

Entry: **C24**  
 Machine Name: Bonn Isochronous Cyclotron  
 Address: Nussallee 14 - 16, D-53115 Bonn, Germany  
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### HISTORY

Design by: Fa. AEG and inhouse  
 Construction time: 1967- 1969  
 First beam: December 1968

### CHARACTERISTIC BEAMS

ions / energy (MeV/n) / current (pps) / power (W) :  
 - Proton / 7 - 14 / 70 x10<sup>12</sup>  
 - Deuteron / 7 - 14 / 30 x10<sup>12</sup>  
 - Alpha / 7 - 14 / 10 x10<sup>12</sup>  
 - Carbon (4+) / 7 / 0.15 x10<sup>12</sup>  
 transmission efficiency (total)  
 - typical: 25 % - best: 30 %  
 transverse emittance (rms)  
 - vertical: 6 .. π mmmrad  
 - horizontal: 6 .. π mmmrad  
 longitudinal emittance (rms) ΔE/E.deg RF

### USES

basic research 20... % therapy: 0... %  
 development: 10... % isotope production: 15... %  
 other applications: 20... % maintenance: 35... %  
 beam tuning: - ... %  
 total time: 8760... h/year

### TECHNICAL DATA

a) magnet  
 type: electromagnetic  
 Kb: MeV/A Kf: MeV/A  
 average field (min-max): 1,3 T  
 number of magnet sectors: 3  
 - angle: 40 deg  
 - spiral (max): 0 deg  
 pole parameters  
 - diameter: 2.000 m  
 - injection radius: 0.037 m  
 - extraction radius: 0.900 m  
 hill gap: 0.084 m valley gap: 0.240 m  
 field trimming  
 - trim coils  
 - number: 7 per sector  
 - current (max): 30 A  
 - harmonic coils  
 - number: -  
 - current (max): - A  
 - others  
 - number: -  
 - current (max): - A  
 main coils:  
 - number: 2  
 - Ampere-turns: A.T.  
 - current: 480 A  
 stored energy: MJ  
 weight: - iron: 250 t - coils: t  
 power  
 - main coils (total): 38 kW  
 - trim coils (total max): 6 kW  
 - refrigerator (cryogenic): - kW

### b) RF

- acceleration  
 - frequency range: 20 - 29 MHz

- harmonic modes: 3 ω  
 - number of dees: 3  
 - angular aperture: - deg  
 - voltage: - average (min-max): 45 kV  
 - variation with radius: -  
 - power in (max): 50 kW  
 - stability: - phase: 2 deg - voltage: 10<sup>6</sup> %

### - 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: ECR-source ( 5 GHz , 0.2 mA/q )  
 Polarized I.S. ( 0.05 mA/q )  
 - source voltage: - kV  
 - injection energy: 0.004 - 0.008 MeV/n  
 - buncher: 2  
 - injection efficiency: 30 %  
 d) ion sources/injector

### e) extraction

- elements, characteristics:  
 - electrostatic deflector  
 - screen channel  
 - focusing channel  
 - efficiency  
 - typical: 50 % - best: 80 %

### f) vacuum

- pumps: 1 oil-diffusion, 12.000 l/s  
 - achieved vacuum: 2 x 10<sup>-4</sup> Pa

### REFERENCES

F. Hinterberger et al., Nucl.Instr.130 (1975) p. 335 and p. 347  
 M. Agena et al., IEEE NS 26 (1979), p. 2156

### EXPERIMENTAL FACILITIES

Isotope production, hot-labors, orange-spectrometer, off-line-mass-separator

### PLAN VIEW OF FACILITY, COMMENTS

