Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Towards Reactor-Relevant Runaway Electron Dynamics: High Temperature Formation and High Current Instability[1] C. PAZ-SOLDAN, Y. Q. LIU, N. EIDIETIS, X. DU, GA, P. ALEYNIKOV, IPP-Greifswald, A. LVOVSKIY, ORAU, E.M. HOLLMANN, I. BYKOV, UCSD, D. SHIRAKI, ORNL — Access to pre-disruption electron temperatures (T_e) in excess of 10 keV and post-disruption runaway electron (RE) currents (I_{RE}) approaching 1 MA allow novel observation of reactor-relevant RE dynamics, such as 80% conversion of thermal to RE current and prompt termination of the RE beam via global current-driven instability. A dramatic increase in RE production with rising pre-disruption T_e is observed, with efficiency increasing from 20% in conventional ≈ 2 keV plasmas to 80% in ≈ 8 keV plasmas. Above 10 keV, evidence supports the formation of sub-MeV RE beams. RE quantities and distribution functions measured via bremsstrahlung will be compared to model predictions across T_e, with implications for accurate prediction of RE formation. When post-disruption I_{RE} approaches 1 MA and edge safety factor q_a crosses 2, current-driven kink instabilities appear with an Alfvenic growth time and ultimately cause complete loss of the RE population without regeneration. Modeling of the critical instability amplitude for total RE orbit loss is in agreement with external magnetic measurement. Implications for RE mitigation from current-driven instability are mixed, with higher peak heat loading yet lower total energy deposition expected.

[1]Work supported by US DOE under DE-FC02-04ER54698

Carlos Paz-Soldan
General Atomics

Date submitted: 01 Jul 2019 Electronic form version 1.4