P 26: Laser Plasmas II

Time: Thursday 16:30–17:15 Location: SPA HS202

P 26.1 Thu 16:30 SPA HS202

Influence of laser contrast, foil thickness and material on laser driven proton acceleration — •Georg A. Becker[1], Jens Polz[1], Oliver Jäckel[1,2], Ajay Kawshik Arunachalam[1,2], Robert Brüning[1], Marco Hornung[1,2], Sebastian Keppler[1], Hartmut Liebetrau[1], Marco Hellwing[1], Frank Schorcht[1,2], Theodor Schlegel[2], and Malte C. Kaluza[1,2] — [1]Institut für Optik und Quantenelektronik, 07743 Jena, Germany — [2]Helmholtz Institut Jena, 07743 Jena, Germany

In a laser-plasma experiment using the fully diode-pumped Yb:glass POLARIS laser system which currently delivers pulses with 4 J energy and 150 fs duration at a repetition rate of 1/40 Hz on target, we investigated the influence of foil thickness, material and pulse contrast on the maximum achievable proton energy.

For this we used copper, silver, gold, aluminium and tantalum foils with different thicknesses from a few 10 micrometers down to 100 nanometers. Furthermore the influence of the pulse contrast was investigated by using a fast Pockels cell and an alternative front-end based on XPW (cross-polarized wave generation).

Significant differences between the different target thicknesses and materials were observed for different contrast ratios which will be discussed in this presentation.

As an approach for the explanation for our findings, we performed hydrodynamic simulations to study the influence of the target's ion species the laser-generated preplasma and the influence of this preplasma on the acceleration process.

P 26.2 Thu 16:45 SPA HS202

Charakterisierung von Plasmatargets für Laser Wakefield Experimente — •Alexander Köhler[1,2], Jurjen Couperus[1,2], Axel Jochmann[1,2], Arie Irman[1] und Ulrich Schramm[1,2] — [1]Helmholtz-Zentrum Dresden - Rossendorf, 01328 Dresden, Deutschland — [2]Technische Universität Dresden, 01062 Dresden, Deutschland

Heutige auf Radiofrequenz (RF) basierende Beschleuniger stoßen an ihre räumlichen und finanziellen Grenzen, da mit ihnen keine elektrischen Feldgradienten größer als 100 MV/m erzeugbar sind. Mit plasmabasierten Beschleunigern sind Feldgradienten realisierbar, die bis zu drei Größenordnungen höher liegen.

Der Entwurf und die Fertigung einer 30 mm lange Quarzkapillare mit einem quadratischen Querschnitt von 0,3 mm wird beschrieben. Ein dazugehörige Aufbau zur Erzeugung des Plasmakanals in der mit Helium gefüllten Kapillare und zur longitudinalen interferometrischen Vermessung der Plasmadichte wird erklärt.

P 26.3 Thu 17:00 SPA HS202

Realizing a laser-driven electron source applicable for radiobiological tumor irradiation — •Maria Nicolai[1], Alexander Sävert[1], Maria Reuter[1,2], Michael Schnell[1], Jens Polz[1], Oliver Jäckel[1,2], Leonhard Karsch[3], Michael Schürer[3], Melanie Oppelt[3], Jörg Pawelke[3,4], and Malte C. Kaluza[1,2] — [1]Institute of Optics and Quantum Electronics, Jena — [2]Helmholtz-Institute Jena — [3]OncoRay, National Center for Radiation Research in Oncology, Dresden — [4]Institute of Radiation Physics, Dresden

Laser-accelerated electron pulses have been used to irradiate human tumors grown on mice's ears during radiobiological experiments [1]. These experiments have been carried out with the JETI laser system at the Institute of Optics and Quantum Electronics in Jena. To treat a total of more than 50 mice, a stable and reliable operation of the laser-electron accelerator with a dose rate exceeding 1 Gy/min was necessary. To achieve this, a sufficient number of electrons at energies in excess of 5 MeV had to be generated. The irradiation time for a single mouse was a few minutes. Furthermore, these particle-pulses' parameters needed to remain achievable for a time period of several weeks. Due to the on-line detection of the radiation dose, the unavoidable shot-to-shot fluctuations, currently still typical for laser-based particle accelerators, could be compensated. The results demonstrate that particle pulses generated with laser-based accelerators have the potential to be a future alternative for conventional particle accelerators used for the irradiation of tumors. [1] M. Nicolai *et al.*, Appl. Phys. B, DOI 10.1007/s00340-013-5747-0 (2013)