Interpretive Modeling of Simple-as-Possible-Plasma Discharges on DIII–D Using the OEDGE Code*

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To help identify the controlling processes in the edge, an iteratively coupled code, OEDGE, is being developed and benchmarked against well-diagnosed, simple plasmas; OEDGE: "Onion-Skin Modeling + EIRENE + DIVIMP for edge analysis." EIRENE is a neutral hydrogen Monte Carlo code developed by D Reiter, KFA Jülich. DIVIMP is an impurity neutral and ion Monte Carlo code. An Onion-Skin Modeling, OSM, code is used to provide the "plasma background" needed by the Monte Carlo codes, by solving the 1-D, along-**B**, plasma (fluid) conservation equations using across-**B** boundary conditions from experiment, e.g. I_{sat}^{+} and T_e across divertor targets from Langmuir probes, to produce a 2-D solution for the edge plasma. Source terms in the OSM's conservation equations are provided by the Monte Carlo codes.

In February 2001 a set of "Simple-as-Possible-Plasma," SAPP, (L-mode, attached), comprehensively-diagnosed discharges was run on DIII-D. OEDGE results for these SAPP discharges are presented here, specifically for the lowest density SAPP shots, the line average density, $n_e = 2.5\text{x}10^{19}\ \text{m}^{-3}$, where the plasma was attached at both inner and outer targets, making for a particularly simple edge. In total 11 identical shots were run to maximize data collection. The objective is to establish, first, if the experimental data are consistent and, second, if the controlling physics processes have been included in the model – starting with the simplest case possible.

Combining data from repeat shots produced particularly well defined radial profiles of n_e and T_e at different poloidal locations, using different diagnostics: (a) across the targets located at the bottom of the vessel (built-in Langmuir probes), (b) from just above the outer target up to the X-point (Divertor Thomson Scattering, DTS), (c) just below the outer mid-plane (fast reciprocating probe), (d) near the top of the machine (main Thomson system). These data have been compared using OEDGE. T_e: quite close agreement, to $\leq 20\%$, was found amongst the different diagnostics and locations, with the exception of some of the target probe and DTS values: the probe and DTS agreed closely over most of the target, but probe values were larger than those of the DTS near the strike point, a discrepancy whose resolution is being pursued. The otherwise consistent T_e-profiles indicate that the EFIT-calculated location of the separatrix is very reliable for these conditions, to $\pm\ 0.01\ \psi_n$ (normalized magnetic flux coordinate). n_e: agreement for all diagnostics and locations was also to $\leq 20\%$, except near the separatrix where the OSM-calculated density was higher than measured by the fast probe and main Thomson by ~ 1.7X. This is interpreted as evidence of drift effects in the SOL – probably the poloidal E_{radial} x B drift – on parallel pressure balance.

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