

Update on radiation damage simulations for endcap upgrades

Alexander Ledovskoy and Laura Bergsten, March 2014

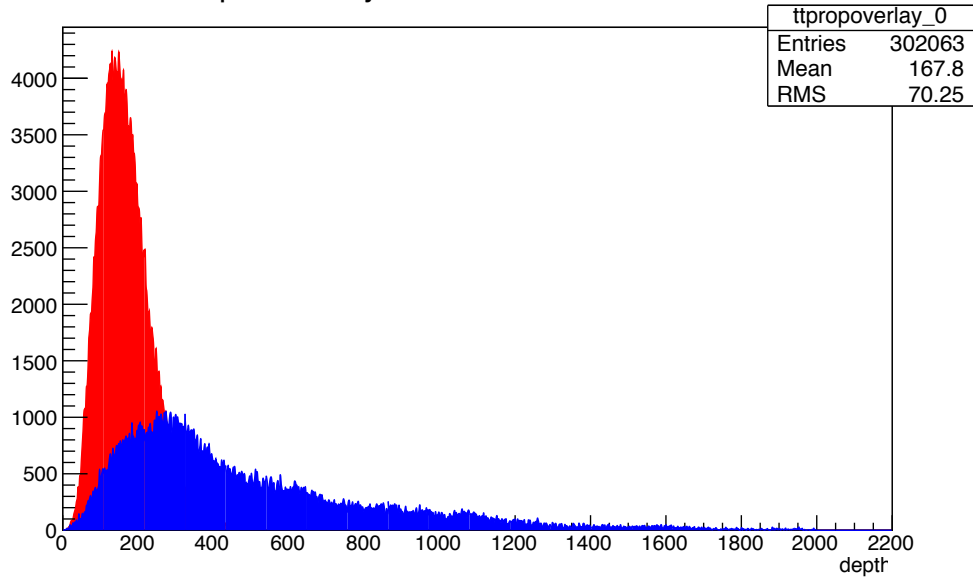


New Data Files

- Numerous depth tests showed that the old files contained an error in the depth variable- this has been pointed out and will be corrected.
- New data files with tungsten and brass do not have this problem.
- Use new code to show radiation damage in terms of dose/factor

Longitudinal particle movement

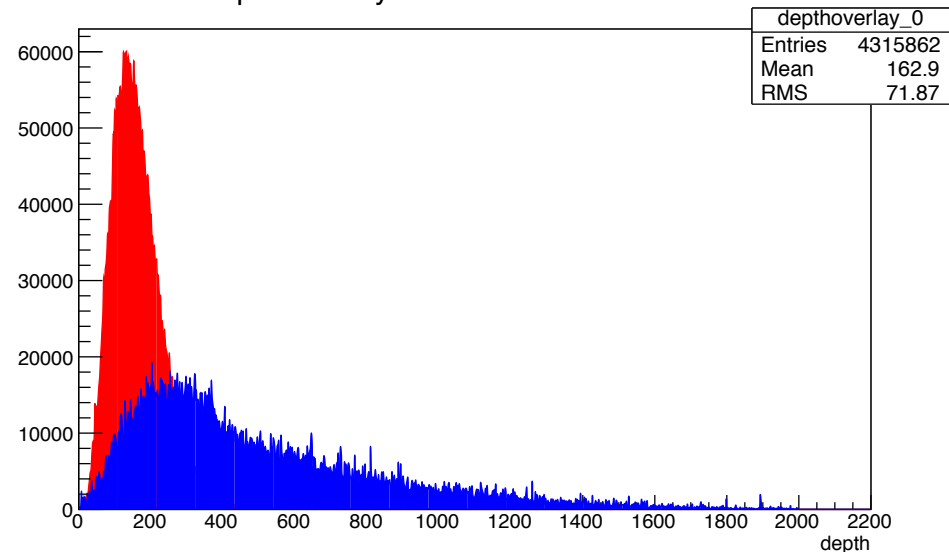
Depth Overlay Electrons/Pions: Scincillator



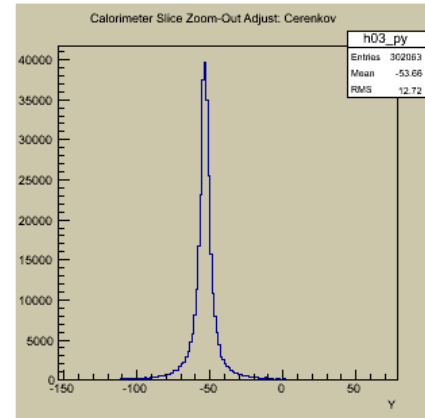
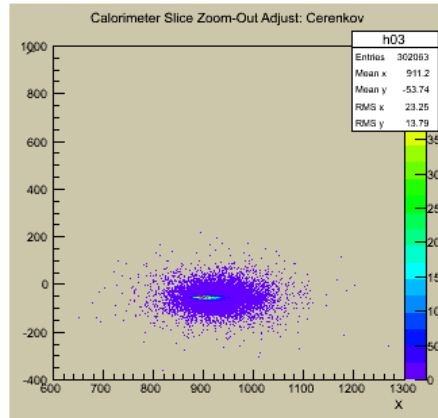
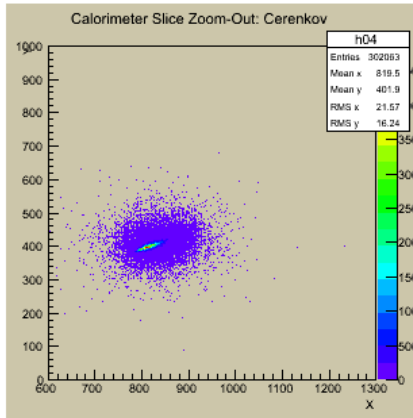
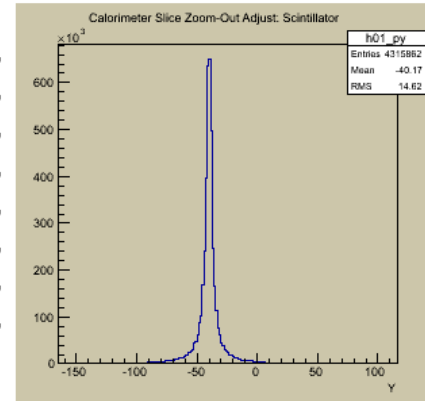
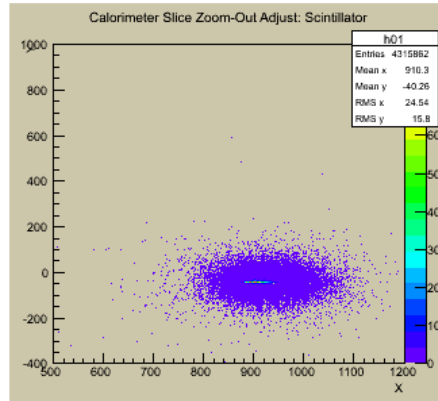
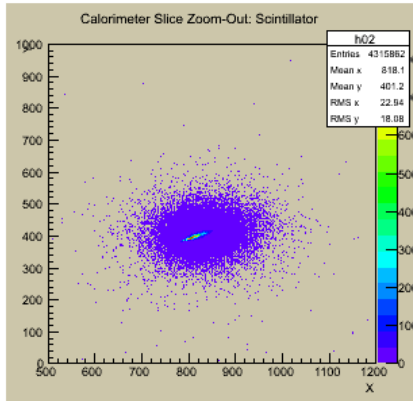
The tested files contain 100 GeV energy pions and electrons interacting with the scincillating and cerenkov fibers.

These depth overlay plots for electrons (red) and pions (blue) show that this new file begins its depth at 0, and ends at 2000mm. The pions penetrate deeper than electrons.

Depth Overlay Electrons/Pions: Cerenkov



Transverse particle movement

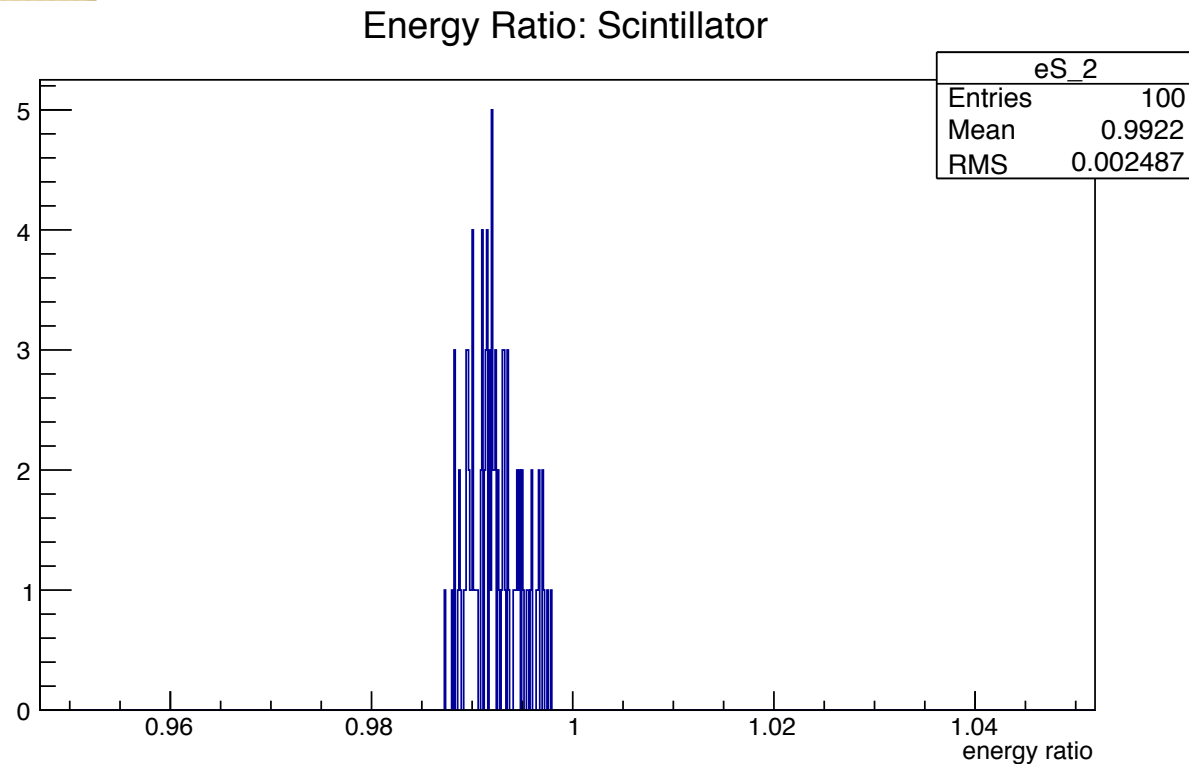


Find angle of xy slice, then turn all points and project on the new y -axis. Find the diameter which 95% of data lie between to find ID moliere radius. The radii make sense for tungsten and brass material, showing correct calculations.

Brass moliere radii calculations are shown above

	Scincillating	Cerenkov
Tungsten	18 mm	14.4 mm
Brass	30.8 mm	25.9 mm

Finding energy changes with radiation dose



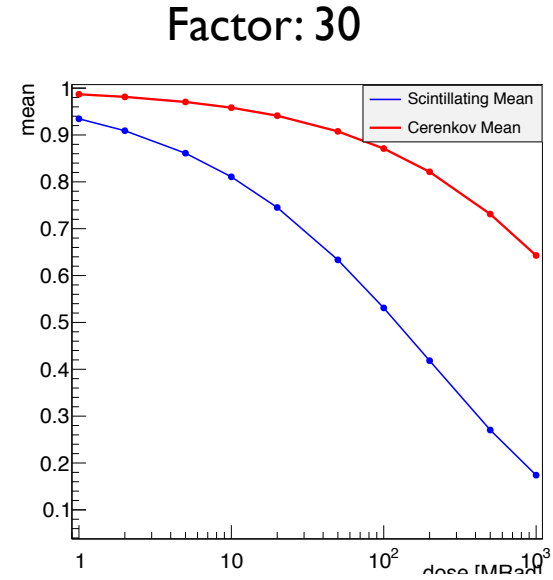
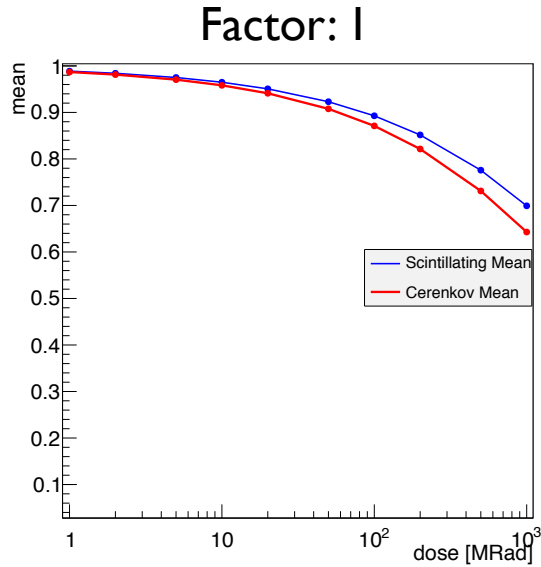
Example Energy Ratio for dose of 2 MRads

11 energy plots formed, each with a different value for dose- ranging from 1 to 1000 MRads, divided over energy with 0 dose.

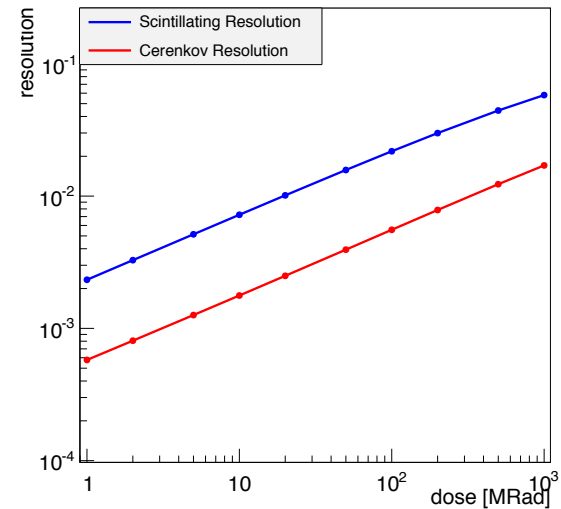
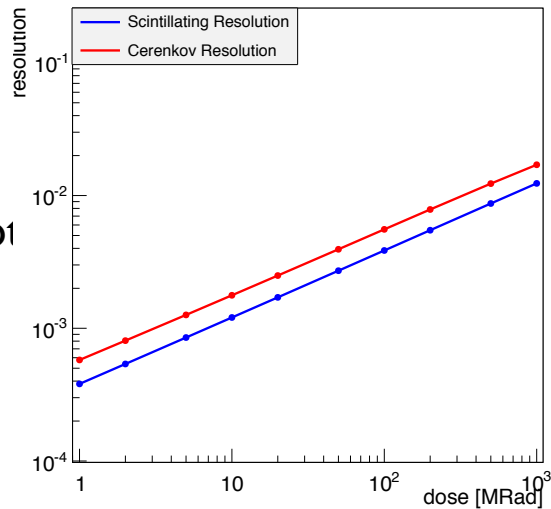
To see how energy changes as dose increases, we plot the mean and resolution of each plot, then experiment with changing factor.

Electrons: mean/res by dose/factor

Mean Plots

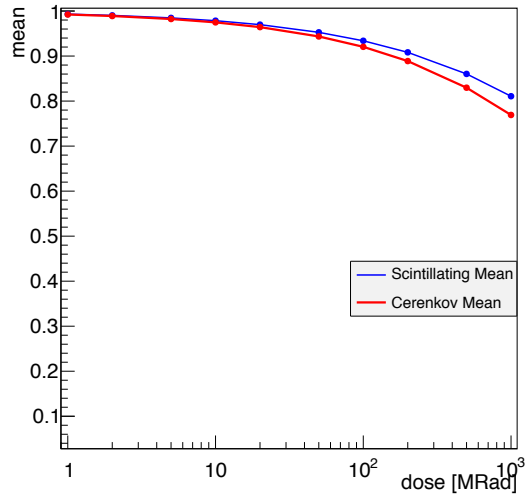


Resolution Plot

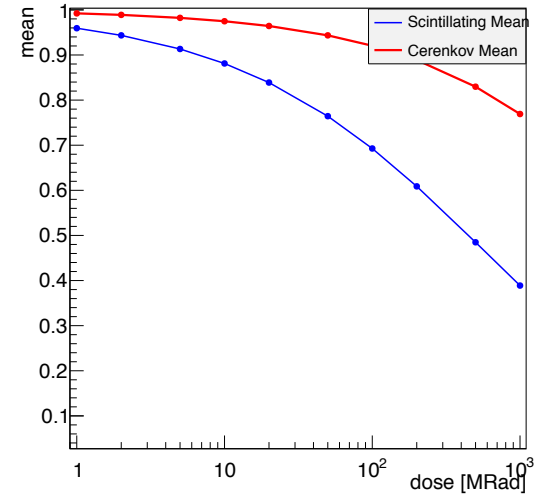


Pions: mean/res by dose/factor

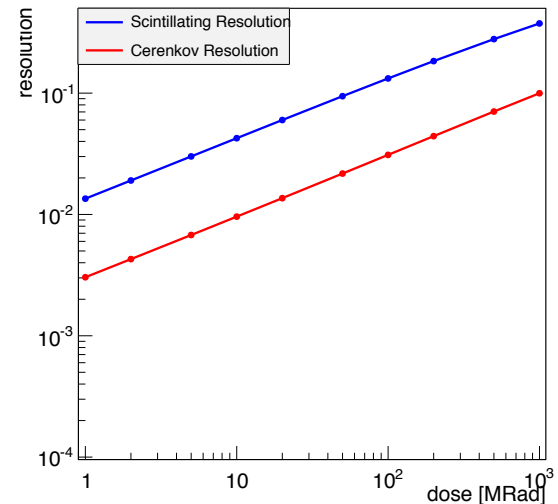
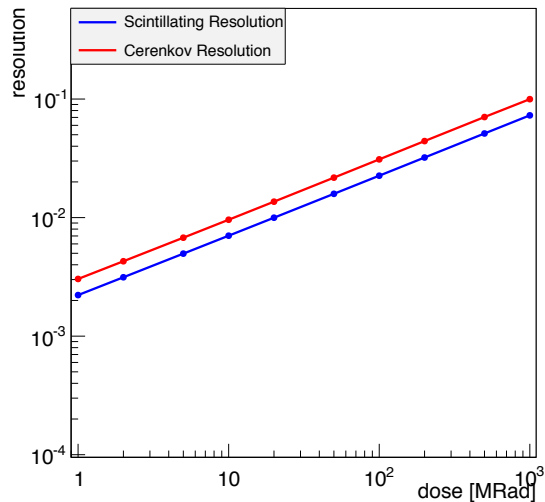
Factor: 1



Factor: 30



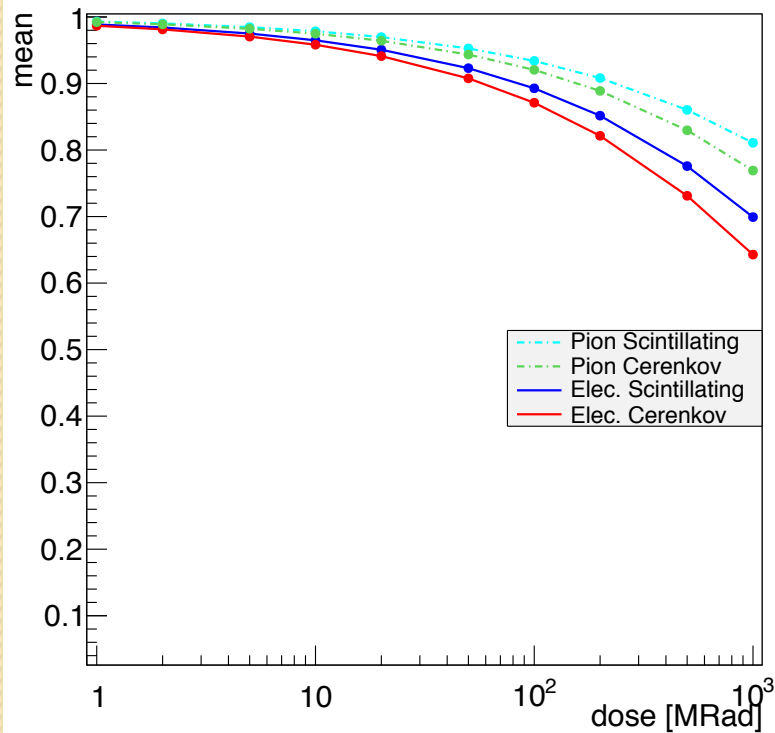
Mean Plots



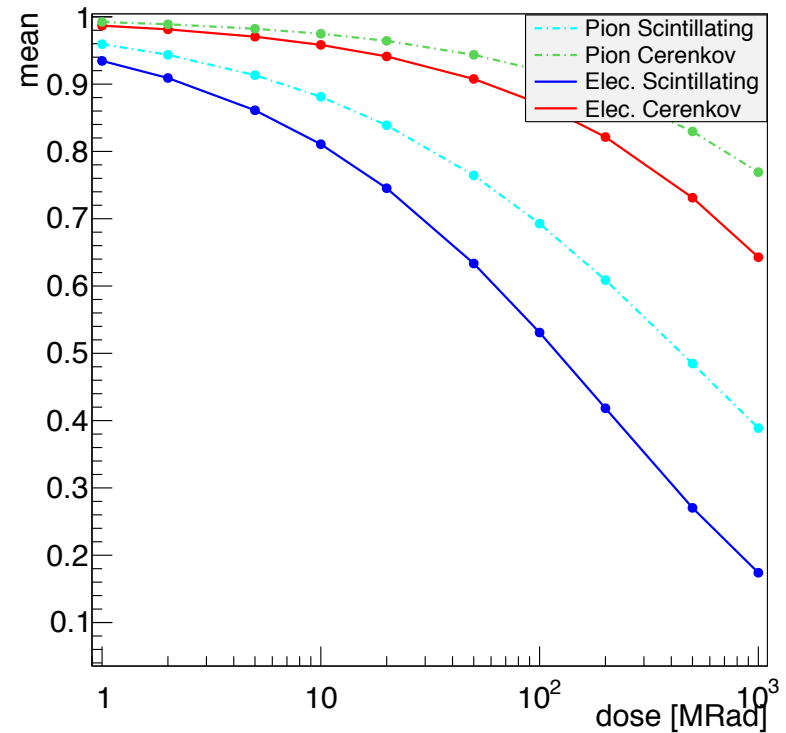
Resolution Plots

Electron/pion overlay: mean

Factor: 1

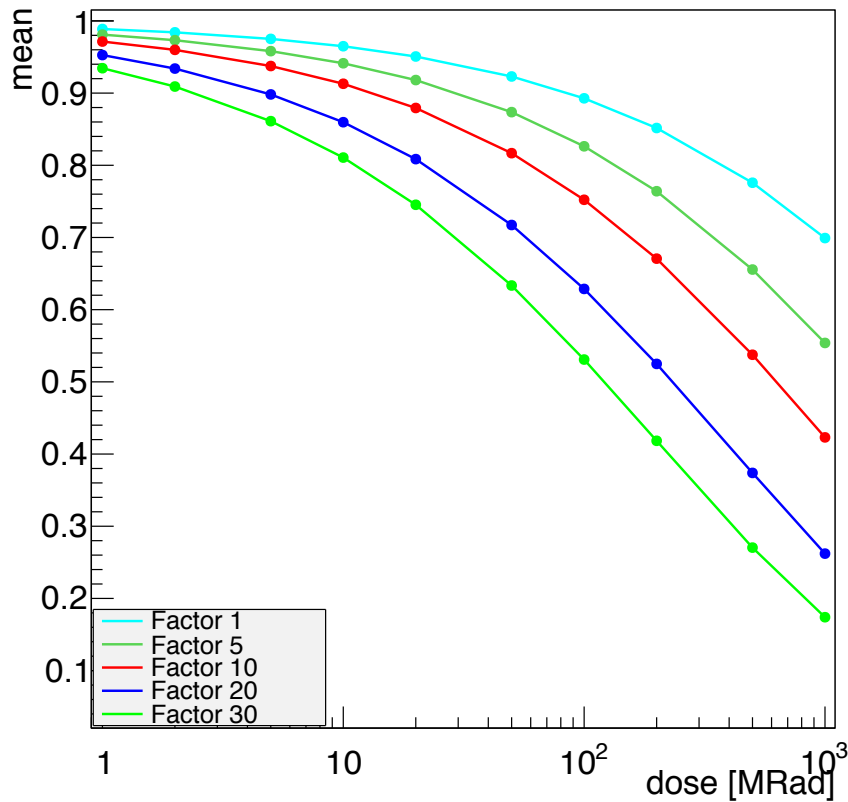


Factor: 30

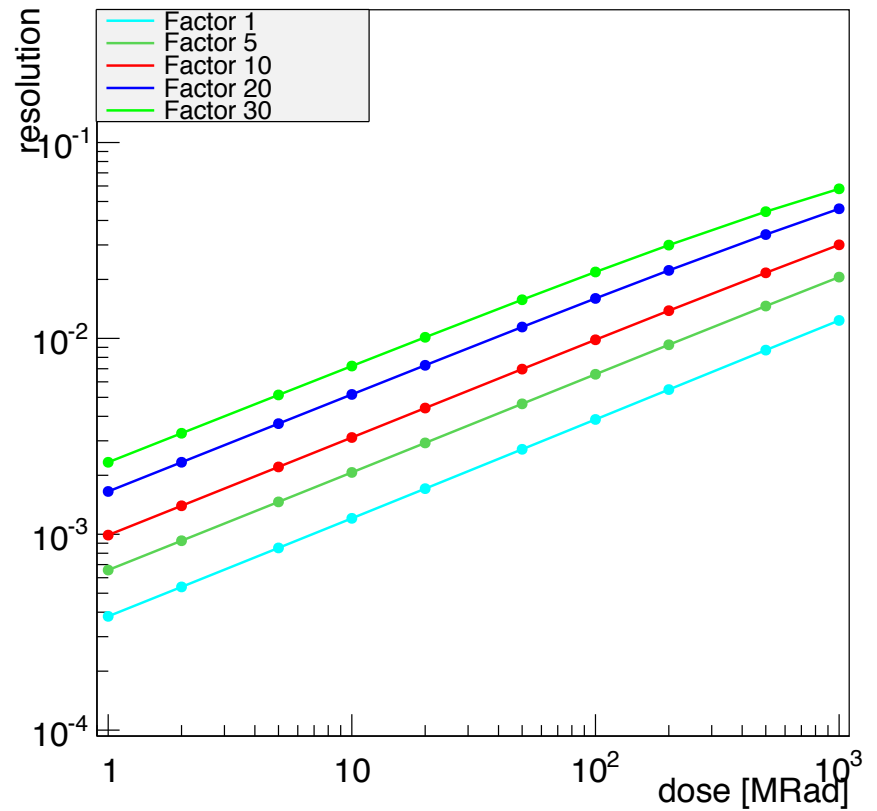


Electron scintillating fibers: factor overlay

Mean



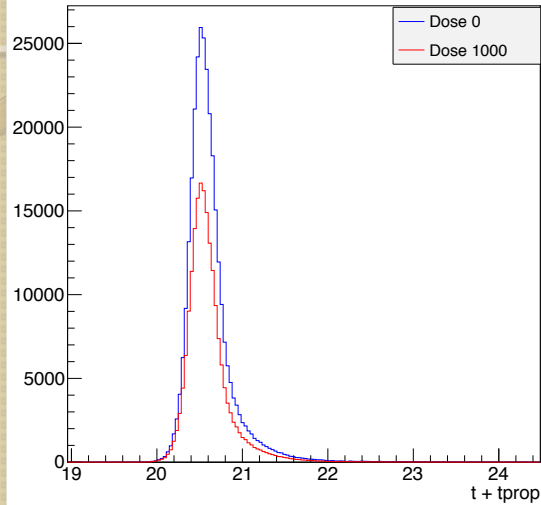
Resolution



Time of arrival overlays

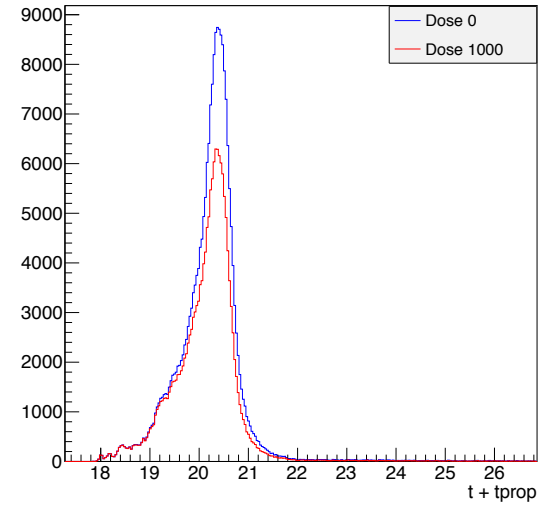
Electrons

t + tprop: Cerenkov

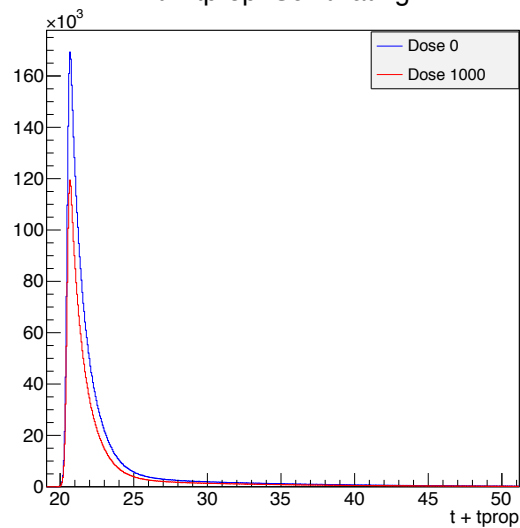


Pions

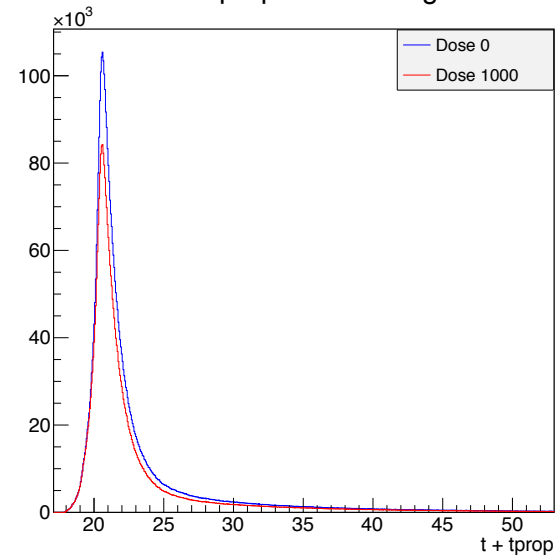
t + tprop: Cerenkov



t + tprop: Scintillating

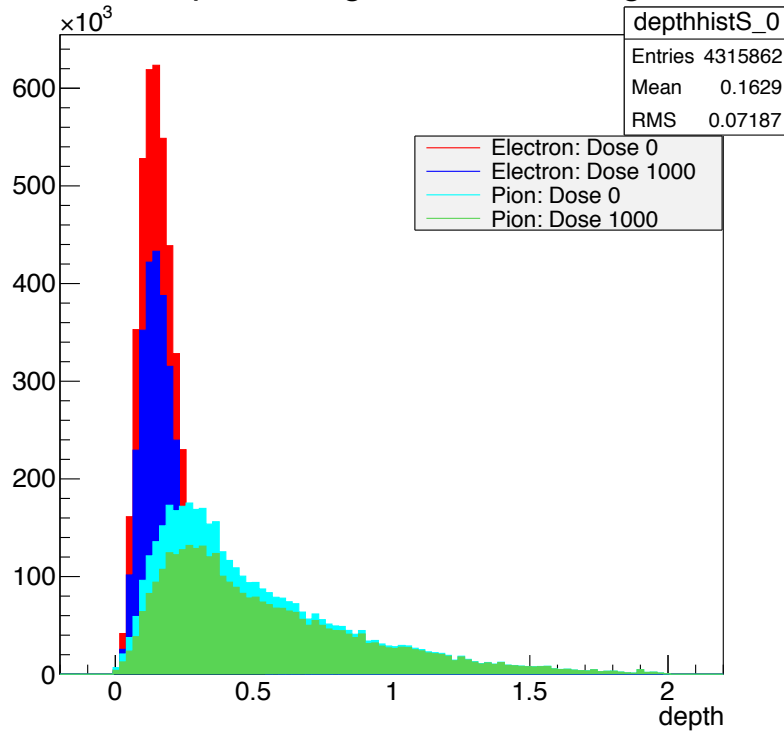


t + tprop: Scintillating

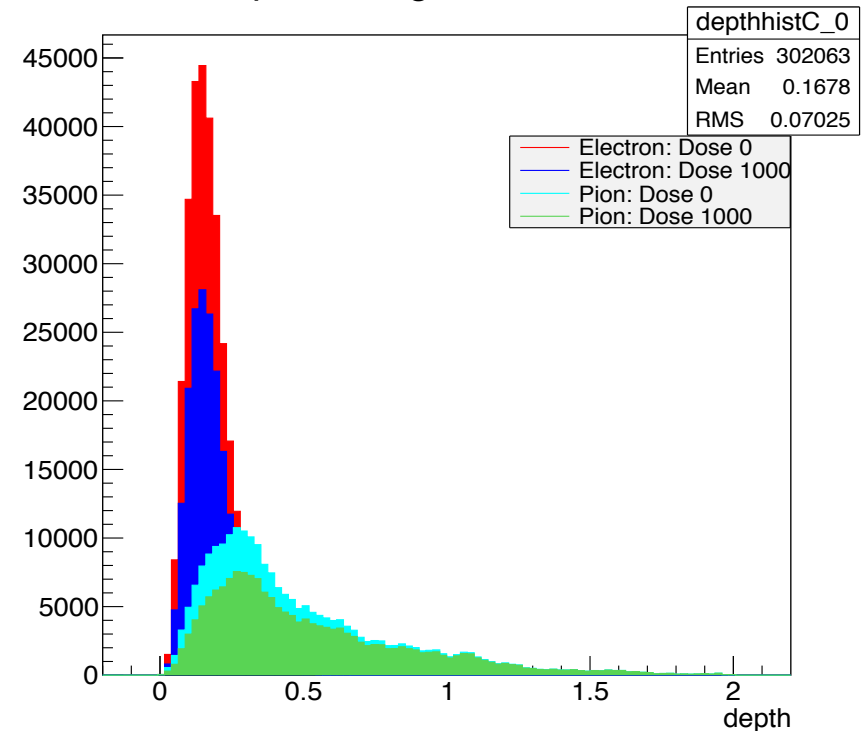


Longitudinal movement

Depth Histogram: Scintillating



Depth Histogram: Cerenkov



This shows how radiation damage affects the longitudinal movement of electrons and pions.



- Thanks to Dr. Alexander Ledovoskoy for all his guidance and help, to University of Michigan for this opportunity, and to the Texas Tech group for letting me join their group!