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The impact of groove depth on ion acceleration through Target Normal Sheath Acceleration

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Researchers have demonstrated that the interaction between a femto-second laser pulse and a structured target significantly increases the cutoff energy of protons, reaching hundreds of MeV, through the target normal sheath acceleration mechanism. The increase in proton cutoff energy is a result of both an expansion in the surface area of laser-plasma interaction and a modification in the mechanism of laser energy transfer to the electrons [1–4]. We have performed 2D particle-in-cell simulations to analyze the proton energy spectra in the presence of a rectangular groove on the target's front surface. The proton energy continuously increases with an increase in the groove depth. The acceleration mechanism undergoes complete modification for the target having complete hole, which results in decay of the proton cutoff energy.

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