Diagnostic Neutral Beam and Beam-Based Diagnostic Development to Study Non-Inductive Startup Techniques\textsuperscript{1} A.K. KEYHANI, M.T. BORCHARDT, R.J. FONCK, B.T. LEWICKI, M.D. NORNBERG, G.R. WINZ, University of Wisconsin-Madison — An 80 kV, 4 A, $H_0^+$ beam is being developed as a plasma diagnostic tool for studying non-inductive tokamak plasma startup methods in the \textit{URANIA} experiment. The new diagnostics will provide measurements of equilibrium magnetic fields and possibly field fluctuations, ion temperatures, and plasma density profiles. These beam-based diagnostics will address important aspects of helicity injection startup and sustainment. These include examining dissipation mechanisms during helicity drive (\textit{e.g.} anomalous ion heating through magnetic reconnection, anomalous resistivity, etc.), the role of impurities, and plasma magnetic field structures. A washer stack arc plasma source is implemented as the source of $H_0^+$ for the DNB. Its plasmas are characterized with a double tip Langmuir probe, a spectrometer, and measurements of the arc voltage and current. Initial results show that stable density plasmas ($n_e \approx 10^{17}\text{m}^{-3}$) with steady electron temperatures of 0.5–4 eV can be generated by the source, which are expected to produce a full energy species fraction of greater than 80%. A novel 80 kV resonant DC-DC converter power supply has been constructed and is being optimized for minimal output voltage ripple. Initial tests have produced a 10 ms pulse at 40 kV.

\textsuperscript{1}Work supported by US DOE grants DE-FG02-96ER54375 and DE-SC0019008.

Michael Bongard
University of Wisconsin-Madison

Date submitted: 28 Jun 2019

Electronic form version 1.4