Scintillator HCAL options

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Shinshu
for CALICE Kobe May-07

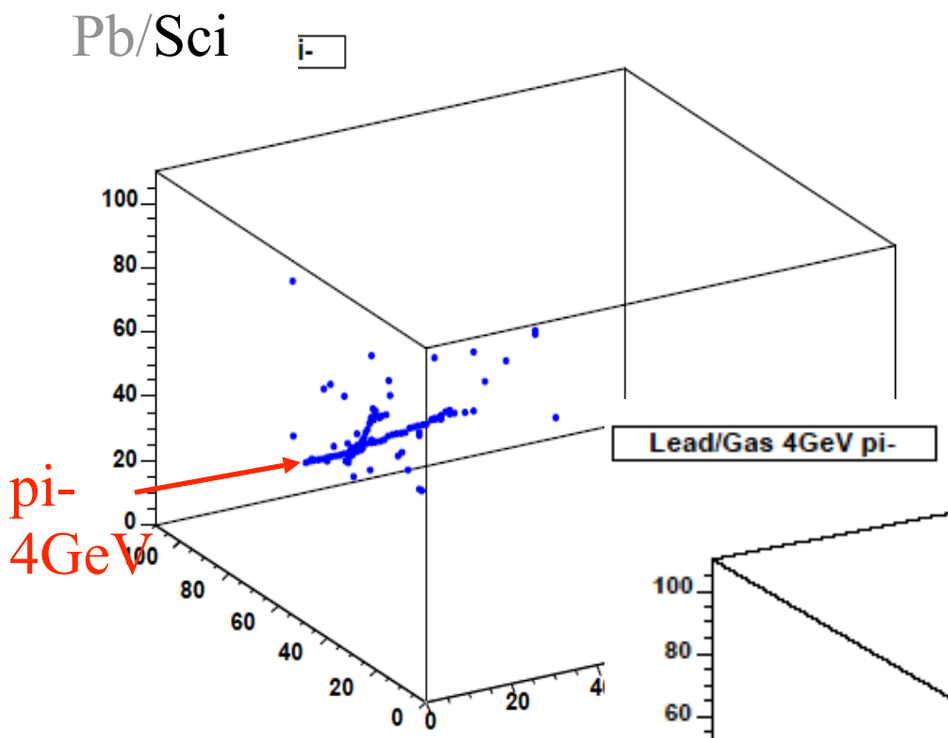
option 1: neutron detection
option 2: absorber = Lead
option 3: strip scintillator

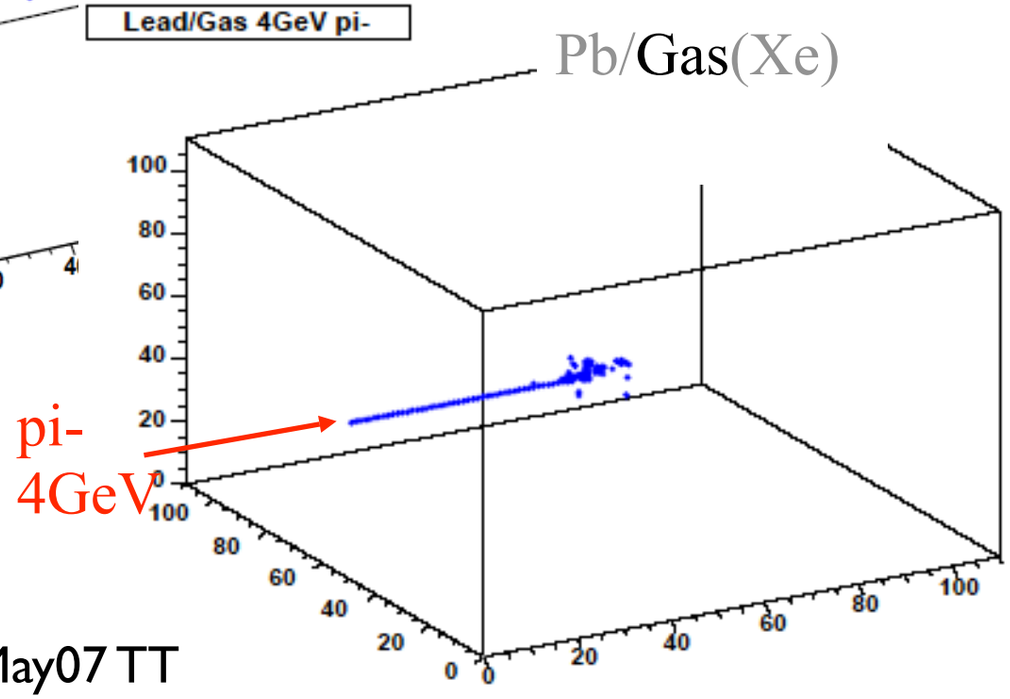
work ; Itoh, Oobe, and Ono

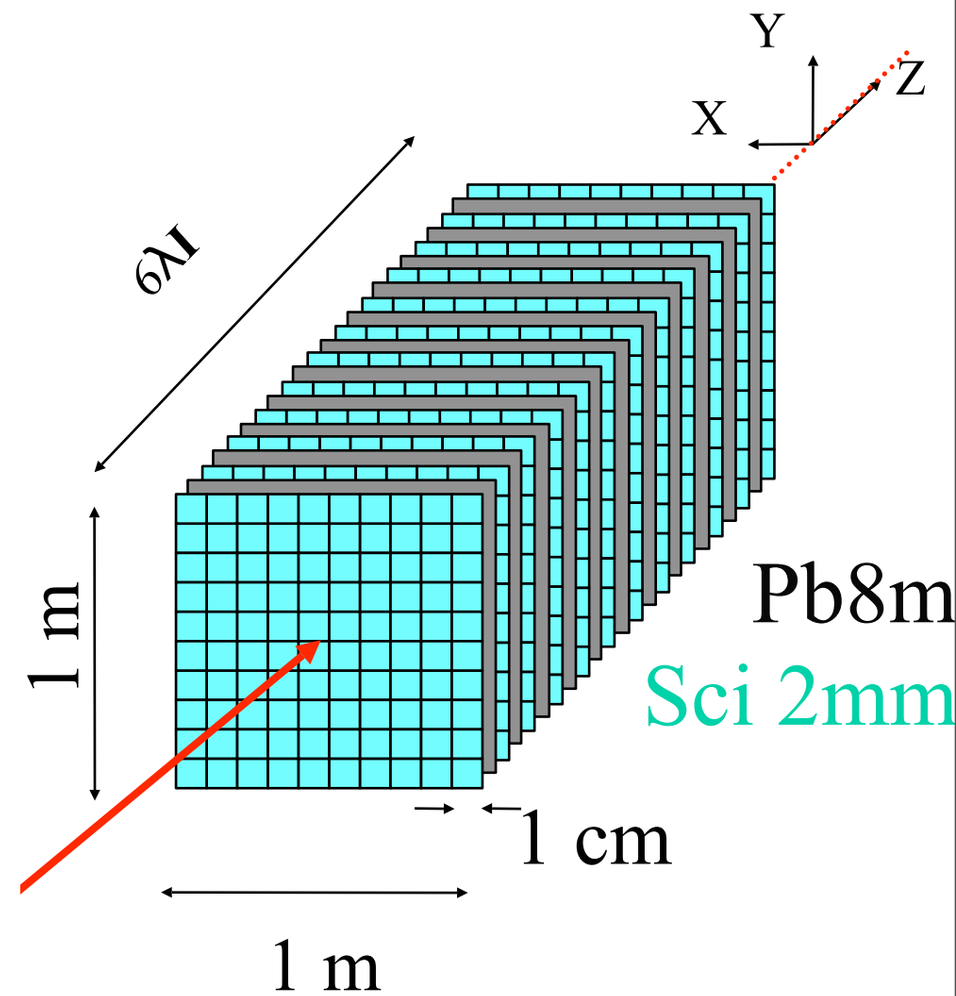
scintillator HCAL option 1:

neutron detection

- scintillator contains Hydrogen = neutron sensitive (gas is insensitive)





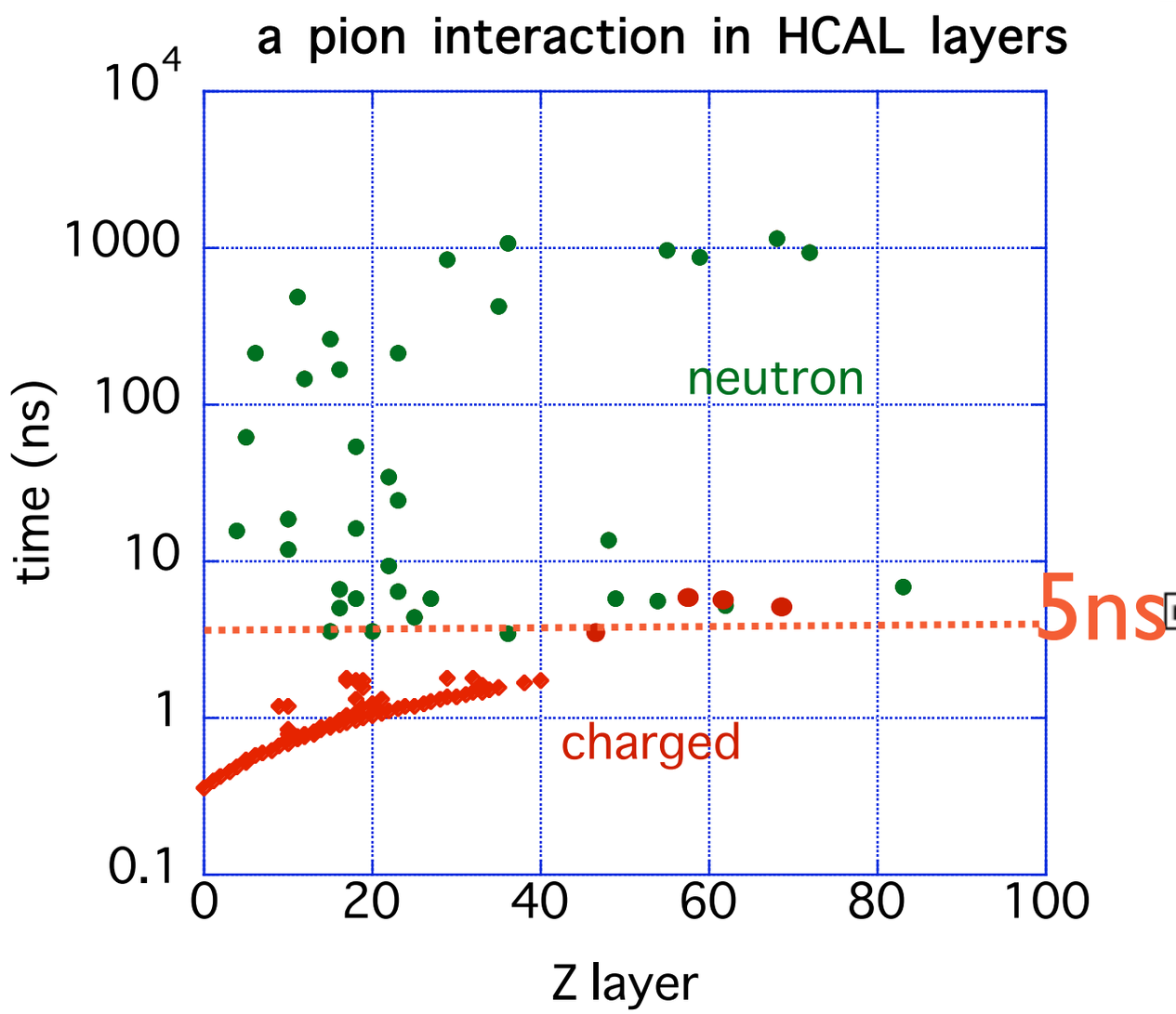


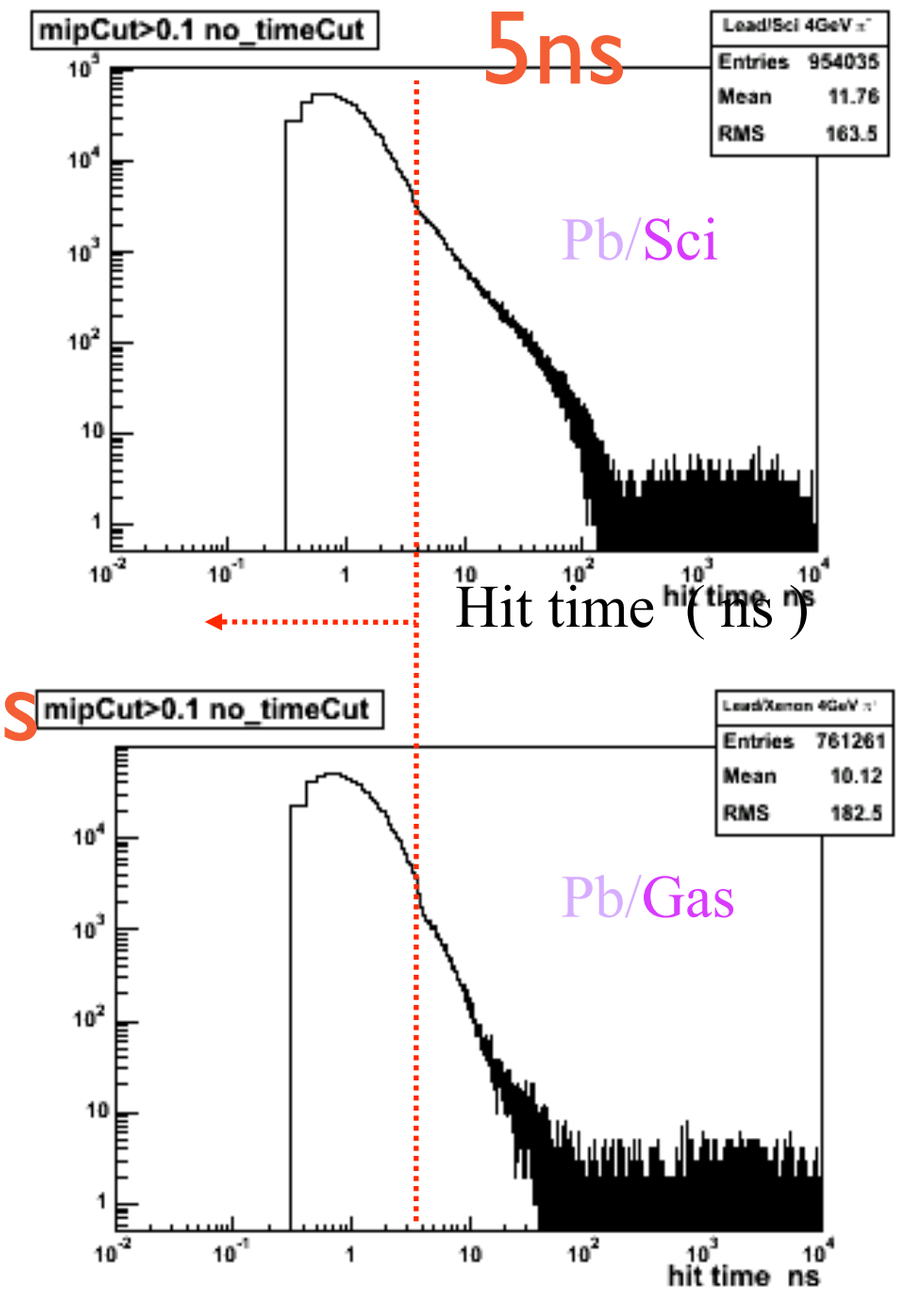
Itoh

scintillator HCAL option 1:

neutron detection

- timing info. helps us to separate neutrons





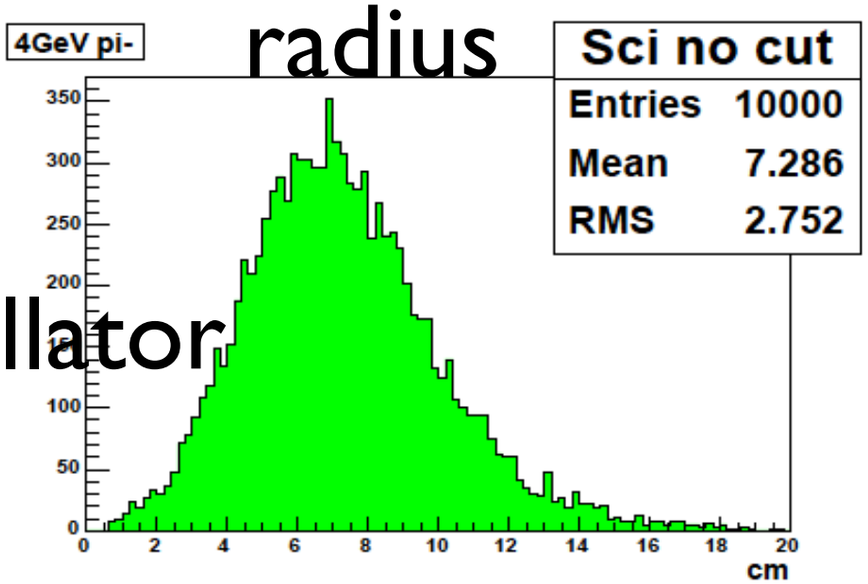
Itoh

scintillator HCAL option 1:

neutron detection

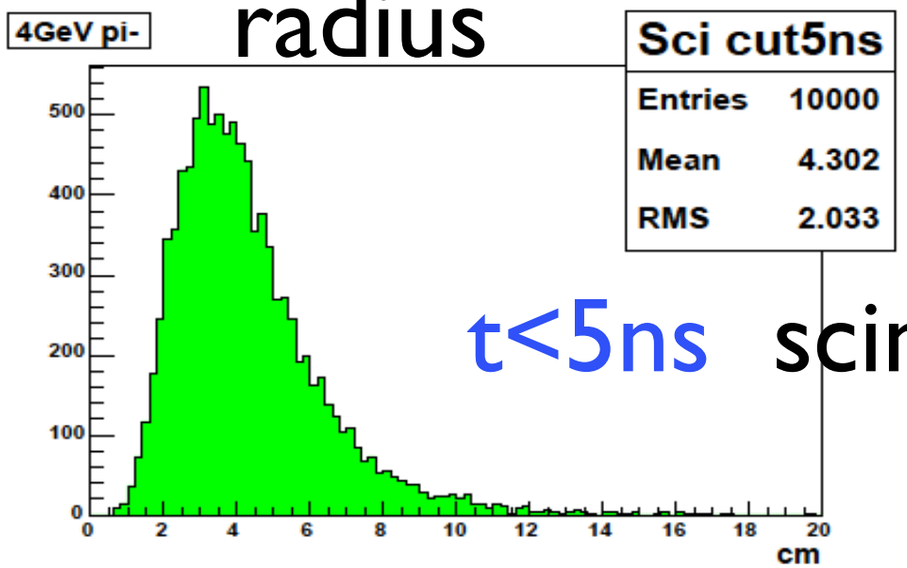
- lateral shower profile due to neutrons

radius



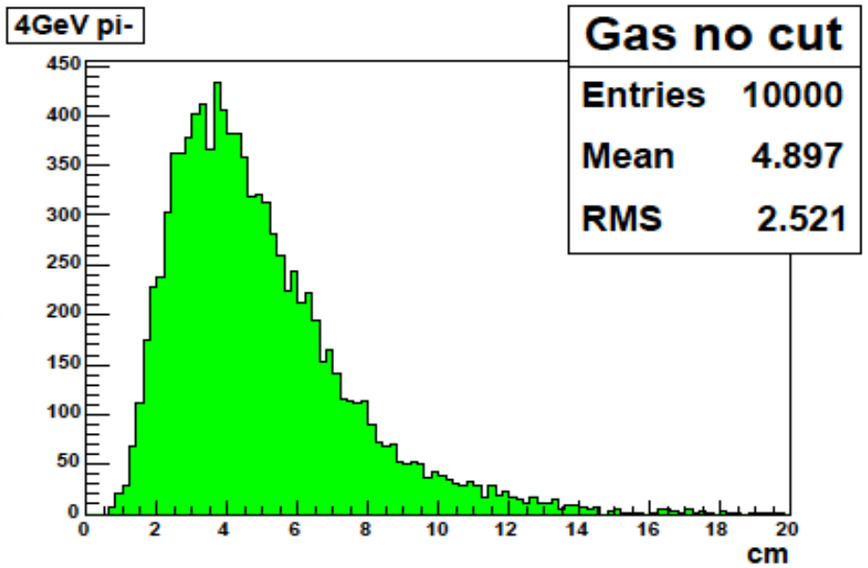
scintillator

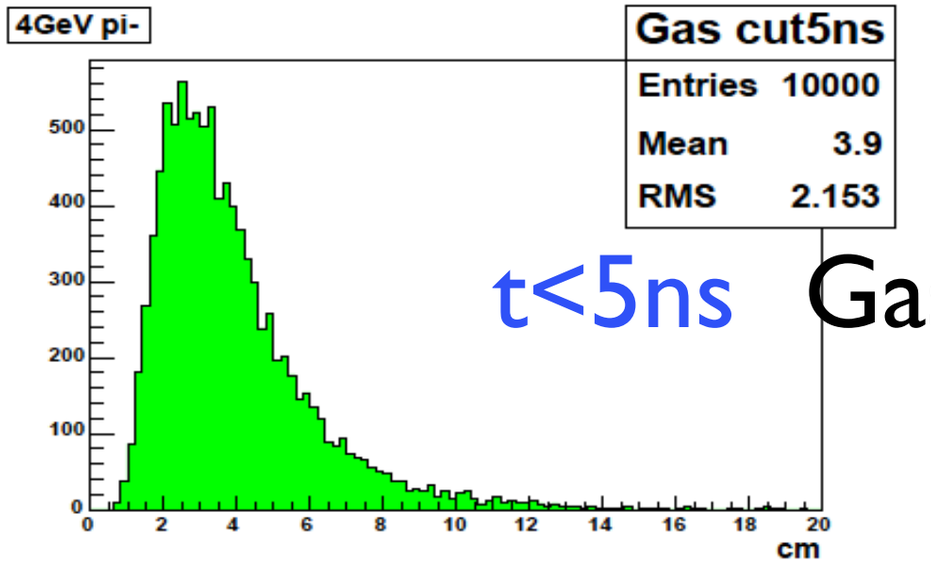
radius



t<5ns scintillator

Gas





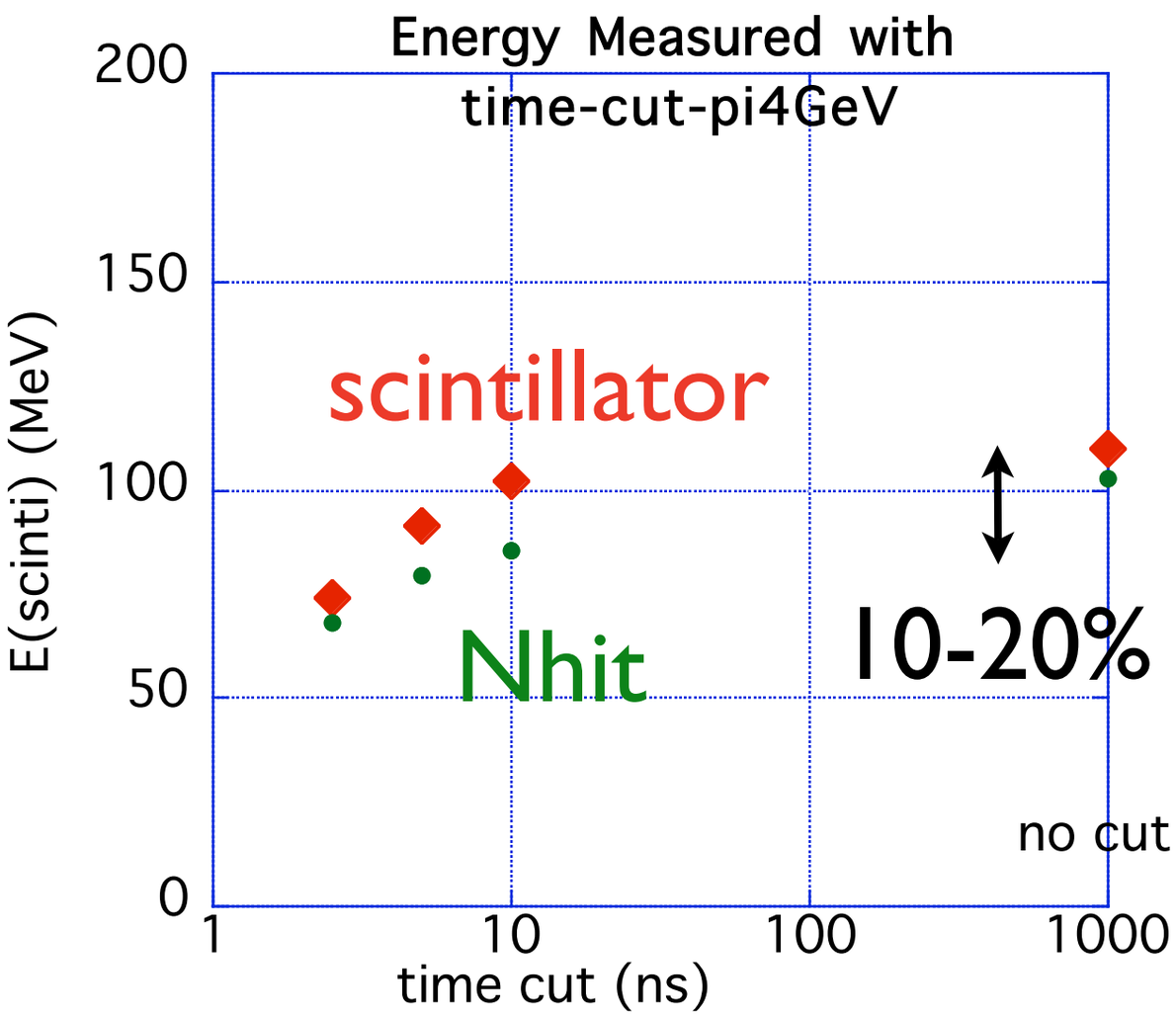
t<5ns Gas

equivalent ltoh

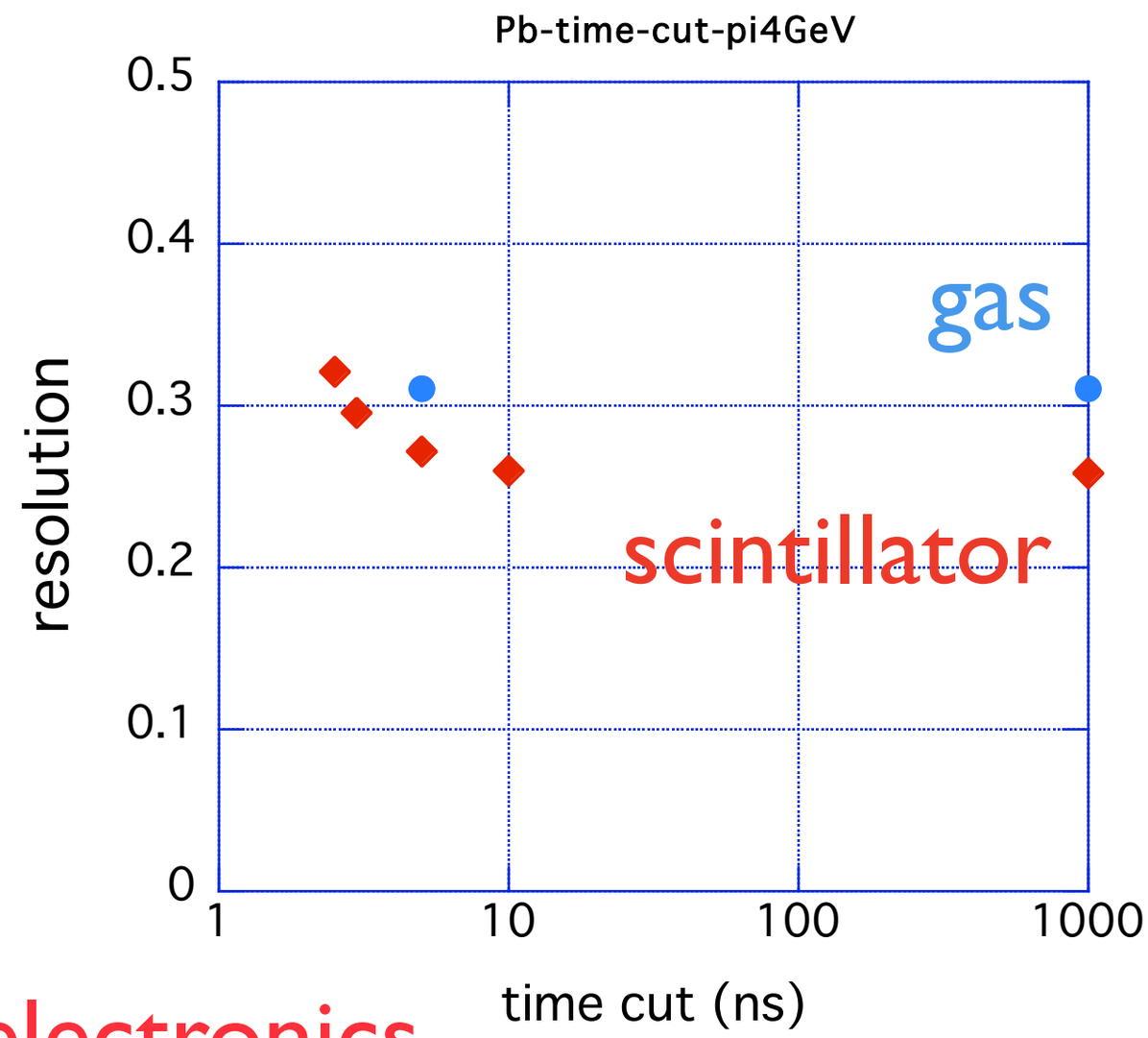
scintillator HCAL option 1:

neutron detection

- energy measurement (4GeV pion)



resolution

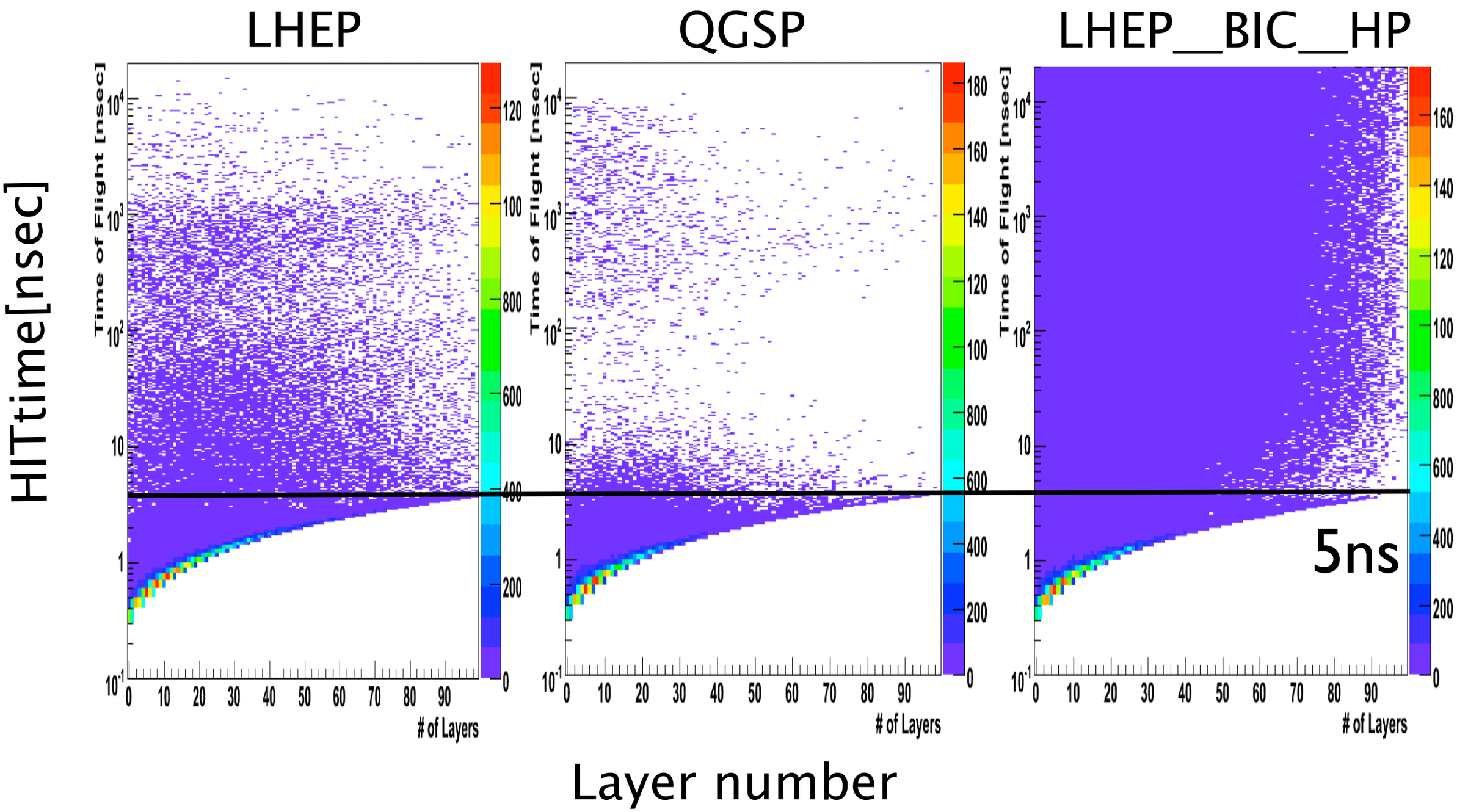


need good electronics

Itoh

scintillator HCAL option 1:

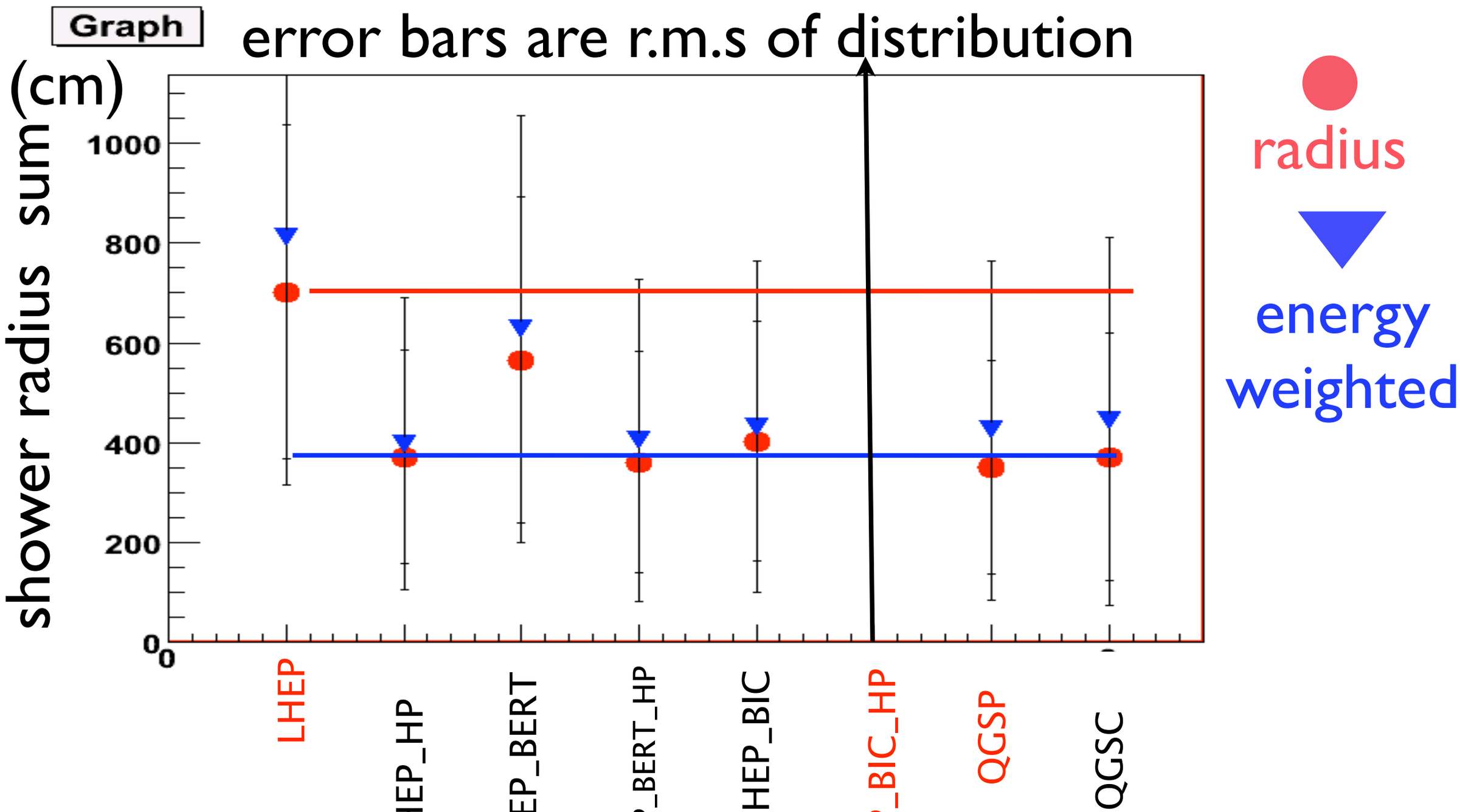
neutron detection



Oobe

scintillator HCAL option 1:

neutron detection



LHEP gives biggest

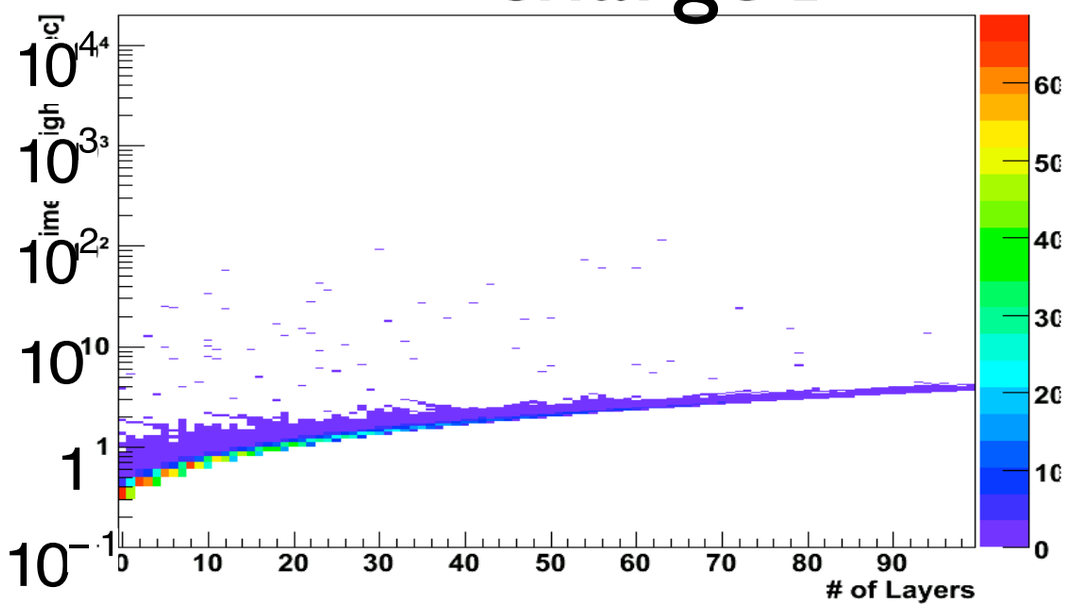
Oobe

scintillator HCAL option 1:

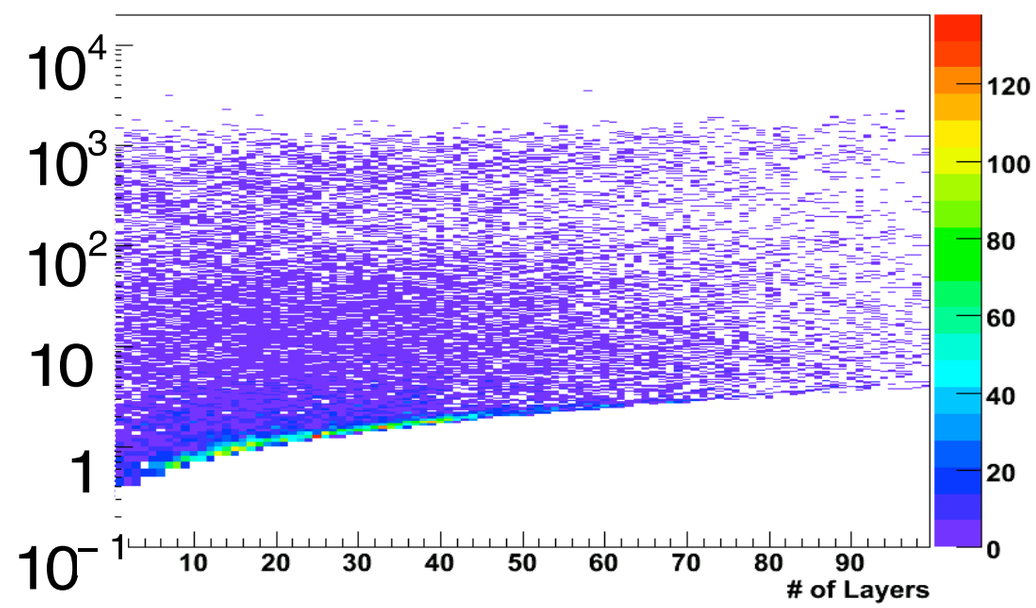
neutron detection

LHEP

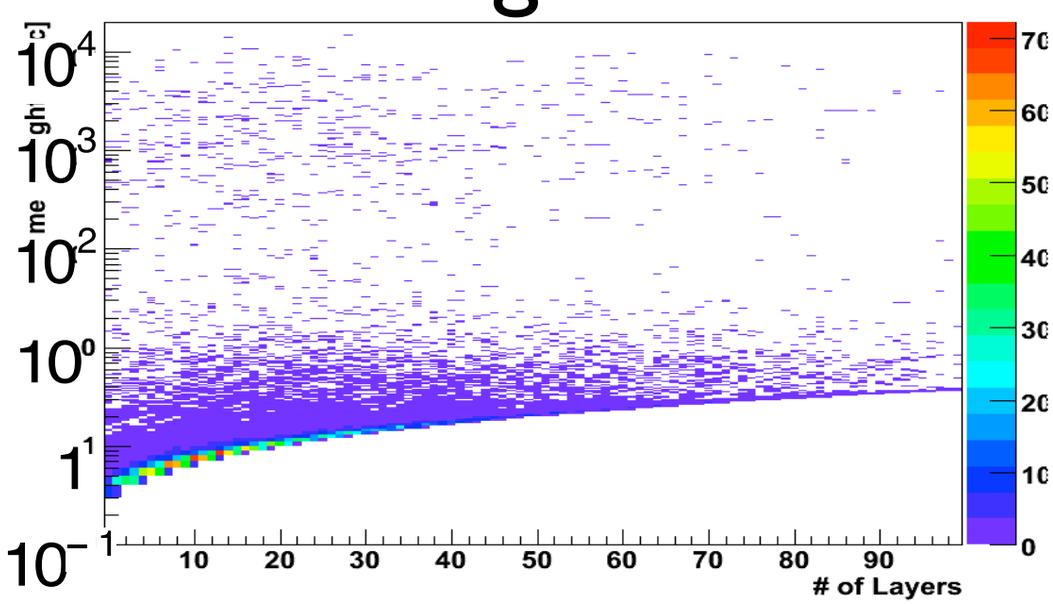
charged



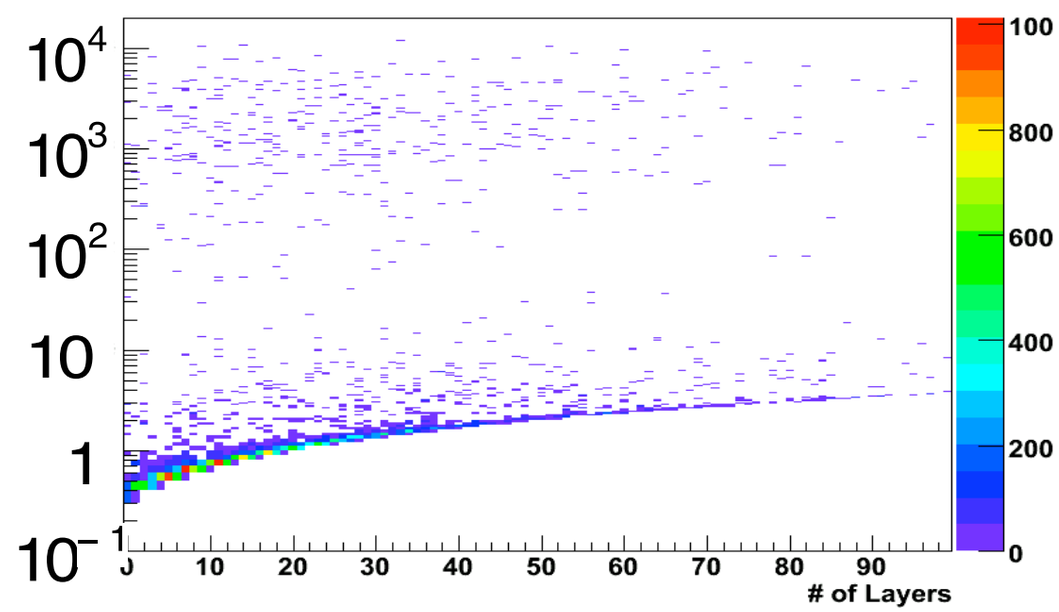
neutron



gamma



e+-



Layer number

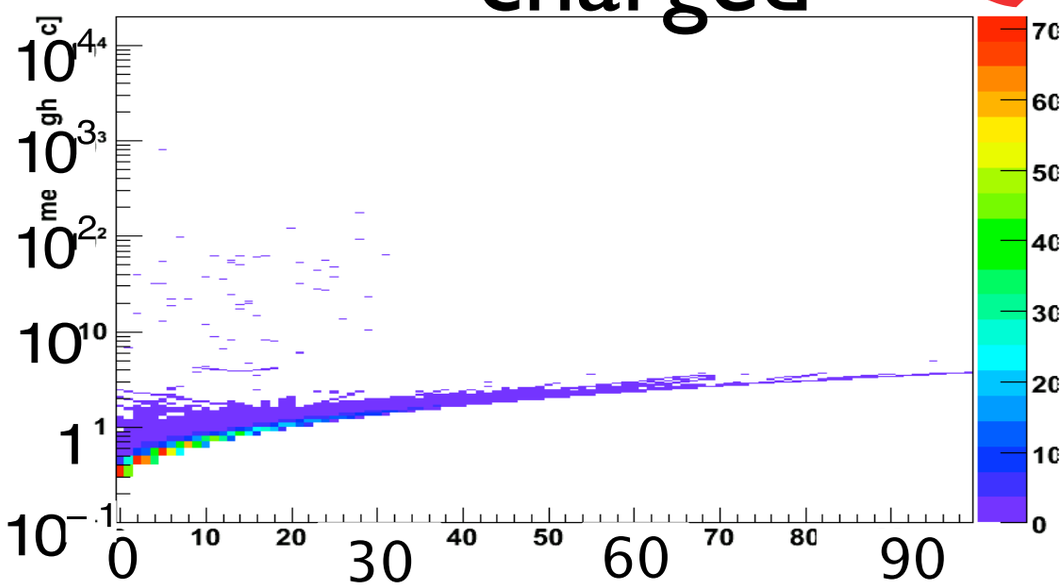
Oobe

scintillator HCAL option 1:

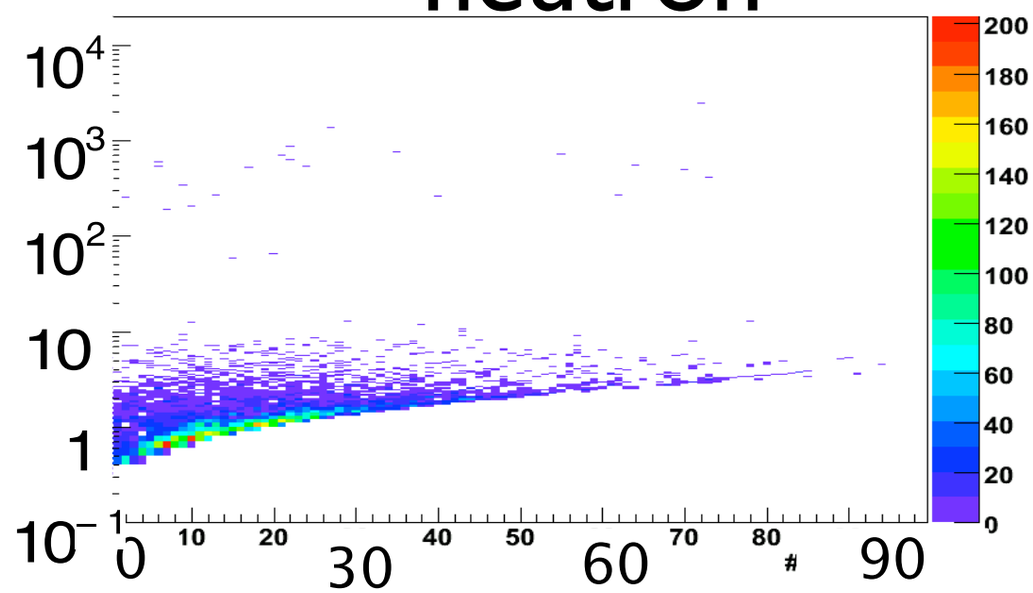
neutron detection

QGSP

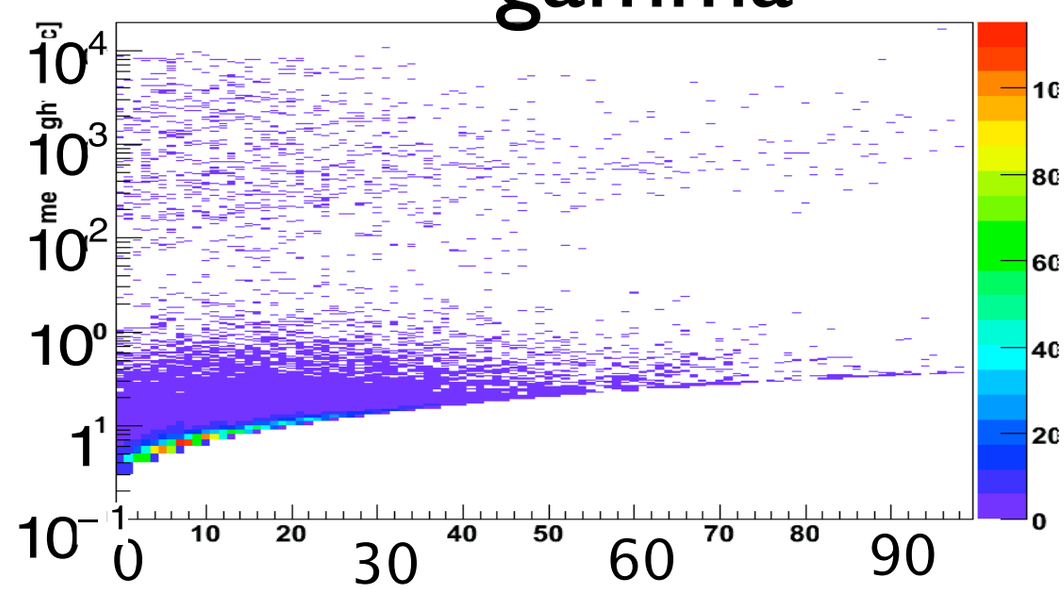
charged



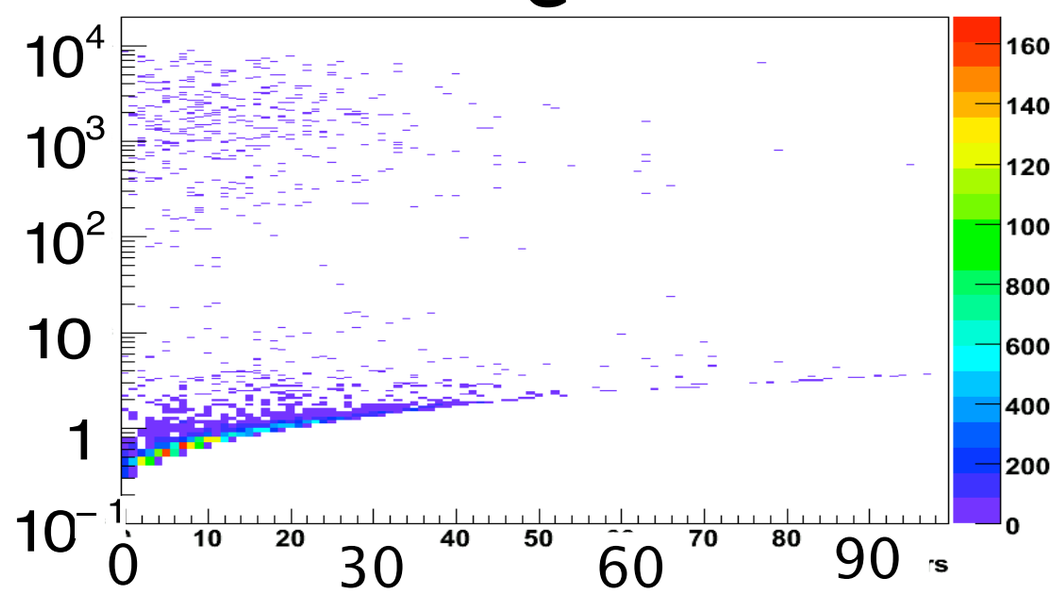
neutron



gamma



e+-



Hit timing [nsec]

Layer number Oobe

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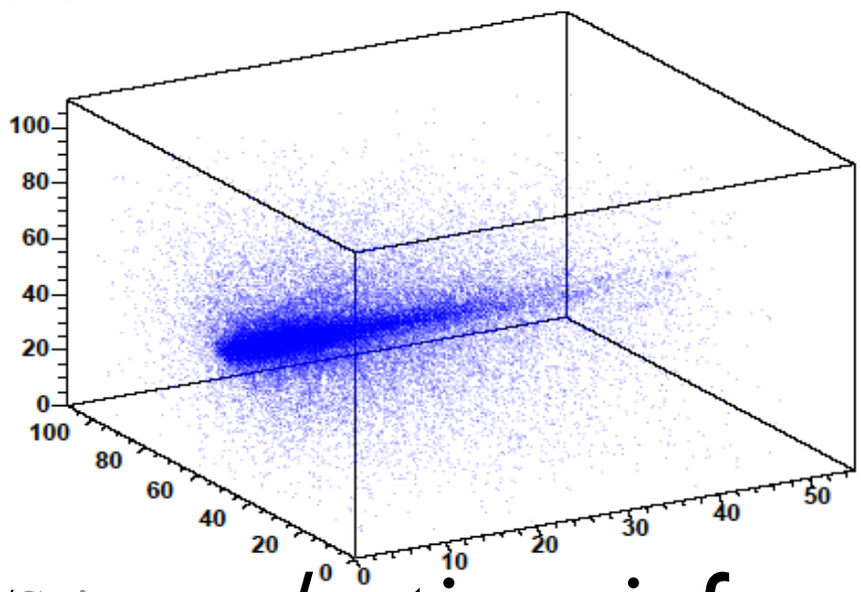
scintillator HCAL option 2:

Lead absorber

- compare with Iron :1000 events overlapped

Pb/Sci

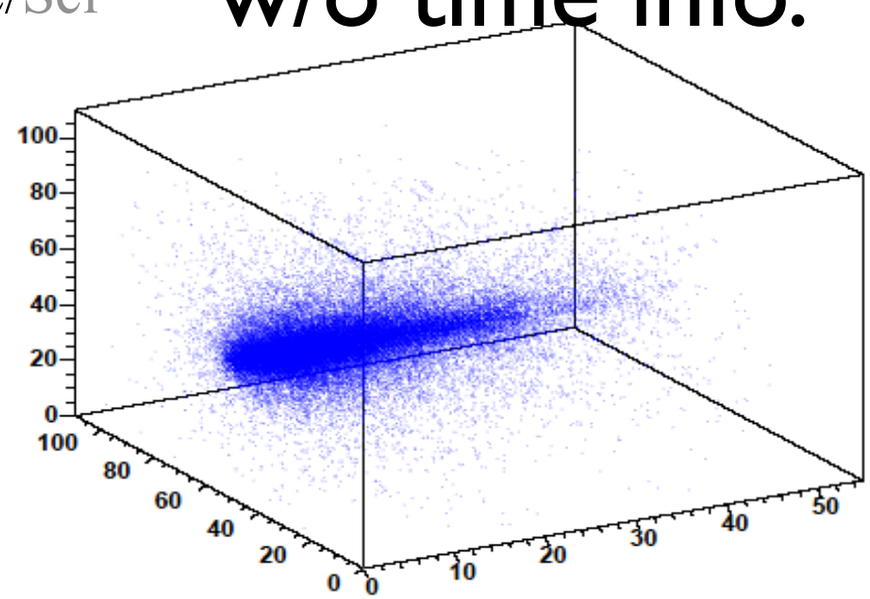
Lead



Fe/Sci

w/o time info.

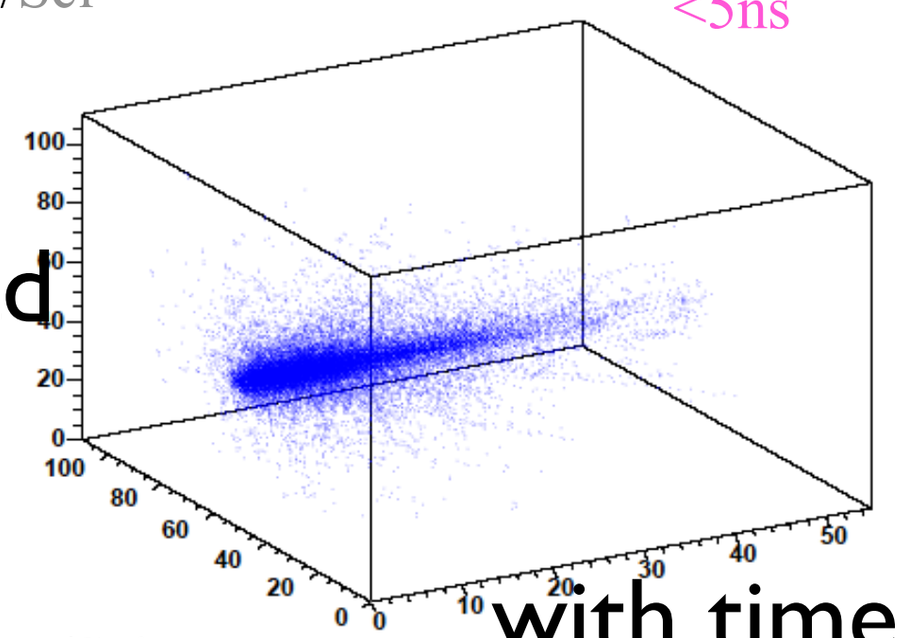
Iron



Pb/Sci

<5ns

Lead

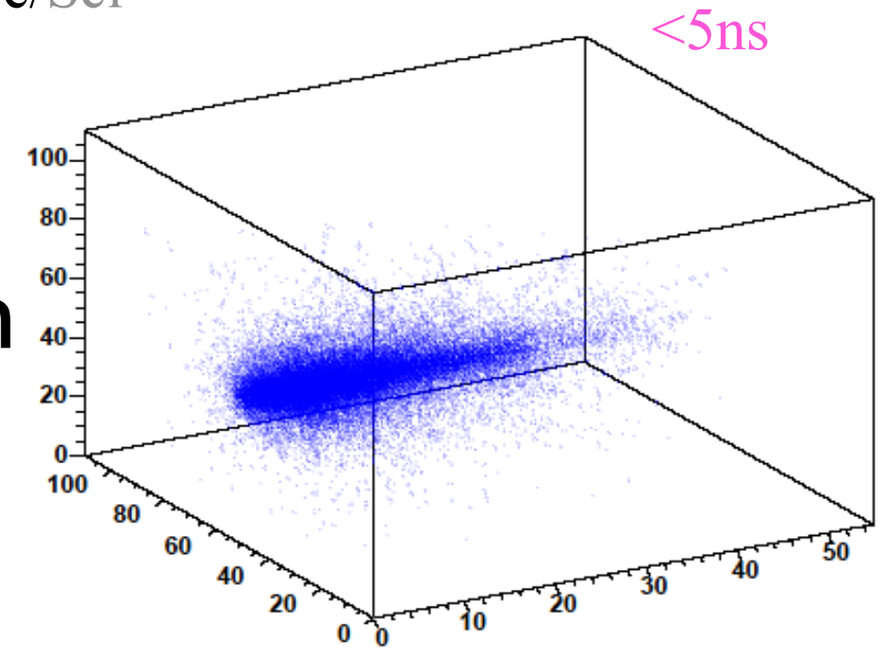


with time info.

Fe/Sci

<5ns

Iron



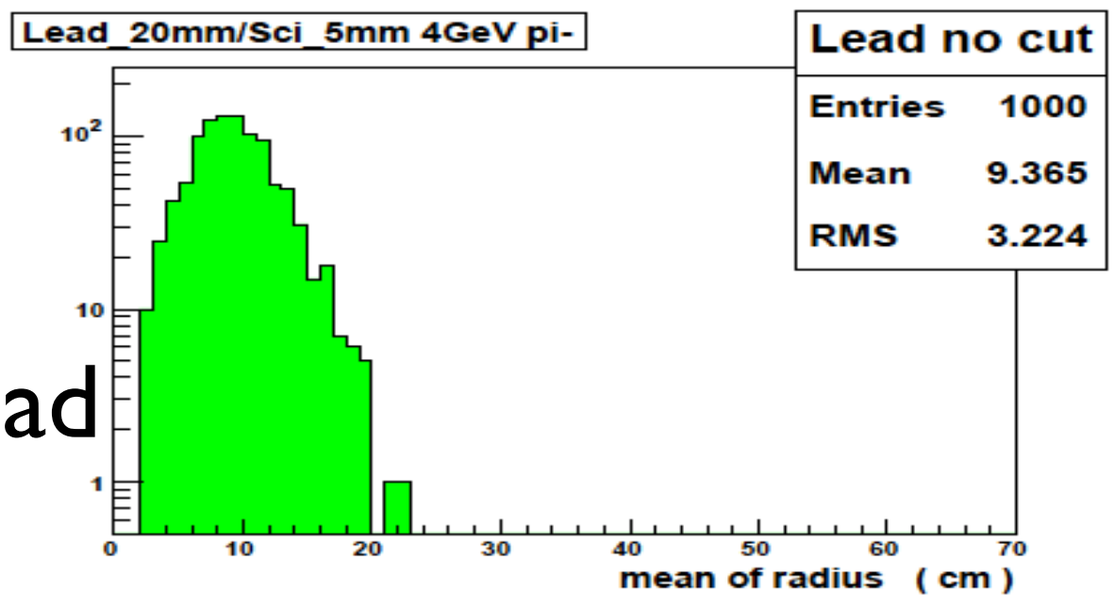
Itoh

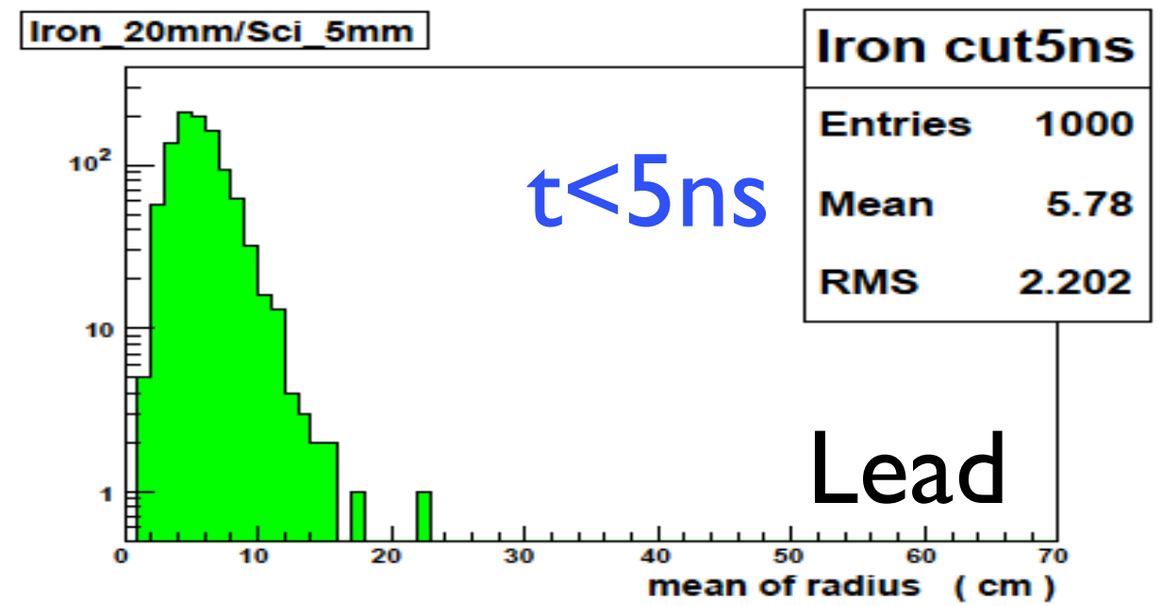
scintillator HCAL option 2:

Lead absorber

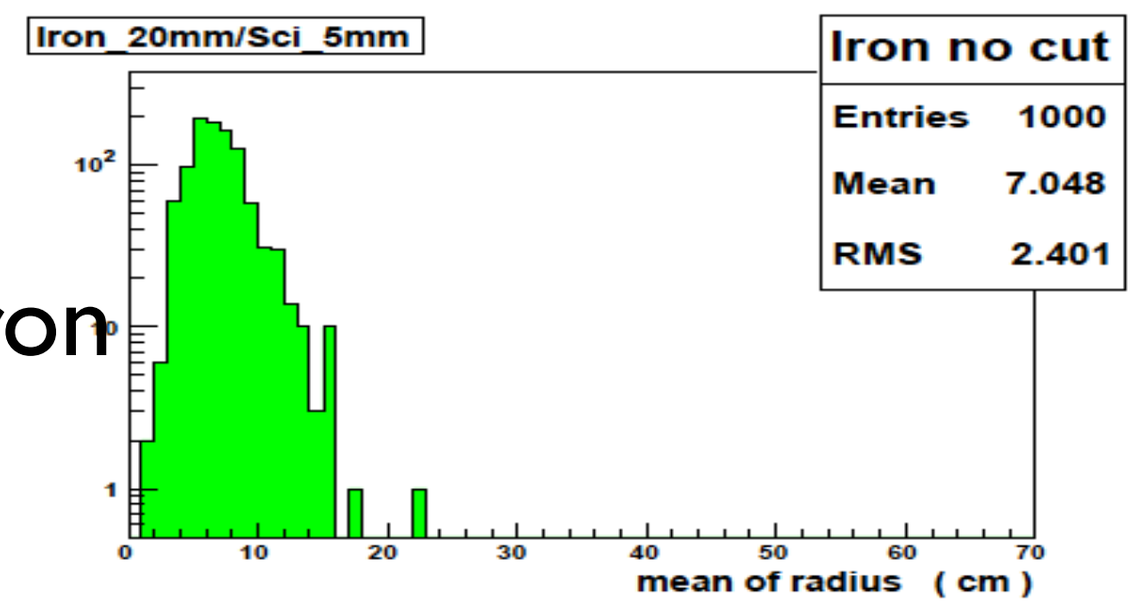
- Lateral shower profile

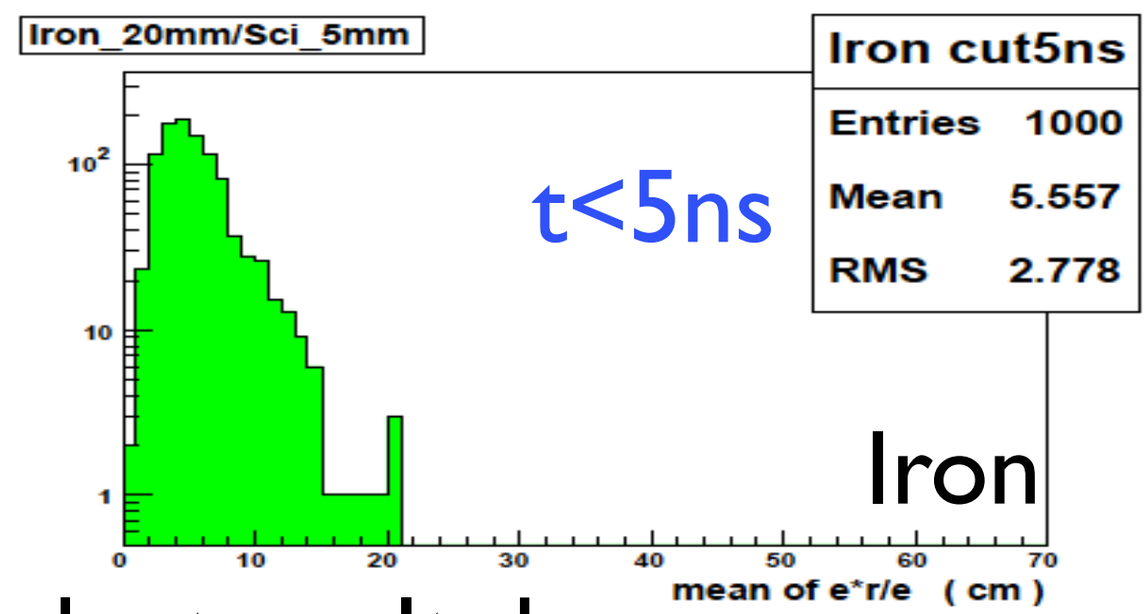
Lead





Iron





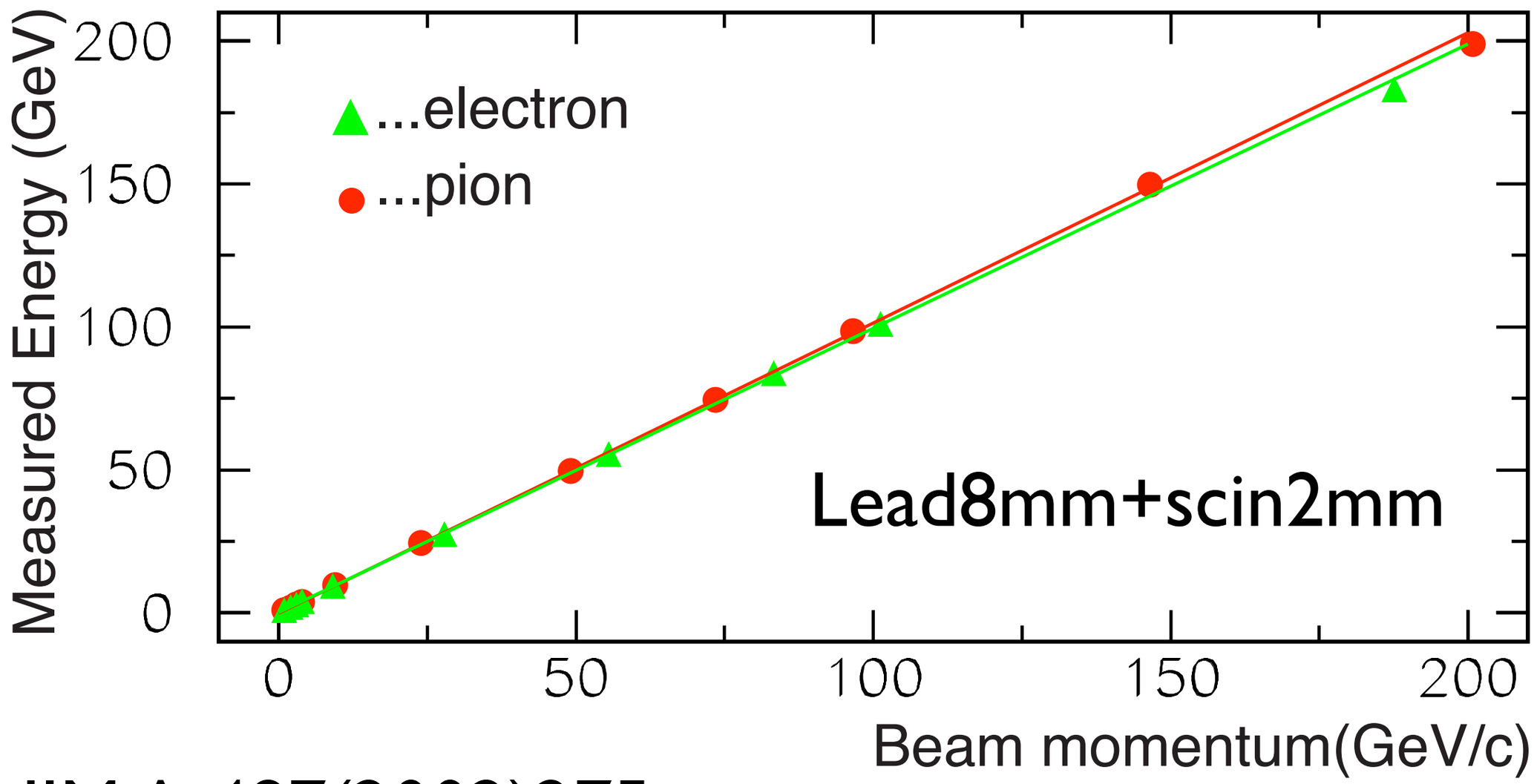
equivalent Itoh

scintillator HCAL option 2:

Lead absorber

- Compensation is achieved only with Lead

linearity and e/pi ratio~1.0



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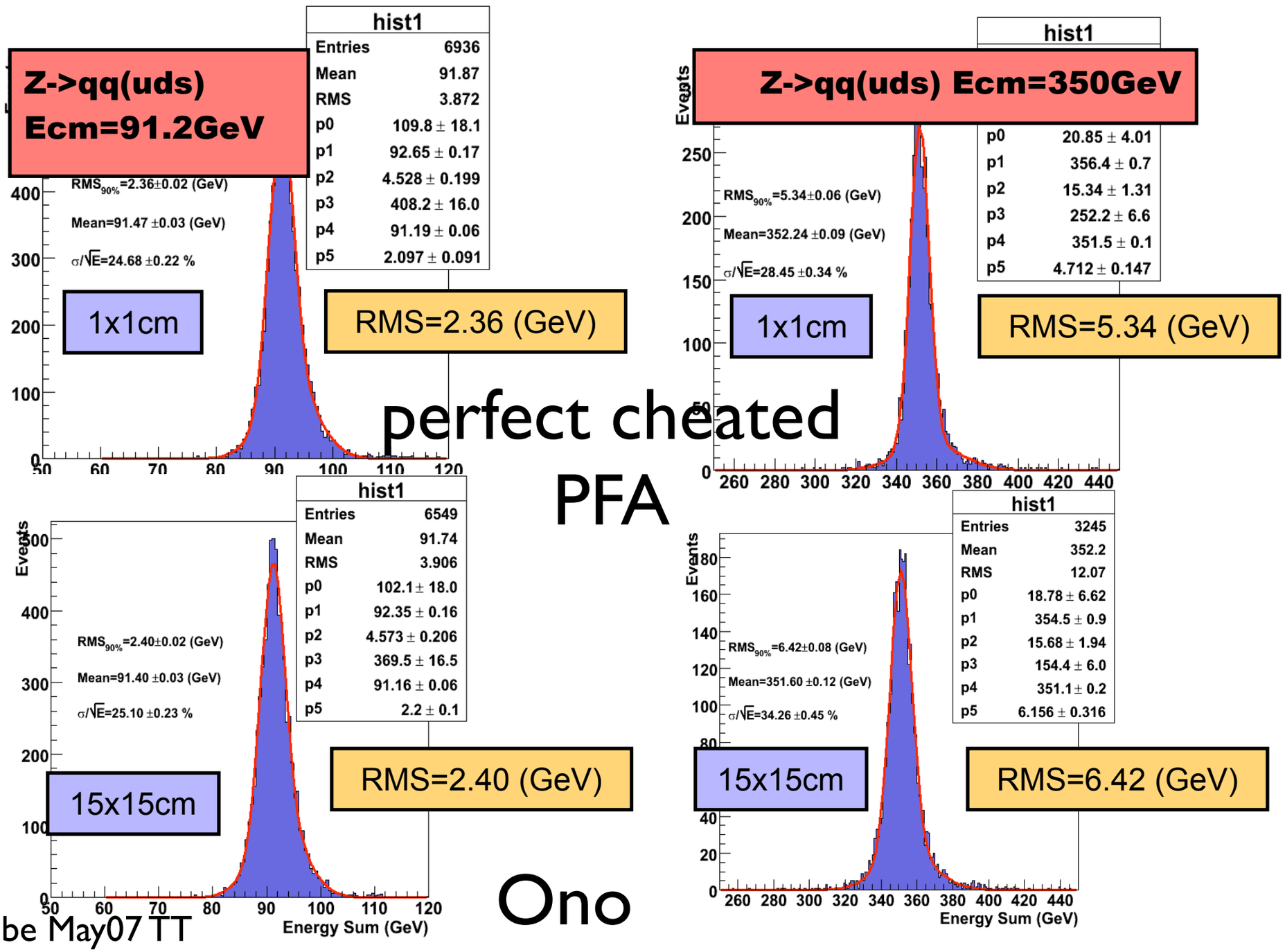
scintillator HCAL option 3:

strip scintillator

Jet energy distribution



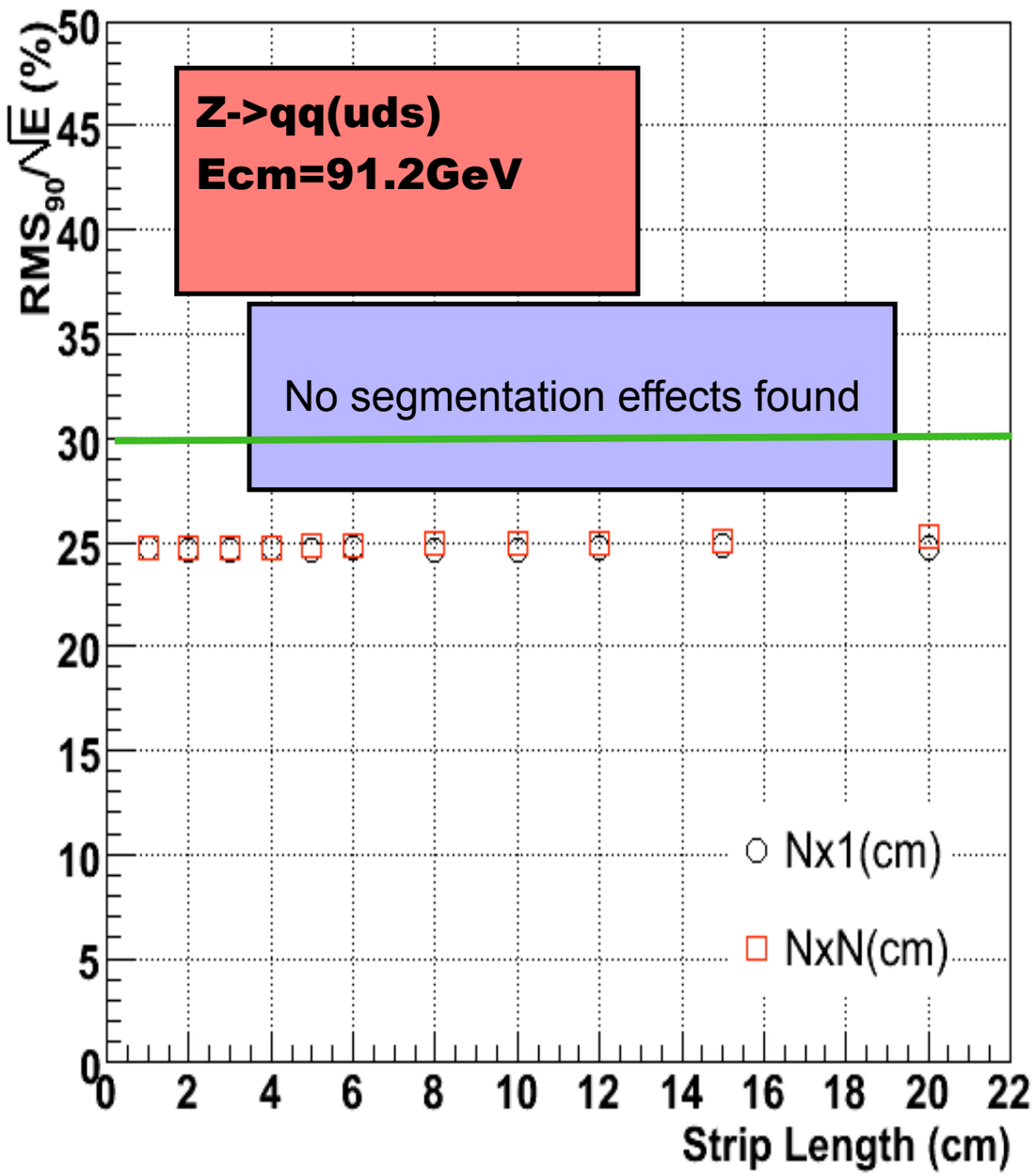
perfect cheated PFA

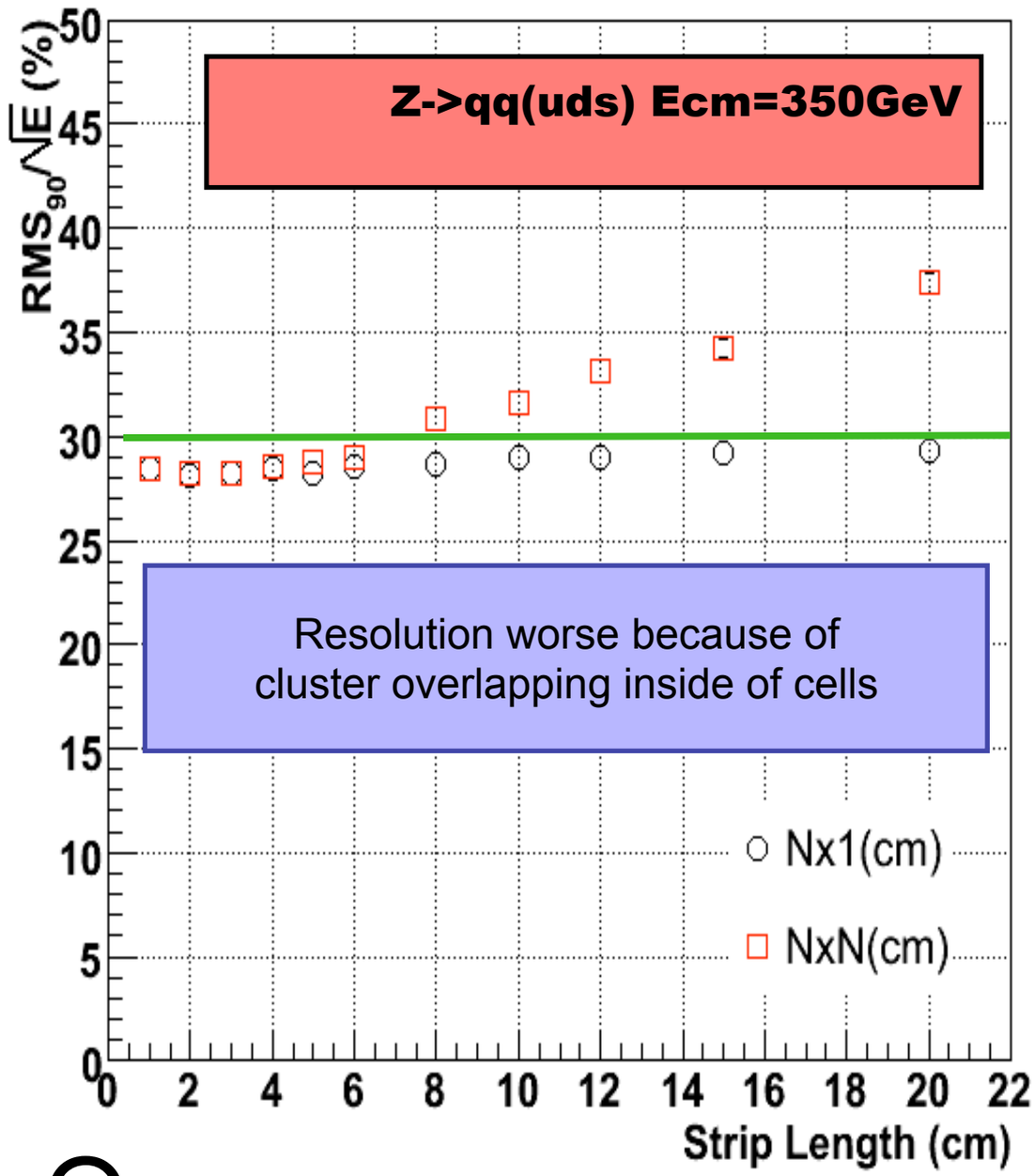
Ono

scintillator HCAL option 3:

strip scintillator

Cheated PFA jet resolution





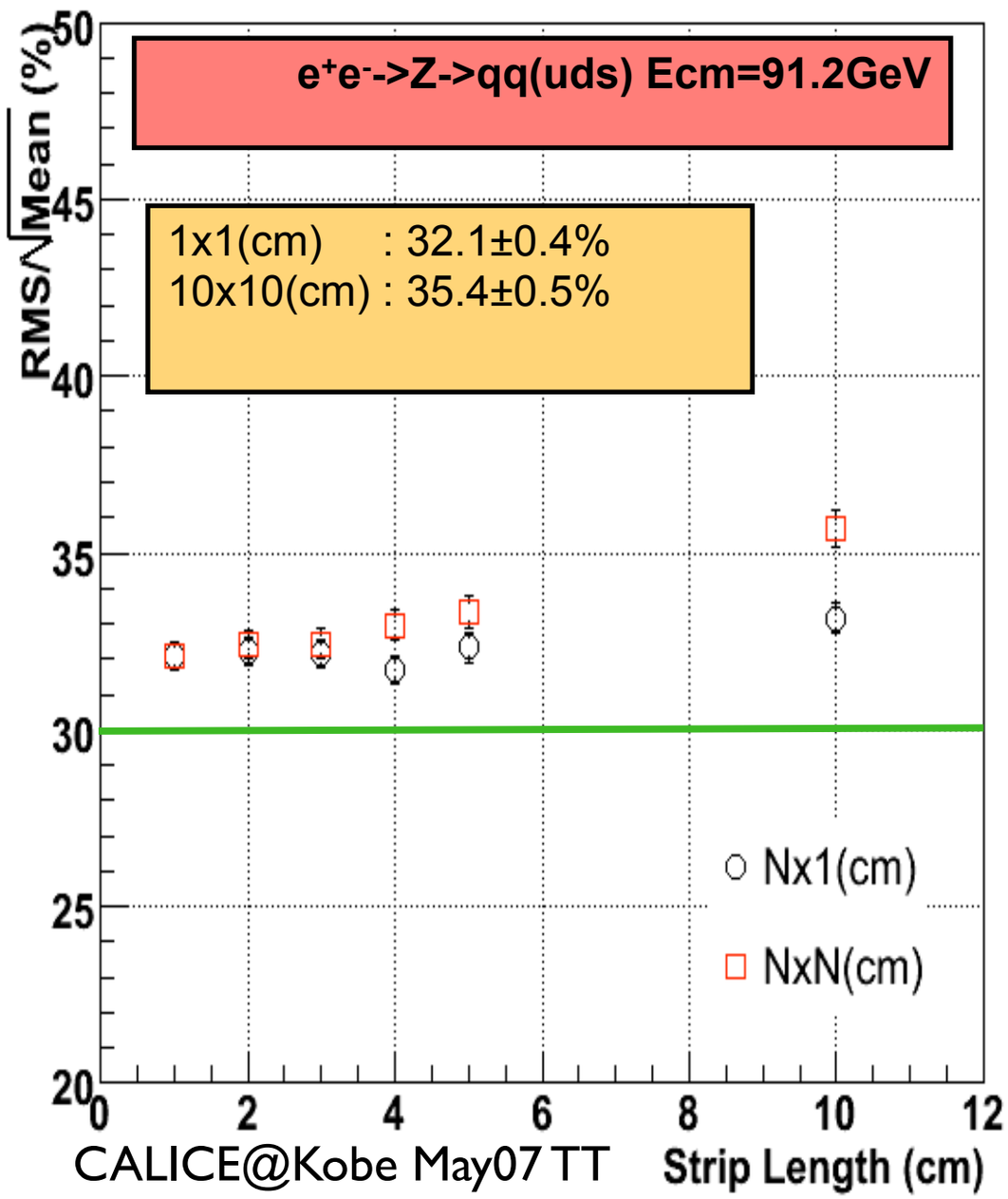
Ono

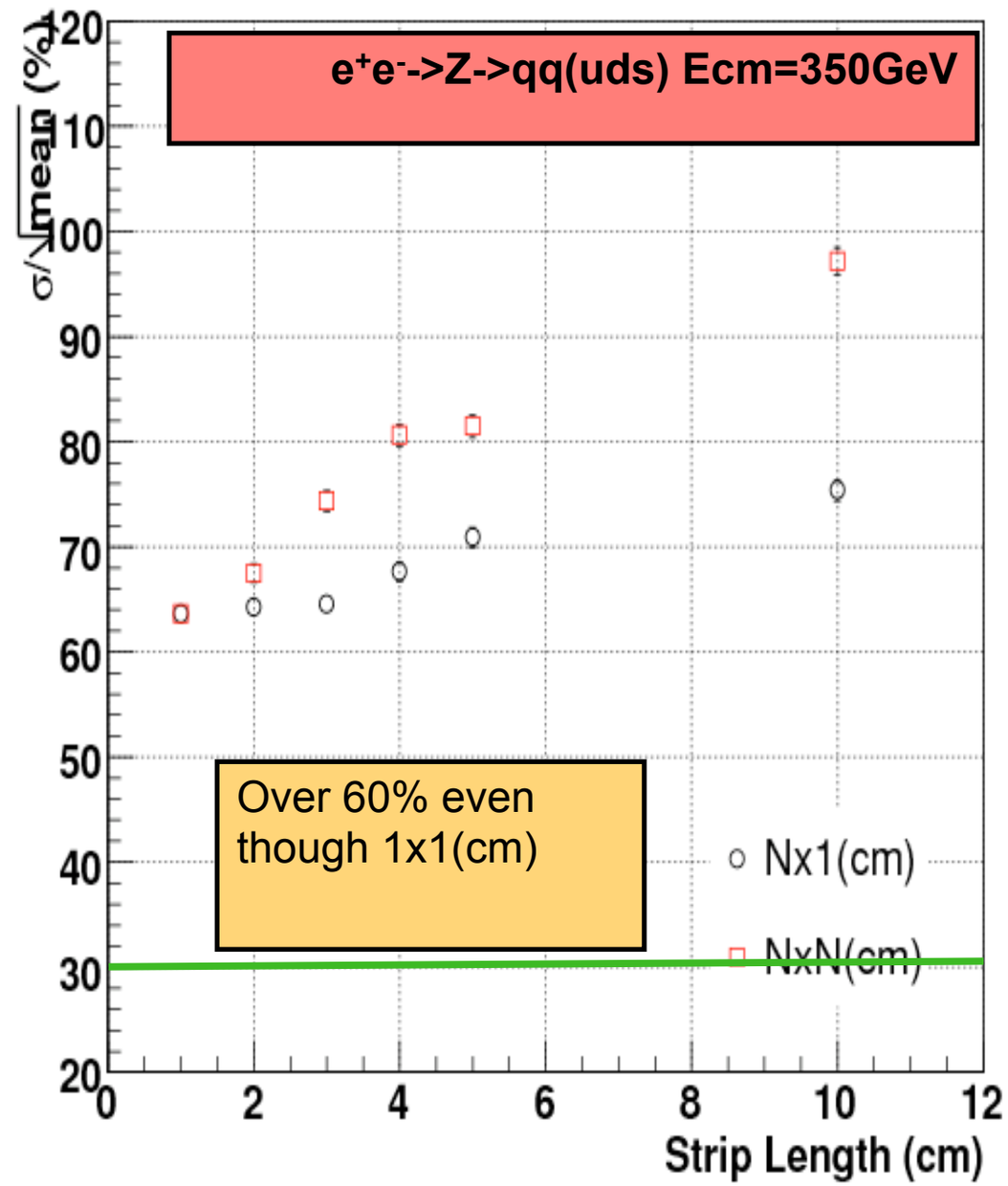
scintillator HCAL option 3:

strip scintillator

GLD-Realistic PF performance

Same PFA scheme applied to cell/strip calorimeter, no strip clustering!





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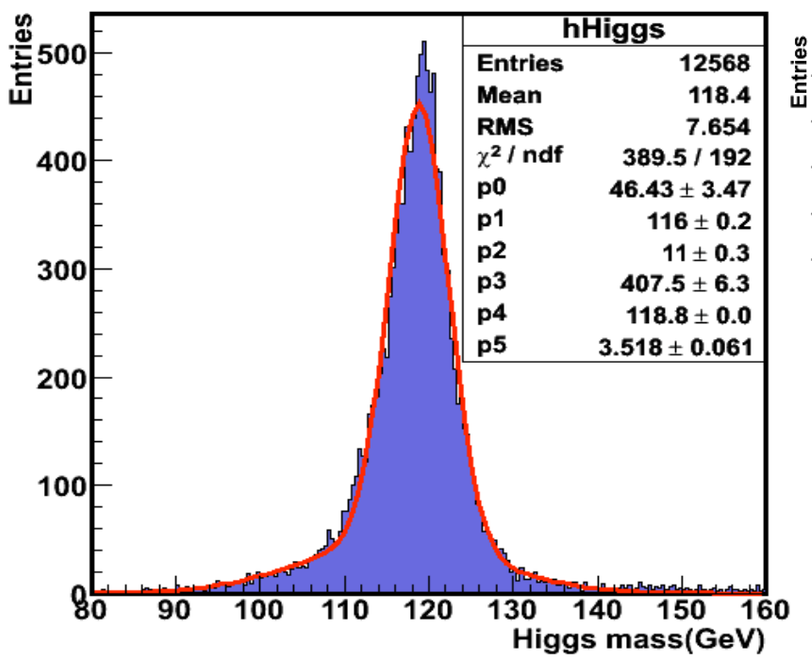
scintillator HCAL option 3:

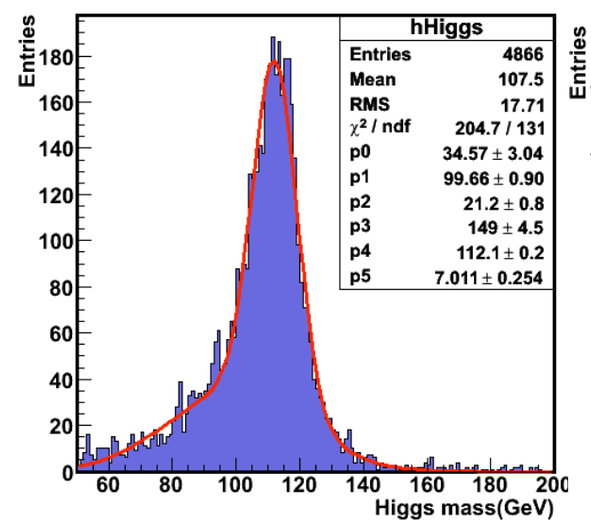
strip scintillator

Cheated PFA

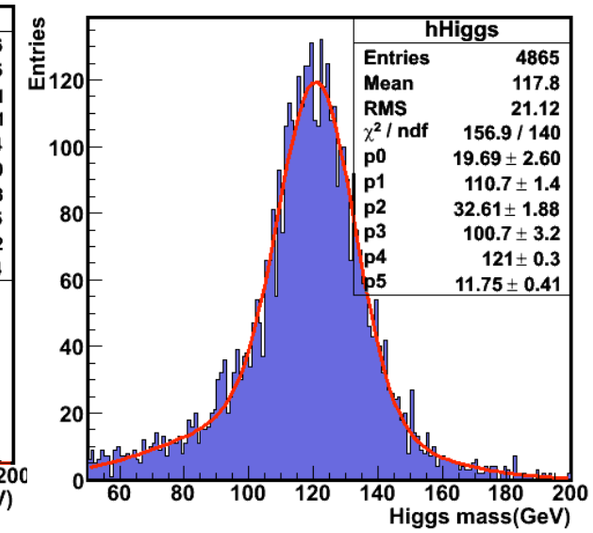
Zh->ννh, 350GeV
Higgs mass plot

GLD-realistic PFA

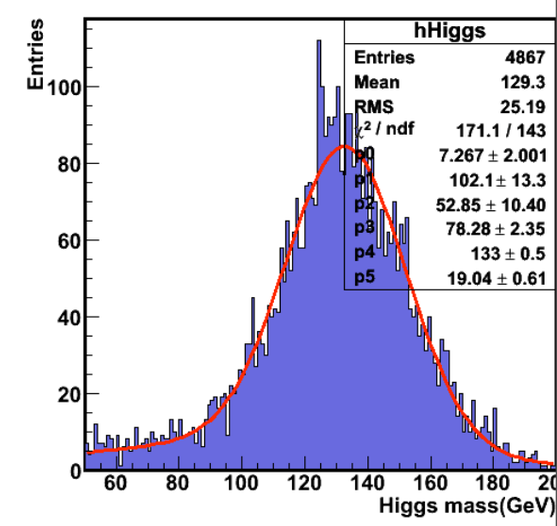




EM:1x1, HD:1x1



EM:4x4, HD:4x4



EM:10x10, HD:10x1

Mh=118.8 GeV
σ = 3.52 GeV

Mh=112.1 GeV
σ = 7.0 GeV

Mh=121 GeV
σ = 11.8 GeV

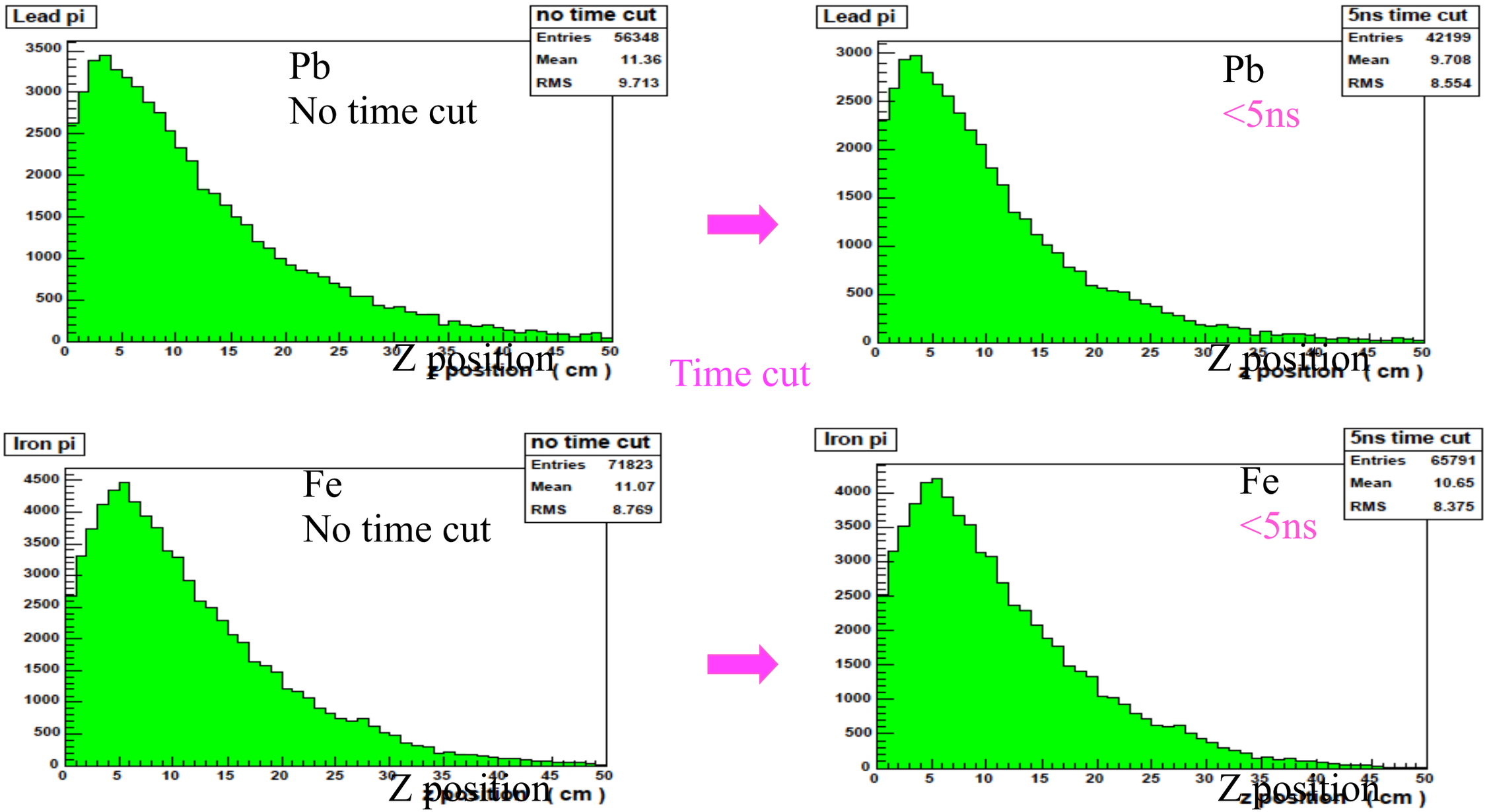
Mh=133 GeV
σ = 19.0 GeV

need more effort

summary and outlook

- neutron detection is one of the scintillator feature
  - by time info, we can eliminate/count
  - need electronics with timing
  - need test beam data to work with MC
- Compensation may help us with Lead abs.
- more effort on PFA
  - perfect PFA require 6cm long strip

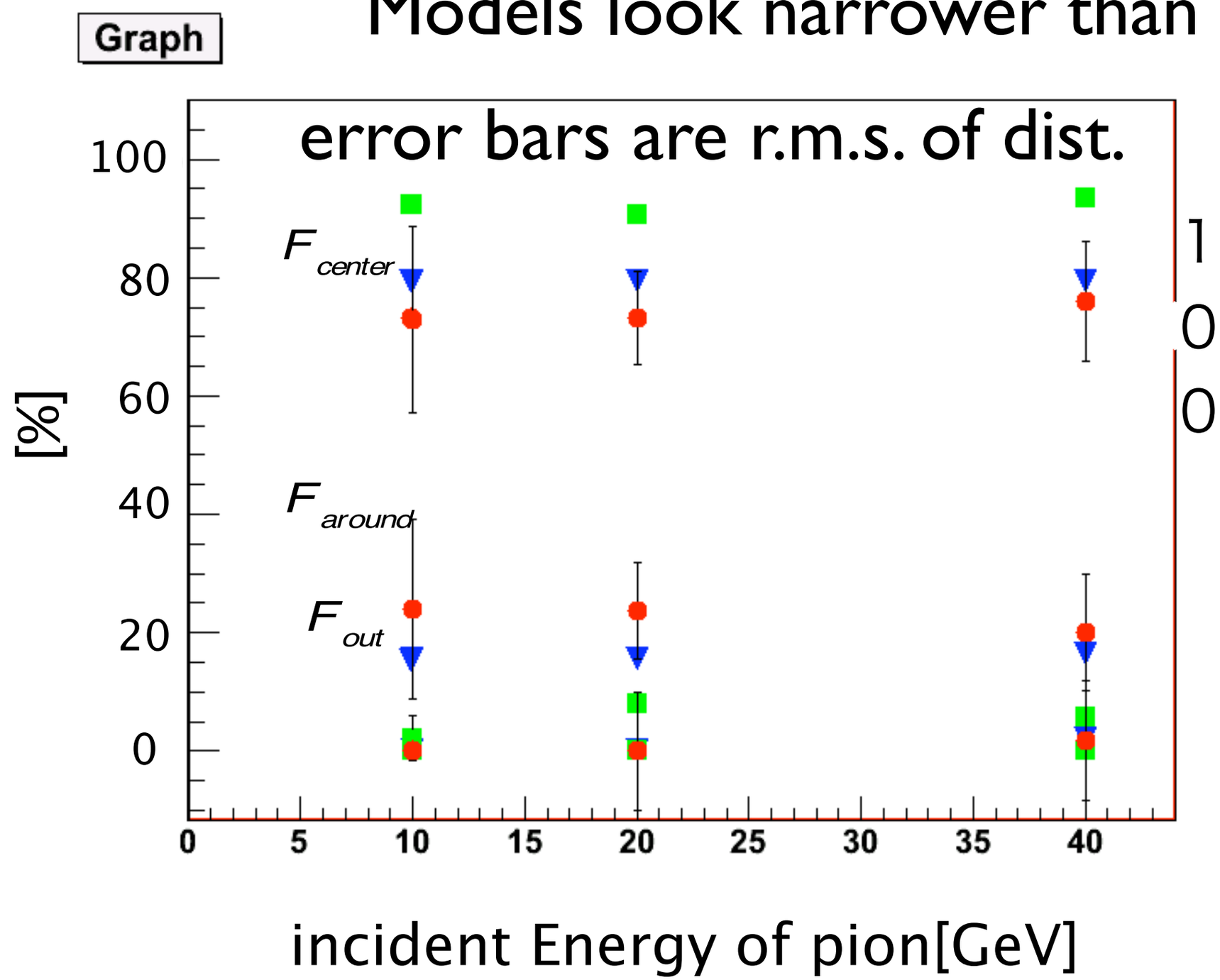
Longitudinal shower profile with absorber

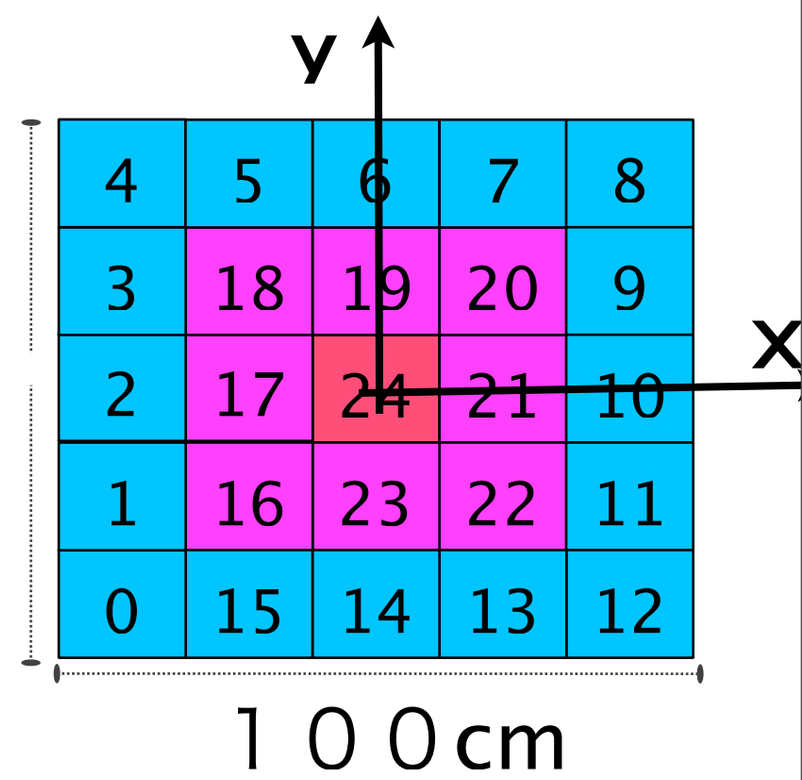


Itoh

compare with the data

Models look narrower than real data





●data

▼LHEP

▪QGSP

Oobe

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