

ENTRY NO. 81 CLATTERBRIDGE CYCLOTRON
 NAME OF MACHINE MEDICAL RESEARCH COUNCIL
 INSTITUTION DOUGLAS CYCLOTRON CENTRE, CLATTERBRIDGE HOSPITAL, BEBINGTON, WIRRAL, MERSEYSIDE, U.K.
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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 12.3 cm, Field 20.7 kG }
 max 22.1 cm, Field 13.0 kG } at 280,000
 AVERAGE FIELD at R ext 17.7 kG Ampere turns
 B max / 1.19
 NUMBER OF SECTORS { compact 3 } Spiral, max 55 deg
 { separated }

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^{-2}
 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 q²/A² MeV/amu
 (Focusing limit) E/A = q/A MeV/amu

ACCELERATION SYSTEM

DEES, number 2 angle 80 deg
 BEAM APERTURE 2.5 cm; DC Bias kV
 TUNED by, coarse fine
 RF 25 to MHz, stable $\pm 1 \times 10^{-6}$
 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 POWER 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 rooms
 STATIONS served at same time, max
 MAG SPECTROGRAPH, type
 COMPUTER model
 OTHER FACILITIES

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT (µA)	
	Goal	Achieved	Internal	External
P	60	62.5	>100	50

SECONDARY n (part/s)
 50 RAD/MIN @ 150CM FROM TARGET AFTER FILTERING

BEAM PROPERTIES

MEASURED	CONDITIONS	
	RF deg	µA of MeV ions
PULSE WIDTH	RF deg	µA of MeV ions
PHASE EXC, max	RF deg	µA of MeV ions
EXTRACT eff	%	µA of MeV ions
RESOL ΔE/E	%	µA of MeV ions
EMITTANCE	axial (π mm-mrad)	rad
		µA of MeV

OPERATING PROGRAMS, time distribution

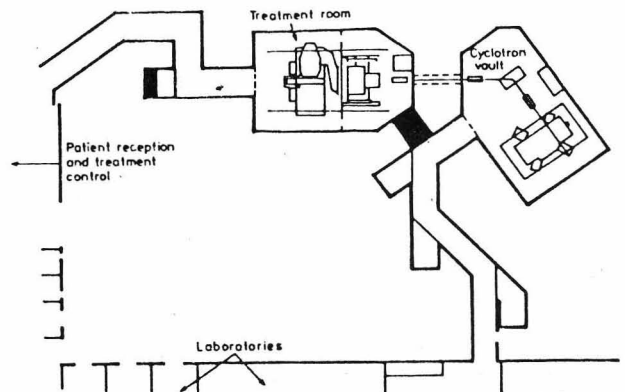
BASIC NUCLEAR PHYSICS
 SOLID STATES PHYSICS
 BIOMEDICAL APPLICAT. 100% ISOTOPE PRODUCTIONS

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.