DESIGN OF THE ACCELERATION CHAMBER AND THE EVACUATION SYSTEM OF THE RIKEN SSC

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A pressure in the transmission lines of the RIKEN SSC must be kept lower than $\sim 1 \times 10^{-7}$ Torr to conserve 90 % of the accelerating particles. A design of an acceleration chamber and its evacuation system is proceeding to realize the condition.

The acceleration chamber consists of eight separate parts; four magnet enclosures, two resonators and two valley enclosures. They are integrated into a single chamber with flanges confronting each other. The flanges are sealed with O-rings which will be compressed by a "pneumatic expansion seals".[1] The magnet enclosures are fitted into the 50 mm pole gap of the sector magnet. A thickness of a wall of the enclosures is 4 mm in this gap and is not sufficient to resist to atmospheric pressure. So the enclosure is surrounded by an auxiliary chamber which is roughing to about 10^{-1} Torr to reduce a pressure difference between the both sides of the thin wall. The main coils of the magnet are put outside of the enclosure but the pole tips and the field trimming coils are included in the auxiliary chamber.

The magnet and the valley enclosures will be made of 304 stainless steel and the resonators are made of stainless steel cladded with copper. The overall diameter of the acceleration chamber is about 9 m and the height of it is 270 cm at the resonator sections and 90 cm at the valley sections. The total volume is nearly 30 m and the surface area exposed to the vacuum is approximately 350 m .

According to a result measured in the 160 cm cyclotron of this institute, a pressure in the acceleration chamber decreases rapidly during the first 20 hours but after then the decrease becomes very slow. The average outgassing rate for all surfaces after 20 hours pumping was 2.2×10^{-9} Torr.ℓ/(sec.cm). Substituting this value, as a temporary standard, for the outgassing rate from the designing chamber, we get a value of 7.7×10^{-3} Torr.ℓ/sec for the total outgassing rate. There will be an additional gas load of $\sim 3 \times 10^{-3}$ Torr.ℓ/sec caused by the evolution from various components within the chamber and the permeation through the sealing elastomers. Therefore an effective pumping speed of 11×10^{4} ℓ/sec is required to achieve a pressure lower than 1×10^{-7} Torr in the beam line of the chamber.

About 70 % of the outgassing is due to water vapor and the residue is due to gases of H_2, Co, Co_2, O_2, N_2. As the pressure becomes low, the proportion of molecular hydrogen becomes large. A pumping system of the chamber must have high pumping speed for water vapor. As a wall area of the chamber to place pumping ports is limited, only cryogenic pumps are able to obtain the required effective pumping speed. They are installed outside of every resonators and every valley enclosures. The total pumping speed is amount to $\sim 16 \times 10^{4}$ ℓ/sec. A possibility of adding little

cryogenic pumps behind the magnet enclosures is considered. Turbo molecular pumps are also installed to operate the cryogenic pumps for quite long periods of time before requiring regeneration.

Baking may be possible to reduce the outgassing rate at the resonator and the valley sections, but his method is far from practical at the magnet sections. A possibility of the discharge cleaning in the magnet enclosure is investigated.[2)]

References

1) THis conference abstract: K. Ikegami et al, "Test of the model pneumatic expansion seal for the RIKEN SSC"
2) This conference abstract: K. Ikegami et al, "Preliminary experiment on discharge cleaning of a sector magnet vacuum chamber.

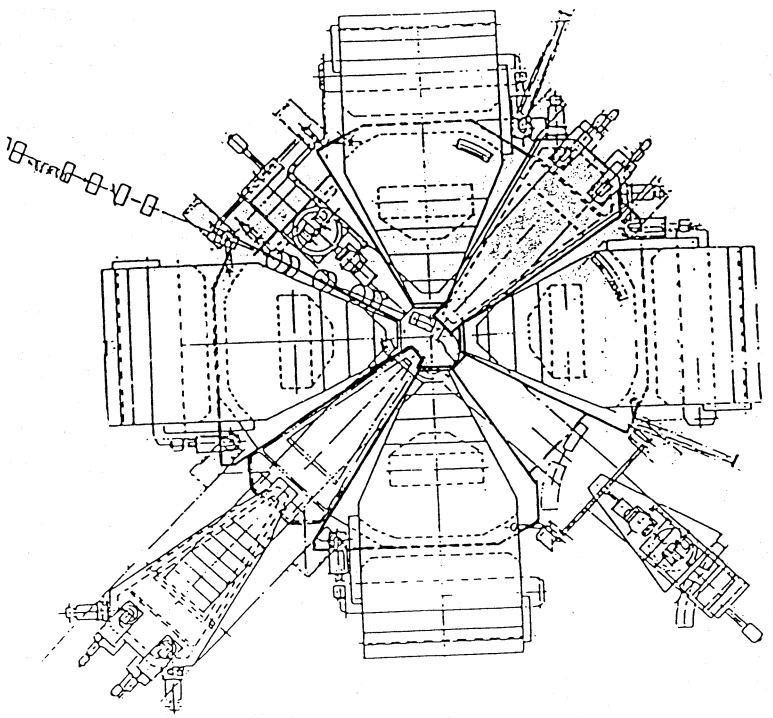

Fig. 1. Plan view of the acceleration chamber of the SSC .