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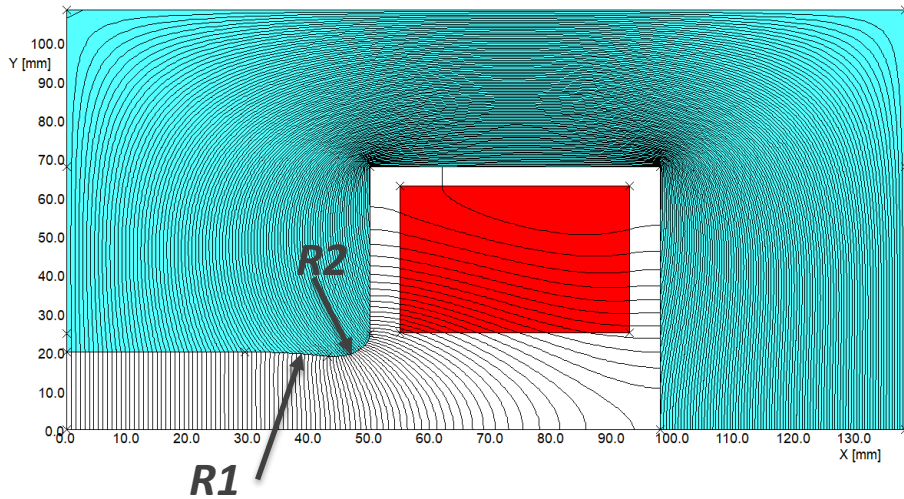
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## **EIC RCS Dipole Magnet**

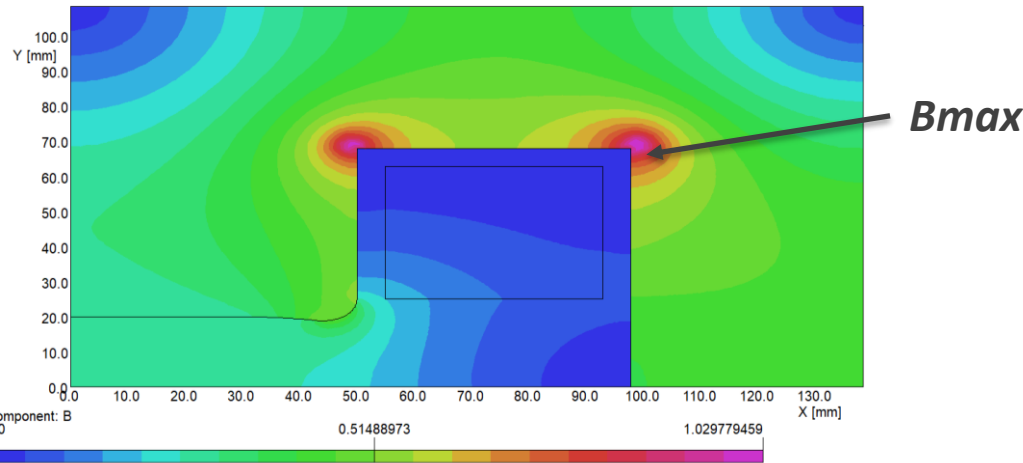
Vladimir Kashikhin  
FNAL-JLAB Meeting  
April 12, 2023

# RCS Dipole 2D Simulation

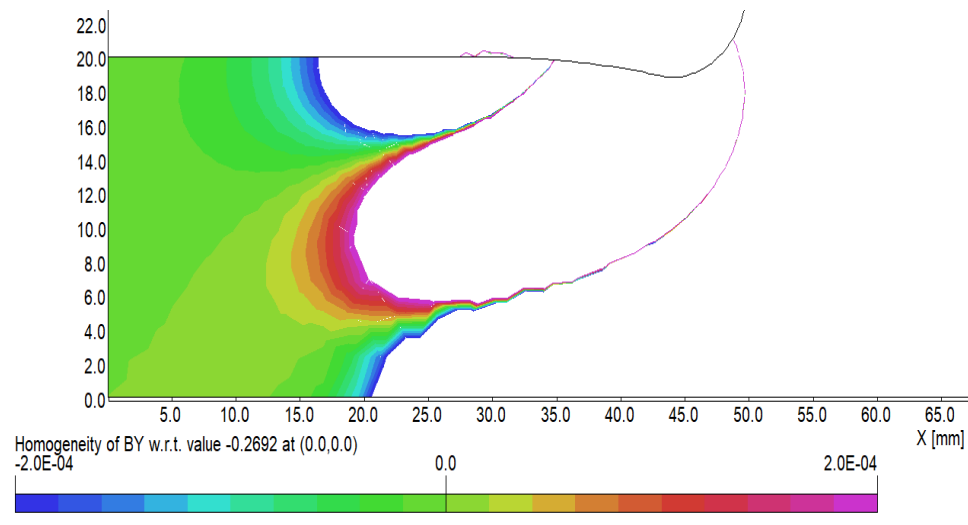
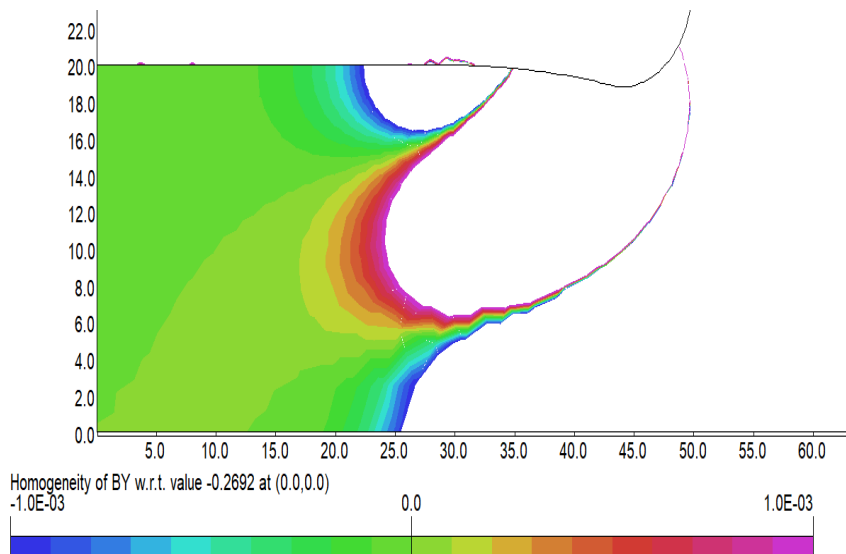


Coil ampere-turns 4100 A.  
Center field 0.25523 T.  
Iron peak field  $B_{max}=1.03$  T.  
Pole profile optimized to obtain the best field homogeneity in the magnet gap by variations:

- Pole width, pole shim height, and radiuses R1, R2.
- Besides the pole contour is smooth and has uninterrupted  $dy/dx$  derivative to eliminate high order harmonics.



# RCS Dipole 2D Field Homogeneity



Field homogeneity area +/- 0.1%.

Field homogeneity area +/- 0.02%.

# RCS Dipole 3D Field

11/Apr/2023 15:17:09

Surface contours: B

1.763188E+00

1.600000E+00

1.400000E+00

1.200000E+00

1.000000E+00

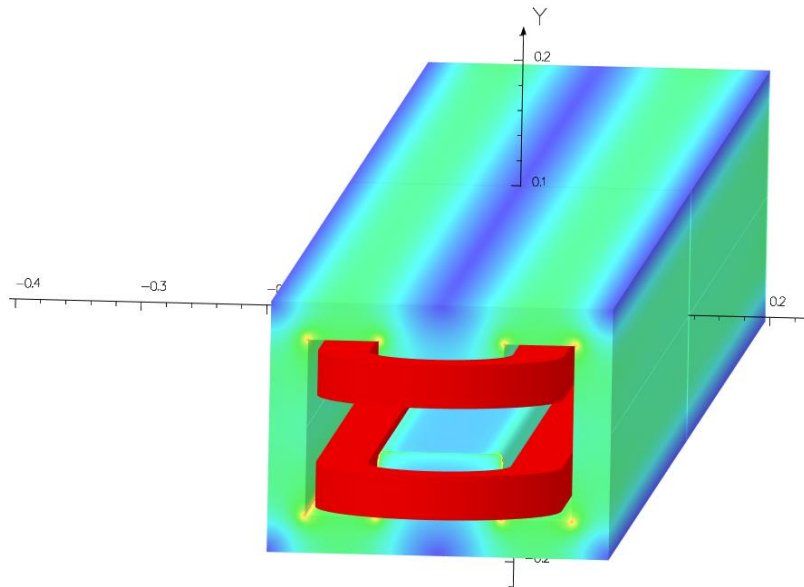
8.000000E-01

6.000000E-01

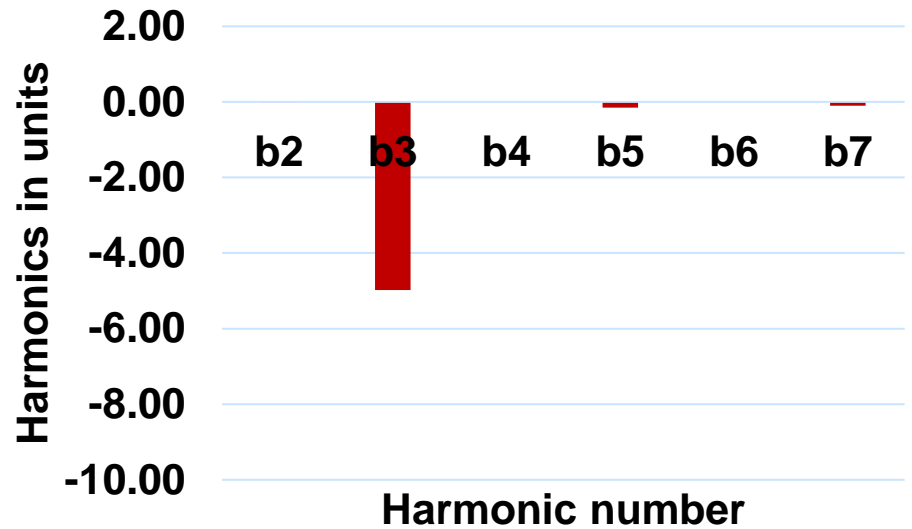
4.000000E-01

2.000000E-01

8.723285E-03



Iron core flux density.  
 $B_{max}=1.4$  T (in corners).



Integrated field harmonics in  
units ( $10^{-4}$ ).  
Integrated field 0.491 T-m.

# RCS Dipole Specification

Parameter	Unit	Value
Number of magnets		768
Magnetic length	m	1.923
Gap	mm	40
Gap minimum field	T	0.013
Gap maximum field	T	0.256
Field quality at Rref=15 mm	%	0.1
Current ramp time	s	0.1
Current pulses repetition rate	Hz	1.0
Field integrated strength	T-m	0.4923
Maximum water pressure drop	psi	80
LCW water inlet temperature (max)	C	30
LCW water rise temperature (max)	C	5.5

# RCS Dipole Parameters

Parameter	Unit	Value
Cu conductor Luvata 8534	mm	20 x 35
Cooling hole diameter	mm	10.5
Coil number of turns/pole		2
Number of racetrack coils		2
Magnet resistance	mOhm	0.57
Peak current	A	1931
Peak voltage	V	2.9
Average power losses	kW	0.18
Number water cooling circuits		1
Water pressure drop	psi	5.0
Water flow velocity	m/s	1.0
Total water flow	gpm	1.4
Water temperature rise	C	0.5

# RCS Dipole Cross-Section

