

Where e^+ comes in hadron interaction ?

Tohru Takeshita (Shinshu)

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GEANT4 : QGSP-BERT model

CALICE AHCAL

experimental data

- (steel 20mm + sc. 5mm) x 38 layers

- pions incident: 8 GeV

- longitudinal shower profile :

FTFP_BERT model Geant4

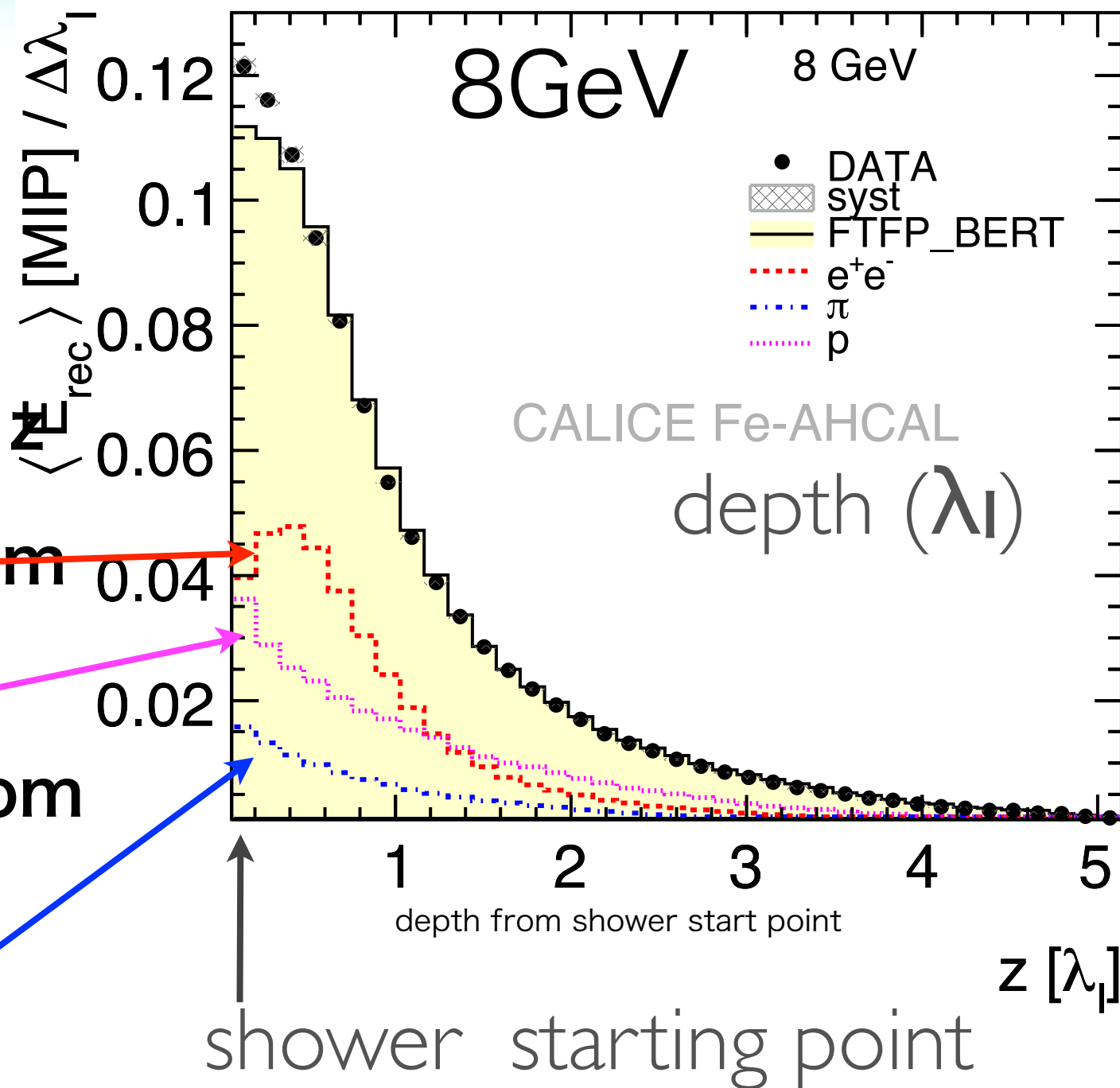
- (1) electron+positron

π^0 & nuclear ex.

- (2) protons

neutron scattering

- (3) charged pions ~ MIP



• JINST 8,2013, P07005

simulation AHCAL

- (steel20mm+sc.5mm) x 100layers

3GeV π^-

- pions: 3GeV with QGSP-BERT

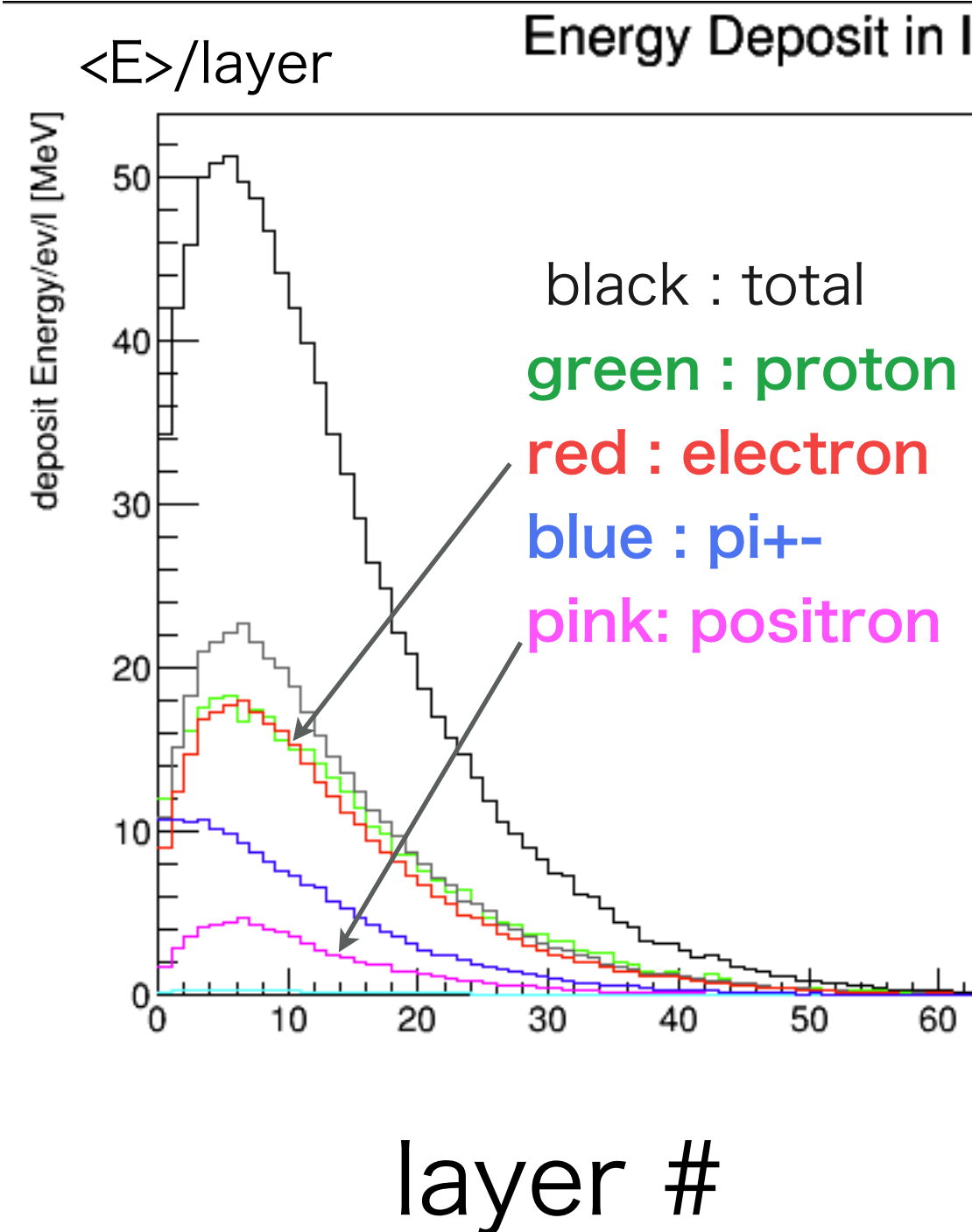
- longitudinal shower profile

- electron/positron

- come from EMshower or

- nuclear excitation emit ~MeV gamma, create e^+e^- pair

- $E_{e^+} \ll E_{e^-}$



energy deposit in sc.

- (steel20mm+sc. 5mm) x 100layers

3GeV π^-

- **pions**: 3GeV with QGSP-BERT

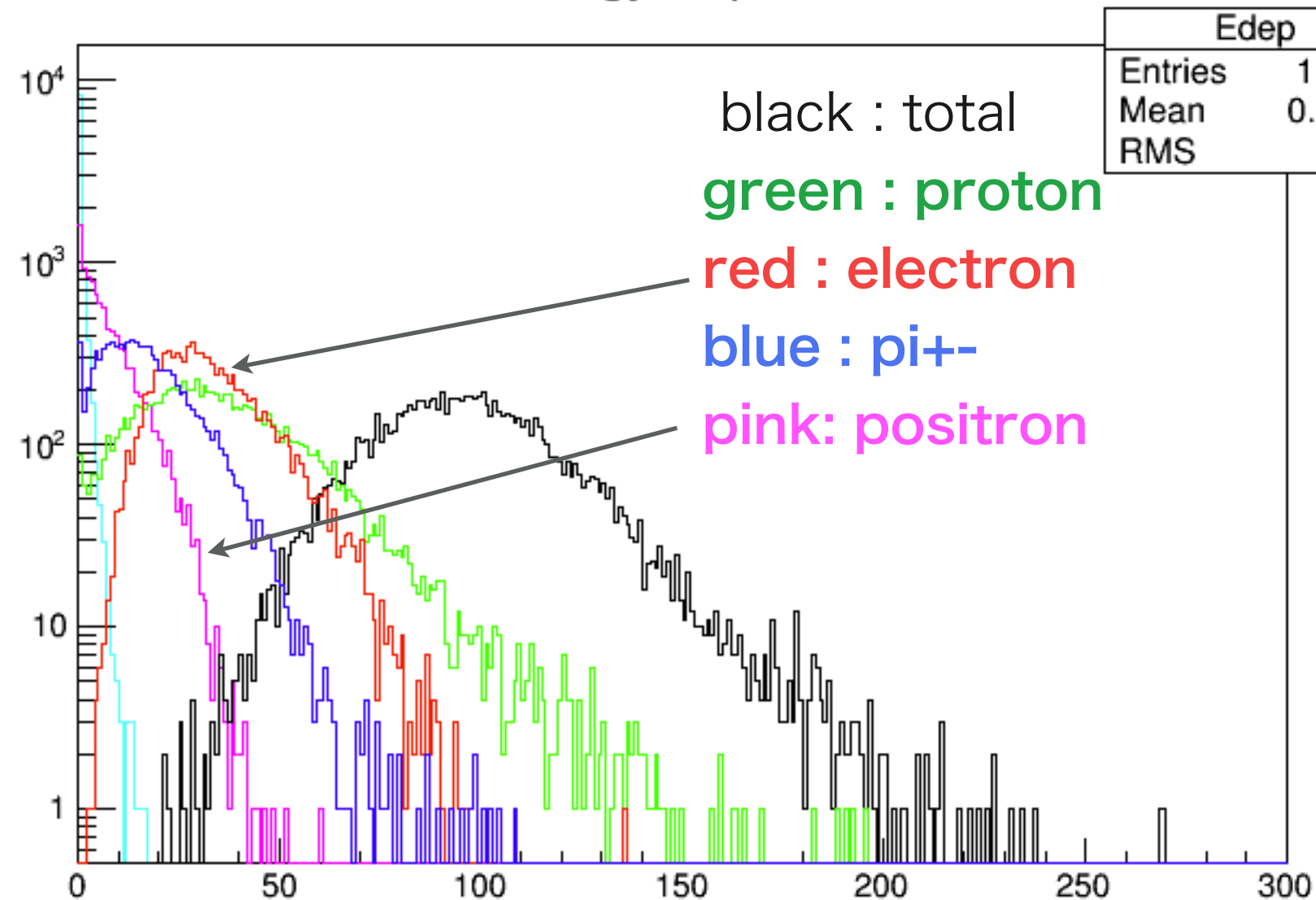
- sum in events

- $E_{e^+} \sim 0$

- E_{e^-} : not starts from 0

positrons annihilate into two photons

Energy Deposit



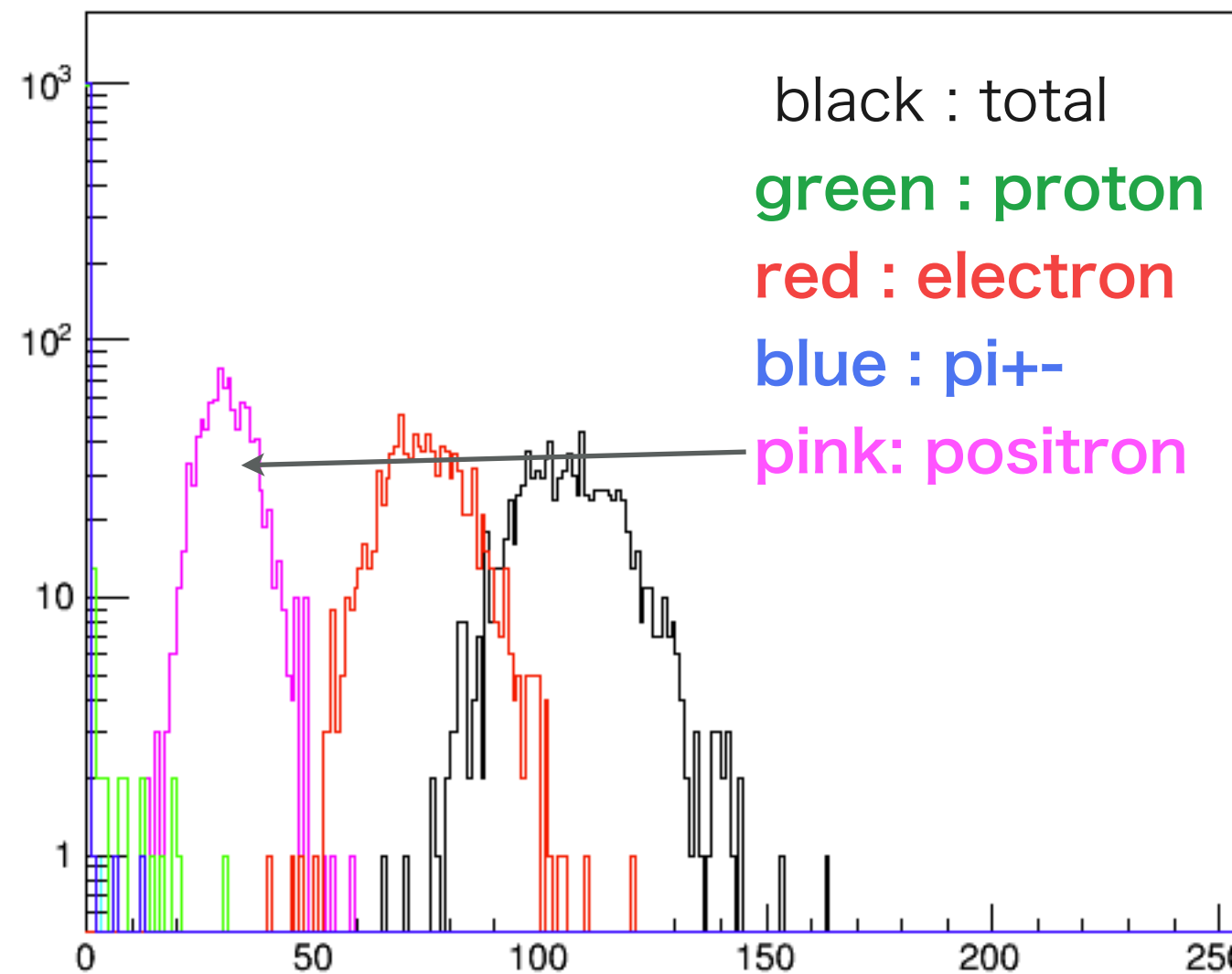
MeV in scintilaltor

energy deposit in sc.

- (steel 20mm + sc. 5mm) x 100 layers
- e^- : 3 GeV **EM shower**
- sum in a event
- E_{e^+} & E_{e^-}
- both not starts from 0

3 GeV e^-

Energy Deposit

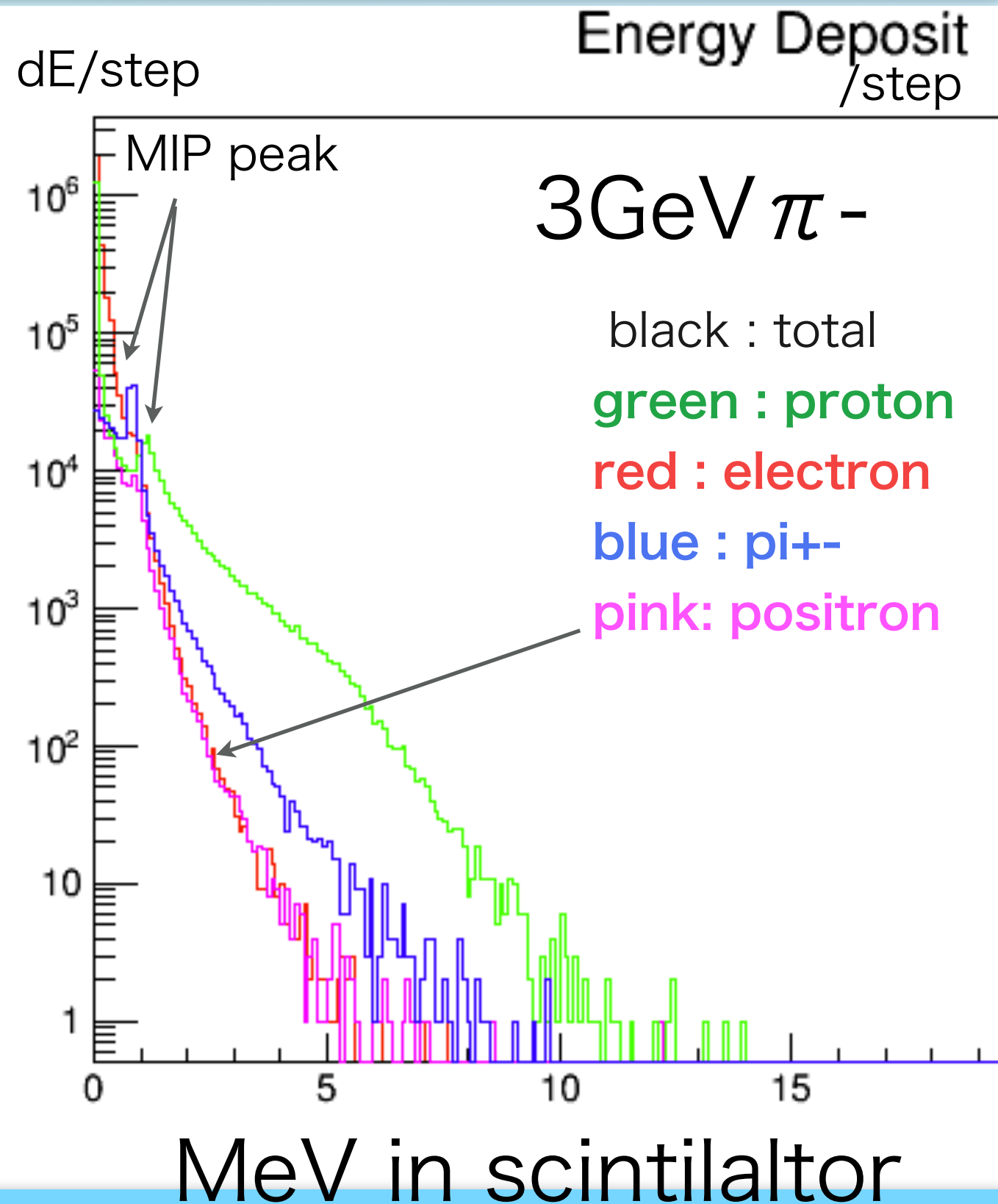


MeV in scintilator

energy deposit in sc.

- (steel20mm+sc. 5mm) x 100layers
- **pions** injected: 3GeV with QGSP-BERT
- dE/step
- E_{e^-} a lot at $E_{e^-} \sim 0$
- at higher E, $N_{e^+} \sim N_{e^-}$

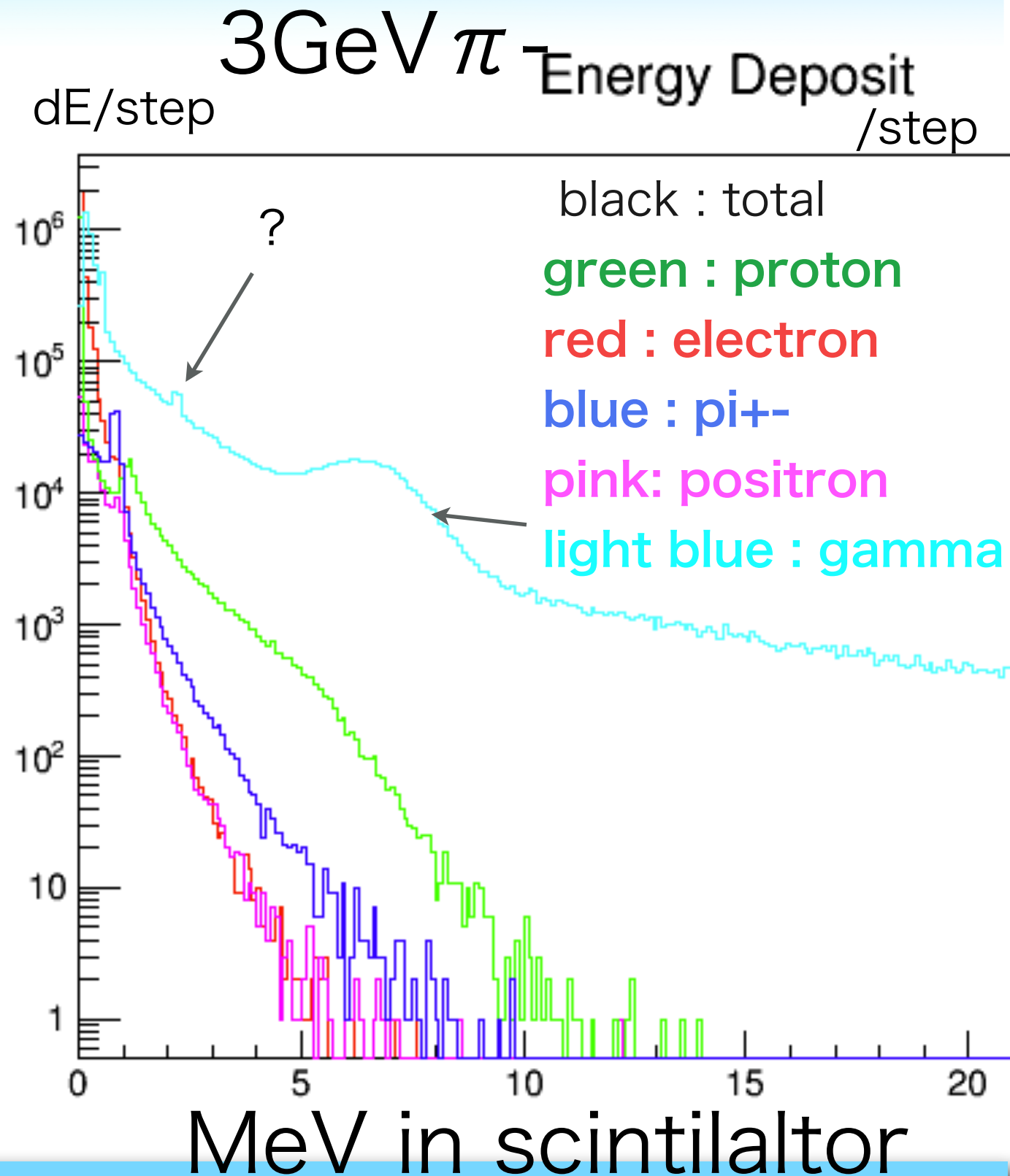
step represents a good
dE/dx



photon energy in sc.

- (steel 20mm + sc. 5mm) x 100 layers
- **pions** incident:
3 GeV with **QGSP-BERT**
- gamma/step
- **multiple entries**

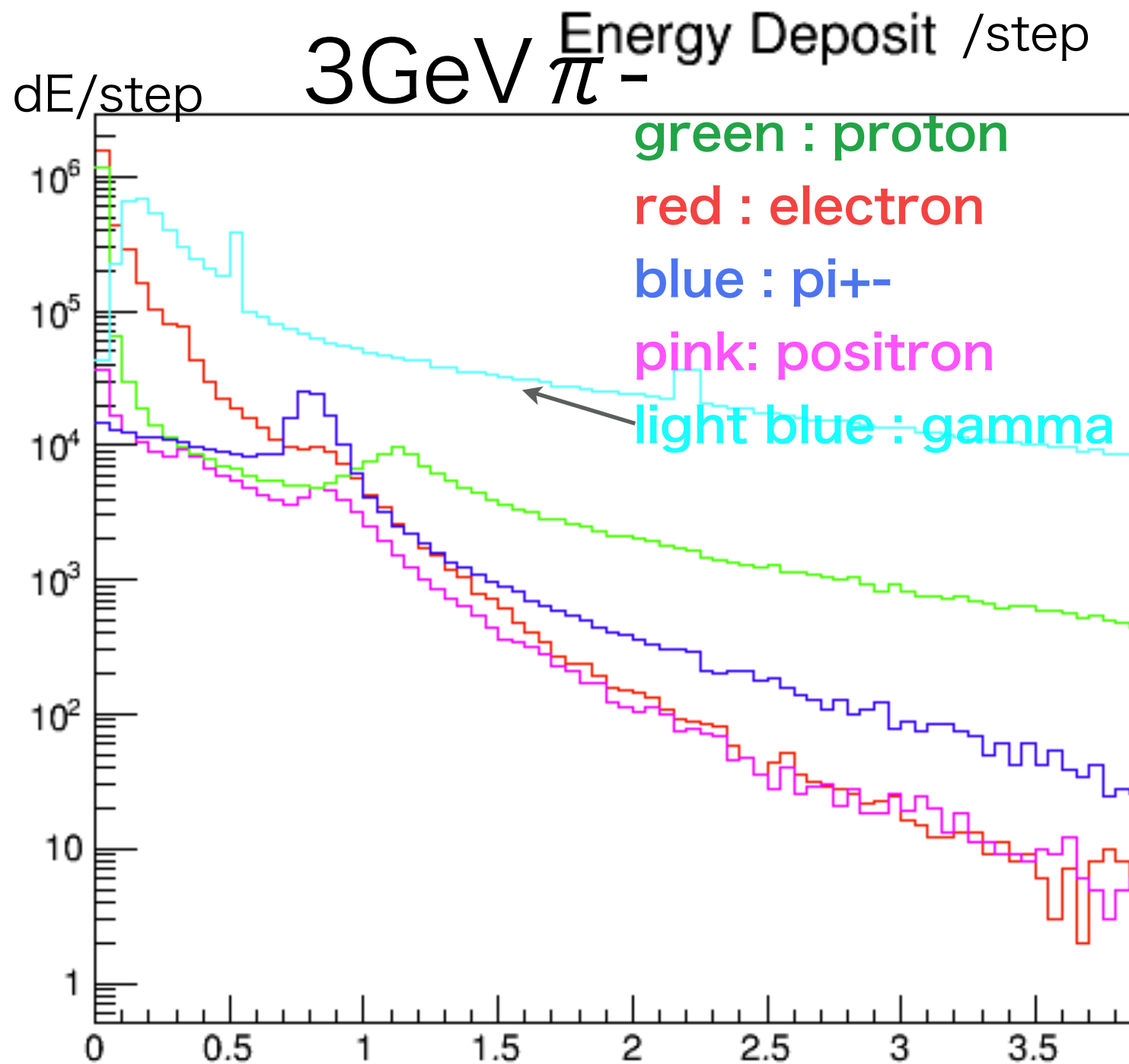
step represents a good
dE/dx



photon energy in sc.

- (steel20mm+sc. 5mm) x 100layers
- **pions** incident:
3GeV with **QGSP-BERT**
- gamma/step
- **multiple entries**

step represents a good
dE/dx

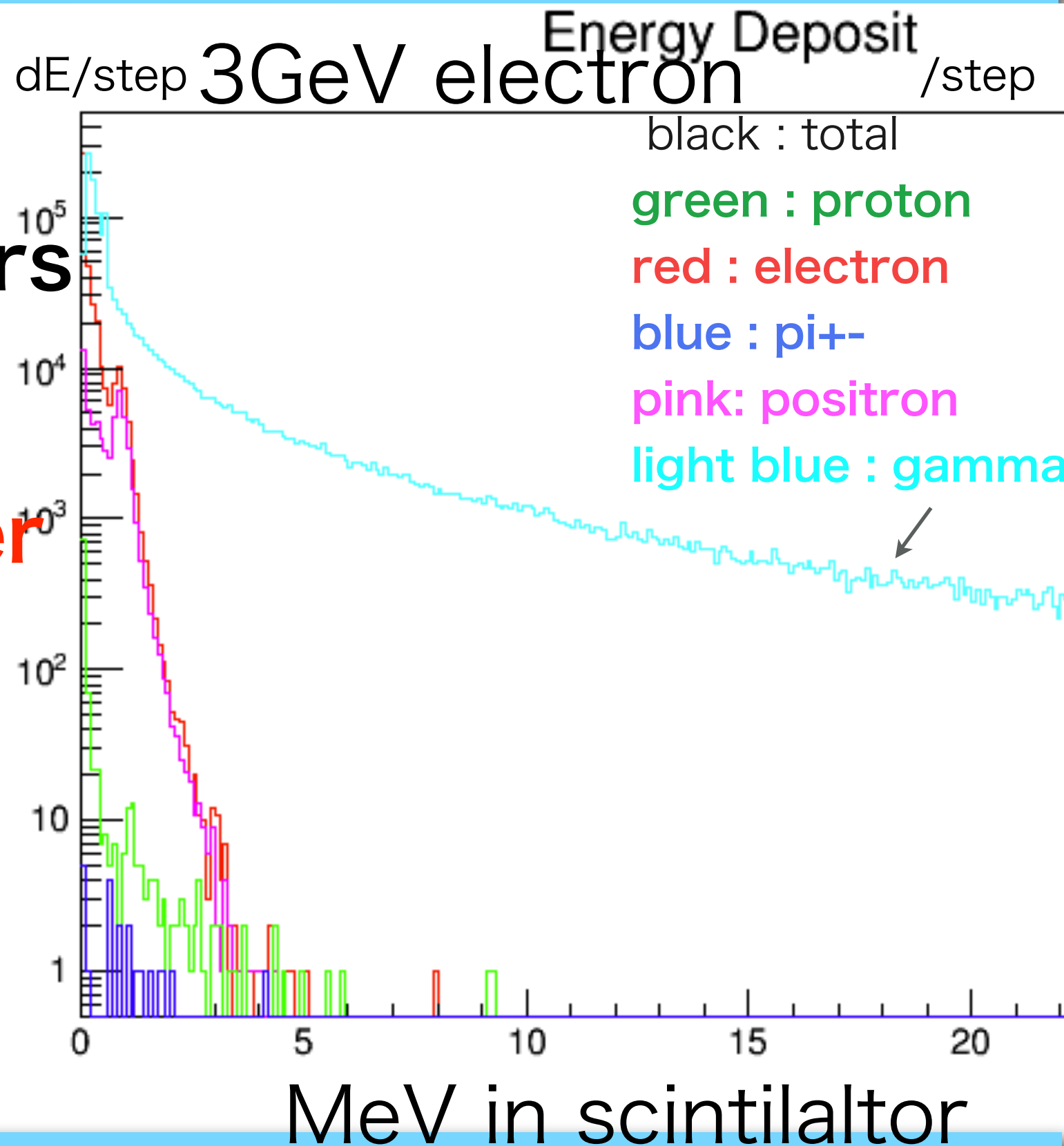


MeV in scintilaltor

photon energy in sc.

- (steel 20mm + sc. 5mm) x 100 layers
- e- inject with 3 GeV **EM shower**
- gamma/step

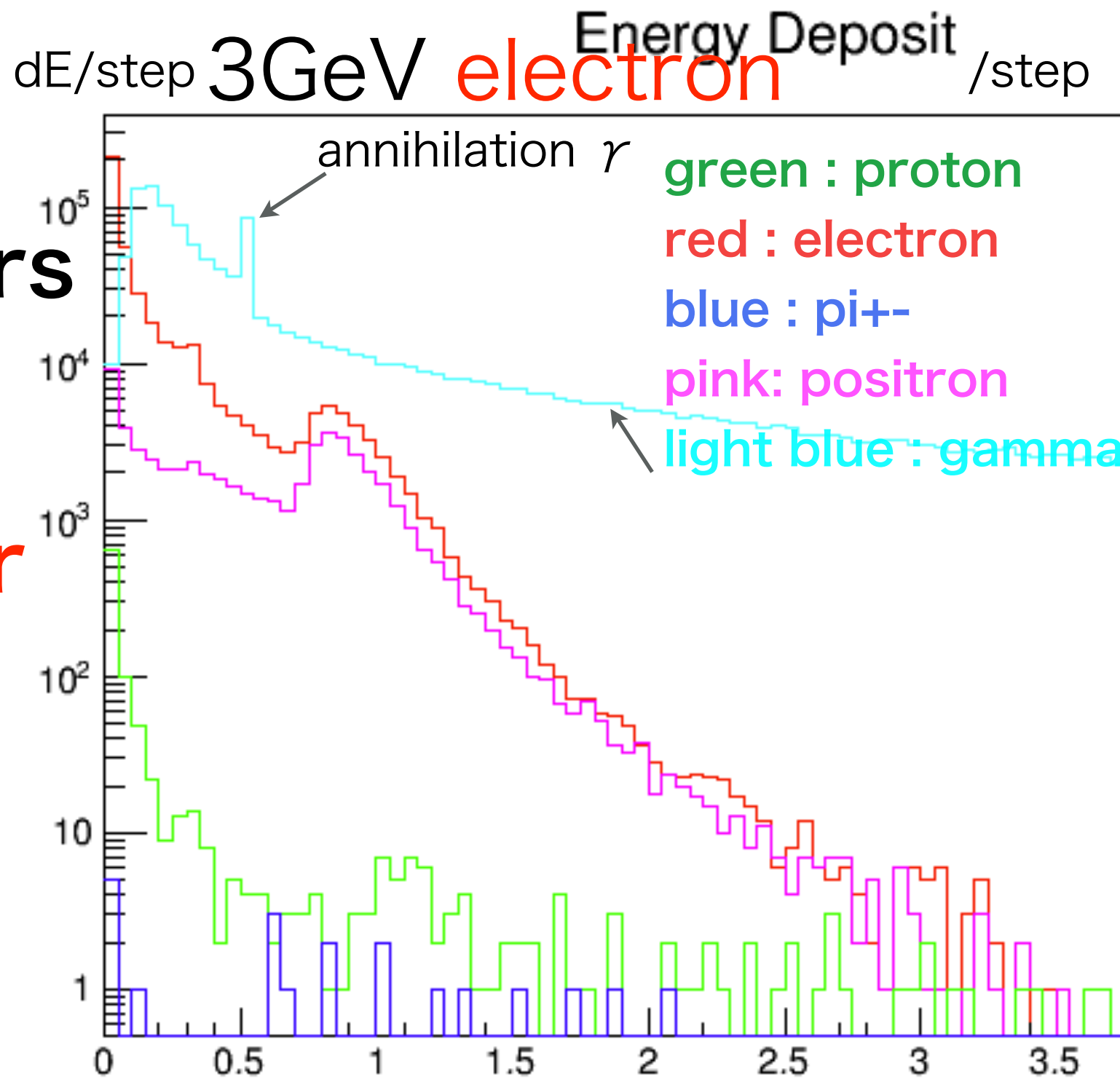
step represents a good
dE/dx



photon energy in sc.

- (steel 20mm + sc. 5mm) x 100 layers
- e- inject with 3 GeV **EM shower**
- gamma/step

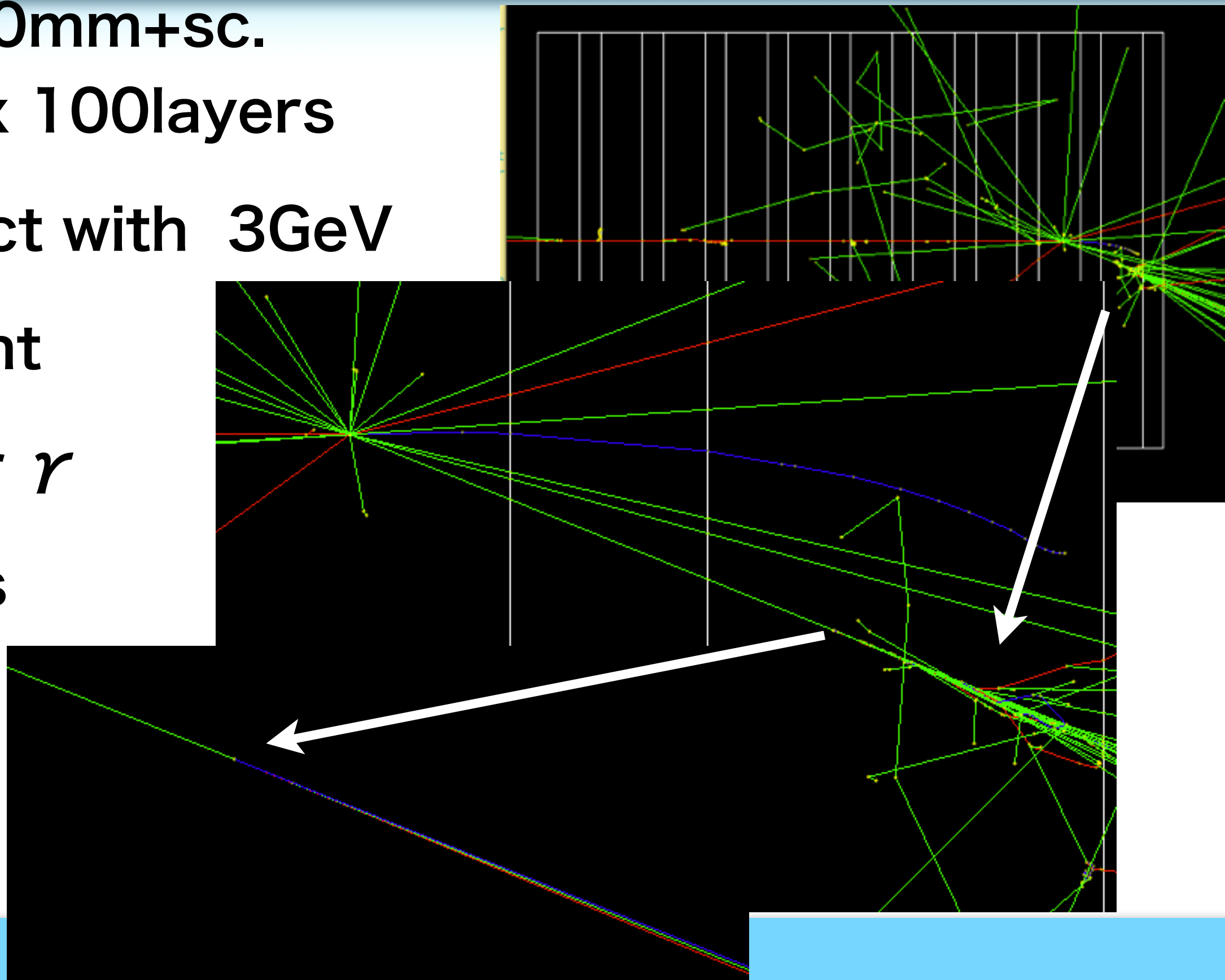
step represents a good
dE/dx



MeV in scintillator

pair creation

- (steel20mm+sc. 5mm) x 100layers
- pi- inject with 3GeV
- an event
- nuclear γ
- creates
- pair

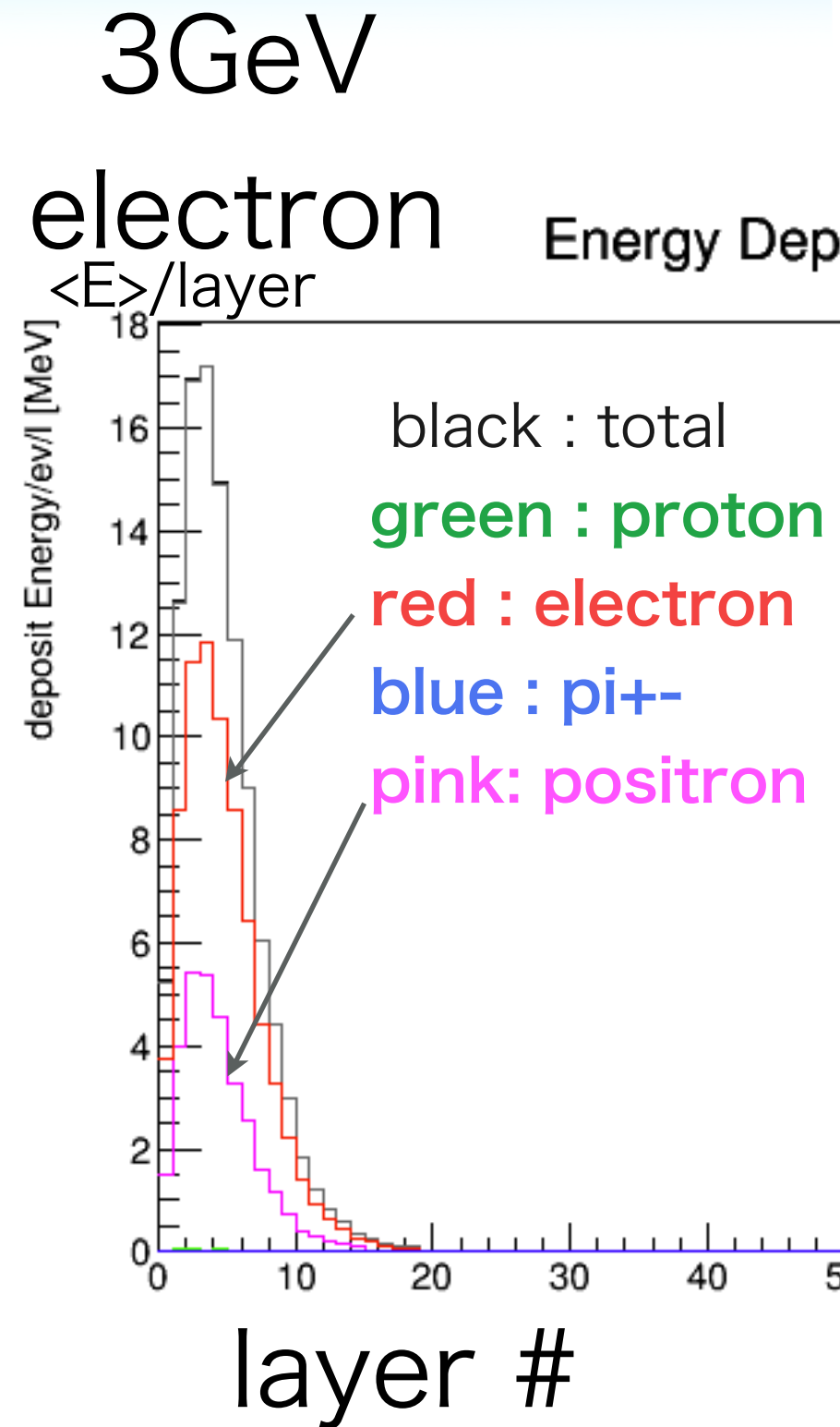


summary

- high energy positrons come from EM shower
- low energy e^+ come from gamma through pair creation
- gammas emerge from nuclear excitations

simulation AHCAL

- (steel20mm+sc.5mm) x 100layers
- electrons: 3GeV EMshower
- longitudinal shower profile :
z
- look into EMshower
- $E_{e^+} < E_{e^-}$



pi0 energy

- (steel20mm+sc.
5mm) x
100layers
- π^- : 3GeV
- pi0 energy
dominated low E
< 300 MeV

3GeV π^-
Energy in ABS

