

VACUUM SYSTEM OF THE PROSCAN CYCLOTRON COMET

U. Kalt, J. Duppich

The COMET accelerator for PROSCAN has been ordered from the German company ACCEL. COMET will be designed by ACCEL and installed at PSI. The vacuum system for COMET will be designed, assembled and commissioned by the PSI vacuum group. High compression ratio turbomolecular vacuum pumps will be used in combination with dry mechanical vacuum backing pumps. Process logic controllers (PLC) will monitor the complete vacuum system and will communicate with the superordinated PLCs.

REQUIREMENTS

- After ventilation, the accelerator has to be operational within four hours.
- The required pressure is $<10^{-5}$ mbar.
- The vacuum system has to be "dry", i.e. hydrocarbon-free.
- For the treatment of patients, the availability of the facility has to be five days per week and 52 weeks per year.

BOUNDARY CONDITIONS

The accelerator can be separated into two, almost symmetric, upper and lower parts. The two halves are sealed from the atmosphere using double elastomer gaskets. The space between the two seals can be separately pumped. The vacuum feedthrough of the radial probe is also equipped with an intermediate vacuum connector. The location of the vacuum connectors and the cross-section of the inlet pipes are dictated by the accelerating structure. The gas load of the ion source is less than $0.5 \text{ cm}^3/\text{min H}_2$. Further gas loading arises from the 40 metres of rubber gaskets and various linear motion feedthroughs. The insulation vacuum of the cyclotron magnet superconducting coil is connected to this vacuum system.

COMPONENTS

- Eight high compression ratio turbomolecular pumps with a pumping speed of 500 l/s each.
- One 60 l/s turbomolecular pump for the insulation vacuum.
- Gate valves and vacuum valves, bellows-sealed.
- One $50 \text{ m}^3/\text{h}$ dry screw vacuum pump.
- Two $15 \text{ m}^3/\text{h}$ dry mechanical backing pumps.
- Twelve Pirani and two Penning gauges.
- Central control system based on Siemens S7.

CONCEPT

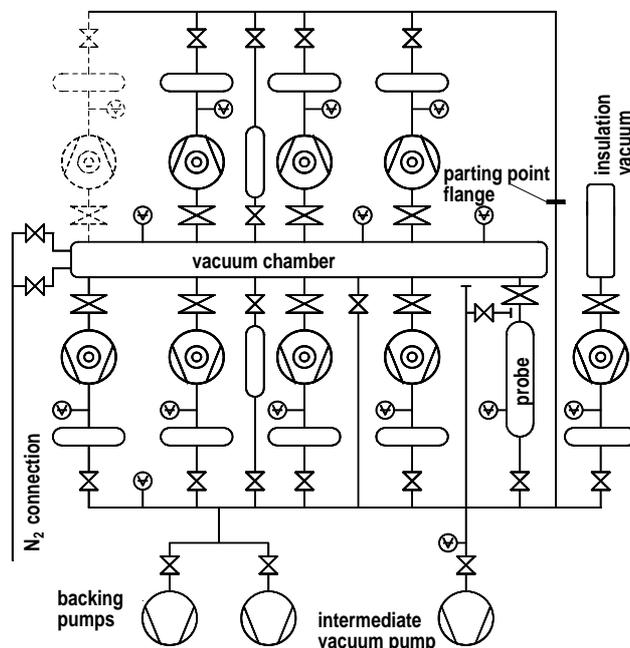
A backing vacuum pumping unit, consisting of the dry screw vacuum pump and one dry piston pump in parallel, evacuates all turbomolecular pumps, the gauges and, if required, the ion source via a ca. 10 metre long connection. This unit is placed, together with the intermediate vacuum pump, in the supply room, which is outside the accelerator bunker and therefore always accessible. The dry screw vacuum pump is used for rapid pumping of the system from atmospheric pressure down to backing vacuum pressure.

During normal operation, only the dry vacuum pump is in use. If this pump fails, the screw pump comes automatically into operation.

The buffering volume at the pump outlets provides relative independence of the turbomolecular pumps from the backing pump unit. For instance, the ion source can be evacuated while the turbomolecular pumps are running.

The turbomolecular pumps are connected to the high frequency wave-guides with gate valves.

Venting is performed using the general nitrogen supply of the institute and monitored with pressure sensors.



CONTROL SYSTEM

The local control system, based on the well-established Siemens S7 PLCs, takes care of the communication with the superordinated systems. All operational status parameters are displayed and all events recorded.

PROSPECTS

With this well established concept, one can expect very reliable operation of the system. Assuming that the surface preparation and component conditioning is carried out properly, a rapid commissioning is guaranteed.