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Modeling of fully non-inductive startup and ramp-up towards development of advanced scenarios in NSTX-U[1] FRANCESCA POLI, ROBERT ANDRE, NICOLA BERTELLI, STEFAN GERHARDT, CHARLES KESSEL, PPPL, ROGER RAMAN, Univ. Washington, GARY TAYLOR, PPPL — The National Spherical Torus eXperiment Upgrade (NSTX-U) will operate at maximum axial toroidal field of 1T, maximum plasma current Ip of 2MA, and pulse length up to 5 seconds. Three additional neutral beam injection (NBI) sources, with tangency radii of 110-130cm, will provide significant off-axis current drive. Time-dependent free-boundary TRANSP/ISOLVER simulations have self-consistently modelled fully non-inductive (NI) Ip ramp-up. Non-solenoidal startup with Coaxial Helicity Injection (CHI), simulated with TSC, provides the initial plasma condition for the simulations. RF waves are injected to prepare target plasmas where NBI can be used with minimal power/particle losses. 1MW of Electron Cyclotron (EC) power can rapidly heat CHI plasmas up to 1keV, and 4MW of High Harmonics Fast Wave power can drive 350kA. With 10MW of NBI, NI Ip ramp up to 900kA is possible in 2.5s. In this paper we discuss how the time of the NBI sources and the NBI source energy affect the profile evolution and access to advanced target scenarios in NSTX-U. These simulations provide a reference operational space for NI ramp-up experiments during the first two years of operation of NSTX-U, as well as guidance for the EC accessibility and use for optimization in non-solenoidal startup experiments.

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