

Entry: **C.66**
 Machine Name: Indiana University Cyclotron Facility
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HISTORY

Design by: IUCF staff with various vendors
 Construction time: 1968-1975
 First beam: Sept. 1975

CHARACTERISTIC BEAMS

Ions / energy (MeV/n) / current (pps) / power (W) :

- H⁺, pol H⁺ / 20-205 / 3×10^{13} / 1000
- D⁺, pol D⁺ / 10-50 / 1.3×10^{13} / 250
- ³He / 8-95 / 0.6×10^{13} / 100
- ⁴He / 7-50 / 0.6×10^{13} / 50

transmission efficiency (total)

- typical: 17% - best: 25%

transverse emittance (rms)

- vertical: 1.5π mmmrad
 - horizontal: 1.5π mmmrad

longitudinal emittance (rms) 0.1%, 4° ΔE/E.deg RF

USES

basic research: 70 % therapy: %
 development: 7 % isotope production: %
 other applications: % maintenance: 15 %
 beam tuning: 8 %
 total time: 4800 h/year

TECHNICAL DATA

a) magnet

type: separated sector
 Kb: 215 MeV/A Kf: 215 MeV/A
 average field (min-max): 0.64 (<0.02 – 1.65) T
 number of magnet sectors: 4
 - angle: 36 deg
 - spiral (max): N/A deg
 pole parameters
 - diameter: N/A m
 - injection radius: 1.01 m
 - extraction radius: 3.30 m
 hill gap: 0.76 m valley gap: ∞ m
 field trimming
 - trim coils
 - number: 21
 - current (max): 950 A
 - harmonic coils
 - number: 4 axial, 4 radial
 - current (max): 40 A
 - others
 - number:
 - current (max): A

main coils:

- number: 1
 - Ampere-turns: 40,000 A.T.
 - current: 1000 A

stored energy: N/A MJ

weight : - iron: 2200 t - coils: 10 t

power

- main coils (total): 250 kW
 - trim coils (total max): 100 kW
 - refrigerator (cryogenic): N/A kW

b) RF

- acceleration

- frequency range: 25 – 35.5 MHz
 - harmonic modes: 3-7, 11-14
 - number of dees: 2 (cavities)
 - angular aperture: 38 deg
 - voltage: - average (min-max): 50-200 kV
 - variation with radius: $V_0 \sin(\pi r/4R)$
 - power in (max): 200 kW

- stability: - phase: 0.25 deg - voltage: 8×10^{-5} %

- other cavities

- purpose:
 - frequency range: MHz
 - region of influence: m
 - voltage (max): kV
 - power in (max): kW
 - stability: - phase: deg - voltage: %

c) injection

- internal source: none
 - external (radial/axial): radial
 - elements: electrostatic inflector
 - source voltage: 600kV
 - injection energy: 0.6 MeV/n
 - buncher: 500V in terminal, 1.5kV in beamline
 - injection efficiency: 75 %

d) ion sources/injector

HIPIOS – ECR source for pol H, pol D, ³He⁺⁺

e) extraction

- elements, characteristics:
 - electrostatic septum – 70kV
 - magnetic deflector
 - efficiency
 - typical: 99 % - best: 99 %

f) vacuum

- pumps: 4 cryogenic, 2 diffusion
 - achieved vacuum: 0.0004 Pa

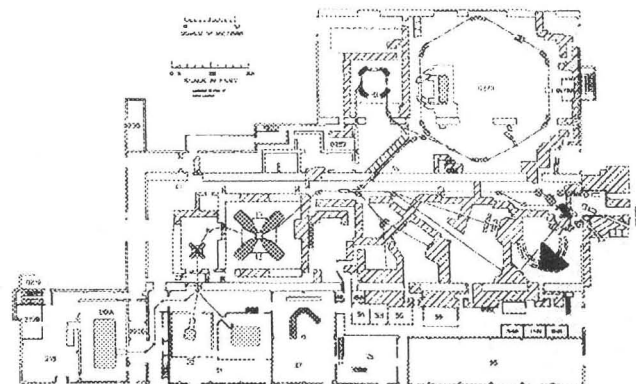
REFERENCES

1995 IUCF Scientific and Technical Report
 IUCF Status Report, R.E. Pollock, IEEE Trans. Nucl. Sci. NS-26
 IUCF Cooler, R.E. Pollock, IEEE Trans. Nucl. Sci. NS-30

EXPERIMENTAL FACILITIES

K600 high resolution spectrometer; Neutron “Swinger”; Proton Therapy Facility; Cooler – electron cooled synchrotron/storage Ring; PNF – Polarized Neutron Facility

PLAN VIEW OF FACILITY



COMMENTS

Research using cyclotrons ends November, 1998.
 Proton therapy using cyclotrons starts Summer, 1999.