Contribution ID: **3662** Type: **not specified**

P5.2017 Validation of radiation-hydrodynamic code DUED using high-precision OMEGA and NIF experiments on exploding pusher implosions

Friday, 12 July 2019 14:00 (2 hours)

See the full abstract here http://ocs.ciemat.es/EPS2019ABS/pdf/P5.2017.pdf

Exploding pusher targets, i.e. gas-filled, large aspect-ratio shells, driven by a strong lasergenerated shock, are widely used as pulsed sources of neutrons and fast charged particles. Due to small convergence ratio, exploding pushers are little affected by fluid instabilities and are weakly sensitive to irradiation nonuniformities. Development of high space- and time-resolution neutron and X-ray diagnostics allows for detailed comparison of experimental data with simulations, and for validation of simulation models. In particular, we refer to simulations with the DUED code of a series of direct-drive experiments performed at the OMEGA laser (reported in Refs [1, 2], and others currently being analyzed) and two indirect-drive NIF shots [3]. Comparisons provided evidence for the transition from a nearly fluid behaviour to a kinetic one, as the implosion Knudsen number Kn (ratio of ion mean-free path to compressed gas radius) becomes comparable or larger than one [1]. Agreement between predicted and measured observables worsens as Kn grows. Ion separation effects occur also for Kn < 1, i.e. in a quasi-hydrodynamic regime [2]. Here we show that in the quasi-hydrodynamic limit simulations reproduce DD and DT reaction yields, bang times, burn-widths, burn radii, compressed fuel radius, reaction-averaged ion temperatures. (For gas fills also containing 3He, the delay between D-3He bang time, instead, is not predicted.) Instrumental to the achievement of such an agreement was the introduction of ion viscosity, of a smooth transition between ion viscosity and artificial viscosity, of an appropriate limiter for momentum flux, of bulk fluid motion in the Monte Carlo neutron synthetic diagnostics. The sensitivity of the results to the shell opacity model has also been tested.

Work supported in part by Eurofusion projects AWP17-ENR-IFE-CEA-01 and ENR-IFE19.CEA-01.

References

[1] M. J. Rosenberg et al., Phys. Rev. Lett. 112, 185001 (2014)
[2] H. Sio et al., Phys. Rev. Lett. 122, 035001 (2019)
[3] S. Le Pape et al., Phys. Rev. Lett. 112, 225002 (2014)

pppo

Presenter: ATZENI, S. (EPS 2019)

Session Classification: Poster P5