

ENTRY NO. FM-2

NAME OF MACHINE McGill Synchrocyclotron DATE July 5, 1978  
INSTITUTION Foster Radiation Laboratory, McGill University  
ADDRESS 3610 University St., Montreal, Quebec, Canada H3A 2B2

IN CHARGE Dr. S.K. Mark REPORTED by Dr. R.B. Moore

HISTORY AND STATUS

DESIGN, date 1945 MODEL tests None  
ENG. DESIGN, date 1945  
CONSTRUCTION, date 1947-49  
FIRST BEAM date (or goal) 1949  
MAJOR ALTERATIONS 1972, 1977  
(Coils, Vacuum Chamber, RF System)  
OPERATION, 120 hr/wk; On Target 100 hr/wk  
TIME DIST., in house 80 %, outside 20 %  
USERS' SCHEDULING CYCLE 2 weeks  
COST, ACCELERATOR 200,000  
COST, FACILITY, total 1,000,000  
FUNDED BY Various

ACCELERATOR STAFF, OPERATION and DEVELOPMENT

SCIENTISTS 1 ENGINEERS 1  
TECHNICIANS 3 CRAFTS  
GRAD STUDENTS involved during year None  
OPERATED BY X Res staff or Operators  
BUDGET, op & dev 250,000  
FUNDED BY NRC (Canada)

RESEARCH STAFF, not included above

USERS, in house 12 outside 7  
GRAD STUDENTS involved during year 15  
RES. BUDGET, in house 400,000  
FUNDED BY NRC (Canada), FCAC (Quebec)

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 200 m<sup>2</sup>  
movable - m<sup>2</sup>  
TARGET STATIONS Flexible in 2 rooms  
STATIONS served at same time, max 1  
MAG SPECTROGRAPH, type None  
COMPUTER, model PDP-8, PDP-15, ADP-11/34  
OTHER FACILITIES Two Pneumatic Rapid  
Extractors, Superconducting Beta  
Spectrometer, Chemistry Laboratory  
ISOL

REFERENCES/NOTES

MAGNET

POLE FACE diameter 229 cm; R extraction 91 cm  
GAP, min 19 cm; Field 17 kG } at 0.6 x 10<sup>6</sup>  
max 20 cm; Field 16 kG } ampere turns  
AVERAGE FIELD at R ext 16 kG  
CURRENT STABILITY 500 parts/10<sup>6</sup>; B<sub>max</sub>/(B) N.A.  
NUMBER OF SECTORS N.A.; SPIRAL, max N.A. deg  
POLE FACE COIL PAIRS: AVF N.A. /sec;  
Harmonic correction N.A.  
Rad grad N.A. /sec or Circ coils 0.1 T/m  
WEIGHT: Fe 200 tons; Coils 16 tons  
CONDUCTOR, Material and type Aluminum  
STORED ENERGY 0.6 MJ  
COOLING SYSTEM Deionized Water  
POWER: Main coils 180 max, kW  
Trimming coils N.A. max, kW  
YOKE/POLE AREA 100 %  
SECTOR ANGLE (Sep Sec) N.A. deg  
ION ENERGY (Bending limit) E/A = 100 q<sup>2</sup>/A<sup>2</sup> MeV  
(Focusing limit) E/A = 100 q/A MeV

ACCELERATION SYSTEM

DEES, number 1 angle 180 deg  
BEAM APERTURE 3 cm; DC BIAS 1.0 kV  
TUNED by, coarse - fine -  
RF - to - MHz, stable ± - /10<sup>6</sup>  
Orb F - to - MHz; GAIN, max 5 kV/turn  
HARMONICS, RF/Orb F, used -  
DEE-Gnd, max 20 kV, min gap 3 cm  
STABILITY, (pk-pk noise)/(pk RF volt) -  
RF PHASE stable to ± - deg  
RF POWER input, max 200; 40 Avg. kW  
RF PROTECT circuit, speed 10,000 μsec  
Type Circuit Breaker  
FREQUENCY MODULATION, rate 400 /sec  
MODULATOR, type Rotating Capacitor  
BEAM PULSE, width 25 μsec

VACUUM SYSTEM

PUMPS, No., Type, Size 2 Diff. Pumps  
10,000 l/sec  
OPERATING PRESSURE 10 μTorr,  
PUMPDOWN TIME 3 hrs

ION SOURCES/INJECTION SYSTEM

PIG

EXTRACTION SYSTEM

REG.

CONTROL SYSTEM

MANUAL

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CHARACTERISTIC BEAMS

	Particle	Goal (MeV)	Achieved (MeV)
ENERGY	$\rho$	100	100
	$\alpha$	100	100
	d	50	50
	$^3\text{He}$	133	133
CURRENT		( $\mu\text{A}$ )	( $\mu\text{A}$ )
	Internal		
	$\rho$	2	2
	d	3	3
External	$\alpha, ^3\text{He}$	0.5	0.5
	$\rho$	0.1	0.1
	d	0.1	0.1
	$\alpha, ^3\text{He}$	0.05	0.05
Secondary		(part/s)	(part/s)
	-	-	-
	-	-	-

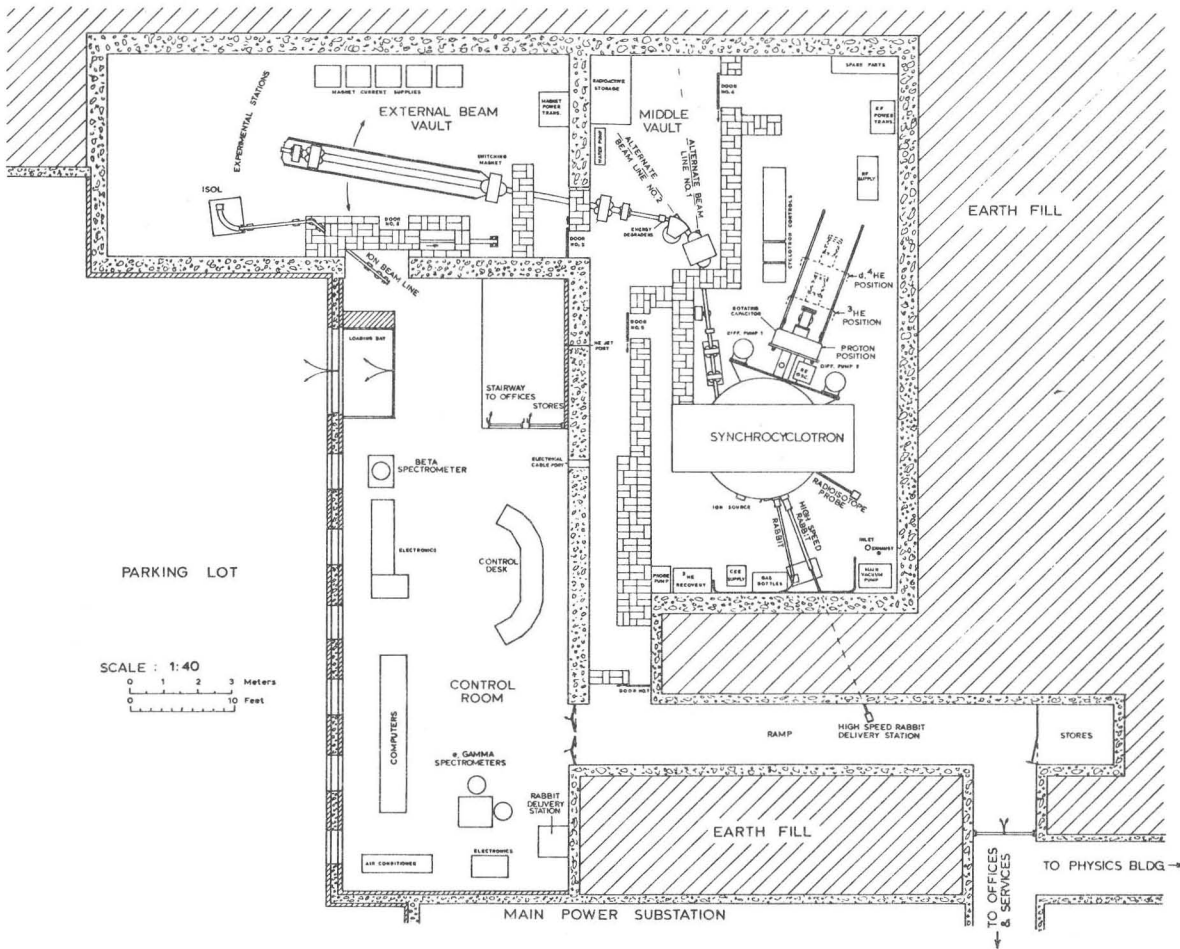
BEAM PROPERTIES

	Measured	Conditions
Pulse Width	60 RF deg	1 $\mu\text{A}$ of 100 MeV $\rho$
Phase Exc, max	- RF deg	- $\mu\text{A}$ of - MeV -
Extract Eff	10 %	0.1 $\mu\text{A}$ of 100 MeV $\rho$
Res, $\Delta E/E$	0.5 %	0.1 $\mu\text{A}$ of 100 MeV $\rho$
Emittance	(mm-mrad) $\left\{ \begin{array}{l} 20 \text{ axial} \\ 40 \text{ radial} \end{array} \right\}$ 0.1 $\mu\text{A}$ of 100 MeV $\rho$	

OPERATING PROGRAMS, time dist

Basic Nuclear Physics	84	%
Solid State Physics	1	%
Bio-Medical Applications	10	%
Isotope Production		%
Development	5	%
		%
		%

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



MCGILL SYNCHROCYCLOTRON FACILITY