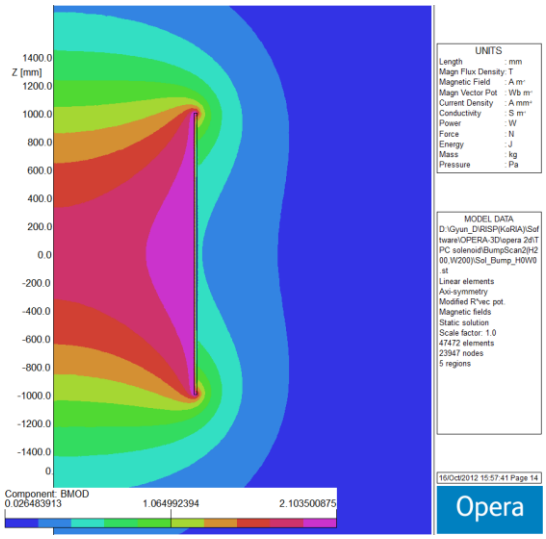
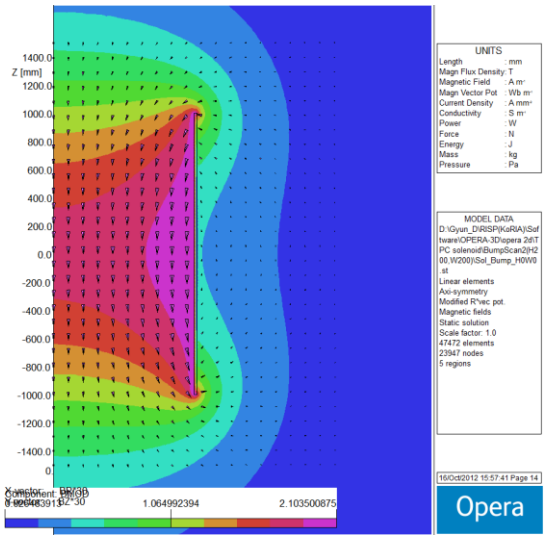
TPC solenoid simulation results_02 (20121102)

- Field distribution of 2m length solenoid (Diameter: 2m)

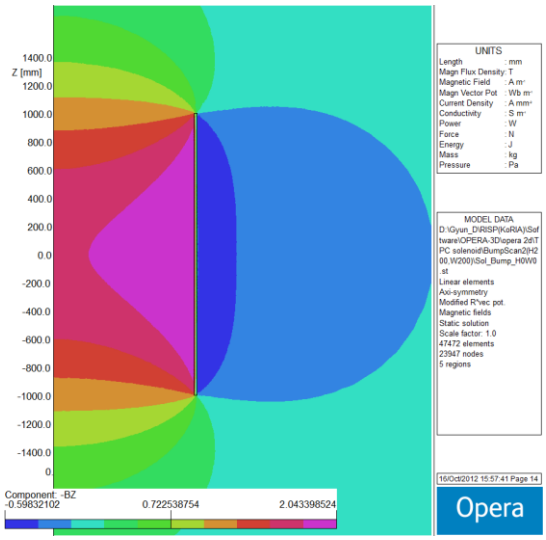
(Coil thickness: 20 mm, Current density: 100A/mm^2)



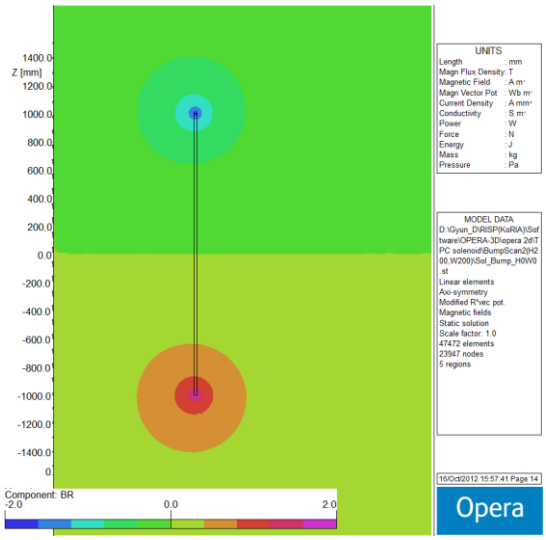
H0W0_Bmod



H0W0_Bmod (with B vector)



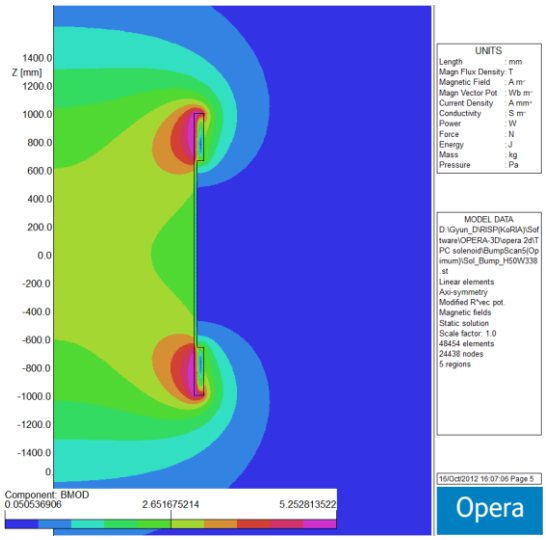
H0W0_(-Bz)



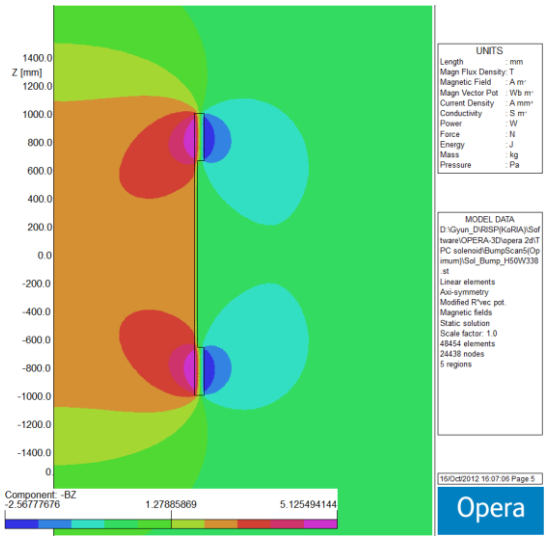
H0W0_Br

- B0(center): 1.7587102284 T
- Bmax(coil): 2.1035008753 T
- SDB_D(TPC): 0.0652953062
- SDB_S(Solenoid): 0.128221905

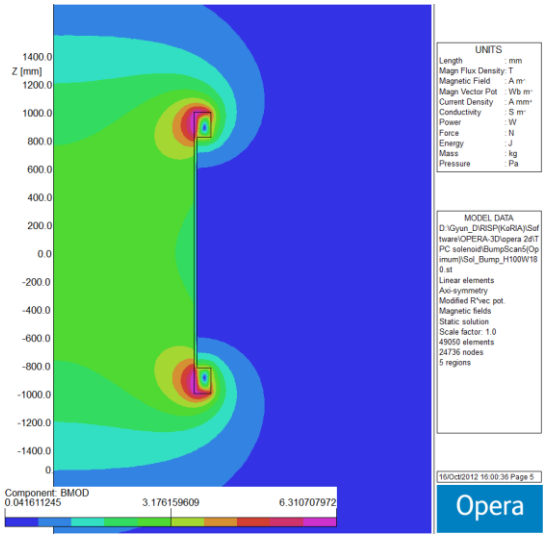
- Field distribution of TPC solenoid with optimized bump coil



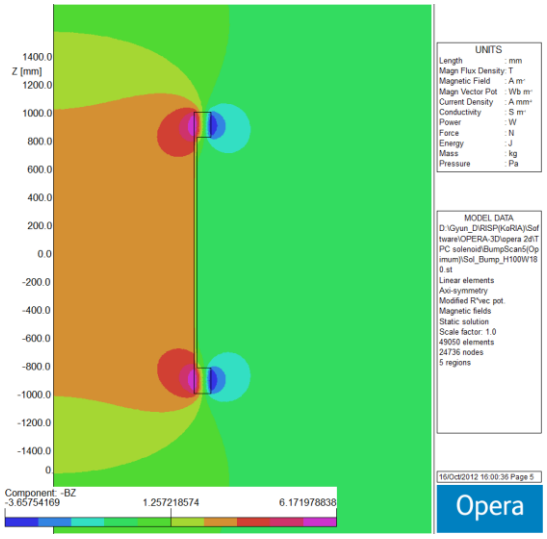
H50W338_Bmod



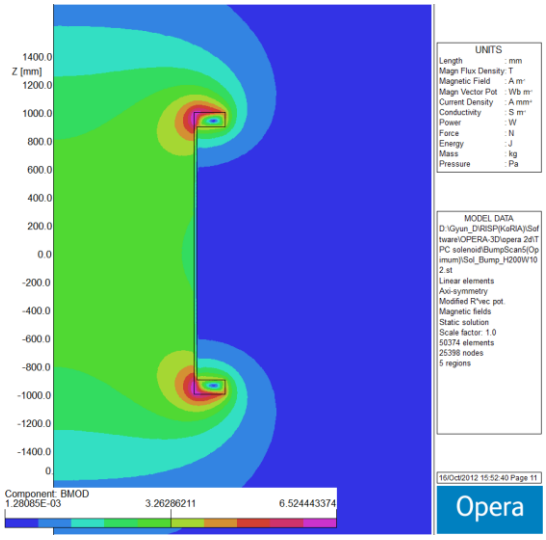
H50W338_(-Bz)



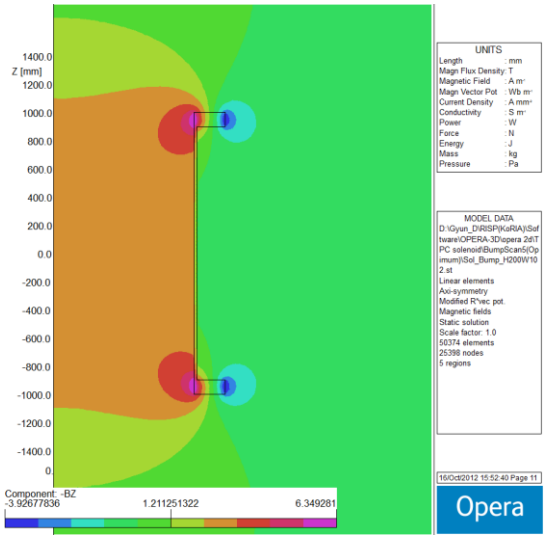
H100W180_Bmod



H100W180_(-Bz)

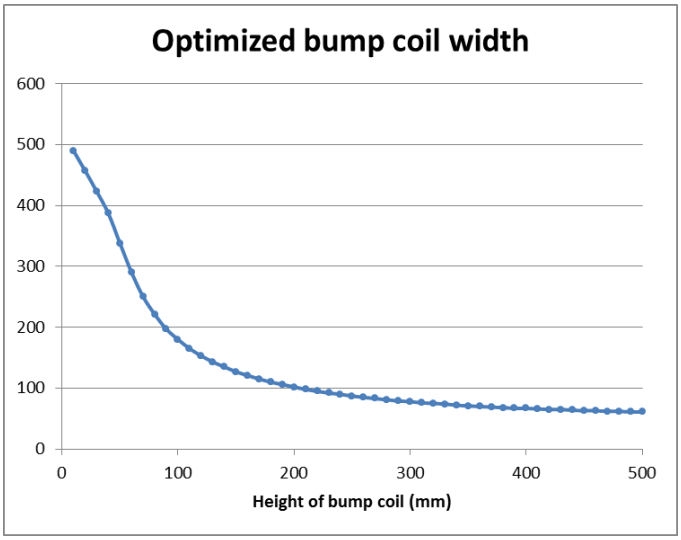


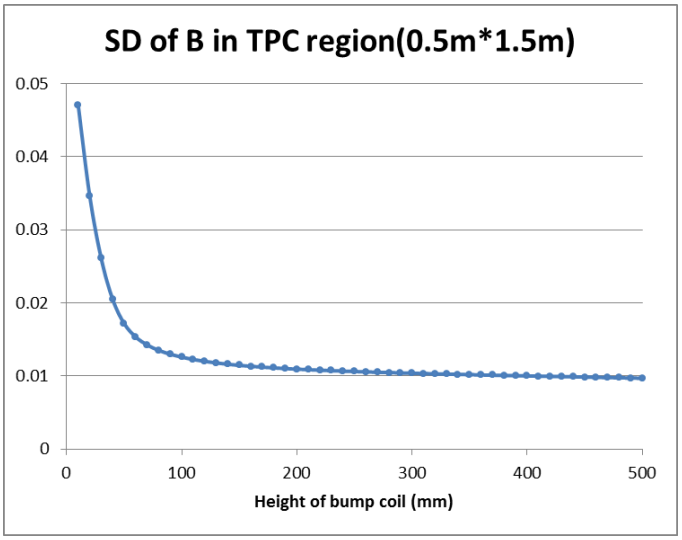
H200W102_Bmod

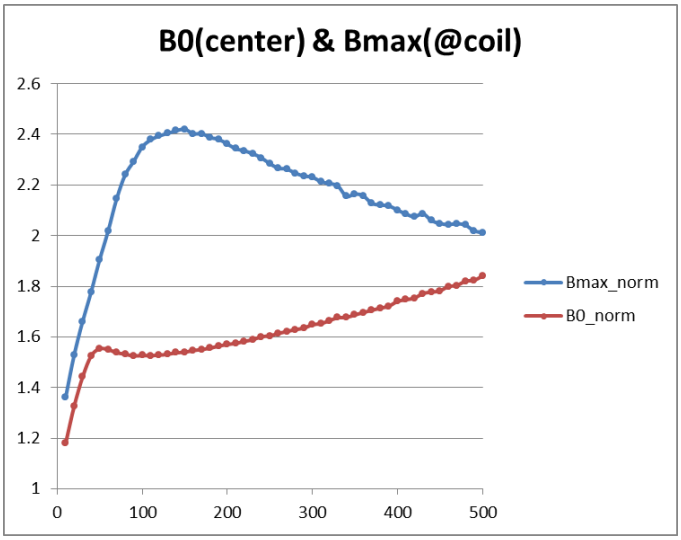


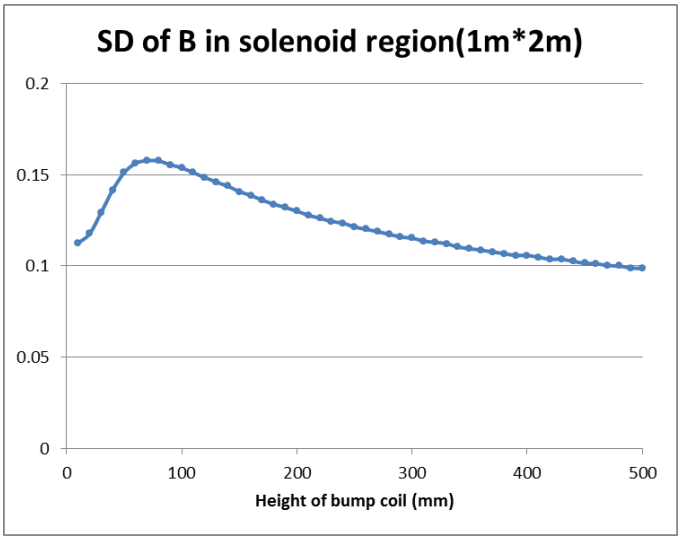
H100W102_(-Bz)

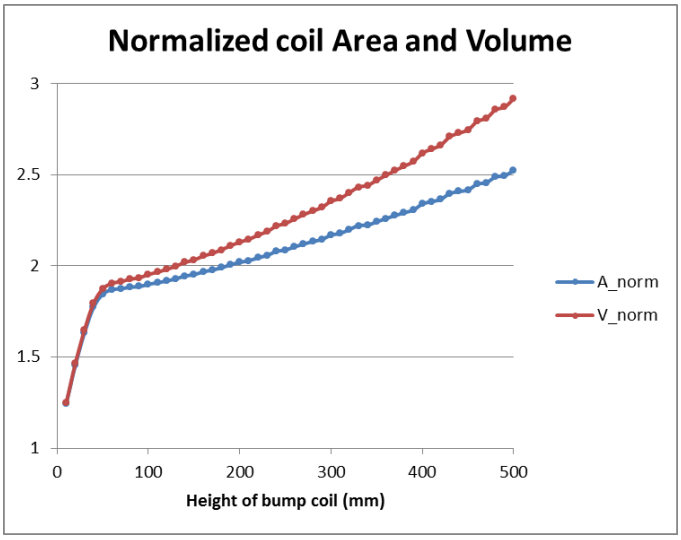
- Optimized bump coil size

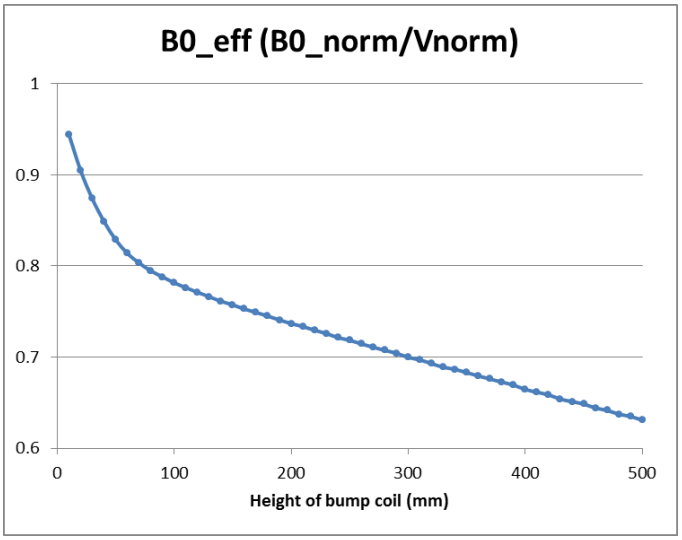






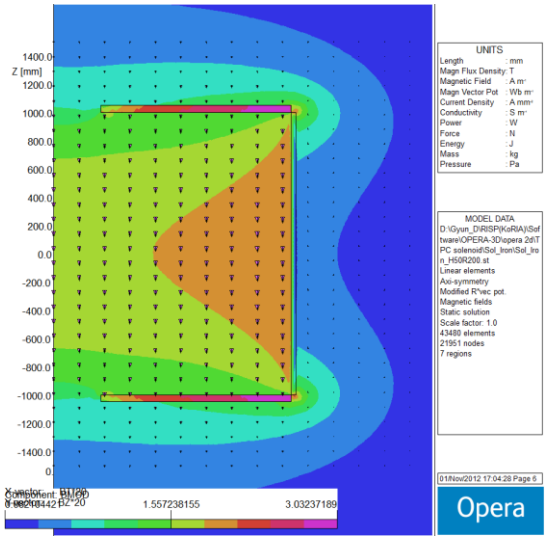


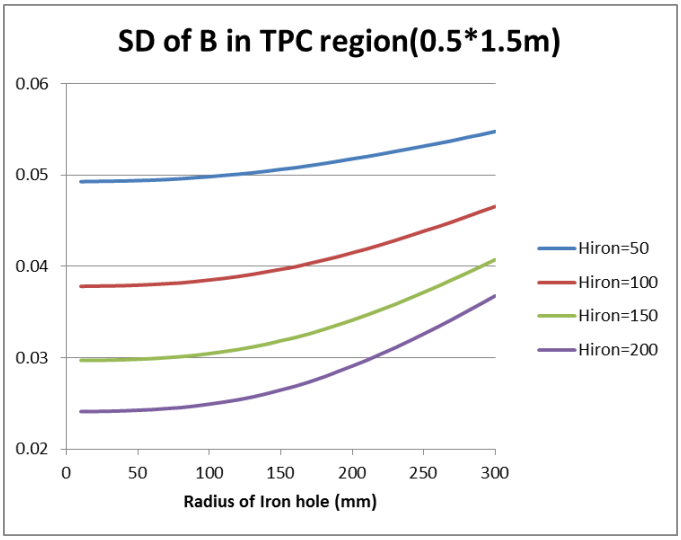




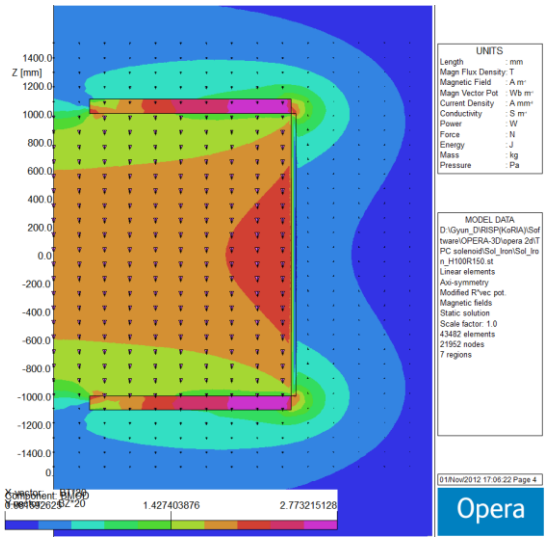
- Iron plate 설치에 따른 변화

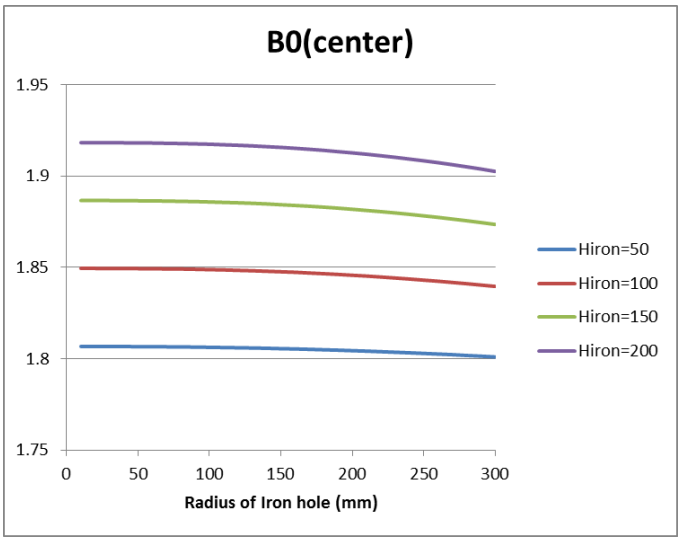
⇨ Iron plate의 두께가 두꺼워질수록 그리고 Iron hole의 크기가 작을수록 Field uniformity는 좋아짐.



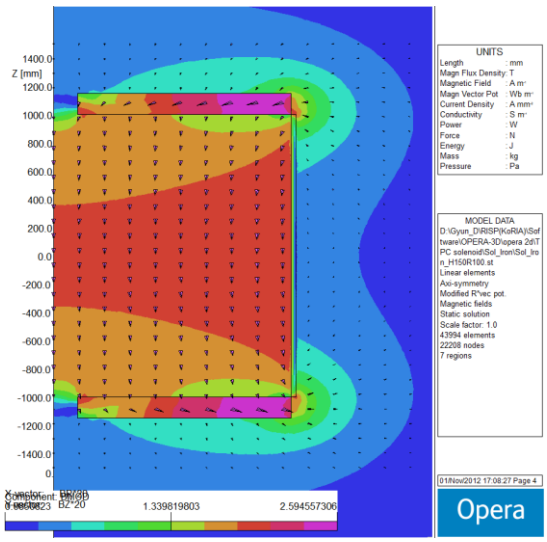


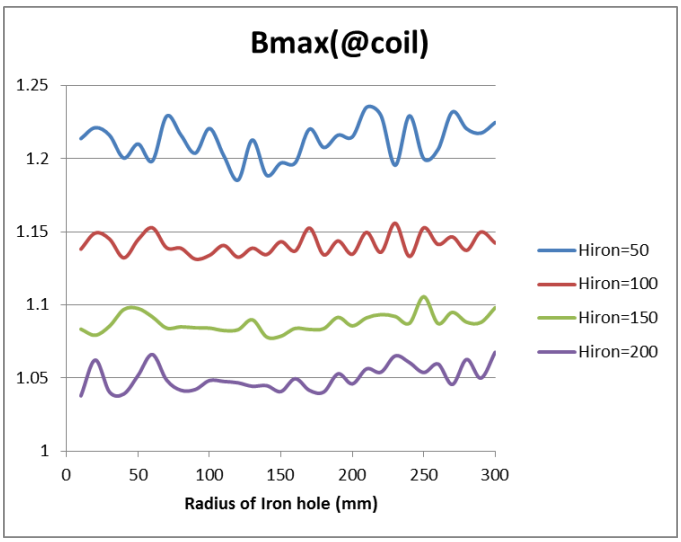
Hiron=50, Riron=200, SDB_D=0.051785





Hiron=100, Riron=150, SDB_D=0.039690

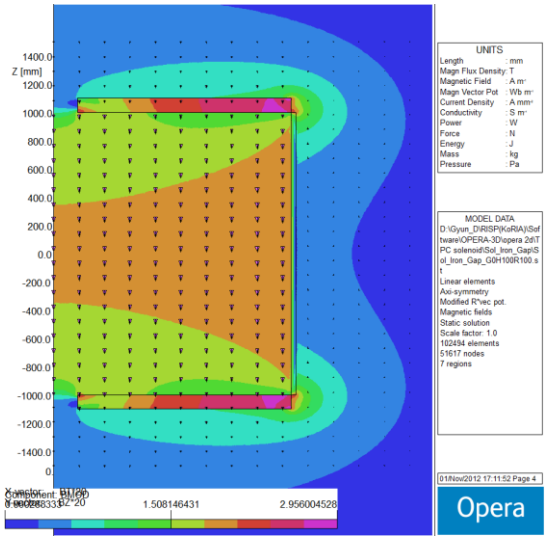


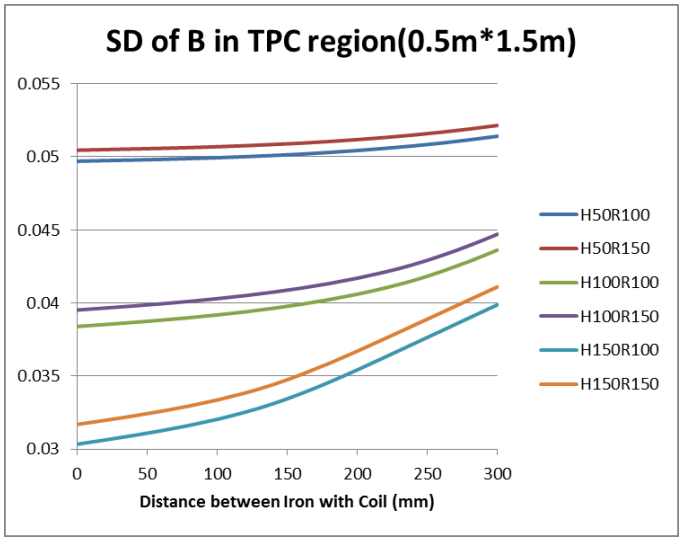


Hiron=150, Riron=100, SDB_D=0.030462

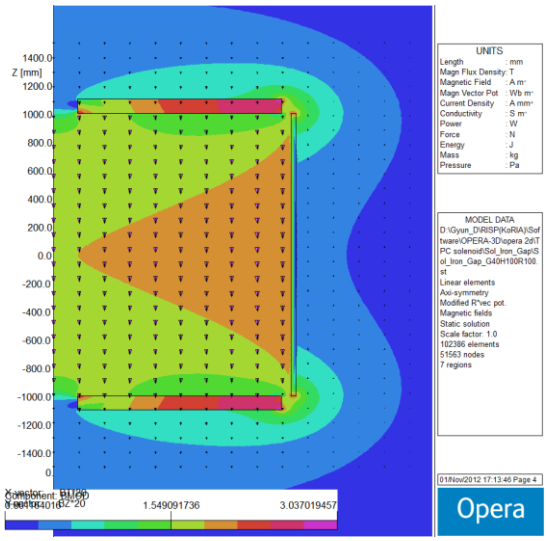
- Iron plate와 Coil과의 간격에 따른 변화

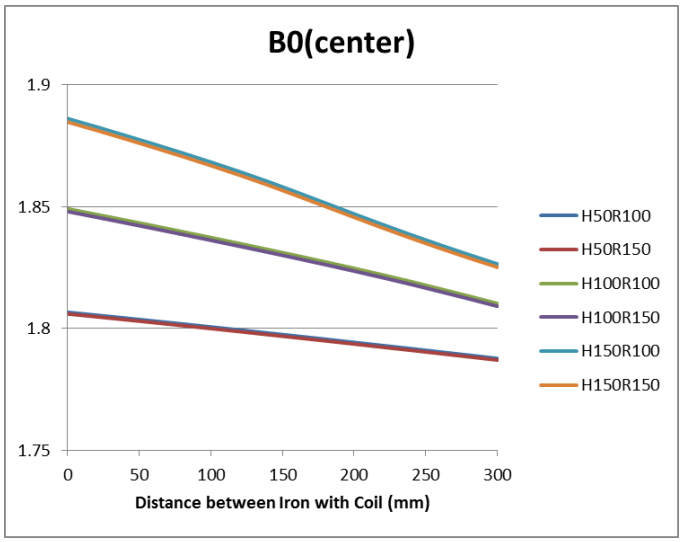
⇨ Iron plate와 Coil과의 간격은 좁을수록 Field uniformity가 좋아짐. Bmax및 구조를 고려해 D=50mm



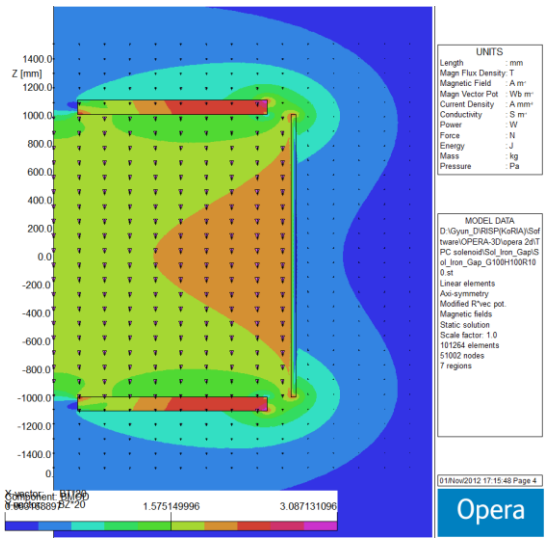


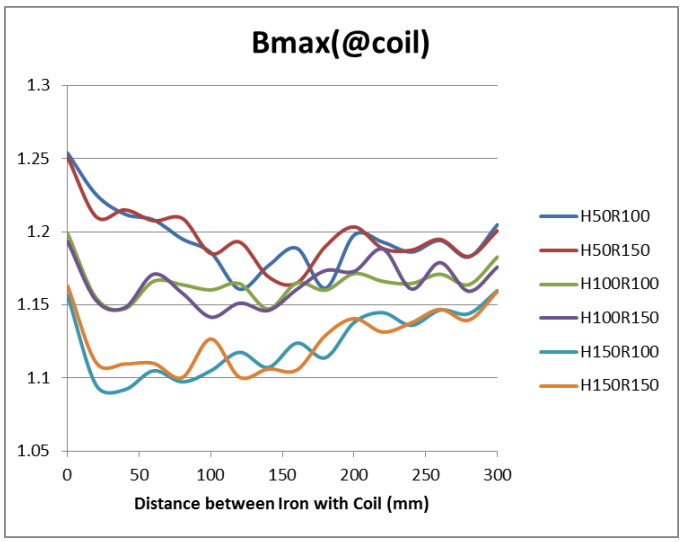
Hiron=100, Riron=100, D=0, SDB_D=0.038395





Hiron=100, Riron=100, D=40, SDB_D=0.038677



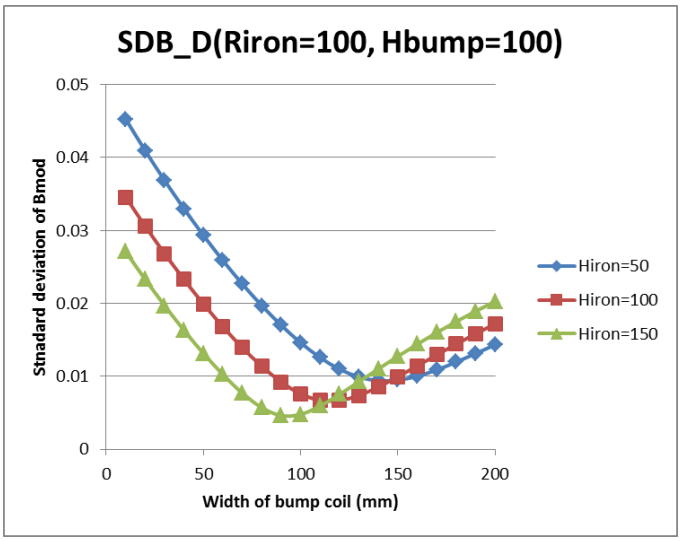


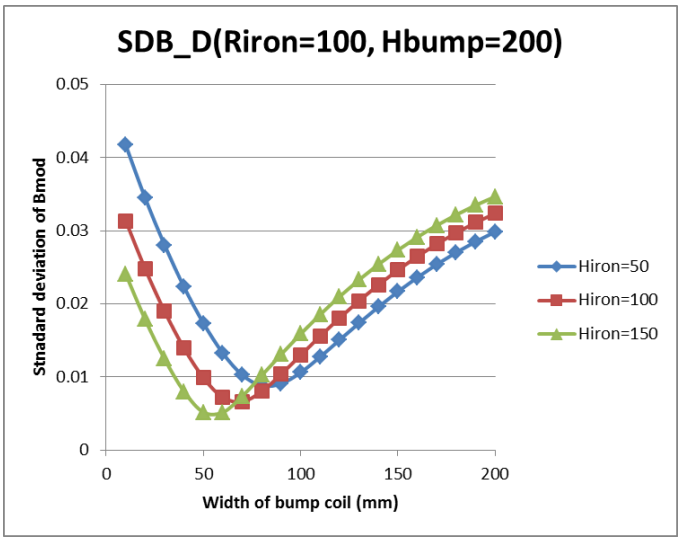
Hiron=100, Riron=100, D=100, SDB_D=0.039187

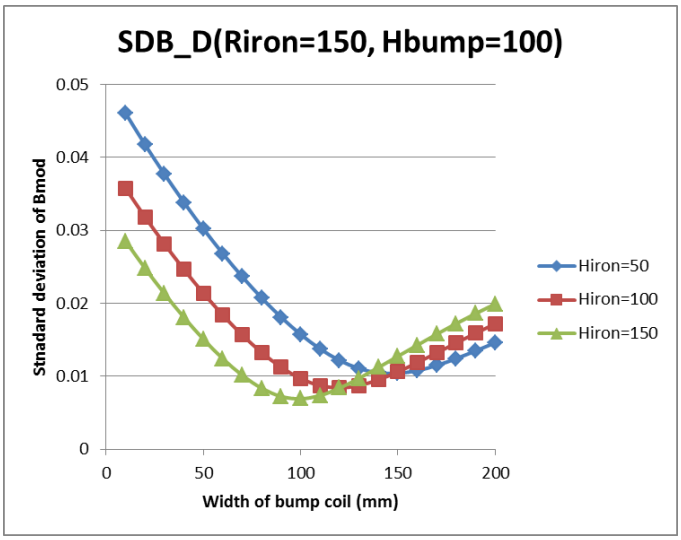
- Iron plate와 Bump coil를 동시에 적용 (Iron plate와 Solenoid의 간격은 50mm)

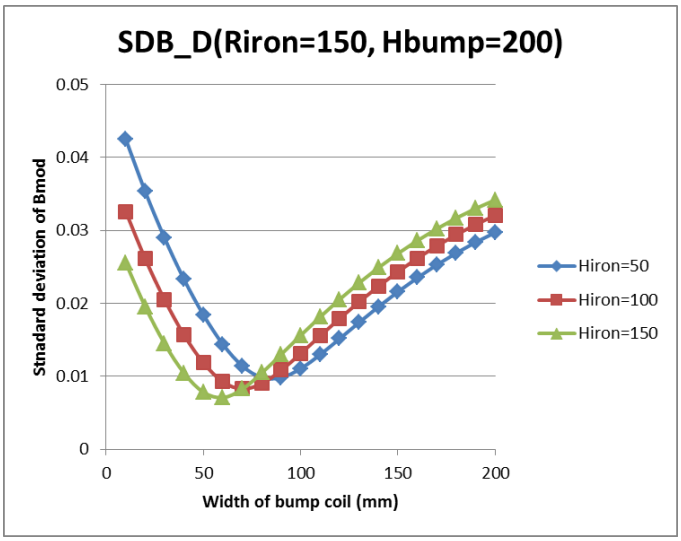
⇨ 이전 결과를 보면 Iron plate와 Bump coil의 두께가 두꺼울수록 그리고 Iron plate의 Hole 지름이 작을수록 Field uniformity는 좋아짐.

⇨ 현실적인 구조를 고려해 Iron plate의 두께(Hiron or H)는 50, 100, 150mm인 경우, Iron plate hole의 반지름(Riron or R)은 100, 150인 경우, 그리고 Bump coil의 두께(Hbump or BH)는 100, 200mm인 경우에 대해서 Field uniformity가 가장 좋은 Bump coil의 폭 결정.







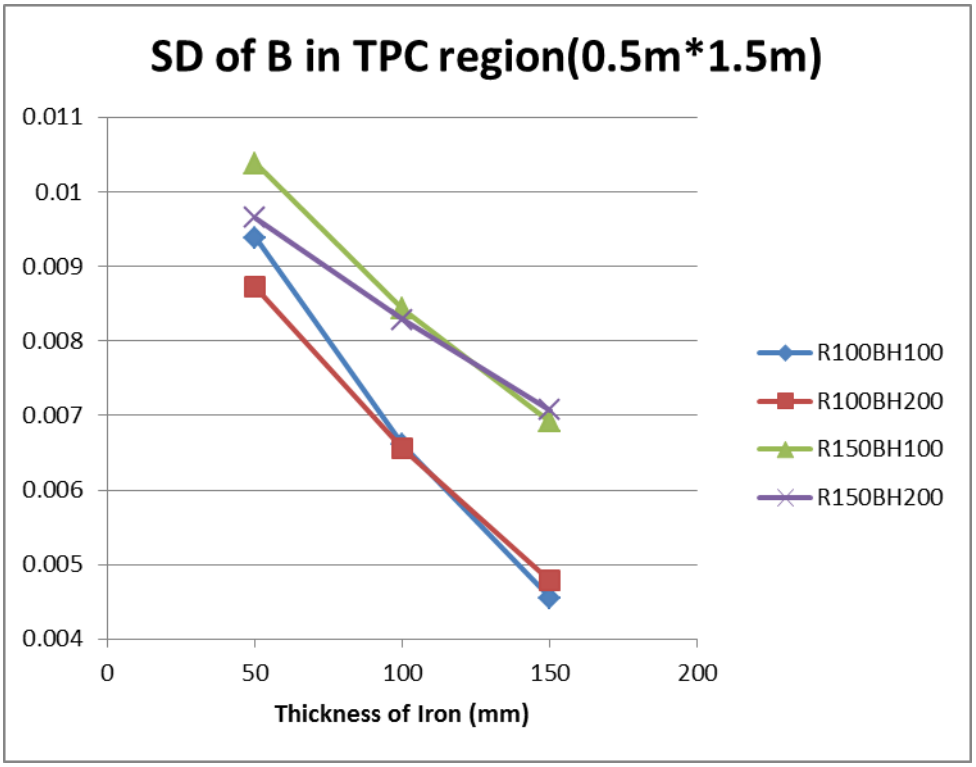


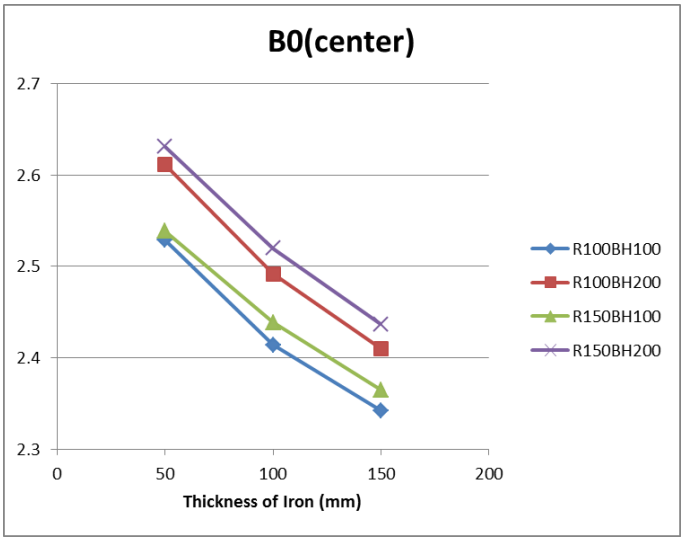
Hbump=100 mm				Hbump=200 mm			
Hiron	Riron	Wbump	SDB_D	Hiron	Riron	Wbump	SDB_D
50	100	144	0.009388	50	100	83	0.008726
100	100	115	0.006605	100	100	67	0.006558
150	100	94	0.004553	150	100	55	0.004780
50	150	146	0.010387	50	150	85	0.009653
100	150	120	0.008430	100	150	70	0.008289
150	150	99	0.006915	150	150	58	0.007069

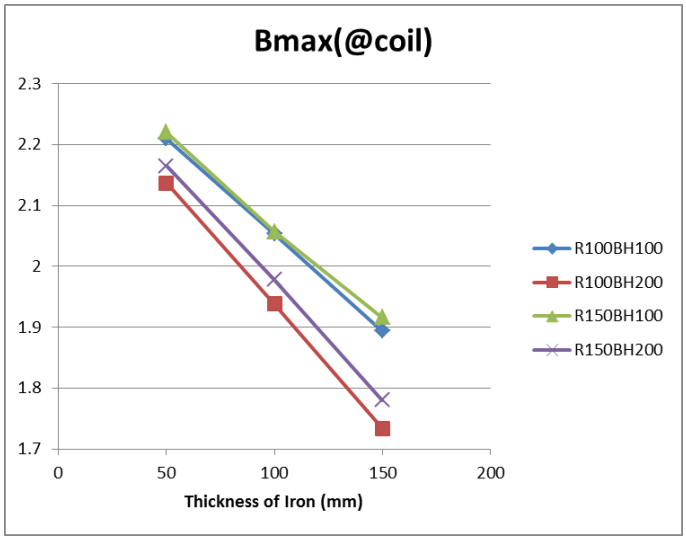
- Field uniformity, Center field and Maximum field

⇨ 이전의 결과와 마찬가지로 Iron plate의 두께가 두꺼울수록 hole의 반경이 작을수록 field uniformity는 좋아짐.

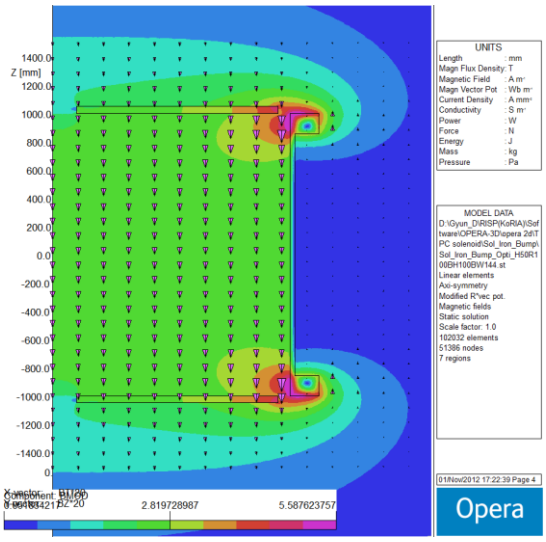
⇨ Bump coil의 두께는 Bump coil의 폭이 최적화되는 경우 100mm와 200mm 두 경우에 대해 Field uniformity는 큰 차이가 없음. Bmax값은 고려하는 경우에는 Bump coil의 두께가 200mm인 경우가 유리함.



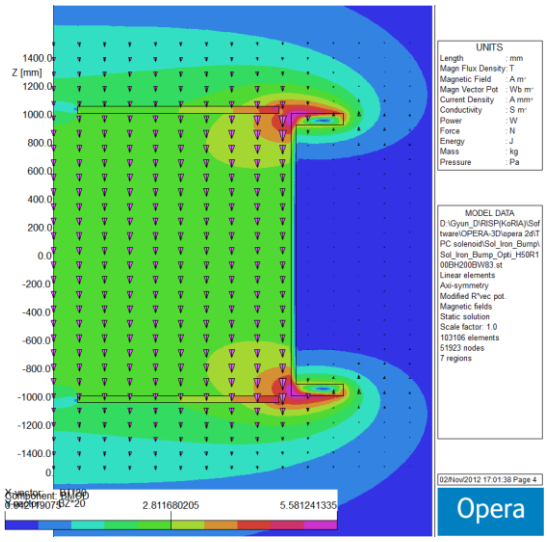




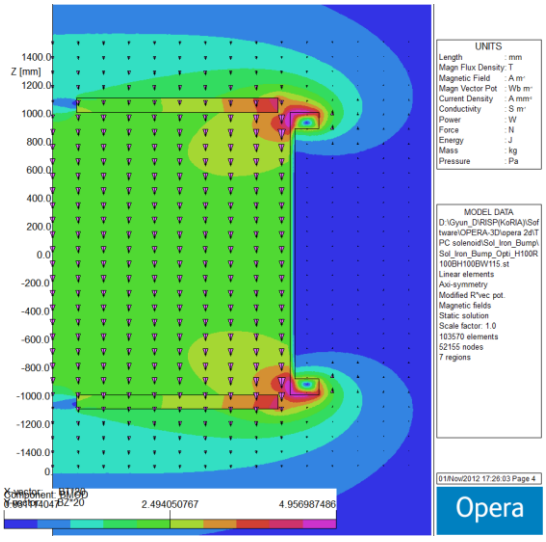
- Iron plate의 두께(50, 100, 150 mm)에 따른 field distribution 변화



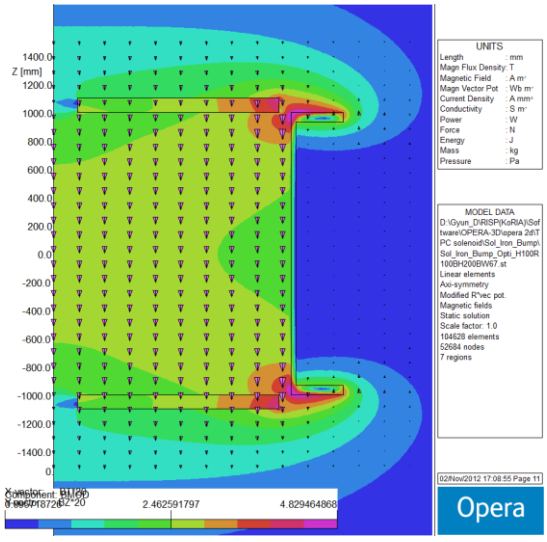
Hiron=50, Riron=100, BH=100, BW=144



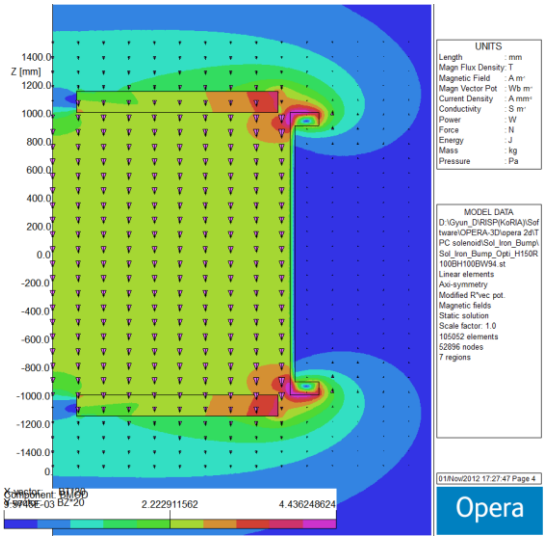
Hiron=50, Riron=100, BH=200, BW=83



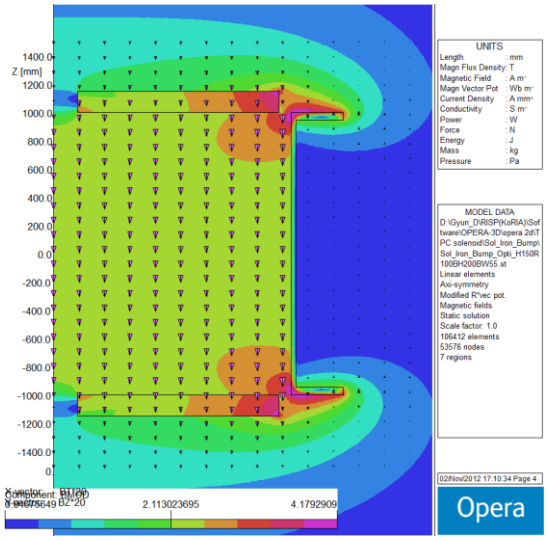
Hiron=100, Riron=100, BH=100, BW=115



Hiron=100, Riron=100, BH=200, BW=67



Hiron=150, Riron=100, BH=100, BW=94

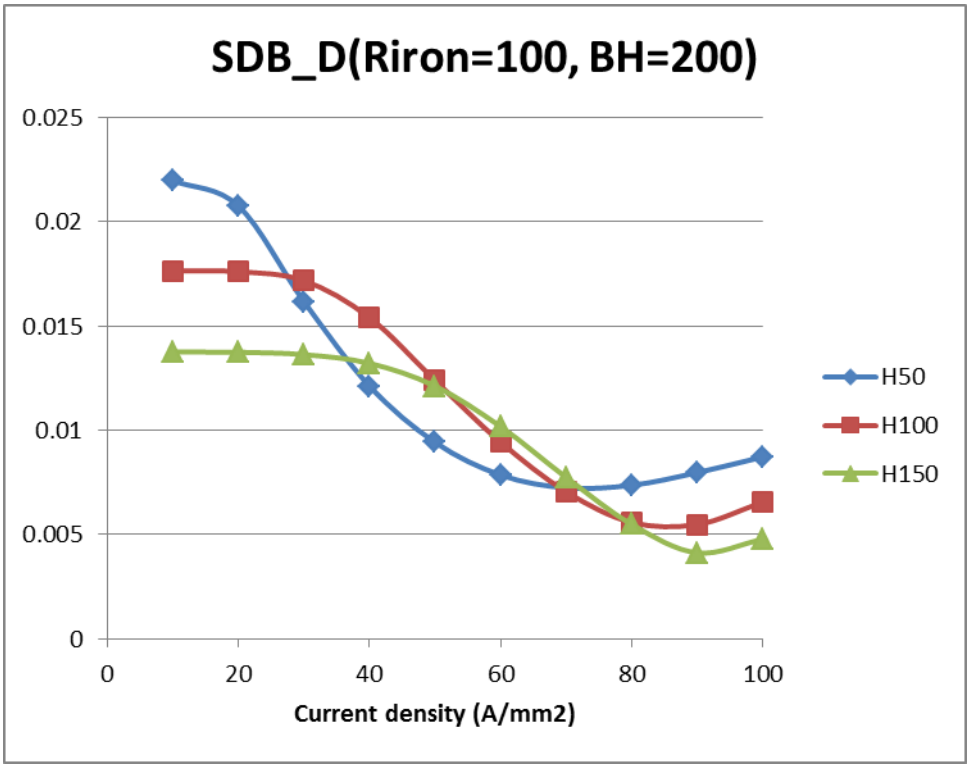


Hiron=150, Riron=100, BH=200, BW=55

- Current density에 따른 field uniformity 변화

⇨ Current density에 따라서 field uniformity가 달라짐.

⇨ Iron plate가 있는 경우 특정한 current density에서는 Solenoid만 있는 경우에 비해 Field uniformity가 좋아지지만, current density에 따라 uniformity가 변하기 때문에 최적화를 하기 힘듬.



- Current density에 따른 Solenoid 중심에서의 B field(Bcen) 및 최대 B field(Bmax)