

ENTRY NO. 28

NAME OF MACHINE Jülich Isochronous Cyclotron (JULIC) DATE Aug. 1978
 INSTITUTION Institut für Kernphysik der Kernforschungsanlage (KFA) Jülich
 ADDRESS D-5170 Jülich, W. Germany

IN CHARGE C.U. Mayer-Böricke REPORTED by C.U. Mayer-Böricke, J. Reich

HISTORY AND STATUS

DESIGN, date 1963 MODEL tests 1963-1965
 ENG. DESIGN, date 1964/1965
 CONSTRUCTION, date 1966-1969
 FIRST BEAM date (or goal) int. 1968; ext. 1969
 MAJOR ALTERATIONS none

OPERATION, 168 hr/wk; On Target 140 hr/wk
 TIME DIST., in house 61* %, outside 39** %
 USERS' SCHEDULING CYCLE 5 weeks
 COST, ACCELERATOR 14x10⁶ DM
 COST, FACILITY, total 24x10⁶ DM (cycl. & bldg.)
 FUNDED BY Kernforschungsanlage Jülich

ACCELERATOR STAFF, OPERATION and DEVELOPMENT

SCIENTISTS 4 ENGINEERS 2
 TECHNICIANS 13 CRAFTS 5
 GRAD STUDENTS involved during year --
 OPERATED BY -- Res staff or 8 Operators
 BUDGET, op & dev --
 FUNDED BY Kernforschungsanlage Jülich

RESEARCH STAFF, not included above

USERS, in house 30* outside 75**
 GRAD STUDENTS involved during year 5
 RES. BUDGET, in house --
 FUNDED BY Kernforschungsanlage Jülich

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 210 (cycl. vault) m²
 movable 915 (exper. rooms) m²
 TARGET STATIONS 11 in 6 rooms
 STATIONS served at same time, max 1
 MAG SPECTROGRAPH, type QQDDQ
 COMPUTER, model PDP15, PDP11
 OTHER FACILITIES In-Beam Gamma Ray Facilities; Bent Crystal Gamma Ray Spectrometer; Orange Type Beta Ray Spectrometer; Facilities for Isotope Production and Chemistry

REFERENCES/NOTES

H. Thimmel, Kerntechnik 12(1968)663
 W. Kuhlmann, J. Bojowald, C. Mayer-Böricke, J. Reich, Proc. Fifth Int. Cycl. Conf., Oxford, 1969, p. 190
 C. Mayer-Böricke, JÜL-665 KP (1970)

* Institut f. Kernphysik of KFA
 ** Other institutes of KFA, foreign and German universities

MAGNET

POLE FACE diameter 330 cm; R extraction 154 cm
 GAP, min 8.4 cm; Field 19.2 kG } at 0.18 x 10⁶
 max 24 cm; Field 7.0 kG } ampere turns
 AVERAGE FIELD at R ext 13.5 kG
 CURRENT STABILITY ±10 parts/10⁶; B_{max}/(B) 1.47
 NUMBER OF SECTORS 3; SPIRAL, max 20 deg
 POLE FACE COIL PAIRS: AVF -- /sec;
 Harmonic correction 13/sec
 Rad grad 12 /sec or Circ coils --
 WEIGHT: Fe ~700 tons; Coils 12 tons
 CONDUCTOR, Material and type copper, square hollow
 STORED ENERGY -- MJ
 COOLING SYSTEM demineralized water
 POWER: Main coils -- 50 max, kW
 Trimming coils -- 12 max, kW
 YOKE/POLE AREA -- 100 %
 SECTOR ANGLE (Sep Sec) -- deg
 ION ENERGY (Bending limit) E/A = 180 q²/A² MeV
 (Focusing limit) E/A = -- q/A MeV

ACCELERATION SYSTEM

DEES, number 3 angle 40 deg
 BEAM APERTURE 2.4 cm; DC BIAS 0 kV
 TUNED by, coarse panels fine rot. loops
 RF 20 to 30 mHz, stable ± 13 /10⁶
 Orb F 6.3 to 10 mHz; GAIN, max 240 kV/turn
 HARMONICS, RF/Orb F, used 3
 DEE-Gnd, max 45 kV, min gap 1 cm
 STABILITY, (pk-pk noise)/(pk RF volt) 8·10⁻⁴
 RF PHASE stable to ± -- deg
 RF POWER input, max 60 kW
 RF PROTECT circuit, speed 1 μsec
 Type ignitron
 FREQUENCY MODULATION, rate -- /sec
 MODULATOR, type --
 BEAM PULSE, width --

VACUUM SYSTEM

PUMPS, No., Type, Size 2, oil diffusion
80 cm diameter, 30 000 l/sec
 OPERATING PRESSURE 5 μTorr,
 PUMPDOWN TIME between 2 and 4 hrs

ION SOURCES/INJECTION SYSTEM

Livingstone type

EXTRACTION SYSTEM

El. defl., screen chann., foc. chann.

CONTROL SYSTEM

conventional

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CHARACTERISTIC BEAMS

	Particle	Goal (MeV)	Achieved (MeV)
ENERGY	p		22.5-45
	d		45-90
	³ He		67-185
	α		90-180
CURRENT		(μA)	(μA)
	Internal		
	p		>100
	d		>100
	³ He, α		> 30
External	p		> 30
	d		> 15
	³ He, α		> 8
	Secondary	(part/s)	(part/s)

BEAM PROPERTIES*

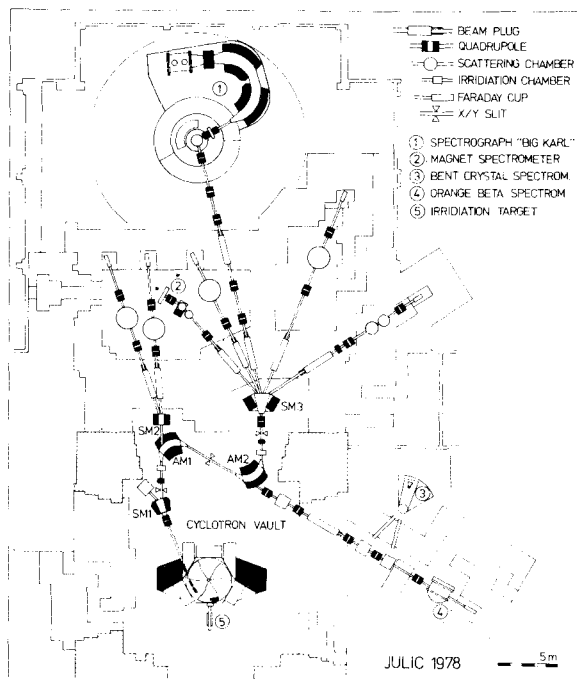
	Measured	Conditions
Pulse Width	15/7 RF deg	100/10 μA of 60 MeV d
Phase Exc, max	RF deg	μA of MeV
Extract Eff	50/75 %	10/4 μA of 60 MeV d
Res, ΔE/E	0.3/0.15 %	10/4 μA of 60 MeV d
Emittance	(mm-mrad) { 20 axial / 20,10 radial }	10/4 μA of 60 MeV d

OPERATING PROGRAMS, time dist (1977)

Basic Nuclear Physics	79.5 %
Solid State Physics Mater. Science	3.5 %
Bio-Medical Applications	%
Isotope Production	9.0 %
Development of Accelerator	3.8 %
of Experiments	2.9 %
Miscellaneous	1.3 %

* second number refers to inserted axial phase slits

PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, OPERATION SUMMARY, ADDITIONAL REFERENCES



OPERATION SUMMARY 1977:

Beam Time for Exper.	6313h	85.0 %
Scheduled Mainten.	254h	3.4 %
System Failures	858h	11.6 %
Scheduled Oper. Time	7425h	100.0 %

OTHER FEATURES

Emittance Measuring Device¹⁾

Double Monochromator²⁾

Momentum resolution $p/\Delta p$ (FWHM) > 20000, transmission ~ 2 %

Beam Pulsing³⁾

Microscopic: 1 out of 3 beam pulses
Macroscopic: Beam-fall-off time ~ μsec

Axial Phase Slits⁴⁾

7° RF, transmission 10 %

12 Beam Phase Probes

Detection on first harmonic with fixed intermediate frequency

REFERENCES :

- 1) J.Bojowald, H.Borsch, W.Kuhlmann, J.Reich, A.Retz, AIP Conference Proceedings No.9(1972), p.399
- 2) J.Reich, C.Mayer-Böricke, S.Martin, K.L.Brown, F.E.Johnson AIP Conference Proceedings No.9(1972), p.401
- 3) R.Brings, G.Lürken, P.Wucherer, Annual Report 1975, KFA-IKP 10/76, p.248
- 4) J.Reich, R.Brings, J.Linz, P.Wucherer, these proceedings