ENTRY No. 43

NAME OF MACHINE INS SF Cyclotron DATE July 24, 1981
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HISTORY AND STATUS

DESIGN, date 1968 Model tests 1968-1970
ENG DESIGN, date 1969-1970
CONSTRUCTION, date 1969-1973
FIRST BEAM, date (or goal) Extracted, 1974
MAJOR ALTERATIONS Deflector system (1978)
MOPA rf system(1980)
COST, ACCELERATOR ~ 3 $\times 10^8$ (#)
COST, FACILITY, total ~ 7 $\times 10^8$ (#)
FUNDED BY Japan Ministry of Education

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 4 ENGINEERS 3
TECHNICIANS 2 CRAFTS 2
GRAD STUDENTS involved during year 0
OPERATED BY 1/2 Research staff or 1/2 Operators
OPERATION 132 hr/wk, On target ~100 hr/wk
TIME DISTR. in house (†) %, Outside (†) %
BUDGET, op & dev ~1.0 $\times 10^8$ (#)
FUNDED BY Japan Ministry of Education

RESEARCH STAFF, not included above

USERS, in house 12 outside ~50
GRAD STUDENTS involved during year 2
RESEARCH BUDGET, in house ~5 $\times 10^7$ (#)
FUNDED BY Japan Ministry of Education

MAGNET

POLE FACE, diameter (compact) 168 cm, R extraction 73 cm
R injection cm
GAP, min 14.6 cm, Field 19.5 kG
max 22.8 cm, Field 13.2 kG
at 3.8 $\times 10^5$ Ampere turns
AVERAGE FIELD at R ext 16.4 kG
B max/ <B> 1.19
NUMBER OF SECTORS compact 3, separated; Spiral, max 55 deg
SECTOR ANGLE (SSC) deg
TRIMMING COILS 11 sets of circular
7 sets of harmonic correction
CONDUCTOR, material and type Cu and MI cable
STORED ENERGY (cryogenic) MJ
POWER : main coils 260 max, kW ; current stability 10^{-5}
trimming coils 60 max, kW ; current stability 10^{-3}
WEIGHT : Fe 130 tons ; coils 5 tons
COOLING system Oil and demineralized water
ION ENERGY (bending limit) E/A = 68 q^2/a^2 MeV/amu
(focusing limit) E/A = 48 q /a MeV/amu

ACCELERATION SYSTEM

DEES, number 1 ; angle 180 deg
BEAM APERTURE 4 cm ; DC Bias 0 kV
TUNED by, coarse Short. plate fine 2 Trim. cap., auto
RF 7.5 to 22.5 mHz, stable ± 10^{-7}
Orb F 2.5 to 22.5 mHz
HARMONICS, RF/Orb F, used 1,3,5
DEE - Gnd, max 80 kV, min gap cm
STABILITY, (pk-pk noise)/(pk RF volt) 2 $\times 10^{-4}$
ENERGY GAIN, max 80 q kV/turn
RF PHASE, stable to ± deg
RF POWER input, max 150 kW
FREQUENCY MODULATION, rate /s
modulator, type
beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 5×10^{-7} Torr or mbar
PUMPS, No, Type, Size 36 inch and 10 inch oil diffusion pumps

ION SOURCES

Hot cathode (A ≤ 4) and cold cathode (A > 4) PIG

INJECTION SYSTEM

Axial injection for $\vec{p}$ and $\vec{d}$

EXTRACTION SYSTEM

2 channel dc deflector

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 950 m² ; movable m²
TARGET STATIONS 11 in 6 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type QDD(designed by INS staffs)
COMPUTER model TOSBAC 40C, FACOM U400-M180II AD
OTHER FACILITIES 80 cm dia. scatt. chamber, Semi-circular scatt. chamber for pγ-correl., Inbeam γ-ray facility, On-line isotope separator

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
p	48	42	40	30
α	68	68	20	15
$^{14}N^{5}$	118	115		1
$^{20}Ne^{6}$	119	115		0.3
SECONDARY			(part/s)	

BEAM PROPERTIES

MEASURED		CONDITIONS	
PULSE WIDTH 15 RF deg	1	pμ A of 60 MeV α	ions
PHASE EXC, max RF deg		pμ A of MeV	ions
EXTRACT eff 100 %	3	pμ A of 22 MeV p	ions
RESOL ΔE/E 0.1 %	1	pμ A of 22 MeV p	ions
EMITTANCE (π mm. mrad) 25 axial, 18 rad	5	pμA of 14 MeV p	ions

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 100 SOLID STATES PHYSICS
BIOMEDICAL APPLICAT. ISOTOPE PRODUCTIONS

REFERENCES/NOTES

Proc. 7th Cyclotron Conf., p.103 and 312(1975)
proc. 8th Cyclotron Conf., p.1984(1978)

(#) Salaries are not included. (†) No distinction is made between inhouse and outside proposals.

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS

(1) A good intensity of Li and B is accelerated by using solid elements.
(2) A storage ring of heavy ions, named TARN (Test Accumulation Ring for Numatron), was installed in one of the experimental halls of this cyclotron facility. The first trial of beam injection from this cyclotron was performed successfully in August 1979 with H_2^+ beam of 7 MeV/u. Since then, beam accumulation experiments have been carried out extensively and great advances were made on the technology of multiturn injection, rf stacking, monitoring and control of the beam in the storage ring (cf. Y. Hirao, IEEE Trans. Nucl. Sci. NS-28(1981)).