Status of MAPS Geometry Simulation

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## MAPS Meeting at Rutherford Appleton Laboratory

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Outline

- Cell size dependence

  - Mokka-06-00 and LCIO-v01-07 are used. (Two cellIDs are available.)

  - 25μm x 25μm ~ 100μm x 100μm cell size variation.

- Incoming Single Electron Energy dependence

  - Default geometry, MAPS thickness and MAPS geometry

- Single muon test

  - Comparison between default and MAPS thickness

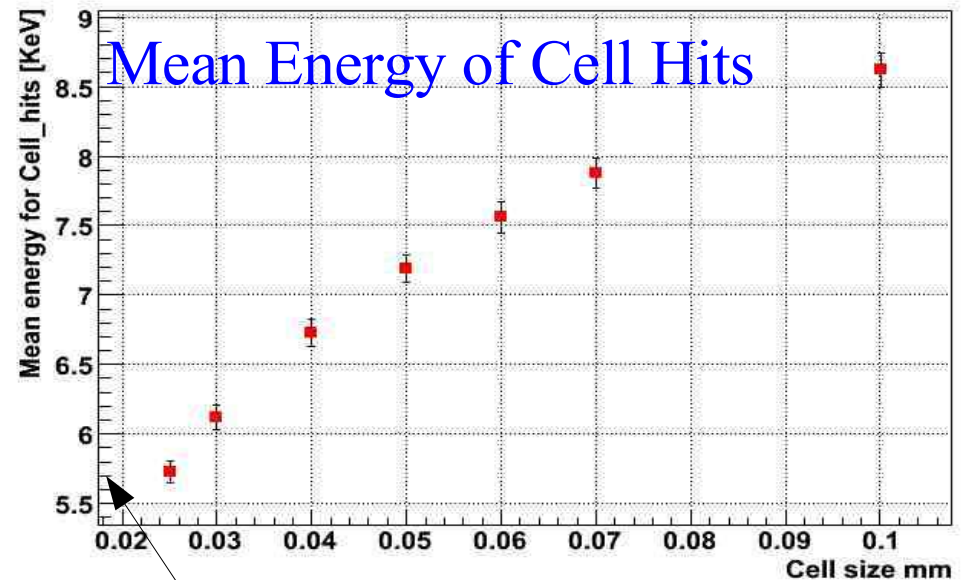 - Comparison with other energy deposit distribution.

Cell size dependence
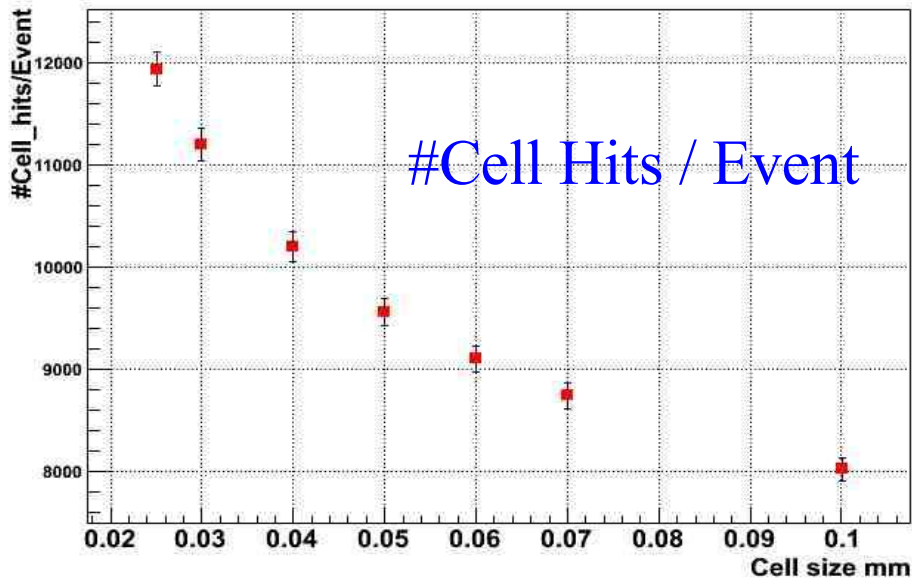
All plots are:
100 GeV Single e- 5,000 events
with sensitive thickness is 15μm.

#Cell Hits / Event

Energy Deposit / Event

Consistency check

Mean Energy of Cell Hits
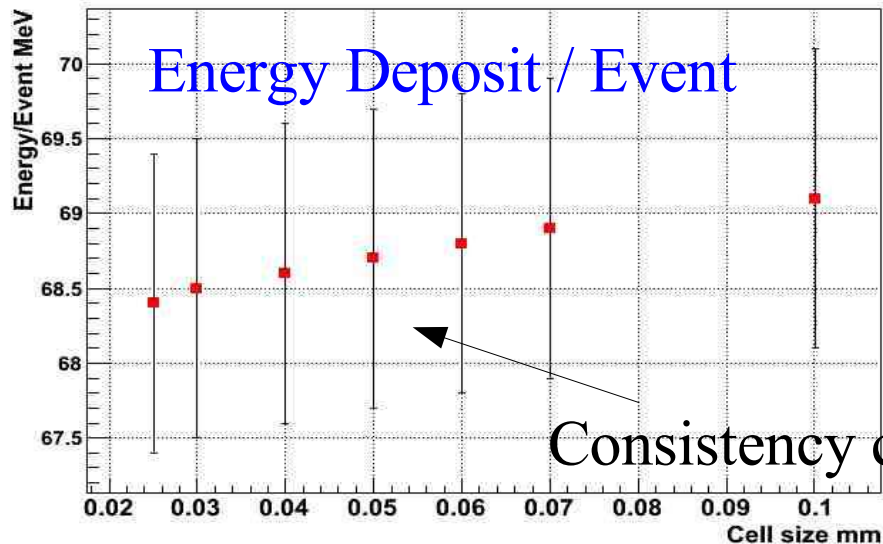
3.88 MeV/cm (Si dE/dx) x 15μm
= 5.82 KeV

More small cell is interesting.

Mean Energy of Cell Hits with
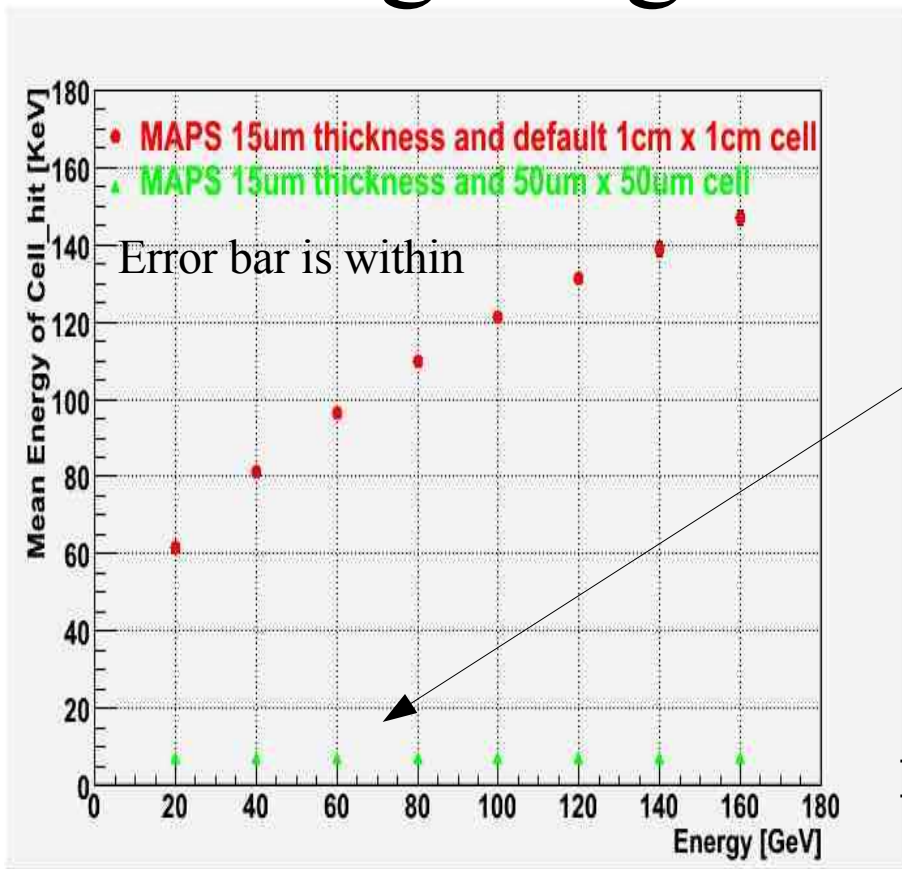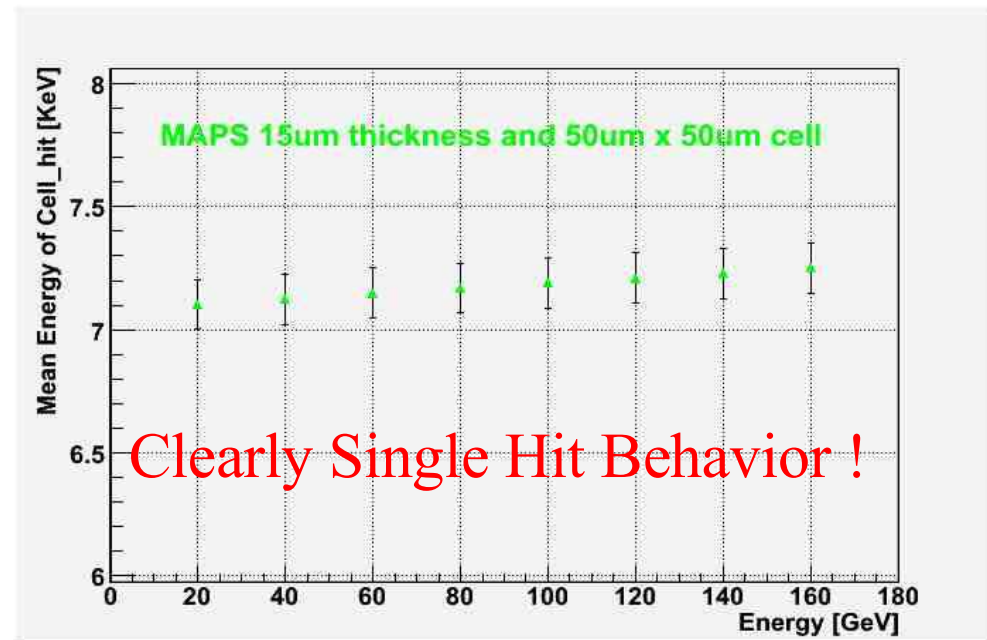# Incoming Single e- Energy dependence
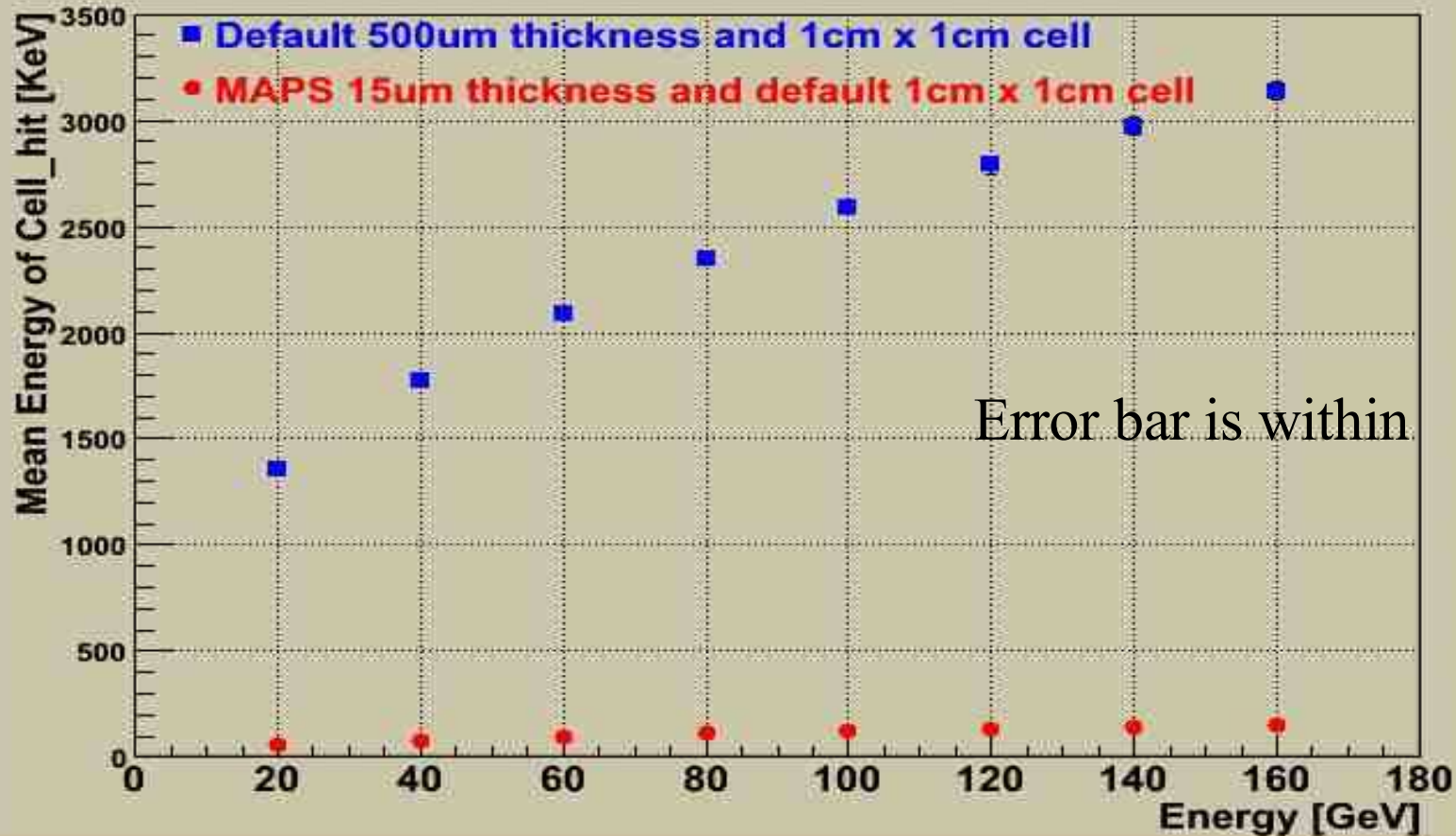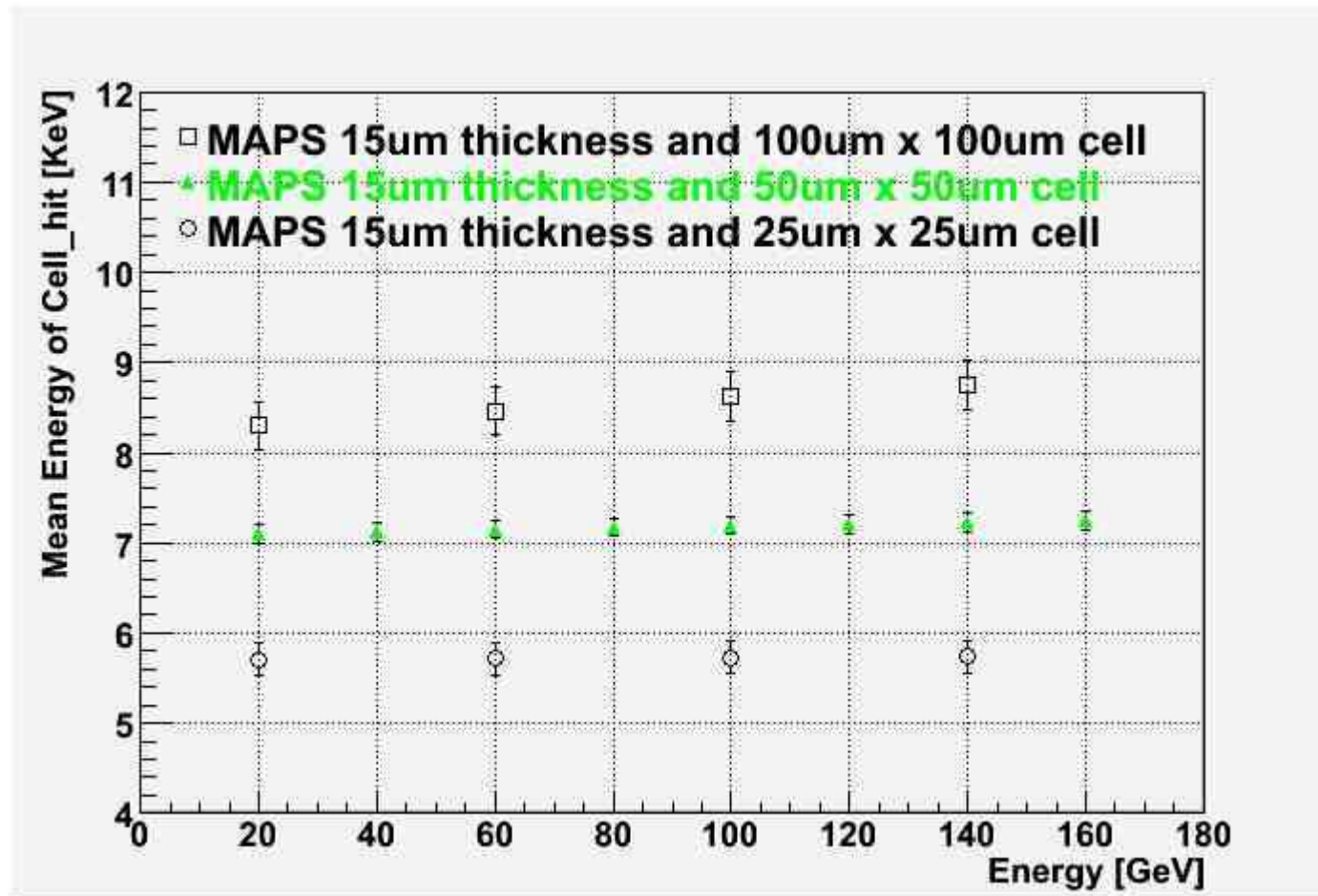

zoom up

in next slide

Mean Energy of Cell Hits
with
Incoming Single e- Energy dependence

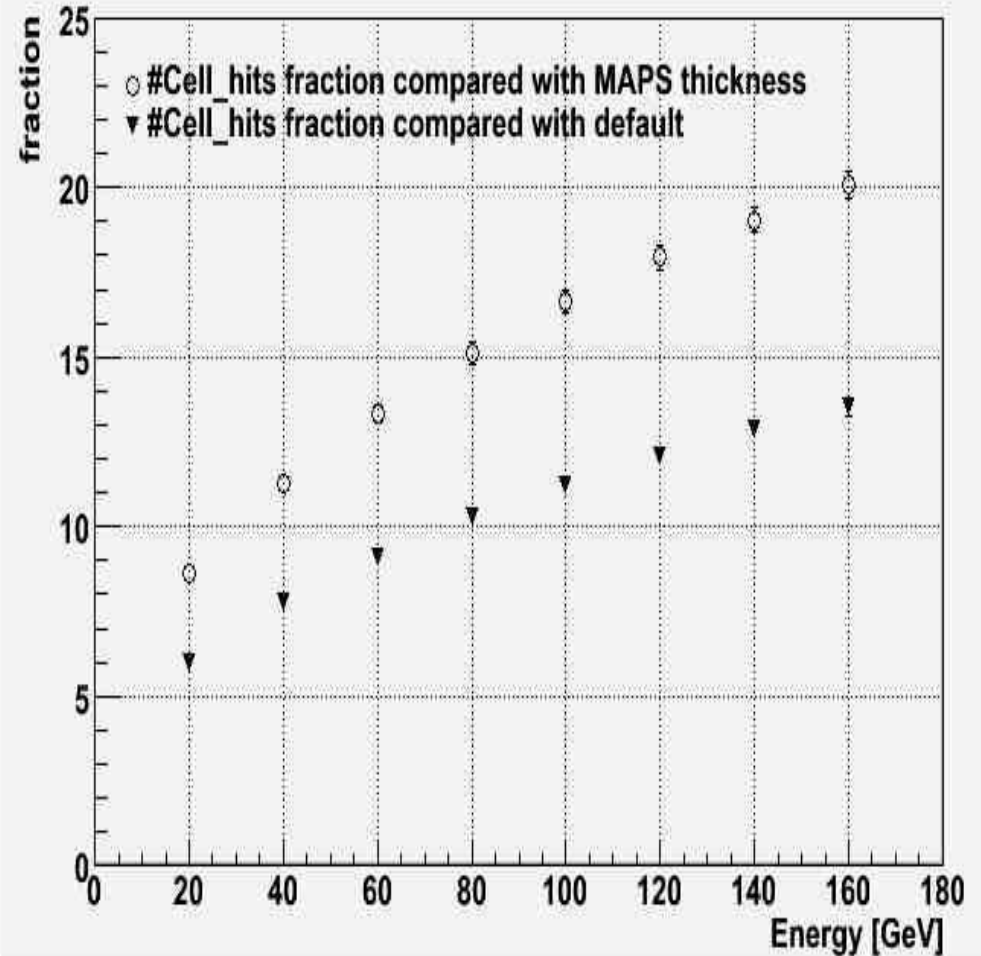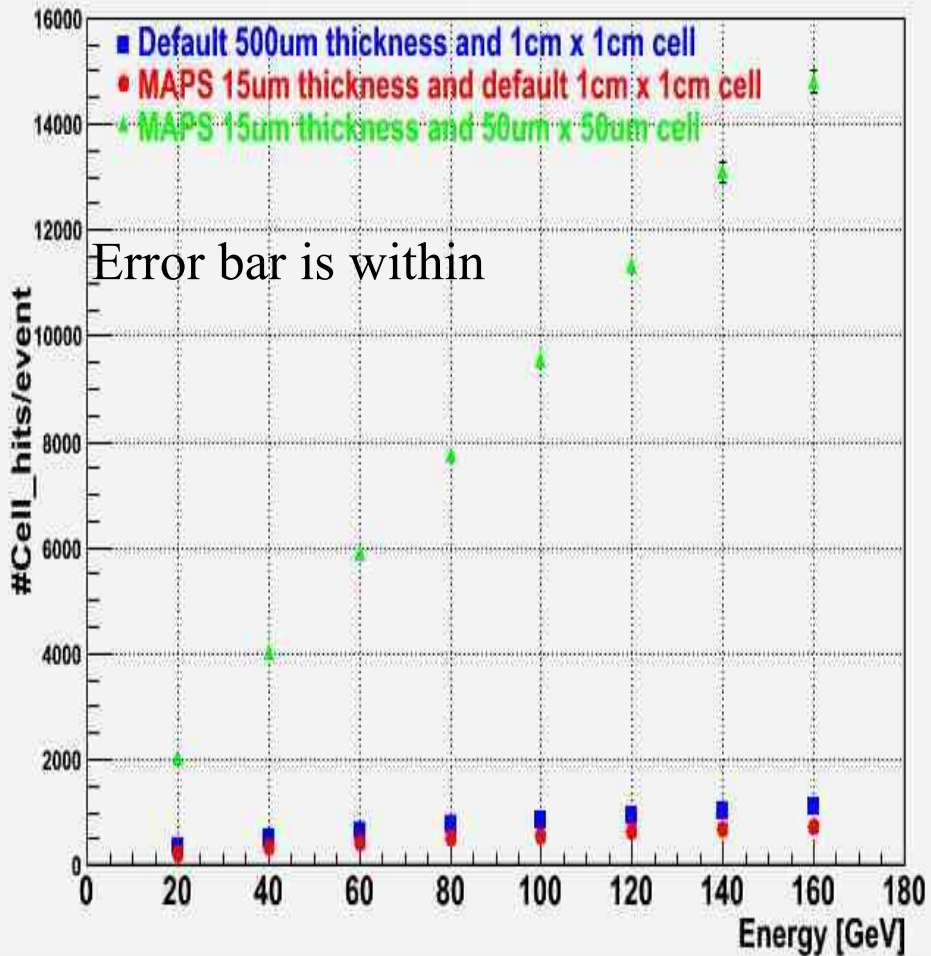MAPS Energy deposit dose NOT depend on incoming electron beam energy !

Mean Energy of Cell Hits
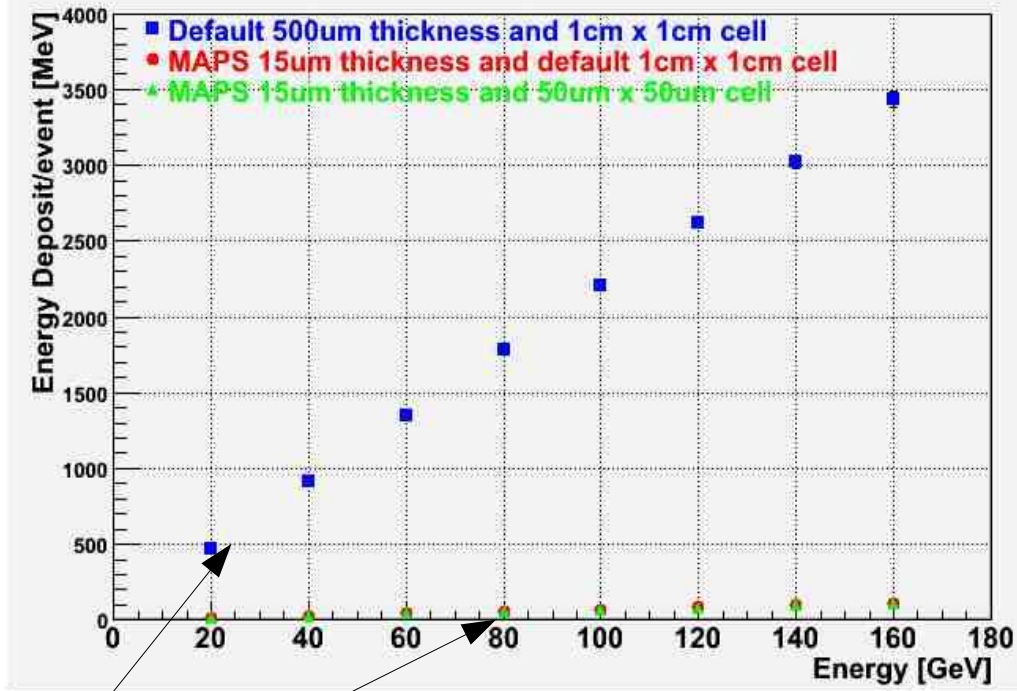# with
Incoming Single e- Energy dependence
& Cell size variation

Mean Energy of Cell Hits

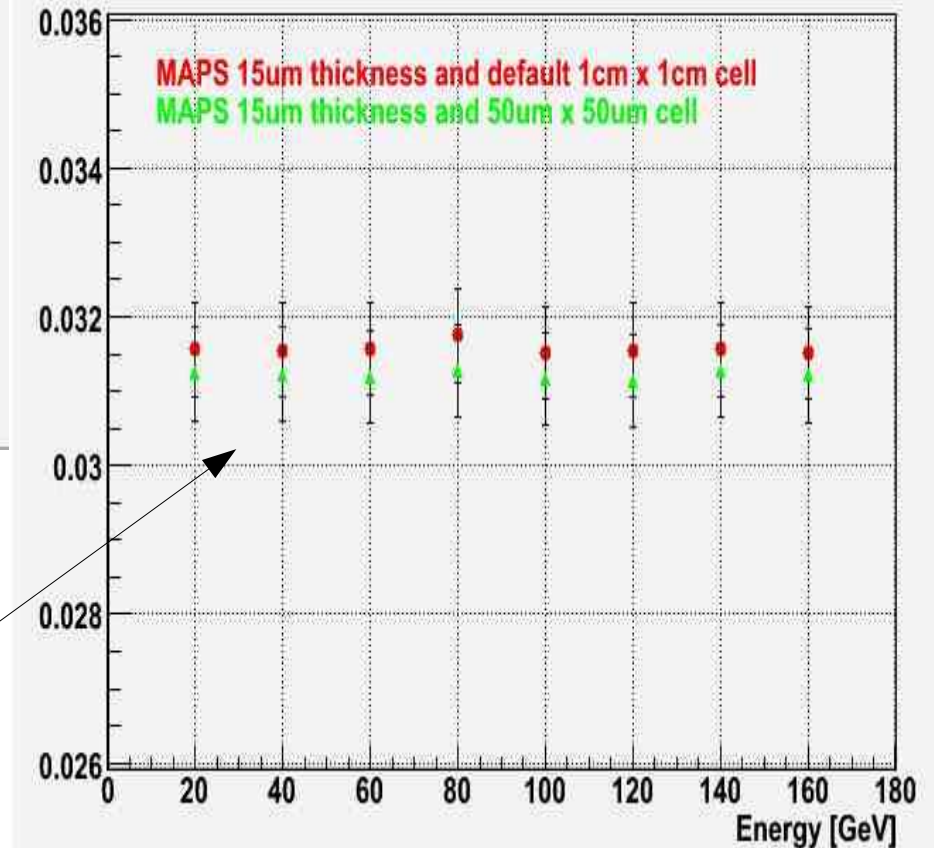|	20 GeV e-	100 GeV e-	fraction (100GeV/20GeV)
Default (500μm thickness, 1cm X 1cm cell)	1360 +/-19 KeV	2590 +/-37 KeV	(190+/-3.8)%
MAPS thickness (15μm thickness, 1cm X 1cm cell)	61.7 +/- 0.9 KeV	121 +/- 1.7 KeV	(196+/-2.8)%
MAPS (15μm thickness, 100μm X 100μm cell)	8.30 +/-0.26 KeV	8.62+/-0.27 KeV	(103.9+/-4.6)%
MAPS (15μm thickness, 50μm X 50μm cell)	7.10+/-0.10 KeV	7.19+/-0.10 KeV	(101.3+/-2.0)%
MAPS (15μm thickness, 25μm X 25μm cell)	5.71 +/- 0.18 KeV	5.73+/-0.18 KeV	(100.4+/-4.5)%

#Cell Hits / Event
with
Incoming Single e- Energy Dependence

Energy Deposit / Event with
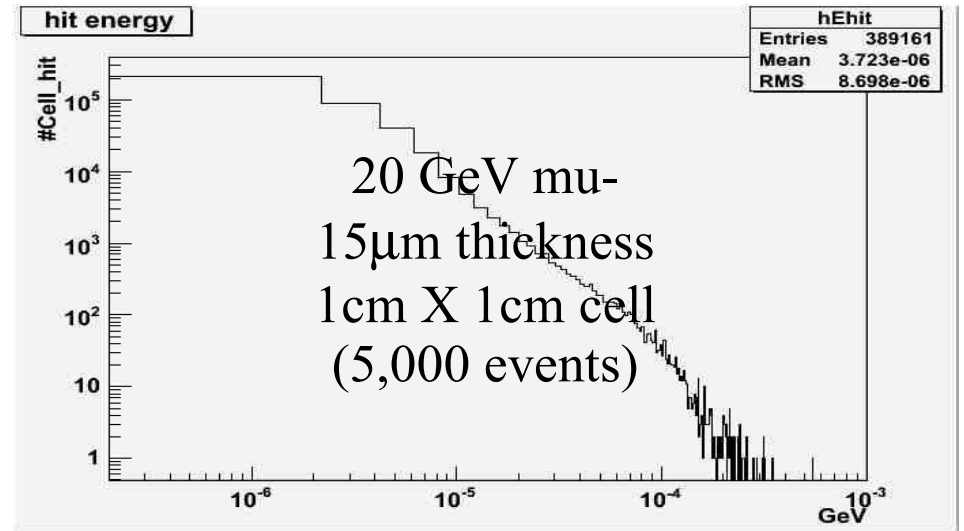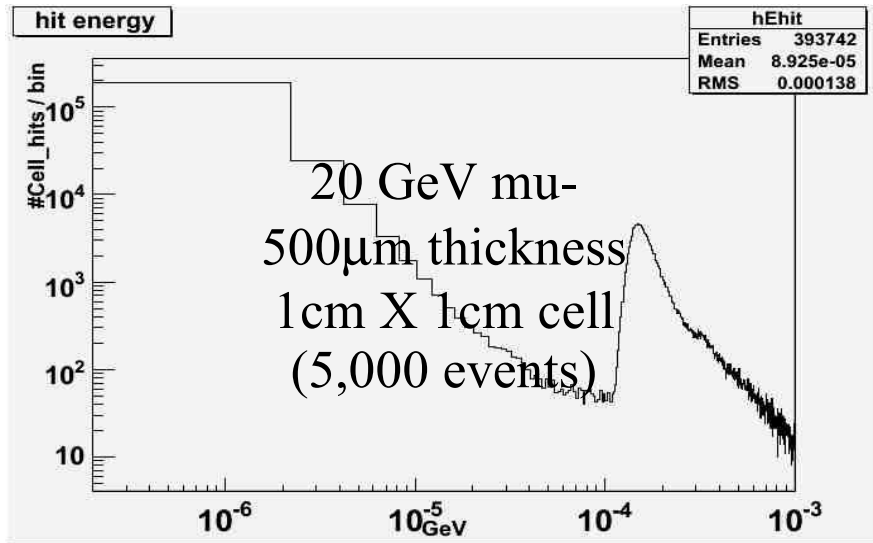# Incoming Single e- Energy Dependence

- Default 500um thickness and 1cm x 1cm cell
- MAPS 15um thickness and default 1cm x 1cm cell
- MAPS 15um thickness and 50um x 50um cell

Linear dependence respectively

Fraction compared with default

MAPS 15um thickness and default 1cm x 1cm cell
MAPS 15um thickness and 50um x 50um cell

Single Muon Energy Deposit (Under study)

Left plot labels:
hit energy
hEhit
Entries 393742
Mean 8.925e-05
RMS 0.000138

#Cell_hits / bin

20 GeV mu-
500μm thickness
1cm X 1cm cell
(5,000 events)

GeV

Right plot labels:
hit energy
hEhit
Entries 389161
Mean 3.723e-06
RMS 8.698e-06

#Cell_hit

20 GeV mu-
15μm thickness
1cm X 1cm cell
(5,000 events)

GeV

- #Cell_hits / event = 78.7 +/- 1.1 (stat)

- Mean E of Cell_hits = 100 +/- 1.4 KeV

- E deposit / event = 7.87 +/- 0.11 MeV

#Cell_hits / event = 77.8 +/- 1.1 (stat)

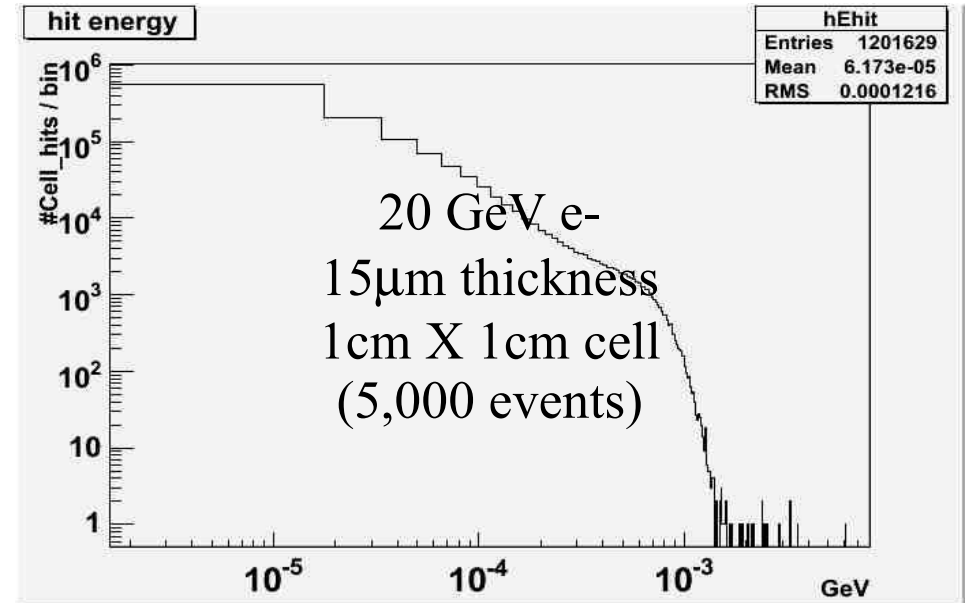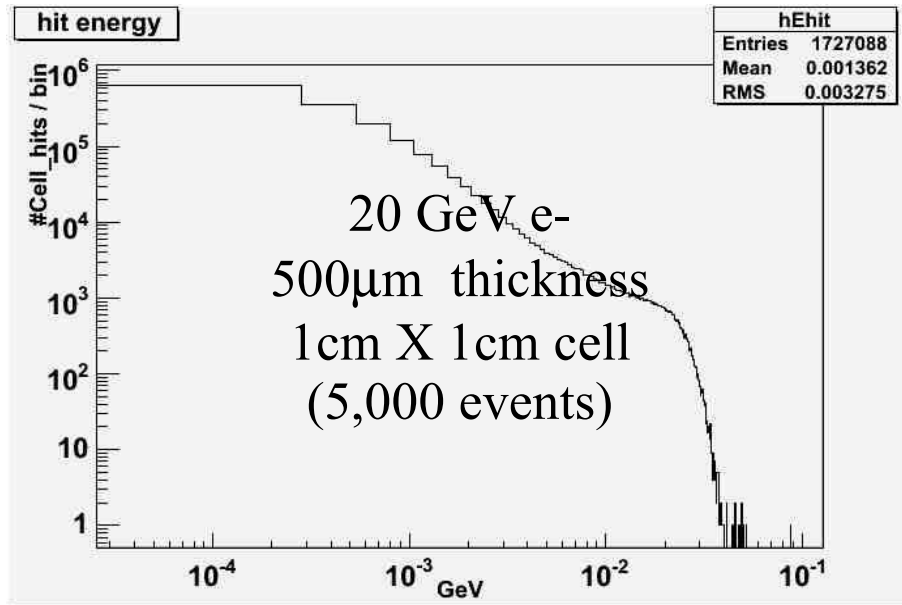Mean E of Cell_hits = 3.72 +/- 0.05 KeV

E deposit / event = 289.8 +/- 4.1 KeV

MAPS/Default ratio for mean energy of Cell_hits = (3.72 +/- 0.07) %

MAPS/Default ratio for energy deposit per event = (3.68 +/- 0.07) %

40 layers means #Cell_hits / layer ~ 2 ----> Mean E / layer ~ 7.4 KeV in 15μm.

Single Electron Energy Deposit

- #Cell_hits / event = 345.4+/- 4.9 (stat)

- Mean E of Cell_hits = 1.36 +/- 0.02 MeV

- E deposit / event = 471 +/- 6.6 MeV
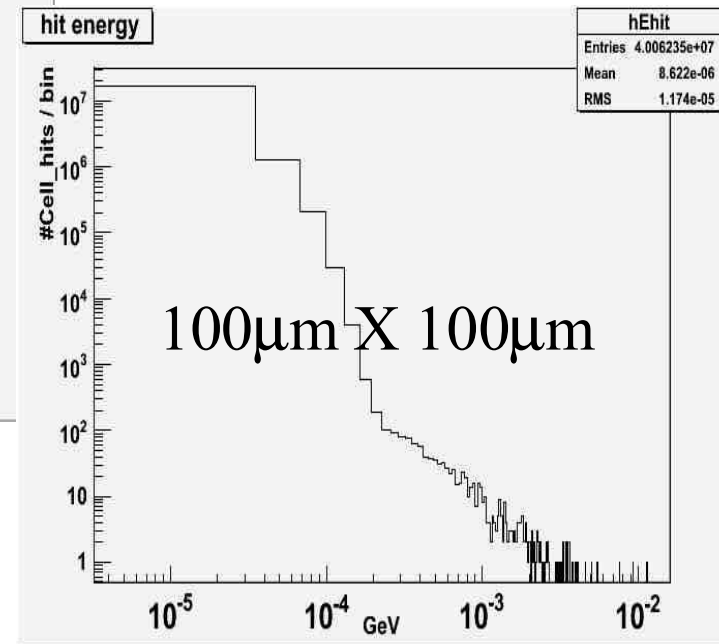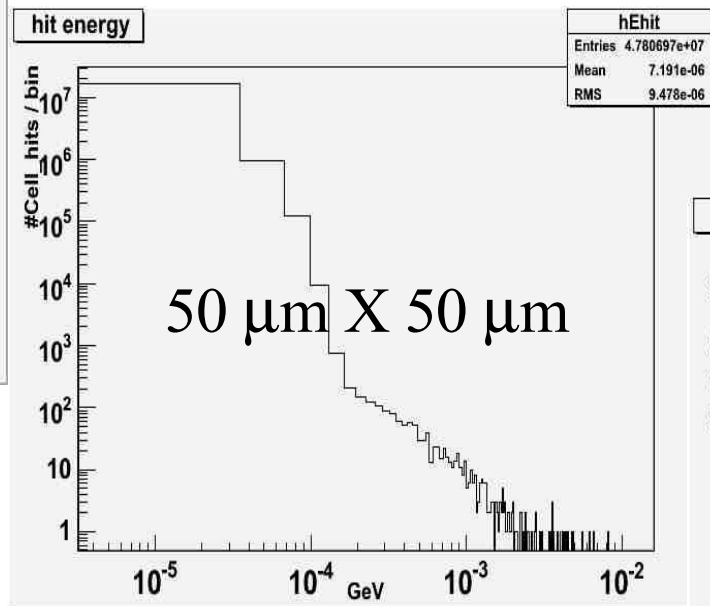
- #Cell_hits / event = 240.3+/- 3.4 (stat)

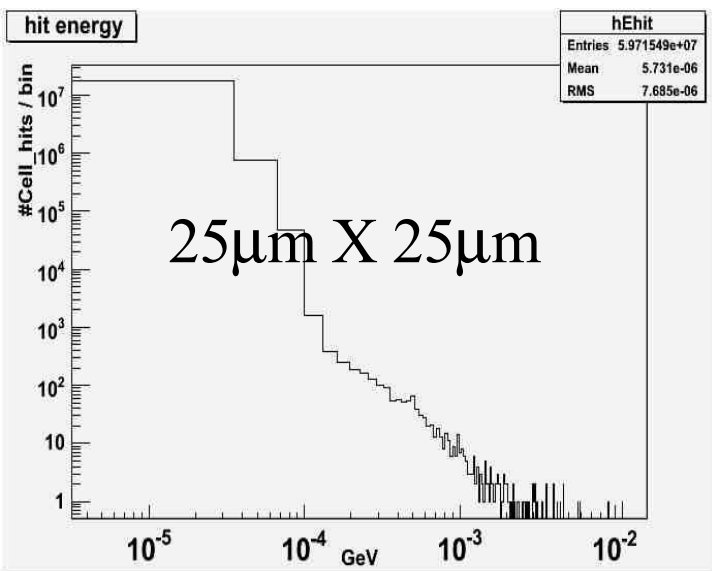- Mean E of Cell_hits = 61.7 +/- 0.9 KeV

- E deposit / event = 14.8 +/- 0.2 MeV

MAPS/Default ratio for mean energy of Cell_hits = (4.31 +/- 0.09) %

MAPS/Default ratio for energy deposit per event = (3.16 +/- 0.06) %

(->Consistent with 3% thickness reduction)

Energy deposit distribution
with
Cell size dependence
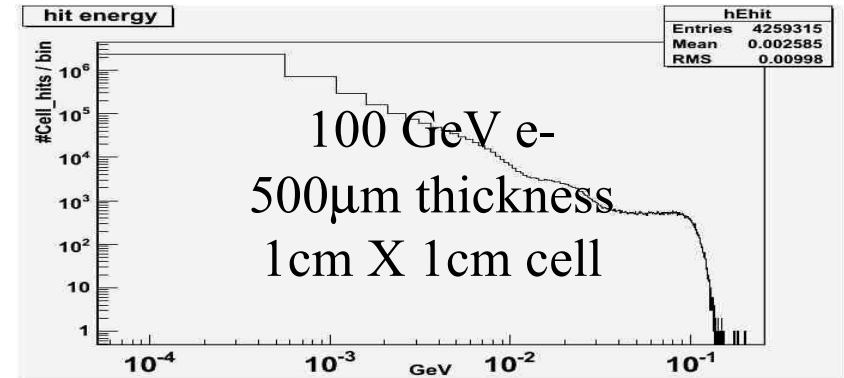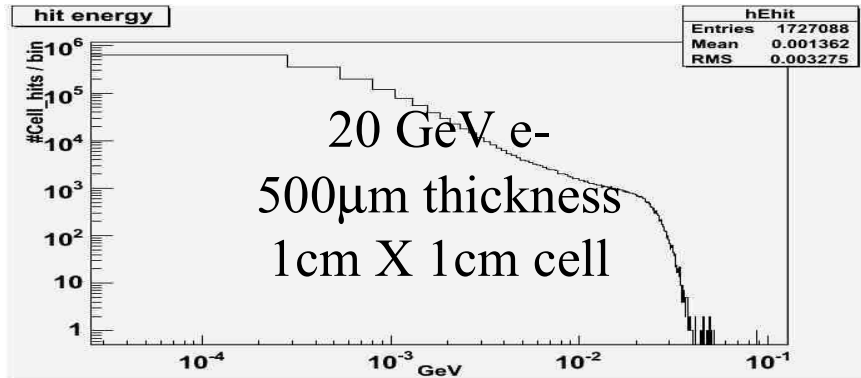

25μm X 25μm

50 μm X 50 μm

100μm X 100μm

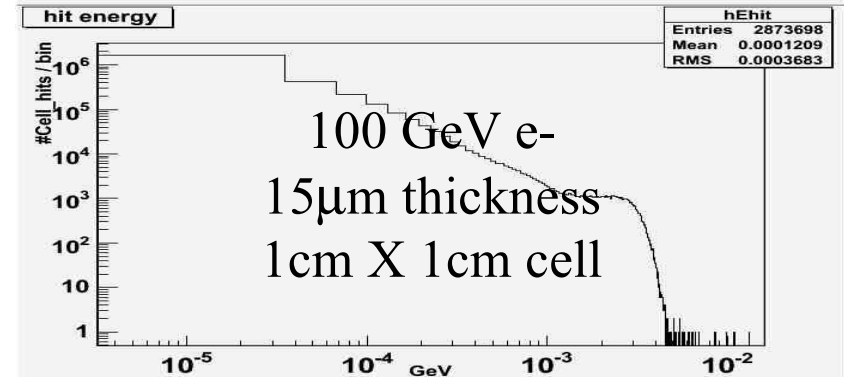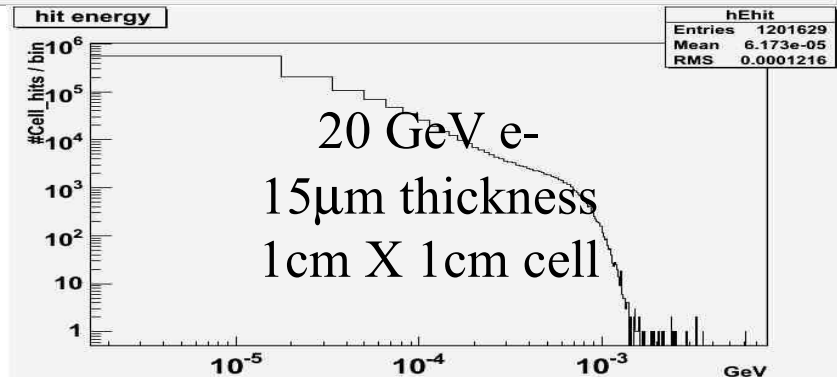100 GeV e-

15μm thickness
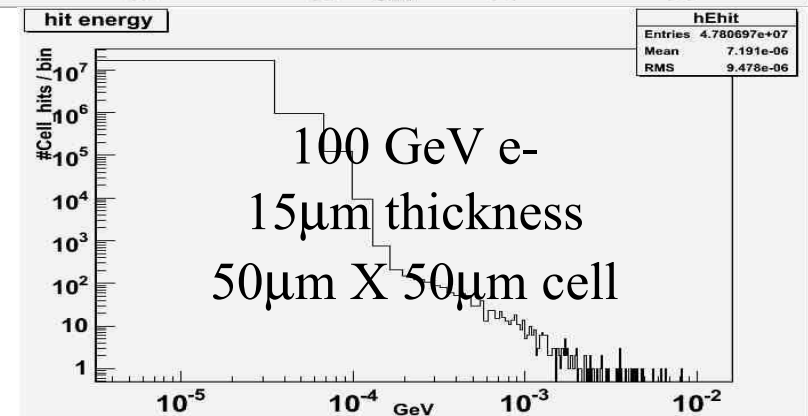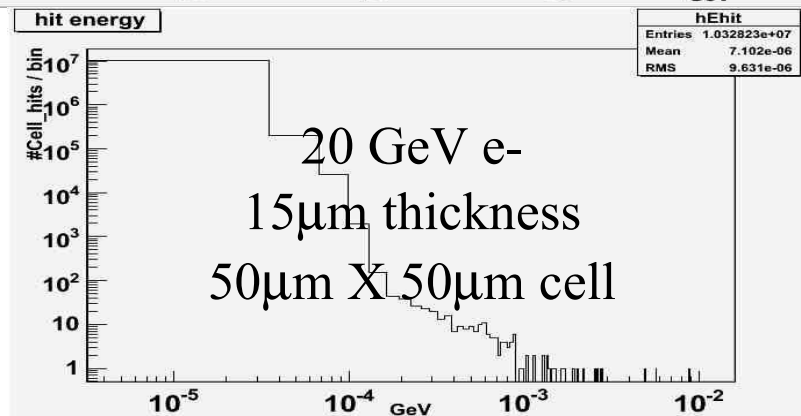
Energy deposit distributions

20 GeV e-

100 GeV e-

default

MAPS thickness

MAPS

(All plots are 5,000 events)

Status and Future Prospects

- Status

  - MAPS Geometry (15μm thickness x 50μm x 50μm cell size) clearly show single hit energy deposit.

  - 5μm x 5μm cell size is under study. (It need modification for bits assignments. <-- We can use provision bit.)

- Next steps

  - MC study for #MIP hits / cell.

  - Muon test with small cell size.

  - Cross-talk/Multi-particle studies with physics events.

  - Disk/CPU consumption estimate with physics events.

- Future Prospect

  - Position/Energy resolutions.