Marco Negrazus :: Magnet Section :: Paul Scherrer Institute

Magnets for SLS 2.0 (1)

DSL-2/SLS 2.0 Meeting October 12th 2020

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- Electrical Quadrupoles
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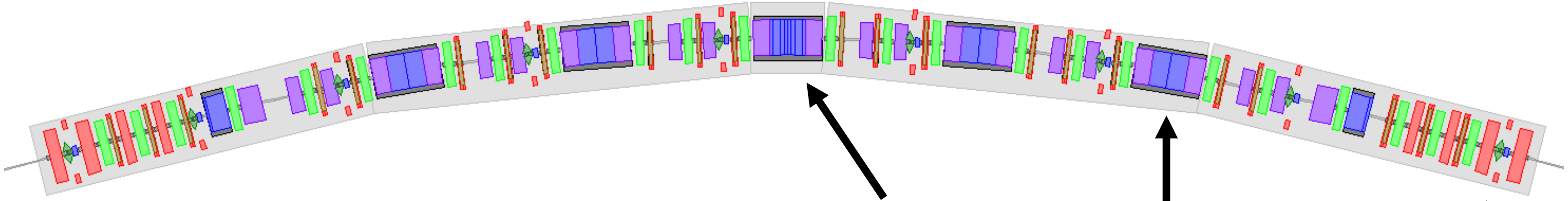
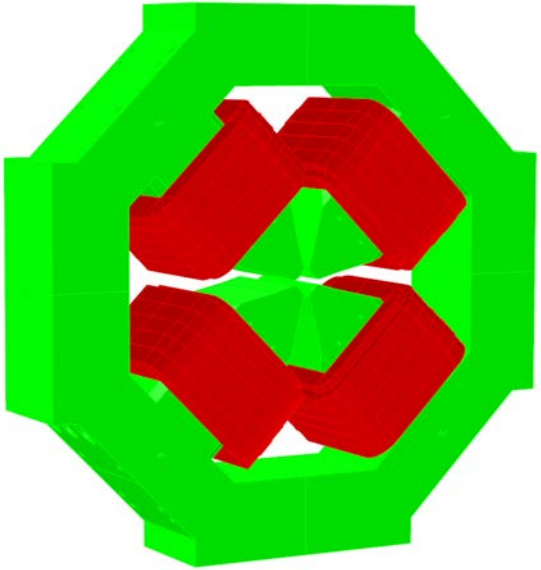
- BN Dipole
- VB combined Dipole – Quadrupole
- Triplet VB-BN-VB

Electrical Quadrupoles QP and QPH

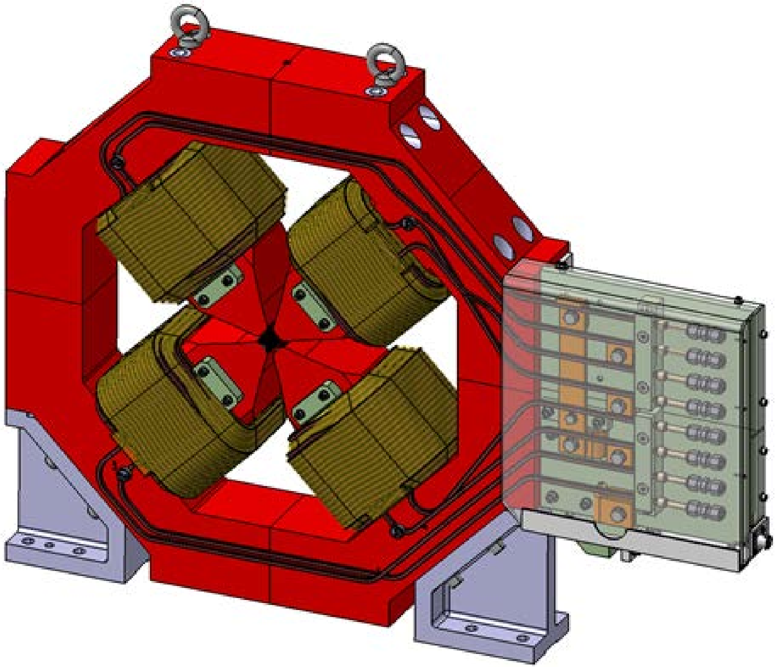




Quadrupoles

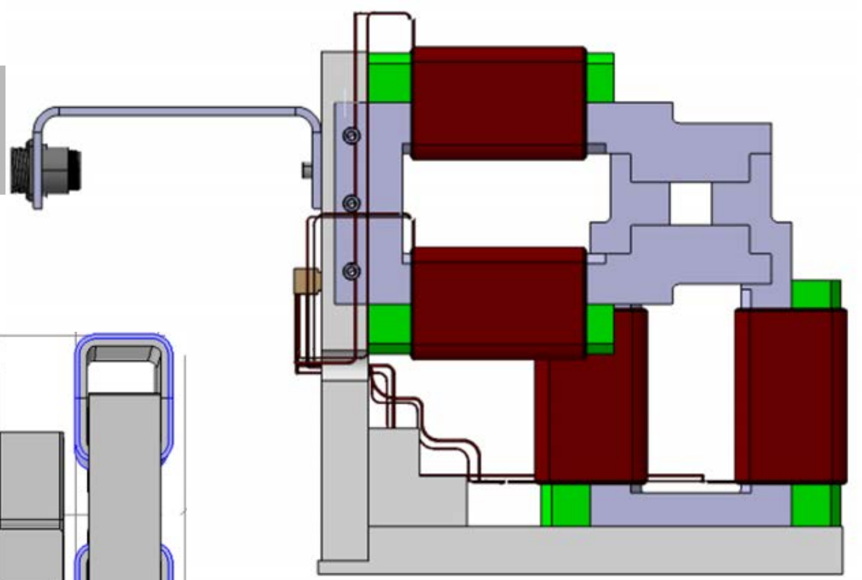
- 2 Typs with 90 and 130 mm yoke length
- Low carbon steel
- Water cooled

Electrical Quadrupoles QP and QPH

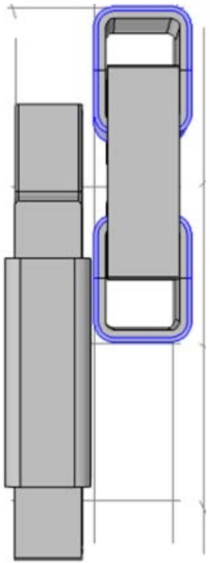


	QP	QPH
Length total [mm]	170	210
Length mag [mm]	100	140
Length yoke [mm]	90	130
Spec. gradient [T/m]	93	98
Aperture radius [mm]	10.5	10.5
Pole Tip Field [T]	0.98	1.03
Number	53	55
I max. [A]	70	70
Resistivity [Ohm]	0.164	0.191
Power max. [W]	803	938
Conductor [mm]	5x5x3	
Windings	75	
Cooling circuit	one per pole	
Delta P [bar]	4	
Delta T [°]	5.2	6.7

Electrical corrector CHV



«Fast» Magnet
Laminated yoke



Side view

Aperture, mm	25
Total Length, mm	95
Integral B.dL, mTm	2 x 3.6
Maximal deflection, mrad	2 x 0.4
Turns number (3 pairs of coils)	4*161+2*81
Current, A	5
Total power (W)	28
Weight (kg)	22
Quantity	115

Permanent Magnets

NdFeB

Properties	B_r		H_{cB}		H_{cJ}		$(BH)_{max}$		Temp. Coef.		T_w
Grade**	Typical mT	Typical gauss	min kA/m	min oersteds	min kA/m	min oersteds	Typical kJ/m^3	Typical MGOe	$\alpha(B_r)$ %/°C	$\alpha(H_{cJ})$ %/°C	max °C
N45UH	1350	13500	995	12500	1910	24000	358	45	-0.12	-0.465	180

Block size [mm] 54 x 47 x 30

Temperature drift control by NiFe thermo shunts (better than -0.02 %/°C)

Magnet constrains

- C Type magnets to insert the vacuum chamber
- No space → Cross talk

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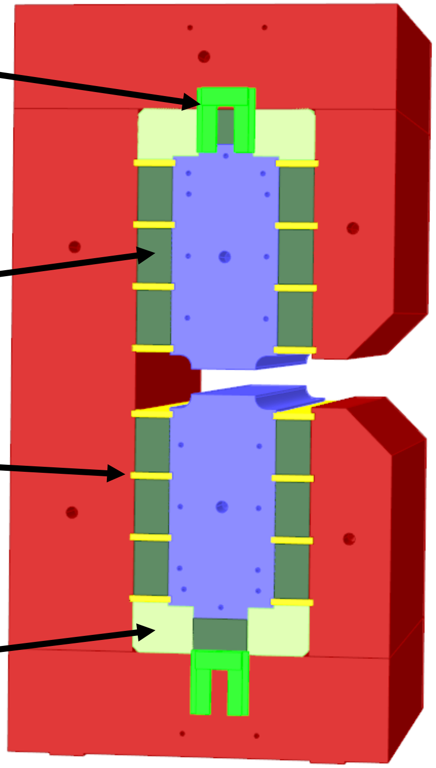
Permanent Magnet BN

Moderator plate
(0.4 % of integral)

PM

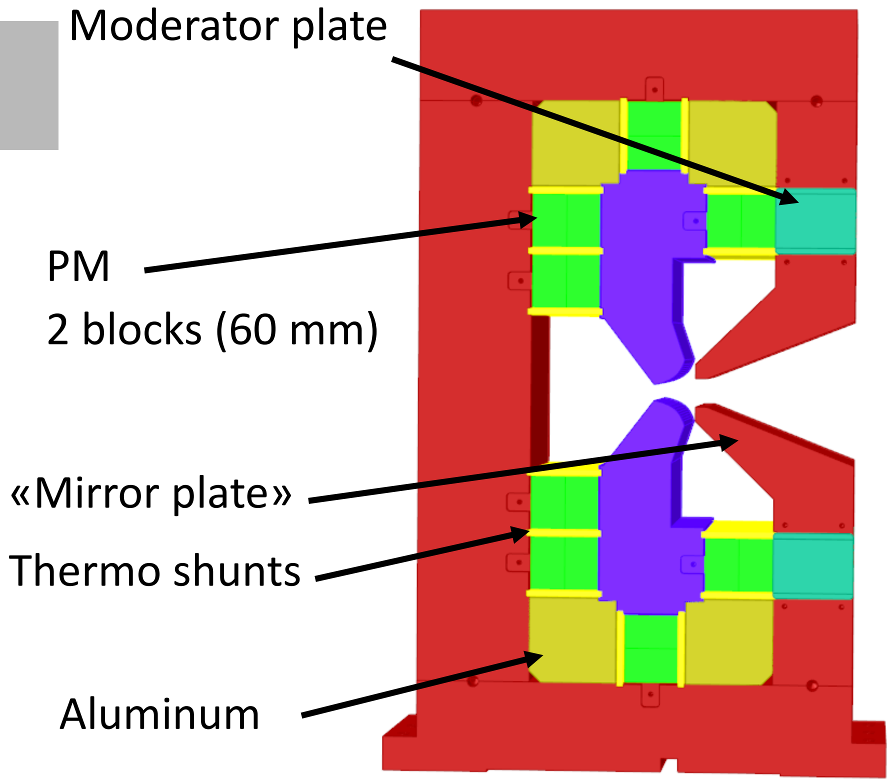
Thermo shunts

Aluminum



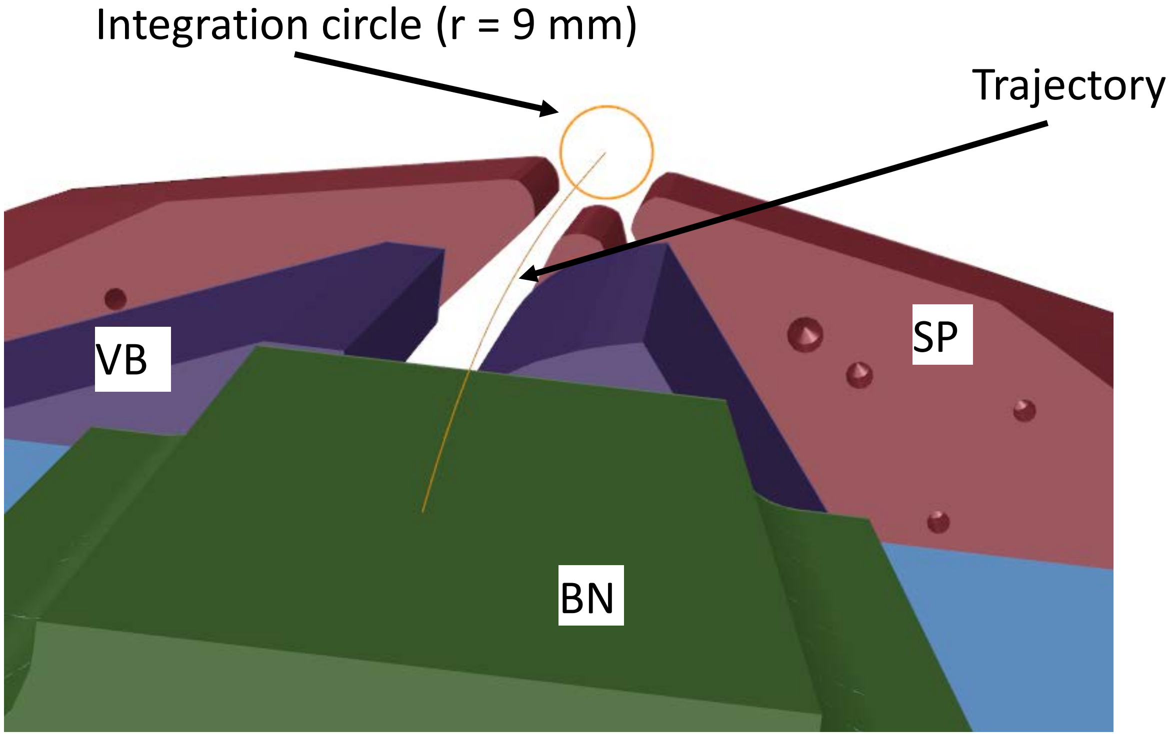
BN	
Length mag [mm]	405
B [T]	1.351
Gap [mm]	22
Angle [deg]	3.48
Number	56
PM blocks	98
Block size [mm]	54 x 47 x 30
Thermo shunts	16

Permanent Magnet VB



VB	
Length mag [mm]	185
B [T]	0.849
Gradient [T/m]	-40.643
Angle [deg]	1.0
Aperture Radius [mm]	11
Pole tip field [T]	0.919
Beam – QP center [mm]	20.89
Number	96
PM blocks	48
Block size [mm]	54 x 47 x 30
Thermo shunts	14

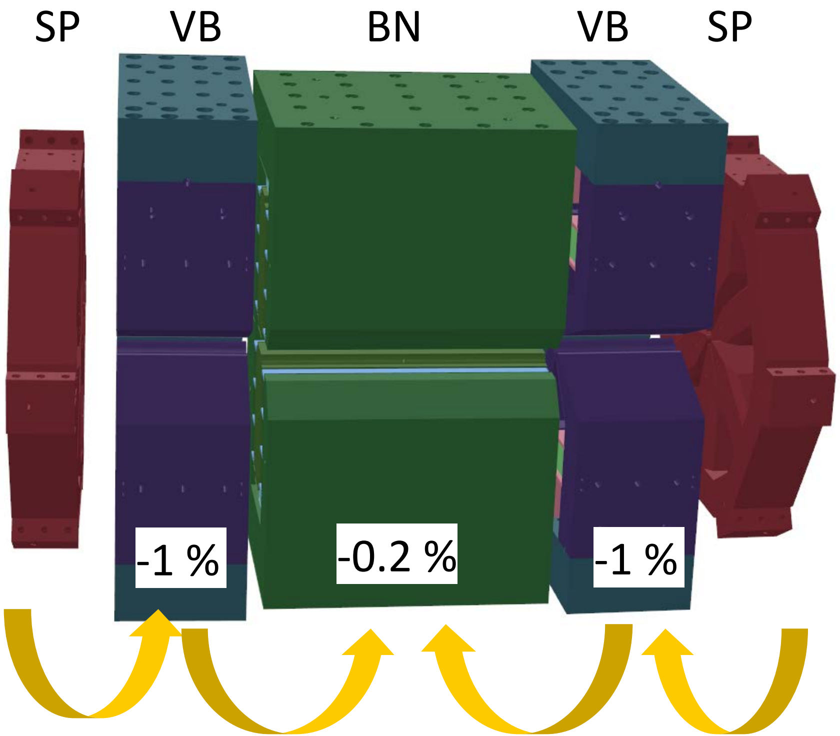
Permanet Magnets VB-BN-VB Triplet



The B field is calculated along the beam trajectory.

Permanent Magnets VB-BN-VB Triplet

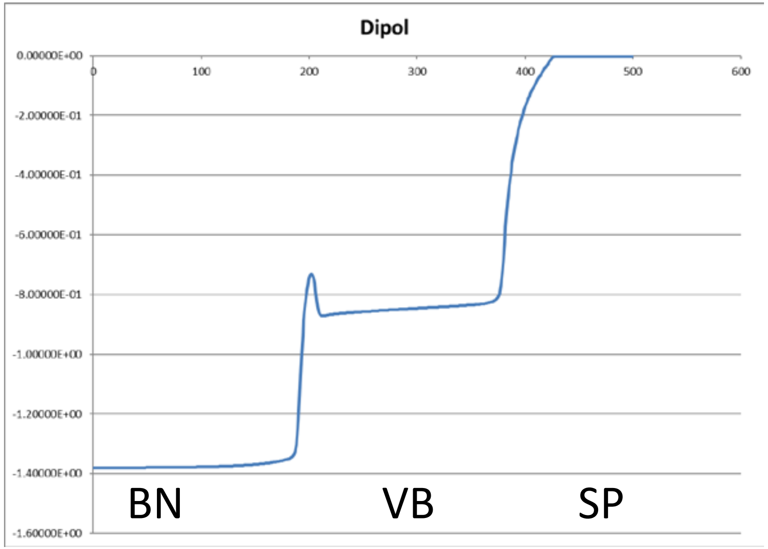
Due to strong cross talk the BN and VB and the first neighbour magnet are simulated together.

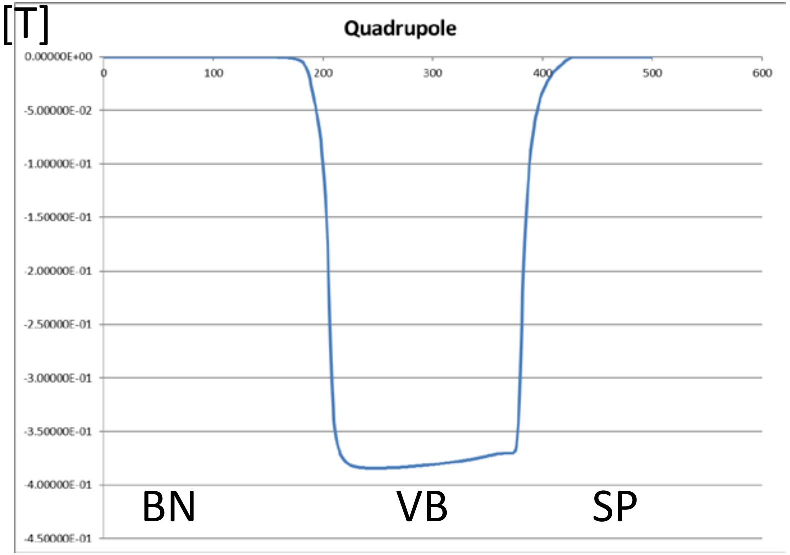


Permanent Magnets VB-BN-VB Triplet

Field harmonics along the trajectory (x-axis [mm], y-axis By [T] amplitude on the circle at radius 9 mm

[T]





Triplet measurement and tuning procedure:

1. Optimizing Triplet + SP in simulation
2. Calculate the naked magnets
3. Adjusting each magnet on the measuring bench to the calculated strength

My thanks go to

- Magnet Section