Transient CHI Research on PEGASUS-III

R. Raman,[1] K. Morgan,[1] M.W. Bongard,[2] S.J. Diem,[2] R.J. Fonck,[2] A.C. Palmer,[2]
J.A. Reusch,[2] J.D. Weberski,[2] G.R. Winz,[2] F. Ebrahimi[3]

1–University of Washington-Seattle
2–University of Wisconsin-Madison
3–Princeton Plasma Physics Laboratory

The spherical tokamak (ST) has the potential for high bootstrap current driven operation, which is necessary to reduce the reactor recirculating power, if the aspect ratio could be sufficiently reduced. This requires the capability for a method, other than the solenoid, to generate a substantial portion of the initial startup current. PEGASUS-III is a ST non-solenoidal startup development station dedicated to solving this problem. One method being explored is transient co-axial helicity injection (T-CHI). T-CHI has shown promising capability on the HIT-II and NSTX STs. However, in both these machines the vacuum vessel was electrically cut. For reactor applications a simpler biased electrode configuration is required in which the insulator is not part of the external vacuum vessel. To develop this capability PEGASUS-III will use a double (floating) biased electrode configuration, which will be a first of its kind for the reactor-relevant development of the CHI concept. The system is projected to generate plasma start-up currents at the levels that can be supported by the external poloidal field coils, ~0.3 MA, with an initial 0.15 MA capability using a 30 kA, 2 kV electrolytic capacitor bank power supply.

Work supported by US DOE grants DE-SC0019008, DE-SC0020402, and DE-SC0019415.