ENTRY No. 76

NAME OF MACHINE NAC Separated-Sector Cyclotron DATE 05/05/1989
INSTITUTION National Accelerator Centre
ADDRESS P O Box 72, Faure, 7131, Republic of South Africa
TEL 024-43820 TELEX TEX555046 SA TELEFAX 024-43525
IN CHARGE D Reitmann REPORTED BY A H Botha

HISTORY AND STATUS
DESIGN, date 1977 Model tests
ENG DESIGN, date 1978
CONSTRUCTION, date 1979
FIRST BEAM, date (~~or goal~~) October 1985
MAJOR ALTERATIONS -

COST, ACCELERATOR
COST, FACILITY, total
FUNDED BY CSIR

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT
SCIENTISTS 12 ENGINEERS 12
TECHNICIANS 20 CRAFTS 10
GRAD STUDENTS involved during year 1
OPERATED BY 10 Research staff ~~of~~ and 4 Operators
OPERATION 123 (average) hr/wk, On target 86 (average) hr/wk
TIME DISTR. in house 121.5 %, Outside 78.5 %
BUDGET, op & dev
FUNDED BY CSIR

RESEARCH STAFF, not included above
USERS, in house 20 outside 70
GRAD STUDENTS involved during year 9
RESEARCH BUDGET, in house
FUNDED BY CSIR

MAGNET
POLE FACE, diameter (compact) -. cm, R extraction 443 cm
R injection 101 cm
GAP, min 6.6 cm, Field 12.7 kG
max cm, Field 5.2 kG
at 1.08 x 10^5 Ampere turns
AVERAGE FIELD at R ext 5.2 kG
B max/ <B> 2.4
NUMBER OF SECTORS compact -, separated 4 Spiral, max deg
SECTOR ANGLE (SSC) 34 deg
TRIMMING COILS 29

CONDUCTOR, material and type Copper, HC
STORED ENERGY (cryogenic) 1.5 MJ
POWER : main coils 700 max, kW ; current stability 10^{-3}
trimming coils 150 max, kW ; current stability 10^{-4}
WEIGHT : Fe 1400 tons ; coils 5.8 tons
COOLING system Demineralised water
ION ENERGY (bending limit) E/A = 200 q^2/a^2 MeV/amu
(focusing limit) E/A = 200 q^2/a^2 MeV/amu

ACCELERATION SYSTEM
DEES, number 2 ; angle 51 deg
BEAM APERTURE 3 cm ; DC Bias 0 kV
TUNED by, coarse MS, VC fine VC, AUTO
RF 6 to 26 mHz, stable ± 1 Hz
Orb F 5 to 6.5 mHz
HARMONICS, RF/Orb F, used 4 and 12
DEE - Gnd, max 250 kV, min gap 10^{-3} cm
STABILITY, (pk-pk noise)/(pk RF volt) 10^{-3}
ENERGY GAIN, max 1000 kV/turn
RF PHASE, stable to ± 0.1 deg
RF POWER input, max 2 x 150 kW
FREQUENCY MODULATION, rate - /s
modulator, type -
beam pulse, width -

VACUUM SYSTEM
OPERATING PRESSURE 7×10^{-7} ~~Torr~~ mbar
PUMPS, No, Type, Size 4 Rotary vane 120 $m^3 h^{-1}$ and 4 Roots pumps 350 $m^3 h^{-1}$, 6 turbo pumps 2 $m^3 s^{-1}$ and 2 cryo pumps 5 $m^3 s^{-1}$

ION SOURCES

INJECTION SYSTEM
Two dipoles and a magnetic channel in one pole-tip

EXTRACTION SYSTEM
One electrostatic channel and two septum-magnets

FACILITIES FOR RESEARCH
SHIELDED AREA, fixed 700 m² ; movable 900 m²
TARGET STATIONS 7 in 5 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type K = 600 QDD (under construction)
COMPUTER model
OTHER FACILITIES
1. Facility for Isotope Production
2. Facility for Radiotherapy

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
p	40 - 200	27 - 200	205	196 (at 66 MeV)
d	40 - 100	70	2	2
$^4He^+$	40 - 50	50	2	2
$^4He^{++}$	40 - 200	120 - 140	2	2
SECONDARY			(part/s)	

BEAM PROPERTIES

MEASURED		CONDITIONS
PULSE WIDTH	6 RF deg	50 pμ A of 66 MeV p ions
PHASE EXC, max	10 RF deg	50 pμ A of 66 MeV p ions
EXTRACT eff	99.6 %	100 pμ A of 66 MeV p ions
RESOL ΔE/E	0.24 %	50 pμ A of 66 MeV p ions
EMITTANCE		
(π mm. mrad)	2 axial, 7 rad	35 pμA of 66 MeV p ions

OPERATING PROGRAMS, time distribution
BASIC NUCLEAR PHYSICS 44% SOLID STATES PHYSICS
BIOMEDICAL APPLICAT. 34% ISOTOPE PRODUCTIONS 17%

REFERENCES/NOTES

1) Proc. Ninth Int. Cycl. Conf., 33 (1981)
2) Proc. Tenth Int. Cycl. Conf., 263 (1984)
3) Proc. Twelfth Int. Cycl. Conf., 9 (1986)

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS

The experimental facilities for basic nuclear research consist of a 1.5 m diameter scattering chamber, a three-armed γ-ray correlation table, a high-energy γ-ray detector, a 7 m neutron, time-of-flight facility, a k = 600 QDD spectrometer (under construction) and a beam swinger facility (under construction) for neutron time-of-flight measurements.

A 66 MeV isocentric system is available for neutron therapy.