ENTRY NO. 92

NAME OF MACHINE Oak Ridge Isochronous Cyclotron

INSTITUTION Holifield Heavy Ion Research Facility, Oak Ridge National Laboratory

ADDRESS P. O. Box X, Building 6000, Oak Ridge, Tennessee 37831

TEL (615) - 574-4753 TELEX 810 572 1076 USDOE OKRE

IN CHARGE Charles M. Jones REPORTED BY John A. Martin

HISTORY AND STATUS

DESIGN, date 1958 Model tests 1958-59

ENG DESIGN, date 1959-1961

CONSTRUCTION, date 1959-1962

FIRST BEAM, date (or goal) 1963

MAJOR ALTERATIONS New dee - 1977

injection system for 25 MV tandem beams - 1979

COST, ACCELERATOR 2.3×10^6

COST, FACILITY, total $6 \times 10^6 + 18 \times 10^6$ tandem facility

FUNDED BY U. S. Department of Energy

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT (1)

SCIENTISTS 4 ENGINEERS 10

TECHNICIANS 11 CRAFTS 8

GRAD STUDENTS involved during year

OPERATED BY Research staff or X Operators

OPERATION (2) 168 hr/wk. On target 106 hr./wk

TIME DISTR. in house 45 % Outside 55 %

BUDGET, op & dev 3.54×10^6

FUNDED BY U. S. Department of Energy

RESEARCH STAFF, not included above

USERS, in house 45 outside 106

GRAD STUDENTS involved during year 20

RESEARCH BUDGET, in house 3.6×10^6

FUNDED BY U. S. Department of Energy

MAGNET

POLE FACE, diameter (compact) 193 cm, R extraction 77 cm

R injection 23-50 cm

GAP, min 19 cm, Field 23.7 kG
min 71 cm, Field 14.0 kG } at 1.6×10^6 Ampere turns

AVERAGE FIELD at R ext 19.2 kG

B max/ < B > 1.3

NUMBER OF SECTORS { compact 3 / separated } Spiral, max 30 deg

SECTOR ANGLE (SSC) deg

TRIMMING COILS 10 pairs - water-cooled copper

CONDUCTOR, material and type aluminum

STORED ENERGY (cryogenic) MJ

POWER: main coils 1750 max, kW; current stability $2/10^5$

trimming coils 250 max, kW; current stability $2/10^4$

WEIGHT: Fe 200 tons; coils 9 tons

COOLING system demineralized water

ION ENERGY (bending limit) E/A = 100 q^2/a^2 MEV/amu

(focusing limit) E/A = 75 q/a MeV/amu

ACCELERATION SYSTEM

DEES, number 1 180 deg

BEAM APERTURE 2.5 cm; DC Bias 0 kV

TUNED by, coarse moveable short fine trim capacitors

RF 6.8 to 19.5 mHz, stable $\pm 1 \times 10^{-6}$

Orb F 2.3 to 19.5 mHz

HARMONICS, RF/Orb F, used 1.3

DEE—Gnd, max 80 kV, min gap 1 cm

STABILITY, (pk-pk noise)/(pk RF volt) $5/10^4$

ENERGY GAIN, max 160 kV/turn

RF PHASE, stable to ± 1 deg

RF POWEP input, max 200 kW

FREQUENCY MODULATION, rate /s

modulator, type

beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 1×10^{-6} Torr ~~or mbar~~

PUMPS, No. Type, Size 3 oil diffusion pumps: 2 80 cm, 1 50 cm; 1 50 cm cryopump; 2 0.3 sq m cryopanels

ION SOURCES

INJECTION SYSTEM

radial injection with foil stripping in cyclotron

EXTRACTION SYSTEM

electrostatic deflector + 2 magnetic channels

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 235 m²; movable 330 m²

TARGET STATIONS 14 in 6 rooms

STATIONS served at same time, max 1

MAG SPECTROGRAPH, type QID

COMPUTER model 3 Perkin-Elmer 3230, vax 11/780

OTHER FACILITIES on line mass spec; 4π γ ray spectrometer; time-of-flight spectrometer;

CHARACTERISTIC BEAMS (coupled operation - tandem + cyclotron)

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
$^{16}O^{+8}$	400	400	~0.120	0.06
$^{32}S^{+15}$	700	700	~0.012	0.006
$^{58}Ni^{+23}$	880	880	0.012	0.004
$^{116}Sn^{+28}$	620	620	0.0042	0.0025
SECONDARY		(part/s)		

BEAM PROPERTIES (coupled operation - tandem + cyclotron)

MEASURED	CONDITIONS
PULSE WIDTH RF deg	pμ A of MeV ions
PHASE EXC. max RF deg	pμ A of MeV ions
EXTRACT eff 65 %	.035 pμ A of 350 MeV $^{18}O^{+8}$ ions
RESOL ΔE/E < 0.1%	.035 pμ A of 350 MeV $^{18}O^{+8}$ ions
EMITTANCE (π mm. mrad) est. 1-2 axial, 1-2 rad	.035 pμ A of 350 MeV $^{18}O^{+8}$

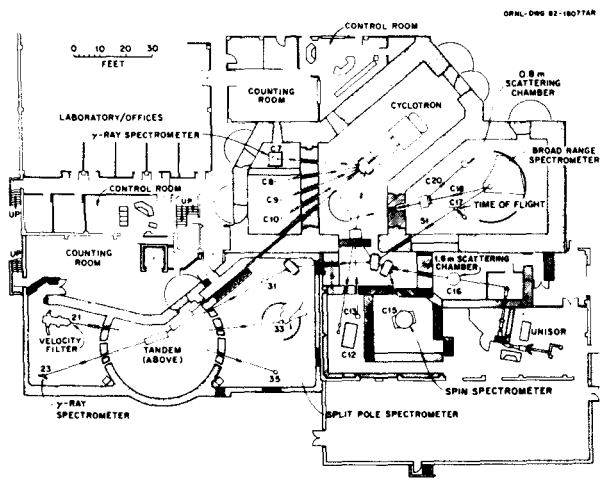
OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 91% SOLID STATES PHYSICS

BIOMEDICAL APPLICAT. ISOTOPE PRODUCTIONS

Atomic Physics - 7%; all other 2%

REFERENCES/NOTES

1) For operation of both tandem and cyclotron.
2) Operation of the tandem accelerator and cyclotron. The cyclotron operates ~ 2300 hours/year.

PLAN VIEW OF FACILITY, COMMENTS, ETC.