Exploring high-charge irradiation conditions with laser-driven very high energy electrons for radiation biology

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Very High Energy Electrons (VHEE, E>70 MeV) have been recently proposed [1] as an alternative approach for cancer radiation therapy due to their promising clinical advantages over photons and protons. The enhanced sparing of critical structures [2] and the reduced susceptibility to tissue inhomogeneities [3] are some of the potential benefits of this technique. Today's technological limitation of using these VHEEs in the clinical sphere could be overcome by laser-plasma wakefield accelerator technology, thus offering compact and more cost-effective facilities. In order to prove the pertinence of such radiation quality, radiation biology studies in in-vitro and ex-vivo samples will have to be performed.

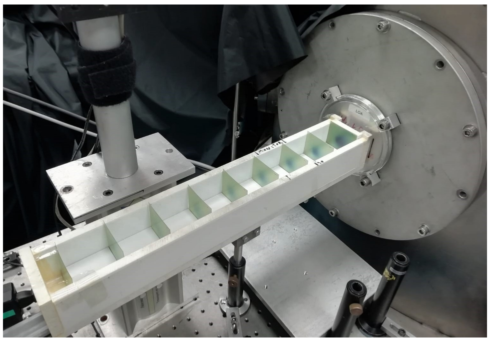

Figure 1: Electron beam propagation in air.

We present the characterization of a laser-driven high charge electron beam in terms of divergence, energy spectrum and shot-to-shot stability. Different gas nozzle profiles in conjunction with varying electron and atomic densities were studied. All acceleration conditions were evaluated in terms of 3D deposited dose profile through 10 cm in depth, using a water equivalent phantom. This survey enables the planning of dose and dose distribution for future radiation biology experiments.

References

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