

ENTRY No. 114

Cyclotron

NAME OF MACHINE Oak Ridge Isochronous Cyclotron DATE May 1, 1989
INSTITUTION Holifield Heavy Ion Research Facility, Oak Ridge National Laboratory
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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 dec. 1977
Injector System for 25 MV tandem beams 1979
COST, ACCELERATOR \$2.3M
COST, FACILITY, total \$6M + \$18M (tandem facility)
FUNDED BY U.S. Department of Energy
ACCELERATOR STAFF, OPERATION AND DEVELOPMENT (1)
SCIENTISTS 4 ENGINEERS 8
TECHNICIANS 11 CRAFTS 5
GRAD STUDENTS involved during year
OPERATED BY Research staff or 8 Operators
OPERATION 168 hr/wk, On target hr/wk
TIME DISTR. in house 45% Outside 55%
BUDGET, op & dev \$3.8M
FUNDED BY U.S. DOE Nuclear Physics
RESEARCH STAFF, not included above
USERS, in house 35 outside 132
GRAD STUDENTS involved during year 25
RESEARCH BUDGET, in house \$4M
FUNDED BY U.S. DOE

MAGNET

POLE FACE, diameter (compact) 193 cm, R extraction .77 cm
R injection 23-30 cm
GAP, min 19 cm, Field 23.7 kG
max 7.1 cm, Field 14.0 kG } at 1.6 x 10^6
AVERAGE FIELD at R ext 19.2 kG } Ampere turns
B max/ <B> 1.3

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

SECTOR ANGLE (SSC) deg
TRIMMING COILS 10 pairs, water cooled copper

CONDUCTOR, material and type aluminium
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^2/a^2 MeV/amu

ACCELERATION SYSTEM
DEES, number 1; angle 180 deg
BEAM APERTURE 2.5 cm; DC Bias 0 kV
TUNED by, coarse moveable short fine trim capacitors
RF 6.8 to 20.1 MHz, stable +/- 1 x 10^-6
Orb F 2.3 to 20.1 MHz
HARMONICS, RF/Orb F, used 1:3
DEE - Gnd, max 80 kV, min gap 1.4 cm
STABILITY, (pk-pk noise)/(pk RF volt) 5/10
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 2, 80-cm oil diff, pumps,
1, 50-cm oil diff, pumps, 1, 90-cm cryopump

ION SOURCES
25 MV tandem accelerator

INJECTION SYSTEM

Radial injection with foil stripping in cyclotron

ELECTROSTATIC SYSTEM

Electrostatic deflector + 2 magnetic channels

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 235 m^2; movable 330 m^2
TARGET STATIONS 14 in 6 rooms
STATIONS served at same time, max 1
MAG SPECTROGRAPH, type Q1D
COMPUTER model 3 P-E 3230, VAX 11/780
OTHER FACILITIES UNISQR (mass spec), HILJ, TOF Spec,
4 pi NaI spin spec, 4 pi Ge compact ball

CHARACTERISTIC BEAMS

Table with columns: PARTICLE, ENERGY (MeV) Goal, Achieved, CURRENT (pA) Internal, External. Rows include 1608+, 58Ni24+, 110Sn28+, 150Gd36+.

SECONDARY

(part/s)

BEAM PROPERTIES

MEASURED CONDITIONS
PULSE WIDTH RF deg pA of MeV ions
PHASE EXC, max RF deg pA of MeV ions
EXTRACT eff 65% 0.035 pA of 350 MeV 180 ions
RESOL delta E/E 0.1% 0.035 pA of 350 MeV 180 ions
EMITTANCE
(pi mm. mrad) {1-2 axial } 0.035 pA of 350 MeV 180 ions
{1-2 rad }

OPERATING PROGRAMS, time distribution
BASIC NUCLEAR PHYSICS 95% SOLID STATES PHYSICS
BIOMEDICAL APPLICAT. ISOTOPE PRODUCTIONS
Atomic Physics 5%

REFERENCES/NOTES

(1) For operation of both tandem and cyclotron.

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS

