GeV electron beams from cm-scale laser driven plasma based accelerators.$^1$

WIM LEEMANS, LBNL

GeV electron accelerators are essential to synchrotron radiation facilities and free electron lasers, and as modules for high-energy particle physics. Radiofrequency-based accelerators are limited to relatively low accelerating fields (10-50 MV/m) requiring tens to hundreds of metres to reach the multi-GeV beam energies needed to drive radiation sources, and many kilometres to generate particle energies of interest to high-energy physics. Laser-wakefield accelerators (LWFA) produce electric fields of order 10-100 GV/m enabling compact devices. Previously, the required laser intensity was not maintained over the distance needed to reach GeV energies, and hence acceleration was limited to the 100 MeV scale [1-3]. In this talk, results will be presented on the first demonstration of the generation of GeV-class beams using an intense laser beam. Laser pulses with peak power ranging from 10-50 TW were guided by a hydrogen filled capillary discharge waveguide [4]. Production of high-quality electron beams with 1 GeV energy by channelling a ~40 TW peak power laser pulse in a 3.3 cm long gas-filled capillary discharge waveguide was observed [5]. Results will be discussed on the dependence of the electron beam characteristics on capillary properties, plasma density and laser parameters.


$^1$Work supported by the U.S. Dept. of Energy, Office of Science under contract No. DE-AC02-05CH11231 and the Engineering and Physical Sciences Research Council, UK.