

ENTRY NO. 91

NAME OF MACHINE Cyclo-Graaff Injector DATE 8/1/81
 INSTITUTION Triangle Universities Nuclear Laboratory
 ADDRESS Duke University Durham, NC 27706
 TEL 919-684-8158 TELEX
 IN CHARGE E.G. Bilpuch REPORTED BY F.O. Purser

HISTORY AND STATUS

DESIGN, date 1964 Model tests
 ENG DESIGN, date 1965
 CONSTRUCTION, date
 FIRST BEAM, date (or goal) Factory 1966, site 1968
 MAJOR ALTERATIONS Additional Harmonic Coils, Phase
 Limiting Slits, Moveable Magnetic Channel
 COST, ACCELERATOR Cyclotron \$360,000, FN Tandem
 COST, FACILITY, total \$3.945M \$1.25M
 FUNDED BY DOE, NSF, HEW, N.C., Duke Univ.

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 19 ENGINEERS
 TECHNICIANS 4 CRAFTS 4
 GRAD STUDENTS involved during year
 OPERATED BY X Research staff or Operators
 OPERATION 168 hr/wk, On target 140 hr/wk
 TIME DISTR. in house 100 %, outside %
 BUDGET, op & dev \$900,000
 FUNDED BY DOE

RESEARCH STAFF, not included above

USERS, in house outside
 GRAD STUDENTS involved during year
 RESEARCH BUDGET, in house
 FUNDED BY

MAGNET

POLE FACE, diameter (compact) 80 cm, R-extraction 33.5 cm
 R injection cm
 GAP, min 5 cm, Field 12 kG
 max 10 cm, Field 20.5 kG } at 167,00
 AVERAGE FIELD at R ext 16.4 kG } Ampere turns
 B max / < B > 1.25
 NUMBER OF SECTORS { compact 3 } Spiral, max deg
 { separated }
 SECTOR ANGLE (SSC) 45 deg
 TRIMMING COILS
 CONDUCTOR, material and type Hollow Core Copper
 STORED ENERGY (cryogenic) MJ
 POWER: main coils 30 max kW: current stability 6×10^{-5}
 trimming coils max kW: current stability
 WEIGHT: Fe 14 tons: coils tons
 COOLING system water
 ION ENERGY (Bending limit) E/A = 15 q^2/A^2 MeV/amu
 (Focusing limit) E/A = q/A MeV/amu

ACCELERATION SYSTEM

DEES, number 2 ; angle 120 deg
 BEAM APERTURE 2.05 cm; DC Bias 1.0 kV
 TUNED by, coarse moveable strap fine moveable plate
 RF 12.8 or 25.0 MHz, stable \pm 1. kHz_z
 Orb F to MHz
 HARMONICS, RF/Orb F, used Fundamental only
 DEE-Gnd, max 40 kV, min gap cm
 STABILITY, (pk-pk noise)/(pk RF volt) 0.002
 ENERGY GAIN, max 120 kV/turn
 RF PHASE, stable to \pm 5 deg
 RF POWER input, max. 40 kW
 FREQUENCY MODULATION, rate /s
 modulator, type
 beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 1×10^{-6} Torr or mbar
 PUMPS, No, Type, Size
 1-10" Diffusion Pump
 IN₂ Traps

ION SOURCES

. Ehlers, Penning Ion Gauge

INJECTION SYSTEM

. Axial

EXTRACTION SYSTEM

Harmonic Precession, Electrostatic Deflector, Mag, Channel

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 1000 m²; movable m²
 TARGET STATIONS 9 in 3 rooms
 STATIONS served at same time, max 1
 MAG SPECTROGRAPH, type
 COMPUTER model DEC VAX 11/780
 OTHER FACILITIES

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT (μ A)	
	Goal	Achieved	Internal	External
$^3\text{H}^-$	15	15	100	25
$^3\text{D}^-$	8	8	50	10
SECONDARY				(part/s)

BEAM PROPERTIES

	MEASURED		CONDITIONS	
PULSE WIDTH	18 RF deg	20 μ A of	15 MeV	H^- ions
PHASE EXC, max	RF deg	μ A of	MeV	ions
EXTRACT eff	30 %	μ A of	MeV	ions
RESOL $\Delta E/E$	0.3 %	μ A of	MeV	ions
EMITTANCE				
(π mm-mrad)	20 axial	10 μ A of	15 MeV	H^-
	20 rad			

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS SOLID STATES PHYSICS
 BIOMEDICAL APPLICAT ISOTOPE PRODUCTIONS
 Basic Nuclear Physics 100%

REFERENCES/NOTES

- 1)
- 2)

PLAN VIEW OF FACILITY, COMMENTS, ETC.

Beam properties with internal phase limiting slits
 Pulse width 3.2 R.F. Deg. 1.5. μ A of 15 MeV H^-
 Res. $\Delta E/E$ 0.1%
 Burst Length 0.5 ns.