ENTRY No. FM-5

NAME OF MACHINE Gustaf Werner Cyclotron DATE 1989-05-03
INSTITUTION The Svedberg Laboratory
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IN CHARGE A Johansson REPORTED BY S Holm

HISTORY AND STATUS

DESIGN, date 1946, 1977 Model tests 1974-1978
ENG DESIGN, date 1946-1951, 1977-1984
CONSTRUCTION, date 1947-1951, 1979-1986
FIRST BEAM, date (or goal) 1951, 1986 int, 1987 ext
MAJOR ALTERATIONS Complete reconstruction to AVF cw and f m cyclotron
COST, ACCELERATOR Reconstruction 25 MSEK
COST, FACILITY, total 70 MSEK
FUNDED BY State

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 3 ENGINEERS 5
TECHNICIANS 7 CRAFTS
GRAD STUDENTS involved during year
OPERATED BY 3 Research staff or 6 Operators
OPERATION 120 hr/wk, On target 110 hr/wk
TIME DISTR. in house 75 %, Outside 75 %
BUDGET, op & dev 1 MSEK
FUNDED BY Sw State

RESEARCH STAFF, not included above

USERS, in house 20 outside 100
GRAD STUDENTS involved during year --
RESEARCH BUDGET, in house 10 MSEK (incl salaries)
FUNDED BY Sw State

MAGNET

POLE FACE, diameter (compact) 180 cm, R extraction 120 cm
R injection cm
GAP, min 20 cm, Field kG
max 36 cm, Field kG } at 0.7·10^6 Ampere turns
AVERAGE FIELD at R ext 17.5 kG
B max/ <B>
NUMBER OF SECTORS { compact 3 / separated } Spiral, max deg
SECTOR ANGLE (SSC) deg
TRIMMING COILS 13 pair circular
2 sets harmonic
CONDUCTOR, material and type Cu, hollow
STORED ENERGY (cryogenic) MJ
POWER : main coils 300 max, kW ; current stability 10 ppM
trimming coils 60 max, kW ; current stability 100 ppM
WEIGHT : Fe 600 tons ; coils 50 tons
COOLING system demineralized water
ION ENERGY (bending limit) E/A = 200 q²/a² MeV/amu
(focusing limit) E/A = 110 q²/a² MeV/amu

ACCELERATION SYSTEM

DEES, number 2 ; angle decreasing from 72 deg
BEAM APERTURE 4.2-2.5 cm ; DC Bias kV
TUNED by, coarse moving short fine plunger
RF 24 to 12 mHz, stable ±
Orb F 24 to 6 (3) mHz
HARMONICS, RF/Orb F, used 1,2 (3,4)
DEE - Gnd, max 50 kV, min gap 0.5 cm
STABILITY, (pk-pk noise)/(pk RF volt) better than 10^{-3}
ENERGY GAIN, max 200 kV/turn
RF PHASE, stable to ± 0.1 deg
RF POWER input, max 200 kW
FREQUENCY MODULATION, rate 1000 /s
modulator, type broad band
beam pulse, width < 25 µS

VACUUM SYSTEM

OPERATING PRESSURE < 10^{-6} Torr or mbar
PUMPS, No, Type, Size 2 oil diff pumps
each 2000 l/s
intermediate vacuum <10^{-4}, 700 l/s

ION SOURCES

internal PIG, Future ECR, Polarized

INJECTION SYSTEM

External under installation

EXTRACTION SYSTEM

Regenerative and precessional, el- and magn channels

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed m² ; movable m²
TARGET STATIONS 8 In 4 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type HESM, double focussing
COMPUTER model VAX Cluster+valet plus (dat eq)
OTHER FACILITIES PACMAN (pair spectrometer for high energy gamma rays
LISA (Light Ion Spectrometer Assembly)

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pµA) Internal	External
p^+	10-200	50-100 (cw)	> 100	10
α	50-200	50-200	100	10
$^{16}O^{5+}$	320	320		0.02
SECONDARY			(part/s)	
n	185	100	10^6 (in 10^{-4} Sr)	

BEAM PROPERTIES

	MEASURED	CONDITIONS
PULSE WIDTH	11 RF deg	0.1 pµ A of 50 MeV p ions
PHASE EXC, max	RF deg	pµ A of MeV ions
EXTRACT eff	≥ 80 %	pµ A of MeV ions
RESOL ΔE/E	0.2 %	0.1 pµ A of 50 MeV p ions
EMITTANCE		
(π mm. mrad)	9π axial / 9π rad	0.1 pµA of 50 MeV p ions

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 80% SOLID STATES PHYSICS 5%
BIOMEDICAL APPLICAT. 12% ISOTOPE PRODUCTIONS 3%

REFERENCES/NOTES

S. Holm et al, Physica Scripta, Vol 34, 513-532, 1986
C. Ekström et al, Physica Scripta, Vol T22, 256-268, 1986

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS