

ENTRY NO. C32 Date July 1, 1992
 Name of Machine RIKEN Ring Cyclotron
 Institution The Institute of Physical and Chemical Research (RIKEN)
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 In Charge: Y.Yano Reported by: A.Goto

HISTORY

MILESTONE DATES:
 Design ¹⁹⁷⁵ Model Tests ¹⁹⁷⁷
 Construction ¹⁹⁸⁰⁻¹⁹⁸⁶ First Beam ^{Dec. 16, 1986}
 DESIGN/CONSTRUCTION BY: Design RIKEN
 in house other Construction SHI (major)
 COST: Accelerator $\yen 40 \times 10^8$ Facility $\yen 137 \times 10^8$
 FUNDED BY: Science and Technology Agency (STA)

STATUS

STAFF: Machine 6
 Scientists 6 Engineers 14
 Technicians Students
 Research (in house/external)
 Scientists 46 / 240 Engineers 2 /
 Technicians / Students / 110
 BUDGET: Machine $\yen 4.2 \times 10^8$ Funded by STA
 Research $\yen 4.4 \times 10^8$ Funded by STA
 TIME DISTRIBUTION:
 Basic Research (in house/external) 20 % / 50 %
 Applied Program (in house/external) % / %
 Development 10 % Maintenance 20 %

MAGNET

POLE PARAMETERS:
 Diameter cm $R_{extract}$ 356 cm R_{inject} 89 cm
 HILL PARAMETERS: Gap (min) 8 cm B_{max} 1.67 T
 (ϕ 1.28 \times 10^5 AT) Gap (max) 8 cm B_{min} T
 VALLEY PARAMETERS: Gap (min) cm B_{max} T
 (ϕ AT) Gap (max) cm B_{min} T
 AVERAGE FIELD: $\langle B \rangle_{min}$ T $\langle B \rangle_{max}$ 0.97 T
 NUMBER OF SECTORS: compact/separated / 4
 sector angle 50 deg. spiral (max) deg.
 FIELD TRIMMING: Trim Coils 26 \times 4 pairs
 Harmonic Coils
 Other
 CURRENT: Main Coils 1072 Amps Stability $< 5 \times 10^{-5}$
 Trim Coils 230-600 Amps Stability $< 5 \times 10^{-3}$
 Stored Energy (cryogenic) MJ
 WEIGHT: Iron 2100 tons Conductor 16 tons
 ION ENERGY: Bending Limit E/A = 540 q²/A² MeV/u
 Focussing Limit E/A = q/A MeV/u

ACCELERATION SYSTEM

FUNDAMENTAL ACCELERATION:
 Description: 2 \times 23.5^\circ -Dees
 No. of Gaps/turn 4 dE/dn(max) 1 MeV/q
 Voltage(max) 0.25 MV Harmonic f_{rf}/f_{ion} 5,9,10,11
 Freq 18-45 MHz Power in(max) 2 \times 0.3 MW
 Stability: Phase $\pm 0.2^\circ$ Voltage $\pm 1.5 \times 10^{-4}$
 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: $< 1 \times 10^{-8}$ Torr
 PUMPS: No. and type 5,000 l/s Cryopanel x4
10,000 l/s Cryopumps x10

ION SOURCE(S)

| Type | Intensity (mA) | ϕ (mm mrad) | $\epsilon_n = \beta\gamma\epsilon$ (mm mrad) | Ion Species |
|--|----------------|------------------|--|-------------|
| (a) External injection by use of two injectors (715 cyclotron and heavy-ion linac) | | | | |
| (b) <u> </u> | | | | |
| (c) <u> </u> | | | | |
| (d) <u> </u> | | | | |

INJECTION SYSTEM

Magnetic chan and electrostatic chan. Efficiency 70 %

EXTRACTION SYSTEM

Electrostatic chan and Magnetic chan. Efficiency 100 %

CHARACTERISTIC BEAMS

| Accelerated Ions | E/A (MeV/u) | Current(part μ A) | |
|--|-----------------|-----------------------|-----------------------------------|
| | | Internal | External |
| (a) <u>P</u> | <u>70-210</u> | <u> </u> | <u>0.03-0.1</u> |
| (b) <u>$d, ^{12}C, ^{14}N, ^{16}O, ^{20}Ne$</u> | <u>30-135</u> | <u> </u> | <u>0.01-0.5</u> |
| (c) <u>^{40}Ar</u> | <u>7.5-9.5</u> | <u> </u> | <u>0.03-0.2</u> |
| (d) <u>$^{132,136}Xe$</u> | <u>7.0-2.6</u> | <u> </u> | <u>0.002-0.004</u> |
| Secondary Particles | | E (MeV) | part/sec |
| (a) <u>^{11}Li</u> | <u> </u> | <u>910</u> | <u>3×10^4</u> |
| (b) <u>^{12}Be</u> | <u> </u> | <u>980</u> | <u>1×10^4</u> |
| (c) <u>^{16}C</u> | <u> </u> | <u>1250</u> | <u>1×10^4</u> |

EXTRACTED BEAM PROPERTIES:

For μ A of MeV/u ions
 $\Delta E/E$ 0.1 % $\Delta \phi$ 4 $^\circ$ rf
 $\epsilon_n = \beta\gamma\epsilon$ x 0.7 π mm mrad z 0.7 π mm mrad

FACILITIES FOR RESEARCH

SHIELDED AREA: Fixed 4000 m² Moveable m²
 Target Stations: 14 No. Served At Same Time: 2
 MAGNETIC SPECTROMETERS: QQD-QD (SMART)
 OTHER FACILITIES: Projectile Fragment Separator (RIPS)

Gas-filled Recoil Isotope Separator / Ion-guided Isotope
 Separator On-line (GARIS/IGISOL)
 Scattering Chamber (ASCHRA), Muon Channel (Large Ω)

REFERENCES/NOTES

(a) Y.Yano: this conference
 (b)

PLAN VIEW OF FACILITY, COMMENTS

