ENTRY No. 25

NAME OF MACHINE Isochronous variable energy DATE CV 28 TCC, Berkeley Sept. 1981
INSTITUTION Institut Medizinische Strahlenphysik und Strahlenbiologie, Universitaetsklinikum Essen
ADDRESS Hufelandstr. 55, D 4300 Essen 1, W-Germany
TEL 0201/723 2171 TELEX 857 9573 klies d
IN CHARGE Prof. Dr. J. Rassow REPORTED BY Rassow

HISTORY AND STATUS

DESIGN, date 1973 Model tests 1974
ENG DESIGN, date 1972
CONSTRUCTION, date 1974
FIRST BEAM, date (or goal) Sept. 1975 (Essen)
MAJOR ALTERATIONS
COST, ACCELERATOR $0.9 10^6
COST, FACILITY, total $1.6 10^6
FUNDED BY Land Nordrhein-Westfalen (University)

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 7 ENGINEERS 4
TECHNICIANS 3 CRAFTS 2
GRAD STUDENTS involved during year
OPERATED BY Research staff or 2 Operators
OPERATION 50 hr/wk, On target 45 hr/wk
TIME DISTR. in house %, Outside %
BUDGET, op & dev
FUNDED BY

RESEARCH STAFF, not included above

USERS, in house 3 outside
GRAD STUDENTS involved during year
RESEARCH BUDGET, in house
FUNDED BY

MAGNET

POLE FACE, diameter (compact) 96 cm, R extraction 42 cm
R injection cm
GAP, min 5.0 cm, Field 14 kG
max 10.1 cm, Field 20 kG
at $0.25 \cdot 10^6$ Ampere turns
AVERAGE FIELD at R ext 17 kG
B max/ <B>
NUMBER OF SECTORS compact / separated 3 Spiral, max 47 deg
SECTOR ANGLE (SSC) 120 deg
TRIMMING COILS 3 pairs inner and outer harmonic coils each
4 pairs profile coils
CONDUCTOR, material and type Cu tubes
STORED ENERGY (cryogenic) MJ
POWER : main coils 70 max, kW ; current stability $2 \cdot 10^{-6}$
trimming coils 20 max, kW ; current stability $1 \cdot 10^{-5}$
WEIGHT : Fe 21 tons ; coils 1.8 tons
COOLING system demineralized water
ION ENERGY (bending limit) E/A = 28 (H^+ 24) q^2/a^2 MeV/amu
(focusing limit) E/A = 28 q /a MeV/amu

ACCELERATION SYSTEM

DEES, number 2 ; angle 90 deg
BEAM APERTURE 2.0 cm ; DC Bias 1 kV
TUNED by, coarse Short Plane fine Trim Capacitor
RF 6.5 to 25.5 MHz, stable ± 100 Hz
Orb F 6.5 to 26.5 MHz
HARMONICS, RF/Orb F, used fundamental
DEE - Gnd, max 30 kV, min gap 1.3 cm
STABILITY, (pk-pk noise)/(pk RF volt)
ENERGY GAIN, max 60 kV/turn
RF PHASE, stable to ± deg
RF POWER input, max 40 kW
FREQUENCY MODULATION, rate 0 /s
modulator, type
beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE < 5×10^{-5} Torr Torr or mbar
PUMPS, No, Type, Size NRC 1 x 25 cm
Oil diffusion pump

ION SOURCES

penning ion source

INJECTION SYSTEM

EXTRACTION SYSTEM

electrostatic deflector magnet channel

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 138 m² ; movable m²
TARGET STATIONS 8 in 4 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type
COMPUTER model
OTHER FACILITIES isocentric neutron therapy facility, 6 external and 1 internal target stations, 1 neutron activation station

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
protons	2-24	2-24	300	85
deuterons	3-14	3-14	400	120
Helium-3 $^{++}$	5-36	5-37	150	80
Helium-4 $^{++}$	6-28	6-28	100	50
SECONDARY				(part/s)

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	70 %	100 pμ A of 14 MeV d^+ ions
RESOL ΔE/E	0.5 %	50 pμ A of 28 MeV He^{++} ions
EMITTANCE		
(π mm. mrad)	250 axial / 250 rad	100 pμA of 14 MeV d^+ ions

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS		SOLID STATES PHYSICS	
BIOMEDICAL APPLICAT.	10%	ISOTOPE PRODUCTIONS	10%
Neutron therapy	42%	Safety tests, maintenance	17%
Radiation physics	16%	Dead time	1%

REFERENCES/NOTES

Rassow, J., Hüdepohl, G., Maier, E., Meissner, P.: CIRCE-Cyclotron Isocentric Neutron Therapy Facility. In: Burger, G., Ebert, H.G.: Proceedings Third Symposium on Neutron Dosimetry, Munich 1977, EURATOM EUR 5848/DE/EN/FR 1978

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS