Here the oscillatory coupling between the Co layers could not be observed. This might be due to the reason that the thickness of the samples in the present study is large as compared to the thickness as reported for the oscillatory behavior to be observed. Thus, for the future studies, this work will be continued with the samples of Co/Si MLs, which have smaller thickness of Co as well as Si.

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A.7 : Indigenous development of turbo molecular pumps

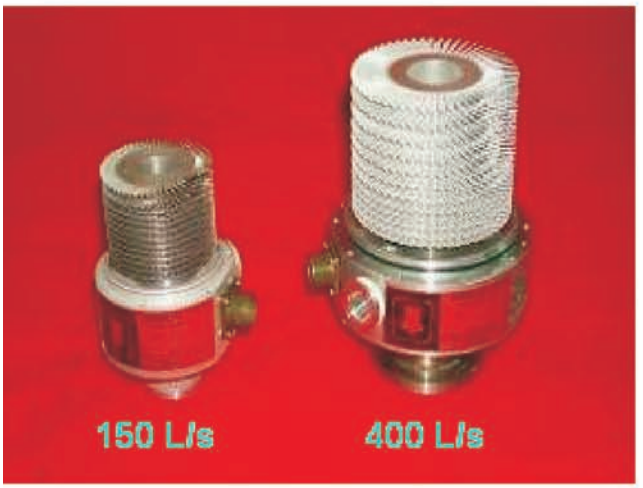

Fig..A.7.1: Assembly of turbomolecular pumps

Indigenous development of two sizes of Turbo Molecular Pumps (TMP) having pumping speed capacities of 150 lit/sec and 400 lit/sec, is going on at the Proton Linac and Vacuum Technology Laboratory of RRCAT (see Fig.A.7.1). Efforts have been made to study the useful life of bearings in the indigenously made TMPs. Few pumps have been assembled with the high precision deep groove ceramic ball bearings. Dynamic balancing of the individual rotating components of TMP was carried out on a hard pedestal balancing machine. Gross unbalance correction due to machining of parts and assembly errors were carried out at low speed (1500 rpm). The balancing of TMP rotor on its motor was performed on a soft pedestal balancing machine up to the operating speed of 48,000 rpm. A software using LabView has been developed for the mass correction on the TMP rotor using soft pedestal balancing machine. The program displays online status of unbalance value in a graphical format in terms of magnitude and direction. The software also helps in comparing the mass correction with respect to the resultant unbalance. Fig.A.7.2 shows the display window of the program developed. This programming has helped in reducing the number of trials required for balancing a TMP rotor assembly. The balanced rotor was assembled. The TMP assembly with stators and stator rings was then subjected to a continuous run for performance evaluation of the TMP and bearing life. Various operating parameters like bearing temperature, bearing shocks, vibration velocity, acceleration, vacuum etc. were recorded during the continuous run test.

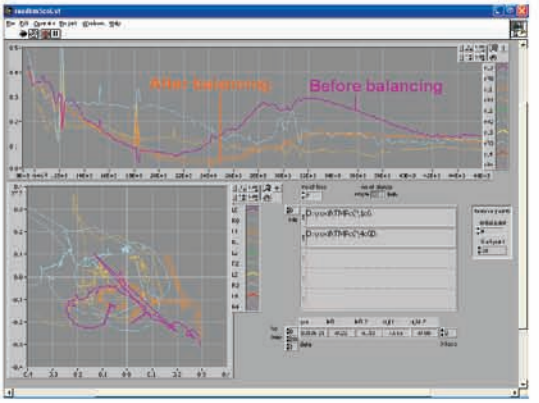

Fig.A.7.2: TMP unbalance spectrum

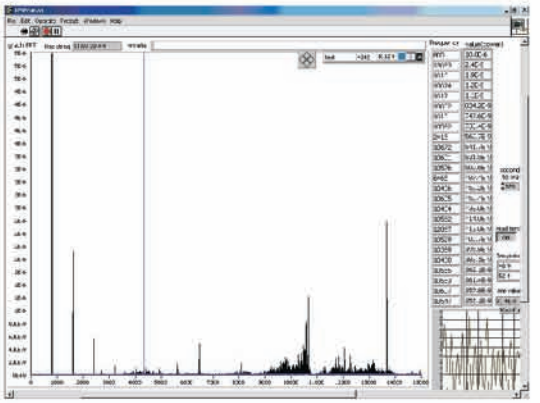

Fig.A..7.3 : FFT of an acceleration signal of an operating TMP

A program was also developed for conditioning monitoring of high-speed bearings. The signal received from an accelerometer was processed to generate a FFT of the vibration signal of a pump, as shown in Fig.A.7.3. Even after a continuous operation of more than 1000 hours, no noticeable deterioration in performance was observed. Two TMPs of 150 lit/sec and one of 400 lit/sec capacity have been operated for ~1000 hrs. One of the smaller capacity TMPs has been given to VPID, BARC Mumbai for field trials and evaluation.

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