

Proton acceleration from the interaction of a PW-class laser and a solid hydrogen ribbon

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The interaction of a high power laser and a pure hydrogen target has advantages from the experimental point of view in terms of plasma characterization, as well as for a potentially use at high repetition rates since such target is essentially debris free.

A cryogenic hydrogen ribbon (75-100 μ m thick) was irradiated with the VULCAN-PW laser (0.6 kJ/1ps) at the RAL facility. High current proton beams with energies exceeding 50 MeV were accelerated into both directions (forward and backward with respect to the incoming laser beam). The energy coupling into energetic protons was very high in comparison to standard plastic foils. This is linked to the laser absorption along the overall target thickness, which is strongly enhanced as confirmed by particle-in-cell simulations.

Such results are very promising for future multidisciplinary applications of laser driven proton beams, e.g. hadrontherapy, both due to high purity and high proton beam charge per laser pulse, as well as technological advantages coming from the debris free nature of the used target.

References

[1] D. Margarone et al., Phys. Rev. X 6 (2016) 041030