# Computation of SOL Flows Using Extended MHD NIMROD Code

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The SOL width and associated particle and heat loads on the tokamak wall and divertor plates are among high priority topics in fusion research because of unfavorable projections of heat and particle loads in ITER. Several physics models that utilize fundamentally different physics assumptions have been recently developed. In spite of differences, the models can reproduce some important experimental observations such as $1/I_{\rm pl}$ scaling for the SOL width. In order to resolve the differences between the models and the role of different physics effects in different plasma parameter regimes, careful comparison of the models is needed. Previously, we have predicted the SOL width using the neoclassical approximation in the kinetic neoclassical XGC0 code and we have investigated the role of different assumptions for plasma edge anomalous transport on the SOL width predictions [1]. In this study, we investigate the SOL flow predictions using the MHD formalism. Evolving the Grad-Shafranov solutions for several DIII-D discharges in the extended MHD NIMROD code [2], we demonstrate that the MHD solution allows narrow SOL flows in the separatrix vicinity that resemble the experimental observations. Various MHD approximations and their role on the SOL flow predictions are investigated including the role of the plasma resistivity, gyro-viscosity, two-fluid effects and the effects of neutrals. It is shown that the SOL flows are significantly below the experimental values when predicted using the resistive MHD with the realistic Spitzer-like resistivity profiles. The SOL flows are found to scale with the resistivity. The flows can also significantly increase and reach experimental relevant values when the gyro-viscosity and two-fluid effects are included.

1. A.Y. Pankin *et al.* Phys. Plasmas **22** (2015) 042511.

2. C.R. Sovinec *et al.* Jour. Comp. Physics, **195** (2004) 355.

* This research is supported by US Department of Energy.