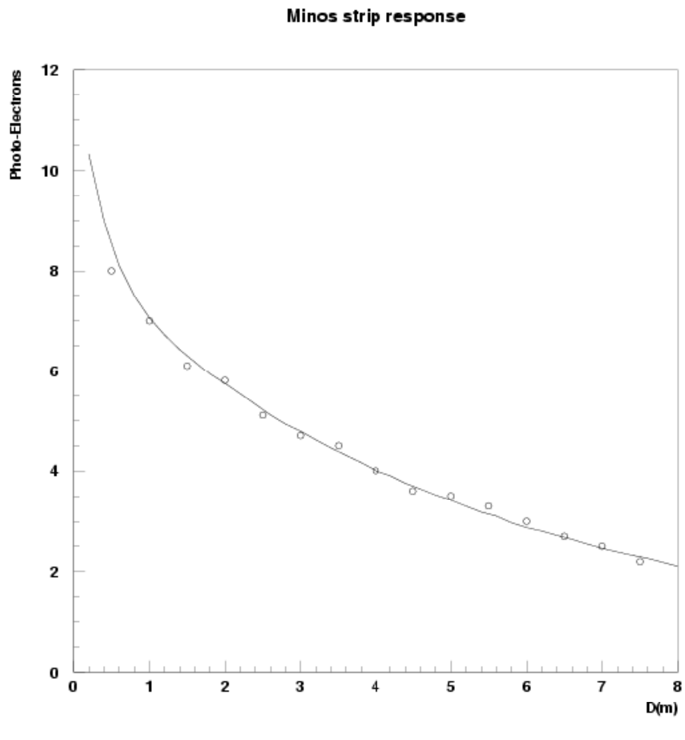
Light Yield Simulations
October 14, 2003

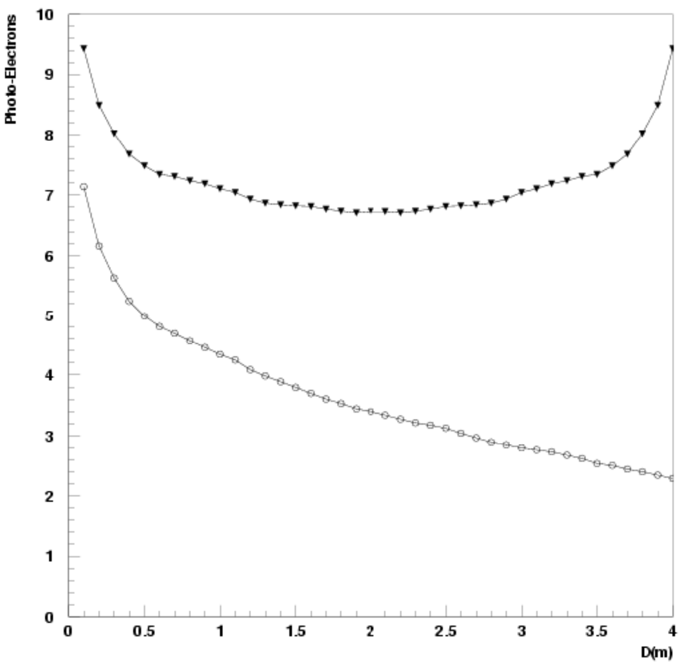
Keith Ruddick has provided us with the code he and others at Minnesota have been using to simulate photon transport and capture in scintillator and wavelength shifting fiber detectors. It has been used and modified by numerous people over the years and has been the basis for many MINOS (and now off-axis) scintillator studies. I have hacked his code to produce a version that does photon transport in triangular extrusions (code). The physics ingredients and their sources are:

- Scintillator density = 1.03 g/cm^2
- Average MIP Energy deposition = 1.68 MeV /g/cm^2
- 1 scintillation photon / 65 eV
- Emission spectrum of scintillation light (MN measurements)
- Wavelength dependent light transmission in scintillator (Dave Anderson)
- WLS fiber emission spectrum
- TiO2 doped PVC reflectivity
- Attenuation length in fiber (Bicron data + MN measurements)
- QE for Hammamatsu and APD readouts

In the code the user changes the strip base (W), height (D), fiber diameter (DFIB) and location (XFIB,YFIB), it outputs the number of p.e.'s (with errors) as a function of distance along the strip. The program can not do dead reckoning of the p.e. yield. I have used the MINOS data to tune the code to reproduce the results from the module factory (open circles). Overall normalization is 0.555, other change is modifying the absorption length in polystyrene from 10m to 12 m.



These tweaks have been incorporated into the code for studying triangular extrusions.



The plot above shows the photo-electron yield for a triangular extusion with base = 4 cm, height = 0.9 cm, fiber diameter = 1.2 mm, placed in a groove along the base.