Landau Beta: Theory vs. Simulation

Josiah D. Kunz

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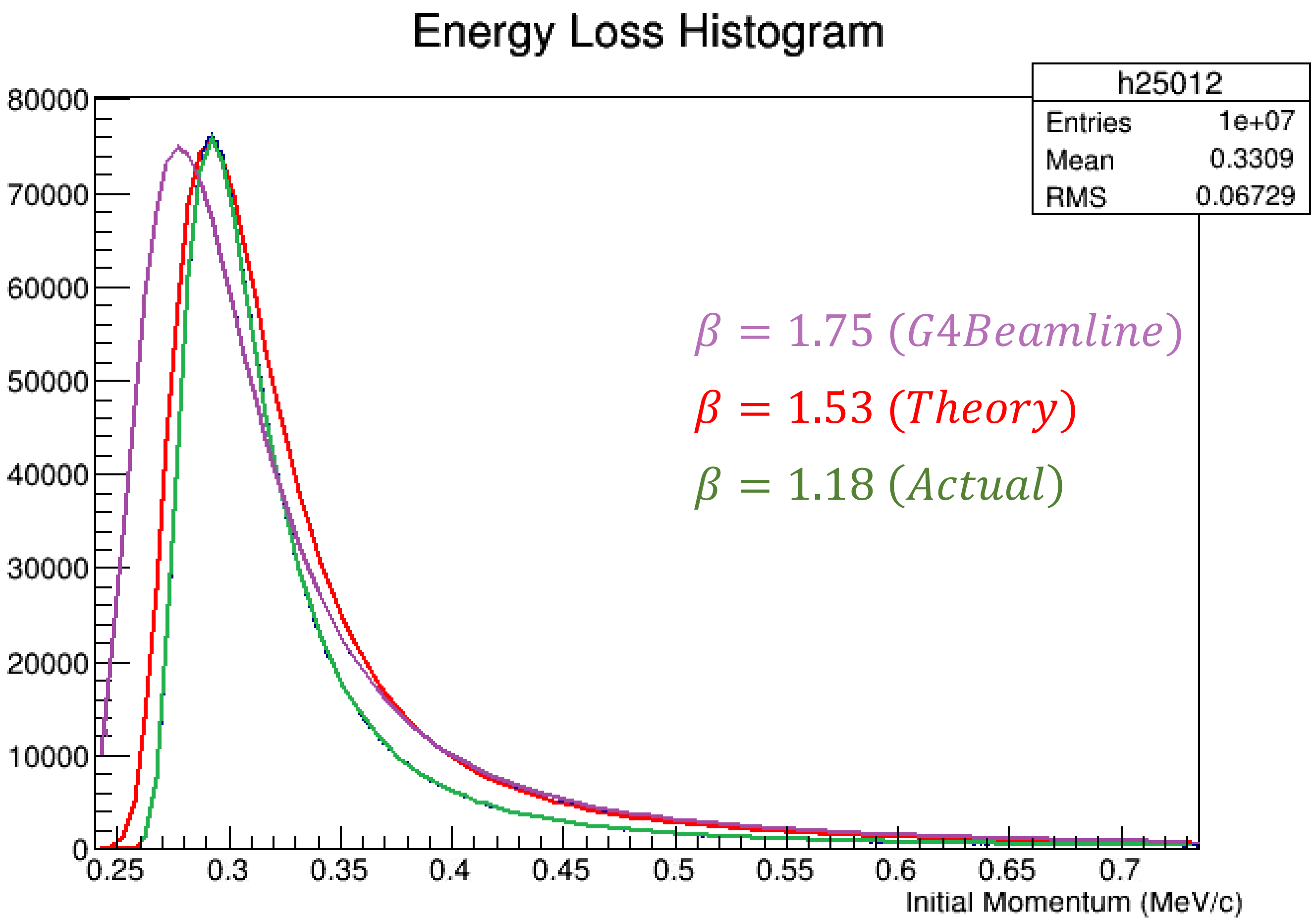
Data from $P = 250\frac{MeV}{c}, L = 12\ mm$



Model Kappa Dependence

- $\kappa = \frac{\xi}{E_{max}} \Rightarrow f(\epsilon) = \begin{cases} Landau, & \kappa < 0.01 \\ Vavilov, & 0.01 < \kappa < 10 \\ Gaussian, & 10 < \kappa \end{cases}$

- Generally, κ is like the time a particle spends inside of the absorber: it increases with L and decreases with P.

- For 12 mm LH, these constraints are equivalent to:

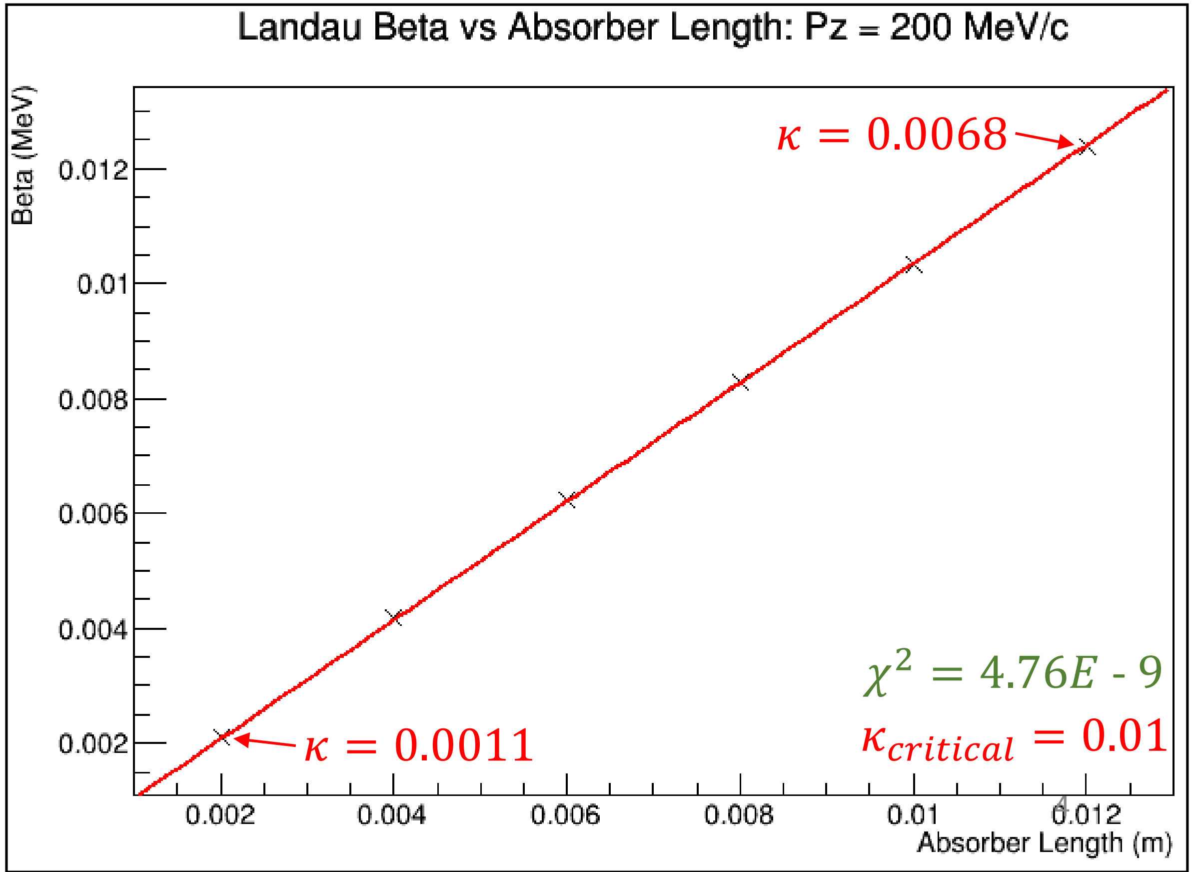
$$f(\epsilon) = \begin{cases} Landau, & 173\ MeV/c < |P| \\ Vavilov, & 24 < |P| < 173 \\ Gaussian, & |P| < 24 \end{cases}$$

β_{Landau} for 0.1 mm, 200 MeV/c ($\kappa = 6E$-6)

- $\beta_L(0.1\ mm, 200\ MeV/c) = \begin{cases} \sim 0.13, & Histogram\ Fit \\ \sim 0.103, & Extrapolation \\ \sim 0.13, & Theory \end{cases}$ [keV]

- Suspicion: our stepsize of ~1 cm is too large for theory.

Slope of β vs L is $C(P)$



Landau region: $173\ MeV/c < P$

- Liquid hydrogen: $\beta = \xi \approx 1.08 * L\left(\frac{m^2}{P^2} + 1\right)$
- $\beta = C(P) * L$
- $C(P) = k * \left(\frac{m^2}{P^2} + 1\right)$