**ENTRY NO.** 69

NAME OF MACHINE: IM Radial Ridge Cyclotron

INSTITUTION: Department of Physics, University of Birmingham

ADDRESS: P.O. Box 363, Birmingham B15 2TT, U.K.

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IN CHARGE: G.C. Morrison, 3013 REPORTED BY: R.G. Green

**HISTORY AND STATUS**

DESIGN, date: 1957 Model tests: None

ENG DESIGN, date: 1957-63

CONSTRUCTION, date: 1958-63

FIRST BEAM, date (or goal): Int. 1961, Ext. 1963

MAJOR ALTERATIONS:

COST, ACCELERATOR: £30,000

COST, FACILITY, total:

FUNDED BY: O.S.I.R. (Now S.E.R.C.)

**ACCELERATOR STAFF, OPERATION AND DEVELOPMENT**

SCIENTISTS: 0 ENGINEERS: 1

TECHNICIANS: 2 CRAFTS: 1

GRAD STUDENTS involved during year:

OPERATED BY: 0 Research staff or: 3 Operators

OPERATION: 100 hr/wk. On target: hr./wk

TIME DISTR. in house: 100 % Outside: - %

BUDGET, op & dev: £20,000

FUNDED BY: University of Birmingham and SERC

**RESEARCH STAFF,** not included above

USERS, in house: 16 outside: 1

GRAD STUDENTS involved during year: 7

RESEARCH BUDGET, in house: £50,000

FUNDED BY: University of Birmingham and SERC

**MAGNET**

POLE FACE, diameter (compact): 102 cm, R extraction: 46 cm

R injection: cm

GAP, min: 7 cm, Field: 19 kG
min: 14.5 cm, Field: 13 kG
at: Ampere turns

AVERAGE FIELD at R ext: 16 kG

B max/ < B >: 1.2

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

SECTOR ANGLE (SSC): deg

TRIMMING COILS: Harmonic 2
Circular B

CONDUCTOR, material and type: Cu Strip

STORED ENERGY (cryogenic): - MJ

POWER: main coils: 40 max, kW; current stability:
trimming coils: max, kW; current stability:

WEIGHT: Fe: 50 tons; coils: 8 tons

COOLING system: water

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

**ACCELERATION SYSTEM**

DEES, number: 1 180 deg

BEAM APERTURE: 2-3 cm; DC Bias: - kV

TUNED by, coarse: M.S. fine: M.S.

RF: 12 to 16 mHz, stable ± 2/$10^6$

Orb F: to mHz

HARMONICS, RF/Orb F, used: 1

DEE—Gnd, max: 27 kV, min gap: 0.3 cm

STABILITY, (pk-pk noise)/(pk RF volt): 0.001

ENERGY GAIN, max: 54 kV/turn

RF PHASE, stable to ±: 3 deg

RF POWEP input, max: 45 kW

FREQUENCY MODULATION, rate: /s

modulator, type:

beam pulse, width:

**VACUUM SYSTEM**

OPERATING PRESSURE: $3-10^{-6}$ Torr or mbar

PUMPS, No, Type, Size: 1 × 40 cm
2 × 22 cm

**ION SOURCES** Internal Hot Cathode
External Pol. $D^+$ and Pol. $^3He$.

**INJECTION SYSTEM**

Axial

**EXTRACTION SYSTEM**

Mag/Elect. Regenerator and Elect. Def.

**FACILITIES FOR RESEARCH**

SHIELDED AREA, fixed: 90 m²; movable: 0 m²

TARGET STATIONS: 4 in 1 room

STATIONS served at same time, max: 1

MAG SPECTROGRAPH, type: None

COMPUTER model: 4190 GEC

OTHER FACILITIES:
10 mass identification system
Using counter telescopes

**CHARACTERISTIC BEAMS**

| PARTICLE | ENERGY (MeV) Goal | Achieved | CURRENT (pμA) Internal | External |
|---|---|---|---|---|
| $^4He$ | | 25 | | 200 |
| $^3He$ | | 34 | | 50 |
| pol. d | | 12.5 | | 0.2 |
| pol. $^3He$ | | 34 | | 0.008 |
| SECONDARY | | (part/s) | | |
| | | | | |
| | | | | |

**BEAM PROPERTIES**

| MEASURED | | CONDITIONS |
|---|---|---|
| PULSE WIDTH | 3.0 RF deg | 10 pμ A of 34 MeV $^3He$ ions |
| PHASE EXC. max | 15 RF deg | 10 pμ A of 34 MeV $^3He$ ions |
| EXTRACT eff | 60 % | 10 pμ A of 34 MeV $^3He$ ions |
| RESOL ΔE/E | 0.4 % | 10 pμ A of 34 MeV $^3He$ ions |
| EMITTANCE ($\pi$ mm. mrad) | 40 axial; rad | 10 pμ A of 34 MeV $^3He$ |

**OPERATING PROGRAMS,** time distribution

BASIC NUCLEAR PHYSICS: 80% SOLID STATES PHYSICS:

BIOMEDICAL APPLICAT: ISOTOPE PRODUCTIONS:

**REFERENCES/NOTES**

1) Nuc.Inst.Methods 18/19, 25, 1962
2) Nuc.Inst.Methods 32, 325, 1965
Major modifications described in Annual Reviews.

**PLAN VIEW OF FACILITY, COMMENTS, ETC.**

A separate ion source room houses the polarised d $^3He$ sources and incorporates a beam switching facility. $^3He$ polarised primary source operates in the magnetic field of a superconducting solenoid.