Abstract Submitted
for the DPP07 Meeting of
The American Physical Society

Petawatt laser-driven wakefield accelerator: All-optical electron injection via collision of laser pulses and radiation cooling of accelerated electron bunches.[1] SERGUEI KALMYKOV, YOAV AVITZOUR, S. AUSTIN YI, GENNADY SHVETS, IFS, The University of Texas at Austin — We explore an electron injection into the laser wakefield accelerator (LWFA) using nearly head-on collision of the petawatt ultrashort ($\sim$30 fs) laser pulse (driver) with a low- amplitude laser (seed) beam of the same duration and polarization. To eliminate the threat to the main laser amplifier we consider two options: (i) a frequency-shifted seed and (ii) a seed pulse propagating at a small angle to the axis. We show that the emission of synchrotron radiation due to betatron oscillations of trapped and accelerated electrons results in significant transverse cooling of quasi- monoenergetic accelerated electrons (with energies above 1 GeV). At the same time, the energy losses due to the synchrotron emission preserve the final energy spread of the electron beam. The "dark current" due to the electron trapping in multiple wake buckets and the effect of beam loading (wake destruction at the instant of beams collision) are discussed.

[1]This work is partly supported by U.S. D.o.E. under Contracts No. DE-FG02-04ER54763, DE-FG02-04ER41321, DE-FG02-07ER54945, and by the NSF grant PHY-0114336 administered by the FOCUS Center at the University of Michigan, Ann Arbor.

Serguei Kalmykov
IFS, The University of Texas at Austin

Date submitted: 23 Jul 2007 Electronic form version 1.4