Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Full-scale 2D and 3D simulations of electron beam acceleration for the LANL dielectric wakefield accelerator experiment[1] THOMAS KWAN, CHENGKUN HUANG, EVGENYA SIMAKOV, DMITRY SHCHEGOLKOV, Los Alamos National Laboratory — Dielectric Wakefield Accelerator (DWA) holds the promise as an upgrade for the X-ray free electron laser of the proposed Los Alamos Matter-Radiation Interactions in Extremes signature facility. Our proof-of-concept DWA experiment aims to produce an acceleration gradient > 100 MV/m with $<$ 0.1% induced beam energy spread. We design a 2.5ps double-triangular drive bunch and a trapezoidal witness bunch through the use of an electron beam mask followed by an Emittance Exchanger (EEX). To understand the DWA performance under transient dynamics, non-perfect EEX and other non-ideal effects, we use the Particle-In-Cell codes Merlin and LSP in 2D cylindrical and 3D geometries, respectively, to model our design. The benchmark shows good agreements with analytic theory on the longitudinal wakefield and the transformer ratio. Our simulations also indicate that longitudinal electric profile is highly insensitive to beam energy, radial distribution and emittance. We have investigated the transverse uniformity of the accelerating field and the effects of beam misalignment with radial beam offset. Full-scale simulation results for the planned experiment will be presented and discussed.

[1]Work supported by the U.S. Department of Energy through the LDRD program at Los Alamos National Laboratory.

Thomas Kwan
Los Alamos National Laboratory

Date submitted: 05 Jul 2013 Electronic form version 1.4