

ENTRY No. 86

NAME OF MACHINE Nuffield 60" Cyclotron DATE  
INSTITUTION Birmingham University, School of Physics and Space Research  
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IN CHARGE Dr. MC Scott REPORTED BY E. C. Cartwright

#### HISTORY AND STATUS

DESIGN, date 1938 Model tests  
ENG DESIGN, date  
CONSTRUCTION, date 1948  
FIRST BEAM, date (or goal) 1948  
MAJOR ALTERATIONS New Dees and Electromagnetic  
Shimming of Magnet Profile for  $H^+$ ,  $He^3$   
COST, ACCELERATOR  
COST, FACILITY, total  
FUNDED BY

#### ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 1 ENGINEERS 77  
TECHNICIANS 3 CRAFTS 77  
GRAD STUDENTS involved during year  
OPERATED BY Research staff or 3 Operators  
OPERATION 120 hr/wk, On target 140 hr/wk  
TIME DISTR. in house 20%, Outside 80%  
BUDGET, op & dev £ 25 K

#### FUNDED BY 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) 180 cm, R extraction 104 cm  
R injection 0 cm  
GAP, max fixed cm, Field 18 max kG }  
max 25 cm, Field kG } at  
AVERAGE FIELD at R ext 13.5 kG } Ampere turns  
B max/ <B>

NUMBER OF SECTORS { compact None } Plane Field  
{ separated None } Spiral, max deg

SECTOR ANGLE (SSC) deg  
TRIMMING COILS 5 Radial 4 in Quadrature

CONDUCTOR, material and type Copper Pyrotenax  
STORED ENERGY (cryogenic) None MJ  
POWER: main coils 4.0 max, kW; current stability 1 in  $10^5$   
trimming coils 1.5 max, kW; current stability 1 in  $10^3$   
WEIGHT: Fe 250 tons; coils 40 tons  
COOLING system Air  
ION ENERGY (bending limit) E/A =  $q^2/a^2$  MeV/amu  
(focusing limit) E/A =  $q^2/a^2$  MeV/amu

#### ACCELERATION SYSTEM

DEES, number 2; angle Symmetrical deg  
BEAM APERTURE at extraction; DC Bias 1 kV  
TUNED by, coarse fixed fine  
RF to 10.5 MHz, stable  $\pm 1$  in  $10^4$   
Orb F to MHz  
HARMONICS, RF/Orb F, used  
DEE - Gnd, max 90 kV, min gap 7.5 cm  
STABILITY, (pk-pk noise)/(pk RF volt)  
ENERGY GAIN, max kV/turn  
RF PHASE, stable to  $\pm$  deg  
RF POWER input, max 80 kW  
FREQUENCY MODULATION, rate None /s  
modulator, type  
beam pulse, width

#### VACUUM SYSTEM

OPERATING PRESSURE  $10^{-5}$  Torr or mbar  
PUMPS, No, Type, Size 2 x 37 cm + 22 cm Booster +  
Leybold Rotary + Kinney for roughing

#### ION SOURCES

Enclosed Graphite (Oak Ridge Variant)

#### INJECTION SYSTEM

NA  
EXTRACTION SYSTEM 70° neg. deflector

#### FACILITIES FOR RESEARCH

SHIELDED AREA, fixed  $m^2$ ; movable  $m^2$   
TARGET STATIONS in rooms  
STATIONS served at same time, max  
MAG SPECTROGRAPH, type  
COMPUTER model None  
OTHER FACILITIES Automatic Internal Rotating Target  
Inserting - Extracting

#### CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT ( $\mu A$ )	
	Goal	Achieved	Internal	External
$H^+$			500	100
$D^+$			500	100
$He^4$			250	50
$He^3$			250	60

#### SECONDARY (part/s)

#### BEAM PROPERTIES

MEASURED N/A CONDITIONS  
PULSE WIDTH RF deg  $\mu A$  of MeV ions  
PHASE EXC, max RF deg  $\mu A$  of MeV ions  
EXTRACT eff %  $\mu A$  of MeV ions  
RESOL  $\Delta E/E$  %  $\mu A$  of MeV ions  
EMITTANCE  
( $\pi$  mm. mrad) { axial }  $\mu A$  of MeV ions  
{ rad }

#### OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS SOLID STATES PHYSICS  
BIOMEDICAL APPLICAT. 5% ISOTOPE PRODUCTIONS 95%

#### REFERENCES/NOTES

#### PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS