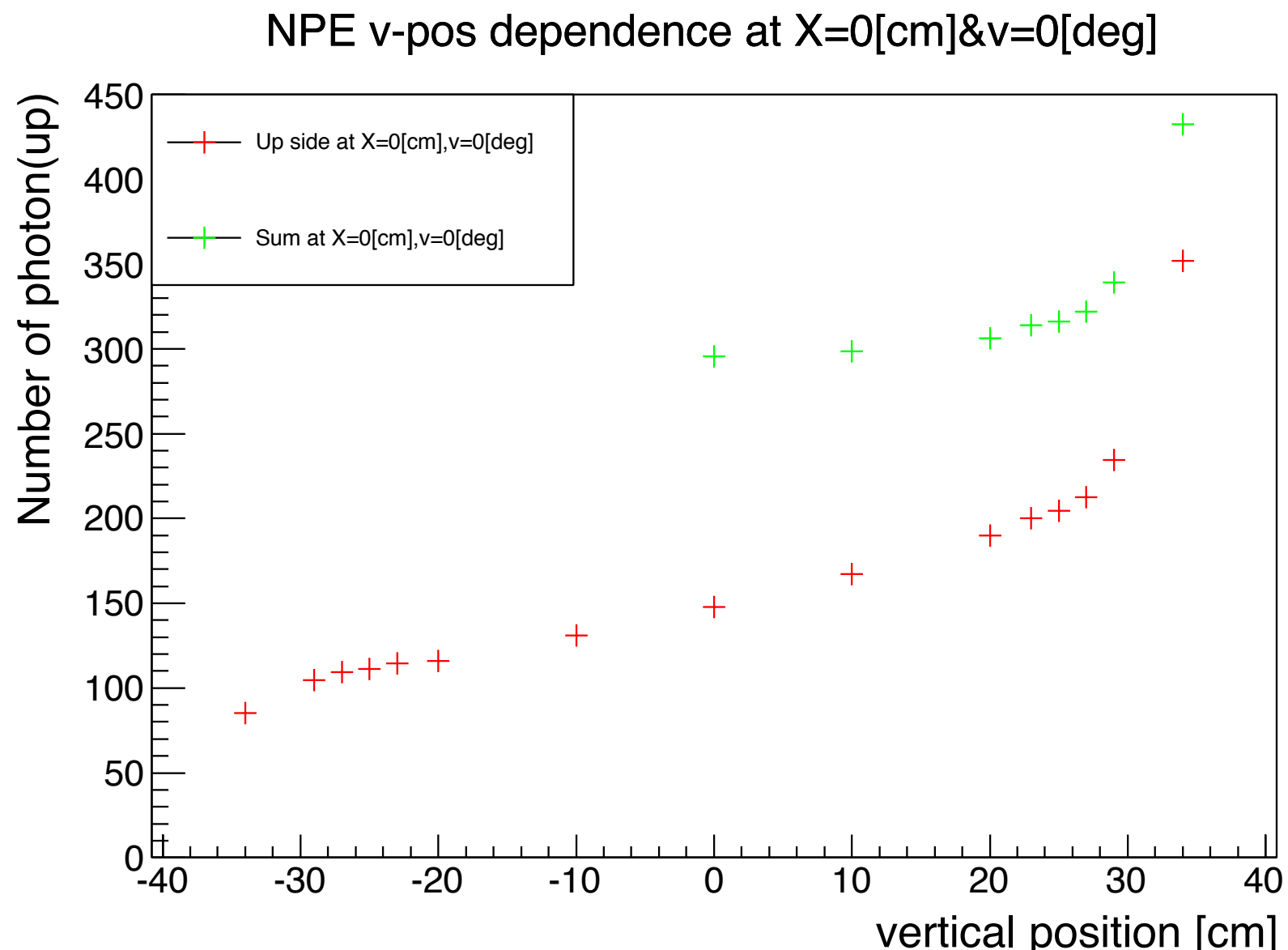


WC Simulation Progress

2018.04.24
Sungwook Choi

Objectives



- Reproduce above plot to figure out the validity of Simulation
- Plotting similar graph for E42 Water Cherenkov Detector

E05 Simulation

- Incident Beam of 400 MeV Electron ($\beta \sim 1$)
- Optical Process in Water (220 nm ~ 700 nm): Set as Default
 - Mie, Rayleigh Scattering, Absorption Length, Scintillation
- Diffuse Reflection :
 - Absorption Rate = 1 - Reflectivity. Rate differs with wavelength
 - Reflectivity : 99%
- Optical Window (UV - Transmitting) :
 - Reflection or Refraction occurs w.r.t Refractive Index
- PMT :
 - Grease and QE Omitted, Photons Counted at the Cathode
 - PMT Glass (UVT Glass)

E42 Simulation

- Optical Process in Water (200 nm ~ 800 nm) : Set as Default
 - Mie, Rayleigh Scattering, Absorption Length, Scintillation
- Diffuse Reflection :
 - Absorption Rate = 1- Reflectivity. Rate was set as 92%
 - 75% Lobe Reflection, 25 % Diffusive (Actually No Difference)
- Optical Window (UV - Transmitting) :
 - Reflection or Refraction occurs w.r.t Refractive Index
- PMT :
 - Grease Included
 - Photons Counted at the Cathode with Q.E Added (SBA & BA)
 - PMT Glass (UVT Glass / Borosilicate Glass)

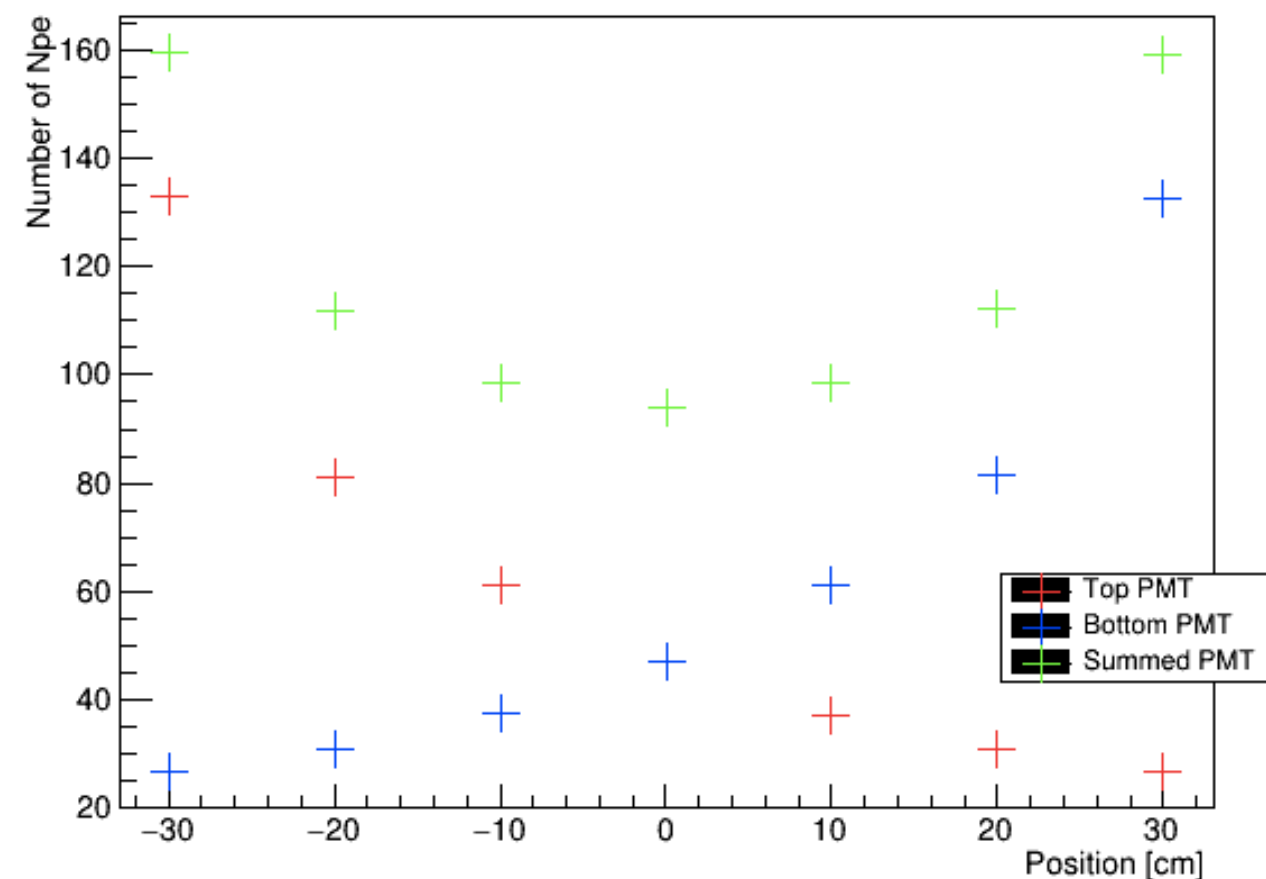
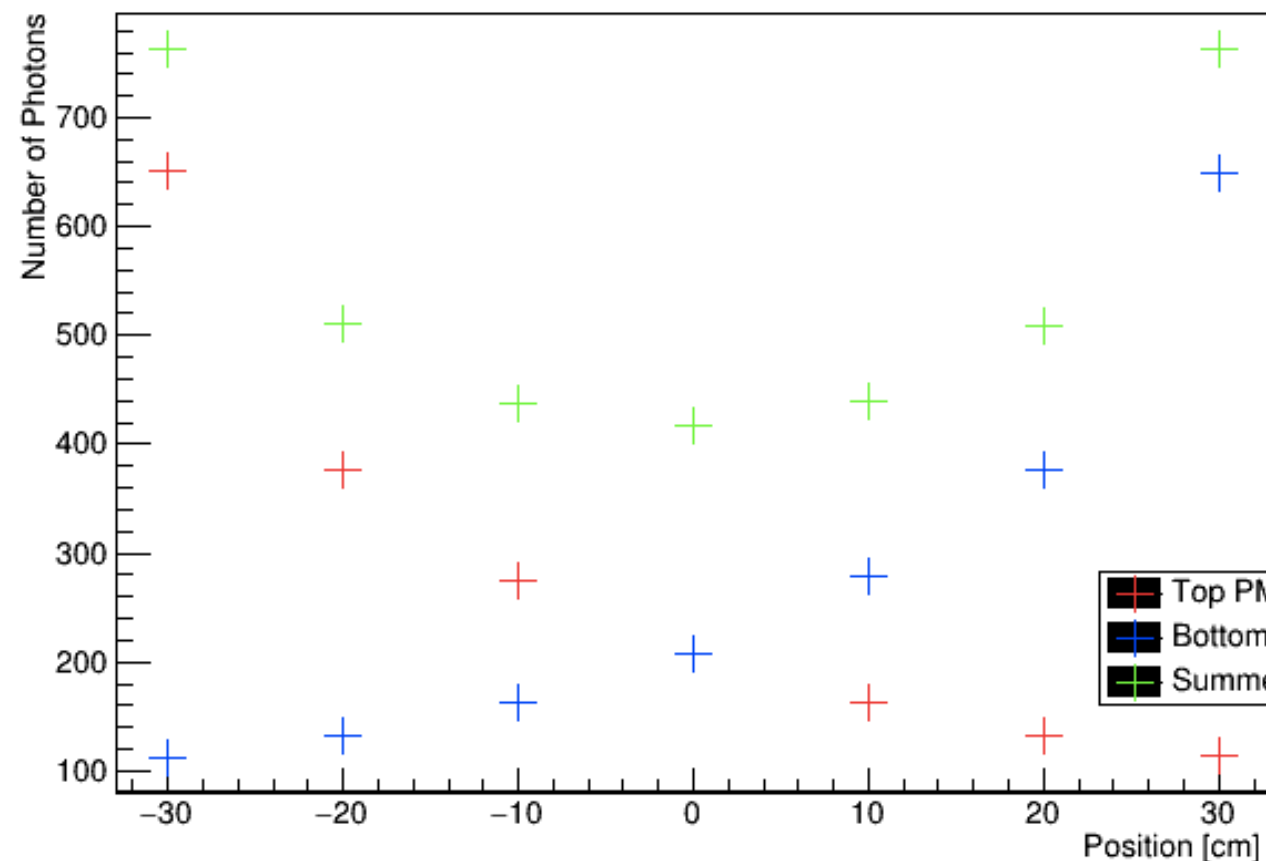
Input Parameters

- Refractive Index
 - Water : Varies from **1.32** to **1.43**
 - Optical Window (Acrylic) : **1.49** Constant.
 - Optical Grease (BC630) : **1.49** Constant.
 - PMT Glass (BSG / UVT) : **1.5** For **BSG**, **1.49** for **UVT**
- Absorption Length & Transmission Rate
 - Water : Data from Super-K Water Cherenkov Simulation
 - Optical Window : Acrylite #000 (**92.3%** in Visible, ~200 nm Calculated)
 - PMT Glass : ~ 0% at 340 nm (BSG) , at 240 nm (UVT)

Input Parameters

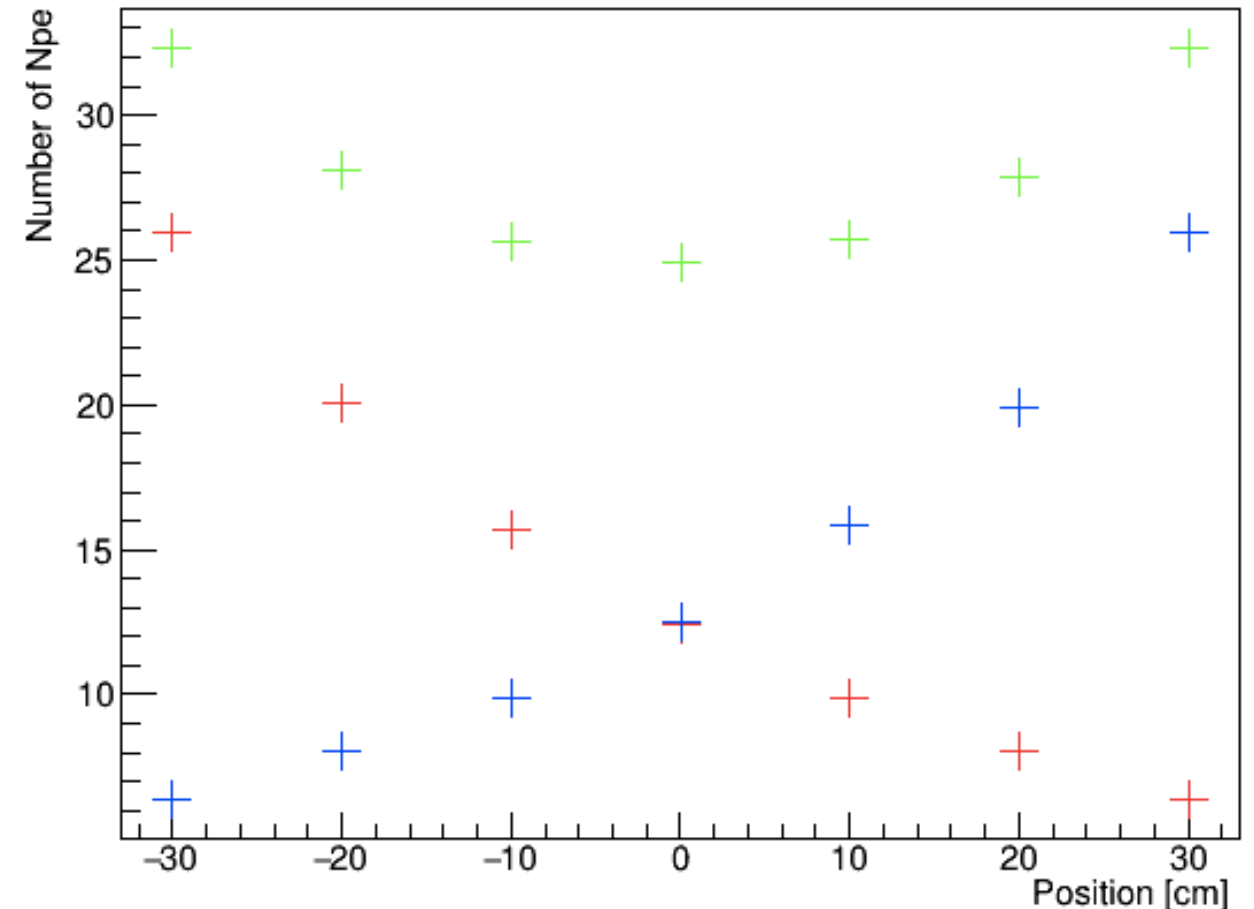
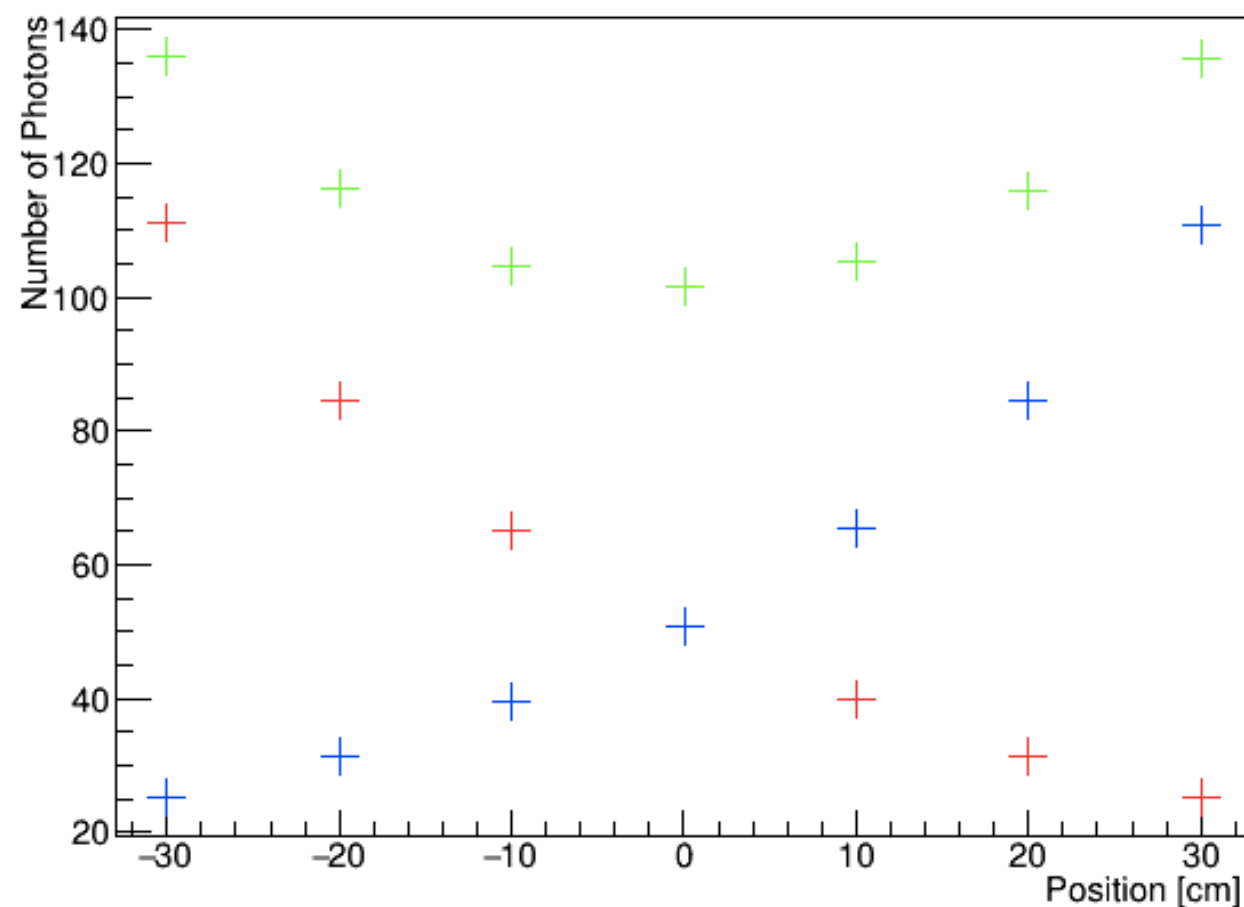
- Reflectivity of Tyvek
 - Specular Reflection : Lobe = 0.75, Spike = 0.0
 - Backscattering : Not Considering
 - Otherwise : **Diffuse Reflection**
- Quantum Efficiency
 - Data from Hamamatsu SBA, BA Curve -> **Determined by Random Number**
(ex. QE Value > Random Number : Npe Counts!)
 - Maximum QE Value of SBA : 0.35
 - Maximum QE Value of BA : 0.25

Simulation Results



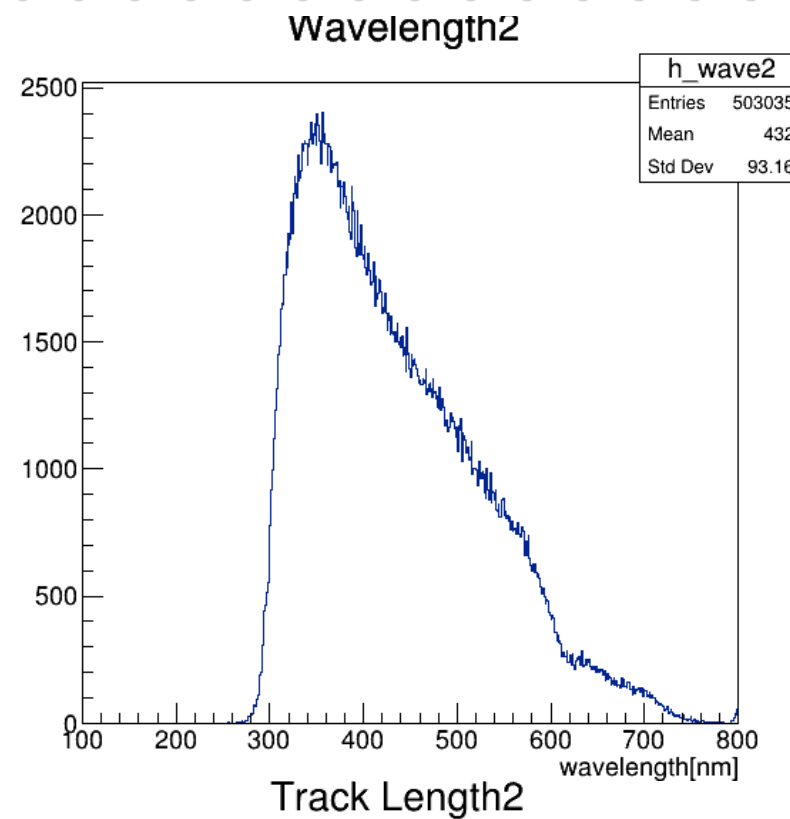
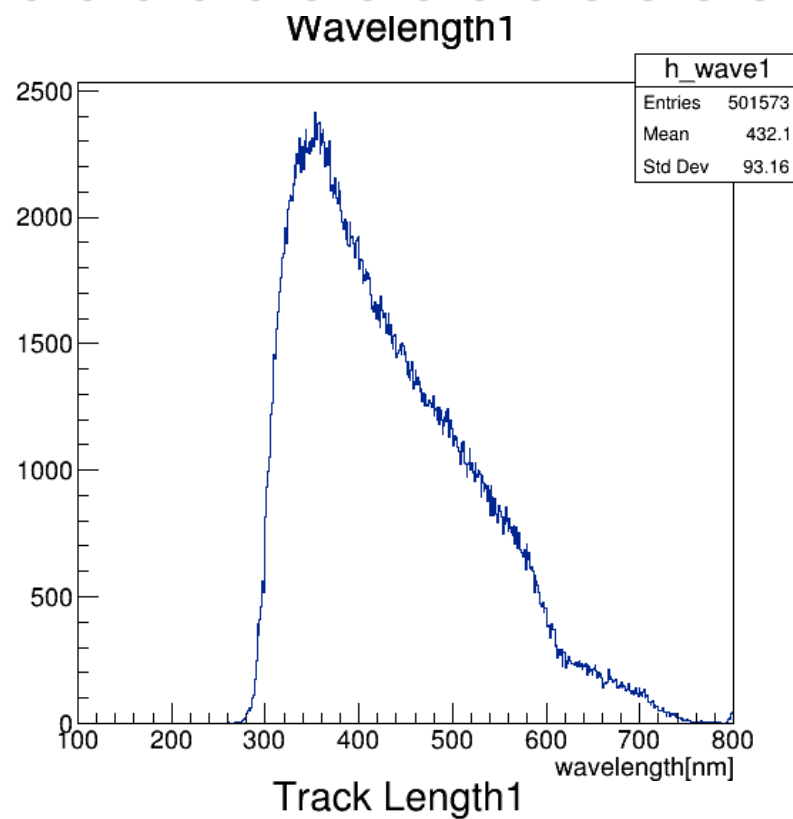
- Reproduced E05 Simulation (Difference ~ 100 Photons)
- Difference caused by Scintillation, Optical Grease etc..
- Estimated Npe : ~ 100 Npes at the Centre Position

Simulation Results

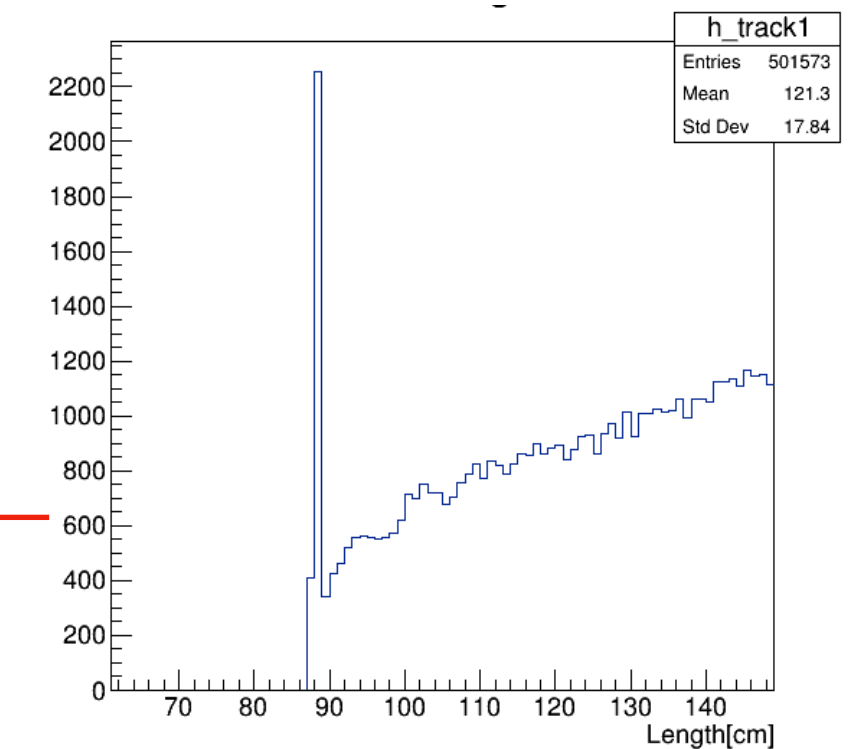
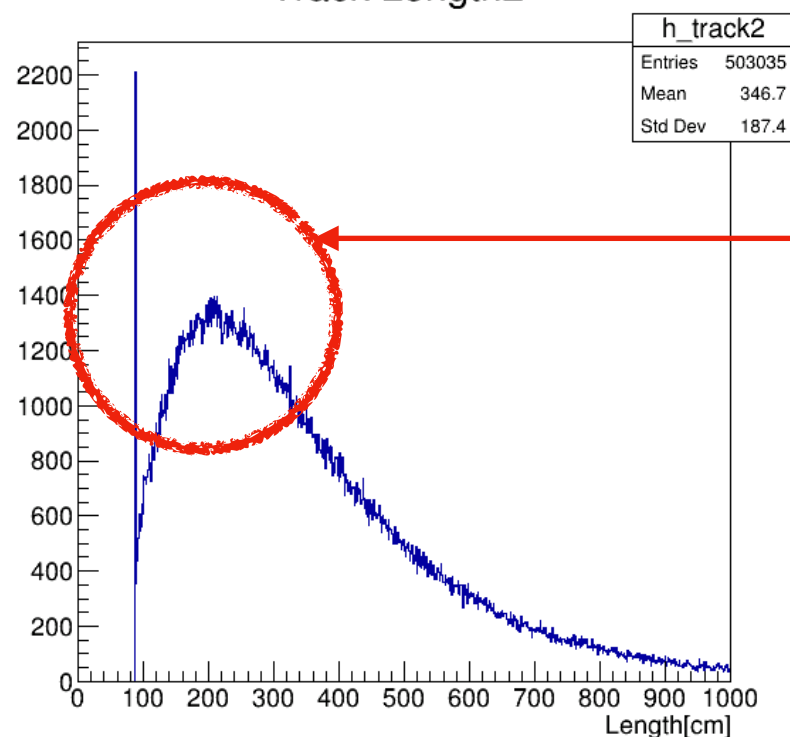
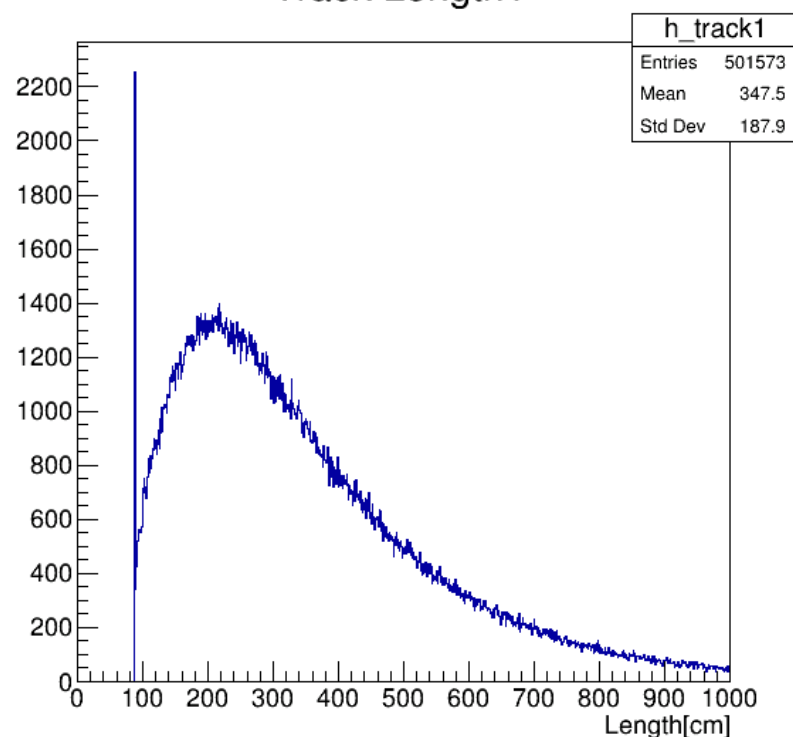


- E42 Simulation (180 cm Long)
- Estimated Npe : ~26 Npes at the Centre Position

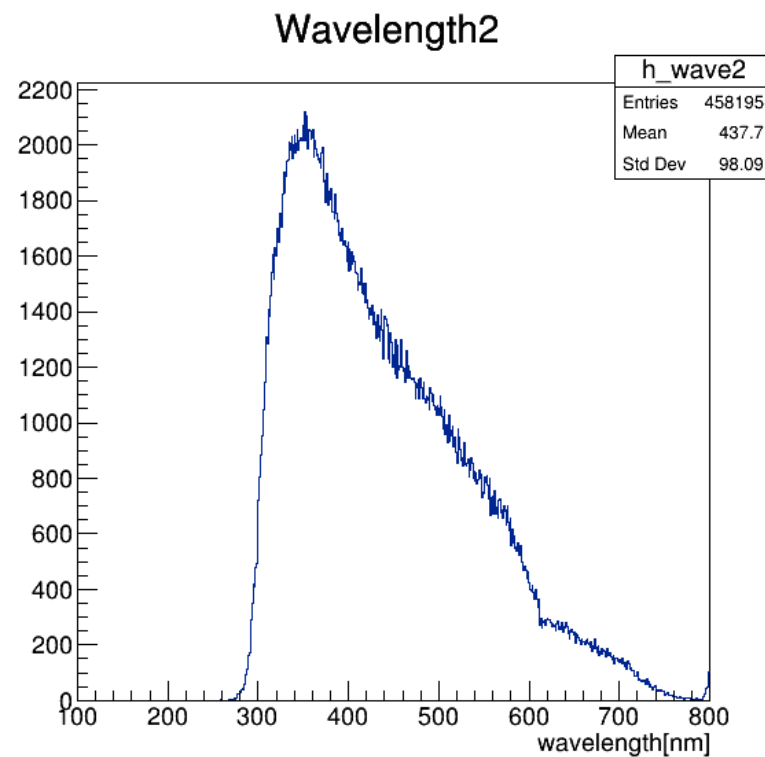
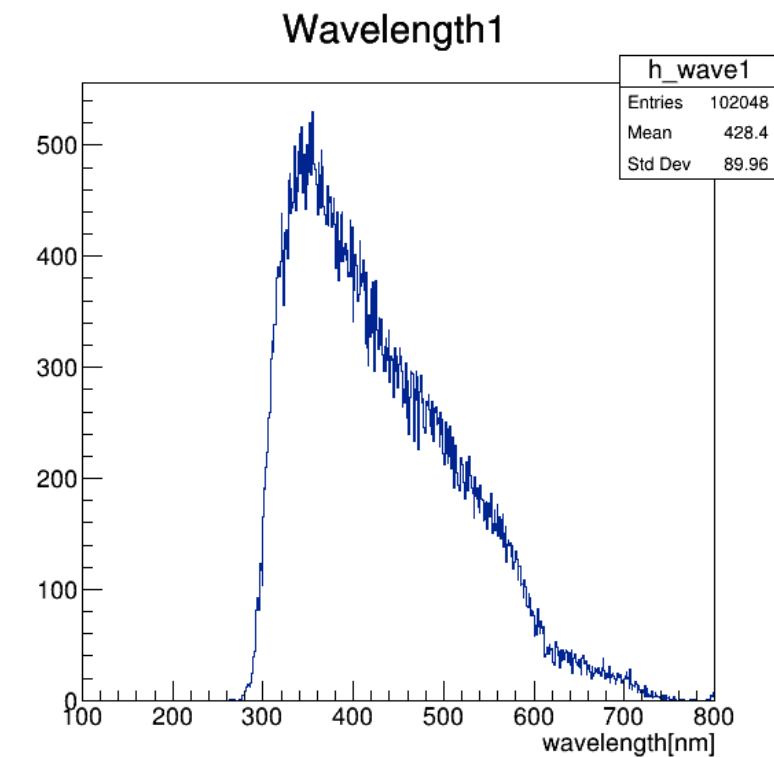
Simulation Results



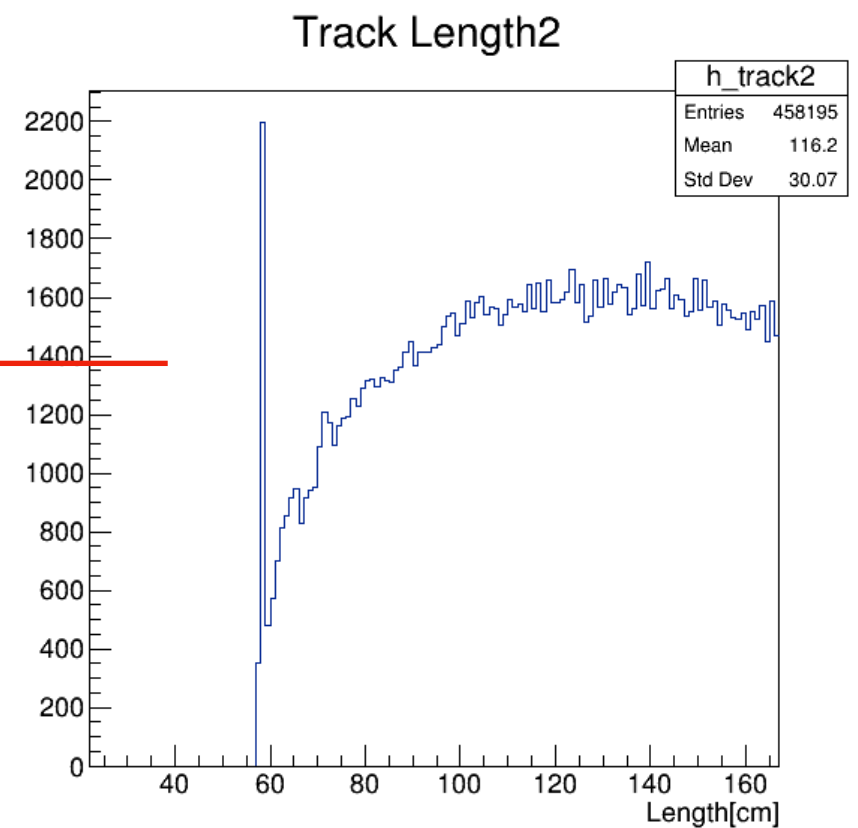
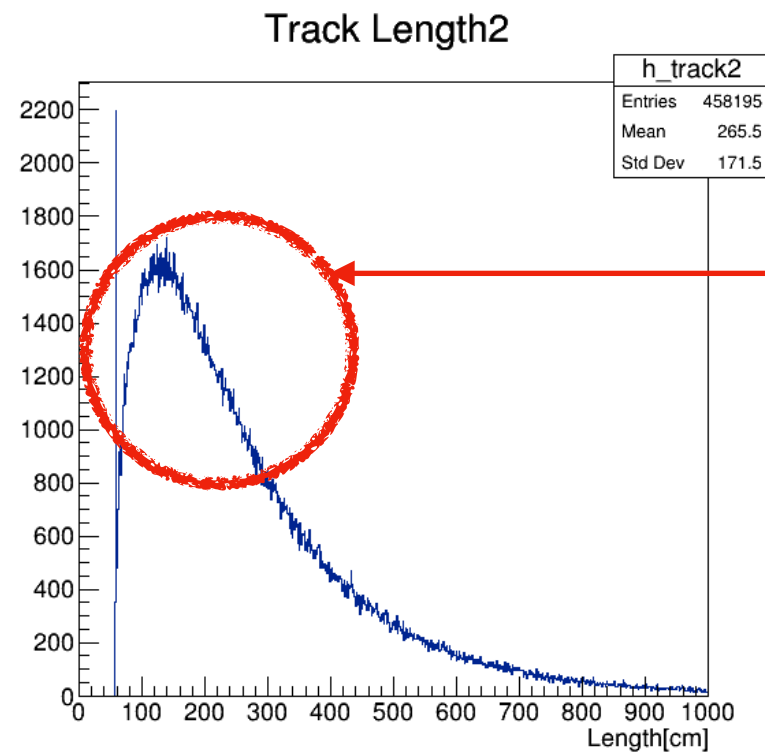
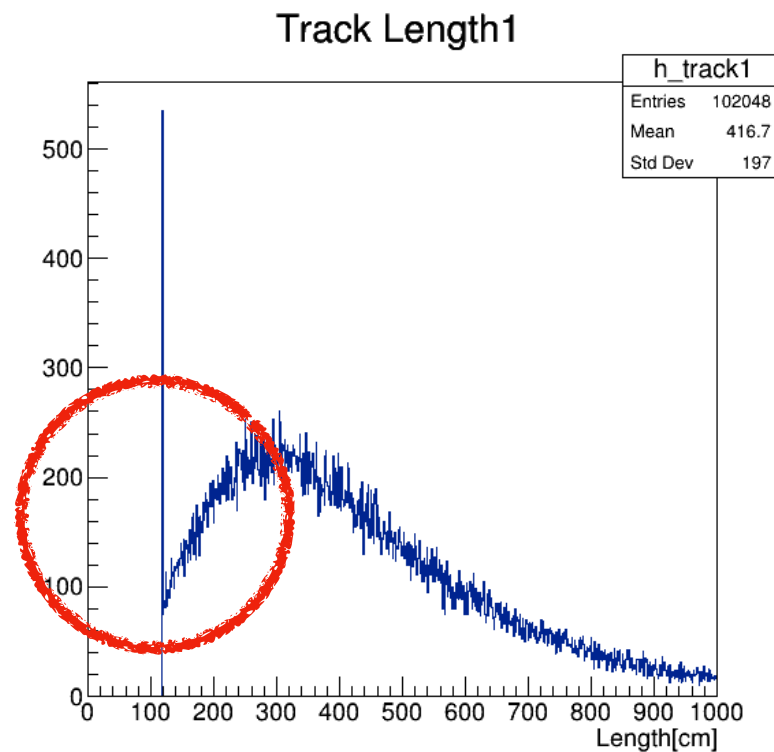
- Photons under 300 nm rarely observed.



Simulation Results



- Photons under 300 nm rarely observed.



Plans

- Cosmic Ray Test (120 cm ? 60 cm Reference Detector ?)
- Waiting for the Response... from Company