2D and 3D modeling of bright X-ray sources on LMJ

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Multi-keV bright X-ray sources are needed for many applications as material testing and plasma diagnostics for inertial confinement fusion. For that purpose, X-ray sources are designed using gas-filled pipes and metallic foils. These targets are expected to be illuminated by up to 12 quads of the LaserMegaJoule facility (LMJ). Here we focus on the simulations of pipes filled with xenon and foils made of silver. The radiative-hydrodynamics simulations are carried out with the 2D code FCI2 [1] and the 3D code Troll. The two codes use the same physics package to simulate radiation transfer, non-local-thermal-equilibrium atomic physics, flux-limited electron thermal conduction and laser propagation. For several target configurations, the energy emitted in multi-keV X-rays (with photon energies above 1 keV) is computed with FCI2 and Troll. The comparison of 2D and 3D results enables to quantify the effect of the asymmetric feature of the laser irradiation configuration on the X-ray fluence. Moreover, Troll provides a 3D characterization of the X-ray emission lobes that are of particular importance for radiographic purposes [2] and to optimize the location of samples for material testing within the LMJ experimental chamber.

References

[1] E. Buresi *et al*., Laser Part. Beams **4**, 531 (1986).
[2] L. Jacquet *et al*., High Energy Density Physics **9** (2013) 601-608.