



MAX-IV optics

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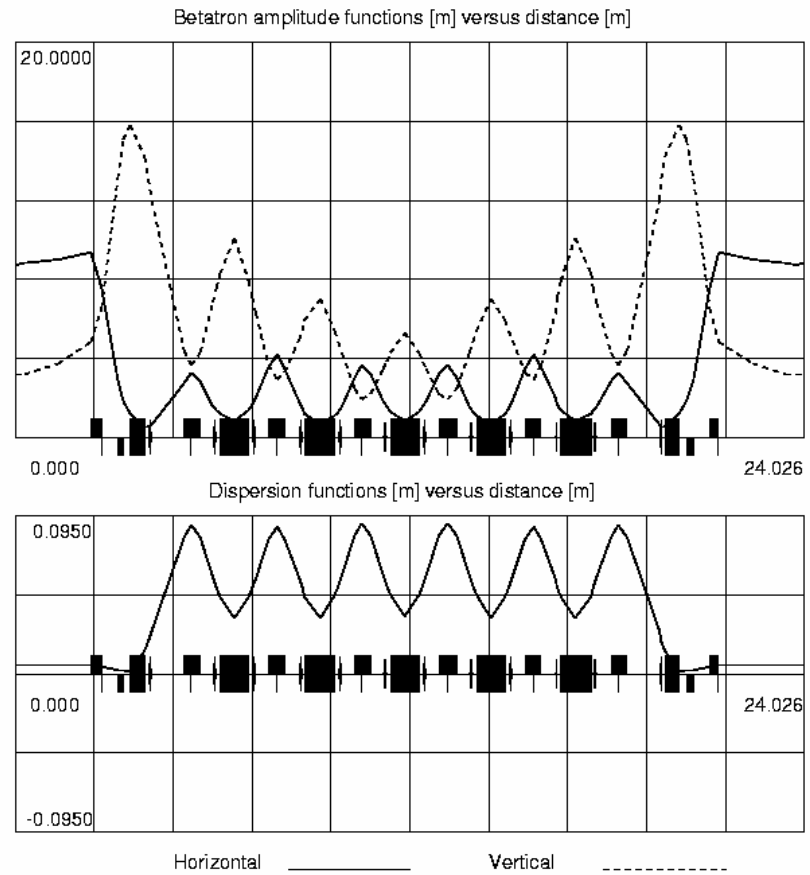
Damping Rings Workshop - Daresbury Laboratory, UK. 27-29 Jan. 2003



MAX-IV Machine Parameters

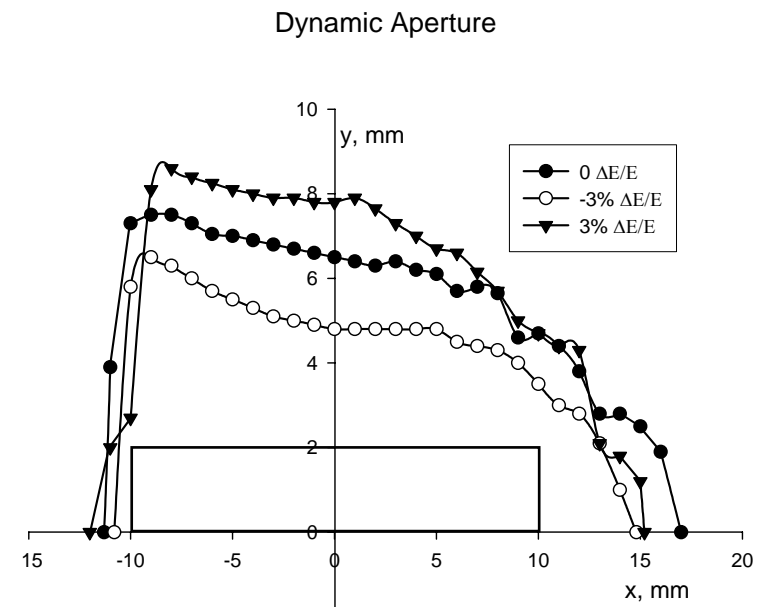
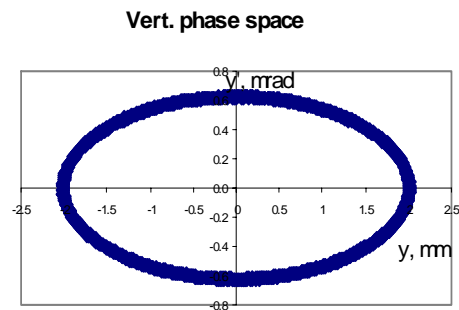
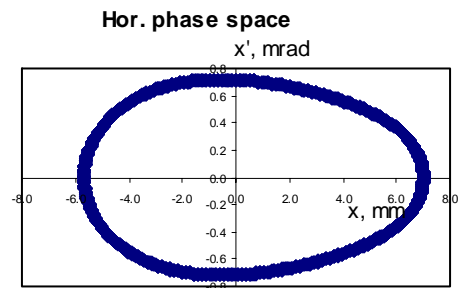
	<u>X-ray ring</u>	<u>Soft X-ray ring</u>
Ring circumference (m)	285	285
Operating energy (GeV)	3	1.5
Circulating current (A)	0.5	0.5
Rad energy loss/turn (keV)	770	50
Hor emittance (nm rad)	1.1	0.29
Qx	26.6	26.6
Qy	9.6	9.6
Nat. Hor. Chromaticity	-33	-33
Nat. Vert. Chromaticity	-29	-29
Hor. Admittance ($\mu\text{m rad}$)	17	17
Vert . Admittance ($\mu\text{m rad}$)	1.25	2.8
Energy acceptance (%)	4	4
Nr of straight sections	12	12
Length of straight section (m)	4.6	4.6
Beam 1/e lifetime		
Touschek (h)	18	28.6
El scattering (h)	131	73
Bremsstrahlung (h)	195	195
Total (h)	14.6	18.6
RF (MHz)	100	100
RF Power (kW)	600	200

Machine functins



Phase Space and Dynamic Aperture

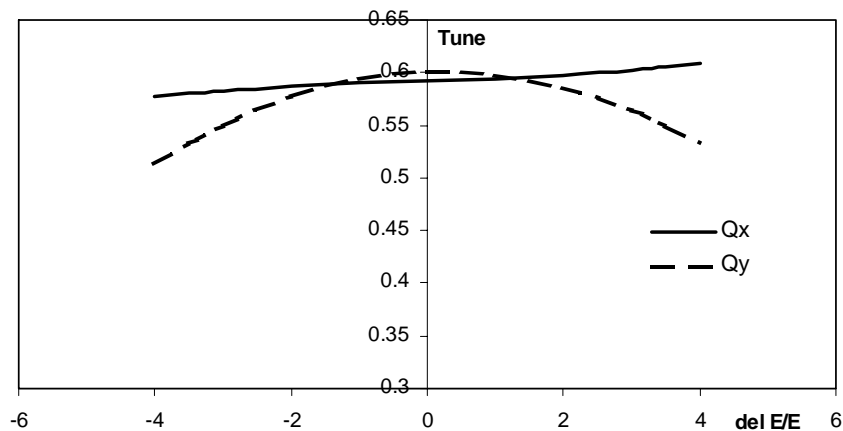
-The inclusion of sextupolar fields reduce the maximum stable oscillation for the particles (Dynamic Aperture).



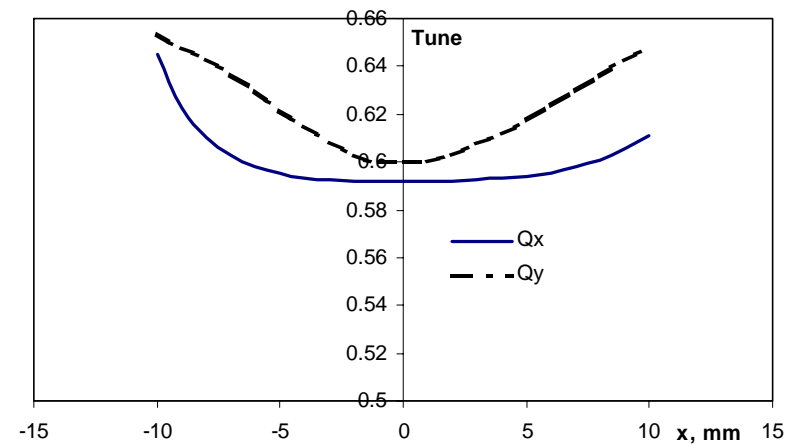
Tune Shift

- Sextupole fields introduce chromatic and geometric aberrations.
- Sextupole component in dispersion-free section and Octupole component were introduced to minimise tune shift with energy deviation and oscillation amplitude.

Tune shift vs. energy deviation



Tune shift with oscillation amplitude





MAX-IV magnets

	Number	Length (m)	B_0 (T)	B' (T/m)	B'' (T/m ²)	B''' (T/m ³)
Dipole 1	60	0.9	0.9	-10.5	-	-
Dipole 2	24	0.45	1.3	-10.8	-	-
F.Quad.1	72	0.5	-	27	600	6850
F.Quad.2	24	0.3	-	25	-110	-
D. Quad.	24	0.2	-	-22	-100	-
V. Sext.	144	0.1	-	-	-2160	-

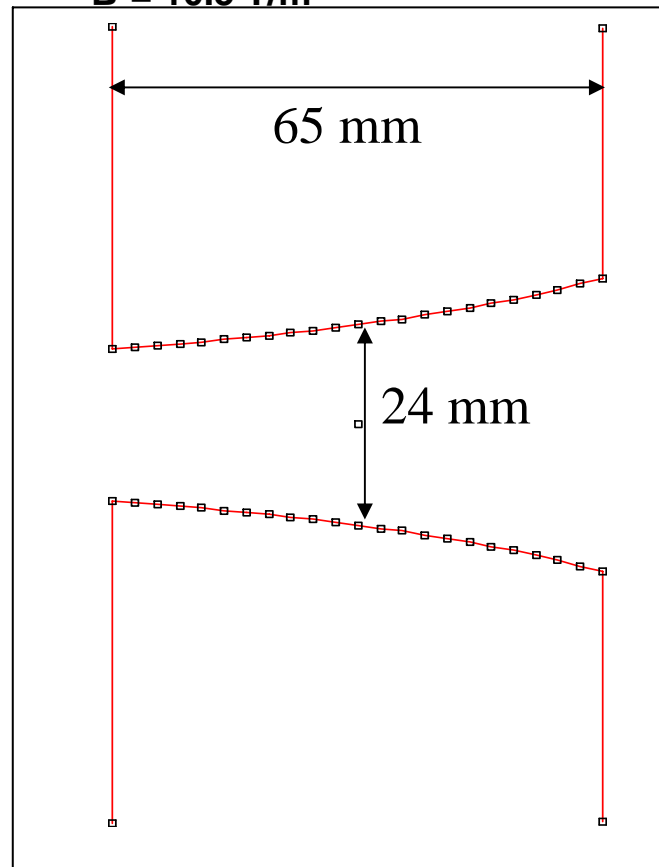
Pole profile for the combined bending magnets

-The small aperture size allows for strong multipole magnet.

Dipole 1:

$$B_0 = 0.9 \text{ T}$$

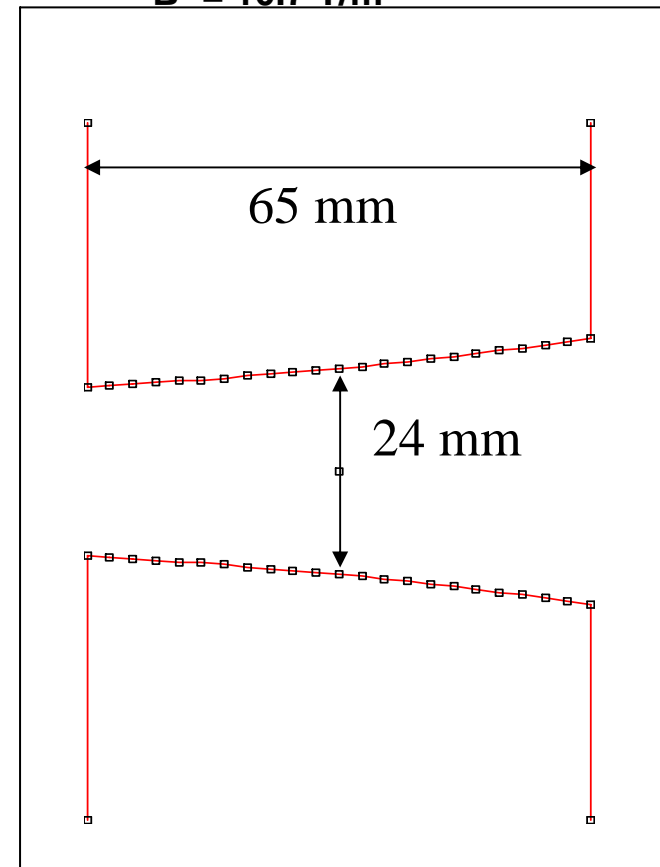
$$B' = 10.5 \text{ T/m}$$



Dipole 2:

$$B_0 = 1.3 \text{ T}$$

$$B' = 10.7 \text{ T/m}$$



Pole profile for the combined Quadrupole magnet

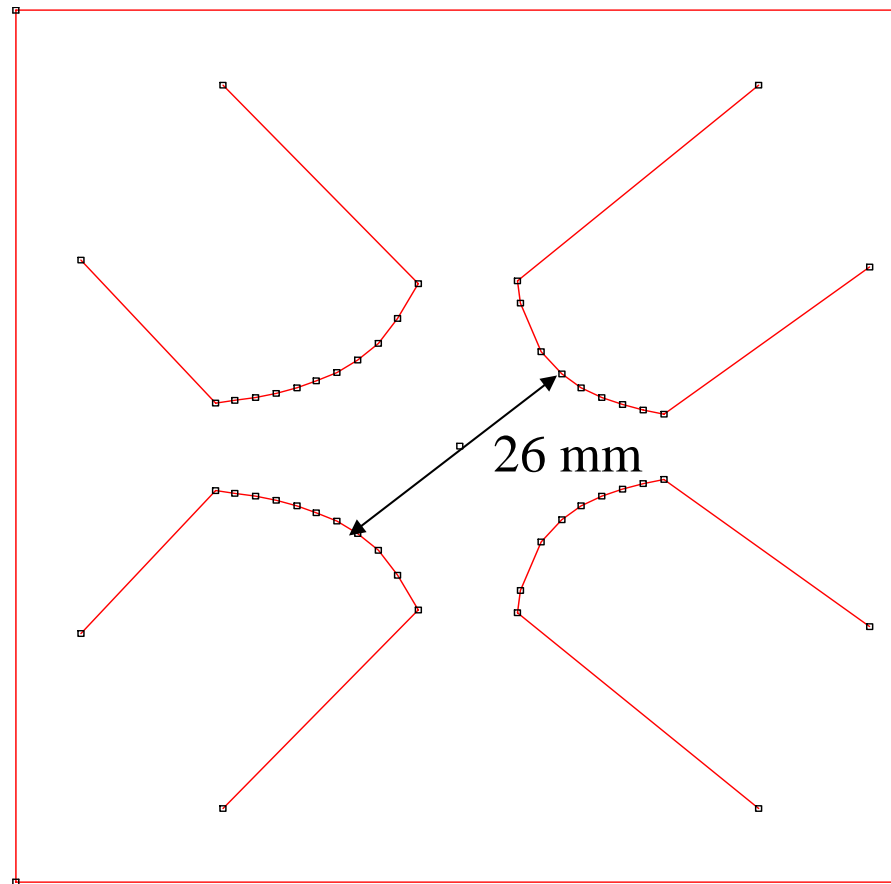


-The integrated components are:

1- Quadrupole $B' = 27 \text{ T/m}$

2- Sextupole $B'' = 600 \text{ T/m}^2$

3- Octupole $B''' = 6850 \text{ T/m}^3$



Permanent magnet for the lattice magnets

- With full energy injector, an interesting alternative is to use permanent magnet.
- Rare Earth Cobalt (SmCo) shows high radiation resistance and temperature stability (low remanence field loss).

