ENTRY NO. 28

NAME OF MACHINE Isochronous variable energy ... DATE CV 28 TCC, Berkeley Sept. 1981 ...
INSTITUTION ... Institut. Medizinische Strahlenpysik 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 ...
... 10^6 ...
COST, ACCELERATOR ... so.9 ... 10^6 ...
COST, FACILITY, total ... s1.6 ... 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 ... 10^6 ...
AVERAGE FIELD at R ext ... 17 ... kG Ampere turns
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 POWER input, max. ... 40 ... kW
FREQUENCY MODULATION, rate ... 0 ... /s
modulator, type ...
beam pulse, width ...

VACUUM SYSTEM

OPERATING PRESSURE ... $\leq 5 \times 10^{-5}$ Torr ... Torr or mbar
PUMPS, No, Type, Size ... NRC 1x25 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 ... 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		pμA of	MeV		ions
PHASE EXC. max	RF deg		pμA of	MeV		ions
EXTRACT eff	70 %	100	pμA of 14	MeV	d^+	ions
RESOL ΔE/E	0.5 %	50	pμA of 28	MeV	He^{-4}	ions
EMITTANCE						
(π mm-mrad)	250 axial	100	pμA of 14	MeV	d^+	
	250 rad					

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

PLAN VIEW OF FACILITY, COMMENTS, ETC. 1978