

Search for time-dependent fluctuations in cosmic rays spectra with the AMS01 detector

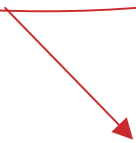
Proton flux: comparison with AMS01 publication results

Selection cuts

(DATA after MIR undocking, AMS Z-axis pointing to Zenith)

+ $\beta > 0$ (downward going particles)

	MC e-	DATA Z=-1	MC p	DATA Z=1	MC He3	MC He4	DATA Z=2 under/above cutoff	
+ $Z_{\text{TOF}} = Z_{\text{Tracker}}$	100.0%	99.6%	100.0%	99.9%	98.6%	98.5%	98.7%	98.7%
+ N TOF hit planes ≥ 3	99.5%	90.0%	99.3%	93.0%	99.6%	99.3%	97.0%	96.6%
+ $\sigma(1/R) < 0.4$	99.8%	97.7%	99.8%	99.9%	99.9%	99.9%	100.0%	100.0%
+ p/ β Z compatibility	99.7%	99.7%	99.6%	99.9%	99.9%	99.9%	99.8%	99.8%



$$\frac{1}{|\beta|} = \sqrt{1 + \left(\frac{m}{Ze}\right)^2 \frac{1}{R^2}} \Rightarrow \left| \frac{R^2}{m^2} \left(\frac{1}{\beta^2} - 1 \right) - \left(\frac{1}{Ze} \right)^2 \right| < 3\sigma$$

Particle selection

e^- :

- + $R < 0$
- + $Z = -1$
- + isolated track (85% MC ; 84% DATA)
- + β ultrarelativistic (99.6% MC ; 96% DATA)

p :

- + $R > 0$
- + $Z = 1$
- + $|\text{mass} - 0.9328| < 3.5 \sigma_{\text{mass}}$ (98% MC ; 95% DATA)

He:

- + $R > 0$
- + $Z = 2$
- + $\beta^4 \cdot \chi^2_{\text{MS off}} < 200$ (MC He3/He4 95%; DATA: 97% (99%) under(above) cutoff)

Electrons: preselection

	Low energy electrons (p: 0.1-> 1 GeV)	High energy electrons (p: 1 -> 60 GeV)	DATA After MIR undocking Zenith pointing
processed entries	35072	100000	1000000
Gen events (single particle)	100.00%	100.00%	----
Good field of view	----	----	77.03%
Triggered	35.33%	10.60%	99.88%
DAQLifetime>0.25	----	----	95.54%
No Anticlusters	99.76%	99.71%	98.80%
Tracks $\neq 0$	44.27%	64.68%	63.85%
Betas $\neq 0$	86.09%	99.77%	100.00%
Charges $\neq 0$	100.00%	100.00%	100.00%
Particles $\neq 0$	100.00%	100.00%	100.00%
Single particle	100.00%	100.00%	99.94%
Particle direction $\theta < 40^\circ$	98.30%	98.06%	92.17%
Ptrackp $\neq \text{NULL}$	100.00%	99.64%	96.96%
Ntracker hits < 500	99.68%	99.41%	99.99%
Pbetap $\neq \text{NULL}$	100.00%	100.00%	100.00%

Electrons: selection

	Low energy electrons (p: 0.1-> 1 GeV)	High energy electrons (p: 1 -> 60 GeV)	DATA After MIR undocking Zenith pointing
Downward going	100.00%	100.00%	99.75%
R<0	100.00%	98.19%	2.57%
Z=-1	100.00%	99.98%	91.59%
$Z_{\text{TOF}}=Z_{\text{Tracker}}$	100.00%	99.88%	98.35%
N TOF hit planes ≥ 3	98.81%	99.75%	88.88%
$\sigma(1/R) < 0.4$	99.43%	99.97%	97.28%
p/ β Z compatibility	99.21%	99.24%	99.40%
β ultrarelativistic	99.76%	99.56%	95.61%
isolated track	85.25%	84.58%	84.06%

$N_{\text{sel}}/N_{\text{presel}}|_{Z=-1} =$

82.89%

83.24%

67.91%

Protons: preselection

	Low energy protons (p: 0.450-> 6 GeV)	High energy protons (p: 6 -> 150 GeV)	DATA After MIR undocking Zenith pointing
processed entries	100000	100000	1000000
Gen events (single particle)	100.00%	100.00%	----
Good field of view	----	----	77.03%
Triggered	65.56%	60.13%	99.88%
DAQLifetime>0.25	----	----	95.54%
No Anticlusters	99.82%	99.77%	98.80%
Tracks $\neq 0$	49.43%	39.30%	63.85%
Betas $\neq 0$	94.70%	94.78%	100.00%
Charges $\neq 0$	100.00%	100.00%	100.00%
Particles $\neq 0$	100.00%	100.00%	100.00%
Single particle	99.98%	100.00%	99.94%
Particle direction $\theta < 40^\circ$	98.35%	97.87%	92.17%
Ptrackp $\neq \text{NULL}$	100.00%	100.00%	96.96%
Ntracker hits < 500	99.69%	99.65%	99.99%
Pbetap $\neq \text{NULL}$	100.00%	100.00%	100.00%

Protons: selection

	Low energy protons (p: 0.450 -> 6 GeV)	High energy protons (p: 6 -> 150 GeV)	DATA After MIR undocking Zenith pointing
Downward going	100.00%	100.00%	99.75%
R>0	99.60%	95.26%	97.43%
Z=1	100.00%	99.98%	87.00%
$Z_{\text{TOF}}=Z_{\text{Tracker}}$	99.99%	99.99%	99.85%
N TOF hit planes ≥ 3	95.98%	99.61%	92.63%
$\sigma(1/R) < 0.4$	99.41%	100.00%	99.72%
p/ β Z compatibility	99.98%	99.35%	99.81%
$ \text{mass} - 0.9328 < 3.5 \sigma_{\text{mass}}$	96.06%	98.47%	94.74%

Nrec/Npresel_{Z=-1}=

91.63%

97.45%

87.21%

94.85%

He: preselection

	He3 (p: 1-> 200 GeV)	He4 (p: 1 -> 200 GeV)	DATA After MIR undocking Zenith pointing
processed entries	100000	100000	1000000
Gen events (single particle)	100.00%	100.00%	----
Good field of view	----	----	77.03%
Triggered	68.87%	69.54%	99.88%
DAQLifetime>0.25	----	----	95.54%
No Anticlusters	99.57%	99.59%	98.80%
Tracks $\neq 0$	61.92%	61.97%	63.85%
Betas $\neq 0$	98.24%	98.33%	100.00%
Charges $\neq 0$	100.00%	100.00%	100.00%
Particles $\neq 0$	100.00%	100.00%	100.00%
Single particle	99.98%	99.99%	99.94%
Particle direction $\theta < 40^\circ$	98.28%	98.40%	92.17%
Ptrackp $\neq \text{NULL}$	100.00%	100.00%	96.96%
Ntracker hits < 500	99.72%	99.77%	99.99%
Pbetap $\neq \text{NULL}$	100.00%	100.00%	100.00%

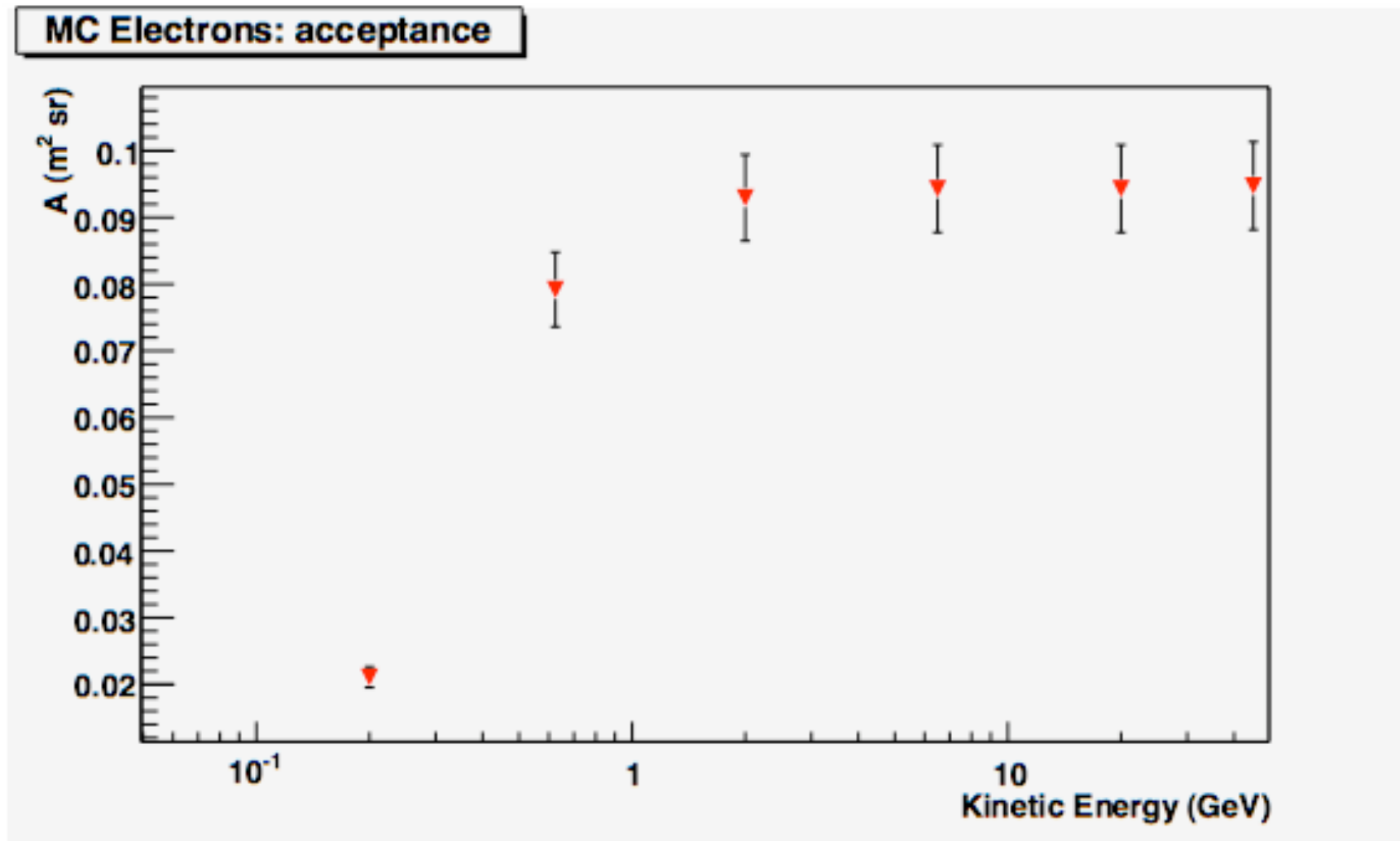
He: selection

	He3 (p: 1-> 200 GeV)	He4 (p: 1 -> 200 GeV)	DATA After MIR undocking Zenith pointing
Downward going	100.00%	100.00%	99.75%
R>0	98.83%	98.67%	97.43%
Z=2	99.28%	99.36%	12.48%
$Z_{TOF}=Z_{Tracker}$	98.34%	98.32%	98.45%
N TOF hit planes ≥ 3	98.54%	97.64%	96.68%
$\sigma(1/R) < 0.4$	99.94%	99.99%	99.76%
p/ β Z compatibility	99.94%	99.95%	99.78%
$\beta^4 \cdot \chi^2_{MS\ off} < 200$	94.95%	95.25%	98.2%

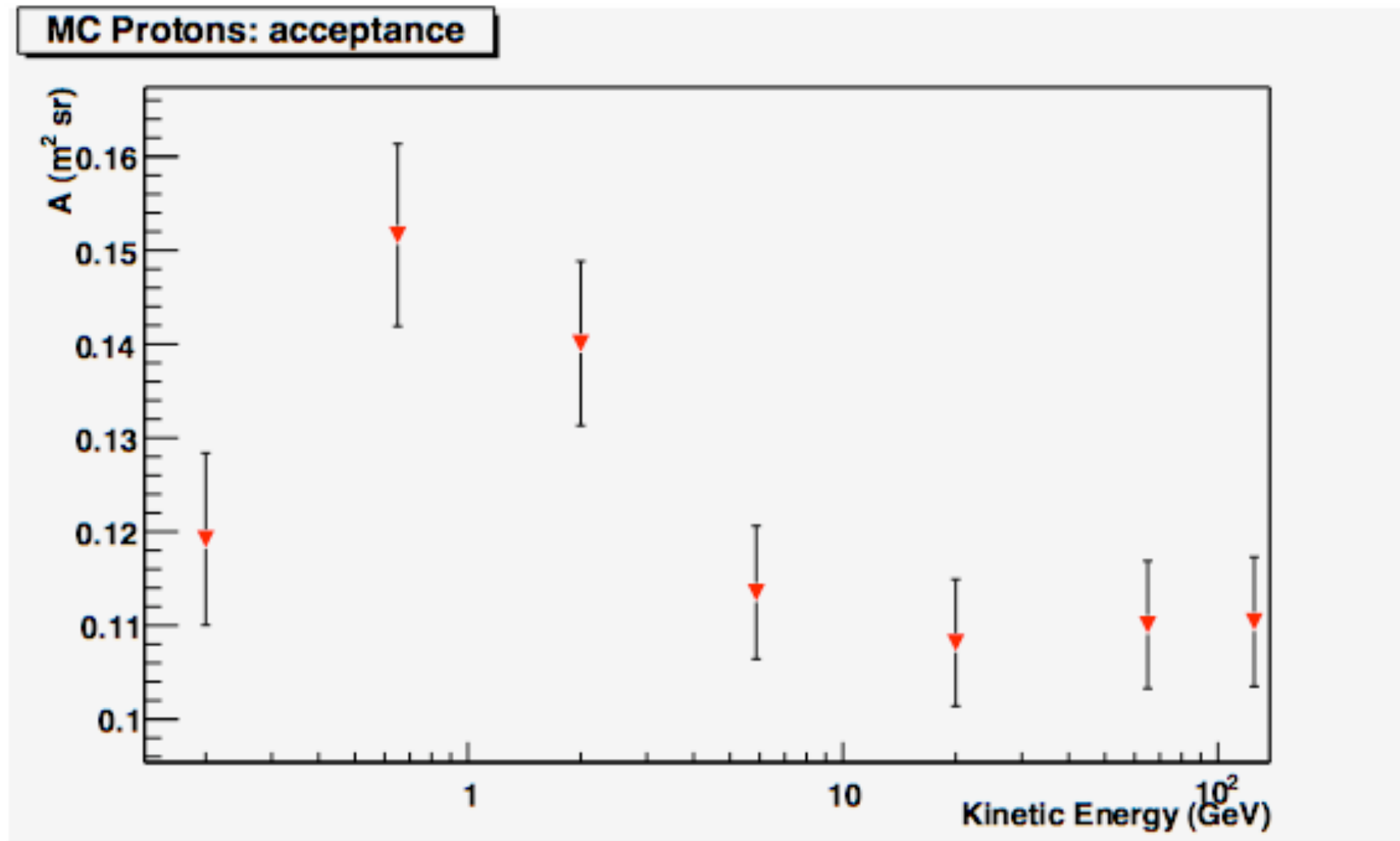
$N_{sel}/N_{presel}_{Z=2} =$
91.91 %
91.39%
under cutoff/ above cutoff
91.29% 94.37%

Acceptance Correction	Value (%)				Error (%)
	electrons	protons	He3	He4	
Fast Trigger	-3	-3	-3	-3	1.5
Anti Trigger	0	0	0	0	1
Level3 TOF	-4	-4	0	0	2
Level3 Tracker	-2	-2	-2	-2	1
Track fit	-2	-2	-2	-2	1
β fit	-3	-3	-3	-3	1
Particle interactions	+1	+1	+1	+1	1.5
MC statistics	0	0	0	0	2
Acceptance θ, ϕ corrections	0	0	0	0	2
electron selection	-15	---	---	---	1
proton selection	---	-8	---	---	3(2) low(high) R
He3 selection	---	---	-1	---	1
He4 selection	---	---	---	+3	1
OVERALL	-28	-21	-10	-6	5 (6 low R protons)

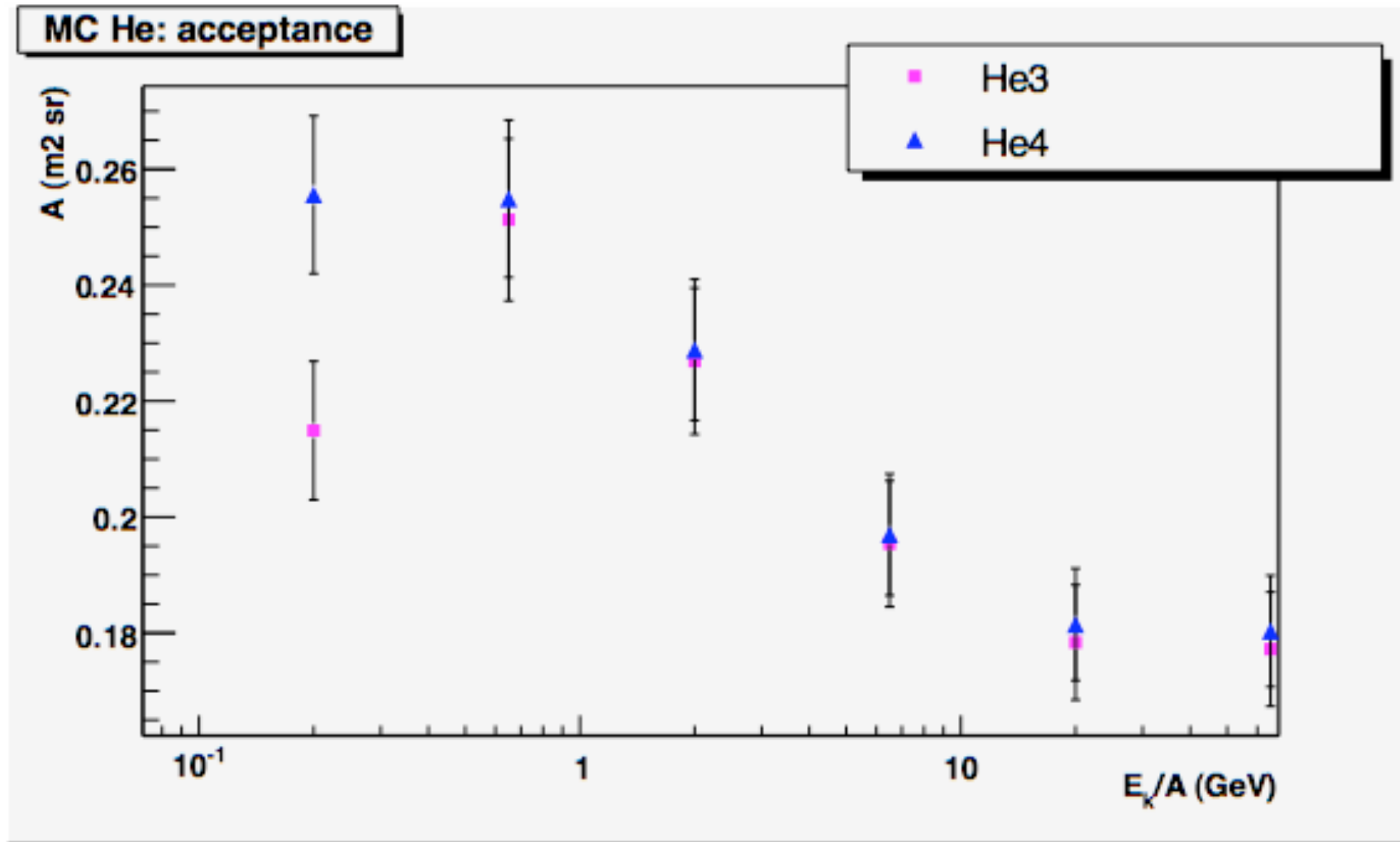
Electrons corected acceptance



Proton corrected acceptance



He corrected acceptance



Comparison with AMS01 publication proton flux

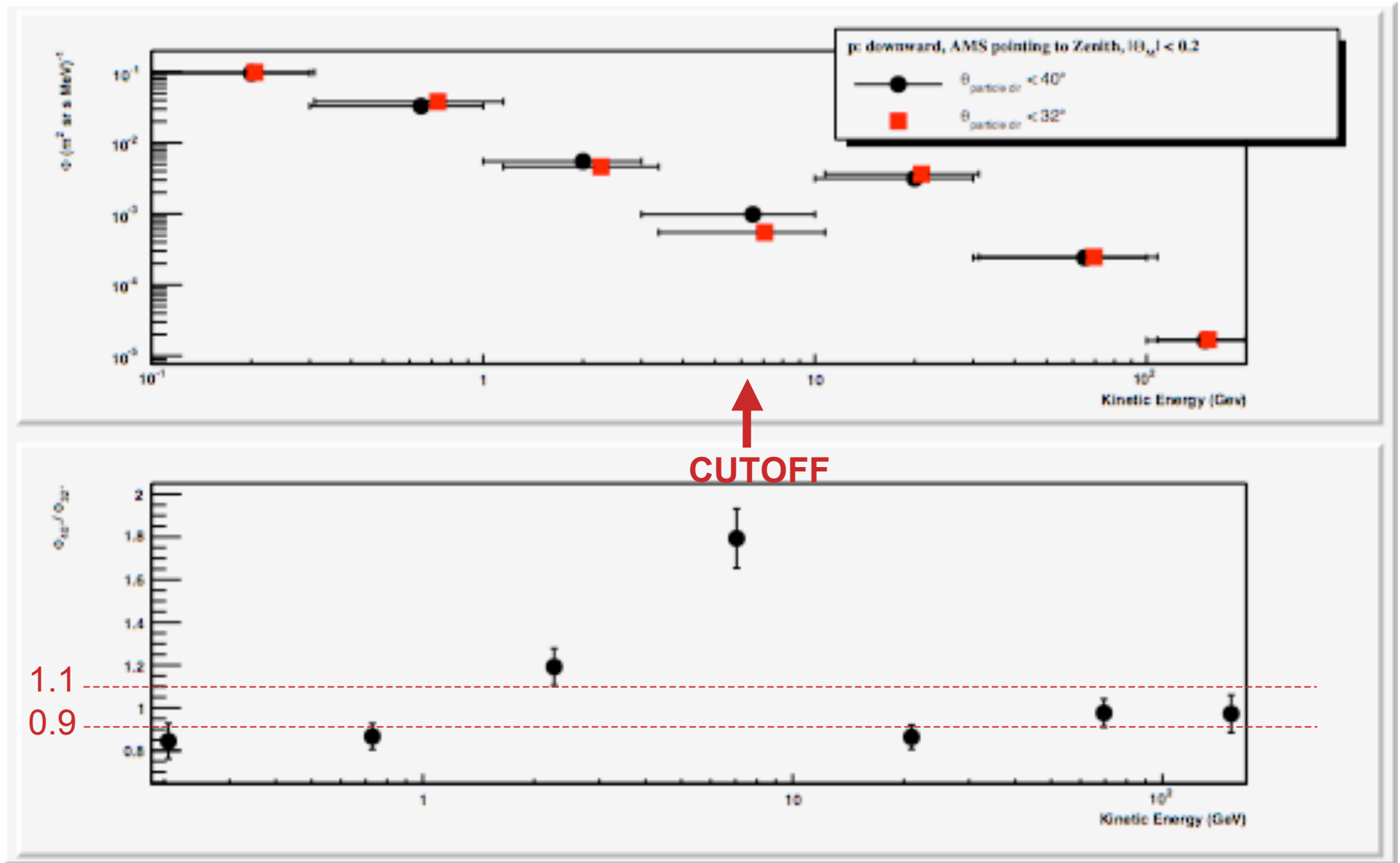
- Data taken after undocking from MIR
- AMS Z-axis pointing within 1° of the zenith
- South Atlantic Anomaly excluded

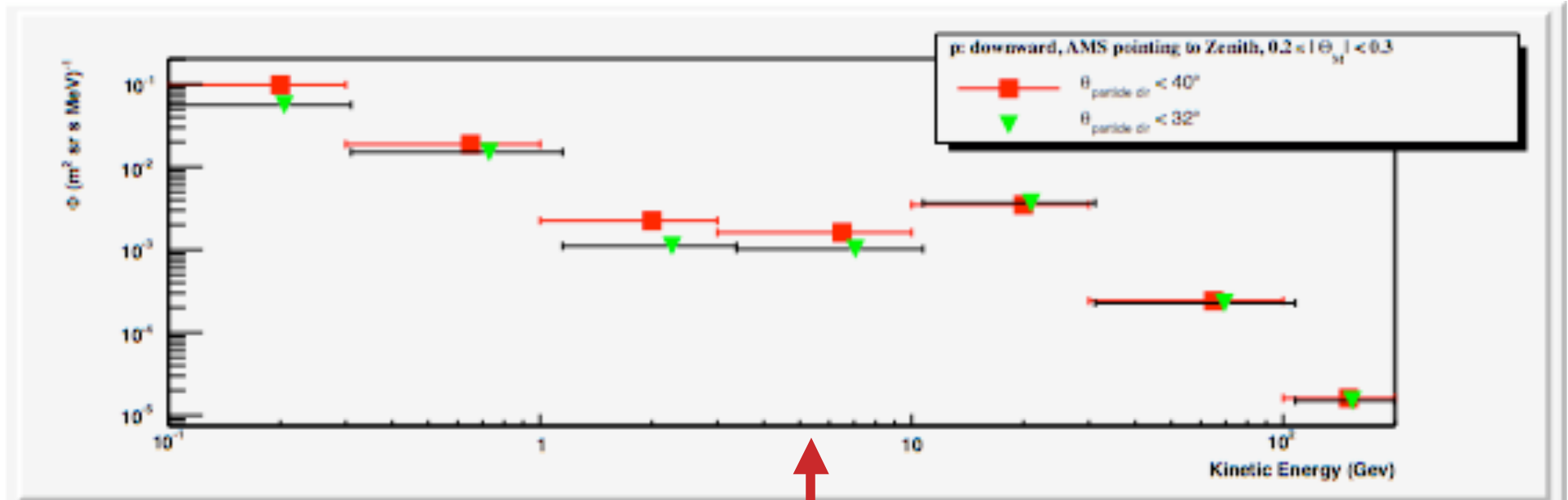
Published flux:

- Particle incident angles within 32° of the AMS Z-axis
- Binning:
 1. 0.1→0.31
 2. 0.31→1.15
 3. 1.15→3.38
 4. 3.38→10.73
 5. 10.73→31.2
 6. 31.2→107.78
 7. 107.78→199.06

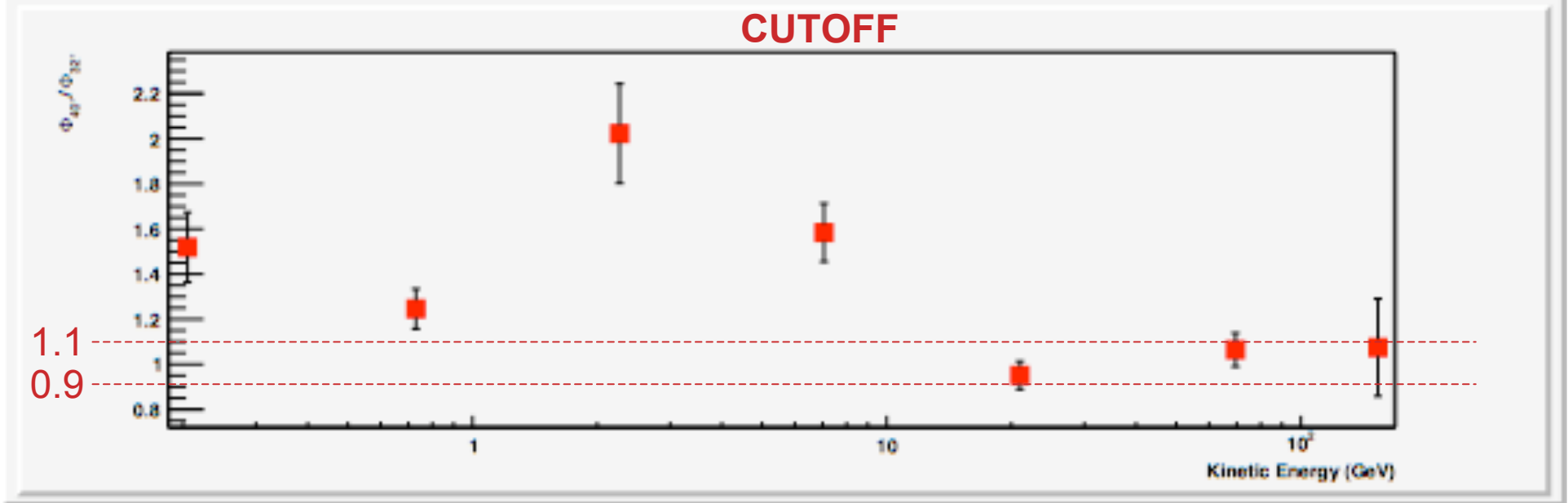
This analysis:

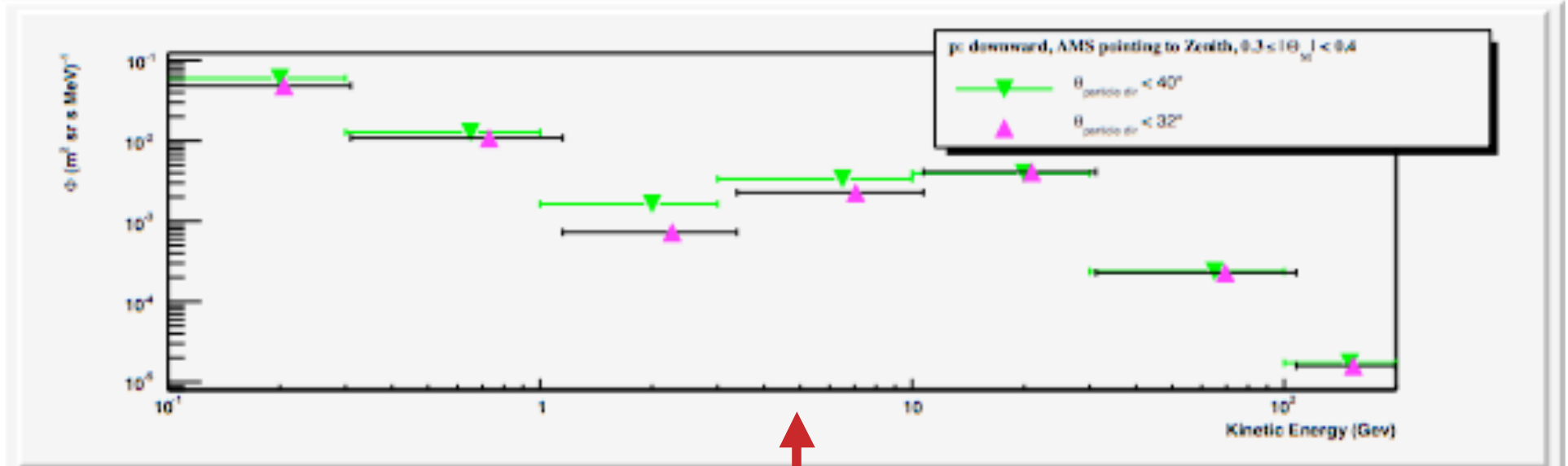
- Particle incident angles within 40° of the AMS Z-axis
- Binning:
 1. 0.1→0.3
 2. 0.3→1.
 3. 1.→3.
 4. 3.→10.
 5. 10.→30.
 6. 30.→100.
 7. 100.→200.



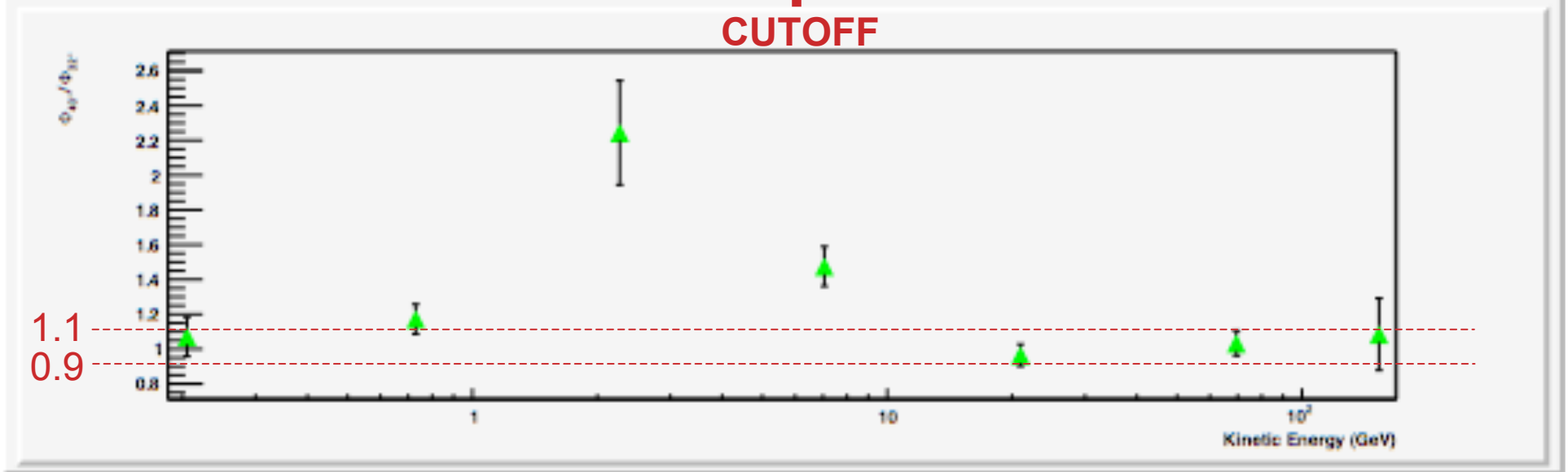


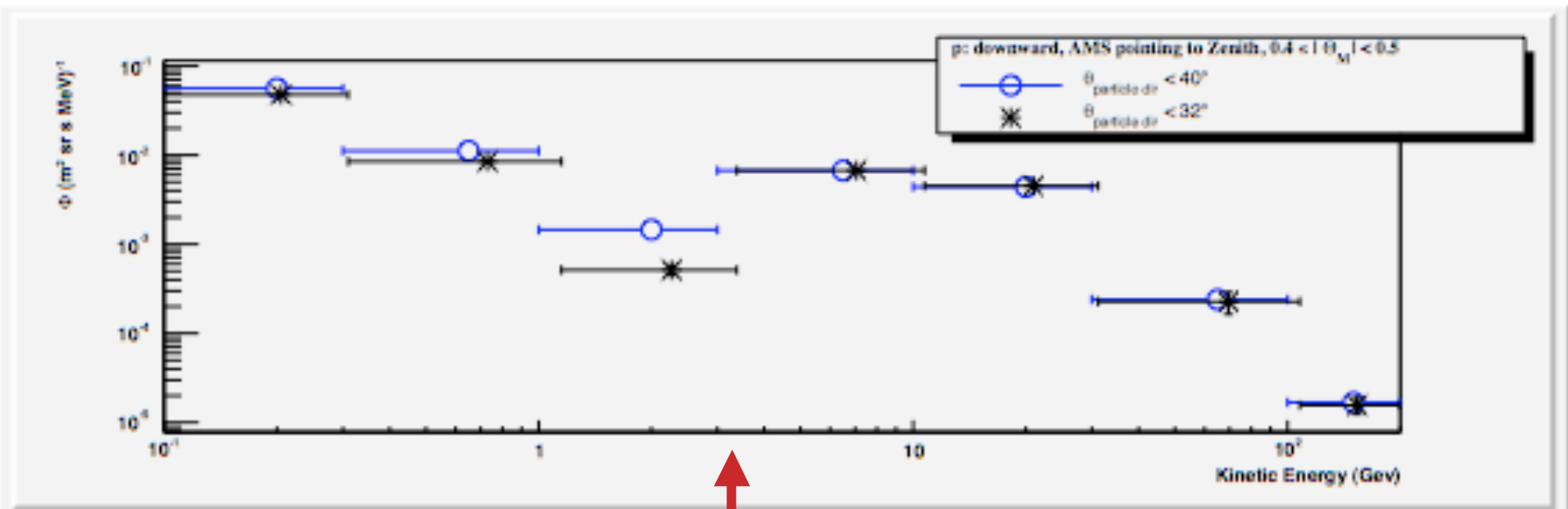
CUTOFF



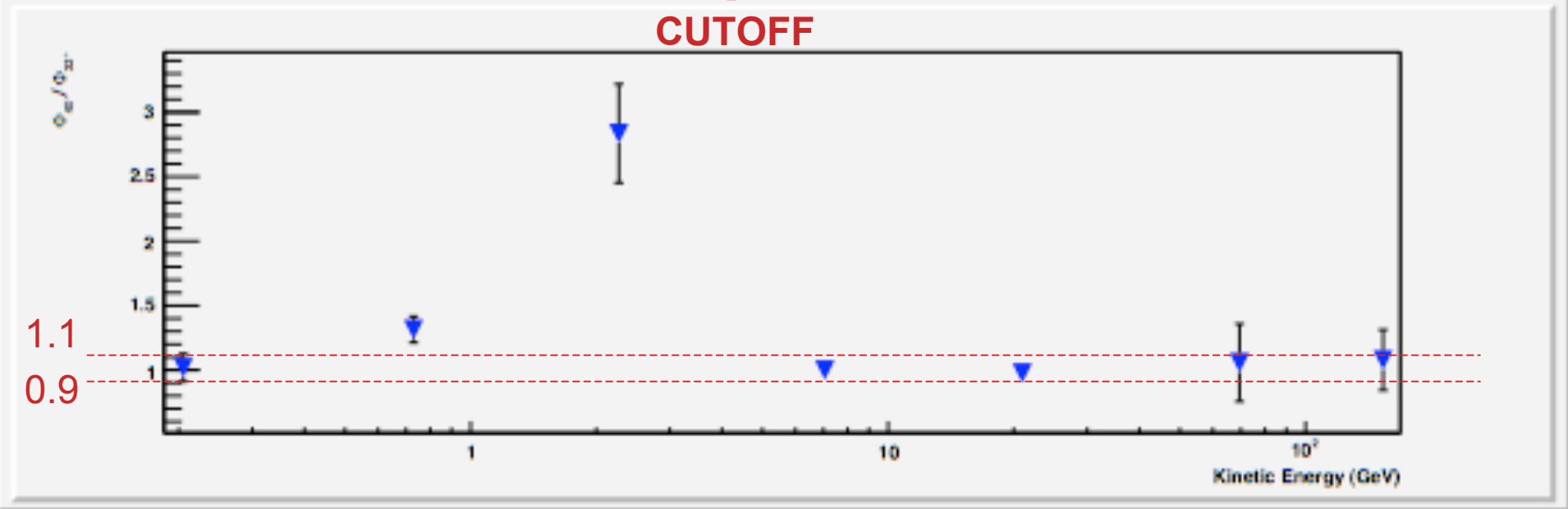


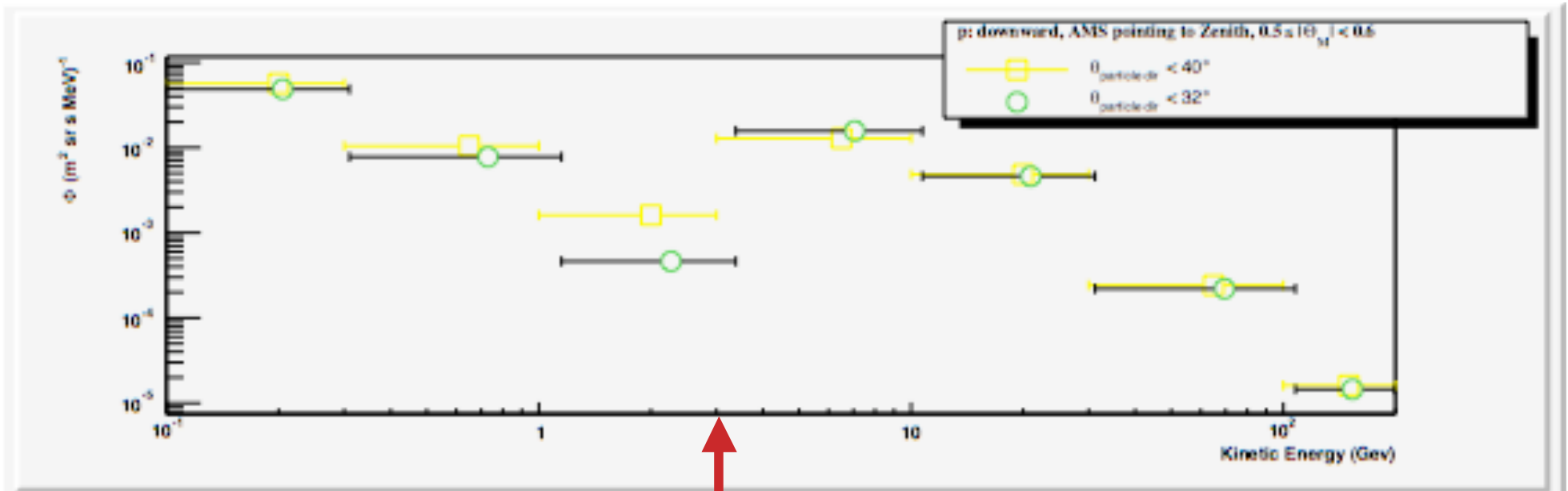
↑
CUTOFF





CUTOFF





CUTOFF

