ENTRY No. 85

NAME OF MACHINE Oak Ridge Isochronous Cyclotron DATE 23 July 1981
INSTITUTION Holifield Heavy Ion Research Facility, Oak Ridge National Laboratory
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IN CHARGE James B. Ball REPORTED BY R. S. Lord

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
25 MV Tandem Injector, 1979
COST, ACCELERATOR $2.27 x 10^6
COST, FACILITY, total $6 x 10^6 + $18 x 10^6 (Tandem)
FUNDED BY U.S. Department of Energy

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT *

SCIENTISTS 3 ENGINEERS 10
TECHNICIANS 7 CRAFTS 8
GRAD STUDENTS involved during year 0
OPERATED BY ..... Research staff or x Operators
OPERATION 120 hr/wk, On target 96 hr/wk
TIME DISTR. in house 50 %, Outside 50 %
BUDGET, op & dev $3.36 x 10^6
FUNDED BY U.S. Department of Energy

RESEARCH STAFF, not included above

USERS, in house 28 outside 63
GRAD STUDENTS involved during year 17
RESEARCH BUDGET, in house $2.84 x 10^6
FUNDED BY U.S. Department of Energy

MAGNET

POLE FACE, diameter (compact) 193 cm, R extraction 75 cm
R injection 23-50 cm
GAP, min 19 cm, Field 23.7 kG
max 71 cm, Field 14.0 kG
at 1.6 x 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 ; angle 180 deg
BEAM APERTURE 2.5 cm ; DC Bias 0 kV
TUNED by, coarse Short Plane fine Trim Capacitors
RF 6.8 to 19.5 mHz, stable ± 1/10^6
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 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 (Two 80 cm, one 50 cm) 1 50-cm Cryopump, 2 0.3 sq.m Cryopanels

ION SOURCES

Internal Penning; 25 MV Tandem Injector/Stripper

INJECTION SYSTEM

Radial with foil stripping inside the magnet gap

EXTRACTION SYSTEM

Electrostatic deflector + 2 magnetic channels

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 235 m² ; movable 330 m²
TARGET STATIONS 13 in 6 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type Q1D
COMPUTER model 3 Perkin-Elmer 3220, 2 SEL 840A
OTHER FACILITIES On-line Mass Spectrometer, Spin Spectrometer, Time-of-Flight Spectrometer, Laser Induced Nuclear Polarization Facility

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
$^{16}O^{8+}$ (Injec.)	400	400		2 x 10^{-3}
$^{16}O^{6+}$ (Int.Sc.)	225	225		0.5
$^{40}Ar^{8+}$ " "	160	160		0.15
SECONDARY			(part/s)	

BEAM PROPERTIES

MEASURED		CONDITIONS	
PULSE WIDTH	RF deg	pμ A of	MeV ions
PHASE EXC, max	RF deg	pμ A of	MeV ions
EXTRACT eff	%	pμ A of	MeV ions
RESOL ΔE/E	%	pμ A of	MeV ions

EMITTANCE
(π mm. mrad) 10 axial / 30 rad ..... 5 pμA of 40 MeV p ions

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 95% SOLID STATES PHYSICS ....
BIOMEDICAL APPLICAT. .... ISOTOPE PRODUCTIONS ....
All other, 5%

REFERENCES/NOTES

*Includes Operations and Development Staff and costs for both ORIC and 25 MV Tandem.

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS

During 1977-1981, ORIC underwent modifications to permit operation as energy booster for beams from the new Holifield 25 MV tandem electrostatic accelerator. First beams from the booster configuration (January 1981) were 20 and 25 MeV/A $^{16}O^{8+}$. 25 MeV/A will be available up to A = 40; > 6 MeV/A for A ≤ 160.