ENTRY NO. 44

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

HISTORY AND STATUS

DESIGN, date: 1965 Model tests: 1966-69
ENG DESIGN, date: 1970-1972
CONSTRUCTION, date: 1971-1973
FIRST BEAM, (or goal): 1974
MAJOR ALTERATIONS: None
COST, ACCELERATOR: 3.5×10^6
COST, FACILITY, total: 9×10^6
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: ∿$1×10^6
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: ∿$1×10^6
FUNDED BY: Ministry of Education Science and Culture

MAGNET

POLE FACE, diameter (compact): 230 cm, R extraction: 100 cm
R injection: cm
GAP, min: 20.7cm, Field: 19.5 kG
min: 34.7cm, Field: 12.0 kG at 0.4×10^6 Ampere turns
AVERAGE FIELD at R ext: 16.0 kG
B max/ < B >: 1.2
NUMBER OF SECTORS: compact 3, separated; Spiral, max 52 deg
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 3×10^{-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 = 120 q^2/a^2 MEV/amu
(focusing limit) E/A = ∿85 q/a MeV/amu

ACCELERATION SYSTEM

DEES, number: 1 180 deg
BEAM APERTURE: 4.4 cm; DC Bias: 0 kV
TUNED by, coarse: MS fine: VC, auto
RF: 6 to 18 mHz, stable ± $0.05/10^6$
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): 1×10^{-4}
ENERGY GAIN, max: 160 kV/turn
RF PHASE, stable to ±: 1 deg
RF POWEP input, max: 430 kW
FREQUENCY MODULATION, rate: /s
modulator, type:
beam pulse, width:

VACUUM SYSTEM

OPERATING PRESSURE: 6×10^{-7} Torr or mbar
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: QDDQ
COMPUTER model: FACOM M-180IIAD, PDP11/40, 44, 70
OTHER FACILITIES: Polarization Spectrograph (DUMAS), Recoil Mass Separator (CARP), Triple Fusuing Electron Spectrometer (AGNES)

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
p	≤75	85	50	50
α	≤120	120	20	20
$\bar{p}$	≤75	85	1	1
Ne^{6+}	216	216	0.2	0.2
SECONDARY		(part/s)		

BEAM PROPERTIES

MEASURED		CONDITIONS			
PULSE WIDTH 12 RF deg	0.1	pμ A of 40	MeV	p	ions
PHASE EXC. max 5 RF deg	1∿2	pμ A of 90	MeV	α	ions
EXTRACT eff 90 %	1∿2	pμ A of 65	MeV	p	ions
RESOL ΔE/E 0.2 %	1∿2	pμ A of 90	MeV	α	ions
EMITTANCE (π mm. mrad) 10 axial, 20 rad	1∿2	pμ A of 90	MeV	α	

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 85% SOLID STATES PHYSICS 1%
BIOMEDICAL APPLICAT 1% ISOTOPE PRODUCTIONS 2%
7% 2%
2%

REFERENCES/NOTES

1) M. Kondo, Eighth Internat.Conf.on Cyclotrons and their Applications, Bloomington, (1978), pp.1904-1911.
2) RCNP Annual Report (1982)

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) $^6Li^{3+}$ (E≤180 MeV), $^7Li^{3+}$ (E≤154 MeV) are supplied using back bombard method with a LIF crystal.
4) The B-beam line is equipped with polarization spectrograph (DUMAS), and the J-beam line is equipped with recoil mass separator (CARP).