ENTRY NO. FM-7

NAME OF MACHINE CERN 600 MeV Synchrocyclotron August 1986

INSTITUTION European Organization for Nuclear Research (CERN)

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IN CHARGE B.W. Allardyce REPORTED BY B.W. Allardyce

HISTORY AND STATUS

DESIGN, date 1952/53 Model tests 1953/54

ENG DESIGN, date 1953

CONSTRUCTION, date October 1953 to July 1957

FIRST BEAM, date (or goal) 1st August 1957

MAJOR ALTERATIONS 1973/1974 SC Improvement Programme (SCIP)

COST, ACCELERATOR 30 M Swiss Francs

COST, FACILITY, total 60 M Swiss Francs

FUNDED BY CERN Member States

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 1 ENGINEERS 4

TECHNICIANS 25 CRAFTS 8

GRAD STUDENTS involved during year

OPERATED BY Research staff or 11 Operators

OPERATION 150 hr/wk. 4000 hrs/yr authorized

TIME DISTR. in house 5 %, outside 95 %

BUDGET, op & dev ~1.5 M Swiss Francs

FUNDED BY CERN Member States

RESEARCH STAFF, not included above

USERS, in house ~10 outside 200 to 250

GRAD STUDENTS involved during year

RESEARCH BUDGET, in house ~ 0.5 M Swiss Francs

FUNDED BY CERN Member States

MAGNET

POLE FACE, diameter (compact) 500 cm, R-extraction 225 cm

R injection cm

GAP, min 36 cm, Field 18.1 kG

max 45 cm, Field 19.4 kG } at 1.23 10^6 Ampere turns

AVERAGE FIELD at R ext 18.1 kG

B max/<B>

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

SECTOR ANGLE (SSC) deg

TRIMMING COILS

CONDUCTOR, material and type Aluminium

STORED ENERGY (cryogenic) MJ

POWER: main coils 800 max kW: current stability 5.10^{-5}

trimming coils max kW: current stability

WEIGHT: Fe 2500 tons: coils 60 tons

COOLING system demineralized water

ION ENERGY (Bending limit) E/A = 800 q^2/A^2 MeV/amu

(Focusing limit) E/A = q/A MeV/amu

ACCELERATION SYSTEM

DEES, number 1: 180° at small radius, 95° large radius

BEAM APERTURE 6-12cm cm; DC Bias up to 1.1 kV

TUNED by, rotating capacitor (ROTCO)

RF 30.4 to 16.6 MHz for protons

7.6 to 6.6 MHz for $^{20}Ne^{5+}$ ions

HARMONICS, RF/Orb F, used 1

DEE-Gnd, max 20 kV, min gap cm

STABILITY, (pk-pk noise)/(pk RF volt)

ENERGY GAIN, max kV/turn

RF PHASE, stable to ± deg

RF POWER input. max. 120 kW

FREQUENCY MODULATION, rate 360 /s

modulator, type rotating capacitor (ROTCO)

beam pulse, width ~40-50 μsec

VACUUM SYSTEM

OPERATING PRESSURE .2 to .3 $.10^{-7}$ Torr

PUMPS, No, Type, Size two 38000 l/sec oil diffusion with refrigerated baffles

ION SOURCES

Mid-plane hooded-arc PIG source, pulsed. Radius of first orbit ~ 1 cm

INJECTION SYSTEM

Internal source

EXTRACTION SYSTEM

Regenerator plus electrical septum magnet followed by passive magnetic channel

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed m^2; movable m^2

TARGET STATIONS in rooms

STATIONS served at same time, max

MAG SPECTROGRAPH, type

COMPUTER model

OTHER FACILITIES By the use of orbit displacement coil (Kim Coil) the total duty cycle of the beam is around 50 to 60% with no rf microstructure.

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
Protons		600	~.7	5.0 or 3.10^{13}/s
$^{3}He^{2+}$		910		0.5 or 2.10^{12}/s
$^{12}C^{4+}$		1020		0.2 or $.10^{12}$/s
$^{18}O^{6+}$		1530		0.05 or 3.10^{11}/s
$^{20}Ne^{5+}$		980		0.06 or 4.10^{11}/s
$^{12}C^{3+}$		588		0.2 or 10^{12}/s

SECONDARY		(part/s)
pions (-)	300 MeV/c	~$.3.10^{-6}$/s.
muons (+)	250 MeV/c	~$.3.10^{-4}$/s.

BEAM PROPERTIES

MEASURED		CONDITIONS			
PULSE WIDTH	RF deg	pμA of	MeV		ions
PHASE EXC. max	RF deg	pμA of	MeV		ions
EXTRACT eff. 50 to 70%		pμA of	MeV		ions
RESOL ΔE/E	%	pμA of	MeV		ions
EMITTANCE					
(π mm-mrad)	.6 axial, .11 rad	pμA of	MeV		

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 2/3 SOLID STATES PHYSICS 1/3

BIOMEDICAL APPLICAT 0 ISOTOPE PRODUCTIONS 0

Isolde facility is now the primary user with some μSR.

Heavy ion programme has been phased out

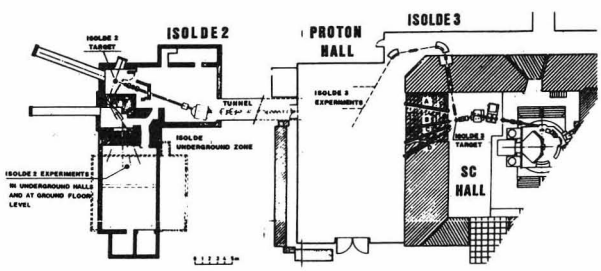
REFERENCES/NOTES

1) W. Gentner et al. Philips Tech.Rev.22, p.141, 1961

2) H. Beger et al. Proc. 7 Int.Cycl.Conf. 1975, p. 149

3) B.W. Allardyce et al., Proc.10th Intl Cycl.Conf. 1984, p.442

PLAN VIEW OF FACILITY, COMMENTS, ETC.



The figure shows the SC with the Isolde facility. Isolde was constructed in 1967 and was upgraded to IS2 in 1974. It uses an underground target station. The new IS3 separator is under construction and has a target station in the SC vault. The SC also has μSR experiments in a hall not shown in the figure.