

ENTRY NO. 53

NAME OF MACHINE Osaka University RCNP Isochronous Cyclotron
 INSTITUTION Research Center for Nuclear Physics, Osaka University
 ADDRESS Ibaraki, Osaka. 567, JAPAN
 TEL 06-877-5111 TELEX 5286-214
 IN CHARGE M. Kondo REPORTED BY T. Itahashi

HISTORY AND STATUS

DESIGN, date Model tests 1966-69
 ENG DESIGN, date 1970-1972
 CONSTRUCTION, date 1971-1973
 FIRST BEAM, date (or goal) 1974
 MAJOR ALTERATIONS

COST, ACCELERATOR \$3.5x10⁶
 COST, FACILITY, total \$9x10⁶

FUNDED BY Ministry of Education, Science and Culture

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS ~8 ENGINEERS 8
 TECHNICIANS — CRAFTS —

GRAD STUDENTS involved during year —

OPERATED BY X Research staff or X Operators

OPERATION 144 hr/wk. On target 120 hr/wk

TIME DISTR. in house — %, outside — %

BUDGET, op & dev ~\$1x10⁶

FUNDED BY Ministry of Education, Science and Culture

RESEARCH STAFF, not included above

USERS, in house ~8 outside ~200

GRAD STUDENTS involved during year 3

RESEARCH BUDGET, in house ~\$1x10⁶

FUNDED BY Ministry of Education, Science and Culture

MAGNET

POLE FACE, diameter (compact) 230 cm, R-extraction 100 cm

R injection — cm

GAP, min 20.7 cm, Field 19.5 kG }
 max 34.7 cm, Field 12.0 kG } at 0.4x10⁶

AVERAGE FIELD at R ext 16.0 kG } Ampere turns

B max / < B > 1.2

NUMBER OF SECTORS { compact 3 } Spiral, max .52 deg
 { separated — }

SECTOR ANGLE (SSC) — deg

TRIMMING COILS Harmonic coil .5/sec

and Circular, 16

CONDUCTOR, material and type Copper, Hollow

STORED ENERGY (cryogenic) 3 MJ

POWER: main coils 450 max kW; current stability 3x10⁻⁵

trimming coils 265 max kW; current stability 10⁻⁴

WEIGHT: Fe 400 tons; coils 13 tons

COOLING system Demineralized water

ION ENERGY (Bending limit) E/A = 140 q²/A² MeV/amu

(Focusing limit) E/A = ~85 q/A MeV/amu

ACCELERATION SYSTEM

DEES, number — 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 ± 0.05/10⁶

Orb F 1.2 to 18 MHz

HARMONICS, RF/Orb F, used 1, 3, 5

DEE-Gnd, max 80 kV, min gap — cm

STABILITY, (pk-pk noise)/(pk RF volt) 1x10⁻⁴

ENERGY GAIN, max 160 kV/turn

RF PHASE, stable to ± 1 deg

RF POWER input, max. 430 kW

FREQUENCY MODULATION, rate — /s

modulator, type —

beam pulse, width —

VACUUM SYSTEM

OPERATING PRESSURE 6x10⁻⁷ Torr or lower

PUMPS, No, Type, Size 3 Diffusion pumps (one 55 cm,

two 90 cm)

ION SOURCES

Oak Ridge Type, Penning and Atomic Beam Type

Polarized Ion Source

INJECTION SYSTEM

Electrostatic Focusing and dc mirror Inflector

EXTRACTION SYSTEM

DC Electrostatic with Magnetic Channel

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 1130 m²; movable — m²

TARGET STATIONS 12 in 5 rooms

STATIONS served at same time, max 1

MAG SPECTROGRAPH, type ODDQ (BAIDEN)

COMPUTER model FACOM M-200, PDPT/44, VAX-11/730

OTHER FACILITIES Polarization Spectrograph (DUMAS)

Recoil Mass Separator (CARP), Triple Focusing

Electron Spectrometer (AGNES)

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT (µA)	
	Goal	Achieved	Internal	External
p	≤75	85	50	50
α	≤120	120	20	20
p	≤75	85	1	1
Ne ⁶⁺	216	216	0.2	0.2
SECONDARY	(part/s)			

BEAM PROPERTIES

	MEASURED		CONDITIONS	
PULSE WIDTH	<u>1.2</u> RF deg	<u>0.1</u> µA of <u>40</u> MeV	p	ions
PHASE EXC, max	<u>5</u> RF deg	<u>1.2</u> µA of <u>90</u> MeV	α	ions
EXTRACT eff	<u>90</u> %	<u>1.2</u> µA of <u>65</u> MeV	p	ions
RESOL ΔE/E	<u>0.2</u> %	<u>1.2</u> µA of <u>90</u> MeV	α	ions
EMITTANCE				

(π mm-mrad) 1.0 axial
20 rad 1.2 µA of 90 MeV α

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 85 % . SOLID STATES PHYSICS 1 %

BIOMEDICAL APPLICAT. 1 % . ISOTOPE PRODUCTIONS 2 %

DEVELOPMENT 6 % . ATOMIC PHYSICS AND

EDUCATION 2 % . OTHER FIELDS 3 %

REFERENCES/NOTES

- 1) M. Kondo, Eighth Internat. Conf. on Cyclotrons and their Applications, Bloomington, (1978), pp.1904-1911
- 2) RCNP Annual Report (1985)

PLAN VIEW OF FACILITY, COMMENTS, ETC.

- 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) ⁶Li³⁺ (E ≤ 210 MeV), ⁷Li³⁺ (E ≤ 180 MeV) and ⁴⁰Ca⁷⁺ (≤ 147 MeV) are supplied using back bomb ard method with LiF and CaF₂ crystals.
- 4) The B-beam line is equipped with polarization spectrograph (DUMAS), and the J-beam line is equipped with recoil mass separator (CARP).
- 5) The cyclotron cascade project has been planned. The six sector ring cyclotron as a booster of the present cyclotron has been designed to achieve energies up to 400 MeV and 100 MeV/u for protons and light ions respectively. (Paper presented at this conference)