ENTRY NO. 59

NAME OF MACHINE: NAC Pretoria Cyclotron

INSTITUTION: National Accelerator Centre, Council for Scientific and Industrial Research

ADDRESS: NAC, CSIR, P O Box 395, Pretoria, 0001, Republic of South Africa

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IN CHARGE: F J Haasbroek REPORTED BY: A H Botha

HISTORY AND STATUS

DESIGN, date: 1950 Model tests: -

ENG DESIGN, date: 1951 - 1953

CONSTRUCTION, date: 1953 - 1958

FIRST BEAM, date (or goal): 1958

MAJOR ALTERATIONS: (See below)

COST, ACCELERATOR:

COST, FACILITY, total: R200 000 (1958)

FUNDED BY: CSIR

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS: - ENGINEERS: 1 (part-time)

TECHNICIANS: 6 CRAFTS: 2

GRAD STUDENTS involved during year: -

OPERATED BY: - Research staff or: 5 Operators

OPERATION: 136 hr/wk. On target: 110 hr./wk

TIME DISTR. in house: 100 % Outside: - %

BUDGET, op & dev: -

FUNDED BY: CSIR

RESEARCH STAFF, not included above

USERS, in house: 4 outside: 3

GRAD STUDENTS involved during year: -

RESEARCH BUDGET, in house: -

FUNDED BY: CSIR

MAGNET

POLE FACE, diameter (compact): 112 cm, R extraction: 49,5 cm

R injection: - cm

GAP, min: 14,7 cm, Field: 17,7 kG
max ~~min~~: 15,9 cm, Field: 16,4 kG
at 0,32 x 10^6 Ampere turns

AVERAGE FIELD at R ext: 17,0 kG

B max/ < B >: 1,04

NUMBER OF SECTORS: compact: 3; separated: -
Spiral, max: 0 deg

SECTOR ANGLE (SSC): - deg

TRIMMING COILS: Two sets of circular coils and one set of harmonic coils.

CONDUCTOR, material and type: Aluminium

STORED ENERGY (cryogenic): 0,2 MJ

POWER: main coils: 70 max, kW; current stability: 10^{-4}

trimming coils: 2 max, kW; current stability: 10^{-3}

WEIGHT: Fe: 73,8 tons; coils: 5,4 tons

COOLING system: Demineralised water

ION ENERGY (bending limit) E/A = 32 q^2/a^2 MEV/amu

(focusing limit) E/A = 15,3 q/a MeV/amu

ACCELERATION SYSTEM

DEES, number: 2, 140 deg

BEAM APERTURE: 5 cm; DC Bias: - kV

TUNED by, coarse: MS fine: VC, AUTO

RF: 10,8 to 17,4 mHz, stable ± 10 ppm

Orb F: 10,8 to 17,4 mHz

HARMONICS, RF/Orb F, used: 1

DEE—Gnd, max: 72 kV, min gap: 1 cm

STABILITY, (pk-pk noise)/(pk RF volt): -

ENERGY GAIN, max: 270 kV/turn

RF PHASE, stable to ±: - deg

RF POWEP input, max: 2 x 20 kW

FREQUENCY MODULATION, rate: - /s

modulator, type: -

beam pulse, width: -

VACUUM SYSTEM

OPERATING PRESSURE: 50 x 10^{-6} Torr or mbar

PUMPS, No, Type, Size:

2 Diffusion, HV 2,2 m^3s^{-1} and 1 m^3s^{-1}

2 Roughing, 176 m^3h^{-1} and 15 m^3h^{-1}

ION SOURCES

Internal Hot Cathode Source

INJECTION SYSTEM

-

EXTRACTION SYSTEM

DC Electrostatic Channel, Two Magnetic Channels

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed: 150 m²; movable: 0 m²

TARGET STATIONS: 3 in: 1 room

STATIONS served at same time, max: 1

MAG SPECTROGRAPH, type: -

COMPUTER model: -

OTHER FACILITIES: 1. Isotope Production Facility
2. Fast Neutron Facility

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
p	8	5,8-15,3	700	60
d	16	11,5-17,3	700	60
^{3}He		18-38	150	50
^{4}He	32	23-34,6	150	50
SECONDARY (part/s)				
-				
-				

BEAM PROPERTIES

MEASURED		CONDITIONS			
PULSE WIDTH	RF deg		pμ A of	MeV	ions
PHASE EXC. max	45 RF deg	100	pμ A of 16	MeV	d ions
EXTRACT eff	30 %	60	pμ A of 16	MeV	d ions
RESOL ΔE/E	%		pμ A of	MeV	ions
EMITTANCE (π mm. mrad)	7,2 axial; 7,2 rad	50	pμ A of 16	MeV	d

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS: 0% SOLID STATES PHYSICS: 0%

BIOMEDICAL APPLICAT: 15% ISOTOPE PRODUCTIONS: 78%

REFERENCES/NOTES

1) Nucl. Inst. & Meth., 3, 323 (1958).
2) Nucl. Inst. & Meth., 8, 261 (1960).
3) Tydskr. Natuurwet., 333 (1967).

PLAN VIEW OF FACILITY, COMMENTS, ETC.

During 1960 Thomas shims were installed in order to improve the vertical focusing.

The cyclotron has been modified for variable energy operation and for acceleration of ^{3}He-ions during 1969. A ^{3}He-recovering system has been installed.

Two magnetic channels have recently been installed in order to improve the focusing along the extraction orbit.

A fixed horizontal collimator, with a remote controlled variable field, for high-energy neutrons has been acquired and will be used for therapy and radiobiological studies.