Simulation Updates For May Collaboration Meeting

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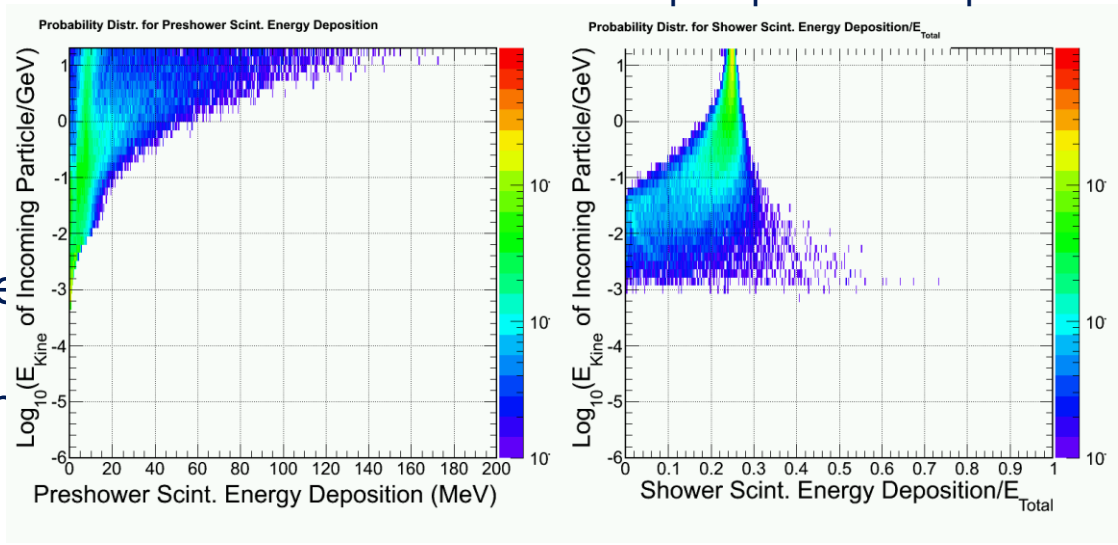
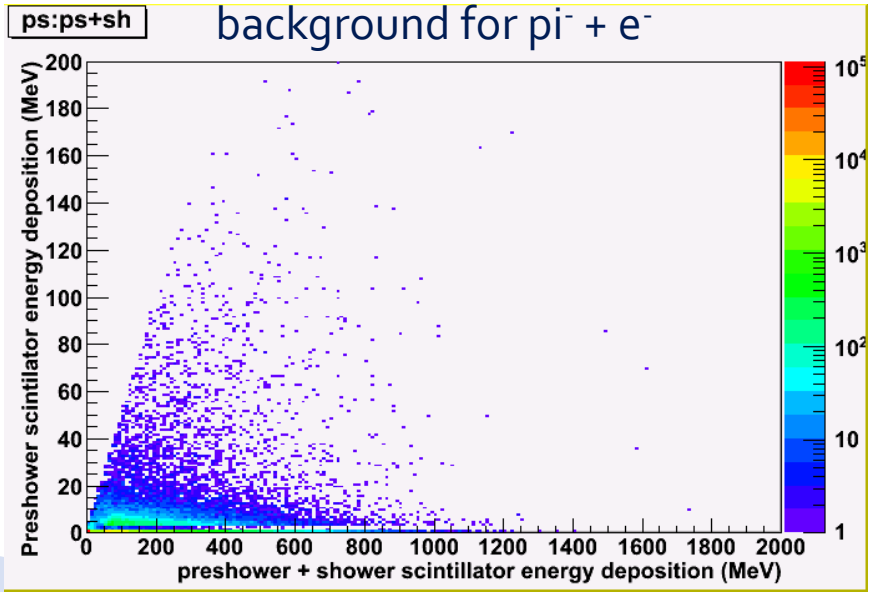
Background simulation

1. Simulate background at front surface of calorimeter (Zhiwen)
2. Simulate calorimeter response to a wide range of background particle
3. Combine above two sum over all contributions (EM, DIS, pio, pi+,pi-) -> background distribution
4. Imbed into the signal simulation (high energy e, pi), assuming a 50ns coincidental window

Example: photon response

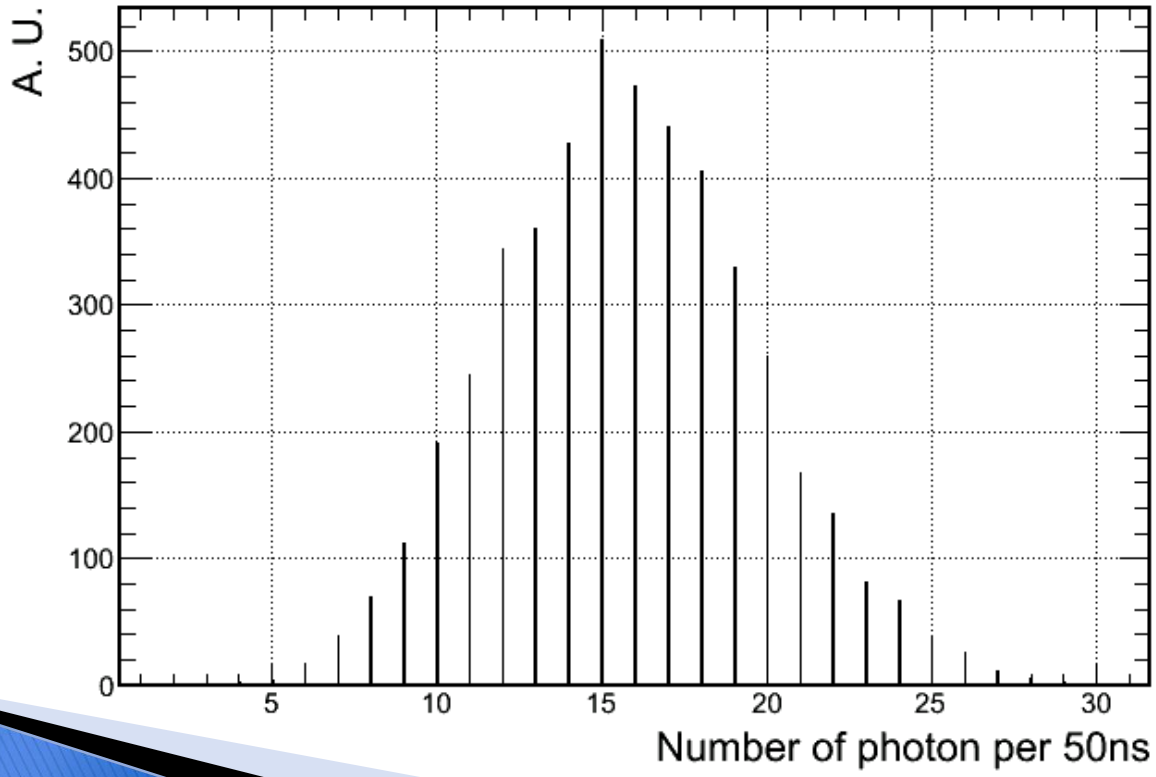




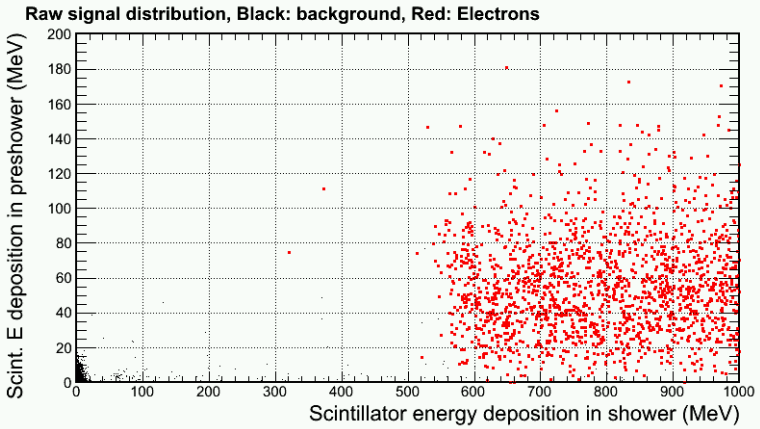
SIDIS – Large Angle

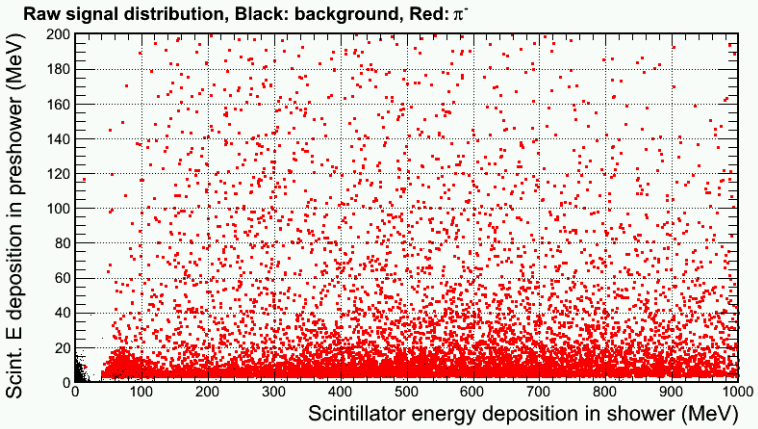
Dominant background

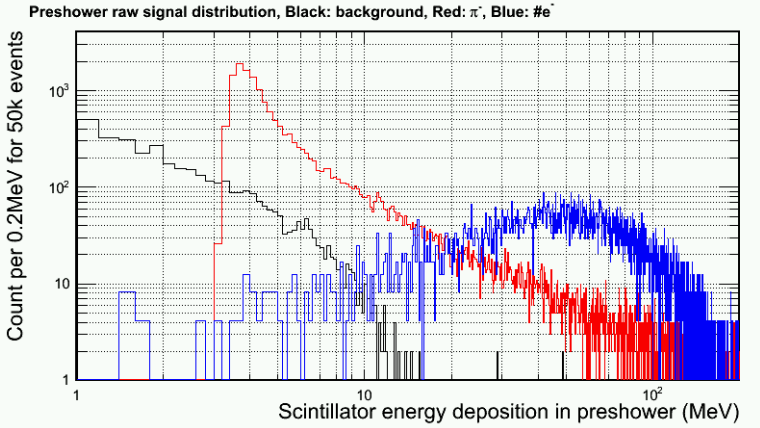
- 0.3 GHz low energy photon for inner-R 1+6 hexagon clusters
- But well shielded by 2-X0 preshower absorber

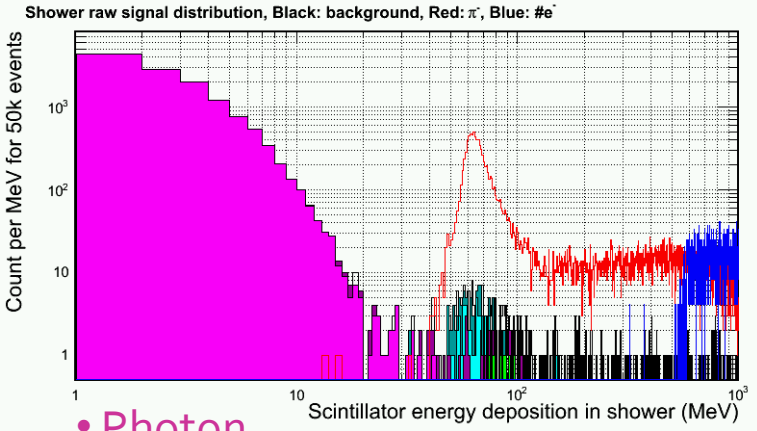


Background distribution



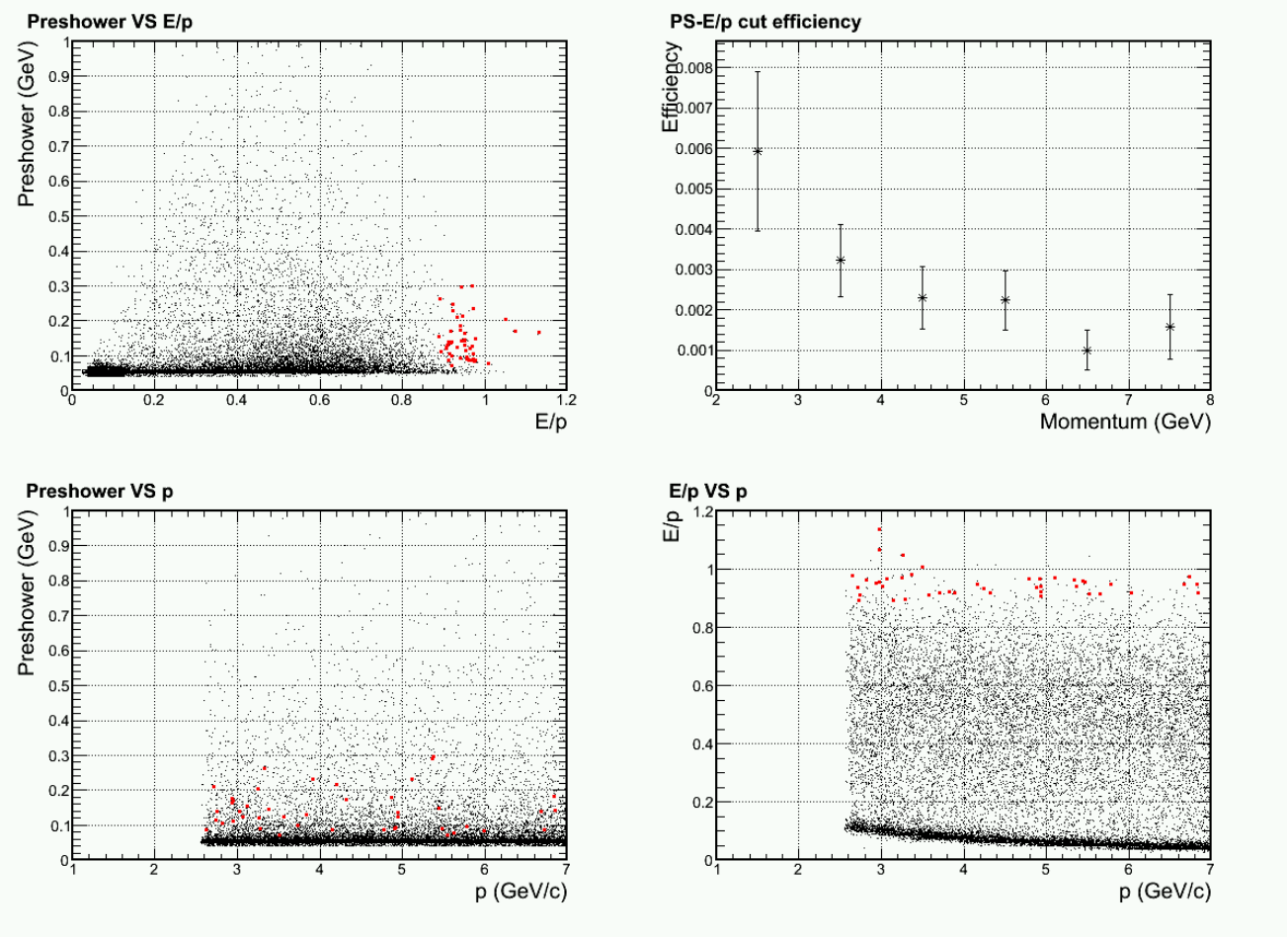




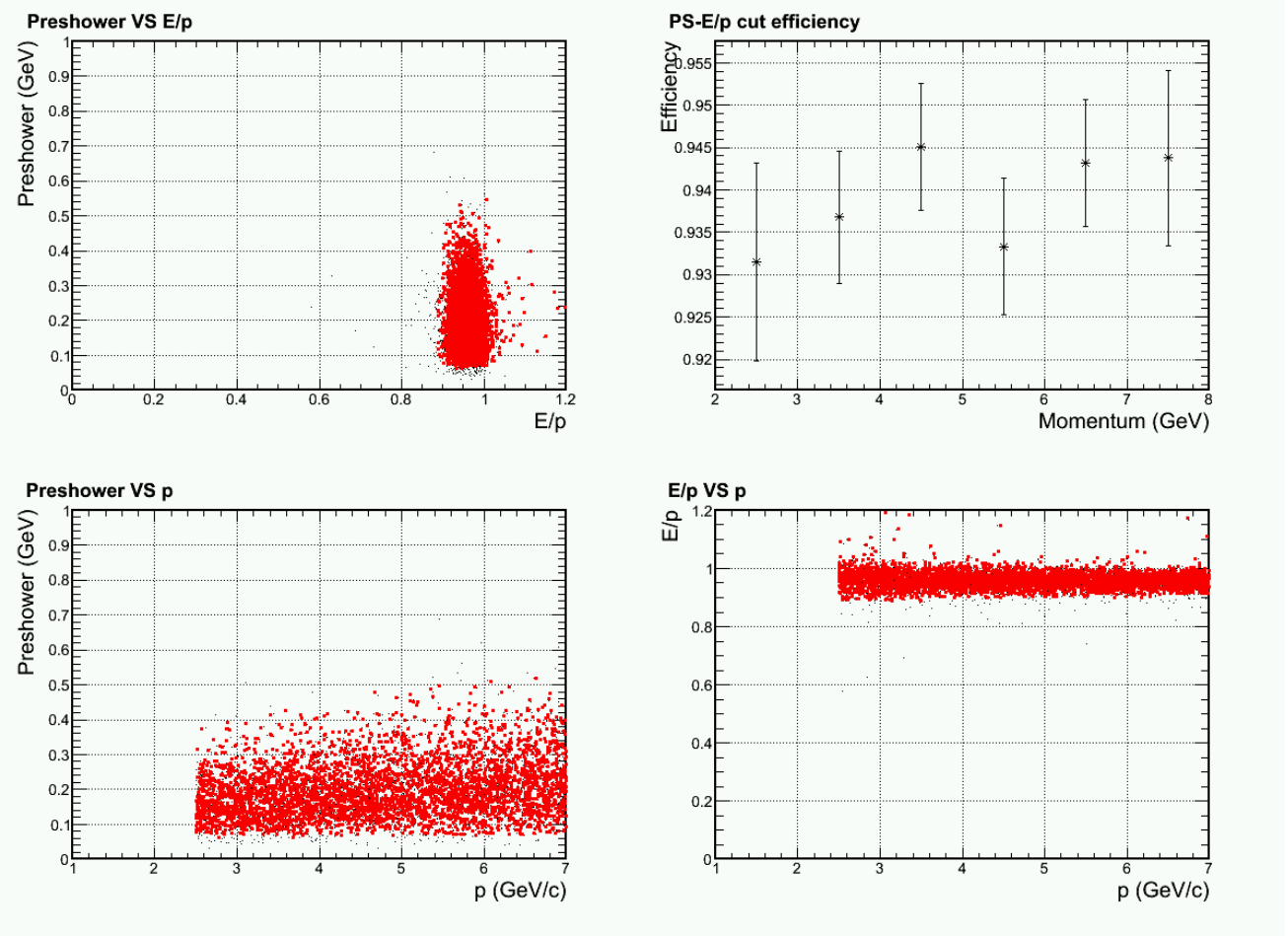


- Photon
- Electron
- Pion

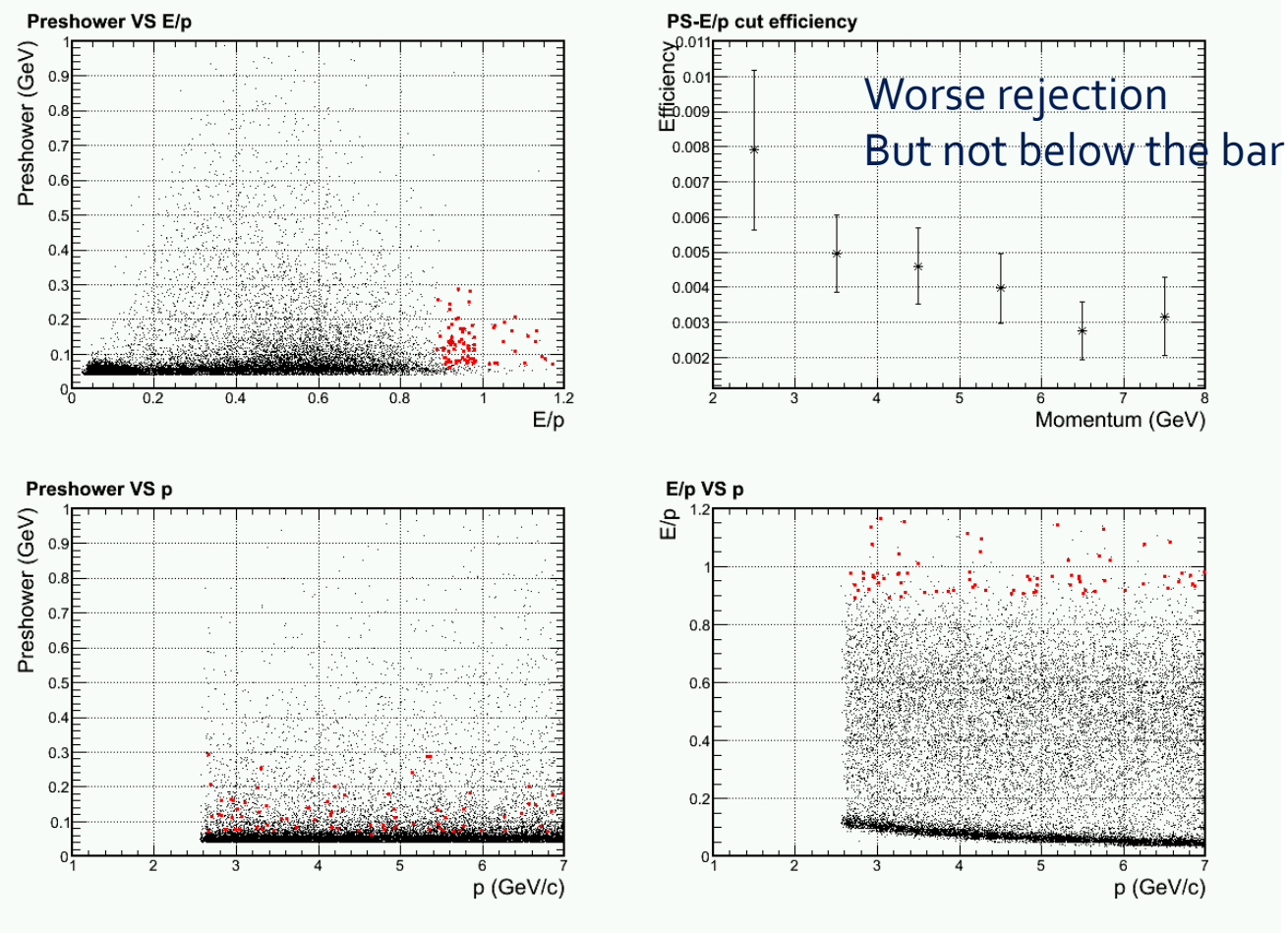
Pion rejection w/o background @ 94% electron eff



w/ background (inner-R) Electron efficiency



w/ background (inner-R)
Pion efficiency (1/rejecton)



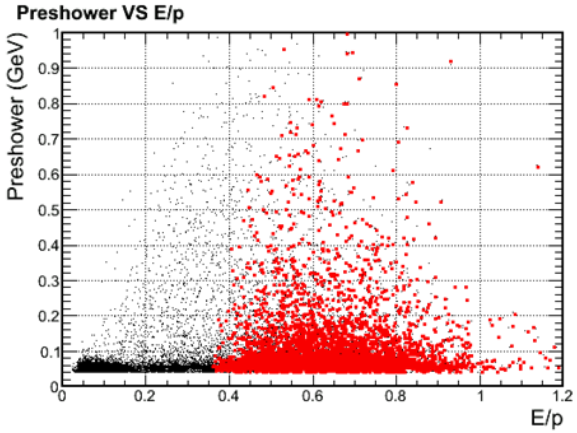
Trigger turn-on curve

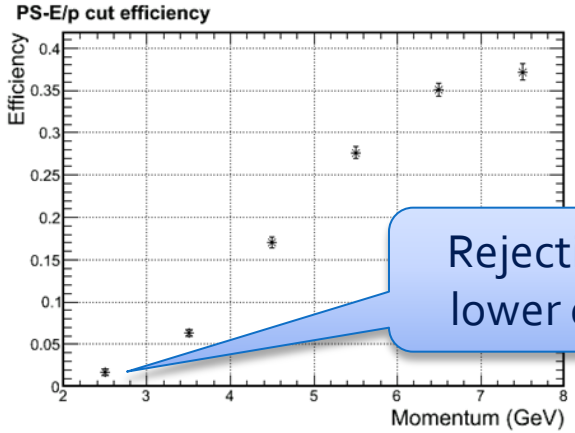
- Proposed trigger rate and rejection

$$T_L^e(11\ \mathrm{GeV}) = Y_L^e + Y_L^\gamma + \frac{Y_L^h}{R_{LC}} = 11 + 51.5 + \frac{55.6}{20} = 65\ \mathrm{kHz}$$

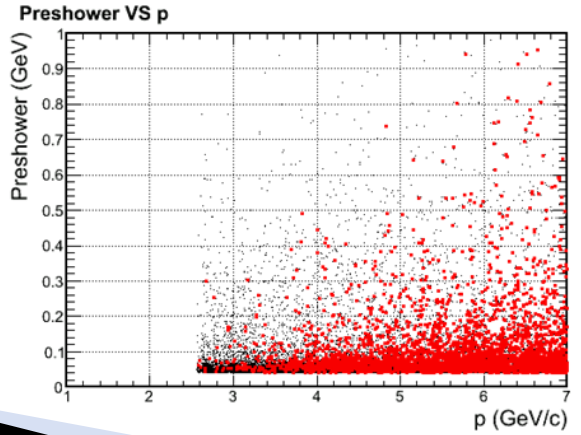
- Pion rejection needed ~ 20:1, but I think can be relaxed
- Additional photon rejection help more
- Single-Shower 1+6 cluster trigger tested
  - Full background spectrum considered
  - Cut on shower energy deposition > 2.6 GeV
  - Very high electron trigger efficiency

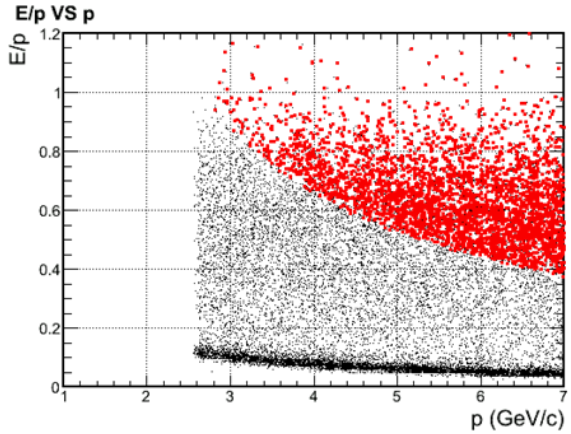
Pion turn-on curve
Single-Shower trigger > 2.6 GeV





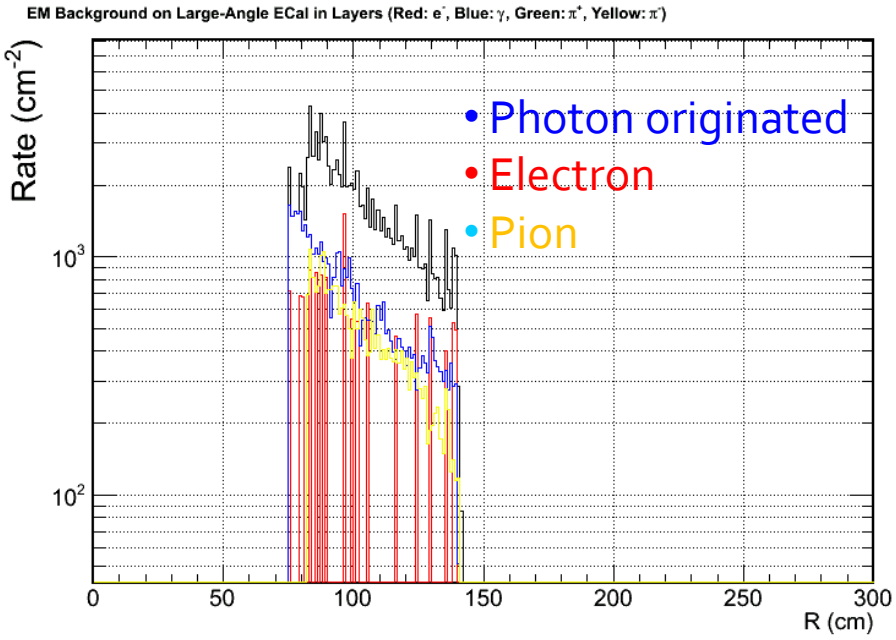
Rejection > 20:1 for lower energy pions

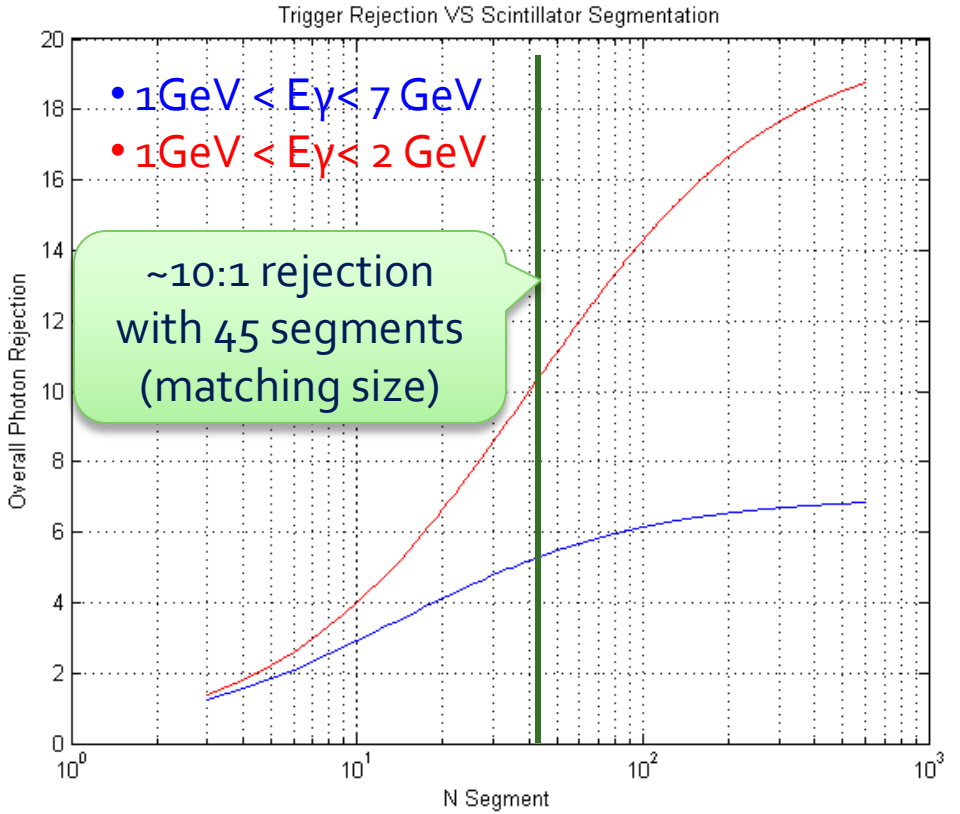




What if we also want to rejection photons? - Add a scintillator pad

Scintillator MIP rate

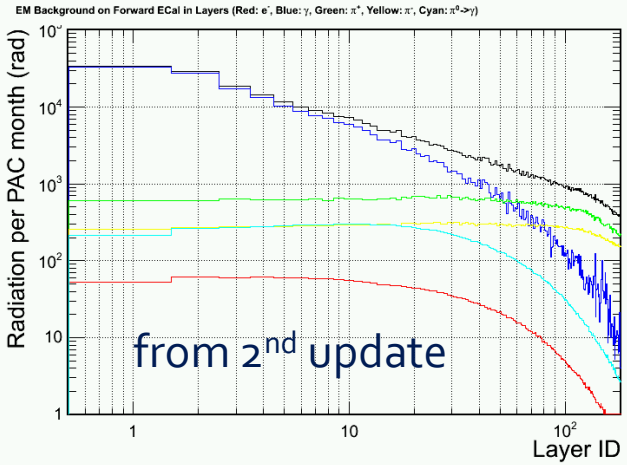


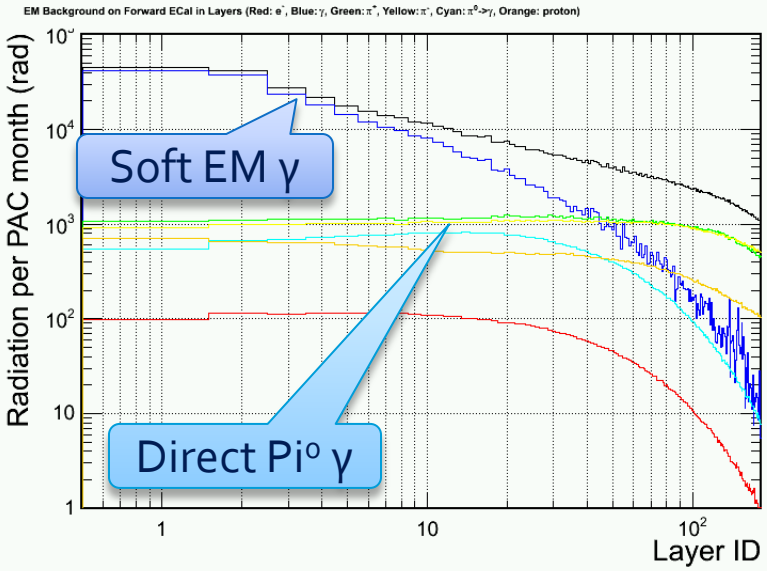


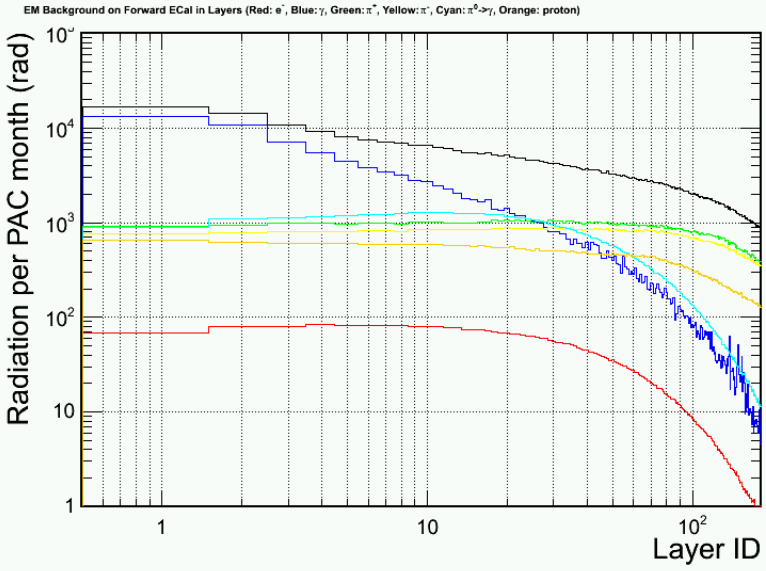
PVIDS Forward

Updated radiation dose VS layers

- Photon (EM) <- dominant!
- Photon (Pi^0)
- Electron
- Pion- Pion+ Proton





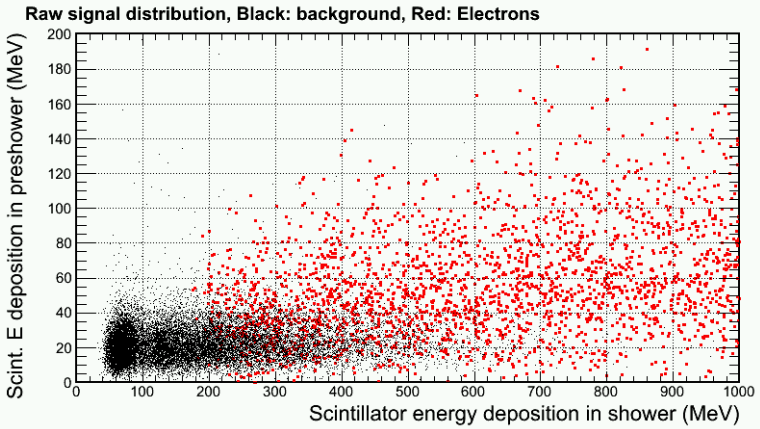


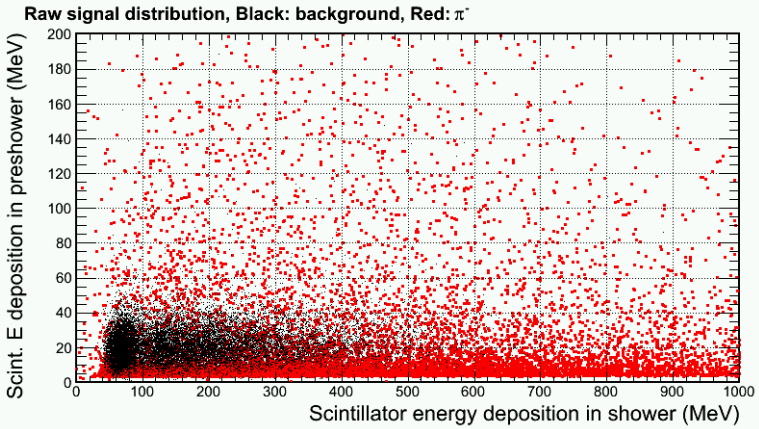
High radiation azimuthal region

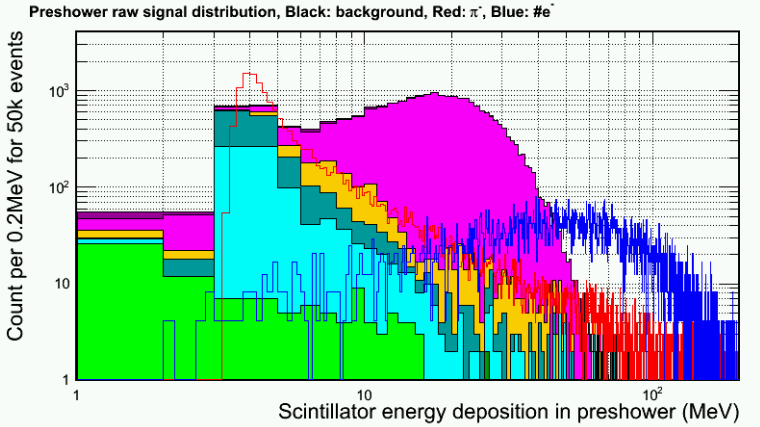
Low radiation azimuthal region

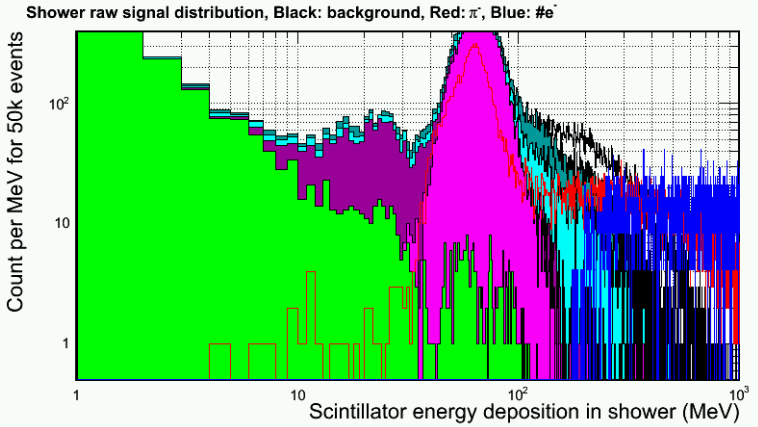
Background imbedding and distribution

Mid-R, High Radiation phi slice





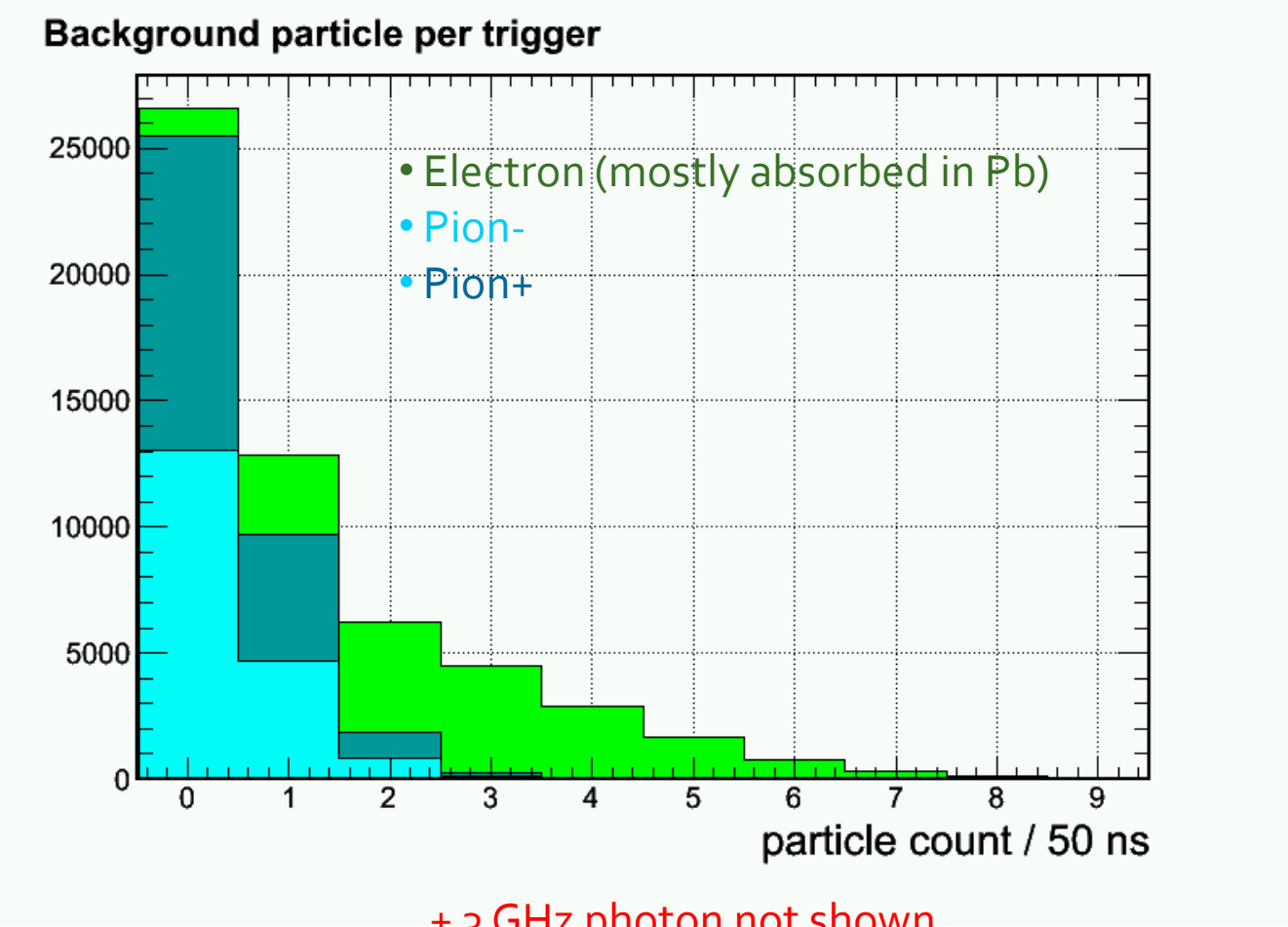




- Photon (6GHz/6+1 Hex cluster)
- Electron
- Pion- Pion+ Proton

Updated: Per-event pion rate

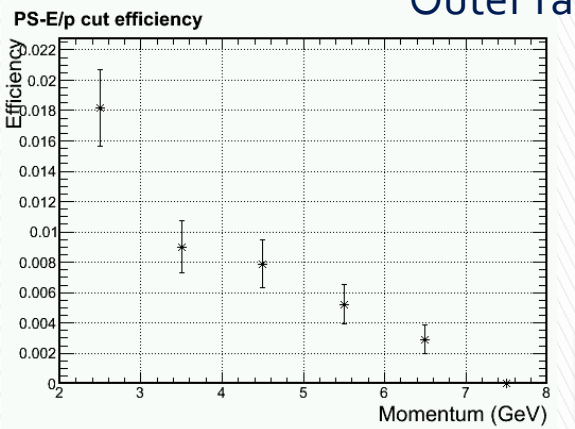
for 1+6 hexagon cluster at Mid radius, high radiation slice

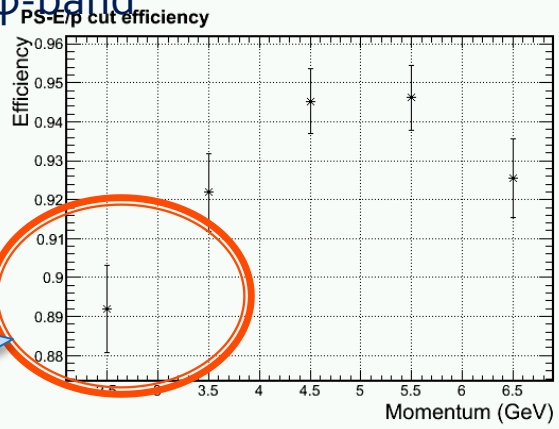


+ 3 GHz photon not shown

Update on PID with DC component removal (PS > MIP + Bgd + (2-3) σ)

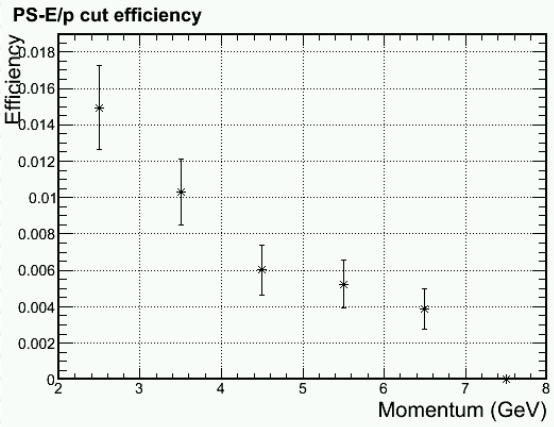
Outer radius, higher γ ϕ-band

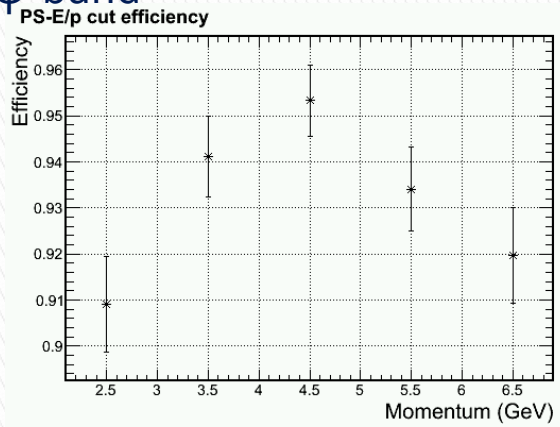




Due to Soft EM γ

Outer radius, lower γ ϕ-band



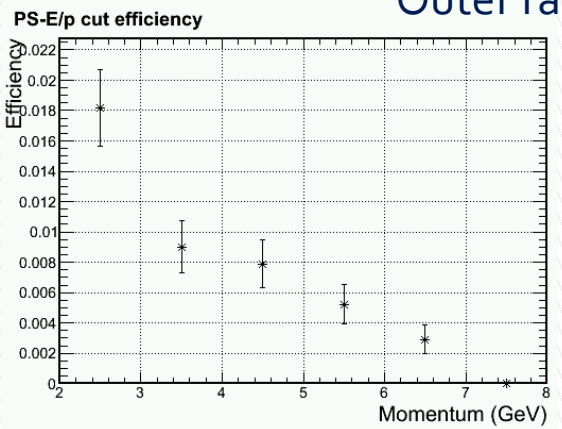


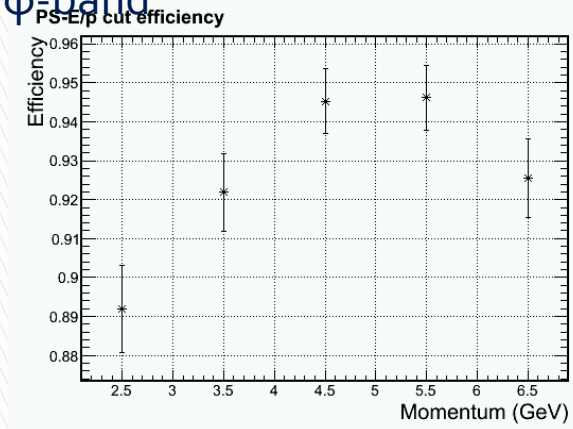
Pion Efficiency

Electron Efficiency

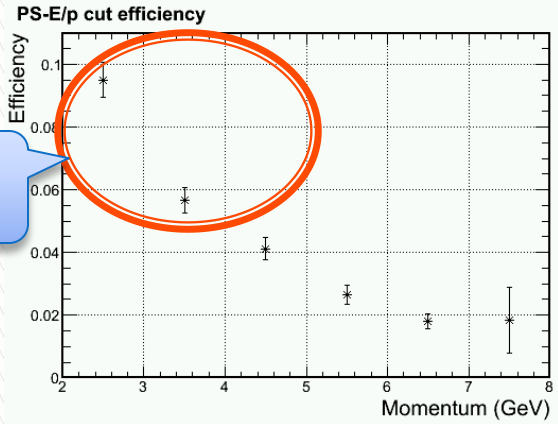
Update on PID with DC component removal (PS > MIP + Bgd + (2-3) σ)

Outer radius, higher γ ϕ-band

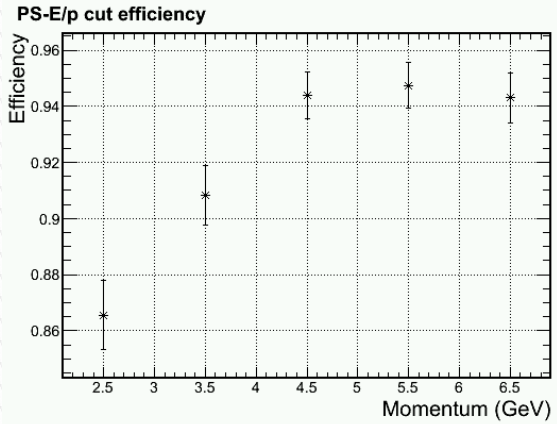




Mid radius, higher γ ϕ-band



Due to Hadron rate

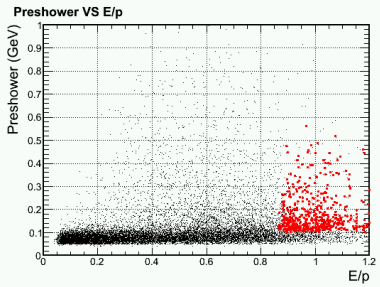


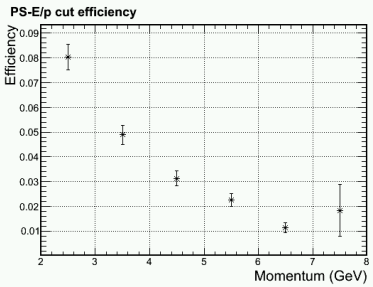
Pion Efficiency

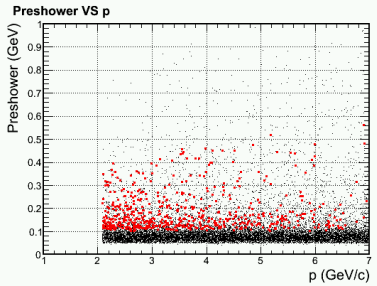
Electron Efficiency

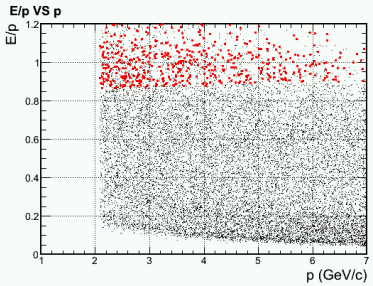
More detail in PID cut

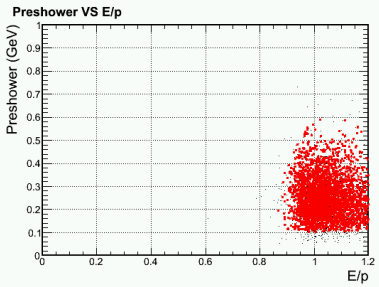
Middle radius, lower γ ϕ-band, full bgd

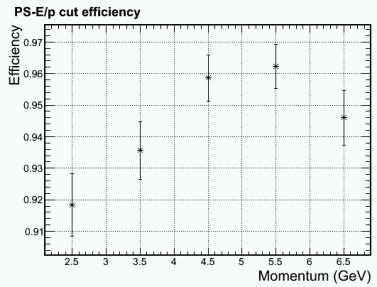


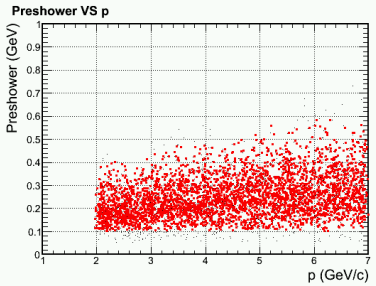


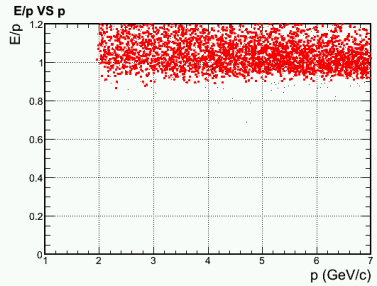










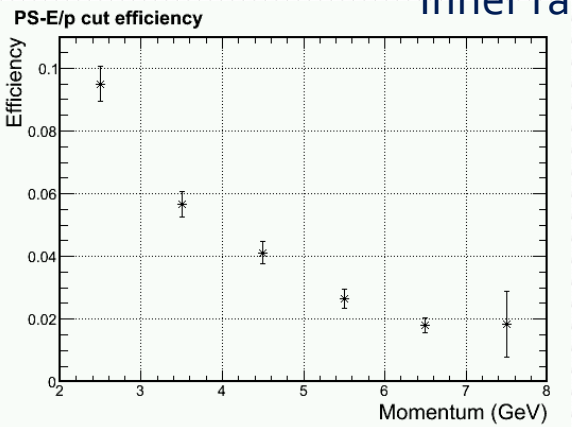


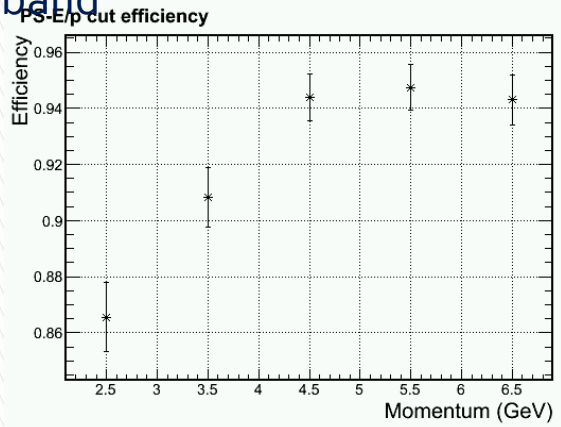
Pion Efficiency

Electron Efficiency

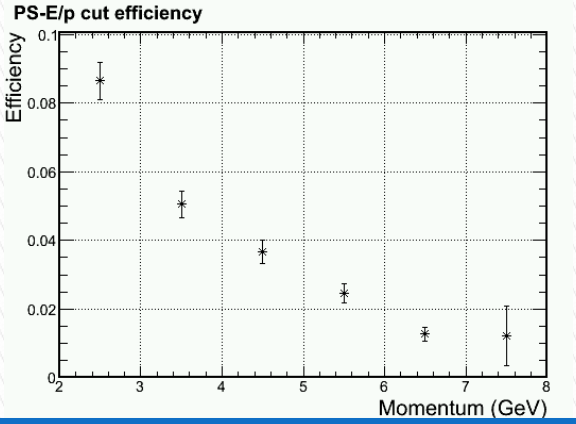
Update on PID with DC component removal (PS > MIP + Bgd + (2-3) σ)

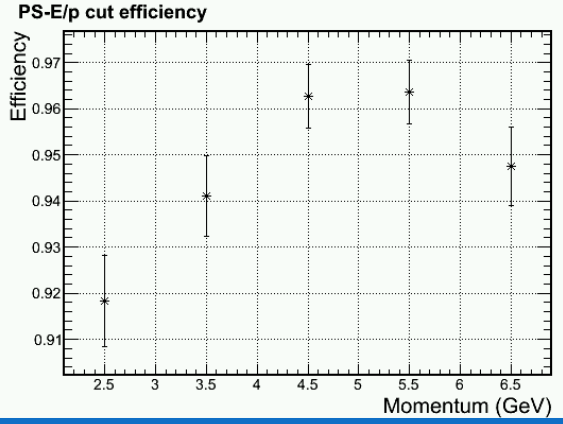
Inner radius, higher γ ϕ-band





Inner radius, lower γ ϕ-band



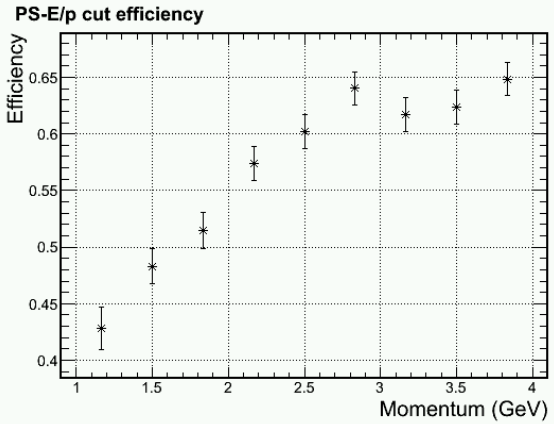


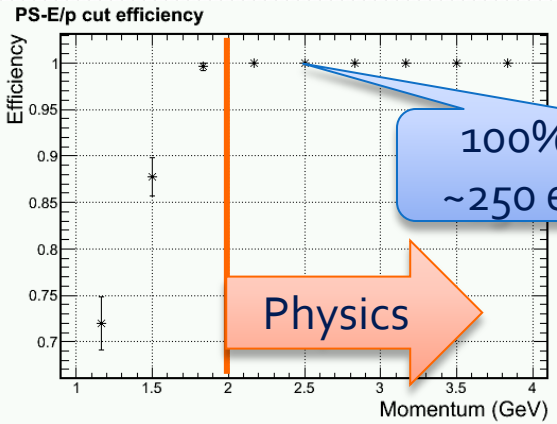
Pion Efficiency

Electron Efficiency

Trigger turn on curve for 2 GeV electron
Shower Hex 1+6 trigger > 1.6 GeV

Inner radius, higher γ ϕ-band, full bgd

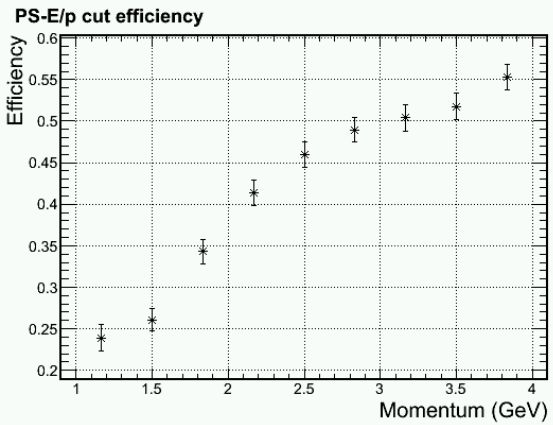


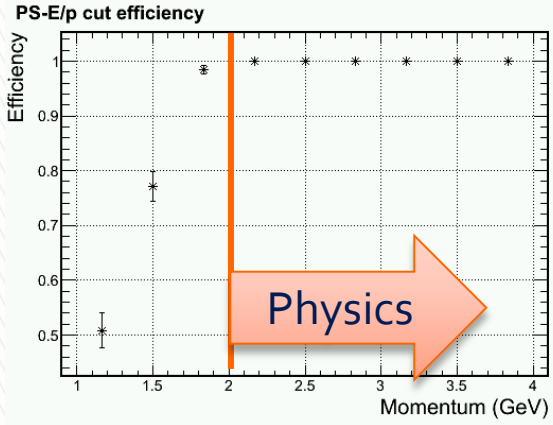


100% pass for
~250 events/bin

, full bgd

Middle radius, higer γ ϕ-band, full bgd



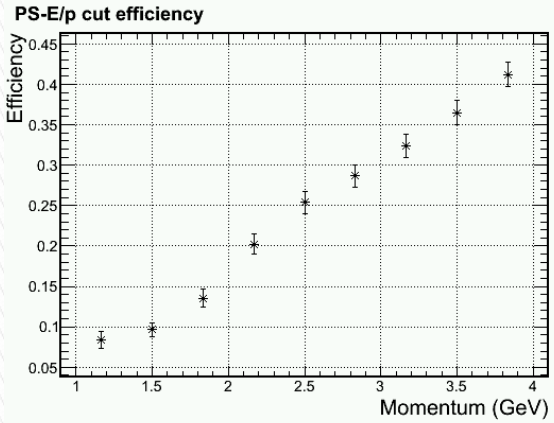


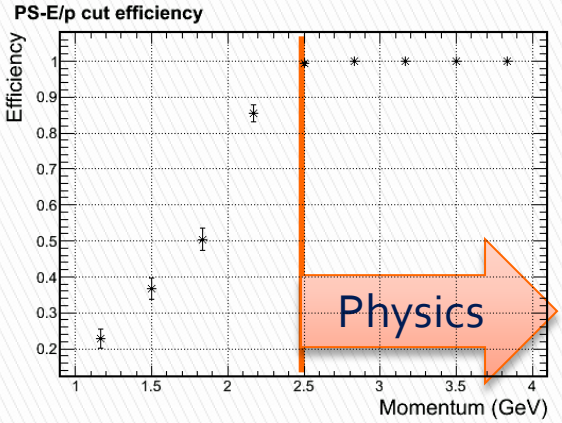
Pion Efficiency

Electron Efficiency

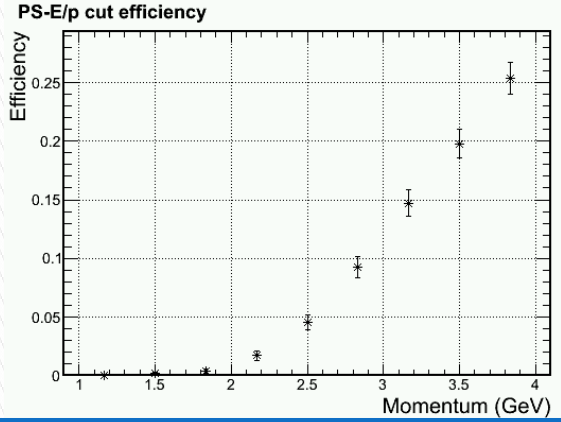
Trigger turn on curve for 2.5 GeV electron
Shower Hex 1+6 trigger > 2.1 GeV

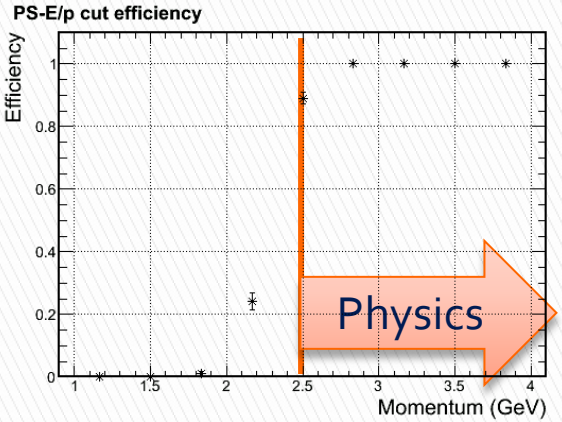
Middle radius, higher γ ϕ-band, full bgd





Outer radius, higer γ ϕ-band, full bgd





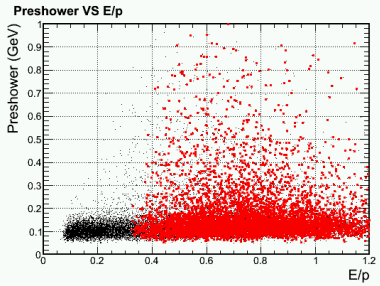
Pion Efficiency

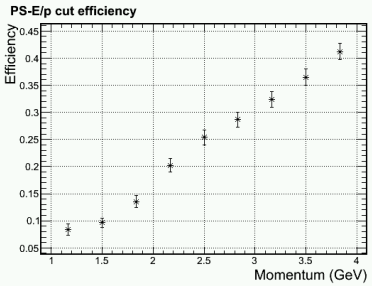
Electron Efficiency

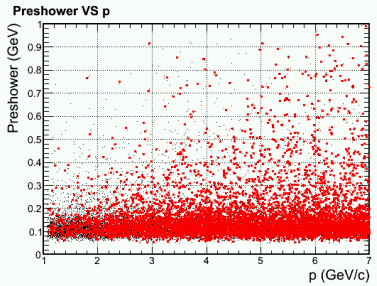
More detail in trigger cut

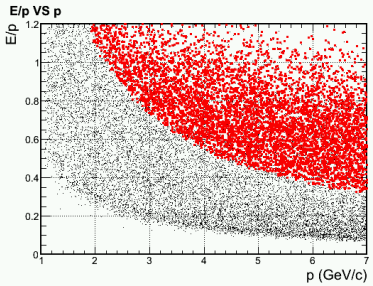
Middle radius, higher γ ϕ-band, full bgd

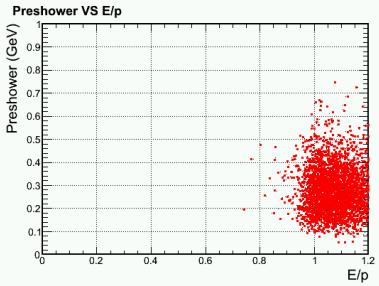
Shower Hex 1+6 trigger > 2.1 GeV

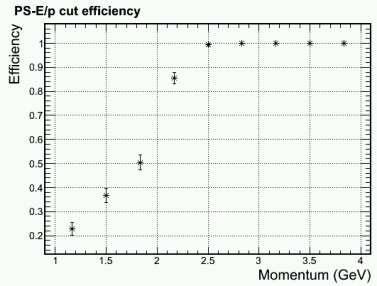


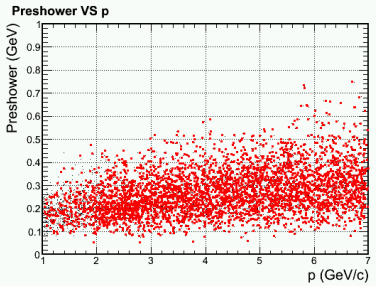


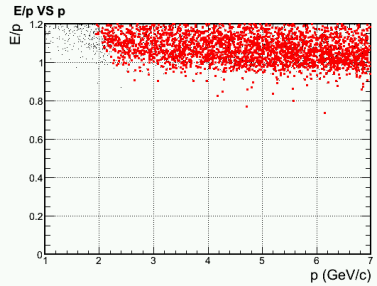












Pion Efficiency

Electron Efficiency

Readout occupancy per shower channel for ~75MeV zero suppression