Entry: FM4
Machine Name: 160 MeV synchrocyclotron
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HISTORY
Design by: in-house group incl R.R. Wilson
Construction time: begun 1946
First beam: June 1949

CHARACTERISTIC BEAMS
ions / energy (MeV/n) / current (pps) / power (W) :
- protons, 158.6 MeV
-
-
-
transmission efficiency (total)
- typical: ..... % - best: ..... %
transverse emittance (rms)
- vertical: ..... π mmmrad
- horizontal: ..... π mmmrad
longitudinal emittance (rms) ..... ΔE/E.deg RF

USES
basic research: 10 % therapy: 90 %
development: ..... % isotope production: ..... %
other applications: ..... % maintenance: ..... %
beam tuning: ..... %
total time: ..... h/year

TECHNICAL DATA
a) magnet
type: room temperature weak focusing
Kb: ..... MeV/A Kf: ..... MeV/A
average field (min-max): 1.8 T (extraction) T
number of magnet sectors: .....
- angle: ..... deg
- spiral (max): ..... deg
pole parameters
- diameter: 2.4 m
- injection radius: 0 m
- extraction radius: 1 m
hill gap: ..... m valley gap: ..... m
field trimming
- trim coils
- number: .....
- current (max): ..... A
- harmonic coils
- number: .....
- current (max): ..... A
- others
- number: .....
- current (max): ..... A
main coils: .....
- number: 2
- Ampere-turns: ..... A.T.
- current: 400A, 200V each coil A
stored energy: ..... MJ
weight : - iron: 641 t - coils: 74 t
power
- main coils (total): 160 kW
- trim coils (total max): ..... kW
- refrigerator (cryogenic): ..... kW
b) RF
- acceleration
- frequency range: approx 30 - 24 MHz
- harmonic modes: first
- number of dees: 1
- angular aperture: 180 deg
- voltage:- average (min-max): 12 kV
- variation with radius: .....
-
- power in (max): ..... kW
- stability: - phase: ..... deg - voltage: ..... %
- other cavities
- purpose: stochastic extraction
- frequency range: approx 24 MHz
- region of influence: ..... m
- voltage (max): ..... kV
- power in (max): ..... kW
- stability:- phase: ..... deg - voltage: ..... %
c) injection
- internal source: hot filament pulsed arc
- external (radial/axial): "volcano"
- elements: .....
.....
- source voltage: ..... kV
- injection energy: ..... MeV/n
- buncher: .....
- injection efficiency: small %
d) ion sources/injector
.....
.....
e) extraction
- elements, characteristics:
- peeler/regenerator system
- with magnetic channel
-
-
- efficiency
- typical: 2 % - best: ..... %
f) vacuum
- pumps: 4 NRC 6" oil diffusion
.....
- achieved vacuum: 3×10^{-7} base Pa

REFERENCES
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EXPERIMENTAL FACILITIES
3 specialized patient treatment stations
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~~PLAXXXPLAXXXXXXXXXXXX~~ comments:
Since 1967 this machine has operated on a fee for service basis, mostly for the treatment of patients with the proton beam (currently 510 patients/year). The fee is approximately $350/hour. Equipment and techniques developed here have proven convenient for radiation damage studies often related to satellites and space probes, and this accounts for about 10% of our activity.

Within the next year the therapy program will be transferred to the new Northeast Proton Therapy Center at the Massachusetts General Hospital (230 MeV cyclotron by IBA) and the Harvard Cyclotron Laboratory will probably be closed.

COMMENTS
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