LXSIM-EDS

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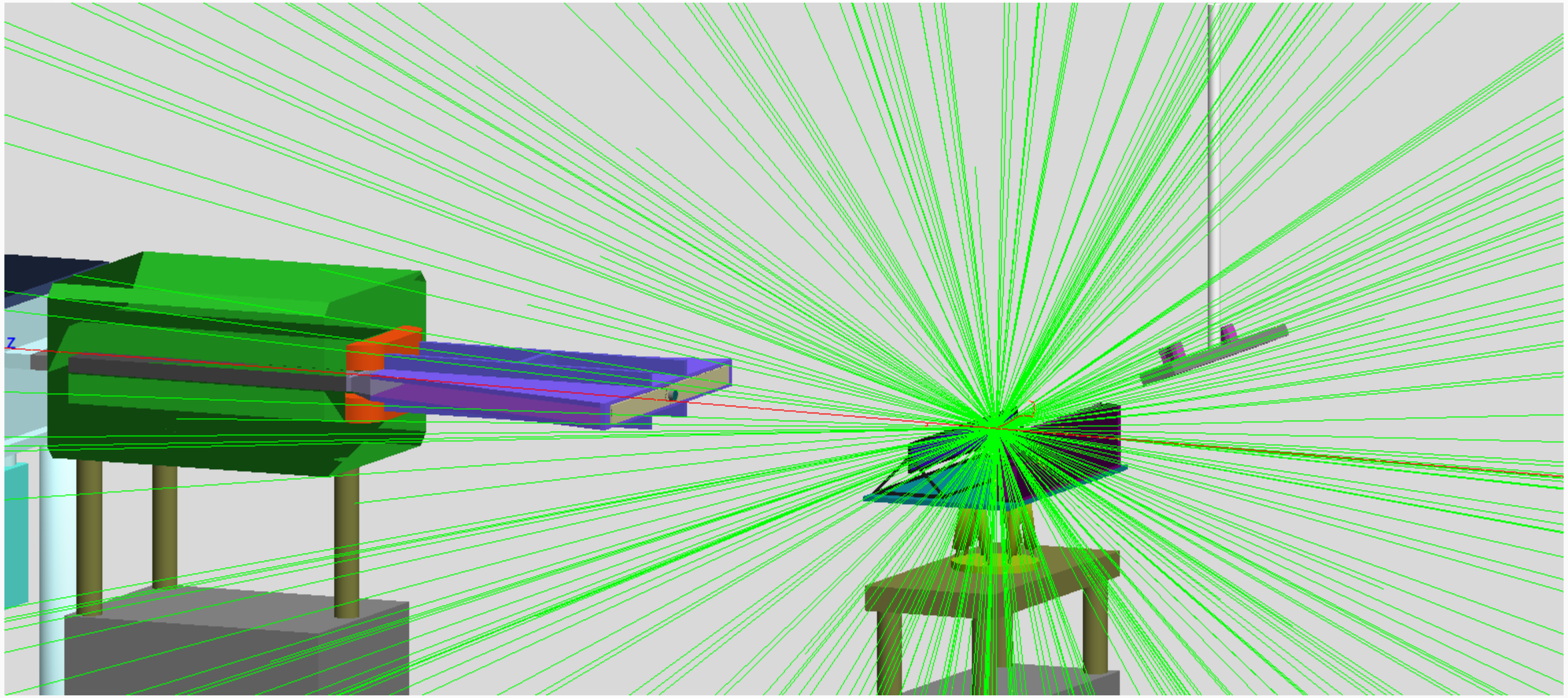
- Based on lxsim; still a lot of difficult code.

- implements geometries of IP chamber, magnet, vacuum chamber, Scintillation screen, Cherenkov detector, cameras

- Simulates the generation of ‘optical photons’ due to scintillation & Cherenkov emission but does not simulate further optical interactions

- Uses QGSP_BERT_HP physics

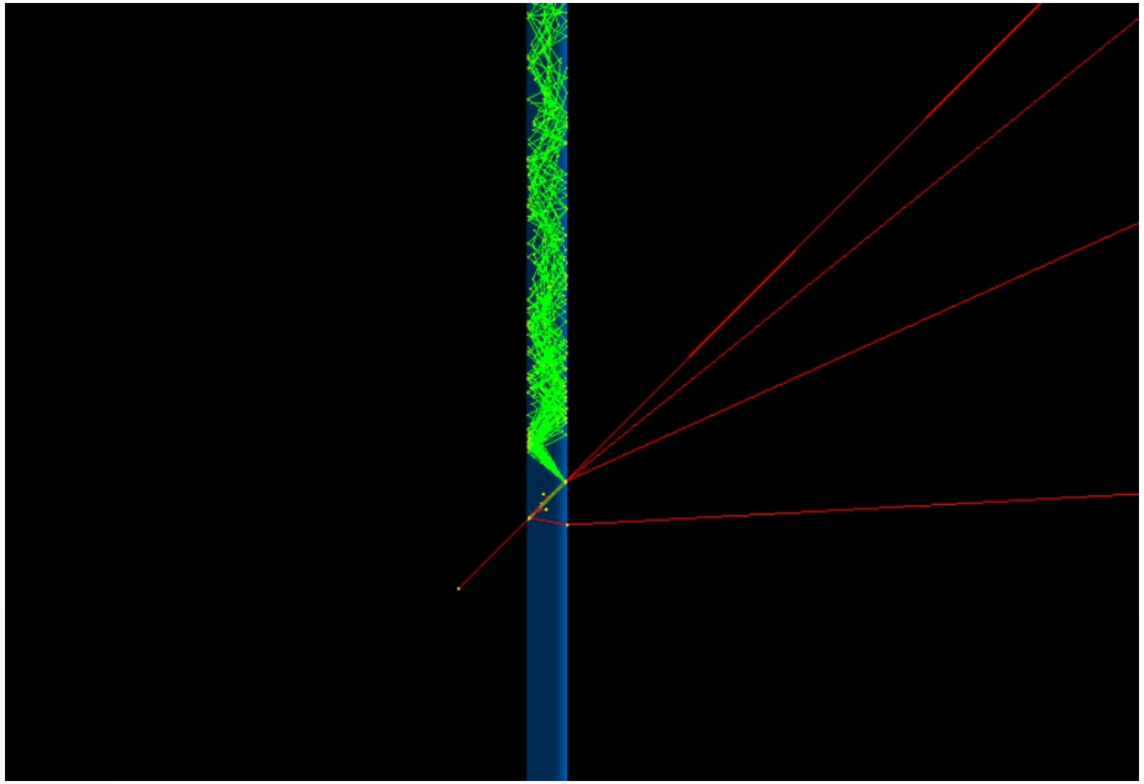
- takes 4s to process 1000 events (primary e-) (with scintillation yield =0.01)

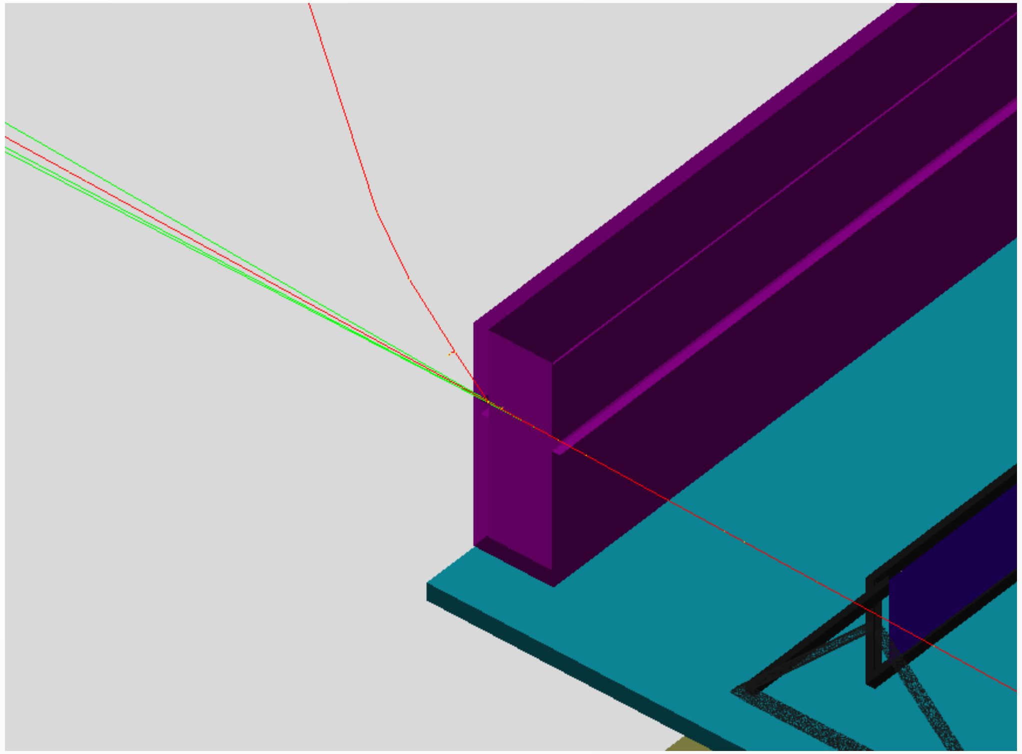


- Output histograms includes map of scintillation photons in plane of screen, and count of Cherenkov photons generated *within* each straw

- Ruth has simulated internal reflection in a single straw before in G4, so it can be implemented; this would slow down the simulation (although it should be still be fast if we turn of scintillation)

- Can still use lxsim ‘Tracks’ TTree to find all (non-optical) particles which contact sensitive volumes





- Key geometry parameters kept in LXSetUp.cc

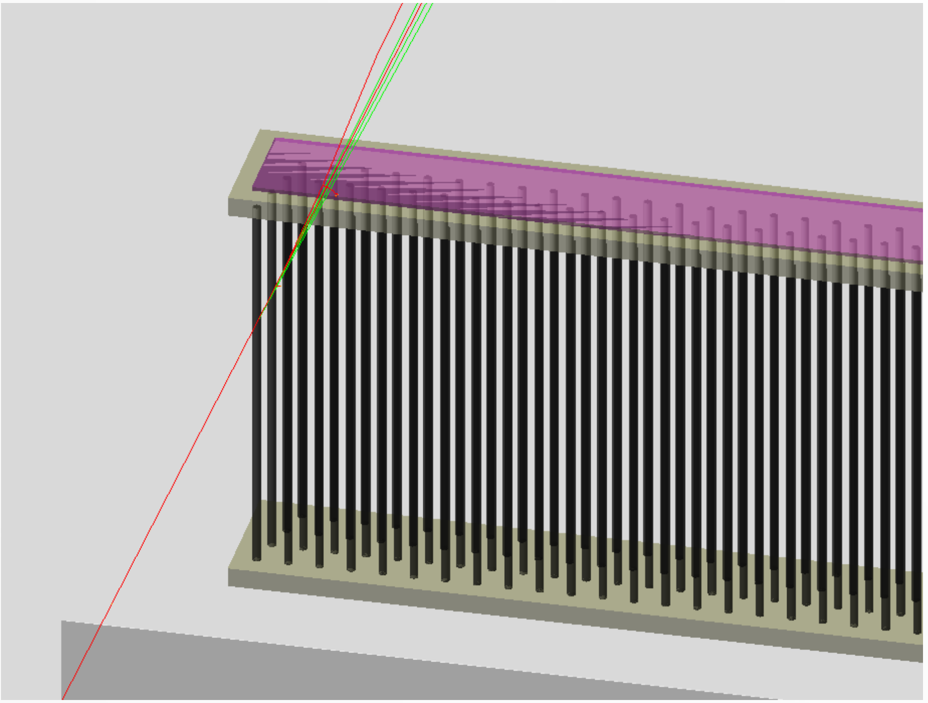
- It's easy to change parameters such as Cherenkov straw layers, straw radius, spacing, scintillator thickness, scintillation yield

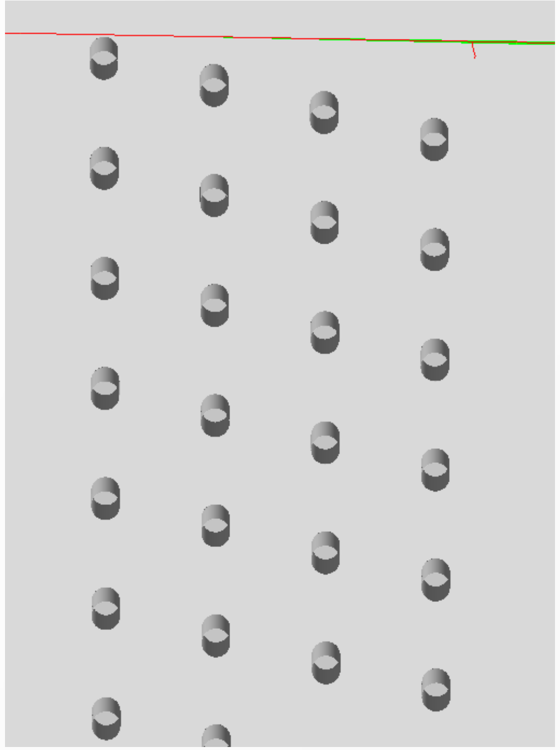
- Implementing them requires recompilation

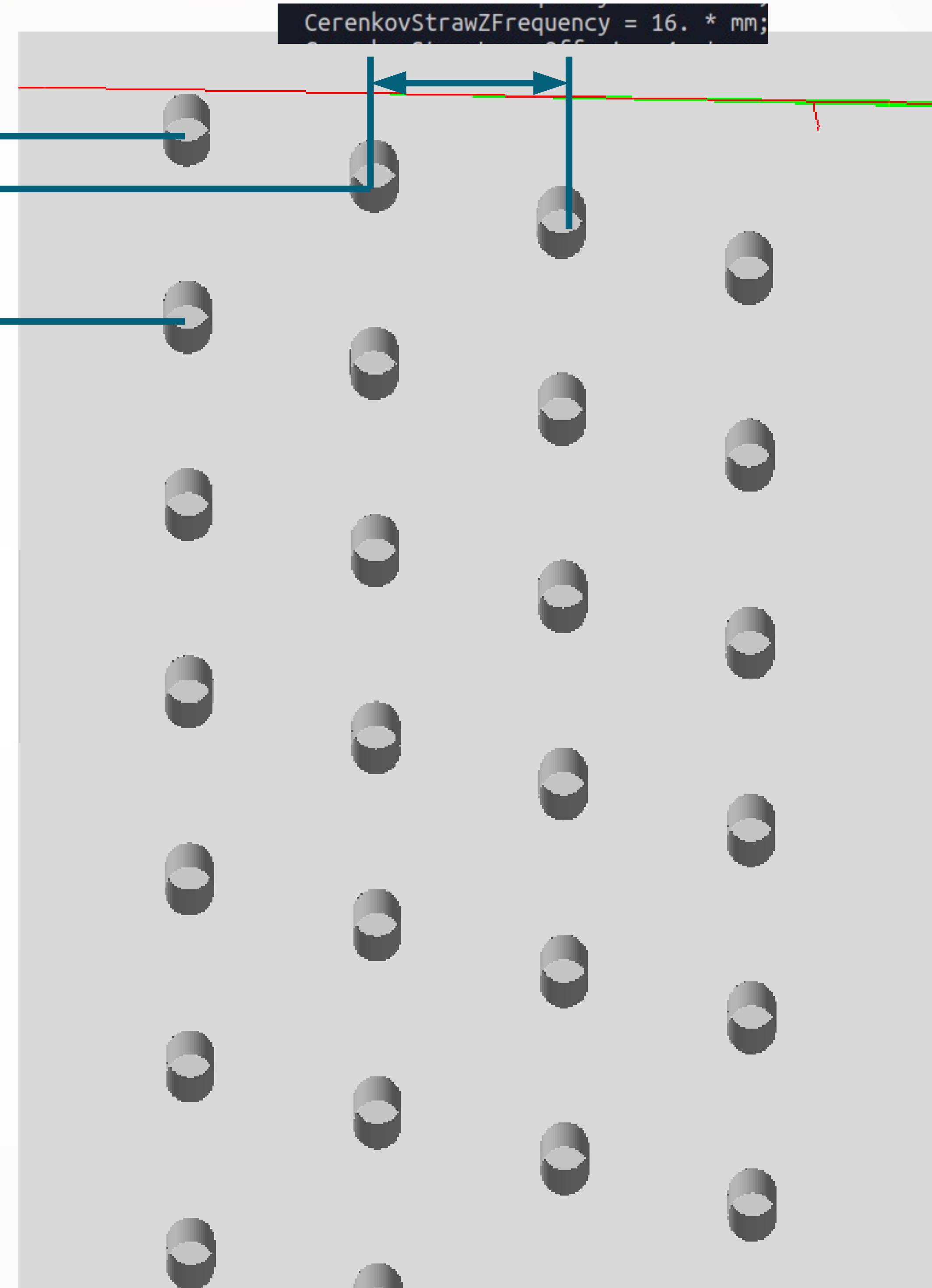
- Straw tubes suspended with Silicon plates above & below within Al box

- information on the straws can be gathered from the Ttree in 'DetSettings'

- As of yet, no 'double-readout' implemented

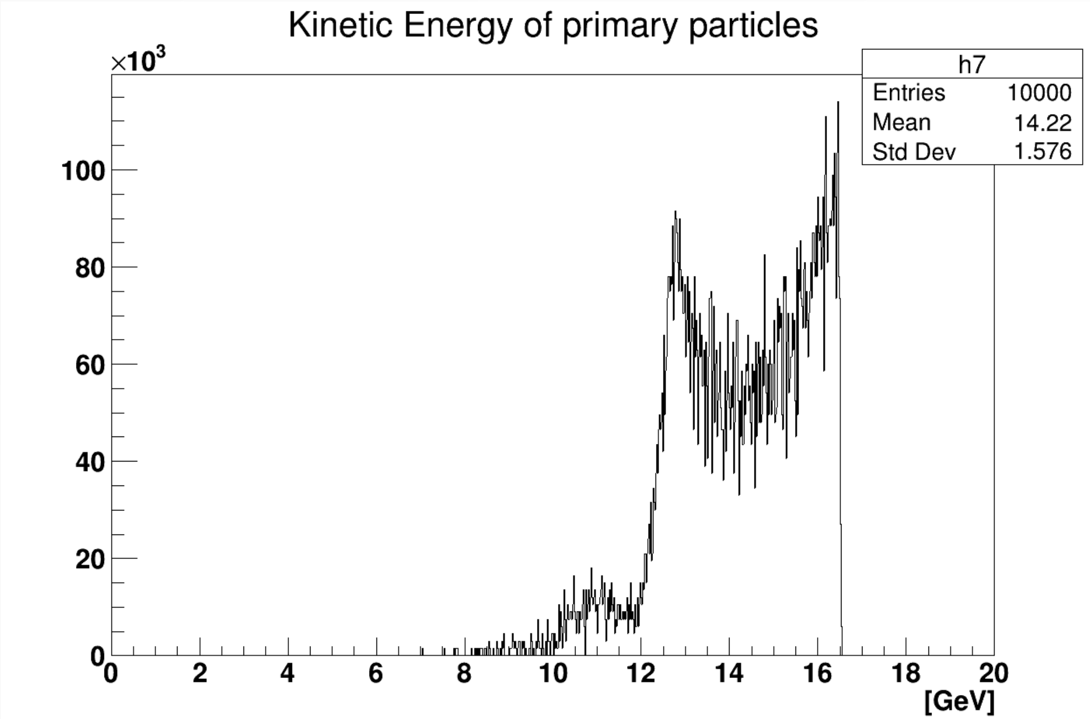


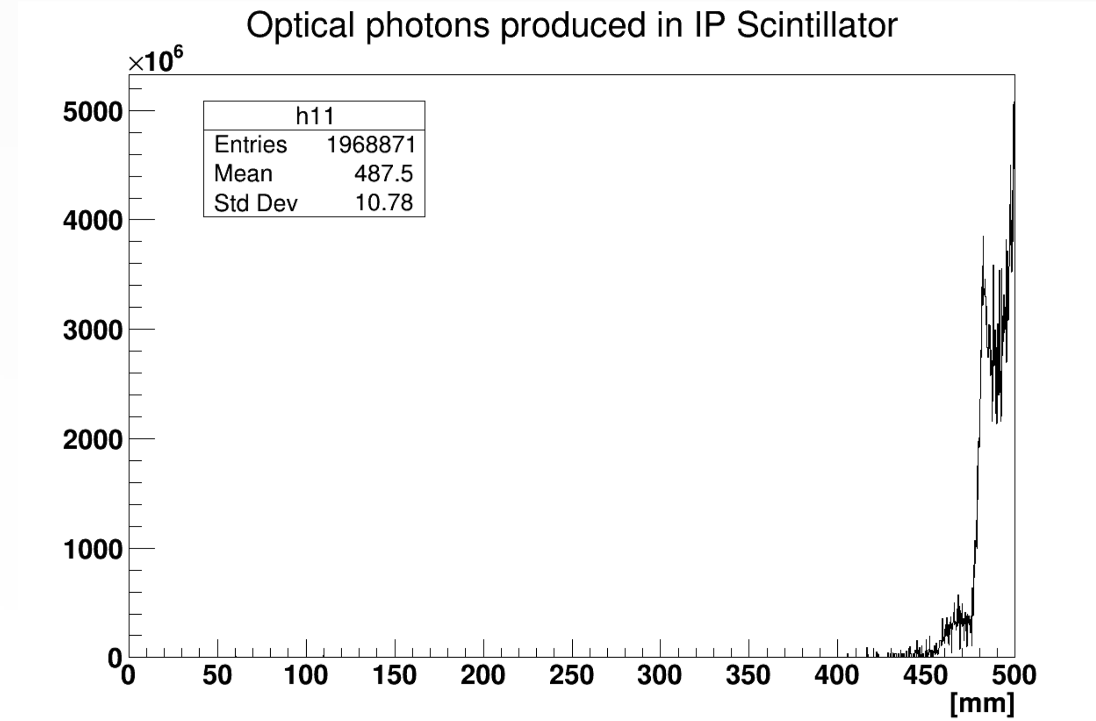


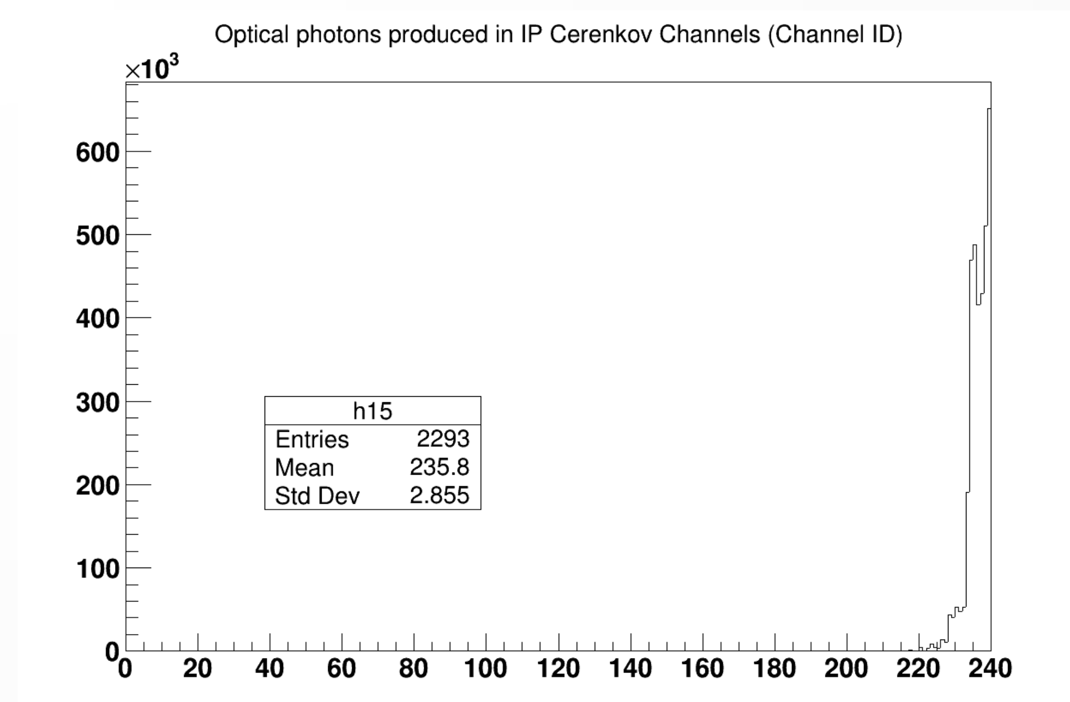



```
CerenkovChannels = 240;
CerenkovStrawHeight = 200. *mm;
CerenkovChannelLayers = 4;
CerenkovStrawInnerRadius = 4.02/2. * mm;
CerenkovStrawGraphiteLayerThickness = 6. * 0.001 * mm;
CerenkovStrawAlLayerThickness = 0.2 * 0.001 * mm;
CerenkovStrawKaptonLayerThickness = 25 * 0.001 * mm;
CerenkovStrawPolyurethaneLayerThickness = 5 * 0.001 * mm;
CerenkovElectronicsBoardThickness = 2. * mm;
CerenkovShieldingPlateThickness = 0.0001 * mm; // 0.5 * c
CerenkovBoxThickness = 0.9 * cm;
CerenkovBeamWindowThickness = 0.15 * mm;

CerenkovStrawXFrequency = 16. * mm;
CerenkovStrawZFrequency = 16. * mm;
CerenkovStrawLayerOffset = 4. * mm; // = CerenkovStrawXFre
CerenkovStrawPlateBuffer = 1. * cm;
CerenkovSupportThickness = 1. * cm;
```







- These histograms are normalised using a from ptarmigan output (and scintillation yield for scintillator hist.)

- Passing an MC file of up to 10^6 e- should take only ~1 hour

- Need some metric to interpret quality of Cherenkov Signal

Backup

- Reconstruction of Screen Spectrometer requires essentially (light collection / charge) and energy➞position measurements / calculations.

- Code offers both finest variable energy binning, and larger more regular bins.

- Calculating energy involves solving a geometrical problem, solving the point of incidence for a given energy (radius)

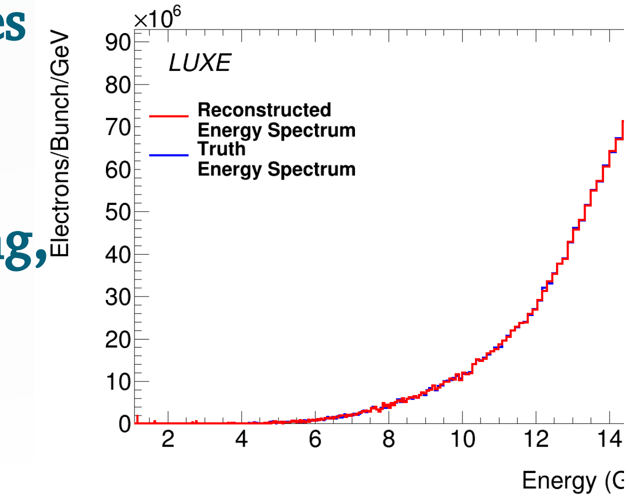
- To do so exactly requires trig functions – which complicates greatly the solving of E for x

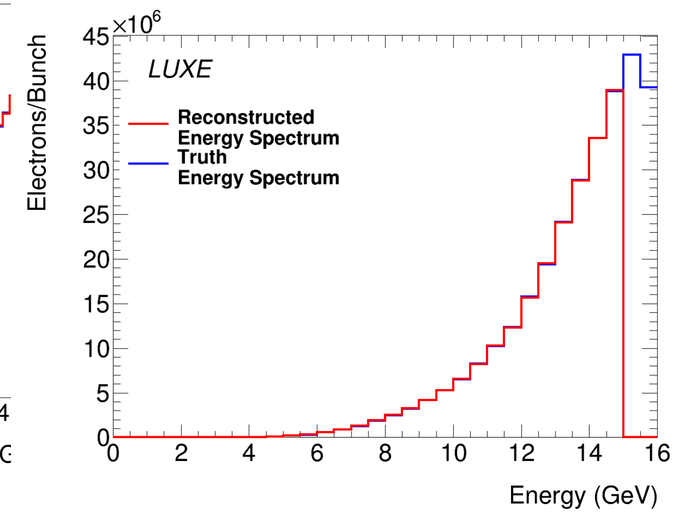
- Can instead evaluate numerically i.e. scan through E until desired x is found ➞ E solved for x. This takes non-negligible computation but is helped by using small angle approximation equation as consistent underestimate

$$x = Bcz_m \times \frac{z_m/2 + z_d}{E}$$

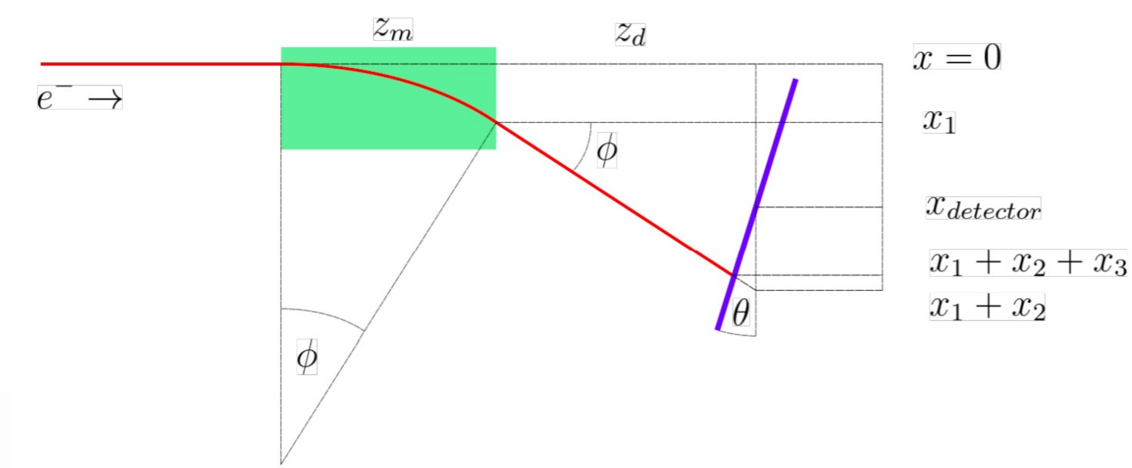
- Also provide correction to signal dependent on angle of approach

- And for the central signal band, subtract at each x pixel the mean of the bkg just above and below

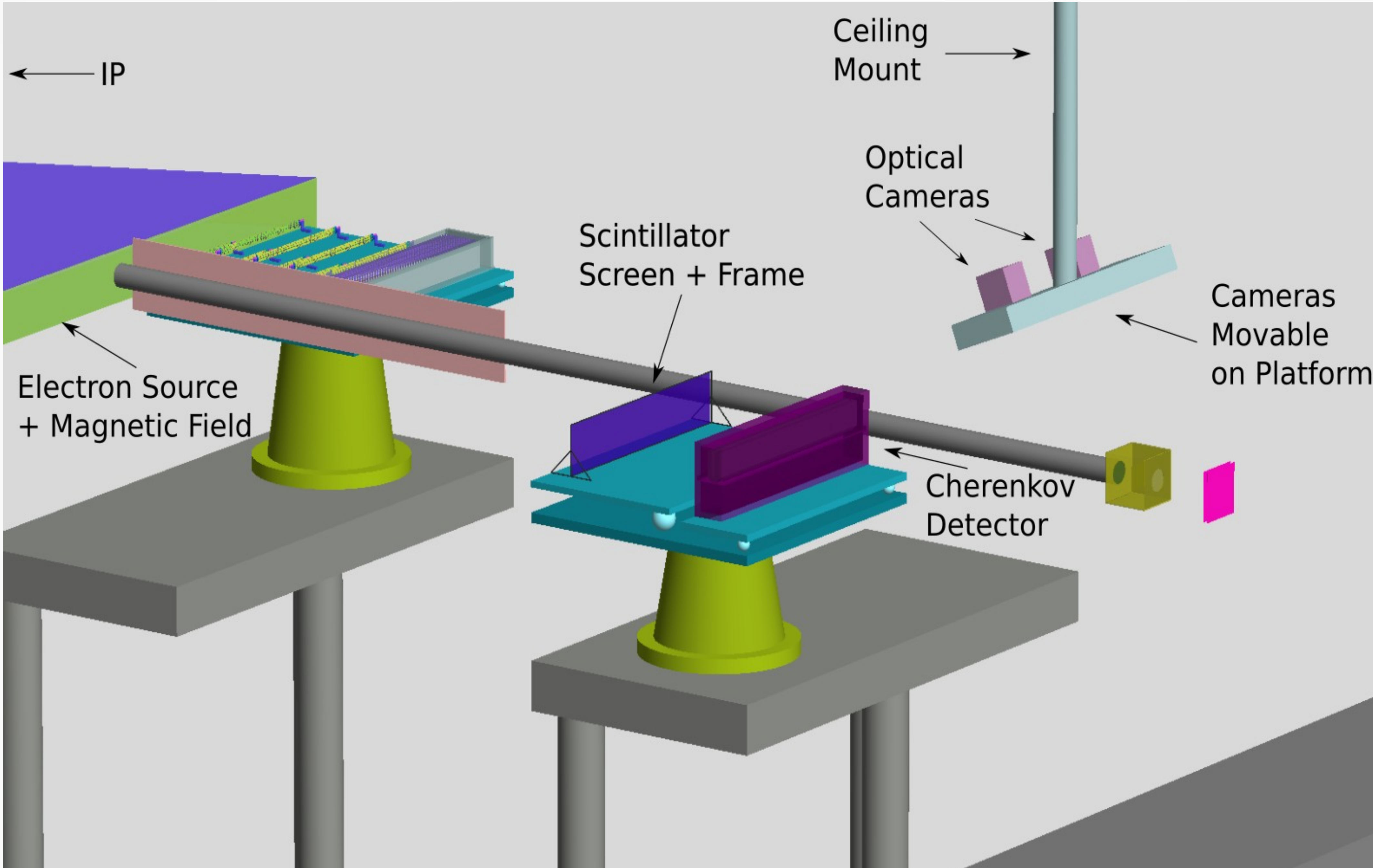


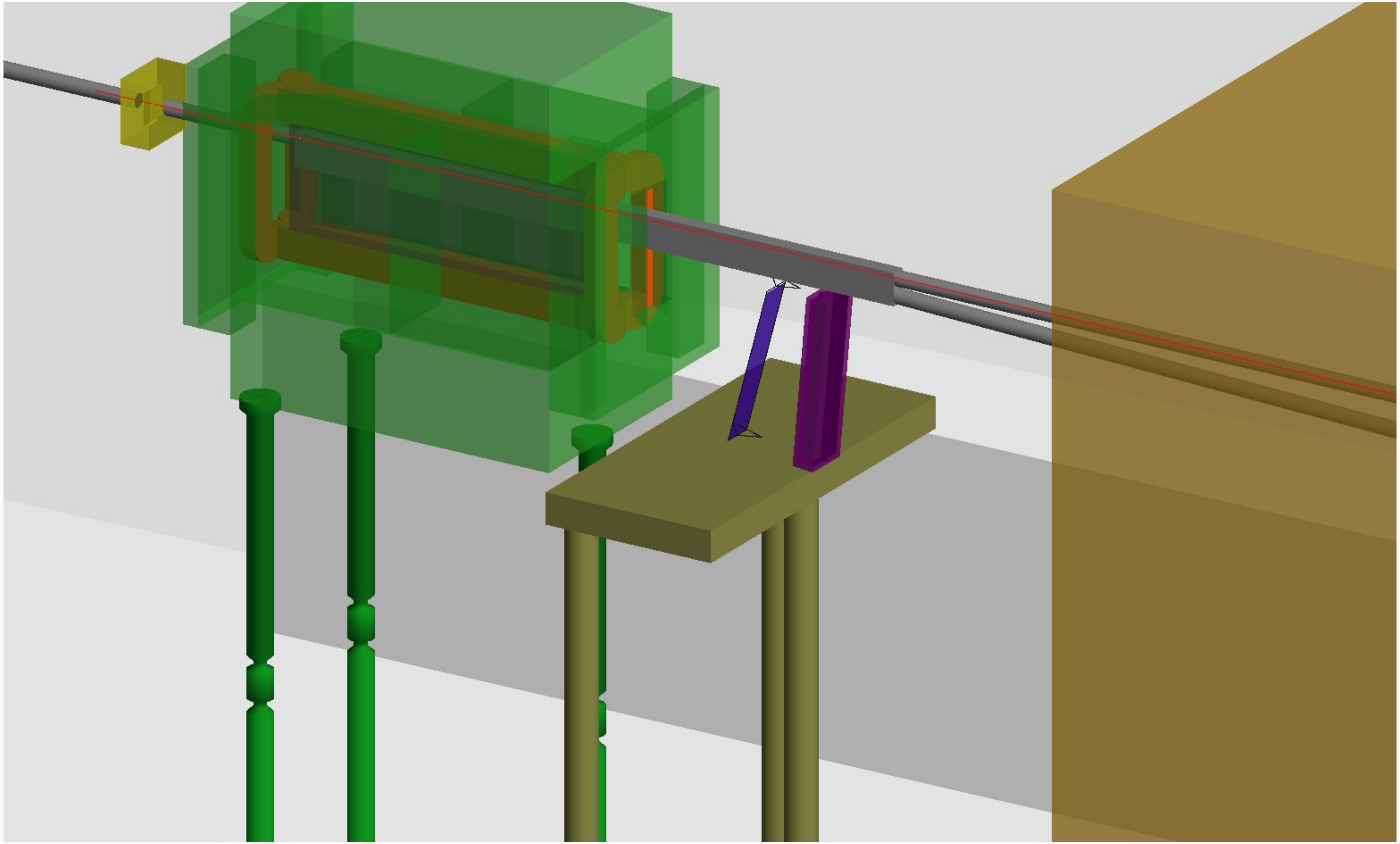


$$\frac{\gamma^2 v^2}{R} = \frac{\gamma q v B}{m_e} \qquad R = \frac{E_{eV}}{Bc} \qquad \phi = sin^{-1}(\frac{z_m}{R})$$



$$x = x_1 + x_2 + x_3 = R(1 - cos(\phi)) + tan(\phi)z_d + \frac{tan(\theta)tan(\phi)(x_{detector} - x_1 - x_2)}{1 + tan(\theta)tan(\phi)}$$


IP
Ceiling Mount
Optical Cameras
Scintillator Screen + Frame
Cameras Movable on Platform
Electron Source + Magnetic Field
Cherenkov Detector



Brem. Electron detectors