ENTRY NO. 69

NAME OF MACHINE NASA-Lewis Research Center DATE 1/79
INSTITUTION National Aeronautics & Space Admin., Lewis Research Center
ADDRESS 21000 Brookpark Road, Cleveland, Ohio 44135

IN CHARGE James W. Blue REPORTED by James W. Blue

HISTORY AND STATUS

DESIGN, date (1) MODEL tests Magnet (1968)
ENG. DESIGN, date 1967
CONSTRUCTION, date 1970
FIRST BEAM date (or goal) July 1972
MAJOR ALTERATIONS Fast neutron cancer therapy facility 1976
OPERATION, 80 hr/wk; On Target 40 hr/wk
TIME DIST., in house 40 %, outside 60 %
USERS' SCHEDULING CYCLE 2 weeks
COST, ACCELERATOR 1.5M
COST, FACILITY, total .4M
FUNDED BY NACA-NASA

ACCELERATOR STAFF, OPERATION and DEVELOPMENT

SCIENTISTS none ENGINEERS 1
TECHNICIANS 1 CRAFTS none
GRAD STUDENTS involved during year none
OPERATED BY Res staff or 3 Operators
BUDGET, op & dev
FUNDED BY NASA & NIH

RESEARCH STAFF, not included above

USERS, in house 3 outside 3
GRAD STUDENTS involved during year 2
RES. BUDGET, in house 40K + salaries
FUNDED BY NASA-NIH

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 180 vault/150 beam/ area m^2
movable none m^2
TARGET STATIONS 2 in 2 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type no
COMPUTER, model two PDP-15
OTHER FACILITIES fast neutron vertical beam and fast neutron horizontal beam.

REFERENCES/NOTES

MAGNET

POLE FACE diameter 175 cm; R extraction 73.5 cm
GAP, min 17 cm; Field 8.8 kG } at .5 X 10^6 ampere turns
max cm; Field 19.2 kG
AVERAGE FIELD at R ext 15.2 kG
CURRENT STABILITY 10 parts/10^6; $B_{max}/\langle B \rangle$ 1.26
NUMBER OF SECTORS 3 ; SPIRAL, max 10^o deg
POLE FACE COIL PAIRS: AVF none /sec;
Harmonic correction 3
Rad grad none /sec or Circ coils 7
WEIGHT: Fe 206 tons; Coils 28 tons
CONDUCTOR, Material and type copper
STORED ENERGY MJ
COOLING SYSTEM water
POWER: Main coils 250 max, kW
Trimming coils max, kW
YOKE/POLE AREA 81 %
SECTOR ANGLE (Sep Sec) deg
ION ENERGY (Bending limit) E/A = q^2/A^2 MeV
(Focusing limit) E/A = q/A MeV

ACCELERATION SYSTEM

DEES, number 2 angle 134 deg
BEAM APERTURE 3.8 cm; DC BIAS none kV
TUNED by, coarse 4 panels fine 2 panels
RF 13.5 to 23 mHz, stable ± .01 /10^6
Orb F 6.7 to 23 mHz; GAIN, max 220 kV/turn
HARMONICS, RF/Orb F, used 1 and 2
DEE-Gnd, max 70 kV, min gap cm
STABILITY, (pk-pk noise)/(pk RF volt) 10^{-3}
RF PHASE stable to ± 20 deg
RF POWER input, max 200 kW
RF PROTECT circuit, speed 10 μsec
Type Ignitron
FREQUENCY MODULATION, rate /sec
MODULATOR, type
BEAM PULSE, width

VACUUM SYSTEM

PUMPS, No., Type, Size 2, oil diffusion, 16"
OPERATING PRESSURE 8×10^{-6} with gas μTorr,
PUMPDOWN TIME 2 hrs

ION SOURCES/INJECTION SYSTEM

internal, hooded, hot filament

EXTRACTION SYSTEM

D.C. electrostatic and 50 kW magnetic channel

CONTROL SYSTEM

semi-automatic turn on

ENTRY NO. 69 (cont.)

CHARACTERISTIC BEAMS

	Particle	Goal (MeV)	Achieved (MeV)
ENERGY	P	50	46
	^{3}d	28	26
	^{3}He		88
	^{4}He	56	52
CURRENT		(μA)	(μA)
Internal	p	200	200
	d	200	200
	α	50	30
External	P		30
	d		30
	α		10
		(part/s)	(part/s)
Secondary			

BEAM PROPERTIES

	Measured		Conditions		
Pulse Width	<1°	RF deg	5	μA of 43	MeV p
Phase Exc, max		RF deg		μA of	MeV
Extract Eff		%		μA of	MeV
Res, ΔE/E		%		μA of	MeV
Emittance					
(mm-mrad) { axial / radial }				μA of	MeV

OPERATING PROGRAMS, time dist

Basic Nuclear Physics	10 %
Solid State Physics	20 %
Bio-Medical Applications	50 %
Isotope Production	20 %
Development	%
	%
	%

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

(1) This cyclotron has the dee design and magnetic field configuration of the MSU cyclotron and a modification of the Princeton RF system. The adaptation of these designs to the NASA 60", fixed frequency cyclotron was done in 1967 and 1968. The RF modification is described in NASA TN-5546.