

**ENTRY NO. 97**

NAME OF MACHINE . . . . . Injector Cyclotron  
 INSTITUTION . . . . . Lawrence Livermore National Laboratory  
 ADDRESS . . . . . P.O. Box 808, Livermore, CA 94550  
 TEL (415) 422-7804 . . . . . TELEX  
 IN CHARGE Ivan D. Proctor . . . . . REPORTED BY Ivan D. Proctor

**HISTORY AND STATUS**

DESIGN, date . . . . . \* . . . . . Model tests  
 ENG DESIGN, date . . . . .  
 CONSTRUCTION, date . . . . . 1968  
 FIRST BEAM, date (or goal) . . . . . 1969  
 MAJOR ALTERATIONS . . . . . None

COST, ACCELERATOR . . . . . 430K\$  
 COST, FACILITY, total . . . . . 580K\$  
 FUNDED BY . . . . . U.S.D.O.E.

**ACCELERATOR STAFF, OPERATION AND DEVELOPMENT**

SCIENTISTS . . . . . 1 . . . . . ENGINEERS  
 TECHNICIANS . . . . . 2 . . . . . CRAFTS  
 GRAD STUDENTS involved during year  
 OPERATED BY . . . . . Research staff or . . . . . X . . . . . Operators  
 OPERATION . . . . . 10 . . . . . hr/wk. On target . . . . . 10 . . . . . hr/wk  
 TIME DISTR, in house . . . . . 90 . . . . . %, outside . . . . . 10 . . . . . %  
 BUDGET, op & dev . . . . .  
 FUNDED BY . . . . . U.S.D.O.E.

**RESEARCH STAFF, not included above**

USERS, in house . . . . . 10 . . . . . outside . . . . . 2  
 GRAD STUDENTS involved during year  
 RESEARCH BUDGET, in house  
 FUNDED BY . . . . . U.S.D.O.E.

**MAGNET**

POLE FACE, diameter (compact) . . . . . 82 . . . . . cm, R-extraction . . . . . 35 . . . . . cm  
 R injection . . . . . cm  
 GAP, min . . . . . 5 . . . . . cm, Field . . . . . 20 . . . . . kG  
~~max~~ . . . . . 10 . . . . . cm, Field . . . . . 12 . . . . . kG } at . . . . . 0.6 x 10<sup>6</sup>  
 AVERAGE FIELD at R ext . . . . . 16 . . . . . kG } Ampere turns  
 B max / < B > . . . . . 1.016  
 NUMBER OF SECTORS { compact . . . . . 3 } Spiral, max 30 deg  
 { separated . . . . . }  
 SECTOR ANGLE (SSC) . . . . . deg  
 TRIMMING COILS . . . . . Bump only

CONDUCTOR, material and type . . . . . Al (edge cooled)  
 STORED ENERGY (cryogenic) . . . . . MJ  
 POWER: main coils . . . . . 58 . . . . . max kW: current stability 4/10<sup>5</sup>  
 trimming coils . . . . . max kW: current stability  
 WEIGHT: Fe . . . . . 14 . . . . . tons: coils . . . . . 1 . . . . . tons  
 COOLING system . . . . . LCW  
 ION ENERGY (Bending limit) E/A = . . . . . 15 . . . . . q<sup>2</sup>/A<sup>2</sup> MeV/amu  
 (Focusing limit) E/A = . . . . . 15 . . . . . q/A MeV/amu

**ACCELERATION SYSTEM**

DEES, number . . . . . 2 . . . . . angle . . . . . deg  
 BEAM APERTURE . . . . . 1.9 . . . . . cm, DC Bias . . . . . 1 . . . . . kV  
 TUNED by, coarse . . . . . strap . . . . . fine . . . . . Capacitor  
 RF . . . . . 12.5 . . . . . to . . . . . 25 . . . . . MHz, stable ±  
 Orb F . . . . . 12.5 . . . . . to . . . . . 25 . . . . . MHz  
 HARMONICS, RF/Orb F, used . . . . . 1  
 DEE-Gnd, max . . . . . 30 . . . . . kV, min gap . . . . . 1 . . . . . cm  
 STABILITY, (pk-pk noise)/(pk RF volt) . . . . . 0.1%  
 ENERGY GAIN, max . . . . . 100 . . . . . kV/turn  
 RF PHASE, stable to ± . . . . . deg  
 RF POWER input, max. . . . . 36 . . . . . kW  
 FREQUENCY MODULATION, rate . . . . . /s  
 modulator, type  
 beam pulse, width

**VACUUM SYSTEM**

OPERATING PRESSURE . . . . . 1.5 x 10<sup>6</sup> . . . . . Torr or mbar  
 PUMPS, No, Type, Size  
 . . . . . 1500 L/S Turbo  
 . . . . . 4000 L/S Cryo

**ION SOURCES**

PIG External

**INJECTION SYSTEM**

. . . . . Axial Mirror

**EXTRACTION SYSTEM**

. . . . . Electrostatic Channel

**FACILITIES FOR RESEARCH**

SHIELDED AREA, fixed . . . . . m<sup>2</sup>; movable . . . . . m<sup>2</sup>  
 TARGET STATIONS . . . . . 6 . . . . . in . . . . . 2 vaults . . . . . rooms  
 STATIONS served at same time, max . . . . . 1  
 MAG SPECTROGRAPH, type . . . . . Enge Split Pole  
 COMPUTER model . . . . . Nuclear Data  
 OTHER FACILITIES . . . . . Neutron T.O.E. Array,  
 . . . . . Quadrupole Spectrometer

**CHARACTERISTIC BEAMS**

PARTICLE	ENERGY (MeV)		CURRENT (µA)	
	Goal	Achieved	Internal	External
H <sup>-</sup>	15	15	75	50
D <sup>-</sup>	8	8	25	15
SECONDARY			(part/s)	

**BEAM PROPERTIES**

	MEASURED		CONDITIONS	
PULSE WIDTH . . . . .	9 . . . . . RF deg	8 . . . . . µA of	15 . . . . . MeV	H <sup>-</sup> . . . . . ions
PHASE EXC. max . . . . .	RF deg	µA of	MeV	ions
EXTRACT eff. . . . . %		µA of	MeV	ions
RESOL ΔE/E . . . . . %		µA of	MeV	ions
EMITTANCE				
(π mm-mrad) . . . . . axial				
. . . . . rad				

**OPERATING PROGRAMS, time distribution**

BASIC NUCLEAR PHYSICS . . . . . 75 . . . . . SOLID STATES PHYSICS  
 BIOMEDICAL APPLICAT. . . . . ISOTOPE PRODUCTIONS  
 . . . . . Applied 25

**REFERENCES/NOTES**

- 1) \*Cyclotron Corp. Model CNI-15
- 2)

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