Visible Imaging and Spectroscopy of Disruption Runaway Electrons in DIII-D

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(Received

Abstract

The first visible light images of synchrotron emission from disruption runaway electrons are presented. The forward-detected continuum radiation from runaways is identified as synchrotron emission by comparing two survey spectrometers and two visible fast cameras viewing in opposite toroidal directions. Analysis of the elongation of 2D synchrotron images of oval-shaped runaway beams indicates that the velocity pitch angle $v_\perp / v_\parallel$ ranges from 0.1 to 0.2 for the detected electrons, with energies above 25 MeV. Analysis of synchrotron intensity from a camera indicates that the tail of the runaway energy distribution reaches energies up to 60 MeV, which agrees with 0D modeling of electron acceleration in the toroidal electric field generated during the current quench. A visible spectrometer provides an independent estimate of the upper limit of RE energy which is roughly consistent with energy determined from camera data.