Nonuniform Mesh Based hPIC Code for Efficient Scrape-Off-Layer Computation MD FAZLUL HUQ, University of Illinois at Urbana-Champaign, VIGNESH VITTAL-SRINIVASARAGAVAN, ONKAR SAHNI, Rensselaer Polytechnic Institute, DAVIDE CURRELI, University of Illinois at Urbana-Champaign — Uniform structured meshes are inefficient in capturing the high plasma gradients in a Scrape-Off-Layer (SOL) spanning a large region including the magnetic and electrostatic sheaths forming in front of material surfaces. In order to resolve the large gradients across the plasma sheath region at a reduced computational cost, we have implemented an approach using a non-uniform mesh in the hPIC Particle In Cell code using the Parallel Unstructured Mesh Infrastructure (PUMI) library. The mesh non-uniformity requires to update not only the field solver, but also the PIC weighting and interpolation procedures in order to avoid artificial forces. On top of the non-uniformity, the algorithm allows to split the entire plasma region into a number of segments hierarchically, for local mesh grading and refinement. Currently, we employ up to 3 segments arranged in a logical order including a segment with a uniform mesh and two segments using boundary-layer meshes with mesh size following a geometric gradation biased at the left and right ends. We report performance measurements on the code, showing that, thanks to the new mesh, the code can resolve a region of Scrape-Off-Layer much larger than with a corresponding uniform mesh.

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