ENTRY No. C3 University of Manitoba
NAME OF MACHINE Spiral Ridge Cyclotron ..... DATE .....
INSTITUTION ..... University of Manitoba Accelerator Laboratory .....
ADDRESS ..... University of Manitoby, Winnipeg, Manitoba, R3T 2N2, CANADA .....
TEL ..(204) 474-9378 ..... TELEX ... 07-587721 .....
IN CHARGE ... J.S.C. McKee ..... REPORTED BY S. Oh, V. Derenchuk, J. Anderson .....

HISTORY AND STATUS
DESIGN, date .....1959..... Model tests ..1959-1961.....
ENG DESIGN, date ..1960-63.....
CONSTRUCTION, date ..1960-64.....
FIRST BEAM, date (or goal) ..1965.....
MAJOR ALTERATIONS .100% external injection (1965), Magnetic field reshaped (1985) & a new dee system (1985).
COST, ACCELERATOR $ 600,000.00 (1960).....
COST, FACILITY, total ..$ 1,500,000.00.....
FUNDED BY .University of Manitoba and NSERC.....

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT
SCIENTISTS .....5..... ENGINEERS .....1.....
TECHNICIANS ....3..... CRAFTS .....1.....
GRAD STUDENTS involved during year .....8.....
OPERATED BY ....X.... Research staff or ..... Operators
OPERATION ..... hr/wk, On target ..... hr/wk
TIME DISTR. in house ..... %, Outside ..... %
BUDGET, op & dev ... $ 500,000.00.....
FUNDED BY ...NSERC, University of Manitoba.....

RESEARCH STAFF, not included above
USERS, in house ....13..... outside ...14.....
GRAD STUDENTS involved during year ....12.....
RESEARCH BUDGET, in house .....
FUNDED BY ...NSERC.....

MAGNET
POLE FACE, diameter (compact) 117 cm, R extraction 30-52cm
R injection ..0.8... cm
GAP, min ..3.6... cm, Field ..26.5..... kG
max ....15... cm, Field ..15.5..... kG } at .280,000. Ampere turns
AVERAGE FIELD at R ext .19.2-19.7..... kG
B max/ <B> ....1.4.....
NUMBER OF SECTORS { compact ..4... / separated ..... } Spiral, max 50 deg
SECTOR ANGLE (SSC) ..... deg
TRIMMING COILS Total of 64 Invar blocks situated on the four hills+.....
CONDUCTOR, material and type .Water cooled copper.....
STORED ENERGY (cryogenic) ..... MJ
POWER : main coils .113. max, kW ; current stability .1/10^4
trimming coils ....+. max, kW ; current stability ...+...
WEIGHT : Fe ...38..... tons ; coils .....4..... tons
COOLING system .... Demineralized water.....
ION ENERGY (bending limit) E/A = ..50... q²/a² MeV/amu
(focusing limit) E/A = ... q²/a² MeV/amu

ACCELERATION SYSTEM
DEES, number ...2..... ; angle .....55..... deg
BEAM APERTURE ...1.8... cm ; DC Bias ...-1..... kV
TUNED by, coarse sliding short fine variable capacitor
RF ...21..... to ...31.... mHz, stable ± .1/10^6.....
Orb F ..15.25... to ...28.3.. mHz
HARMONICS, RF/Orb F, used ....1 or 2.....
DEE - Gnd, max ..42.. kV, min gap ....0.3..... cm
STABILITY, (pk-pk noise)/(pk RF volt) ....1/10^3.....
ENERGY GAIN, max .80 for H ...140 for D..... kV/turn
RF PHASE, stable to ± .....1°..... deg
RF POWER input, max ..... 2 x 15..... kW
FREQUENCY MODULATION, rate ..... /s
modulator, type .....E.....
beam pulse, width .....

VACUUM SYSTEM
OPERATING PRESSURE ..15-25 x 10^6..... Torr or mbar
PUMPS, No, Type, Size ..2 x 16" Balzers diffusion pumps, 1 x 6" NRC diffusion pump, 2 cryopumps on injection system.....

ION SOURCES
Duoplasmatron, Ehlers source for H⁻ & D⁻, Lamb-shift nuclear spin filter source for H⁻ & D⁻ ions.

INJECTION SYSTEM
..... Axial injection.....

EXTRACTION SYSTEM
Stripping of electrons from H⁻ & D⁻ by a stripping foil

FACILITIES FOR RESEARCH
SHIELDED AREA, fixed .....300... m² ; movable ...20..... m²
TARGET STATIONS ..7..... in .....2... rooms
STATIONS served at same time, max ....1.....
MAG SPECTROGRAPH, type .....
COMPUTER model .....VAX 11/750.....
OTHER FACILITIES .PIXE, Neutral Hydrogen Beam, 10-50 MeV, Proton Microprobe, High resolution spectroscopy, Isotope production.....

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
p	20-50	20-50	10-1	10-1
d	10-27	11-21	5-1	5-1
H⁰	10-50	23-47	4	0,25
d	10-27	11-21		12-2 nA
SECONDARY			(part/s)	
n			4 x 10^7 sr^{-1}	

BEAM PROPERTIES

MEASURED		CONDITIONS
PULSE WIDTH	20 RF deg	1 pμA of 20-50 MeV p, ions
PHASE EXC, max	12 RF deg	pμA of .... MeV p, ions
EXTRACT eff	...100. %	pμA of 20-50 MeV p, ions
RESOL ΔE/E	1,2... %	pμA of .... MeV p, ions
EMITTANCE (π mm. mrad)	{ ... axial / .... rad }	pμA of ..... MeV ... ions

OPERATING PROGRAMS, time distribution
BASIC NUCLEAR PHYSICS 40% SOLID STATES PHYSICS ....
BIOMEDICAL APPLICAT. ..20% ISOTOPE PRODUCTIONS 5% ..
Applied Physics.....35%.....

REFERENCES/NOTES
1) IEEE Trans.Nucl.Sci. NS-32, No.5 (1985) 2724
+) Invar is an alloy with temperature dependent permeability. Magnetic field is shaped by controlling the temperature of each Invar block.

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS