

ENTRY NO. C8 Date June 20/92
 Name of Machine HIRFU Separated Sector Cyclotron (Main Accelerator)
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HISTORY
 MILESTONE DATES:
 Design 1976 Model Tests 1976
 Construction 1978 First Beam Dec.12, 1988
 DESIGN/CONSTRUCTION BY:
 in house YES other engineering contracts
 COST: Accelerator 100 M yuans Facility 140 M yuans
 FUNDED BY: State Planning Commission, CAS

STATUS
 STAFF: Machine
 Scientists 40 Engineers 50
 Technicians 60 Students 10
 Research (in house/external)
 Scientists / Engineers /
 Technicians / Students /
 BUDGET: Machine 10 M yuans Funded by SPC
 Research 2 M yuans Funded by CAS
 TIME DISTRIBUTION:
 Basic Research (in house/external) 40 % / 11 %
 Applied Program (in house/external) 10 % / 5 %
 Development 14 % Maintenance 20 %

MAGNET
 POLE PARAMETERS:
 Diameter 7.17 cm R_{extract} 321 cm R_{inject} 100 cm
 HILL PARAMETERS: Gap (min) 10 cm B_{max} 16 T
 (@ AT) Gap (max) 10 cm B_{min} 6 T
 VALLEY PARAMETERS: Gap (min) cm B_{max} T
 (@ AT) Gap (max) cm B_{min} T
 AVERAGE FIELD: < B >_{min} 0.35 T < B >_{max} 0.92 T
 NUMBER OF SECTORS: compact/separated / 4
 sector angle 52° deg. spiral (max) deg.
 FIELD TRIMMING: Trim Coils 36
 Harmonic Coils
 Other
 CURRENT: Main Coils 4000 Amps Stability 5 e⁻⁶
 Trim Coils 300 Amps Stability 5 e⁻⁵
 Stored Energy (cryogenic) MJ
 WEIGHT: Iron 2000 tons Conductor 15.6 tons
 ION ENERGY: Bending Limit E/A = 450 q²/A² MeV/u
 Focussing Limit E/A = q/A MeV/u

ACCELERATION SYSTEM
 FUNDAMENTAL ACCELERATION:
 Description: 1/2 lambda / 2 resonators
 No. of Gaps/turn 4 dE/dn(max) 1.0 MeV/q
 Voltage(max) 250 MV Harmonic f_{rf}/f_{ion} 2, 4, 6
 Freq 6.5-14 MHz Power in(max) 0.24 MW
 Stability: Phase 1° Voltage 10⁻³
 OTHER CAVITIES (Flattopping or otherwise):
 Description:
 Region of Influence: R_{min} cm R_{max} cm
 No. of Gaps/turn dE/dn(max) MeV/q
 Voltage(max) MV Harmonic f_{rf}/f_{ion}
 Freq MHz Power in(max) MW
 Stability: Phase Voltage

VACUUM SYSTEM
 OPERATING PRESSURE: 10⁻⁵ Pa
 PUMPS: No. and type 4 HIRFU 800 cryo-pumps with
 rough pumping system

ION SOURCE(S)

Type	Intensity (mA)	ε _n = βγε (πmm mrad)	Ion Species
(a) ECR	0.1-0.3	200	C-Ta
(b)			
(c)			
(d)			

INJECTION SYSTEM
 bending magnets + deflector + magnetic channels Efficiency 50 %

EXTRACTION SYSTEM
 bump+deflector+magnetic channels+bending magnets Efficiency 50 %

CHARACTERISTIC BEAMS

Accelerated Ions	E/A (MeV/u)	Current(part μA)	
		Internal	External
(a) C ⁶⁺	50		0.07
(b) C ⁶⁺	75		0.07
(c) O ⁸⁺	50		0.05
(d) Ar ¹⁶⁺	25		

Secondary Particles	E (MeV)	part/sec
(a)		
(b)		
(c)		

EXTRACTED BEAM PROPERTIES:
 For 0.4 μA of 50 MeV/u C⁶⁺ ions
 ΔE/E 0.3 % Δφ 7 °rf
 ε_n = βγε x 7 πmm mrad z 7 πmm mrad

FACILITIES FOR RESEARCH
 SHIELDED AREA: Fixed 1456 m² Moveable m²
 Target Stations: 8 No. Served At Same Time:
MAGNETIC SPECTROMETERS:
OTHER FACILITIES: Isotope Separator, In-beam γ-ray Measuring Device, Heavy Ion Telescope, Ionization Chamber, Scattering Chamber, Fast Chemistry Separation Apparatus, Material Science Terminal, Atomic Physics Terminal

REFERENCES/NOTES
 (a)
 (b)

