

# Status of MAPS Geometry Simulation

21<sup>th</sup> April 2006

MAPS Meeting at Rutherford Appleton Laboratory

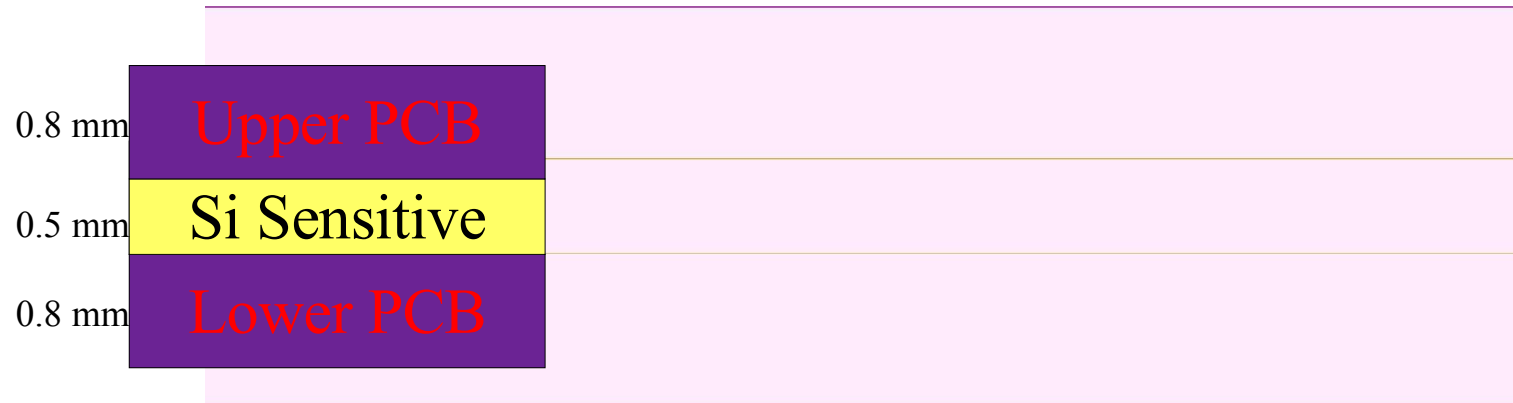
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# Introduction

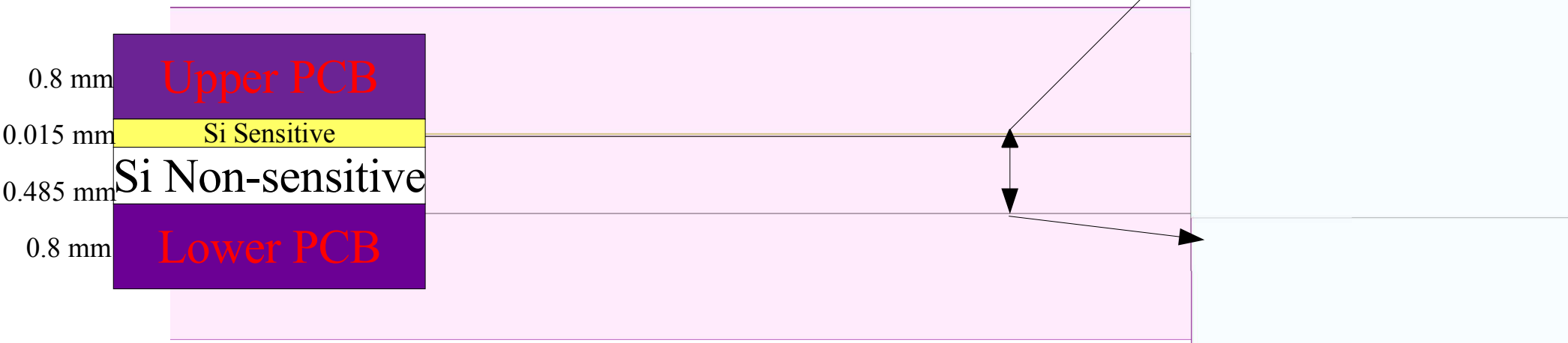
- We studied Si thickness modification ( $15\mu\text{m}$ ).
  - Mokka-05-05 and LCIO-v01-06 is used.
- We tried Cell size modification ( $50\mu\text{m} \times 50\mu\text{m}$ ).
  - Mokka-06-00 and LCIO-v01-07 is used.

# Si Thickness Geometry Comparison

## Default

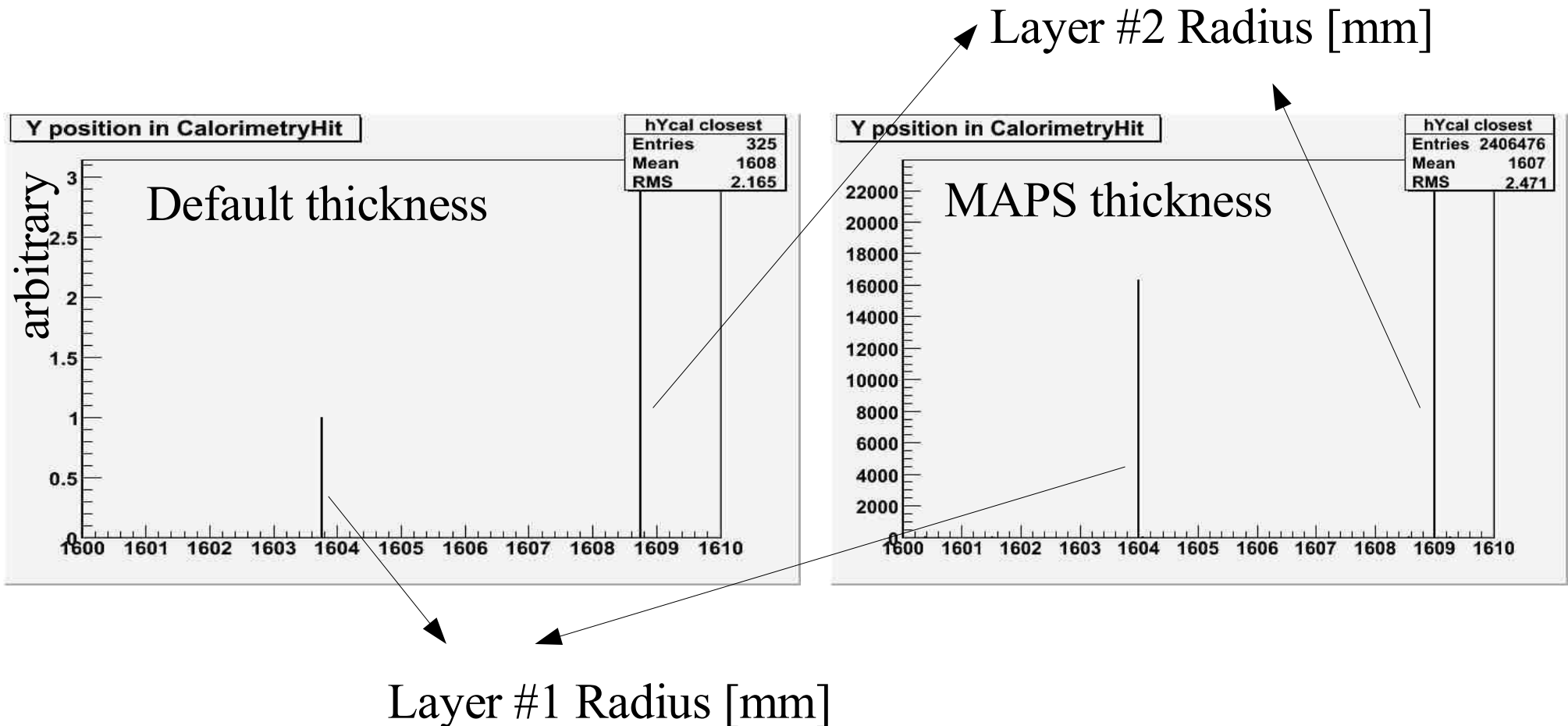


## MAPS Si thickness



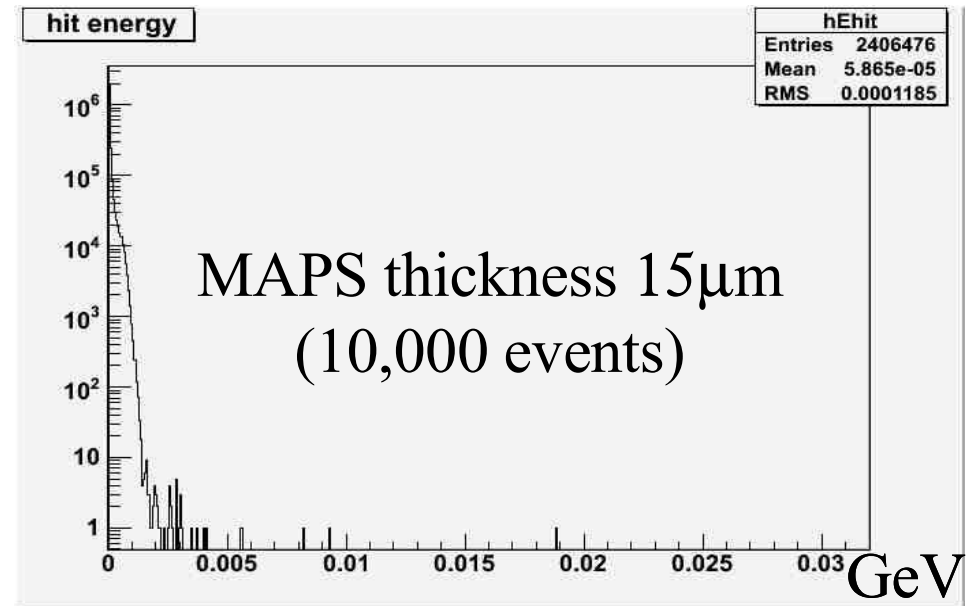
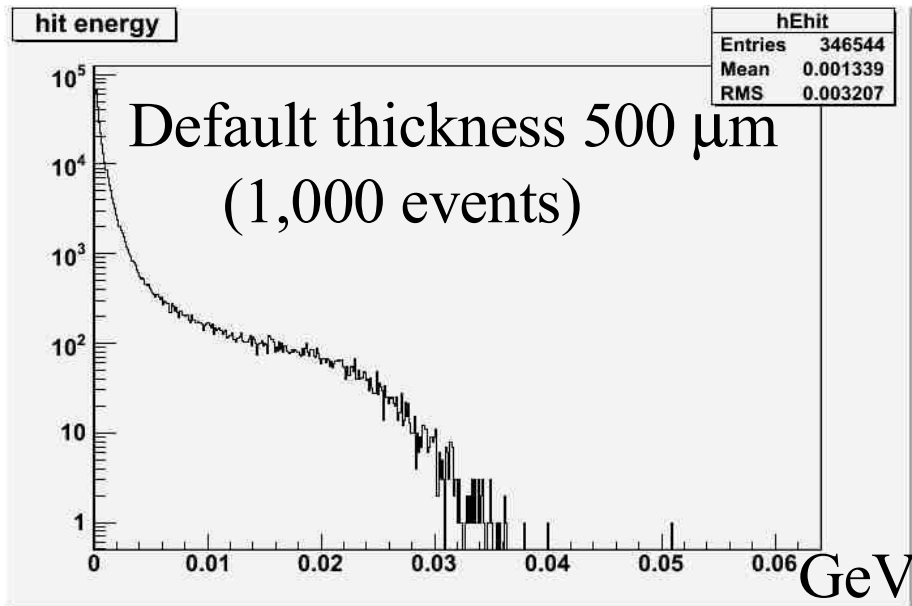
Geant4 Adaptive GUI (GAG) output distributions looks fine.

# Layer Interval Distribution



- 5 mm interval is the same and center values of each layer radius shifted  $242.5 \mu\text{m}$ . --> **Agree with expects.**

# 20 GeV Single Electron Energy Deposit



#hits/event = 346.5 +/- 11.0 (stat)  
Mean E of hits = 1.34 +/- 0.04 MeV  
E deposit/event = 464 +/- 15 MeV

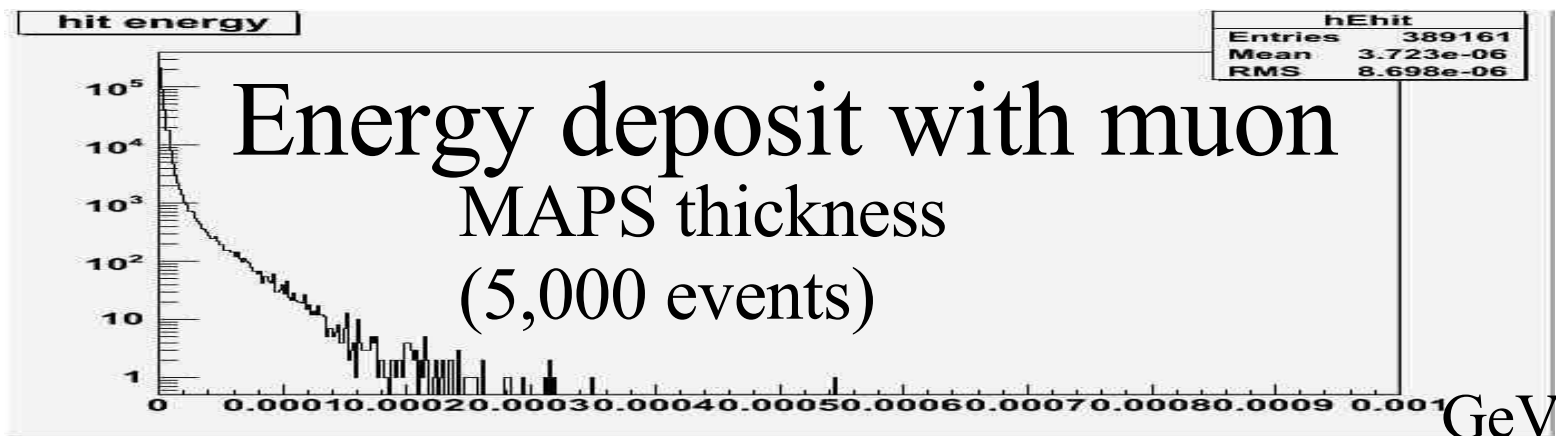
#hits/event = 240.6 +/- 2.4 (stat)  
Mean E of hits = 58.7 +/- 0.6 KeV  
E deposit/event = 14.1 +/- 0.2 MeV

MAPS/Default ratio for mean of hits = (4.38 +/- 0.14) %

MAPS/Default ratio for energy deposit per event = (3.04 +/- 0.10) %  
(--> Agree with thickness 3% reduction.)

#hits mainly depends on radiator tungsten thickness.

# Crosscheck with 20 GeV Single Muon

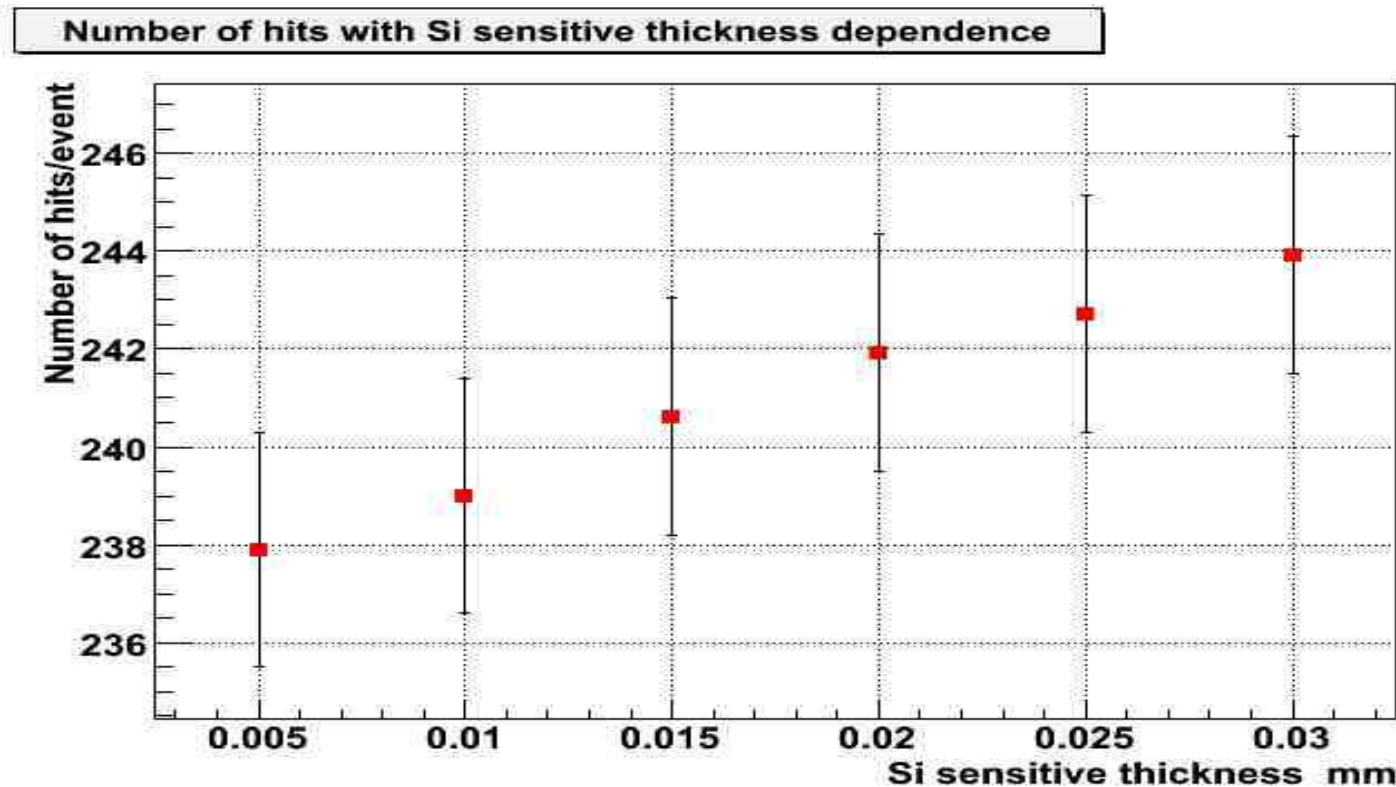


- #hits/events = 77.8 +/- 1.1
- Mean energy of hits = 3.72 +/- 0.05 KeV
- Energy deposit/event = 289.8 +/- 4.1 KeV
  - Si  $dE/dx|_{\min} = 3.88$  MeV/cm (PDG)
  - $3.88 \text{ MeV/cm} \times 40$  (layers)  $\times 15 \mu\text{m} = 233$  KeV

→ **Agree with expect.** (20 GeV is higher velocity than the velocity of MIP.)

# Si Sensitive Thickness Dependence (1)

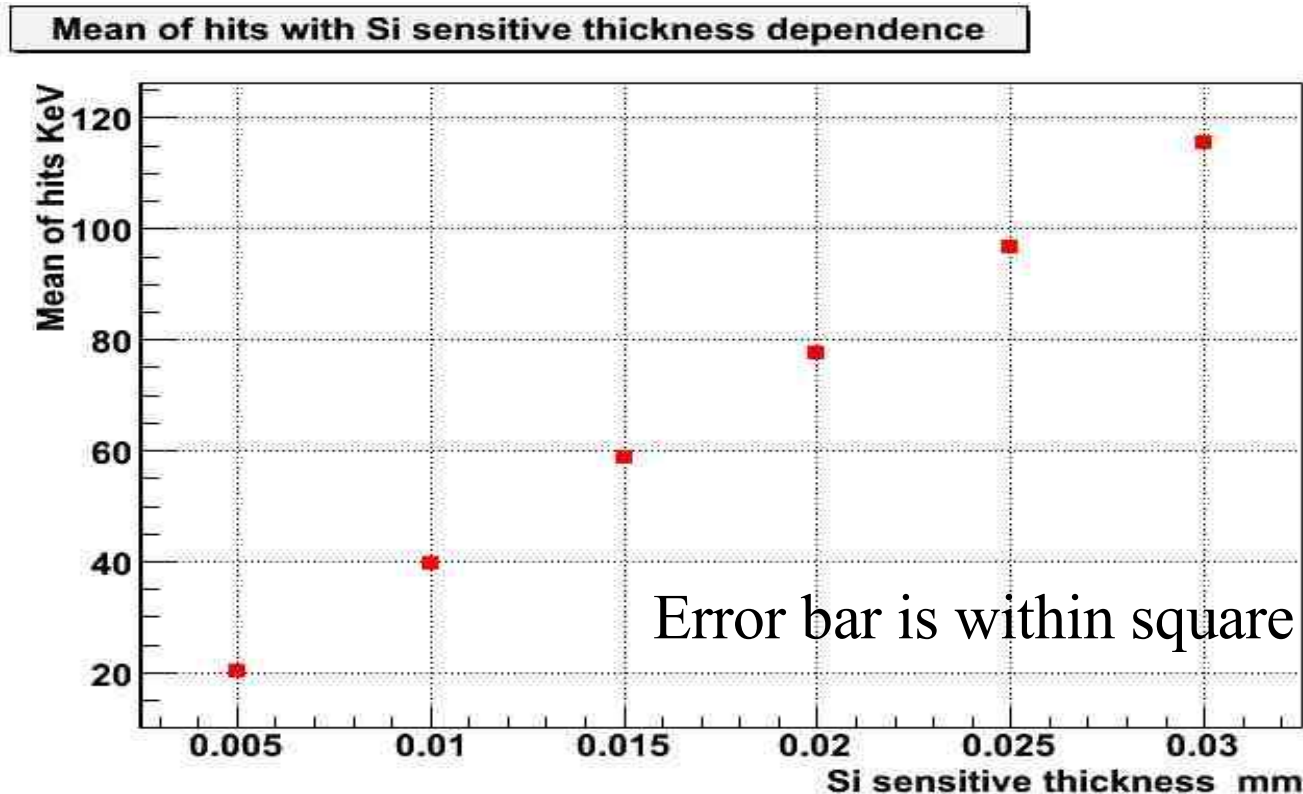
- 20 GeV single electron 10,000 events
- Cell size is still 1cm times 1cm



#hits/events depends on Si sensitive thickness slightly.

# Si Sensitive Thickness Dependence (2)

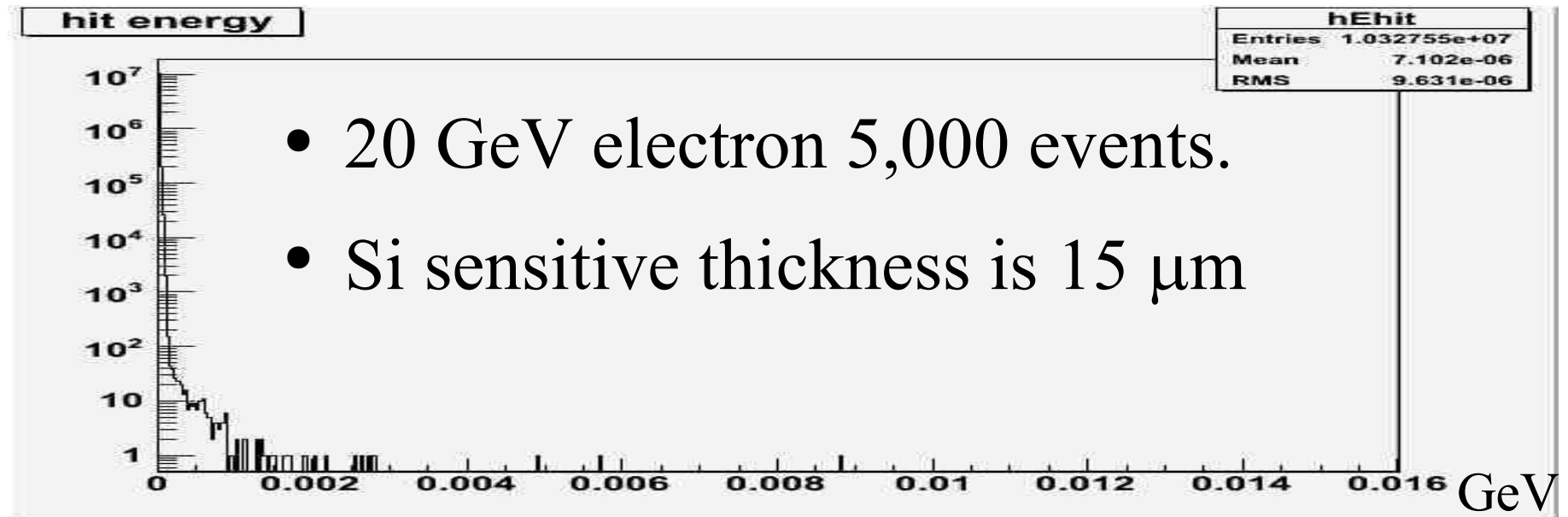
- 20 GeV single electron 10,000 events
- Cell size is still 1cm times 1cm



Mean energy of hits depends on Si sensitive thickness linearly.



# Cell Size Modification (50 $\mu\text{m}$ x 50 $\mu\text{m}$ )



#hits/events = 2065.5 +/- 29.2

Mean energy of hits = 7.10 +/- 0.10 KeV

Energy deposit/event = 14.7 +/- 0.2 MeV

Compared with only thickness modification -> 8.6 times #hits/event  
-> The same energy deposit.

# Data Size/CPU Time Comparison

- Default 500  $\mu\text{m}$  thickness and 1cm x 1cm cell size
  - 250Mbytes/1,000 events
  - 154 minutes CPU time/1,000 events
- MAPS 15 $\mu\text{m}$  thickness and default 1cm x 1cm cell size
  - 79.4Mbytes/1,000 events
  - 157 minutes CPU time/1,000 events
- **MAPS 15  $\mu\text{m}$  thickness and 50 $\mu\text{m}$  x 50 $\mu\text{m}$  cell size**
  - 111Mbytes/1,000 events
  - 239 minutes CPU time/1,000 events

#hits/events:  $(15\mu\text{m} \times 1\text{cm}^2) < (500\mu\text{m} \times 1\text{cm}^2) < (15\mu\text{m} \times 50\mu\text{m} \times 50\mu\text{m})$

#Secondary shower/cell:  $(15\mu\text{m} \times 50\mu\text{m} \times 50\mu\text{m}) < (15\mu\text{m} \times 1\text{cm}^2) < (500\mu\text{m} \times 1\text{cm}^2)$

# Summary and Future Prospects

- Summary
  - Thickness modification will be fine.
  - Cell size modification studies were started.
- Next steps
  - Cell division for  $5\mu\text{m}$  times  $5\mu\text{m}$  to study efficiency (It needs modifying code to assign more bits on #cells.)
  - Digitization studies to make cross-check
  - Position/Angle/Energy resolutions
  - Backgrounds study with physics events
  - Systematic studies and cross-checks for all steps