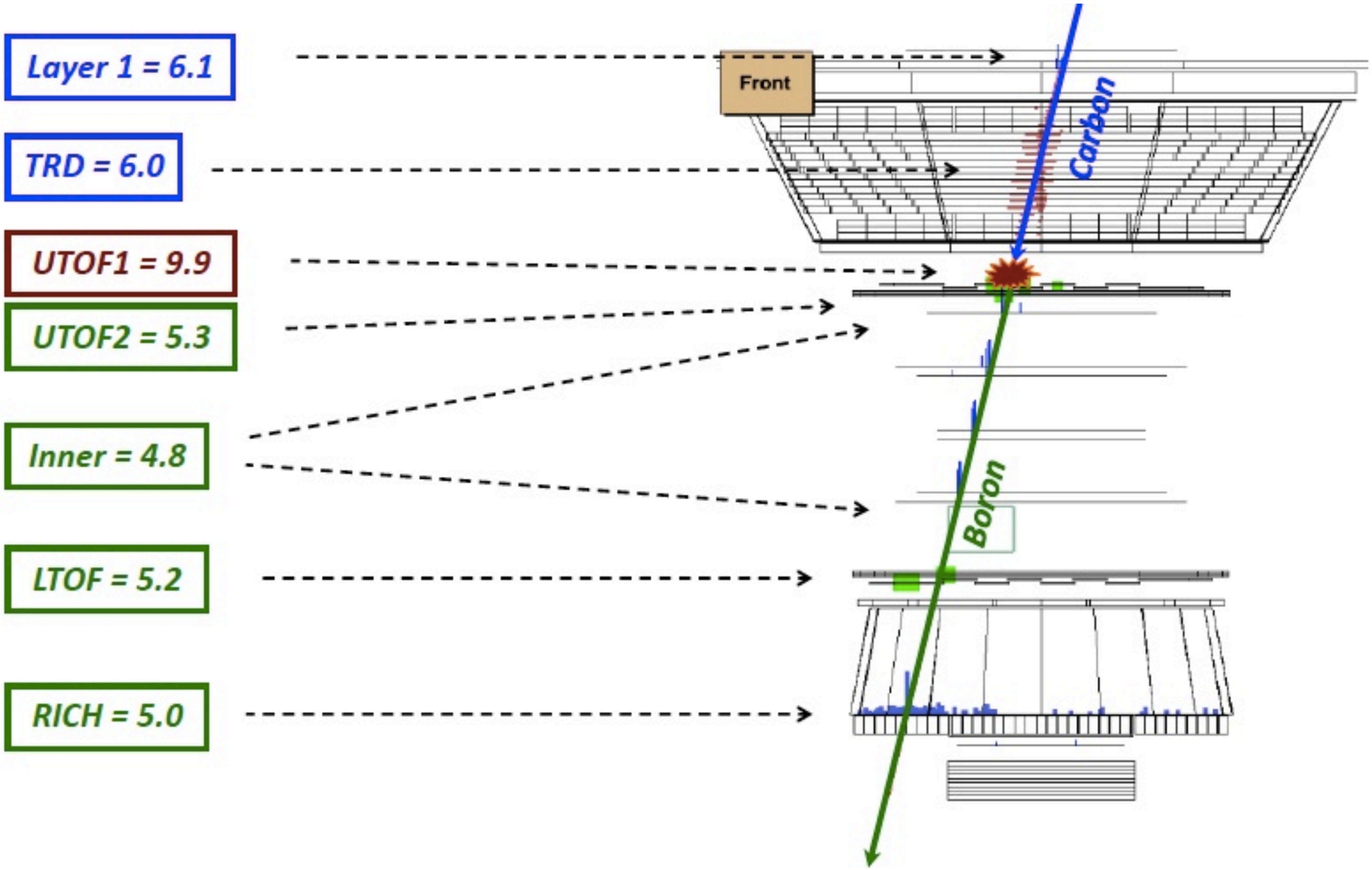


AMS-02 measures CR spectra up to the iron in GeV to TeV



AMS-02 is the only detector capable of measuring all the species of cosmic rays at the % level. AMS-02 measurements will improve our knowledge about CR sources, acceleration mechanisms and propagation.

AMS-02 has 7 independent charge measurements



It is possible to evaluate also fragmentation of GCR inside the detector.

AMS-02 proton flux

Precision Measurement of the Proton Flux in Primary Cosmic Rays from 1 GV to 1.8 TV with the Alpha Magnetic Spectrometer on the International Space Station

M. Aguilar,[26] B. Alpat,[33] G. Ambrosi,[33] K. Andeen,[22] L. Arruda,[24] N. Attig,[21] P. Azzarello,[16,a] A. Bachlechner,[1] F. Barao,[24] A. Barrau,[17] L. Barrin,[15] A. Bartoloni,[38] L. Basara,[3,37] M. Battarbee,[45] R. Battiston,[37,b] J. Bazo,[33] J. Becker,[9] M. Behlmann,[9] B. Beischer,[1] J. Berdugo,[26] B. Bertucci,[33,34] V. Bindi,[19] C. Boella,[28,29] W. de Boer,[22] K. Bollweg,[20] V. Bonnivard,[17] B. Borgia,[38,39] M. Boschini,[28] M. Bourquin,[16] J. Burger,[9] F. Cadoux,[16] X.D. Cai,[9] M. Capell,[9] S. Caroff, J. Casaus,[26] G. Castellini,[14] I. Cernuda,[26] D. Cerreta,[33,34] F. Cervelli,[35] M.J. Chae,[41] Y.H. Chang,[10] A.I. Chen,[9] H. Chen,[9] G.M. Cheng,[6] H.S. Chen,[6] L. Cheng,[42] H.Y. Chou,[10] E. Choumilov,[9] V. Choutko,[9] C.H. Chung,[1] C. Clark,[20] R. Clavero,[23] G. Coignet,[3] C. Consolandi,[19] A. Contin,[7,8] C. Corti,[19] B. Coste,[37,15] M. Crispoltoni,[33,34] Z. Cui,[42] Y.M. Dai,[5] C. Delgado,[26] S. Della Torre,[28] M.B. Demirköz,[2] L. Derome,[17] S. Di Falco,[35] F. Dimiccoli,[37] C. Díaz,[26] P. von Doetinchem,[19] F. Donnini,[33,34] W.J. Du,[42] M. Duranti,[33] D. D'Urso,[33] A. Eline,[9] F.J. Eppling,[9] T. Eronen,[45] Y.Y. Fan,[44,c] J. Feng,[3,d] E. Fiandrini,[33,34] A. Fiasson,[3] E. Finch,[32] P. Fisher,[9] Y. Galaktionov,[9] G. Gallucci,[35] B. García,[26] R. García-López,[23] C. Gargiulo,[15] H. Gast,[1] I. Gebauer,[22] M. Gervasi,[28,29] A. Ghelfi,[17] W. Gillard,[10] F. Giovacchini,[26] P. Goglov,[9] J. Gong,[31] C. Goy,[3] V. Grabski,[27] D. Grandi,[28] M. Graziani,[33]

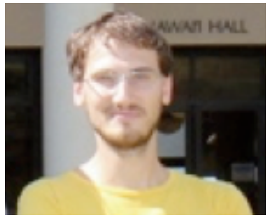
Submitted to PRL

New AMS-02 Results in P, He, B/C, Li, C/He will be presented during the AMS days - CERN webcast April 15-16-17

Low Energy Studies @ UH

V. Bindi, C. Consolandi, C. Corti, K. Whitman






The AMS group at UH (1 PostDoc + 2 RAs) is focused on the Low Energy part of the AMS-02 data spectrum

Main research fields:

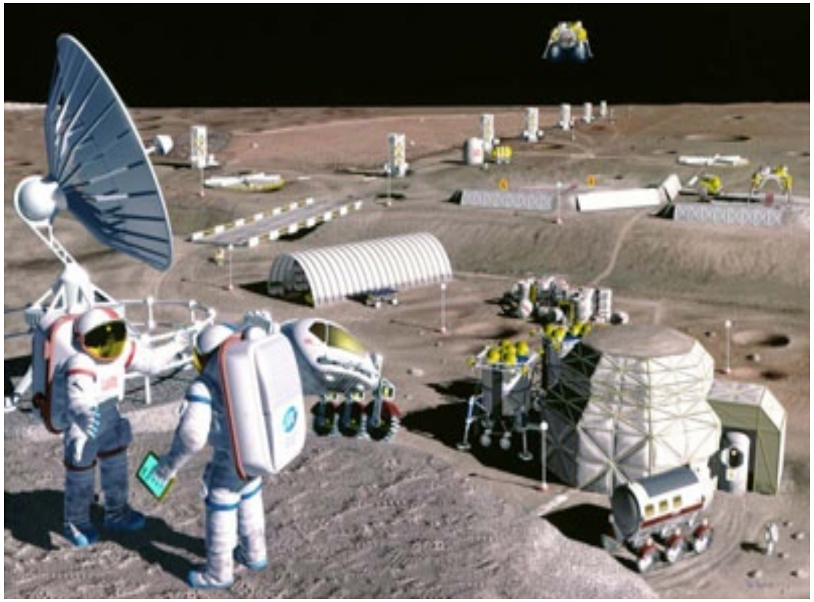
- Cosmic Rays Fluxes and their changes with the solar activity and extrapolation of the Local Interstellar Spectrum of GCRs.
- Heliophysics - Study of the Solar Energetic Particles.

Collaboration on going between the NASA Space radiation group (lead by E. Semones) and AMS UH group (lead by V. Bindi) since July 2014.

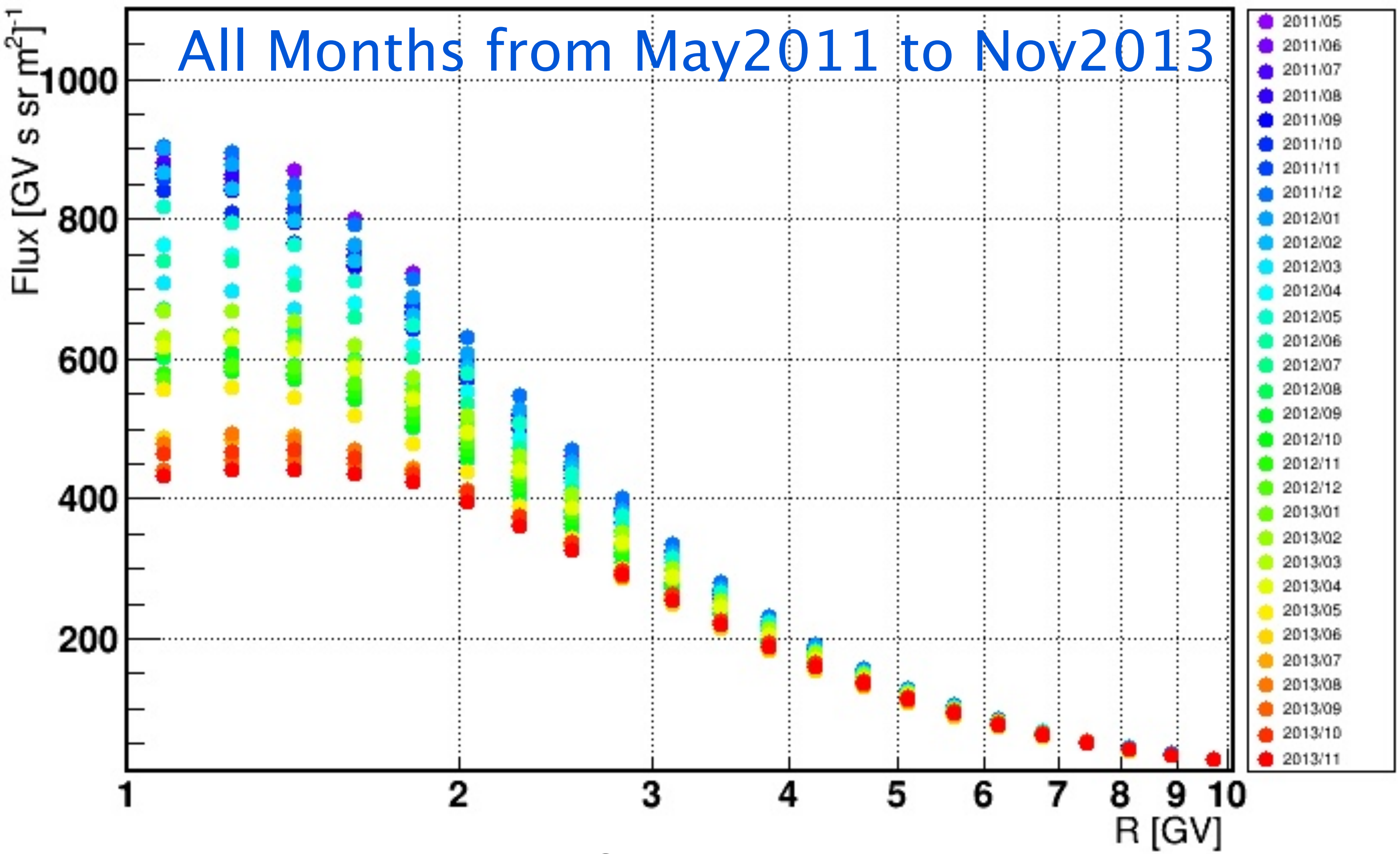
Collaboration with NASA Space Radiation group

Main goal of this collaboration is to provide to NASA during the next 5 years, the **monthly P-He-C fluxes measured by AMS-02 from 2011 till 2019, in the energy range from 1 to 10 GV** - where the radiation is expected to be the most harmful.

The radiation group will use the AMS monthly fluxes to improve the GCR models employed to predict the radiation dose absorbed by astronauts for both ISS operations and long duration missions.

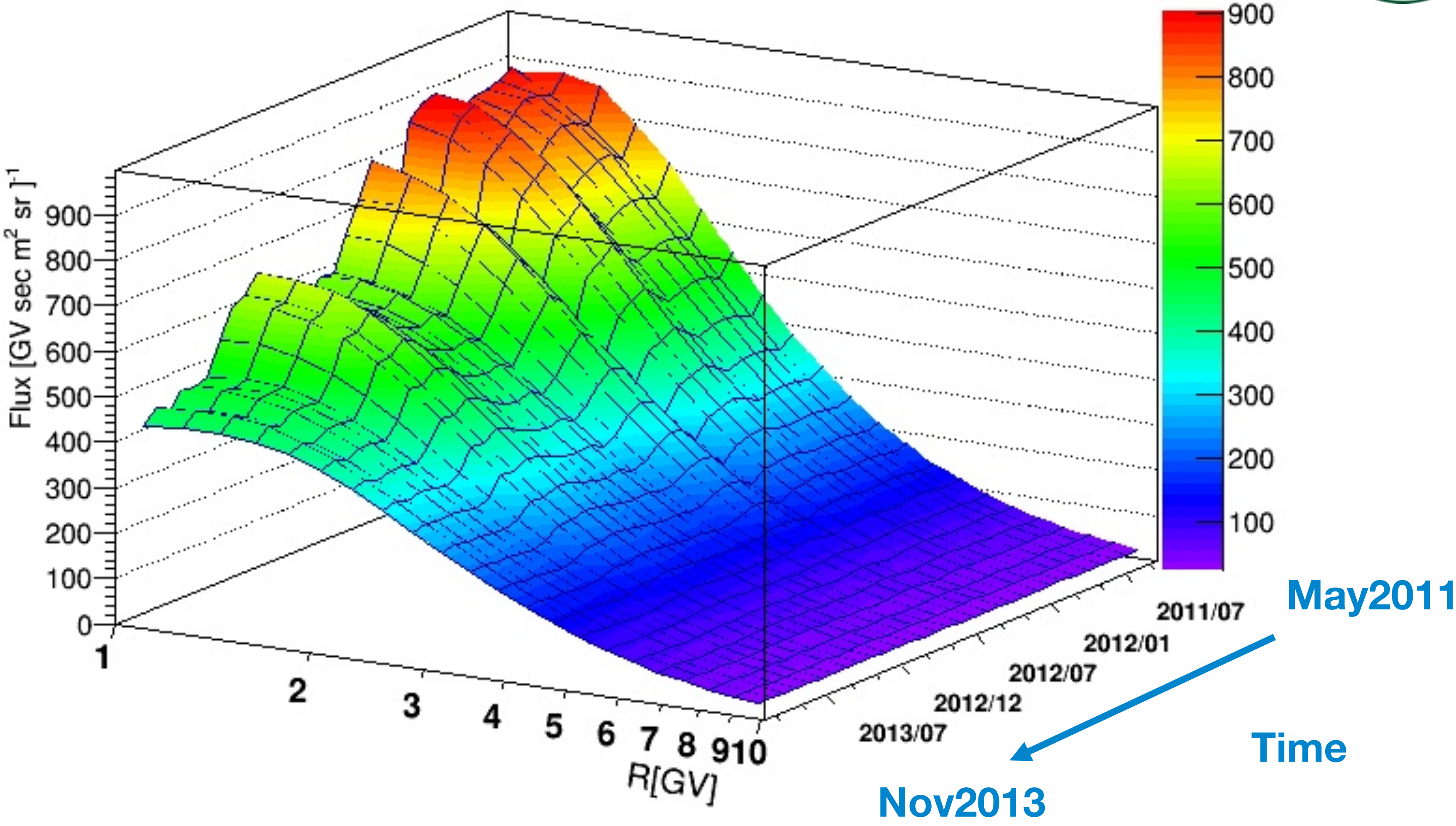


Current study: Evaluating Monthly P Flux



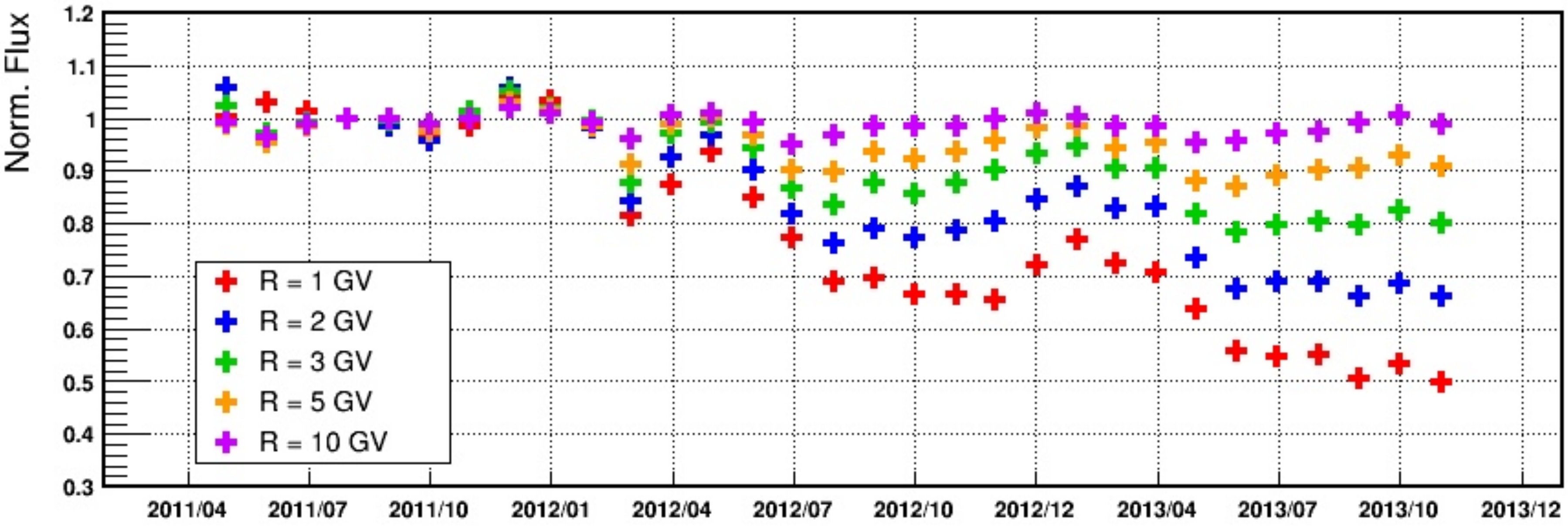
A systematic study of the Detector behavior and its efficiencies has been performed.

Monthly P Flux



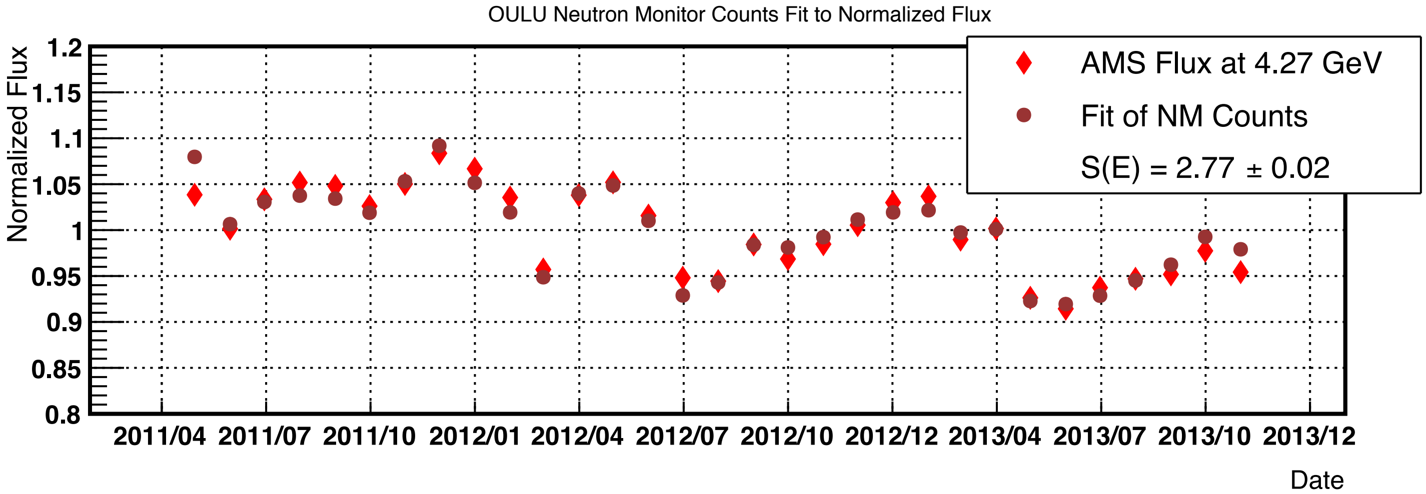
The monthly fluctuations are the result of short timescale solar activity.

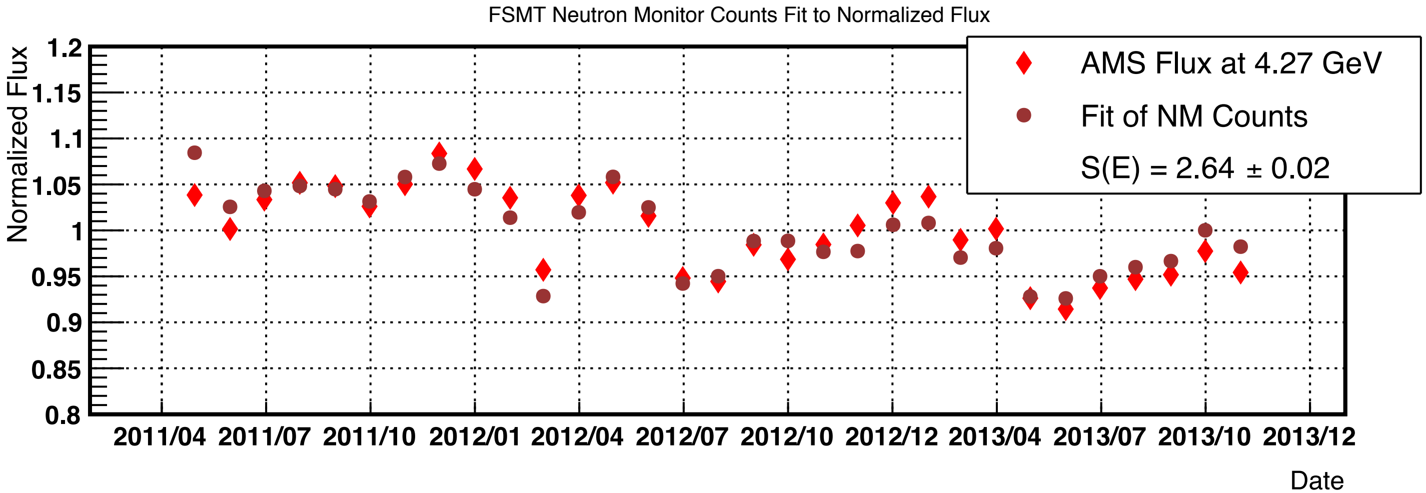
Flux Normalized at different rigidities



Comparison with NMs

AMS-02 monthly proton fluxes have been compared with NMs



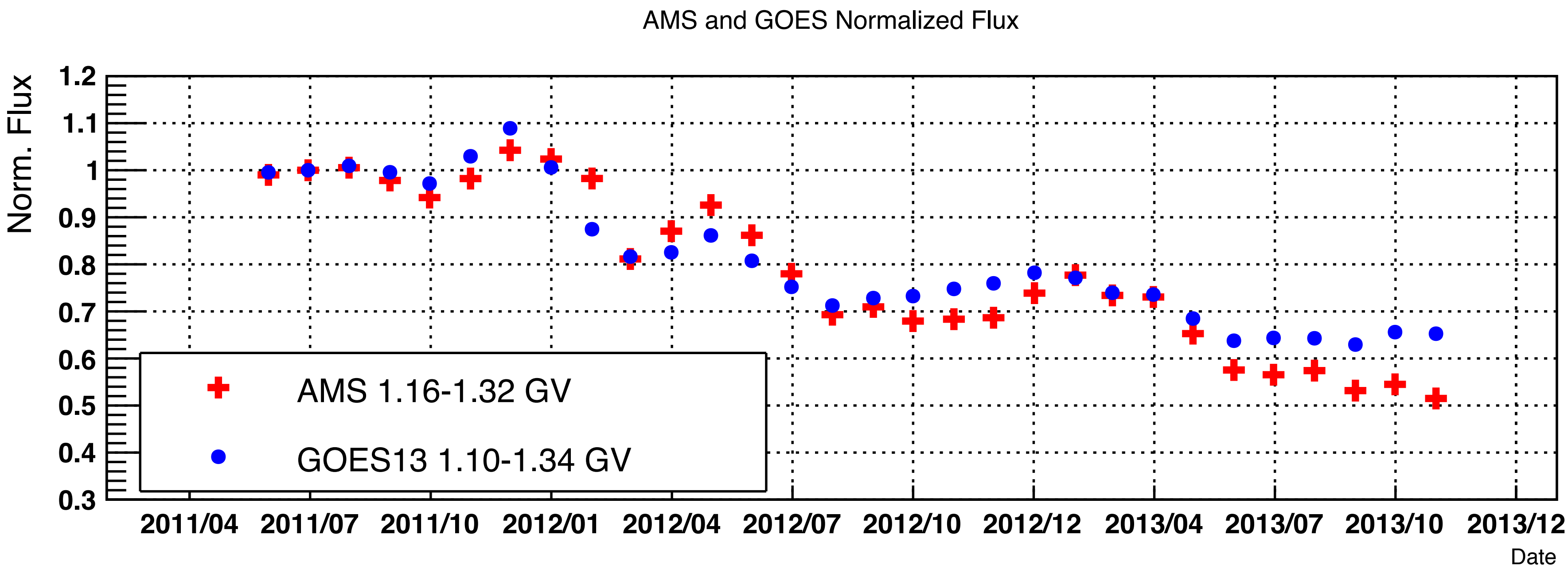


The monthly fluctuations are well-correlated and are the result of short timescale solar activity.

Comparison with GOES-13

GOES-13 normalized monthly proton protons flux measured in the rigidity range 1.1 – 1.3 GV

AMS proton flux (same rigidity bins as GOES-13) is well correlated to the one of GOES-13



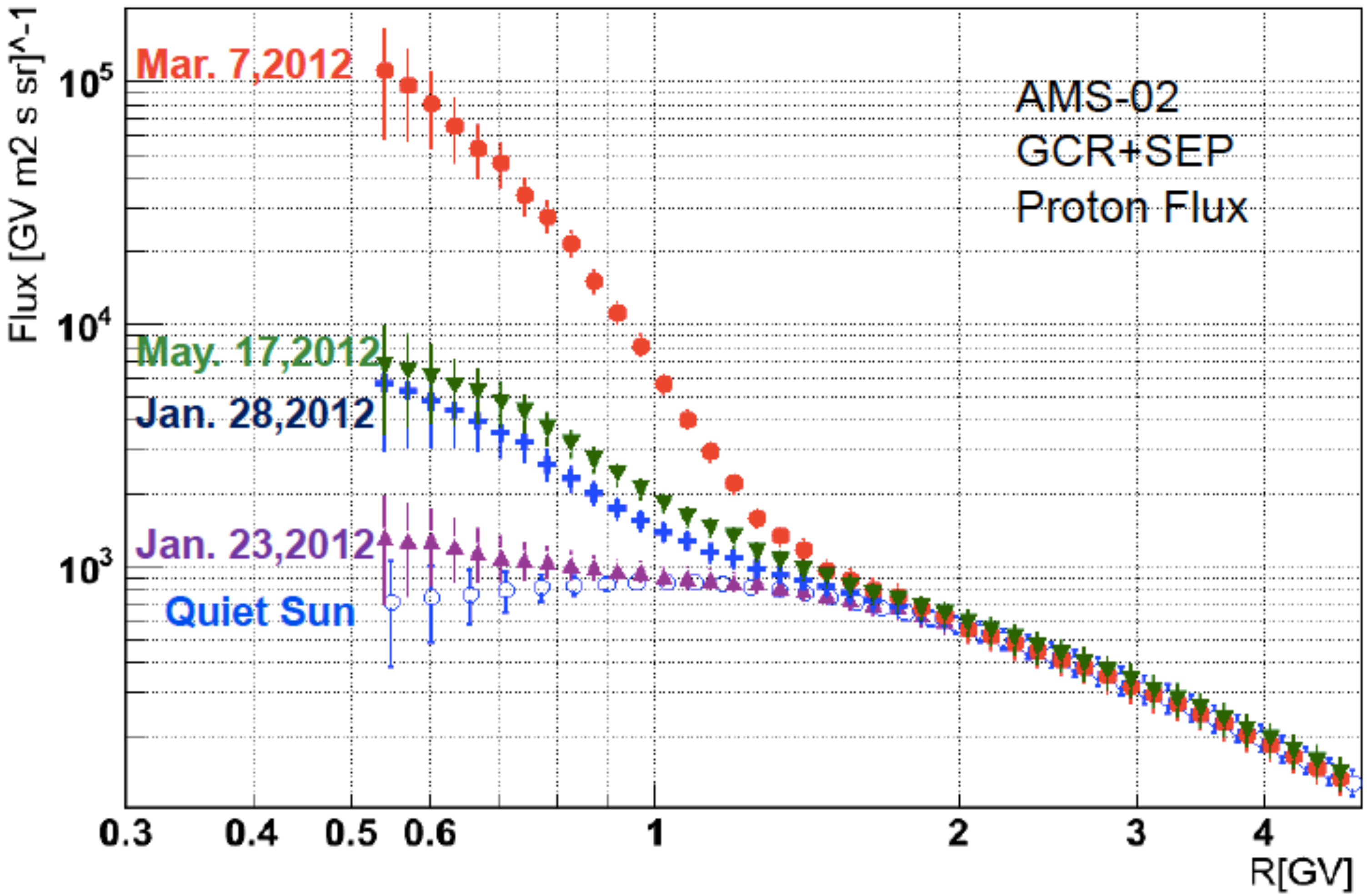
Heliophysics with AMS-02

AMS-02 is **the largest SEP detector ever flown in Space** that can measure **P** and **He** from solar events with unprecedented statistics at energies not always accessible from current satellites.

Date Observed by AMS-02	Date of Event	Time of Flare (UT)	Flare Class	CME Linear Speed (km/s)
June 7, 2011	June 7, 2011	06:16	M2.5	1255
Aug 4, 2011	Aug 4, 2011	03:41	M9.3	1315
Aug 9, 2011	Aug 9, 2011	07:48	X6.9	1610
Jan 23, 2012	Jan 23, 2012	03:38	M8.7	2175
Jan 28, 2012	Jan 27, 2012	17:37	X1.7	2508
Mar 7, 2012	Mar 7, 2012	00:02, 01:05	X5.4, X1.3	2684, 1825
May 17, 2012	May 17, 2012	01:25	M5.1	1582
July 17, 2012	July 17, 2012	12:03	M1.7	958
July 19, 2012	July 19, 2012	04:17	M7.7	1631
July 23, 2012	July 23, 2012	-	-	2003
May 23, 2013	May 22, 2013	13:08	M5.8	1466
Oct 28, 2013	Oct 28, 2013	01:25, 15:07	X1.0, M5.1	1201, 1073
Oct 29, 2013	Oct 29, 2013	21:42	X2.3	1001
Nov 2, 2013	Nov 2, 2013	04:40	C8.2	828
Nov 7, 2013	Nov 7, 2013	-	-	1033
Dec 28, 2013	Dec 28, 2013	-	-	1118
Jan 6, 2014	Jan 6, 2014	-	-	1402
Jan 7, 2014	Jan 7, 2014	18:04	X1.2	1830
Feb 25, 2014	Feb 25, 2014	00:39	X4.9	2147

~20 High Energy SEP events observed by AMS-02

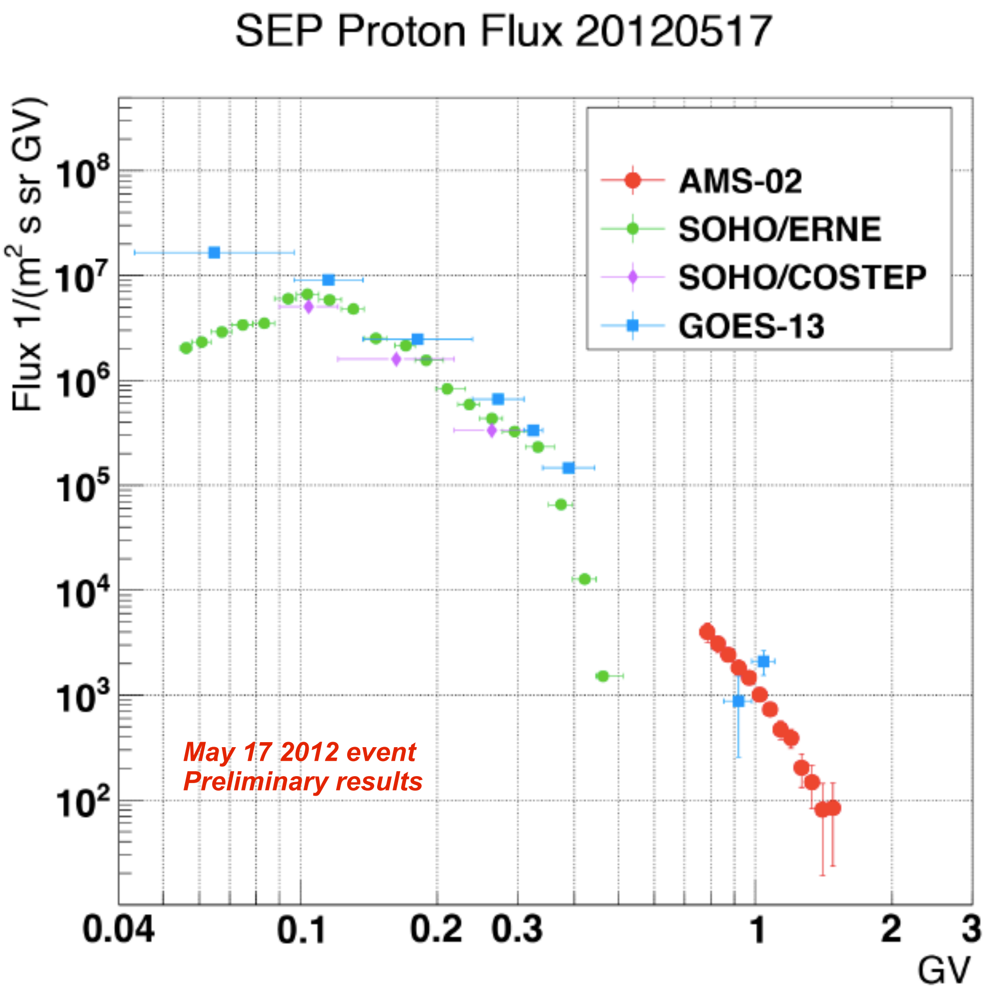
AMS-02 GCR + SEP proton Flux



Daily SEP fluxes measured by AMS-02 will be provided to NASA Space Radiation group starting from 2016.

SEP Spectra

SEP spectra measured by AMS-02 cover the highest energy range of SEPs. AMS data combined with other instruments at lower energy, will provide a baseline for the modeling of SEP produ



Monthly fluxes and SEPs: Status and Next

- Last refinements to the monthly proton analysis plus the evaluation of the systematic errors are on going.

- We expect to have the monthly proton fluxes available and ready to be delivered to the NASA Space Radiation group starting from the Summer 2015 (internal cross check from the AMS collaboration might cause some delay).

- Monthly Helium flux and SEP Proton fluxes will be studied and provided to NASA in 2016, SEP Helium fluxes in 2017 and the monthly Carbon fluxes in 2018.

Conclusions

The Space Station is a unique platform for precision physics research.

AMS-02 is measuring the cosmic ray fluxes with ~% uncertainty and unprecedented accuracy.

The improvement in accuracy will provide new insights in many different fields such as the study of the cosmic rays, solar activity, space radiation and others.

In the next 5 years, the **AMS UH group** will provide to the NASA **Space Radiation group** the monthly P-He-C fluxes and the SEP fluxes measured by AMS-02 from 2011 till 2019.

More science coming soon! Stay tuned!!!