AbstractID: 7798 Title: Laser-accelerated electrons for radiation therapy

Laser plasma accelerators provide electron beams with parameters of interest in many fields and in particular for radiotherapy. A short review of progress achieved recently including bubble [1] and colliding [2] schemes will be presented. Using the last improvements of laser-plasma accelerators, we performed dose deposition simulations using a quasi-monoenergetic electron beam in the 200 MeV range [3]. It is shown that electron beam properties offer advantageous dosimetric characteristics compare to those calculated with high energy photons. The depth dose curve shows a broad maximum at large depths (> 20 cm). The lateral penumbra of treatment fields for focused electron beams is smaller compared to 6 MeV photons at depths smaller than 10 cm. These advantages result in an improvement of the quality of a clinically approved prostate treatment plan. While the target coverage is the same or even slightly better for 250 MeV electrons compared to photons the dose sparing of sensitive structures is improved. E.g. the dose to the rectum is reduced by 19% for 250 MeV, focused electrons. These findings agree with previous results regarding very high energy electrons as a treatment modality [4, 5, 6].
The lack of compact and cost-efficient electron accelerators could be overcome by laser-plasma systems.

Educational Objectives:
1. Understand the origin electron injection in plasma
2. Understand the acceleration process and to motivate this approach which uses extremely high electric field
3. Understand the issues related to clinical application for radiotherapy.

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[4] C. DesRosiers et al., Phys. Med. Biol. 45, 1781 (2000)
[5] C. Yeboah et al., Phys. Med. Biol. 47, 1285 (2002)
[6] C. Yeboah et al., Phys. Med. Biol. 47, 2247 (2002)