AMD,PHITS Analysis Forward Region

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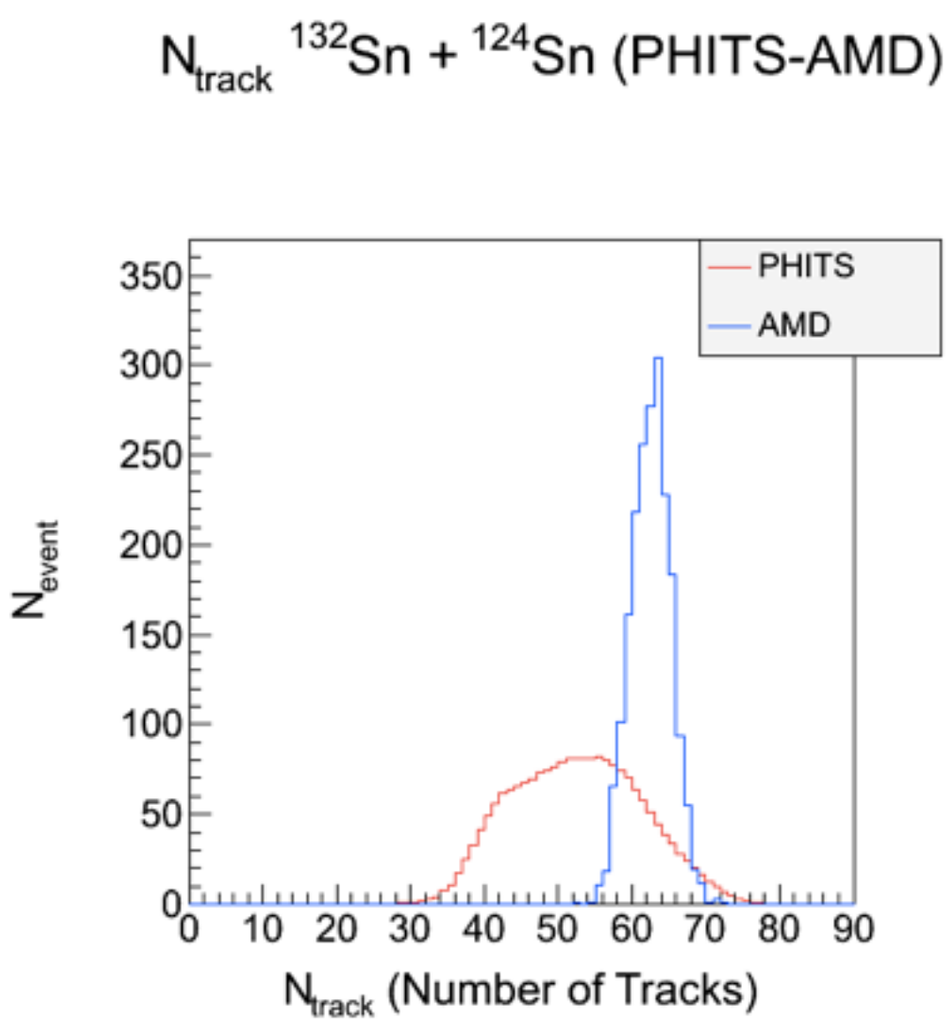
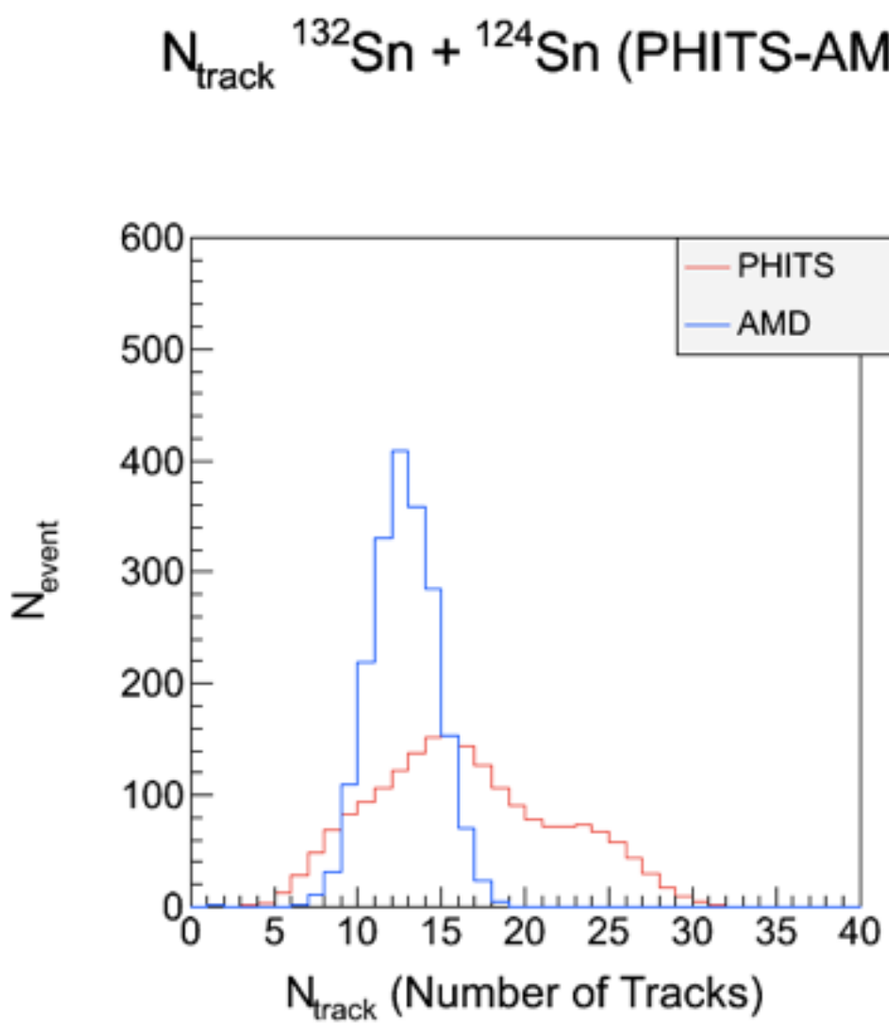
$^{132}Sn+^{124}Sn$ - AMD&PHITS

	AMD	PHITS
Number of Events	N(event) = 2010	N(event) = 272018
Number of particles (per event)	<N> = 62.047	<N>=52.040
Number of Neutrons (per event)	< neutron> = 49.783 (80.23%)	< neutron>=33.138 (63.68%)
Number of Charged Particles (per event)	< charged>= 12.265 (19.77%)	< charged>=15.986 (30.72%)
Number of Protons (per event)	< proton> = 5.213 (8.40%)	< proton>=10.059 (19.33%)
Number of Gammas	no gammas	<gammas>=2.916 (5.60%)

Number of Track (0°<θ<180°)



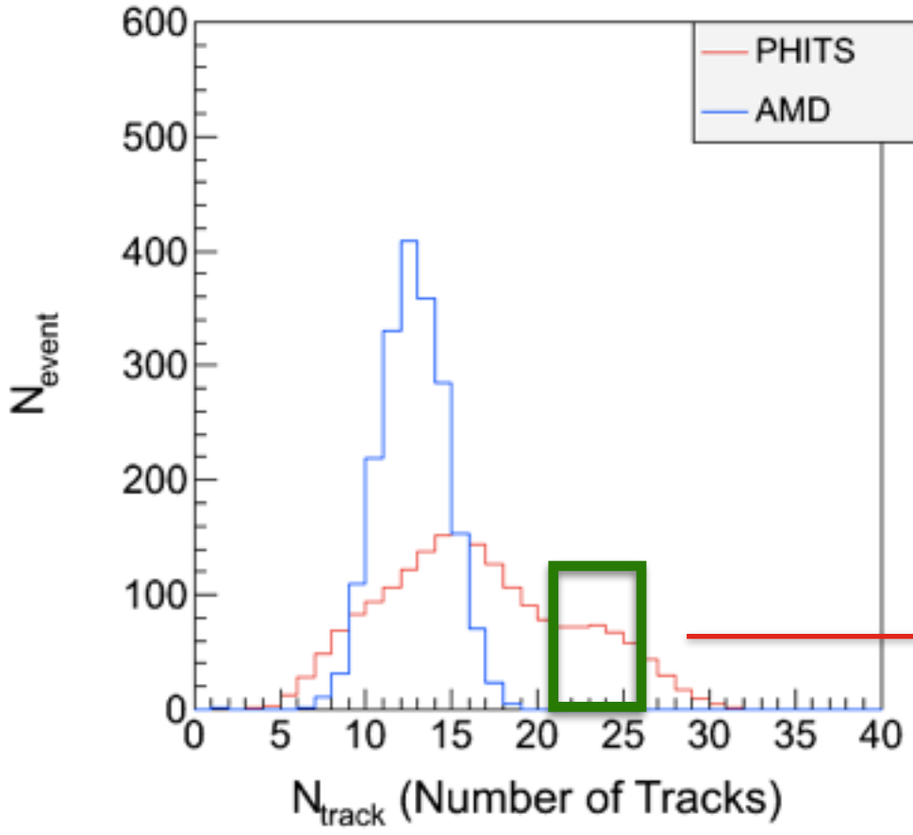


X Axis : Number of tracks in each event for neutrons & charged particles (left plot) and for only charged particles for all region (0°<θ<180°) (right plot).

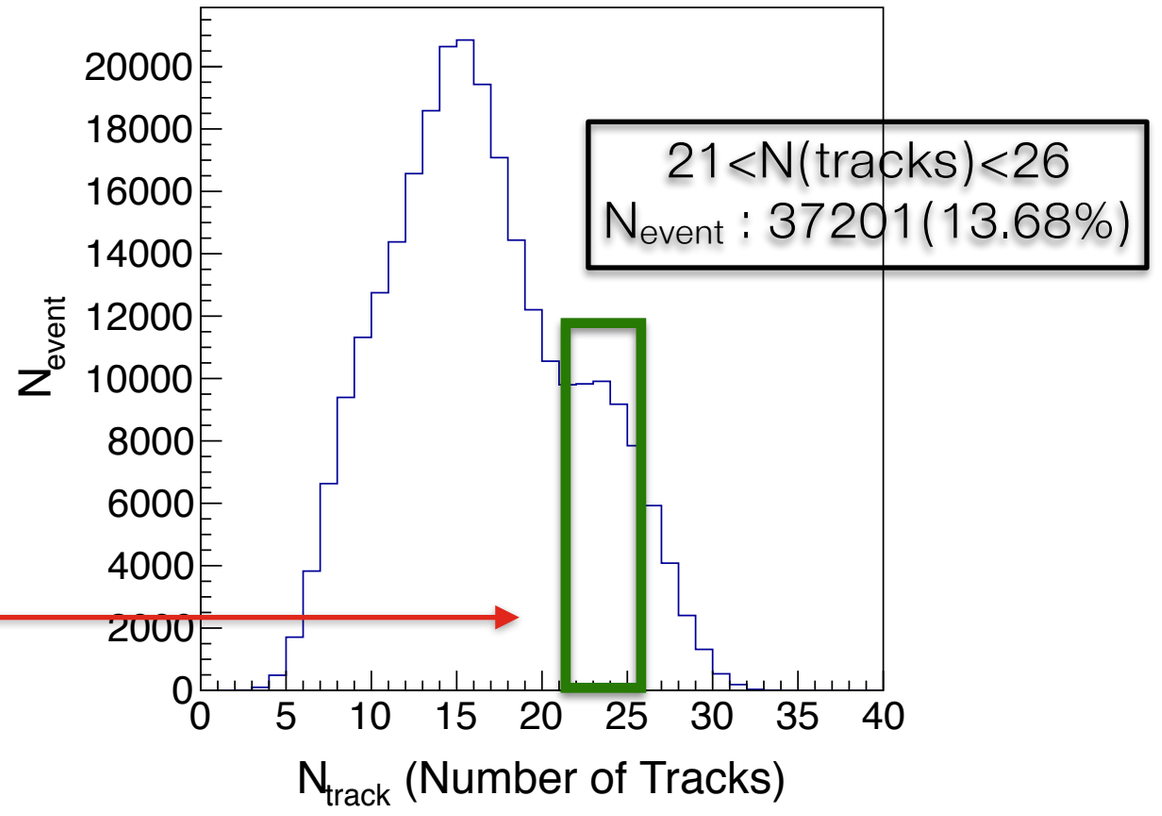
Y Axis : Number of events for each number of tracks. PHITS data is normalized to the AMD data by the number of events.

Number of Track (0°<θ<180°)

N_{track} ^{132}Sn + ^{124}Sn (PHITS-AMD)



N_{track} (^{132}Sn + ^{124}Sn - PHITS)

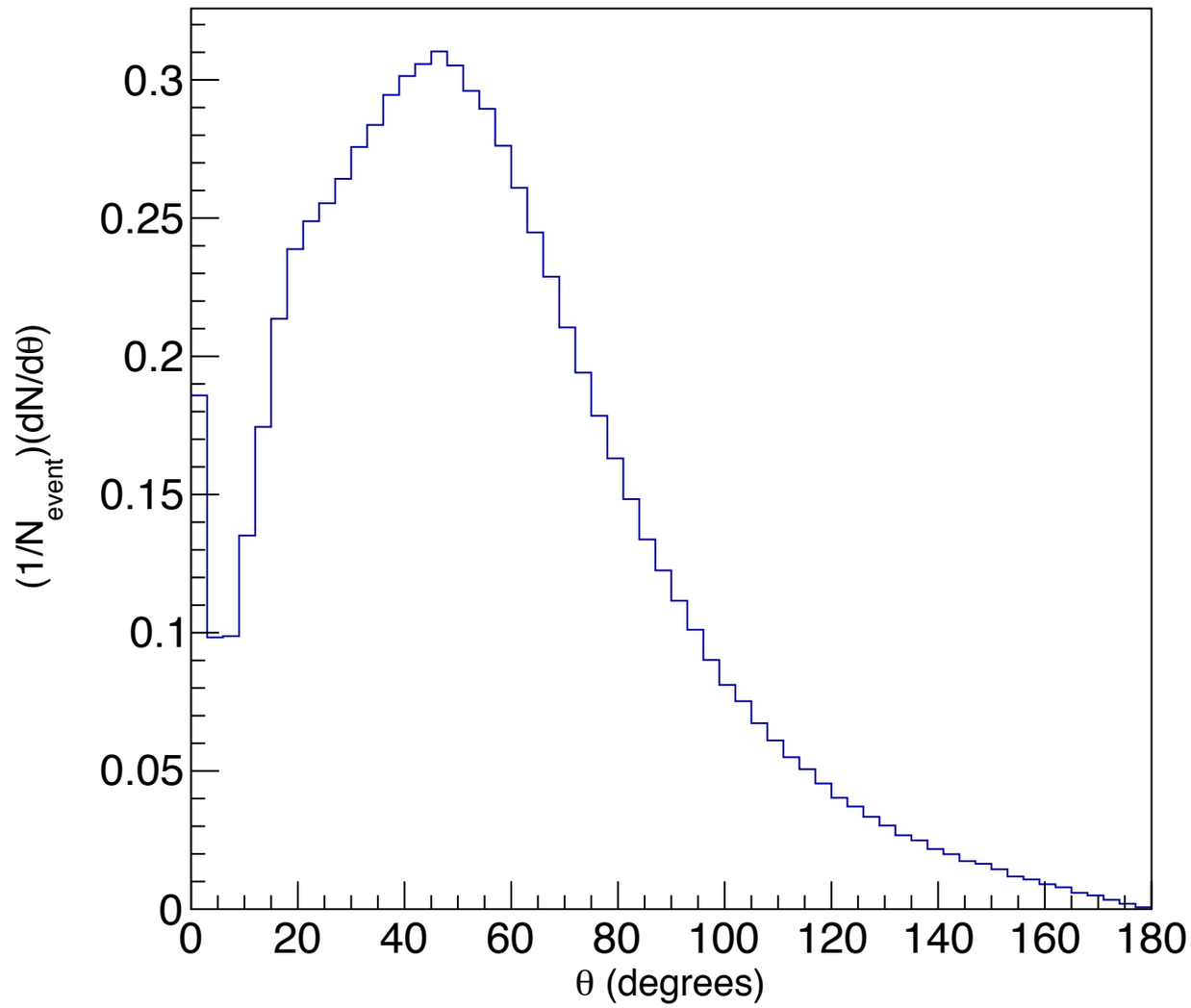


Track Distribution only for PHITS without normalization to AMD data (right plot).

Theta (Charged)

(number of bins : 60)

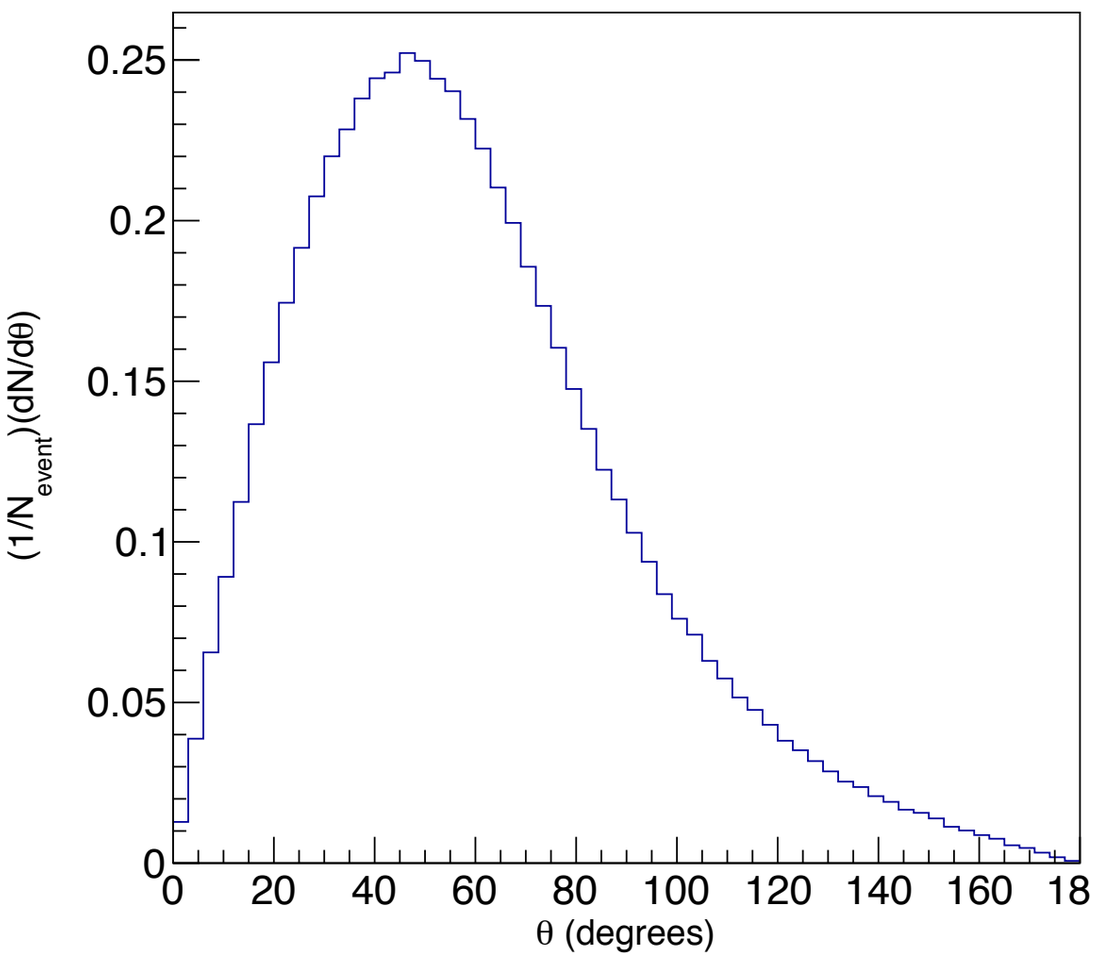
$\theta_{charged}$ ($21 < N^{charged}_{track} < 26$ - PHITS)



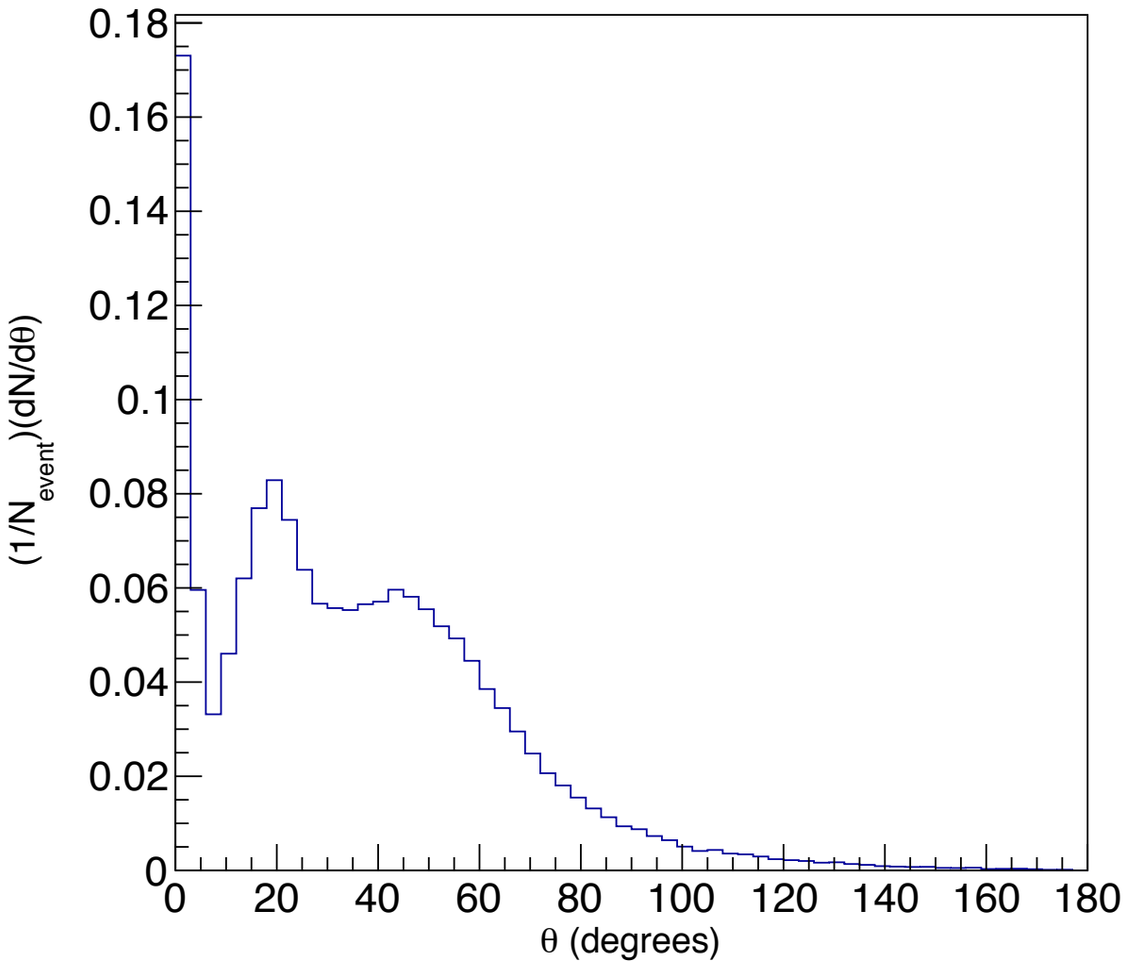
Theta (Charged)

(number of bins : 60)

$\theta^{proton}_{charged}$ ($21 < N^{charged}_{track} < 26$ - PHITS)



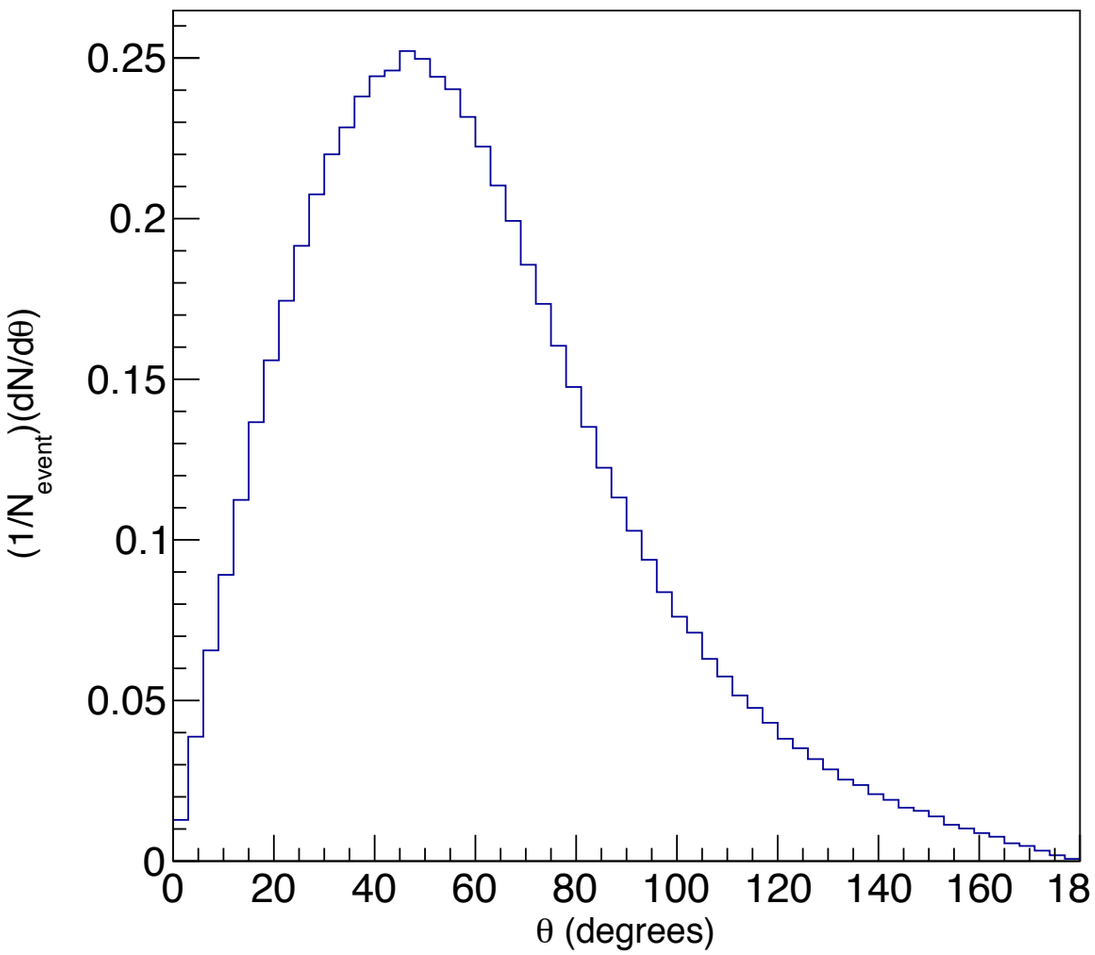
$\theta^{nonproton}_{charged}$ ($21 < N^{charged}_{track} < 26$ - PHITS)



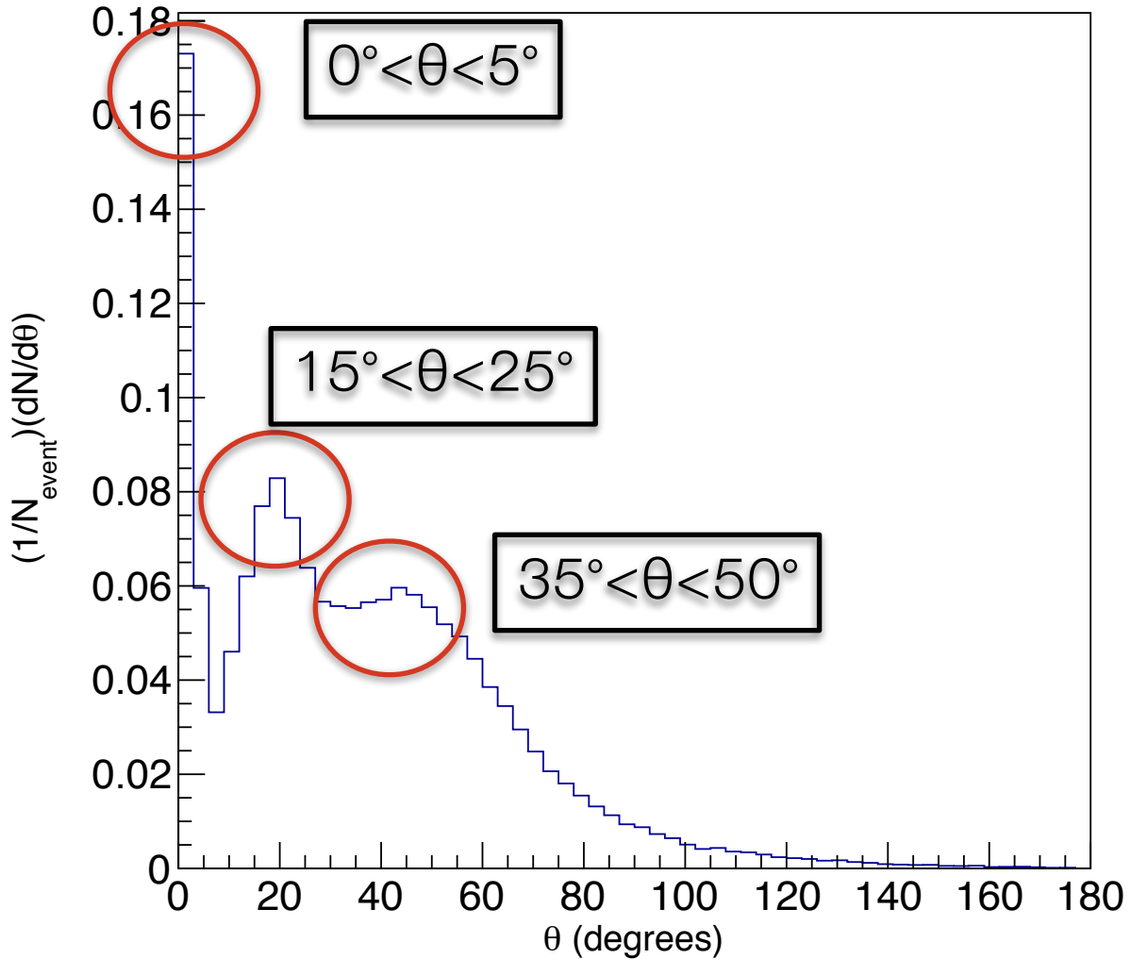
Theta (Charged)

(number of bins : 60)

$\theta^{proton}_{charged}$ ($21 < N^{charged}_{track} < 26$ - PHITS)



$\theta^{nonproton}_{charged}$ ($21 < N^{charged}_{track} < 26$ - PHITS)



Particle Identification - PHITS

(21<Number of Track (charged)<26)

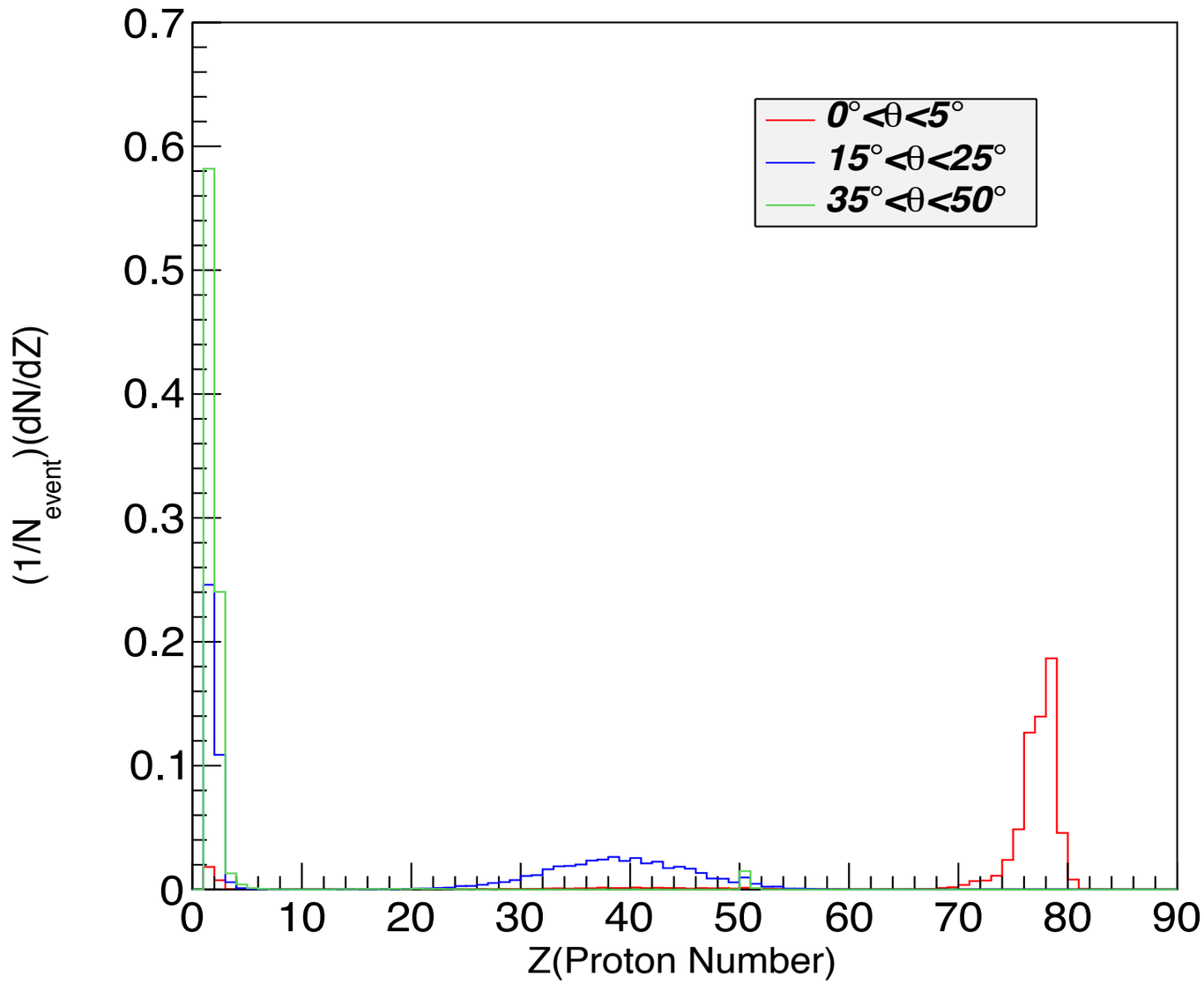
	0°<θ<180°	0°<θ<5°	15°<θ<25°	35°<θ<50°
All	60.744	1.217	8.160	12.733
Neutron	34.866 (57.40%)	0.437 (35.91%)	5.718 (70.07%)	7.957 (62.49%)
Charged	23.445 (38.60%)	0.775 (63.68%)	2.36 (28.92%)	4.529 (35.57%)
Proton	18.787 (30.93%)	0.107 (8.79%)	1.589 (19.47%)	3.668 (28.81%)
Non-proton	4.657 (7.67%)	0.667 (54.81%)	0.77 (9.44%)	0.861 (6.76%)
Gamma	2.433 (4.0%)	0.005 (0.41%)	0.084 (1.03%)	0.247 (1.94%)

Number of particles detected per event.

Percentage is the ratio compared to all particles produced in the region “All”

Proton Number (Non-proton)

$N_Z^{nonproton}$ ($21 < N_{track}^{charged} < 26$ - PHITS)



Particle Identification - PHITS

(charged particles)

	0°<θ<5°	15°<θ<25°	35°<θ<50°
Non-Proton	0.667	0.770	0.861
Deuteron	0.010 (1.5%)	0.132 (17.14%)	0.308 (35.77%)
Triton	0.008 (1.2%)	0.114 (14.81%)	0.274 (28.69%)
3He	0.001 (0.15%)	0.010 (1.30%)	0.024 (2.79%)
Alpha	0.006 (0.9%)	0.094 (12.21%)	0.205 (23.81%)
Fragments 20≤Z<50	0.022 (3.3%)	0.385 (50.0%)	0.0025 (0.3%)
Fragments 50≤Z<70	0.010 (1.5%)	0.021 (2.73%)	0.016 (1.86%)
Fragments 70≤Z<80	0.600 (90.0%)	0	0
Fragments 80≤Z<90	0.010 (1.5%)	0	0

Particle Identification - PHITS

(0°<θ<10°)

Particle Identification - PHITS

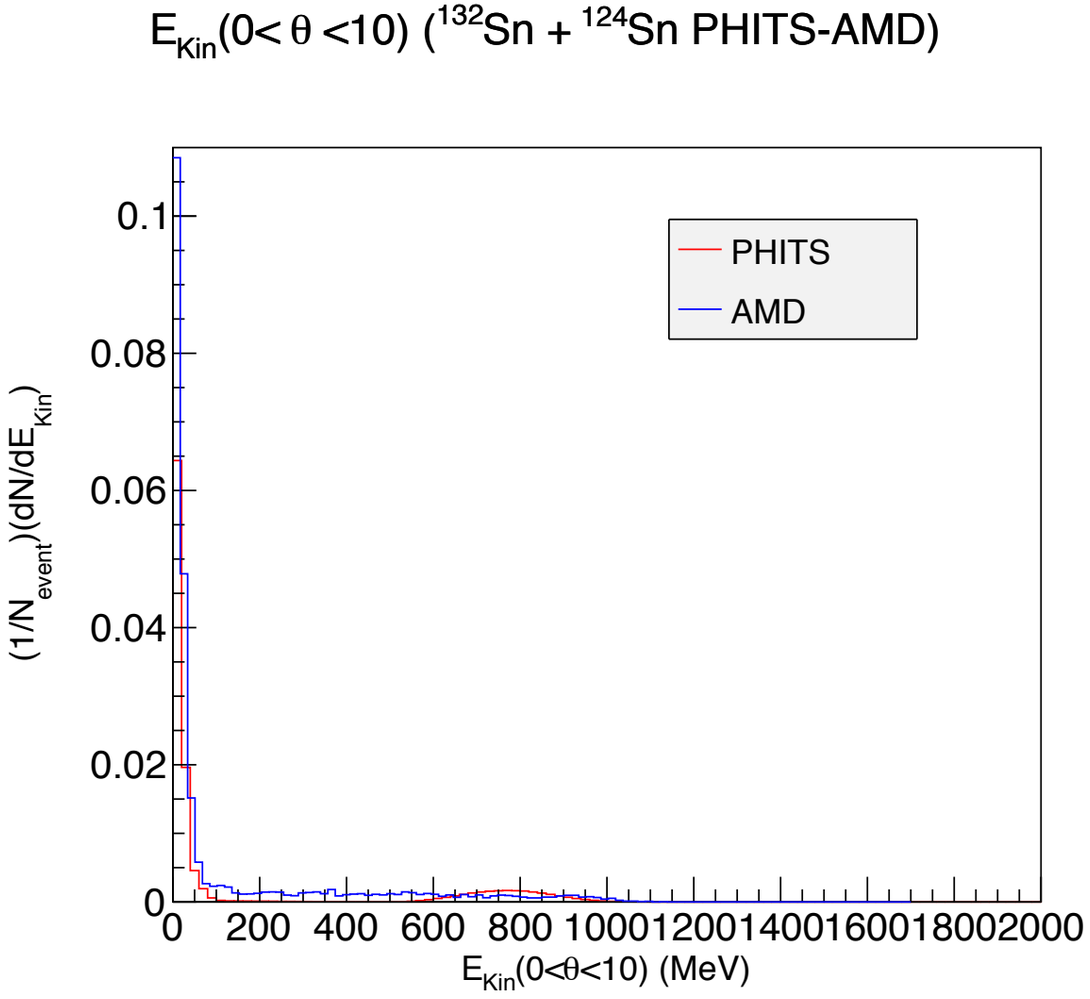
(0°<θ<10°)

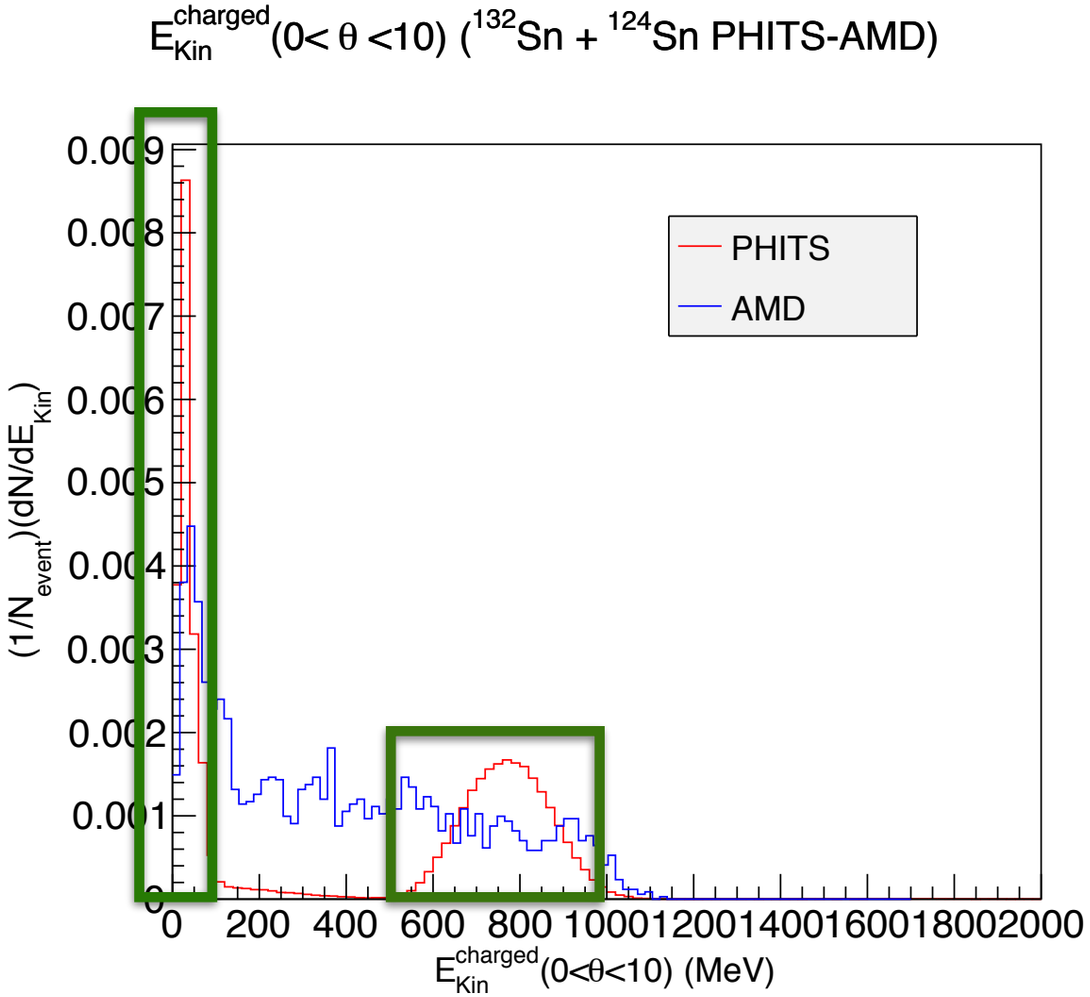
	0°<θ<10°	0°<θ<10° & 0 MeV<Ekin<100 MeV	0°<θ<10° & 500 MeV<Ekin<1000 MeV
All	2.309	1.848	0.426
Neutron	1.467 (63.53%)	1.467 (79.38%)	0
Charged	0.816 (35.34%)	0.355 (19.2%)	0.426 (100%)
Proton	0.226 (9.78%)	0.226 (12.23%)	0
Non-proton	0.590 (25.55%)	0.129 (6.98%)	0.426 (100%)
Gamma	0.026 (1.13%)	0.026 (1.41%)	0

Number of particles detected per event.

Percentage is the ratio compared to all particles produced in the region “All”

Kinetic Energy
(0°<θ<10°)





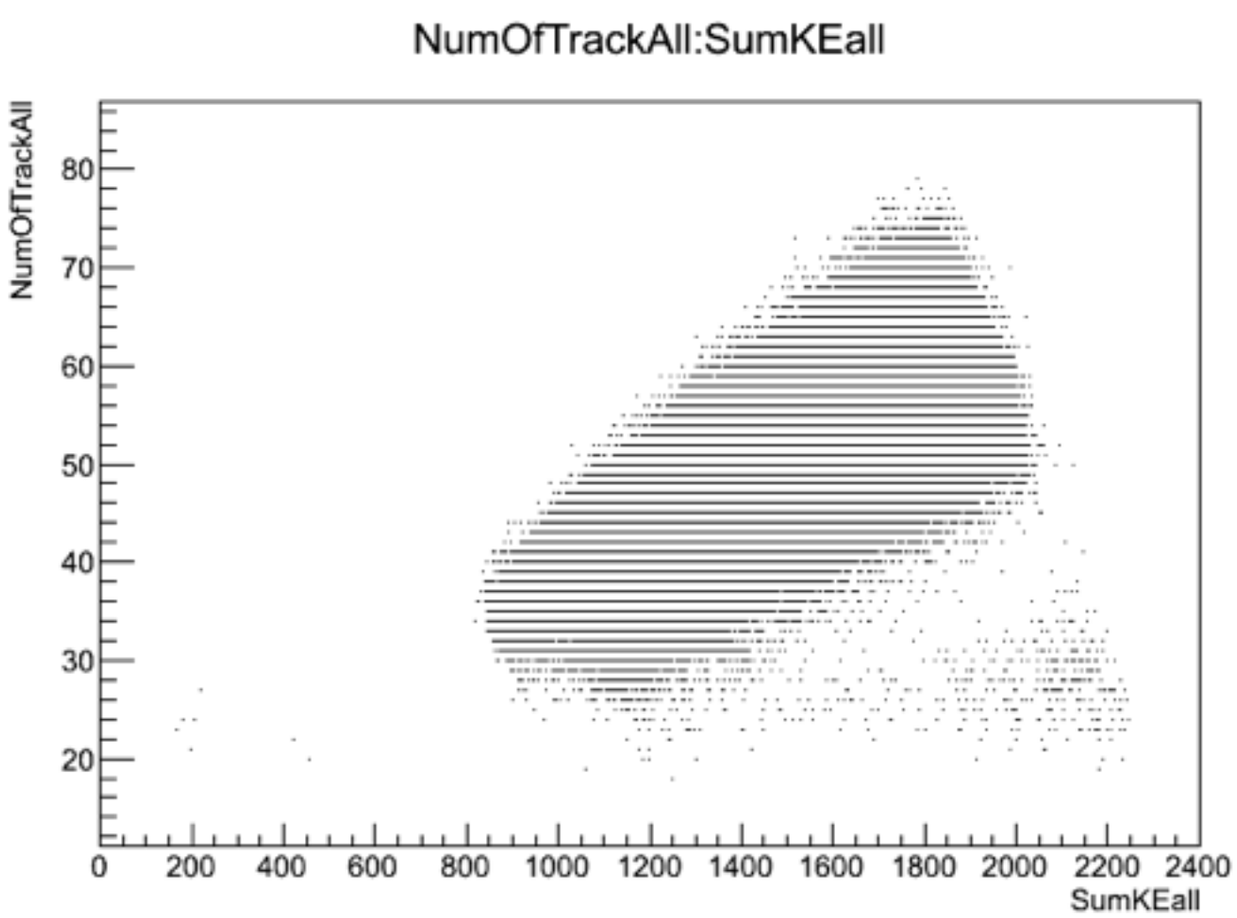
95.7% of charged particles for 0°<θ<10° in PHITS
(Ekin<100MeV & 500MeV<Ekin<1000MeV

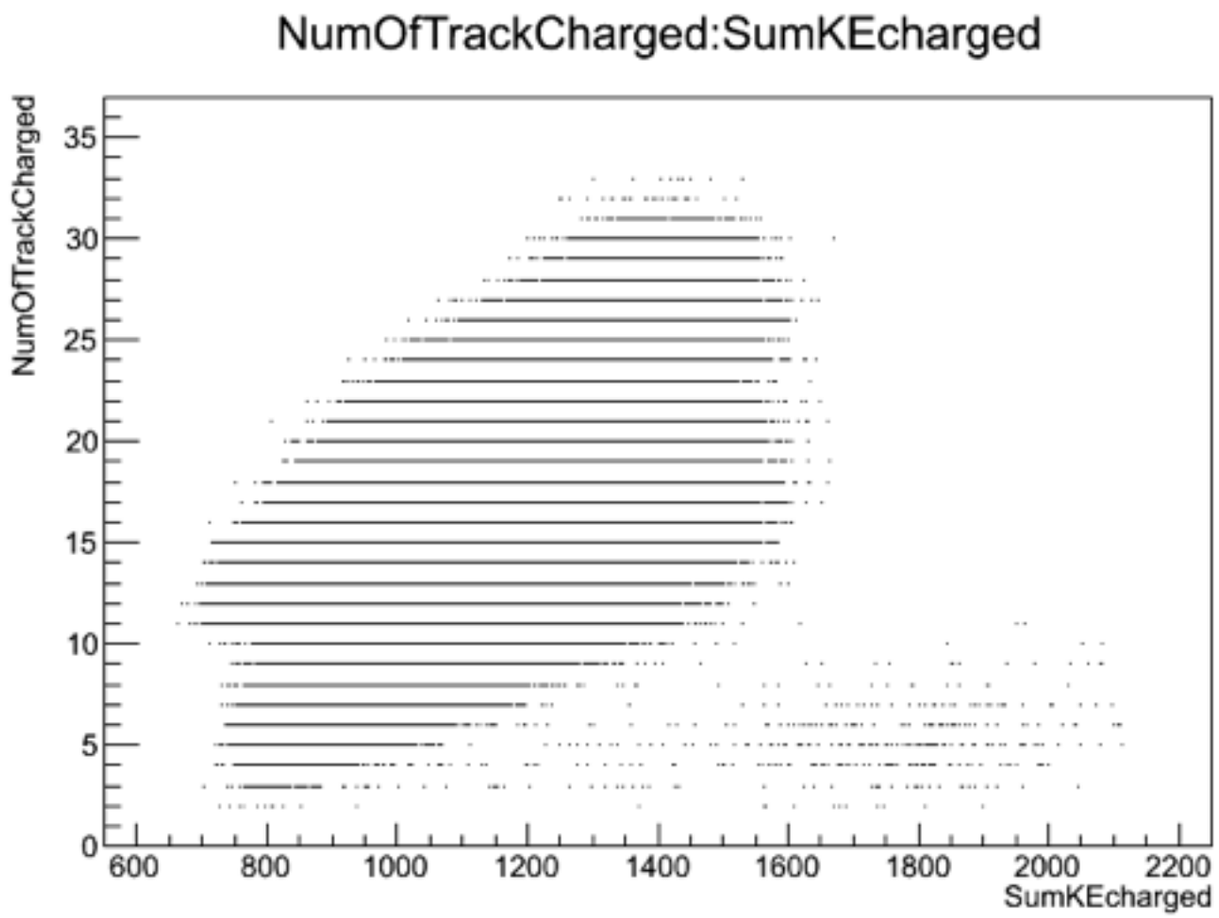
Particle Identification - PHITS

(0°<θ<10°, charged particles)

	0°<θ<10° & 0 MeV<Ekin<100 MeV	0°<θ<10° & 500 MeV<Ekin<1000 MeV
Charged	0.355	0.426
Proton	0.226 (63.66%)	0
Deuteron	0.047 (13.24%)	0
Triton	0.033 (9.30%)	0
3He	0.0026 (0.73%)	0
Alpha	0.039 (10.99%)	0
Fragments 30≤Z<50	0.0029 (0.82%)	0.0822 (19.30%)
Fragments 50≤Z<70	0.0018 (0.51%)	0.0417 (9.79%)
Fragments 70≤Z<80	0	0.1526 (35.82%)
Fragments 80≤Z<90	0	0.1449 (34.01%)

Number of Track (0°<θ<180°)

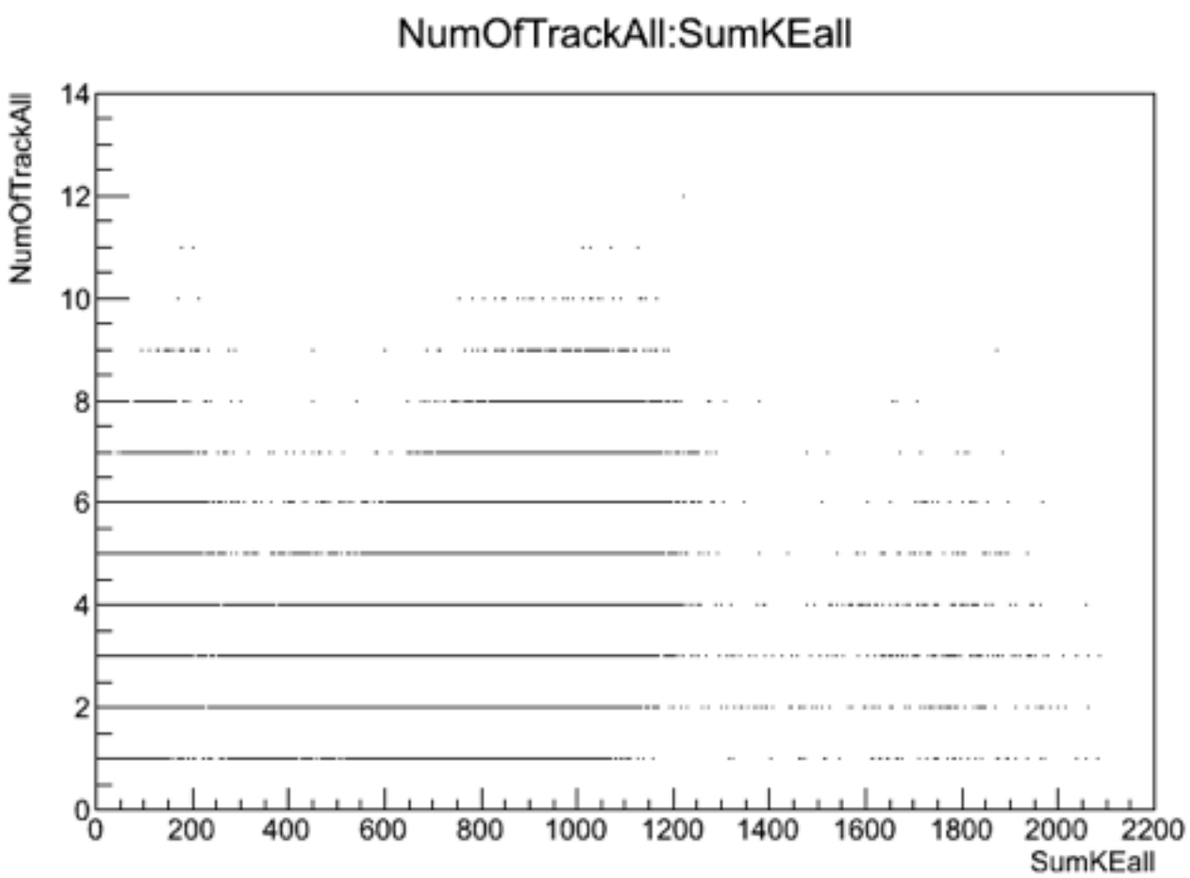


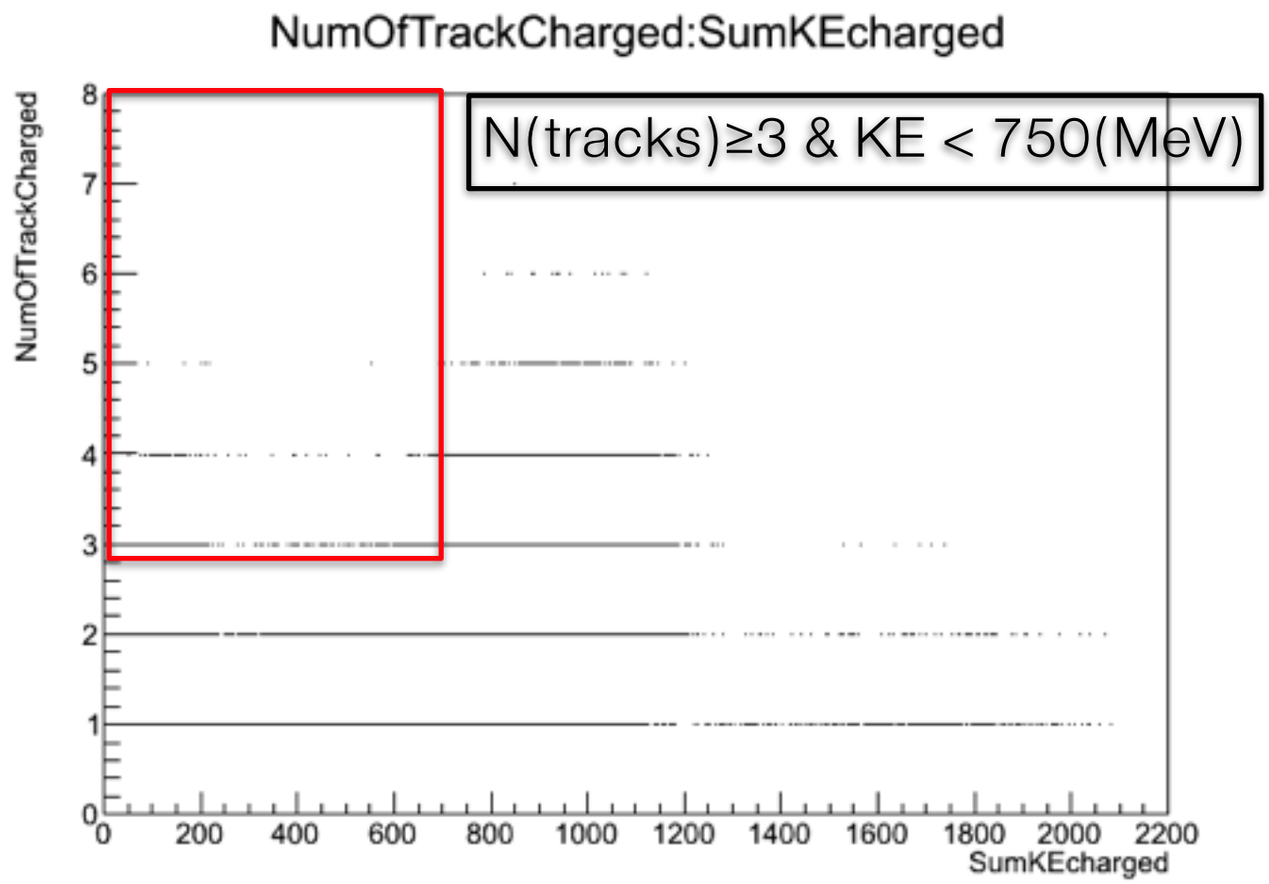


X Axis : Sum of the Kinetic Energy per event for both (neutrons + charged particles) & (charged particles) in all polar angle (0°<θ<180°)

Y Axis : Number of tracks for in each event

Number of Track (0°<θ<10°)





X Axis : Sum of the Kinetic Energy per event for both (neutrons + charged particles) & (charged particles) in forward region (0°<θ<10°)

Y Axis : Number of tracks for in each event

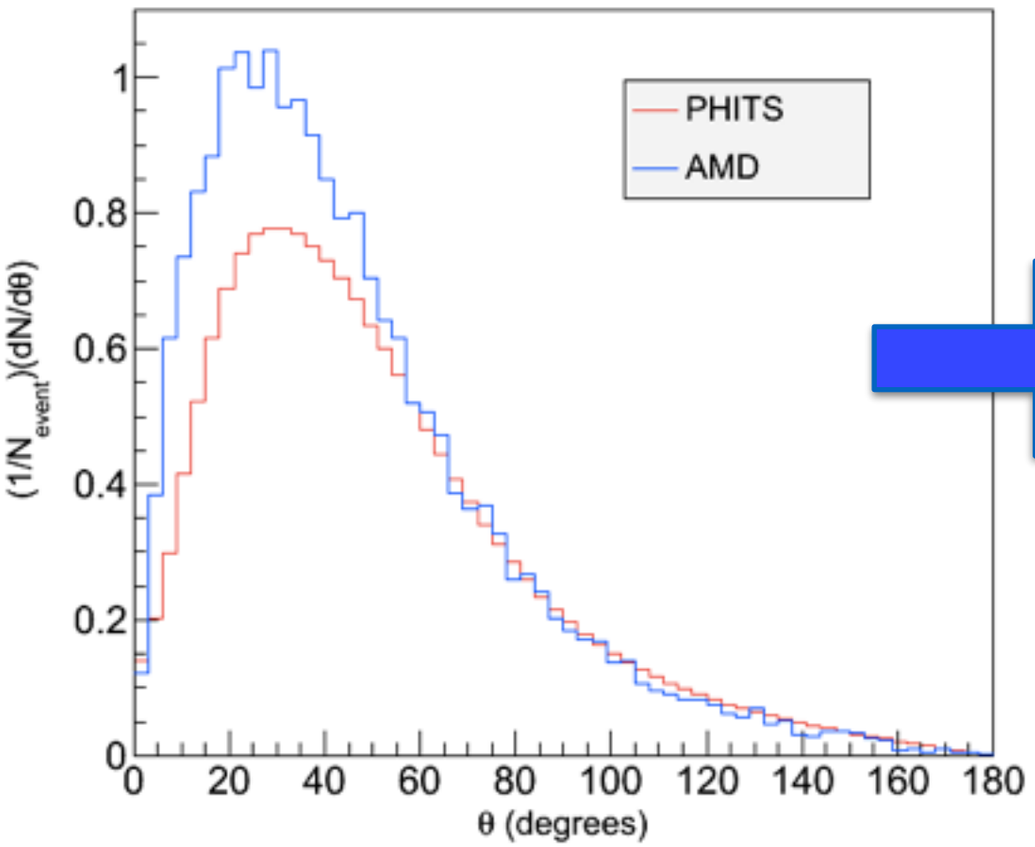
$^{132}Sn+^{124}Sn$ - AMD&PHITS (Selected Events)

	AMD	PHITS (all)	PHITS (selected)
Number of Events	N(event) = 2010	N(event) = 272018	N(event) = 2009
Number of particles (per event)	<N> = 62.047	<N>=52.040	<N>=53.912
Number of Neutrons (per event)	<neutron> = 49.783 (80.23%)	<neutron>=33.138 (63.68%)	<neutron>=32.487 (60.26%)
Number of Charged Particles (per event)	<charged>= 12.265 (19.77%)	<charged>=15.986 (30.72%)	<charged>=18.732 (34.75%)
Number of Protons (per event)	<proton> = 5.213 (8.40%)	<proton>=10.059 (19.33%)	<proton>=12.619 (23.41%)
Number of Gammas	no gammas	<gammas>=2.916 (5.60%)	<gammas>=2.673 (4.96%)

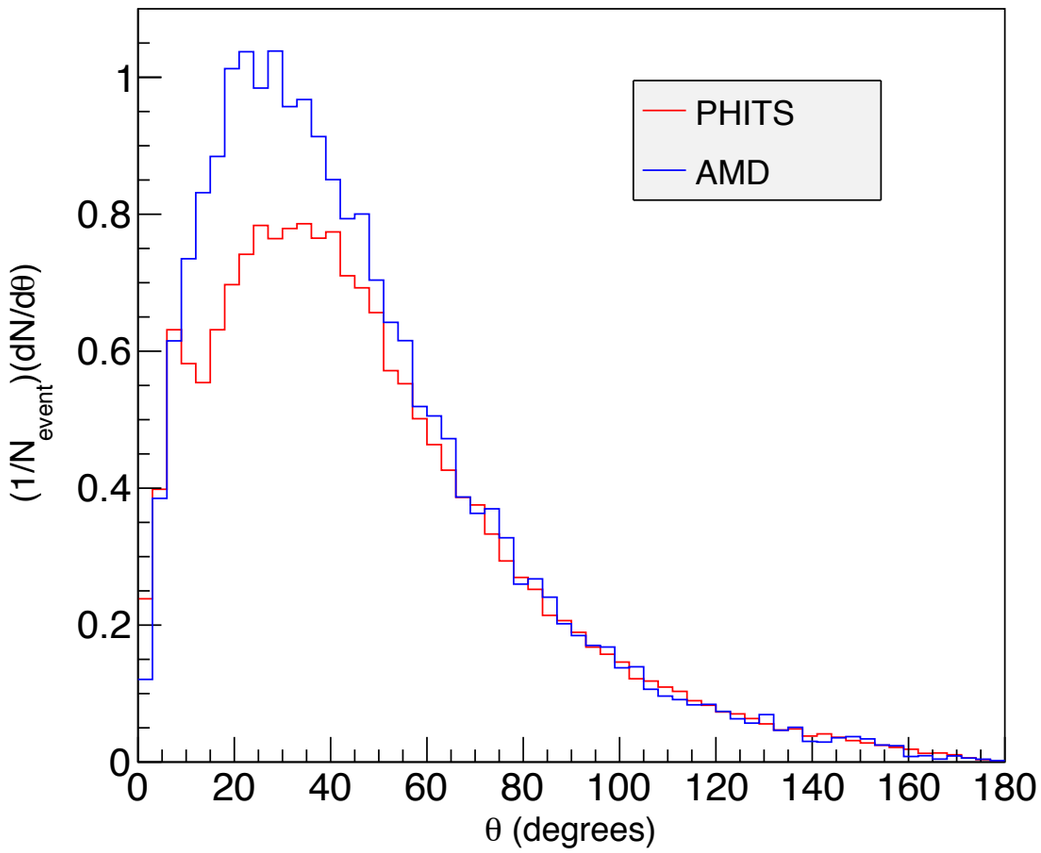
Theta - Selected Events

(number of bins : 60)

θ (^{132}Sn + ^{124}Sn (PHITS-AMD))

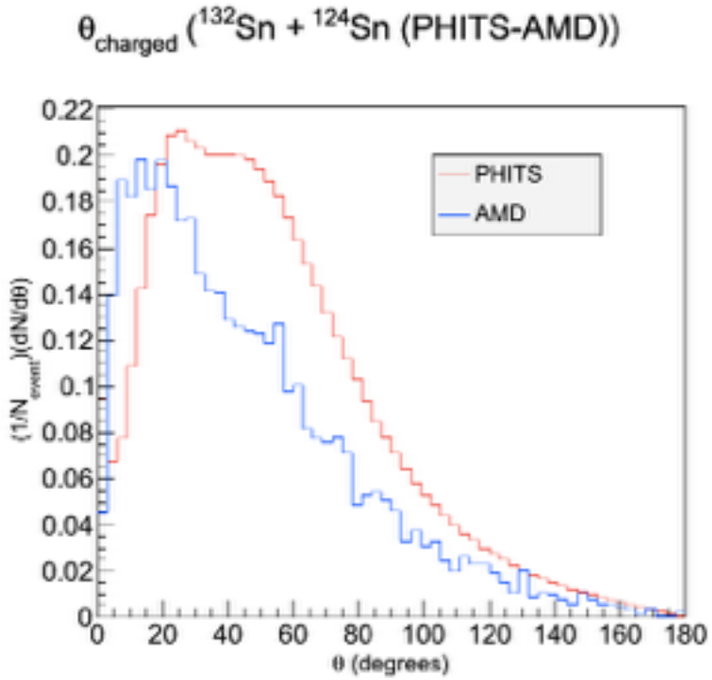


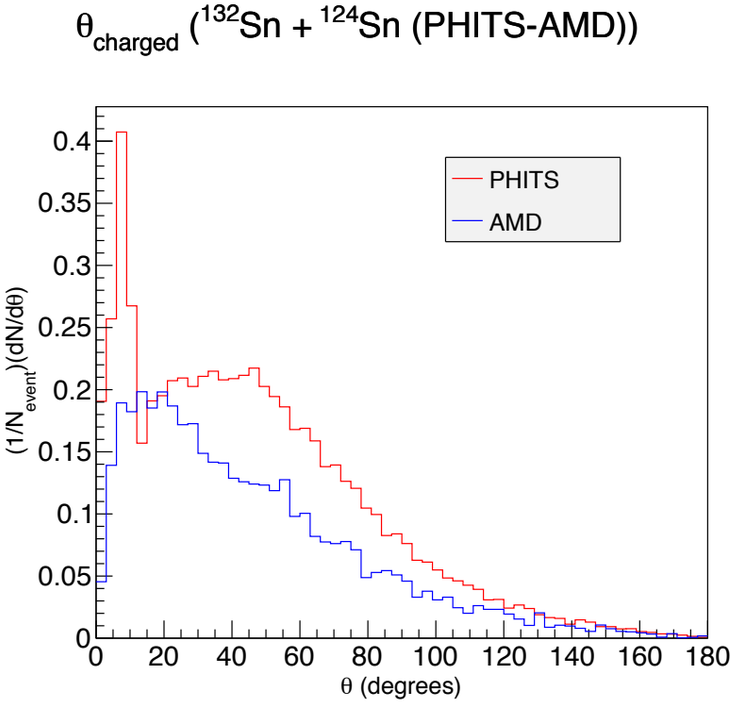
θ (^{132}Sn + ^{124}Sn (PHITS-AMD))

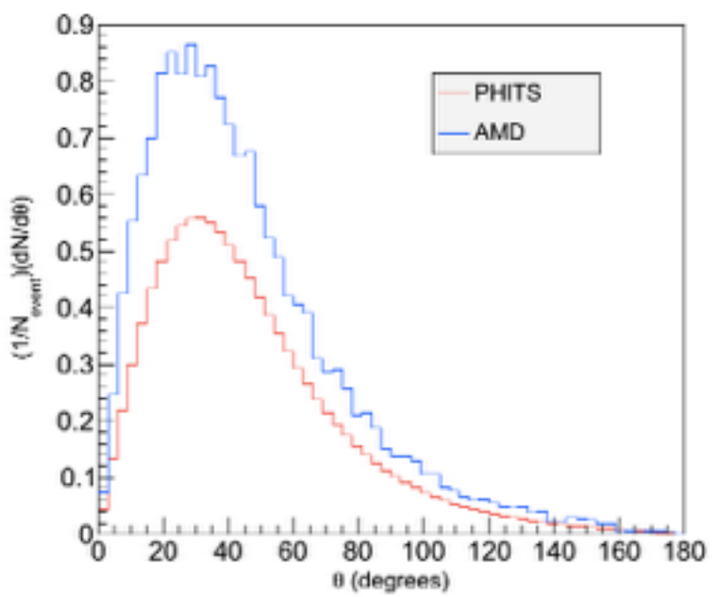


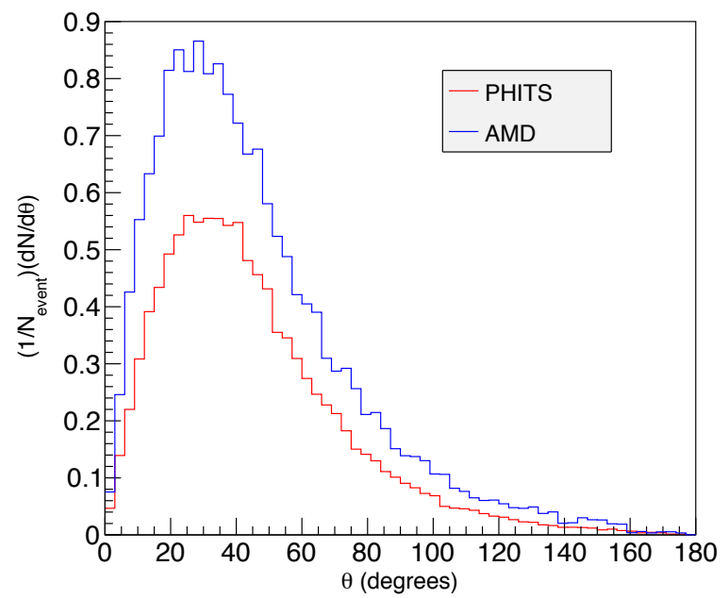
Theta - Charged/Neutron

(number of bins : 60)



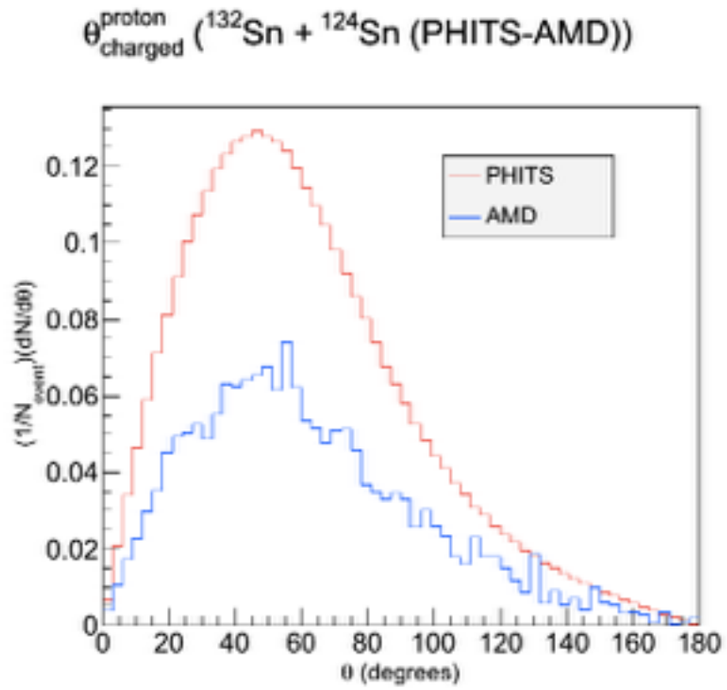


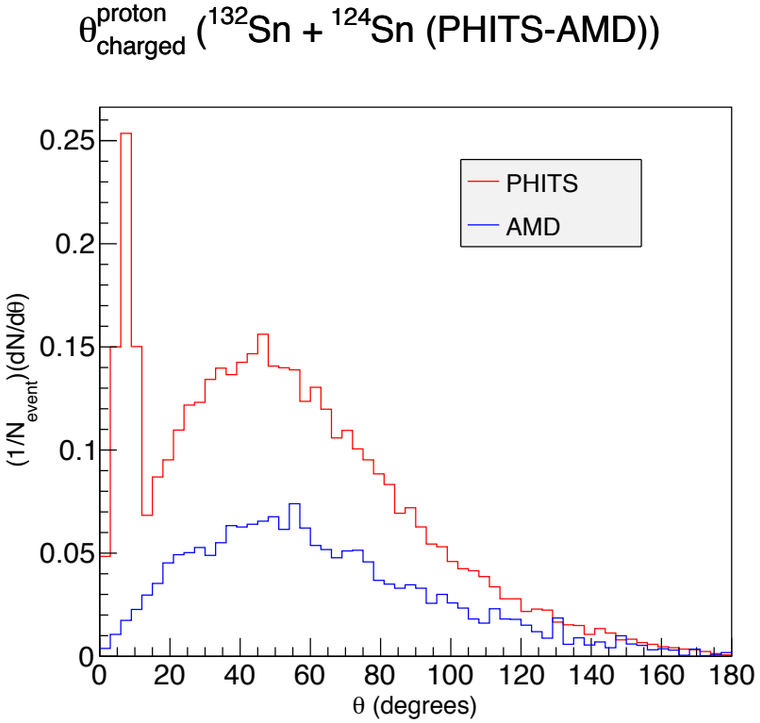


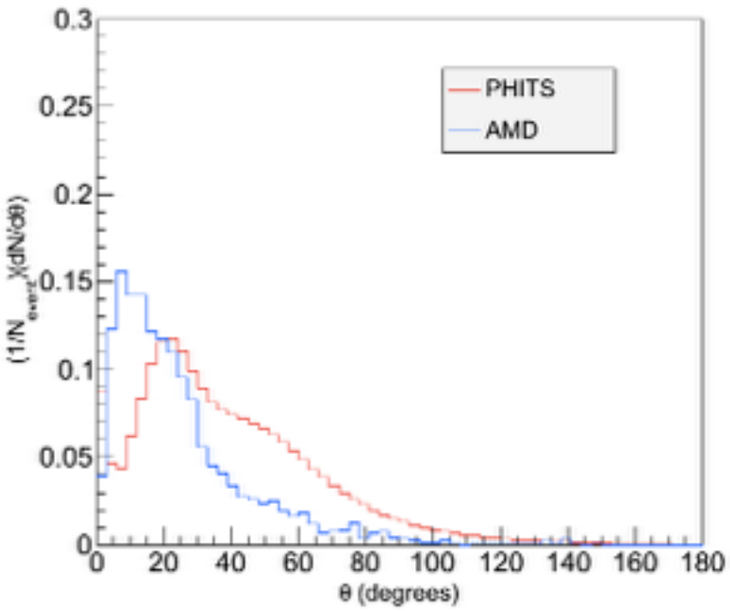


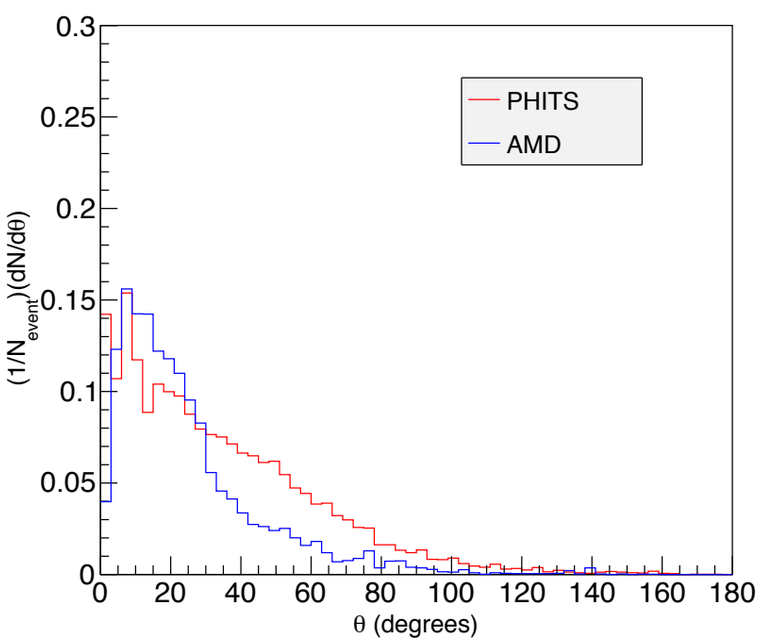
Theta - Charged

(number of bins : 60)



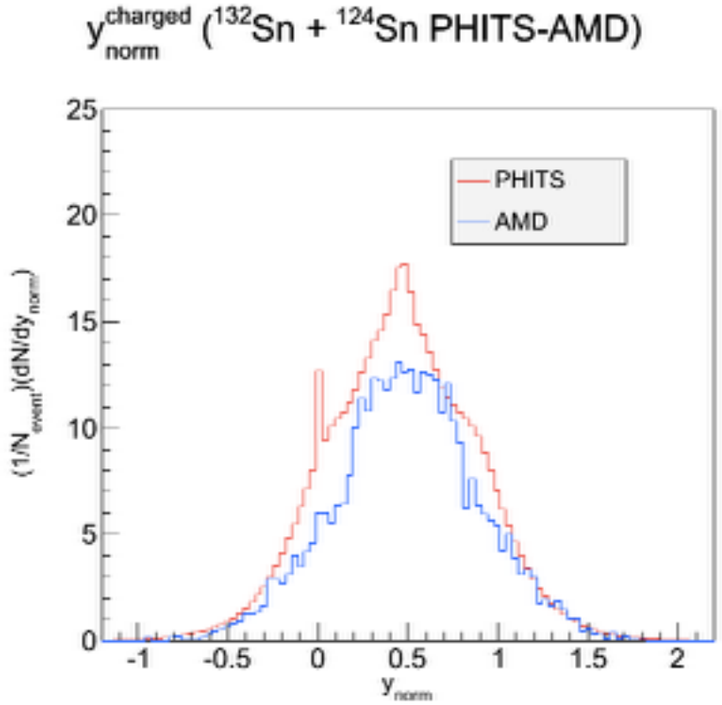


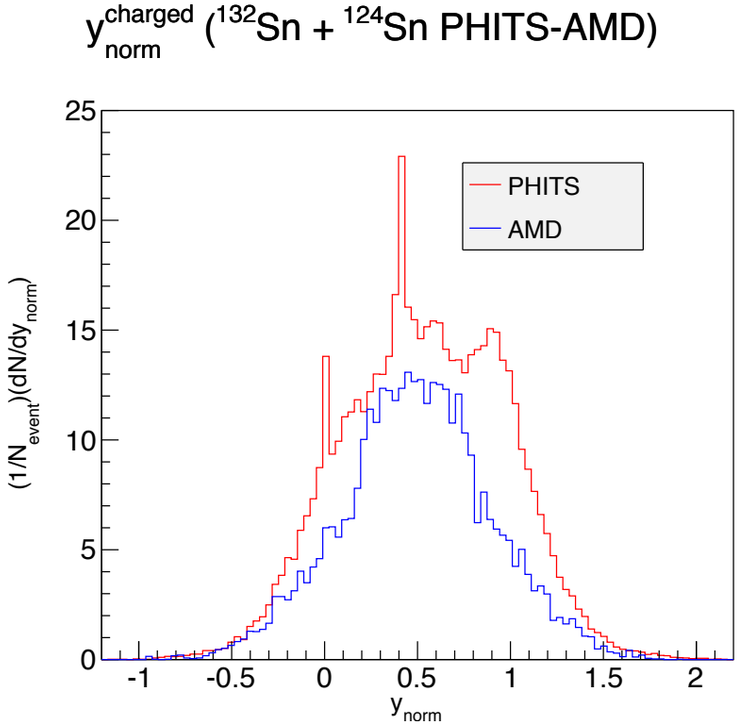


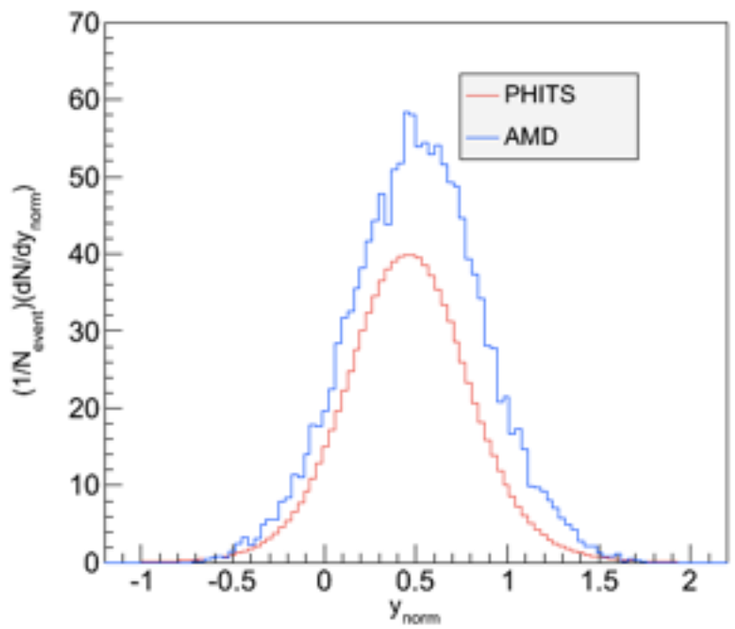


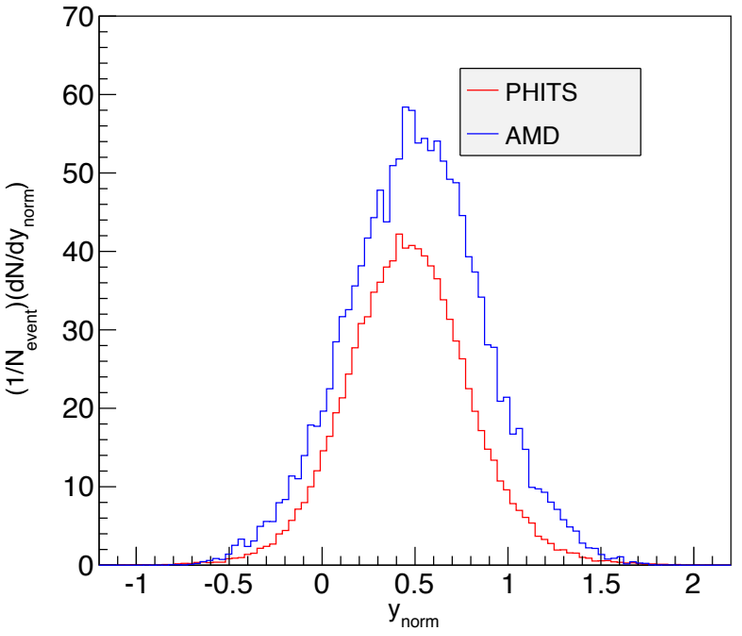
Rapidity - Charged/Neutron

(number of bins : 60)



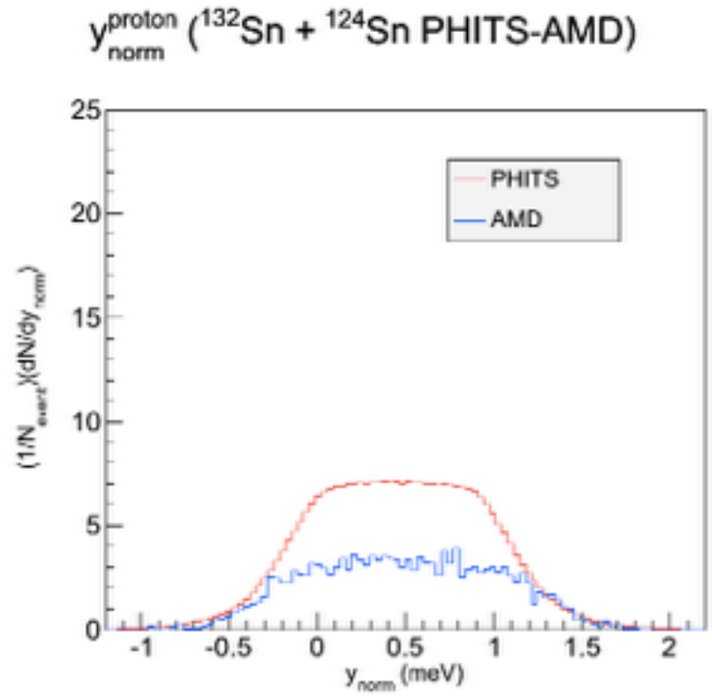


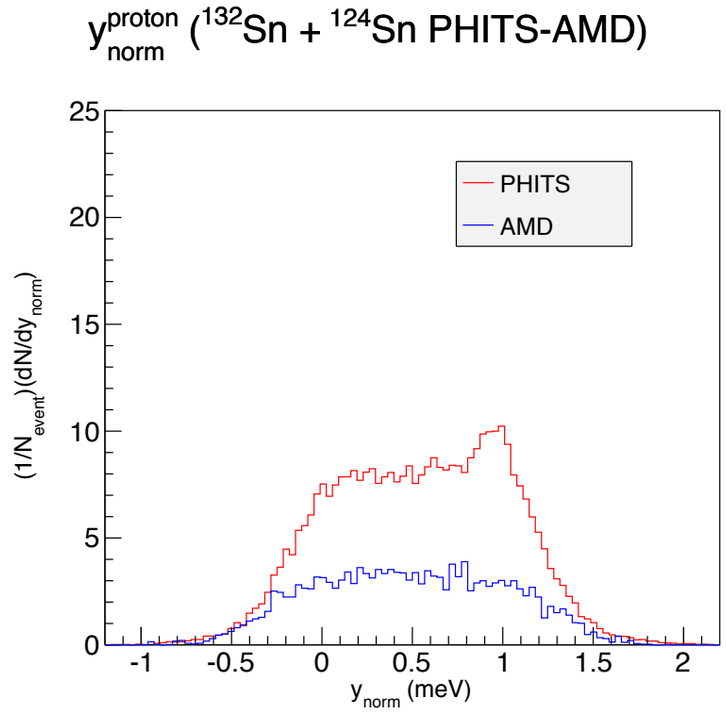


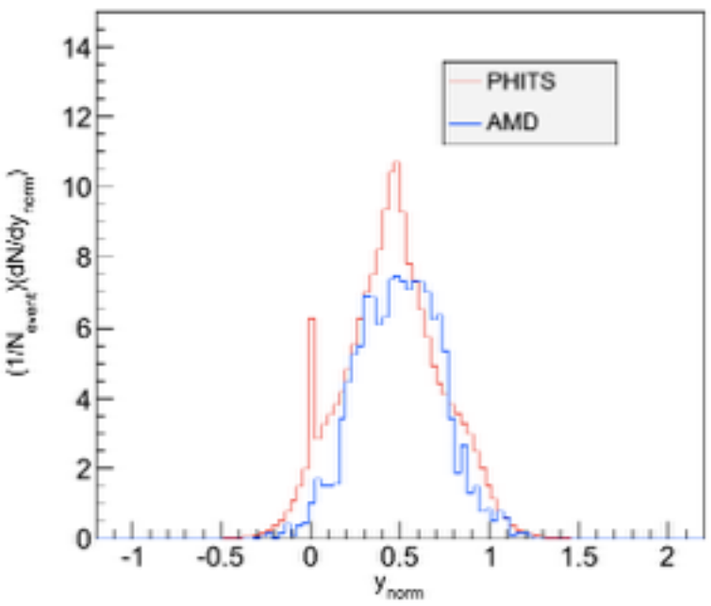


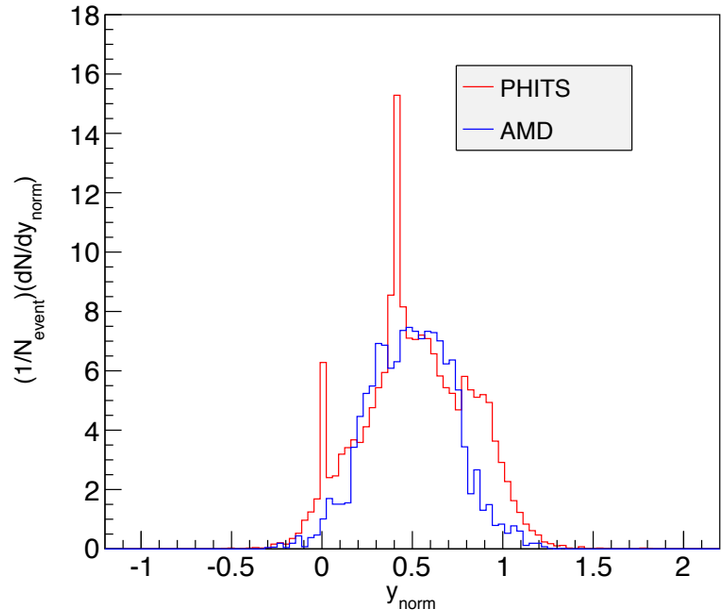
Rapidity - Charged

(number of bins : 60)









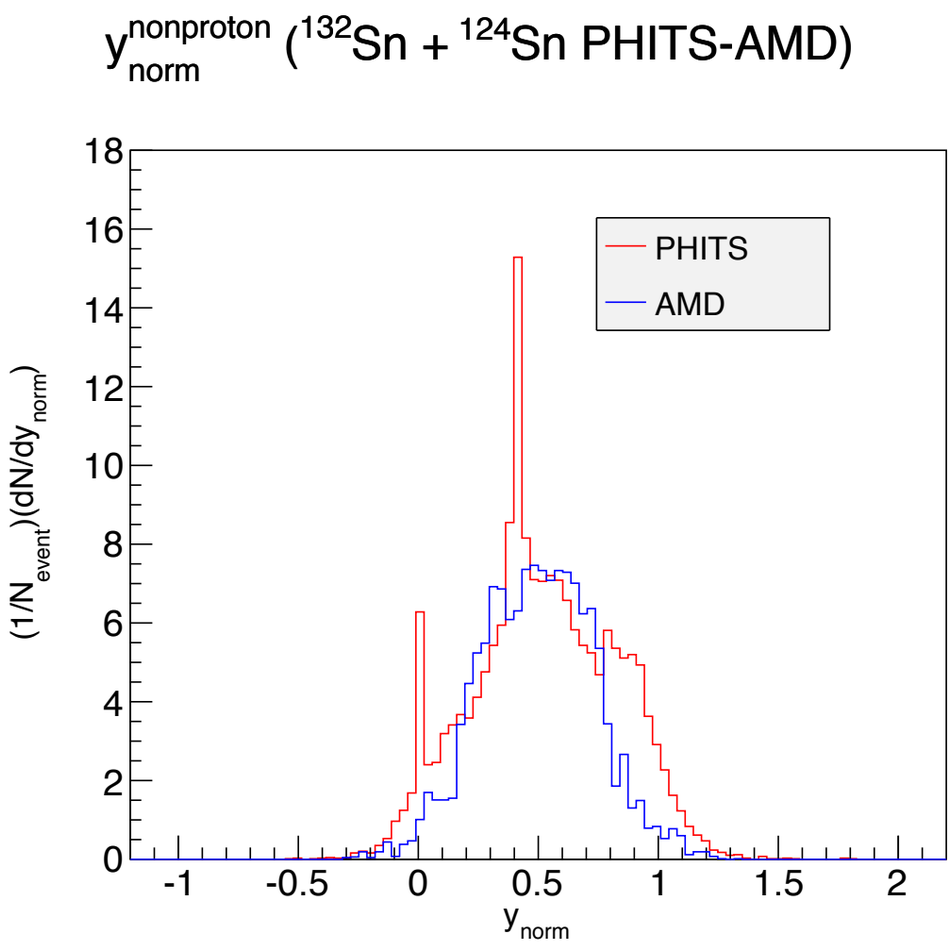
Particle Identification - PHITS

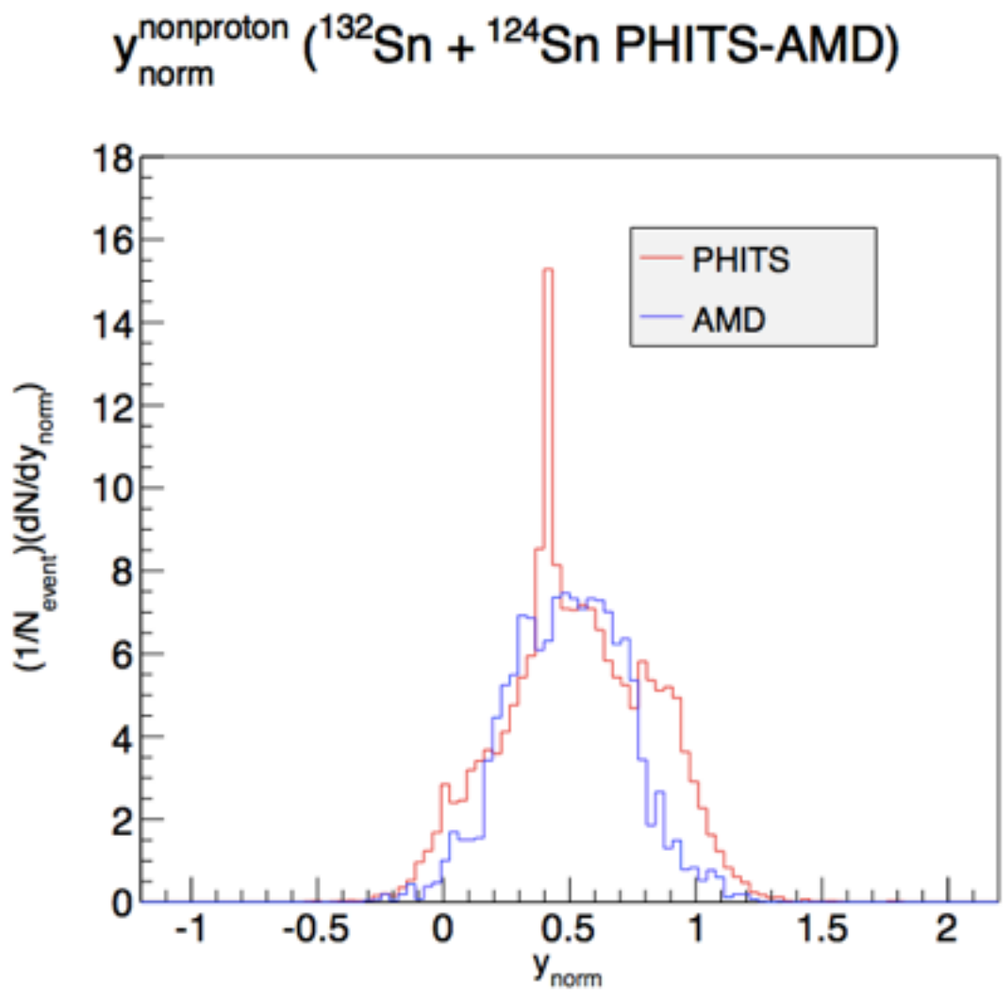
(0°<θ<10°, charged particles)

	-0.03<y<0.03	0.38<y<0.45	0.8<y<0.94
Non-Proton	0.264	1.069	0.726
Z=1 or Z=2	0.121 (45.83%)	0.35 (34.72%)	0.700 (96.42%)
Target (Z=50, A=124)	0.117 (44.32%)	0.0005 (0.047%)	0
Isotope, Isobar (Z=50, Z=51)	0.026 (9.85%)	0.002 (0.187%)	0
Fragments 30≤Z<60	0.143 (54.17%)	0.264 (24.70%)	0
Fragments 70≤Z<90	0	0.410 (38.35%9)	0

Rapidity - Charged

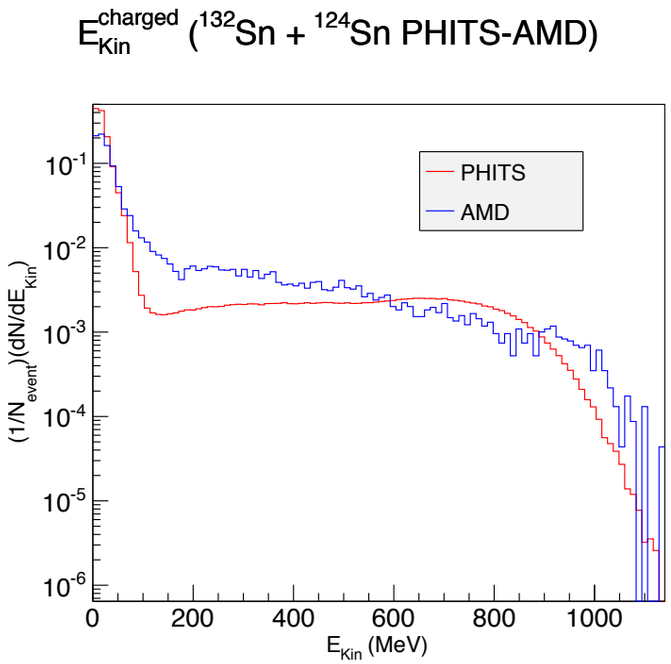
(number of bins : 60)

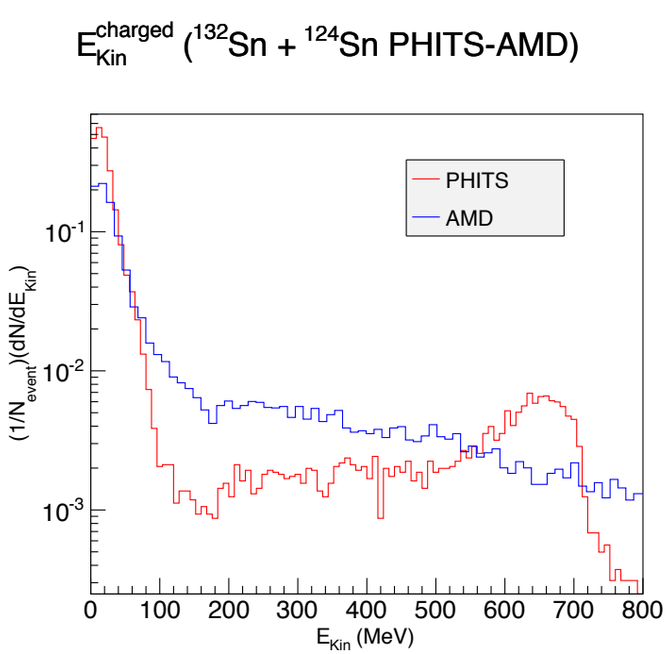


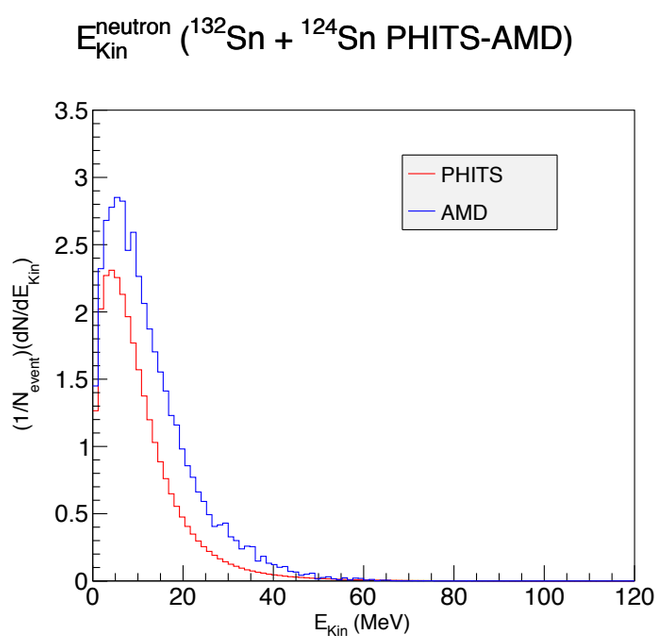


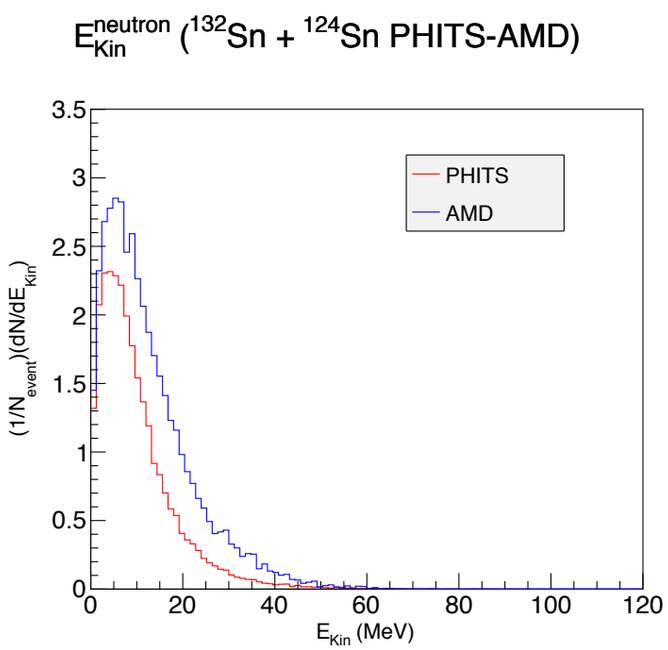
Kinetic Energy - Charged/ Neutrons

(number of bins : 60)



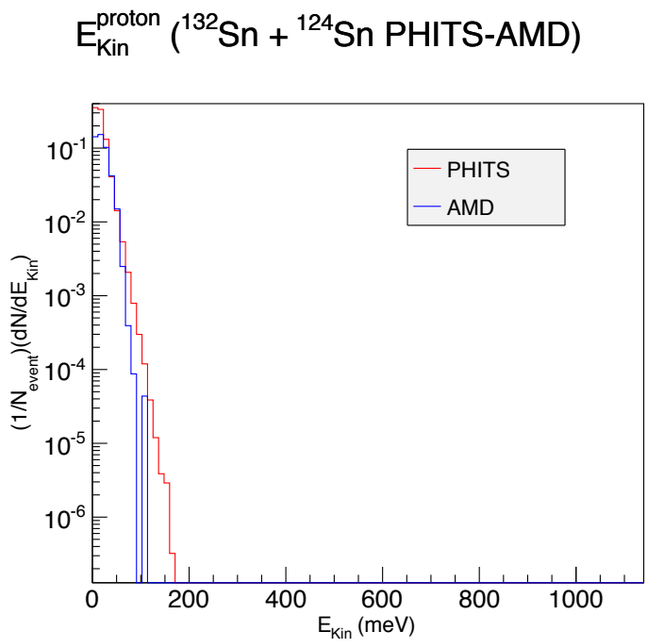


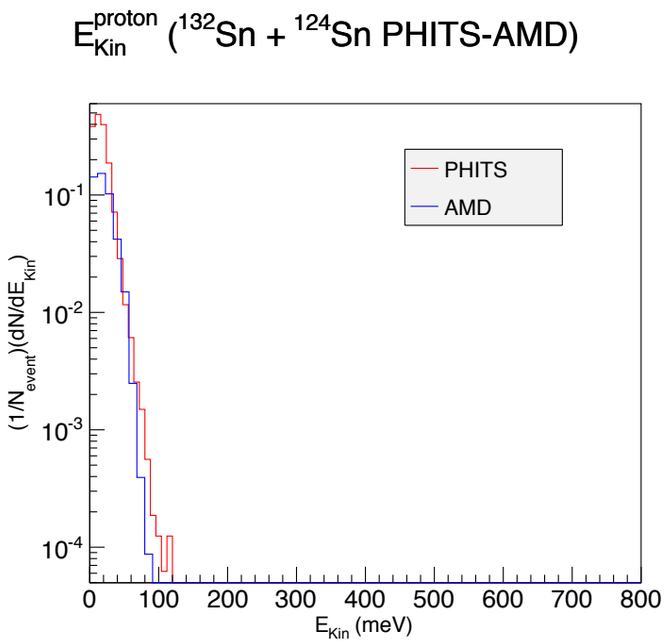


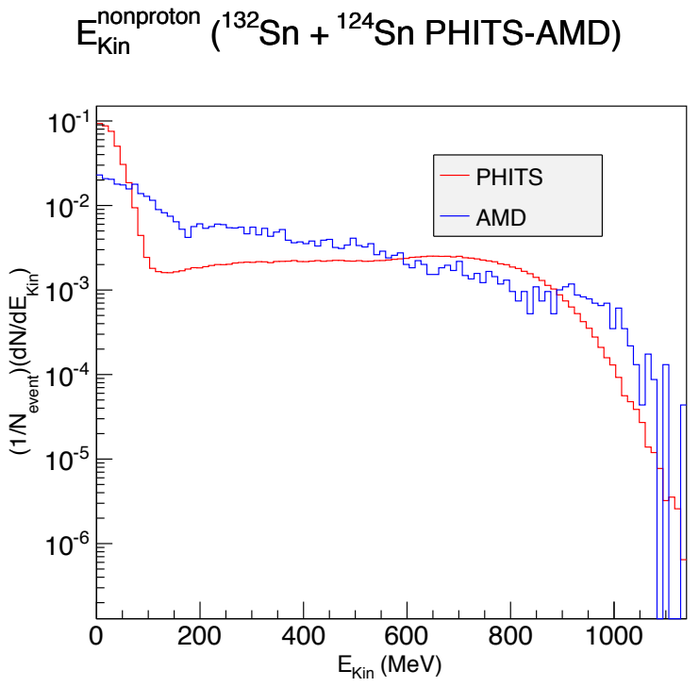


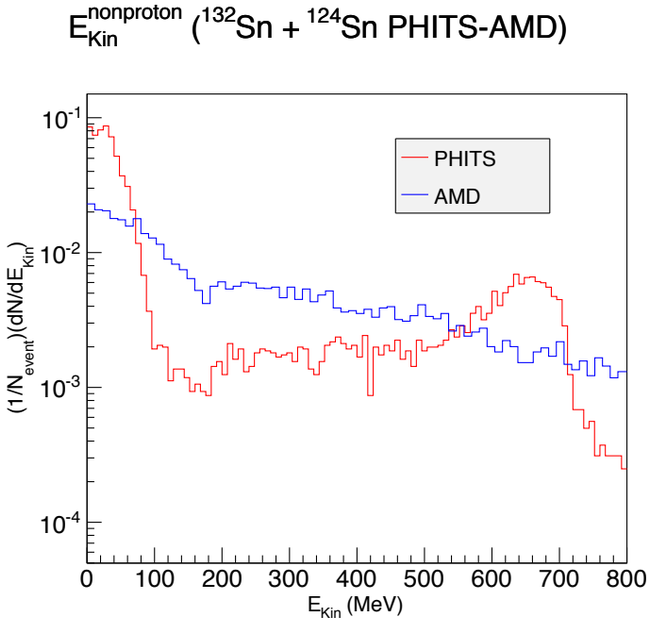
Kinetic Energy - Charged

(number of bins : 60)









Number of particles detected by each detector by one event.

$< N_{charged} > = N_{Det} \times R$, Occupancy : R = 0.05 (5%)

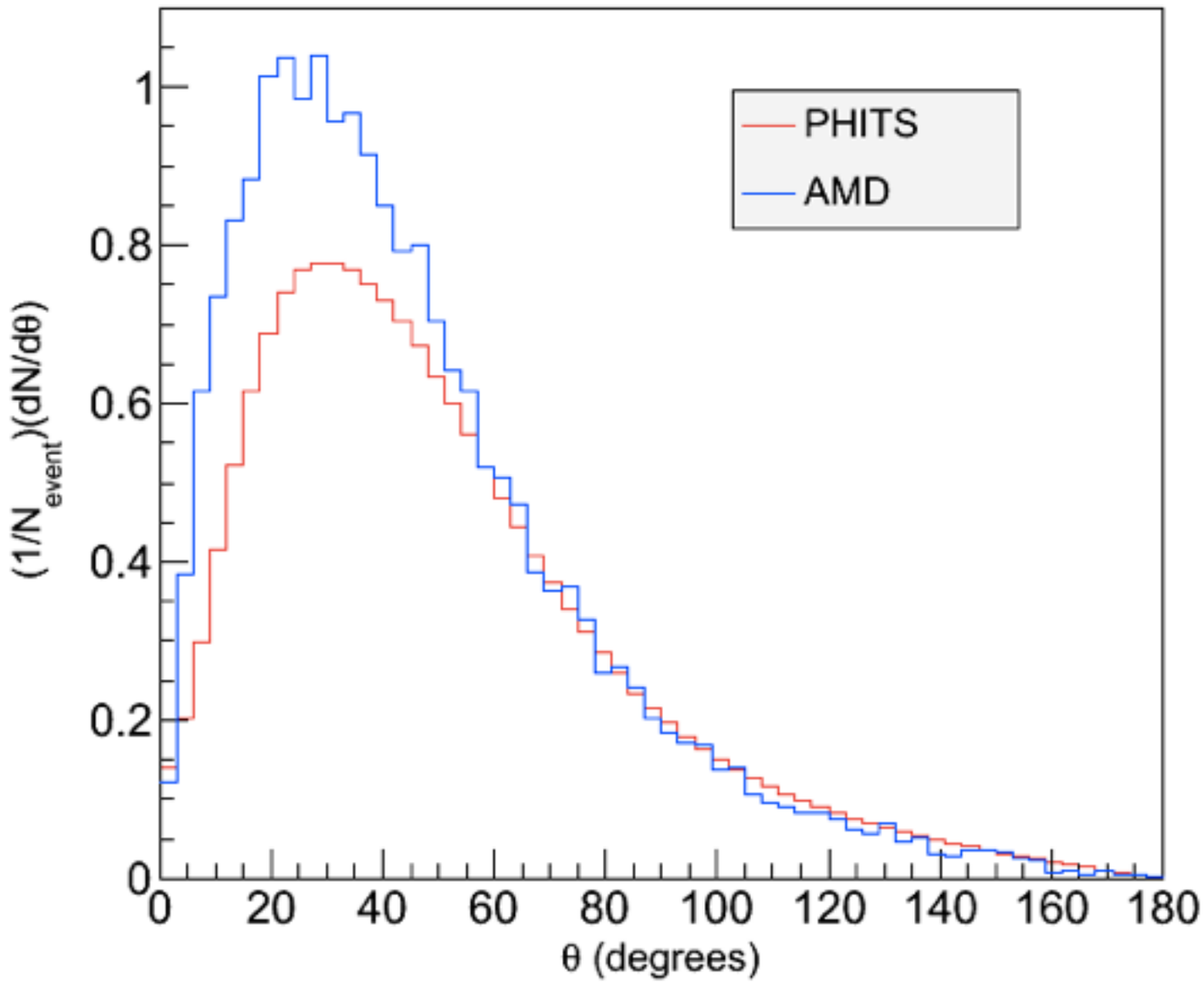
Bin	N(△θ)	N_Det	Φ(△θ) = 360°/ N_Det	S (cm^2)	X(cm)	N(△θ)	N_Det	S (cm^2)	X(cm)
1 : (10°<θ<20°)	1.6965	33	10.9	7.73	2.78	1.8876	38	11.57	2.59
2 : (20°<θ<30°)	2.0562	41	8.7	10.16	3.18	1.8219	36	11.57	3.40
3 : (30°<θ<40°)	2.1065	42	8.5	13.46	3.66	1.4303	29	19.50	4.41
4 : (40°<θ<50°)	2.0950	41	8.7	17.00	4.12	1.2363	25	27.88	5.28
5 : (50°<θ<60°)	1.8627	37	9.7	21.82	4.67	1.1657	23	35.10	5.92
6 : (60°<θ<75°)	2.1930	43	8.3	31.71	5.63	1.2413	25	54.55	7.38
7 : (75°<θ<90°)	1.4736	29	12.4	50.47	7.10	0.8343	17	86.09	9.27
8 : (90°<θ<115°)	1.3184	26	13.8	91.92	9.58	0.7811	16	149.36	12.22
9 : (115°<θ<145°)	0.6313	12	30.0	186.86	13.66	0.4269	9	249.15	15.78

Back-up

Theta

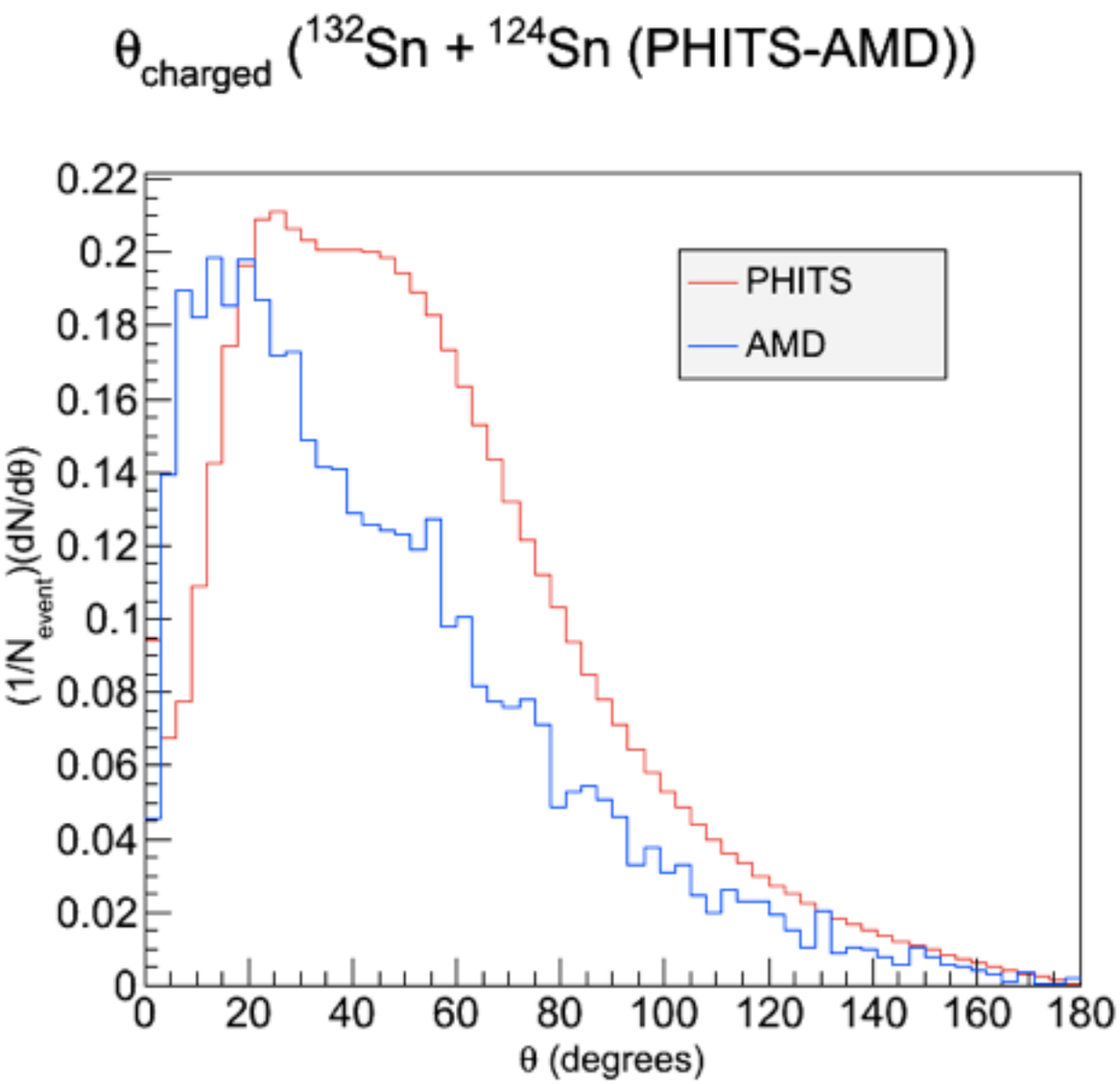
(number of bins : 60)

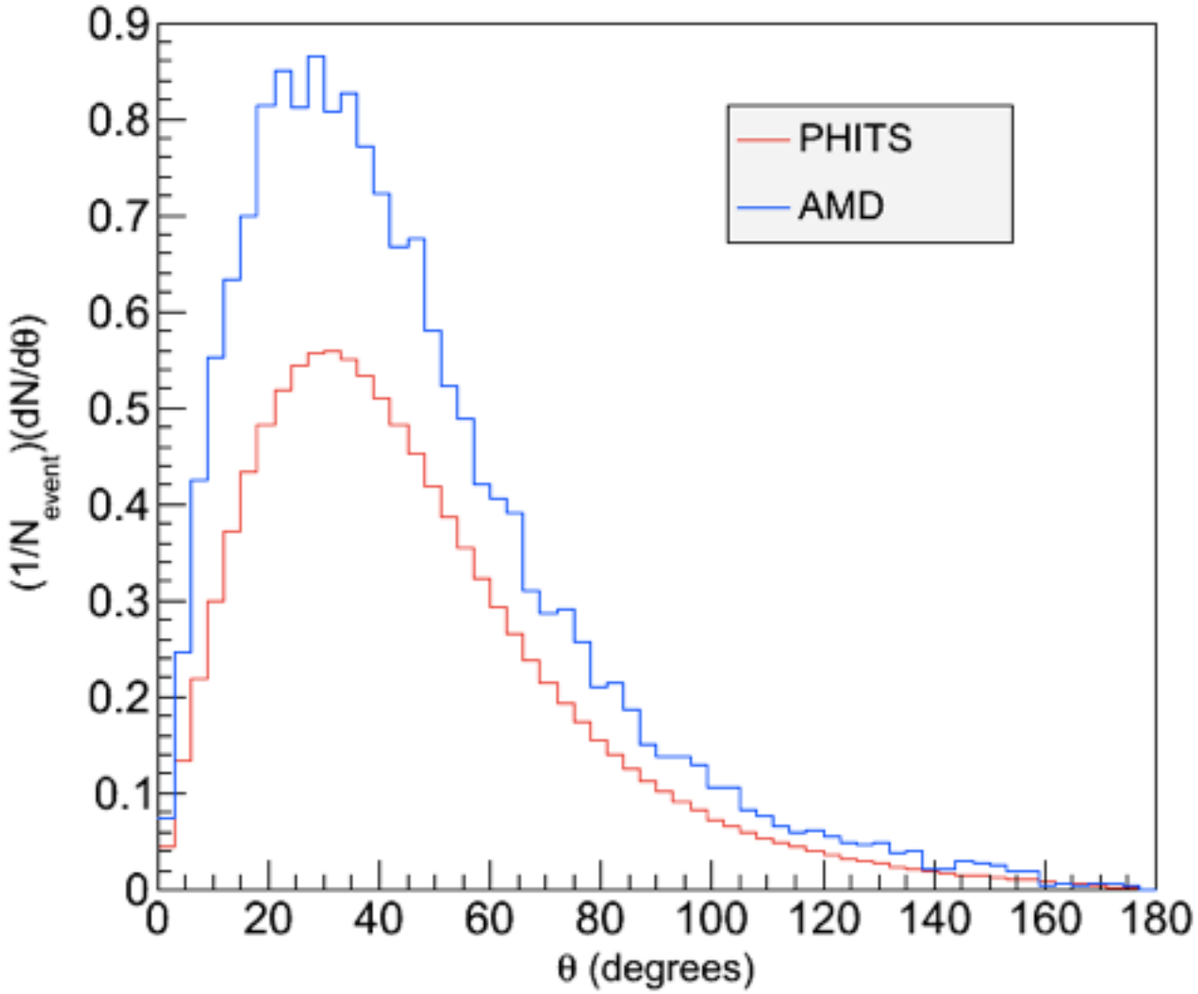
θ (^{132}Sn + ^{124}Sn (PHITS-AMD))



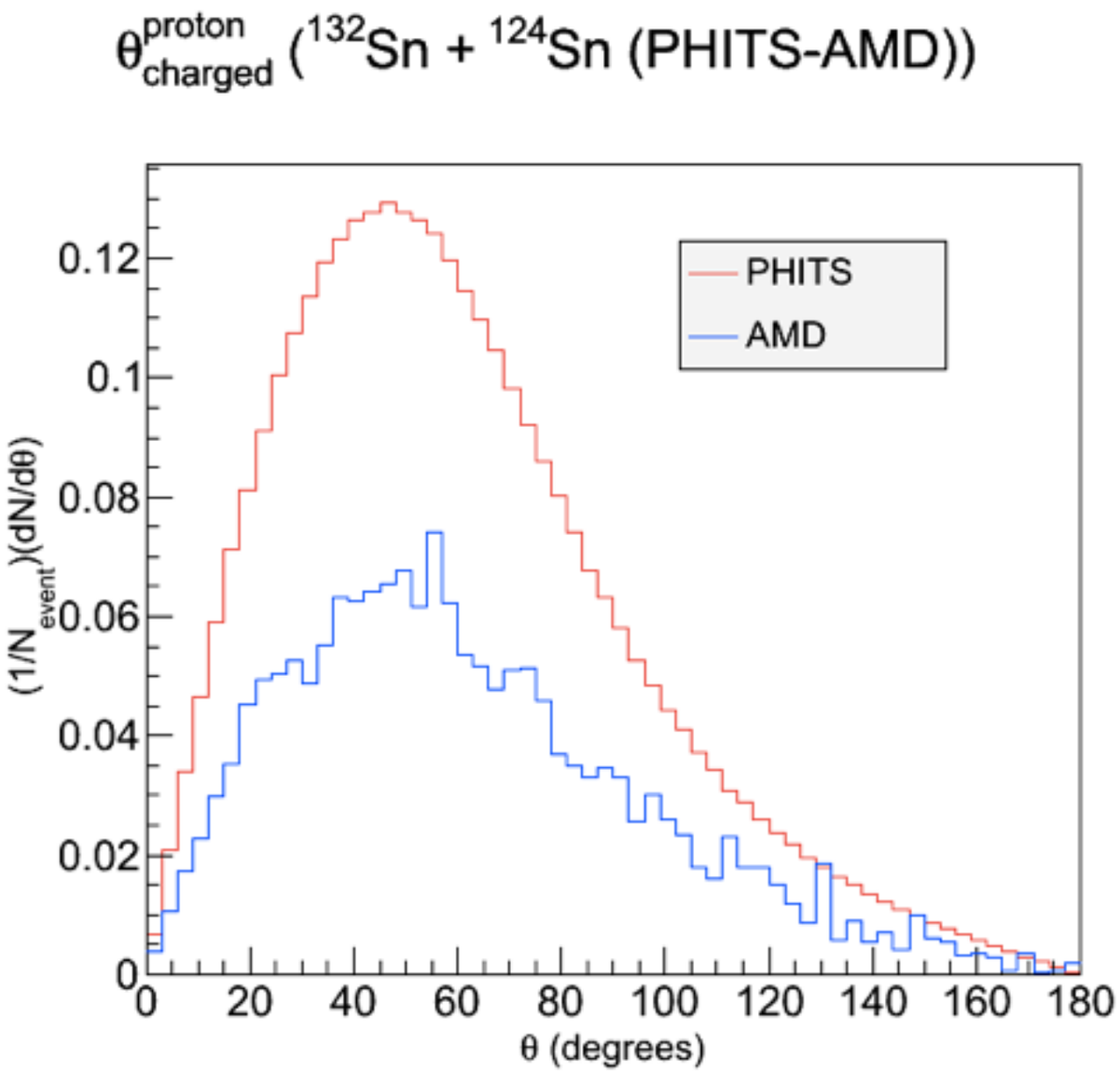
Theta - Charged/Neutron

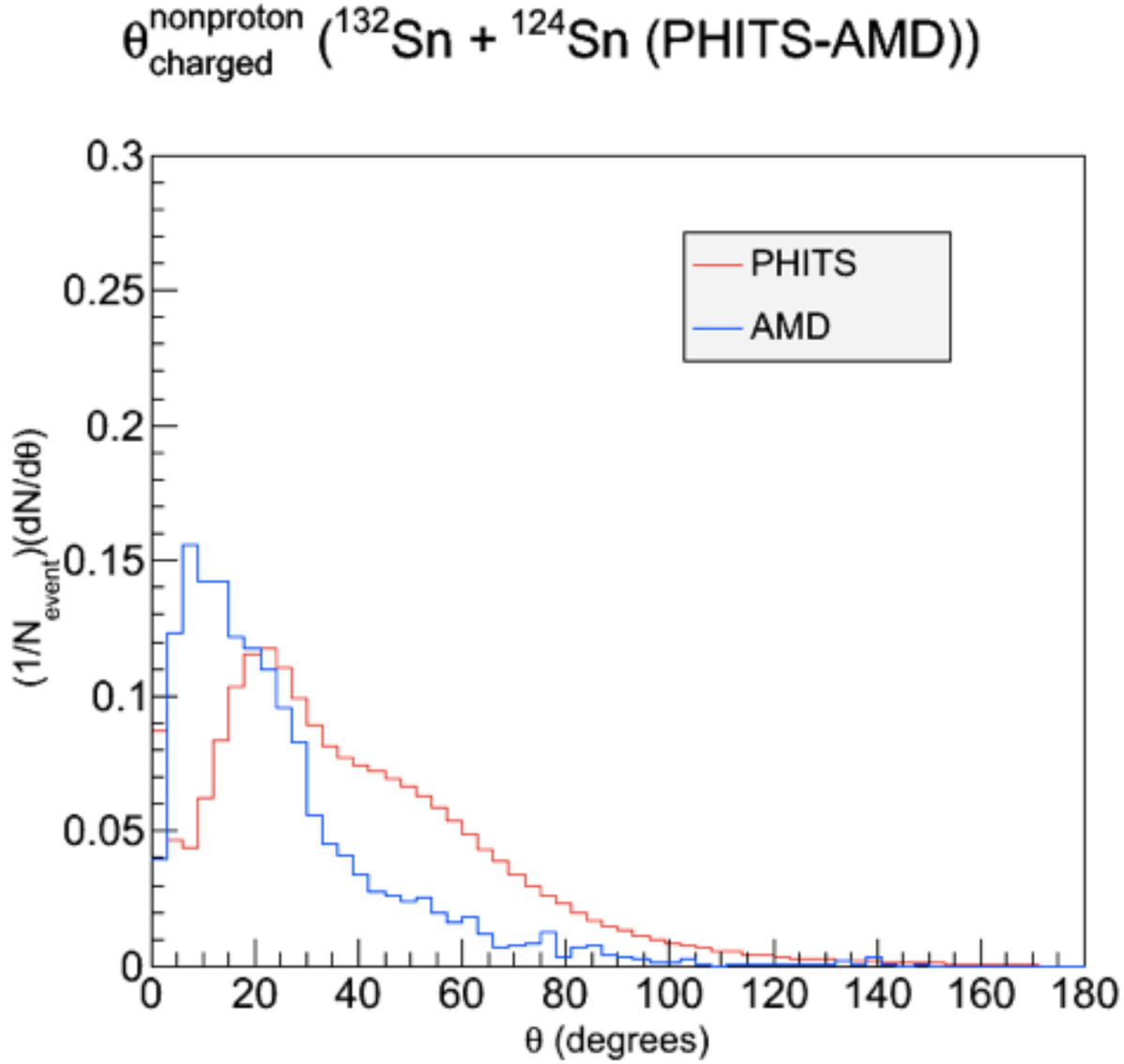
(number of bins : 60)





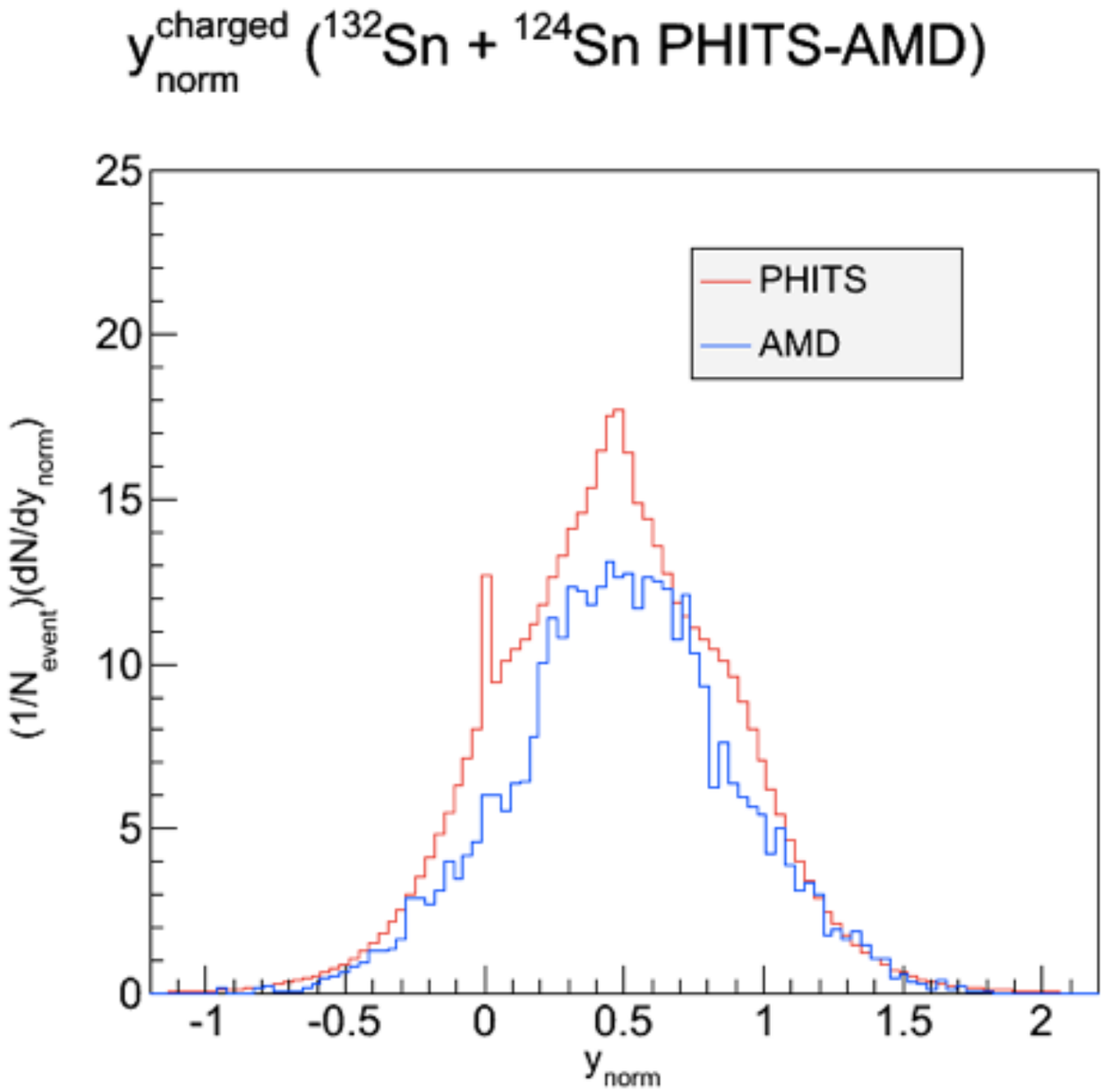
Theta - Charged

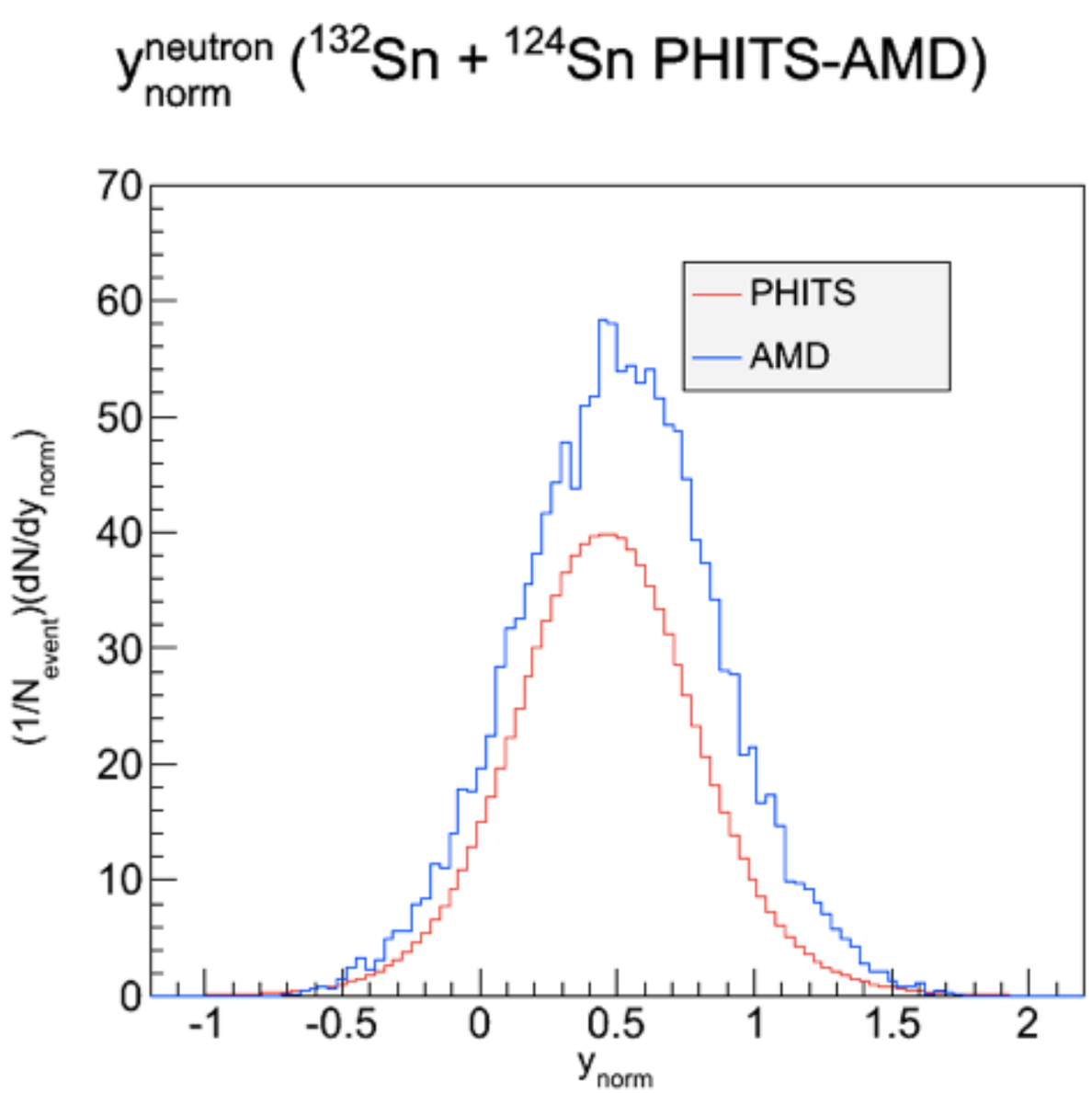




Rapidity - AMD

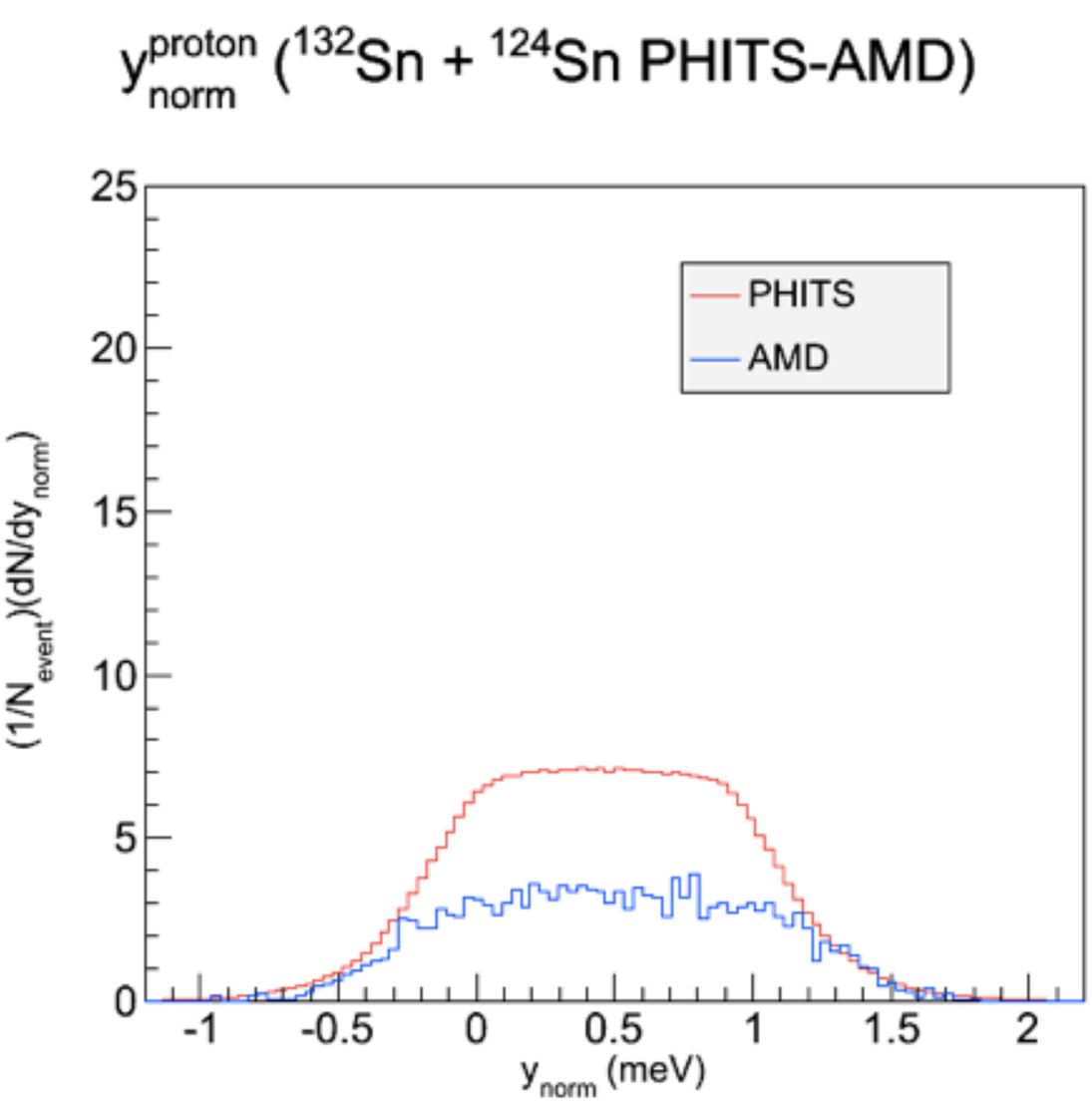
(number of bins : 100)

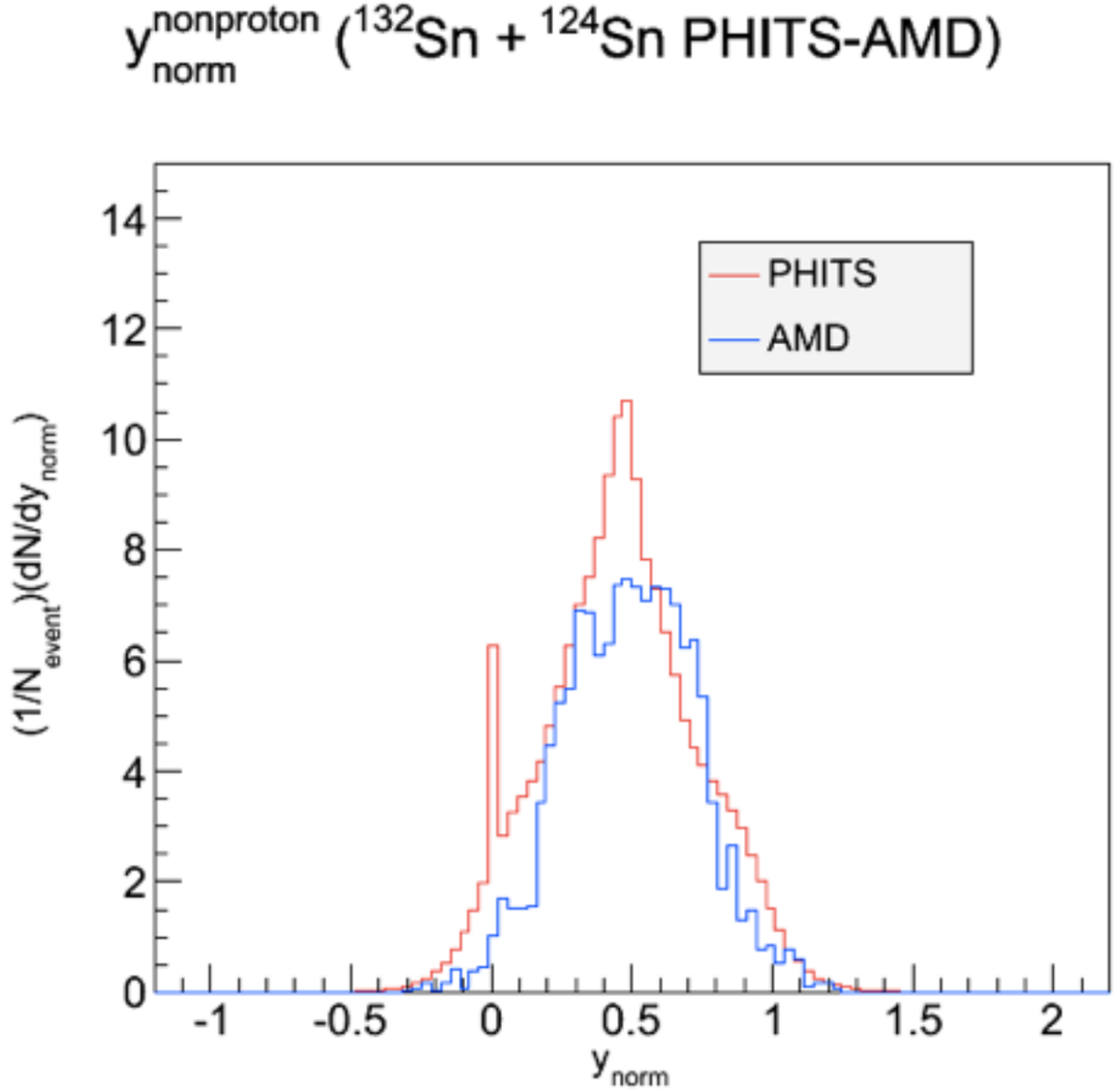




Rapidity - Charged

(number of bins : 100)





Number of Track (charged)