

**ENTRY NO.** 8  
**NAME OF MACHINE** TRIUMF  
**INSTITUTION** Universities of Alberta, British Columbia, Victoria and Simon Fraser University  
**ADDRESS** 4004 Westbrook Mall, Vancouver, B.C., Canada V6T 2A3  
**TEL (604)** 228-4711 **TELEX** 04-508503  
**IN CHARGE** E.W. Vogt **REPORTED BY** D.A. Dohan, G.H. Mackenzie, G. Dutto

**HISTORY AND STATUS**

DESIGN, date July 1966..... Model tests December 1966  
 ENG DESIGN, date October 1968.....  
 CONSTRUCTION, date January 1970.....  
 FIRST BEAM, date (or goal) December 1974.....  
 MAJOR ALTERATIONS .....

COST, ACCELERATOR Can. \$12,000,000 (1974)  
 COST, FACILITY, total Can. \$50,000,000 (1984)\*\*  
 FUNDED BY AECB, NRC and TRIUMF Universities

**ACCELERATOR STAFF, OPERATION AND DEVELOPMENT**  
 SCIENTISTS .....15..... ENGINEERS .....19.....  
 TECHNICIANS .....55..... CRAFTS .....22.....  
 GRAD STUDENTS involved during year .....2.....  
 OPERATED BY ..... Research staff or .....17..... Operators  
 OPERATION .....24 x 7..... hr/wk. On target .....24 x 6..... hr/wk  
 TIME DISTR. in house .....60%..... % Outside .....40..... %  
 BUDGET, op & dev .....Can. \$24,000,000\*\*  
 FUNDED BY .....National Research Council of Canada.....

**RESEARCH STAFF**, not included above  
 USERS, in house .....90..... outside .....168.....  
 GRAD STUDENTS involved during year .....35.....  
 RESEARCH BUDGET, in house .....Can. \$3,351,875.....  
 FUNDED BY .....NSERC.....

**MAGNET**

POLE FACE, diameter (compact) 1717. cm, R extraction 780. cm  
 R injection 25. cm  
 GAP, min 52.8 cm, Field 5.8..... kG }  
 max min..... cm, Field 2.0..... kG at 0.72 x 10<sup>6</sup>..... }  
 AVERAGE FIELD at R ext .....4.6..... kG } Ampere turns  
 B max / < B > .....1.26..... }

NUMBER OF SECTORS { compact ..... } Spiral, max 7.0 deg  
 { separated 6..... }

SECTOR ANGLE (SSC) ..... deg  
 TRIMMING COILS .....55 circular.....  
 .....13 harmonic.....

CONDUCTOR, material and type .....Al.....  
 STORED ENERGY (cryogenic) ..... MJ  
 POWER: main coils 1270. max, kW; current stability 0.7x10<sup>-6</sup>  
 trimming coils 68. max, kW; current stability 0.1%F.S.

WEIGHT: Fe 4000. tons; coils 170. tons  
 COOLING system .....Closed loop water.....  
 ION ENERGY (bending limit) E/A = .520..... q<sup>2</sup>/a<sup>2</sup> MEV/amu  
 (focusing limit) E/A = ..... q/a MeV/amu

**ACCELERATION SYSTEM**

DEES, number .....2..... 180..... deg  
 BEAM APERTURE .....8..... cm; DC Bias .....Ω..... kV  
 TUNED by, coarse .....panels..... fine water pressure.....  
 RF .....23.055..... to 23.070..... MHz, stable ± 1/10<sup>8</sup>  
 Orb F .....4.61..... to 4.77..... MHz  
 HARMONICS, RF/Orb F, used .....5.....  
 DEE-Gnd, max .....85..... kV, min gap .....2.5..... cm  
 STABILITY, (pk-pk noise)/(pk RF volt) .....4/10<sup>4</sup>  
 ENERGY GAIN, max .....340..... kV/turn  
 RF PHASE, stable to ± ..... deg  
 RF POWER input, max .....800..... kW  
 FREQUENCY MODULATION, rate ..... /s  
 modulator, type .....  
 beam pulse, width .....

**VACUUM SYSTEM**

OPERATING PRESSURE .....5 x 10<sup>-8</sup>..... Torr or mbar  
 PUMPS, No. Type, Size 2. He-cooled 20. K cryopanel. 1.2. m<sup>2</sup>  
 4-10" diffusion pump.....  
 1-8" diffusion pump. 1-30,000 L/SEC. turbo. pump.....

**ION SOURCES**

Ehlers. IIG. H<sup>-</sup> and Lamb shift polarized H<sup>-</sup>.....

\* includes 4 funding universities  
 \*\* includes experimental facilities

**INJECTION SYSTEM**

40 m long, electrostatic bends & quadrupoles

**EXTRACTION SYSTEM**

Electron stripping in 25 μ carbon foil

**FACILITIES FOR RESEARCH**

SHIELDED AREA, fixed 2350..... m<sup>2</sup>; movable ..... m<sup>2</sup>  
 TARGET STATIONS .....17..... in .....12.....  
 STATIONS served at same time, max .....10.....  
 MAG SPECTROGRAPH, type QD.R. = 2.5 m + QOD, 0.6 m + 7 PC  
 COMPUTER model VAX 11/780, 730, AMDAHL, PDP 11/xx  
 OTHER FACILITIES Polarized fast neutron beam.....  
 Thermal neutron source.....  
 Biomedical π<sup>-</sup> irradiation.....

**CHARACTERISTIC BEAMS**

PARTICLE	ENERGY (MeV)		CURRENT (pA)	
	Goal	Achieved	Internal	External
H <sup>-</sup>	65-100	70-90	170	170
	180-520	180-520	0.6	0.6
Polarized H <sup>-</sup>	180-520	180-520	0.6	0.6
			.78% polarization..	
<b>SECONDARY (part/s)</b>				
π <sup>+</sup>	20-350	15-170	10 <sup>7</sup>	
μ <sup>+</sup>	4-90	4-90	10 <sup>5</sup>	

**BEAM PROPERTIES**

MEASURED	CONDITIONS	
	PULSE WIDTH	PHASE EXC.
25. RF deg	150. pA of 500. MeV H <sup>-</sup> ions	
20. RF deg	100. pA of 500. MeV H <sup>-</sup> ions	
99.95 %	100. pA of 500. MeV H <sup>-</sup> ions	
0.3 %	100. pA of 500. MeV H <sup>-</sup> ions	
0.1	3 pA of 500 MeV H <sup>-</sup> ions	
0.3 axial	100. pA of 500. MeV H <sup>-</sup>	
0.3 rad		

**OPERATING PROGRAMS**, time distribution

BASIC NUCLEAR PHYSICS yes.. SOLID STATES PHYSICS..yes..  
 BIOMEDICAL APPLICAT...yes.. ISOTOPE PRODUCTIONS..yes..  
 Nuclear physics, condensed matter physics, ..  
 applied research & cancer therapy operate simul-  
 taneously during high intensity

**REFERENCES/NOTES**

- 1) running (70% of production time)
- 2)

**PLAN VIEW OF FACILITY, COMMENTS, ETC.**

