Subject: Radiation length units
Posted by Artem Basalaev on Mon, 07 May 2012 15:16:23 GMT
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Hello!

Can you tell me what units are used for radiation length in FairRadLenPoint?
When I do GetRadLength(), I get numbers up to 3000 * 10^(30)! I thought that units are cm instead of g/(cm^2), but even if I multiply it by density, which I get via GetDensity(), I get numbers up to 100*10^(15).

Thanks in advance.

Subject: Re: Radiation length units
Posted by Artem Basalaev on Sun, 27 May 2012 08:22:56 GMT
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Hello! So much time passed and nobody answered here, I already found a solution myself.

In case somebody else has such a problem:
Values of radiation length are in cm and they may be very high, because length of step is variable, that is, distance between ponts where radiation length is calculated is also variable. This distance is a length of homogeneous volume which particle passes along its track.

One may need not the radiation length itself, but the effective radiation length which is defined as length divided by radiation length. It's easy to get these values, since FairRadLenPoint has coordinates where the particle enters volume and where the particle leaves it.

Thus, assuming you have your FairRadLenPoint
as RadLenP:

```
TVector3 PosIn=RadLenP->GetPosition();
TVector3 PosOut=RadLenP->GetPositionOut();
TVector3 InOut=PosOut-PosIn;
Double_t Distance=InOut.Mag();
Double_t RadLen=RadLenP->GetRadLength();
Double_t RadLenEffective=Distance/RadLen;
```

There is a detailed example:
materialana.C

And an example of simulation:
materialsim.C

Subject: Re: Radiation length units
Posted by Volker Friese on Mon, 11 May 2015 16:54:54 GMT
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Radiation length is a material property, so it must not vary with the step size in the simulation.

The large values you see are possibly due to your encountering vacuum, the radiation length of which is infinite.

Usually, the radiation length is given in units of g/cm^2, so to arrive at the unit cm you would have to divide by the density in g/cm^3. It is unclear which value FairRadLenPoint::GetRadLength() returns. It would be nice if at least the unit of the return value could be specified in the class documentation.

Assuming the unit is cm, then what you calculate is the material budget along the trajectory step described by the FairRadLenPoint, in units of the radiation length of the material. Since this is a measure of the energy loss of electrons by Bremsstrahlung and also for multiple scattering, it makes sense tu sum up this value along the trajectory, even if different materials are involved.
