ENTRY NO. 68

NAME OF MACHINE: CLATTERBRIDGE CYCLOTRON

INSTITUTION: MEDICAL RESEARCH COUNCIL, CYCLOTRON UNIT

ADDRESS: CLATTERBRIDGE HOSPITAL, BEBINGTON, MERSEYSIDE, L63 4JY

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IN CHARGE: T.E. SAXTON REPORTED BY: T.E. SAXTON

HISTORY AND STATUS SCANDITRONIX MODEL MC60PF

DESIGN, date: 1981/82 Model tests:

ENG DESIGN, date: 1981/82

CONSTRUCTION, date: 1982/83

FIRST BEAM, date (or goal): FACTORY 1983, SITE 1984

MAJOR ALTERATIONS:

COST, ACCELERATOR: £1.5M

COST, FACILITY, total: £4.5M

FUNDED BY: U.K. CANCER CHARITIES

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS: 2 ENGINEERS: 3

TECHNICIANS: 2 CRAFTS: 1

GRAD STUDENTS involved during year:

OPERATED BY: Research staff or: Operators

OPERATION: hr/wk. On target: hr./wk

TIME DISTR. in house: % Outside: %

BUDGET, op & dev:

FUNDED BY: MEDICAL RESEARCH COUNCIL

RESEARCH STAFF, not included above

USERS, in house: outside:

GRAD STUDENTS involved during year:

RESEARCH BUDGET, in house:

FUNDED BY:

MAGNET

POLE FACE, diameter (compact): 160 cm, R extraction: 64 cm

R injection: cm

GAP, min: 12.3cm, Field: 20.7 kG
max: 22.1cm, Field: 13.0 kG at 280,000 Ampere turns

AVERAGE FIELD at R ext: 17.7 kG

B max/ < B >: 1.19

NUMBER OF SECTORS: compact: 3; separated: Spiral, max 55 deg

SECTOR ANGLE (SSC): deg

TRIMMING COILS: 4 SETS HARMONIC COILS
6 SETS CIRCULAR GRADIENT COILS

CONDUCTOR, material and type: HOLLOW COPPER

STORED ENERGY (cryogenic): MJ

POWER: main coils: 110 max, kW; current stability: 1×10^{-5}
trimming coils: 5 max, kW; current stability: 1×10^{-4}

WEIGHT: Fe: 120 tons; coils: 4.4 tons

COOLING system: DEMINERALISED WATER

ION ENERGY (bending limit) E/A = 62 q^2/a^2 MEV/amu
(focusing limit) E/A = q/a MeV/amu

ACCELERATION SYSTEM

DEES, number: 2 80 deg

BEAM APERTURE: 2.5 cm; DC Bias: kV

TUNED by, coarse: fine:

RF: 25 to: mHz, stable ±: 1×10^{-6}

Orb F: 25 to: mHz

HARMONICS, RF/Orb F, used: 1

DEE—Gnd, max: 40 kV, min gap: cm

STABILITY, (pk-pk noise)/(pk RF volt): $< 10^{-3}$

ENERGY GAIN, max: 100 kV/turn

RF PHASE, stable to ±: 0.5 deg

RF POWEP input, max: 60 kW

FREQUENCY MODULATION, rate: /s

modulator, type:

beam pulse, width:

VACUUM SYSTEM

OPERATING PRESSURE: $\leq 10^{-5}$ Torr or mbar

PUMPS, No, Type, Size:

2 x 4000 L/SEC OIL DIFFUSION PUMP
100m³/HR+BOOSTER, 20m³/HR MECHANICAL BACKING

ION SOURCES

INTERNAL, COLD CATHODE

INJECTION SYSTEM

ELECTROSTATIC+ELECTROMAGNETIC+FOCUSSING CHANNEL

EXTRACTION SYSTEM

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:

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	ENERGY (MeV) Achieved	CURRENT (μA) Internal	CURRENT (μA) External
P	60	62.5	>100	50
SECONDARY (part/s)				
n	50 RAD/MIN @ 50CM FROM TARGET AFTER FILTERING			

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 .....%	..... pμ A of ..... MeV ..... ions
RESOL ΔE/E.....%	..... pμ A of ..... MeV ..... ions
EMITTANCE (π mm. mrad) axial	..... pμ A of ..... MeV .....
EMITTANCE (π mm. mrad) rad	

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS ..... SOLID STATES PHYSICS.....

BIOMEDICAL APPLICAT..100%... ISOTOPE PRODUCTIONS.....

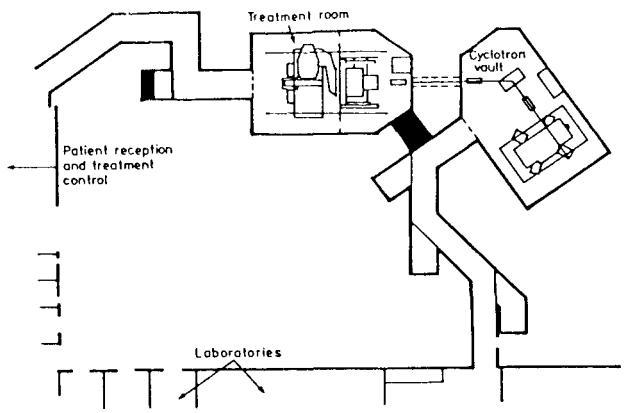
REFERENCES/NOTES

1) SCANDITRONIX MC60PF

2)

PLAN VIEW OF FACILITY, COMMENTS, ETC.

ACCELERATOR USED WITH SCANDITEM HIGH ENERGY ISOCENTRIC NEUTRON THERAPY UNIT.
CONTROLLED BY PDP11-23.



Plan view of Clatterbridge high energy neutron therapy facility.