

ENTRY No. 91  
 NAME OF MACHINE 60" Cyclotron DATE June 19, 1989  
 INSTITUTION Brookhaven National Laboratory  
 ADDRESS Upton, NY 11973 USA  
 TEL (516) 282-4587 TELEX 6852516 BNL DOE  
 IN CHARGE A.P. Wolf REPORTED BY D.J. Schlyer

**HISTORY AND STATUS**

DESIGN, date 1963 Model tests 1963  
 ENG DESIGN, date 1964  
 CONSTRUCTION, date 1965-1967  
 FIRST BEAM, date (or goal) 1968  
 MAJOR ALTERATIONS None  
 COST, ACCELERATOR 400,000 (conversion)  
 COST, FACILITY, total 950,000  
 FUNDED BY USAEC-DOE  
**ACCELERATOR STAFF, OPERATION AND DEVELOPMENT**  
 SCIENTISTS 1 ENGINEERS  
 TECHNICIANS 3 CRAFTS  
 GRAD STUDENTS involved during year 0  
 OPERATED BY Research staff or  Operators  
 OPERATION 40 hr/wk, On target 20 hr/wk  
 TIME DISTR. in house % , Outside %  
 BUDGET, op & dev  
 FUNDED BY Dept. of Energy - National Institutes of Health  
**RESEARCH STAFF, not included above**  
 USERS, in house 3 outside Variable  
 GRAD STUDENTS involved during year Varies  
 RESEARCH BUDGET, in house  
 FUNDED BY Dept. of Energy - National Institutes of Health

**MAGNET**

POLE FACE, diameter (compact) 152 cm, R extraction 65 cm  
 R injection 0 cm  
 GAP, min 19 cm, Field 18 kG }  
 max 34.5 cm, Field 12 kG } at  
 AVERAGE FIELD at R ext 15.4 kG } Ampere turns  
 B max/ < B >  
 NUMBER OF SECTORS { compact 3 } Spiral, max 50 deg  
 { separated }  
 SECTOR ANGLE (SSC) 8 deg  
 TRIMMING COILS 8

CONDUCTOR, material and type Hollow copper  
 STORED ENERGY (cryogenic) MJ  
 POWER: main coils 200 max, kW ; current stability  
 trimming coils 100 max, kW ; current stability  
 WEIGHT: Fe 196 tons ; coils 10 tons  
 COOLING system Water  
 ION ENERGY (bending limit) E/A = q<sup>2</sup>/a<sup>2</sup> MeV/amu  
 (focusing limit) E/A = q<sup>2</sup>/a<sup>2</sup> MeV/amu

**ACCELERATION SYSTEM**

DEES, number 1 ; angle 180° deg  
 BEAM APERTURE 3.5 cm ; DC Bias 0 kV  
 TUNED by, coarse Ms fine Panels  
 RF 9 to 21 MHz, stable ±  
 Orb F 3 to 22 MHz  
 HARMONICS, RF/Orb F, used 1,3  
 DEE - Gnd, max 60 kV, min gap 0.7 cm  
 STABILITY, (pk-pk noise)/(pk RF volt)  
 ENERGY GAIN, max 120 kV/turn  
 RF PHASE, stable to ± deg  
 RF POWER input, max 100 kW  
 FREQUENCY MODULATION, rate /s  
 modulator, type  
 beam pulse, width

**VACUUM SYSTEM**

OPERATING PRESSURE 1 x 10<sup>-5</sup> Torr ~~or better~~  
 PUMPS, No, Type, Size 1 - Diffusion Pump 24"

**ION SOURCES**

Hooded Hot Filament

**INJECTION SYSTEM**

**EXTRACTION SYSTEM**

Electrostatic Deflector

**FACILITIES FOR RESEARCH**

SHIELDED AREA, fixed 100 m<sup>2</sup> ; movable 0 m<sup>2</sup>  
 TARGET STATIONS 2 in 2 rooms  
 STATIONS served at same time, max 1  
 MAG SPECTROGRAPH, type  
 COMPUTER model  
 OTHER FACILITIES

**CHARACTERISTIC BEAMS**

PARTICLE	ENERGY (MeV)		CURRENT (pA)		} Max Power ~ 1 kW
	Goal	Achieved	Internal	External	
H	10-34	400	400	40	}
D	17-23	400	400	40	
<sup>3</sup> He	30-65	200	200	20	
<sup>4</sup> He	34-46	200	200	20	

**SECONDARY**

(part/s)

**BEAM PROPERTIES**

MEASURED CONDITIONS  
 PULSE WIDTH 5 RF deg pA of MeV ions  
 PHASE EXC, max 20 RF deg pA of MeV ions  
 EXTRACT eff 20 % pA of MeV ions  
 RESOL ΔE/E % pA of MeV ions  
 EMITTANCE  
 (π mm. mrad) { axial } pA of MeV ions  
 { rad }

**OPERATING PROGRAMS, time distribution**

BASIC NUCLEAR PHYSICS SOLID STATES PHYSICS  
 BIOMEDICAL APPLICAT. 50 ISOTOPE PRODUCTIONS 20  
 Chemistry Research 30

**REFERENCES/NOTES**

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