

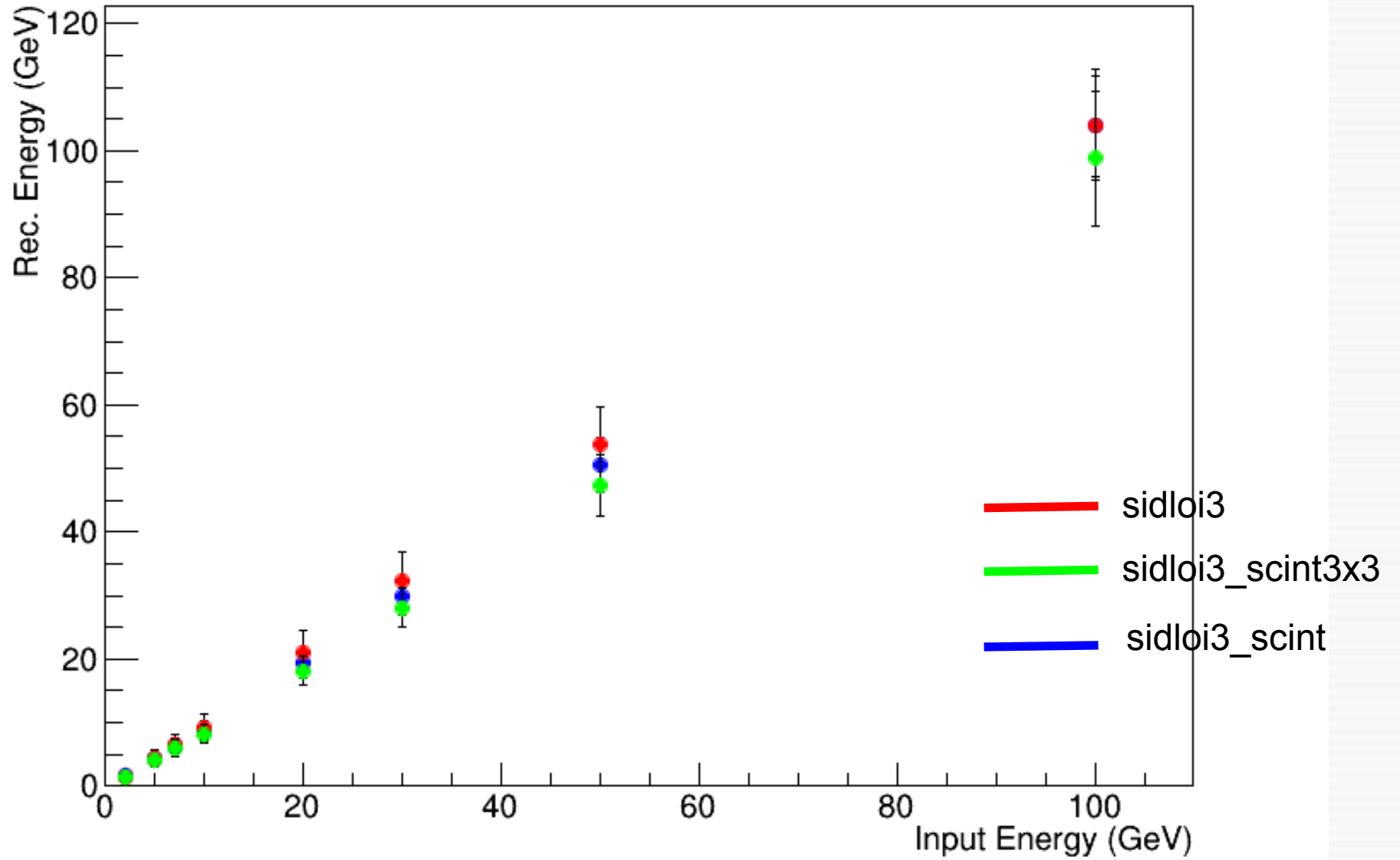
# Optimizing SiD

Marcel Stanitzki  
28/08/2014

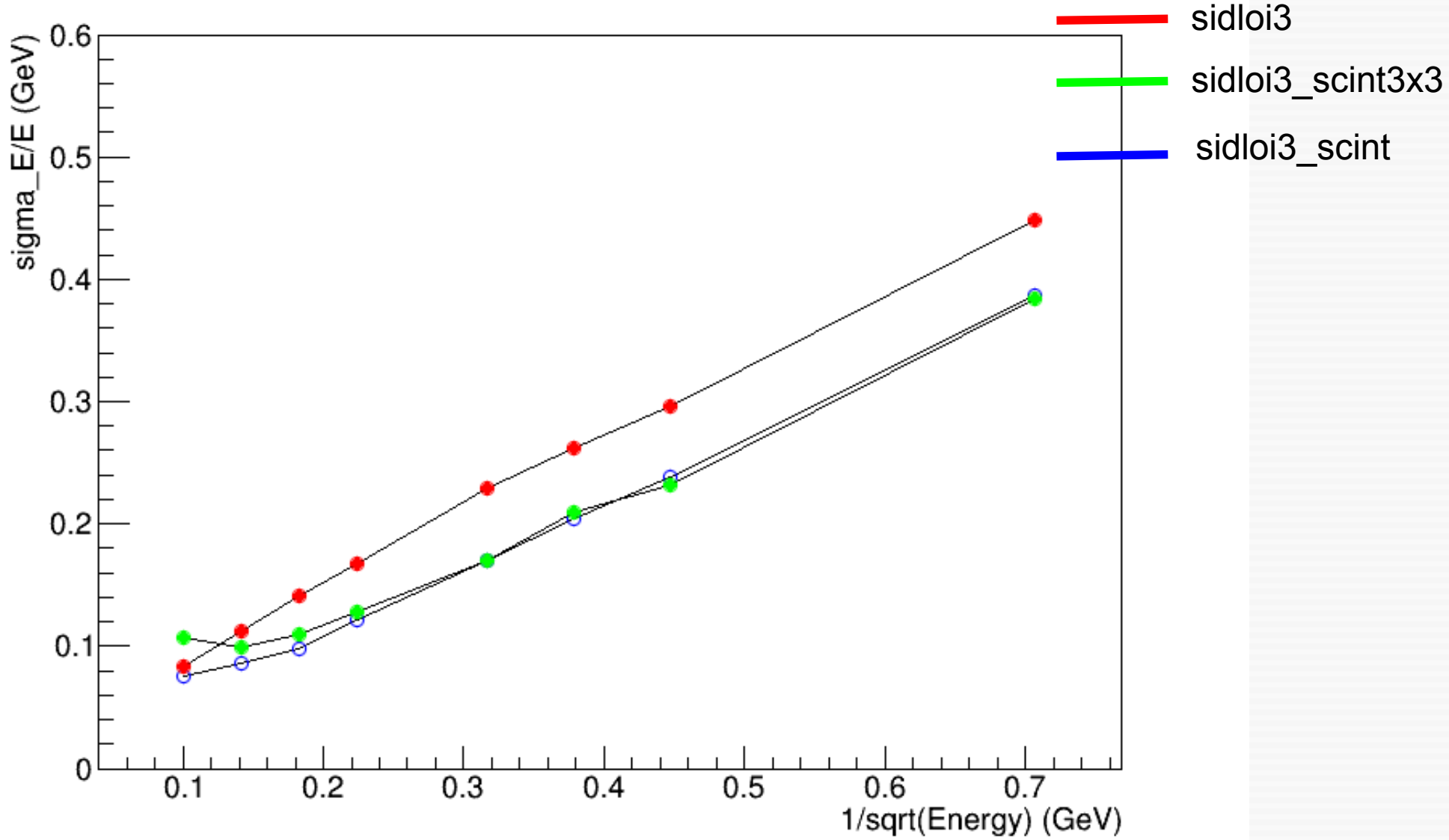
# HCAL comparison with SiD

- Using DBD reco suite
- Three variants
  - Sidloi3 (baseline, DHCAL RPC 1x1 cm)
  - sidloi3\_scint (AHCAL 1x1 cm)
  - sidloi3\_scint3x3 (AHCAL 3x3 cm)
- Firing neutrons at 90 angle
  - Various energies
  - Full Reco and take Energy from Pandora Object
  - Mean and sigma from Gauss Fit

# sidloi3\_scint linearity



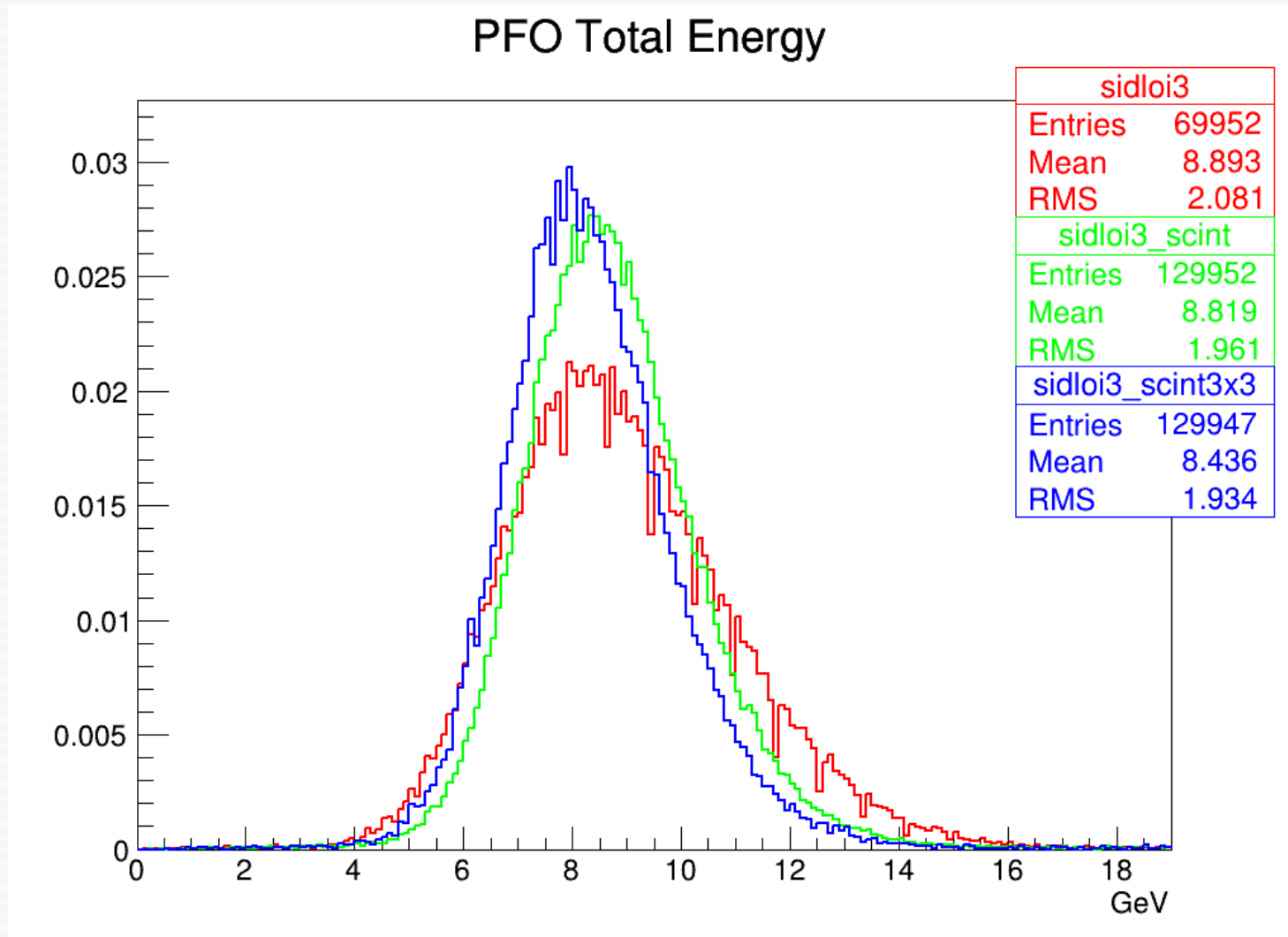
# sidloi3\_scint sigmaE/E



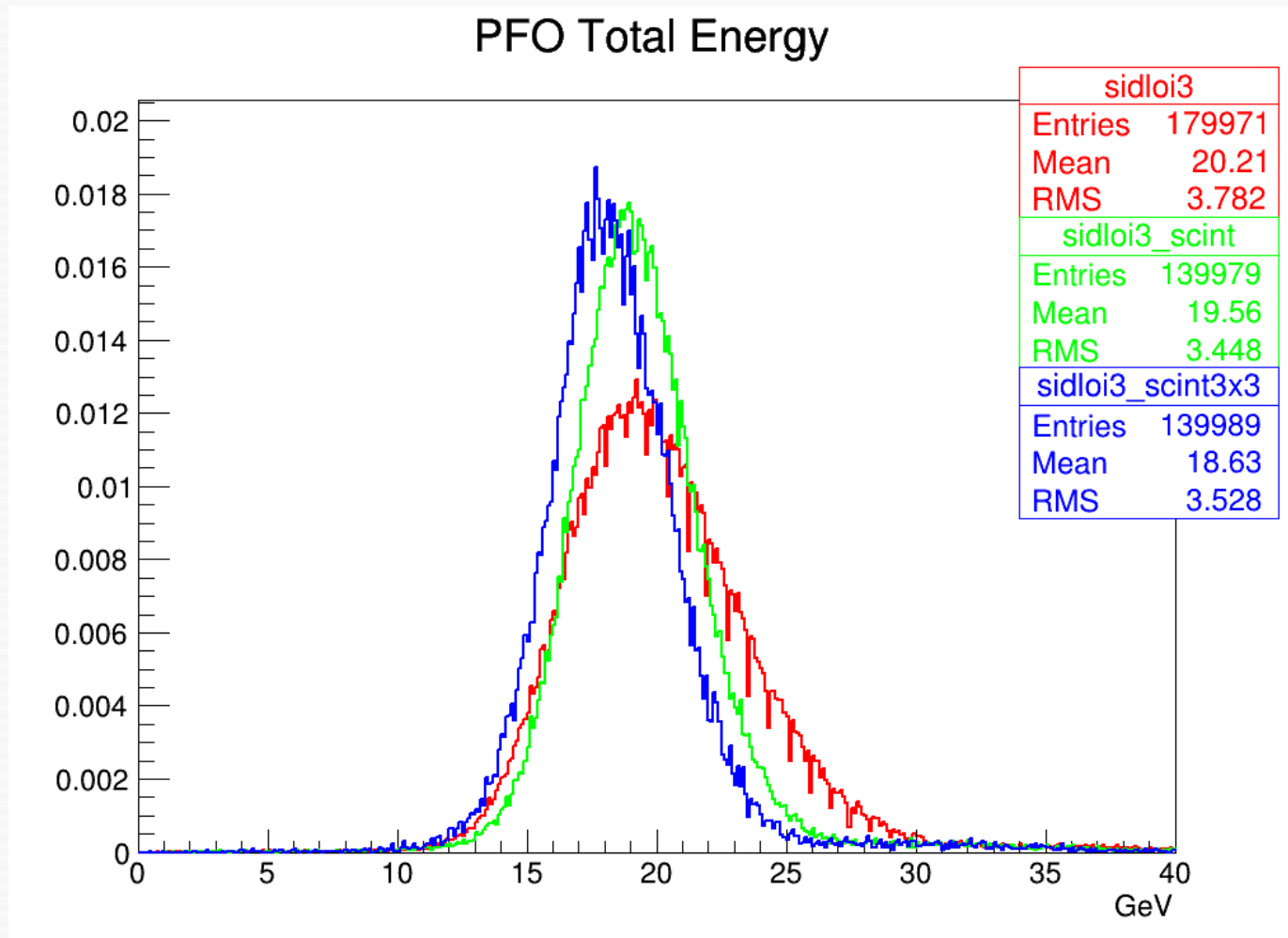
# Change of gear

- Firing neutrons and photons
  - From 5 to 175 GeV in Theta
  - Energies 5,10,20 GeV
  - Full reco and take rec Energy from Pandora
  - Binwise fits for  $\sigma_E/E$  (later)

# Neutrons at 10 GeV

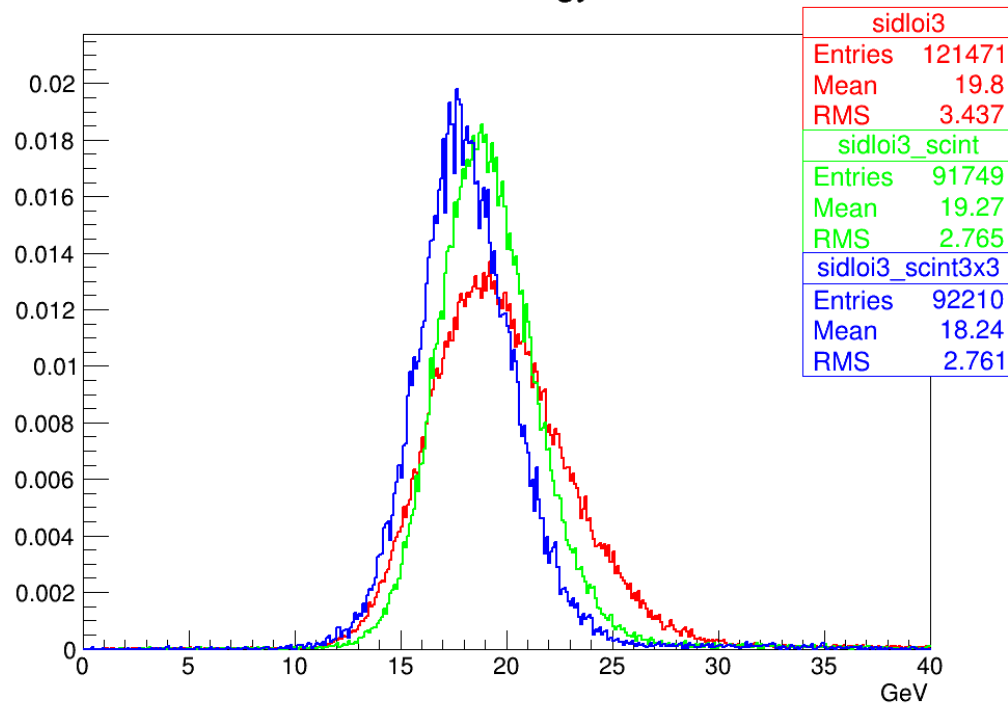


# Neutrons 20 GeV

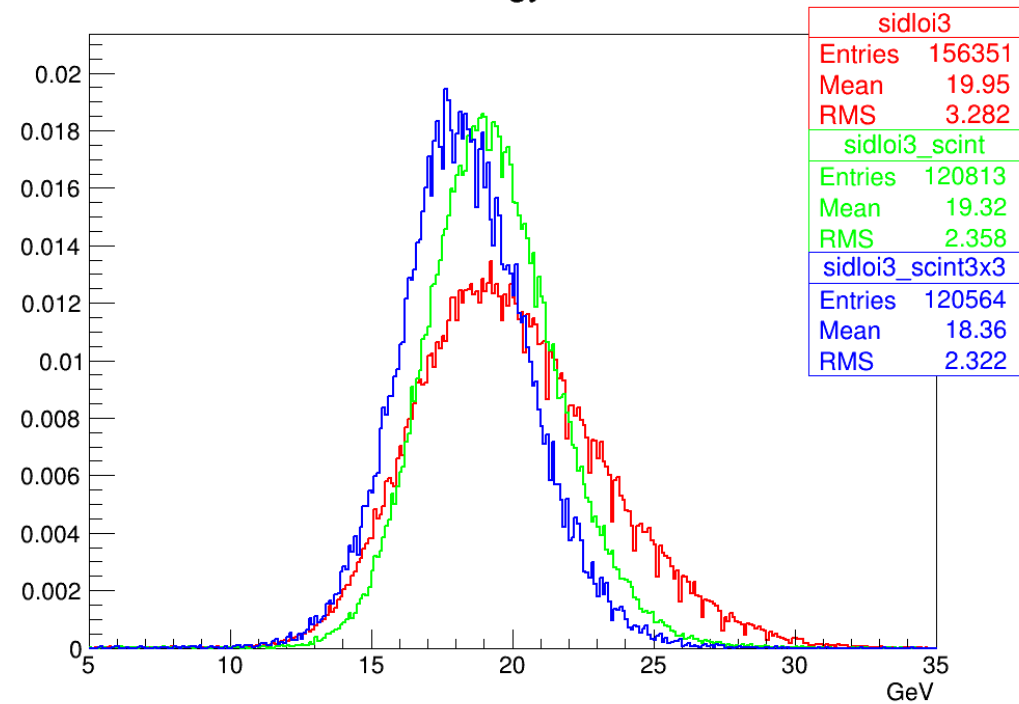


# Neutrons 20 GeV Cont'd

PFO Total Energy Barrel



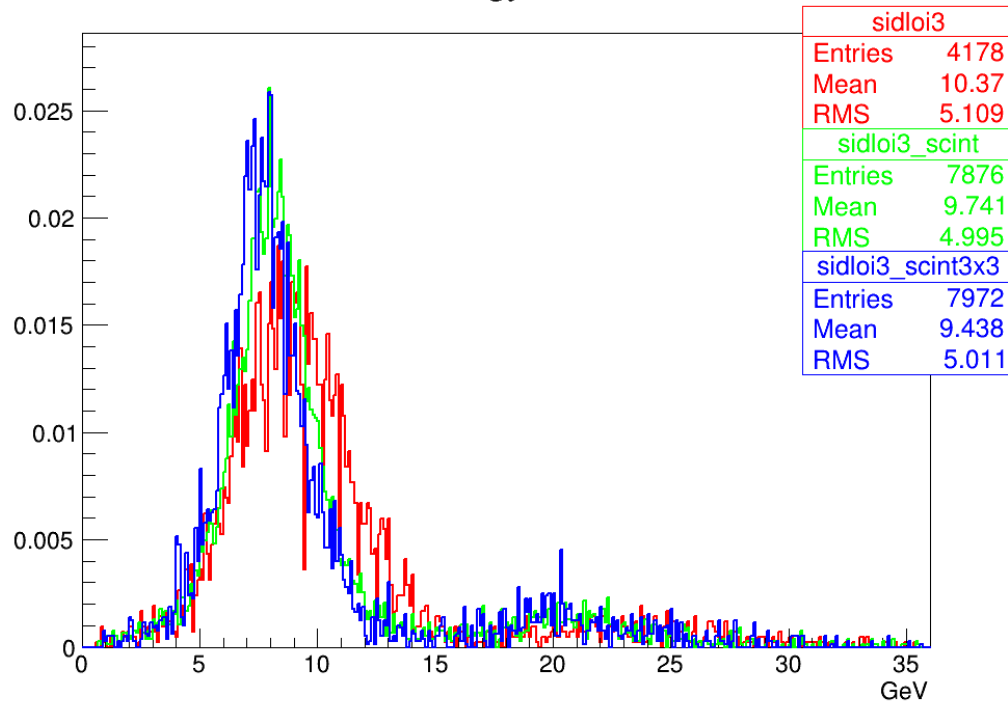
PFO Total Energy NoMuonHits



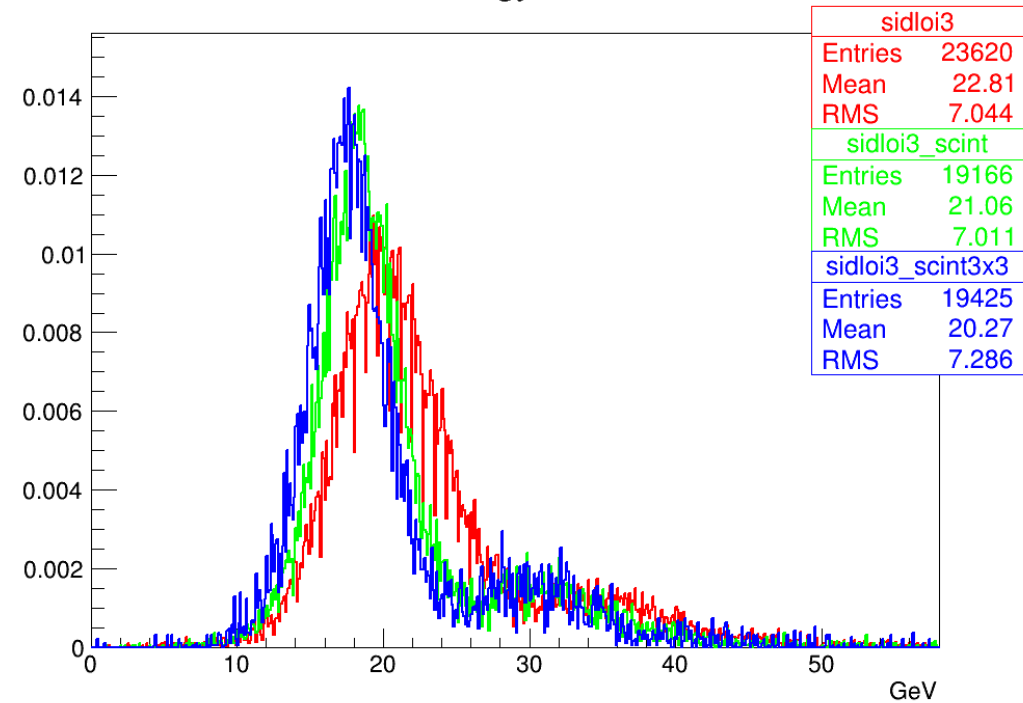


# Events with Muon Hits

PFO Total Energy with MuonHits

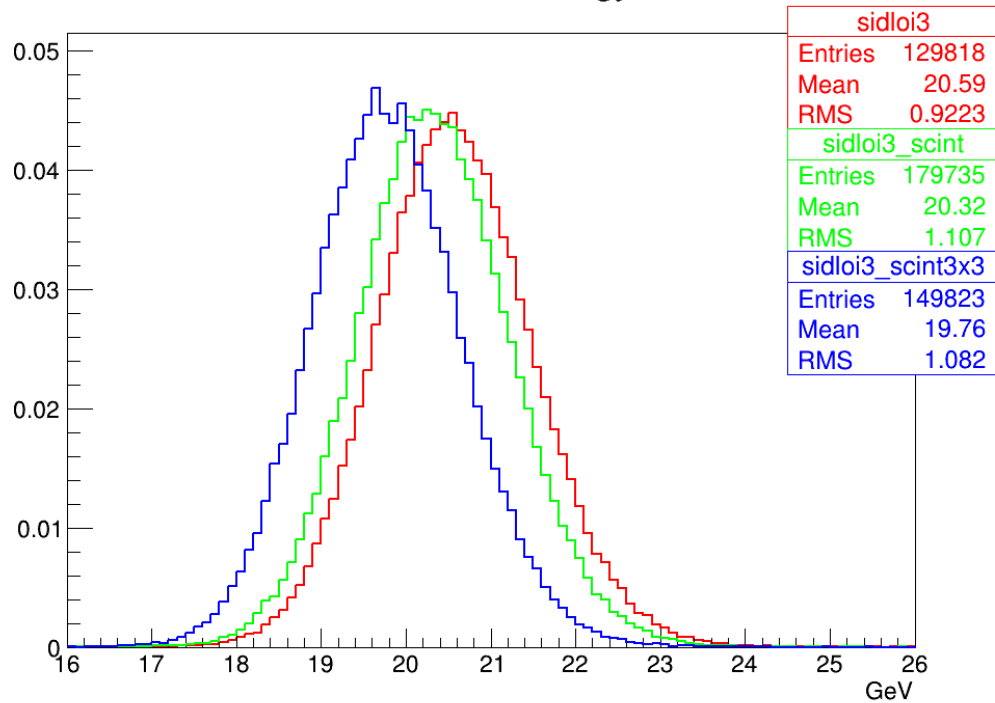


PFO Total Energy with MuonHits

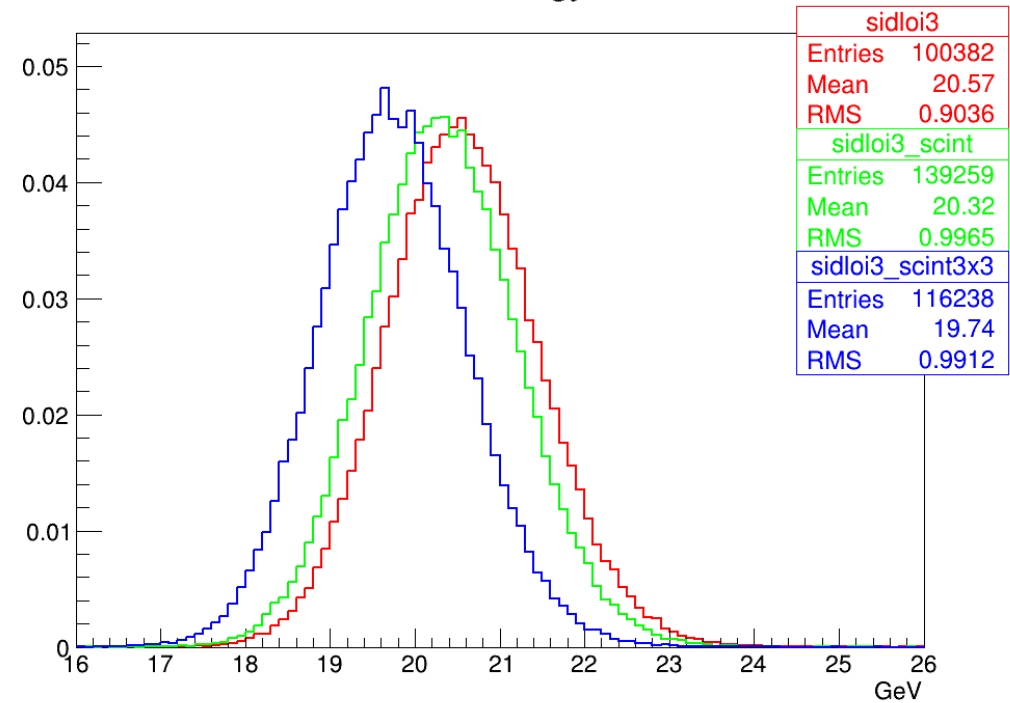


# 20 GeV Photons as cross-check

PFO Total Energy

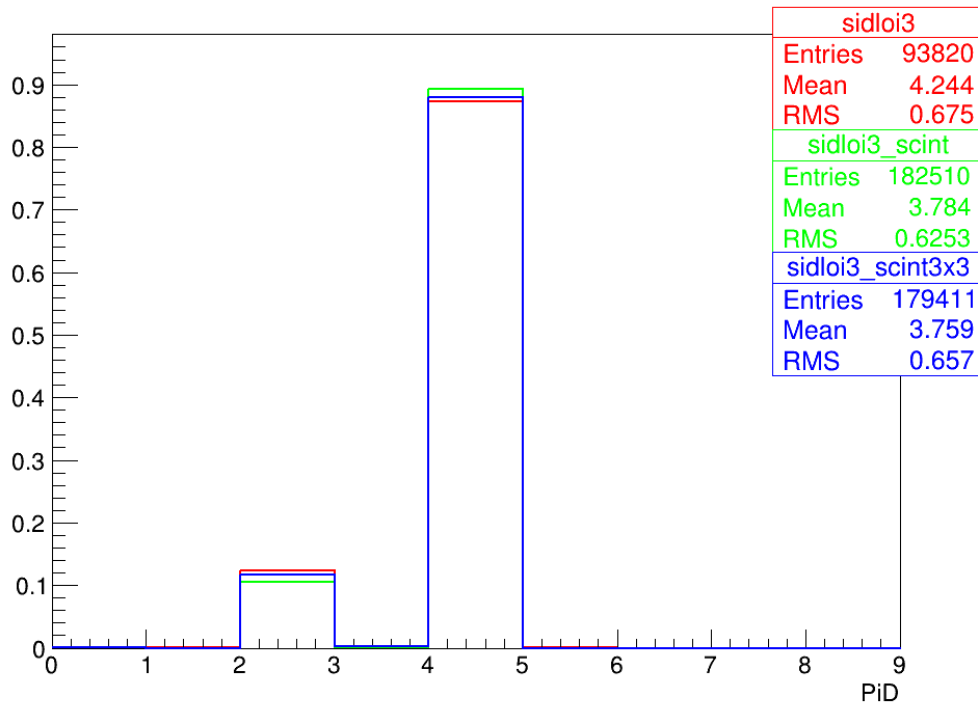


PFO Total Energy Barrel

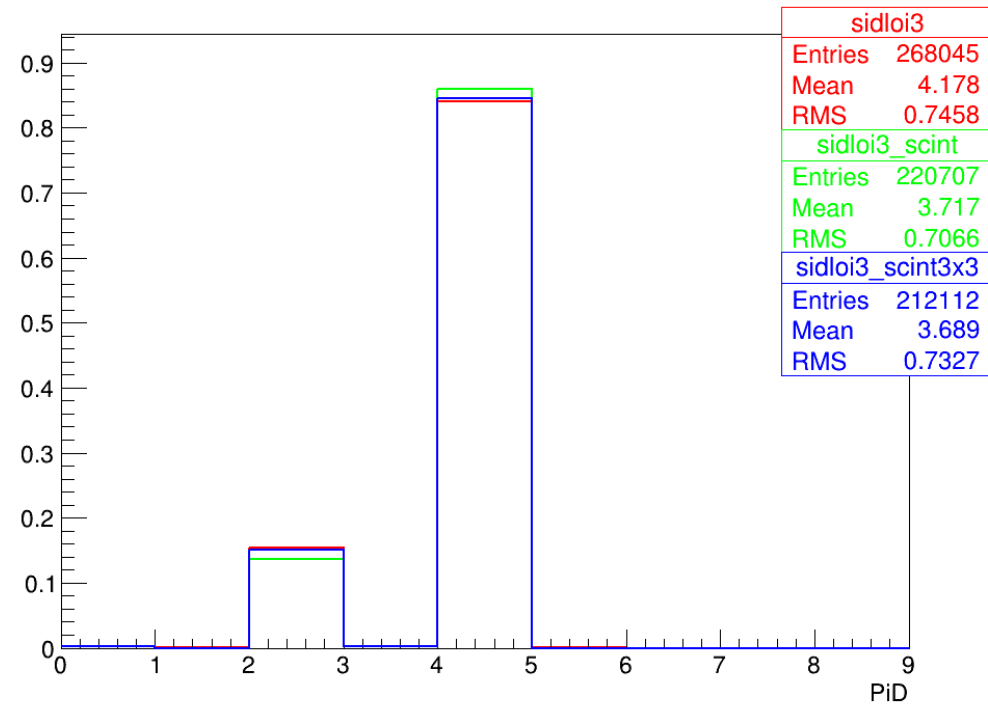


# Most Neutrons are neutrons

PFO PiD



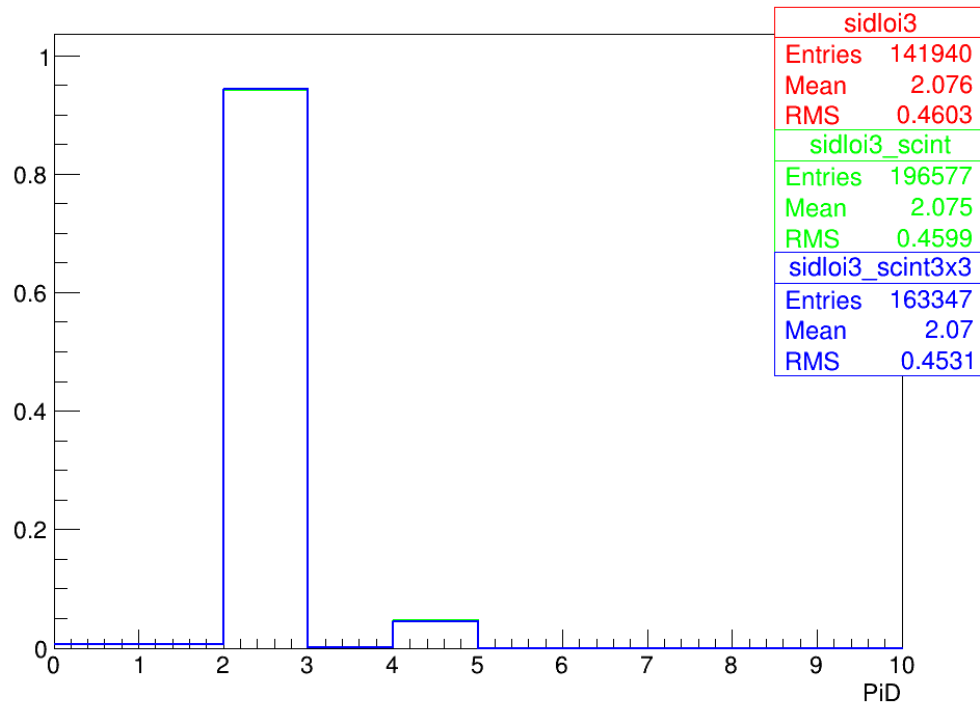
PFO PiD



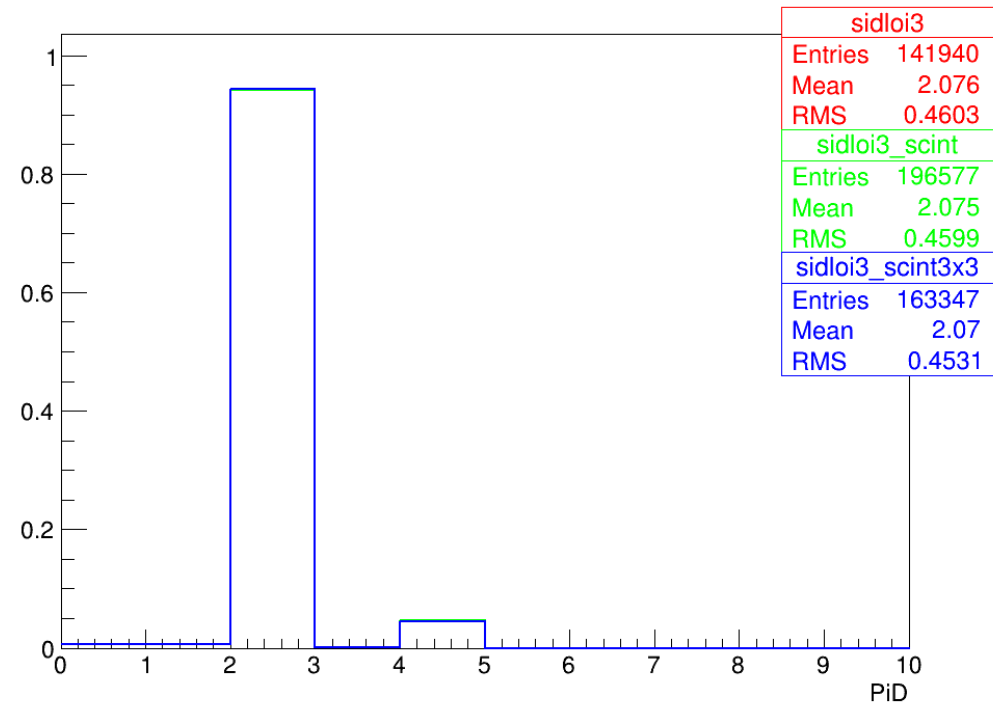
Note 2= photon, 4 =neutron and there is some mistagging ....  
No huge differences between HCALs

# Most Photons are Photons

PFO PiD

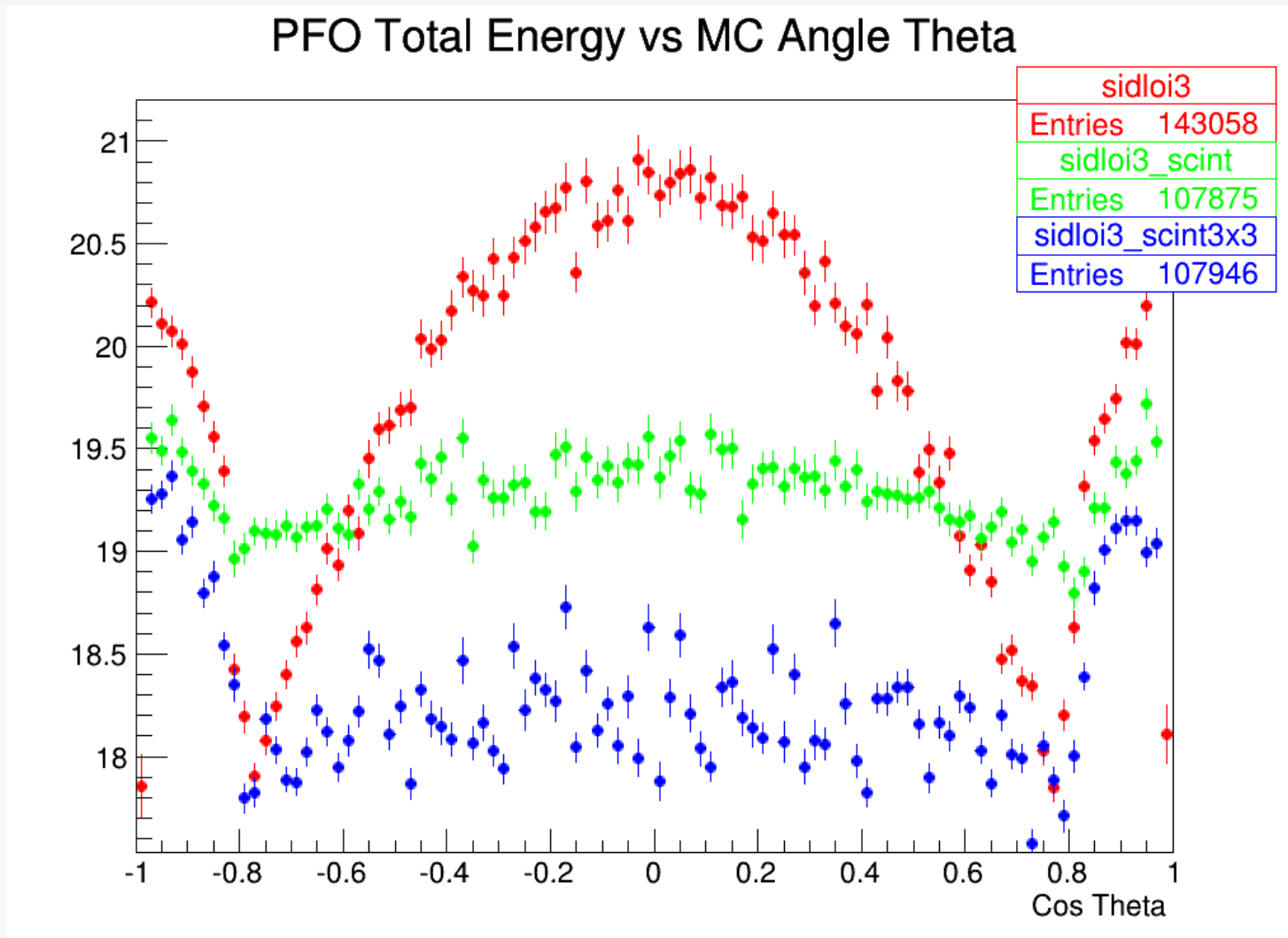


PFO PiD

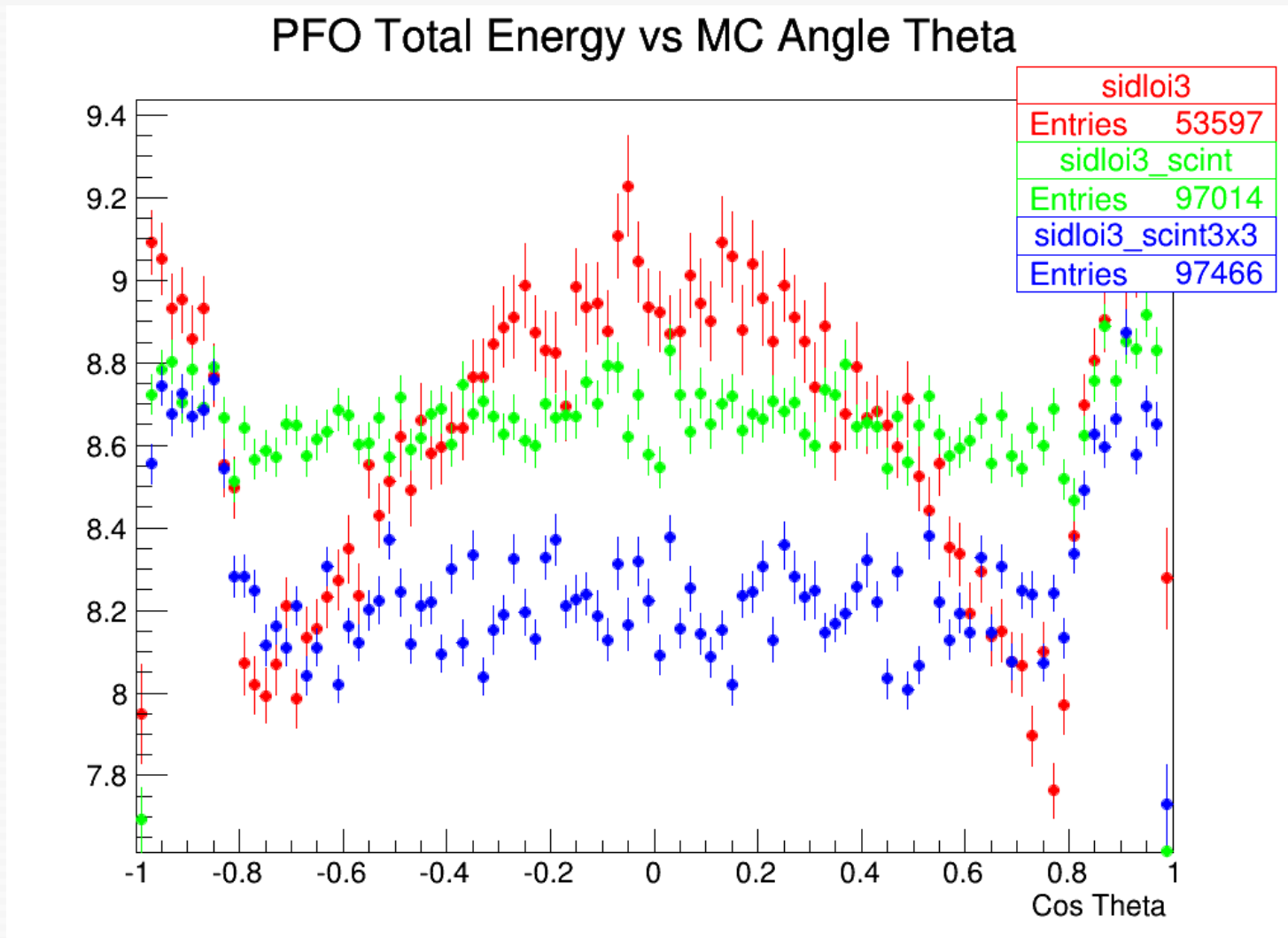


Note 2= photon, 4 =neutron and there is some mistagging ....  
No differences between HCALs (nor should there really be)

# Angles :20 GeV Neutrons

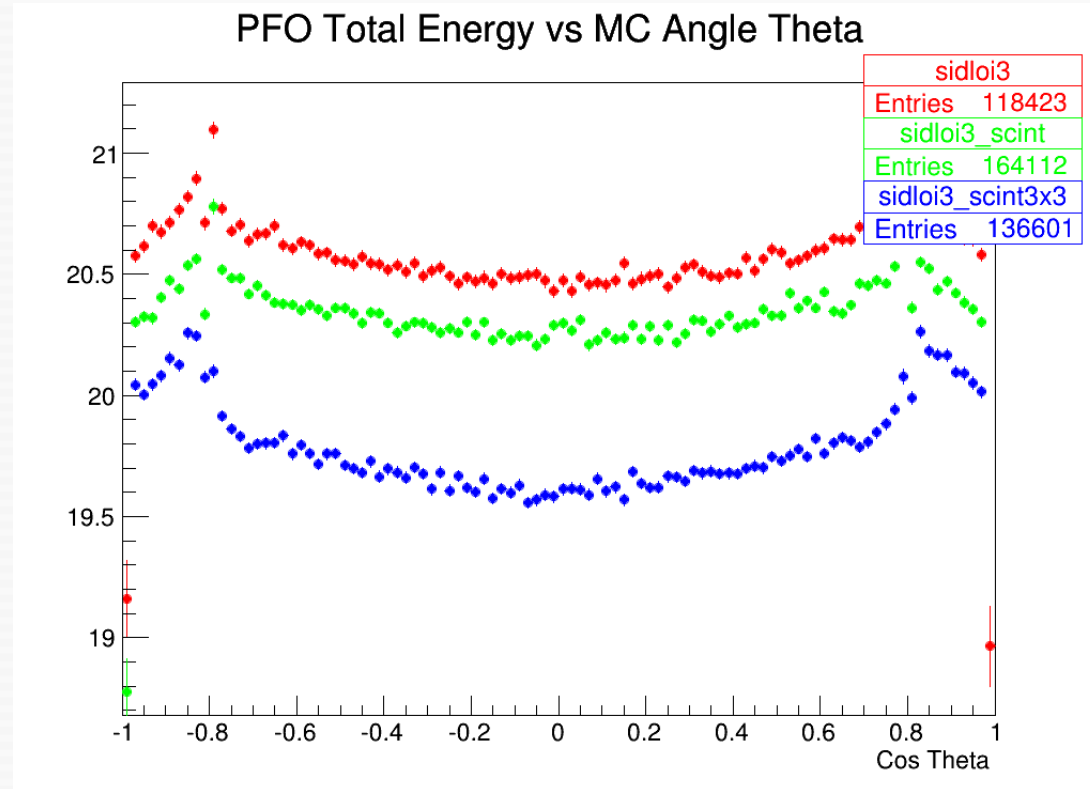


# Angles : 10 GeV Neutrons



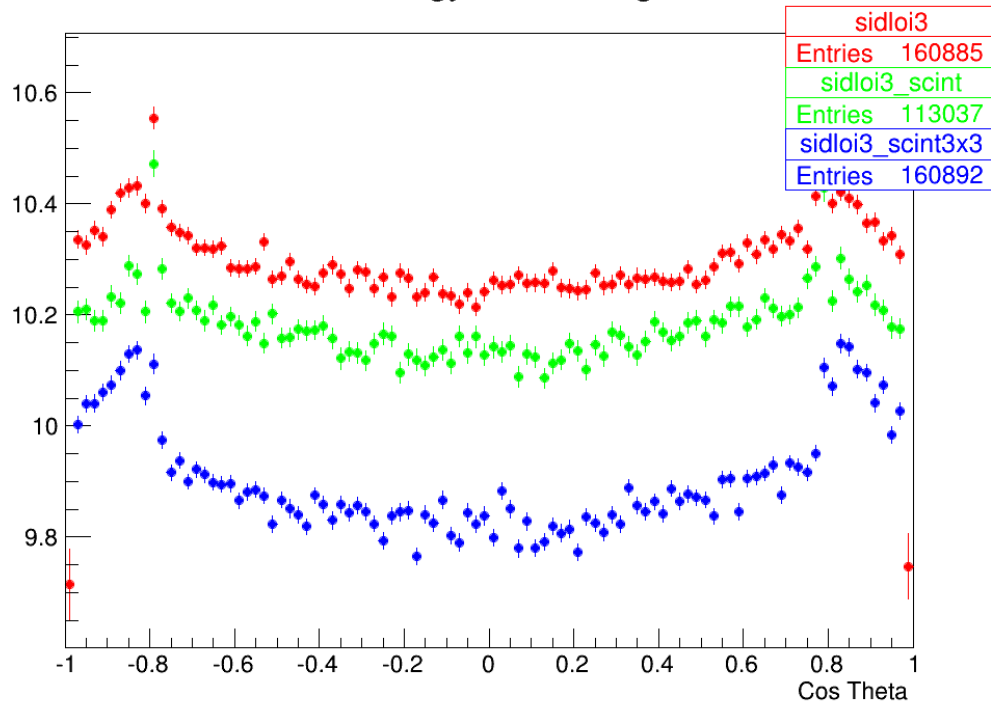
# Something's wrong here

- RPC HCAL
  - shows odd behavior
- ECAL does not
  - 20 GeV photons
- Calibration does have some features
  - ECAL response should be the same

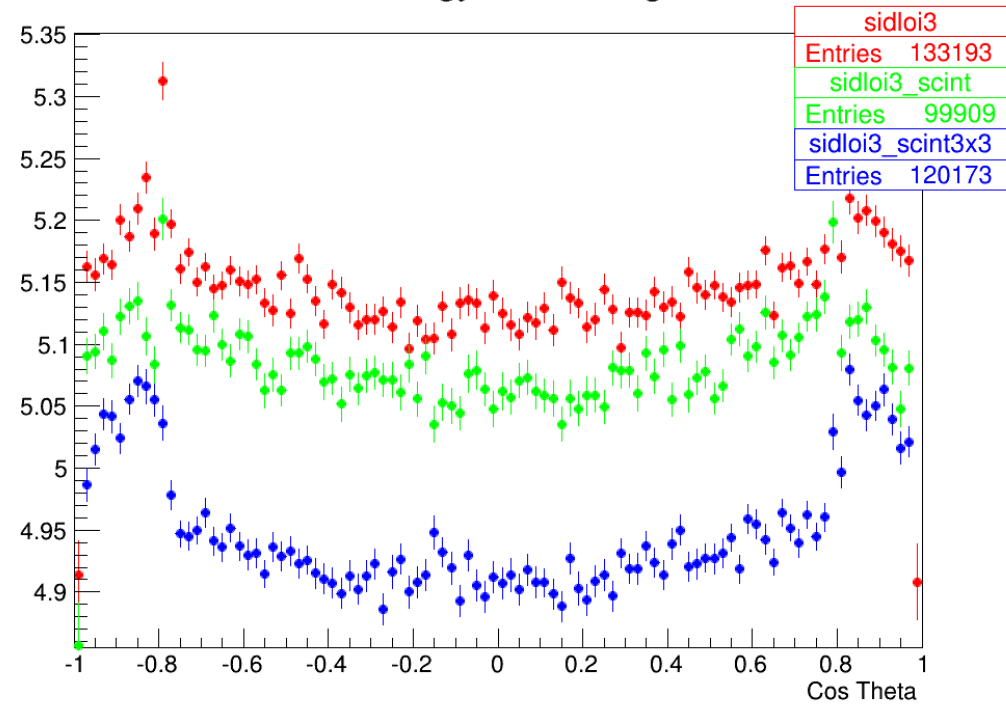


# 5 and 10 GeV Photons

PFO Total Energy vs MC Angle Theta

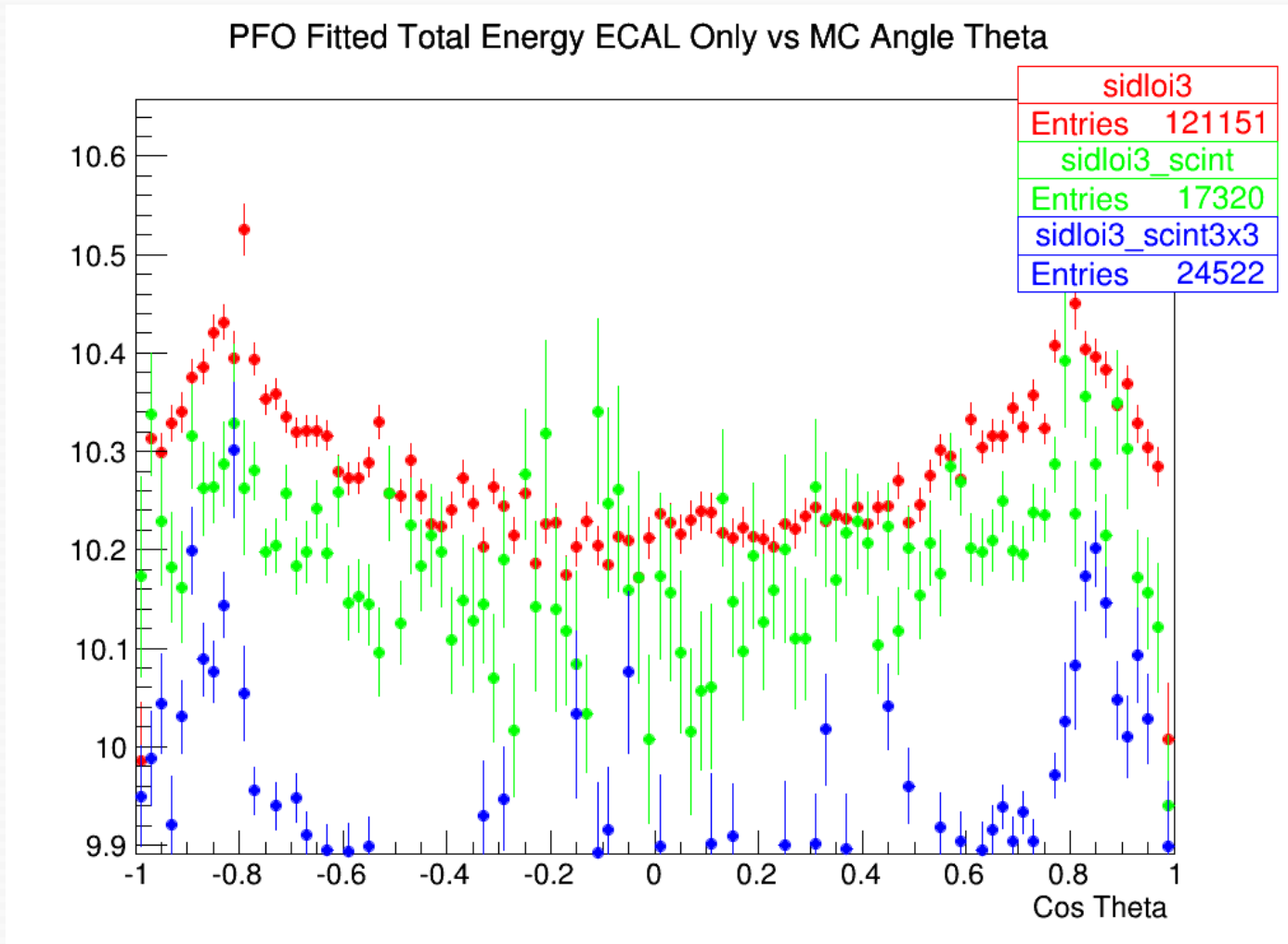


PFO Total Energy vs MC Angle Theta

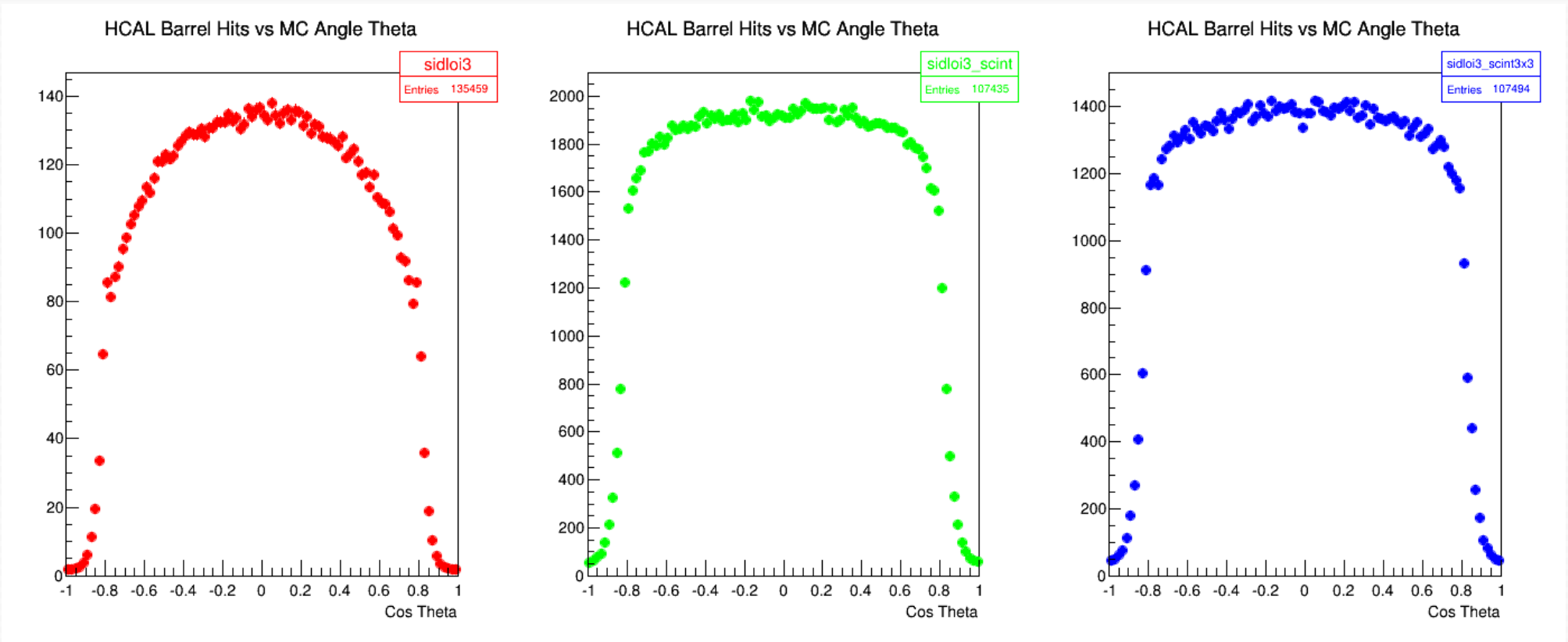




# ECAL Only check

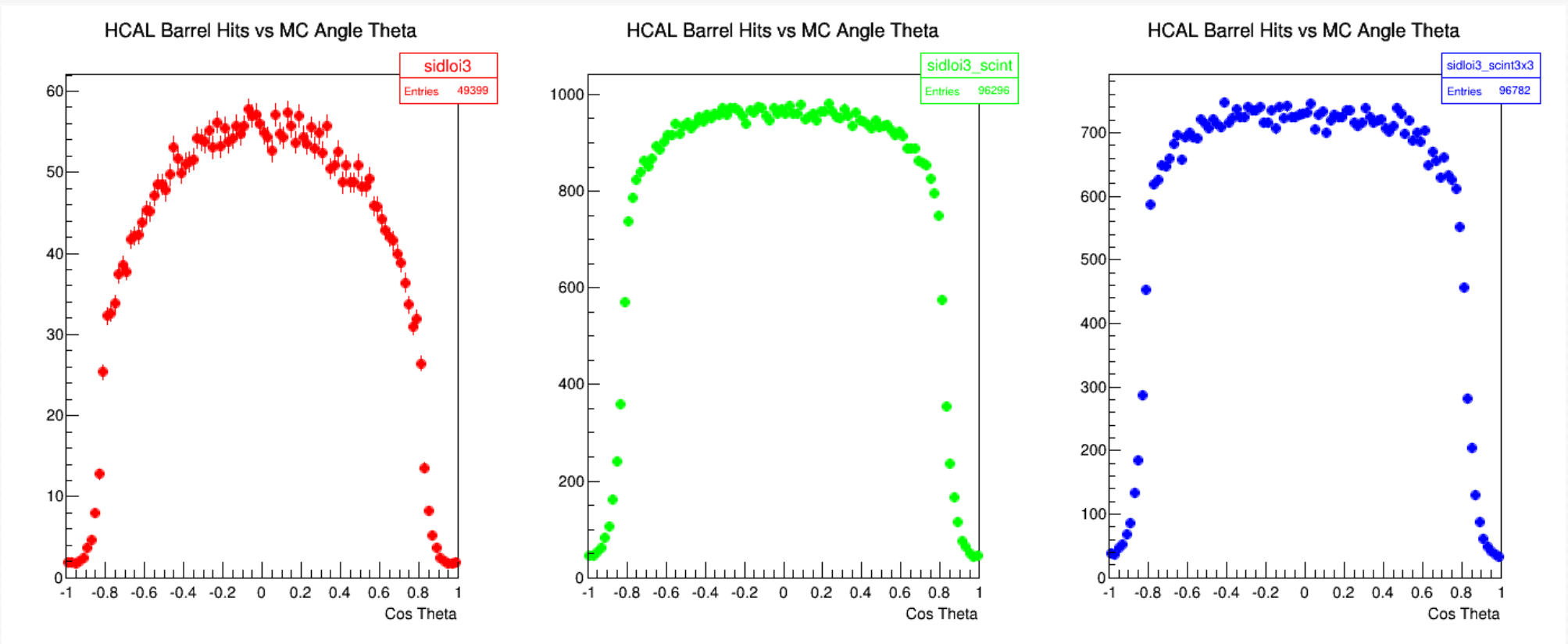


# Looking at SimCalorimeterHits



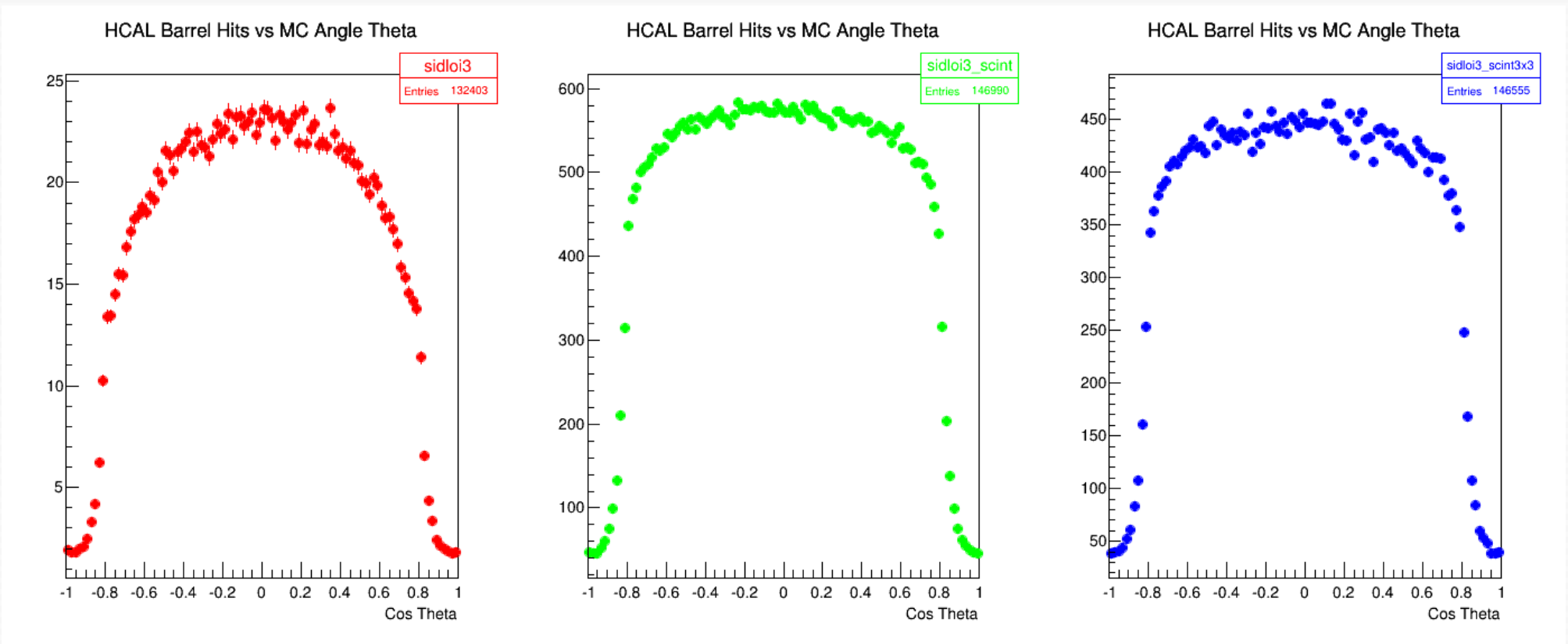
20 GeV Neutrons

# Looking at SimCalorimeterHits



10 GeV Neutrons

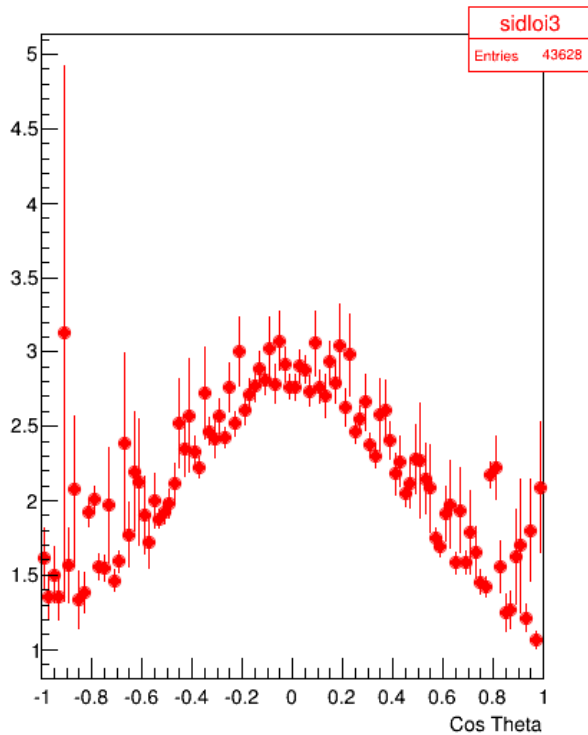
# Looking at SimCalorimeterHits



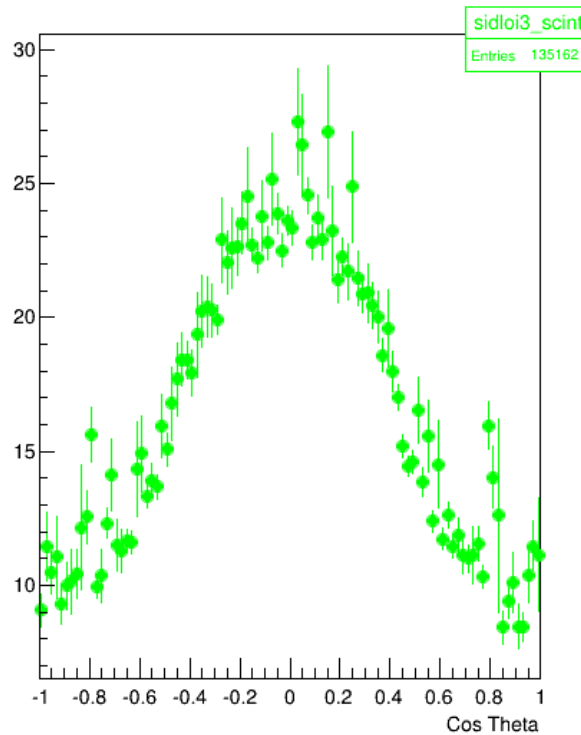
5 GeV Neutrons

# Cross-Check: 20 GeV Photons

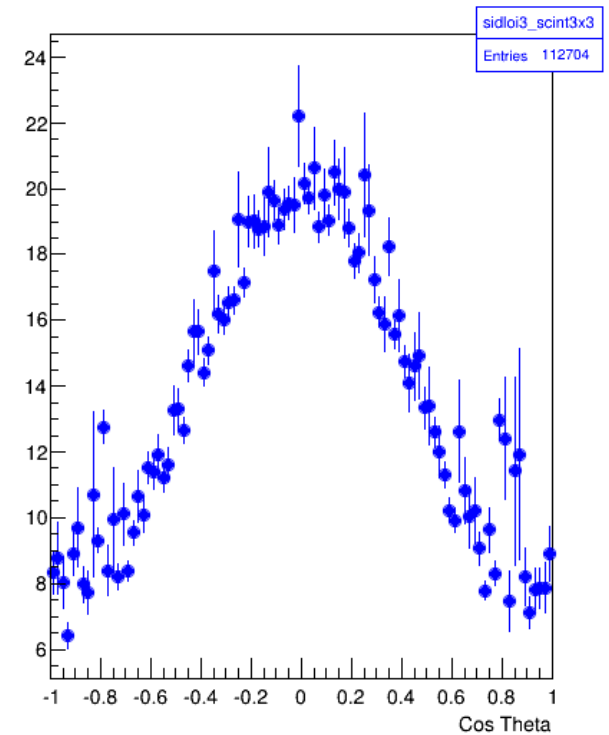
HCAL Barrel Hits vs MC Angle Theta



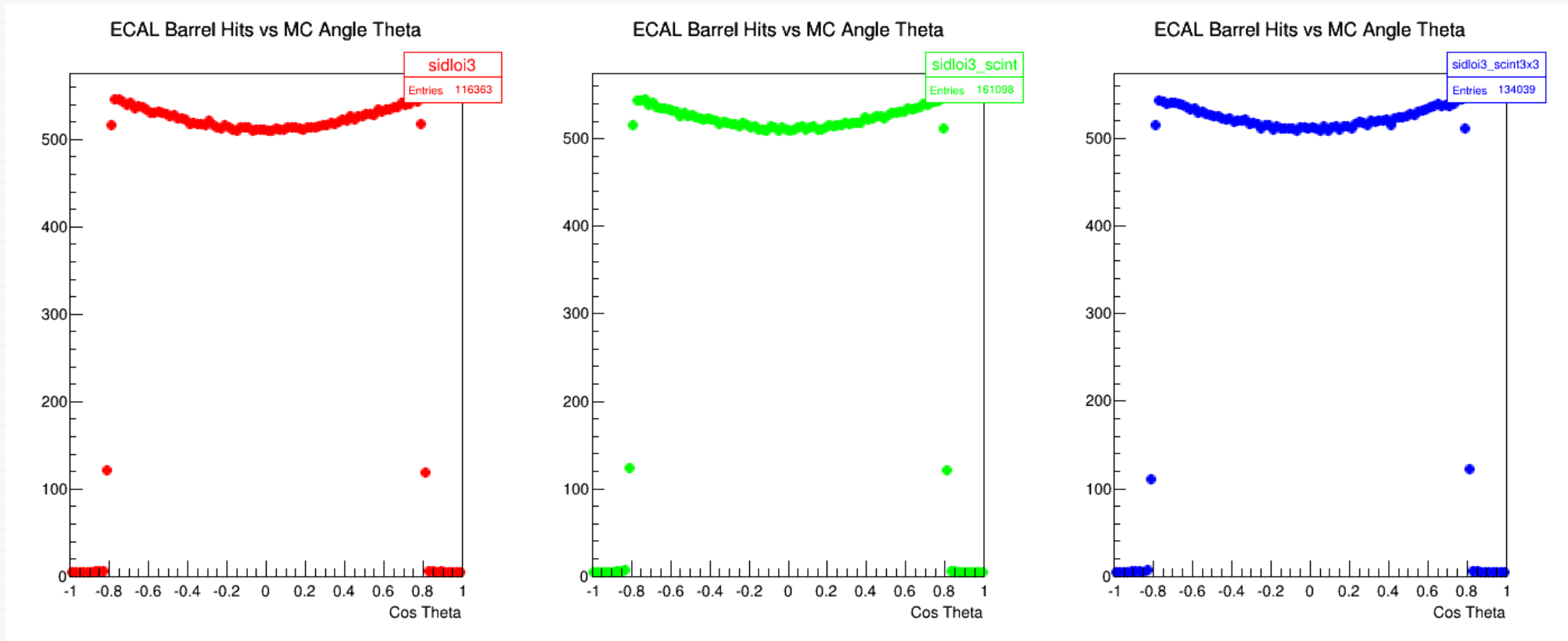
HCAL Barrel Hits vs MC Angle Theta



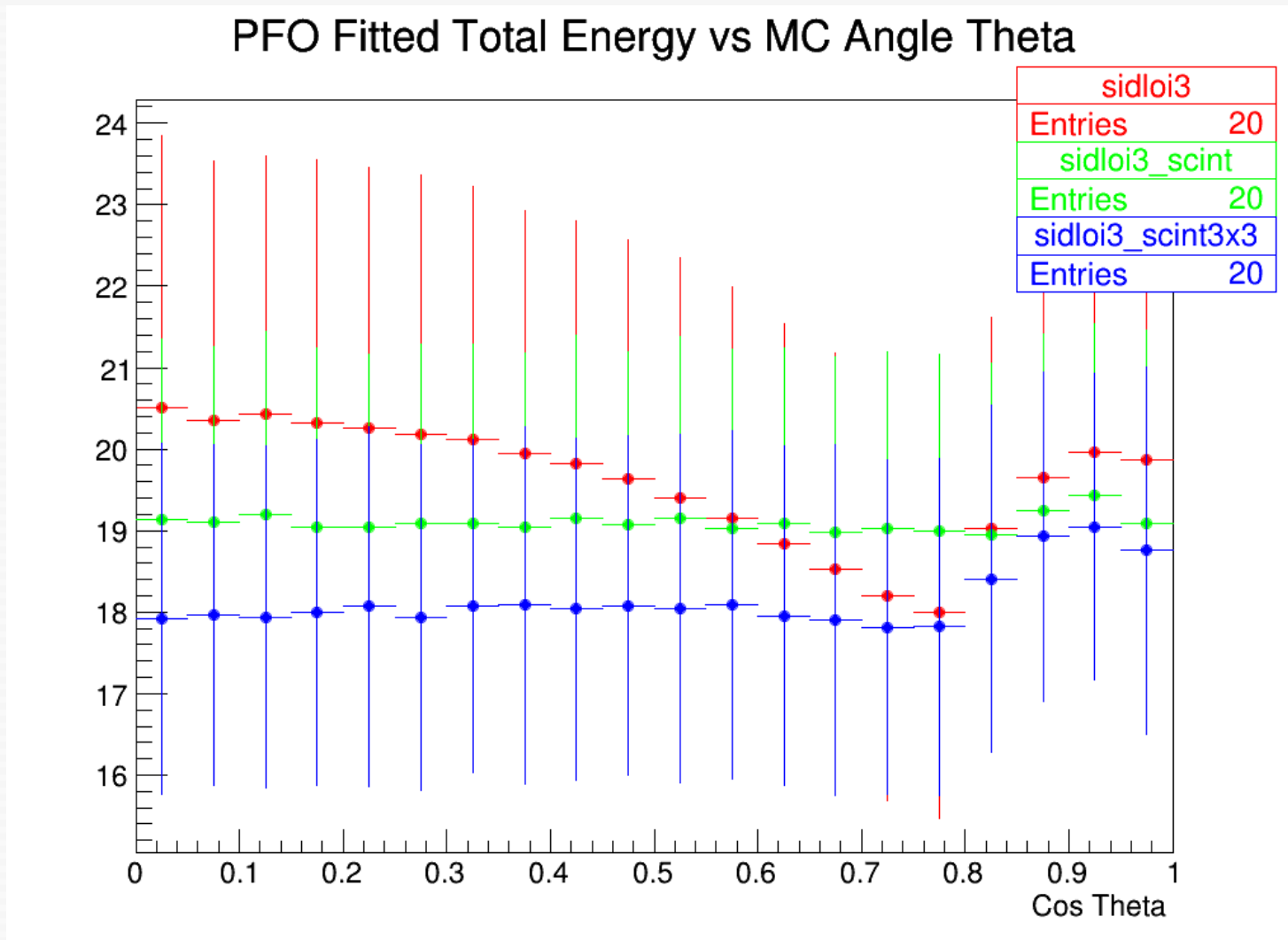
HCAL Barrel Hits vs MC Angle Theta



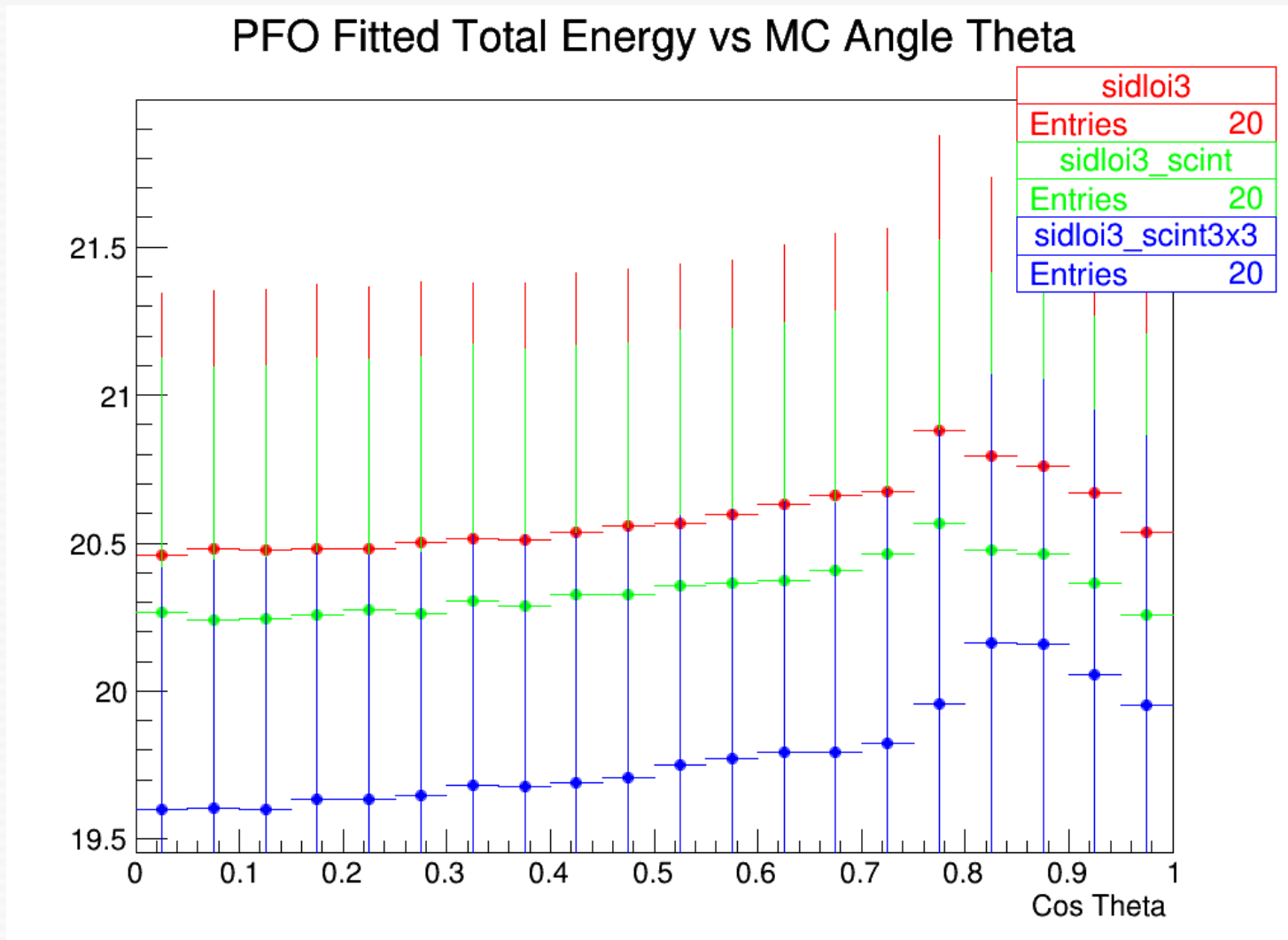
# ECAL Barrel Hits



# Fitted Energy (Gauss Fit)



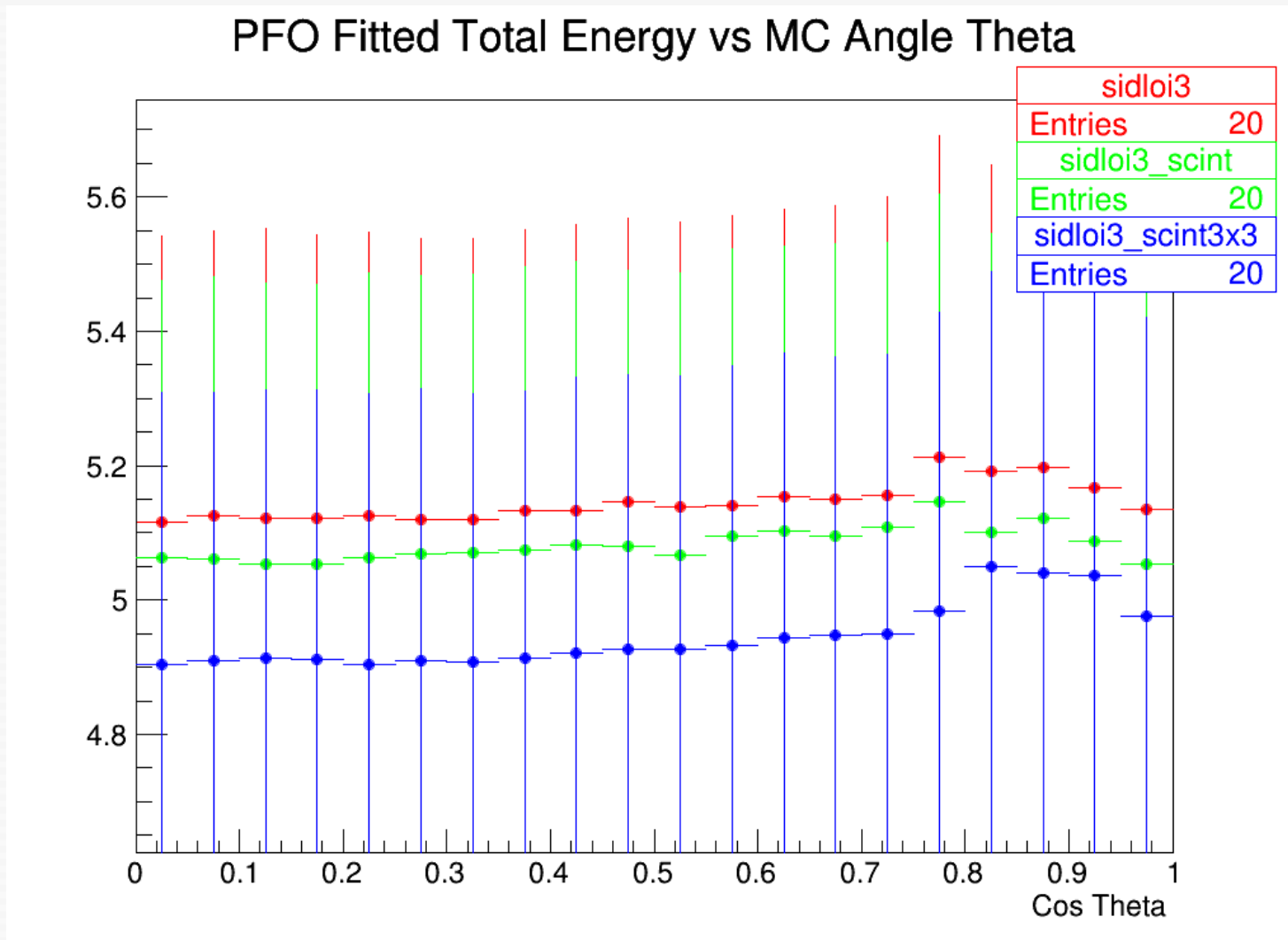
# Fitted Energy (Gauss Fit)



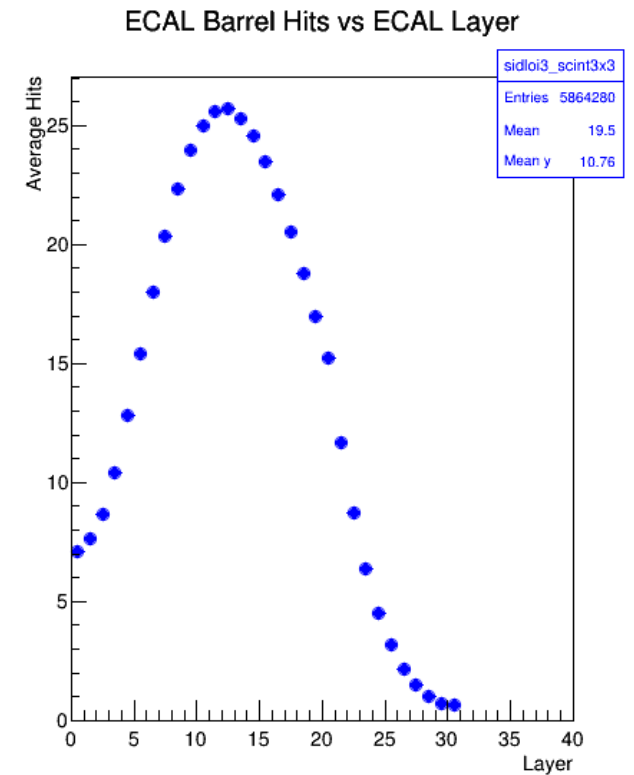
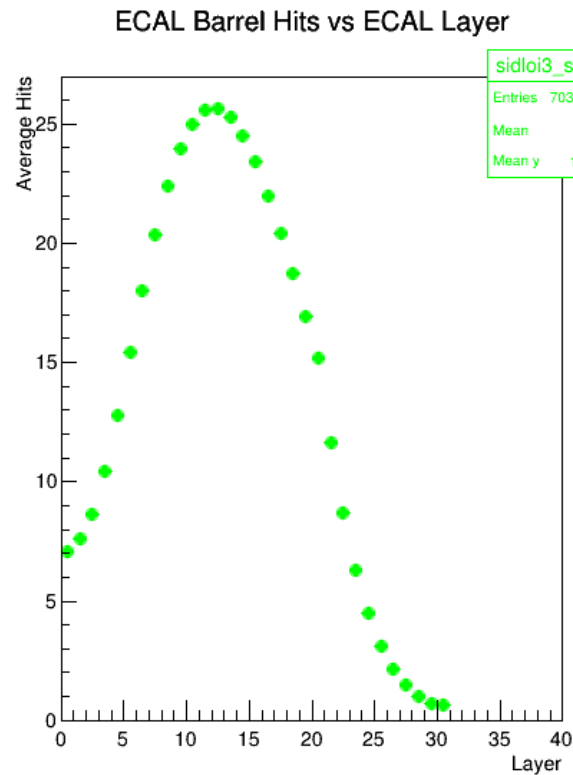
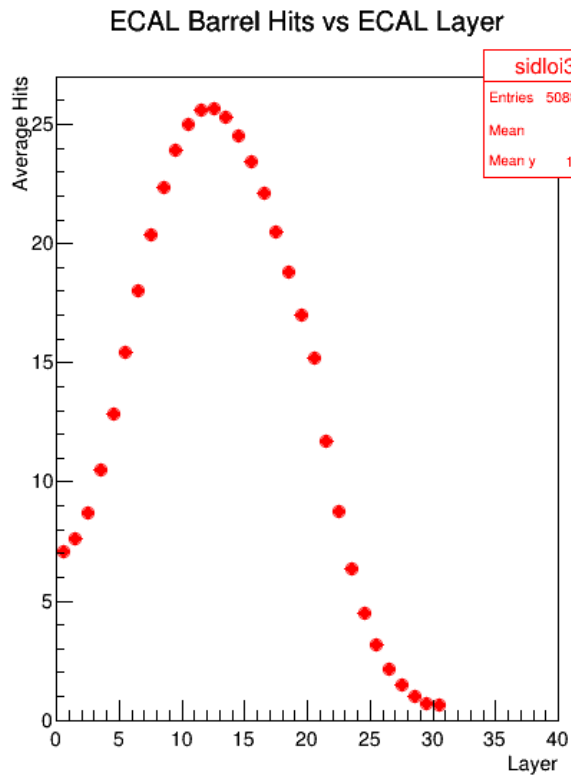
20 GeV Photons



# Fitted Energy (Gauss Fit)

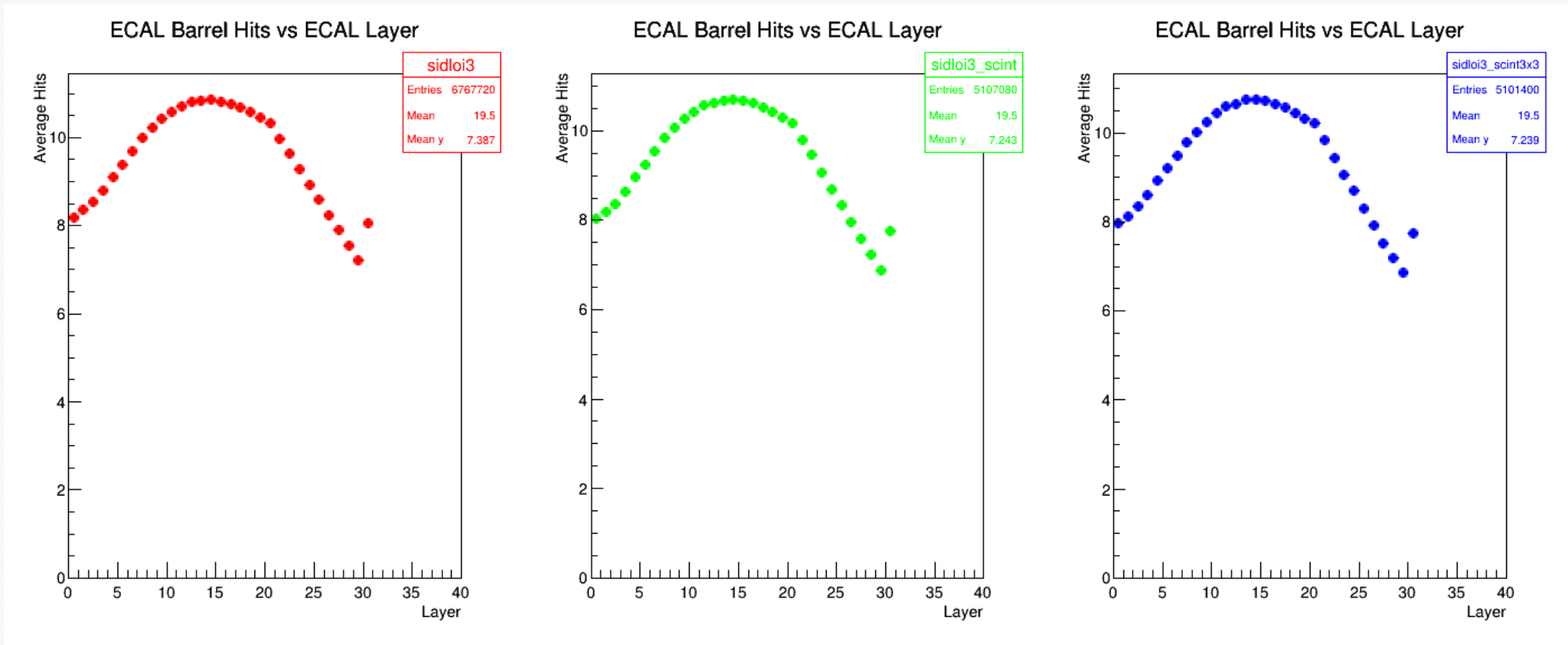


# Shower Shapes

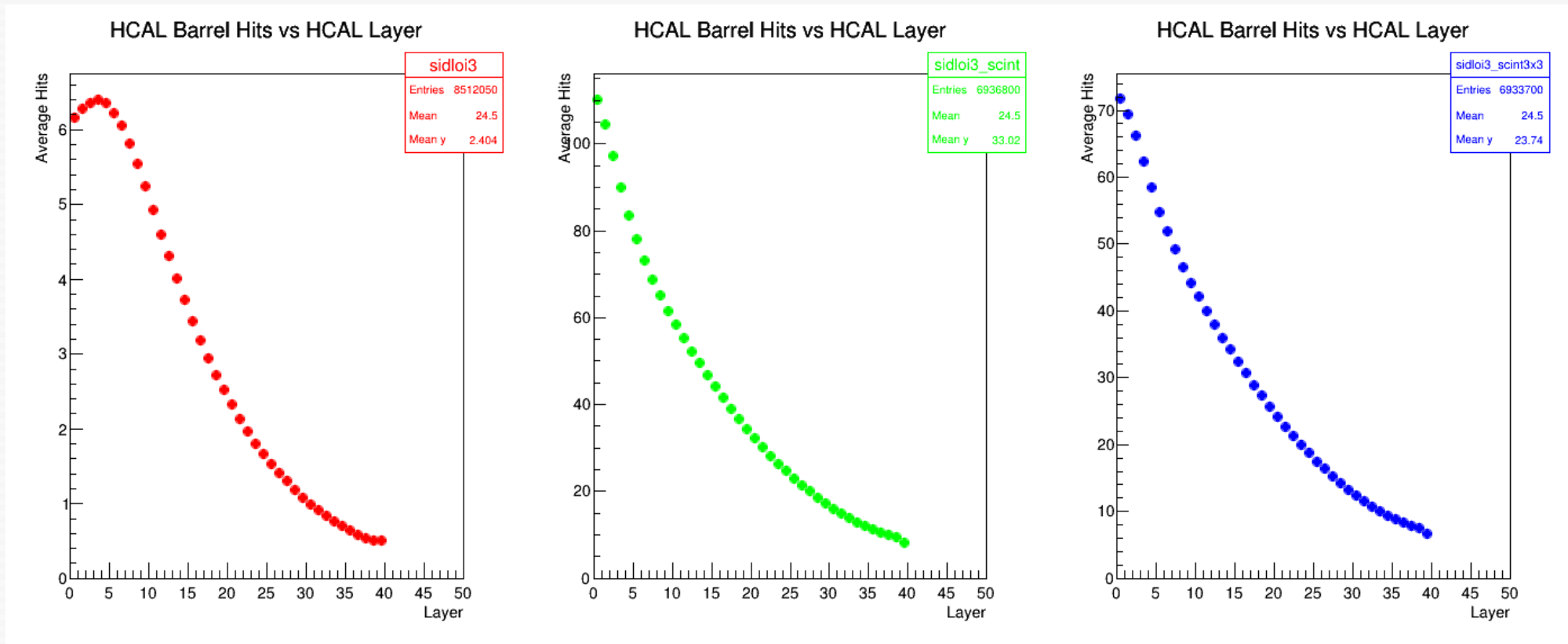


20 GeV Photons → ECAL behaves as expected

# 20 GeV Neutrons in ECAL

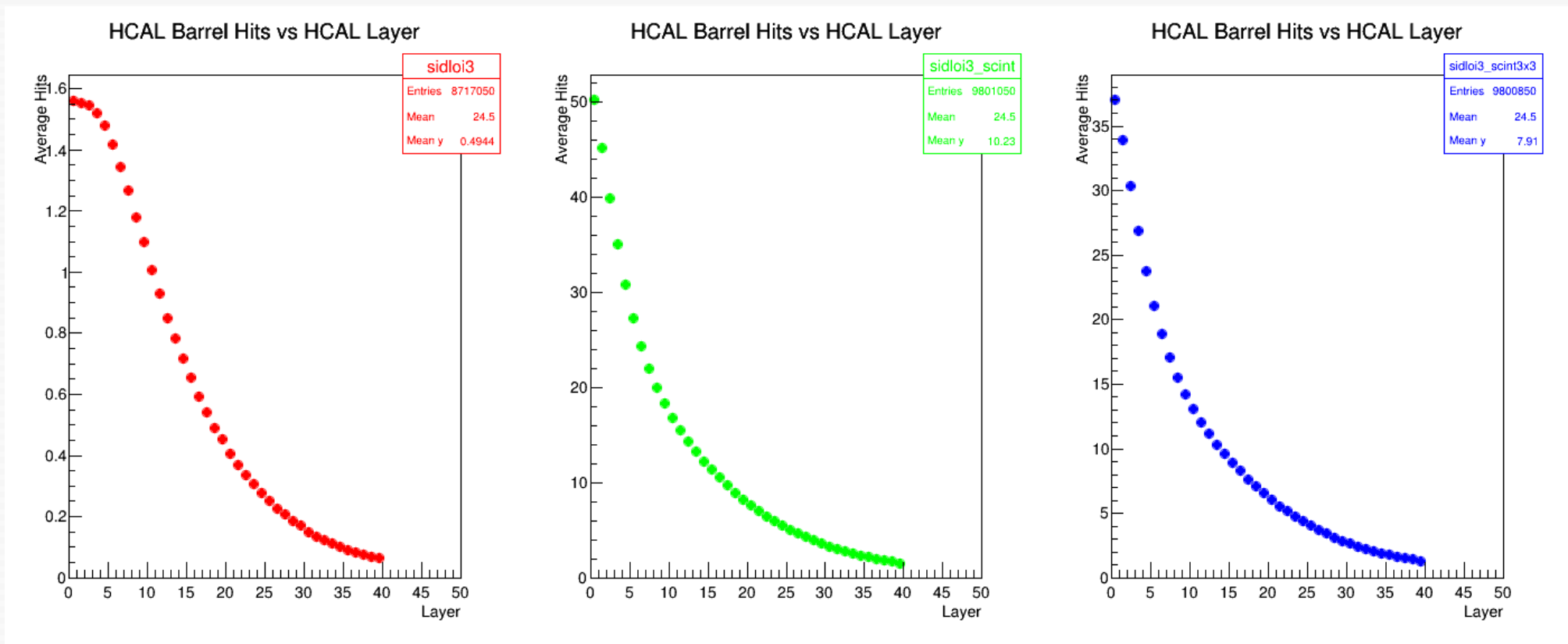


# 20 GeV Neutrons in the HCAL



Clearly different

# 10 GeV Neutrons Cross-check



# Fit Results Photons

Energy	Histo	Sidloi3 Mean		sidloi3_scint Mean		sidloi3_scint3x3 Mean	
20	Total Energy	20.58	0.91	20.34	0.89	19.78	0.88
10	Total Energy	10.30	0.63	10.17	0.62	9.90	0.60
5	Total Energy	5.15	0.43	5.09	0.43	4.95	0.42
20	Total Energy Barrel	20.57	0.89	20.33	0.88	19.74	0.86
10	Total Energy Barrel	10.29	0.62	10.17	0.61	9.88	0.59
5	Total Energy Barrel	5.14	0.43	5.08	0.42	4.94	0.41
20	Total Energy ECAL Only	20.56	0.89	20.44	0.86	19.86	0.85
10	Total Energy ECAL Only	10.28	0.62	10.21	0.60	9.92	0.59
5	Total Energy ECAL Only	5.14	0.43	5.09	0.42	4.96	0.41

# Summary

- RPC behavior
  - Is odd
  - It's not the PFA (alone)
  - Starts in SLIC already
- Calibration process
  - Is not optimal
  - e.g. ECAL performance should be the same all over
  - Why sidloi\_scint flat, but sidloi\_scint3x3 not