

ENTRY No. 60

NAME OF MACHINE IMS(IKAKEN) Cyclotron DATE 6-MAR-1989  
INSTITUTION The Institute of Medical Science, The University of Tokyo  
ADDRESS 4-6-1, Shirokanedai, Minato-ku, Tokyo 108, Japan  
TEL 03 (446) 6771 TELEX  
IN CHARGE Akira ITO REPORTED BY Akira ITO

### HISTORY AND STATUS

DESIGN, date Model tests  
ENG DESIGN, date TCC model CS-30  
CONSTRUCTION, date 1971-1973  
FIRST BEAM, date (or goal) Aug., 1973  
MAJOR ALTERATIONS replacement of magnet coil  
(1976)  
COST, ACCELERATOR about \$1M(1973)  
COST, FACILITY, total about \$1M(1973)  
FUNDED BY Japanese Government

### ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 1 ENGINEERS  
TECHNICIANS 3 CRAFTS  
GRAD STUDENTS involved during year  
OPERATED BY Research staff or Operators  
OPERATION 50 hr/wk, On target 40 hr/wk  
TIME DISTR. in house 90%, Outside 10%  
BUDGET, op & dev \$0.14M(1986)  
FUNDED BY Japanese Government

RESEARCH STAFF, not included above  
USERS, in house 6 outside 10  
GRAD STUDENTS involved during year 0  
RESEARCH BUDGET, in house

### MAGNET

POLE FACE, diameter (compact) 96 cm, R extraction 42 cm  
R injection  
GAP, min 5 cm, Field 20 kG }  
max 10 cm, Field 12 kG } at  $0.2 \times 10^6$   
AVERAGE FIELD at R ext 16 kG } Ampere turns  
B max/ <B> 1.25

NUMBER OF SECTORS { compact 3 } Spiral, max 60deg  
separated

SECTOR ANGLE (SSC) deg  
TRIMMING COILS 2 (inner & outer) /sec

CONDUCTOR, material and type  
STORED ENERGY (cryogenic) MJ  
POWER: main coils 60 max, kW; current stability 10%  
trimming coils max, kW; current stability

WEIGHT: Fe 23 tons; coils 1 tons  
COOLING system demineralized water  
ION ENERGY (bending limit) E/A =  $q^2/a^2$  MeV/amu  
(focusing limit) E/A =  $0.30 q^2/a^2$  MeV/amu

### ACCELERATION SYSTEM

DEES, number 2; angle 90 deg  
BEAM APERTURE 4 cm; DC Bias -1.5 kV  
TUNED by, coarse short bar fine V.C.  
RF 14 to 26 MHz, stable  $\pm 10/10^6$   
Orb F to mHz  
HARMONICS, RF/Orb F, used  
DEE - Gnd, max 30 kV, min gap 1 cm  
STABILITY, (pk-pk noise)/(pk RF volt) 0.1%  
ENERGY GAIN, max kV/turn  
RF PHASE, stable to  $\pm 5$  deg  
RF POWER input, max 75 kW  
FREQUENCY MODULATION, rate /s  
modulator, type  
beam pulse, width

### VACUUM SYSTEM

OPERATING PRESSURE less than  $10^{-5}$  Torr or mbar  
PUMPS, No, Type, Size One diffusion pump  
(30 cm dia)

### ION SOURCES

PIG type

### INJECTION SYSTEM

Internal only

### EXTRACTION SYSTEM

DC deflector + mag-channel

### FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 330 m<sup>2</sup>; movable 0 m<sup>2</sup>

TARGET STATIONS 6 in 4 rooms

STATIONS served at same time, max 1

MAG SPECTROGRAPH, type

COMPUTER model VAX 11/750, PDP-11/34 & Lecroy 3500

OTHER FACILITIES Isotopes production

Neutron therapy

PIXE & Proton CT / Microbeam

### CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT ( $\mu$ A)	
	Goal	Achieved	Internal	External
P		26		70
d		14		150
He		38		70
$\alpha$		28		50

SECONDARY Be (d,n)  $\bar{n}=6$  MeV

### BEAM PROPERTIES

MEASURED	CONDITIONS	
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PULSE WIDTH 10 RF deg	1 $\mu$ A of 28 MeV d. ions	
PHASE EXC, max RF deg	$\mu$ A of MeV ions	
EXTRACT eff 60%	100 $\mu$ A of 14 MeV d. ions	
RESOL $\Delta E/E$ 1%	1 $\mu$ A of 14 MeV d. ions	

EMITTANCE  $(\pi$  mm. mrad) { 10. axial } 1  $\mu$ A of 14 MeV d. ions  
14. rad

### OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS SOLID STATES PHYSICS 10%

BIOMEDICAL APPLICAT. 60% ISOTOPE PRODUCTIONS 20%

Development 10%

### REFERENCES/NOTES

1) Y. Yoshida et al. Nucl. Instr. & Meth.,  
vol. 138, pp.579-788 (1976).

### PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS

