LAMPS Si-CsI Detector

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LAMPS Review

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Design of Low Energy LAMPS (LAMPS-L) Experimental Setup

^{132}Sn + ^{124}Sn @ 18.5*A* MeV

Particle and Heavy Ion Transport code System (PHITS) event

^{132}Sn + ^{124}Sn @ 20*A* MeV

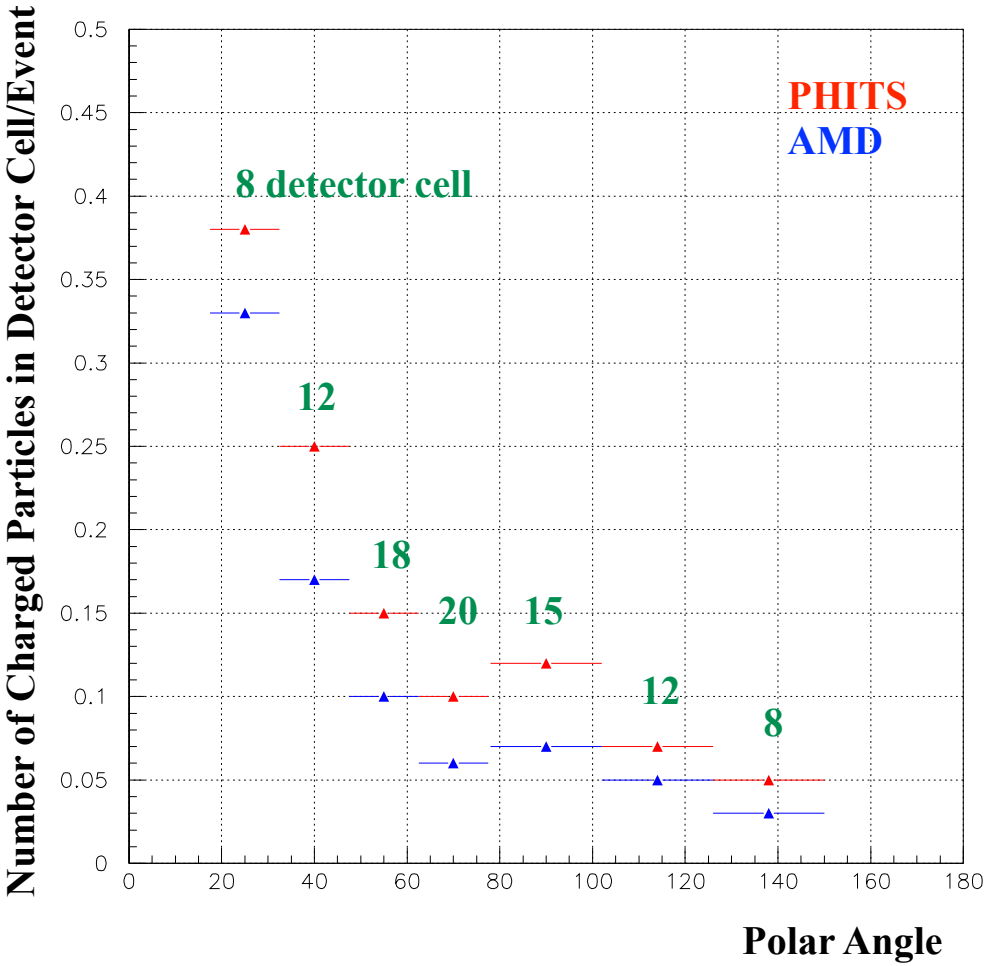
Antisymmetrized Molecular Dynamics(AMD) event

Simulation

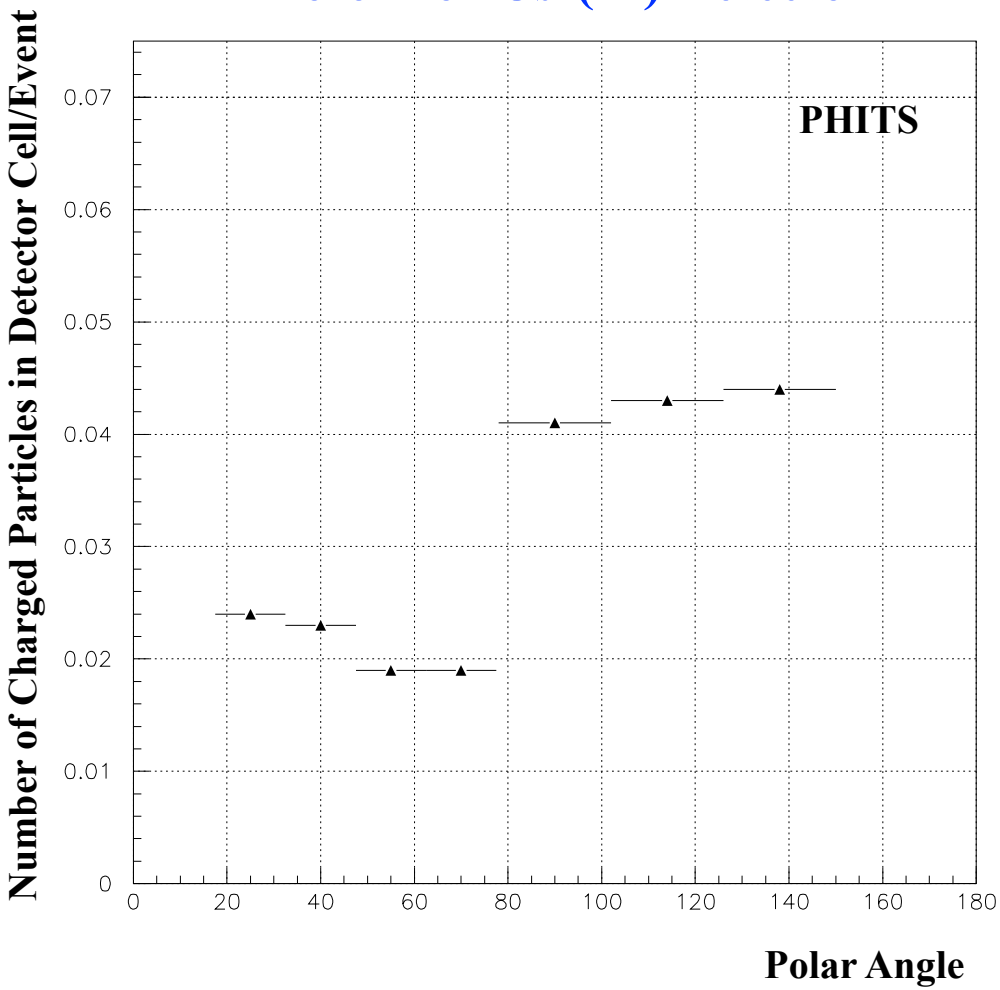
	AMD b = 0	PHITS charged particle multiplicity ≥ 26
Number of Events	N(event) = 2010	N(event) = 272018
Number of particles (per event)	<N> = 62.047	<N>=52.040
Number of Neutrons (per event)	< neutron> = 49.783 (80.23%)	< neutron>=33.138 (63.68%)
Number of Charged Particles (per event)	< charged>= 12.265 (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%)

Design of LAMPS-L Experimental Setup

Charged Particle for CsI(Tl) Detector



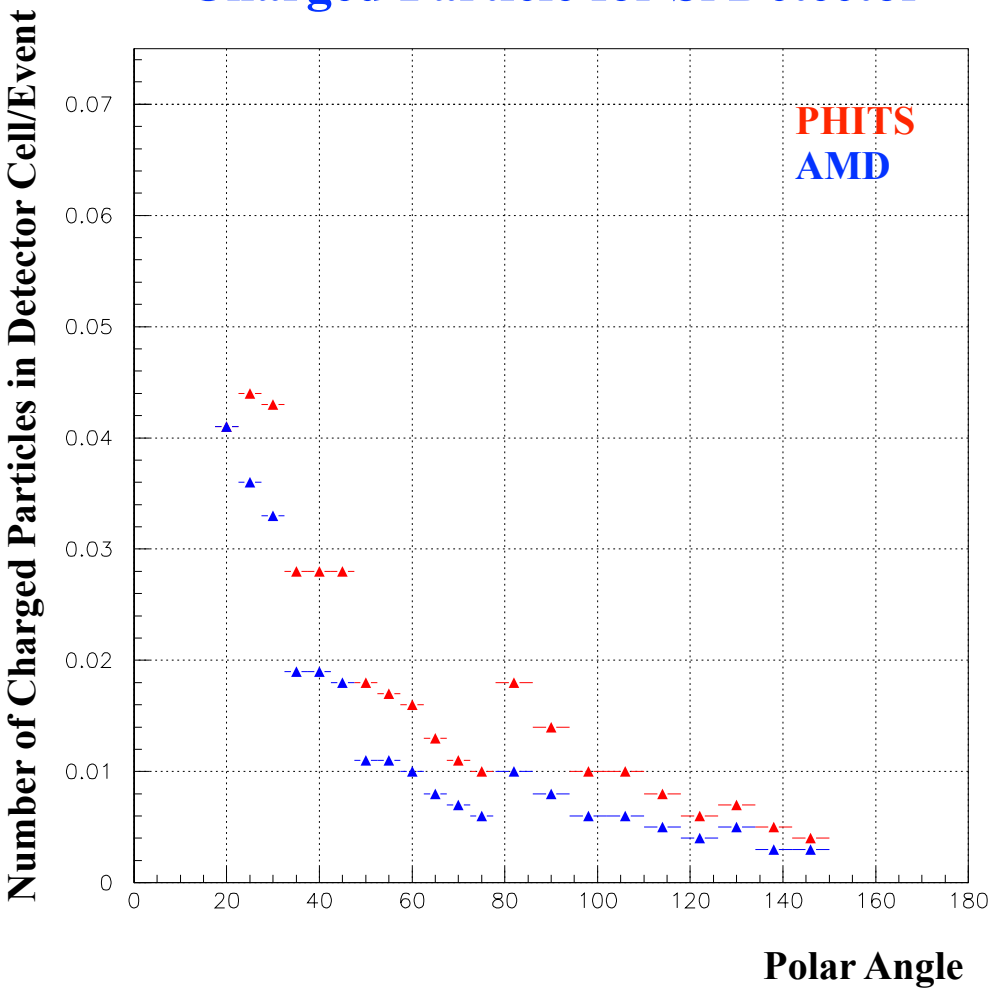
Photon for CsI(Tl) Detector



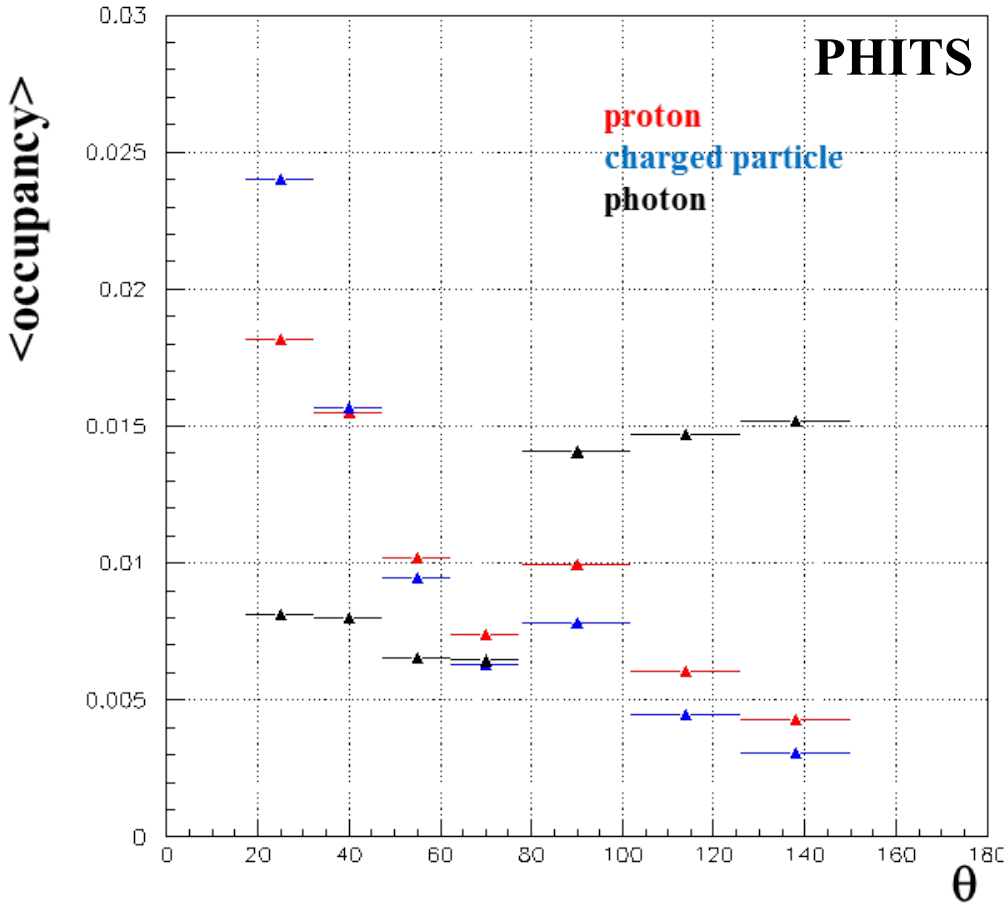
CsI(Tl) detector will cover 17.5° - 150°
From 17.5° to 77.5°: 4 detector segments 15° interval
From 78° to 150°: 3 detector segments 24° interval

Design of LAMPS-L Experimental Setup

Charged Particle for Si Detector



Divided unit CsI(Tl) polar angle coverage into 3

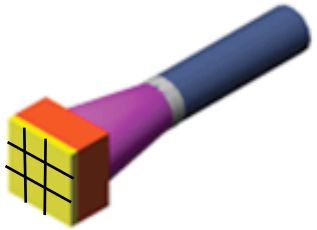


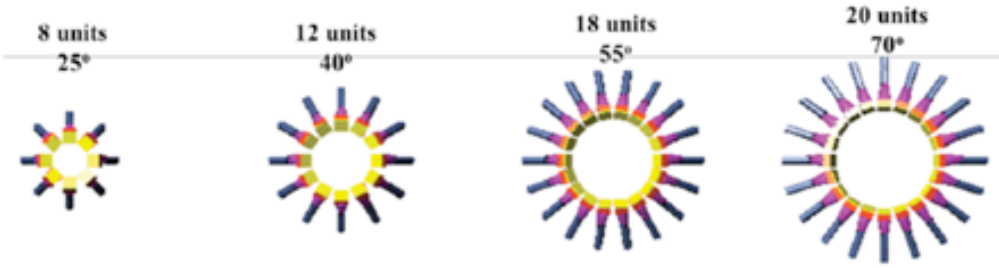
Si-CsI detector unit coverage of polar angle tuned to be <occupancy> < 0.1

Same simulation has been done for neutron detector

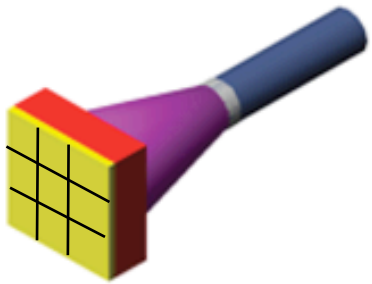
LAMPS-L Si-CsI Detector Design

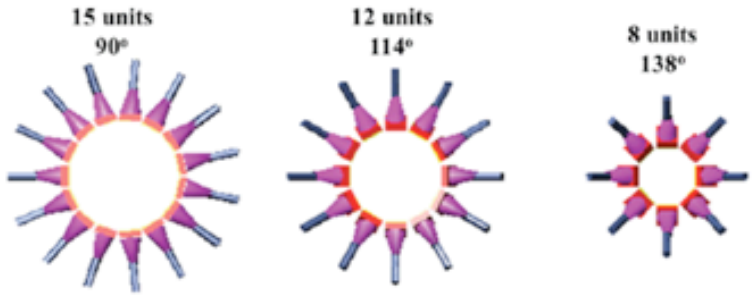
Total 58 detector units
($17.5^o < \theta_{lab} < 77.5^o$)
9 x 9 x 0.01 cm^3 Si (3 x 3 Pad)
9 x 9 x 5 cm^3 CsI (PMT readout)





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)





GEANT4 Simulation is going on

Si-CsI detector:

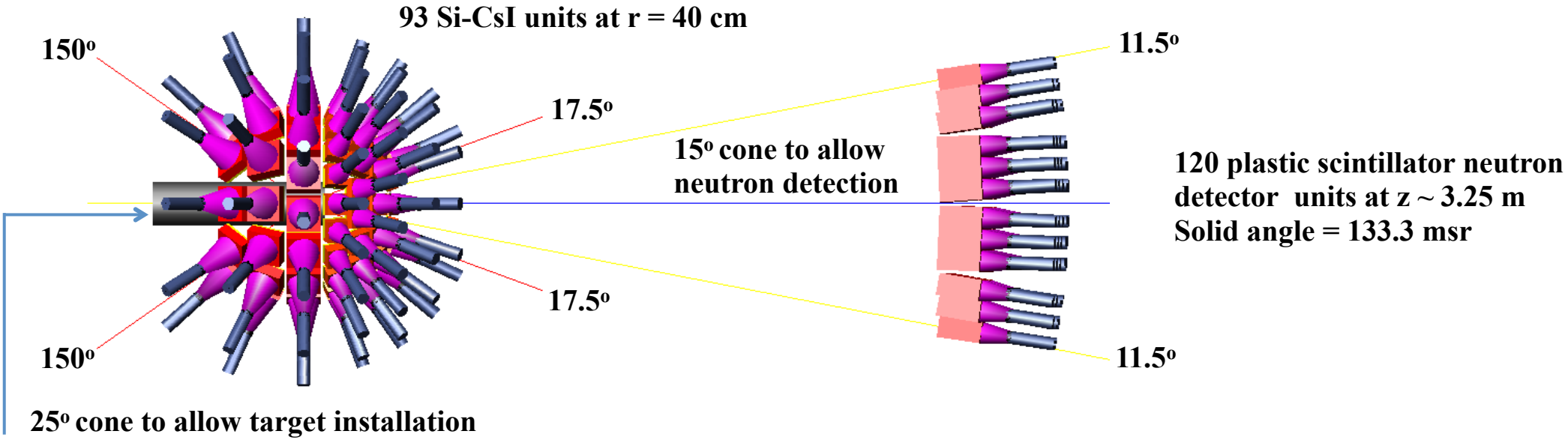
(ΔE-E technique for charged particle measurement as well as γ measurement)

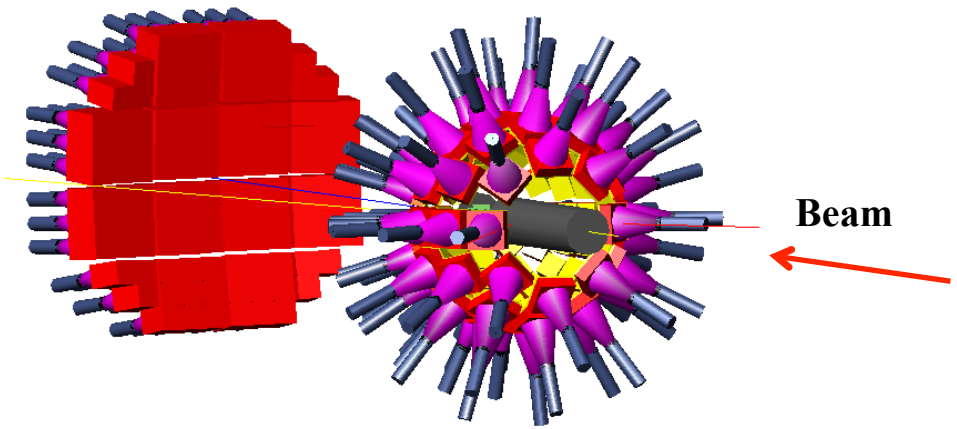
- **Energy resolution from simulation study**
  - **Si: 0.5% of FWHM**
    (Energy resolution < 2% required for charged particle)
  - **CsI: 2.0% of FWHM**
    (Energy resolution < 5% required for max. 30 MeV γ-ray)

LAMPS-L Experimental Setup

$E_{beam} < 18.5A$ MeV

For GDR Experiments (to test PDR measurements as well)





Example:

^{50,54}Ca, ^{68,70,72}Ni, ^{106,112,124,130,132}Sn RI beam

+ ^{197}Au/^{208}Pb (stable target)

+ ^{12}C/no target (background control)

❖could be possible from ISOL

LAMPS-L Experimental Setup

$E_{beam} < 18.5A$ MeV

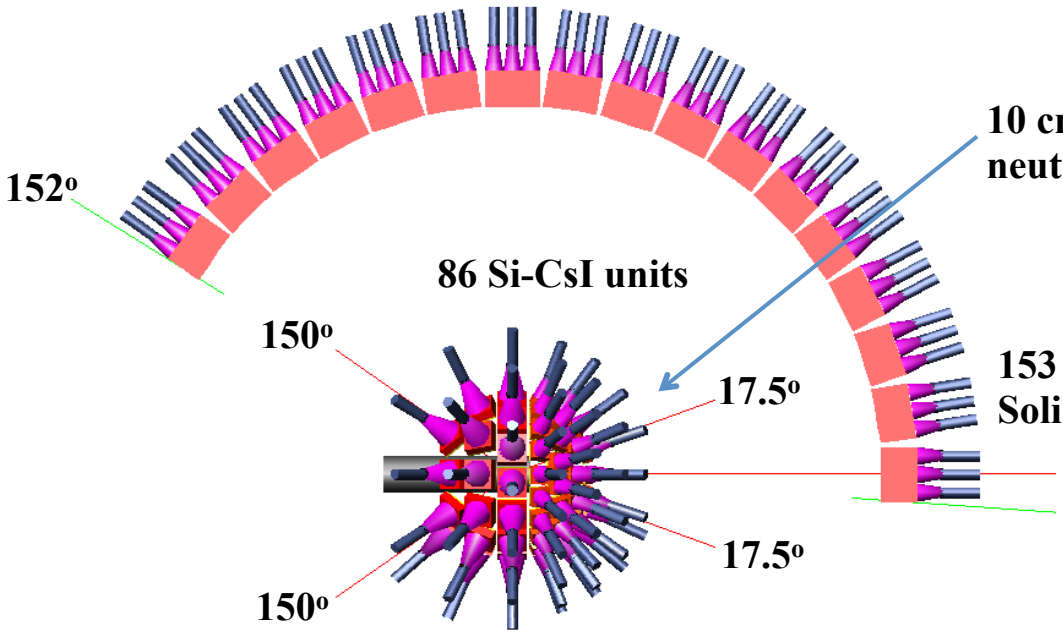
For Heavy-Ion Collision Experiments

Example:

^{50,54}Ca, ^{68,70,72}Ni, ^{106,112,124,130,132}Sn RI beam

+ ^{40}Ca, ^{58}Ni, ^{112,118,124}Sn stable target

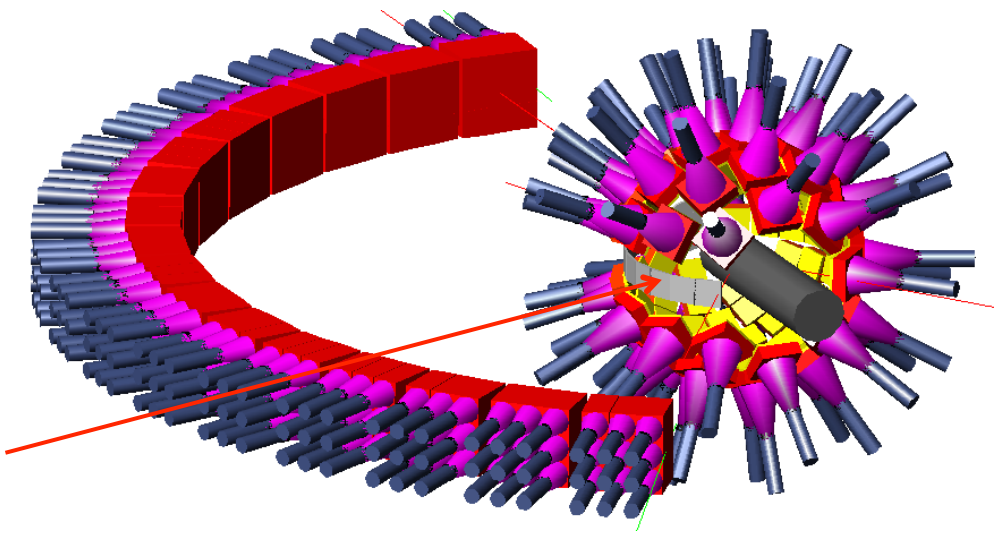
❖could be possible from ISOL



10 cm wide window to allow neutron detection along equator

153 neutron detector units at r = 2.0 m
Solid angle = 382.5 msr

- 4.0°



10 cm wide window to allow neutron detection along equator

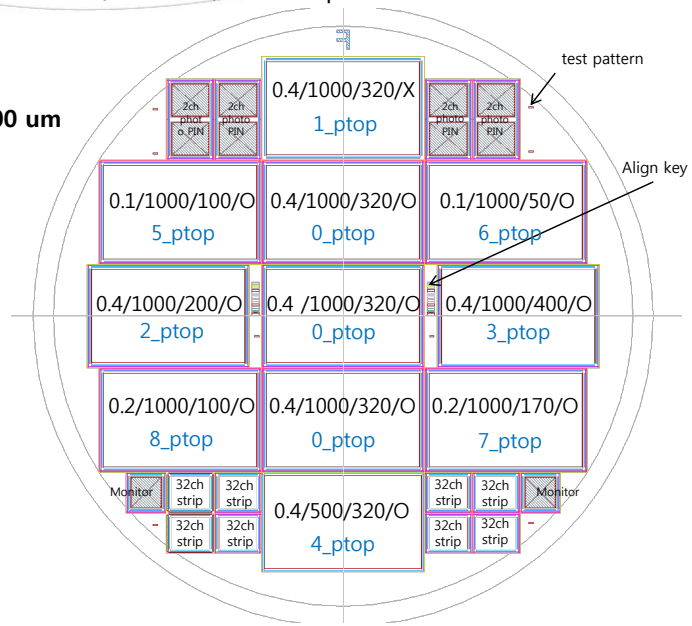
LAMPS Si-CsI Detector R&D

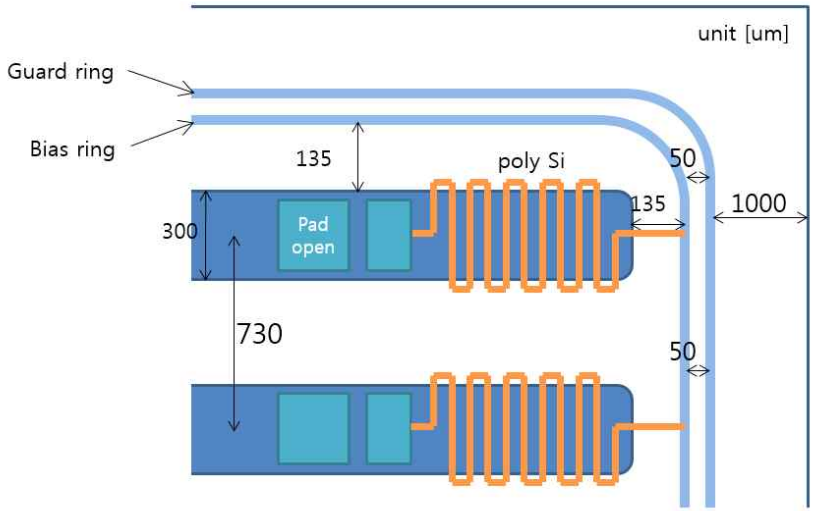
Si detector: R&D with Kyungpook National University

CsI detector: 1st prototype in preparation

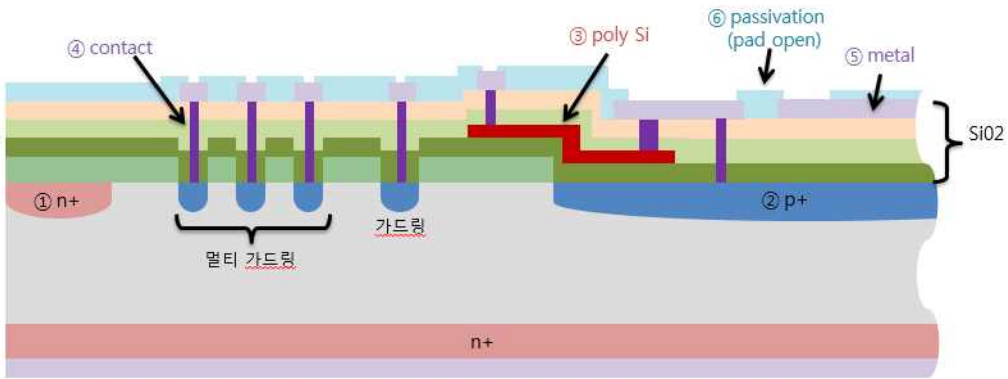
Implant width / Strip pitch /guard-ring distance/Al width/field shaper

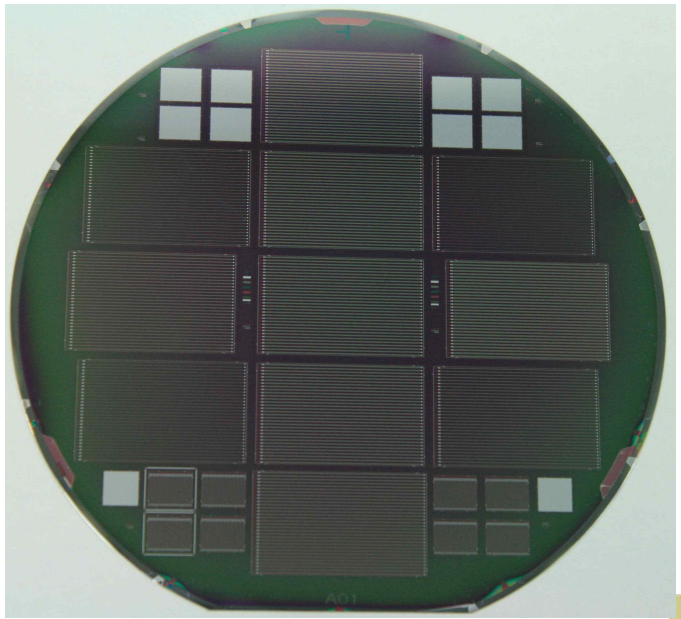
- **32 ch**
  Thickness of wafer = 400 um
  Sensor pitch = 730 um





공정 순서
1. n-channel stop
2. p+ implant
3. poly Si
4. contact
5. metal
6. pad open

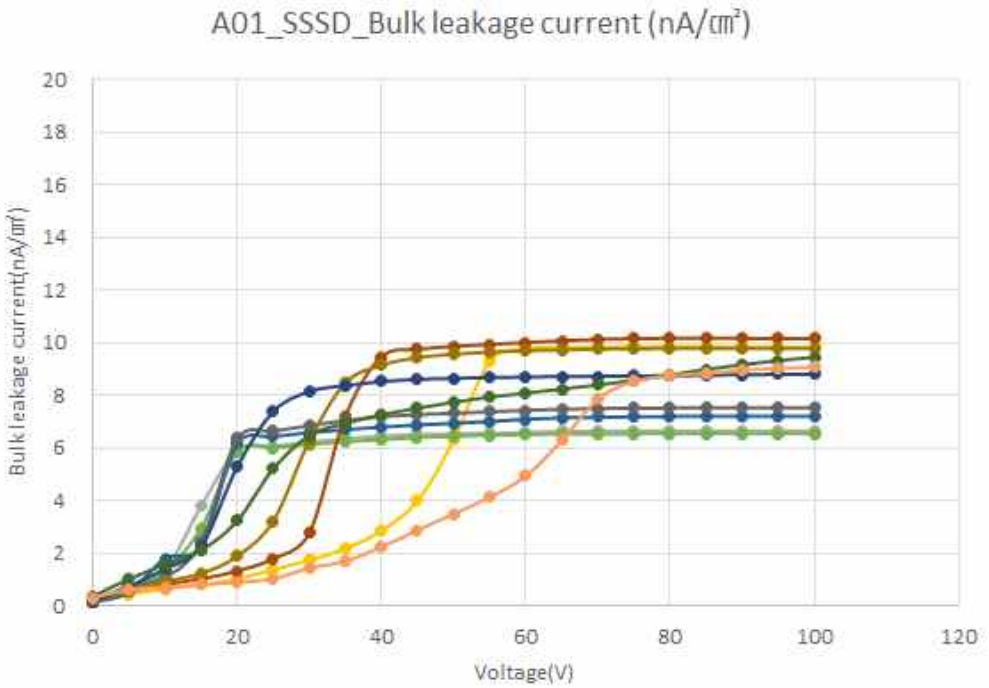


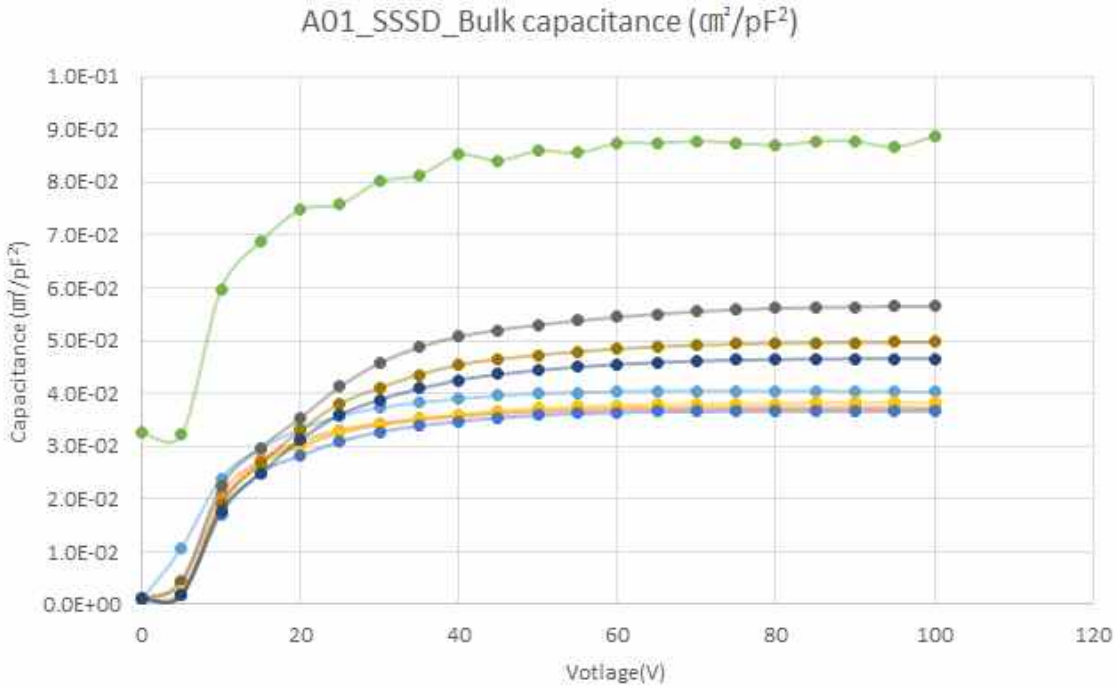


LAMPS Si-CsI Detector R&D

Si detector: R&D with Kyungpook National University

CsI detector: 1st prototype in preparation

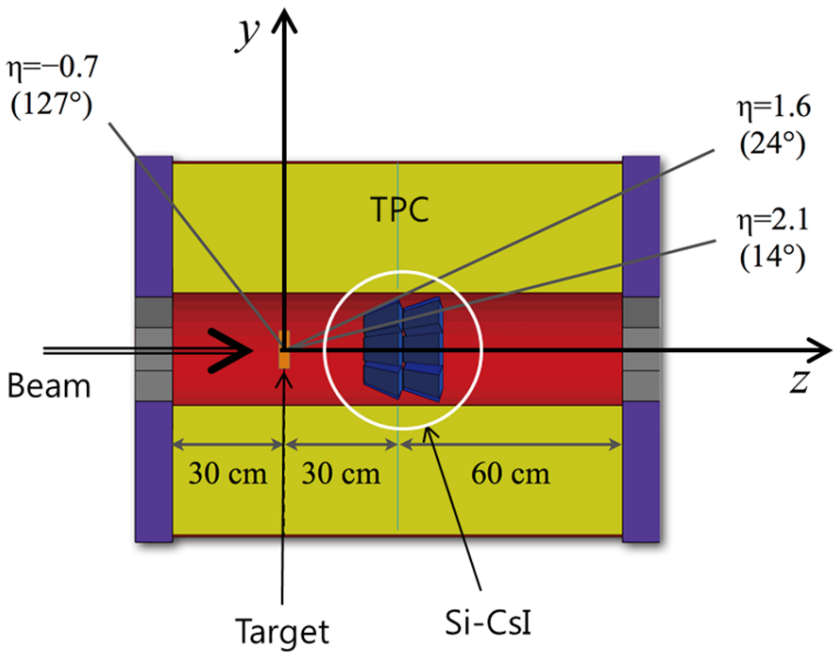


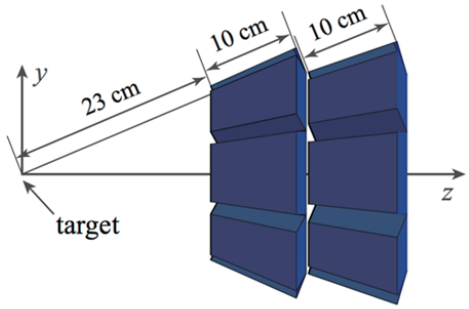


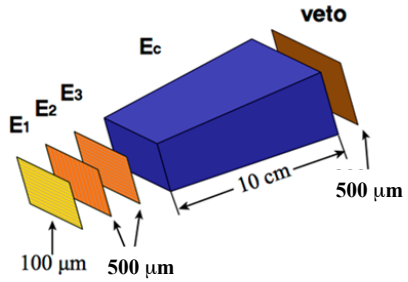
Plan for Si-CsI detector R&D

- -Develop back-thinning process (for 100μm)
- -SSSD test with beam
- -Pad Si sensor R&D
- -Readout electronics with APV or VAchip R&D
- -Test different CsI(Tl) crystals (Saint-Gobain & Amcrys)

LAMPS-H Si-CsI Detector (future upgrade)





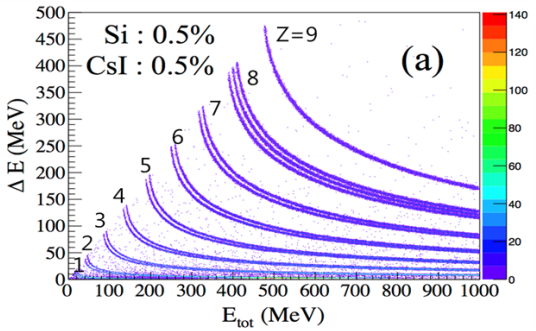


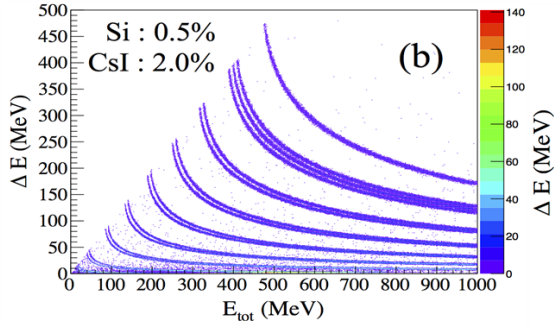
350 msr each		size (mm^2)
inner ring (14° - 19°)	front	66.80 × 26.20
	rear	86.92 × 37.84
outer ring (19° - 24°)	front	62.09 × 20.08
	rear	89.17 × 28.84

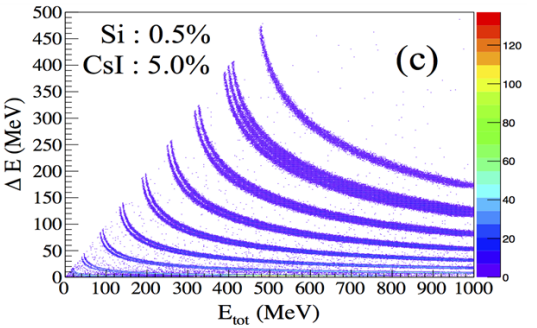
Si-CsI module

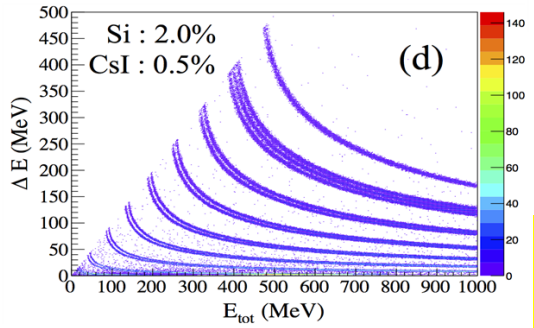
Si: 2 x 8 pad readouts

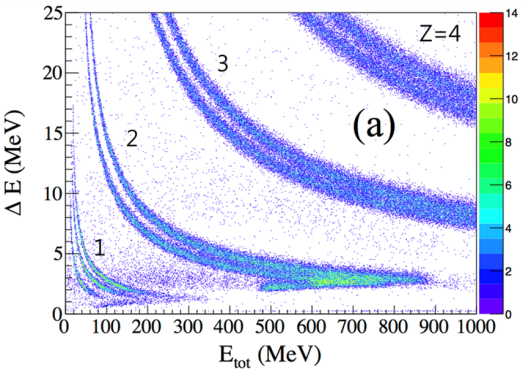
CsI: 4 x 4 APD readouts

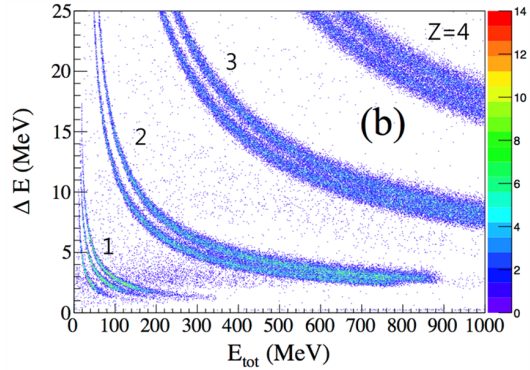








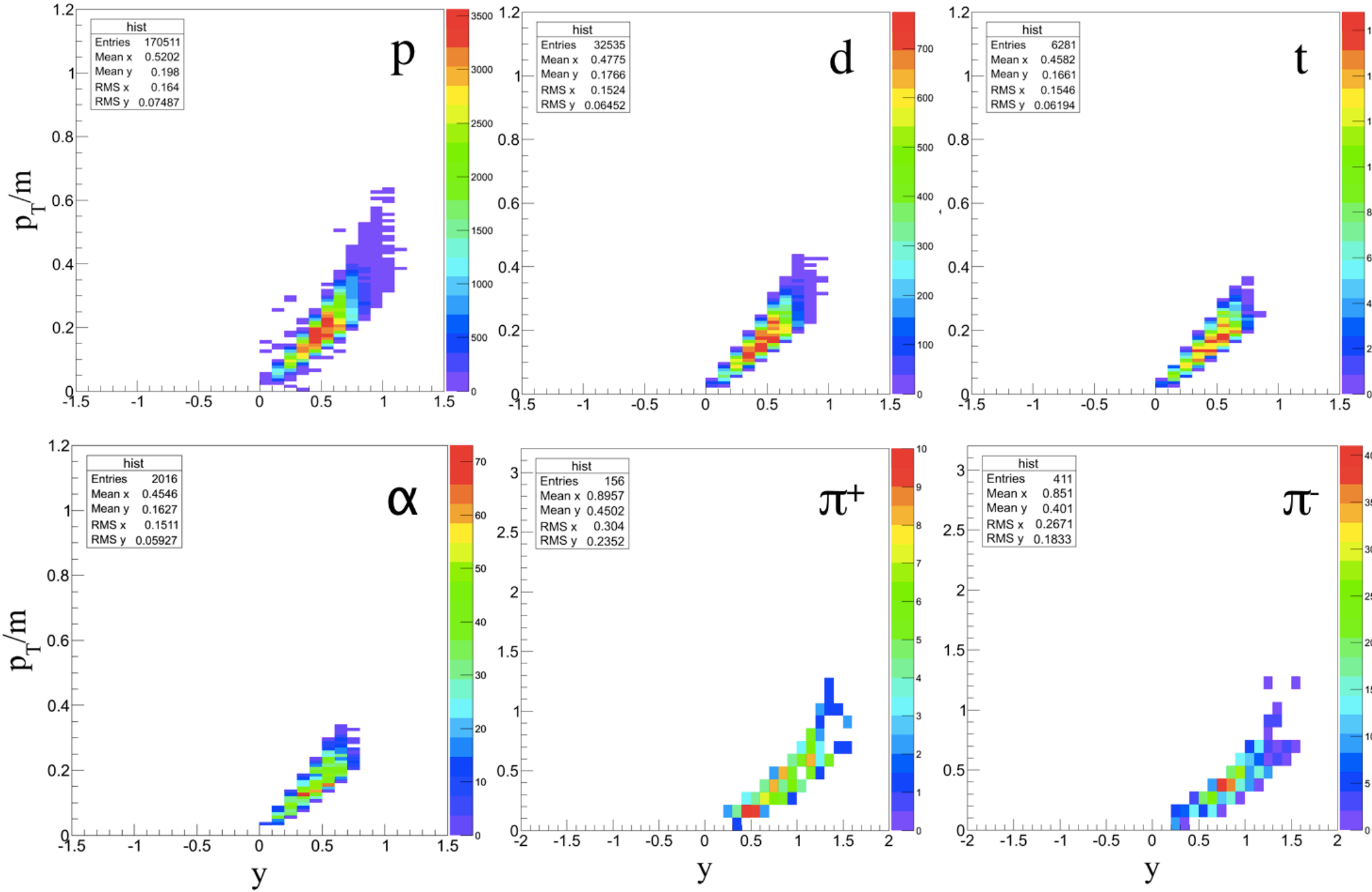




veto Si detector can clean up unexpected correlation

Based on IQMD Au+Au@250*A* MeV & GEANT4 Simulation

LAMPS-H Si-CsI Detector Acceptance



Input: IQMD Au+Au @ 250*A* MeV

Thank for your attention!