

ENTRY No. 15

NAME OF MACHINE Minicyclotron MC-20 DATE July 8, 1981
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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

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 1 CRAFTS 4
 GRAD STUDENTS involved during year 2

OPERATED BY * Research staff or Operators
 OPERATION 70 hr/wk, On target 60 hr/wk
 TIME DISTR. in house % , Outside %

BUDGET, op & dev 1 300 000 FIM
 FUNDED BY Government of Finland

RESEARCH STAFF, not included above
 USERS, in house 20 outside 15
 GRAD STUDENTS involved during year 10
 RESEARCH BUDGET, in house 1 000 000 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
 max 16.5 cm, Field 13.7 kG } at 300 000
 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/sector and 8 circular

CONDUCTOR, material and type Copper
 STORED ENERGY (cryogenic) MJ₅
 POWER: main coils 90 max, kW ; current stability 2x10⁻⁵
 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 = q/a MeV/amu

ACCELERATION SYSTEM

DEES, number 2 ; angle 90 deg
 BEAM APERTURE 1.8 cm ; DC Bias 0 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 1,2
 DEE - Gnd, max 30 kV, min gap 1 cm
 STABILITY, (pk-pk noise)/(pk RF volt) 0.001
 ENERGY GAIN, max 120 kV/turn
 RF PHASE, stable to ± 0.5 deg
 RF POWER input, max 50 kW
 FREQUENCY MODULATION, rate
 modulator, type
 beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 10⁻⁵ Torr or mbar
 PUMPS, No, Type, Size 2 oil diffusion pumps
 2 x 2500 l/s ; with baffles

ION SOURCES

Internal cold cathode penning, biased

INJECTION SYSTEM

EXTRACTION SYSTEM

Electrostatic deflector + magnetic channel

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 100 m² ; movable m²
 TARGET STATIONS 6 in 3 rooms
 STATIONS served at same time, max 1
 MAG SPECTROGRAPH, type
 COMPUTER model PDP 11/45
 OTHER FACILITIES In-beam gamma ray and electron
 spectrometers, on-line mass separator, helium-jet
 recoil transport

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV)		CURRENT (µA)	
	Goal	Achieved	Internal	External
p	2.5-20	4.8-20.2	200	10
d	1.5-10	6-10	200	10
³ He	2.5-27	12-27.5	3	1
α	2.5-20	6-20.5	3	1

SECONDARY

(part/s)

BEAM PROPERTIES

MEASURED CONDITIONS
 PULSE WIDTH RF deg µA of MeV ions
 PHASE EXC, max RF deg µA of MeV ions
 EXTRACT eff 35 % 4 µA of 13 MeV p ions
 RESOL ΔE/E 0.5 % 2 µA of 20 MeV α ions
 EMITTANCE

(π mm. mrad) { axial } µA of MeV ions
 { rad }

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS 80 % SOLID STATES PHYSICS 10 %
 BIOMEDICAL APPLICAT. ISOTOPE PRODUCTIONS
 activations 5 % development 5 %

REFERENCES/NOTES

+ No distinction has been made.

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS

