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Towards fully non-inductive operation in NSTX-U[1] FRANCESCA POLI, ROBERT ANDRE, NICOLA BERTELLI, GARY TAYLOR, Princeton Plasma Physics Laboratory — The start-up, ramp-up, and sustainment of a tokamak plasma utilizing little to no induction from a central solenoid is a major challenge in magnetic fusion. Because of the scientific and operational challenges, the problem is best solved by employing an iterative loop between experiment and simulation where validation plays a critical role in the improvement of modeling and in the projection to new experiments. On NSTX-U, high harmonic fast waves (HHFW) and NBI are combined to ramp the plasma current non-inductively. Current profile control is critical in order to attain the desired target and avoid the peaking of profiles at start-up and ramp-up that are conducive to ideal MHD instabilities. An interesting synergy is observed in the simulations between the HHFW and Electron Cyclotron (EC) waves. The addition of EC wave heating can in fact significantly increase the effectiveness of the RF power and relax the requirements on the total level of power that must be coupled to the start-up plasma. The feasibility of EC/EBW startup is discussed. This work describes and revisits these simulations in light of the first experimental campaign on NSTX-U, with emphasis on the limitations in our modeling capabilities.

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