Energy Deposition and Excitation of Wakefield in Case of 100keV/u Ion Beam Passing through a Plasma Target

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Recently our team investigated the energy deposition and excitation of wakefield in case of hundreds keV proton/helium ion beams passing a gas-discharged plasma target. The plasma target was produced by igniting an electric discharge of hydrogen gas in two-collinear quartz tubes, each of 5mm in diameter and 78mm in length, the electrical current even up to kA will flow in two opposite directions in either of the two quartz tubes. This device could produce the hydrogen plasma with the line-integrated free electron density of up to $10^{17\text{-}18}$ /cm^2, and with the temperature of around 2eV when the discharge current was reaching the maximum, as shown in figure1.

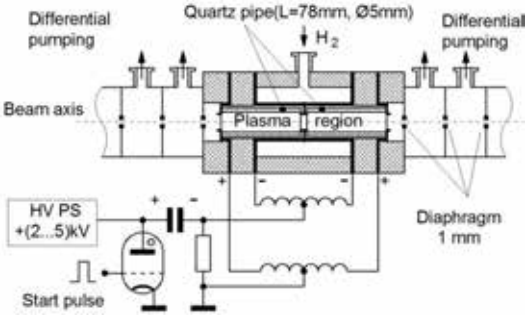

Figure 1 the scheme of the plasma target

The experiments were performed at the HV-ECR platform at IMP (see details in ref [1, 2]). As an example. figure 2 shows the measured beam after 100keV proton beam penetrating the hydrogen plasma target (with initial gas pressure of 3mbar, and discharging High-Voltage of 3kV) in terms of time after discharging. Enhanced energy loss comparing to that for neutral gases has been observed. Moreover, we found that the proton beam was strongly focused while energy of the focused beams is uniform. We carried out some PIC simulations, which suggests that the wake-field could form a self-modulated, periodic(pulsed), focusing, collision-less tunnel. More details will be reported later [3,4].

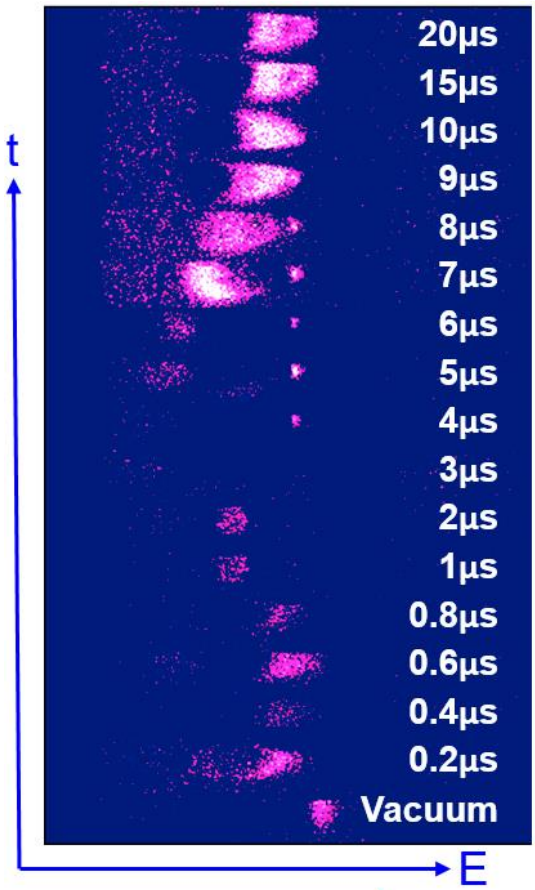

Figure 2 the measured beam after 100keV proton beam penetrating the hydrogen plasma target.

The work is supported by NSFC (11275241, 11375034 and U1532263).

References

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[2] Cheng R. et al. 2013 Phys. Scr. T**156**, 014074
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[4] Y. Zhao, et al, Excitation of Plasma Wakefield by 100keV/u proton Beam, under preparing