ADVANCED TOKAMAK MODELING BASED ON DIII-D ECCD EXPERIMENTS AND FLUX EVOLUTION MEASUREMENTS*

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The objective of this work is to develop realizable advanced tokamak scenarios based on experimental results from high performance negative central shear (shots 99411,103322) and QDB (quiescent- elm free,double barrier,shot 103818) discharges in DIII-D.

The study is carried out under a new collaboration between GA and LLNL in transport modelling, the Onetwo/Corsica project. The collaboration is based on the GA transport code ONETWO and LLNL's Corsica which results in increased modeling capabilites. Improvements in the resolution of magnetic reconstruction techniques in EFIT and refined accuracy in the DIII-D MSE diagnosticsignificantly enhance our ability to reliably design ECCD and beam current drive scenarios for DIII-D.

An interesting application of ONETWO/Corsica is the use of time dependent EQDSK equilibrium data files from experiment (TDEM) for determination of non inductive current profiles. The TDEM method allows us to treat the total and ohmic currents as experimentally observed quantities thus making an experimental determination of the non-inductive current profile possible. In H-mode discharges the formation of an edge transport barrier leads to significant edge bootstrap current which can drive MHD instabilitites such as ELMs. In these cases the theoretically calculated edge bootstrap current can be significantly larger than TDEM methods indicate. This may be due to uncertainty in our ability to model such discharges accurately because of the kink unstable nature of the predicted edge current profile. The stability packages in the new ONETWO/Corsica will be used to evaluate the effects of ELMS on the predicted non-inductive current profiles.

Control of the ITB and, in particular, its stability during the long time evolution of AT discharges is addressed in this work. With density profiles fixed in space and time we introdce dynamic transport barrier modeling with the GLF23 confinement model. This confinement model has had some success in modeling DIII-D discharges[1] and consequently represents our best choice for DIII-D AT scenario development at this time. We are also exploring scenarios for use of ECH/ECCD to control the QDB mode. Using measurements of electron and ion transport coefficients the ability to modify and control the q profile in QDB discharges with various amounts of ECH/ECCD power are modeled using the ray tracing code TORAY-GA.

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[1]J.E. Kinsey, *et al*., Phys. Rev. Lett. **86**, 814 (2001).