

**ENTRY No. 80**

NAME OF MACHINE NAVAL RESEARCH LABORATORY CYCLOTRON Date : 7/24/78  
 INSTITUTION NAVAL RESEARCH LABORATORY, Radiation Technology Division  
 ADDRESS Washington, D.C. 20375, USA  
 TEL TELEX  
 IN CHARGE Rollon O. Bondelid REPORTED BY Rollon O. Bondelid

**HISTORY AND STATUS**

DESIGN, date (1)..... Model tests (1)  
 ENG DESIGN, date 1963-1964.....  
 CONSTRUCTION, date 1965-1967.....  
 FIRST BEAM, date (or goal) int. 1967, ext. 1968.....  
 MAJOR ALTERATIONS (2).....

COST, ACCELERATOR \$ 1.8 10<sup>6</sup>  
 COST, FACILITY, total \$ 6.0 10<sup>6</sup>  
 FUNDED BY U.S. Navy Department

**ACCELERATOR STAFF, OPERATION AND DEVELOPMENT**

SCIENTISTS 0 ENGINEERS 4  
 TECHNICIANS 6 CRAFTS 2  
 GRAD STUDENTS involved during year 3

OPERATED BY Research staff or Operators  
 OPERATION 52 hr/wk, On target 50 hr/wk  
 TIME DISTR. in house 60 %, Outside 40 %

BUDGET, op & dev  
 FUNDED BY Office of Naval Research & Users

**RESEARCH STAFF**, not included above  
 USERS, in house 11 outside 3  
 GRAD STUDENTS involved during year 3  
 RESEARCH BUDGET, in house 725. k  
 FUNDED BY Office of Naval Research

**MAGNET**

POLE FACE, diameter (compact) 193 cm, R extraction .80 cm  
 R injection ..... cm  
 GAP, min 19 cm, Field 22.7 kG }  
 max 71 cm, Field 12.7 kG } at .....  
 AVERAGE FIELD at R ext 17 kG } Ampere turns  
 B max/ <B> 1.3

NUMBER OF SECTORS { compact 3 } Spiral, max 30 deg  
 { separated ..... }

SECTOR ANGLE (SSC) ..... deg  
 TRIMMING COILS Harmonic correction : 3/sect.....  
 10 circular coils.....

CONDUCTOR, material and type .....  
 STORED ENERGY 6.5 MJ  
 POWER : main coils 800 max, kW ; current stability 5.10<sup>-5</sup>  
 trimming coils 350 max, kW ; current stability

WEIGHT : Fe 250 tons ; coils 4.5 tons  
 COOLING system Demineralized water.....  
 ION ENERGY (bending limit) E/A = ..... q<sup>2</sup>/a<sup>2</sup> MeV/amu  
 (focusing limit) E/A = ..... .75 q /a MeV/amu

**ACCELERATION SYSTEM**

DEES, number 1 ; angle 180 deg  
 BEAM APERTURE 4.5 cm ; DC Bias 0 kV  
 TUNED by, coarse MS. fine VC, auto

RF 7.5 to 22.5 MHz, stable ± 10<sup>-6</sup>  
 Orb F 1.5 to 22.5 MHz

HARMONICS, RF/Orb F, used 1, 3  
 DEE - Gnd, max 70 kV, min gap 1 cm  
 STABILITY, (pk-pk noise)/(pk RF volt) 0.005

ENERGY GAIN, max 100 kV/turn  
 RF PHASE, stable to ± 3 deg  
 RF POWER input, max 300 kW

FREQUENCY MODULATION, rate /s  
 modulator, type  
 beam pulse, width

**VACUUM SYSTEM**

OPERATING PRESSURE 10<sup>-5</sup> Torr or mbar  
 PUMPS, No, Type, Size 2 diffusion 30", 32"  
 (.32 k. & 5.0 k.l./s)

**ION SOURCES**

Hot filament.....

**INJECTION SYSTEM**

**EXTRACTION SYSTEM**

Electrostatic with magnetic channel.....

**FACILITIES FOR RESEARCH**

SHIELDED AREA, fixed 868 m<sup>2</sup> ; movable ..... m<sup>2</sup>  
 TARGET STATIONS 4 in 3 rooms  
 STATIONS served at same time, max 1  
 MAG SPECTROGRAPH, type  
 COMPUTER model SEL 32/55  
 OTHER FACILITIES Double focusing 2.75 m beam  
 analyzing magnet ; provision for 11 beam paths, 8 with  
 analyzed beam ; beam pickoff unit for T.Q.F. measurements

**CHARACTERISTIC BEAMS**

PARTICLE	ENERGY (MeV)		CURRENT ( μA)	
	Goal	Achieved	Internal	External
p	70	52	30	10
d	40	40	30	12
α	78	78	30	10
<sup>3</sup> He	120	90		

SECONDARY (part/s)

**BEAM PROPERTIES**

MEASURED CONDITIONS  
 PULSE WIDTH 5 RF deg μA of MeV ions  
 PHASE EXC, max 30 RF deg μA of MeV ions  
 EXTRACT eff 40 % μA of MeV ions  
 RESOL ΔE/E % μA of MeV ions  
 EMITTANCE

(π mm. mrad) { axial } μA of MeV ions  
 { rad }

**OPERATING PROGRAMS**, time distribution

BASIC NUCLEAR PHYSICS 0 SOLID STATES PHYSICS 40 %  
 BIOMEDICAL APPLICAT. 60% ISOTOPE PRODUCTIONS 0

**REFERENCES/NOTES**

- 1) Horizontal median plane version of ORIC
- 2) Conversion to RCA 4648 power tetrode from RCA 6949 in late 1976. New computer installed July 1976.

**PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS**

