Abstract Submitted
for the DAMOP07 Meeting of
The American Physical Society

Elongation of plasma channel for electron acceleration LIMING CHEN, Advanced Photon Research Center, Japan Atomic Energy Agency — Experiments for the laser guiding studies has been carried out with the 30 fs, 100 TW Ti:Sapphier laser pulse interaction with the long slab (*1.2x10* mm^2) and discharged capillary of underdense plasma. Formation of extremely long plasma channel with its length ($\sim$ *10 mm*) 10 times above the Rayleigh length is observed when the laser pulse power is much higher than the critical power for relativistic self-focusing. The long self-guiding channel formation is accompanied by the quasi-monoenergetic electron acceleration with a low transverse emittance ($<$ *0.8* π *mm mrad*) and high electric current (up to $\sim$ *10 nC/shot*). In order to continuously elongate plasma channel, a 4 cm-scale discharged capillary was used. We successfully demonstrated laser-plasma acceleration of high-quality electron beams up to nearly GeV. Our results exactly verified the prediction of laser-wakefield acceleration through a cm-scale plasma channel in the "blowout bubble" regime, where a micro-scale plasma cavity produced through the ultra-relativistic laser-plasma interactions plays an essential role in the self-injection and acceleration of electrons.

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Date submitted: 26 Jan 2007 Electronic form version 1.4