

**ENTRY NO. 85**

NAME OF MACHINE . . . . . ANL 60-inch Cyclotron . . . . . DATE . . August 14, 1981 . . . . .  
INSTITUTION . . . . . Argonne National Laboratory, Chemistry Division . . . . .  
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IN CHARGE J. Aron . . . . . REPORTED BY M. Oselka . . . . .

**HISTORY AND STATUS**

DESIGN, date . . 1949 . . . . . Model tests . . 1951-1952 . . . . .  
ENG DESIGN, date . . . . . 1949-1951 . . . . .  
CONSTRUCTION, date . . . . . 1949-1952 . . . . .  
FIRST BEAM, date (or goal) . . . . . 1952 . . . . .  
MAJOR ALTERATIONS . Magnet trim coils added 1964 . . . . .  
New Dees - 1974 . . . . .  
COST, ACCELERATOR . . . . . \$950,000 . . . . .  
COST, FACILITY, total . . . . . \$2,200,000 . . . . .  
FUNDED BY . . . . . AEC, ERDA . . . . .

**ACCELERATOR STAFF, OPERATION AND DEVELOPMENT**

SCIENTISTS . . . . . ENGINEERS . . . . . 1 . . . . .  
TECHNICIANS . . . . . 1 . . . . . CRAFTS . . . . .  
GRAD STUDENTS involved during year . . . . .  
OPERATED BY . . . . . Research staff or . . . . . X . . . . . Operators . . . . .  
OPERATION . . . . . hr/wk. On target . . . . . hr/wk . . . . .  
TIME DISTR, in house . . 30 . . . . . %, outside . . 70 . . . . . %  
BUDGET, op & dev . . . . .  
FUNDED BY . . . . . DOE . . . . .  
**RESEARCH STAFF**, not included above . . . . .  
USERS, in house . . . . . 3 . . . . . outside . . . . . 4 . . . . .  
GRAD STUDENTS involved during year . . . . .  
RESEARCH BUDGET, in house . . . . .  
FUNDED BY . . . . . DOE . . . . .

**MAGNET**

POLE FACE, diameter (compact) . . . . . 152 cm, R-extraction . . . . . 68 cm  
R injection . . 0 . . . . . cm  
GAP, min 30.5 cm, Field . . . . . kG }  
max . . . . . cm, Field . . . . . kG } at 440,000  
AVERAGE FIELD at R ext . . . . . 15 . . . . . kG } Ampere turns  
B max / < B > . . . . .  
NUMBER OF SECTORS { compact . . . . . } Spiral, max . . . . . deg  
{ separated . . . . . }  
SECTOR ANGLE (SSC) . . . . . deg  
TRIMMING COILS . . . . .  
CONDUCTOR, material and type . . . . . Aluminum . . . . .  
STORED ENERGY (cryogenic) . . . . . MJ  
POWER: main coils . . 200 max kW: current stability . . 16 parts/10<sup>6</sup>  
trimming coils . . . . . max kW: current stability . . . . .  
WEIGHT: Fe . . . . . 265 . . . . . tons: coils . . . . . 26 . . . . . 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 = . . . . . q/A MeV/amu

**ACCELERATION SYSTEM**

DEES, number . . . . . 2 . . . . . ; angle . . . . . 180 . . . . . deg  
BEAM APERTURE . . . . . cm; DC Bias . . . . . 0 . . . . . kV  
TUNED by, coarse . . . . . fine . . . . . Trim. Cap. . . . .  
RF . . . . . 11.2 . . . . . to . . . . . 11.5 . . . . . MHz, stable ± 5 parts/10<sup>6</sup>  
Orb F . . . . . 11.2 . . . . . to . . . . . 11.5 . . . . . MHz  
HARMONICS, RF/Orb F, used . . . . . 1 . . . . .  
DEE-Gnd, max . . . . . kV, min gap . . . . . cm  
STABILITY, (pk-pk noise)/(pk RF volt) . . . . .  
ENERGY GAIN, max . . . . . 240 . . . . . kV/turn  
RF PHASE, stable to ± . . . . . deg  
RF POWER input, max. . . . . 150 . . . . . kW  
FREQUENCY MODULATION, rate . . . . . 0 . . . . . /s  
modulator, type . . . . .  
beam pulse, width . . . . .

**VACUUM SYSTEM**

OPERATING PRESSURE . . . . . 5 x 10<sup>-6</sup> . . . . . Torr or mbar  
PUMPS, No, Type, Size . . . . . 2. Diffusion Pumps, 16 inch . . . . .

**ION SOURCES**

. . . . . DC-type, hooded, arc . . . . .

**INJECTION SYSTEM**

**EXTRACTION SYSTEM**

Electrostatic Deflector . . . . .

**FACILITIES FOR RESEARCH**

SHIELDED AREA, fixed . . 350 . . . . . m<sup>2</sup>; movable . . . . . m<sup>2</sup>  
TARGET STATIONS . . . . . 7 . . . . . in . . . . . 3 . . . . . rooms  
STATIONS served at same time, max . . . . . 1 . . . . .  
MAG SPECTROGRAPH, type . . . . .  
COMPUTER model . . . . .  
OTHER FACILITIES . . Hot Lab, with caves . . . . .

**CHARACTERISTIC BEAMS**

PARTICLE	ENERGY (MeV)		CURRENT (µA)	
	Goal	Achieved	Internal	External
H <sub>2</sub> <sup>+</sup>		10.7		100
D <sup>+</sup>		21.4		150
<sup>3</sup> He <sup>++</sup>		33.0		100
α <sup>++</sup>		43.0		90
SECONDARY				(part/s)

**BEAM PROPERTIES**

MEASURED		CONDITIONS	
PULSE WIDTH . . . . .	RF deg . . . . .	µA of . . . . .	MeV . . . . . 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 . . . . .	µA of . . . . .	MeV . . . . .
	rad . . . . .		

**OPERATING PROGRAMS**, time distribution

BASIC NUCLEAR PHYSICS 10% SOLID STATES PHYSICS . . . . .  
BIOMEDICAL APPLICAT. . . 40% ISOTOPE PRODUCTIONS . 50% . . . . .

**REFERENCES/NOTES**

W.J. Ramler & G.W. Parker, THE ARGONNE  
60-INCH CYCLOTRON ANL-5907; W.J. Ramler, et al., ARGONNE  
CYCLOTRON- HELIUM 3 CONVERSION, ANL-7171; W.J. Ramler, et al.  
ENERGY-ANALYZING SYSTEM FOR THE ARGONNE 60-INCH CYCLOTRON,  
ANL-7251.

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