ENTRY No. FM3

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 16.07 to 14.8

GAP, min 40. cm, Field 15.4 14.1 kG

max cm, Field 15.4 14.1 kG } at 6.3 à 5. x 10^6 Ampere turns

AVERAGE FIELD at R ext kG

B max/ <B>

NUMBER OF SECTORS { compact / separated } Spiral, max deg

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 q^2/a^2 MeV/amu

(focusing limit) E/A = q^2/a^2 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 ±

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 ± 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 one-line Mass Snectrometer

ISOCELE II

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) 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
PULSE WIDTH RF deg	pμ A of MeV Ions
PHASE EXC, max RF deg	pμ A of MeV Ions
EXTRACT eff 80 %	4 pμ A of 201 MeV P. Ions
RESOL ΔE/E 0.7 %	4 pμ A of 201 MeV P. Ions
EMITTANCE (π mm. mrad) { 9 axial / 19 rad }	4 pμA 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