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Growth and decay of runaway electrons above the critical electric field under quiescent conditions

C. Paz-Soldan,[1] N.W. Eidietis,[2] R. Granetz,[3] E.M. Hollmann,[4] R.A. Moyer[4] J.C. Wesley,[2] J. Zhang,[5] M.E. Austin,[6] N.A. Crocker,[5] A. Wingen,[7], and Y.B. Zhu[8][1,2,3,4,5,6,7,8]

[1)] *Oak Ridge Institute for Science and Education, Oak Ridge TN 37830-8050, USA*[a)]

[2)] *General Atomics, PO Box 85608, San Diego, CA 92186-5608, USA*

[3)] *Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge MA 02139, USA*

[4)] *University of California San Diego, 9500 Gilman Dr., La Jolla, CA 92093-0417, USA*

[5)] *University of California Los Angeles, PO Box 957099, Los Angeles, CA 90095-7099, USA*

[6)] *University of Texas at Austin, 2100 San Jacinto Blvd, Austin, TX 78712-1047, USA*

[7)] *Oak Ridge National Laboratory, PO Box 2008, Oak Ridge, TN 37831, USA*

[8)] *University of California Irvine, University Dr., Irvine, California 92697, USA*

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Extremely low density operation free of error field penetration supports the excitation of trace-level quiescent runaway electron (RE) populations during the flat-top of DIII-D Ohmic discharges. Operation in the quiescent regime allows accurate measurement of all key parameters important to RE excitation, including the internal broadband magnetic fluctuation level. RE onset is characterized and found to be consistent with primary (Dreicer) generation rates. Impurity-free collisional suppression of the RE population is investigated by stepping the late-time main-ion density until RE decay is observed. The transition from growth to decay is found to occur 3-5 times above the theoretical critical electric field for avalanche growth and is thus indicative of anomalous RE loss. This suggests that suppression of tokamak RE avalanches can be achieved at lower density than previously expected, though extrapolation requires predictive understanding of the RE loss mechanism and magnitude.

[a)]Electronic mail: paz-soldan@fusion.gat.com