

## ENTRY NO. 37

NAME OF MACHINE Osaka University RCNP Isochronous Cyclotron DATE 7/22/78  
 INSTITUTION Research Center for Nuclear Physics, Osaka University  
 ADDRESS Suita, Osaka 565, Japan

IN CHARGE M. Kondo REPORTED by M. Kondo

## HISTORY AND STATUS

DESIGN, date 1965 MODEL tests 1966 - 69  
 ENG. DESIGN, date 1970 - 1972  
 CONSTRUCTION, date 1971 - 1973  
 FIRST BEAM date (or goal) 1974  
 MAJOR ALTERATIONS None

OPERATION, 120 hr/wk; On Target ~ 100 hr/wk  
 TIME DIST., in house \* %, outside \* %  
 USERS' SCHEDULING CYCLE ~ 12 weeks  
 COST, ACCELERATOR \$ 3.5 × 10<sup>6</sup>  
 COST, FACILITY, total \$ 9 × 10<sup>6</sup>  
 FUNDED BY Ministry of Education, Japan

## ACCELERATOR STAFF, OPERATION and DEVELOPMENT

SCIENTISTS ~ 8 ENGINEERS -  
 TECHNICIANS 8 CRAFTS -  
 GRAD STUDENTS involved during year -  
 OPERATED BY x Res staff or x Operators  
 BUDGET, op & dev ~ \$ 1 × 10<sup>6</sup>  
 FUNDED BY Ministry of Education

## RESEARCH STAFF, not included above

USERS, in house ~ 8 outside ~ 200  
 GRAD STUDENTS involved during year 2  
 RES. BUDGET, in house ~ \$ 1 × 10<sup>6</sup>  
 FUNDED BY Ministry of Education

## FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 1130 m<sup>2</sup>  
 movable - m<sup>2</sup>  
 TARGET STATIONS 11 in 5 rooms  
 STATIONS served at same time, max 1  
 MAG SPECTROGRAPH, type QDDQ  
 COMPUTER, model TOSBAC 5600, PDP 11/40 & 70  
 OTHER FACILITIES Scattering Chamber  
Scattering Chamber with Polarization  
Monitor  
In-Beam Gamma Ray Facility  
Irradiation Facility with Rabbit System

## REFERENCES/NOTES

M. Kondo, et al., Seventh Internat. Conf. on Cyclotrons and their Applications, Zürich(1975), pp 95 - 98.  
 M. Kondo, these Proceedings

\* Time is assigned by Programme Committee. No distinction is made between "In-house" and "Outside" proposal.

## MAGNET

POLE FACE diameter 230 cm; R extraction 100 cm  
 GAP, min 20.7 cm; Field 19.5 kG } at 0.4 × 10<sup>6</sup>  
 max 34.7 cm; Field 12.0 kG } ampere turns  
 AVERAGE FIELD at R ext 16.0 kG  
 CURRENT STABILITY 10 parts/10<sup>6</sup>; B<sub>max</sub>/(B) 1.2  
 NUMBER OF SECTORS 3; SPIRAL, max 52 deg  
 POLE FACE COIL PAIRS: AVF - /sec;  
 Harmonic correction 5/sec  
 Rad grad - /sec or Circ coils 16  
 WEIGHT: Fe 400 tons; Coils 13 tons  
 CONDUCTOR, Material and type Copper, Hollow  
 STORED ENERGY ~ 3 MJ  
 COOLING SYSTEM Demineralized water  
 POWER: Main coils 450 max, kW  
 Trimming coils 265 max, kW  
 YOKE/POLE AREA 100 %  
 SECTOR ANGLE (Sep Sec) - deg  
 ION ENERGY (Bending limit) E/A = 120 q<sup>2</sup>/A<sup>2</sup> MeV  
 (Focusing limit) E/A = ~ 80 q/A MeV

## ACCELERATION SYSTEM

DEES, number 1 angle 180 deg  
 BEAM APERTURE 4.4 cm; DC BIAS 0 kV  
 TUNED by, coarse MS fine VC. auto  
 RF 6 to 18 mHz, stable ± 0.005 /10<sup>6</sup>  
 Orb F 1.2 to 18 mHz; GAIN, max 160 kV/turn  
 HARMONICS, RF/Orb F, used 1, 3  
 DEE-Gnd, max 80 kV, min gap - cm  
 STABILITY, (pk-pk noise)/(pk RF volt) 1 × 10<sup>-4</sup>  
 RF PHASE stable to ± 1 deg  
 RF POWER input, max 430 kW  
 RF PROTECT circuit, speed 1 μsec  
 Type Ignitron Crowbar  
 FREQUENCY MODULATION, rate - /sec  
 MODULATOR, type -  
 BEAM PULSE, width -

## VACUUM SYSTEM

PUMPS, No., Type, Size 3 Diffusion Pumps  
(one 55 cm, two 90 cm)  
 OPERATING PRESSURE 1 μTorr,  
 PUMPDOWN TIME 3 hrs

## ION SOURCES/INJECTION SYSTEM

Oak Ridge Type & Penning  
Polarized p and d

## EXTRACTION SYSTEM

DC Electrostatic with Magnetic Channel

## CONTROL SYSTEM

Digital Control System Plus PDP 11/40

ENTRY NO. 37 (cont.)

CHARACTERISTIC BEAMS

|           | Particle             | Goal (MeV) | Achieved (MeV) |
|-----------|----------------------|------------|----------------|
| ENERGY    | p                    | ≤ 75       | ≤ 75           |
|           | α                    | ≤ 120      | ≤ 120          |
|           | $^{14}\text{N}^{5+}$ |            | 215            |
| CURRENT   |                      | (μA)       | (μA)           |
|           | Internal             |            |                |
|           | External             |            |                |
|           |                      | (part/s)   | (part/s)       |
| Secondary |                      |            |                |

BEAM PROPERTIES

|                | Measured  | Conditions         |
|----------------|-----------|--------------------|
| Pulse Width    | 12 RF deg | 0.1 μA of 40 MeV p |
| Phase Exc, max | 5 RF deg  | 1~2 μA of 90 MeV α |
| Extract Eff    | 90 %      | 1~2 μA of 65 MeV p |
| Res, ΔE/E      | 0.2 %     | 1~2 μA of 90 MeV α |

Emittance

|           |                                 |               |
|-----------|---------------------------------|---------------|
| (mm-mrad) | { 10 axial } 1~2 μA of 90 MeV α | { 20 radial } |
|-----------|---------------------------------|---------------|

OPERATING PROGRAMS, time dist

|                          |       |
|--------------------------|-------|
| Basic Nuclear Physics    | ~80 % |
| Solid State Physics      | %     |
| Bio-Medical Applications | %     |
| Isotope Production       | ~2 %  |
| Development              | ~18 % |
|                          | %     |
|                          | %     |

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, OPERATION SUMMARY, ADDITIONAL REFERENCES

All research facilities in the Research Center for Nuclear Physics (RCNP) are open to all nuclear scientists in Japan. Beams of p, d,  $^3\text{He}$ ,  $^4\text{He}$ ,  $\vec{p}$ ,  $\vec{d}$ ,  $^{12}\text{C}^{4+}$ ,  $^{14}\text{N}^{4+,5+}$ ,  $^{16}\text{O}^{5+}$  and  $^{20}\text{Ne}^{4+,5+}$  have been used for many kinds of experiments. The B-beam line is mainly used for polarization experiments. The E-line is equipped with a large scattering chamber. The F-line is for an in-beam spectroscopy. A reaction particle analyzer (230t, ρ = 1500 mm). of QDDQ-type<sup>1)</sup>, whose momentum resolution is 20,000 is located in room W.

1) H. Ikegami et al, RCNP Annual Report (1976)

