**ENTRY No.** 27

NAME OF MACHINE Heidelberg Compact Cyclotron DATE August 1981
INSTITUTION German Cancer Research Center - Institute for Nuclear Medicine
ADDRESS D-6900 Heidelberg, Im Neuenheimer Feld 280 (W. Germany)
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IN CHARGE W.J.Lorenz REPORTED BY G. Wolber

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## 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 $1.5 \times 10^6$ DM
COST, FACILITY, total $10 \times 10^6$ DM
FUNDED BY Volkswagenwerk Foundation

## ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 1 ENGINEERS 1
TECHNICIANS 3 CRAFTS 3
GRAD STUDENTS involved during year 1
OPERATED BY Research staff or 3 Operators
OPERATION 40 hr/wk, On target 20 hr/wk
TIME DISTR. in house 90 % Outside 10 %
BUDGET, op & dev $0.5 \times 10^6$ DM
FUNDED BY Federal Government 90%, State 10%

## RESEARCH STAFF, not included above

USERS, in house 4 outside 3
GRAD STUDENTS involved during year 2
RESEARCH BUDGET, in house
FUNDED BY Federal Government > 90 %

## MAGNET [1]

POLE FACE, diameter (compact) 109 cm, R extraction 49 cm
R injection cm
GAP, min 5.4 cm, Field 20 kG
max 17.5 cm, Field 8 kG
AVERAGE FIELD at R ext 14 kG
} at 175 000 Ampere turns
B max/ <B> 1.43
NUMBER OF SECTORS compact 4 / separated } Spiral, max 0 deg
SECTOR ANGLE (SSC) deg
TRIMMING COILS 4 pairs at 4 radii

CONDUCTOR, material and type Cu pipes
STORED ENERGY (cryogenic) MJ
POWER : main coils 40 max, kW ; current stability $10^{-5}$
trimming coils 0,8 max, kW ; current stability $10^{-4}$
WEIGHT : Fe 24 tons ; coils 2 tons
COOLING system Deionized water
ION ENERGY (bending limit) E/A = $q^2/a^2$ MeV/amu
(focusing limit) E/A = q /a MeV/amu

## ACCELERATION SYSTEM

DEES, number 2 ; angle 43 deg
BEAM APERTURE 2.3 cm ; DC Bias - kV
TUNED by, coarse manual fine variable capacitor
RF 28.6 to 43 mHz, stable ± $2.5/10^6$
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) $5/10^3$
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 $2/10^5$ $10^{-1}$ Torr or mbar
PUMPS, No, Type, Size 2 x 450/ltrsec
Vertical Turbomolecular Pumps

## ION SOURCES

Livingstone Type

## INJECTION SYSTEM

## EXTRACTION SYSTEM

DC Electrostatic Deflector + Magnetic Channel

## FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 16 x 18 m² ; movable m²
TARGET STATIONS 7 in 2 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type
COMPUTER model
OTHER FACILITIES Fast Neutron D-D-Target

## CHARACTERISTIC BEAMS

| PARTICLE | ENERGY (MeV) Goal | Achieved | CURRENT (pμA) Internal | External |
|---|---|---|---|---|
| p | 22 | 21,5 | ≤ 1000 | 30 |
| d | 11 | 10,6 | ≤ 1000 | 80 |
| $^3He^{++}$ | 28 | 28 | ≤ 50 | 10 |
| α | 22 | 21,5 | ≤ 50 | 10 |
| SECONDARY | | | | (part/s) [2] |
| n | En = 8,5 MeV | | $6 \times 10^7$ | |

## BEAM PROPERTIES

| | MEASURED | CONDITIONS |
|---|---|---|
| PULSE WIDTH | RF deg | pμ A of MeV ions |
| PHASE EXC, max | RF deg | pμ A of MeV ions |
| EXTRACT eff | % | pμ A of MeV ions |
| RESOL ΔE/E | % | pμ A of MeV ions |
| EMITTANCE (π mm. mrad) axial | | pμA of MeV ions |
| EMITTANCE (π mm. mrad) rad | | pμA of MeV ions |

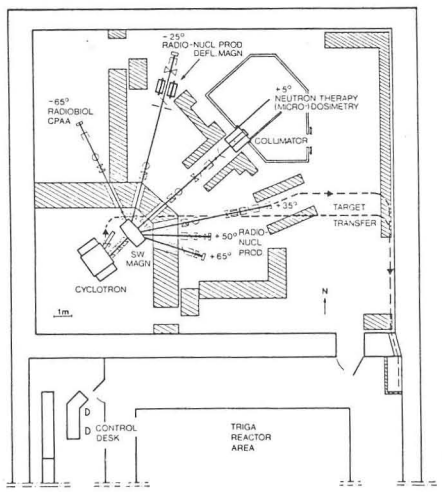
## OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS SOLID STATES PHYSICS
BIOMEDICAL APPLICAT. 30 % ISOTOPE PRODUCTIONS 70 %

## REFERENCES/NOTES


1) LIESEM, H.: Nucl.Instr.Meth. 105, p.329 (1972)
2) WOLBER, G. et al.: 7th Int.Conf. on Cyclotrons and Their Applications, SIN Aug. 19-22, 1975


## PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS




THE HEIDELBERG COMPACT CYCLOTRON LABORATORY