Abstract Submitted for the DPP08 Meeting of The American Physical Society

Multi Bunch Plasma Wakefield Acceleration Experiments¹ PATRIC MUGGLI, University of Southern California, VITALY YAKIMENKO, BNL, EFFTIMIOS KALLOS, USC, KARL KUSCHE, JANGHO PARK, MARCUS BABZIEN, ADAM LICHTL, BNL — We have demonstrated a method to produce a train of equidistant drive electron bunches (P. Muggli et al, Phys. Rev. Lett. 2008) followed by a witness bunch, suitable for multi-bunch plasma wakefield acceleration experiments (MB-PWFA). The drive bunches are separated by an adjustable distance d=100 to 450 microns. The witness bunch follows the last drive bunch by 1.5d. At the Brookhaven National Laboratory Accelerator Test Facility this bunch train is sent into a 2cm-long capillary discharge. The electron plasma density is adjusted by varying the timing between the firing capillary discharge and the arrival time of the electron bunch train. Calculations show that the acceleration of the witness bunch is maximum when the plasma wavelength is equal to d (resonant excitation of the wakefield). In the experiment we measure the energy gained by the witness bunch as a function of the plasma density and of the number of drive bunches. This scheme could be used to multiply the energy of the witness bunch in a single PWFA stage. Preliminary experimental results will be presented.

¹Work supported by the US Department of Energy.

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Date submitted: 19 Jul 2008

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