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Experiments on exhaust performance by NEG applied pumping system

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Vacuum system of the RAON heavy ion accelerator has been designed to meet local vacuum requirements based on the pressure rise due to the stimulated desorption by scattered ions interacting with residual gases. Main pumps of warm section, of which the target pressure is 5×10^{-9} mbar, between cryomodules will be of NEG type which has merits such as a large effective pumping speed if installed inside, no limit in mechanical life time, continuous pumping even in the case of power break, and robustness in the aspect of vacuum break accident. However NEG pumps have apparent demerits of finite pumping capacity, periodic activation, above all, disability for pumping inert gases (Ar, He) and hydrocarbons (CH₄). Limited pumping capacity of NEG pumps can be overcome easily in UHV conditions, while a solution to overcome the handicap is using small supplement pumps like sputter ion pump to pump the inactive gases. In simulation results of MolFlow, the size of SIP is not that important for sustaining the required vacuum pressure at warm section chamber because NEG pump alone can accomplish the goal when neglecting inactive gas sources through real and/or virtual leaks and permeations. In real situation there must be finite sources of inactive gases regardless of magnitude, which put a question to us about the practical limit in size of the SIP. A vacuum system with integrated getter pump using an NEX Torr Z300-5 pump has been established and vacuum performance was tested. Vacuum properties of the NEG material ZAO and vacuum characteristics of various pump combinations including even NEG pump alone were investigated. We could reach the 10⁻¹¹ mbar range using a NEX Torr pump after minor activation, and the pressure was maintained at low 10⁻¹⁰ mbar range when operating Z300 only.

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