

ELECTRON IONIZATION LOSS IN A SAMPLING CALORIMETER

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Problem from two weeks ago

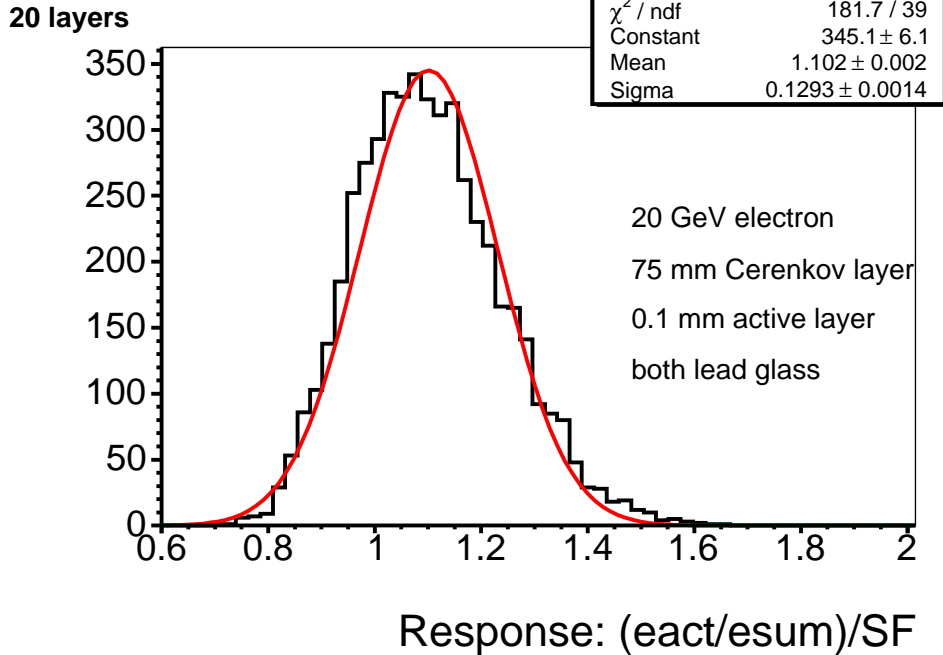
- ➡ Configuration: 400 layers of lead glass calorimeter (transverse size 100m X 100 m)
- ➡ The replication of calorimeter layers followed Example 03 of Geant4
 - ➡ `GEANT4SOURCE_DIR/GEANT4.7.1/EXAMPLES/NOVICE/N03/`
- ➡ Incident particle: 20 GeV electron
- ➡ Check only the total energy deposited in Cerenkov and active part
- ➡ When the sampling fraction is small, $\frac{eact/esum}{dact/dsum}$ is **greater** than one.
 - ➡ 75 mm Cerenkov layer and 0.1 mm active layer: mean $\frac{eact/esum}{dact/dsum} = 1.100 \pm 0.002$, $\sigma = 0.129 \pm 0.001$
 - ➡ 0.1 mm active layer and 75 mm Cerenkov layer: mean $\frac{eact/esum}{dact/dsum} = 1.020 \pm 0.002$, $\sigma = 0.107 \pm 0.001$
- ➡ Niki suggested to use a simpler detector and generate N jobs for N layers of active layer at different position, separately.
- ➡ Tianchi suggested to check if the transverse size is too big.

What I have now

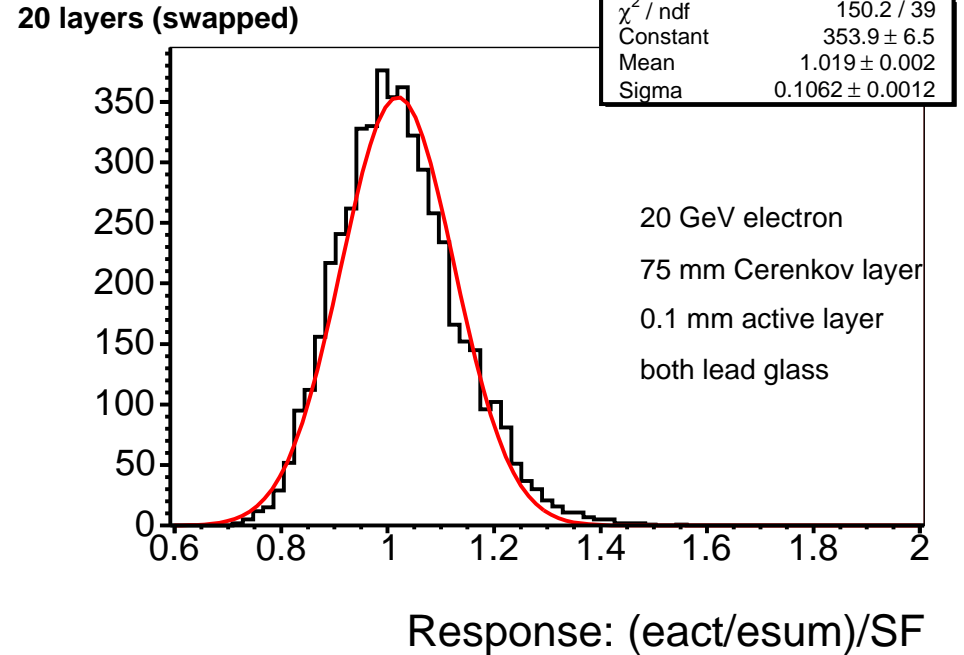
- ➡ Intentionally make Cerenkov and active volumes overlap, Geant4 didnt complain: Only the energy losses in two volumes cancel when they overlap.
- ➡ Use old code to check the response with transverse size 1m X 1m and 20 layers only
- ➡ Instead of using Geant4's replication, evoke and fix my old code where an array of pointers is used instead
 - ➡ Check the response with 20 or 400 layers configuration, 75 mm Cerenkov layer, 0.1 mm active layer
 - ➡ Perform Niki's test with new code

Small Detector

Cerenkov layer before active layer



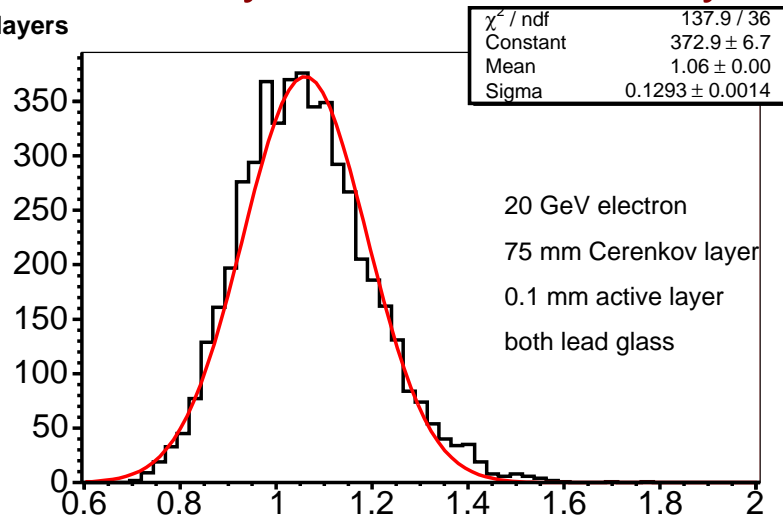
Active layer before Cerenkov layer



New Code: 400 Layers and 20 Layers

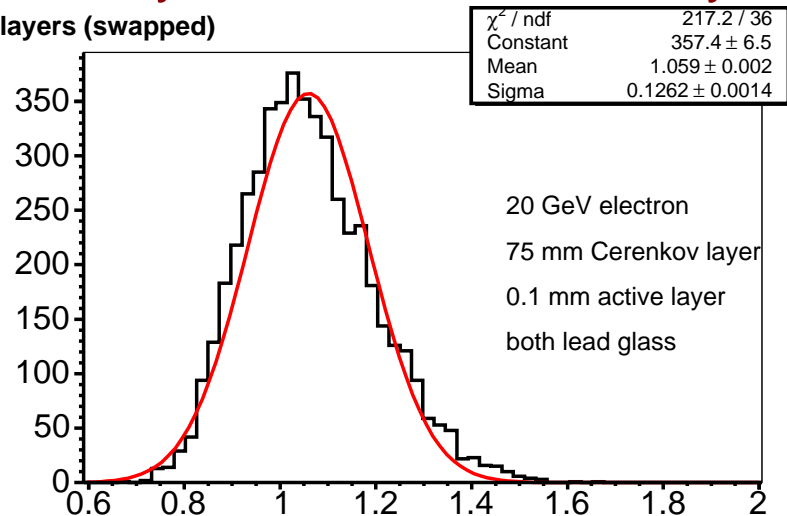
Cerenkov layer before active layer

400 layers



Active layer before Cerenkov layer

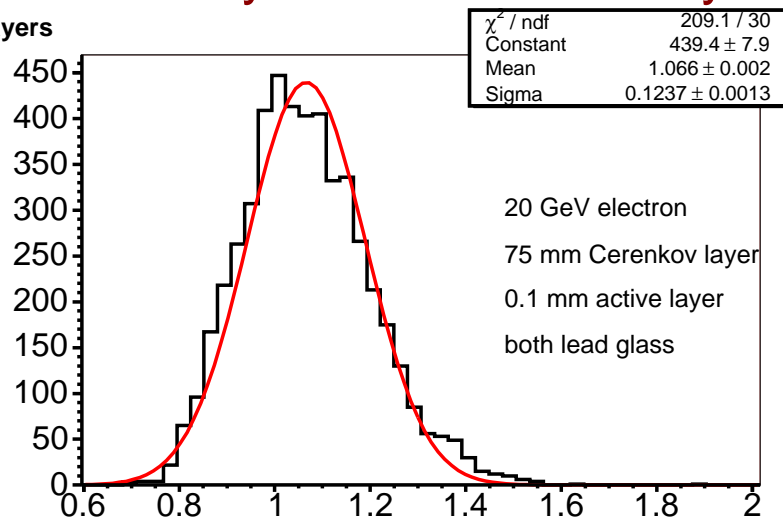
400 layers (swapped)



Response: (eact/esum)/SF

Cerenkov layer before active layer

20 layers

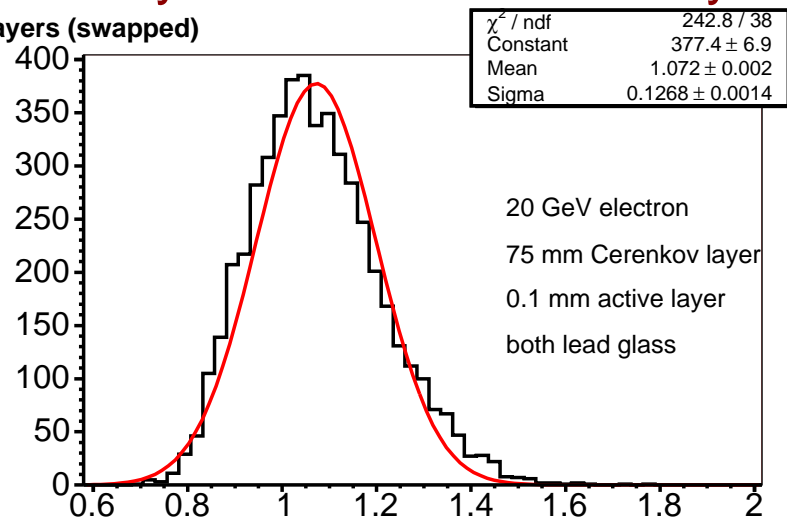


Response: (eact/esum)/SF

Response: (eact/esum)/SF

Active layer before Cerenkov layer

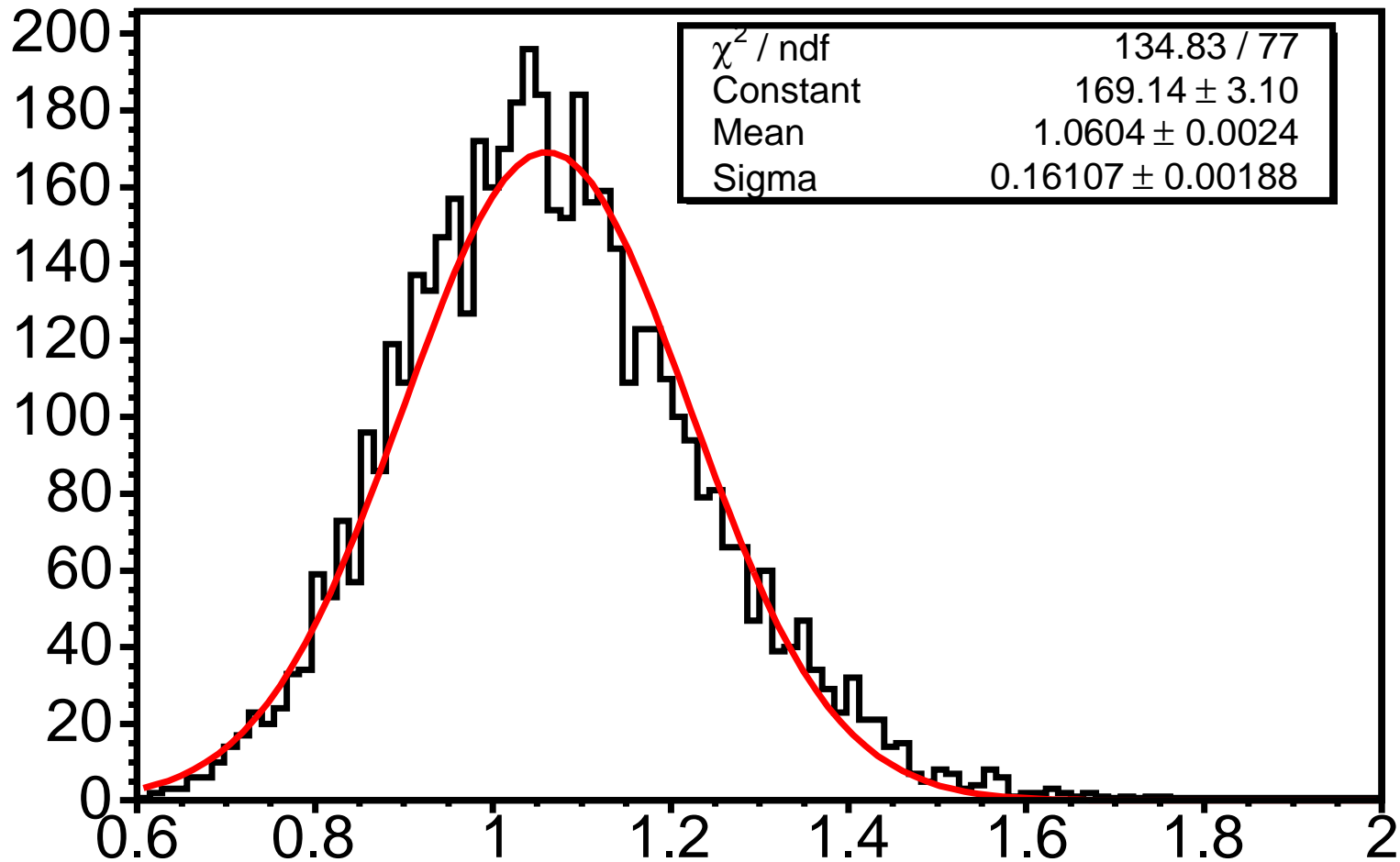
20 layers (swapped)



Response: (eact/esum)/SF

Niki's Test: 20 Layers

Cerenkov layer before active layer

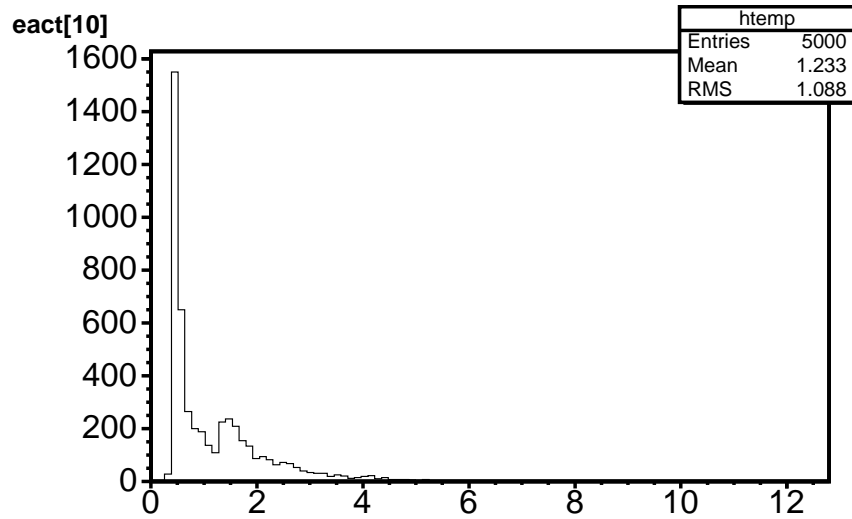


Response: $(e_{act}/e_{sum})/SF$

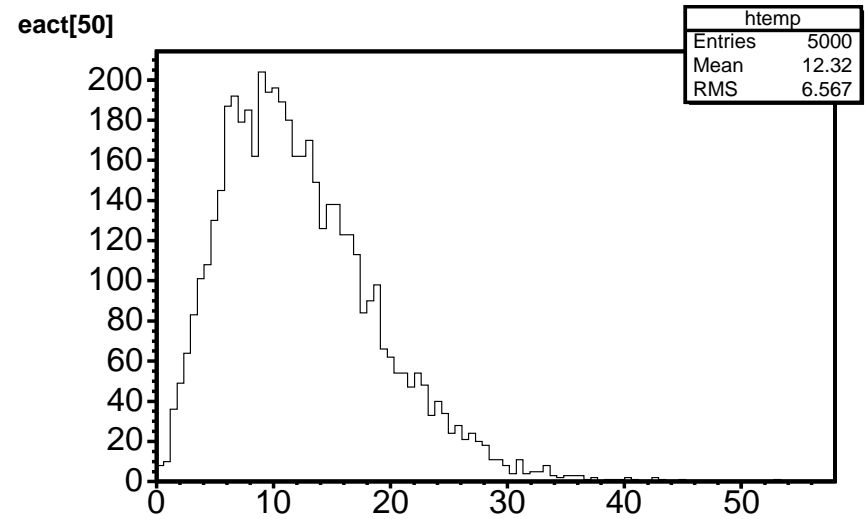
Conclusion

- ➡ The old code with G4Replica should be discarded.
- ➡ Use array of pointers or sensitive detectors.

New Code: 20 GeV Electron Energy



Energy deposited in 10th active layer [MeV]
Most probably energy



Energy deposited in 50th active layer [MeV]
Mean energy

