

ENTRY NO. CM1 Date October 9, 1995  
 Machine Name CYCLONE 3  
 Manufacturer ION BEAM APPLICATIONS (IBA)  
 Address Rue Jean Lenoir 6 - 1348 Louvain-la-Neuve, BELG  
 Tel 32-10-47.58.11 Telex  
 Fax 32-10-47.58.10 E-MAIL  
 In Charge: Yves JONGEN Reported by: Françoise VAMECQ

**HISTORY AND STATUS**

DATES: Design 1989 First Machine 1990  
 SALES: No. Sold/Operational 4 / 2 Currently Available Y  
 COST: Accelerator Facility

**MAGNET**

**POLE PARAMETERS:**

Diameter 50 cm  $R_{extract}$  20.5 cm  $R_{inject}$  2 cm  
 HILL PARAMETERS: Gap (min) 3.4 cm  $B_{max}$  1.95 T  
 (@ AT) Gap (max) cm  $B_{min}$  T  
 VALLEY PARAMETERS: Gap (min) 5 cm  $B_{max}$  1.70 T  
 (@ AT) Gap (max) cm  $B_{min}$  T  
 AVERAGE FIELD:  $\langle B \rangle_{min}$  1.85 T  $\langle B \rangle_{max}$  T  
 NUMBER OF SECTORS: compact/separated 4 /  
 sector angle 40 deg. spiral (max) deg.  
 FIELD TRIMMING: Trim Coils  
 Harmonic Coils  
 Other  
 CURRENT: Main Coils 225 Amps Stability  $10^{-4}$   
 Trim Coils Amps Stability  
 Stored Energy (cryogenic) MJ  
 WEIGHT: Iron 5 Tons Conductor 0.5 Tons  
 ION ENERGY: Bending Limit E/A = 15.2 q<sup>2</sup>/A<sup>2</sup> MeV/u  
 Focusing Limit E/A = 15.2 q/A MeV/u

**ACCELERATION SYSTEM**

**FUNDAMENTAL ACCELERATION:**

Description: 2 x 90° Dees  
 No. of Gaps/turn 4 dE/dn(max) 0.08 MeV/q  
 Voltage (max) 0.02 MV Harmonic  $f_r/f_{ion}$  2  
 Freq 30 MHz Power in(max) 10 kW MW  
 Stability: Phase +/- 10 % Voltage  $10^{-3}$

**VACUUM SYSTEM**

OPERATING PRESSURE:  $8 \cdot 10^{-5}$  mbar  
 PUMPS: (No. and type) 1 x 300 l/sec ODP

**ION SOURCE(S)**

Type	Intensity (mA)	@	$\epsilon_n = \beta\gamma\epsilon$ ( $\pi$ mm mrad)	Ion Species
(a) PIC cold	1			deuteron
(b) cathode				

**INJECTION SYSTEM**

Efficiency %

**EXTRACTION SYSTEM**

Deflector Efficiency 70 %

**CHARACTERISTIC BEAMS**

Accelerated Ions	E/A (MeV/u)	Current (part. $\mu$ A)	
		Internal	External
(a) deuteron	1.90	100	70
(b)			

**EXTRACTED BEAM PROPERTIES:**

For  $\mu$ A of MeV/u ions  
 $\Delta E/E$  %  $\Delta\phi$  \*rf  
 $\epsilon_n = \beta\gamma\epsilon$  x  $\pi$  mm mrad z  $\pi$  mm mrad

**REFERENCES/NOTES**

(a) EPAC 1990, Y. Jongen et al., Nice 1990  
 (b)

ENTRY NO. CM2 Date October 9, 1995  
 Machine Name CYCLONE 10/5  
 Manufacturer ION BEAM APPLICATIONS (IBA)  
 Address Rue Jean Lenoir 6 - 1348 Louvain-la-Neuve, BELG  
 Tel 32-10-47.58.11 Telex  
 Fax 32-10-47.58.10 E-MAIL  
 In Charge: Yves JONGEN Reported by: Françoise VAMECQ

**HISTORY AND STATUS**

DATES: Design 1988 First Machine 1989  
 SALES: No. Sold/Operational 2 / 2 Currently Available Y  
 COST: Accelerator Facility

**MAGNET**

**POLE PARAMETERS:**

Diameter 76 cm  $R_{extract}$  35 cm  $R_{inject}$  2 cm  
 HILL PARAMETERS: Gap (min) 3 cm  $B_{max}$  1.9 T  
 (@ 112.000 AT) Gap (max) cm  $B_{min}$  T  
 VALLEY PARAMETERS: Gap (min) 80 cm  $B_{max}$  0.4 T  
 (@ AT) Gap (max) cm  $B_{min}$  T  
 AVERAGE FIELD:  $\langle B \rangle_{min}$  1.3 T  $\langle B \rangle_{max}$  1.3 T  
 NUMBER OF SECTORS: compact/separated 4 /  
 sector angle 50 deg. spiral (max) 0 deg.  
 FIELD TRIMMING: Trim Coils None  
 Harmonic Coils None  
 Other  
 CURRENT: Main Coils 200 Amps Stability  $5 \cdot 10^{-5}$   
 Trim Coils N/A Amps Stability N/A  
 Stored Energy (cryogenic) N/A MJ  
 WEIGHT: Iron 12 Tons Conductor 1.250 Tons  
 ION ENERGY: Bending Limit E/A = 11 q<sup>2</sup>/A<sup>2</sup> MeV/u  
 Focusing Limit E/A = 11 q/A MeV/u

**ACCELERATION SYSTEM**

**FUNDAMENTAL ACCELERATION:**

Description: 2 x 30° Dees on  $\lambda/2$  Vertical Stems  
 No. of Gaps/turn 4 dE/dn(max) 0.104 MeV/q  
 Voltage (max) 0.03 MV Harmonic  $f_r/f_{ion}$  2p/4d  
 Freq 40 MHz Power in(max) 0.010 MW  
 Stability: Phase +/- 10 % Voltage  $2 \cdot 10^{-3}$

**VACUUM SYSTEM**

OPERATING PRESSURE:  $3 \cdot 10^{-6}$   
 PUMPS: (No. and type) 2 x 2000 l/sec ODP

**ION SOURCE(S)**

Type	Intensity (mA)	@	$\epsilon_n = \beta\gamma\epsilon$ ( $\pi$ mm mrad)	Ion Species
(a) PIC	1 DC			H <sup>+</sup>
(b) PIC	1 DC			d <sup>+</sup>

**INJECTION SYSTEM**

2 Internal Sources Efficiency 10 %

**EXTRACTION SYSTEM**

Stripping Efficiency 100 %

**CHARACTERISTIC BEAMS**

Accelerated Ions	E/A (MeV/u)	Current (part. $\mu$ A)	
		Internal	External
(a) H <sup>+</sup>	10	100	100
(b) d <sup>+</sup>	2.5	50	50

**EXTRACTED BEAM PROPERTIES:**

For  $\mu$ A of MeV/u ions  
 $\Delta E/E$  %  $\Delta\phi$  \*rf  
 $\epsilon_n = \beta\gamma\epsilon$  x  $\pi$  mm mrad z  $\pi$  mm mrad

**REFERENCES/NOTES**

(a) EPAC 1990, Y. Jongen et al., Nice 1990  
 (b)