Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Ionization Injection of Electrons into a Plasma Wakefield Accelerator at FACET* CHRIS CLAYTON, University of California, Los Angeles, E-200 AT FACET COLLABORATION — In the PWFA experiments at FACET, a low ionization-potential (IP) metal vapor gas (Li) is confined within a heat-pipe oven by a higher IP buffer gas (typically He). The Li is easily field-ionized by the FACET beam. A non-linear wake is formed in the blowout regime when the 20.3 GeV bunch containing 2e10 electrons in a $\sigma_z \sim 30$ μm is focused to a (vacuum) $\sigma_r < 25$ near the $\sim$ 10cm-long boundary region. There the Li density rises from zero up to the oven's 30cm-long flat-topped density of 2.5e17 cm^{-3}. To obtain a mono-energetic beam from accelerated ionization-injected electrons at the far end of the oven—the goal of this experiment—it is necessary for the FACET beam to have a betatron pinch just where the flat-topped region begins; i.e., where the wake wavelength is no longer changing. If the buffer gas contains a mixture of He and a moderate IP gas, the "impurity" gases will also be field ionized and potentially contribute more charge to the injected bunch than with He alone. Moderate IP gases were added to the He buffer gas: 10%, 20%, and 50% Ar (balance He) and 30% Ne (balance He) have been used. Evidence for ionization injection and acceleration appears through the observation of distinct features, characterized by their very narrow size and thus angular spread, at the image plane of a magnetic imaging spectrometer. Analysis aimed at characterizing these features with respect to energy, charge, and angular spread is underway and will be presented. *This work was supported by the DOE and the NSF.

Chris Clayton
University of California, Los Angeles

Date submitted: 12 Jul 2013 Electronic form version 1.4