ENTRY NO. 5

NAME OF MACHINE . Ciclotron de Energia Variável
INSTITUTION Instituto de Engenharia Nuclear
ADDRESS . C.P. 2186 - CEP 20001 - Rio de Janeiro - Brasil
TEL . 280-5622 . TELEX . 2121112 CNEN BR
IN CHARGE A.G. da Silva . REPORTED BY . Arthur Gerbasi da Silva

HISTORY AND STATUS

DESIGN, date . - . Model tests . - .
ENG DESIGN, date . Cyclotron Corp CV-28
CONSTRUCTION, date . '71 - '74
FIRST BEAM, date (or goal) Dec '74
MAJOR ALTERATIONS . Harmonic coils and main magnet coils replaced,
COST, ACCELERATOR . US $.5 x 10^6
COST, FACILITY, total . US $1.4 x 10^6
FUNDED BY . CNEN - Brasil, FINEP - Brasil

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS . 1 . ENGINEERS . 2
TECHNICIANS . 8 . CRAFTS . - .
GRAD STUDENTS involved during year . -
OPERATED BY . - . Research staff or . 2 . Operators
OPERATION . 50 . hr/wk. On target . 30 . hr/wk
TIME DISTR. in house . 80 . %, outside 20 . %
BUDGET, op & dev . -
FUNDED BY CNEN - Brasil

RESEARCH STAFF, not included above

USERS, in house . 14 . outside . 6
GRAD STUDENTS involved during year . 3
RESEARCH BUDGET, in house . -
FUNDED BY CNEN - Brasil

MAGNET

POLE FACE, diameter (compact) . 96.5 . cm, R-extraction . 41 . cm
R injection . - . cm
GAP, min . 5.1 . cm, Field . 21 . kG
max 10.2 cm, Field . 14.2 . kG } at $.2 x 10^6$ Ampere turns
AVERAGE FIELD at R ext . 17.4 . kG
B max/<B> 1.2
NUMBER OF SECTORS { compact . 3 . / separated . . } Spiral, max . 50 deg
SECTOR ANGLE (SSC) . 120 . deg
TRIMMING COILS 2 sets of Harmonic coils
4 circular coils (radial profile)
CONDUCTOR, material and type . copper tube
STORED ENERGY (cryogenic) . - . MJ
POWER: main coils . 69 . max kW; current stability $1 x 10^{-5}$
trimming coils . 1.2 max kW; current stability -
WEIGHT: Fe . 20 . tons; coils . 2 . tons
COOLING system . deionized water
ION ENERGY (Bending limit) E/A = . 28 . q^2/A^2 MeV/amu
(Focusing limit) E/A = . 24 . q/A MeV/amu

ACCELERATION SYSTEM

DEES, number . 2 . angle . 81 . deg
BEAM APERTURE . 2 . cm; DC Bias . 2.5 . kV
TUNED by, coarse shorting plane . fine variable capacitor
RF . 6.0 . to . 25.5 . MHz, stable ± $1 x 10^{-4}$
Orb F . 6.0 . to . 25.5 . MHz
HARMONICS, RF/Orb F, used 1
DEE–Gnd, max . 30 . kV, min gap . 1 . cm
STABILITY, (pk-pk noise)/(pk RF volt) . 1 % .
ENERGY GAIN, max . 100 . kV/turn
RF PHASE, stable to ± . - . deg
RF POWER input, max. 75 kW
FREQUENCY MODULATION, rate . - . /s
modulator, type . -
beam pulse, width -

VACUUM SYSTEM

OPERATING PRESSURE . 10^{-5} . Torr or mbar
PUMPS, No, Type, Size . Two 10" oil diffusion jumps

ION SOURCES

PIG

INJECTION SYSTEM

EXTRACTION SYSTEM

Electrostatic Defletor 1rst harmonic bump and magnetic channel

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed . 50 . m²; movable . 400 . m²
TARGET STATIONS 5 . in . 4 . rooms
STATIONS served at same time, max . 1
MAG SPECTROGRAPH, type . -
COMPUTER model Bull DPS/
OTHER FACILITIES He-jet nuclear recoil transport system; electron, gamma-ray, charged particle, timing and neutron spectrometers; irradiated target transport and radioisotope production system.

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
Protons	24	24	-	70
Deuterons	14	14	-	100
$^3He^{++}$	36	36	-	70
$^4He^{++}$	28	28	-	50
SECONDARY			(part/s)	
Neutrons				

BEAM PROPERTIES

	MEASURED		CONDITIONS		
PULSE WIDTH	35 RF deg	.1	pμA of 28	MeV	alpha ions
PHASE EXC, max	- RF deg	-	pμA of -	MeV	- ions
EXTRACT eff	82 %	6.6	pμA of 19	MeV	protons ions
RESOL ΔE/E	.4 %	1	pμA of 28	MeV	alpha ions
EMITTANCE					
(π mm-mrad)	.71 axial 41 rad	1	pμA of 28	MeV	alpha part.

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 50 % SOLID STATES PHYSICS . 20 %
BIOMEDICAL APPLICAT . - . ISOTOPE PRODUCTIONS . 30 %

REFERENCES/NOTES

1) Proc.Intern.Sym.Appl.Technol.Ion.Rad. Vol 2 1007-1019 (1982)
2) K.H.Börkhoff (ed.) Nuclear Data for Science and Technology 843-846 (1983)

PLAN VIEW OF FACILITY, COMMENTS, ETC.