

AGING OF THE NEW ACCELERATING TUBE OF THE RCNST TANDEM

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1. New Accelerating Tube

Both negative and positive ion accelerating tube consist of nine sections. Each section is 508 mm in length. Ceramic insulators of Murite ($3\text{Al}_2\text{O}_3\cdot 2\text{SiO}_2$) are 190 mm diameter and 29 mm in thickness. Electrodes consist of two parts. Outer ones are flat disks of covar and cemented to the insulators with Araldite. Dismountable stainless-steel inner electrodes are of re-entrant type with 90 mm inner diameters. Sixteen permanent magnets for electron suppression are installed between tube sections.

2. High Voltage Generation and Aging of the Accelerating Tubes

Fig. 1 shows the progress of aging of the accelerating tubes. While high voltage was generated, pressure of insulating gas ($\text{N}_2 + 10\% \text{CO}_2$) was maintained at least higher than 10 atm, the dewing point of gas at about -60°C , and vacuum degrees of the tubes at $1\sim 2 \times 10^{-6}$ Torr. Vacuum degrees of the tubes, column currents, and intensities and energy spectra of X-ray generated in the tubes were watched to monitor extraordinary discharges in the tubes.

The procedure of raising voltage was as follows: After the conditioning run of 30~60 minutes, the belt was gradually charged. At first voltage was smoothly raised without discharge. At some voltage, vacuum degrees and column currents began to oscillate and bursts of X-ray were generated in coincidence with oscillation. This indicated occurrence of small discharges in the tubes. Then, the generator was leaved as it was. These discharges gradually calmed down and amplitude of the oscillation was reduced. After these discharges sufficiently calmed down, the belt charging current was slightly increased to raise voltage. Then small discharges came back again and the same process was repeated. In this procedure rate of voltage increase was about 100 kV per hour.

The voltage, at which small discharges occurred, gradually became higher as aging of the tubes progressed. But after evacuation of the tubes had been stopped for some period, or after stripper gas had flowed into the tubes during acceleration of beam, the voltage lowered a little.

Sometimes, but not frequently, another type of discharge occurred. In this discharge, vacuum degree of a tube and column current of the same side swing to about ten times of the amplitude of oscillation in the small discharge, and voltage was reduced by a few hundred kV. This type of discharge was payed with special attention. When it seemed to occur frequently, charging current was reduced a little to lower voltage.

Energy spectra of X-ray had a broad peak around the energy corresponding to two thirds of the voltage of one section of the tube. This showed that electrons generated in the tubes were trapped by the fields of installed permanent magnets.

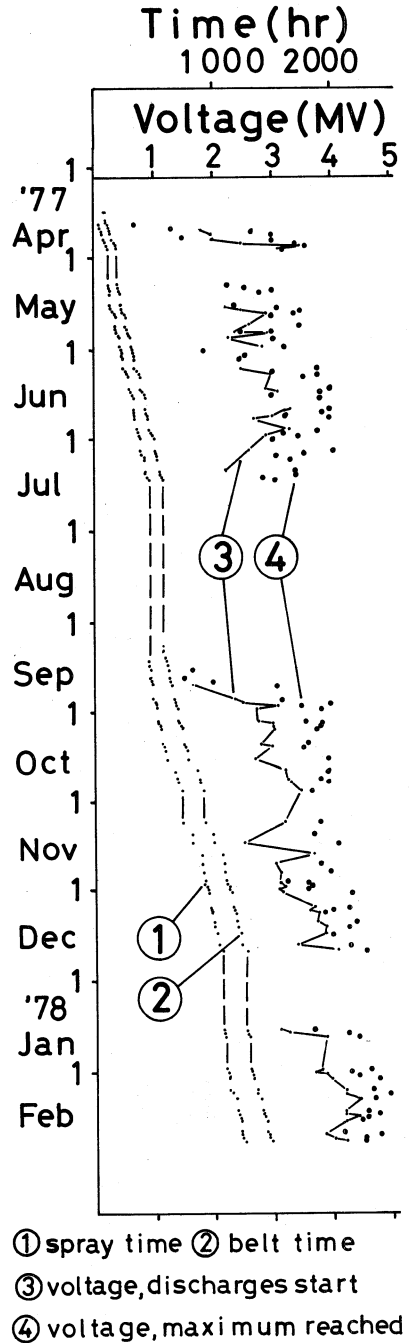


Fig.1 Aging of the new accelerating tube of the RCNST Tandem