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EXPERIMENTAL STUDIES OF ELECTRONS IN A HEAVY-ION BEAM*

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Electron cloud effects, ECEs, are normally a problem only in ring accelerators. However, heavy-ion induction linacs for inertial fusion energy have an economic incentive to fit beam tubes tightly to intense beams. This places them at risk from electron clouds produced by emission of electrons and gas from walls. We have measured electron and gas emission from 1 MeV K^+ impact on surfaces near grazing incidence on the High-Current Experiment (HCX) at LBNL and are making similar measurements below 500 KeV on the injector test stand STS-500 at LLNL. Electron emission scales with 1/cos consistent with emission from a thin layer, whereas gas desorption varies much more slowly with angle indicating sources other than adsorbed gas layers. Mitigation techniques are being studied: A bead-blasted rough surface reduces electron emission by a factor of 10 and gas desorption by a factor of 2. A biased cylindrical mesh on the Neutralized Transport Experiment (NTX) at LBNL prevents electron emission from the beam-tube. Diagnostics are installed on HCX, between and within quadrupole magnets, to measure the beam halo loss, net charge and expelled ions, from which we infer gas density, electron trapping, and the effects of mitigation techniques. We have also installed clearing electrodes between magnets to remove electrons, and a suppressor electrode after the magnets to block secondary electrons off the end wall from entering the magnets. The effects of electrons on ion beams are determined with slit scanners. These data will be compared with predictions of theory and simulations.

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