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Energy gain and spectral tailoring of ion beams using ultra-high intensity laser beams RAJENDRA PRASAD, MARCO SWANTUSCH, MIRELA CERCHEZ, SVEN SPICKERMANN, BASTIAN AUORAND, THOMAS WOWRA, JUERGEN BOEKER, OSWALD WILLI, Heinrich Heine University — The field of laser driven ion acceleration over the past decade has produced a huge amount of research. Nowadays, several multi-beam facilities with high rep rate system, e.g. ELI, are being developed across the world for different kinds of experiments. The study of interaction dynamics of multiple beams possessing ultra-high intensity and ultra-short pulse duration is of vital importance. Here, we present the first experimental results on ion acceleration using two ultra-high intensity beams. Thanks to the unique capability of Arcturus laser at HHU Düsseldorf, two almost identical, independent beams in laser parameters such as intensity ($>10^{20}$ W/cm²), pulse duration (30fs) and contrast ($>10^{10}$), could be accessed. Both beams are focused onto a 5 μ m thin Ti target. While ensuring spatial overlap of the two beams, at relative temporal delay of ~ 50 ps (optimum delay), the proton and carbon ion energies were enhanced by factor of 1.5. Moreover, strong modulation in C⁴⁺ ions near the high energy cut-off is observed later than the optimum delay for the proton enhancement. This offers controlled tailoring of the spectral content of heavy ions.

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