ENTRY NO. 77

NAME OF MACHINE Sloan-Kettering Institute Cyclotron
INSTITUTION Sloan-Kettering Institute for Cancer Research
LOCATION New York, New York DATE May, 1975

IN CHARGE T.Y.T. Kuo REPORTED by T.Y.T. Kuo

HISTORY AND STATUS

DESIGN, date CS-15, Cyclotron Corporation MODEL tests
ENG. DESIGN, date
CONSTRUCTION, date Nov. 1967
FIRST BEAM date (or goal)
MAJOR ALTERATIONS see features
OPERATION, 60 hr/wk; On Target 30 hr/wk
TIME DIST., in house 98 %, outside 2 %
USERS' SCHEDULING CYCLE 1 weeks
COST, ACCELERATOR
COST, FACILITY, total
FUNDED BY ERDA

ACCELERATOR STAFF, OPERATION and DEVELOPMENT

SCIENTISTS 1/2 ENGINEERS 1.2
TECHNICIANS 0 CRAFTS 0.2
ADMIN & CLER 0 TOTAL 1.9
GRAD. STUDENTS involved during year 0
OPERATED BY x Res staff or x Sp operators
BUDGET, op & dev
FUNDED BY NCI,ERDA

RESEARCH STAFF, not included above

USER GROUPS, in house 8 outside 1
STAFF SCIENTISTS, in house outside
TOTAL RES STAFF, in house 15 outside
GRAD STUDENTS involved during year
RES. BUDGET, in house
FUNDED BY NCI,ERDA

FACILITIES FOR RESEARCH PROGRAMS

SHIELDED AREA, fixed 60 m^2
movable 0 m^2
TARGET STATIONS 1 in 1 ROOMS
STATIONS SERVED AT THE SAME TIME, max 1
MAG SPECTROGRAPH, type
ON-LINE COMPUTER, model IBM 1800
FACILITIES for:
Isotope production Internal & External
Irradiation, Solid State Yes
Biological Yes
Time-of-Flight Study Being developed
On-Line Mass Separation

NOTATIONS

MAGNET

POLE FACE dia 80 cm; R ext 36 cm
GAP, min 5 cm; Field 20 kG
max 10 cm; Field 12 kG at 0.2 x 10^6 A-turns
AVE FIELD at R max 16 kG
CURRENT, STABILITY ± 100 parts/10^6
B max/<B> =
AVF SECTORS 3 SPIRAL, max 0 deg
POLE FACE coil pairs, AVF /sec
Harmonic /sec; Rad Grad /sec, or
circular; HEAVY ION, E max = q^2/A
WEIGHT, Fe 14, Cu, or Al tons
POWER, main coils 40, pole tips
total kW; cooled by water
YOKE/POLE area %; θ sec (Sect Mag) deg
TOTAL POWER, installed 0.06 MW
normal load 0.04 MW

ION SOURCE, int PIG *
ext

ACCELERATION SYSTEM

DEES, number 2, width 120 deg
BEAM APERTURE 2 cm; DC BIAS 1.5 kV
TUNED by, coarse MP, fine VC, Trimmer
RF 12, 16, 24 MHz, stable ± 10 /10^6
Orb F 12,16,24 Mc/s; GAIN 120 kV/t
HARMONICS, RF/OF, used 1
DEE-Gnd, max 30 kV, x/field, min cm,
STABILITY, (pk-pk noise)/(pk RF volt) 0.0005
RF PHASE stable to ± deg
RF POWER input, max 30 kW
RF PROTECT curcuit, speed μs
type Ignitron crowbar
EXTRACT System
see features

FREQUENCY MODULATION, rate /sec
MODULATOR, type
BEAM PULSE, width nsec
(FM only)

SELECTED REFERENCES

1. Radiology 93,331-337,1969.
2. IEEE Tran. Nucl. Sci. NS-14(3) 1967.
3. Proc. of the 5th Int. Cyc. Conf. 1969.
4. Proc. of the 6th Int. Cyc. Conf. 1972.
5. Proc. of the 1975 Nat. Acc. Conf.

ENTRY NO. 77 (cont.)

CHARACTERISTIC BEAMS

	Particle	Goal (MeV)	Achieved (MeV)
ENERGY	p	15	14.7
	d	7.5	7.9
	$^3He^{++}$	20	23.3
		(μA)	(μA)
CURRENT Internal	p	100	500
	d	100	800 *
	$^3He^{++}$	100	400 *
External	p	50	100 **
	d	50	400 **
	$^3He^{++}$	50	200 **
		(part/s)	(part/s)
Secondary	n ***		$2x10^{13}$
HEAVIEST ion	alpha		

** 300μA ext.
* 400μA int.

BEAM PROPERTIES

	Measured		Conditions		
Pulse Width	___ RF deg	___ μA of	___ MeV	___	
Phase Exc, max	___ RF deg	___ μA of	___ MeV	___	
Extract Eff	70 %	200 μA of	23 MeV	$^3He^{++}$	
Res, ΔE/E	___ %	___ μA of	___ MeV	___	
Emittance (mm-mrad)	50 axial; 50 radial	90% μA of	___ MeV	___	

VACUUM norm 1 μtorr; PUMPDOWN time 2 hr

OPERATING PROGRAMS, time dist

Basic Nuclear Physics/Chemistry	%
Solid State Physics	%
Bio-Medical Applications 100	%
Isotope Production	%
Materials Science	%
	%

OTHER FEATURES and OPERATION SUMMARY

This is the first proto-type cyclotron built by the Cyclotron Corporation, Berkeley, California. Major modifications included: Dees and RF system, ion source and extraction system.

* There are four independent coordinate controls for the ion source. The high beam currents are resulted from high operating power density in the order of 140 kW/cm^3.

** The extraction system:

Harmonic coils: azimuthal angle and current controls
Deflector: fine adjust of extraction radius (change of energy also)
taper angle adjust
channal gap adjust
dc voltage adjust
Magnetic channel: compensated-iron type
entrance position control
exit position control
channel curvature control

*** Neutron programs: Dosimetry
Neutron Physics
Activation
Therapy