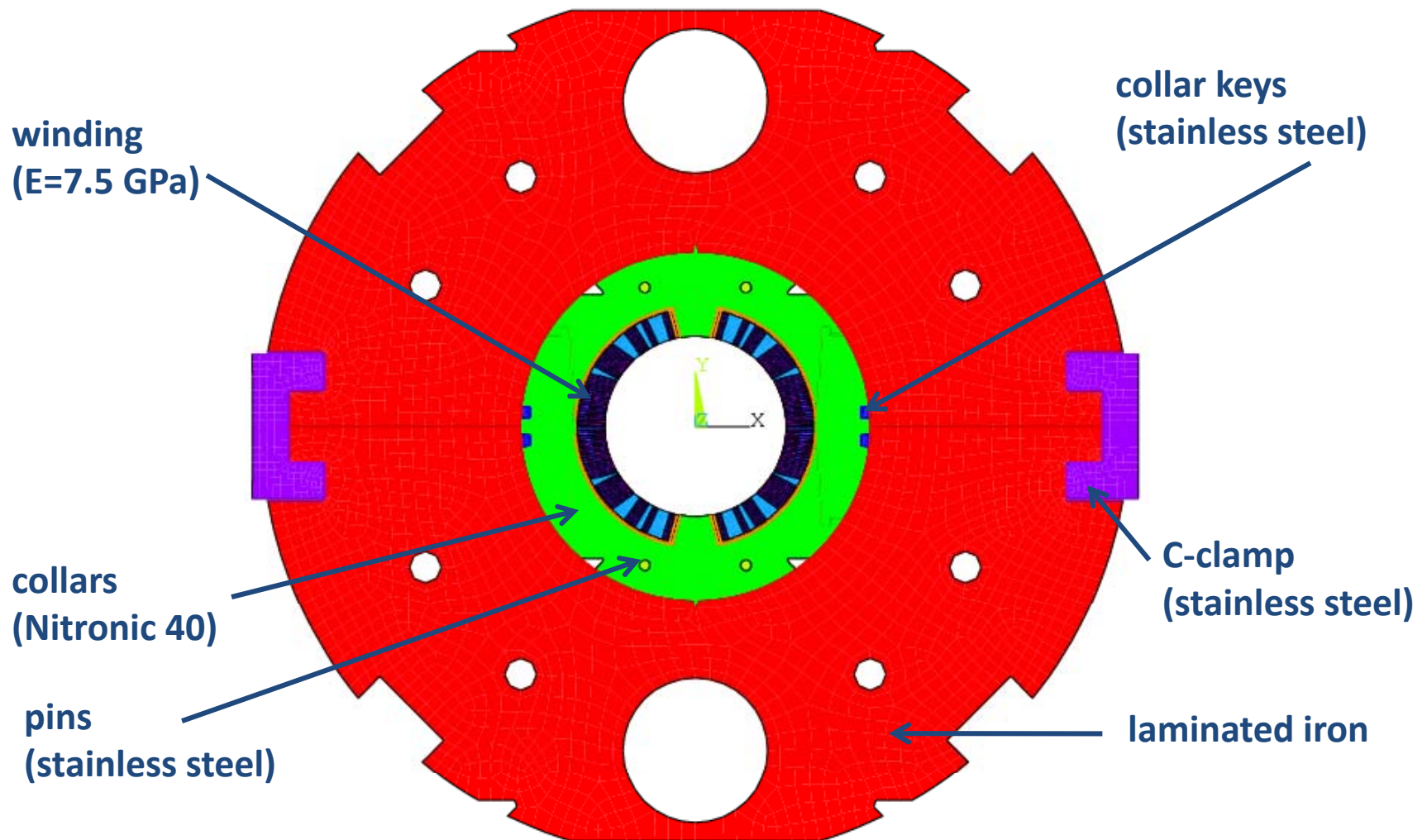


# **Magnetic and mechanical considerations on SIS300 dipole structure**

**Stefania Farinon**

**INFN/GSI Meeting March 6<sup>th</sup> 2008**

# Last configuration



# Material properties

material	Young modulus (GPa)	thermal contraction ( $10^{-3}$ )	magnetic permeability
winding	7.5	5.63	1
Nitronic 40	192	2.4	1.002
stainless steel	220	3.0	1.02
iron	200	1.8	BH curve*0.97

NODAL SOLUTION

TIME=.1

SEQV (AVG)

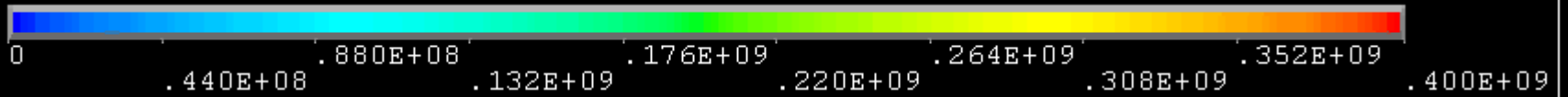
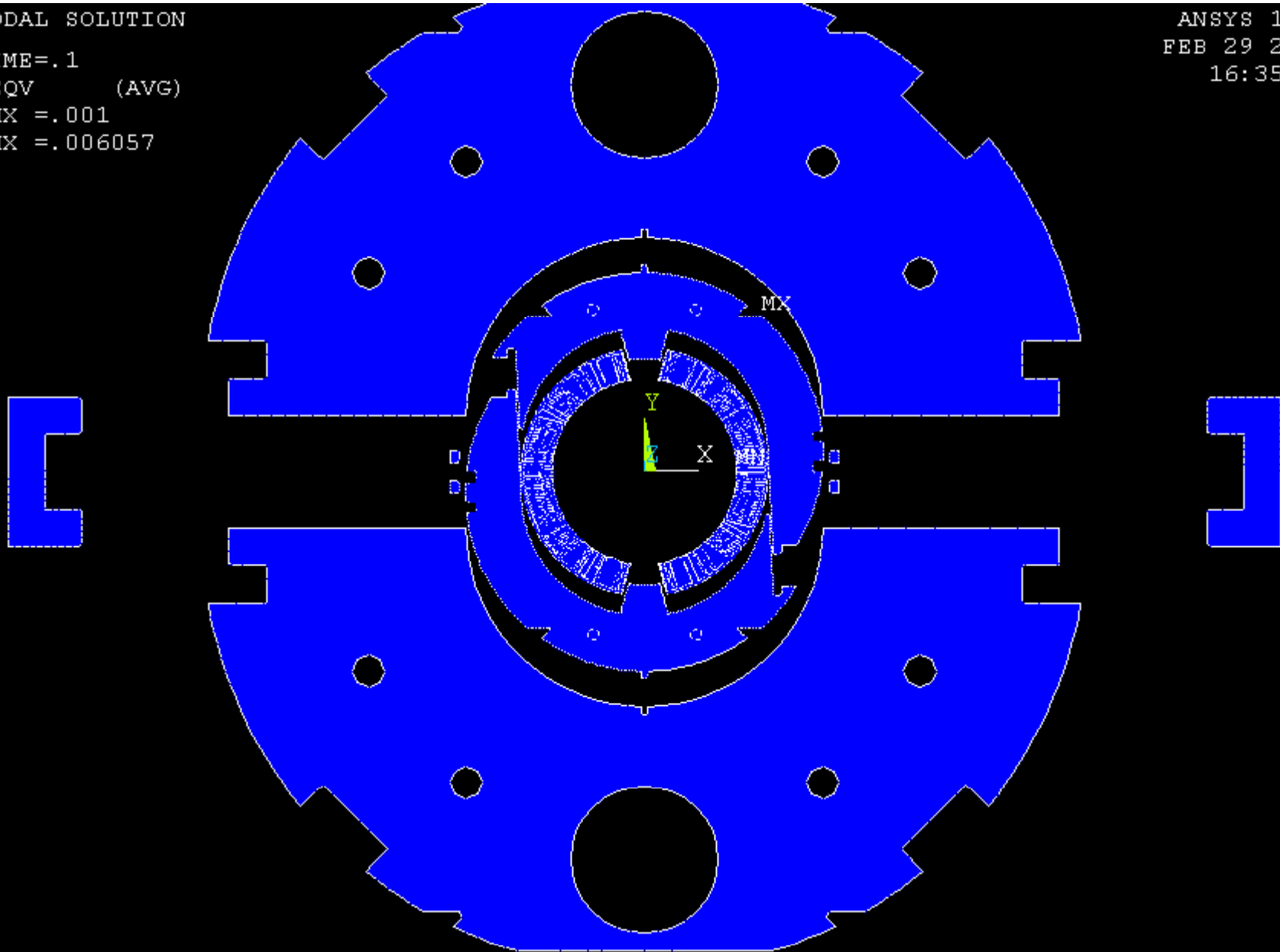
DMX =.001

SMX =.006057

ANSYS 11.0

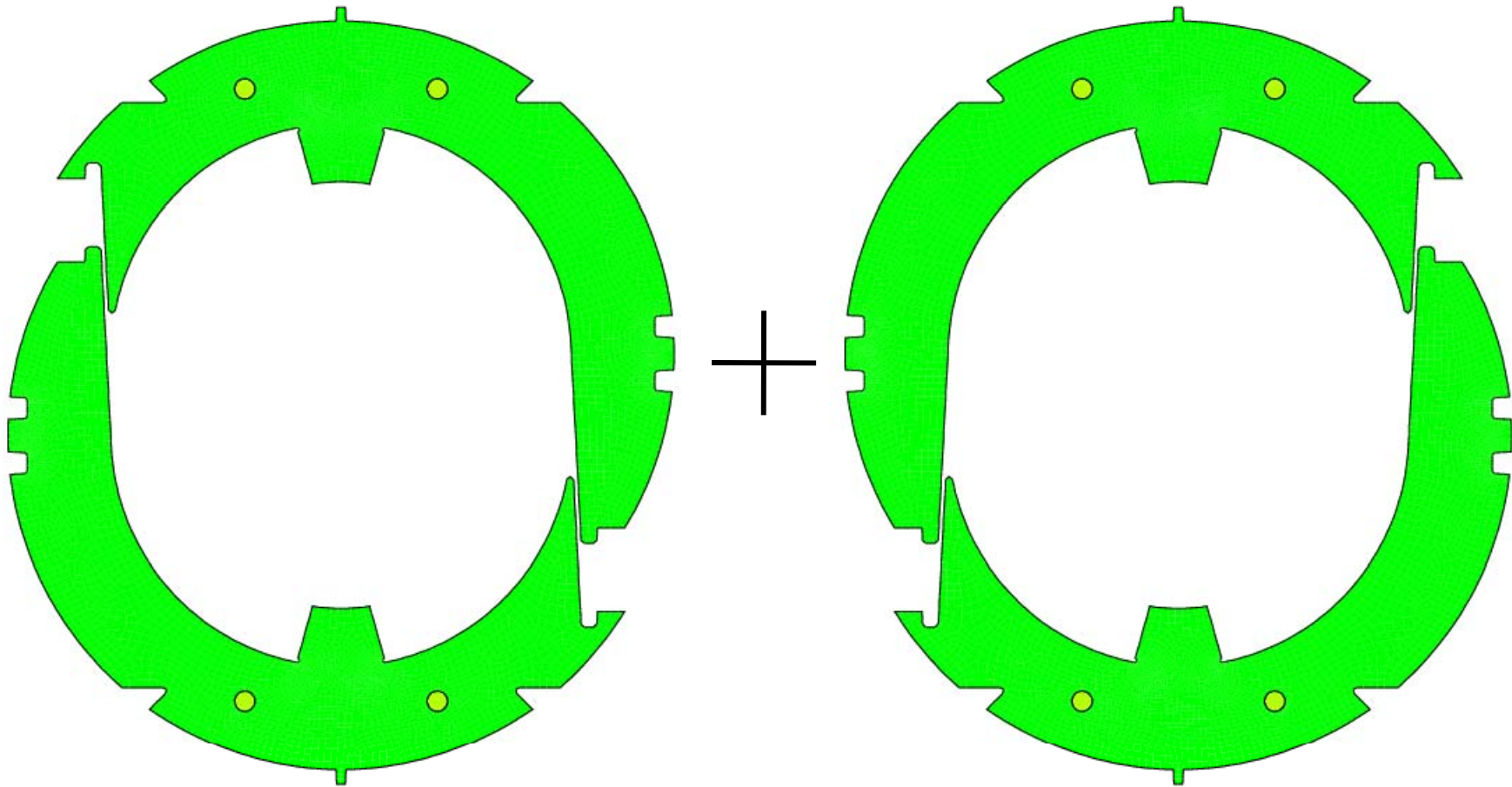
FEB 29 2008

16:35:21

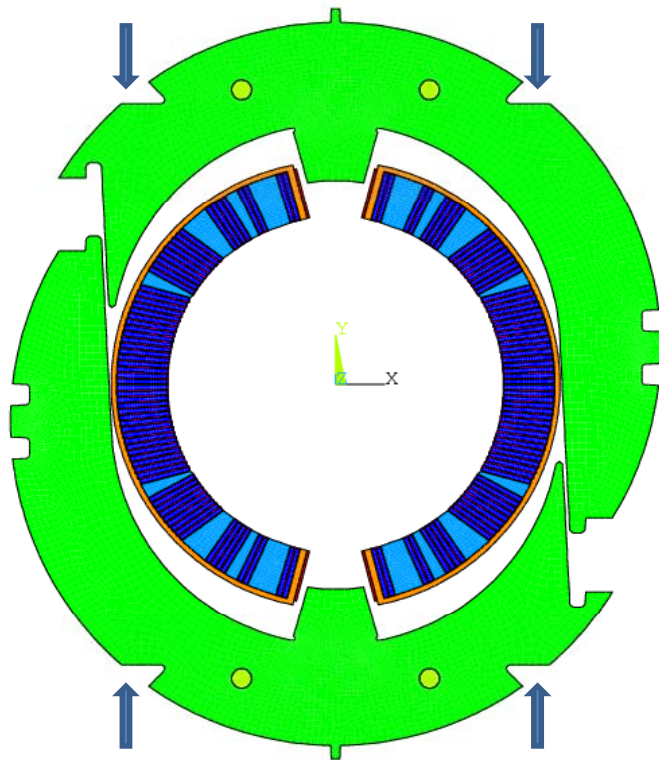


# **Mechanical analysis: collaring**

# Closing of collars and keys: collars representative unit



# Closing of collars and keys: force needed to close the collars



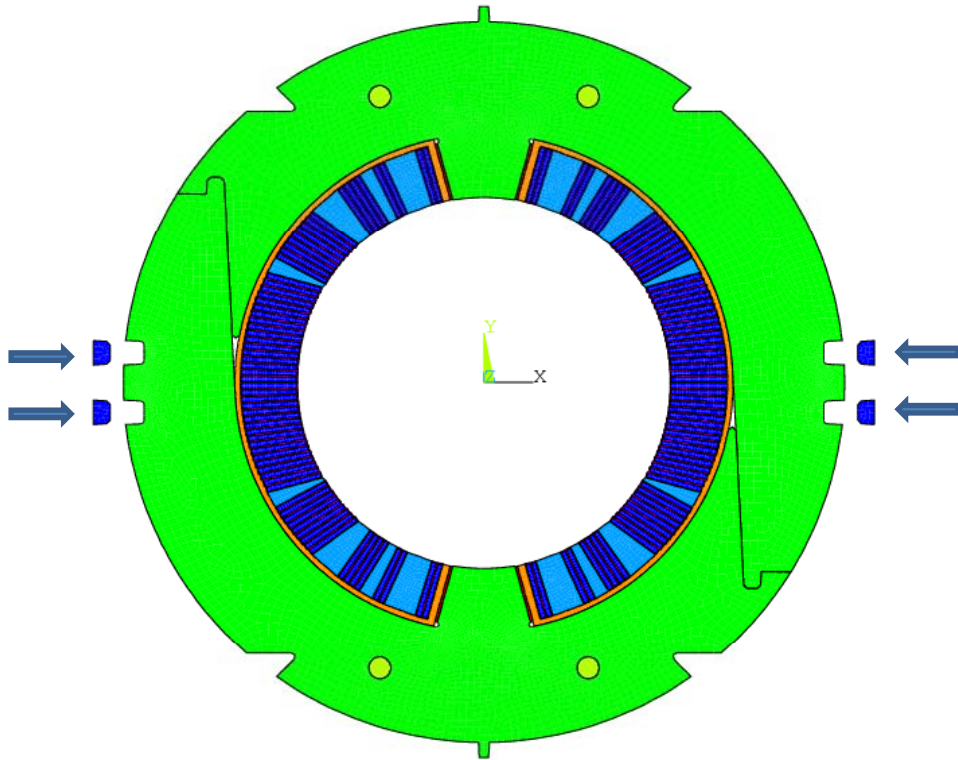
force needed to close the  
collars:

7516 N per collar (3 mm thick)

or

256 tons/m each side

# Closing of collars and keys: force needed to insert the keys

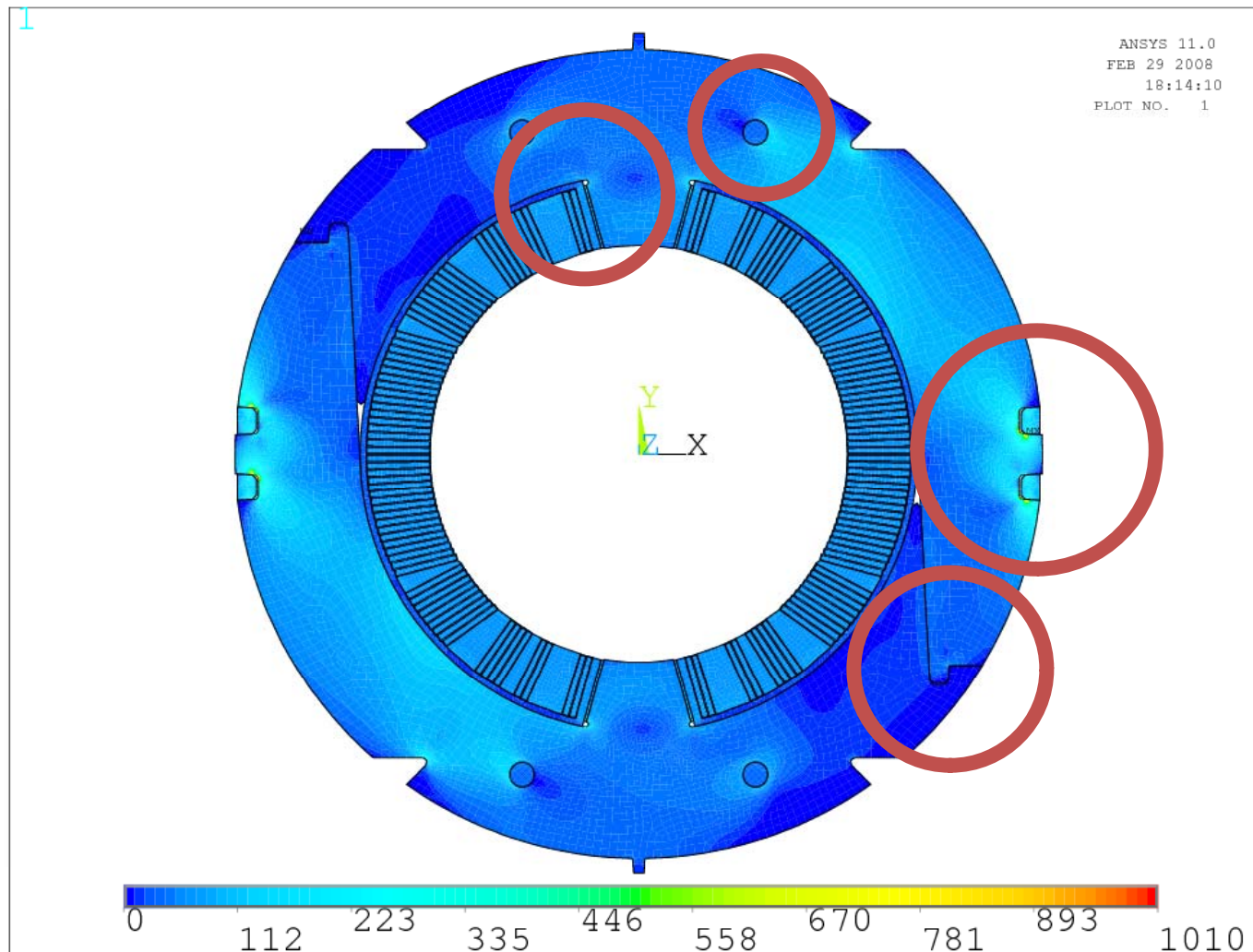


NO FORCE is needed  
to close the keys

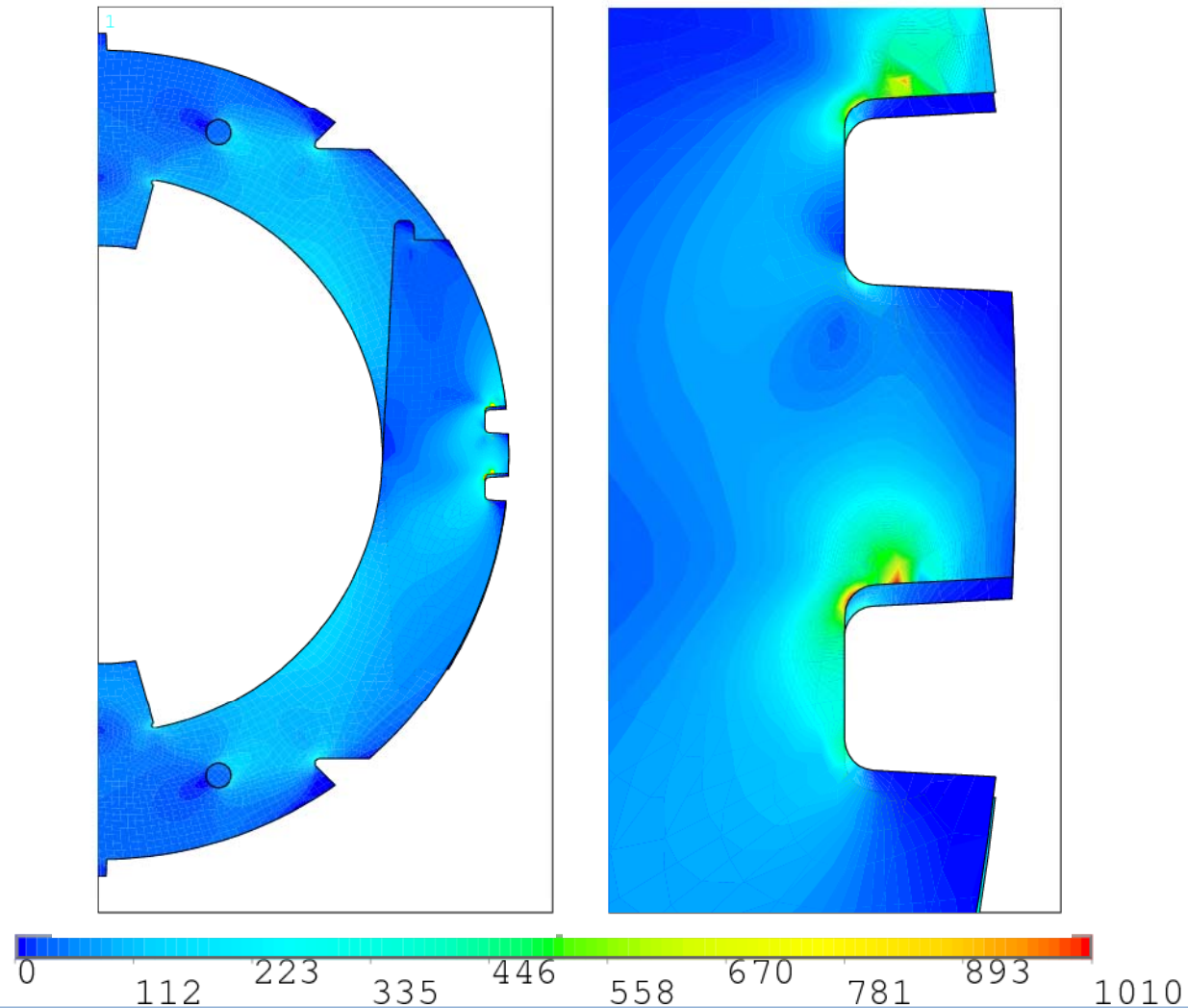
collars are over-  
closed by  $45\ \mu\text{m}$



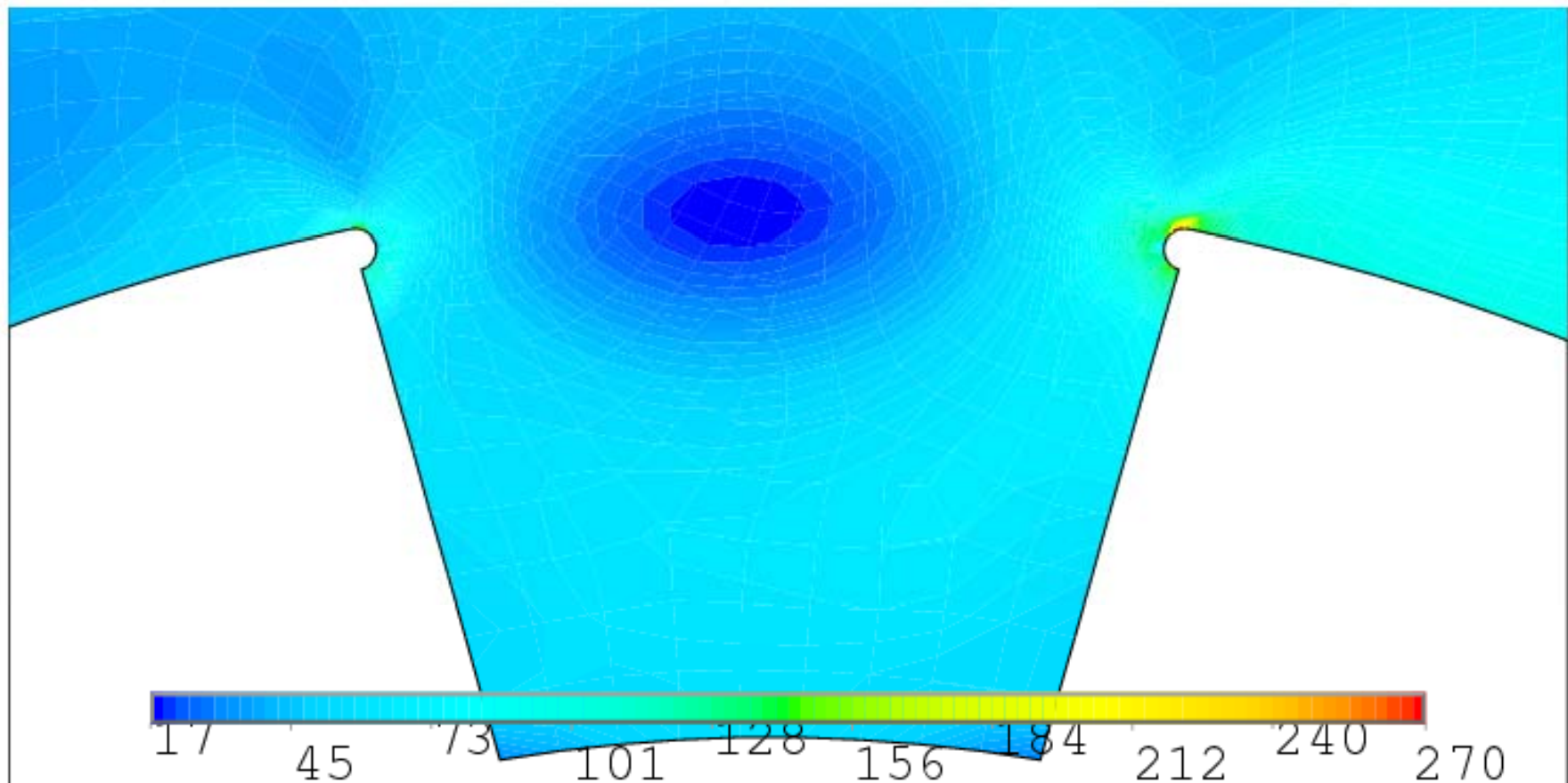
# Closing of collars and keys: Von Mises stress at the end of the operation



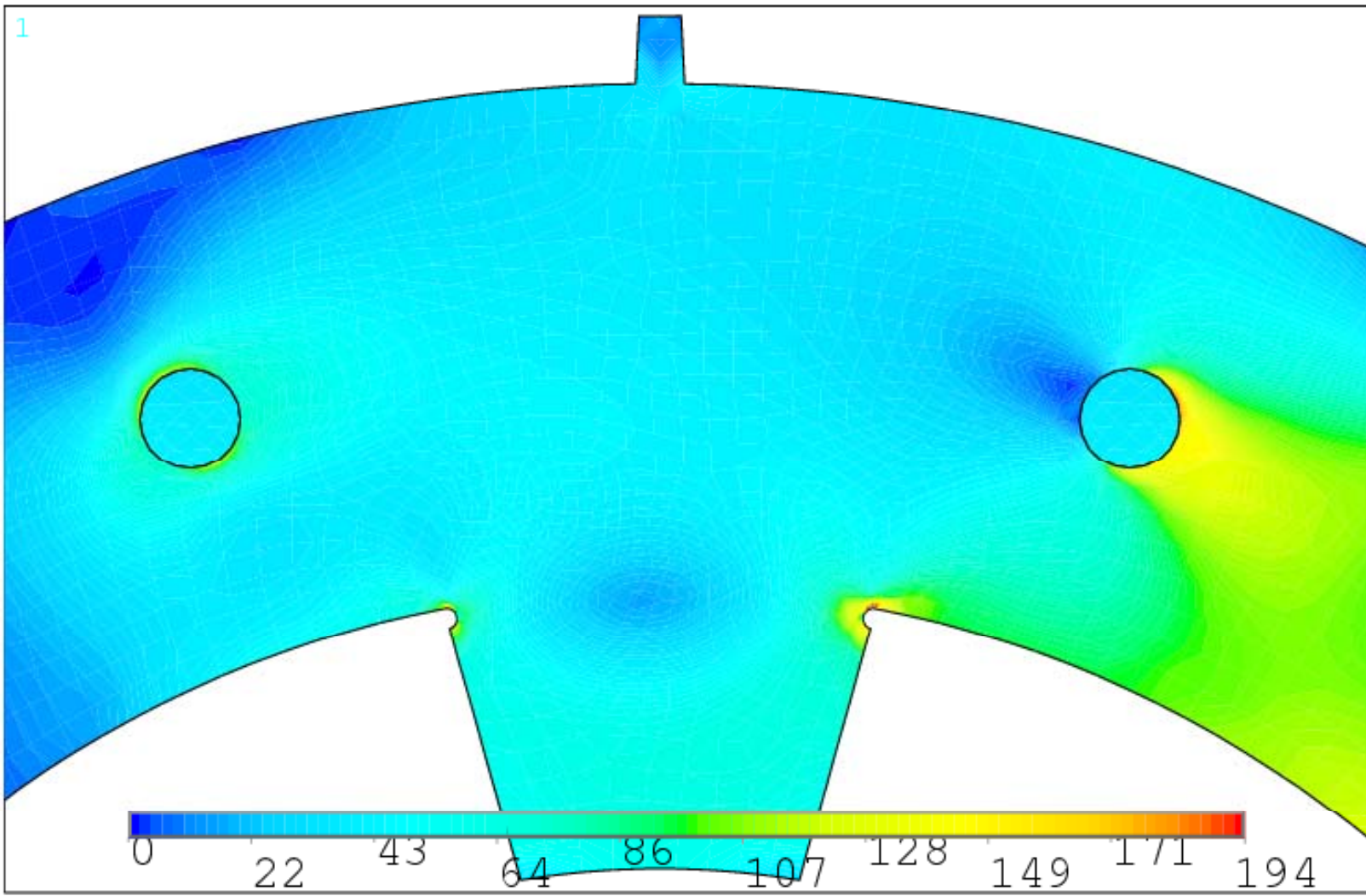
# Closing of collars and keys: Von Mises stress in the key region



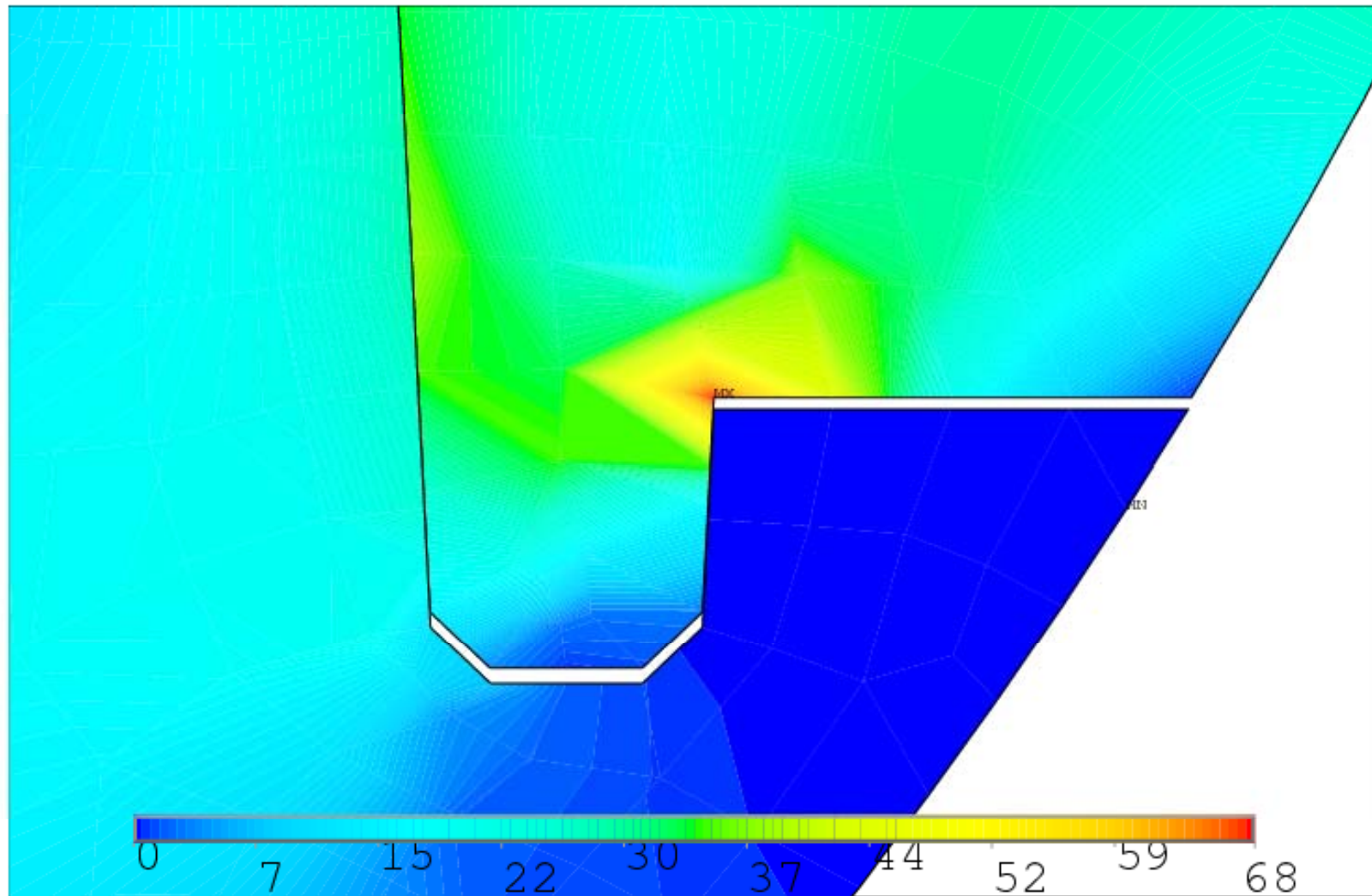
# Closing of collars and keys: Von Mises stress in the pole corner



# Closing of collars and keys: Von Mises stress in the pin region

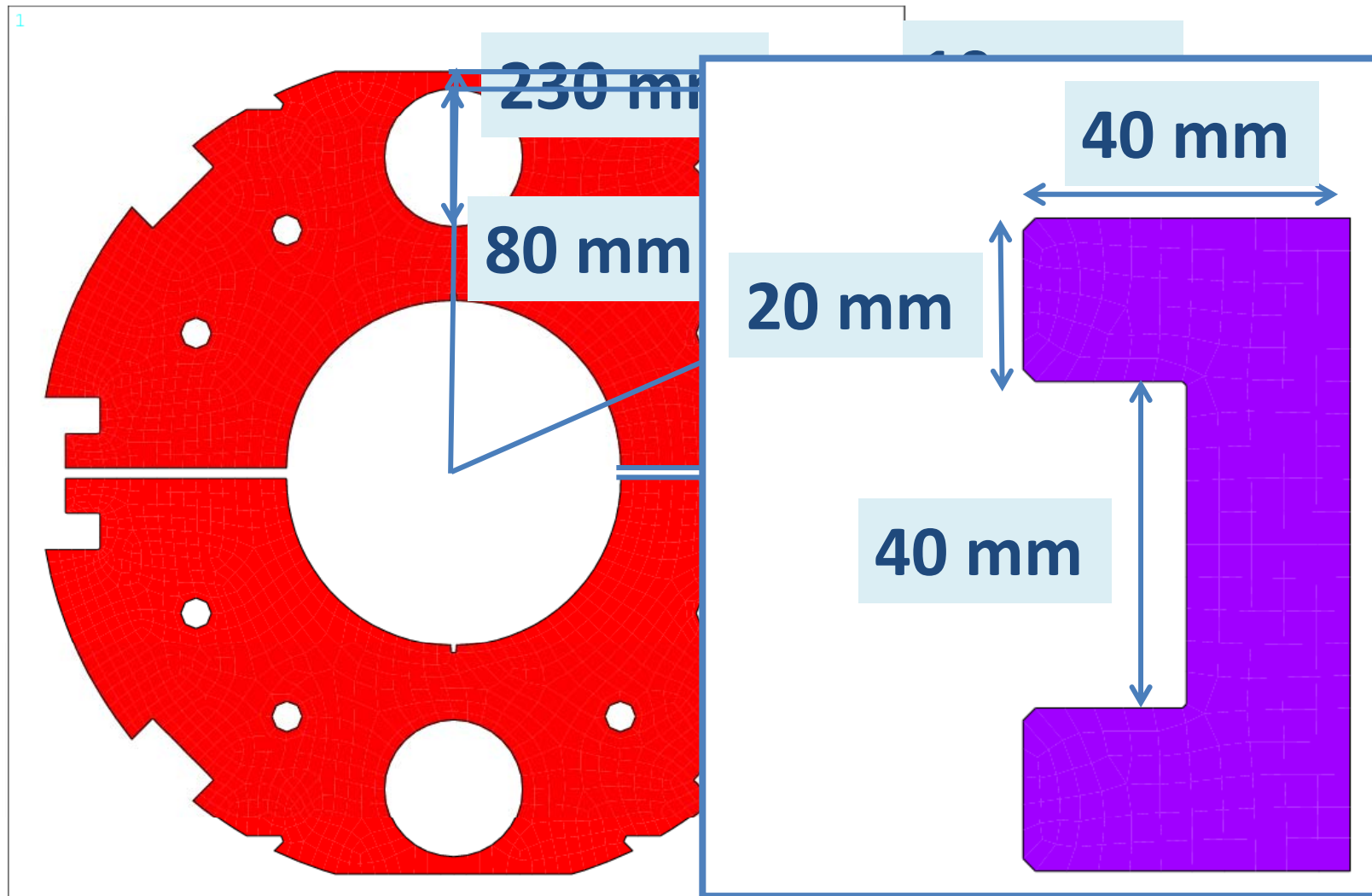


# Closing of collars and keys: Von Mises stress in the notch region

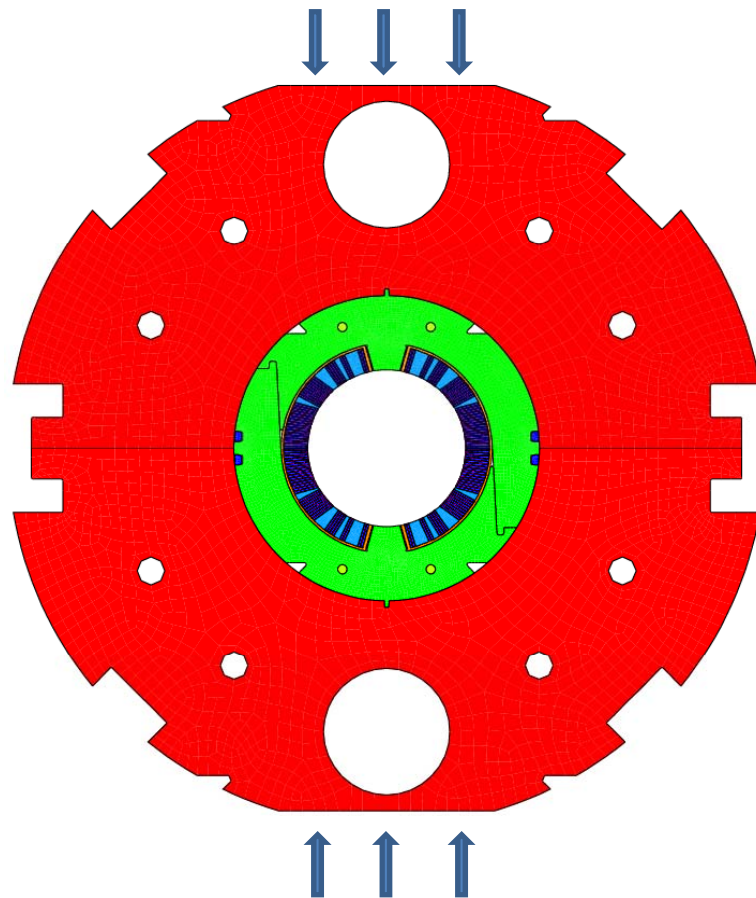


# **Mechanical analysis: iron assembly**

# Closing of iron shells and C-clamps: main dimensions



# Closing of iron shells and C-clamps: force needed to close the iron shells



force needed to close the  
iron shells:

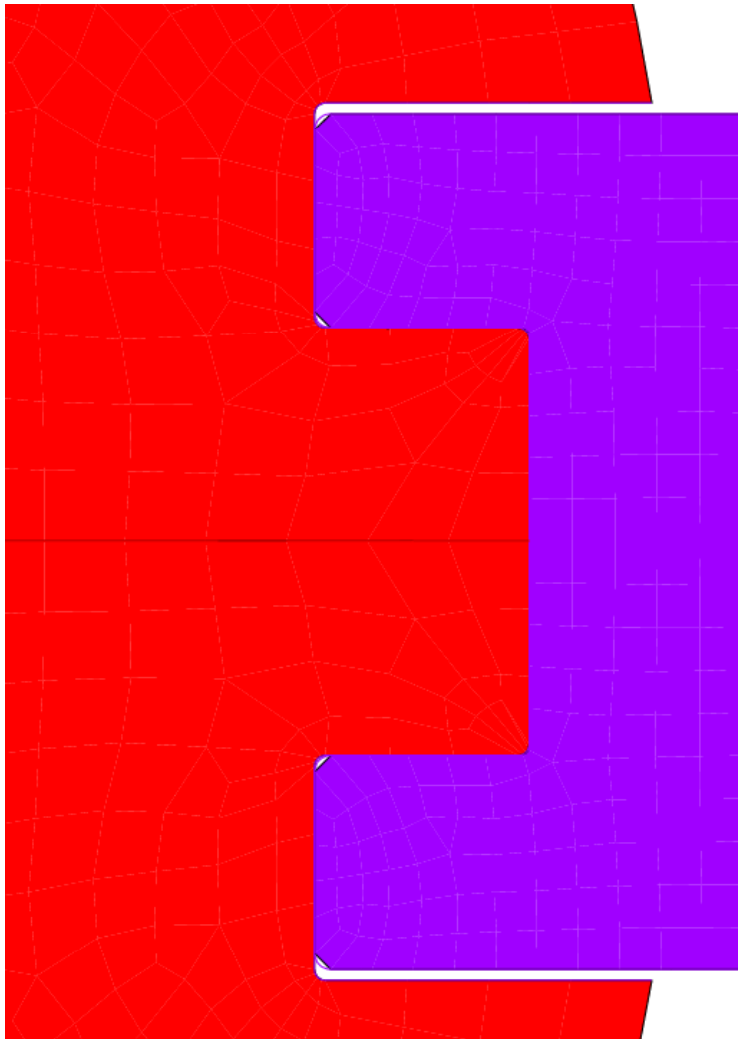
15692 N per iron shell  
(6 mm thick)

or

267 tons/m each side

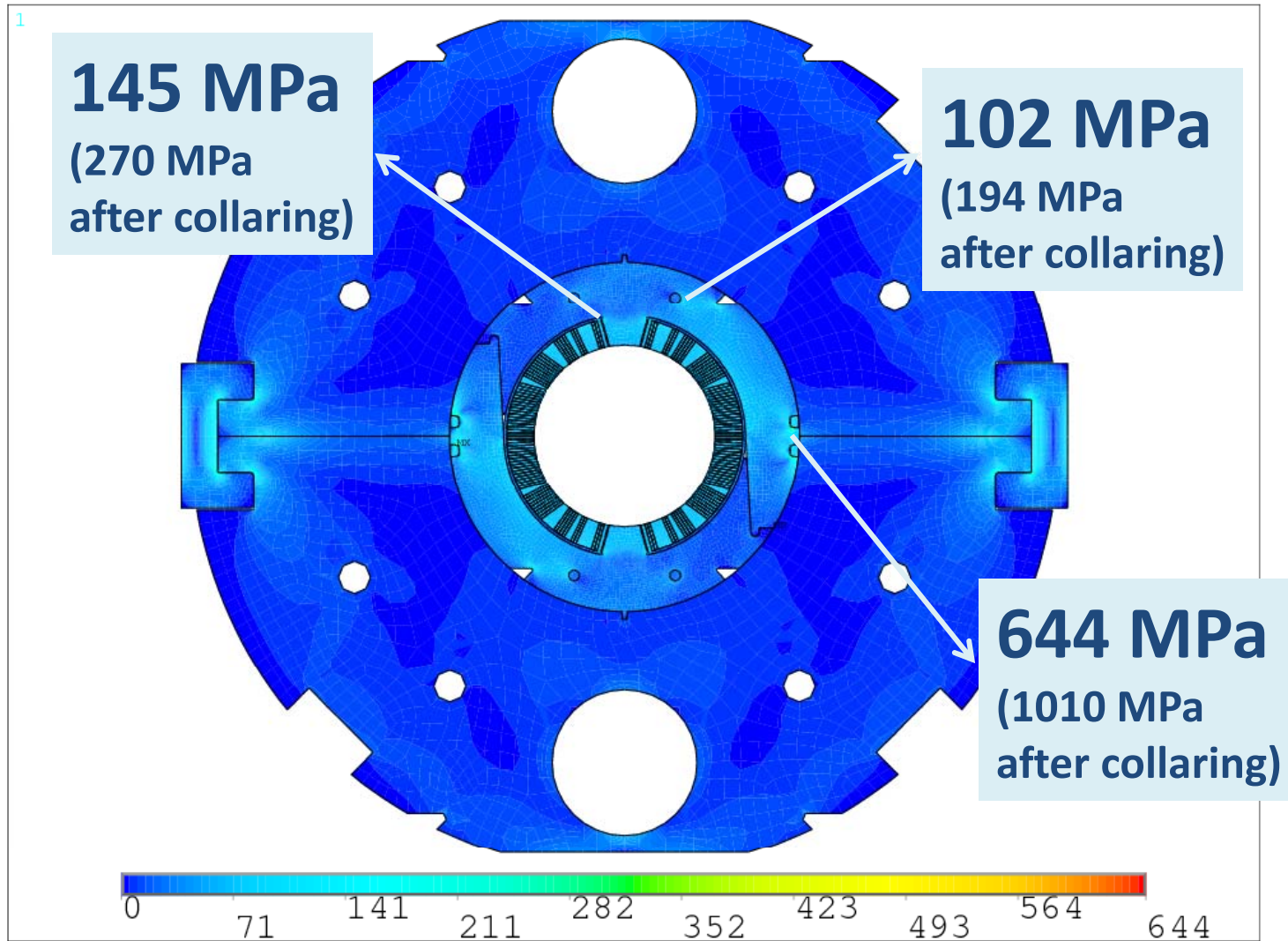


# Closing of iron shells and C-clamps: force needed to insert the C-clamps

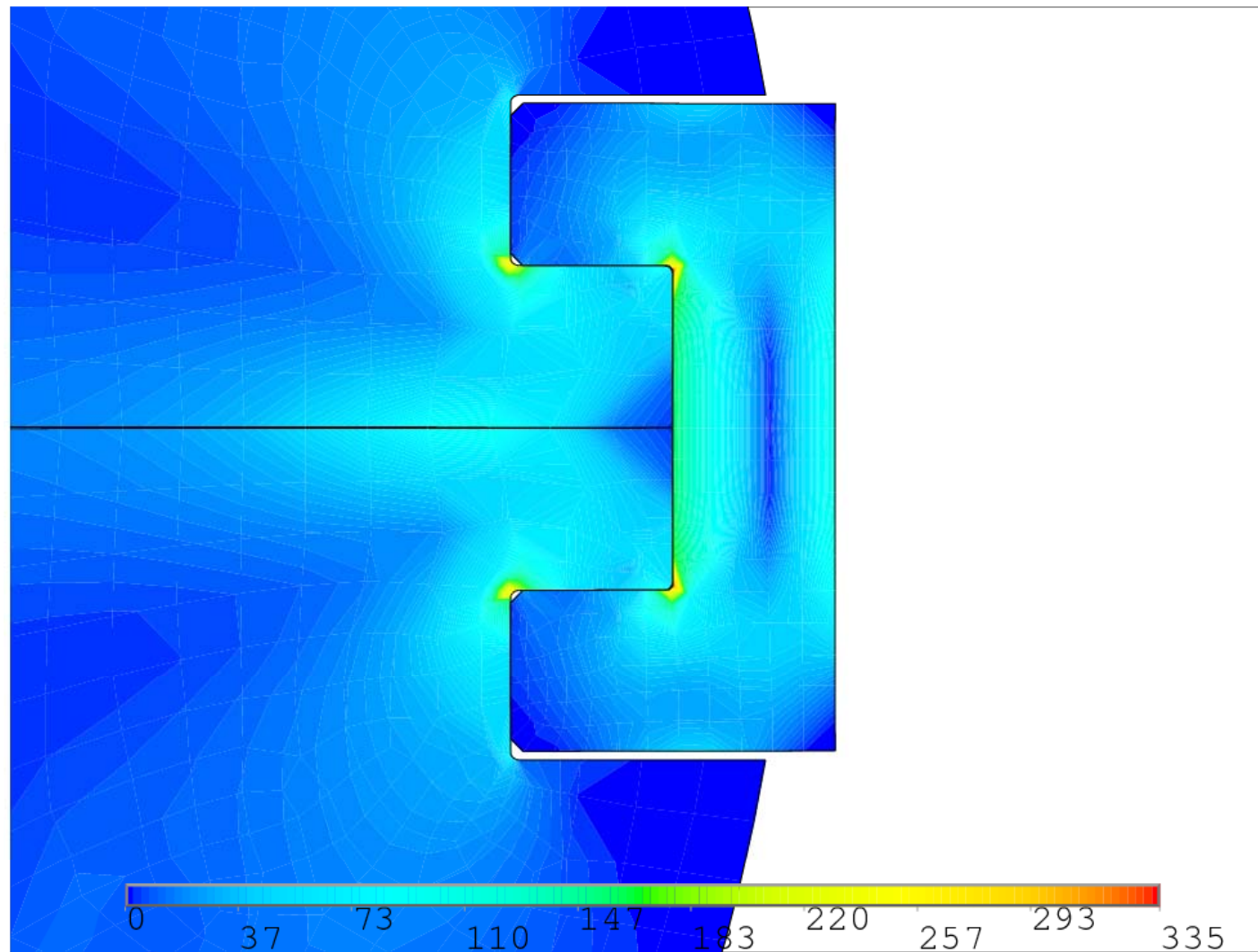


C-clamps are shrink fitted, so NO FORCE is needed

# Closing of iron shells and C-clamps: Von Mises stress at the end of the operation

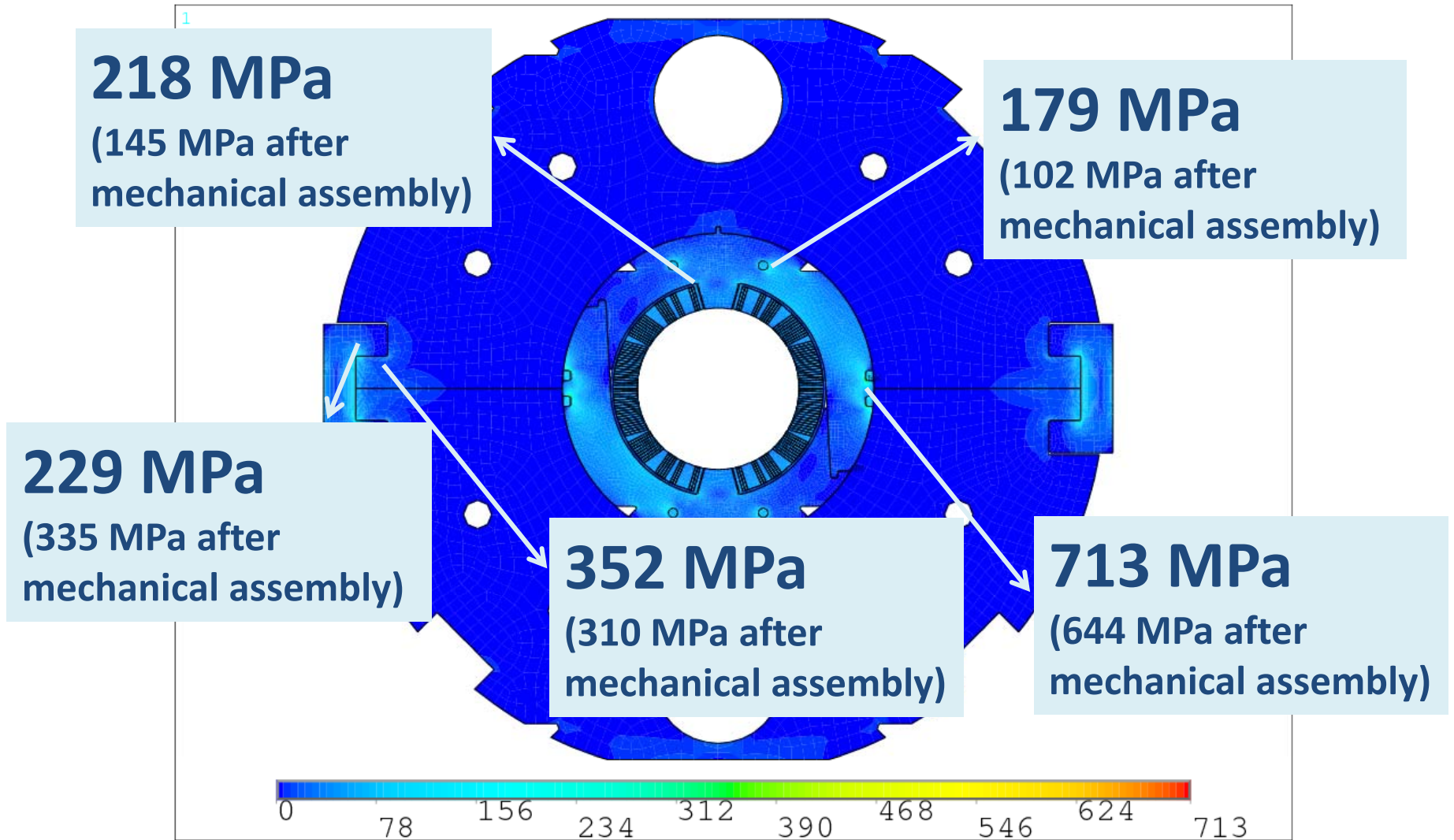


# Closing of iron shells and C-clamps: Von Mises stress in iron and keys

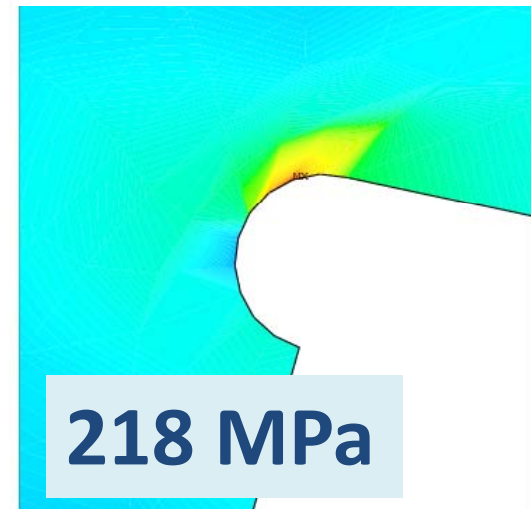
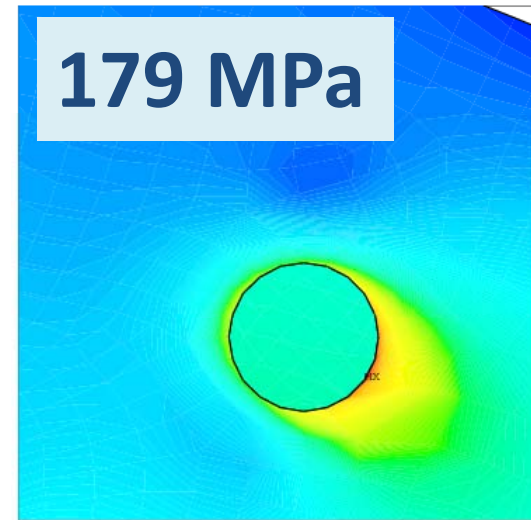
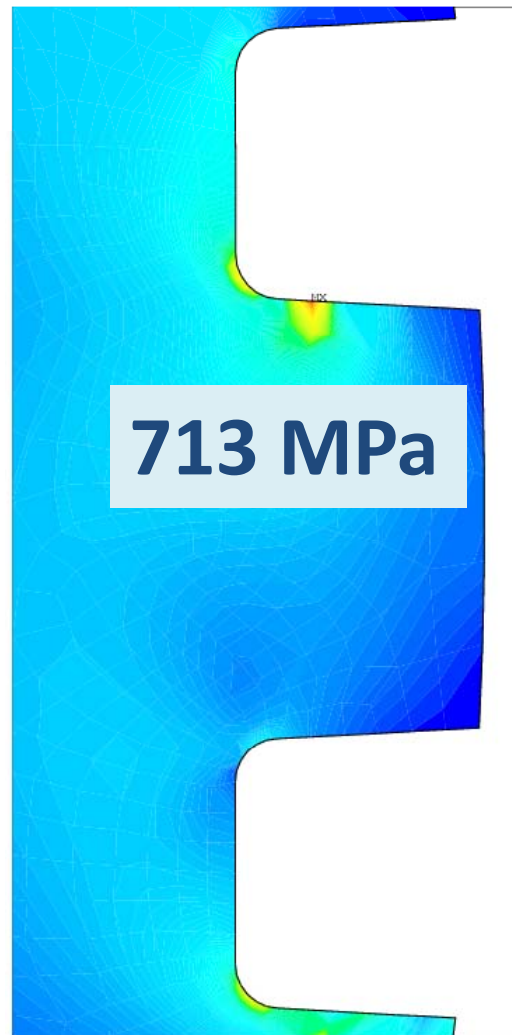
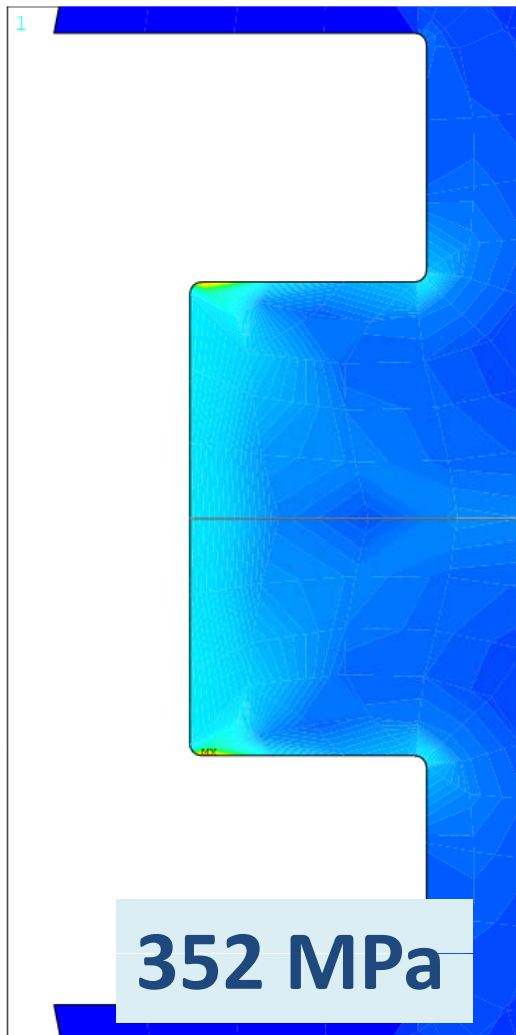


# **Mechanical analysis: cool-down**

# Cool-down to 4.2 K: Von Mises stress

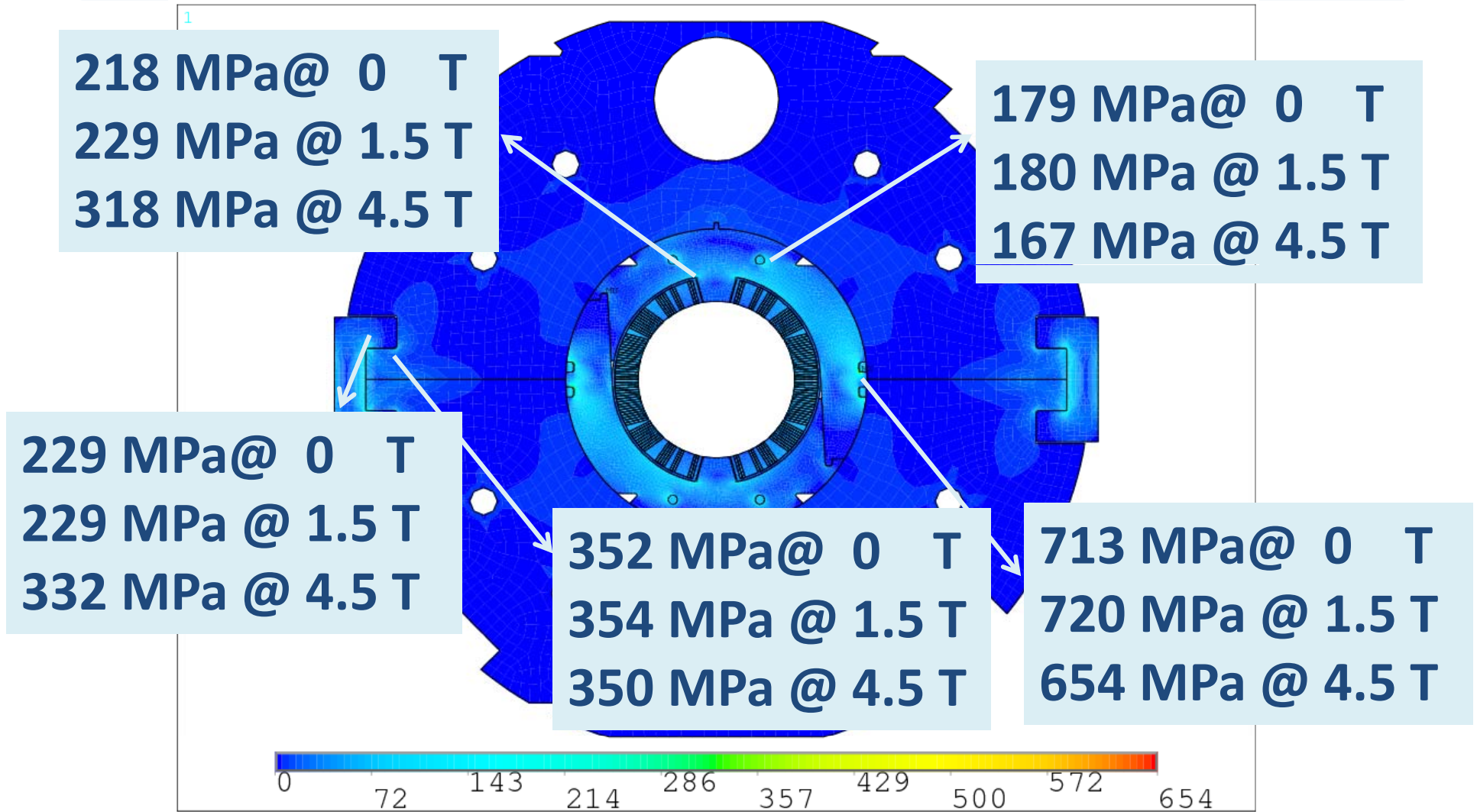


# Cool-down to 4.2 K: peak stress location



# **Mechanical analysis: energization**

# Energization @ 4.5 T: Von Mises stress





# Azimuthal stress in conductors

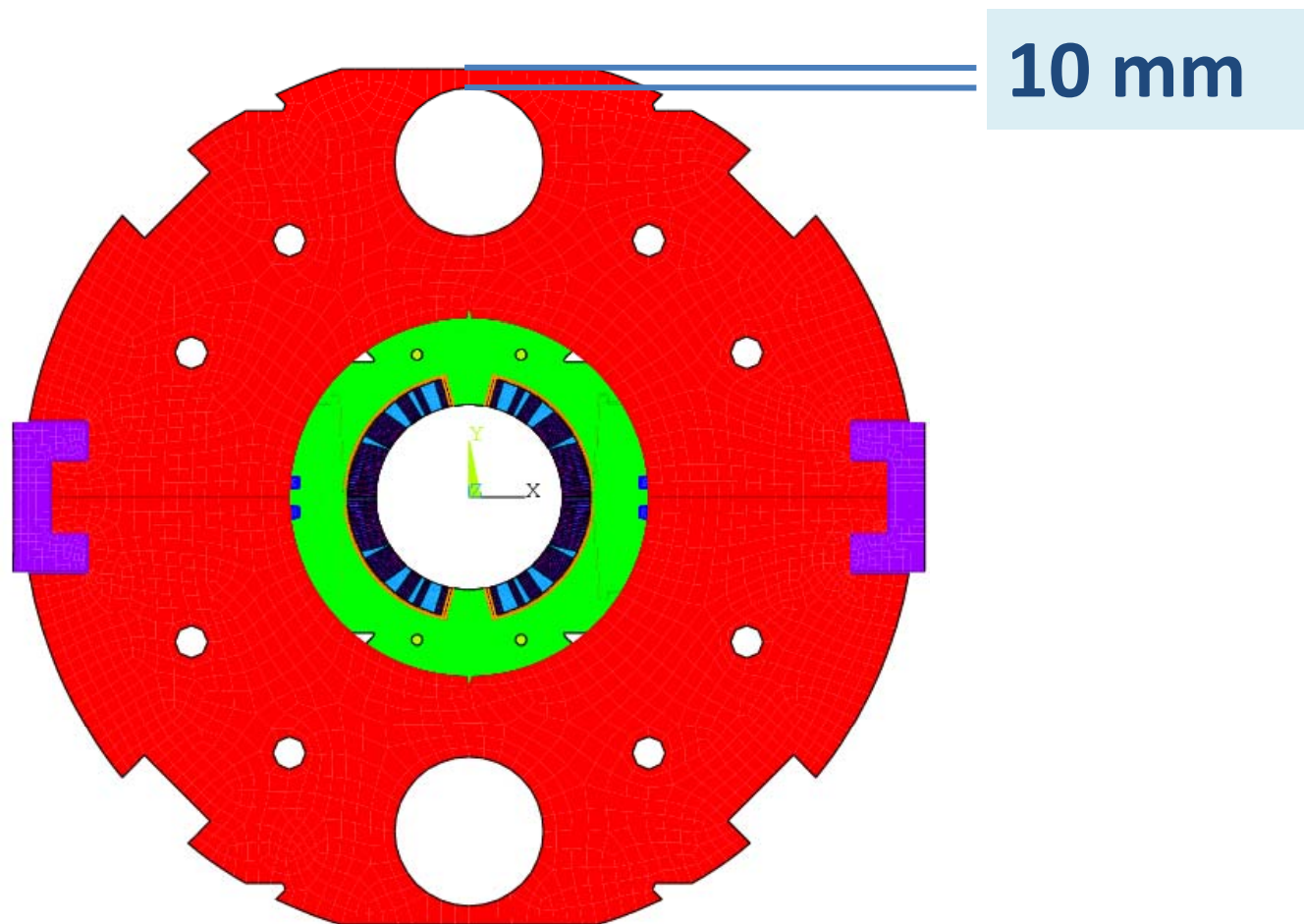
LOADSTEP	Maximum azimuthal stress (MPa)	Minimum azimuthal stress (MPa)	Average azimuthal stress (MPa)
Collaring	-36	-104	-74
Cool-down	-17	-66	-46
Energization	-7	-77	-50

# Distance between iron shells

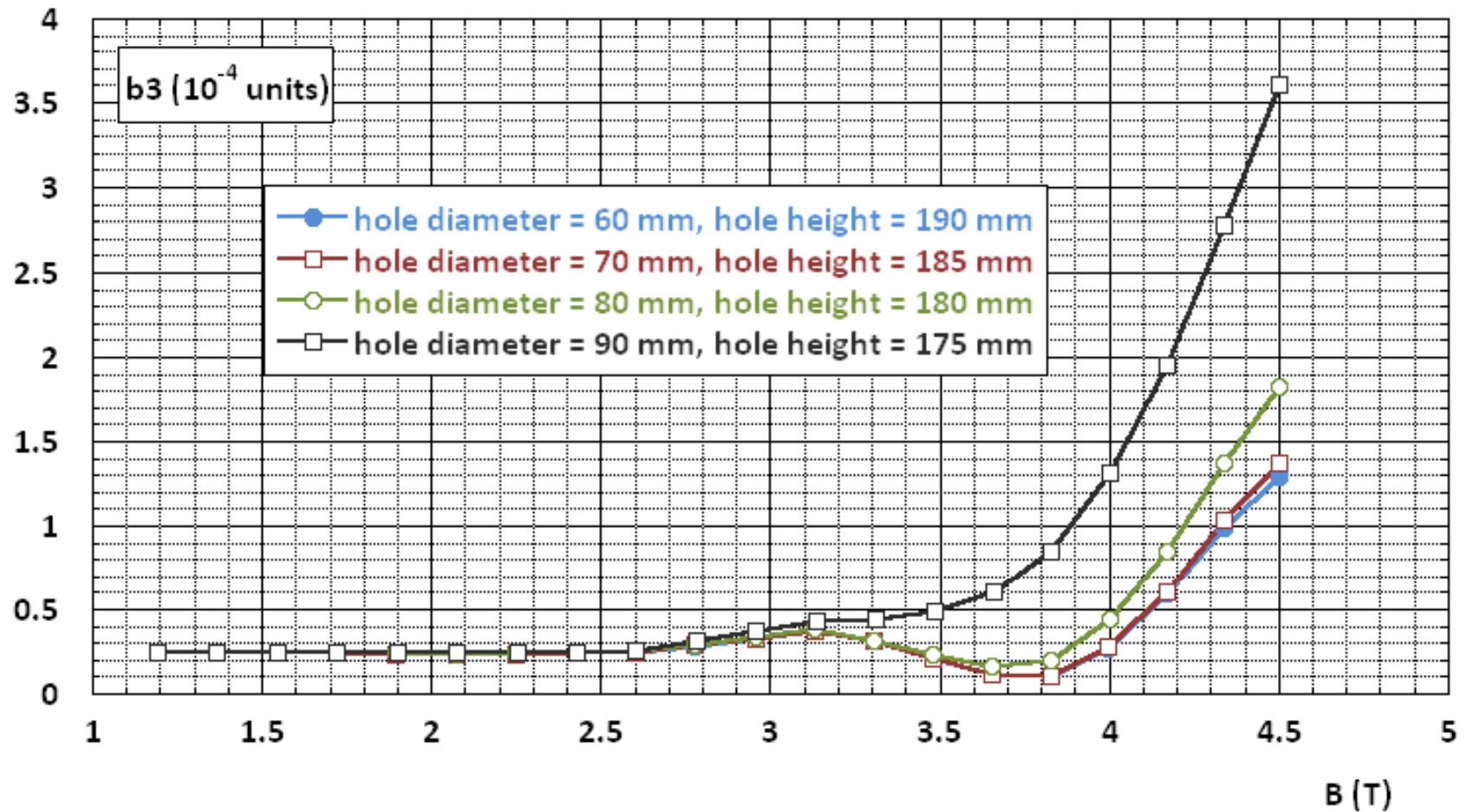
LOADSTEP	Inner distance ( $\mu\text{m}$ )	Outer distance ( $\mu\text{m}$ )
Collaring	182	59
Cool-down	30	1
Energization	9	1

# **Magnetic analysis**

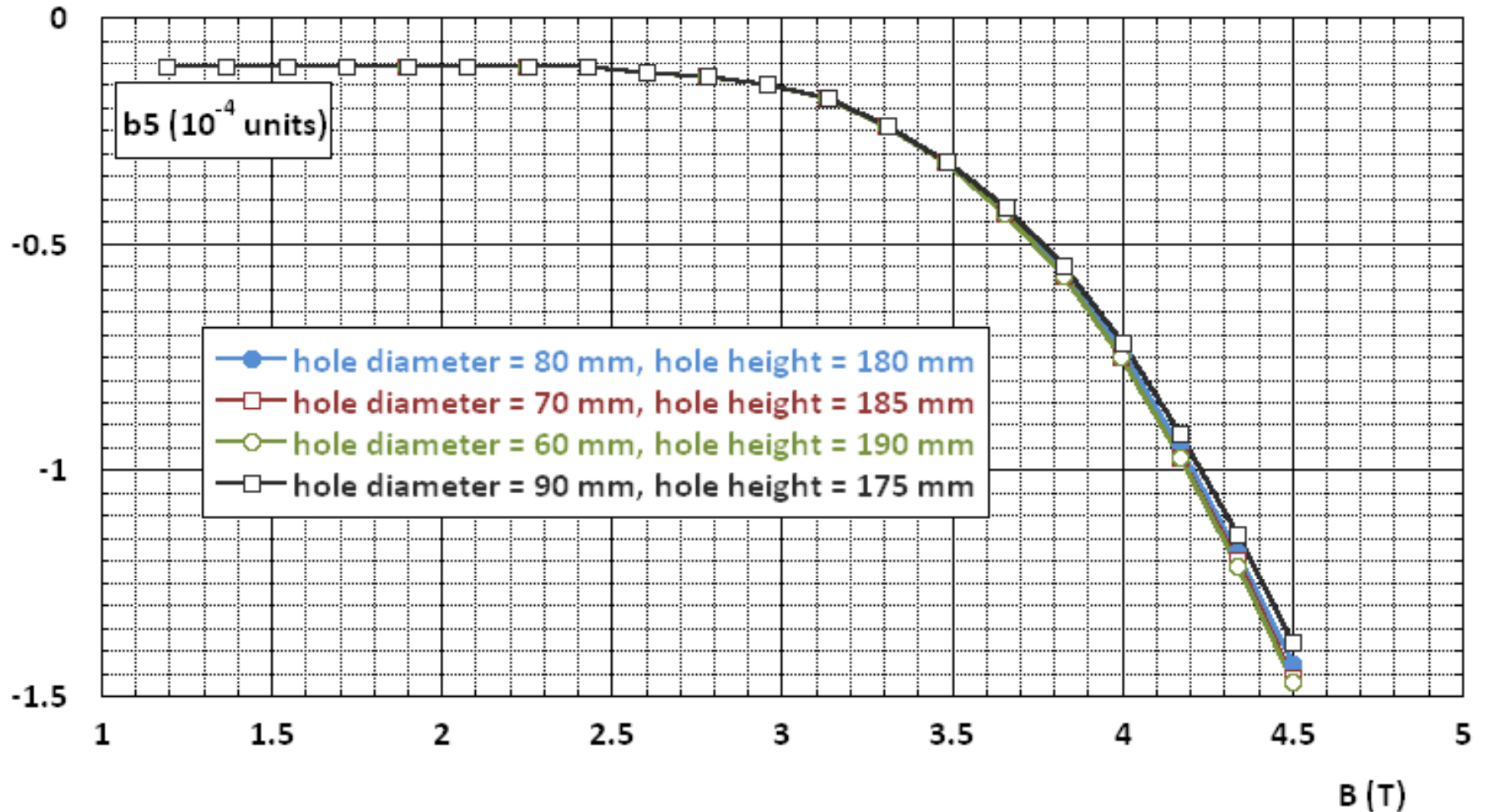
# hole dimensions



# b3 for different hole dimensions

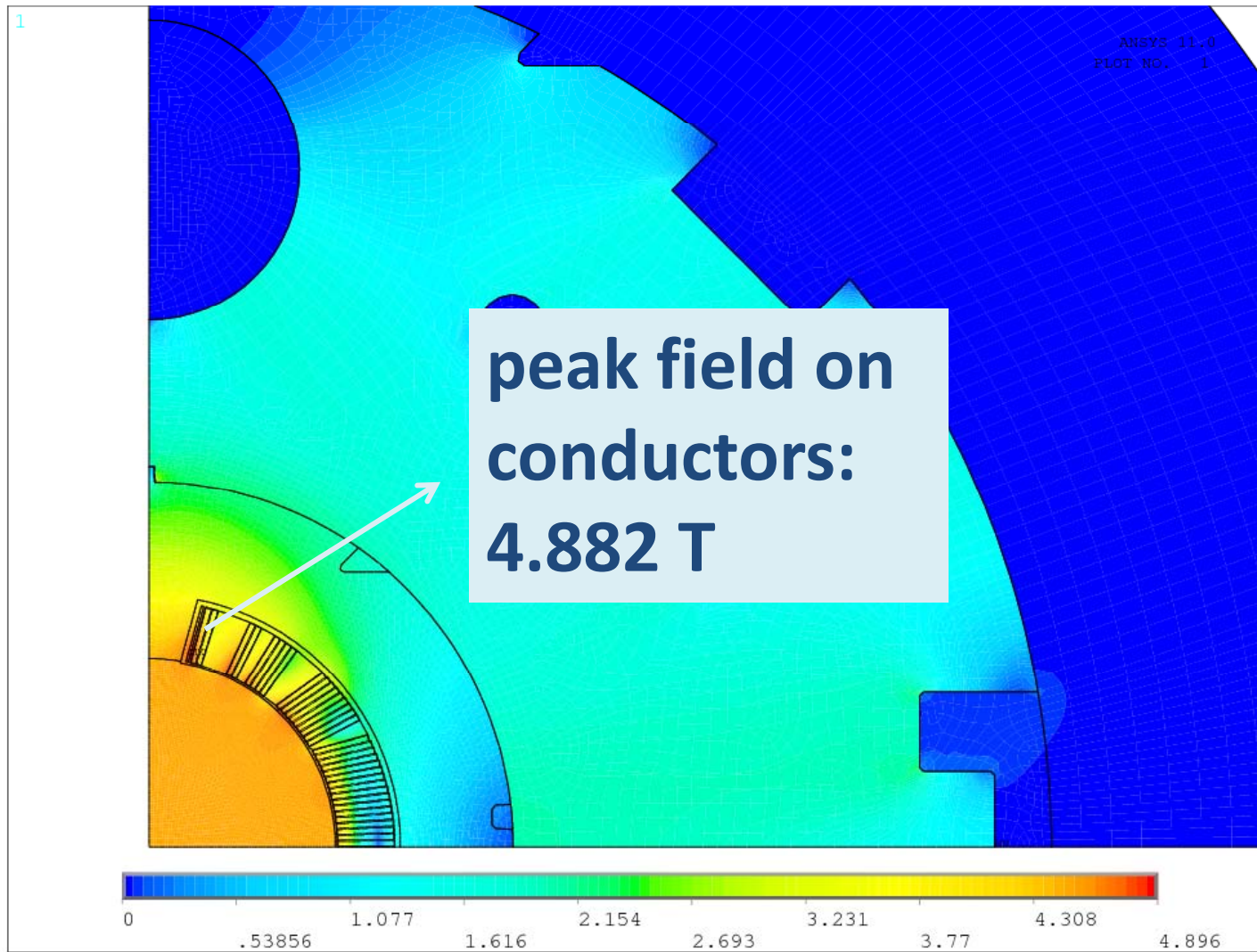


# b5 for different hole dimensions



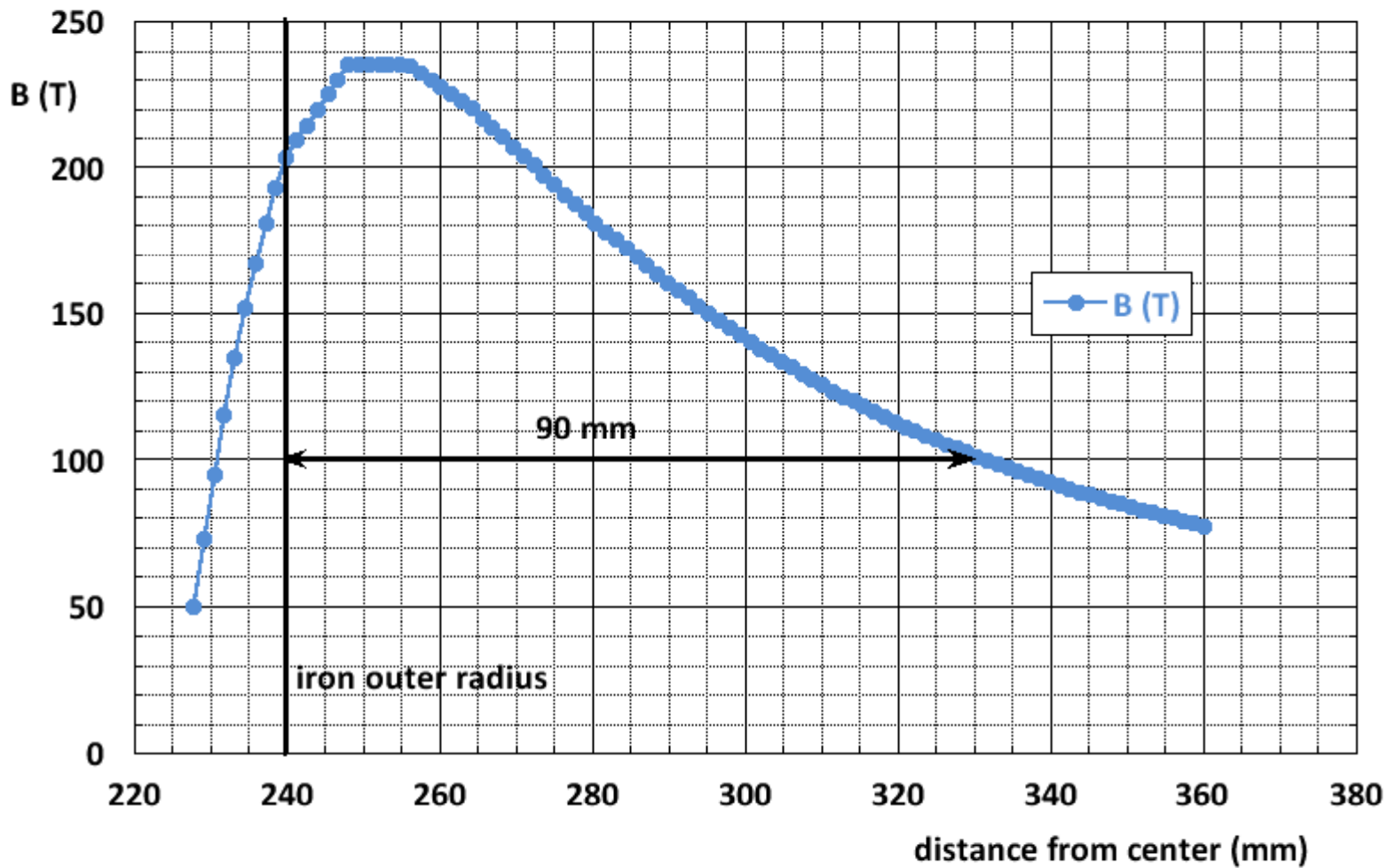
**we need the hole dimensions to  
finalize the iron shape**

# magnetic field map

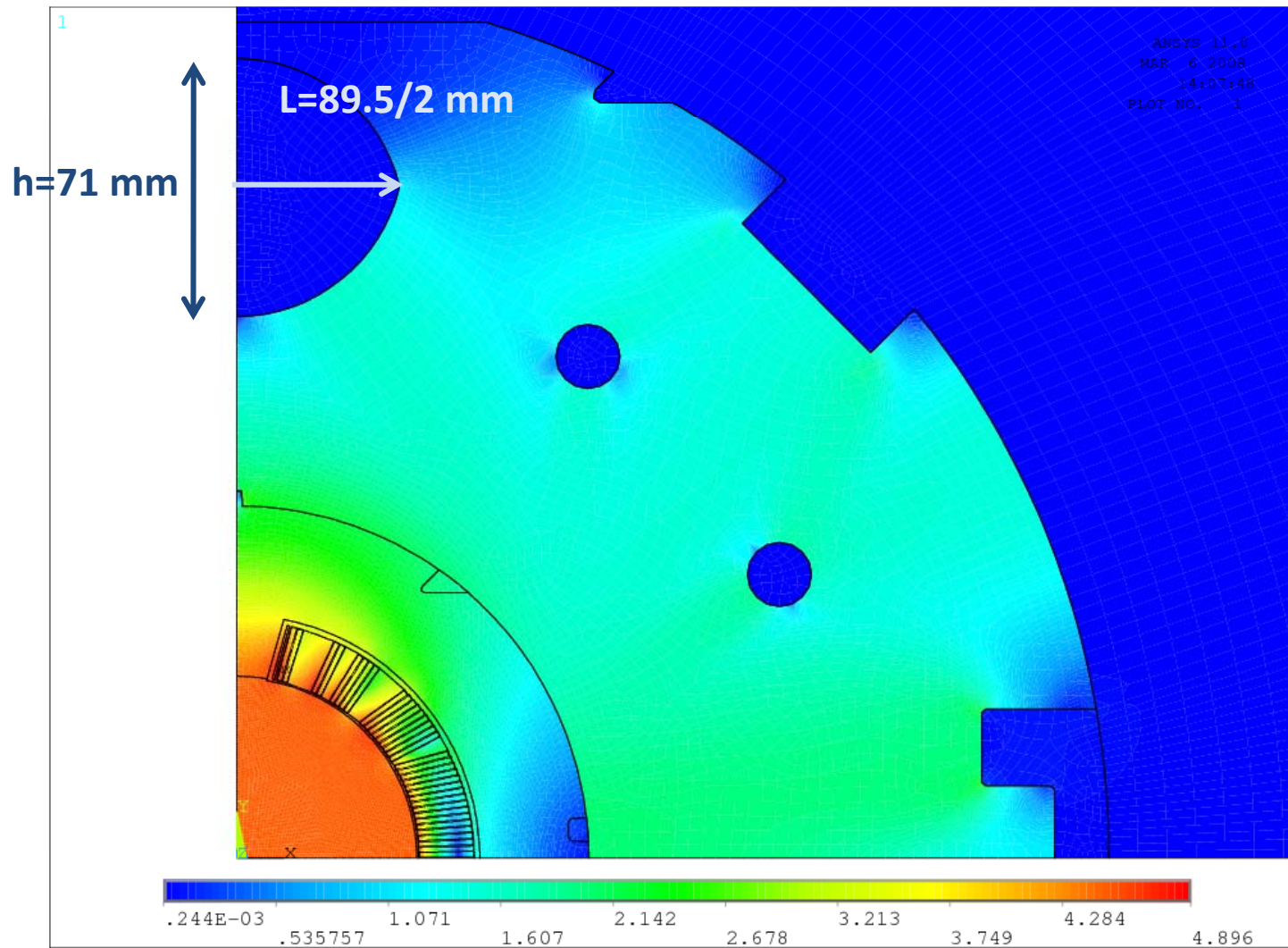




# fringe field



# New iron hole proposal



# b3 for different hole dimensions

