

ENTRY No. 18

NAME OF MACHINE Minicyclotron MC-20 **DATE** April 28, 1989
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HISTORY AND STATUS

DESIGN, date 1968-69 Model tests 1968-69
ENG DESIGN, date 1969-71
CONSTRUCTION, date 1969-73
FIRST BEAM, date (or goal) 1974
MAJOR ALTERATIONS New central region and ion source 1985 (RF-extraction)
COST, ACCELERATOR 2 500 000 FIM
COST, FACILITY, total 5 000 000 FIM
FUNDED BY Government of Finland
ACCELERATOR STAFF, OPERATION AND DEVELOPMENT
SCIENTISTS ENGINEERS 3
TECHNICIANS 2 **CRAFTS** 5
GRAD STUDENTS involved during year 4
OPERATED BY Research staff or Operators
OPERATION 85 hr/wk, On target 70 hr/wk
TIME DISTR. in house 1) % , Outside 1) %
BUDGET, op & dev 1 500 000 FIM
FUNDED BY Government of Finland
RESEARCH STAFF, not included above
USERS, in house 25 outside 15
GRAD STUDENTS involved during year 10
RESEARCH BUDGET, in house 2 500 000 FIM
FUNDED BY Government of Finland

MAGNET

POLE FACE, diameter (compact) 90 cm, R extraction .39 cm
R injection cm
GAP, min 6.5 cm, Field 20.5 kG } at 300 000
max 16.5 cm, Field 13.7 kG }
AVERAGE FIELD at R ext 17.1 kG } Ampere turns
B max/ 1.2
NUMBER OF SECTORS { compact 4 } Spiral, max 48 deg
{ separated }
SECTOR ANGLE (SSC) deg
TRIMMING COILS 4 sets in valleys and 8 circular

CONDUCTOR, material and type copper, hollow
STORED ENERGY (cryogenic) MJ/5
POWER: main coils 90 max, kW ; current stability 2x10
trimming coils 6 max, kW ; current stability
WEIGHT: Fe 19.5 tons ; coils 1 tons
COOLING SYSTEM Demineralized water
ION ENERGY (bending limit) E/A = 20 q²/a² MeV/amu
(focusing limit) E/A = q²/a² MeV/amu

ACCELERATION SYSTEM

DEES, number 2 ; angle 90 deg
BEAM APERTURE 1.8 cm ; DC Bias - kV
TUNED BY, coarse MS fine VC
RF 10.5 to 25.6 MHz, stable ±
Orb F 5.3 to 25.6 MHz
HARMONICS, RF/Orb F, used 1 and 2
DEE - Gnd, max 30 kV, min gap 1 cm
STABILITY, (pk-pk noise)/(pk RF volt) 10
ENERGY GAIN, max 120 kV/turn
RF PHASE, stable to ± 0.5 deg
RF POWER input, max 50 kW
FREQUENCY MODULATION, rate /s
modulator, type
beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 10 Torr or mbar
PUMPS, No, Type, Size 2, oil diffusion, 5000 l/s

ION SOURCES

..Internal cold cathode penning, RF-extraction

INJECTION SYSTEM

EXTRACTION SYSTEM

Electrostatic deflector and magnetic channel

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 100 m² ; movable m²
TARGET STATIONS 5 in 3 rooms
STATIONS served at same time, max
MAG SPECTROGRAPH, type
COMPUTER model VAX 11/750, PDP 11/44, VAXstations
OTHER FACILITIES On line mass separator

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT (pA)	
	Goal	Achieved	Internal	External
p	2.5-20	4.8-20.4	200	10
d	1.5-10	6-10.2	200	10
He	2.5-27	11-27.6	3	1
α	2.5-20	6-20.5	5	2

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 35% 4 pA of 13 MeV ions
RESOL ΔE/E 0.5% 1 pA of 20 MeV ions
EMITTANCE
(π mm. mrad) { axial } pA of MeV ions
{ rad }

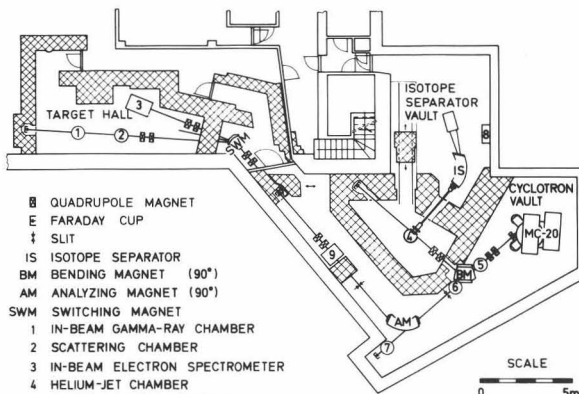
OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 85% **SOLID STATES PHYSICS** 5%
BIOMEDICAL APPLICAT. **ISOTOPE PRODUCTIONS**
..others 10%

REFERENCES/NOTES

- 1) No distinction made.
Operation will be stopped permanently in 1991.

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS



- Q QUADRUPOLE MAGNET
- E FARADAY CUP
- † SLIT
- IS ISOTOPE SEPARATOR
- BM BENDING MAGNET (90°)
- AM ANALYZING MAGNET (90°)
- SWM SWITCHING MAGNET
- 1 IN-BEAM GAMMA-RAY CHAMBER
- 2 SCATTERING CHAMBER
- 3 IN-BEAM ELECTRON SPECTROMETER
- 4 HELIUM-JET CHAMBER
- 5-7 CHAMBERS FOR ACTIVATION
- 8 ³He-RECOVERY SYSTEM
- 9 FAST PULSING SYSTEM