ENTRY No. 58

NAME OF MACHINE SIN Injector Cyclotron Date July 31, 1981
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. Injector-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
max 45 cm, Field kG } at 650 000
AVERAGE FIELD at R ext 16.5 kG } Ampere turns
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, hollow
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 ; angle 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 $\pm$ $6 \cdot 8 \cdot 2 \cdot 10^{-6}$
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 $\pm$ 1 deg & < 0.1 deg
RF POWER 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-pellet
Atomic beam pol. p. d; ANAC ionizer
ORTEC duoplasmatron

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

INJECTION SYSTEM
axial injection system, magn. quad.

EXTRACTION SYSTEM
electrostatic, electromagn. and passive magn.

FACILITIES FOR RESEARCH VE-mode only
SHIELDED AREA, fixed 300 m² ; movable - m²
TARGET STATIONS 7 in 2 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type -
COMPUTER model PDP 11/40
OTHER FACILITIES New area: 200 m² under construction

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
Inj.-mode p		72	180	170
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	pμ A of 72 MeV p ions
PHASE EXC, max ?	RF deg 100	pμ A of 72 MeV p ions
EXTRACT eff 93	% 100	pμ A of 72 MeV p ions
RESOL ΔE/E 0.5	% 100	pμ A of 72 MeV p ions
EMITTANCE (+/- 2σ or 88 %)		
(π mm. mrad) { 2. axial / 3. rad }	100	pμA of 72 MeV p ions

OPERATING PROGRAMS, time distribution in %
BASIC NUCLEAR PHYSICS 22 SOLID STATES PHYSICS 2
BIOMEDICAL APPLICAT. - ISOTOPE PRODUCTIONS 4
INJECTOR-MODE 72

PUBLICATIONS

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)

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