

ENTRY NO. 66

NAME OF MACHINE MSU 50 MeV Cyclotron DATE 8/11/78
 INSTITUTION Michigan State University
 ADDRESS East Lansing, Michigan 48823

IN CHARGE H. G. Blosser REPORTED by P. S. Miller

HISTORY AND STATUS

DESIGN, date 1958-63 MODEL tests 1959-64
 ENG. DESIGN, date 1961-63
 CONSTRUCTION, date 1963-65
 FIRST BEAM date (or goal) Feb. 1965
 MAJOR ALTERATIONS ---

OPERATION, 168 hr/wk; On Target 140 hr/wk
 TIME DIST., in house 90 %, outside 10 %
 USERS' SCHEDULING CYCLE 4 weeks
 COST, ACCELERATOR \$940,000
 COST, FACILITY, total \$ 3,900,000
 FUNDED BY NSF & MSU

ACCELERATOR STAFF, OPERATION and DEVELOPMENT

SCIENTISTS 4 ENGINEERS 3
 TECHNICIANS 5 CRAFTS 5
 GRAD STUDENTS involved during year 2
 OPERATED BY X Res staff or --- Operators
 BUDGET, op & dev ---
 FUNDED BY NSF

RESEARCH STAFF, not included above

USERS, in house 22 outside 10
 GRAD STUDENTS involved during year 15
 RES. BUDGET, in house ---
 FUNDED BY NSF

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed --- m²
 movable 900 m²
 TARGET STATIONS 9 in 4 rooms
 STATIONS served at same time, max 1
 MAG SPECTROGRAPH, type Engel Split-pole
 COMPUTER, model XDS-Sigma 7; PDP 11/45, 11/20
 OTHER FACILITIES pneumatic rabbit,
He jet recoil thermalizer with recoil
mass analyzer (Siegfried). 0.3 nsec
TOF with selectable rep. rate.
G-factors of excited states (21 kg).
 REFERENCES/NOTES γ-γ coincidence in beam.

MAGNET

POLE FACE diameter 170 cm; R extraction 73 cm
 GAP, min 16.8 cm; Field 19.3 kG } at: 475 × 10⁶
 max --- cm; Field 8.5 kG } ampere turns
 AVERAGE FIELD at R ext 15 kG
 CURRENT STABILITY 10 parts/10⁶; B_{max}/(B) ---
 NUMBER OF SECTORS 3; SPIRAL, max small deg
 POLE FACE COIL PAIRS: AVF 0 /sec;
 Harmonic correction 2
 Rad grad 0 /sec or Circ coils 8
 WEIGHT: Fe 103 US tons; Coils 13 US tons
 CONDUCTOR, Material and type Cu
 STORED ENERGY --- MJ
 COOLING SYSTEM Water
 POWER: Main coils 140 max, kW
 Trimming coils 15 max, kW
 YOKE/POLE AREA 70 %
 SECTOR ANGLE (Sep Sec) --- deg
 ION ENERGY (Bending limit) E/A = 58 q²/A² MeV
 (Focusing limit) E/A = 45 q/A MeV

ACCELERATION SYSTEM

DEES, number 2 angle 134 deg
 BEAM APERTURE 2.5 cm; DC BIAS 0 kV
 TUNED by, coarse panels fine capacitor
 RF 14.3 to 21.5 MHz, stable ± 0.5 /10⁶
 Orb F 3.53 to 21.5 MHz; GAIN, max 250 kV/turn
 HARMONICS, RF/Orb F, used 1,2,4
 DEE-Gnd, max 70 kV, min gap 0.9 cm
 STABILITY, (pk-pk noise)/(pk RF volt) 6/10,000
 RF PHASE stable to ± --- deg
 RF POWER input, max 250 kW
 RF PROTECT circuit, speed few μsec
 Type grid clamp
 FREQUENCY MODULATION, rate --- /sec
 MODULATOR, type ---
 BEAM PULSE, width ---

VACUUM SYSTEM

PUMPS, No., Type, Size One 36" oil diffusion
pump, freon baffle
 OPERATING PRESSURE 8 μTorr
 PUMPDOWN TIME 2 hrs

ION SOURCES/INJECTION SYSTEM

Hooded filament arc for H, He.
PIG for heavy ions

EXTRACTION SYSTEM Precessional into 60°
elect. defl. into 45° iron-free channel

CONTROL SYSTEM

direct and computer control

CHARACTERISTIC BEAMS

	Particle	Goal (MeV)	Achieved (MeV)
ENERGY	p	56	56
	d	26	26
	³ He	76	76
	¹² C ⁴⁺	77	77
CURRENT		(μA)	(μA)
	Internal		3000*
		(part/s)	(part/s)
External	p		20
Secondary			

BEAM PROPERTIES

	Measured	Conditions
Pulse Width	1.5 RF deg	14 μA of 40 MeV p
Phase Exc, max	RF deg	μA of MeV
Extract Eff	100 %	15 μA of 40 MeV p
Res, ΔE/E	.06 %	μA of 40 MeV p
Emittance	(mm-mrad) { 5.0 axial 0.4* radial }	1.0 μA of 40 MeV p

*incoherent

OPERATING PROGRAMS, time dist

Basic Nuclear Physics & Chemistry	80 %
Solid State Physics	%
Bio-Medical Applications	10 %
Isotope Production	%
Development of accelerators	10 %
	%

* to 1/3 radius only (probe power limit)

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

Proc. 7th Int. Cyc. Conf. Zurich (1975) 249; Nucl. Inst. & Meth. 143 (1977) 63

