



Contribution ID: 66

Type: talk

Contrast Dependence of Laser-Driven Proton Acceleration

Thursday, September 19, 2019 4:00 PM (20 minutes)

Laser-driven proton acceleration to high kinetic energies has great potential for applications in e.g. time-resolved radiography or in high-dose radio-biology. To date, however, a strong discrepancy remains between theoretical predictions of the maximum proton energies (E_{prot}) and the experimental results. Furthermore, a tremendous progress in laser development did not lead to a dramatic improvement of E_{prot} , which suggests principally limiting physical processes that need to be investigated in detail. For this reason, we carried out an experimental study on the POLARIS laser facility of the E_{prot} -scaling with laser energy, which was varied by more than one order of magnitude and with different levels of temporal intensity contrast. The results show a clear increase of the scaling exponent with reduced pre-plasma scale lengths from a root-like up to a linear E_{prot} scaling, which occurs for a scale length of $L \leq 2\mu\text{m}$. This is most likely induced by laterally recirculating hot electrons enhancing the rear-surface electric field. Furthermore, we see a clear limitation of E_{prot} , whereby a further increase of the laser energy does not lead to a further increase of E_{prot} . This, we attribute to stopping of hot electrons inside the target due to the onset of two-stream-instabilities.

Primary author: KEPPLER, Sebastian (Helmholtz-Institute Jena)

Co-authors: Mr BECKER, Georg Alexander (University Jena, Germany); Dr ELKINA, Nina (Helmholtz-Institute Jena); Mr TAMER, Issa (Helmholtz-Institute Jena); Mr MÄUSEZAHN, Max (Friedrich-Schiller-University Jena / Institute for Optics and Quantumelectronics); Dr RÖDEL, Christian (Helmholtz-Institute Jena); Dr HORNUNG, Marco (Helmholtz-Institute Jena); Prof. ZEPF, Matt (Helmholtz-Institute Jena); Prof. KALUZA, Malte (University of Jena, Helmholtz-Institute Jena)

Presenter: KEPPLER, Sebastian (Helmholtz-Institute Jena)

Session Classification: WG2

Track Classification: WG2 - Ion beams from plasmas