

**ENTRY NO:** FM-3  
**Machine Name:** 160MeV synchrocyclotron  
**Date:** 6/5/01 1:53:17 PM  
**Institution:** Harvard University  
**Address** 44 Oxford Street, Cambridge, MA 02138, USA  
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## HISTORY

**Designed By:** in house group incl R.R. Wilson  
**Construction Dates:** began 1946  
**First Beam Date:** June 1949  
**CHARACTERISTIC BEAMS**

|         |                                       |
|---------|---------------------------------------|
| ions    | / energy(MeV/N)/current(pps)/power(w) |
| protons | 158.6                                 |

**transmission efficiency(source to extract beam)**  
**typical:** % - **best:** %  
**tranverse emittance**  
**emittance definition:**  
**vertical:**  $\pi$  mm mrad  
**horizontal:**  $\pi$  mm mrad  
**longitudinal:** ( $\Delta$ ) E/E)%xdeg RF

## USES

|                            |                              |
|----------------------------|------------------------------|
| <b>basic research:</b> 10% | <b>therapy:</b> 90%          |
| <b>development:</b> %      | <b>isotope production:</b> % |
| <b>other:</b> %            | <b>maintenance:</b> %        |
| <b>beam tuning:</b> %      | <b>Total Time:</b> 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:**  
**hill angular width:** hill angular width  
**spiral (max):** deg  
**pole parameters**  
**diameter:** 2.4 m  
**injection radius:** 0 m  
**extraction radius:** 1 m  
**hill gap:** m **valley gap:** m  
**trim coils**  
**-number:** x2  
**-current(max):** A-turns  
**harmonic coils**  
**-number:** xNsectorsx2  
**-current(max):** A-turns  
**main coils**  
**number:** 1x2  
**total ampere-turns:** A-turns  
**current:** 400 A  
**stored energy:** MJ  
**weight - iron:** 641t **coils:** 74t  
**power**  
**main coils (total):** 160 kW  
**trim coils (total max):** kW  
**refrigerator (cryogenic):** kW  
**b)RF**  
**acceleration**  
**frequency range:** 30 - 24MHz

**harmonic modes:** first  
**number of dees:** 1  
**number of cavities:**  
**dee angular width:** degrees  
**voltage**  
**at injection:** kV(peak to ground, max)  
**at extraction:** kV(peak to ground, max)  
**peak:** kV(peak to ground, max)  
**line power(max):** kW  
**stability**  
**phase:** deg  
**voltage:** %  
**injection**  
**c)ion source:** hot filament source  
**external injection:** "volcano"  
**components:**  
**source bias voltage:** kV  
**injection energy:** MeV/N  
**buncher:**  
**injection efficiency:** small%  
**d)injector:**  
**e)extraction**  
**peeler/regenerator system with magnetic channel**  
**efficiency**  
**typical:** 2%  
**best:** %  
**f)vacuum**  
**pumps:** 4 NRC 6" oil diffusion  
**achieved vacuum:**  $3 \times 10^{-7}$  Pa  
**REFERENCES**

## EXPERIMENTAL FACILITIES

3 Specialized patient treatment stations

## COMMENTS