ENTRY No. 35

NAME OF MACHINE Karlsruhe Isochronous Cycl. DATE
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IN CHARGE H. Schweickert REPORTED BY H. Schweickert

HISTORY AND STATUS
DESIGN, date 1958 Model tests 1958 - 60
ENG DESIGN, date
CONSTRUCTION, date 1960 - 1962
FIRST BEAM, date (or goal) int. 1962; ext. 1964
MAJOR ALTERATIONS axial Injection 1971
COST, ACCELERATOR 4.6×10^6 DM
COST, FACILITY, total 20×10^6 DM
FUNDED BY Federal Goverment & State of Baden-Württemberg

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT
SCIENTISTS 5 ENGINEERS 5
TECHNICIANS 10 CRAFTS 20
GRAD STUDENTS involved during year
OPERATED BY - Research staff or 10 Operators
OPERATION 168 hr/wk, On target 135 hr/wk
TIME DISTR. in house 50 %, Outside 50 %
BUDGET, op & dev 2×10^6 DM
FUNDED BY Federal Goverment & State of Baden-Württemberg

RESEARCH STAFF, not included above
USERS, in house 40 outside 90
GRAD STUDENTS involved during year
RESEARCH BUDGET, in house
FUNDED BY

MAGNET
POLE FACE, diameter (compact) 225 cm, R extraction 105 cm
R injection
GAP, min 8 cm, Field 19.5 kG
max 16 cm, Field 9.5 kG
at 0.16×10^6 Ampere turns
AVERAGE FIELD at R ext 14.4 kG
B max/ <B> 1.3
NUMBER OF SECTORS compact 3 / separated — Spiral, max deg
SECTOR ANGLE (SSC) deg
TRIMMING COILS 6 coils per plate with summing field on hill sectors
CONDUCTOR, material and type copper
STORED ENERGY (cryogenic) MJ
POWER : main coils 32 max, kW ; current stability 10^{-6}
trimming coils 1 max, kW ; current stability 10^{-4}
WEIGHT : Fe 280 tons ; coils 8.5 tons
COOLING system water
ION ENERGY (bending limit) E/A = 104 q^2/a^2 MeV/amu
(focusing limit) E/A = q^2/a^2 MeV/amu

ACCELERATION SYSTEM
DEES, number 3 ; angle 60 deg
BEAM APERTURE 3.5 cm ; DC Bias 0 kV
TUNED by, coarse - fine rotating loop
RF to 33 mHz, stable ± 5×10^{-6}
Orb F to 11 mHz
HARMONICS, RF/Orb F, used 3
DEE - Gnd, max 40 kV, min gap 1 -3 cm
STABILITY, (pk-pk noise)/(pk RF volt) 10
ENERGY GAIN, max 240 kV/turn
RF PHASE, stable to ± 1 deg
RF POWER input, max 50 kW
FREQUENCY MODULATION, rate /s
modulator, type
beam pulse, width 0.5 - 3.0 nsec

VACUUM SYSTEM
OPERATING PRESSURE 2×10^{-6} Torr or mbar
PUMPS, No, Type, Size 2 diffusions pumps
2 x 12.000 l/sec

ION SOURCES
Internal: Hot cathode Penning; External: polarized atomic-beam source; ECR-ion-source

INJECTION SYSTEM
Axial 10 keV, electrostatic with hyperboloid inflector

EXTRACTION SYSTEM
Two electrostatic deflectors + magn. iron channel

FACILITIES FOR RESEARCH
SHIELDED AREA, fixed 350 m² ; movable m²
TARGET STATIONS 8 in 3 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type Little John K = 300
COMPUTER model 4 x DEC-PDP 11/73, Ethernet-LAN, CAMAC
OTHER FACILITIES
Neutron Hall with POLKA, DUAL-BEAM for material research

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
d		52	> 1000	> 30
α		104	80	> 15
$^6Li^{3+}$		156	2.0	0.8
d+		52	1.2	0.5
SECONDARY			(part/s)	

BEAM PROPERTIES

MEASURED		CONDITIONS
PULSE WIDTH	10 RF deg	1 pμ A of 52 MeV d ions
PHASE EXC, max	20 RF deg	1 pμ A of 52 MeV d ions
EXTRACT eff	> 70 %	pμ A of 52 MeV d ions
RESOL ΔE/E	0.3 %	pμ A of 52 MeV d ions
EMITTANCE (π mm. mrad)	9 axial / 6 rad	5 pμA of 52 MeV d ions

OPERATING PROGRAMS, time distribution
BASIC NUCLEAR PHYSICS 60 % SOLID STATES PHYSICS 20 %
BIOMEDICAL APPLICAT. ISOTOPE PRODUCTIONS 10 %
Material Research 10 %

REFERENCES/NOTES

1) Proc. Int. Conf. SF Cyclotrons, CERN 63-19, p. 24
2) Nucl. Instr. Meth. 13, 55 (1961), KfK 754 (1968)

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS
1. Applications of cyclotrons in technical and analytical studies: A. Gervé, G. Schatz; Proc. 7th Int. Conf. on cyclotrons and their Applications (Birkhäuser, Basel, 1975) p.496-502
2. Axial injection system: G. Haushahn, J. Möllenbeck, G. Schatz F. Schulz, H. Schweickert; Proc. 7th Int. Conf. on Cyclotrons and their Appl. (Birkenhäuser, Basel, 1975) p. 376-380
3. The Ion Sources at the Karlsruhe Cyclotron: H.P. Ehret, R. Ernst, L. Friedrich, E. Huttel, J. Kaltenbaek, F. Schulz, L. Wiss, P. Ziegler; these Proceedings