

BISMV simulations with Flux2D

BISMV parameters used

Septum	4 mm	
Gap width	55	(vertical beam acceptance)
Rear conductor thickness	10 mm	
Gap height	70 mm	(horizontal beam acceptance)
Play between septum and yoke	0.05 mm	
Cooling tube diameter	2 mm	
Steel used	VM111ISO	
Required deflection	170 mrad	
Assumed L_{eq}	960 mm	
B.dI required	323 mT.m	
Required gap field	376 mT	
Required current	19 kA	
Available $L_{physical}$	1000 mm	

Predetermination BISMV Linac4	
INPUT data	RESULTS PROTONS
PARTICLES	rest mass m_0 0.93826 GeV/c ²
Particle type: electrons, protons: ions p	Kinetic energy 0.1600 GeV
Momentum, kinetic energy, beam rigidity ec	Beam momentum 0.5708 GeV/c
Kinetic energy $E_c =$ 0.16 GeV	beta 0.5198
	gamma 1.1705
	beta*gamma 0.6084
	Brho 1.9040 Tm
	Rho 5.651 m
Required deflexion 170 mrad	Intergrated field BdL 0.323 T.m
Septum thickness 4 mm	Induction in gap 0.337 T
Gap Heigth 70 mm	Magnetic field $H=B/uo$ 2.68E+05 A/m
Gap width 69 mm	
Magnetic length 960 mm	Required current 18769 A
Rear conductor thickness 10 mm	i rms 646 A
Heigth rear conductor 69 mm	Rms current density septum 2.34 A/mm ²
# of turns 1 turn	Rms current density rear conductor 0.95 A/mm ²
Drift space length 0 mm	Magnet resistance 0.10 mOhms
	Magnet inductance 1.1 uH
	Power consumption 0.044 kW
Copper resistivity (1.72E-2) 0.0172 mO.mm	Magnetic energy stored in the gap 188 J
Youngs modulus (12500) 12500 daN/mm ²	
Current pulse shape	Beam displacement after drift space 82 mm
DC, half sine, trapezoidal t	
rise time = fall time 0.1 ms	Lamination dimensions
flat top 1 ms	Gap width 69 p en mm
Repetition time (total cycle) 0.9 s	Gap Heigth 70 h en mm
repetition rate of the current pulse 1.1 Hz	Lamination width L 111 L en mm
	Lamination height H 154 H en mm
Cooling circuit parameters	Total water flow 1.96 l/min
septum/return cond. channels in series? yes	Flow per cooling channel of septum 0.98 l/min
water pressure difference (dP) 12 bar	Water speed in septum 9.23 m/s
total # of cooling channels septum 2	
total # of return cond. cooling channels 2	Total water temperature rise 0.3 K
septum	Copper cross section septum 276.5 mm ²
cooling circuit shape rec	Cooling cross section septum 3.5 mm ²
Horizontal dimension 4 mm	Copper cross section rear conductor 682.0 mm ²
Vertical dimension 35 mm	Cooling cross section rear conductor 8.0 mm ²
water passage shape circ	
Diametre trou 1.5 mm	Force septum /rear conductor 304 daN
return conductor	Max . septum flection (appui) 0.021 mm
cooling circuit shape rec	Max. moment of flection(appui) 2.77 mm*daN
Horizontal dimension 10 mm	Max. stress <5 (appui) 1.04 daN/mm ²
Vertical dimension 34.5 mm	
water passage shape rec	
Cote horizontal 2 mm	
Cote vertical 2 mm	
	Yoke material
Yoke material	average field in yoke 0.5 T
	Yoke weight without support 84 kg

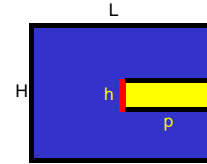
pour R électrique, les sections spécifiées dans hydraulique avec viscosité constant

- 2/8/1994:Hydraulique révisé ,J. Borburgh
- 12/10/1998 Ajouté ions , J. Borburgh
- 1/9/1999: hydraulique révisé pour permettre le
- 12/9/1999: modifié formule energy stocké pour
- 2/4/2001: ajouté rigidité magnétique
- 4/11/2002: puissance dissipée basé surWJS c
- 5/11/2002: Rho ajouté, Brho pour ions corrigé
- 19/5/2005: Modifié calcul resistance électrique
- 25/7/2005: ms option added; half coil cooling
- 26/7/2005: rear conductor cooling circuit numl
- 28/7/2005: layout changed. English version
- 4/4/2006: R calculation modified

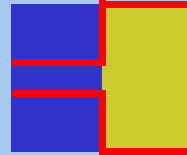
2.3 A/mm² approx.

0.09 mOhm approx.

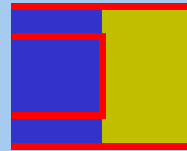
0.0 kW approx.



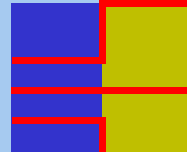
septum/return cond. channels in series?



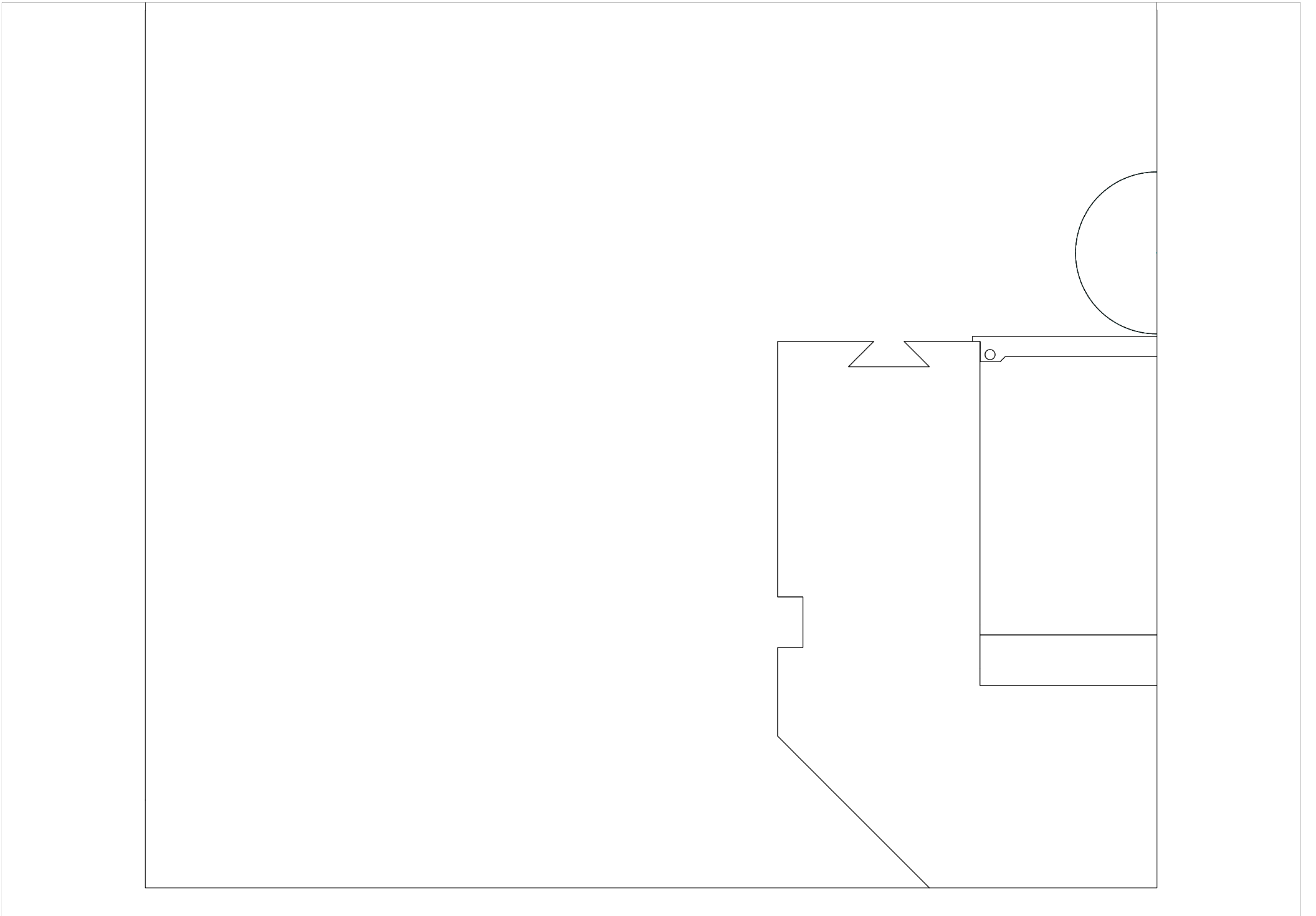
YES



NO



MS



Color Shade Results

Quantity : |Flux density| Tesla

Scale / Color

0 / 0.05

0.05 / 0.1

0.1 / 150.00001E-3

150.00001E-3 / 0.2

0.2 / 0.25

0.25 / 300.00001E-3

300.00001E-3 / 349.99999E-3

349.99999E-3 / 400.00001E-3

400.00001E-3 / 450.00002E-3

450.00002E-3 / 0.5

0.5 / 550.00001E-3

550.00001E-3 / 600.00002E-3

600.00002E-3 / 650.00004E-3

650.00004E-3 / 699.99999E-3

699.99999E-3 / 0.75

0.75 / 800.00001E-3



Isovalues Results

Quantity : Equi flux Weber

Line / Value

1 / -20.93838E-3

2 / -16.7507E-3

3 / -12.56303E-3

4 / -8.37535E-3

5 / -4.18768E-3

6 / 0

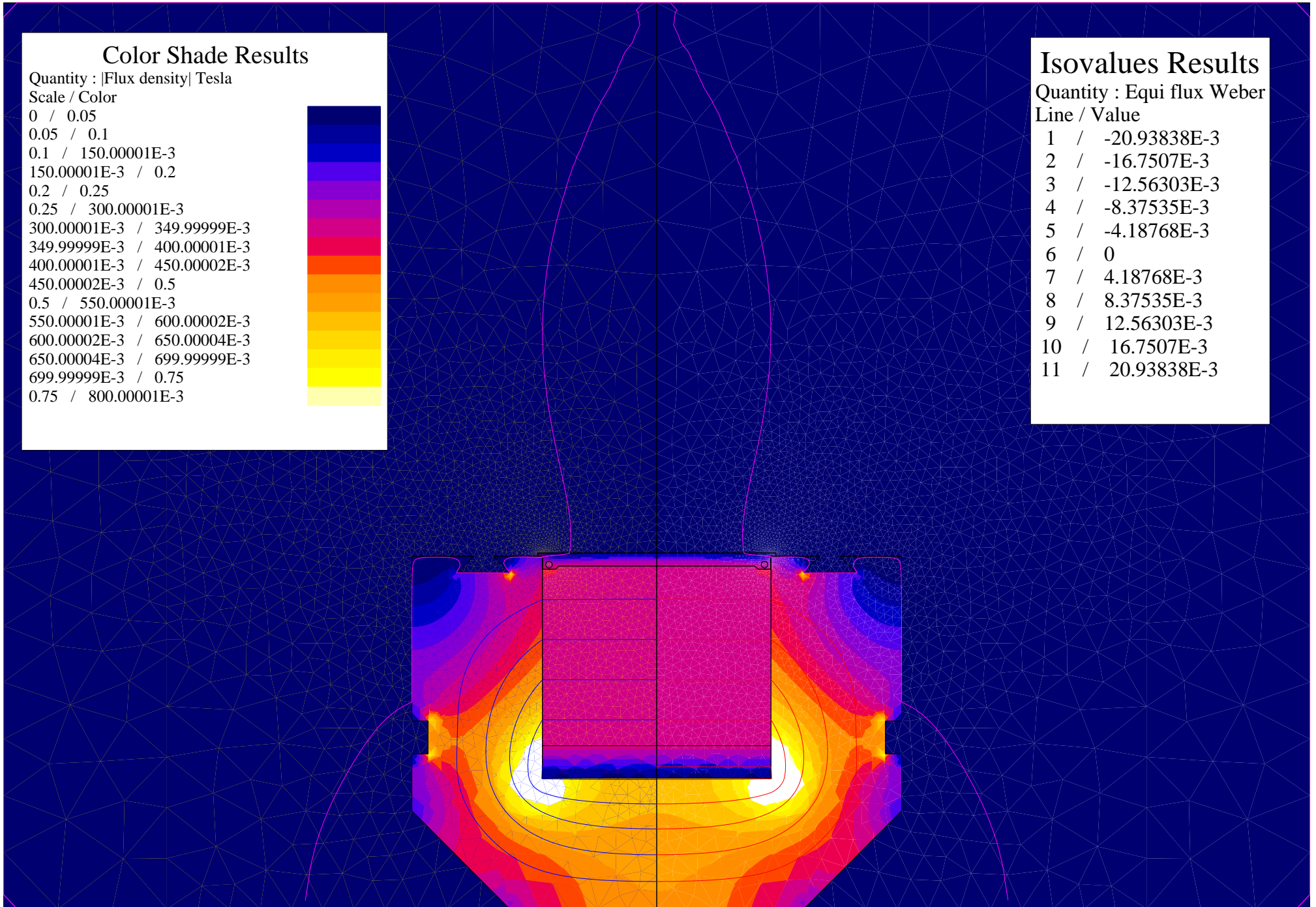
7 / 4.18768E-3

8 / 8.37535E-3

9 / 12.56303E-3

10 / 16.7507E-3

11 / 20.93838E-3



Isovalues Results

Quantity : Equi flux Weber

Line / Value

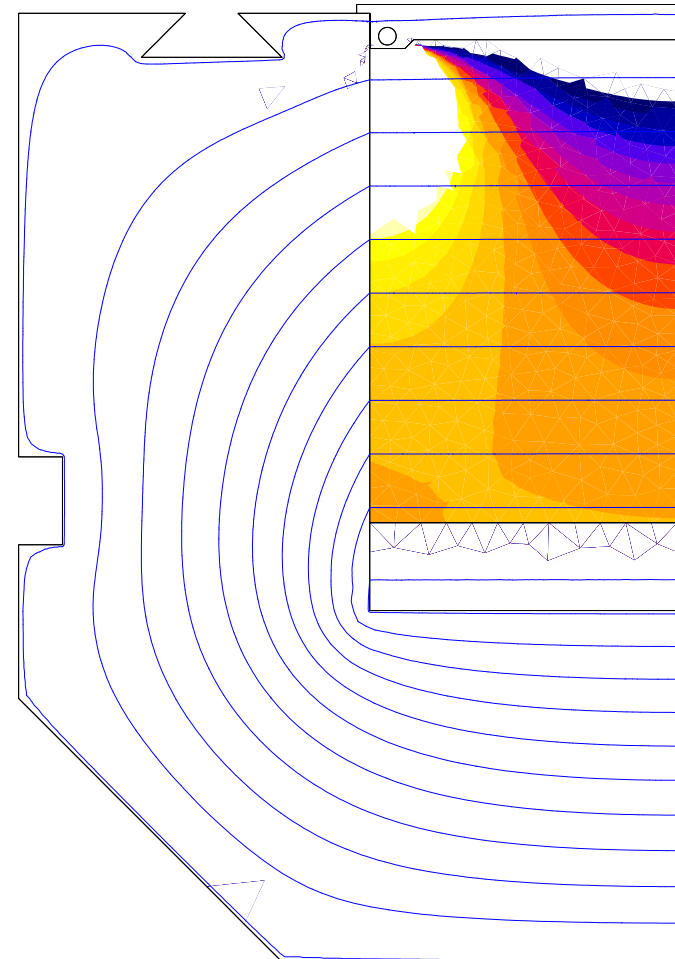
1	/	-20.93838E-3
2	/	-18.85618E-3
3	/	-16.77397E-3
4	/	-14.69177E-3
5	/	-12.60957E-3
6	/	-10.52737E-3
7	/	-8.44516E-3
8	/	-6.36296E-3
9	/	-4.28076E-3
10	/	-2.19856E-3
11	/	-116.35478E-6

Color Shade Results

Quantity : |Flux density| Tesla

Scale / Color

338.99999E-3	/	339.17499E-3
339.17499E-3	/	339.34999E-3
339.34999E-3	/	339.52498E-3
339.52498E-3	/	339.69998E-3
339.69998E-3	/	339.87498E-3
339.87498E-3	/	340.04998E-3
340.04998E-3	/	340.22498E-3
340.22498E-3	/	340.39998E-3
340.39998E-3	/	340.57501E-3
340.57501E-3	/	340.75001E-3
340.75001E-3	/	340.92501E-3
340.92501E-3	/	341.10001E-3
341.10001E-3	/	341.27501E-3
341.27501E-3	/	341.45001E-3
341.45001E-3	/	341.62501E-3
341.62501E-3	/	341.8E-3



Isovalues Results

Quantity : Equi flux Weber

Line / Value

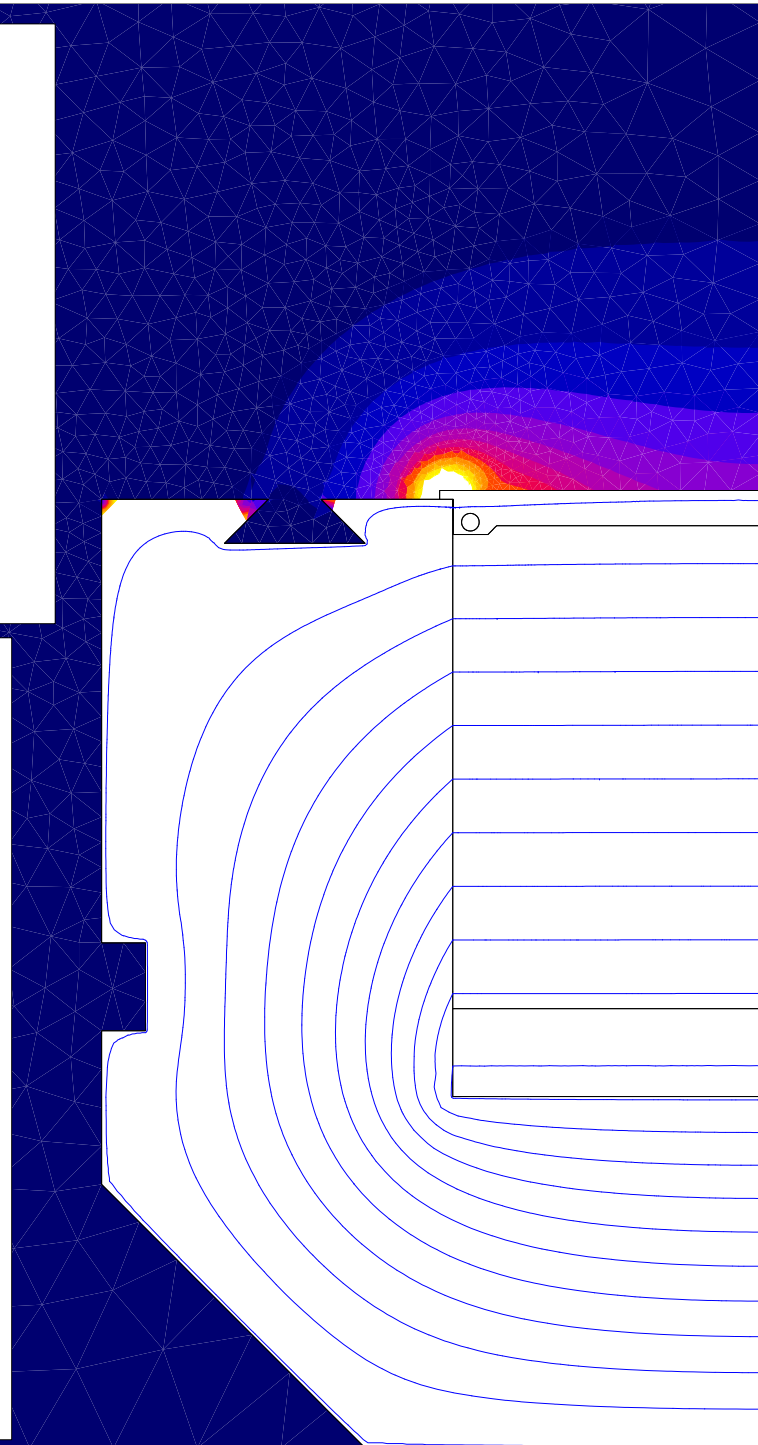
1	/	-20.93838E-3
2	/	-18.85618E-3
3	/	-16.77397E-3
4	/	-14.69177E-3
5	/	-12.60957E-3
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11	/	-116.35478E-6

Color Shade Results

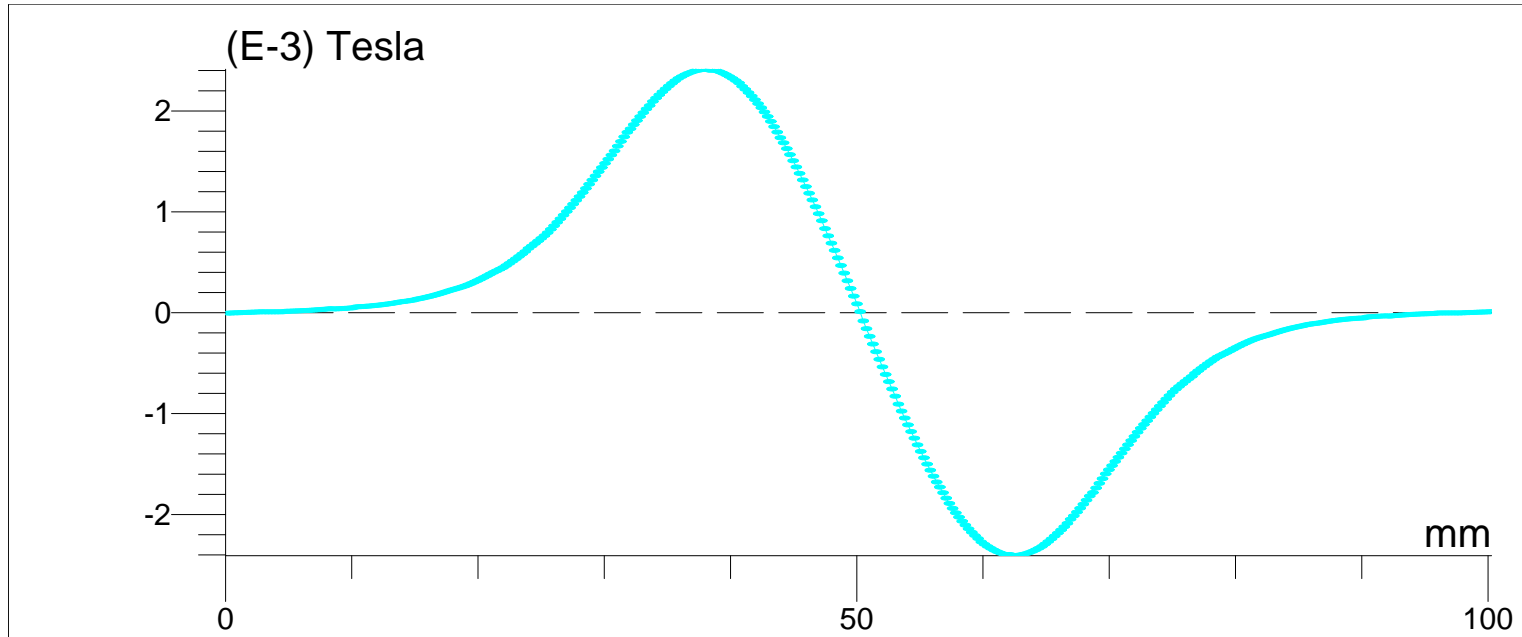
Quantity : |Flux density| Tesla

Scale / Color

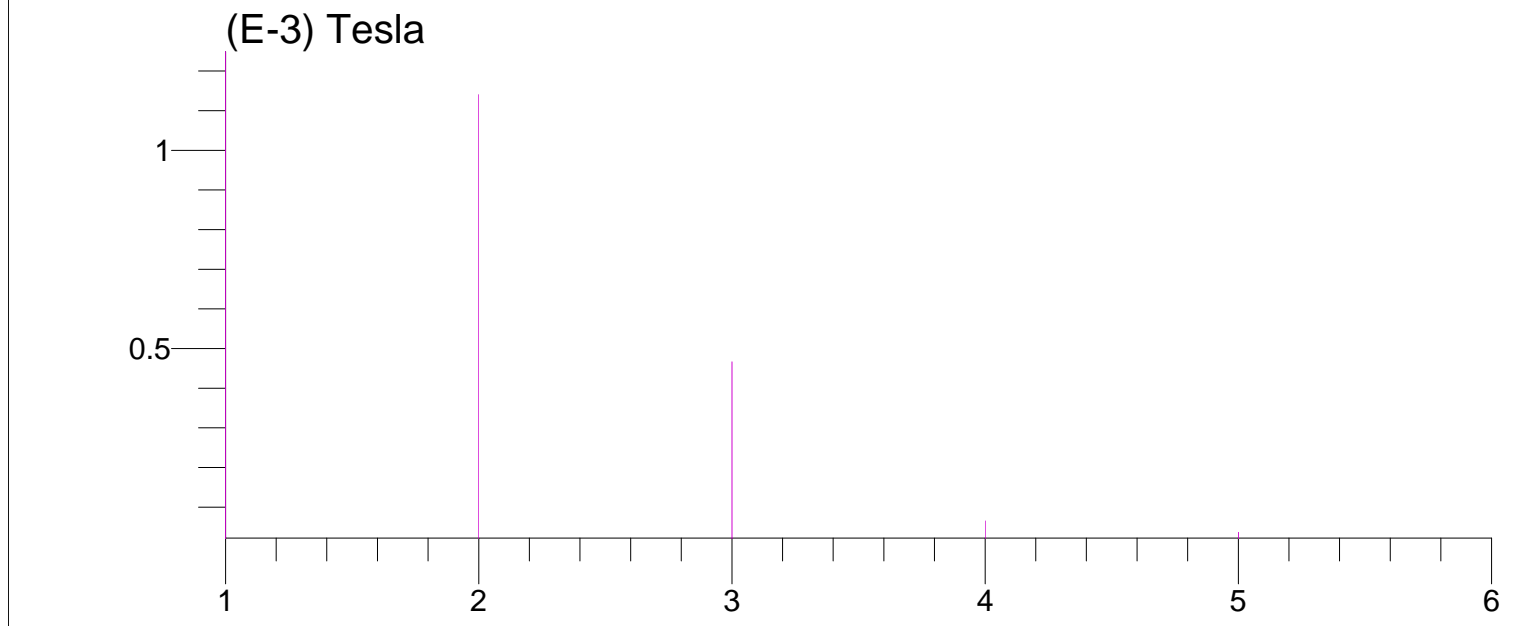
0	/	637.50002E-6
637.50002E-6	/	1.2741E-3
1.2741E-3	/	1.9125E-3
1.9125E-3	/	2.5491E-3
2.5491E-3	/	3.1875E-3
3.1875E-3	/	3.825E-3
3.825E-3	/	4.4625E-3
4.4625E-3	/	5.0991E-3
5.0991E-3	/	5.7375E-3
5.7375E-3	/	6.375E-3
6.375E-3	/	7.0125E-3
7.0125E-3	/	7.65E-3
7.65E-3	/	8.2875E-3
8.2875E-3	/	8.925E-3
8.925E-3	/	9.5625E-3
9.5625E-3	/	10.1991E-3



COV_VARIABLE



CURVE C2D_2
Flux density / Normal component
beam
Half cycle / Odd symmetry



SPECTRUM Spectr_3
From C2D_2
Fundamental 9.946E-3

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BISMV simulations with Flux2D

Gap field plotted between 340 and 342.8 mT

Gap field at 0,0 (magnet gap center) 341.4 mT

Fringe field plotted max 3% of center gap field

Stray field analysis for beam of Ø32 mm adjacent to septum blade.

The magnetic field normal to half circle representing the outer diameter of the beam was calculated. Subsequently the spectrum analysis by Flux2d yields the values below for the field decomposition.

Harmonic number

X value ()	Y value (Tesla)	Phase
1	1.249242E-3	-90.005752
2	1.140339E-3	89.999992
3	466.658849E-6	-90.015403
4	65.253457E-6	90
5	36.443983E-6	90.196944
6	22.085914E-6	-90.000076