ENTRY NO. 33

NAME OF MACHINE: Karlsruhe Isochronous Cyclotron
INSTITUTION: Kernforschungszentrum Karlsruhe GmbH, Institue of Nuclear Physics/Cyclotron
ADDRESS: D-7500 Karlsruhe, Postfach 3640, West-Germany
TEL: 07247.82.2433 TELEX: 7826484.d Telefax: 07247.82.3156
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, (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 B.-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: cm
GAP, min: 8 cm, Field: 19.5 kG
max: 16 cm, Field: 9.5 kG } at 0.16×10^6
AVERAGE FIELD at R ext: 14.4 kG Ampere turns
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/A 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 $\pm 5 \times 10^{-6}$
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 (8000 l/sec + 12,000 l/sec)

ION SOURCES

Internal: Hot cathode Penning; External: Hot cathode Penning, Lambshift, ECR-source

*In house refers to users from KfK

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: Two Nova 2, CAMAC
OTHER FACILITIES: Large neutron-time-of-flight Spectrometer (190 m), resolution 5 psec/m
Neutron Hall with POLKA

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
d		52	> 1000	> 20
α		104	80	> 10
$^6Li^{3+}$		156	0.2	0.1
d↑		52	0.4	0.2
SECONDARY			(part/s)	

BEAM PROPERTIES

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

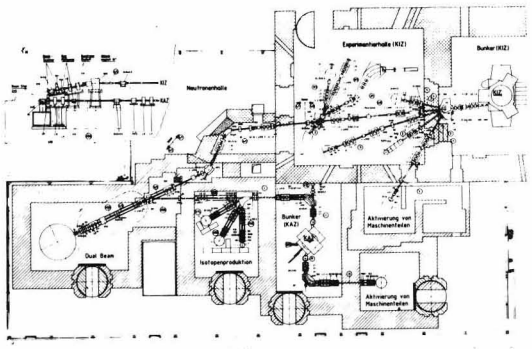
OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 60 % SOLID STATES PHYSICS 30 %
BIOMEDICAL APPLICAT. ISOTOPE PRODUCTIONS 10 %
Materials Research 10 %

REFERENCES/NOTES

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

PLAN VIEW OF FACILITY, COMMENTS, ETC.



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) External Ion Sources: V. Bechtold, L. Friedrich, F. Schulz; Proc. 10th Int. Conf. on Cyclotrons and their Appl. (Michingan, USA, 1984)