Outline

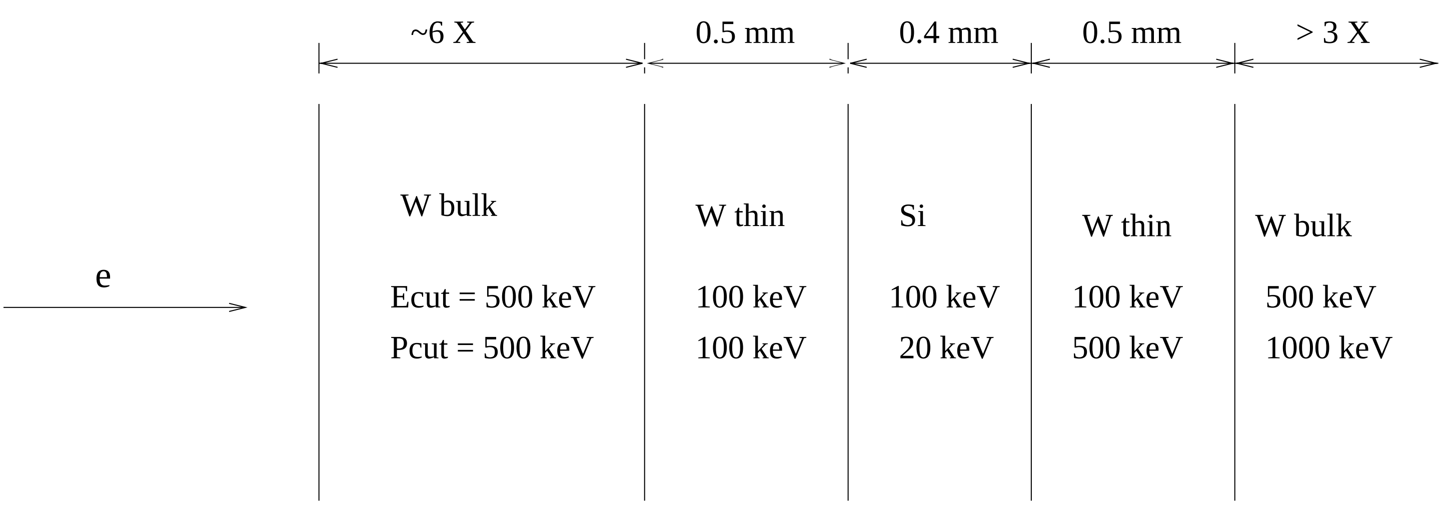
- Issue
  - Want to measure MIPs (400 keV/mm in Si) *and* dense EM showers due to 250 (500) GeV Bhabha $e^{\pm}$
  - EM showers in W are dense: $R_m = X_0(21.2\text{MeV}/E_c) = 9.1$ mm
  - For EFlow, need to id. tracks at < 1 cm from shower core (requirement from physics simulations)
- EGS setup
- Results
- Question of sampling layers thickness

EGS Setup

- Use the G. Lindstrom recommendations for E_{cut} in thin sampling layers. (Good accuracy with finite CPU time.)

- Reduced E_{cut}, P_{cut} in thin regions near the Si

- Step size small (0.3%) everywhere

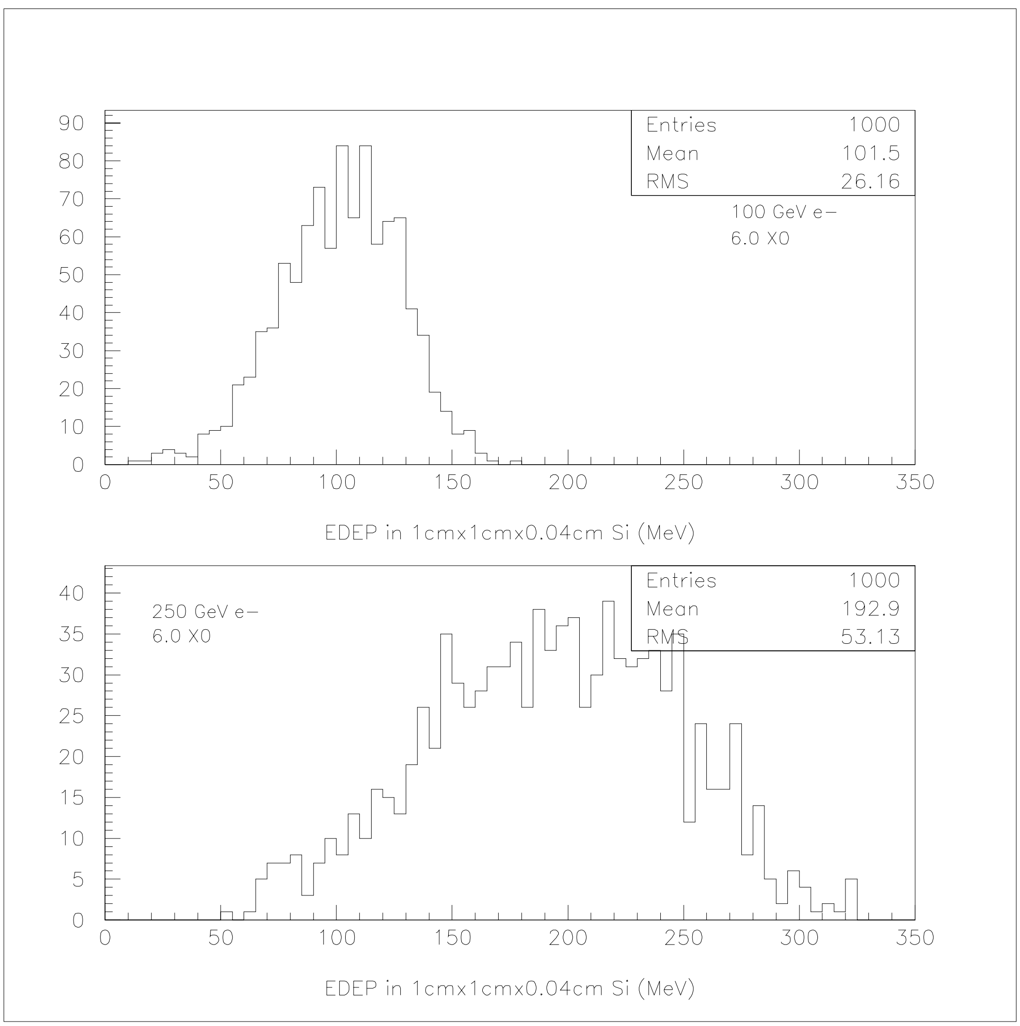


- Si layer at depth 6 X_0

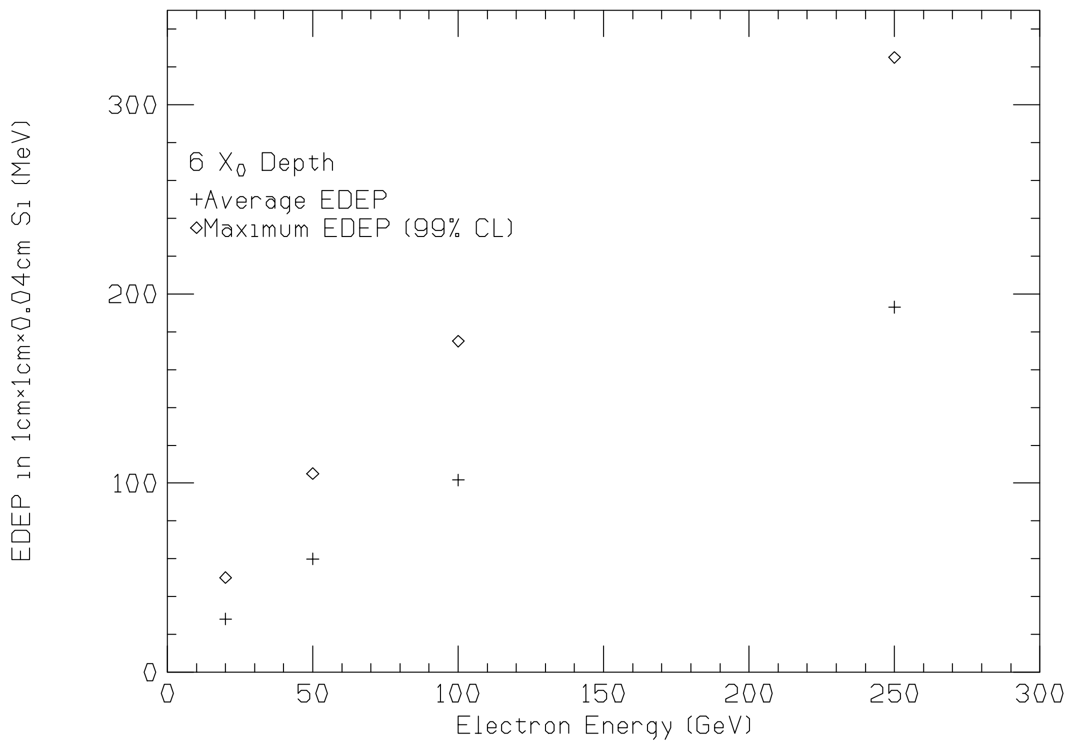
- Initial electron (E_e) centered on a 1cm$\times$ 1cm pixel

  - Si thickness 0.4 mm

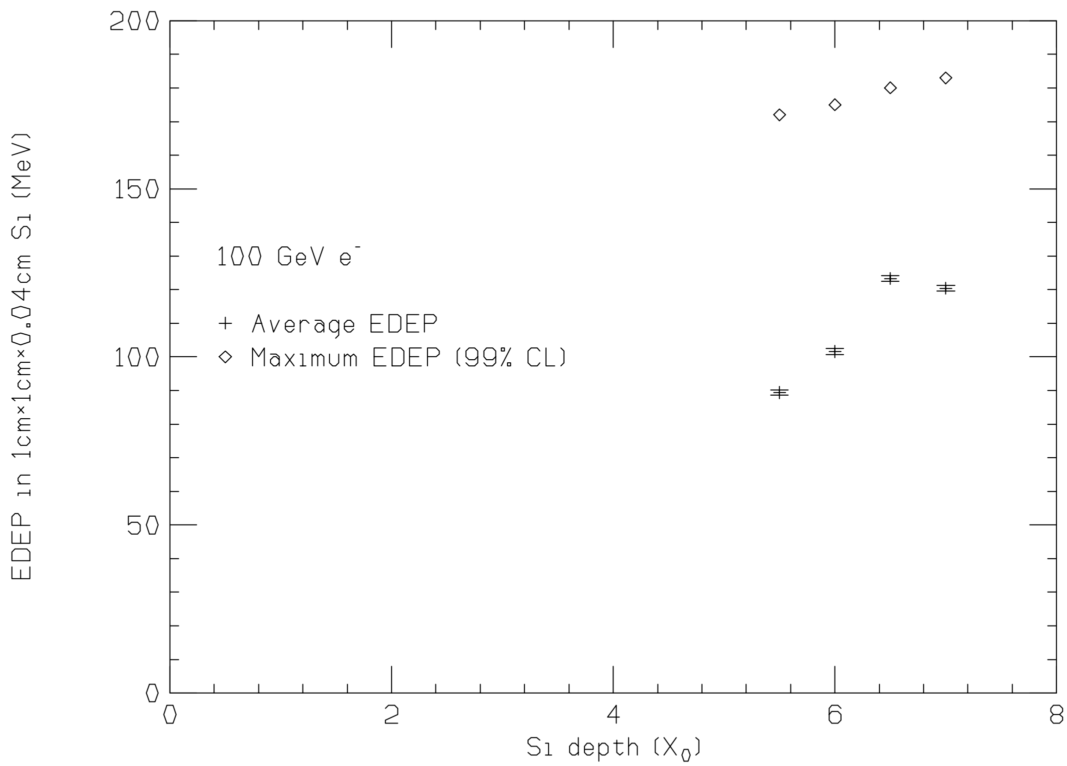
- Typical EDEP (in MeV) distributions:



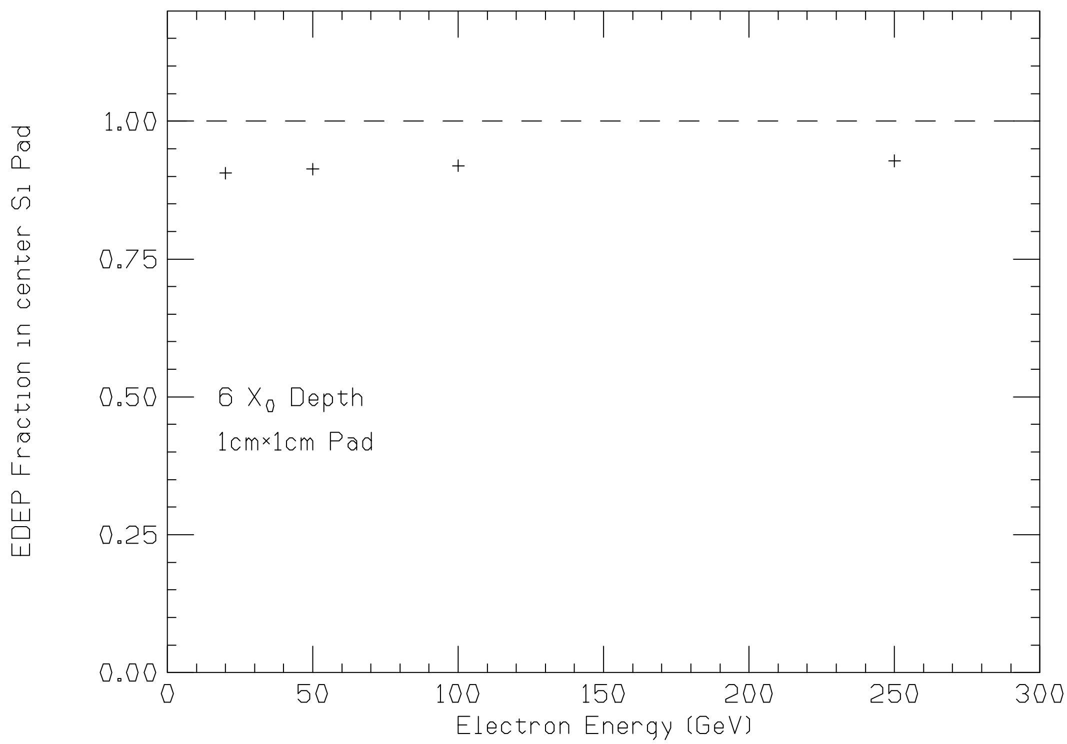
- EDEP as function of E_e:



- EDEP as function of depth for $E_e = 100$ GeV:



- Fraction of total EDEP in 1cm$\times$ 1cm :
  ($E_e = 100$ GeV)



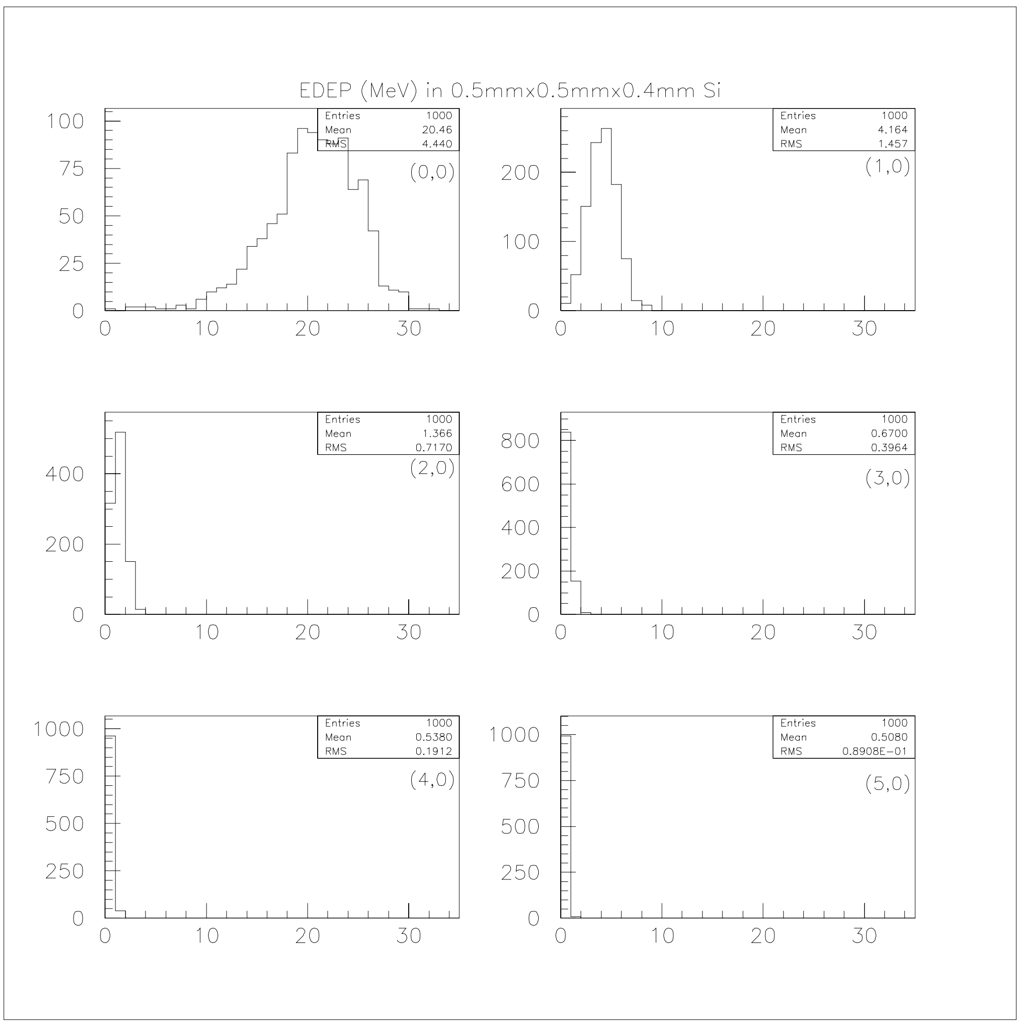
1. Broad shower max in depth $\sim 6.5 \pm 1\ X_0$

2. Fraction of energy in central 1cm$\times$ 1cm is $\sim$independent of E_e

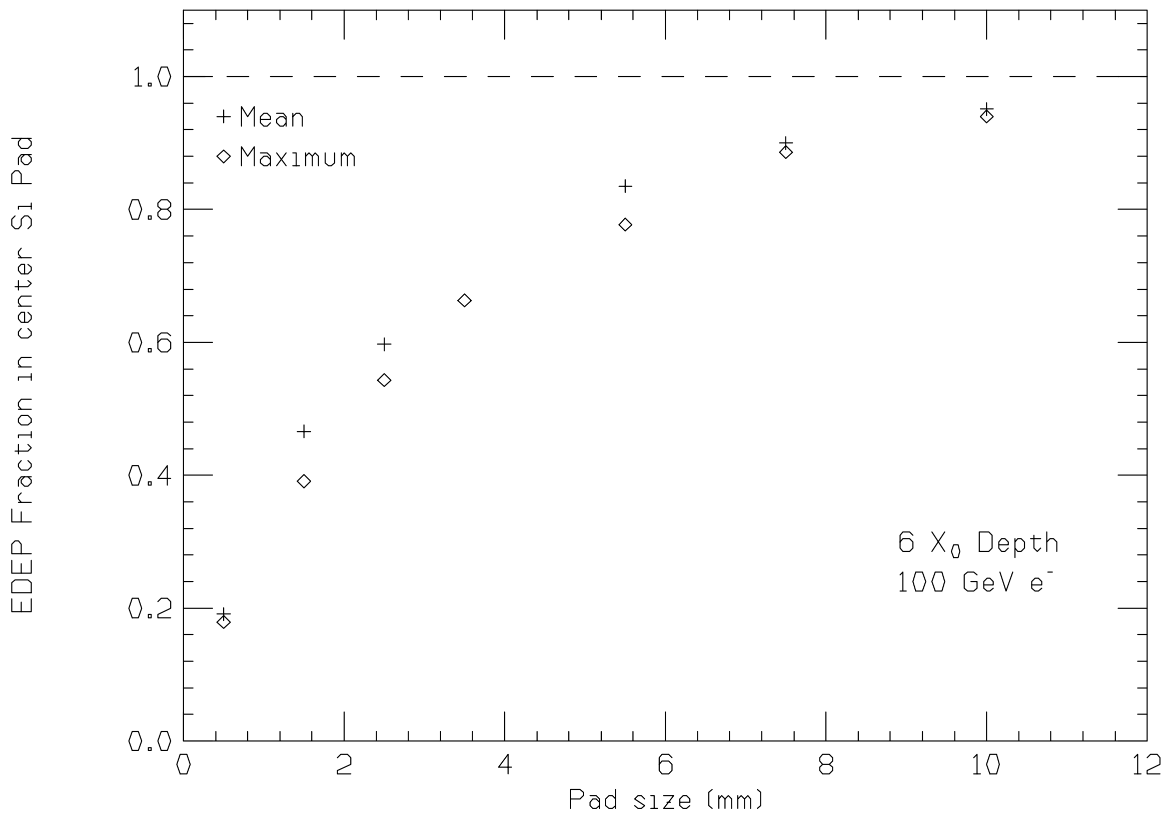
$\Rightarrow$ Results not sensitive to these

- EDEP (MeV) in 0.5 mm pixels from $x = 0$ to $x = 3$ mm:

  ($E_e = 100$ GeV, 6 X_0)



- EDEP fraction in center pixel as function of pixel size (mm):



⇒ need big pixel size reduction to change dynamic range requirement significantly

- So for 1cm×1 cm :
  250 GeV Bhabha / MIP = (340MeV)/(0.16MeV) = 2100 ≈ 11 bits
  +3 bits for MIP over threshold +2 bits for margin = 16 bits

- decrease in pixel area by 100 gives 2-3 bits reduction

- Need to put in sampling layers; large gaps increase R_m:

$$R_m = \sum w_i R_m^i, \; R_m^i \propto \Delta z_i / E_c^i$$

where Δz_i is gap; E_c^i is critical energy

- This also degrades performance; not a good way to beat the dynamic range issue!