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Hytrac: A Hydrodynamic Front-Tracking Code for the Study of High Energy Density Multi-Material Flows NATHAN JOINER, DAVE CHAPMAN, NIKITA CHATURVEDI, THOMAS EDWARDS, ADAM FRASER, NICHOLAS HAWKER, JON HERRING, NICOLAS NIASSE, JAMES PECOVER, MARTIN READ, DAN VASSILEV, ARTURAS VENSKUS, First Light Fusion Ltd. — Inertially Confined nuclear Fusion (ICF) is an established research field pursued in laboratories worldwide; most notably in the US National Ignition Facility. First Light Fusion (FLF) is exploring alternative ICF directions, with the prime focus being sustainable power generation. Hydrodynamics and mixing of materials are critical to the design of an ICF target, where high-energy densities bring additional complexities to CFD models. Interface-tracking is a challenging numerical problem in terms of accuracy and robustness. Hytrac, an AMR front-tracking code, was developed with the aim of overcoming these challenges, to enable reliable and rapid iteration of complex target geometries and optimisation. It has been verified in detail, with standard compressible fluid tests and methods, and validated against in-house experimental capability. Hytrac is parallelised using HPX, for efficient load balancing. It includes state-free tracking methods, and the more established Glimm approach. It also supports fluid nodes of arbitrary order, includes thermal conduction, thermal nonequilibrium, advanced physics, exact and approximate Riemann solvers, and several algorithms for space reconstruction and explicit time solution

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