ENTRY NO. 25

NAME OF MACHINE ... Isochronous variable energy ... DATE CV 28 TCC, Berkeley ... Sept. 1981

INSTITUTION ... Institut Medizinische Strahlenphysik und Strahlenbiologie, Universitaetsklinikum Essen

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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
min 10.1 cm, Field ... 20 ... kG } at ... 0.25 ... 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 ± ... 100Hz

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 POWEP input, max ... 40 ... kW

FREQUENCY MODULATION, rate ... 0 ... /s

modulator, type

beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE ... $< 5 \times 10^{-5}$ 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 ... m^2; movable ... m^2

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^{-4} ions
EMITTANCE (π mm. mrad)	250 axial / 250 rad	100	pμ A of 14	MeV	d^+

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., Hudepohl, 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, COMMENTS, ETC.