RF SYSTEMS FOR THE RING CYCLOTRON PROJECT IN RCNP

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An intermediate energy particle accelerator complex is being designed as a new accelerator facility of RCNP[1]. Variable frequency H_{101} mode single gap RF cavities with turning plates are proposed for the 1st ring and the 2nd ring. These single gap acceleration cavities with inductive couplings are fitted well for this cascade ring cyclotrons. The characteristics of the RF systems are given in table 1.

The RF system is synchronized MOPA systems and π type damped resonance networks are designed for grid tuning circuits of final power tubes. Inductive trimmers and electrical phase control systems are needed to keep RF phase error below $\pm 0.1°$. A preliminary test for the RF phase stabilizer was done with the RF system of RCNP cyclotron[2].

To ensure the single turn extraction mode, the RF voltage and the cyclotron frequency stability must be better than 10^{-4} and 10^{-6} respectively. For high intensity beam, stable injection beam is desired to keep stable beam loading. The desired cyclotron frequency stability(10^{-6}) is very hard for main magnet power supply. However beam phase can be stabilized using frequency compensation method.

A preliminary study of the RF cavities for the 1st and 2nd Ring was done with 1/10 scale model. Each cavity has an oval sliding tuner plate and covers the proposed frequency range ($20\times10 \sim 32\times10$ MHz). Fig. 1 shows the model cavity of the 2nd ring. Fig. 2 shows the measured RF voltage distributions along acceleration gaps. As shown in the figure, radially increasing RF voltage is produced and the beam phase width compression can be expected.

References

1) I. Miura, T. Yamazaki, A. Shimizu, M. Inoue, T. Saito, K. Hosono, T. Itahashi, M. Fujiwara and M. Kondo, The RCNP Intermediate Energy Particle Accelerator Complex, these proceedings.

2) T. Saito and I. Miura, RF System for the RCNP Cyclotron, these proceedings.

Table 1. Characteristics of the RF system.

	1st Ring	2nd Ring
RF frequency	20∿32 MHz	20∿32 MHz
Harmonic No.	4,6,8,12	4,6,8,12
RF peak volt.	400 kV	500 kV
RF peak cur. (density)	15kA(40A/cm)	15kA(40A/cm)
No. of cavity	2	4
RF power	150kW/cavity	200kW/cavity
$\Delta V/V$	10^{-4}	10^{-4}
$\Delta F/F$	10^{-8}	10^{-8}
$\Delta\theta$	±0.1°	±0.1°
$\Delta\phi$	±1°	±1°
$\Delta\omega/\omega$ ($\Delta\phi$)	10^{-6}(±1°)	10^{-6}(±1°)

$\Delta V/V$; pk-pk noise/pk RF voltage
$\Delta F/F$; frequency stability
$\Delta\theta$; RF phase excursion
$\Delta\phi$; beam phase excursion
$\Delta\omega/\omega$; cyclotron frequency stability

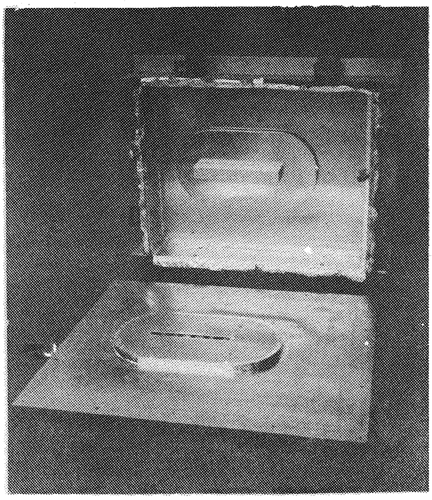

Fig. 1. Photograph of the model cavity of the 2nd ring.

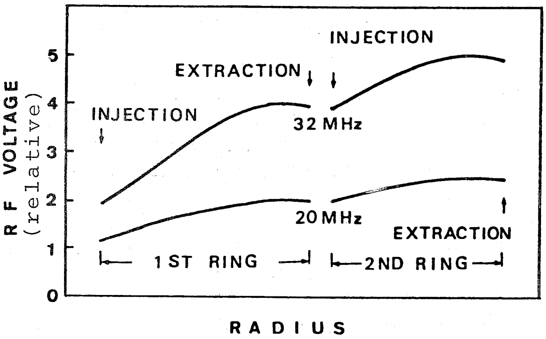

Fig. 2. Measured RF voltage distributions along acceleration gaps.