ENTRY NO. C29 **Date** 1st July, 1992

Name of Machine RCNP AVF cyclotron

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In Charge: M. Kondo **Reported by:** T. Itahashi

HISTORY

MILESTONE DATES:

Design 1970-1972 Model Tests 1966-69

Construction 1971-1973 First Beam 1974

DESIGN/CONSTRUCTION BY:

in house design other various engineering contracts

COST: Accelerator 3.5×10^6(1971) Facility 9×10^6(1971)

FUNDED BY: Ministry of Education, Science and Culture

STATUS

STAFF: Machine

Scientists ~8 (including Ring Cyclotron) Engineers 6 (including Ring Cyclotron)

Technicians — Students —

Research (in house/external)

Scientists ~9 / ..... Engineers 1 / .....

Technicians ..... / ..... Students 2 / .....

BUDGET: Machine ~3×10^6 (including Ring) Funded by Ministry of Education, Science and Culture

Research ~2×10^6 " Funded by "

TIME DISTRIBUTION:

Basic Research (in house/external) 85 % / (inhouse & ext.) %

Applied Program (in house/external) 5 % / (") %

Development 5 % Maintenance 5 %

MAGNET

POLE PARAMETERS:

Diameter 230 cm $R_{extract}$ 100 cm R_{inject} ..... cm

HILL PARAMETERS: Gap (min) 20.7 cm B_{max} 1.95 T

(@ ..... AT) Gap (max) ..... cm B_{min} ..... T

VALLEY PARAMETERS: Gap (min) 34.7 cm B_{max} 1.2 T

(@ ..... AT) Gap (max) ..... cm B_{min} ..... T

AVERAGE FIELD: $< B >_{min}$ ..... T $< B >_{max}$ 1.6 T

NUMBER OF SECTORS: compact/separated 3 / .....

sector angle ..... deg. spiral (max) 52 deg.

FIELD TRIMMING: Trim Coils 16

Harmonic Coils 5/sec

Other .....

CURRENT: Main Coils 6×10^5 AT Amps Stability 3×10^{-5}

Trim Coils 4.5×10^3 AT Amps Stability 10^{-4}

Stored Energy (cryogenic) ..... MJ

WEIGHT: Iron 400 tons Conductor Copper, Hollow

ION ENERGY: Bending Limit E/A = 140 q^2/A^2 MeV/u

Focussing Limit E/A = 85 q/A MeV/u

ACCELERATION SYSTEM

FUNDAMENTAL ACCELERATION:

Description: Single Dee, Coaxial Resonator

No. of Gaps/turn 2 dE/dn(max) 0.16 MeV/q

Voltage(max) 0.08 MV Harmonic f_{rf}/f_{ion} 1.3

Freq 6~18 MHz Power in(max) 0.4 MW

Stability: Phase 1 deg Voltage 1×10^{-4}

OTHER CAVITIES (Flattopping or otherwise):

Description: .....

Region of Influence: R_{min} ..... cm R_{max} ..... cm

No. of Gaps/turn ..... dE/dn(max) ..... MeV/q

Voltage(max) ..... MV Harmonic f_{rf}/f_{ion} .....

Freq ..... MHz Power in(max) ..... MW

Stability: Phase ..... Voltage .....

VACUUM SYSTEM

OPERATING PRESSURE: 6×10^{-7}

PUMPS: No. and type 3 Diffusion pumps

(one 55cm, two 90 cm)

ION SOURCE(S)

	Type	Intensity (mA)	@	$\epsilon_n = \beta\gamma\epsilon$ (πmm mrad)	Ion Species
(a)	Internal, hoodedarc				p,d,h,α
(b)	Internal, pulsedPIG				Li, ... Ar
(c)	External, pol, atomic				p, d
(d)					

INJECTION SYSTEM

Electrstatic Focusing and dc mirror Inflector Efficiency ~10 %

EXTRACTION SYSTEM

Dc Electrostatic with Magnetic Channel Efficiency 50~100 %

CHARACTERISTIC BEAMS

	Accelerated Ions	E/A (MeV/u)	Current(part μA) Internal	External
(a)	p	≤ 85	50	50
(b)	α	≤ 30	20	20
(c)	p	≤ 85	1	1
(d)	Ne^{6+}	≤ 11	0.2	0.2

	Secondary Particles	E (MeV)	part/sec
(a)			
(b)			
(c)			

EXTRACTED BEAM PROPERTIES:

For 1 μA of 65 MeV/u p ions

$\Delta E/E$ 0.2 % $\Delta\phi$ 12 °rf

$\epsilon_n = \beta\gamma\epsilon$ x 6 πmm mrad z 3 πmm mrad

FACILITIES FOR RESEARCH

SHIELDED AREA: Fixed 1130 m^2 Moveable — m^2

Target Stations: ..... No. Served At Same Time: 1

MAGNETIC SPECTROMETERS: QDDQ(RAIDEN)

OTHER FACILITIES:

Recoil Mass Separator (CARP), Triple Focusing Electron Spectrometer (AGNES)

REFERENCES/NOTES

(a) M.Kondo, Eighth Internat. Conf on Cyclotrons and their applications, Bloomington, (1979), pp.1904-1911

(b) RCNP Annual Report (1987)

PLAN VIEW OF FACILITY, COMMENTS

1) Intensity of polarized proton and deuteron beam is increased up to 600 nA at target.
2) Horizontally polarized proton and deuteron beam are used in experiments.
3) $^6Li^{3+}$(E≤210 MeV). $^7Li^{3+}$(E≤180 MeV) and $^{40}Ca^{7+}$ (≤147 MeV) are supplied using back bombard method with LiF and CaF_2 crystals.
4) The J-beam line is equipped with recoil mass separator (CARP).
5) The six sector ring cyclotron as a booster of the present cyclotron was completed in March 1991.