ENTRY NO. 63

NAME OF MACHINE SIN Injector Cyclotron Date: April 1984
INSTITUTION Swiss Institute for Nuclear Research
ADDRESS CH - 5234 Villigen, Switzerland
TEL (0)56/99 31 11 TELEX 5 46 40 sin ch
IN CHARGE U. Schryber REPORTED BY Th. Stammbach / S. Jaccard

HISTORY AND STATUS

DESIGN, date 1967/69 Model tests 1968/71
ENG DESIGN, date 1969/73 Philips Company
CONSTRUCTION, date 1970/73 Netherlands
FIRST BEAM, date (or goal) Jan. 1, 1974
MAJOR ALTERATIONS -

COST, ACCELERATOR 14 MSFr. (1975)
COST, FACILITY, total 134 MSFr. (1975)
FUNDED BY Swiss Federal Government

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS *) ENGINEERS *)
TECHNICIANS *) CRAFTS *)
GRAD STUDENTS involved during year *)
OPERATED BY *) Research staff or *) Operators
OPERATION *) hr/wk. On target *) hr./wk
TIME DISTR. Inj.-mode 75% VE-mode 25%
BUDGET, op & dev *)
FUNDED BY *)

RESEARCH STAFF, not included above VE-mode only
USERS, in house none outside 13
GRAD STUDENTS involved during year ca. 15
RESEARCH BUDGET, in house -
FUNDED BY -

MAGNET

POLE FACE, diameter (compact) 250 cm, R extraction 105 cm
R injection 1.5 cm
GAP, min 24 cm, Field kG
min 45 cm, Field kG at 650 000 Ampere turns
AVERAGE FIELD at R ext 16.5 kG
B max/ < B > 1.25
NUMBER OF SECTORS compact 4 separated - Spiral, max 55 deg
SECTOR ANGLE (SSC) - deg
TRIMMING COILS 12 concentric
4 sets harmonic
CONDUCTOR, material and type Al, 24x24 mm, hallow
STORED ENERGY (cryogenic) -- MJ
POWER: main coils 400 max, kW;) phase stabilized
trimming coils 100 max, kW;) to $1 \cdot 10^{-6}$
WEIGHT: Fe 470 tons; coils 20 tons
COOLING system demin. water
ION ENERGY (bending limit) E/A = 135 q^2/a^2 MEV/amu
(focusing limit) E/A = 135 q/a MeV/amu

ACCELERATION SYSTEM VE- and Inj.-Mode:

DEES, number 1 180 deg
BEAM APERTURE 2 to 4 cm; DC Bias 1.5 and 0 kV
TUNED by, coarse moved short fine hydr.trimplate (cap.)
RF 4.6 to 17 & 50 mHz, stable ± $6 \cdot 8 \cdot 2 \cdot 10^{-6}$
Orb F 4.6 to 17 mHz
HARMONICS, RF/Orb F, used 1, 3 VE-mode; 3 Inj.-mode
DEE—Gnd, max 80 kV, min gap 5 cm
STABILITY, (pk-pk noise)/(pk RF volt) 10^{-2} & $2 \cdot 10^{-4}$
ENERGY GAIN, max 160 kV/turn
RF PHASE, stable to ± 1 deg. & < 0.1 deg
RF POWEP input, max 100 kW
FREQUENCY MODULATION, rate - /s
modulator, type -
beam pulse, width -

VACUUM SYSTEM

OPERATING PRESSURE without gas: $1 \cdot 10^{-6}$ Torr or mbar
PUMPS, No. Type, Size cryogenic panel (Philips)
20 000 l/s oil-diff. pump (Balzers)
12 000 l/s oil-diff. pump (Balzers)

ION SOURCES Livingston, W-filament with LaB_6-
Atomic beam pol. p, d; ANAC innizer pellet
ORTEC duoplasmatron

INJECTION SYSTEM

axial injection system, magn. quad.

EXTRACTION SYSTEM

electrostatic, electromagn. and passive magn.

FACILITIES FOR RESEARCH VE-mode only

SHIELDED AREA, fixed 500 m^2; movable - m^2
TARGET STATIONS 7 in 2
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type -
COMPUTER model PDP 11/40
OTHER FACILITIES

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
Inj.-mode p		72	215	200
VE-mode p		10 - 72	25 - 60	20 - 50
α	20-130	20 - 120	4	3
$^{14}N^{++++}$		100		10 nA
SECONDARY		(part/s)		

BEAM PROPERTIES

MEASURED		CONDITIONS
PULSE WIDTH	10 RF deg	100 pμA of 72 MeV p ions
PHASE EXC. max	2 RF deg	100 pμA of 72 MeV p ions
EXTRACT eff	93 %	100 pμA of 72 MeV p ions
RESOL ΔE/E	0.5 %	100 pμA of 72 MeV p ions
EMITTANCE (88 %) (π mm. mrad)	2 axial, 3 rad	100 pμA of 72 MeV p

OPERATING PROGRAMS, time distribution in %

BASIC NUCLEAR PHYSICS 22 SOLID STATES PHYSICS 2
BIOMEDICAL APPLICAT 1 ISOTOPE PRODUCTIONS 4
INJECTOR-MODE 71

REFERENCES/NOTES

1) The SIN injector cyclotron (A. Baan et al.) IEEE Trans.Nucl.Sci. NS-20.3 (1973) 257
2) Some aspects of the design of a cyclotron central region (J.M. van Nieuwland et al.) Philips Res.Repts. 29 (1974) 528
3) The axial injection system of the SIN injector cyclotron (N. Hazewindus), I. Design considerations / II. Description and experiments, buncher, Nucl.Instr.& Meth. 129 (1975) 325/331
4) The central region of the SIN injector cyclotron (J.M. van Nieuwland et al.) Nucl.Instr.& Meth. 142 (1977) 339
5) Improvements in the SIN injector RF system (P. Sigg) Nucl.Instr.& Meth. 155 (1978) 1
6) SIN upgraded polarized beams (S. Jaccard et al.) AIP Conf.Proc. 69 (1980) 904 (5th Int.Symp. on polarization phenomena in Nuclear Physics, Santa Fee)
7) Aspects of the 100 μA operation (G. Heidenreich et al.) Ninth Int. Conf. on Cyclotrons, Caen 1981

PLAN VIEW OF FACILITY: see next entry
SIN 590 MeV Ring Cyclotron

*) see SIN 590 MeV Ring Cyclotron (this compilation)