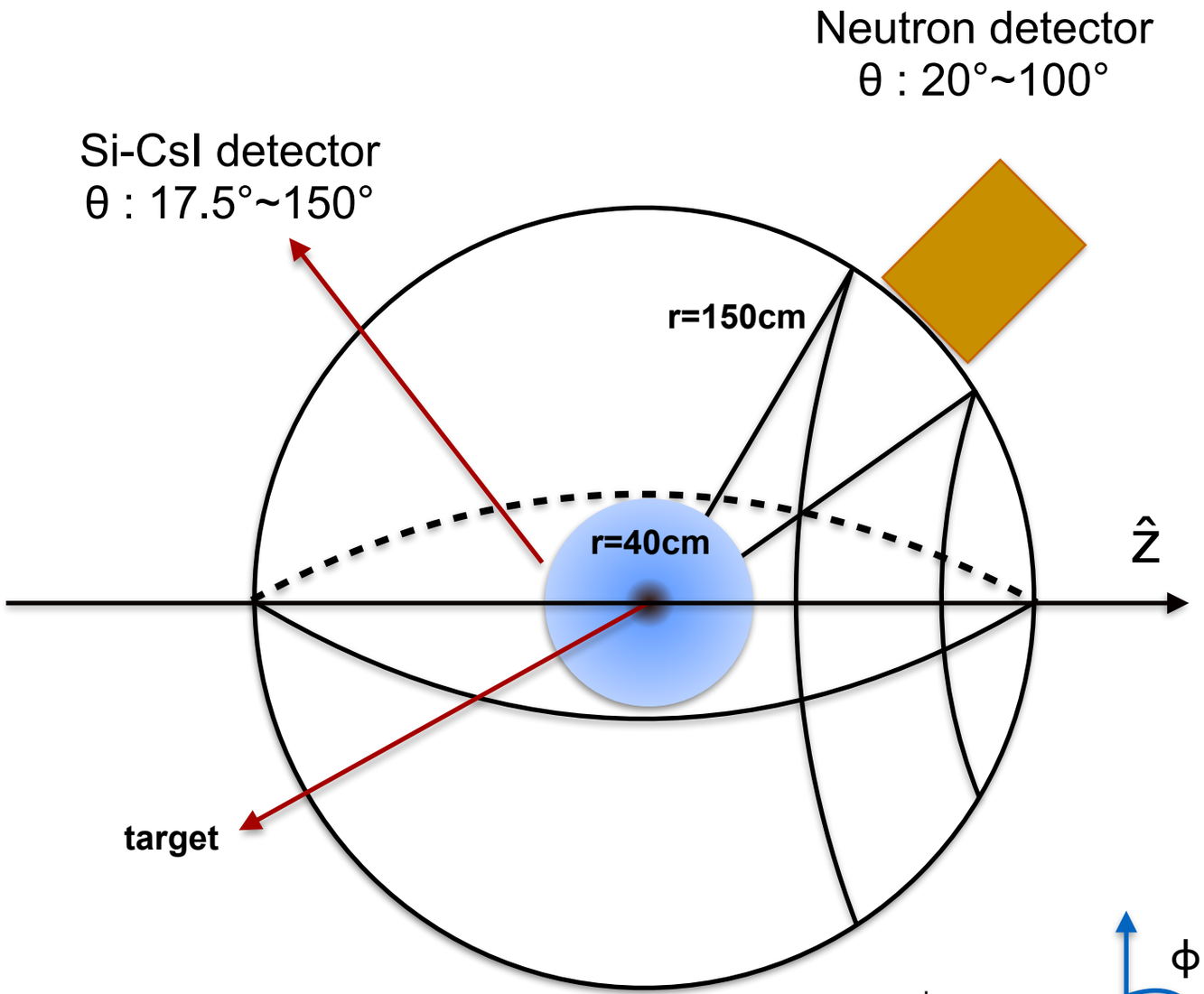
LAMPS-low

Status of LAMPS-low simulation

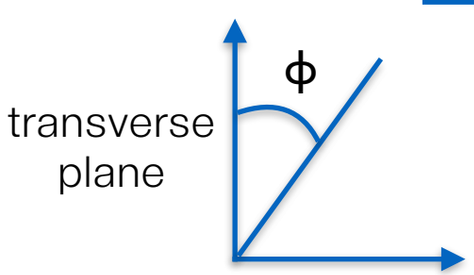
Jaebeom Park

Neutron detector geometry



Neutron detecter size : 15x15x20cm^3

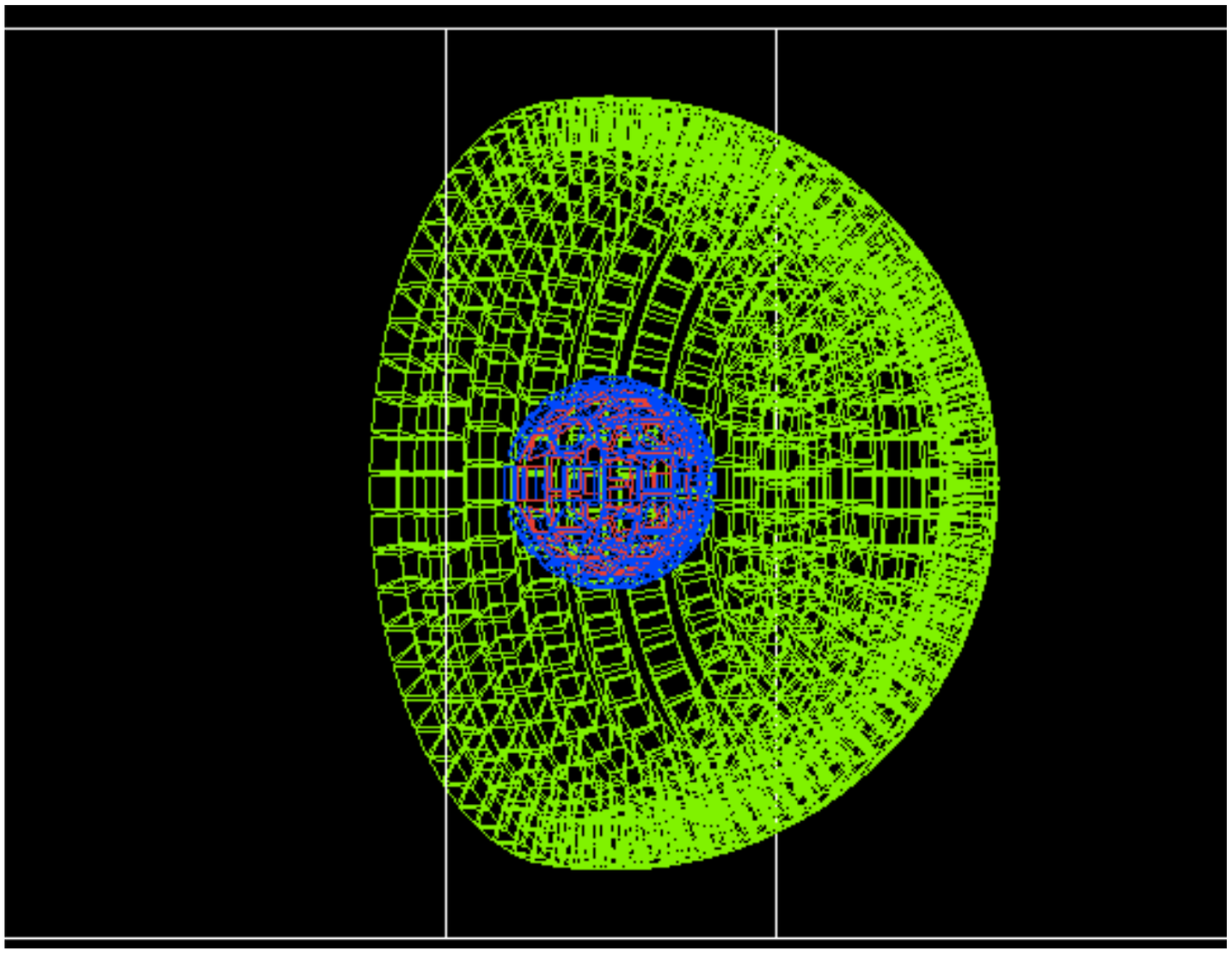
	# of Det.
ring 1 : 20° ~ 28°	20
ring 2 : 28° ~ 36°	30
ring 3 : 36° ~ 44°	36
ring 4 : 44° ~ 52°	43
ring 5 : 52° ~ 60°	49
ring 6 : 60° ~ 68°	53
ring 7 : 68° ~ 76°	57
ring 8 : 76° ~ 84°	60
ring 9 : 84° ~ 92°	61
ring 10 : 92° ~ 100°	61
all	470



Non-realistic design - just to see the scattering of neutrons in CsI detector

Realistic : $\phi = \pm(45° \sim 135°)$

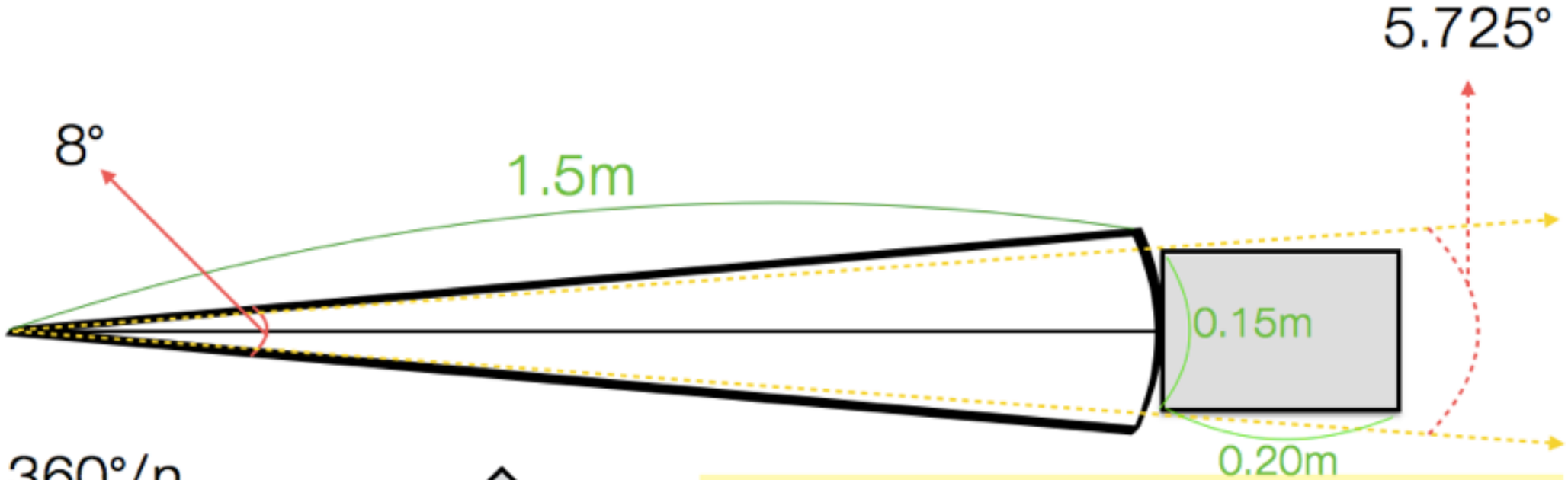
LAMPS-low detector geometry

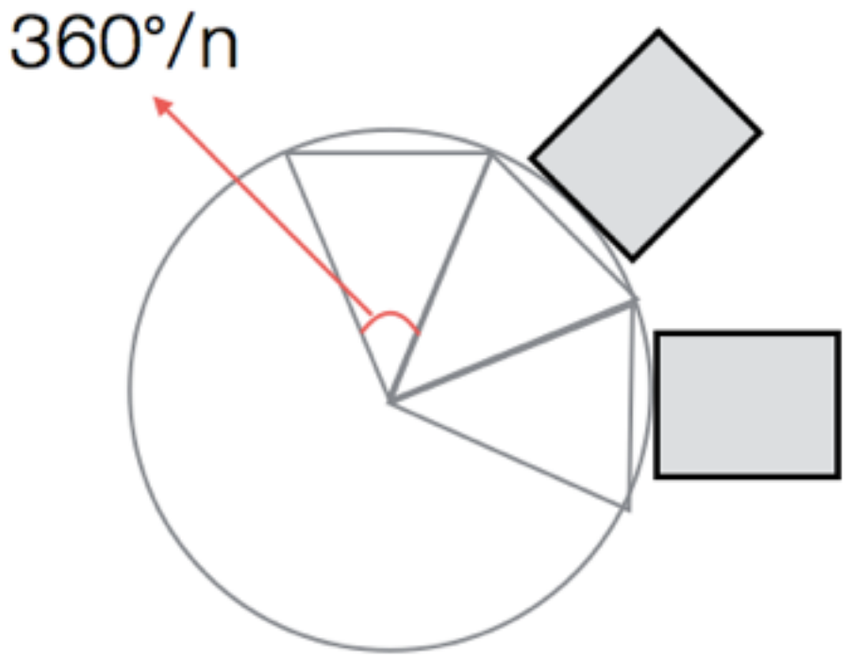


View in Geant4

red : Si detector
blue : CsI detector
green : Neutron detector

Neutron detector geometry





- Area of detector :
  470 x 0.225m^2 =10.58 m^2
- Area of surface between
  θ = 20° ~ 100° : 15.74 m^2
- (10.58/15.74) x 100% = 67.22%

Neutron detector geometry

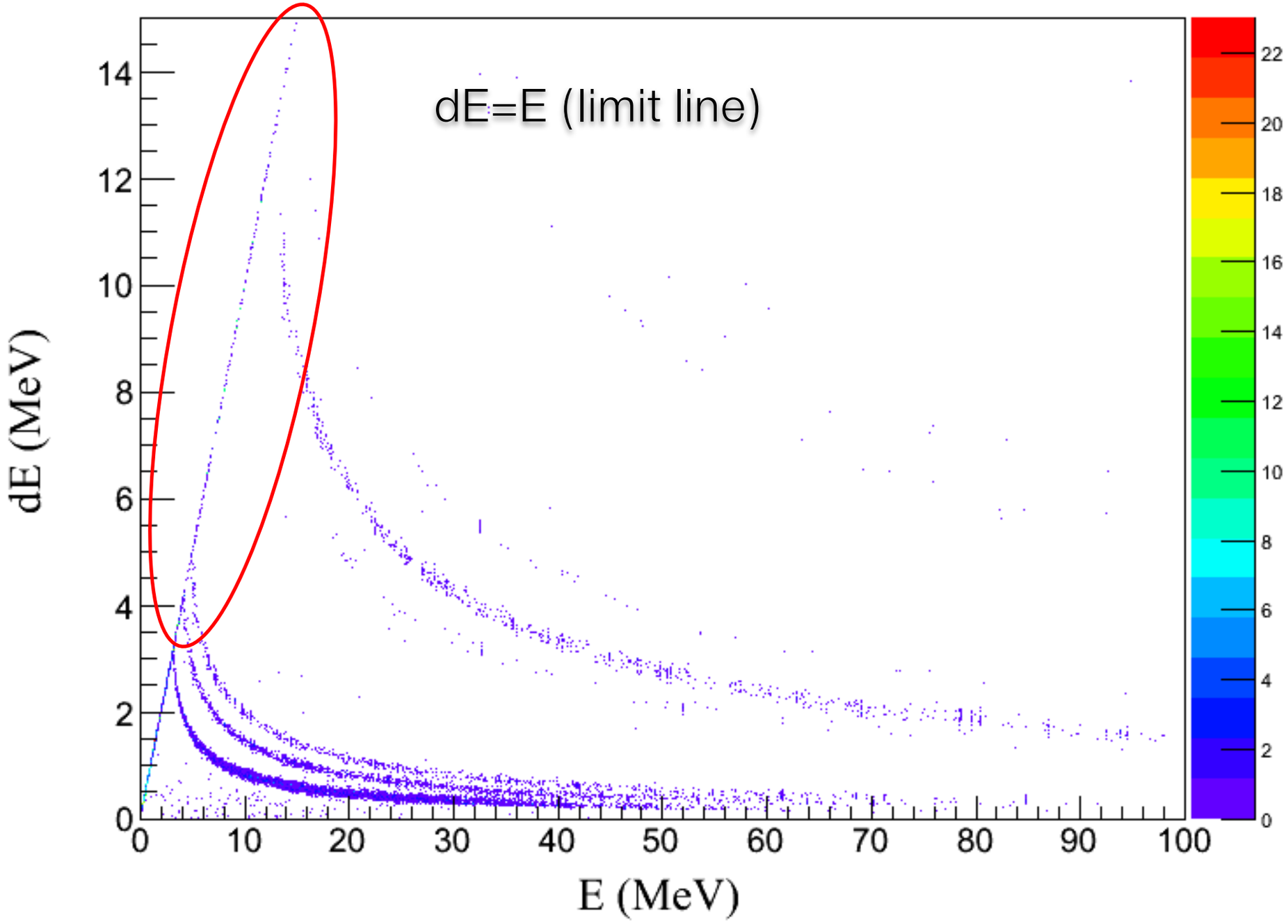
Time of Flight

$E_K = E_0[(1-v^2/c^2)^{-1/2} - 1]$, E_0 : rest mass

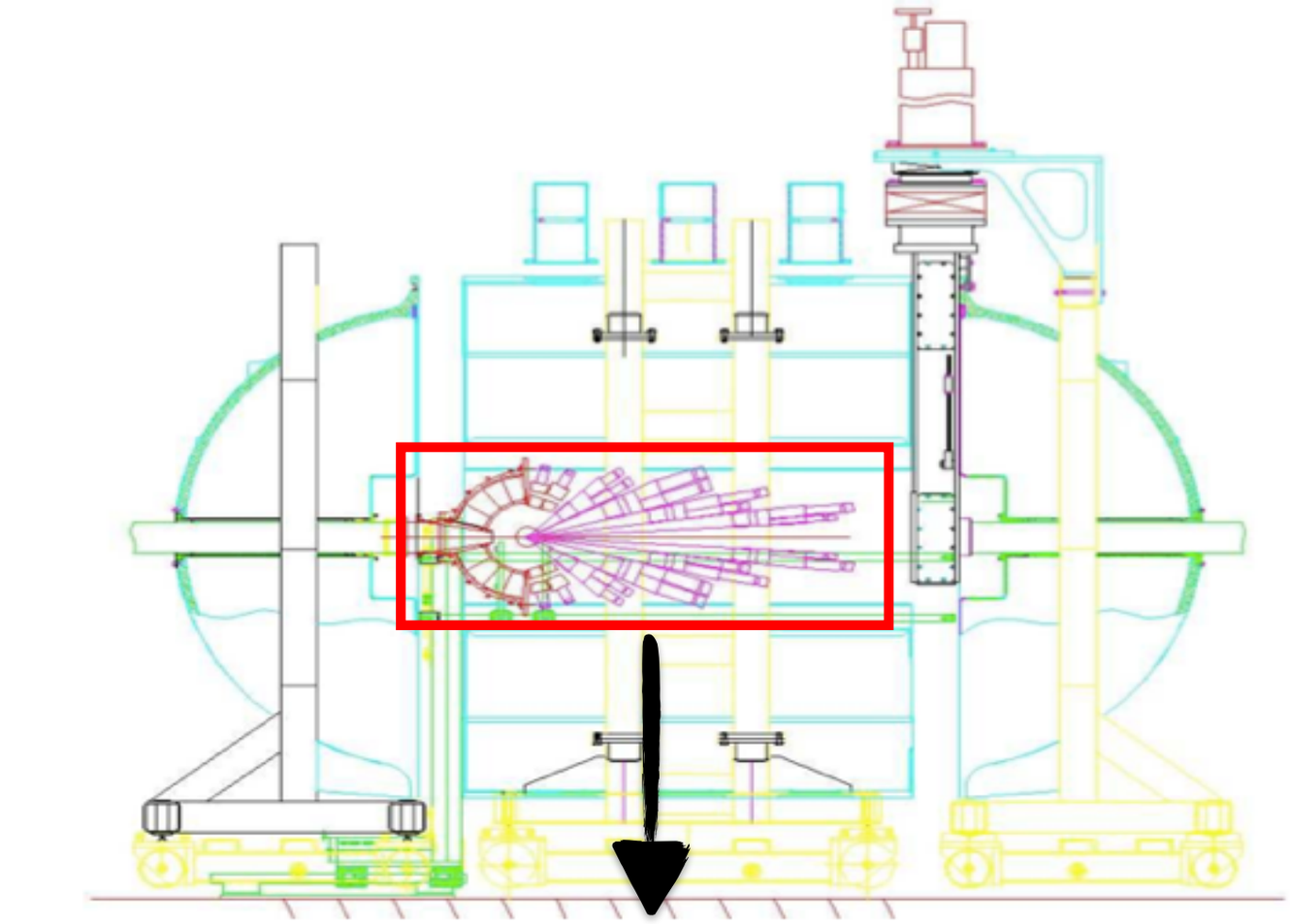
$$E_K = E_0[(1-L^2/\triangle t^2 c^2)^{-1/2} - 1]$$

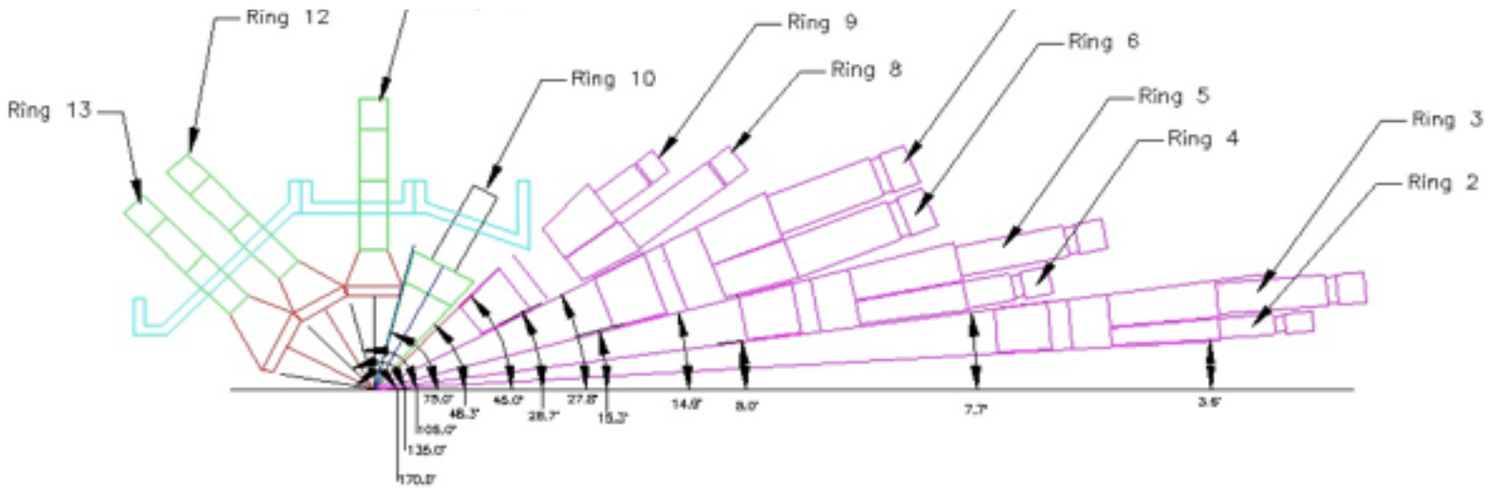
PID dE vs E

<All AMD data>



PID – NIMROD in Texas A&M

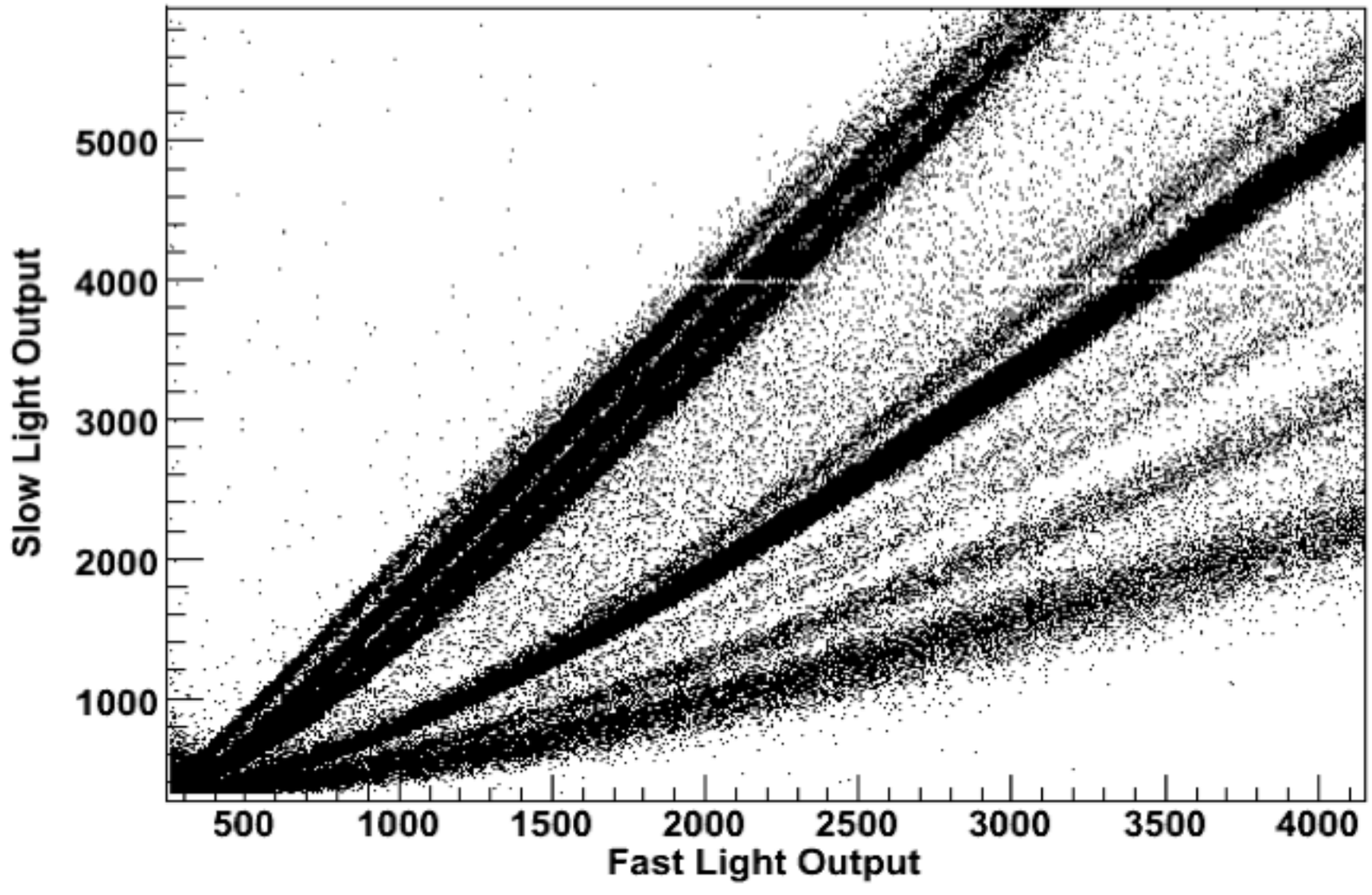




Ring	Θ Range degrees	ϕ Range degrees	Telescopes Silicon number (thickness)	Super Telescopes	CsI Length cm
2	3.6-5.0	30	10 (300μm)	2	10.0
3	5.0-7.6	30	10 (300μm)	2	10.0
4	8.0-10.8	30	10 (300μm)	2	10.0
5	10.8-14.7	30	10 (300μm)	2	10.0
6	15.3-20.9	30	5 (300μm) 5 (150μm)	2	6.5
7	20.9-27.6	15	5 (300μm) 5 (150μm)	2	6.5
8	28.6-35.8	30	6 (300μm) 4 (150μm)	2	6.0
9	35.8-45.0	15	6 (300μm) 4 (150μm)	2	6.0
10	52.7-69.2	-	-	140+100μm	4.0
11	70.1-86.3	20	1 (300μm) 1(500μm)	-	3.0
12	93.5-110.8	20	18 (500μm)	-	2.8
13	110.8-128.4	20	18 (500μm)	-	2.8
14	128.4-147.4	20	18 (500μm)	-	2.8
15	147.4-167.0	20	18 (500μm)	-	2.8

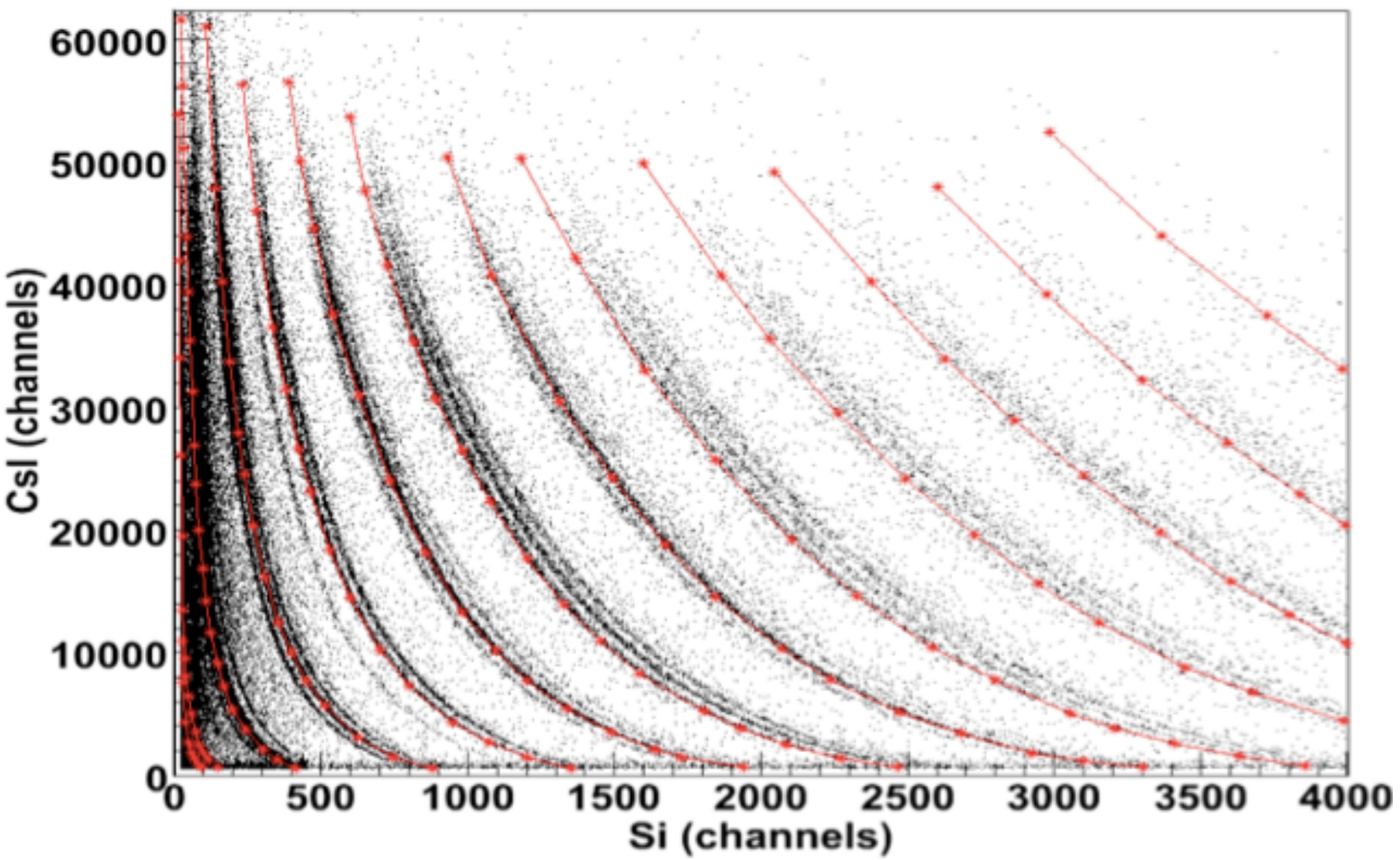
CsI shape discrimination

$^{86,78}Kr+^{64,58}Ni$ at 35MeV/A - for Z=1,2



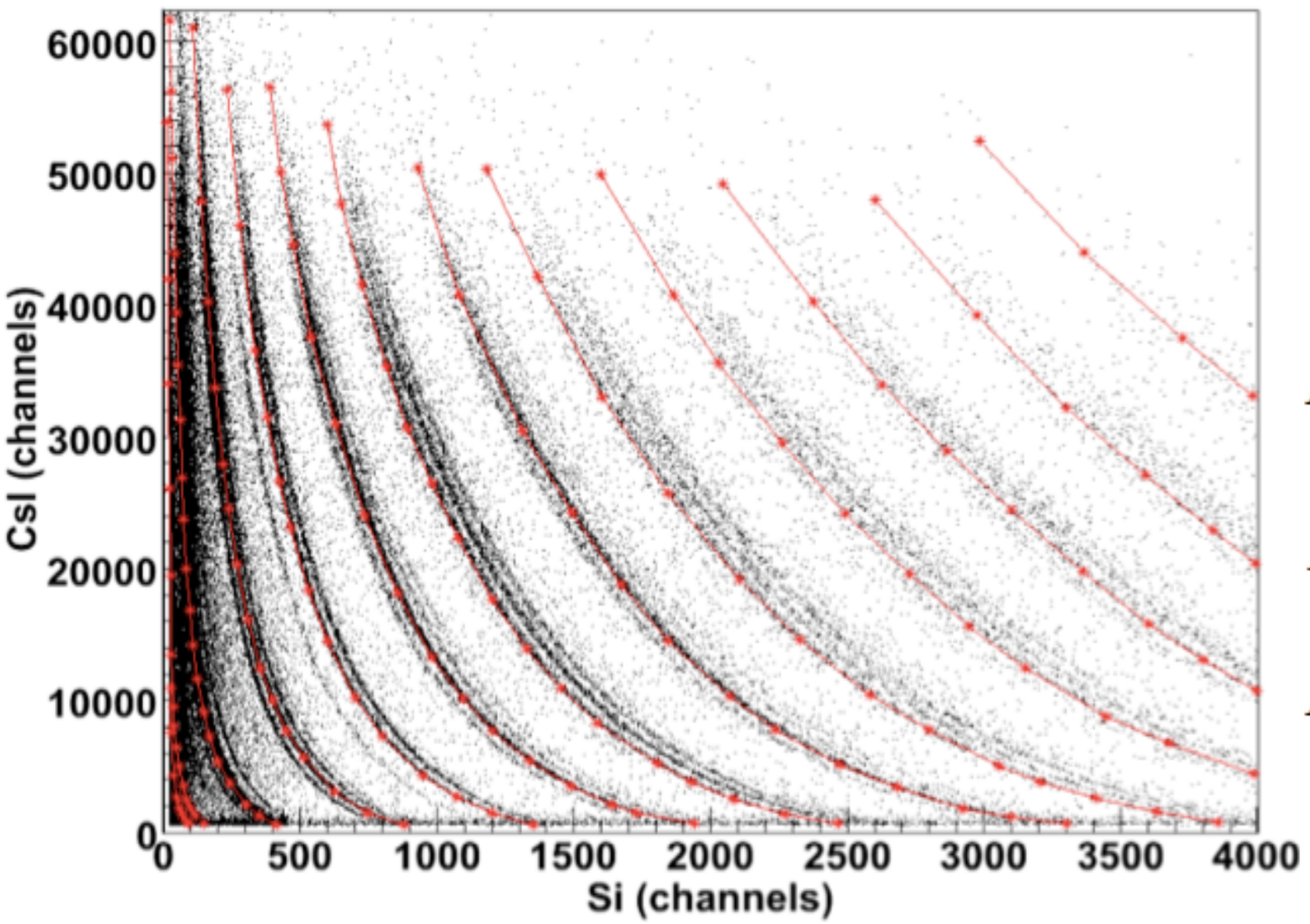
PID CsI vs. Si

^{86,78}Kr+^{64,58}Ni at 35MeV/A - for Z=3~10



PID CsI vs. Si

^{86,78}Kr+^{64,58}Ni at 35MeV/A - for Z=3~7



$$-\frac{dE}{dx} \propto \frac{Z^2}{\nu^2} \propto \frac{Z^2 \cdot A}{KE}$$

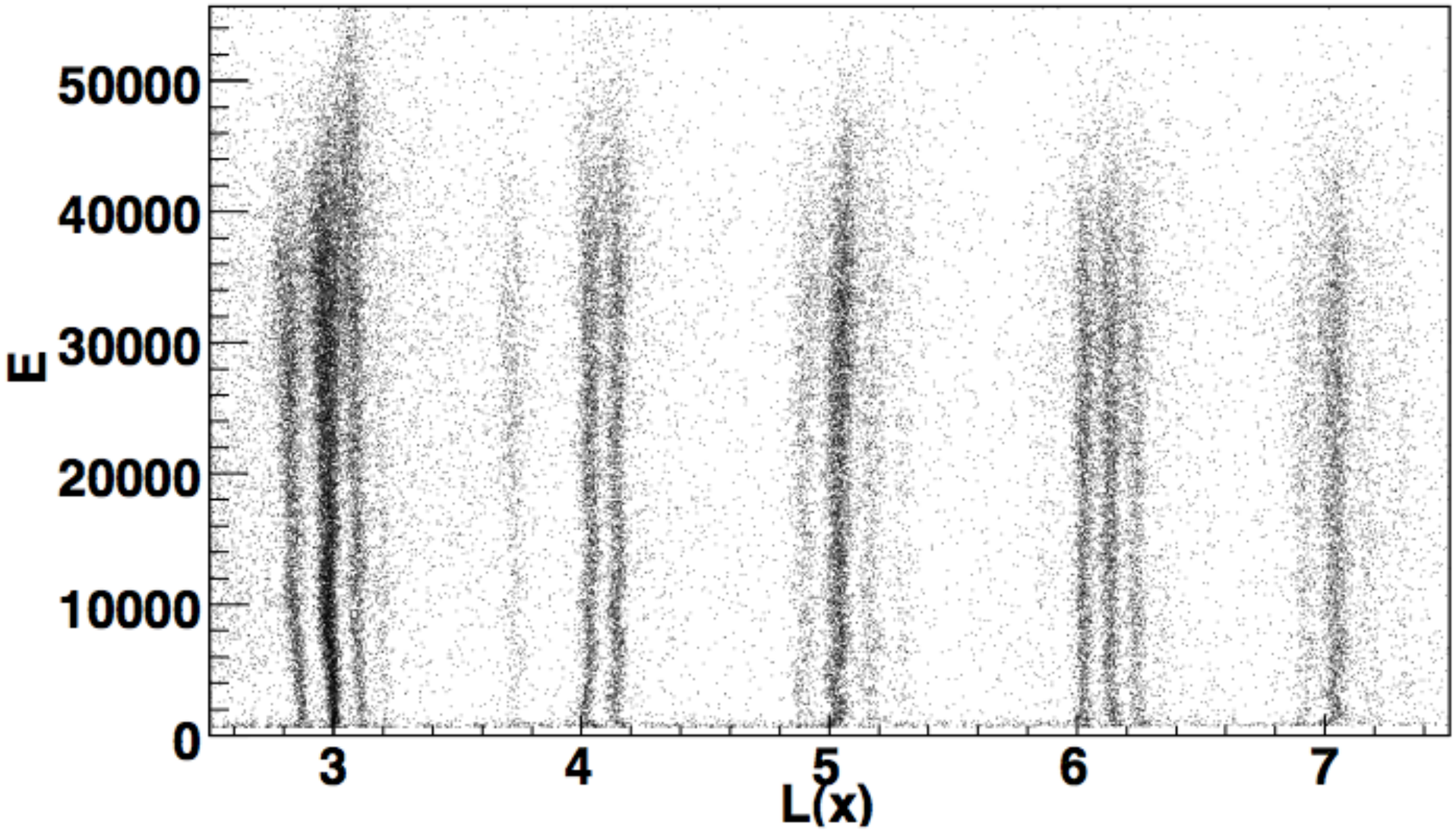
$$L_X = \frac{dist_1}{|dist_1 - dist_2|} Z_2 - \frac{dist_2}{|dist_1 - dist_2|} Z_1$$

$$L_X = \frac{dist_1}{|dist_1 + dist_2|} Z_2 + \frac{dist_2}{|dist_1 + dist_2|} Z_1$$

$$L_X = \frac{dist_2}{|dist_2 - dist_1|} Z_1 - \frac{dist_1}{|dist_2 - dist_1|} Z_2$$

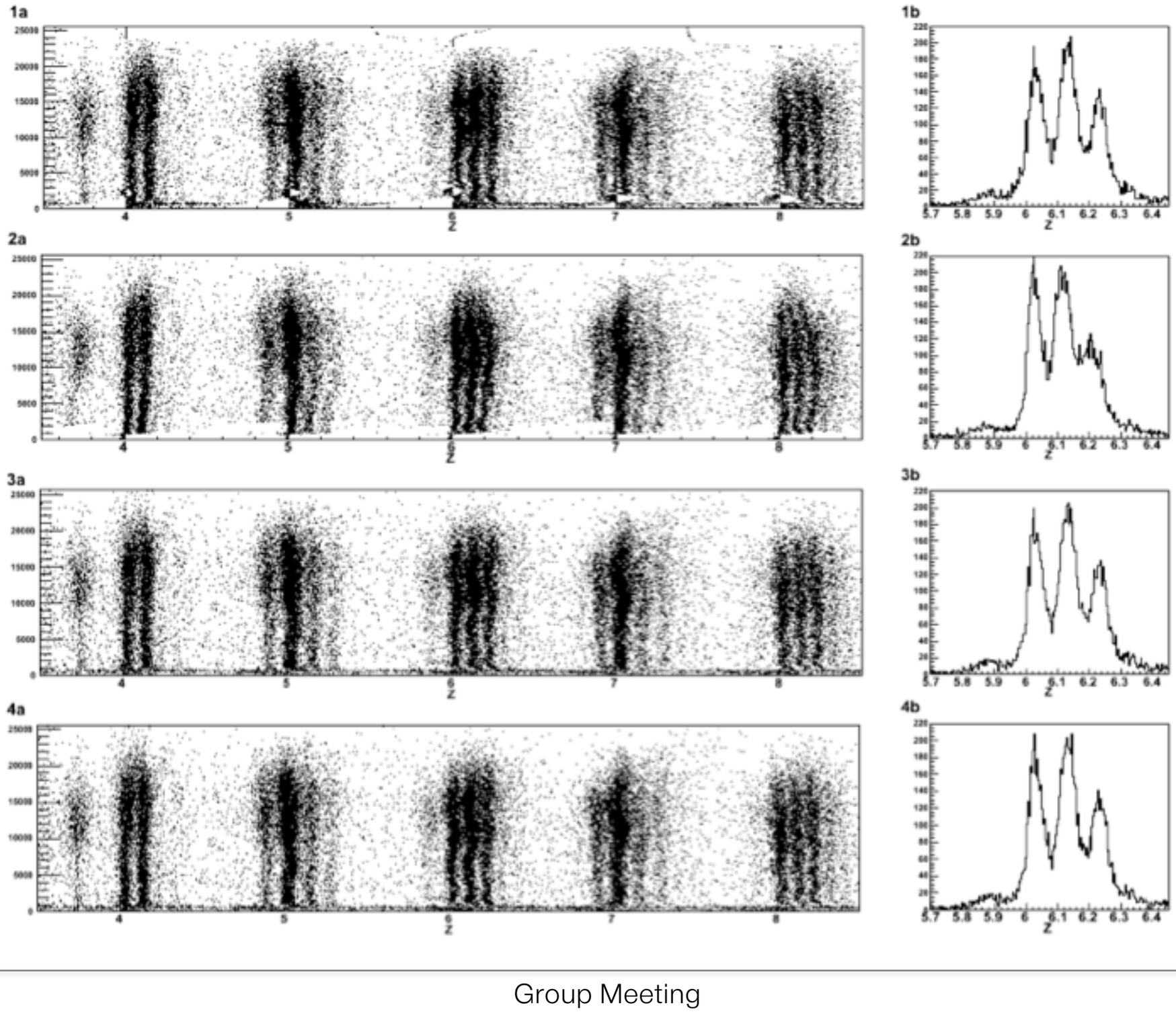
PID CsI vs. Si

^{86,78}Kr+^{64,58}Ni at 35MeV/A - for Z=3~7



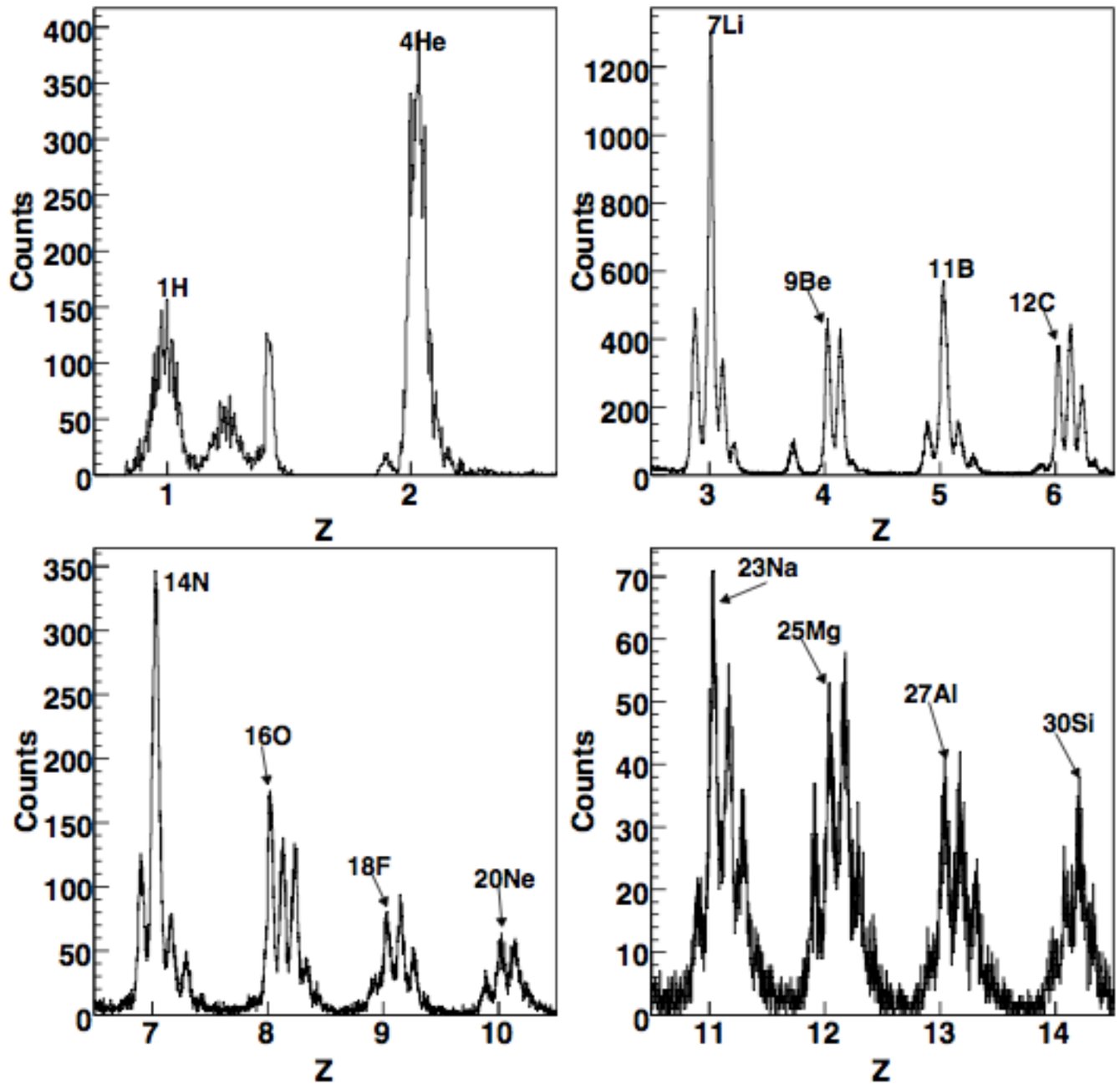
PID – Z distribution

$^{86,78}Kr+^{64,58}Ni$ at 35MeV/A



PID – mass distribution

$^{86,78}Kr+^{64,58}Ni$ at 35MeV/A



Plan

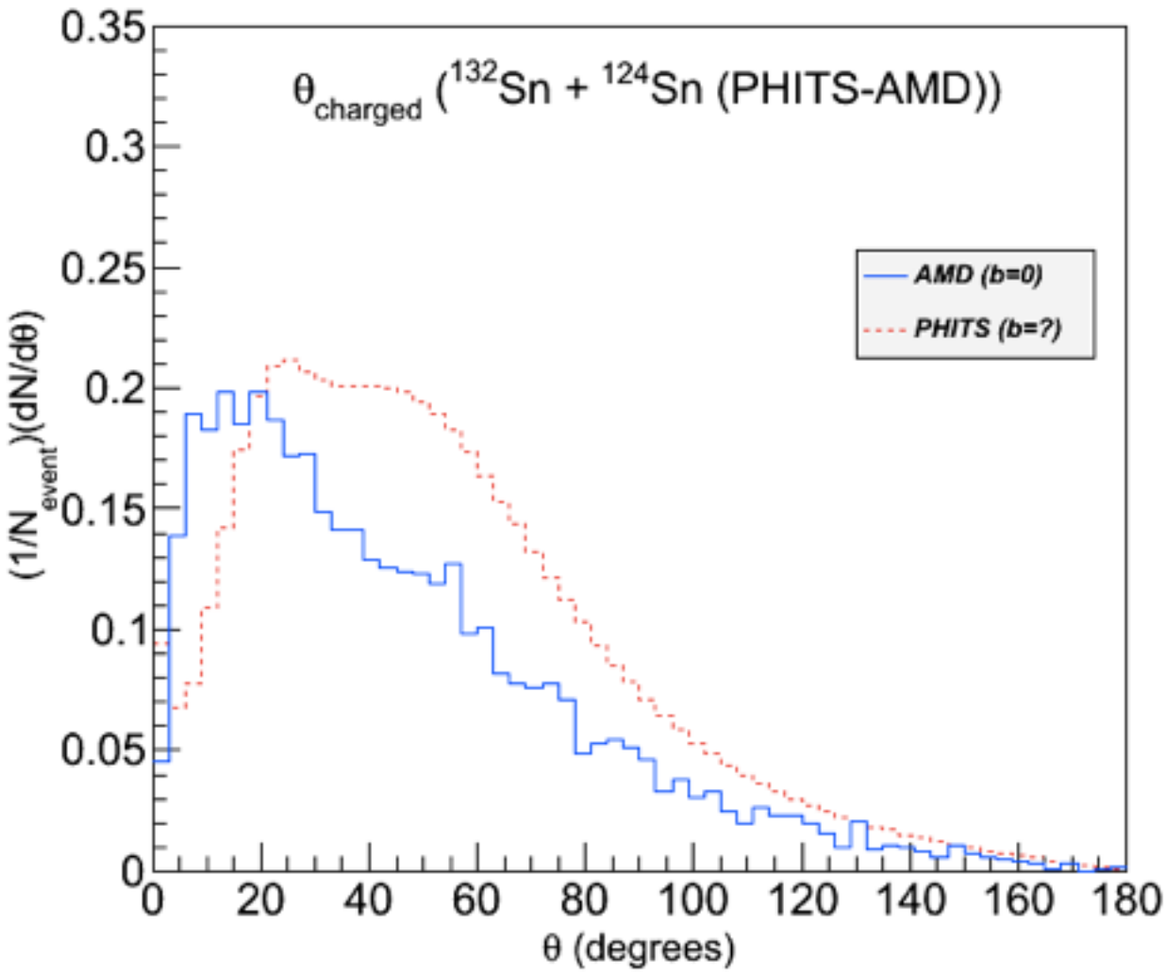
1. One CsI & One Scintillator -> kinetic energy loss of neutron in different energy region

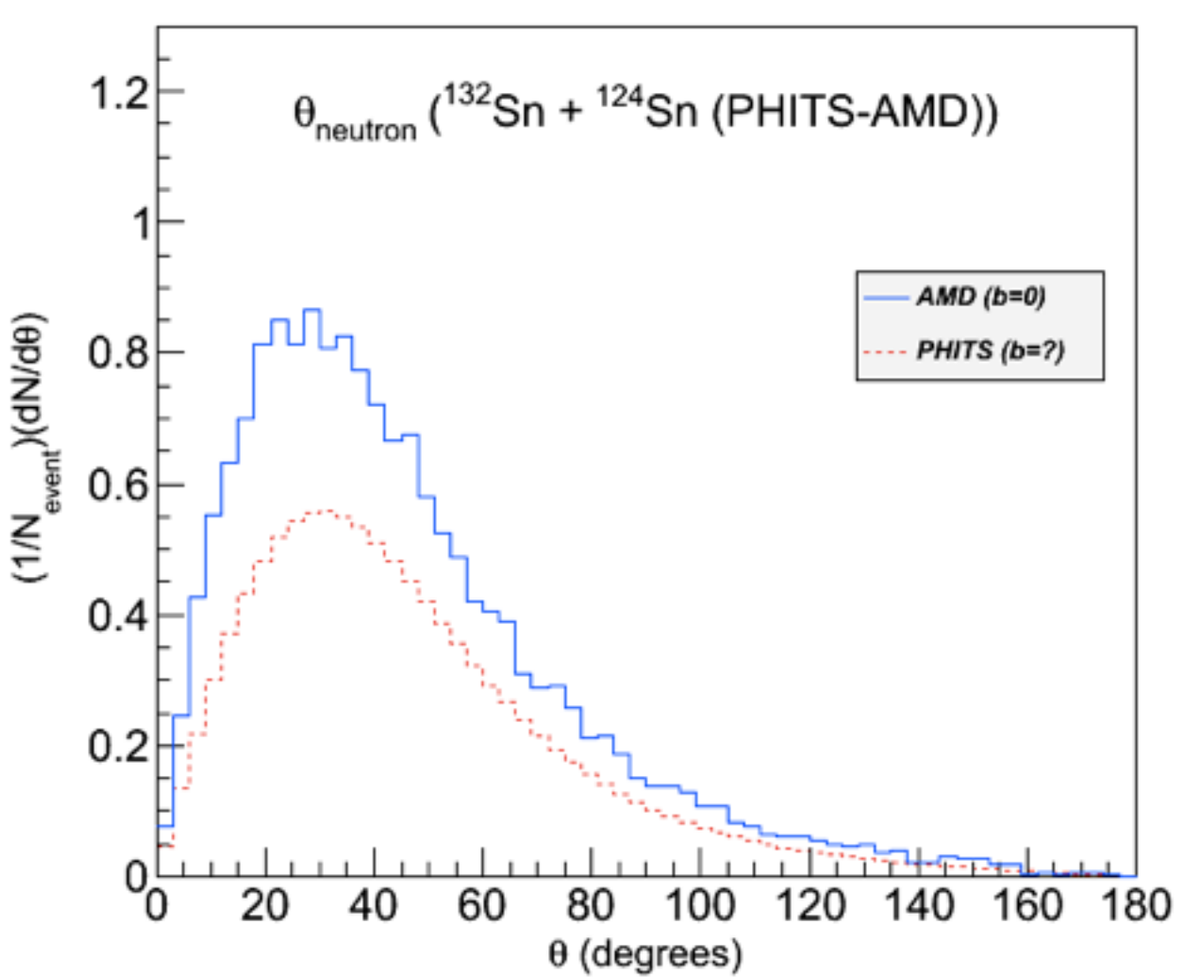
2. Various CsI thickness 5cm, 4cm, 3cm : Gamma efficiency

3. Si-CsI mass distribution fitting study - details in A&M and LNS

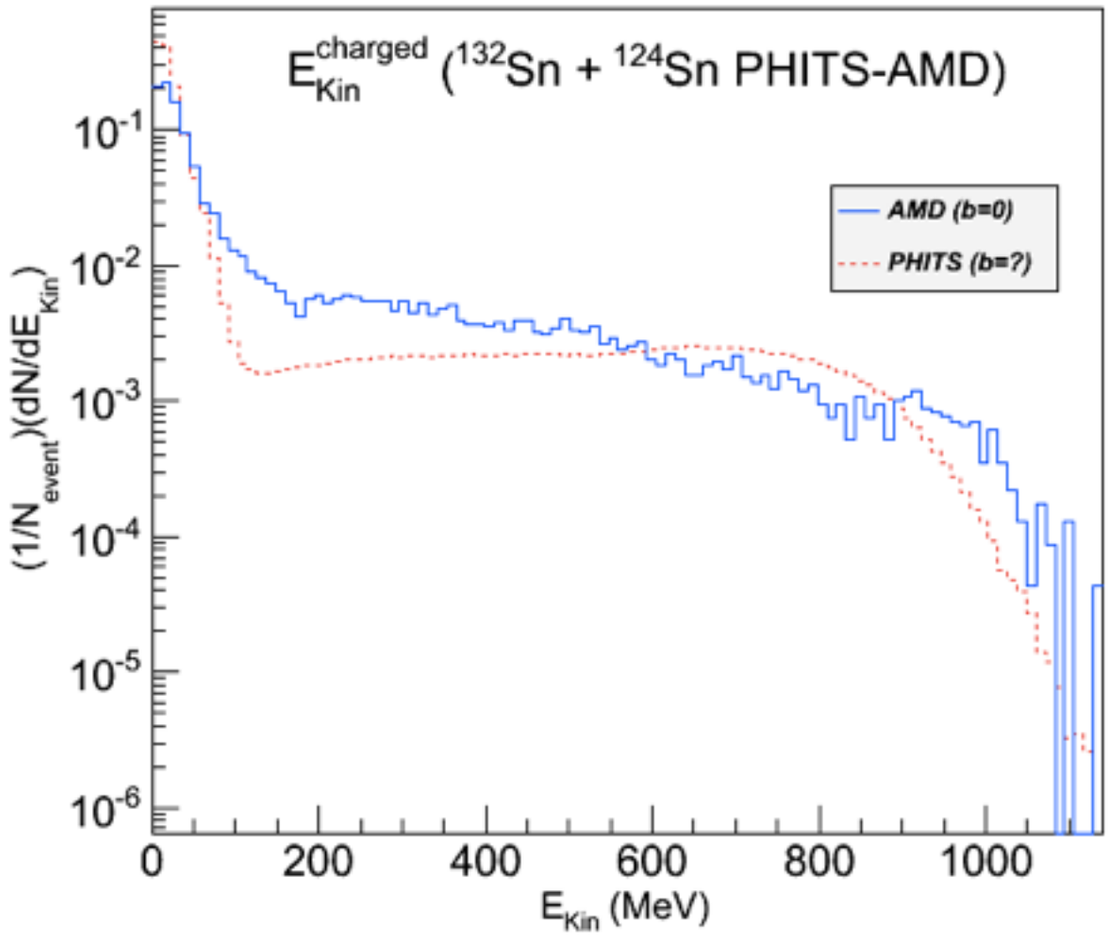
Back- up

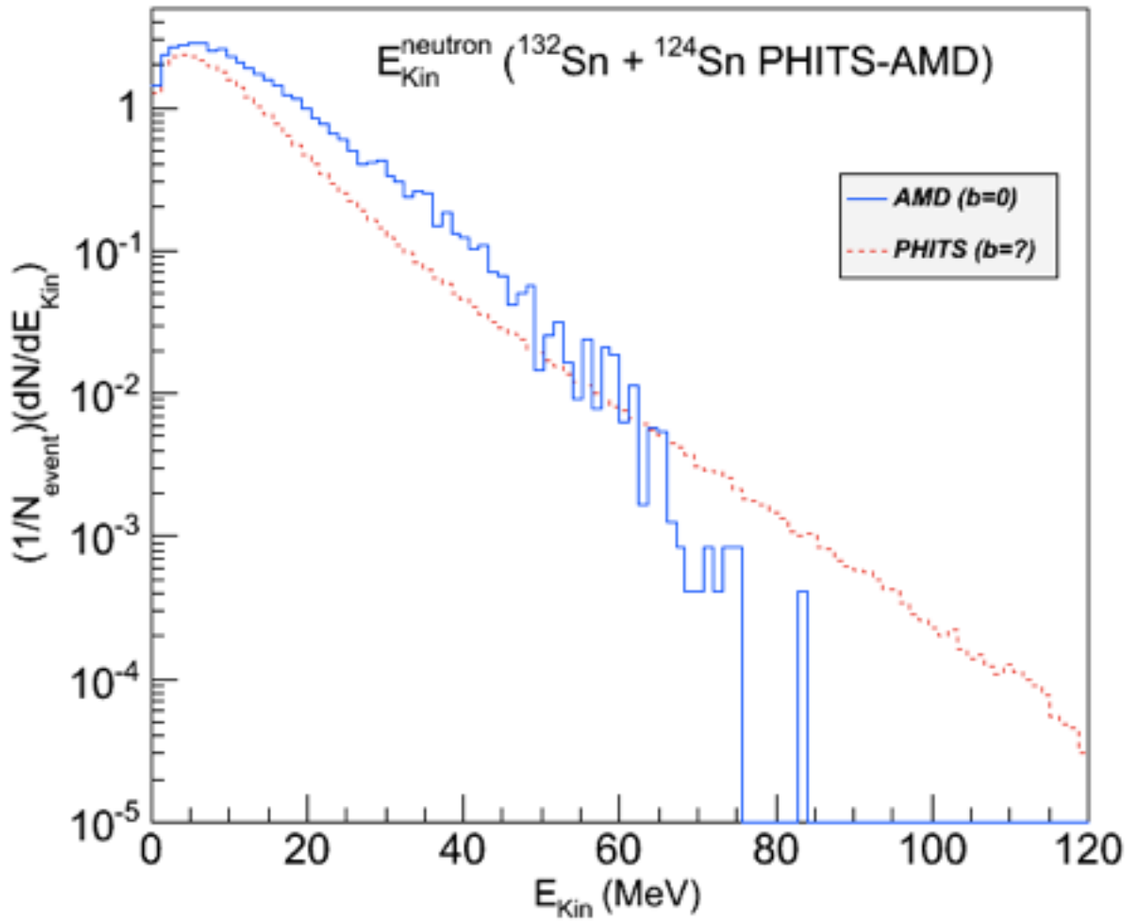
AMD&PHITS – Theta Distribution (Charged/Neutron)





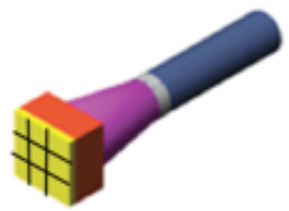
AMD&PHITS – Kinetic Energy (Charged/Neutron)



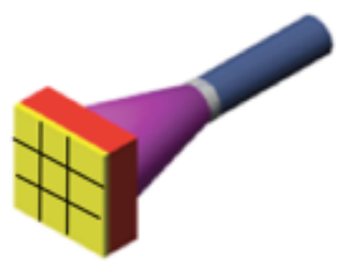


SiCsI Geometry

Total 58 detector units
($17.5^{o} < \theta_{lab} < 77.5^{o}$)
9 x 9 x 0.01 cm^3 Si (3 x 3 Pad)
9 x 9 x 5 cm^3 CsI (PMT readout)



Total 35 detector units
($78^{o} < \theta_{lab} < 150^{o}$)
15 x 15 x 0.01 cm^3 Si (3 x 3 Pad)
15 x 15 x 5 cm^3 CsI (PMT readout)

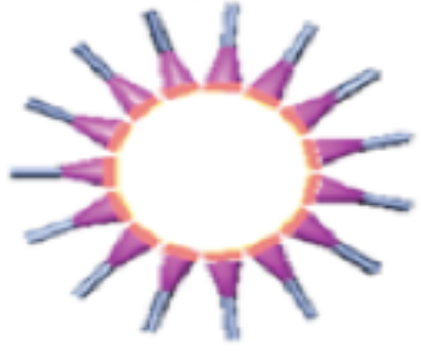


CsI(T1) cover polar angle 17.5° ~ 150°
17.5° ~ 77.5° : 4 detector pieces
(15° interval)

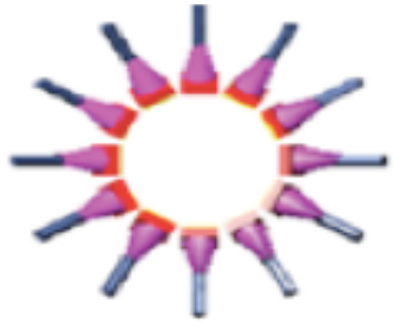
78° ~ 150° : 3 detector pieces
(24° interval)

8units **12units** **18units** **20units**
25° **40°** **55°** **70°**

15units
90°



12units
114°

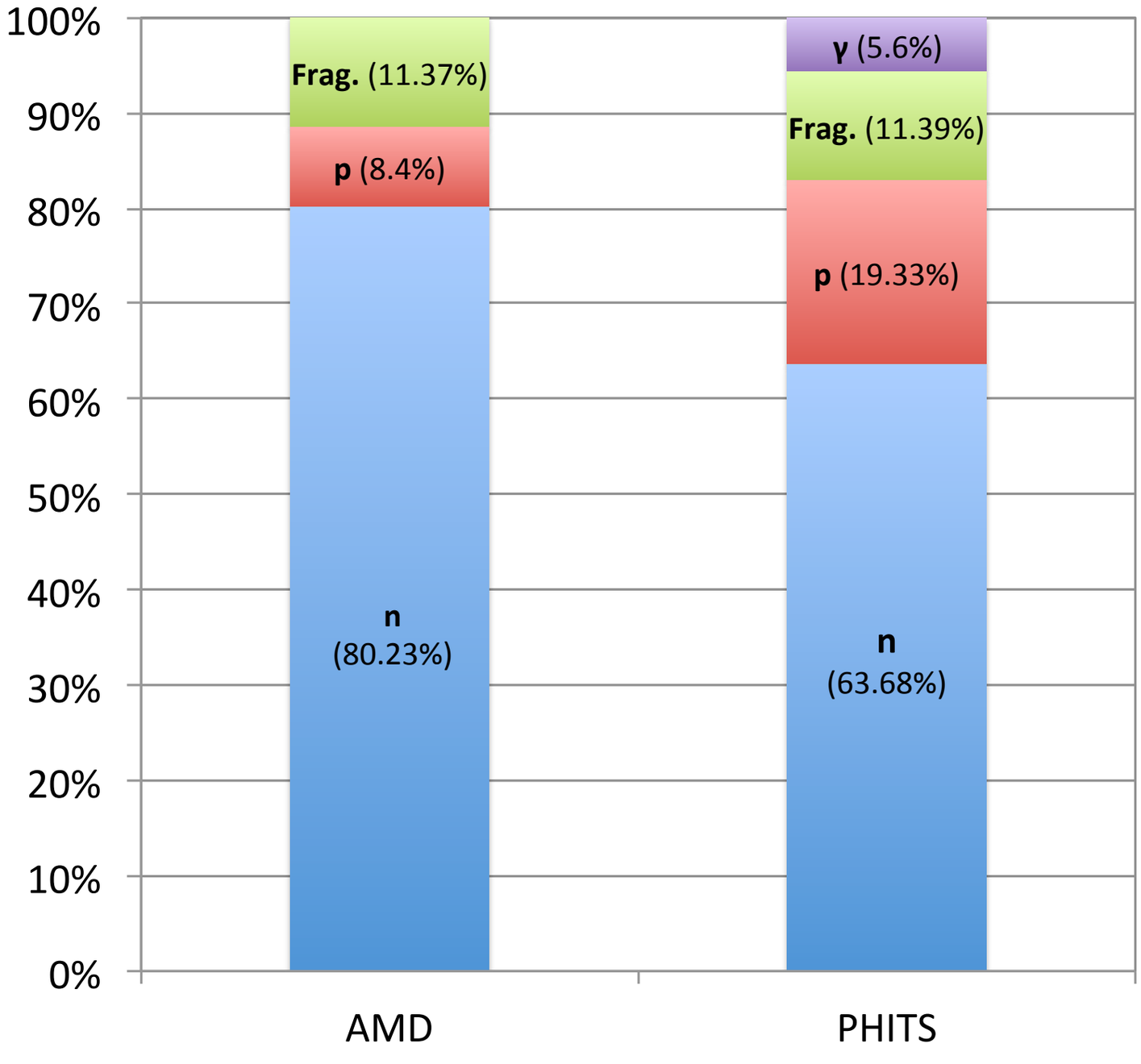


8units
138°

1st ring – change to vacuum

	N_gen(△θ)	N_det(△θ)	Det.CovRange (%) (simulation)	Det.CovRange (%) (geometrical)	# of particle/ Det.cell/event	Occupancy
1 : (17.5°<θ<32.5°)	2.67	1.53	57.25	58.43	0.191	0.0156
2 : (32.5°<θ<47.5°)	1.98	1.14	57.56	57.62	0.095	0.0077
3 : (47.5°<θ<62.5°)	1.17	1.14	66.88	67.81	0.063	0.0052
4 : (62.5°<θ<77.5°)	1.17	0.73	62.33	65.69	0.037	0.0030
5 : (77.5°<θ<102°)	1.10	0.84	76.36	79.11	0.056	0.0046
6 : (102°<θ<126°)	0.56	0.37	67.47	70.70	0.031	0.0025
7 : (126°<θ<150°)	0.25	0.14	57.03	64.35	0.018	0.0014

AMD & PHITS



AMD : $^{132}Sn + ^{124}Sn$ - (20 MeV/u)
impact parameter : b = 0
N_{event}=2010

PHITS : $^{132}Sn + ^{124}Sn$ - (18.5 MeV/u)
impact parameter : wide
N_{event}=272018