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Simulations of laser-driven ion acceleration using the quasi-cylindrical PIC code CALDER-CIRC and application to the PETAL facility XAVIER DAVOINE, CEA, DAM, DIF, F-91297 Arpajon, France, NATHALIE BLANCHOT, CEA, DAM, CESTA, BP 12, Le Barp 33405, France, LAURENT GREMILLET, CEA, DAM, DIF, F-91297 Arpajon, France, EMMANUEL D'HUMIÈRES, CELIA, UMR 5107, Bordeaux Univ.-CNRS-CEA, Talence, France, PAUL-EDOUARD MASSON-LABORDE, CEA, DAM, DIF, F-91297 Arpajon, France, DIDIER RAFFESTIN, CELIA, UMR 5107, Bordeaux Univ.-CNRS-CEA, Talence, France — Realistic simulation of ion acceleration in the TNSA regime is very challenging. Indeed, the hot electrons' transverse expansion, which strongly affects the dynamics and spatial distribution of the accelerating sheath field, can only be correctly described in a 3D geometry. Despite this limitation, 2D PIC simulations often appear to be the only reasonable option due to the excessive computational cost of 3D simulations. As an alternative, we investigate here the benefit of using the quasi-cylindrical PIC code CALDER-CIRC to describe TNSA over experimentally relevant scales. This code enables reduced 3D simulations at a computational cost close to that of 2D Cartesian simulations. To illustrate both its potential and limitations, we will compare simulations of a typical TNSA setup carried out using CALDER-CIRC and the 2D and 3D Cartesian versions of CALDER. Moreover, we will report on a CALDER-CIRC simulation of TNSA under conditions relevant to the PW PETAL laser ($\sim$ 450 J energy, 600 fs pulse duration, 50 μm focal spot). The effect of the laser prepulse on the relativistic laser interaction and the acceleration processes will be analyzed.

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