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Towards 100 MeV maximum energy for laser-accelerated proton beams FLORIAN WAGNER, VINCENT BAGNOUD, CHRISTIAN BRABETZ, THOMAS STOEHLKER, GSI Darmstadt, STEFAN BEDACHT, OLIVER DEPPERT, MARKUS ROTH, ALEXANDRA TEBARTZ, TU Darmstadt — Since the discovery of the target normal sheath acceleration mechanism, laser-driven ion acceleration has been a field of very active research. Despite numerous investigations to optimize laser and target conditions the initially observed maximum proton energy of about 60 MeV can neither be reproduced routinely with up to date laser systems nor has this limit been exceeded significantly. At the same time simulations show promising results for alternative mechanisms based on ultrathin targets and high temporal contrast. We report on results of an experimental campaign at the PHELIX laser. Using micrometer thick plastic targets and laser intensities on the order of 10^{20}W/cm^2 we achieved monotonically decreasing proton spectra with cutoff energies in excess of 85 MeV and particle numbers of 10^9 in an energy bin of 1 MeV around this maximum. For a certain match of laser and target conditions we could also observe angular separation of proton beams accelerated via different mechanisms. In this contribution we define the experimental conditions that enable such high energy maxima and particle numbers and we discuss the limitations that prevent maximum energies of hundreds of MeV as predicted by simulations.

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