

ENTRY NO. FM-4

NAME OF MACHINE SYNCHRO-CYCLOTRON - LYON DATE January 79
 INSTITUTION UNIVERSITE CLAUDE BERNARD - LYON 1 - FRANCE
 ADDRESS 43 bd du 11 Nov. 1918 - 69621 Villeurbanne - France

IN CHARGE Prof. B. E. LAHNECHE REPORTED BY G. HADINGER

HISTORY AND STATUS

DESIGN, date _____ MODEL tests _____
 ENG. DESIGN, date 1956
 CONSTRUCTION, date 1962
 FIRST BEAM date (or goal) 1963
 MAJOR ALTERATIONS 1965

OPERATION, 110 hr/wk; On Target 20 hr/wk
 TIME DIST., in house 90 %, outside 10 %
 USERS' SCHEDULING CYCLE 2 weeks
 COST, ACCELERATOR 2.7 MF
 COST, FACILITY, total 7.5 MF
 FUNDED BY Ministre de l'Education Nationale

ACCELERATOR STAFF, OPERATION and DEVELOPMENT

SCIENTISTS _____ ENGINEERS 1
 TECHNICIANS 2 CRAFTS _____
 GRAD STUDENTS involved during year _____
 OPERATED BY _____ Res staff or _____ Operators
 BUDGET, op & dev 30 KF
 FUNDED BY _____

RESEARCH STAFF, not included above

USERS, in house 8 outside 7
 GRAD STUDENTS involved during year _____
 RES. BUDGET, in house _____
 FUNDED BY _____

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 160 m²
 movable _____ m²
 TARGET STATIONS 6 in 2 rooms
 STATIONS served at same time, max _____
 MAG SPECTROGRAPH, type _____
 COMPUTER, model _____
 OTHER FACILITIES pneumatic system for irradiations

REFERENCES/NOTES

G. T. de Kruift and N. F. Verster
 CERN report 63-19 (1963) p 80-84

MAGNET

POLE FACE diameter 180 cm; R extraction 75 cm
 GAP, min 35 cm; Field 14.7 kG } at 0.61×10^6
 max 35 cm; Field 14.7 kG } ampere turns
 AVERAGE FIELD at R ext _____ kG
 CURRENT STABILITY 5.0 parts/10⁶; B_{max}/⟨B⟩ _____
 NUMBER OF SECTORS _____; SPIRAL, max _____ deg
 POLE FACE COIL PAIRS: AVF _____ /sec;
 Harmonic correction _____
 Rad grad _____ /sec or Circ coils _____
 WEIGHT: Fe 180 tons; Coils 10 tons
 CONDUCTOR, Material and type Aluminium
 STORED ENERGY ~ 1 MJ
 COOLING SYSTEM Demineralized water
 POWER: Main coils 176 max, kW
 Trimming coils _____ max, kW
 YOKE/POLE AREA _____ %
 SECTOR ANGLE (Sep Sec) _____ deg
 ION ENERGY (Bending limit) E/A = _____ q²/A² MeV
 (Focusing limit) E/A = _____ q/A MeV

ACCELERATION SYSTEM

DEES, number 2 angle 180 deg
 BEAM APERTURE 18.5 cm; DC BIAS 0.2 kV
 TUNED by, coarse _____ fine _____
 RF 10.4 to 11.0 MHz, stable ± _____ /10⁶
 Orb F _____ to _____ MHz; GAIN, max _____ kV/turn
 HARMONICS, RF/Orb F, used _____
 DEE-Gnd, max 22 kV, min gap _____ cm
 STABILITY, (pk-pk noise)/(pk RF volt) _____
 RF PHASE stable to ± _____ deg
 RF POWER input, max 23 kW
 RF PROTECT circuit, speed _____ μsec
 Type _____
 FREQUENCY MODULATION, rate 2000 /sec
 MODULATOR, type rotating capacitor
 BEAM PULSE, width 40 μ sec macrocycle

VACUUM SYSTEM

PUMPS, No., Type, Size 1 diffusion pump
50 cm
 OPERATING PRESSURE 8 μTorr,
 PUMPDOWN TIME 4 hrs

ION SOURCES/INJECTION SYSTEM

Open ion source

EXTRACTION SYSTEM

magnetic regenerative

CONTROL SYSTEM

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CHARACTERISTIC BEAMS

	Particle	Goal (MeV)	Achieved (MeV)
ENERGY	d		28
	α		56
CURRENT		(μ A)	(μ A)
	d		30
	α		10
External			
	d		1.5
Secondary		(part/s)	(part/s)
	n		10 ¹⁰

BEAM PROPERTIES

	Measured	Conditions
Pulse Width	RF deg	μ A of MeV
Phase Exc, max	RF deg	μ A of MeV
Extract Eff	10 %	μ A of 28 MeV d
Res, $\Delta E/E$	2-2.5 %	μ A of 28 MeV d
Emittance	(mm-mrad) { 120 axial } μ A of 28 MeV d	
	{ 120 radial }	

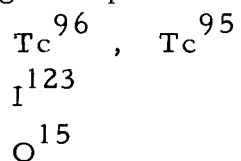
OPERATING PROGRAMS, time dist

Basic Nuclear Physics	20	%
Solid State Physics	5	%
Bio-Medical Applications	60	%
Isotope Production	15	%
Development		%

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, OPERATION SUMMARY, ADDITIONAL REFERENCES

Since January 1978 the Synchro-cyclotron is mainly used for medical and biological research. Radionuclides have been prepared for clinical use.

The following isotopes were produced :



References :

La capacité de diffusion de l'oxygène

R. C. Munsch, B. Philipon, T. Wiesendanger, A. Brune,

G. Hadinger

17ème colloque de Médecine Nucléaire de Langue Française

Ed. Kellershohn - Raynaud, C.E.A., p. 202-204