

P1.2004 Estimates of the radio isotope production from laser driven proton acceleration

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Laser-driven ion acceleration is an attractive way to realize compact and affordable ion sources for many exciting applications including cancer therapy, proton radiography, and inertial confinement fusion. Many of these applications require high energy ion beams with narrow energy spread as well as high flux.

Several new acceleration mechanisms have been explored by varying laser conditions and target states. So when a near critical (or rather overdense) target is irradiated by a laser pulse, ions are compressed to form a density spike, which in turn launches electrostatic shocks in the target. These shocks can reflect upstream ions and yield ion beams with monoenergetic peaks of a few MeV [1].

Currently, laser driven ion acceleration does not allow to reach the energies required for protontherapy ($E > 200\text{MeV}$). In this study, we propose to estimate the use of protons to induce reactions in secondary targets to produce radioisotopes of relevance to the nuclear medicine community (beta+ emitters), like ^{11}C , ^{13}N or ^{18}F via (p,n) or (p,alpha) reactions. Indeed, these radioisotopes can be produced with lower proton energy, below 35MeV, energy achievable by laser acceleration. Laser ion acceleration is therefore promising to replace cyclotrons by a more flexible devices : laser systems.

In this work, we present the numerical chain formed by PIC [2] and MONTE CARLO [3] codes. First results of radioisotope production are analysed, as a function of ion acceleration mechanisms and of targets properties.

References

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[3] A. Ferrari, P.R. Sala, A. Fasso, and J. Ranft, FLUKA : a multi-particle transport code, CERN-2005-10 (2005)

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Presenter: BONVALET, J. (EPS 2019)

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