

ENTRY NO. 56

NAME OF MACHINE Tohoku University Cyclotron
 INSTITUTION Cyclotron and Radioisotope Center, Tohoku University
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 IN CHARGE M. Fujioka REPORTED BY T. Shinozuka

HISTORY AND STATUS CGR-MeV Model 680

DESIGN, date Model tests
 ENG DESIGN, date
 CONSTRUCTION, date 1975-1977
 FIRST BEAM, date (or goal) December, 1977
 MAJOR ALTERATIONS none
 COST, ACCELERATOR
 COST, FACILITY, total \$ 14x10⁶
 FUNDED BY Japan Ministry of Education

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 4 ENGINEERS
 TECHNICIANS 4 CRAFTS 1
 GRAD STUDENTS involved during year ~10
 OPERATED BY 5 Research staff or 4 Operators
 OPERATION 100 hr/wk. On target 88 hr/wk
 TIME DISTR. in house 10 %, outside 90 %
 BUDGET, op & dev \$ 1x10⁶
 FUNDED BY Japan Ministry of Education

RESEARCH STAFF, not included above

USERS, in house 6 outside ~60
 GRAD STUDENTS involved during year ~20
 RESEARCH BUDGET, in house \$ 0.3x10⁶
 FUNDED BY Japan Ministry of Education

MAGNET

POLE FACE, diameter (compact) 160 cm, R-extraction 68 cm
 R injection cm
 GAP, min 13 cm, Field 19.0 kG
 max 28 cm, Field 10.7 kG } at 0.26x10⁶
 AVERAGE FIELD at R ext 15.6 kG } Ampere turns/
 B max / 1.22

NUMBER OF SECTORS { compact 4 } Spiral, max. 50 deg
 { separated }
 SECTOR ANGLE (SSC) deg

TRIMMING COILS 8 circular coils and
 2 harmonic coils pairs

CONDUCTOR, material and type
 STORED ENERGY (cryogenic) MJ
 POWER: main coils 100 max kW; current stability 2x10⁻⁵
 trimming coils 26 max kW; current stability 2x10⁻⁵

WEIGHT: Fe 100 tons; coils tons
 COOLING system Deionized water
 ION ENERGY (Bending limit) E/A = 50 q²/A² MeV/amu
 (Focusing limit) E/A = q/A MeV/amu

ACCELERATION SYSTEM

DEES, number 2 angle 60 deg
 BEAM APERTURE 3 cm; DC Bias 0 kV
 TUNED by, coarse M.P. fine M.P.
 RF 20 to 40 MHz, stable ± <1x10⁻⁶
 Orb F 5 to 20 MHz
 HARMONICS, RF/Orb F, used 2, 3, and 4
 DEE-Gnd, max 50 kV, min gap cm
 STABILITY, (pk-pk noise)/(pk RF volt) 10⁻³
 ENERGY GAIN, max 200 kV/turn
 RF PHASE, stable to ± 0.5 deg
 RF POWER input, max. 120 kW
 FREQUENCY MODULATION, rate /s
 modulator, type
 beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 1x10⁻⁶ Torr or mbar
 PUMPS, No, Type, Size 2x8000 l/s
 oil diffusion pumps

ION SOURCES

. Internal hot cathode P.I.G. for light ions
 Internal cold cathode P.I.G. for heavy ions

INJECTION SYSTEM

EXTRACTION SYSTEM

. Deflector + two magnetic channels

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 800 m²; movable m²
 TARGET STATIONS 10 in 6 rooms
 STATIONS served at same time, max 1
 MAG SPECTROGRAPH, type
 COMPUTER model MELCOM COSMO 500+70/35, PDP 11/44
 OTHER FACILITIES Isotope production, irradiation of
 solids, neutron TOF (44 m flight path), mass
 separator, beam choppers, positron tomograph

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT (µA)	
	Goal	Achieved	Internal	External
p(d)	3(5), 4(25)	same		100
³ He	7, 65	same		60
⁴ He	10, 50	same		40
¹⁴ N	50, 84	same		1
SECONDARY				(part/s)

BEAM PROPERTIES

MEASURED	CONDITIONS	
	PULSE WIDTH	RESOL ΔE/E
4.7 RF deg	0.5 %	0.20 µA of 3.5 MeV
PHASE EXC. max RF deg	0.50 µA of 4.0 MeV	0.20 µA of 3.5 MeV
EXTRACT eff. 7.2 %	0.50 µA of 4.0 MeV	0.20 µA of 3.5 MeV
EMITTANCE	0.20 µA of 3.5 MeV	0.20 µA of 3.5 MeV
(π mm-mrad) 21 axial	0.40 µA of 4.0 MeV	0.40 µA of 4.0 MeV
. 30 rad		

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 50% SOLID STATES PHYSICS 10%
 BIOMEDICAL APPLICAT. 15% ISOTOPE PRODUCTIONS 10%
 OTHERS 15%

REFERENCES/NOTES

- 1) S. Morita et al., IEEE Trans. N. S., NS-26 (1979) 1930.
- 2) M. Fujioka et al., these proceedings.

PLAN VIEW OF FACILITY, COMMENTS, ETC.

