

ENTRY No. 66

NAME OF MACHINE Harwell V.E.C. DATE July, 1981
 INSTITUTION Atomic Energy Research Establishment
 ADDRESS Harwell, Nr. Didcot, Oxon., OX11 0RA, England
 TEL 0235-24141 Ext. 2793 TELEX 83135
 IN CHARGE R. W. McIlroy REPORTED BY E. J. Jones

HISTORY AND STATUS

DESIGN, date 1961-62 Model tests 1961-63
 ENG DESIGN, date 1962-64
 CONSTRUCTION, date 1962-65
 FIRST BEAM, date (or goal) int. 1965, ext. 1966
 MAJOR ALTERATIONS None

COST, ACCELERATOR £ 1.2 x 10⁶
 COST, FACILITY, total £ 1.6 x 10⁶
 FUNDED BY U.K.A.E.A.

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 3 ENGINEERS 1
 TECHNICIANS 9 CRAFTS 10

GRAD STUDENTS involved during year 7
 OPERATED BY Research staff or Operators
 OPERATION 120 hr/wk, On target 77 hr/wk

TIME DISTR. in house 79%, Outside 21%
 BUDGET, op & dev £ 1M
 FUNDED BY U.K.A.E.A.

RESEARCH STAFF, not included above

USERS, in house 16 outside 14
 GRAD STUDENTS involved during year 6

RESEARCH BUDGET, in house 7
 FUNDED BY U.K.A.E.A.

MAGNET

POLE FACE, diameter (compact) 17.8 cm, R extraction 80 cm
 R injection 2.0-6.8 cm
 GAP, min 19 cm, Field 21.6 kG }
 max 43 cm, Field 13.1 kG } at 5.5 x 10⁵
 AVERAGE FIELD at R ext 17 kG } Ampere turns
 B max/ 1.30

NUMBER OF SECTORS { compact 3 } Spiral, max 48 deg
 { separated }

SECTOR ANGLE (SSC) deg
 TRIMMING COILS 12 circular coils for field trimming;
 3 coils per sector for harmonic correction

CONDUCTOR, material and type Copper
 STORED ENERGY (cryogenic) 2 MJ
 POWER: main coils 300 max, kW; current stability 2 x 10⁻⁵
 trimming coils 650 max, kW; current stability 2 x 10⁻⁴

WEIGHT: Fe 170 tons; coils 10 tons
 COOLING system Demineralized water

ION ENERGY (beam limit) E/A = .86 q²/a² MeV/amu
 (focusing limit) E/A = .65 q/a MeV/amu

ACCELERATION SYSTEM

DEES, number 1; angle 180 deg
 BEAM APERTURE 4.5 cm; DC Bias 0 kV
 TUNED by, coarse Short Pl. fine Trim. Cap.

RF 7.5 to 23 MHz, stable ± 1 x 10⁻³
 Orb F 1.1 to 20.6 MHz

HARMONICS, RF/Orb F, used 1, 3, 5, 7, 9
 DEE - Gnd, max 80 kV, min gap 0.7 cm

STABILITY, (pk-pk noise)/(pk RF volt) .001
 ENERGY GAIN, max kV/turn

RF PHASE, stable to ± deg
 RF POWER input, max 200 kW

FREQUENCY MODULATION, rate /s
 modulator, type
 beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 1.2 Torr or mbar
 PUMPS, No, Type, Size 3 Oil diffusion pumps (one 60 cm,
 two 76 cm); Liq. N₂ cryopanel

ION SOURCES Internal Penning

INJECTION SYSTEM

Internal ion source

EXTRACTION SYSTEM 2 channel electrostatic deflector
 + magnetic channel (for radial focussing)

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 360 m²; movable 0 m²
 TARGET STATIONS 7 in 3 rooms

STATIONS served at same time, max 1
 MAG SPECTROGRAPH, type
 COMPUTER model PDP11

OTHER FACILITIES 1. Isotope Production Rig with
 variable target assemblies 2. Irradiation facility
 for damage studies - programmed beam scanning and target
 rocking

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT (µA)	
	Goal	Achieved	Internal	External
p		60	60	50
¹⁶ O ⁶⁺		190	0.2	0.1
⁴⁰ Ar ⁸⁺		132	0.2	0.1
⁵⁸ Ni ⁶⁺ 10+		50	14	7

SECONDARY (part/s)

BEAM PROPERTIES

MEASURED CONDITIONS
 PULSE WIDTH 20-40RF deg µA of MeV ions
 PHASE EXC, max RF deg µA of MeV ions
 EXTRACT eff. 85% 50 µA of 60 MeV p. ions
 RESOL ΔE/E .025% 20 µA of 60 MeV p. ions
 EMITTANCE

(π mm. mrad) { 20 axial } 10 µA of 60 MeV p. ions
 { 20 rad }

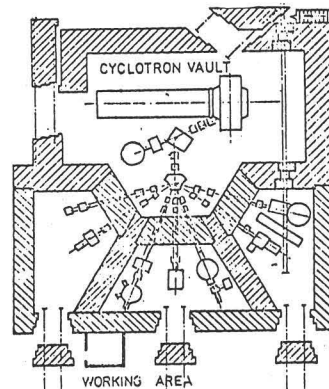
OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 10% SOLID STATES PHYSICS 40%
 BIOMEDICAL APPLICAT. 8% ISOTOPE PRODUCTIONS 12%
 NUCLEAR CHEMISTRY 10% RAD. CHEMISTRY 5%
 DEVELOPMENT 15%

REFERENCES/NOTES

RHEL report NIRL/R/85. Harwell Report - R5744 (pp 5-9)
 Proc. Fifth Int. Cycl. Conf., 200, 318 (1969).
 IEEE Trans. Nucl. Sci NS-19, no. 2 101 (1972).

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS



The cyclotron delivers routinely beams of light ions (p, d, α) for isotope production, medium heavy ions (Li, B, C, N, O, Ne) for nuclear underlying work and metal ions (Cr, Fe, Ni) for radiation damage studies.