ENTRY NO. 82

NAME OF MACHINE 88-Inch Cyclotron
INSTITUTION Lawrence Berkeley Laboratory
ADDRESS 1 Cyclotron Road, Berkeley, CA 94720, U.S.A.
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IN CHARGE R. G. Stokstad REPORTED BY David J. Clark

HISTORY AND STATUS

DESIGN, date 1958 Model tests 1958-59
ENG DESIGN, date 1959-61
CONSTRUCTION, date 1959-62
FIRST BEAM, date (or goal) Internal 1961, External 1962
MAJOR ALTERATIONS External injection with polarized and heavy ions, ECR source 1984, MOPA RF System
COST, ACCELERATOR $3.5 x 10^6 (1962)
COST, FACILITY, total $5.1 x 10^6 (1962)
FUNDED BY U.S. Department of Energy

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 2 ENGINEERS 4
TECHNICIANS 11 CRAFTS 2
GRAD STUDENTS involved during year 0
OPERATED BY Research staff or X Operators
OPERATION 116 hr/wk. On target 80 hr./wk
TIME DISTR. in house 75 % Outside 25 %
BUDGET, op & dev $2.0 x 10^6
FUNDED BY U.S. Department of Energy

RESEARCH STAFF, not included above

USERS, in house (LBL) 21 outside 110/yr.
GRAD STUDENTS involved during year 23
RESEARCH BUDGET, in house $2.4 x 10^6
FUNDED BY U.S. Department of Energy

MAGNET

POLE FACE, diameter (compact) 224 cm, R extraction 99 cm
R injection ..... cm
GAP, min 19 cm, Field 21 kG
min 30 cm, Field 15 kG } at .64 x 10^6 Ampere turns
AVERAGE FIELD at R ext 18 kG
B max/ < B > 1.17
NUMBER OF SECTORS { compact 3 / separated ..... } Spiral, max 55 deg
SECTOR ANGLE (SSC) ..... deg
TRIMMING COILS 17 circular, 5 valley harmonic

CONDUCTOR, material and type Copper, hollow water-cooled
STORED ENERGY (cryogenic) ..... MJ
POWER: main coils 700 max, kW; current stability 10^{-5}
*trimming coils 600 max, kW; current stability 10^{-3}
WEIGHT: Fe 290 tons; coils 10 tons
COOLING system Demineralized water
ION ENERGY (bending limit) E/A = 160 q^2/a^2 MEV/amu
(focusing limit) E/A = 70 q/a MeV/amu

ACCELERATION SYSTEM

DEES, number 1 180 deg
BEAM APERTURE 3.8 cm; DC Bias 0 kV
TUNED by, coarse Mov. panels fine Var. cap., auto.
RF 5.5 to 16.2 mHz, stable ± 10^{-8}
Orb F 1.1 to 16.2 mHz
HARMONICS, RF/Orb F, used 1, 3, 5
DEE—Gnd, max 60 kV, min gap (puller) 1 cm
STABILITY, (pk-pk noise)/(pk RF volt) 10^{-3}
ENERGY GAIN, max 120 kV/turn
RF PHASE, stable to ± deg
RF POWEP input, max 300 kW
FREQUENCY MODULATION, rate 0 /s
modulator, type
beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE $1-2 x 10^{-6} Torr or mbar
PUMPS, No, Type, Size Four oil diffusion pumps, (Two 81 cm, Two 25 cm, LN trapped), two 20°K cryopanels

ION SOURCES

Internal fil., PIG; External pol., ECR (1984)

INJECTION SYSTEM

Internal sources. External sources with axial injection.

EXTRACTION SYSTEM

D.c. electrostatic deflector

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed - m^2; movable 800 m^2
TARGET STATIONS 14 in 8 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type QSD, LBL Design
COMPUTER model MOD Comp IV/25, Classic
OTHER FACILITIES Isotope production, On-line Mass Separator (He Jet), Trans-uranium chemistry, In-beam Gamma-ray, Bio-med Irradiation, Polarimeter, TOF System

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	†External
p	≤ 50	2-60	≤ 3000	1-200
^{4}He	≤ 130	3-140	≤ 250	.2-50
$^{16}O^{2+...6+}$	.....	9-150	.....	.1-7
$^{40}Ar^{2+...8+}$	.....	4-224	.....	.05-.5

†Highest intensities for low or mid-range energies

BEAM PROPERTIES

	MEASURED	CONDITIONS
PULSE WIDTH	6-20 RF deg	5 pμA of 65 MeV α ions
PHASE EXC. max	20 RF deg	5 pμA of 65 MeV α ions
EXTRACT eff	50 %	5 pμA of 65 MeV α ions
RESOL ΔE/E	3 %	5 pμA of 65 MeV α ions
EMITTANCE (π mm. mrad)	22 axial, 16 rad	5 pμA of 65 MeV α

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 78 SOLID STATES PHYSICS 8
BIOMEDICAL APPLICAT 4 ISOTOPE PRODUCTIONS
DEVELOPMENT 10

REFERENCES/NOTES *Installed. 300 kw max. power used.

1) International Cyclotron Conferences.
2) Nucl. Instr. & Meth. 154, 1 (1978)
3) IEEE Trans. Nucl. Sci. NS-28, 3, 2934 (1981).

PLAN VIEW OF FACILITY, COMMENTS, ETC.