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Kinetic, Unstructured Finite Element PIC-DSMC Simulation of Ultra-Fast Pin-to-Plane Discharge in Air CHRISTOPHER MOORE, ANDREW FIERRO, Sandia Natl Labs, JEAN-MICHEL POUVESLE, ERIC ROBERT, CNRS/Universit d'Orlans, ANNE BOURDON, CNRS/Polytechnique, ROY JORGENSON, ASHISH JINDAL, MATTHEW HOPKINS, Sandia Natl Labs — Recently, highly reproducible breakdown experiments in air at atmospheric pressure, leading to large volume homogeneous plasmas, have been performed in a 1.5 cm gap, pin-to-plane geometry with ˜2 ns rise-time [1]. The present work compares temporally resolved experimental results for the electric field and electron density to kinetic simulations using an unstructured finite element Particle-In-Cell code that models the collisions via Direct Simulation Monte Carlo. The model includes electron-neutral elastic, excitation, ionization, and attachment collisions; ion and photon induced electron emission from surfaces; ion-neutral collisions; and self-absorption, photoionization, and photodissociation. The model tracks excited state neutrals which can be quenched through collisions with the background gas and surfaces or spontaneously emit a photon (isotropically) and transition to a lower state. [1] J-M. Pouvesle, et al. "Experimental Study of an Ultra-Fast Atmospheric Pressure Discharge in a Pin-to-Plate Geometry", ICOPS 2017. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

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