ENTRY NO. FM-3

NAME OF MACHINE CERN 600 MeV Synchro-Cyclotron DATE August 1978
INSTITUTION European Organisation for Nuclear Research (CERN)
ADDRESS CH 1211 Genève 23, Switzerland

IN CHARGE P.H. Standley REPORTED by P.H. Standley

HISTORY AND STATUS

DESIGN, date 1952/3 MODEL tests 1953/4
ENG. DESIGN, date 1953
CONSTRUCTION, date Oct. 54 to July 57
FIRST BEAM date (or goal) August 57
MAJOR ALTERATIONS 1973/74

OPERATION, 150 hr/wk; On Target 144 hr/wk
TIME DIST., in house 5 %, outside 95 %
USERS' SCHEDULING CYCLE --- weeks
COST, ACCELERATOR 30 M Swiss Francs
COST, FACILITY, total 60 M Swiss Francs
FUNDED BY CERN Member States

ACCELERATOR STAFF, OPERATION and DEVELOPMENT

SCIENTISTS 3 ENGINEERS 13
TECHNICIANS 47 CRAFTS 10
GRAD STUDENTS involved during year ---
OPERATED BY --- Res staff or 13 Operators
BUDGET, op & dev 11 M Swiss Francs
FUNDED BY CERN Member States

RESEARCH STAFF, not included above

USERS, in house 10 outside ~ 200
GRAD STUDENTS involved during year ---
RES. BUDGET, in house 3 M Swiss Francs
FUNDED BY CERN Member States

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 110 m^2
~~movable~~ unshielded 760 m^2
TARGET STATIONS 12 in 3 rooms
STATIONS served at same time, max 3
MAG SPECTROGRAPH, type Omicron
COMPUTER, model provided by users
OTHER FACILITIES ISOLDE facility serving up to 7 stations with separated beams of unstable nuclei.

REFERENCES/NOTES

1. W. Gentner et al. Philips Tech Rev.22 p.141, 1961
2. MSC Staff, Proc. 5 Int. Cyclotron Conf. p.719,1969
3. EG.Michaelis, Proc.6 Int. Cycl.Conf. p.141. 1972
4. H.Beger et al.Proc.7 Int.Cycl. Conf. p.49, 1975
5. B.W. Allardyce et al. these Proceedings.

MAGNET

POLE FACE diameter 500 cm; R extraction 225 cm
GAP, min 36 cm; Field 18.1 kG
max 45 cm; Field 19.4 kG
} at 1.23 X 10^6 ampere turns
AVERAGE FIELD at R ext 18.1 kG
CURRENT STABILITY 50 parts/10^6; $B_{max}/(B)$ 1
NUMBER OF SECTORS -- ; SPIRAL, max -- deg
POLE FACE COIL PAIRS: AVF -- /sec;
Harmonic correction --
Rad grad -- /sec or Circ coils --
WEIGHT: Fe 2500 tons; Coils 60 tons
CONDUCTOR, Material and type Aluminium
STORED ENERGY MJ
COOLING SYSTEM Demineralized Water
POWER: Main coils 800 max, kW
Trimming coils -- max, kW
YOKE/POLE AREA 100 %
SECTOR ANGLE (Sep Sec) deg
ION ENERGY (Bending limit) E/A = 800 q^2/A^2 MeV
(Focusing limit) E/A = q/A MeV

ACCELERATION SYSTEM

DEES, number 1 angle 180-95 deg
BEAM APERTURE 6-12 cm; DC BIAS 1.1 kV
TUNED by, ~~xxxxx~~ Rotating ~~xx~~ capacitor
RF 30.4 to 16.6 mHz, stable ± -- /10^6
Orb F 30.1 to 16.8 mHz; GAIN, max kV/turn
HARMONICS, RF/Orb F, used 1
DEE-Gnd, max 20 kV, min gap cm
STABILITY, (pk-pk noise)/(pk RF volt)
RF PHASE stable to ± deg
RF POWER input, max 120 kW
RF PROTECT circuit, speed 10 μsec
Type Series modulator cut off
FREQUENCY MODULATION, rate 360 /sec
MODULATOR, type Rotary capacitor
BEAM PULSE, width 30 μs

VACUUM SYSTEM

PUMPS, No., Type, Size Two 38 kℓ s^{-1} (baffled) oil diffusion pumps
OPERATING PRESSURE 0.2 - 0.3 μTorr,
PUMPDOWN TIME 3 hrs

ION SOURCES/INJECTION SYSTEM

Mid plane calutron

EXTRACTION SYSTEM electrical septum magnet followed by passive magnetic channel

CONTROL SYSTEM

Conventional. Siemens 301 computer for status bit acquisition.

ENTRY NO. FM-3 (cont.)

CHARACTERISTIC BEAMS

	Particle	Goal (MeV)	Achieved (MeV)
ENERGY	p		600
	$^3He^{2+}$		910
	$^{12}C^{4+}$	1030	
		(μA)	(μA)
CURRENT Internal	p		4
External	p		3
	$^3He^{2+}$		1
	$^{12}C^{4+}$	∿ 0.1	
		(fall '79) (part/s)	(part/s)
Secondary			

BEAM PROPERTIES

	Measured		Conditions			
Pulse Width	____	RF deg	____	μA of ____	MeV	____
Phase Exc, max	____	RF deg	____	μA of ____	MeV	____
Extract Eff	70	%	4	μA of 600	MeV	p
Res, ΔE/E	____	%	____	μA of ____	MeV	____
Emittance (mm-mrad)	6 π axial / 11 π radial		3	μA of 600	MeV	p

OPERATING PROGRAMS, time dist

Basic Nuclear Physics	∿ 50 %
Solid State Physics	contained in μSR %
Bio-Medical Applications	2 %
Isotope Production	%
Development	10 %
ISOLDE facility	∿ 25 %
μSR	∿ 10 %

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

1. $^3He^{2+}$ ions were accelerated to full energy and extracted in May 1978.
2. Beams in the "Neutron" Room are derived from internal targets. Beams in the "Proton" Room are derived from an external target in the SC Hall. Alternatively the external primary beam is taken underground to the ISOLDE target.