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Laser proton acceleration from mass limited silicon foils

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Recent studies of laser proton acceleration from mass limited targets at the 100 TW laser at LULI have shown an increase of proton energy with decreasing target size for pulses with a length of 400 fs attributed to electron refluxing during the laser pulse (S. Buffechoux *et al.*, PRL accepted).

In the last years high power laser systems in the 100 TW range with much shorter pulses (~30 fs) and higher repetition rates (10 Hz) have come into operation . In order to determine the energy dependence in this laser regime we have performed a series of experiments using mass limited silicon targets. Small micro machined silicon foils with 2 µm thickness and 20x20 μm^2 to 100x100 μm^2 size mounted on tiny stalks where shot with ultra short laser pulses of 30 fs duration from the new 150 TW DRACO Laser facility of the Forschungszentrum Dresden-Rossendorf. The experiments where carried out using a high contrast level of 10^{-10} in the picosecond as well as the nanosecond range.

Proton spectra have been measured with magnetic spectrometers and radio chromic film stacks and the scaling of the maximum proton energy as function of the target size was investigated. Depending of the size of the targets strong influences of the stalks as well as the target edges where found which can both increase or decrease the maximum proton energy with respect to a plain foil.