

Entry: **C 54**
 Machine Name: NAC Injector Cyclotron 1
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Date: June 1998
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HISTORY

Design by: National Accelerator staff
 Construction time: 1978 – 1983
 First beam: December 1983

CHARACTERISTIC BEAMS

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

-p	3.15	2.1×10^{15}	1017
-p	8.0	8.2×10^{13}	104
-d	1.9	1.9×10^{13}	5.7
-He	2.5	9.3×10^{12}	8

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

USES

basic research: 10 % therapy: 35 %
 development: % isotope production: 40 %
 other applications: % maintenance: 3 %
 beam tuning: 12 %
 total time: 7229 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: 5
 - current (max): 180 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): 9 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): 2×25 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):
 - elements:
 - source voltage: kV
 - injection energy: MeV/n
 - buncher:
 - injection efficiency: %

d) ion sources/injector

PIG

e) extraction

- elements, characteristics:
 - electrostatic channel
 - 2x magnetic channels
 - efficiency
 - typical: 75 % - best: 96 %

f) vacuum

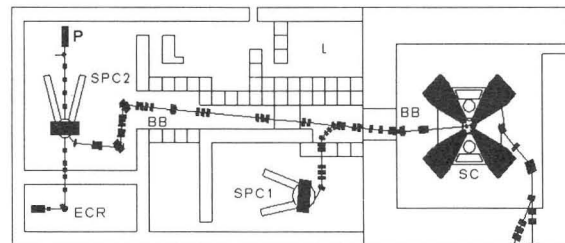
- pumps: turbo $4.8 \text{ m}^3 \text{ s}^{-1}$, Roots $350 \text{ m}^3 \text{ h}^{-1}$ and rotary vane $60 \text{ m}^3 \text{ h}^{-1}$
 - achieved vacuum: 1.5×10^{-3} Pa

REFERENCES

Proc. 10th Int. Conf. on Cyclotrons (1984) 67, 94, 373
 Proc 11th Int. Conf on Cyclotrons (1986) 9, 109

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