

Entry: **C 55**
 Machine Name: NAC Injector Cyclotron 2
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HISTORY

Design by: National Accelerator staff
 Construction time: 1989 – 1993
 First beam: December 1993

CHARACTERISTIC BEAMS

ions / energy (MeV/n) / current (pps) / power (W) :
 -p 3.15 5.1×10^{14} 258
 -p 8.0 8.2×10^{13} 104
 -⁴⁰Ar⁸⁺ 0.36 2.1×10^{12} 40
 -¹²⁹Xe²²⁺ 0.32 5.7×10^{10} 8

transmission efficiency (total)
 - typical: 15 % - best: 30 %
 transverse emittance (rms)
 - vertical: 10 π mmmrad
 - horizontal: 15 π mmmrad
 longitudinal emittance (rms) 0.042 ΔE/E.deg RF

USES

basic research: 86 % therapy: 0.5 %
 development: 5 % isotope production: 0.5 %
 other applications: % maintenance: 3 %
 beam tuning: 5 %
 total time: 4016 h/year

TECHNICAL DATA

a) magnet
 type: sector magnets
 Kb: 8 MeV/A Kf: 8 MeV/A
 average field (min-max): 0.3-1.0 T
 number of magnet sectors: 4
 - angle: 45 deg
 - spiral (max): deg
 pole parameters
 - diameter: 1.16 m
 - injection radius: m
 - extraction radius: 0.476 m
 hill gap: 0.156 m valley gap: 0.250 m
 field trimming
 - trim coils
 - number: 6
 - current (max): 200 A
 - harmonic coils
 - number: 2
 - current (max): 20 A
 - others
 - number: cone coils 2
 - current (max): 200 A
 main coils:
 - number: 224
 - Ampere-turns: 154560 A.T.
 - current: 690 A
 stored energy: 0.1 MJ
 weight : - iron: 54.5 t - coils: 1.85 t
 power
 - main coils (total): 46 kW
 - trim coils (total max): 12 kW
 - refrigerator (cryogenic): kW

b) RF

- acceleration
 - frequency range: 8.6 - 26 MHz
 - harmonic modes: 2 and 6
 - number of dees: 2
 - angular aperture: 90 deg
 - voltage:- average (min-max): 60 kV
 - variation with radius: % at injection
 - % at extraction
 - power in (max): 2x 25 kW
 - stability:- phase: 0.1 deg - voltage: 0.1 %

- 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:
 - external (radial/axial): axial
 - elements: 3 spiral inflectors (interchangeable)
 - source voltage: 9-20 kV
 - injection energy: $1.4-20 \times 10^{-3}$ MeV/n
 - buncher: Double-gap, sine wave
 - injection efficiency: 55-70 %

d) ion sources/injector

(1) ECR
 (2) Polarized ion source

e) extraction

- elements, characteristics:
 - electrostatic channel
 - 2x magnetic channels
 - efficiency
 - typical: 70 % - best: 90 %

f) vacuum

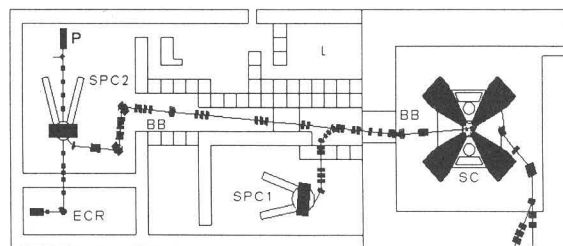
- pumps: turbo $2.2 \text{ m}^3 \text{ s}^{-1}$, cryopump $10 \text{ m}^3 \text{ s}^{-1}$ and
 2 LN_2 cryopump $18 \text{ m}^3 \text{ s}^{-1}$
 - achieved vacuum: 1.7×10^{-5} Pa

REFERENCES

Proc. 11th Int. Conf. on Cyclotrons and their Appl. (1986) p.515 ...
 Proceeding of this Conference

EXPERIMENTAL FACILITIES

PLAN VIEW OF FACILITY



BB Beamline buncher
 ECR ECR ion source (basement)
 L Low energy experimental area
 P Polarized ion source (basement)
 SPC1 Solid pole injector for light ions
 SPC2 Solid pole injector for heavy or polarized ions
 SC Separated-sector cyclotron

COMMENTS

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