Gas Transport and Density Control in the HYLIFE Heavy-Ion Beam Lines

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The effective propagation and focusing of heavy-ion beams in the final-focus magnet region of heavy-ion inertial fusion chambers requires control of the background gas density and pressure in the tubes. Previous studies have focused on evaluating the amount of ablation debris reaching the entrance of the beam ports. A modified version of the TSUNAMI code has been used to assess the density and temperature of gas debris transported approximately three meters up the beam tubes and reaching the final-focus magnet region, assuming that the liquid vortexes are perfectly condensing surfaces. Results are presented and compared to a simple, analytical method that estimates the density profile in the beam tubes as a function of time. A new beam line design is described. A magnetic "sweeper" has been envisaged to divert the ablation debris into the liquid vortexes that coat the inside walls of the beam tubes. This sweeper would prevent the hot ablation debris from reaching the magnet region, and conveniently suppress the need for mechanical shutters to reduce debris venting in the final-focus magnet region. The final, pre-shot, density profile in the beam tube is given as well.

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