Update on Redmine Task: Beam energy and energy loss corrections

Reynier Cruz Torres

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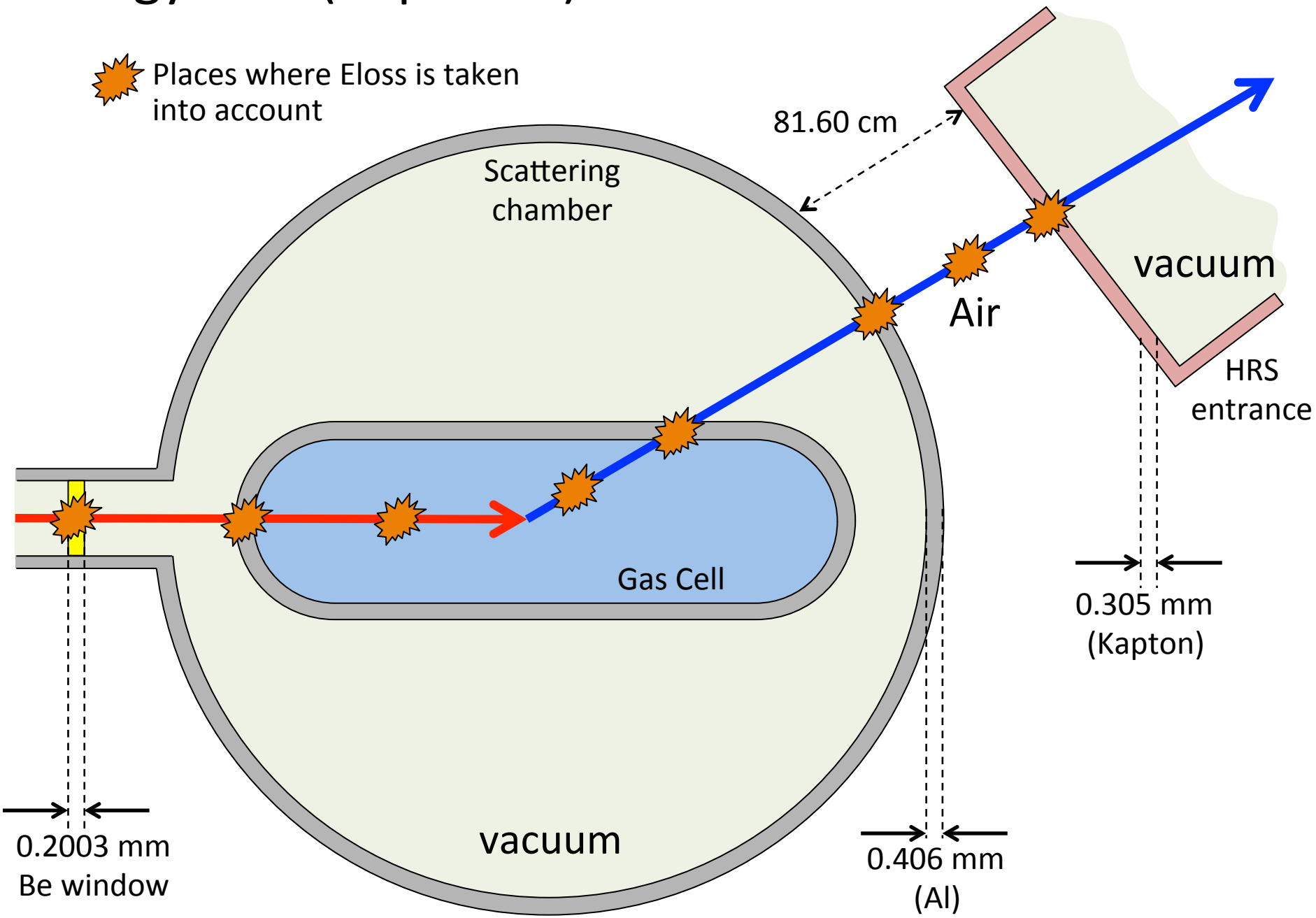
Arc Beam Energy Correction

Multiply the beam energy stored in the db_run.dat file by:

1st pass: x1.0018
2nd pass: x1.0025(5)
3rd pass: x1.003
4th pass: x1.003
5th pass: x1 (no scale needed)

Taken from talk by Doug Higinbotham's slide 13 here:
https://www.jlab.org/indico/event/197/session/3/contribution/12/material/slides/0.pdf

Energy Loss (Top View)



Energy Loss

Class to determine beam Eloss

Tri_Beam_Eloss

Calls

Class to determine scattered electron and proton Eloss

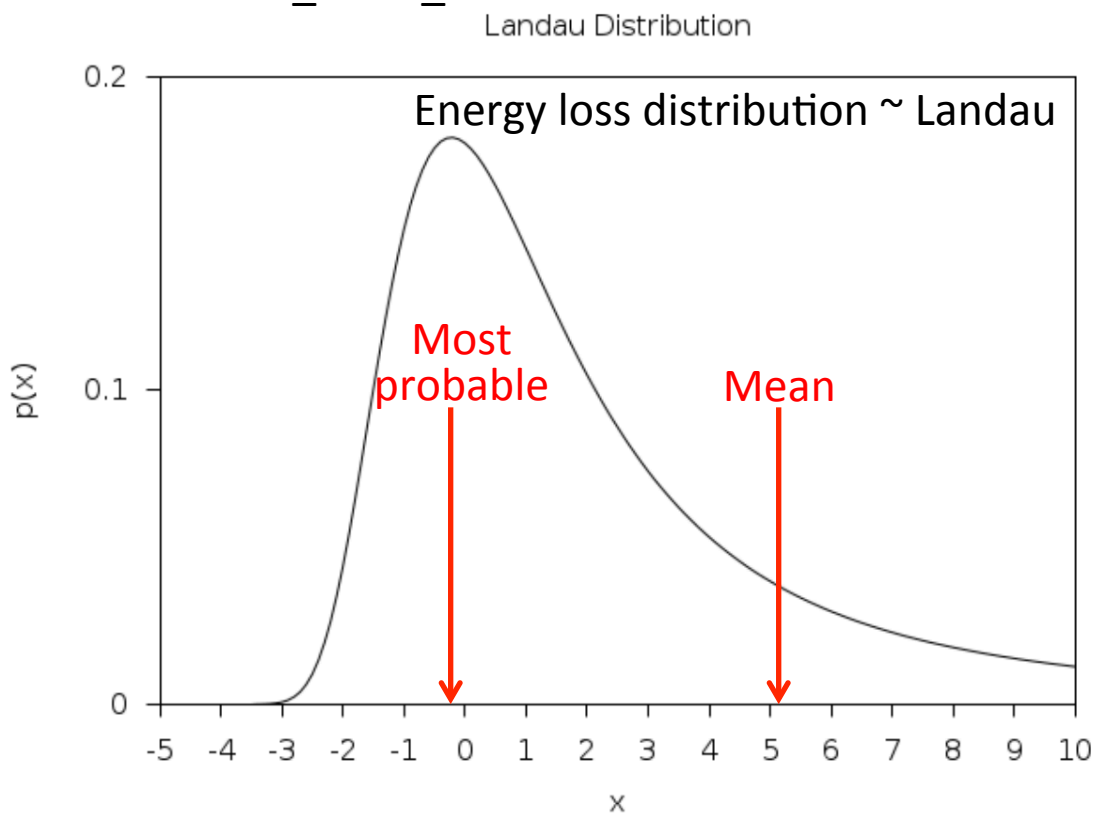
Tri_Track_Eloss

Calls

Tri_ElossCorrection

Class that does the actual Eloss calculation

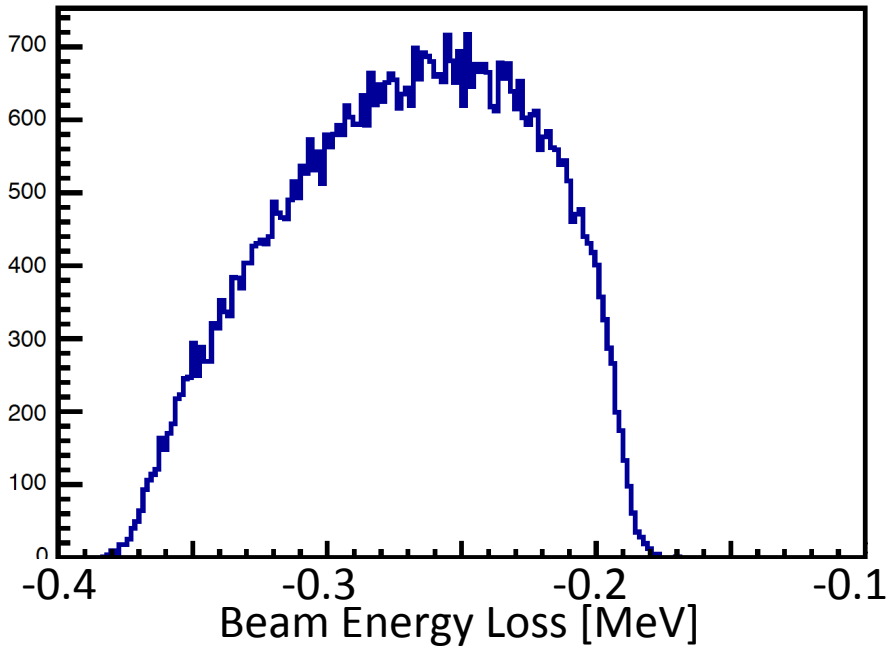
* Uses most prob Eloss equation

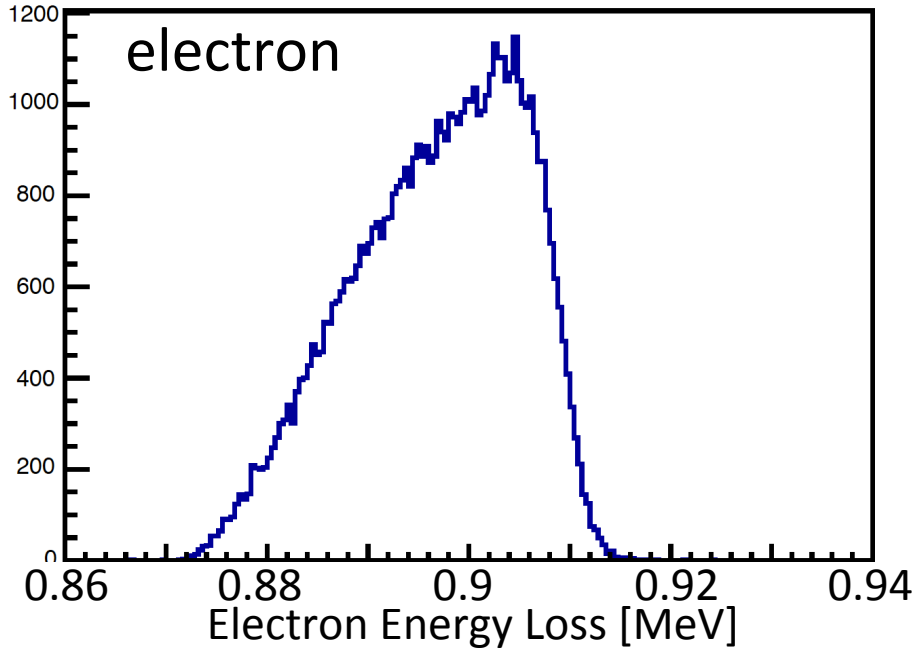


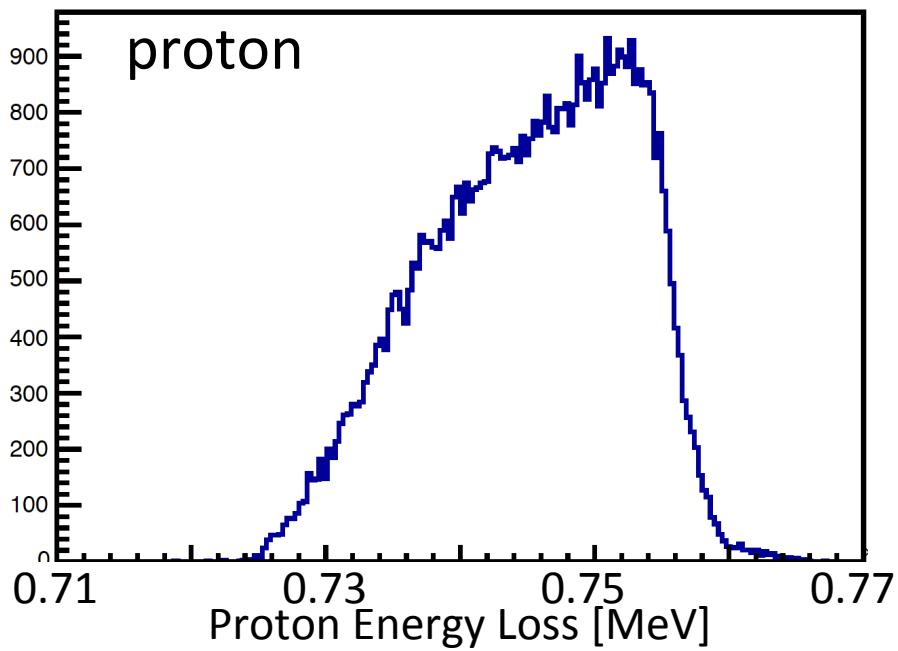
For most-probable Eloss equation check out "Particle Detectors" (2nd edition) - C.Grupen, B.Shwartz, Equation (1.22)

Energy Loss

- Eloss corrected E_{beam} should be lower than arc measurement (E_{beam} is measured, then beam loses energy)
- Eloss corrected scattered electron and proton track momenta should be higher than measured by spectrometers (tracks lose energy, then the momenta are measured)





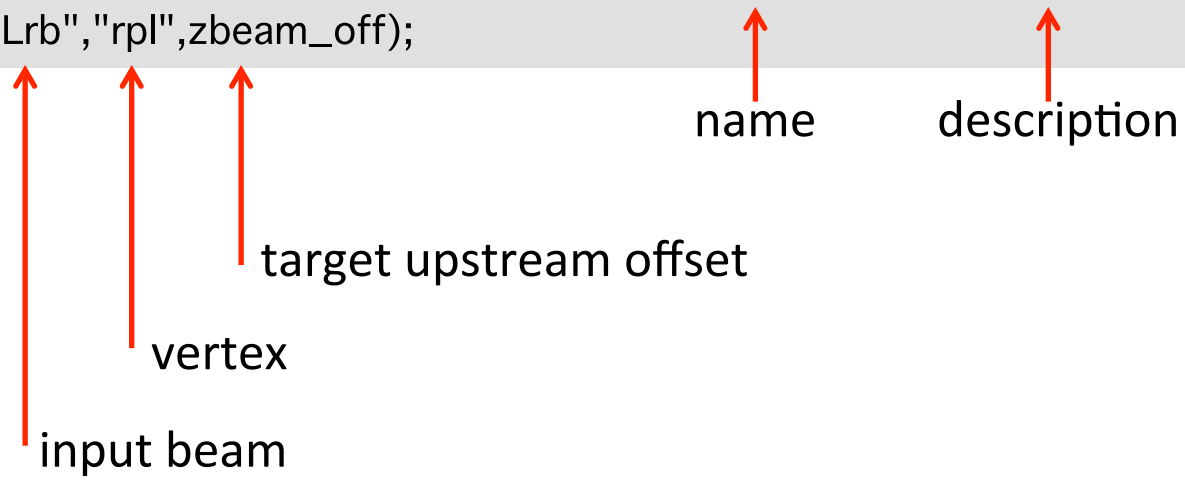


Implementing into the replay script

Beam Energy Loss

Add this to your replay script:

```
Double_t zbeam_off = -0.125 ; //For a target centered at z=0, this should equal to the targetlength/2. (in m)

Tri_Beam_Eloss *Elb = new Tri_Beam_Eloss("Elb","Beam Corrected for Energy Loss","Lrb","rpl",zbeam_off);
```

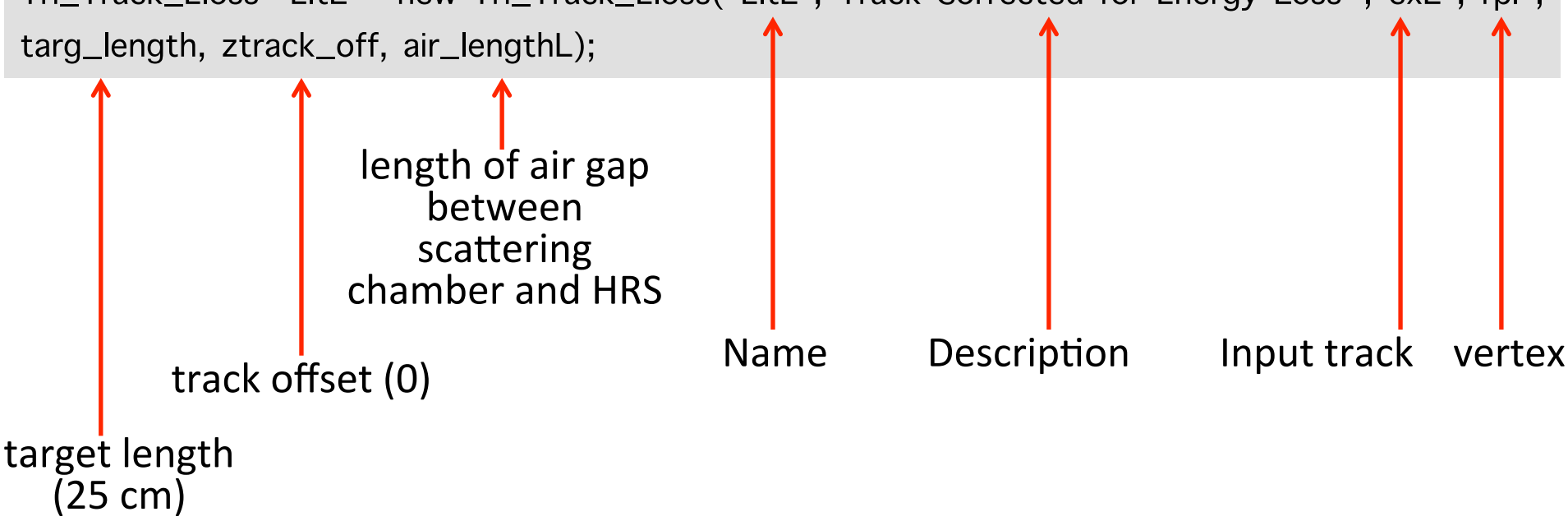


Followed by:

```
Elb->SetDebug(1);
Elb->SetMedium(Z,A,density);
gHaPhysics->Add(Elb);
```

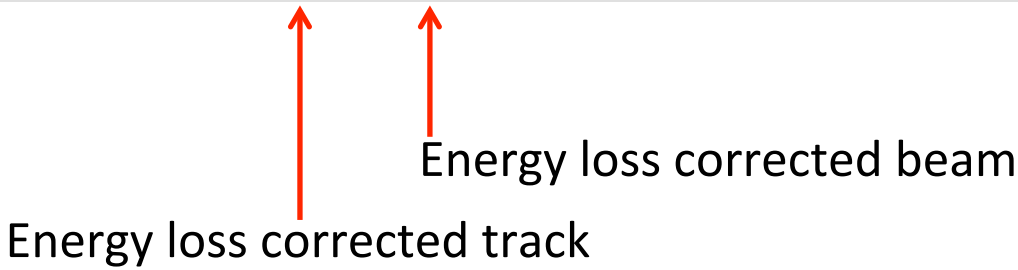
Track Energy Loss (LHRS example)

```
Double_t targ_length = 0.25 ; // In meters. Set to 25 cm for Tritium gas target cells
Double_t ztrack_off  = 0.   ; // For a target centered at z=0, this should equal to 0. (in m)

// Pathlength through air between scattering chamber exit and spectrometer entrance
Double_t air_lengthL = 0.8160; // In meters.
Double_t air_lengthR = 0.8160; // In meters.

Tri_Track_Eloss *EltL = new Tri_Track_Eloss("EltL","Track Corrected for Energy Loss",,"exL","rpl",
targ_length, ztrack_off, air_lengthL);
```



Track Energy Loss (LHRS example)

```
EltL->SetDebug(1);
EltL->SetMedium(Z,A,density);
gHaPhysics->Add(EltL);

THaPhysicsModule *EKLxe = new THaPrimaryKine  ("EKLxe","Electron kinem in LHRS corrected also for eloss",,"EltL" ,"Elb",mass_tg);
```



And don't forget:

```
gHaPhysics->Add(EKLxe);
```

Track Energy Loss (RHRS coincidence example)

```
Tri_Track_Eloss *EltR = new Tri_Track_Eloss("EltR","Track Corrected for Energy
Loss","exR","rpl",targ_length,ztrack_off,air_lengthR,0.938);
```


Particle mass

```
EltR->SetDebug(1);
EltR->SetMedium(Z,A,density);
gHaPhysics->Add(EltR);

THaPhysicsModule *EKRxe = new THaSecondaryKine("EKRxe","Proton kinem in RHRS corrected
also for eloss","EltR" ,"EKLxe",mass_prot);
gHaPhysics->Add(EKRxe)
```