Z-PINCH $(LIF)_2$-BEF_2 (FLIBE) PRELIMINARY VAPORIZATION ESTIMATION USING THE BUCKY 1-D RADIATION HYDRODYNAMICS CODE

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The material vaporization and shock characteristics of the proposed Z-Pinch rector design were simulated using the BUCKY 1-D radiation hydrodynamics code[1]. In order to model the 3-D variations in the reactor chamber design, three separate BUCKY runs were performed – one run in each of the cylindrical coordinate geometries +z, -z, and r. The simulations were run to a time of 500 ns and the chamber material characteristics were analyzed. These results were compared to a simple analytical model to verify the vaporization radii in each of the three modeled directions. The +z material vaporization has been estimated to be at a radius 62.72 cm, compared to an analytic result of 78.76 cm. The –z material vaporization has been estimated to be at a radius of 107.55 cm, compared to an analytic result of 102.76 cm. The r material vaporization has been estimated to be at a radius of 83.63 cm, compared to an analytic result of 77.57 cm.

These simulation results confirm the idea that we can model the exploding Z-Pinch target and its resulting effects on the reactor chamber using the BUCKY 1-D radiation hydrodynamics code. This model is appropriate for analysis of the Z-Pinch reactor because it is a massive structure and because most of energy coupling to surrounding structure is via x-rays (30%) rather than expanding ionic debris (4%). Furthermore, we have confirmed the viability of using three different 1-D simulations in each of the +z, -z, and r directions and merging the three results. Such an approximation to a 3-D phenomenon is valid for times where the outward blast and energy transfer remain nearly spherical.

[1]This research was conducted in support of the Z-Pinch reactor design study conducted by Sandia National Laboratory.