EXPERIMENTS ON BEAM-PLASMA INTERACTION PHYSICS

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Investigation of heavy ion beam interaction physics with dense plasma is one of key issues for Inertial Confinement Fusion (ICF) driven by powerful heavy ion beams. In fact it determines the requirements to the output parameters of powerful ion beams, final focusing system, number of beamlets in reactor chamber, beam transport through the reactor chamber, target positioning and the design of the target geometry itself. The detailed modeling of the heavy ion beam driven ICF conditions requires adequate quantitative description of the interaction processes of heavy ion beams with dense plasmas in a wide range of parameters.

Since 2001 at the UNILAC accelerator at GSI an experimental set-up exists for measuring the interaction of heavy ions with non-ideal plasmas. [1] The experimental results of energy loss measurements of C, Ne, Ar and Xe ions in energy range 5.9 – 11.4 MeV/u and charge state distribution in a shockwave-driven, strongly-coupled (non-ideal) Ar plasma with a variation of the plasma parameters are present.

New experimental setup for stopping power measurements based on a 27 MHz RFQ-linac has been designed and assembled at ITEP, Moscow. Energy losses of 101 keV/n Cu ions in nitrogen and hydrogen have been measured for subsequent comparison with the energy losses of the same ions in plasma. The plasma was generated by igniting a 3 kA electric discharge in two 78 mm long collinear quartz tubes of 6 mm in diameter [2]. It is closed at both sides by 1 mm diameter diaphragms. This set-up allows producing plasma with linear electron density of up to $5 \cdot 10^{17}$ cm^{-2}.

1. K.Werich, H.Wahl, M.Giessel, D.H.H.Hoffmann, A.Golubev, A.Fertman, A.Kantsyrev, B.Sharkov, M.Kulish, S.Dudin, V.Mintsev. “Interaction of heavy ion with shockwave-driven, strongly-coupled plasma” *Abstakts of the 14th International Symposium on Heavy Ion Inertial fusion*, May 26-31, 2002 99.

2. Belyaev G., Basko M., A.Cherkasov, A.Golubev, A.Fertman, I.Roudskoy, S.Savin, V.Turtikov, A.Arzumanov, A.Borisenko, I.Gorlachev, S.Lysukhin, D.H.H.Hoffmann, A.Tauschwitz. “Measurement of the Coulomb energy loss by fast protons in a plasma target.” *Phys. Rev. E*, 53, 3, 2701 (1996)