ENTRY NO. FM5 Date 28 August 1995

Name of Machine 160 MeV Synchrocyclotron

Institution Harvard Cyclotron Laboratory, Harvard University

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HISTORY

MILESTONE DATES:

Design ... Model Tests ...

Construction 1946 ... First Beam 1949 ...

DESIGN / CONSTRUCTION BY:

in house X ... other ...

COST: Accelerator $1 million Facility $1.7 million

FUNDED BY: Office of Naval Research 1946-67

STATUS

STAFF: Machine

Scientists 4 ... Engineers 1 ...

Technicians 7 ... Students 0 ...

Research (in house/external)

Scientists ... / ... Engineers ... / ...

Technicians ... / ... Students ... / ...

BUDGET: Machine $1.2 million Funded by operations

Research ... Funded by ...

TIME DISTRIBUTION:

Basic Research (in house/external) ... % / 5 %

Applied Program (in house/external) ... % / 90 %

Maintenance 0 % Development 5 %

MAGNET

POLE PARAMETERS: (NO SECTORS!)

Diameter 241 cm $R_{extract}$ 105 cm R_{inject} 0 cm

HILL PARAMETERS: Gap (min) 29.6 cm B_{max} 1.90 T

(@ $.6 \times 10^6$ AT) Gap (max) 30.5 cm B_{min} 1.83 T

VALLEY PARAMETERS: Gap (min) ... cm B_{max} ... T

(@ ... AT) Gap (max) ... cm B_{min} ... T

AVERAGE FIELD: $<B>_{min}$ ... T $<B>_{max}$ ... T

NUMBER OF SECTORS: compact/separated ... / ...

sector angle ... deg. spiral (max) ... deg.

FIELD TRIMMING: Trim Coils Ø

Harmonic Coils Ø

Other Ø

CURRENT: Main Coils 160 KW ~~Amps~~ Stability ...

Trim Coils Ø Amps Stability ...

Stored Energy (cryogenic) ... MJ

WEIGHT: Iron 641 tons Conductor 74 tons

ION ENERGY: Bending Limit E/A = ... q^2/A^2 MeV/u

Focusing Limit E/A = ... q/A MeV/u

ACCELERATION SYSTEM

FUNDAMENTAL ACCELERATION:

Description: Single Dee, 180°

No. of Gaps/turn 2 ... dE/dn(max) ... MeV/q

Voltage (max) .012 ... MV Harmonic f_{rf}/f_{ion} 1

Freq 30.25 MHz Power in(max) .008 MW

Stability: Phase ... Voltage ...

OTHER CAVITIES (Flattopping or otherwise):

Description: ...

Region of Influence: R_{min} ... cm R_{max} ... cm

No. of Gaps/turn ... dE/dn(max) ... MeV/q

Voltage (max) ... MV Harmonic f_{rf}/f_{ion} ...

Freq ... MHz Power in(max) ... MW

Stability: Phase ... Voltage ...

VACUUM SYSTEM

OPERATING PRESSURE: 3×10^{-7} base

PUMPS: (No. and type) Four NRC 6 inch oil diffusion pump

ION SOURCE(S)

	Type	~~Intensity (mA)~~	~~@ $\varepsilon_n = \beta\gamma\varepsilon$ (π mm mrad)~~	~~Ion Species~~
(a)	hot filament pulsed arc "volcano"			
(b)				
(c)				
(d)				

INJECTION SYSTEM

... Efficiency ... %

EXTRACTION SYSTEM

passive regenerator and channel ... Efficiency ... %

CHARACTERISTIC BEAMS

	Accelerated Ions	E/A (MeV/u)	Current (part μA) Internal	External
(a)	proton	159	2 microA	10 nA
(b)				
(c)				
(d)				

	Secondary Particles	E (MeV)	part/sec
(a)			
(b)			
(c)			

EXTRACTED BEAM PROPERTIES:

For ... μA of ... MeV/u ... ions

$\Delta E/E$ ... % $\Delta\phi$ ... °rf

$\varepsilon_n = \beta\gamma\varepsilon$ x ... π mm mrad z ... π mm mrad

FACILITIES FOR RESEARCH

SHIELDED AREA: Fixed: ... m^2 Moveable ... m^2

Target Stations: ... No. Served At Same Time: ...

MAGNETIC SPECTROMETERS: ...

OTHER FACILITIES: ...

REFERENCES/NOTES

(a) ...

(b) ...

PLAN VIEW OF FACILITY, COMMENTS

Since 1967 we have operated on a fee for service basis, mostly for treatment of patients with the proton beam (currently 260/year). The current fee is $350/hr. The equipment and techniques developed for irradiating patients have proved convenient for radiation damage and single event upset studies often related to satellites and space probes. Such studies, done at lower priority, account for about 10% of our work.