TH/5-1: M. Honda et al., *IAEA Fusion Energy Conference 2014 at Saint Petersburg, Russia*

Integrated modeling of toroidal rotation with the 3D non-local drift-kinetic code and boundary models for JT-60U analyses and predictive simulations

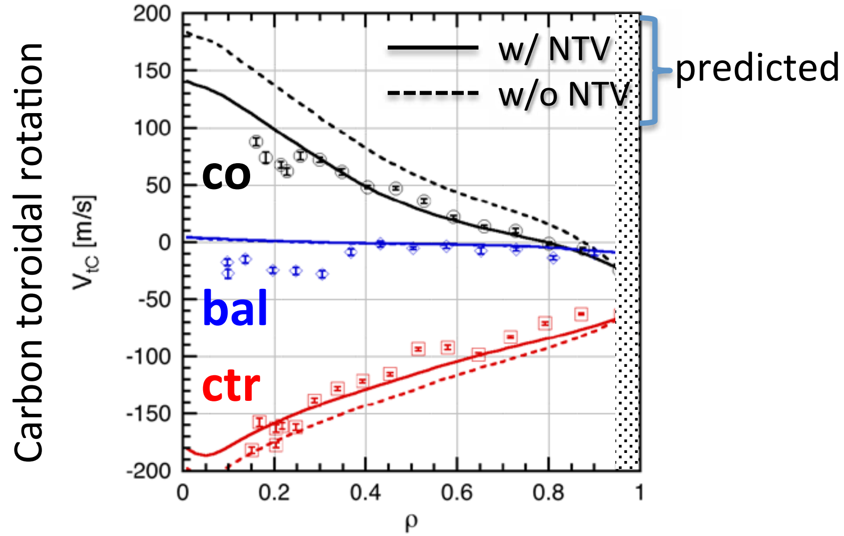
Motivation

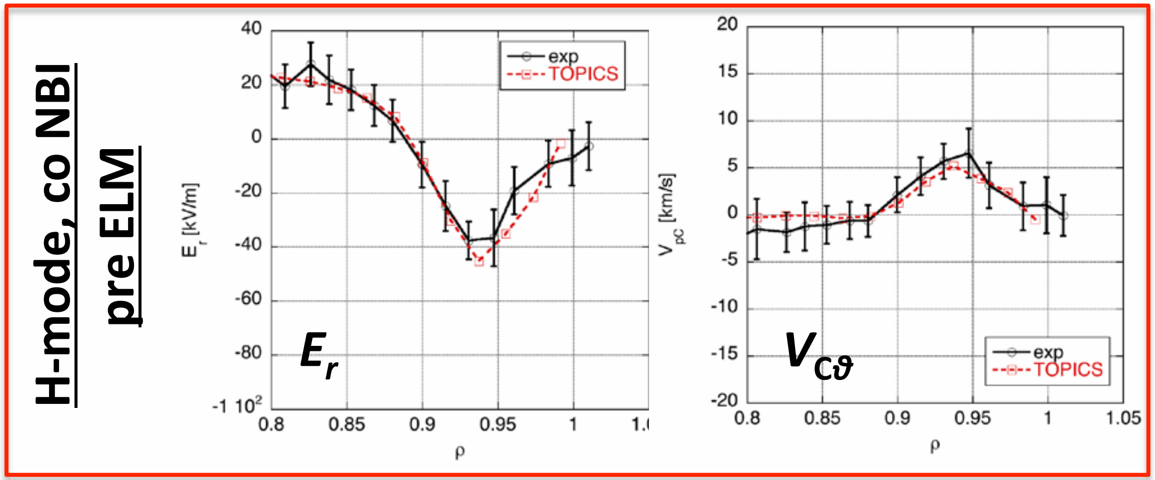
1) 3D perturbed ***B*** field is present in tokamaks, due to toroidal field coils, ferritic steel tiles (FSTs) and so on.
2) It creates not only the fast-ion jxB torque but also the neoclassical toroidal viscosity (NTV) torque.
3) Analyzing and predicting toroidal rotation in present and future devices, we estimate these torque effects by developing the framework of the integrated transport code **TOPICS** coupled with the drift-kinetic code **FORTEC-3D** and the 3D equilibrium code **VMEC**.
4) The strong momentum pinch necessitates a modeling of a boundary condition for rotation simulations.

Chief results of the JT-60U analyses and the modeling:

- For a typical NB-heated L-mode shot w/ the FSTs, including the NTV reduces the total torque by ~25-45%.
- The NTV depends on the radial electric field E_r and improves the reproducibility of toroidal rotation (left fig.).
- The neoclassical transport model successfully reproduces E_r and $V_{C\vartheta}$ in the edge region (right figs.).
- Based on the JT-60U observation that grad E_r=0 at the separatrix, a boundary model for rotation is developed.
- Toroidal rotation is predicted in the ITER Hydrogen L-mode plasma, using the NTV and the boundary model.

Role of the NTV





Carbon poloidal rotation and E_r are reproduced even in H mode!