ENTRY NO. 78

NAME OF MACHINE PSI Injector Cylotron Date: September 1989

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IN CHARGE U. Schryber REPORTED BY T. Stammbach

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 0,5 ENGINEERS 1

TECHNICIANS 2 CRAFTS 2

GRAD STUDENTS involved during year

OPERATED BY Research staff or *) Operators

OPERATION *) hr/wk. On target 60% hr/wk

TIME DISTR. in house %

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 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, 24x24mm, 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 1 180 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 ±6E-6 & 2E-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) E-2 & 2E-4

ENERGY GAIN, max 160 kV/turn

RF PHASE, stable to ± 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: 1E-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

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 rooms

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	? 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 65 SOLID STATES PHYSICS 2

BIOMEDICAL APPLICAT. 7 ISOTOPE PRODUCTIONS 10

INJECTOR-MODE 16

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 Fe)
7) Aspects of the 100μA operation (G. Heidenreich et al.) 9th Int.Conf. on Cyclotrons, Caen (1981)365

PLAN VIEW OF FACILITY: see next entry

PSI 590 MeV Ring Cyclotron

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