

GEANT4 Simulations of LumiCal



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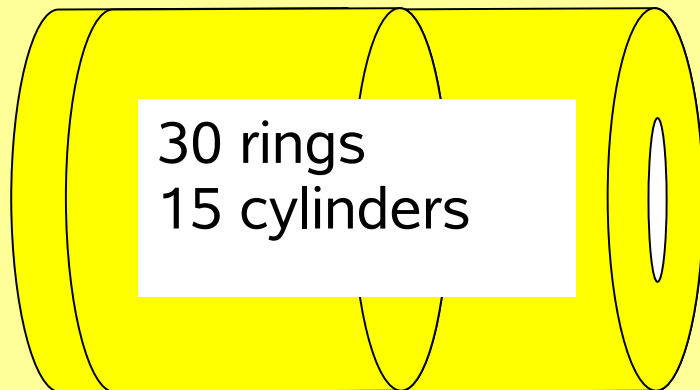
Outline

- **Brief explanation of current G4geometry of Lumical**
 - block schema
 - G4geometry
 - G4material
- **MC simulations**
 - Energy resolution
 - Energy resolution vs. beam energy
 - Energy deposit distribution in Z-axis
- **Summary**
- **Outlook**

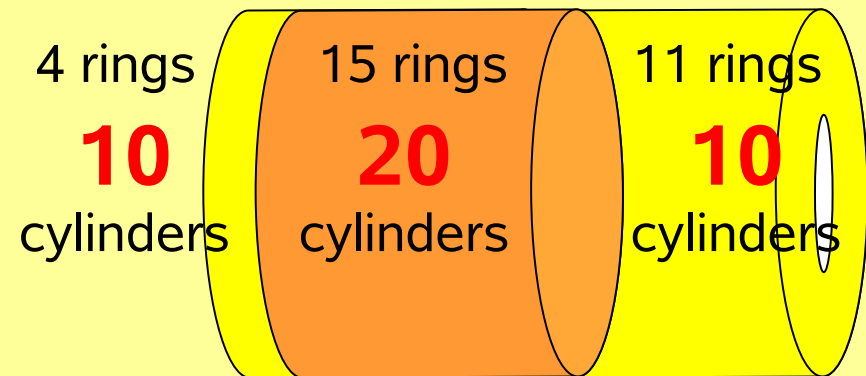
LumiCal design

Basic detector design

30 rings * **24** sectors * **15** cylinders = **10,800** channels

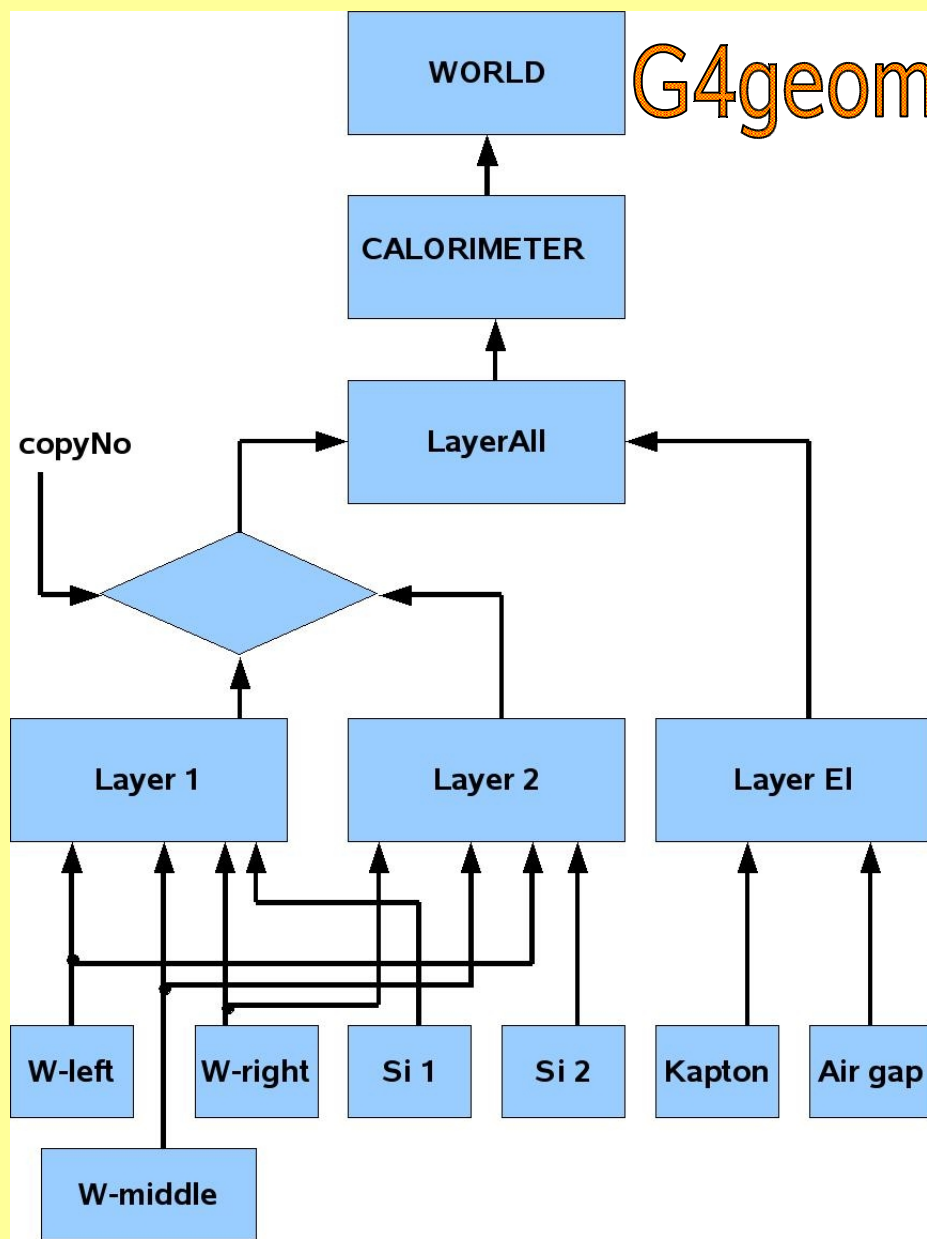


Max shower peak design



24 sectors * **15** rings * (10 cylinders + 20 cylinders) = **10,800** channels

G4geometry – block schema



```

g->numberOfLayers1    = 4;
g->numberOfLayers2    = 15;
g->numberOfLayers3    = 11;
g->numberOfDivisions  = 10;
g->numberOfDivisions2 = 20;
g->numberOfReplicas   = 24;
    
```

```

WThickness      = 2.5*mm;
WThicknessEdge  = 0.01*mm;
    
```

```

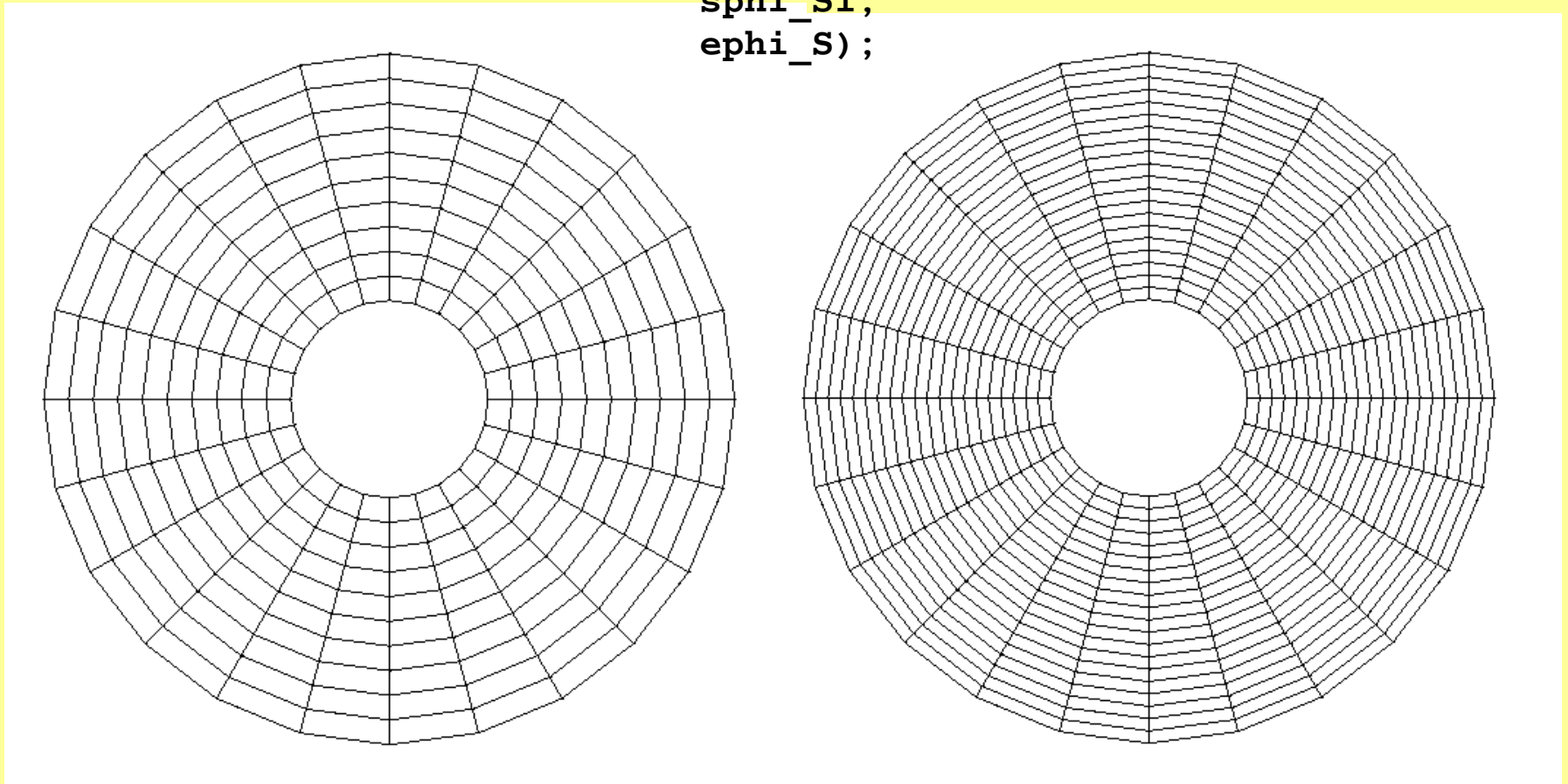
SiThickness      = 0.3*mm;
ElThickness      = 1.0*mm;
AirThickness     = 1.2*mm;
StripThickness   = 0.2*mm;
    
```

```

cal_innerradius = 80. *mm;
cal_outerradius = 280.*mm;
sphi = 0.;
ephi = 360.*deg;
    
```

G4geometry of LumiCal

```
solidSi = new G4Tubs("Silicon2",Rmin,  
                    Rmax,  
                    SiThickness/2.,  
                    sphi_Si,  
                    ephi_S);
```



G4material

Tungsten (2.5 mm)

```
new G4Material("Tungsten", 74., 183.84*g/mole, 19.250*g/cm3,  
kStateSolid, 273.15*kelvin, 1.0*atmosphere );
```

Silicon (0.3 mm)

```
new G4Material("Silicon", 14., 28.0855*g/mole, 2.330*g/cm3,  
kStateSolid, 273.15*kelvin, 1.0*atmosphere );
```

Electronic board (0.8 mm)

```
G4Material* Ka = new G4Material("Kapton", 1.43*g/cm3,  
ncomponents=4);
```

```
Ka->AddElement(elC,natoms=22);
```

```
Ka->AddElement(elH,natoms=10);
```

```
Ka->AddElement(elN,natoms=2);
```

```
Ka->AddElement(elO,natoms=5);
```

```
density = (fractionmass1/100*1.43 +  
fractionmass2/100*8.960)*g/cm3;
```

```
G4Material*Electronic = new G4Material("Electronic_board",  
density, ncomponents=2);
```

```
Electronic->AddMaterial(Ka, fractionmass1*perCent);
```

```
Electronic->AddMaterial(Cu, fractionmass2*perCent);
```

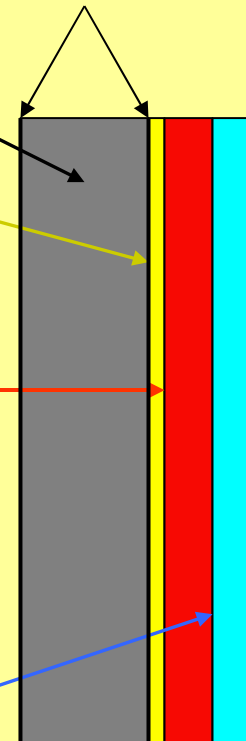
Air (1.2 mm)

```
G4Material* Air = new G4Material("Air", 1.290*mg/cm3, 2);
```

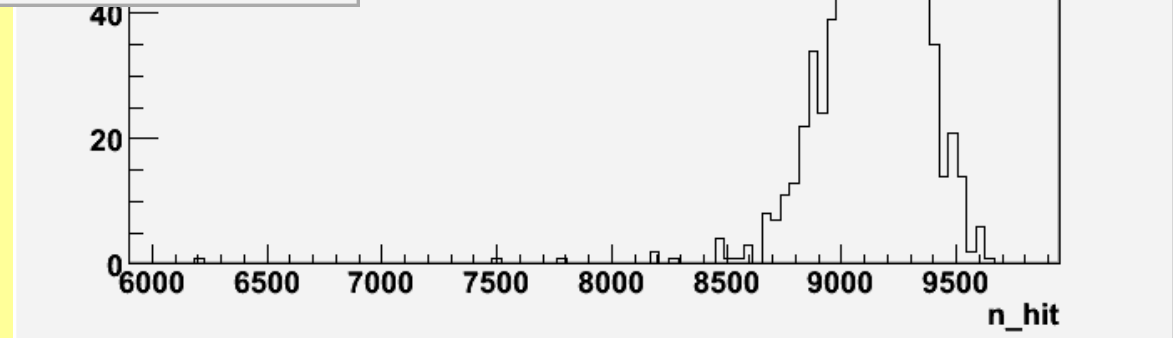
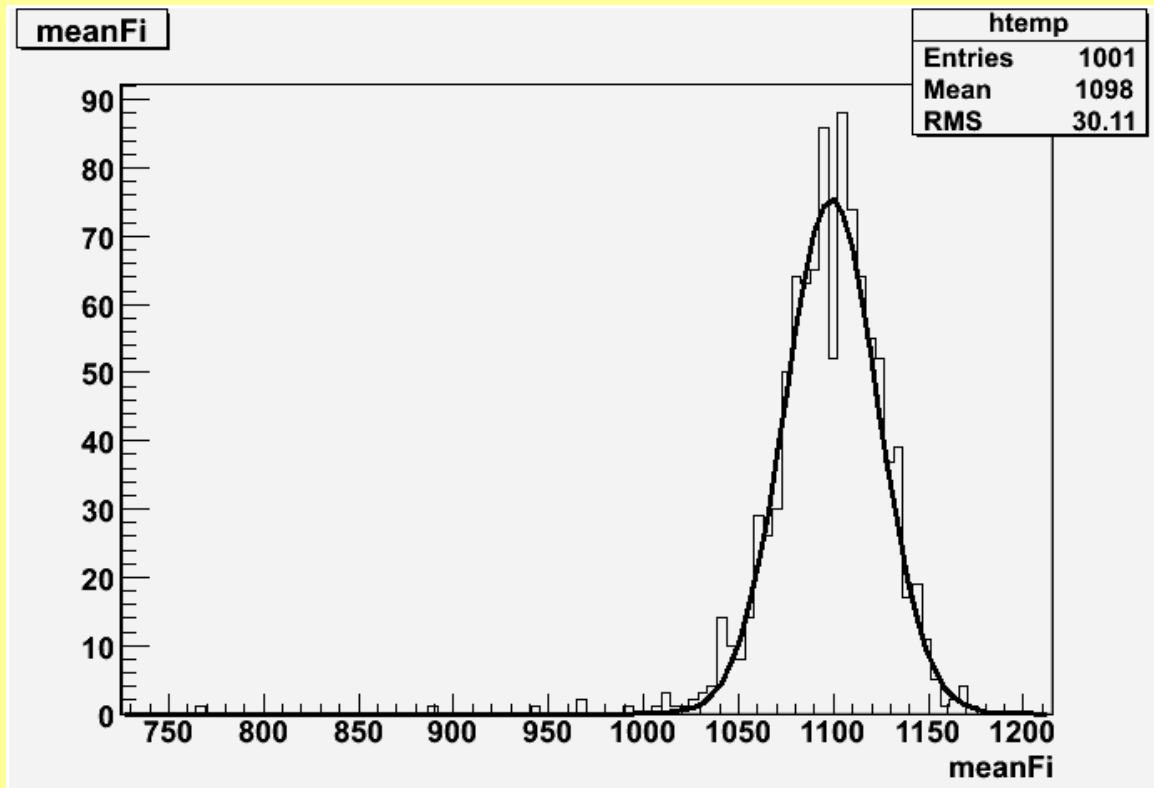
```
Air->AddElement( elN, 0.7);
```

```
Air->AddElement( elO, 0.3);
```

Thin Layers of
tungsten

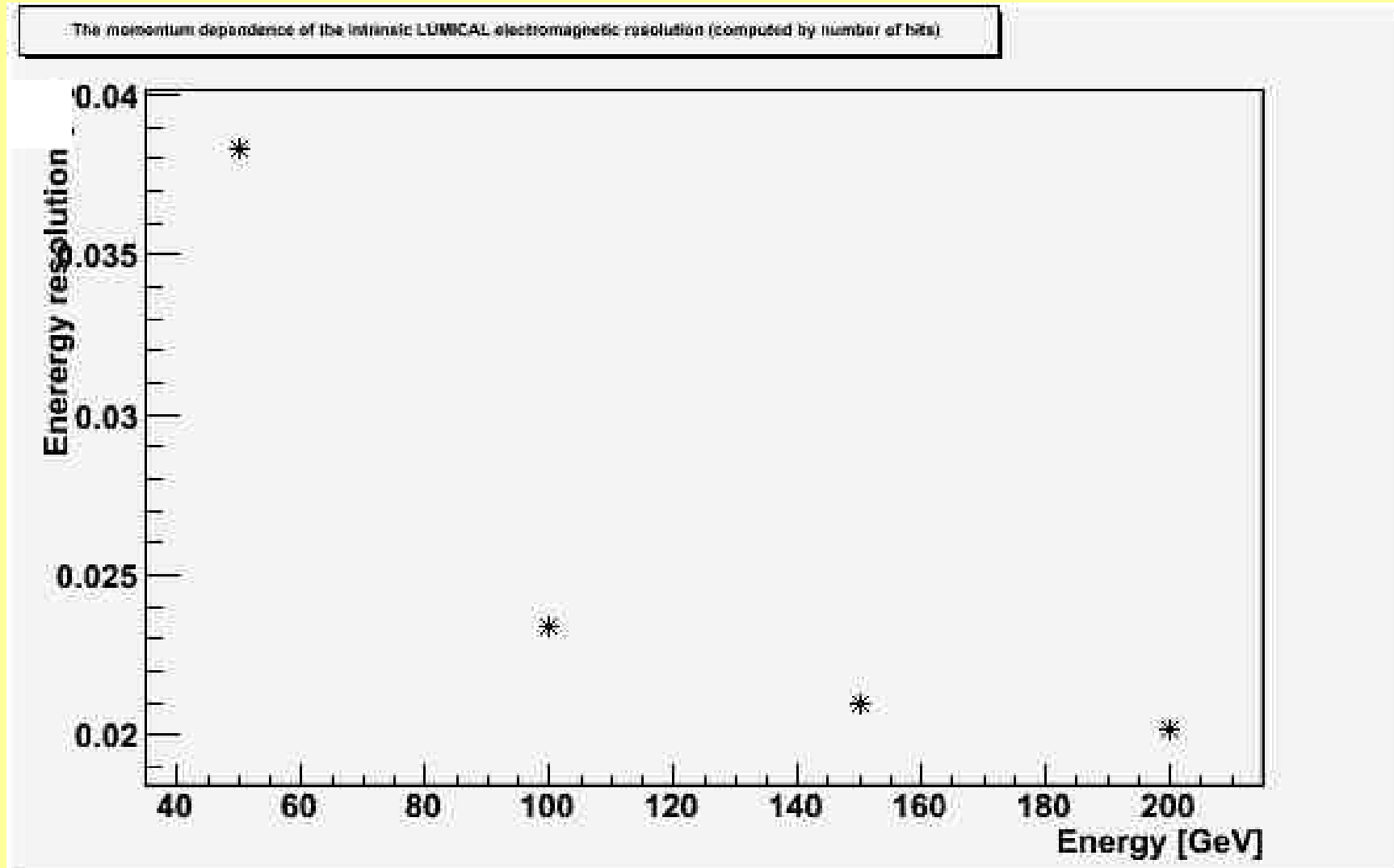


Energy resolution

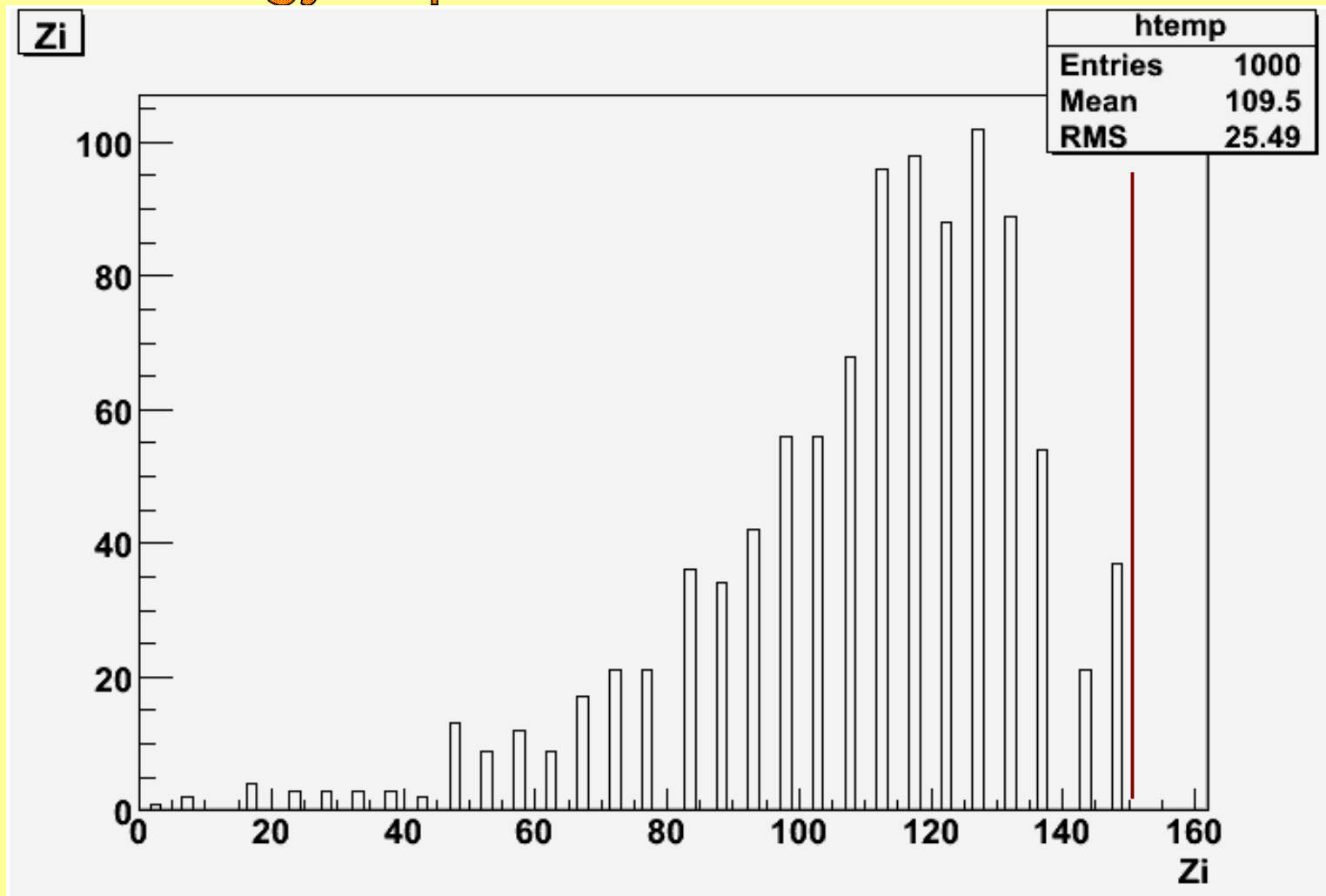


Particle: electron
Particle energy: 100 GeV
Initial beam position: X= 18cm
Y=18cm

Energy resolution vs energy of the beam



Energy deposit distribution in Z-axis



We need to measure energy leak

Summary

- All LumiCal geometry is now done included Max shower peak design.
- By our program we can build any geometry
- We can use three P4@3GHz CPU for simulations
- We need to fix some problems with XY sensitivity (about one week of work)

Outlook

In one week we are able to start full LumiCal simulations included XY energy distributions

We want to add sensitive layer around LumiCal for measuring energy leak.

And after this, we are waiting for your tasks