A.11: Differential vacuum pump for Indus-2 beam line

Differential vacuum pumping system provides windowless transition between high vacuum region and low vacuum region by using series of vacuum pumps and conductance limited openings (tubes). It is highly useful for the SRS beam lines where 10^{-6} to 10^{-7} mbar pressure is maintained at an experimental station which has many dynamic parts to manipulate the samples, making it difficult to reach to higher vacuum level. Also sample changing time is reduced as no baking is required. This has to be isolated from the beam line region towards machine side where 10^{-9} to 10^{-10} mbar pressure is to be maintained. A differential pumping system does this job without physically obstructing the beam at any point. As there is no physical barrier in the beam path it eliminates the beam loss, heating and mechanical issues of mounting the physical window.

A two stage differential pumping system is designed, fabricated in house, assembled and tested. It will be a part of beam line-3 of Indus-2. It is an import substitute. Main challenge was to design such a system which fits in the available linear space of 450 mm in the beam line, our system occupies 415 mm of linear space. It is supposed to maintain a pressure ratio of 1000 across its both ends i.e. $1x10^{-6}$ mbar on experimental side (input pressure) and $1x10^{-9}$ mbar on machine side (output pressure). Outline drawing of the system is shown in Fig. A.11.1.

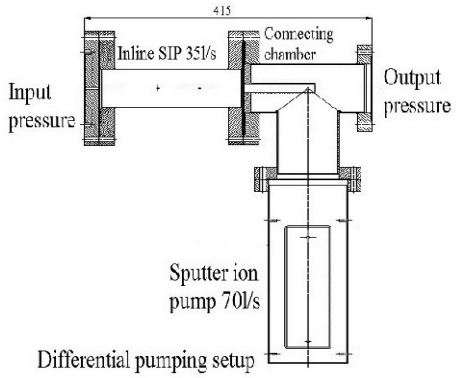
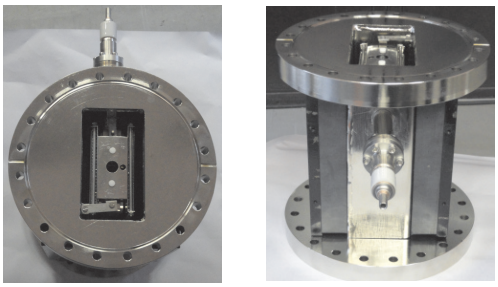


Fig. A.11.1: Outline drawing of differential pumping setup

A unique 35 l/s in-line sputter ion pump is designed and fabricated in house for this purpose. It has a clear opening to pass beam through its anode assembly. It also acts as conductance limited path and thus helps in reducing the integrated length of the system. Details of the pump are shown in Fig. A.11.2. Complete system consists of a conductance limited opening in a flange, a 35 l/s in-line SIP, another conductance limited tube and a 70-l/s SIP connected in series. System assembly is shown in Fig. A.11.3.



(a) (b)

Fig. A.11.2 (a) 35 l/s SIP showing through opening in anode Assy. (b) 35 l/s in-line SIP Assy.

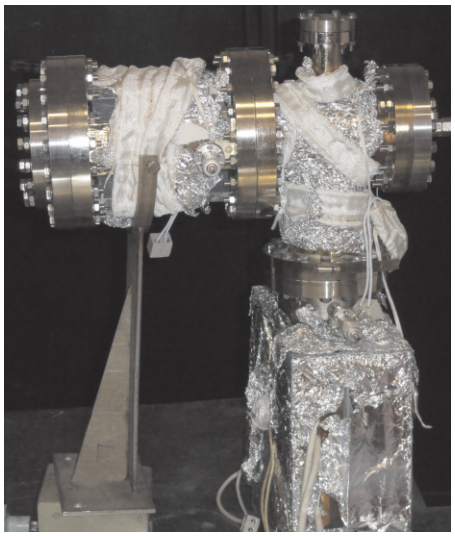


Fig. A.11.3: Differential pumping system

The system was tested in Lab. from $5x10^{-4}$ mbar pressure to $2x10^{-10}$ mbar pressure. The maximum pressure ratio of 2400 has been observed at $1x10^{-4}$ mbar input pressure. At input pressure of $1x10^{-6}$ mbar the pressure ratio is found to be around 1000 which is the desired result. The system is integrated with the beam line and is working satisfactorily. The plot of input v/s output pressure is shown in figure A.11.4.

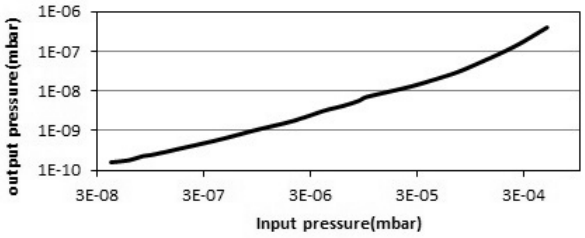


Fig. A.11.4: Input v/s output pressure characteristic

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