

ENTRY NO. 27  
 NAME OF MACHINE HEIDELBERG KOMPAKT CYCLOTRON  
 INSTITUTION INSTITUTE FOR NUCLEAR MEDICINE - GERMAN CANCER RESEARCH CENTER  
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 IN CHARGE W. J. LORENZ, G. WOLBER REPORTED BY GERD. WOLBER

**HISTORY AND STATUS**

DESIGN, date 1967 Model tests 1968-69  
 ENG DESIGN, date  
 CONSTRUCTION, date Oct. 71 - May 72  
 FIRST BEAM, date (or goal) June 1972  
 MAJOR ALTERATIONS

COST, ACCELERATOR 1.5 MDM  
 COST, FACILITY, total 10 MDM  
 FUNDED BY Volkswagenwerk Foundation

**ACCELERATOR STAFF, OPERATION AND DEVELOPMENT**

SCIENTISTS 1 ENGINEERS 1  
 TECHNICIANS 3 CRAFTS 3  
 GRAD STUDENTS involved during year  
 OPERATED BY Research staff or 3 Operators  
 OPERATION 44 hr/wk. On target 20 hr/wk  
 TIME DISTR. in house 90 % Outside 10 %  
 BUDGET, op & dev 300 - 500 KDM  
 FUNDED BY Federal Government 90%, State 10%

**RESEARCH STAFF**, not included above  
 USERS, in house 4 outside 3  
 GRAD STUDENTS involved during year  
 RESEARCH BUDGET, in house  
 FUNDED BY Federal Government 90%

**MAGNET**

POLE FACE, diameter (compact) 109 cm, R extraction 49 cm  
 R injection cm  
 GAP, min 5.4 cm, Field 20 kG }  
 min 17.5 cm, Field 8 kG } at 175,000  
 AVERAGE FIELD at R ext 1.4 kG } Ampere turns  
 B max/ < B > 1.43 }  
 NUMBER OF SECTORS { compact 4 } Spiral, max 0 deg  
 { separated }  
 SECTOR ANGLE (SSC) deg  
 TRIMMING COILS 4 pairs at 4 radii

CONDUCTOR, material and type Cu pipe  
 STORED ENERGY (cryogenic) MJ  
 POWER: main coils 40 max, kW; current stability 10<sup>-5</sup>  
 trimming coils 0.8 max, kW; current stability 10<sup>-4</sup>  
 WEIGHT: Fe 24 tons; coils 2 tons  
 COOLING system deionized water  
 ION ENERGY (bending limit) E/A = q<sup>2</sup>/a<sup>2</sup> MEV/amu  
 (focusing limit) E/A = q/a MEV/amu

**ACCELERATION SYSTEM**

DEES, number 2 43 deg  
 BEAM APERTURE 2.3 cm; DC Bias - kV  
 TUNED by, coarse λ/4 stub line fine variable capacitor  
 RF 28.6 to 43 MHz, stable ± 2.5 x 10<sup>-6</sup>  
 Orb F 10.5 to 21 MHz  
 HARMONICS, RF/Orb F, used 2 / 4  
 DEE-Gnd, max 50 kV, min gap 5 cm  
 STABILITY, (pk-pk noise)/(pk RF volt) 5 / 10<sup>3</sup>  
 ENERGY GAIN, max 165 kV/turn  
 RF PHASE, stable to ± not measured deg  
 RF POWER input, max 60 kW  
 FREQUENCY MODULATION, rate /s  
 modulator, type  
 beam pulse, width

**VACUUM SYSTEM**

OPERATING PRESSURE 2 x 10<sup>-5</sup> Torr or mbar  
 PUMPS, No, Type, Size 2 x 450 ltr/s  
 vertical turbomolecular pumps

**ION SOURCES**

Livingston type

**INJECTION SYSTEM**

**EXTRACTION SYSTEM**

DC electrostatic deflector + magnetic  
**FACILITIES FOR RESEARCH** channel  
 SHIELDED AREA, fixed 16x18 m<sup>2</sup>; movable m<sup>2</sup>  
 TARGET STATIONS 8 in 3  
 STATIONS served at same time, max 1 (2 proposed)  
 MAG SPECTROGRAPH, type  
 COMPUTER model  
 OTHER FACILITIES D<sub>2</sub>-Target for fast  
 d-D neutrons

**CHARACTERISTIC BEAMS**

PARTICLE	ENERGY (MeV)		CURRENT (μA)	
	Goal	Achieved	Internal	External
p	22	21.5	£1000	30
d	11	10.6	£1000	70
<sup>3</sup> He <sup>++</sup>	28	28	£50	15
α	22	21.5	£50	15

SECONDARY (part/s)  
 n E<sub>n</sub> = 8.5 MeV 6x10<sup>7</sup>

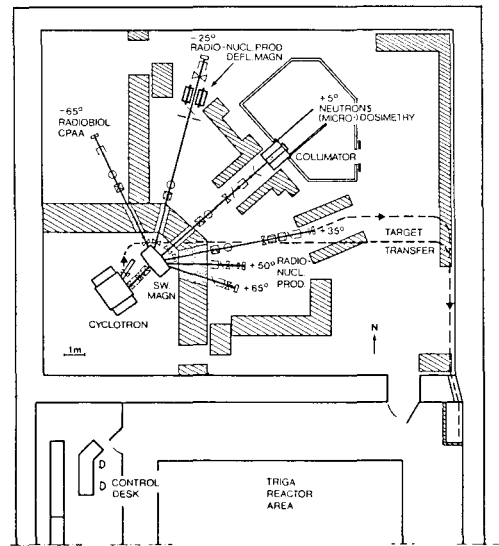
**BEAM PROPERTIES**

MEASURED CONDITIONS  
 PULSE WIDTH RF deg μA of MeV ions  
 PHASE EXC. max RF deg μA of MeV ions  
 EXTRACT eff % μA of MeV ions  
 RESOL ΔE/E % μA of MeV ions  
 EMITTANCE { axial } μA of MeV  
 (π mm. mrad) { rad } 2 )  
**OPERATING PROGRAMS**, time distribution  
 BASIC NUCLEAR PHYSICS SOLID STATES PHYSICS  
 BIOMEDICAL APPLICAT 10% ISOTOPE PRODUCTIONS 90%

**REFERENCES/NOTES**

- 1) H. Liesem, Nucl. Instr. Meth. 105, 329, 1972
- 2) G. Wolber et al., 7th Int. Conf. on Cycl. and Their Applications, SIN, Aug. 1975

**PLAN VIEW OF FACILITY, COMMENTS, ETC.**



THE HEIDELBERG COMPACT CYCLOTRON LABORATORY