

ENTRY No. FM-3

NAME OF MACHINE SYNCHROCYCLOTRON 200 MeV protons (S.C. 200) DATE April 1989
INSTITUTION Institut de Physique Nucléaire (I.P.N.)
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IN CHARGE Mr. J. GUILLOT REPORTED BY Mr. M. LOUIS

HISTORY AND STATUS

DESIGN, date 1972 Model tests
ENG DESIGN, date 1973
CONSTRUCTION, date September 1975
FIRST BEAM, date (or goal) 20.06.1977
MAJOR ALTERATIONS
COST, ACCELERATOR about 10 MF, 1975
COST, FACILITY, total about 20 MF
FUNDED BY Institut de Physique Nucléaire & Phy. Particules
ACCELERATOR STAFF, OPERATION AND DEVELOPMENT
SCIENTISTS 1 ENGINEERS 1
TECHNICIANS 18 CRAFTS
GRAD STUDENTS involved during year
OPERATED BY Research staff or 8 Operators
OPERATION 104 hr/wk, On target 200 hr/wk
TIME DISTR. in house 90 % Outside 10 %
BUDGET, op & dev 570 KF (1989)
FUNDED BY
RESEARCH STAFF, not included above
USERS, in house 50 outside 20
GRAD STUDENTS involved during year
RESEARCH BUDGET, in house
FUNDED BY C.N.R.S. - I.N.2.P.3.

MAGNET

POLE FACE, diameter (compact) 320 cm, R extraction 140 cm
R injection 1 cm 1.67 to 1.8
GAP, min 40 cm, Field 1.5 kG }
max cm, Field 1.5 kG } at 6.3 Å x 10⁶
AVERAGE FIELD at R ext kG } Ampere turns
B max/ < B >
NUMBER OF SECTORS { compact } Spiral, max deg
separated }
SECTOR ANGLE (SSC) no. deg
TRIMMING COILS yes

CONDUCTOR, material and type copper
STORED ENERGY (cryogenic) MJ
POWER: main coils 350 max, kW; current stability $\pm 3 \cdot 10^{-5}$
trimming coils max, kW; current stability $\pm 3 \cdot 10^{-5}$
WEIGHT: Fe 900 tons; coils 22 tons
COOLING system De-ionized water
ION ENERGY (bending limit) E/A = 223 q²/a² MeV/amu
(focusing limit) E/A = q²/a² MeV/amu

ACCELERATION SYSTEM

DEES, number 1; angle 180 deg
BEAM APERTURE 6 cm; DC Bias 1 kV
TUNED by, coarse fine
RF 25 to 10 MHz, stable \pm
Orb F 25 to 10 MHz
HARMONICS, RF/Orb F, used
DEE - Gnd, max 20 kV, min gap 0.4 cm
STABILITY, (pk-pk noise)/(pk RF volt)
ENERGY GAIN, max 20 kV/turn
RF PHASE, stable to \pm deg
RF POWER input, max 30 kW
FREQUENCY MODULATION, rate 440 anc 700 new /s
modulator, type rotating condenser
beam pulse, width 50-100 micro-second

VACUUM SYSTEM

OPERATING PRESSURE Torr or mbar
PUMPS, No, Type, Size oil diffusion Galileo
16.000 l/s

ION SOURCES

Pig Hot Filament

INJECTION SYSTEM

Internal ion source

EXTRACTION SYSTEM

Electromagnetic and magnetostatic channels

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 500 m²; movable m²
TARGET STATIONS 3 In rooms
STATIONS served at same time, max
MAG SPECTROGRAPH, type 102°N = 1/2
COMPUTER model micro-processors
OTHER FACILITIES on-line Mass Spectrometer
ISOCLE 11

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT (pA)	
	Goal	Achieved	Internal	External
P	168 to 201		4	3
d	83 to 107		9	7
³ He++	233 to 281		3.2	2.5
⁴ He++	166 to 216		3.2	2.5

SECONDARY (part/s)

BEAM PROPERTIES

MEASURED	CONDITIONS	
	RF deg	pA of MeV ions
PULSE WIDTH		
PHASE EXC, max		
EXTRACT eff	80 %	4 pA of 201 MeV p. ions
RESOL $\Delta E/E$	0.7 %	4 pA of 201 MeV p. ions
EMITTANCE		
(π mm. mrad)	{ 9 axial } { 19 rad }	4 pA of 201 MeV p. ions

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 90 % SOLID STATES PHYSICS
BIOMEDICAL APPLICAT. 10 % ISOTOPE PRODUCTIONS
Protontherapy

REFERENCES/NOTES

In project, 100 % Protontherapy programs

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS