A Brief introduction of backsplash study inside HerdSoftware

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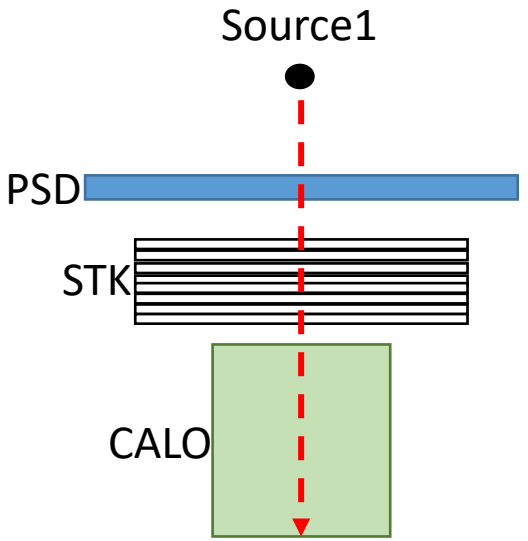
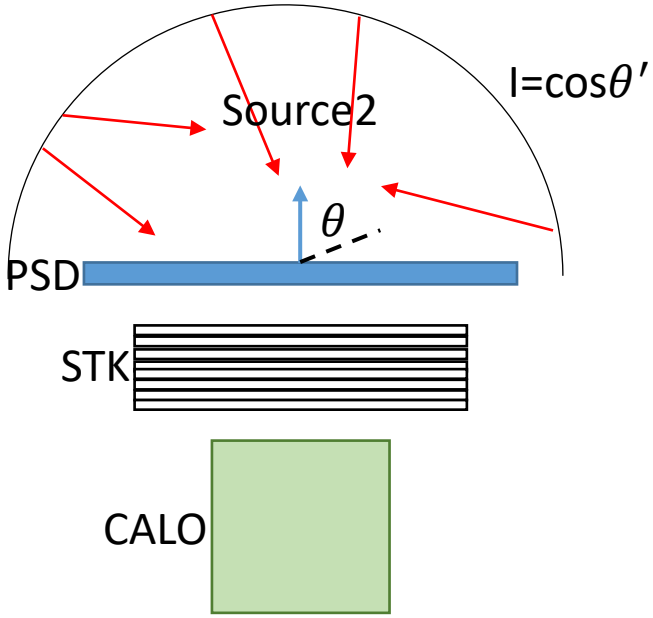
Simulation Setup

➢Geomerty

- top psd thickness = 1cm
- caloTopStkDistance = 12cm
- topPsdTopStkDistance = 12cm
- all sub-detectors are activated





➢Particle

1. Gamma: vertical incidence towards Calo center, energy from 500MeV to 50GeV
2. Gamma: identical intensity within top psd acceptance(theta from 90-180 deg relative to top psd normal), energy from 500MeV to 50GeV

➢Physics_list

FTFP_BERT(Default)

PSD geometry used

- We have simulated the tile option with small tiles (1x1 cm) and than we have group the tiles together to get different bigger tiles or bars

Trigger Defintion

HARDWARE TRIGGER

CaloCell_Fire_Threshold > 1/3 LYSO MIP
Shell_Trig_Threshold > 350MeV
Core_Trig_Threshold > 10GeV

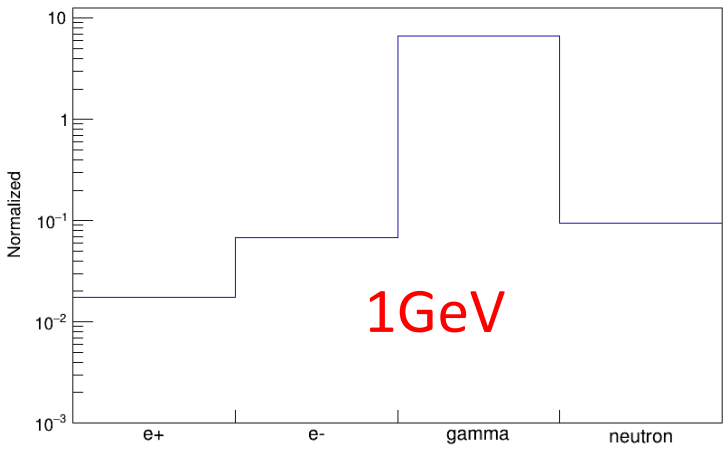
LOGICAL TRGGER

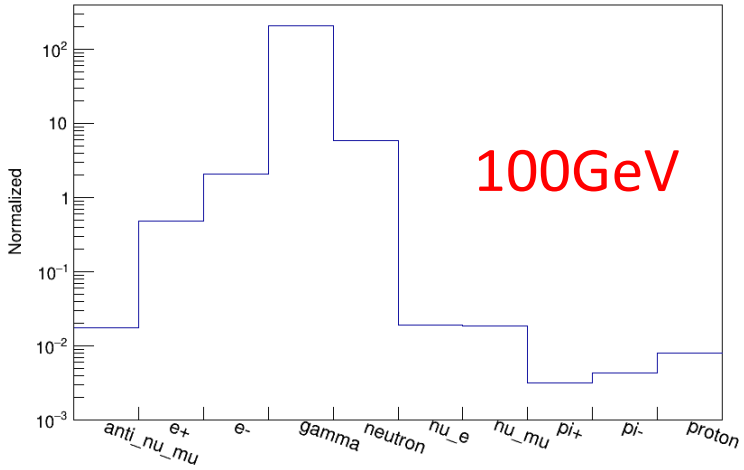
LE_Trig=Shell_Trig&&(!Veto)
HE_Trig=Core_Trig

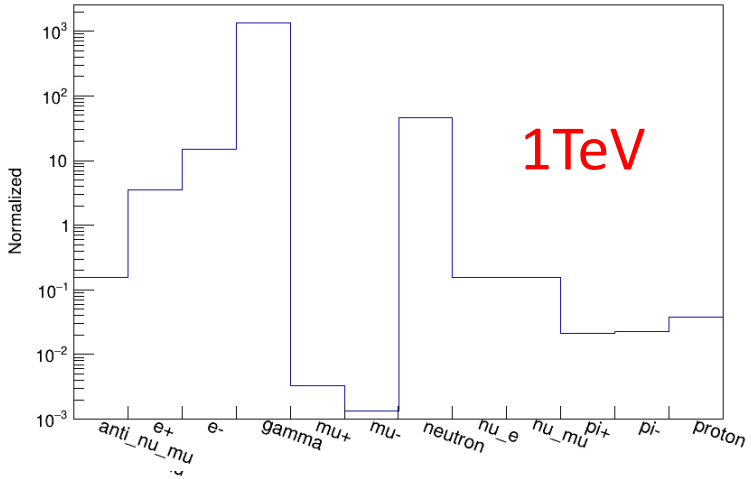
Veto (from PSD): assume that we can find the hit cell with 100% efficiency to give a veto signal (threshold=1/3 MIP)

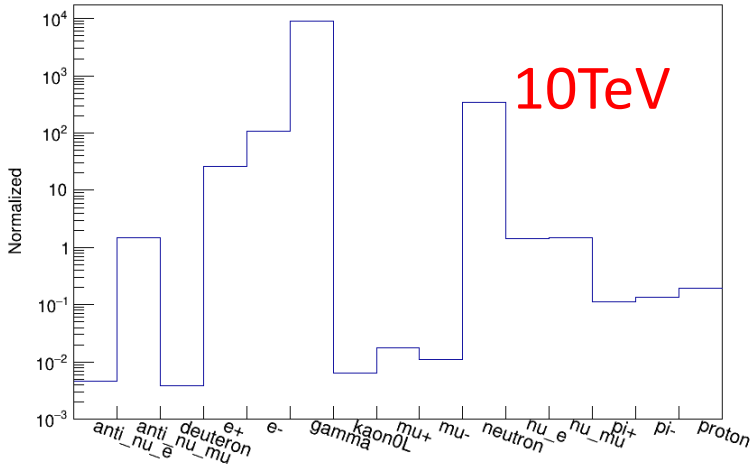
Back Splashed Particle

Source2





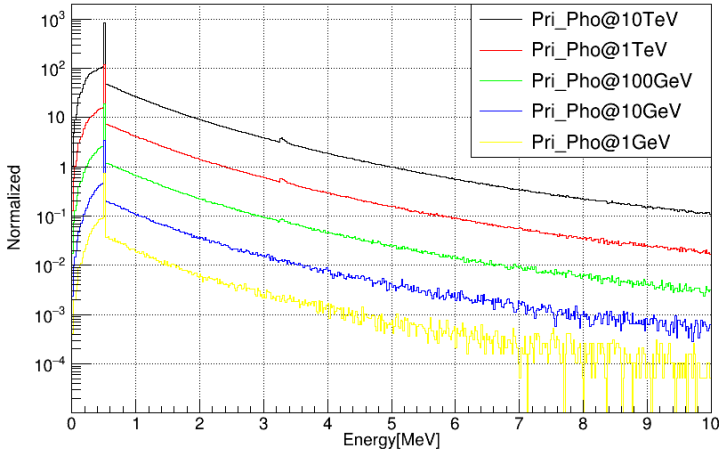




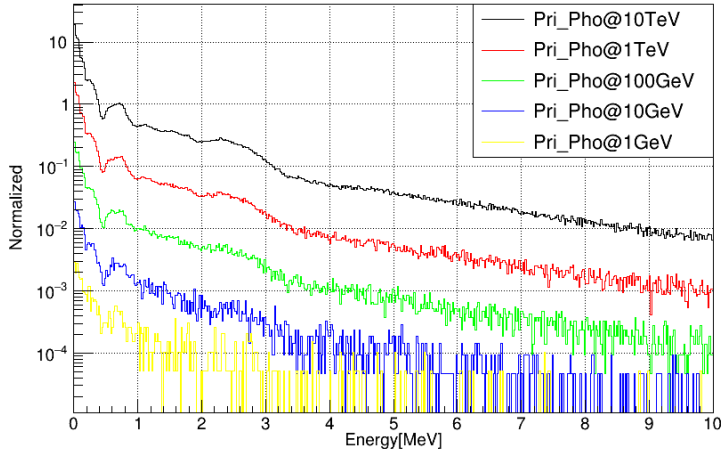
- Include only those events which cross psd and have a Shell Trigger or Core Trigger
- The main components of back splashed particle are gamma+neutron(netural) and e-/e+(charged)

Back Splashed Particle

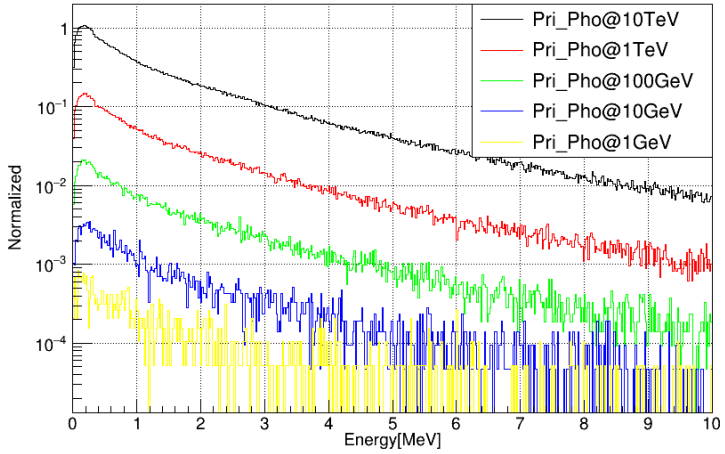
Source2



Back Splashed
Gamma



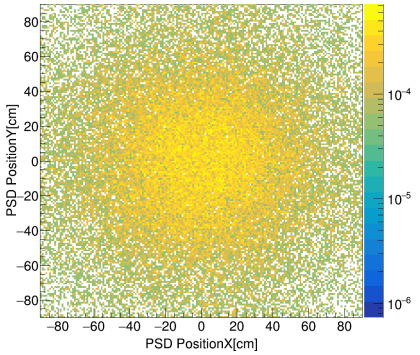
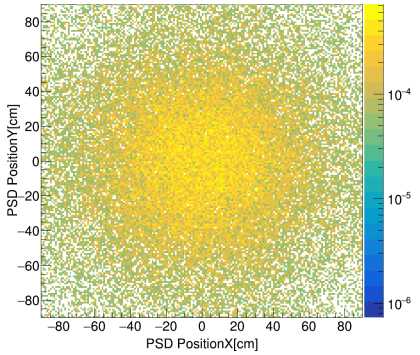
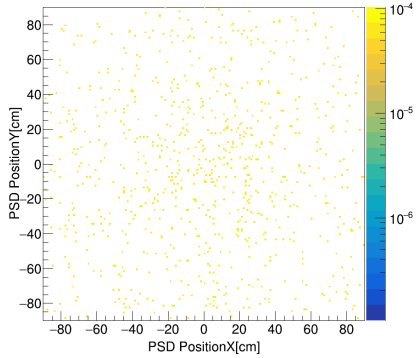
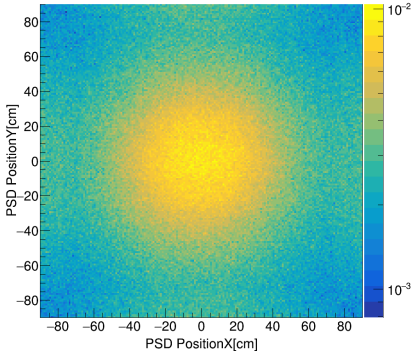
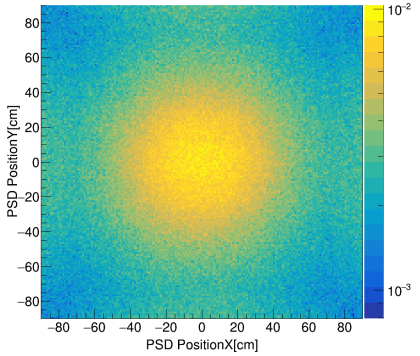
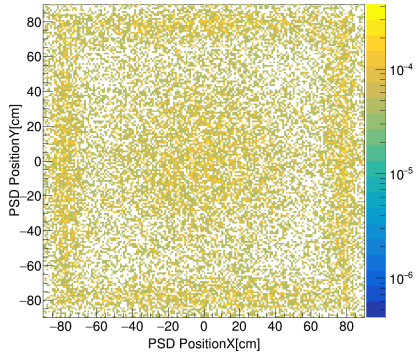
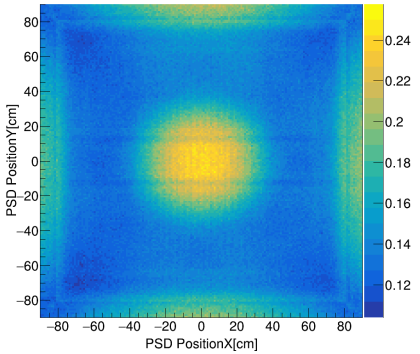
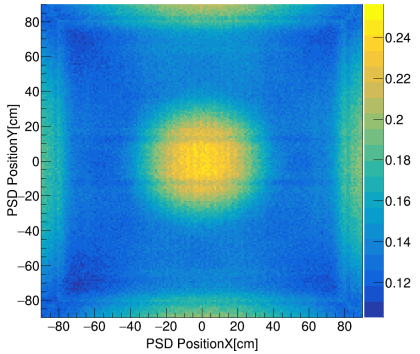
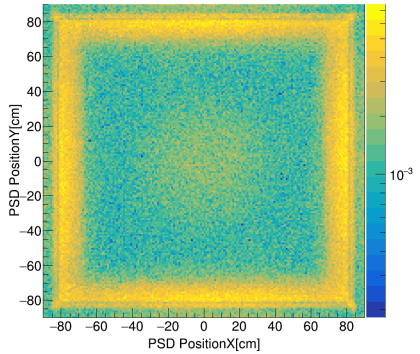
Back Splashed
Neutron

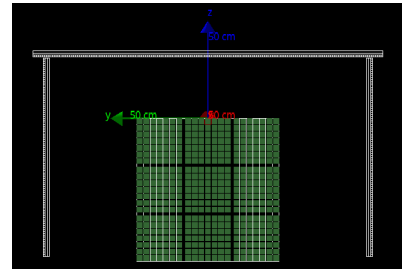


Back Splashed
Electron+Positron

Back Splashed Particle

Source2

	ALL Particle	Gamma&Neutron	Electron&Positron
Primary Photon @1GeV			
Primary Photon @100GeV			
Primary Photon @10TeV			



The square shaped feature is due to particle interactions in the STK and psd geometry

Event Analysis

- For better comparison between two different source environments, the following definition are used:

$$MisVetoRatio = \frac{N_{[Cross\_psd\&\&(Shell\_Trig||Core\_Trig)\&\&Veto]}}{N_{[Cross\_psd\&\&(Shell\_Trig||Core\_Trig)]}}$$

CaloCell_Fire_Threshold > 1/3 LYSO MIP
Shell_Trig_Threshold > 350MeV
Core_Trig_Threshold > 10GeV

$$TotalTrigEff = \frac{N_{[Cross\_psd\&\&(LE\_Trig||HE\_Trig)]}}{N_{[Cross\_psd\&\&(Shell\_Trig||Core\_Trig)]}}$$

LE_Trig=Shell_Trig&&(!Veto)
HE_Trig=Core_Trig

$$PIDEff = \frac{N_{[Cross\_psd\&\&(Shell\_Trig||Core\_Trig)\&\&(!Veto)]}}{N_{[Cross\_psd\&\&(LE\_Trig||HE\_Trig)]}}$$

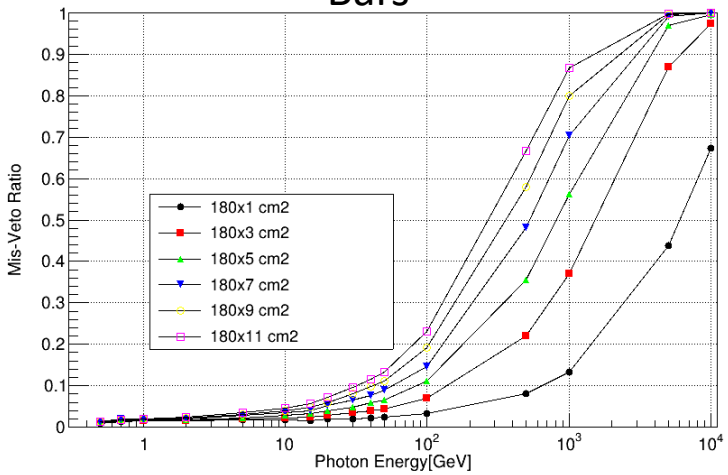
- PSD Trigger Mode: assume that we can find the hit cell with 100% efficiency to give a veto signal (threshold=1/3 MIP)

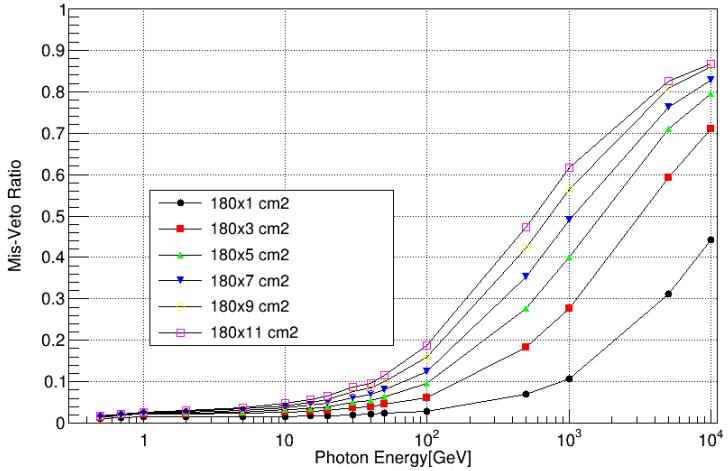
Mis-Veto Ratio

Vertical Incidence – source 1

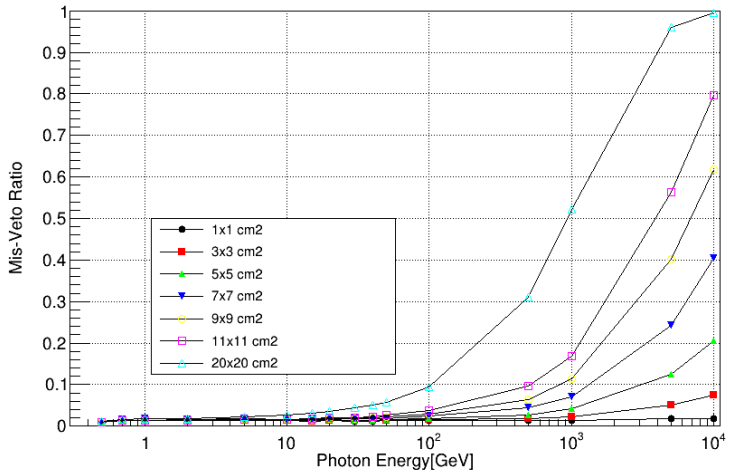
Identical Intensity – source 2

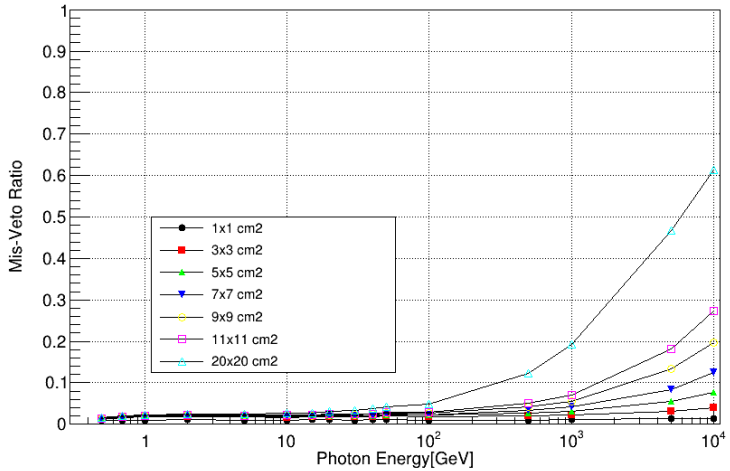
Bars





Tiles





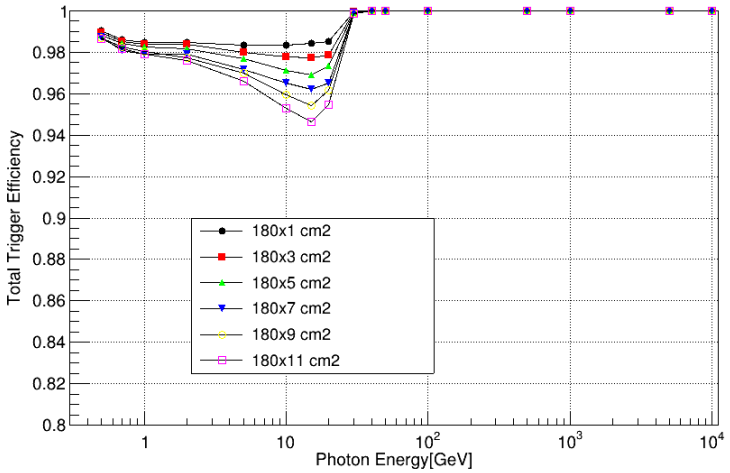
- For identical intensity source, the Mis-Veto Ratio will be better than vertical incidence(because less particle have sufficient shower development OR most particle hit position is off center)
- For both sources, tile option will have a significant suppression of Mis-Veto

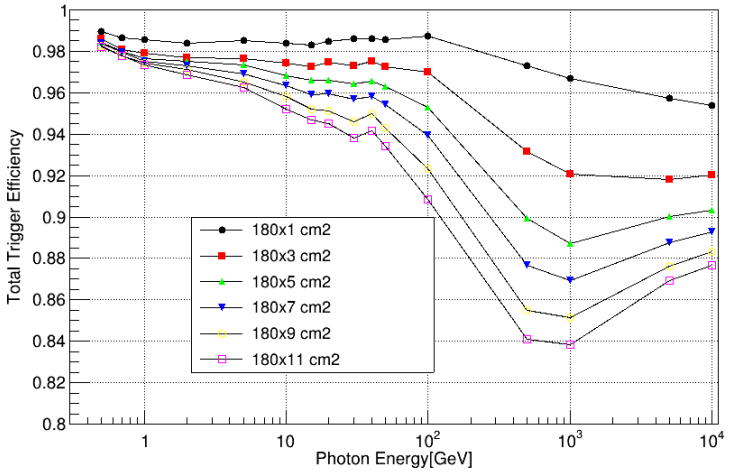
Total Trigger Efficiency

Vertical Incidence – source 1

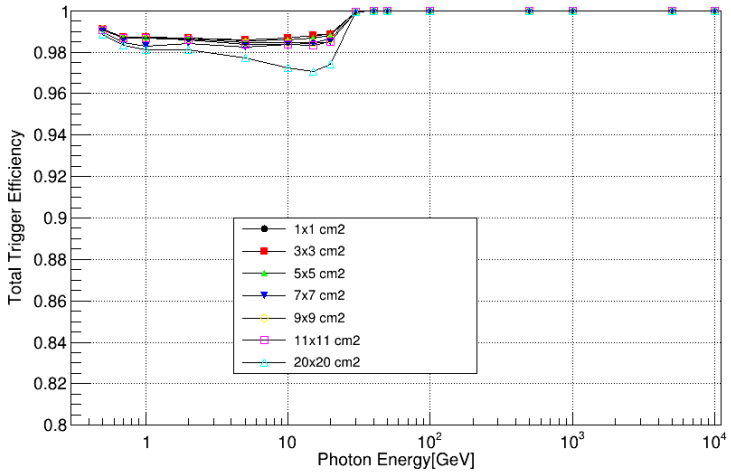
Identical Intensity – source 2

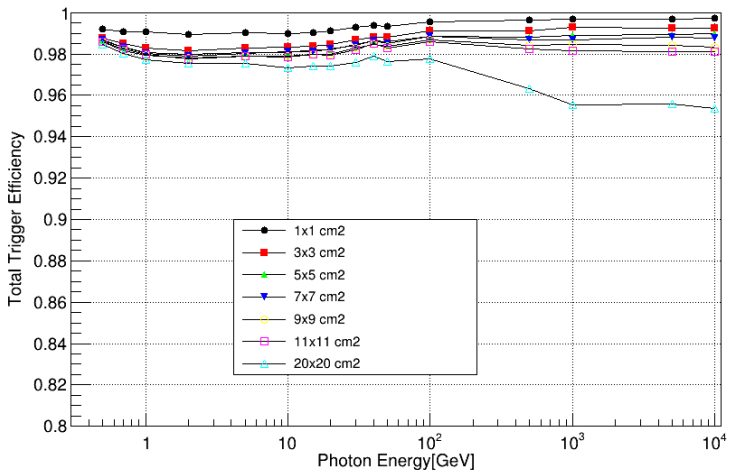
Bars





Tiles





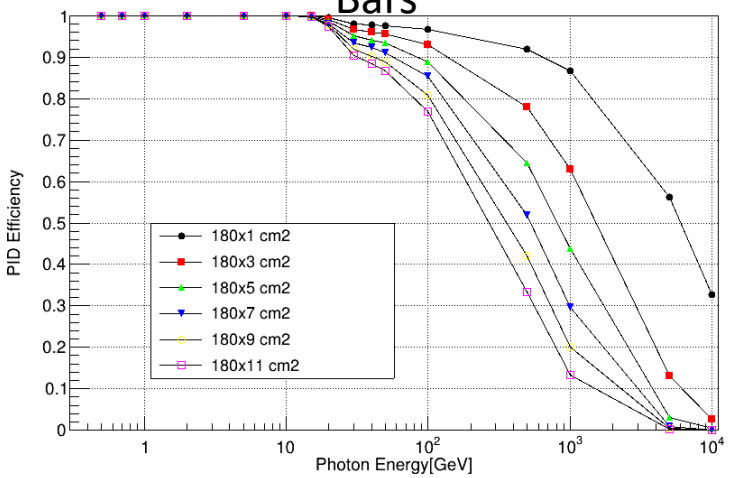
- For vertical incidence, tile or bar option almost have no difference in total trigger efficiency, but for identical intensity source, bar option will lose more than 10% efficiency above 100GeV

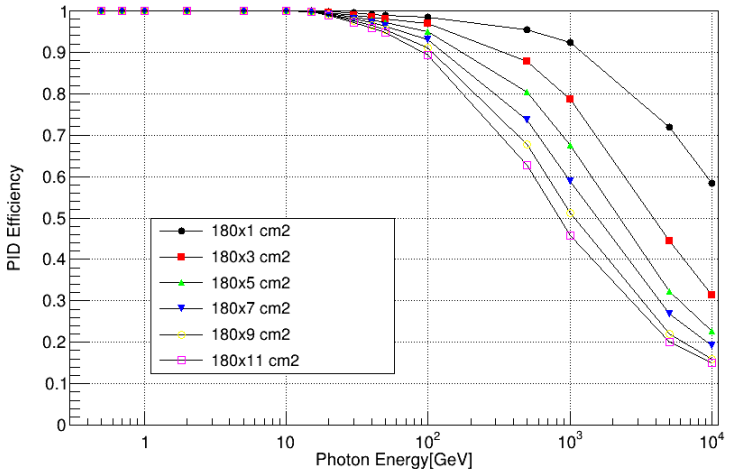
PID Efficiency

Vertical Incidence – source 1

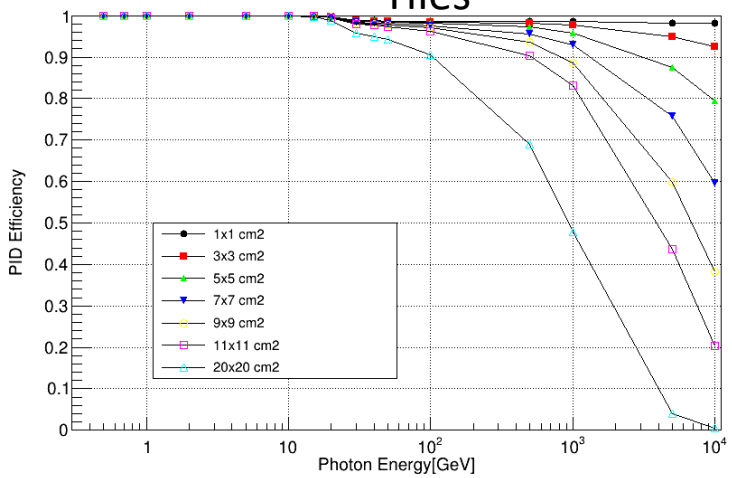
Identical Intensity – source 2

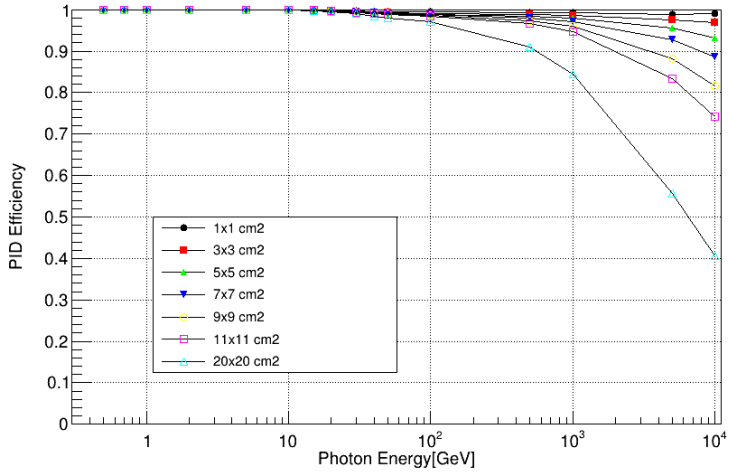
Bars





Tiles





- For both sources, bar option will have a sharp decrease in PID efficiency above 100GeV