Quasimonoenergetic MeV-Proton Generation via the Coulomb Explosion of Optimally Nanostructured Targets

Myles Allen ZOSA [1] and Masakatsu MURAKAMI [1]

1) Institute of Laser Engineering, Osaka University, Japan

E-mail: zosa-m@ile.osaka-u.ac.jp

High energy ion beams have been widely studied due to their applications in neutron production [1] and cancer therapy [2]. Preceding studies on the CE scheme have regarded CE to be unable to produce monoenergetic ions [3]. However, with a special composition of heavy and light ions in a solid spherical target, it is possible to produce quasimonoenergetic light ions [4]. Furthermore, we conducted three-dimensional molecular dynamics simulations to confirm which structure gives the

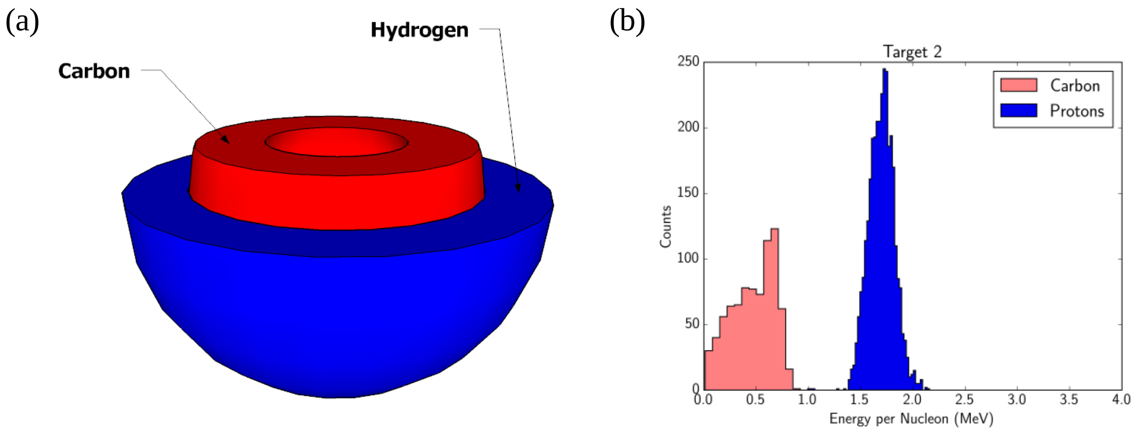

Figure 1: (a) shows a cross-sectional schematic of the hollow target (b) shows the energy per nucleon distribution of both protons and carbon ions obtained from an optimized hollow target, where the proton kinetic energy is ~55% of the total energy and ~30% of the total energy is attributed to protons within a 5% energy bandwidth from the peak of the distribution.

most efficient quasimonoenergetic proton profile. Our simulation results shows that optimized hollow spherical targets are able to produce better quasimonoenergetic profiles when compared to their solid target counterpart. In addition, the simulation results also show that it is possible to produce quasimonoenergetic protons of ~ 2 MeV energies from nanometer sized (20nm – 50nm) targets. Hence, although this energy may not be suitable for cancer therapy applications, the protons from this acceleration scheme can be used to bombard a lithium target to produce neutrons [1].

References

[1] B. Bayanov *et al.*, *Applied Radiation and Isotopes*, 2004, **61**, 817.

[2] I. J. Kim, K. H. Pae, *et al*, *Phys. Rev. Lett.*, 2013, **111**, 16.

[3] K. Nishihara *et al.*, *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 2001, **464**, 98.

[4] M. Murakami, K. Mima, *Physics of Plasmas*, 2009, **16**, 2.