

ENTRY NO. C 4 Date November 24, 1995
 Name of Machine TRIUMF Cyclotron
 Institution TRIUMF
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 In Charge: G. Dutton Reported by: D. Pearce

HISTORY

MILESTONE DATES:

Design July 1966 Model Tests December 1966
 Construction October 1968 First Beam December 1974

DESIGN/CONSTRUCTION BY:

in house Yes other various engineering contracts

COST: Accelerator 12 M\$ Can Facility 50 M\$ Can

FUNDED BY: AECS, SFU, UBC, U of Victoria, U of

Alberta (to 1976), NRC, Province of B.C. (Since 1977)

STAFF:

Machine & Facilities

Scientists 15 Engineers 26
 Technicians 70 Students 2

Research (in house/external)

Scientists 47 / 150 Engineers 12 /
 Technicians 30 / Students 30 / 64

BUDGET: Machine & Facilities

Research 30 M\$ Can Funded by NRC

Research 3.9 M\$ Can Funded by NSERC

TIME DISTRIBUTION:

Basic Research (in house/external) 20 % / 35 %
 Applied Program (in house/external) 5 % / 5 %
 Maintenance 28 % Development 7 %

MAGNET

POLE PARAMETERS:

Diameter 1717 cm R_{extract} 580-780 cm R_{inject} 25 cm

HILL PARAMETERS: Gap (min) 52.8 cm B_{max} 0.58 T

(@ 720000 AT) Gap (max) 52.8 cm B_{min} 0.30 T

VALLEY PARAMETERS: Gap (min) 52.8 cm B_{max} 0.30 T

(@ 720000 AT) Gap (max) 52.8 cm B_{min} 0.12 T

AVERAGE FIELD: $\langle B \rangle_{\text{min}}$ 0.30 T $\langle B \rangle_{\text{max}}$ 0.46 T

NUMBER OF SECTORS: compact/separated / 6

sector angle 17.5 deg. spiral (max) 70 deg.

FIELD TRIMMING: Trim Coils 55

Harmonic Coils 13

Other

CURRENT: Main Coils 18400 Amps Stability 10 ppm

Trim Coils Amps Stability

Stored Energy (cryogenic) MJ

WEIGHT: Iron 4000 tons Conductor 170 tons

ION ENERGY: Bending Limit $E/A = 520$ q²/A² MeV/u

Focusing Limit $E/A =$ q/A MeV/u

ACCELERATION SYSTEM

FUNDAMENTAL ACCELERATION:

Description: 80 $\lambda/4$ resonators, push-pull mode

No. of Gaps/turn 2 $dE/dn(\text{max})$ 0.34 MeV/q

Voltage (max) 0.085 MV Harmonic f_r/f_{ion} 5

Freq 23.05 MHz Power in(max) 1.1 $\times 10^{-4}$ MW

Stability: Phase ± 5 deg. Voltage 4×10^{-4}

OTHER CAVITIES (Flattopping or otherwise):

Description: Auxiliary Acc. Cav., $\lambda/4$

Region of Influence: R_{min} 700 cm R_{max} 775 cm

No. of Gaps/turn 2 $dE/dn(\text{max})$ 0.30 MeV/q

Voltage (max) 0.15 MV Harmonic f_r/f_{ion} 20

Freq 92 MHz Power in(max) 0.060 MW

Stability: Phase Voltage

VACUUM SYSTEM

OPERATING PRESSURE: 5×10^{-8} Torr

PUMPS: (No. and type) 2 He cooled cryo-panels (2.8 m²)

4-41 cm cryo-pumps, 1-46 cm cryo-pump, 1-25 cm turba

ION SOURCE(S)

Type	Intensity (mA)	@ $\epsilon_n = \beta\gamma\epsilon$ (π mm mrad)	Ion Species
(a) Ehlers PIG	0.30	0.2 h x .05 v	H ⁺
(b) Cusp	2	0.25 h x v	H ⁺
(c) Lamb Shift	6×10^{-4}	0.35 h x v	H ⁺ pol (80%)
(d) Optically pumped	0.20 mA	0.8 h x v	H ⁺ pol (85%)

INJECTION SYSTEM

axial injection, two bunchers Efficiency 65-70 %
 spiral inflector

EXTRACTION SYSTEM

stripping in pyrolytic graphite foil Efficiency 99.95 %

CHARACTERISTIC BEAMS

Accelerated Ions	E/A (MeV/u)	Current (part μ A)
(a) H ⁺	180-520	180 H ⁺ 180 p ⁺
(b) H ⁺	65-100	100 H ⁺ 100 p ⁺
(c) H ⁺ (pol)	180-520	5 H ⁺ 5 p ⁺ (pol)
(d)		
Secondary Particles	E (MeV)	part/sec
(a) p ⁺	20-350	$10^7 - 10^8$
(b) π^+	4-90	$10^6 - 10^7$
(c)		

EXTRACTED BEAM PROPERTIES:

For 160 μ A of 500 MeV/u p ions

$\Delta E/E$ 0.2 % $\Delta \phi$ 35 °rf

$\epsilon_n = \beta\gamma\epsilon$ x 2 π mm mrad z 2 π mm mrad

FACILITIES FOR RESEARCH

SHIELDED AREA: Fixed: 2350 m² Moveable m²

Target Stations: 18 No. Served At Same Time: 10

MAGNETIC SPECTROMETERS: MRS R=2.5m, OOD R=0.6m

OTHER FACILITIES: Biomedical π^+ irradiation

Isotope Production, on line isotope separator

Proton Therapy, 1.5 MeV/u accelerator under construction

REFERENCES/NOTES

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PLAN VIEW OF FACILITY, COMMENTS

