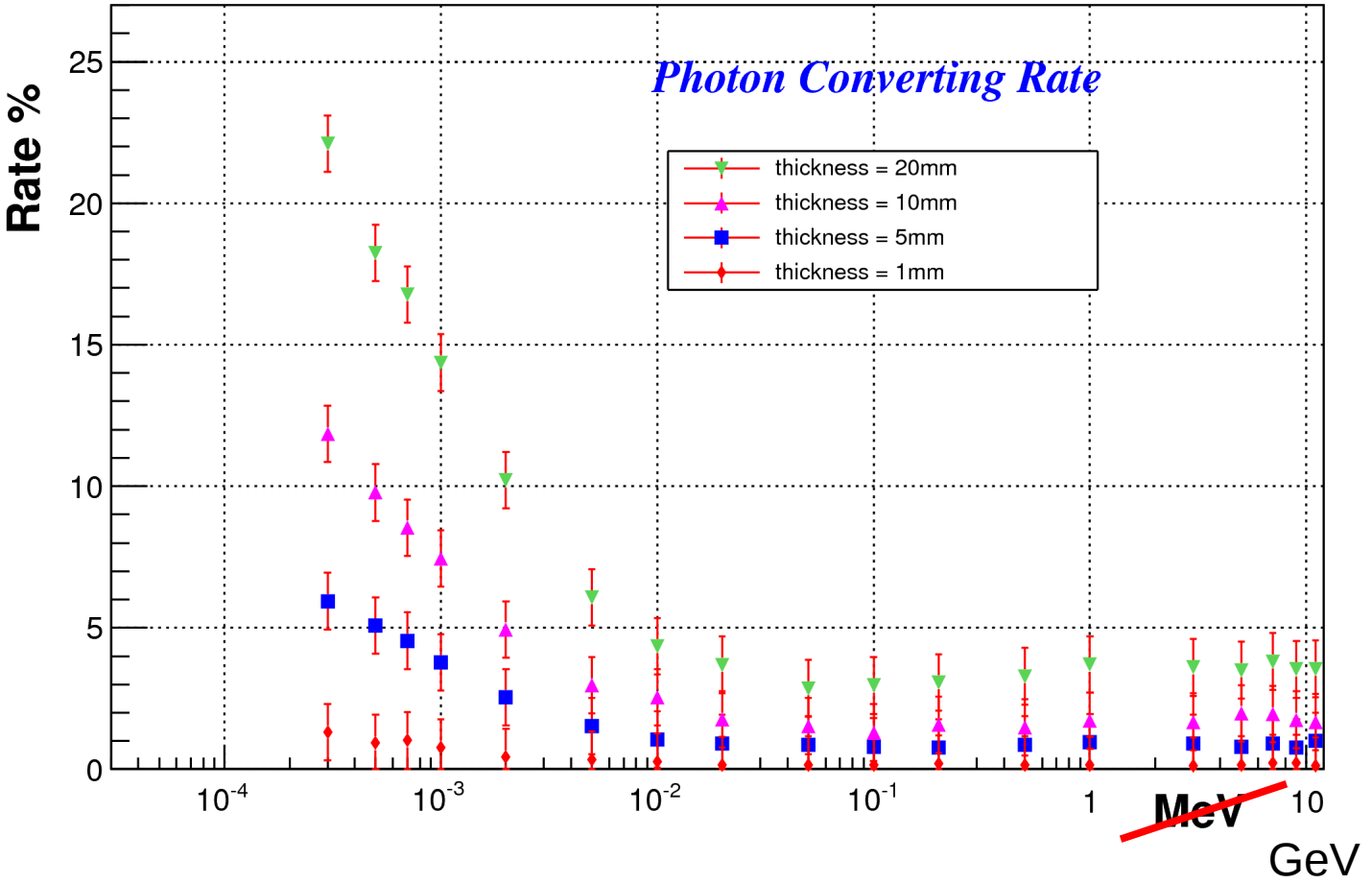
SPD Segmentation

A Learn and double check to Zhihong's Work

Xinzhan Bai

Ratio of Incident Photon that induced Electron in SPD

With a photon particle Gun (Not from Background):



$$\frac{number\ of\ incident\ \gamma\ that\ induced\ electron}{total\ number\ of\ incident\ \gamma}$$

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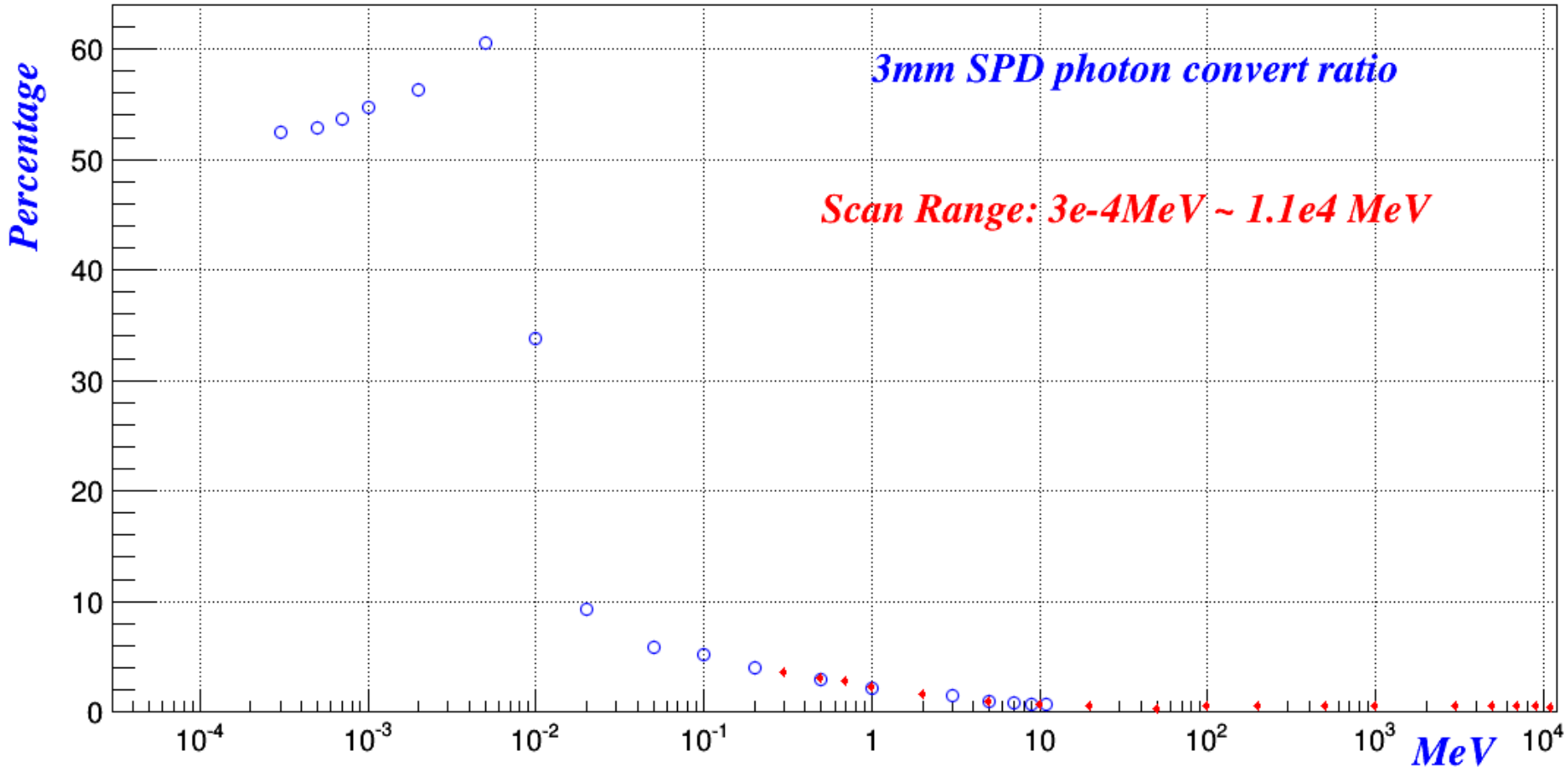


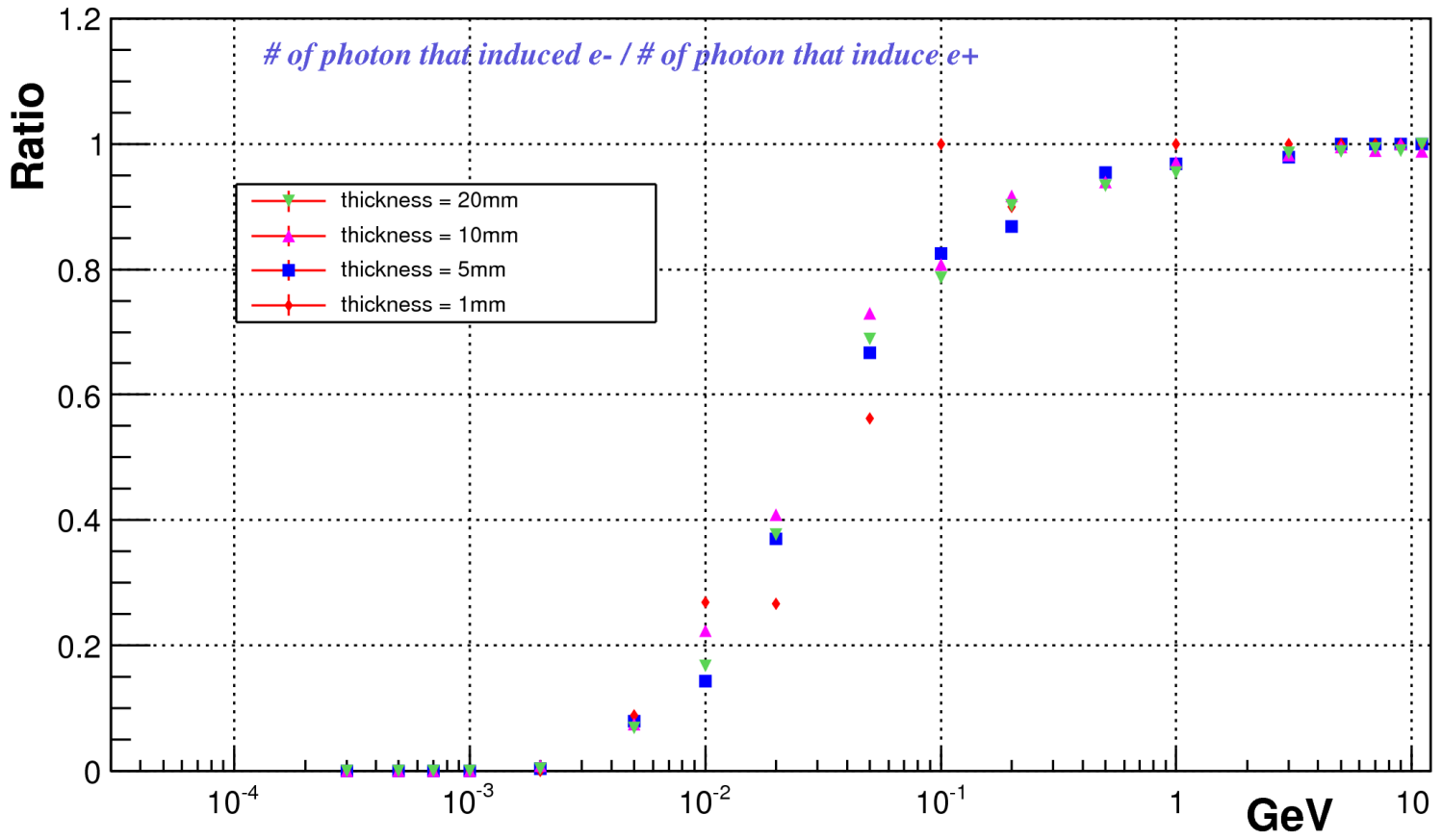
1). Low Energy Photons have a high ratio to introduce electron in SPD

2), However, total energy deposited cannot exceed energy of incident photon

3), Edep_tot smaller than energy cut Threshold in SPD, then SPD could reject these photons even they produced electrons in SPD.

Pair effect

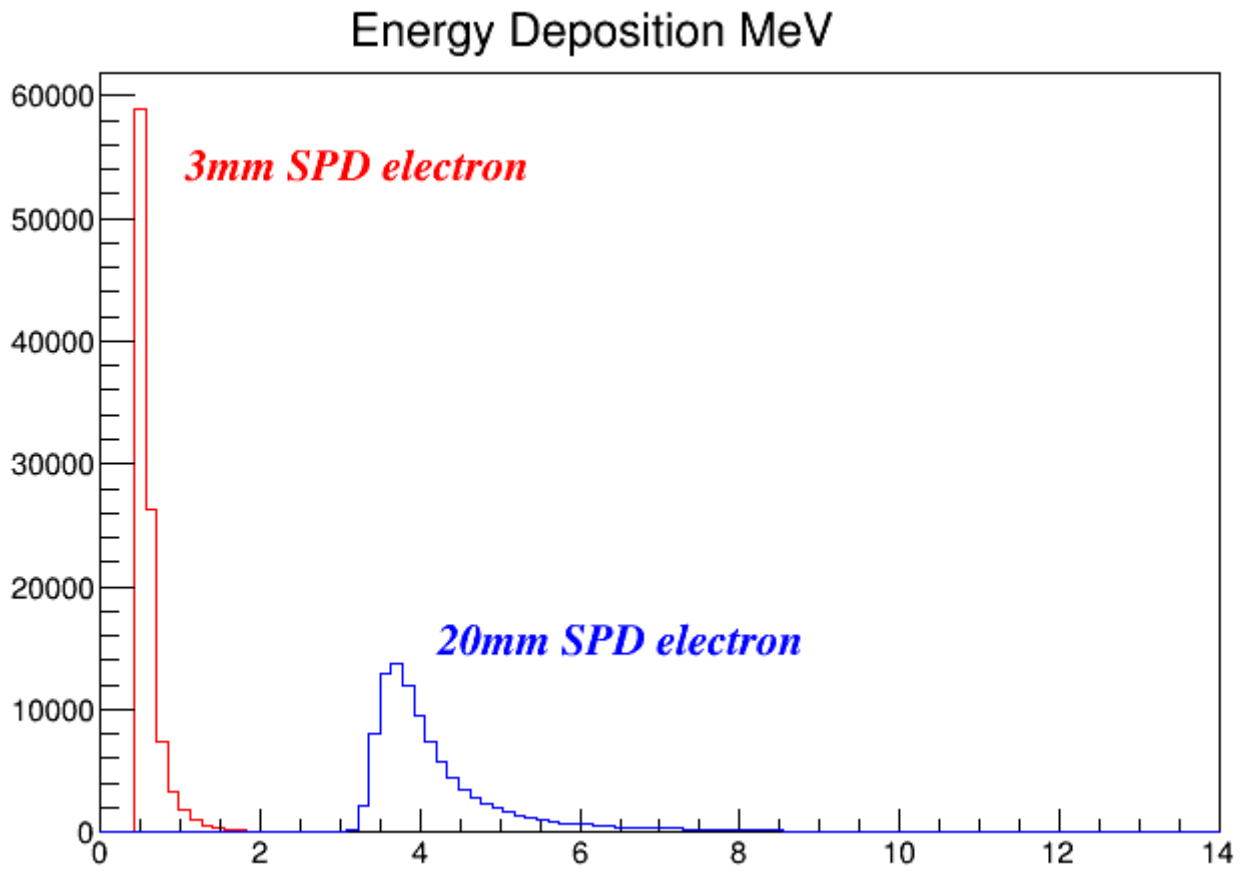
With a photon particle Gun (Not from Background):



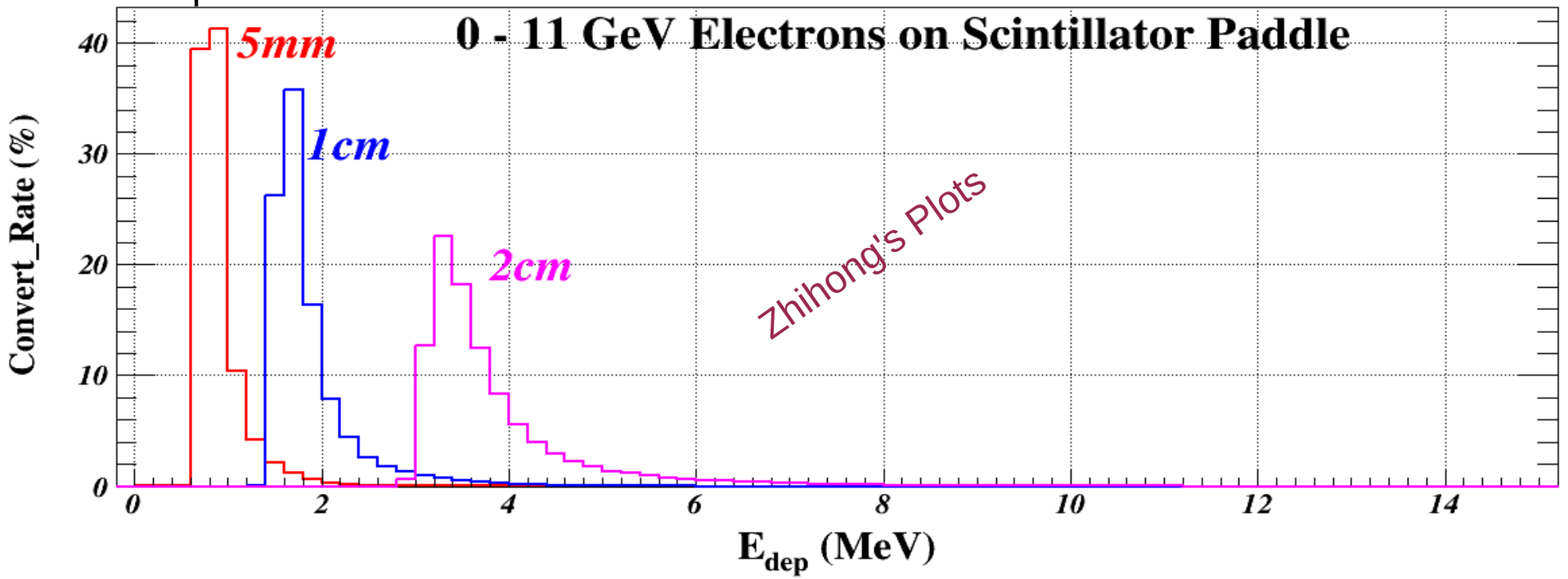
$$\frac{number\ of\ incident\ \gamma\ that\ induced\ positron}{total\ number\ of\ incident\ \gamma}$$

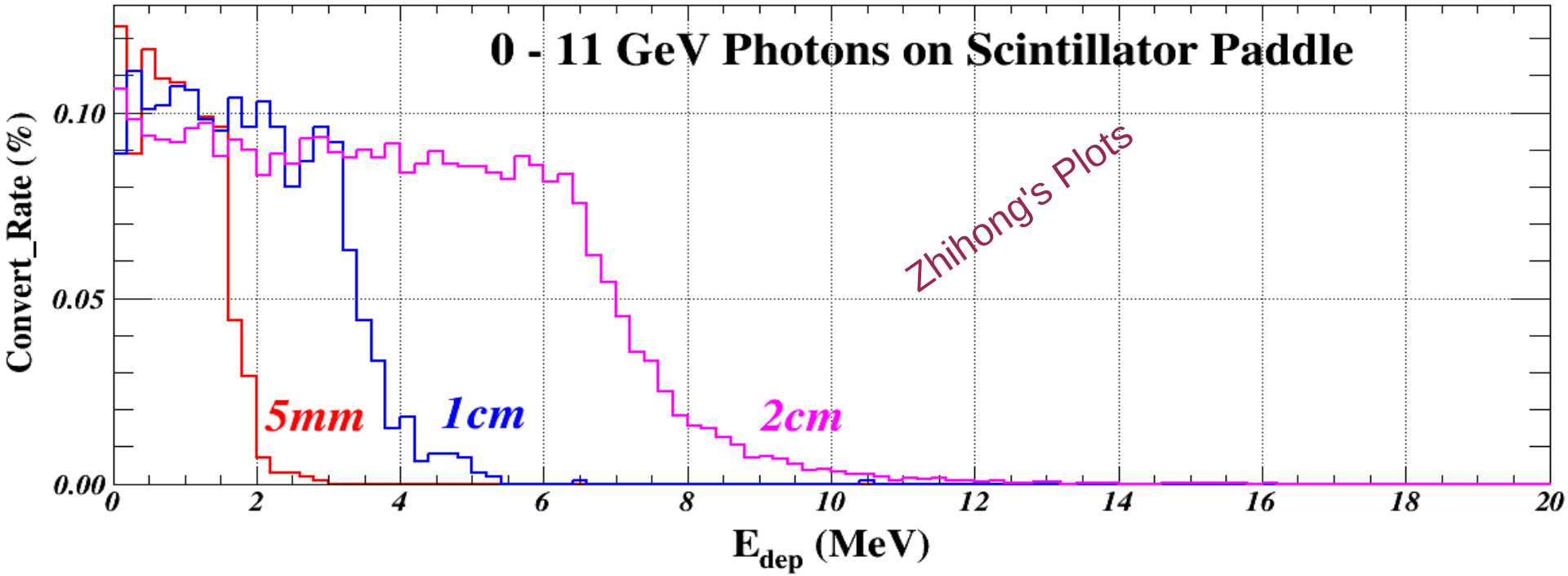
MIP Look up:

With an *e-* particle Gun (Not from Background):
Mean Beam Energy 5.5GeV
Energy Spread: 5.5 GeV
Energy range: 0~11 GeV

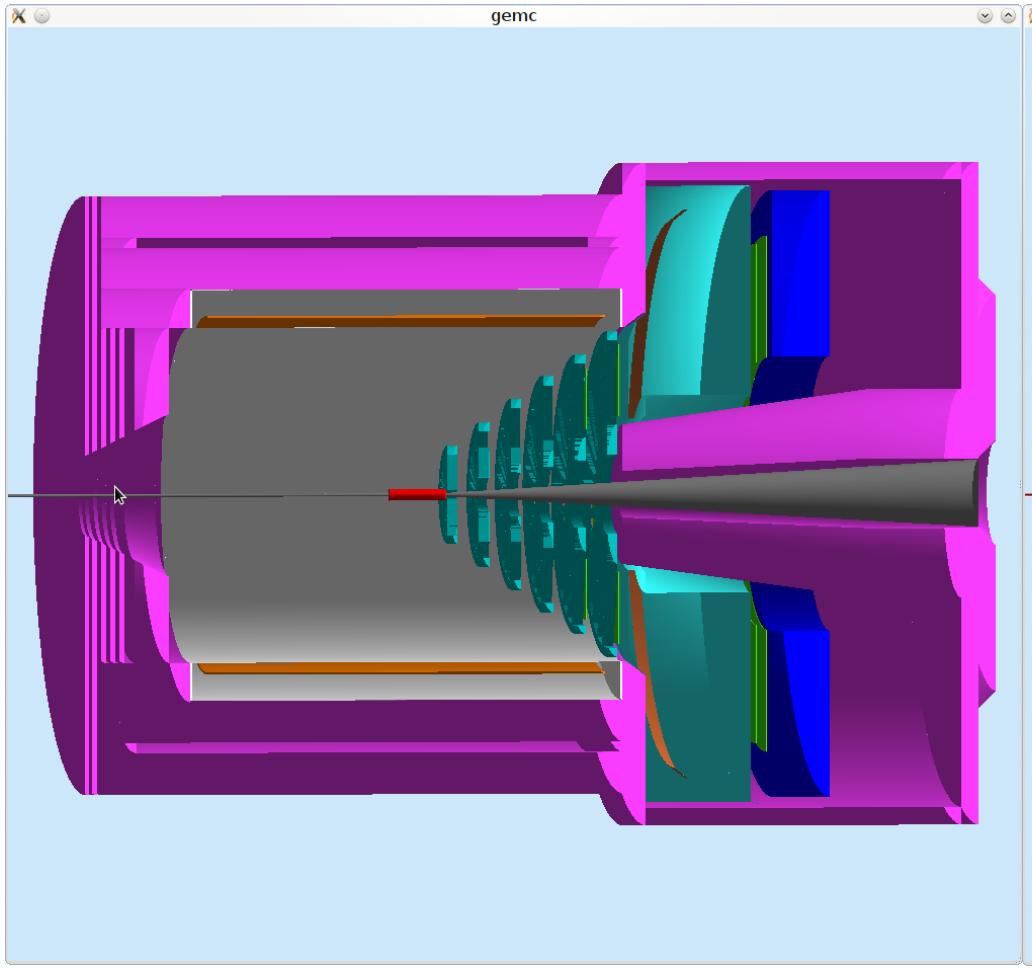


MIP Look up:

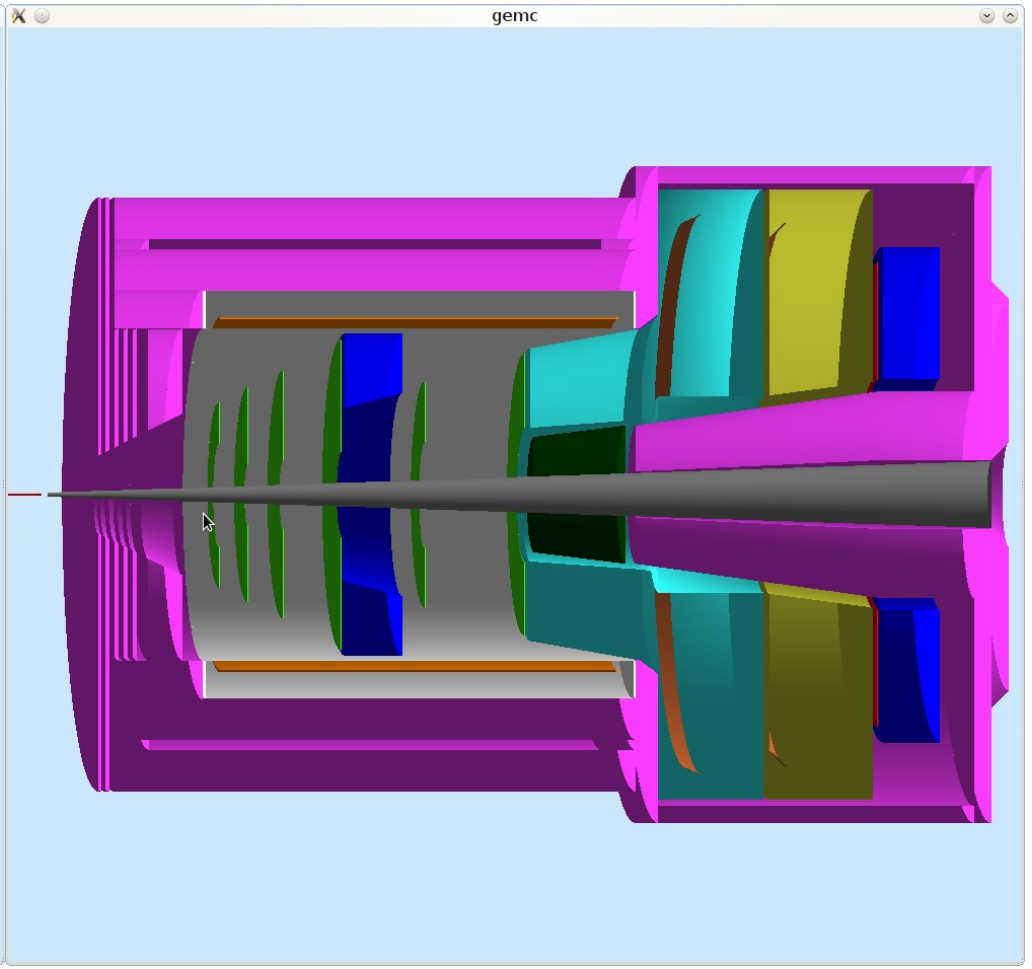

0 - 11 GeV Electrons on Scintillator Paddle
5mm
1cm
2cm
Zhihong's Plots
Convert_Rate (%)
E_dep (MeV)


0 - 11 GeV Photons on Scintillator Paddle
Zhihong's Plots
5mm
1cm
2cm
Convert_Rate (%)
E_dep (MeV)

Simulated Data with FULL detector Configuration –SIDIS Configuration

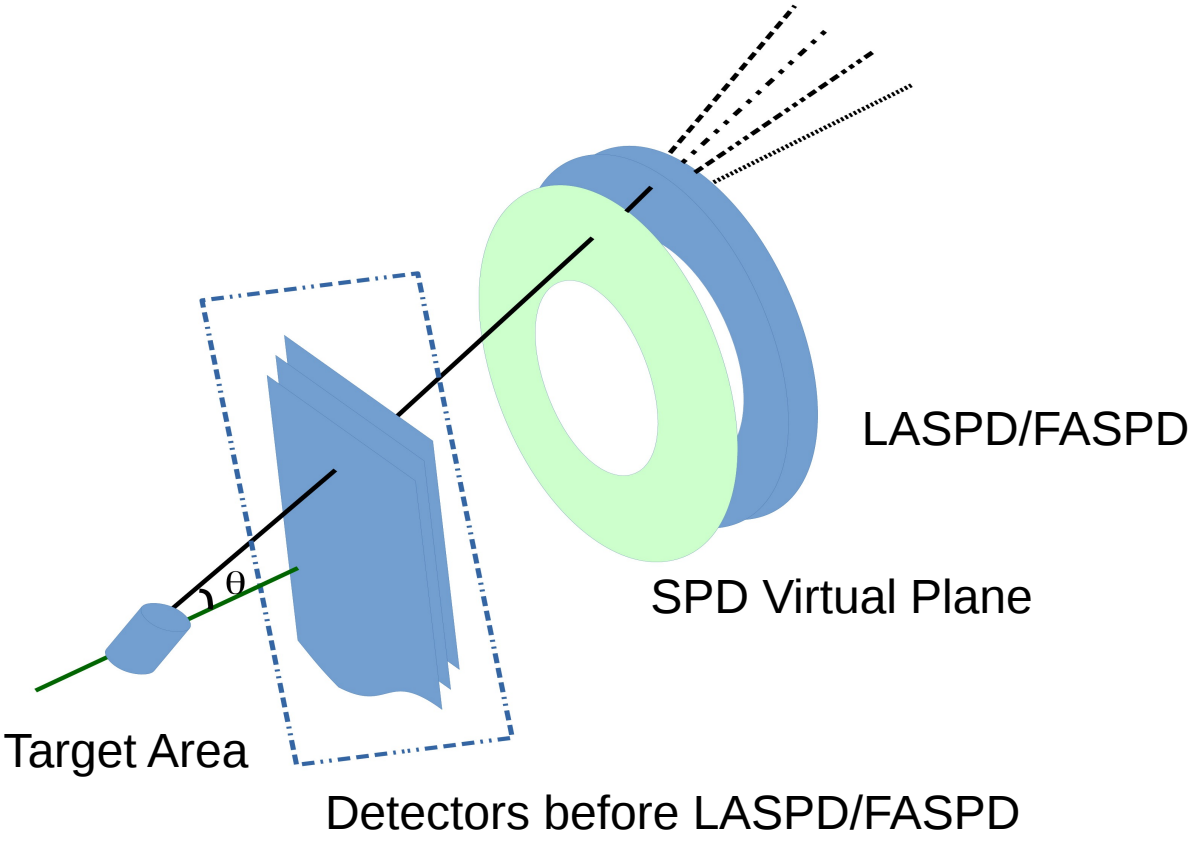


SoLID PVDIS

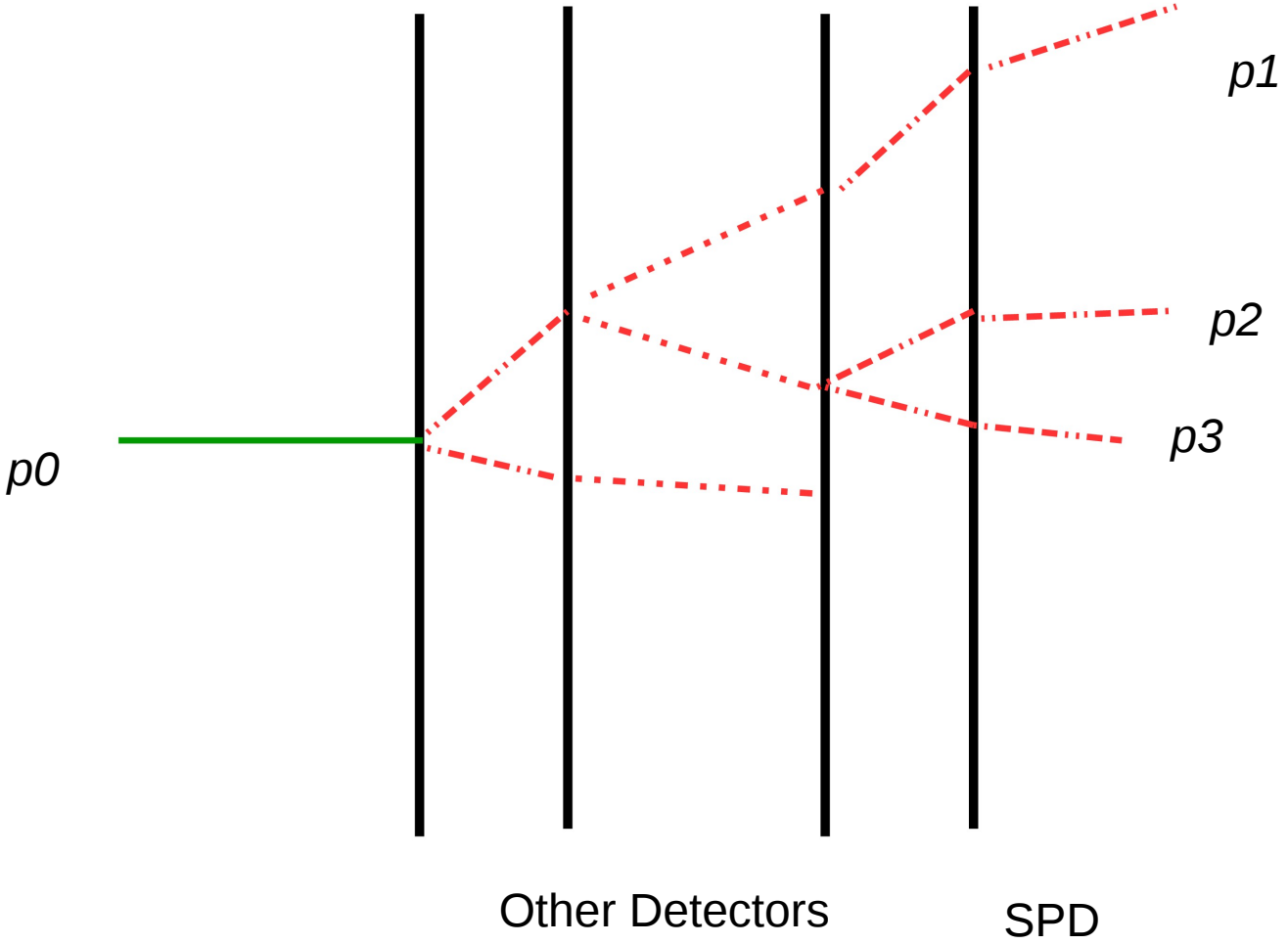


SoLID SIDIS

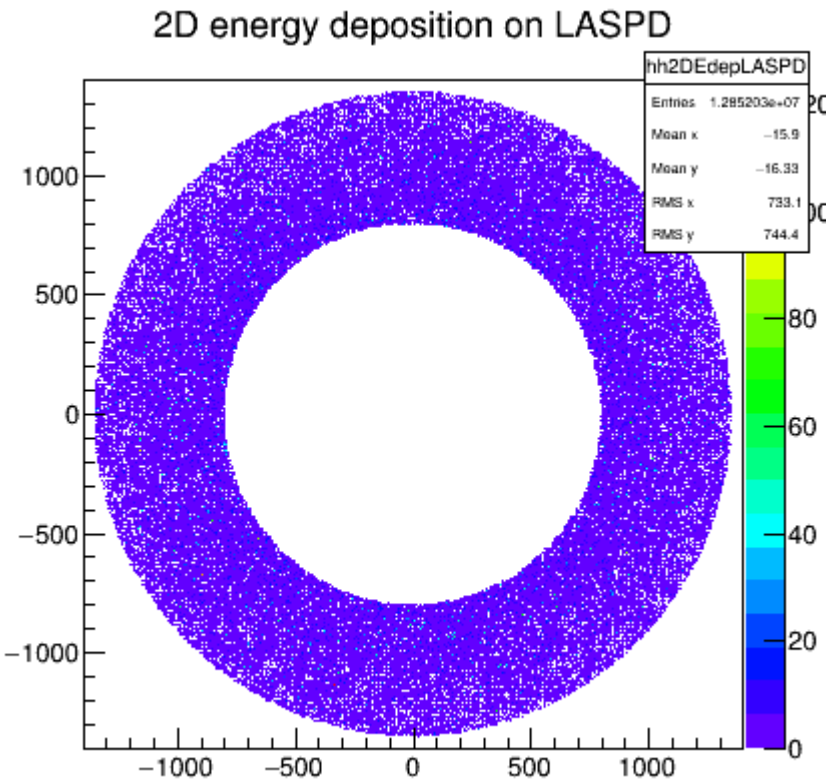
SPD isolation

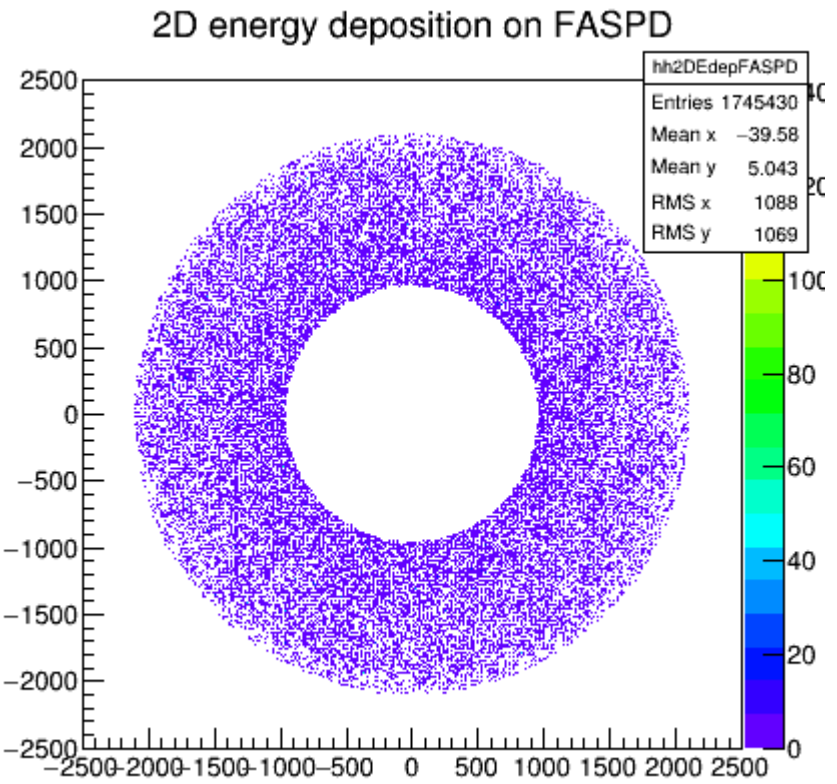


For each particle in SPD, Track down to its original mother particle (beam):



Energy Deposition from Proton Background bird view:





Segmentation

1), Background data:

e^- : (Electro Magnetic)

π^+ : (Window Upstream, Target)

π^- : (Window Upstream, Window Downstream, Target)

$proton$: (Window Upstream, Window Downstream, Target)

2), For π^0 Data:

$$E_{dep}^{tot} = E_{dep}^{photon} + \frac{\sum^{Total} E_{dep}^{e} + E_{dep}^{\pi^+} + E_{dep}^{\pi} + E_{dep}^{proton}}{N}$$

$$E_{cut} = 0.2 \times E_{MIP}$$

N: Segmentation

Actual Background Particle Rate on SPD

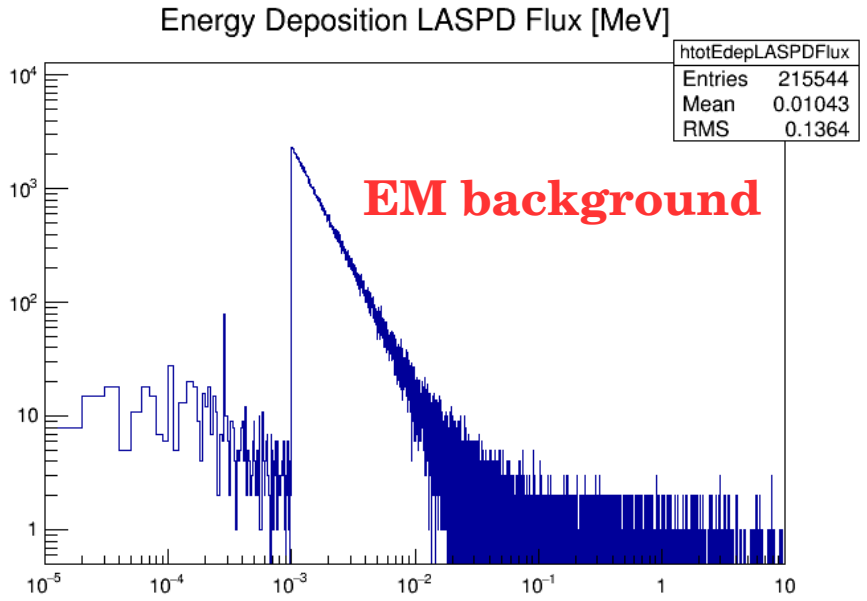
Method to calculate Particle Number Rate on SPD:

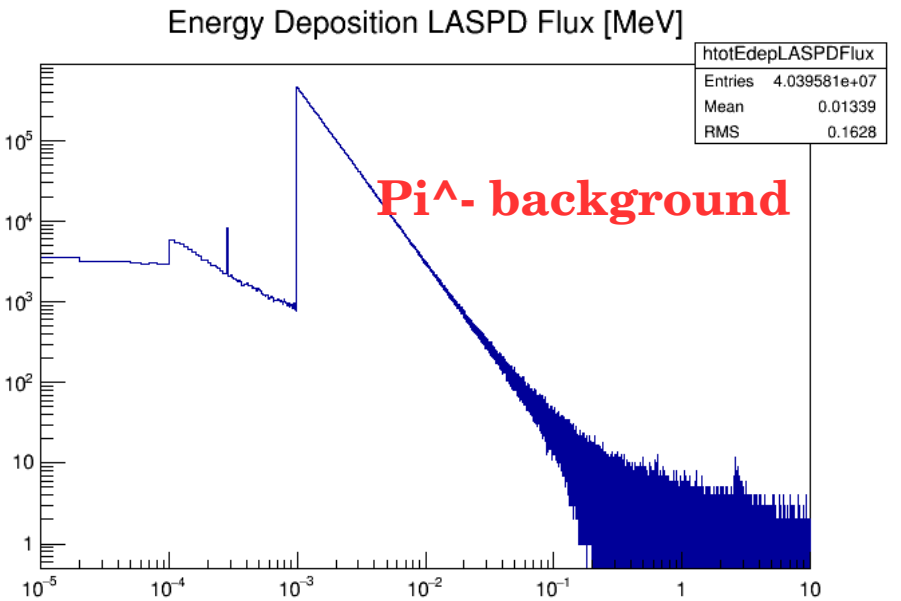
$$Rate(Wiser\ Model)\times\frac{number\ of\ particles\ received\ by\ SPD}{number\ of\ incident\ particles}$$

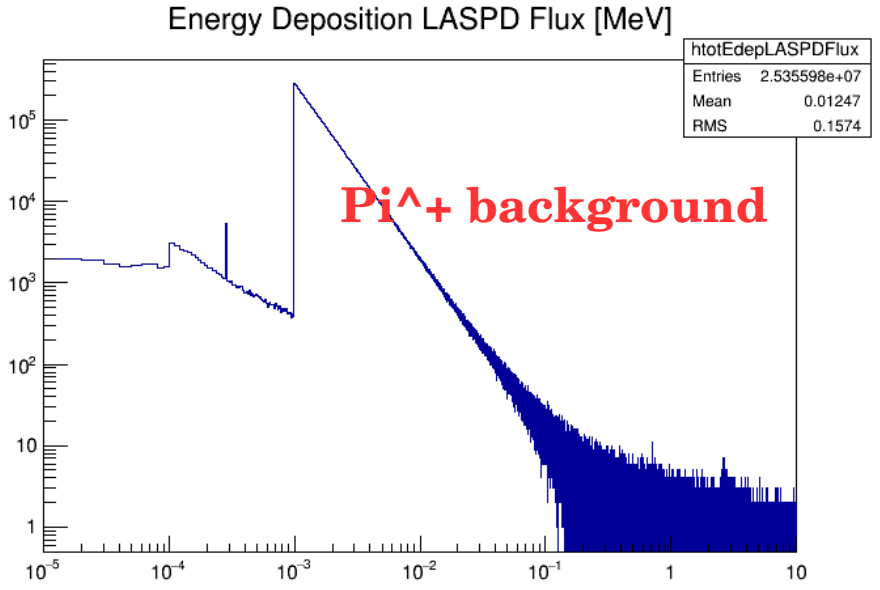
(Hz)	e^-	π^-_{target}	$\pi^-_{downstream}$	$\pi^-_{upstream}$	π^+_{target}	$\pi^+_{upstream}$	$p_{upstream}$	$p_{downstream}$
FASPD	5.37E09	1333	493	361.36	2873.6	412.23	272.68	236.93
LASPD	5.05E10	10216.8	9219.28	5635.51	23591.3	6531.67	2007.8	1872.58

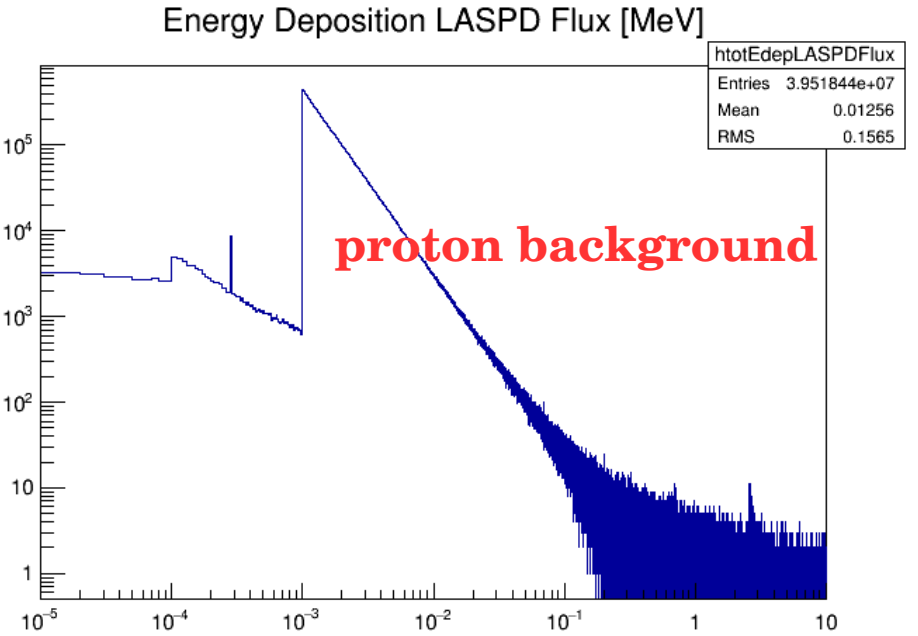
Actual # of particles on SPD = TimeWindow (30ns/50ns) X Rate

Flux Edep Distribution

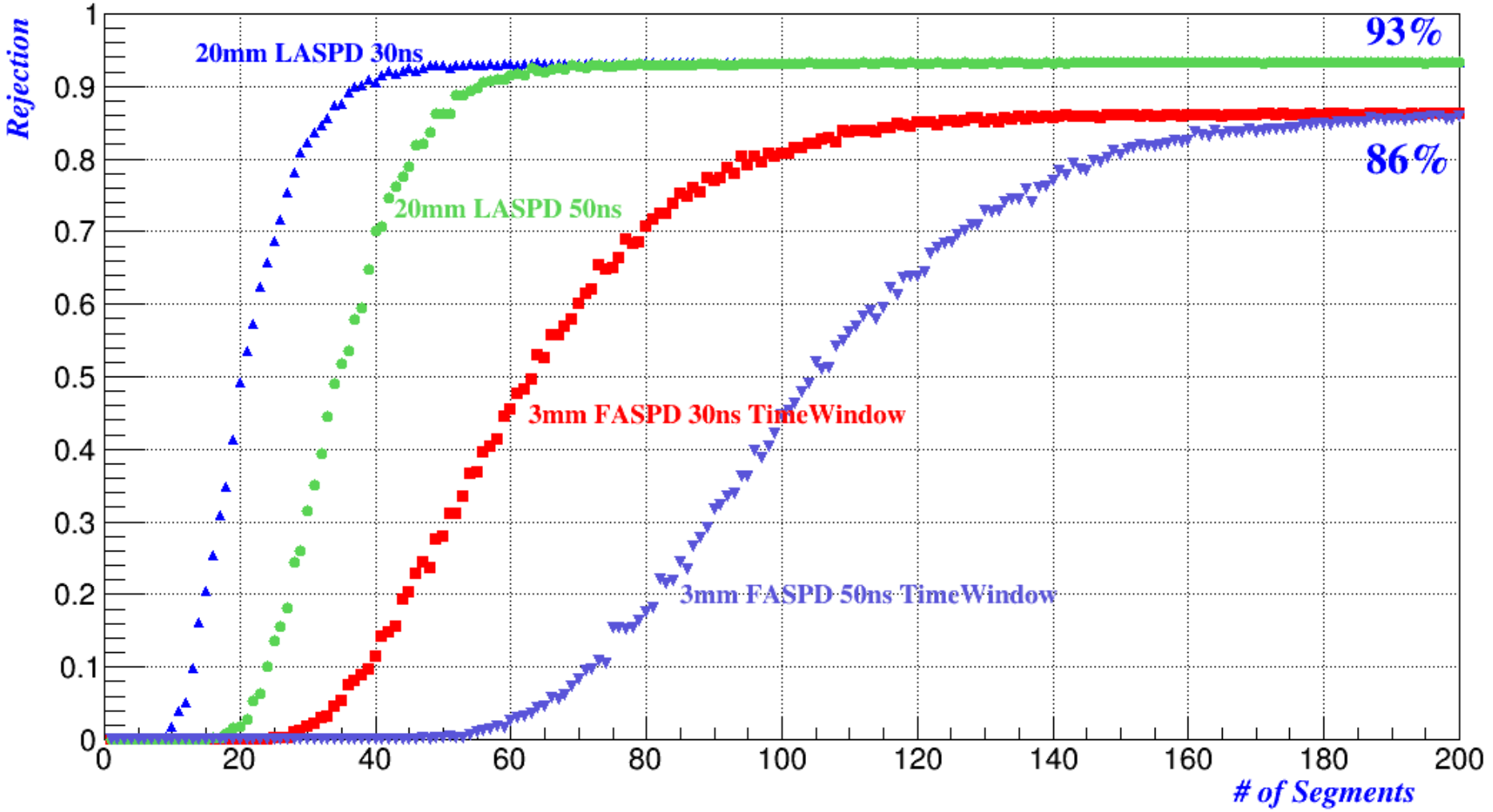








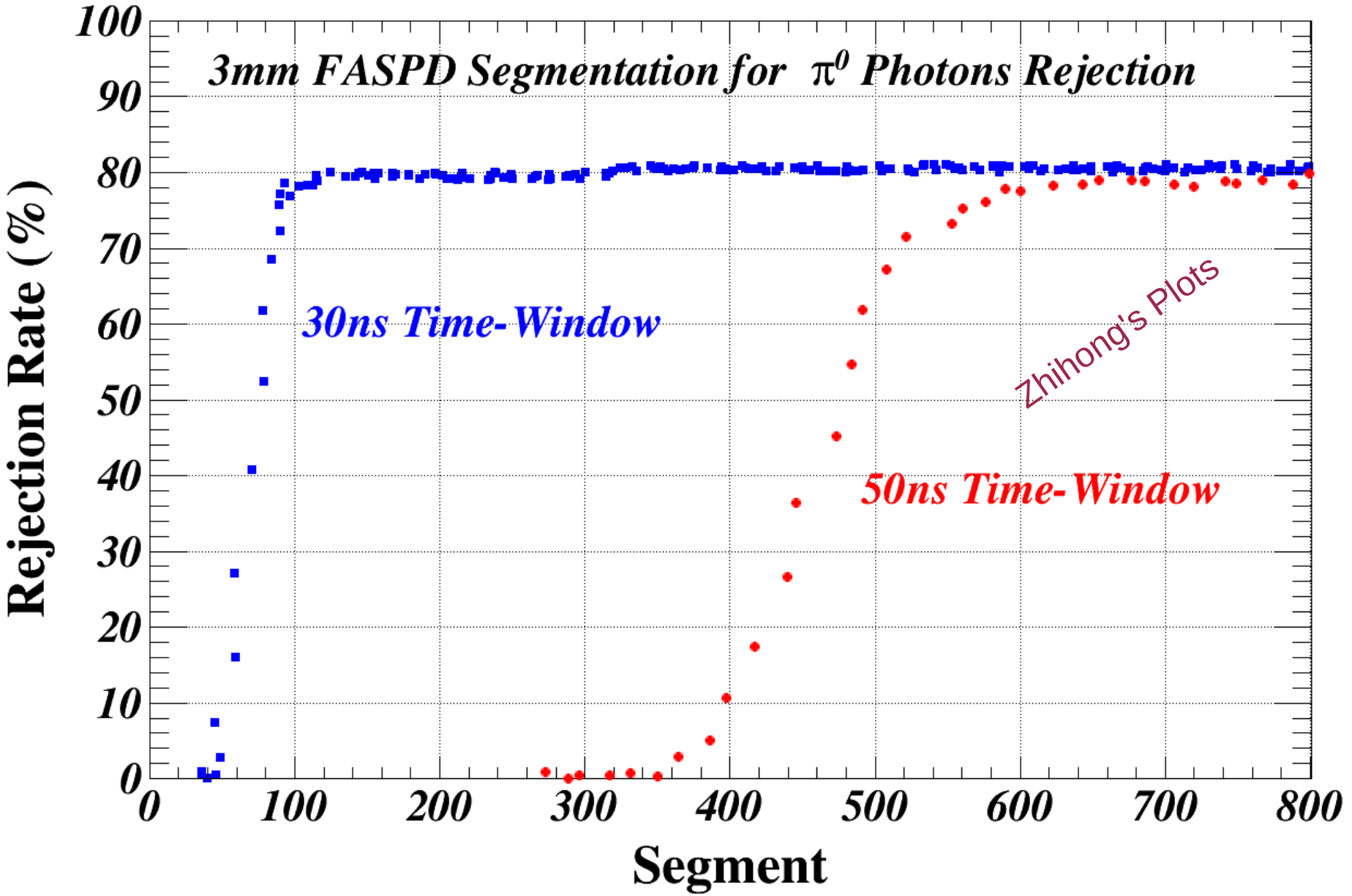
Segmentation



# of Bkg Particles = TimeWindow X Rate

Mostly EM Background, No Proton, Kaon, Pi^+ etc, due to low rate in SPD

Segmentation



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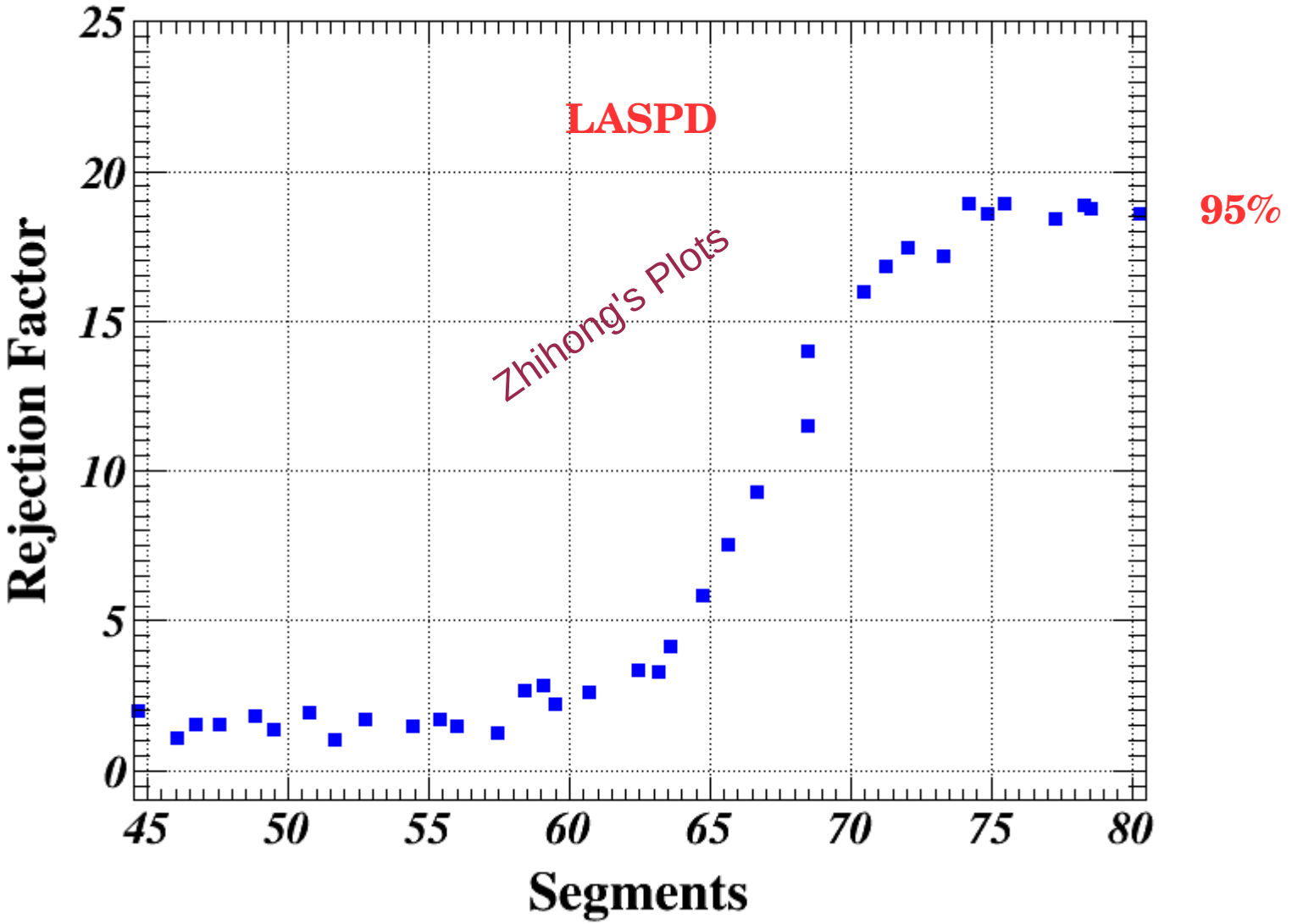
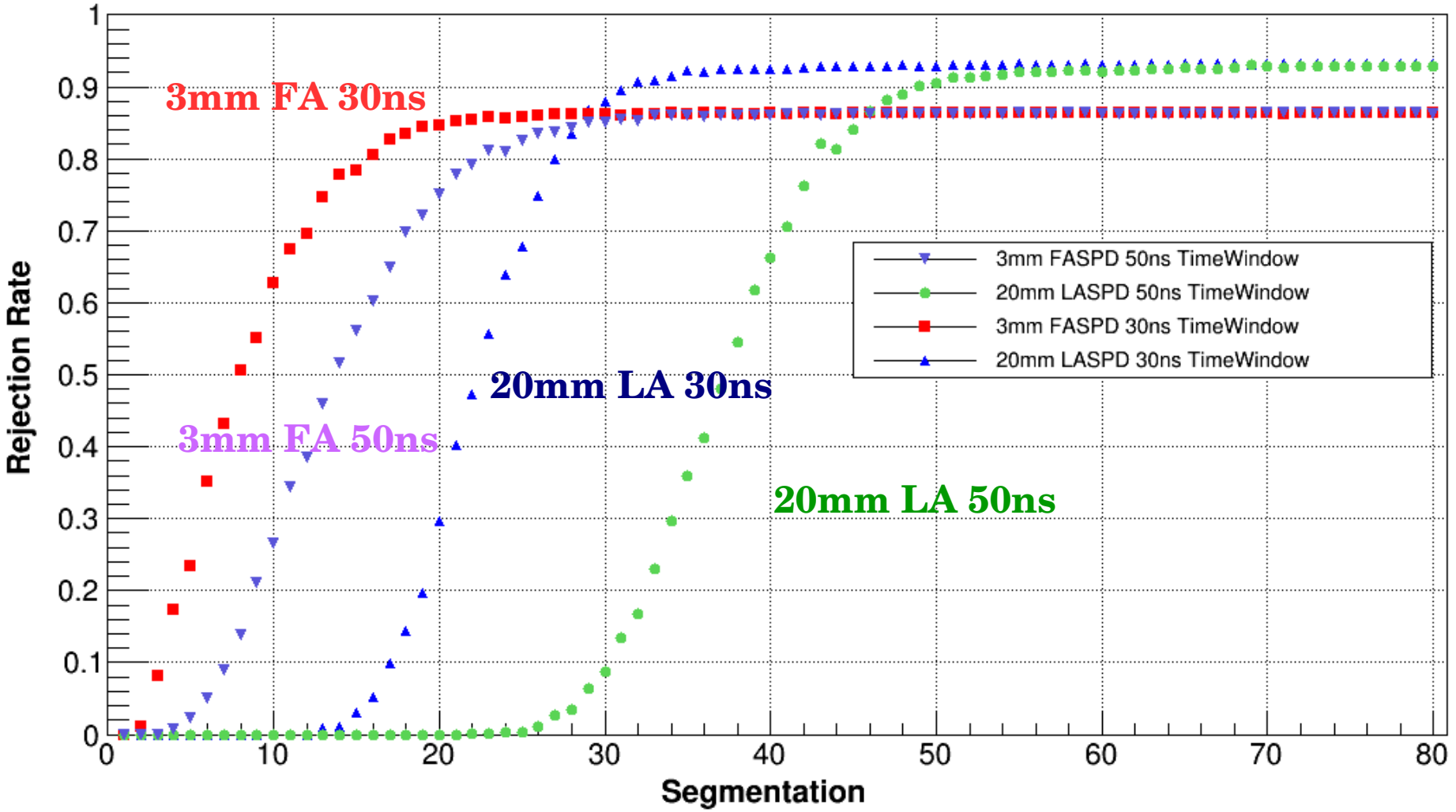


Q:


Rejection Rate
Segmentation
3mm FA 30ns
20mm LA 30ns
3mm FA 50ns
20mm LA 50ns
3mm FASPD 50ns TimeWindow
20mm LASPD 50ns TimeWindow
3mm FASPD 30ns TimeWindow
20mm LASPD 30ns TimeWindow

93%

86%