ENTRY NO. 118

NAME OF MACHINE FMI CYCLOTRON

INSTITUTION Franklin McLean Memorial Research Institute

ADDRESS 5841 S. Maryland Avenue, Chicago, Illinois 60637

TEL ..... TELEX .....

IN CHARGE S. J. Gatley REPORTED BY A. J. Creer/N. Odeh

HISTORY AND STATUS

DESIGN, date 1965 Model tests 1967

ENG DESIGN, date 1965-67

CONSTRUCTION, date 1969

FIRST BEAM, date (or goal) July, 1969

MAJOR ALTERATIONS Deflector

COST, ACCELERATOR 240,000

COST, FACILITY, total 600K

FUNDED BY Department of Energy

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 5 ENGINEERS 1

TECHNICIANS 4 CRAFTS 1

GRAD STUDENTS involved during year -

OPERATED BY X Research staff or Operators

OPERATION 15 hr/wk. On target 10 hr/wk

TIME DISTR. in house 100 %, outside - %

BUDGET, op & dev

FUNDED BY

RESEARCH STAFF, not included above

USERS, in house Yes outside -

GRAD STUDENTS involved during year 4

RESEARCH BUDGET, in house

FUNDED BY

MAGNET

POLE FACE, diameter (compact) 81 cm, R-extraction 35 cm

R injection cm

GAP, min 5 cm, Field 20 kG
max 10 cm, Field 12 kG } at 2 x 10^5 Ampere turns

AVERAGE FIELD at R ext 16 kG

B max/<B> 1.25

NUMBER OF SECTORS { compact / separated } Spiral, max deg

SECTOR ANGLE (SSC) deg

TRIMMING COILS 3 ea. 8 Turns 100A max.

CONDUCTOR, material and type AL Foil 1 mm

STORED ENERGY (cryogenic) MJ

POWER: main coils 58 max kW: current stability 5 x 10^{-4}

trimming coils max kW: current stability

WEIGHT: Fe 14 tons: coils tons

COOLING system Water

ION ENERGY (Bending limit) E/A = q^2/A^2 MeV/amu

(Focusing limit) E/A = q/A MeV/amu

ACCELERATION SYSTEM

DEES, number 2 angle deg

BEAM APERTURE 2 cm; DC Bias 1.5 KV kV

TUNED by, coarse MS fine VC Trimmer

RF 12 to 25 MHz, stable ± 1 x 10^{-4}

Orb F 12 to 25 MHz

HARMONICS, RF/Orb F, used

DEE–Gnd, max 30 kV, min gap cm

STABILITY, (pk-pk noise)/(pk RF volt)

ENERGY GAIN, max 60 max kV/turn

RF PHASE, stable to ± deg

RF POWER input, max. 29 kW

FREQUENCY MODULATION, rate /s

modulator, type

beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 1 x 10^{-5} Torr or mbar

PUMPS, No, Type, Size 1 ea. 10" Oil Diffusion,
1 ea. 21 CFM Mechanical

ION SOURCES

Ion Heated Pig

INJECTION SYSTEM

None

EXTRACTION SYSTEM

Electrostatic Channel with Compensated Iron Channel

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 62 m^2; movable -- m^2

TARGET STATIONS 2 in 2 rooms

STATIONS served at same time, max 1

MAG SPECTROGRAPH, type --

COMPUTER model --

OTHER FACILITIES

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
Proton	15	14.8	110	55
Deut.	8	8.3	400	270
He 3^{++}	20	20.3	120	53
He 4^{++}	15	15	80	40
SECONDARY			(part/s)	

BEAM PROPERTIES

	MEASURED		CONDITIONS		
PULSE WIDTH	RF deg		pμA of	MeV	ions
PHASE EXC. max	RF deg		pμA of	MeV	ions
EXTRACT eff.	55 %	270	pμA of 8	MeV D	ions
RESOL ΔE/E	1 %		pμA of	MeV	ions
EMITTANCE					
(π mm-mrad)	50 axial / 50 rad	90	pμA of	MeV	

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS SOLID STATES PHYSICS

BIOMEDICAL APPLICAT 100% ISOTOPE PRODUCTIONS

REFERENCES/NOTES In AIP Conference Proceedings, #9, 1972

1) Compact Cyclotron Engg. G.O. Hendry

2) ACRH Cyclotron, P.V. Harper

3) Design of Neutron Therapy Facility, F.T. Kuchnir

PLAN VIEW OF FACILITY, COMMENTS, ETC.

1. ^3He recovery system for economical $^3He^{++}$ operation
2. Particle changes are made in 30 minutes
3. Targets may be irradiated internally or externally
4. Two external target stations; one for isotope, the other for neutron production
5. External beams transport system includes two quadrupole doublets, one steering magnet, one switching magnet, and four collimators