ENTRY NO. 84

NAME OF MACHINE: Harwell V.E.C.

INSTITUTION: Atomic Energy Research Establishment
ADDRESS: Harwell, Oxfordshire, OX11 ORA, England
TEL: 0235-24141 Ext.5870 TELEX: 83135
IN CHARGE: M. S. Coates 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 10^6
COST, FACILITY, total: £1.6 x 10^6
FUNDED BY: U.K.A.E.A.

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS: 1 ENGINEERS: 1
TECHNICIANS: 8 CRAFTS: 9
GRAD STUDENTS involved during year: –
OPERATED BY: Research staff or: x Operators
OPERATION: 80 hr/wk. On target: 65 hr/wk
TIME DISTR. in house: 80% outside: 20%
BUDGET, op & dev: £750K
FUNDED BY: U.K.A.E.A./Isotope Sales/EURATOM

RESEARCH STAFF, not included above

USERS, in house: 6 outside: 6
GRAD STUDENTS involved during year: 4
RESEARCH BUDGET, in house:
FUNDED BY: U.K.A.E.A./Isotope Sales/EURATOM

MAGNET

POLE FACE, diameter (compact): 178 cm, R-extraction: 80 cm
R injection: 2-7 cm
GAP, min: 19 cm, Field: 21.6 kG
max: 43 cm, Field: 13.1 kG } at 5.5 x 10^5 Ampere turns
AVERAGE FIELD at R ext: 17 kG
B max/<B>: 1.30
NUMBER OF SECTORS: compact 3 / separated – Spiral, max: 48 deg
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: Demineralised water
ION ENERGY (Bending limit) E/A = 86 q^2/A^2 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 plane fine: Trim cap.
RF: 7.5 to 23 MHz, stable ±: 1 x 10^{-8}
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): 0.001
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 x 10^{-6} Torr or mbar
PUMPS, No, Type, Size: 3 oil diffusion pumps (one 60 cm and two 76 cm): Liq. N_2 cryopanels

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: PDP II
OTHER FACILITIES: 1. Isotope Production Rig with variable target assemblies. 2. Radiation Damage Rig with temp. control and programmed beam scanning and target rocking.

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
p		60	80	70
$^{16}O^{6+}$		190	0.2	0.1
$^{40}Ar^{8+}$		132	0.2	0.1
$^{58}Ni^{6+, 10+}$		50, 150	14, 02	7, .01
SECONDARY			(part/s)	

BEAM PROPERTIES

MEASURED		CONDITIONS			
PULSE WIDTH	20–40 RF deg	pμ A of	MeV	ions	
PHASE EXC. max	RF deg	pμ A of	MeV	ions	
EXTRACT eff	85 %	50	pμ A of	60	MeV p ions
RESOL ΔE/E	0.25 %	20	pμ A of	60	MeV p ions
EMITTANCE					
(π mm-mrad)	7 axial / 7 rad	10	pμ A of	60	MeV p

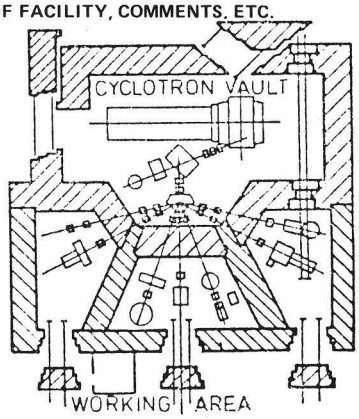
OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 8% SOLID STATES PHYSICS
BIOMEDICAL APPLICAT. ISOTOPE PRODUCTIONS 26%
Nuclear Chemistry 6% Radiation Chemistry 2%
Radiation Damage 43% Development 15%

REFERENCES/NOTES

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

PLAN VIEW OF FACILITY, COMMENTS, ETC.



The cyclotron delivers routinely beams of light ions (p, d, α) for radio-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.
There are also available a number of 'mixed beams' which have been specially developed for radiation damage work on fusion reactor materials.