

EM Processes and Tracking

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Outline

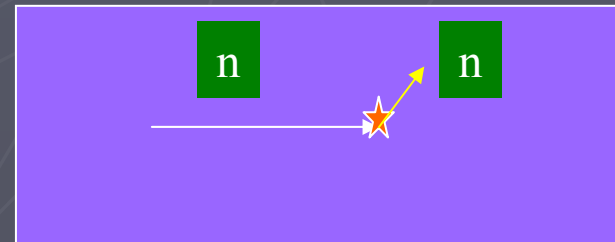
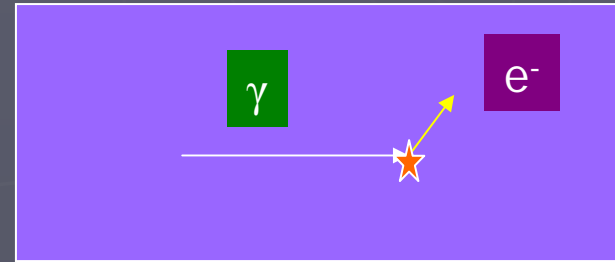
- ▶ Motivation for this discussion
- ▶ Four moments when tracking and EM physics interact to each other:
 - Where energy is delivered?
 - Multiple scattering near the boundary
 - Multiple scattering model
 - Sub-cutoff

Motivation

- ▶ LHC experiments are satisfied in general by quality of standard EM package
- ▶ There are concerns for CPU performance
- ▶ The review of interfaces and optimization was carried out for recent years
 - We have no much resources to improve CPU improving other our models
 - Msc process is the limiting factor
 - In this discussion we can learn whether we use tracking and geometry in a correct and optimal way

Where energy is delivered?

- ▶ Photoelectric effect left atom excited
 - In standard it is local energy deposition
 - In low-energy atomic deexcitation can be sampled
- ▶ In new elastic scattering recoil below the threshold is not simulated



Multiple scattering model

► GetContinuesStepLimit

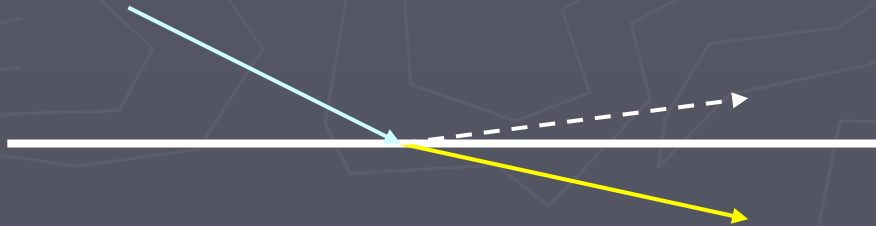
```
preSafety = preStepPoint->GetSafety();  
navigator->LocateGlobalPointWithinVolume(preStepPoint->GetPosition());  
geomLimit = navigator->ComputeStep(preStepPoint->GetPosition(), dir, gbig, preSafety);
```

► PostStep

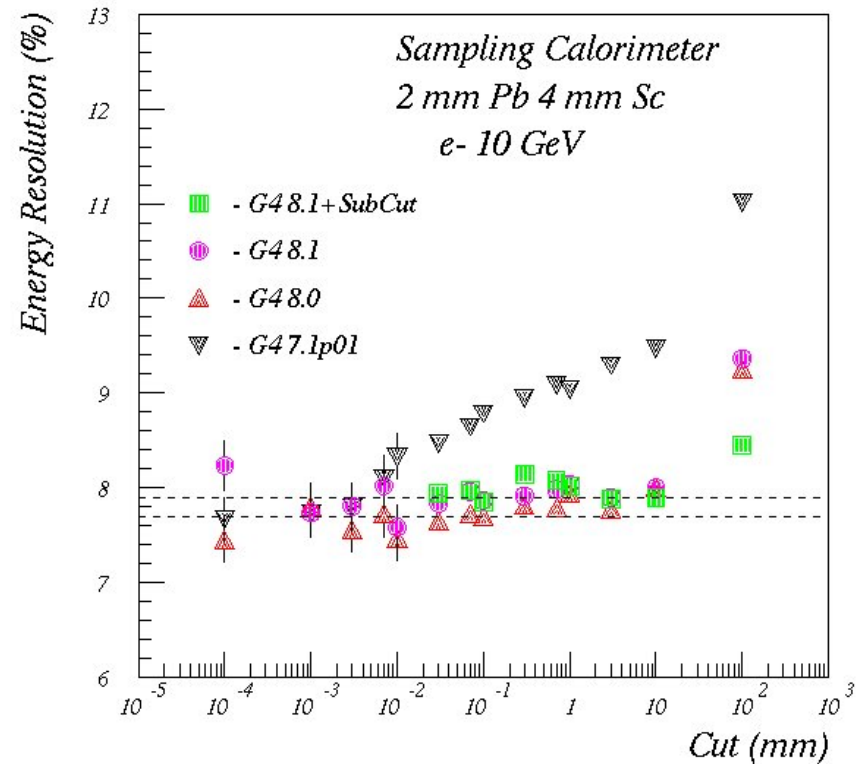
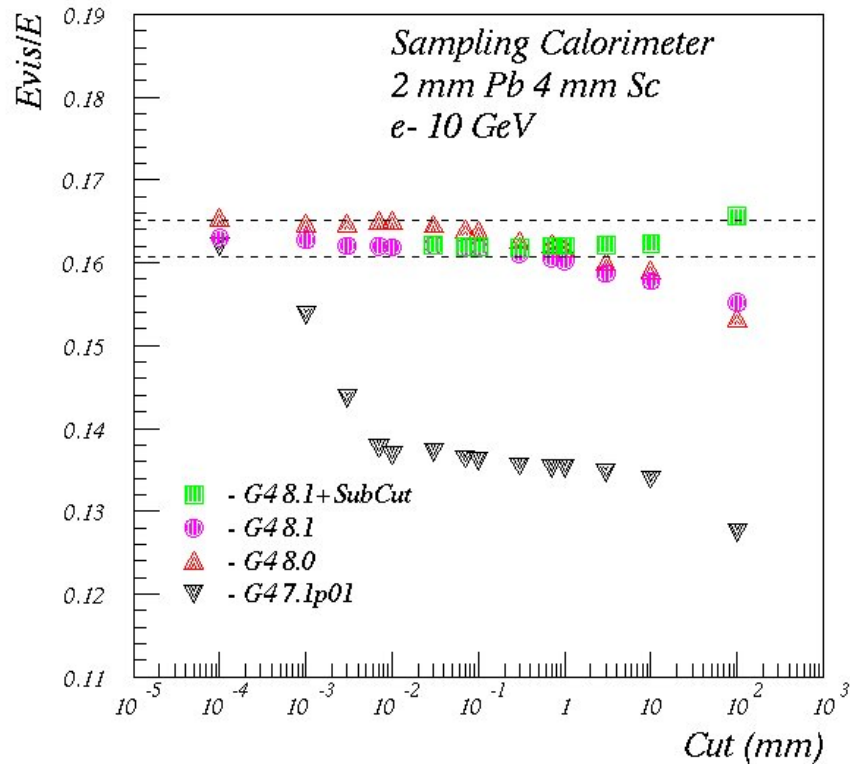
```
fac = 1;  
if(r > safety) {  
    navigator->ComputeStep(pos, latDirection, safety, newSafety);  
    if(r > newSafety) fac = newSafety/r;  
}  
if(fac > 0) {  
    newPos = pos + fac*r*latDirection;  
    navigator->LocateGlobalPointWithinVolume();  
}
```

Multiple scattering near the boundary

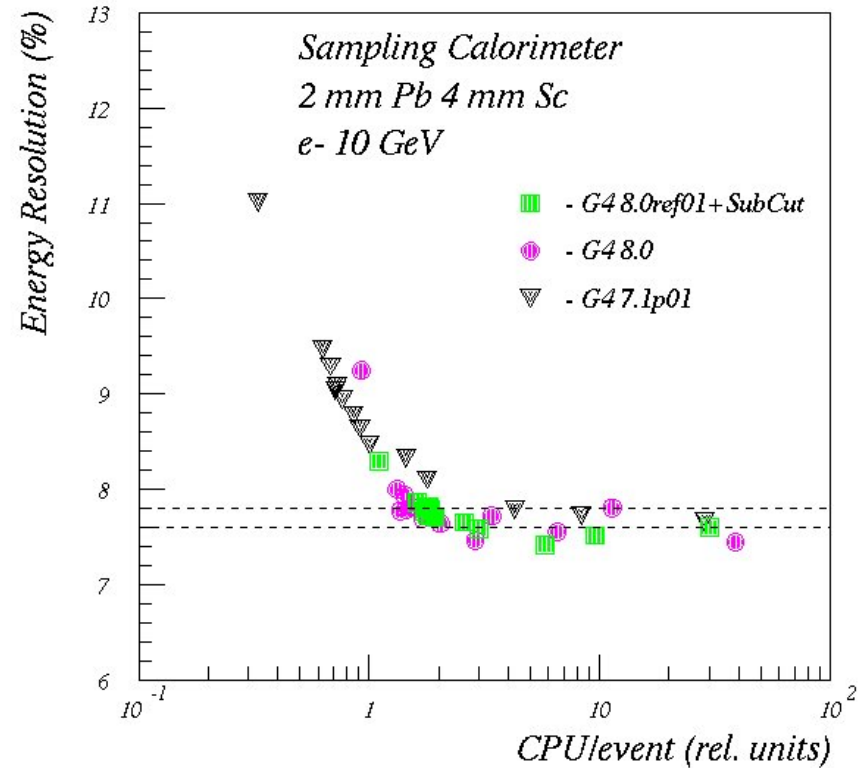
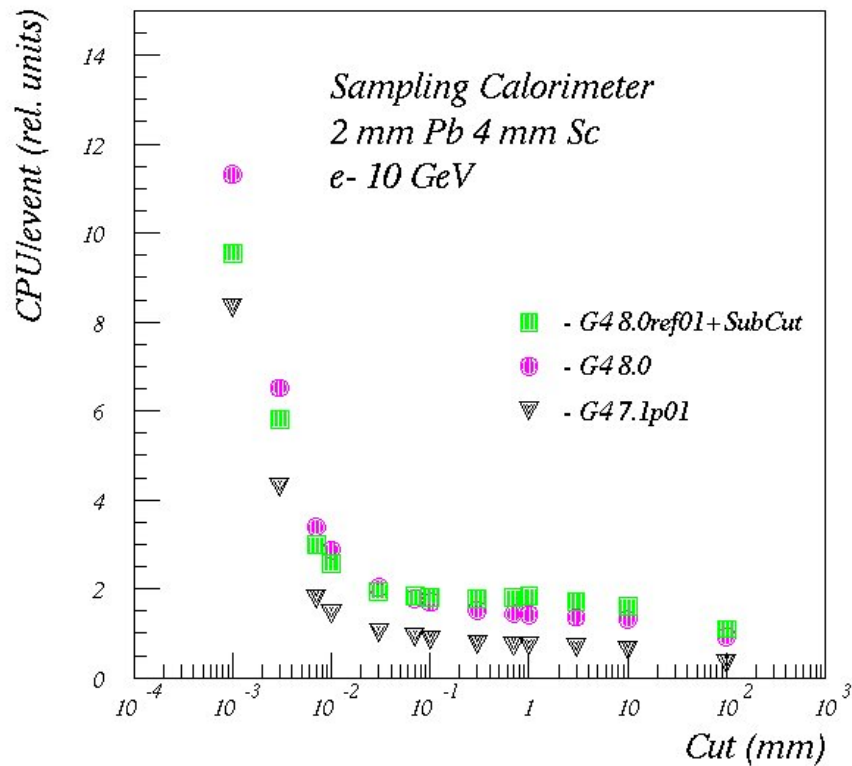
- ▶ In the case when PostStepPoint is on the boundary there is no check whether after scattering track still directed outside



LHCB Type Calorimeter with Sub-cut



LHCB Type Calorimeter with Sub-cut



Sub-cutoff Restoration

▶ AlongStep

```
if(preSafety < rangeCut)
```

```
    preSafety=navigator->ComputeSafety(prePosition);
```

```
if(preSafety - step < rangeCut)
```

```
    postSafety = navigator->ComputeSafety(postPosition);
```

▶ Secondary particles (e^- or γ) are randomly spread over step

- no check on the range

Comments

- ▶ Tracking is delicate area of Geant4
- ▶ Please, feedback what can be improved