

ENTRY NO. 3

NAME OF MACHINE CYCLONE DATE JAN 79
 INSTITUTION Université Catholique de Louvain
 ADDRESS Chemin du Cyclotron, 2 - B - 1348 LOUVAIN-LA-NEUVE, Belgium

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HISTORY AND STATUS

DESIGN, date 1969 MODEL tests 1969
 ENG. DESIGN, date 1968-1969
 CONSTRUCTION, date 1969-1971
 FIRST BEAM date (or goal) 1972
 MAJOR ALTERATIONS -
 OPERATION, 168 hr/wk; On Target 140 hr/wk
 TIME DIST., in house _____ %, outside _____ %
 USERS' SCHEDULING CYCLE 8 weeks
 COST, ACCELERATOR 3 10⁶ \$
 COST, FACILITY, total 6.5 10⁶ \$
 FUNDED BY University of Louvain, State

ACCELERATOR STAFF, OPERATION and DEVELOPMENT

SCIENTISTS - ENGINEERS 3
 TECHNICIANS 9 CRAFTS 3
 GRAD STUDENTS involved during year -
 OPERATED BY _____ Res staff or 4 Operators
 BUDGET, op & dev 900.000 \$ with salaries
 FUNDED BY I.I.S.N., U.C.L.

RESEARCH STAFF, not included above

USERS, in house 38 outside 45
 GRAD STUDENTS involved during year 10
 RES. BUDGET, in house 450.000 \$ without salaries
 FUNDED BY I.I.S.N., U.C.L.

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 390 m²
 movable 1300 m²
 TARGET STATIONS 14 in 8 rooms
 STATIONS served at same time, max 1
 MAG SPECTROGRAPH, type -
 COMPUTER, model PDP 8-9-11/20-11/34
 OTHER FACILITIES remote target handling - hot chemistry - neutron beam (radio-therapy-biology) - neutron beam (polarized-unpolarized) - On-Line-Mass Separators (LISOL) - External ECR Ion
 REFERENCES/NOTES Source (Atomic beam) (1979)

MAGNET

POLE FACE diameter 215.6 cm; R extraction 9.3 cm
 GAP, min 16.6 cm; Field 21 kG } at 4 X 10⁶
 max 40.5 cm; Field 11.5 kG } ampere turns
 AVERAGE FIELD at R ext 16 kG
 CURRENT STABILITY ± 20 parts/10⁶; B_{max}/(B) 1.25
 NUMBER OF SECTORS 4; SPIRAL, max 53 deg
 POLE FACE COIL PAIRS: AVF - /sec;
 Harmonic correction 2 x 4 pairs
 Rad grad _____ /sec or Circ coils 12
 WEIGHT: Fe 200 tons; Coils 6 tons
 CONDUCTOR, Material and type Cu (20x20 φ 13 mm)
 STORED ENERGY _____ MJ
 COOLING SYSTEM desionized water
 POWER: Main coils 300 max, kW
 Trimming coils 100 max, kW
 YOKE/POLE AREA 115 %
 SECTOR ANGLE (Sep Sec) _____ deg
 ION ENERGY (Bending limit) E/A = 110 q²/A² MeV
 (Focusing limit) E/A = 93 q/A MeV

ACCELERATION SYSTEM

DEES, number 2 angle 86 deg
 BEAM APERTURE 38 cm; DC BIAS 0 kV
 TUNED by, coarse MP fine MP auto
 RF 10.6 to 23 MHz, stable ± 0.1 /10⁶
 Orb F 3.6 to 23 MHz; GAIN, max 200 kV/turn
 HARMONICS, RF/Orb F, used 1-2-3
 DEE-Gnd, max 50 kV, min gap 0.4 cm
 STABILITY, (pk-pk noise)/(pk RF volt) 10-4
 RF PHASE stable to ± 0.1 deg
 RF POWER input, max 240 kW
 RF PROTECT circuit, speed 4 μsec
 Type crowbar
 FREQUENCY MODULATION, rate - /sec
 MODULATOR, type -
 BEAM PULSE, width -

VACUUM SYSTEM

PUMPS, No., Type, Size 2x (OIL diff. 12000 l/s)
1 cryopanel 10000 l/s 15°K
 OPERATING PRESSURE 2 μTorr,
 PUMPDOWN TIME 4 hrs

ION SOURCES/INJECTION SYSTEM

~~Livingston-Jones-Internal Hot Cathode Pig External ECR Source (1979)~~

EXTRACTION SYSTEM

~~DC electrostatic + Weak Magn. Chan. +~~
 CONTROL SYSTEM Positive grad corr.
Manual

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CHARACTERISTIC BEAMS

	Particle	Goal (MeV)	Achieved (MeV)
ENERGY	p	80	95
	α	80	110
	Heavy Ions		110 Q ² /A
CURRENT		(μA)	(μA)
	Internal		
	p	100	> 2000
	α	20	> 200
External	p 40 MeV	20	50
	d 50 MeV	20	66
	α 60 MeV	20	45
	Ar ⁸⁺ (Pig)		100 en A
		(part/s)	(part/s)
Secondary	n		10 ¹⁴
	from d+Be		
	50 MeV		

BEAM PROPERTIES

	Measured	Conditions
Pulse Width	10/30 RF deg	20 μA of 33 MeV d
Phase Exc, max	RF deg	μA of MeV
Extract Eff	95 %	20 μA of 50 MeV d
Res, ΔE/E	3 %	1 μA of 40 MeV α
Emittance		

(mm-mrad)	{ 30 axial } 50 μA of 50 MeV d
	{ 70 radial }

OPERATING PROGRAMS, time dist

Basic Nuclear Physics	51 %
Solid State Physics	- %
Bio-Medical Applications	20 %
Isotope Production	10 %
Development	7.5 %
	%
	%

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

An external Electron Cyclotron Resonance (ECR) Ion Source is under construction : it will provide heavy ions beams up to ⁸⁴Kr ; fully stripped ions up to ¹⁶O and ions like ⁴⁰A¹⁴⁺ could be accelerated.

