G4Beamline Simulation Details

- Sanjeev ran G4Beamline simulation of a 3 GeV electron beam interacting with a 7 cm x 7 cm x 10 cm volume of LXe.
  - 10 cm is approximately 3.5 LXe radiation lengths
- The LXe volume was divided into 61250 2 mm x 2 mm x 2mm cubes.
- The simulation was performed with 1000 macro particles.
- The simulation records the amount of energy deposited in each 8 mm^3 cube.

Analysis Details

- The output of the simulation is the amount of energy deposited in each 8 mm^3 LXe cube measured in MeV-per-1000 macroparticles.

- The energy was scaled up for 2.5E10 electrons/bunch and 1312 bunches per train to match the ILC values.

  - This is the most demanding set of parameters for the LXe target application.

- The energy per cube was re-scaled to an energy density in J/g, which is the unit used to discuss Peak Energy Deposition Density (PEDD).

- The results are promising because the max PEDD value is below the ΔH_{mass} = 96 J/g heat of vaporization threshold.
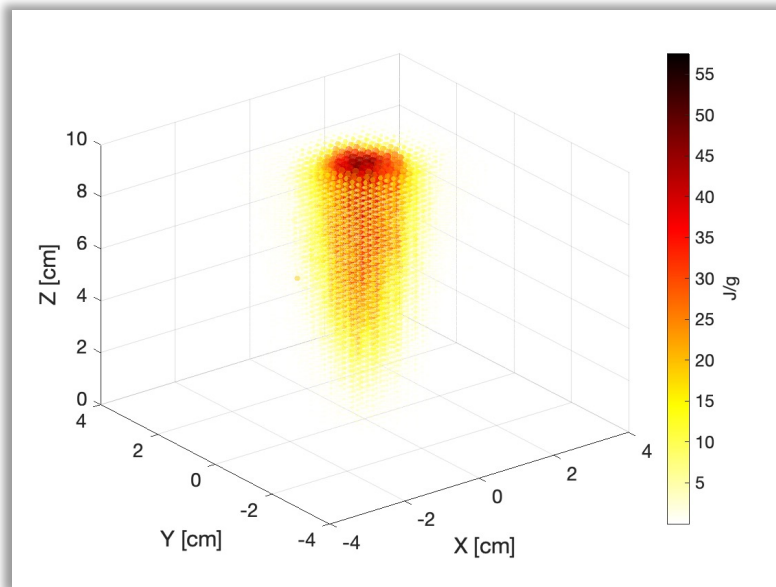
Fit Details

- Nathan performed a symbolic regression in Mathematica to produce the following fit function:
  - PEDD(J/g) = -0.15734 - 15.377*(-1.4087 + ArcSinh(1.6977 - 0.34648*z))*(1.0114 + Erf(0.44675 - 1.0009*r))
  - This function produces negative values at small z and small r. Need additional condition:
    - PEDD(PEDD<0) = 0
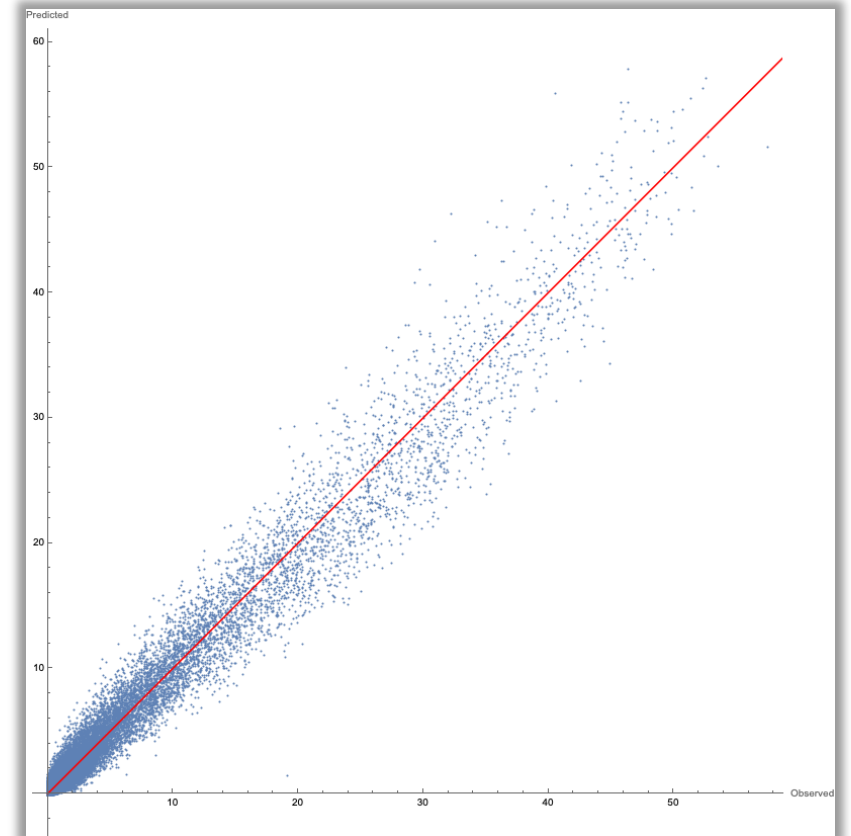
Simulation Output
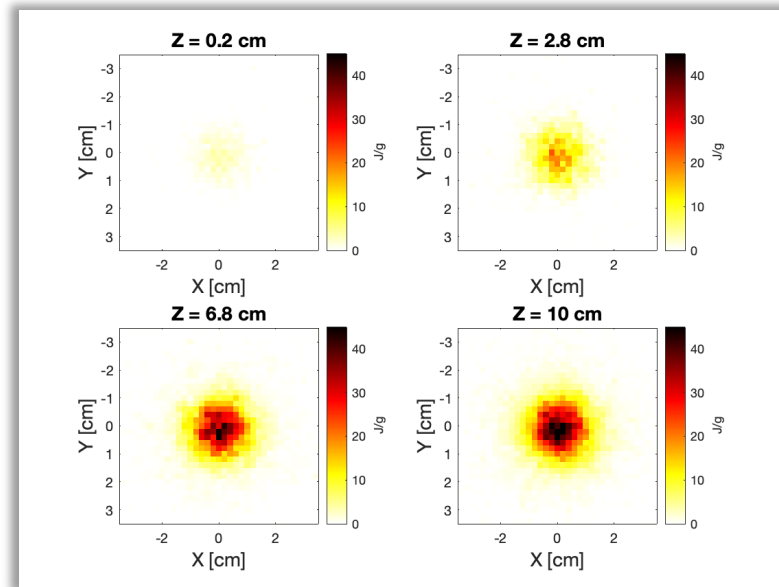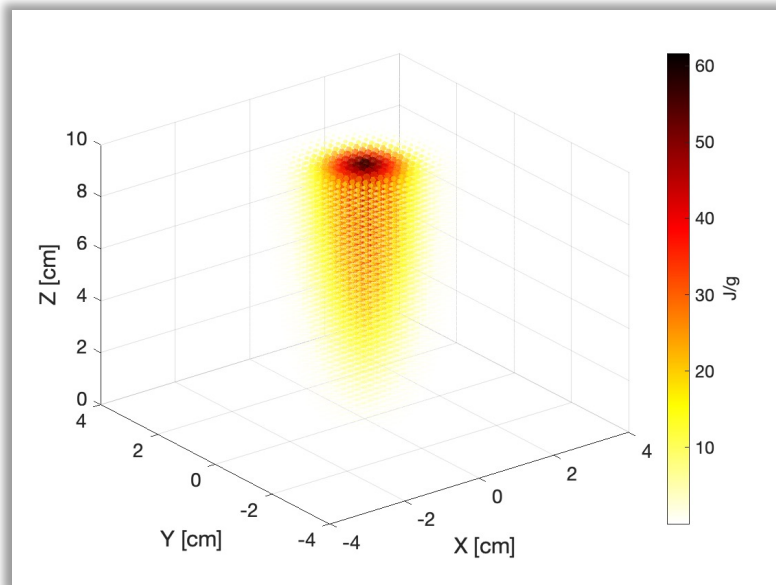
Simulation Output

Fit Result

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