Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

Simulations of Slow Capillary Discharges for BELLA JEFFREY JOHNSON, PHILLIP COLELLA, CAMERON GEDDES, ERIC ESAREY, WIM LEEMANS, Lawrence Berkeley National Lab, DANIEL MITTELBERGER, STEPAN BULANOV, U.C. Berkeley, PETER STOLTZ, Tech-X Corporation, BELLA COLLABORATION — Capillary plasma channels are used to extend the propagation distance of relativistically intense laser pulses for laser plasma acceleration [1], and axial density modulation has been used to stabilize injection at LBNL. Channel formation is a complex process in which a gas is ionized via a slow discharge, and subsequently stabilized by a capillary wall via heat transfer. Here we describe simulations using a multi-species, 2-temperature plasma model to study the effects of electrical and thermal conduction, species diffusion, and externally-applied magnetic fields on this process for present experiments and to plan m-scale capillaries at reduced densities for the BELLA laser. These radially-symmetric simulations, performed with the 1D cylindrical code SCYLLA from LBNL, resolve the radial behavior of the plasma within the capillary but do not accurately describe dynamics near the ends of the capillary or near gas feed slots or jets. To understand these regions, we present results of simulations using the 3-dimensional hydrodynamics code HYDRA from Lawrence Livermore National Laboratory. We discuss work in progress on a multi-dimensional plasma model that leverages results from these simulations. References: [1] W. Leemans et al., Nat. Phys. 2, 696 (2006)

Jeffrey Johnson
Lawrence Berkeley National Lab

Date submitted: 16 Jul 2010 Electronic form version 1.4