Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Self-modulation of a Long Electron Bunch in a Dense Plasma PATRIC MUGGLI, Max Planck Institute for Physics, JORGE VIEIRA, NELSON LOPES, LIGIA DIANA AMORIM, IST, SPENCER GESSNER, MARK HOGAN, MICHAEL LITOS, SELINA LI, SLAC, NAVID VAFAEI-NAJAFABADI, CHAN JOSHI, KENNETH MARSH, CHRIS CLAYTON, UCLA, ERIK ADLI, Oslo University — The self-modulation instability of long charged particle bunches in plasmas was recently proposed as a means to drive large amplitude wakefields.[1] This instability transforms a long particle bunch into a train of shorter bunches with a periodicity approximately equal to that of the plasma wavelength. We proposed to study this instability at SLAC-FACET with electron and positron bunches.[2] The occurrence of the instability leads to three possible observables. First, bunch particles lose energy driving wakefields while the instability develops and after it has saturated. Second, the bunch particles are alternatively focused and defocused, leading to a transverse profile with a dense core and a waker halo. Third, the radius of the bunch becomes periodically modulated. Long particle bunches, meter-long high-density plasmas and well developed diagnostics are available at FACET. We present experimental results obtained with electron bunches that suggest the development of the instability. These results are supported by numerical simulations results.

[1]N. Kumar et al., Phys. Rev. Lett. 104, 255003 (2010).
[2]J. Vieira et al., Phys. Plasmas 19, 063105.

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Date submitted: 11 Jul 2014 Electronic form version 1.4