ENTRY No. 79

NAME OF MACHINE Cleveland Clinic Therapy Cycl DATE July 29, 1981
INSTITUTION NASA Lewis Research Center
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IN CHARGE J.W. Blue REPORTED BY J.W. Blue

HISTORY AND STATUS
DESIGN, date see note Model tests
ENG DESIGN, date 1967
CONSTRUCTION, date 1970
FIRST BEAM, date (or goal) July 1972
MAJOR ALTERATIONS 1976 Modified beam room for vertical and horizontal neutron beams for cancer therapy
COST, ACCELERATOR $1,000,000
COST, FACILITY, total $ 400,000
FUNDED BY NASA, NCI, and Cleveland Clinic

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT
SCIENTISTS 2 ENGINEERS 1
TECHNICIANS 1 CRAFTS
GRAD STUDENTS involved during year none
OPERATED BY Research staff or 1 Operators
OPERATION 30 hr/wk, On target 20 hr/wk
TIME DISTR. in house 70 %, Outside 30 %
BUDGET, op & dev $300,000
FUNDED BY NCI

RESEARCH STAFF, not included above
USERS, in house 5 outside occasional
GRAD STUDENTS involved during year none
RESEARCH BUDGET, in house $5000
FUNDED BY NCI

MAGNET
POLE FACE, diameter (compact) 175 cm, R extraction 73.5 cm
R injection cm
GAP, min 17 cm, Field 8.8 kG
max cm, Field 19.2 kG } at 500000
AVERAGE FIELD at R ext 15.2 kG } Ampere turns
B max/ <B> 1.26
NUMBER OF SECTORS { compact 3 / separated } Spiral, max deg
SECTOR ANGLE (SSC) deg
TRIMMING COILS 8

CONDUCTOR, material and type hollow core H_2O cooled Cu
STORED ENERGY (cryogenic) MJ
POWER : main coils 200 max, kW ; current stability 10^{-5}
trimming coils 35 max, kW ; current stability 10^{-3}
WEIGHT : Fe 300 tons ; coils tons
COOLING system distilled water
ION ENERGY (bending limit) E/A = 55 q^2/a^2 MeV/amu
(focusing limit) E/A = 45 q /a MeV/amu

ACCELERATION SYSTEM
DEES, number 2 ; angle 56 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 ± 10^{-8}
Orb F 6.7 to 23 mHz
HARMONICS, RF/Orb F, used 1&2
DEE - Gnd, max 70 kV, min gap 1.0 cm
STABILITY, (pk-pk noise)/(pk RF volt) 10^{-3}
ENERGY GAIN, max 220 kV/turn
RF PHASE, stable to ± 1 deg
RF POWER input, max 200 kW
FREQUENCY MODULATION, rate /s
modulator, type
beam pulse, width

VACUUM SYSTEM
OPERATING PRESSURE 8×10^{-6} Torr or mbar
PUMPS, No, Type, Size 2, oil diff, 16 inch

ION SOURCES
hooded, internal

INJECTION SYSTEM
Axial mounted ion source

EXTRACTION SYSTEM
electrostatic deflector followed by magnetic channel

FACILITIES FOR RESEARCH
SHIELDED AREA, fixed 140 m² ; movable none m²
TARGET STATIONS 5 in 4 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type none
COMPUTER model DEC PDP 15
OTHER FACILITIES Vertical & horizontal neutron beams shielded and collimated for therapy.

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	ENERGY (MeV) Achieved	CURRENT (pμA) Internal	CURRENT (pμA) External
p	50	45	100	50
d		26	100	40
He-3		88	5	15
He-4		56	5	15
SECONDARY			(part/s)	

BEAM PROPERTIES

MEASURED		CONDITIONS			
PULSE WIDTH	RF deg	pμ A of	MeV	ions	
PHASE EXC, max	RF deg	pμ A of	MeV	ions	
EXTRACT eff	%	pμ A of	MeV	ions	
RESOL ΔE/E	%	pμ A of	MeV	ions	
EMITTANCE (π mm. mrad) { axial / rad }		pμA of	MeV	ions	

OPERATING PROGRAMS, time distribution
BASIC NUCLEAR PHYSICS 0 SOLID STATES PHYSICS 0
BIOMEDICAL APPLICAT. 80 ISOTOPE PRODUCTIONS 20

REFERENCES/NOTES This cyclotron has the dee design and magnetic field configuration of the first MSU isochronous cyclotron. The RF system is not the MSU design and is described in NASA TN5546. The yoke, power supplies and exciting coil are from a GE fixed frequncy 60" cycl.

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS