

Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Integrated test cases for the kinetic neutrals code Eunomia¹

COURTNEY JOHNSON, Rowan University, J.A. SCHWARTZ, R.J. GOLDSTON, Princeton Plasma Physics Laboratory — B2.5-Eunomia is a code that couples kinetic neutral and multifluid plasma models. Eunomia [1] was developed as a replacement for Eirene with a focus on linear geometries. This makes it suitable for modeling experiments such as those involving linear plasma generators like Magnum-PSI; e.g. Eunomia can simulate passing a Magnum-PSI plasma beam through a chamber filled with neutral lithium gas as an experiment towards the development of the lithium vapor box divertor. Prior to this work, Eunomia did not possess a suite of integrated tests. We developed regression test cases to verify properties such as the velocity invariance of the collision operation. In order to test this, a new boundary condition for flowing gas was added. This boundary condition can be used to validate the code against analytic solutions as well as to model the neutral particles that flow adjacent to a plasma beam. In addition to the development of test cases, parts of the code have been modified to improve readability and vectorization.

[1] Wieggers, Rob. “B2.5-Eunomia simulations of Pilot-PSI.” PhD Thesis, Dutch Institute for Fundamental Energy Research, 2012.

¹This work was made possible by funding from the Department of Energy Workforce Development for Teachers and Scientists (WDTS) for the Summer Undergraduate Laboratory Internship (SULI) program. This work is supported by the US DOE Contract No. DE-AC02-09CH11466.

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Date submitted: 12 Jul 2019

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