

ENTRY No. 71

NAME OF MACHINE Cyclo-Graaff Injector DATE 8/1/81
INSTITUTION Triangle Universities Nuclear Laboratory
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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 \$1.25 M
COST, FACILITY, total \$3.945 M
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 } at 1.67,000
max .10 cm, Field 20.5 kG } Ampere turns
AVERAGE FIELD at R ext 16.4 kG }
B max/ 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) MJ₅
POWER : main coils 30 max, kW ; current stability 6 x 10⁻⁵
trimming coils max, kW ; current stability

WEIGHT : Fe 14 tons ; coils tons
COOLING system Water
ION ENERGY (bending limit) E/A = 15 q²/a² 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 ± 1 KH₂
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 ± .5 deg
RF POWER input, max 40 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
1-10¹¹ Diffusion Pump
LN₂ 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 (µA)	
	Goal	Achieved	Internal	External
H ⁻	15	15	100	25
D ⁻	8	8	50	10

SECONDARY

(part/s)

BEAM PROPERTIES

MEASURED CONDITIONS
PULSE WIDTH .18 RF deg .20 µA of .15 MeV H⁻ ions
PHASE EXC, max RF deg µA of MeV ions
EXTRACT eff .30 % µA of MeV ions
RESOL ΔE/E .0.3 % µA of MeV ions
EMITTANCE

(π mm. mrad) { .20 axial } .10 µA of .15 MeV H⁻ ions
{ .20 rad }

OPERATING PROGRAMS, time distribution

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

REFERENCES/NOTES

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS

Beam properties with internal phase limiting slits
Pulse width 3.2 R.F. Deg. 1.5 µA of 15 MeV H⁻
Ext. eff 60%
Res. ΔE/E 0.1%
Burst Length 0.5 ns.