

ENTRY NO. 60

NAME OF MACHINE Croningen K160 Cyclotron
 INSTITUTION Kernfysisch Versneller Instituut
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 IN CHARGE R.H. Siemssen REPORTED BY H.W. Schreuder

HISTORY AND STATUS

DESIGN, date 1963 Model tests 1964 - 1966
 ENG DESIGN, date 1966 - 1968
 CONSTRUCTION, date 1968 - 1970
 FIRST BEAM, date (or goal) 1970
 MAJOR ALTERATIONS central region (1972)
 axial injection (1983)
 COST, ACCELERATOR \$ 4.10⁶
 COST, FACILITY, total
 FUNDED BY Croningen University

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 3 ENGINEERS 1
 TECHNICIANS 10 CRAFTS 2
 GRAD STUDENTS involved during year 1
 OPERATED BY Research staff or 8 (half t) Operators
 OPERATION 130 hr/wk, On target 110 hr/wk
 TIME DISTR. in house 70 % , outside 30 %
 BUDGET, op & dev
 FUNDED BY Croningen University and foundation FOM

RESEARCH STAFF, not included above

USERS, in house 20 incl. grad. st outside
 GRAD STUDENTS involved during year 12
 RESEARCH BUDGET, in house
 FUNDED BY Croningen University and foundation FOM

MAGNET

POLE FACE, diameter (compact) 280 cm, R-extraction 121 cm
 R injection cm
 GAP, min 22.4 cm, Field 20 kG }
 max 45 cm, Field 10 kG } at 560000
 AVERAGE FIELD at R ext 16 kG } Ampere turns
 B max / < B > 1.25

NUMBER OF SECTORS { compact 3 } Spiral, max 56 deg
 { separated }
 SECTOR ANGLE (SSC) deg
 TRIMMING COILS 12 concentric
 5 harmonic + 2 bump coils

CONDUCTOR, material and type aluminium
 STORED ENERGY (cryogenic) MJ
 POWER: main coils 360 max kW: current stability < 10⁻⁵
 trimming coils 100 max kW: current stability < 10⁻³
 WEIGHT: Fe 650 tons: coils 29 tons
 COOLING system demin water
 ION ENERGY (Bending limit) E/A = 160 q²/A² MeV/amu
 (Focusing limit) E/A = q/A MeV/amu

ACCELERATION SYSTEM

DEES, number 1 angle 180 deg
 BEAM APERTURE 2.5 cm; DC Bias 700 kV
 TUNED by, coarse moving short fine trim cap
 RF 4.7 to 13.9 MHz, stable ± 5.10⁻⁶
 Orb F to 13.9 MHz
 HARMONICS, RF/Orb F, used 1, 3
 DEE-Gnd, max 70 kV, min gap 0.6 cm
 STABILITY, (pk-pk noise)/(pk RF volt) 2.10⁻⁴
 ENERGY GAIN, max 140 kV/turn
 RF PHASE, stable to ± deg
 RF POWER input, max 150 kW
 FREQUENCY MODULATION, rate /s
 modulator, type
 beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 1.10⁻⁶ (ext src.) Torr or mbar
 PUMPS, No, Type, Size 1 oil diffusion 4000 l/s
 2 cryo (7000 l/s) total

ION SOURCES

..... internal Livingston, P.I.C.
 external ECR, pol ions (1985)

INJECTION SYSTEM

axial, hyperboloidal inflector

EXTRACTION SYSTEM

electrostatic and magnetic

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed m²; movable 450 m²
 TARGET STATIONS 10 in 7 rooms
 STATIONS served at same time, max 1
 MAG SPECTROGRAPH, type QMG/2 (Q3D type)
 COMPUTER model VAX 11-780, VAX 22-750, PDP 11-34 (Cycl.)
 OTHER FACILITIES large scatt. chamber, HI-detector,
 multiplicity filter, Sumspectrometer and BGO-Anti-
 Compton spectrometers, Mini-Orange filters

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT (µA)	
	Goal	Achieved	Internal	External
P	12 - 65	MeV		
α	25 - 160	MeV		
¹⁶ O	5 - 40	MeV/amu		
⁴⁰ Ar	5 - 12	MeV/amu		
SECONDARY			(part/s)	

BEAM PROPERTIES

MEASURED CONDITIONS
 PULSE WIDTH 4-40 RF deg µA of MeV ions
 PHASE EXC. max RF deg µA of MeV ions
 EXTRACT eff < 50 % µA of MeV ions
 RESOL ΔE/E 0.2 % µA of MeV ions
 EMITTANCE
 (π mm-mrad) 10 axial µA of MeV
 7 rad

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 84 SOLID STATES PHYSICS 10
 BIOMEDICAL APPLICAT 6 ISOTOPE PRODUCTIONS 10

REFERENCES/NOTES

- O.C. Dermois, A.G. Drentje, H.W. Schreuder, IEEE Trans NS 26-2(1979)1992
- W.K.v.Asselt, O.C. Dermois, A.G. Drentje, H.W. Schreuder, Proc. Ninth Int. Conf. Caen (1981)p.267

PLAN VIEW OF FACILITY, COMMENTS, ETC.

