Ion stopping measurements near the Bragg peak in laser-induced plasmas

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Ion stopping in plasmas is a key process in ICF for which the ion velocity range near the Bragg peak is of special importance. There, large discrepancies are reported between various stopping-power models [1], and measurements are scarce. We report experimental data near the Bragg peak in laser-generated plasmas reaching temperatures of 100-200 eV and electron densities of 10^{20}-10^{21} cm^{-3}. For these conditions, non-perturbative theories predict stopping-power values by 20-30% smaller than the usual perturbative approaches [2].

Firstly, we show energy-loss measurements performed at GSI with nitrogen ions from an accelerator source in highly ionized carbon plasma heated by two laser beams and obtained from time-of-flight measurements with a Chemical-Vapour-Deposition diamond detector. The results provide a discriminating test of stopping-power theories [3].

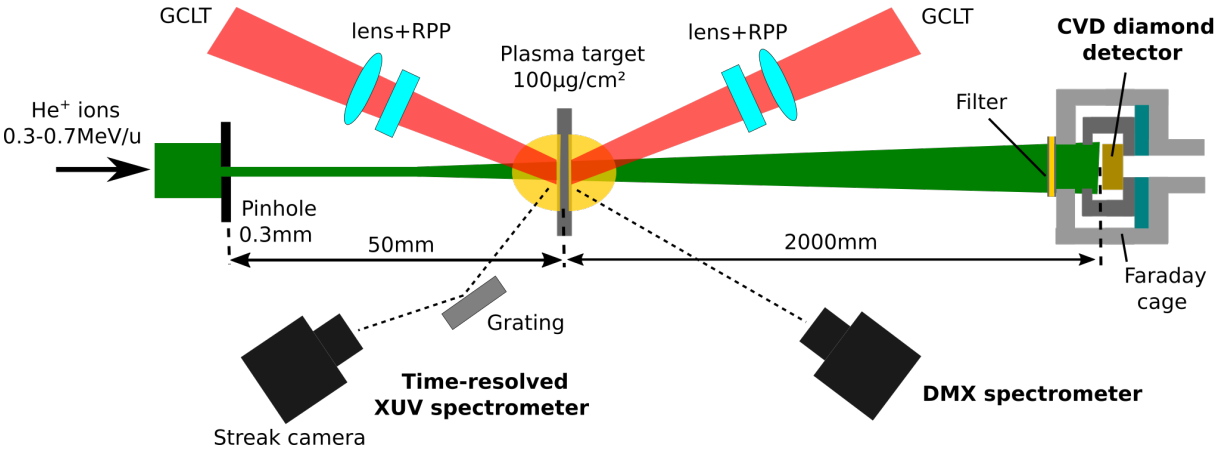

Figure 1: Schematics of the experimental setup at CEA-DIF

Secondly, we present preliminary energy-loss results obtained at CEA-DIF with a newly developed experimental platform using alpha-particle projectiles from an accelerator source and a similar plasma as well as similar time-of-flight detector (Fig. 1).

References

[1] D. O. Gericke and M. Schlanges, Physical Review E **67**, 037401, 2003

[2] W. Cayzac *et al.*, Physical Review E **92**, 053109, 2015

[3] W. Cayzac *et al.*, accepted for publication in Nat. Commun.