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Plasma physics at the Z6 station, GSI

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The Z6 station at GSI Helmholtzzentrum für Schwerionenforschung offers the unique possibility to conduct combined experiments with two high energy laser systems (nhelix and PHELIX) and a heavy ion beam from the UNILAC accelerator.
The PHELIX laser can be operated in a long or short pulse option, the nhelix system deliver up to 3 beams simultaneously on the target and the UNILAC accelerator allows probing with heavy ions ranging from 3 < Z < 92 with energies of 3 –13 MeV/u.

In this talk we will report about the three major experiments at the Z6 station:

1) Energy loss measurements of swift heavy ions in dense carbon plasma heated by hohlraum generated x-rays. A special double hohlraum configuration has been designed to heat carbon homogeneously and to prevent inflow of hot gold plasma into the carbon plasma as well as into the interaction area of the ion beam. Carbon plasmas with an electron density of 1022 cm-3 and an ionization degree of 4 have been generated. The radiation temperatures in the primary and the secondary hohlraum as well as the plasma conditions were characterized and compared with 2D-hydro simulations and theoretical predictions. In the first energy loss experiments with a Ca17+ ion beam with 4 MeV/u we observed an increase of the stopping power of up to 40%.

2) Experimental investigation of the interaction of the ion beam in plasma in the non-linear regime. A hot fully ionized carbon plasma (electron density up to 1021 cm-3 ,electron temperature of 200 eV) is generated by irradiating a thin foil from both sides simultaneously with the nhelix and PHELIX lasers and probed by carbon ions which are slowed down to 0.5 MeV/u. With this set of parameters the projectile velocity is close to the thermal velocity of the electrons and the known linear response theories, like Bethe-Bloch, are not longer valid for energy loss calculations. Strong deviations from the standard approaches are expected.
3) Focusing and coupling of laser accelerated ion bunches into conventional ion optics and RF technology. Aim of this experimental campaign (LIGHT project) is the exploration of the interface between laser ion acceleration (based on “target normal sheath acceleration”) and common accelerator technology. It combines in a unique and highly efficient way the capabilities of PHELIX laser (100 TW) with the accelerator know-how available at GSI.

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Session Classification: High energy density physics & Warm dense matter - Chairs: Y. Oguri and R. Davidson - Featured Posters: K.P. Driver, K, Kondo, Y. Miki, F. Tachinami