2D and 3D simulations of multi-keV X-ray sources

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Bright multi-keV X-ray sources are needed for diagnostics of inertial confinement fusion and material testing. Up to now, for our program of X-ray source development we have used the 2D radiation-hydrodynamics code FCI2 [1] as laser-target design tool. We recently used a 3D code, Troll, to perform the same kind of simulations of laser-produced plasmas. We report here the first comparisons between computational results obtained with FCI2 and Troll for X-ray source simulations. The source is created from a planar thin foil of titanium illuminated by a *quad* of the LaserMegaJoule facility. In 2D and the 3D simulations, we took care to use the same physics package to simulate radiation transfer, non-local-thermal-equilibrium atomic physics, flux-limited electron thermal conduction and laser propagation. This way, we can investigate differences due to numerical schemes, 3D and 2D meshes only. The consequences of taking into account non-axisymmetric laser irradiation are also examined. To this end, we compare properties of the titanium plasma—mass density, electron temperature, ion temperature—obtained with the two codes. Are also compared the calculated X-ray power end energy radiated by the foil and the emission lobes which are of particular importance for radiographic purposes [2].

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.