**ENTRY NO.** FM-7

NAME OF MACHINE CERN 600 MeV Synchrocyclotron March 1984

INSTITUTION European Organization for Nuclear Research (CERN)

ADDRESS 1211 - Geneva 23 (Switzerland)

TEL 83.61.11 TELEX 419000 CER CH

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

**HISTORY AND STATUS**

DESIGN, date 1952/3 Model tests 1953/4

ENG DESIGN, date 1953

CONSTRUCTION, date October 1953 to July 1957

FIRST BEAM, date (or goal) 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 2 ENGINEERS 5

TECHNICIANS 25 CRAFTS 10

GRAD STUDENTS involved during year

OPERATED BY Research staff or 12 Operators

OPERATION 150 hr/wk. 4000 hrs/yr authorized

TIME DISTR. in house 5 % Outside 95 %

BUDGET, op & dev ∿2.5 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
min 45 cm, Field 19.4 kG
at 1.2310$^6$ 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 Aluminum

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 q²/a² 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

RF 30.4 to 16.6 Mhz for protons

7.6 to 6.6MHz 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 POWEP input, max 120 kW

FREQUENCY MODULATION, rate 360 /s

modulator, type rotating capacitor

beam pulse, width ∿ 40μsec

**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 calutron (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 m²; movable m²

TARGET STATIONS in

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 r.f. 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 | | | | |
| pions (-) | | 300 MeV/c | | ∿ 3.10$^{6}$/s |
| muons (+) | | 250 MeV/c | | ∿ 3.10$^{4}$/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 50 to 70% | pμ A of MeV ions |
| RESOL ΔE/E % | pμ A of MeV ions |
| EMITTANCE (π mm. mrad) 6 axial, 11 rad | pμ A 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.

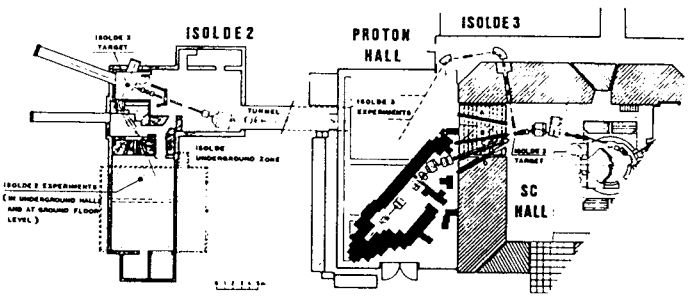
**REFERENCES/NOTES**


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., Status Rept 1981 to Int. Cycl. Conf.


**PLAN VIEW OF FACILITY, COMMENTS, ETC.**




The figure shows the SC with the Isolde facility. Isolde 2 exists and the new separator Isolde 3 is under design (Installation in 1985). The SC also runs for μSR spectroscopy using a beam in a hall not shown on the figure, where there are test beams of π, μ also. When the SC accelerates heavy ions these are sent to the heavily shielded zone shown on the figure.