Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Self-consistent calculation of the radial electric field with ion orbit loss mechanism by using BOUT+[1] N.M. LI, DLUT, X.Q. XU, LLNL, T.M. WILKS, MIT, B. GUI, X.T. XIAO, ASIPP, J.Z. SUN, D.Z. WANG, DLUT — The steady state radial electric field (Er) can be self-consistently calculated by coupling a plasma transport model with a quasi-neutrality constraint and the vorticity formulation within the BOUT++ framework. Based on the experimentally measured plasma density and temperature profiles inside the separatrix, the effective particle and heat diffusivities can be interpreted from the set of plasma transport equations. The effective diffusivities are then extended into the scrape off layer (SOL) to calculate the plasma density, temperature and flow profiles across the separatrix into the SOL. With plasma quantities defined in both the pedestal and SOL regions, the electric field can be calculated across the separatrix from the vorticity equations with a sheath boundary condition, and the cross-field drifts are shown to play a significant role by inducing a net flow in both the edge and the SOL region. The sheath boundary condition acts to generate a large, positive Er in the SOL, which is consistent with experimental measurements. Furthermore, the particle, momentum, and energy ion-orbit losses are incorporated into the transport equations and shown to impact intrinsic rotation, and therefore the self-consistent Er calculation.

[1]Prepared by LLNL under Contract DE-AC52-07NA27344 and the CSC (No. 201606060097).

N.M. Li
DLUT

Date submitted: 13 Jul 2017 Electronic form version 1.4