An empirical estimation of the energy deposition in the 4th layer of the BCAL for 1 GeV and 2 GeV photons at 90^0

April 9th, 2015

Method

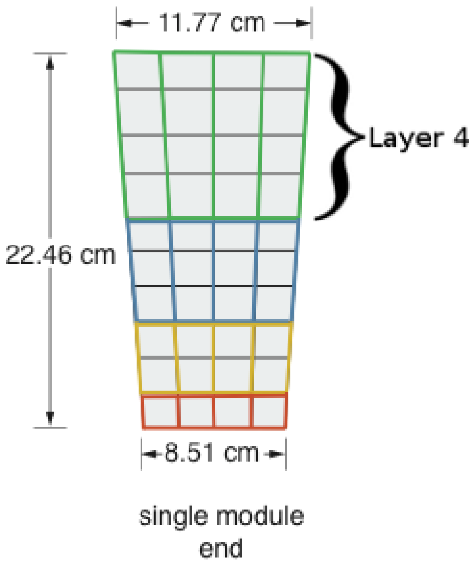
1. Estimation based on the Monte Carlo simulation used by Longo and Sestili for photons in lead glass with energies $0.1 \leq E \leq 5GeV$

   E. Longo and I. Sestili, "Monte Carlo Calculation of Photon Initiated Electromagnetic Showers in Lead Glass," Nucl. Instrum. Meth. **128** *(1975) 283*

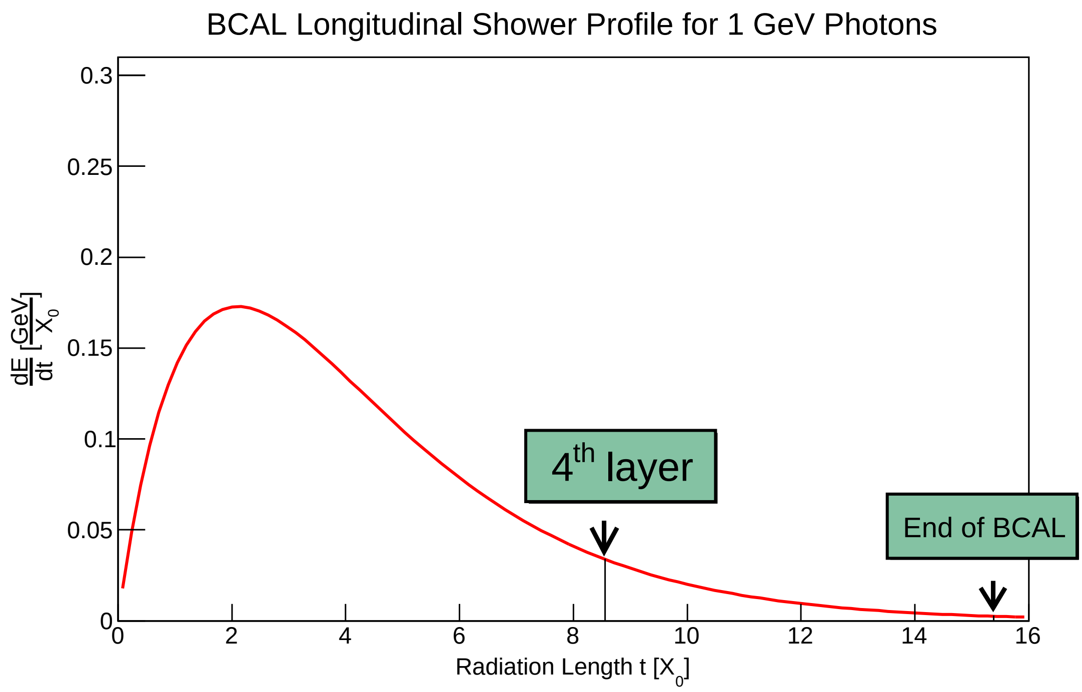
2. Energy deposition per radiation length (longitudinal shower profile):

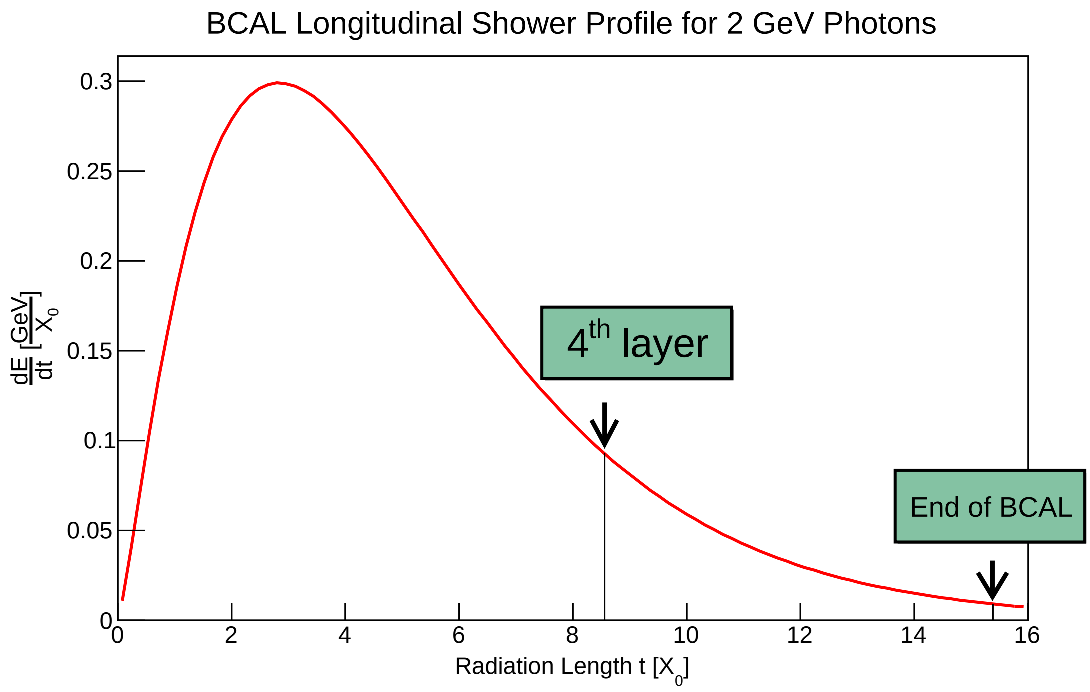
$$\frac{dE}{dt} = E_0 \beta \frac{(\beta t)^{\alpha-1} e^{-\beta t}}{\Gamma(\alpha)}$$

with: $\alpha = 1.985 + 0.430 \ln E$, $\beta = 0.467 - 0.021 lnE$



Energy Deposition

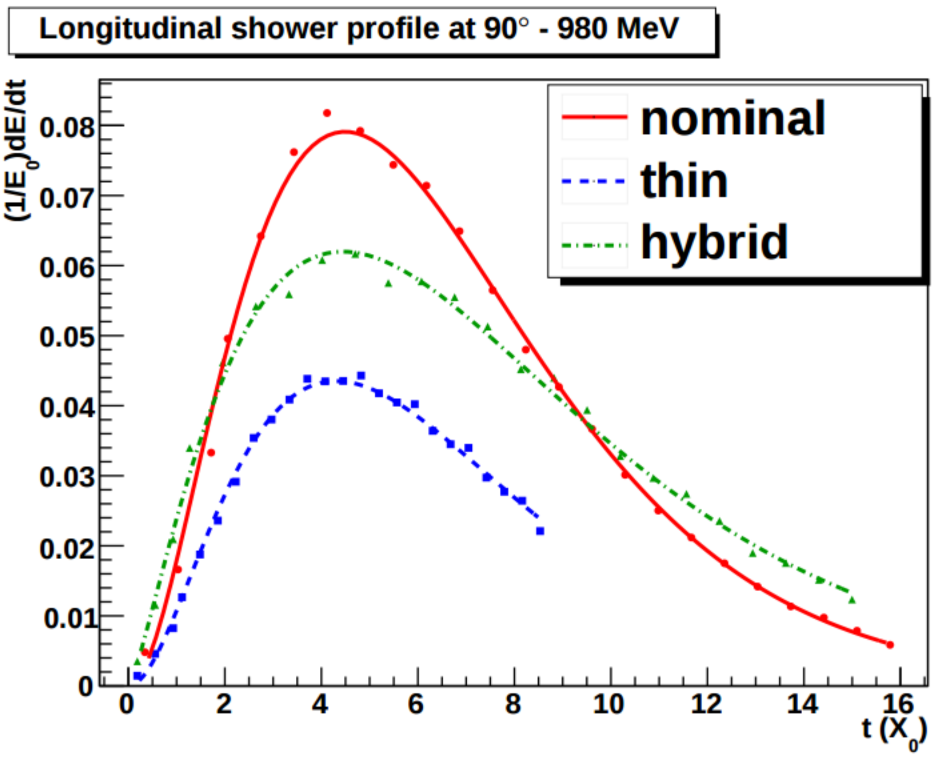




Results

Photon Energy (GeV)	Energy deposition up to layer 4 (GeV)	Percent (%)	Energy deposition in layer 4 (GeV)	Percent (%)
1	0.909	90.9	0.084	8.4
2	1.723	86.1	0.254	12.7

Results from Simulation (Zisis, Stamatis: GlueX-doc-1871-v1)



Comments:

1. The simulation gives a maximum at $\simeq 4.5X_0$ for 1 GeV photons, whereas the empirical formula gives a maximum at $\simeq 2.2X_0$
2. The empirical formula gives a longitudinal deposition of $\simeq 43MeV$ in row 7 (1 GeV photons), which is even smaller for rows 8, 9, 10. Detectable or not?

TO DO:

1. Simulation
2. Cross check with the results from Zisis, Stamatis
3. Compare with data from the October run