ENTRY NO. 3

NAME OF MACHINE . CYCLOTRON LIEGE
INSTITUTION . UNIVERSITE DE LIEGE-BELGIUM
ADDRESS . CYCLOTRON RESEARCH CENTER - B.30 - B - 4000 LIEGE
TEL 3241561687 TELEX 41397 UNIV. LG.
IN CHARGE . D. LAMOTTE REPORTED BY . D. LAMOTTE

HISTORY AND STATUS

DESIGN, date 1972 Model tests 1973
ENG DESIGN, date 1973
CONSTRUCTION, date 1973-1975
FIRST BEAM, date (or goal) 23,3,1975
MAJOR ALTERATIONS 1982 : new dees
COST, ACCELERATOR
COST, FACILITY, total
FUNDED BY SPPS+, FNRS* and UNIVERSITY

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS ENGINEERS 1
TECHNICIANS 4 CRAFTS 2
GRAD STUDENTS involved during year
OPERATED BY Research staff or 4 Operators
OPERATION 68 hr/wk. On target ≃55 hr/wk
TIME DISTR. in house %, outside %
BUDGET, op & dev
FUNDED BY UNIVERSITY

RESEARCH STAFF, not included above

USERS, in house 8 outside 10
GRAD STUDENTS involved during year 5
RESEARCH BUDGET, in house
FUNDED BY I.I.S.N.[X], FNRS, FRSM[O], UNIVERSITY

MAGNET

POLE FACE, diameter (compact) cm, R-extraction cm
R injection cm
GAP, min 8.6 cm, Field 17.5 kG
max 14.0 cm, Field 11.0 kG } at 150 $\times 10^6$ Ampere turns
AVERAGE FIELD at R ext 14.6 kG
B max/<B> 1.18
NUMBER OF SECTORS { compact 4 / separated } Spiral, max 3..4 deg
SECTOR ANGLE (SSC) deg
TRIMMING COILS 7
CONDUCTOR, material and type Cu
STORED ENERGY (cryogenic) MJ
POWER: main coils 70 max kW: current stability
trimming coils 10 max kW: current stability
WEIGHT: Fe 28 tons: coils tons
COOLING system Water
ION ENERGY (Bending limit) E/A = .29 q^2/A^2 MeV/amu
(Focusing limit) E/A = q/A MeV/amu

ACCELERATION SYSTEM

DEES, number 2 angle 50 deg
BEAM APERTURE 2..5 cm; DC Bias kV
TUNED by, coarse S.C. pistons. fine panels
RF 19,5 to 40,5 MHz, stable ± 10^{-6}
Orb F 4,9 to 20.5 MHz
HARMONICS, RF/Orb F, used 2-3-4
DEE–Gnd, max 35 kV, min gap 2 cm
STABILITY, (pk-pk noise)/(pk RF volt) .002
ENERGY GAIN, max kV/turn
RF PHASE, stable to ± 2 deg
RF POWER input, max. 85 kW
FREQUENCY MODULATION, rate /s
modulator, type
beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 10^{-6} Torr or mbar
PUMPS, No, Type, Size diffusion 3200 l/s
primary 60 m^3/h

ION SOURCES

Axial Livingston Jones

INJECTION SYSTEM

EXTRACTION SYSTEM

electrostatic deflector, passive corrector

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 700 m^2; movable - m^2
TARGET STATIONS 8 in 6 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type
COMPUTER model PDP 11-45
OTHER FACILITIES remote target handling, biological laboratories, medical unit (positron tomographs, ...)

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
p	6-20	2.5-23	300	100
d	3-11.5	3-14.5	500	100
3 He	6-29	6-32	200	100
4 He	6-24	6-29	100	60
SECONDARY			(part/s)	

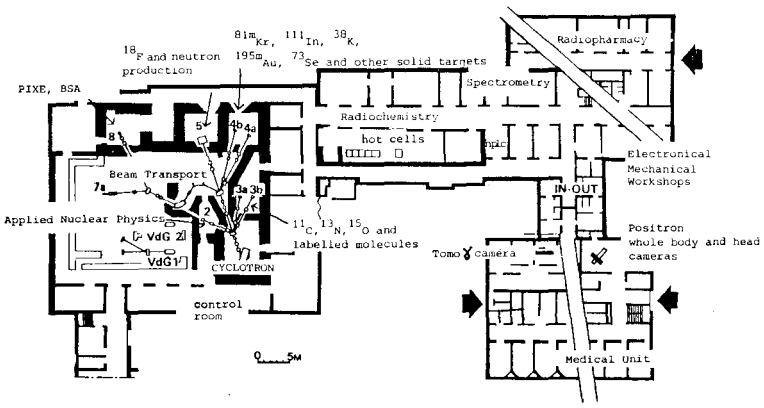
BEAM PROPERTIES

	MEASURED		CONDITIONS		
PULSE WIDTH	RF deg		pμA of	MeV	ions
PHASE EXC. max	RF deg		pμA of	MeV	ions
EXTRACT ef	50-70%	30	pμA of 23	MeV	P ions
RESOL ΔE/E	5 %		pμA of	MeV	ions
EMITTANCE					
(π mm-mrad)	15 axial / 15 rad	20	pμA of 20	MeV	P ions

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS - SOLID STATES PHYSICS 20
BIOMEDICAL APPLICAT. 40 ISOTOPE PRODUCTIONS 40

REFERENCES/NOTES



CYCLOTRON CGR MeV 520

PRESENT AND UPGRADED PERFORMANCES

P	24 MeV
D	14 MeV
^{3}HE	33 MeV
^{4}HE	29 MeV