Development and validation of the TROLL rad-hydro code for 3D hohlraum calculations

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The ultimate configuration of Laser Mégajoule (LMJ) features 40 quadruplets irradiating the hohlraum targets with two rings per hemisphere and ten quads per ring. During the early days of LMJ operations, however, these rings will be unevenly filled as quads are progressively commissioned, and 3D effects in the hohlraums will be exacerbated by this imperfect azimuthal symmetry.

Even though NIF and Omega routinely shine 48 quads and 40 beams respectively in hohlraums, with 5-, 8- or 10-fold symmetry, the effect of residual asymmetry have been measured in several experiments. For instance, on Omega, 10-fold vs 5-fold symmetry of the inner beam spot layout on the hohlraum wall has led to subtle differences in wall motion, hohlraum energetics, and implosion dynamics. Radiography holes, or EOS patches placed on the hohlraum wall, can also be sources of 3D singularities in the dynamics of the experiment.

The development of a 3D radiation-hydrodynamics code for hohlraum calculations is therefore a high priority for progress in understanding NIF and Omega campaigns, as well as for designing and analyzing current and future LMJ experiments. The TROLL code project at CEA/DAM has delivered an initial capability for 3D lagrangian hydrodynamics coupled to Monte-Carlo, multigroup radiation transport. Laser propagation (ray-tracing), flux-limited electron heat conduction, and Non-Local Thermodynamic Equilibrium radiative properties of plasmas are handled with the same methods as already used in our 2D code, FCI2. Domain decomposition and replication strategies are used for efficient parallel calculations. Arbitrary Lagrange-Euler (ALE) hydrodynamics is mandatory for analyzing realistic experiments and is currently being developed and distributed to designers.

This talk will review the current capabilities of TROLL, and illustrate them with several experiments performed at Omega and LMJ, as part of the CEA/DAM experimental program, or in collaboration.