

Entry: **C 60**
 Machine Name: PSI 590 MeV Ring Cyclotron
 Address: Paul Scherrer Institute, CH - 5232 Villigen-PSI, Switzerland
 In Charge of the cyclotron: Dr. Thomas Stammach, Dr. Stefan Adam
 Tel: 41 56 310 33 93
 Fax: 41 56 310 33 83

Date: July 1998
 Institution: Paul Scherrer Institute
 Web: www.psi.ch
 E-mail: adam@psi.ch

HISTORY

Design by: Hans A. Willax with PSI (former SIN) -team
 Construction time: 1968 - 1974
 First beam: Jan 18th 1974

CHARACTERISTIC BEAMS

ions / energy (MeV/n) / current (pps) / power (W) :
 - Protons, 590 MeV, 1.5 (-1.8) mA, =1MW

transmission efficiency (total)

- typical: (inj 99.93, ext 99.97%) - best: 99.97%

transverse emittance (rms)

- vertical: 1 π mmmrad
 - horizontal: 1 π mmmrad

longitudinal emittance (rms) 0.1% * 4deg $\Delta E/E$.deg RF

USES

basic research: 70 % therapy: 5 %
 development: 3 % isotope production:
 other applications: 5 % maintenance: 11 %
 beam tuning: 5 %
 total time: 6500 h/year

TECHNICAL DATA

a) magnet

type: separate sectormagnets
 Kb: 592 MeV/n Kf: 592 MeV/n
 average field (min-max): 0.58 - 0.87 T
 number of magnet sectors: 8
 - angle: 18 deg
 - spiral (max): 35 deg

pole parameters

- diameter: 9 m
 - injection radius: 2.1 m
 - extraction radius: 4.45 m

hill gap: 0.05 - 0.09 m valley gap: (open)

field trimming

- trim coils
 - number: 18
 - current (max): 30/200 A
 - harmonic coils
 - number: 5
 - current (max): 200 A
 - others
 - number:
 - current (max):

main coils:

- number: 8 pairs
 - Ampere-turns: 1.5e5 A.T.
 - current: 930 A

stored energy:

weight : - iron: 1960 t - coils: 28t

power

- main coils (total): 620 kW
 - trim coils (total max): < 30 kW
 - refrigerator (cryogenic):

b) RF

- acceleration

- frequency range: 50.633 MHz
 - harmonic modes: 6th
 - number of dees: 4 cavities
 - angular aperture: single gap cavities
 - voltage:- average (min-max): 670 kV
 - variation with radius: inj 500 kV
 - peak 730 kV, extr 630 kV
 - power in (max): 4 * 520 kW
 - stability:- phase: 0.01 deg - voltage: 0.03 %

- other cavities

- purpose: flattop
 - frequency range: 151.9 MHz
 - region of influence: 2.1-4.45 m (full radial range)
 - voltage (max): 460 kV
 - power in (max): 120 kW
 - stability:- phase: <0.1 deg - voltage: 0.1%

c) injection

- internal source:

- external (radial/axial): Injection at 72 MeV
 - elements: magnetic channel (floating shim) and electrostatic inflector

- source voltage:

- injection energy: 72 MeV

- buncher: none

- injection efficiency: 99.93 %

d) ion sources/injector

Phillips Cyclotron = PSI Injector 1 : 72 MeV p, polarized
 PSI Injector 2 72 MeV p, high intensity

e) extraction

- elements, characteristics:

- electrostatic extraction channel
 - Panowsky type magnetic focussing channel
 - septum magnet inside vacuum chamber

- efficiency

- typical: 99.94 % - best: 99.97 %

f) vacuum

- pumps: 4 cryo pumps, 4 small turbo pumps,
 1 booster pump, 2 large roughing pumps
 - achieved vacuum: 2.66E-4 Pa

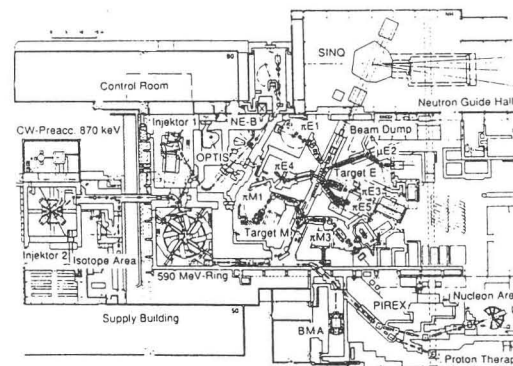
REFERENCES

U.Schryber et al, Proc EPAC 1992, p173 ff
 U. Schryber et al, Proc. 14th Int Cycl Conf, Cape Town

EXPERIMENTAL FACILITIES

pi-Meson Areas, mu-Meson Areas, MuSR
 Gantry for proton therapy
 Neutron spallation source SINQ

PLAN VIEW OF FACILITY



COMMENTS

Designed for 100 (-200) muA, upgraded 1990 - 1994 for higher intensity, running at 1.5 mA since 1996