

ENTRY NO. CU101
 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. Gately 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 11
 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 2×10^5

AVERAGE FIELD at R ext 16 kG Ampere turns

B max / < B > 1.25

NUMBER OF SECTORS {compact} 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 5×10^{-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 line VC Trimmer 4

RF 12 to 25 MHz, stable $\pm 1 \times 10^{-4}$

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 $\pm$ deg

RF POWER input, max 29 kW

FREQUENCY MODULATION, rate /s

modulator, type

beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 1×10^{-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 Chann

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 62 m², movable 77 m²

TARGET STATIONS 2 rooms

STATIONS served at same time, max 1

MAG SPECTROGRAPH, type

COMPUTER model

OTHER FACILITIES

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT (pA)	
	Goal	Achieved	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	pA of	MeV ions
PHASE EXC, max	RF deg	pA of	MeV ions
EXTRACT eff	55 %	270 pA of	8 MeV D ions
RESOL $\Delta E/E$	1 %	pA of	MeV ions

EMITTANCE 50 axial 90 μ m-rad

(π mm-mrad) 50 rad

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS SOLID STATES PHYSICS

BIOMEDICAL APPLICAT 100% ISOTOPE PRODUCTIONS

REFERENCES/NOTES In AIP Conference Proceedings, #9, 1

1) Compact Cyclotron Engg. G.O. Hendry

2) ACRH Cyclotron, P.V. Harper

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

PLAN VIEW OF FACILITY, COMMENTS, ETC.

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