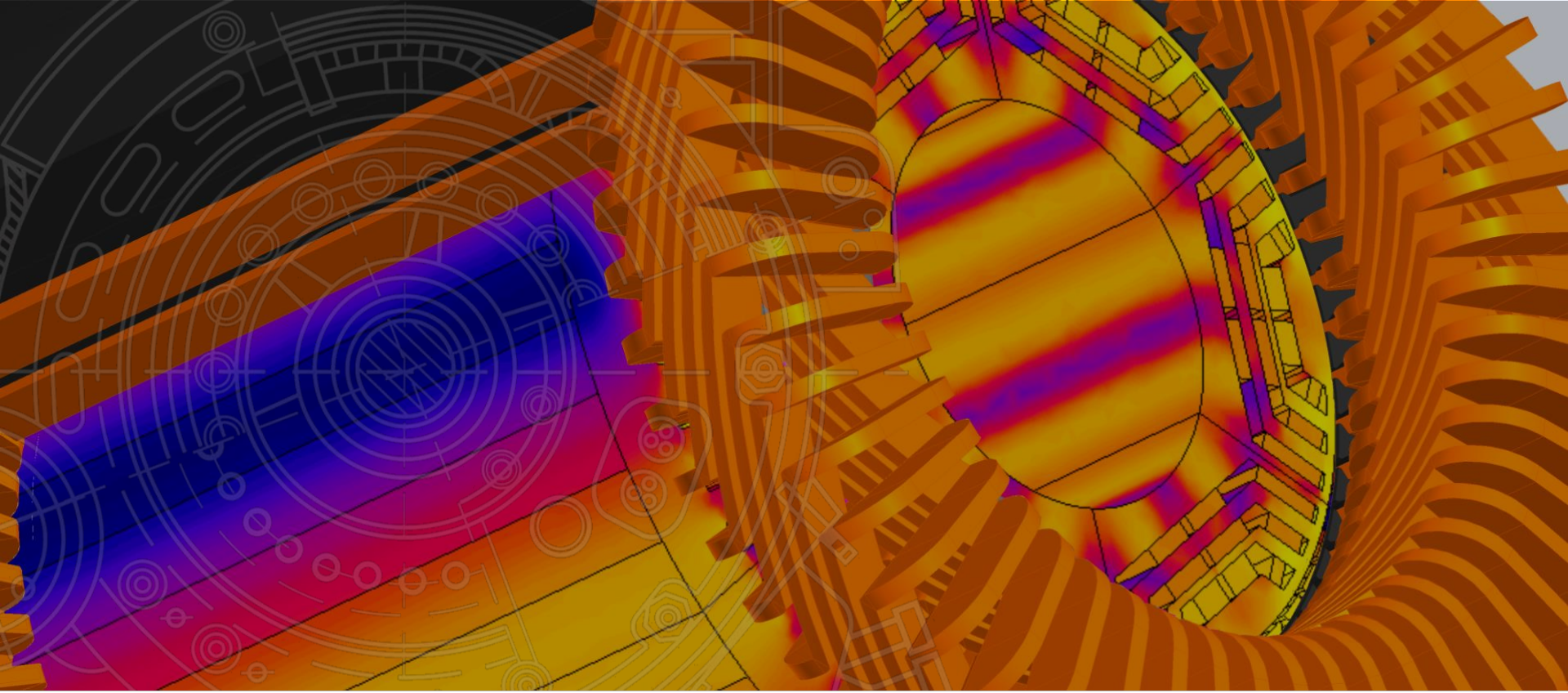


ALTAIR

HELMHOLTZ COIL

Flux 3D : project step by step

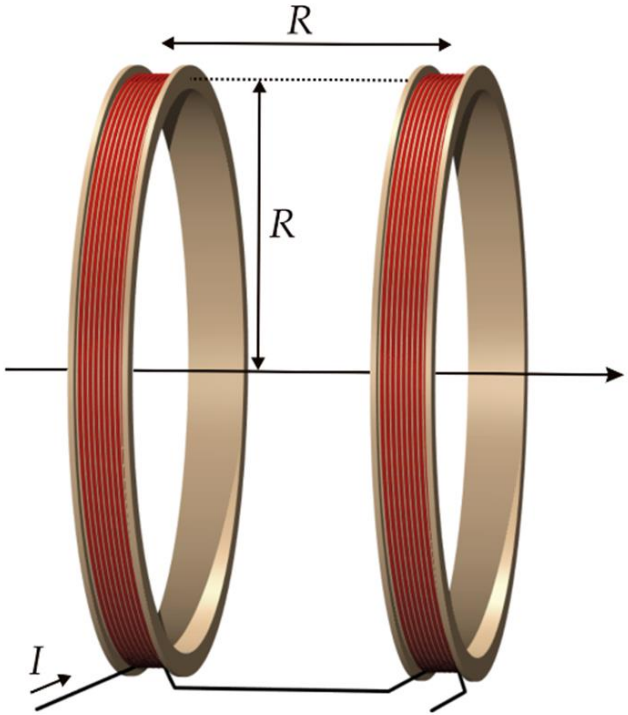
Overall view on the device

A Helmholtz coil is a coil divided into two parts to obtain a constant magnetic field in a large volume inside the coil.

A gap equivalent of the radius of the coil shares the two parts, in order to reach this constant magnetic field inside the coil.

The following tutorial shows how to create a Helmholtz coil of 10 turns for each half of the coil in Flux software.

The device will be drawn in Flux 3D using a non meshed coil.



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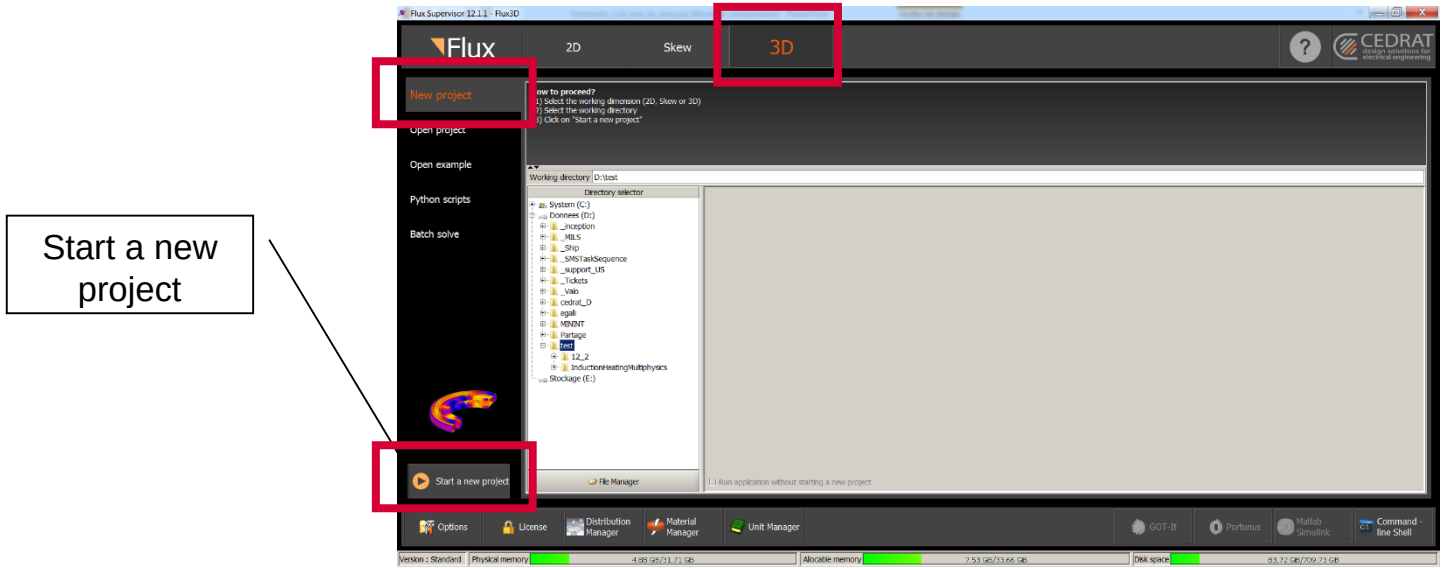
STARTING A NEW PROJECT

Starting a new project : new project

Open Flux 12.1 supervisor

Start a new 3D project (select 3D at the top of the supervisor, and then the tab New project on the left)

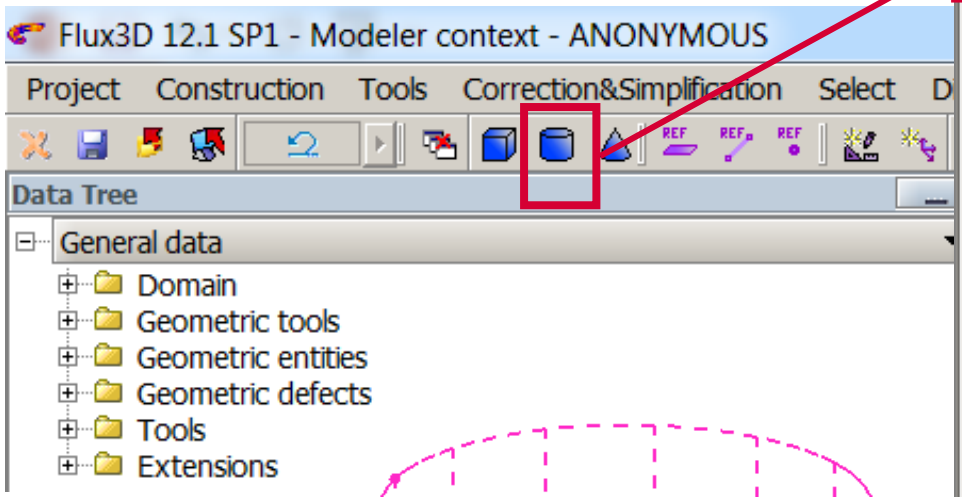


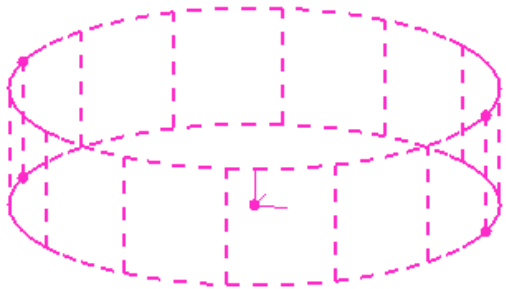
Open the Modeler context if necessary (Geometry > Modeler context)

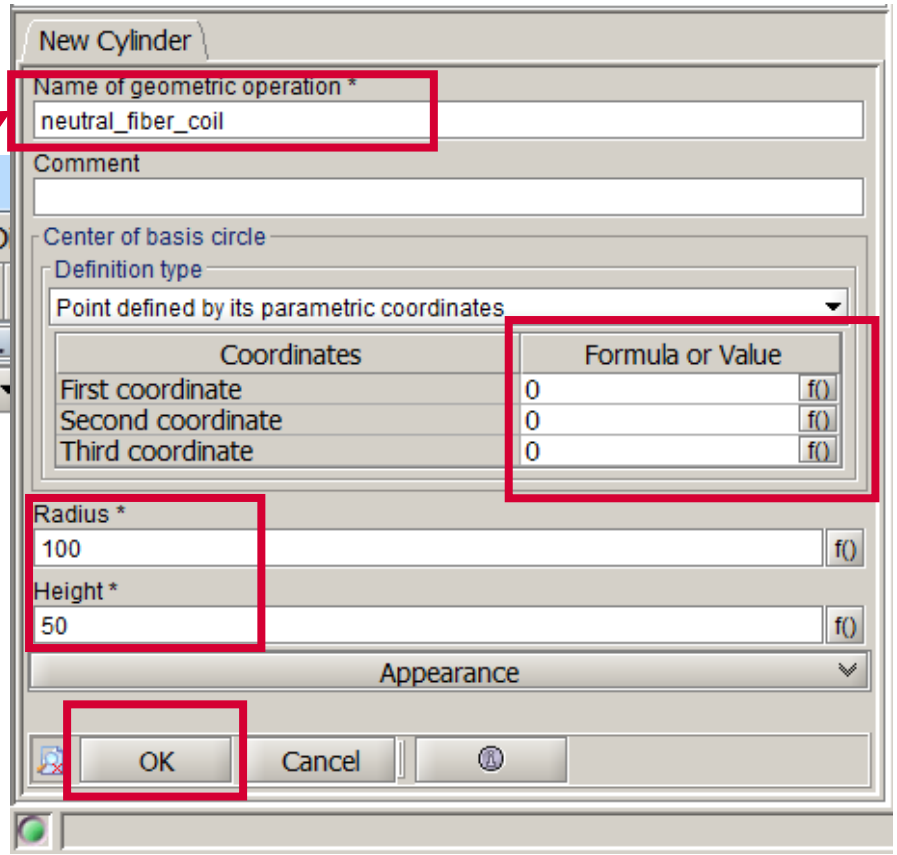
GEOMETRY

Geometry : create a new cylinder

From the graphical shortcut







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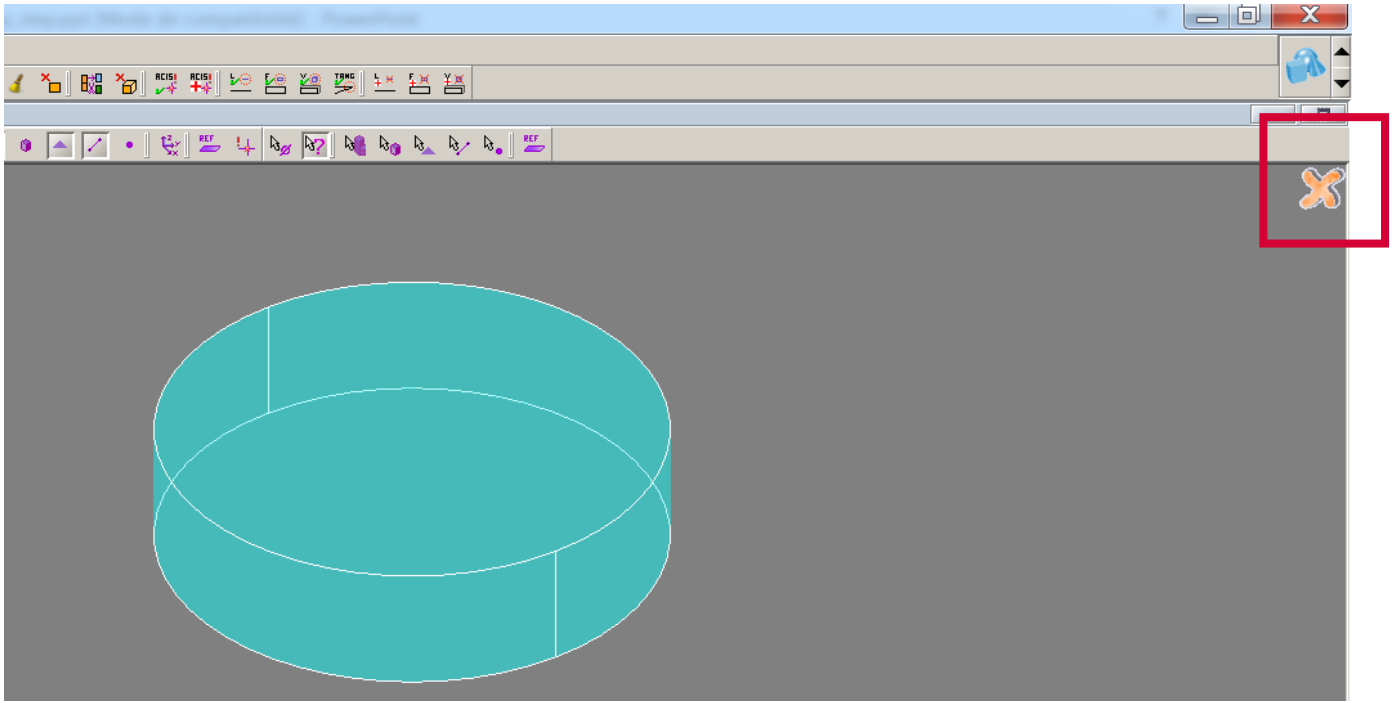
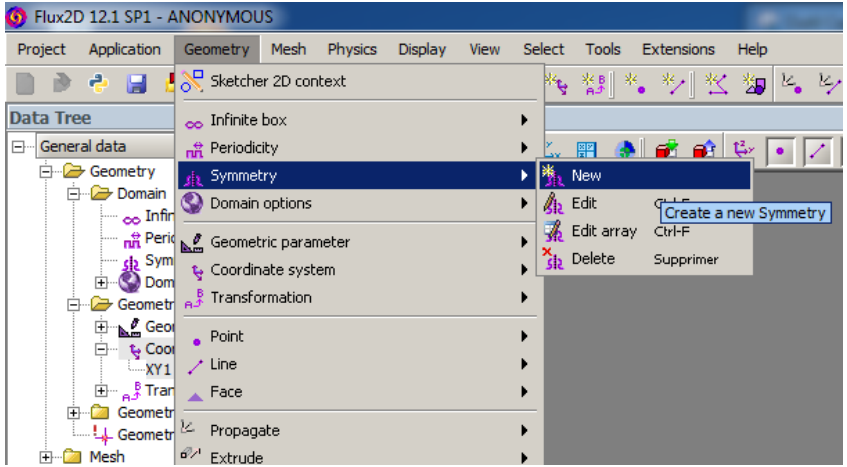
Geometry : close Modeler context

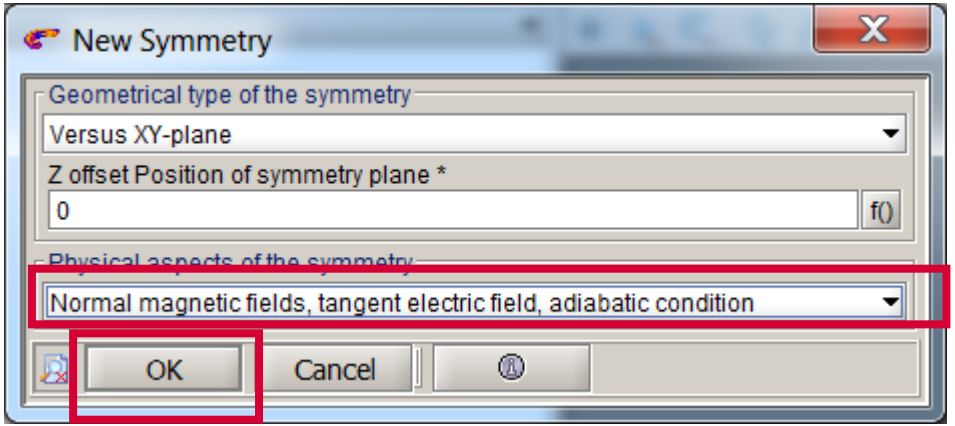
From the graphical shortcut (orange cross at the top right of the screen)



Geometry : symmetry

Create a symmetry along X-axis (Geometry > Symmetry > New)





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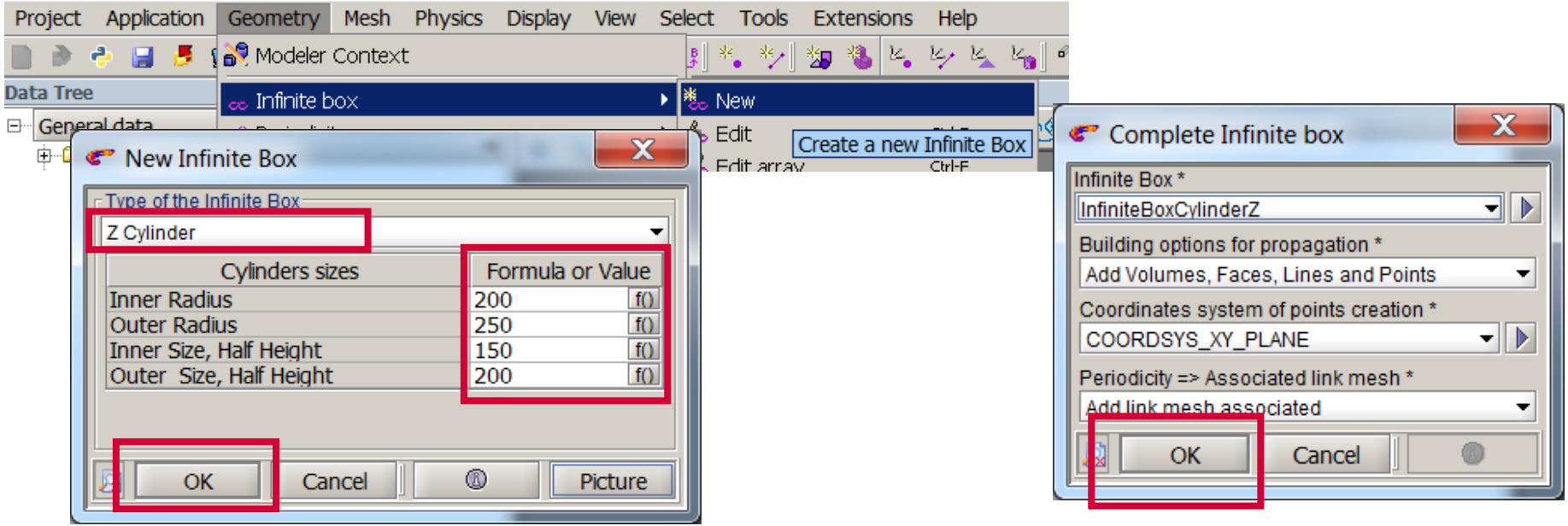
Geometry : infinite box

Create an infinite box (Geometry > Infinite box > New)

Complete infinite box (Geometry > Infinite box > Complete infinite box)



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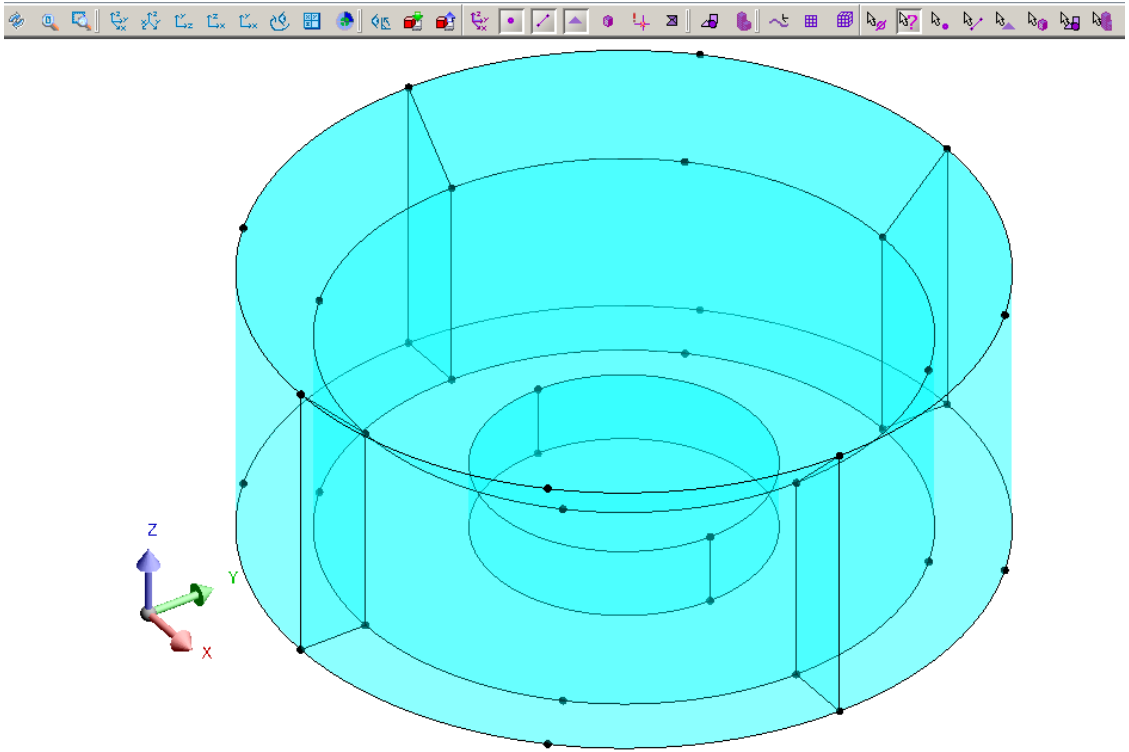
Geometry view of he geometry

All built faces appear in Turquoise



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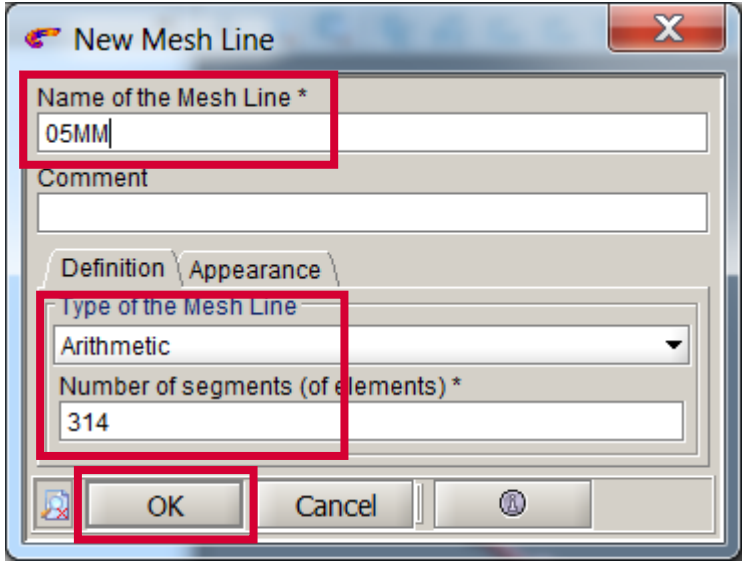
MESH

Mesh : create a mesh line

Create a new mesh line “05MM” (Mesh > Meshline > New)



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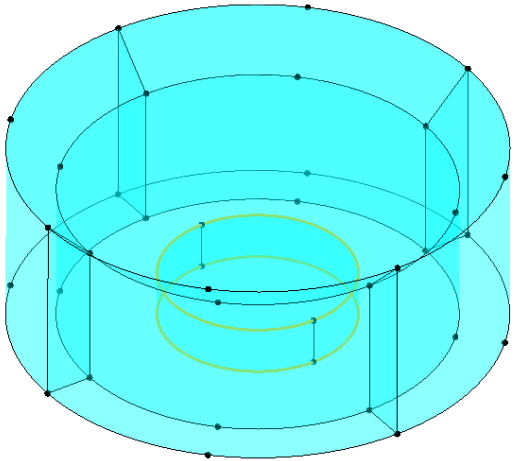
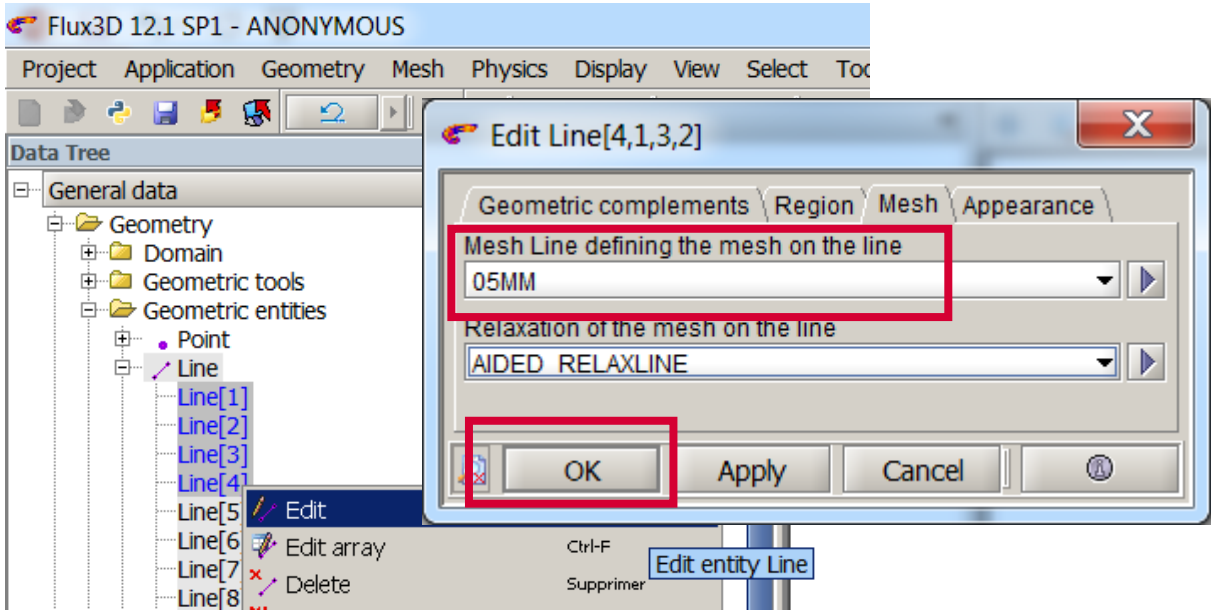
Mesh : assign mesh line

Assign the mesh line 05MM to 4 lines of the built cylinder (CTRL + click on lines 1,2,3,4 in the data tree > right click on one of the selected lines > Edit)





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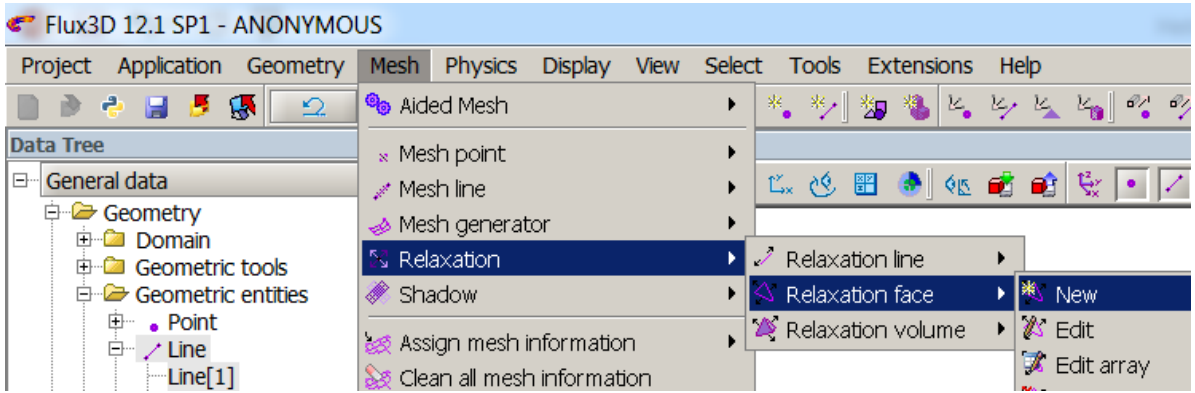
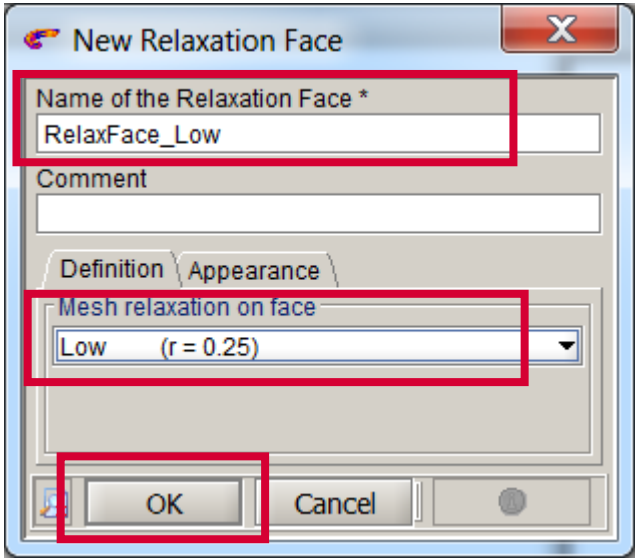
Mesh : create a relaxation on face

Create a new relaxation on face (Mesh > Relaxation > Relaxation on face > New)





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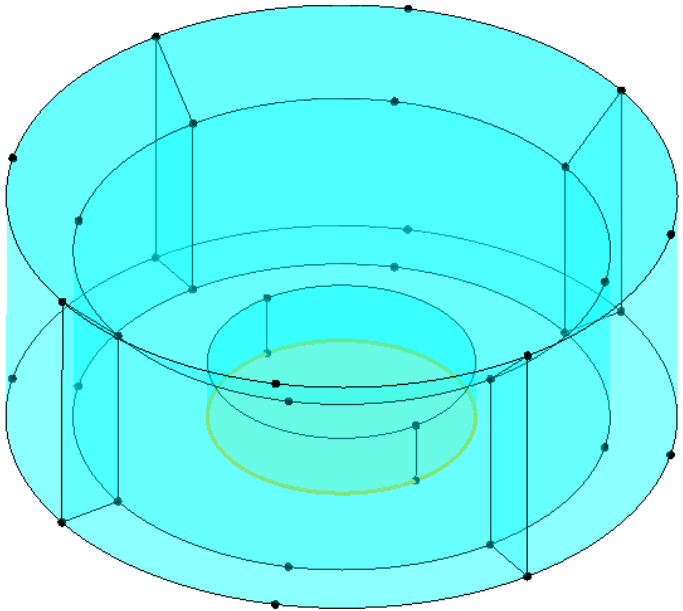
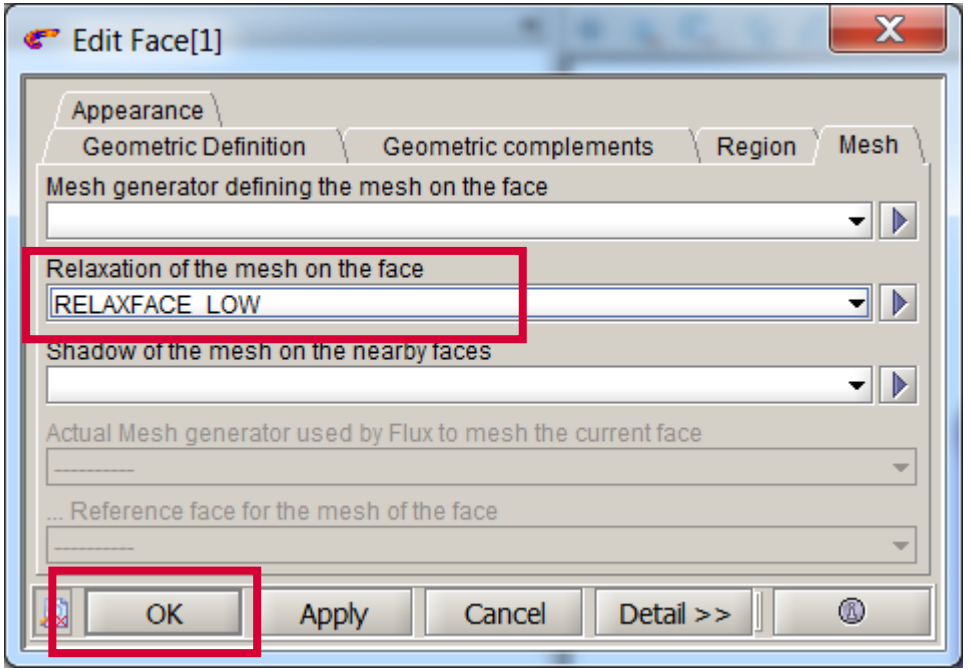
Mesh : Assign the relax face

Assign the relaxation “RelaxFace_Low” to face 1 (right click on face 1 in the data tree > Edit)





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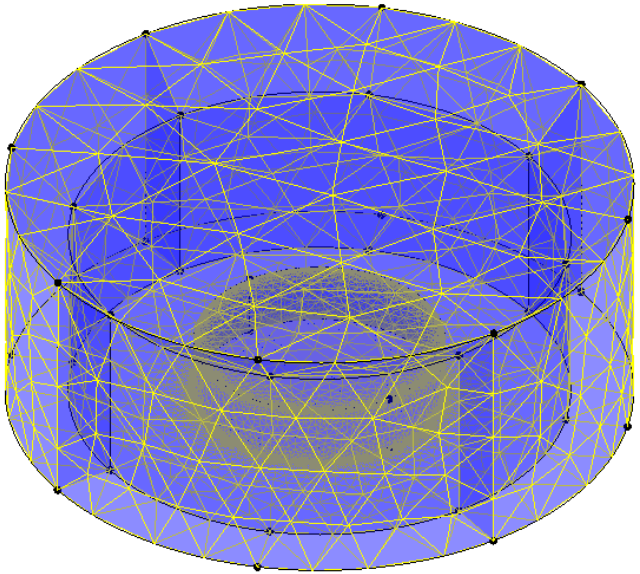
Mesh : mesh the domain

Mesh domain (Mesh > Mesh Domain).

Check the mesh (Mesh > Check Mesh) The results of the check mesh appears in the output window, as following



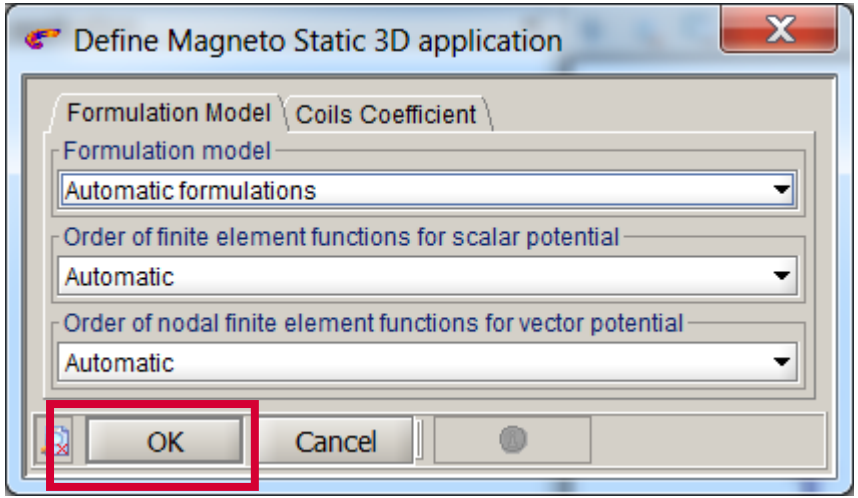
```
Volume elements :
   Number of elements not evaluated     : 0  %
   Number of excellent quality elements : 19.82  %
   Number of good quality elements      : 47.45  %
   Number of average quality elements   : 28.9  %
   Number of poor quality elements      : 3.83  %

Number of nodes : 11341
Number of line elements : 1409
Number of surface elements : 21105
Number of volume elements : 46871
Mesh order : 1st order
   checkMesh executed
```

PHYSICS

Physics : create a new application

Create a new application “Magneto static 3D” (Application > Define > Magnetic > Magneto Static 3D)



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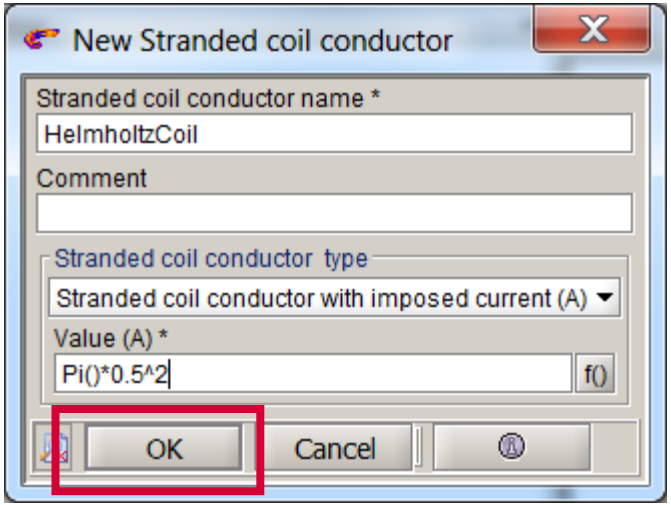
Physics : create a new stranded coil conductor

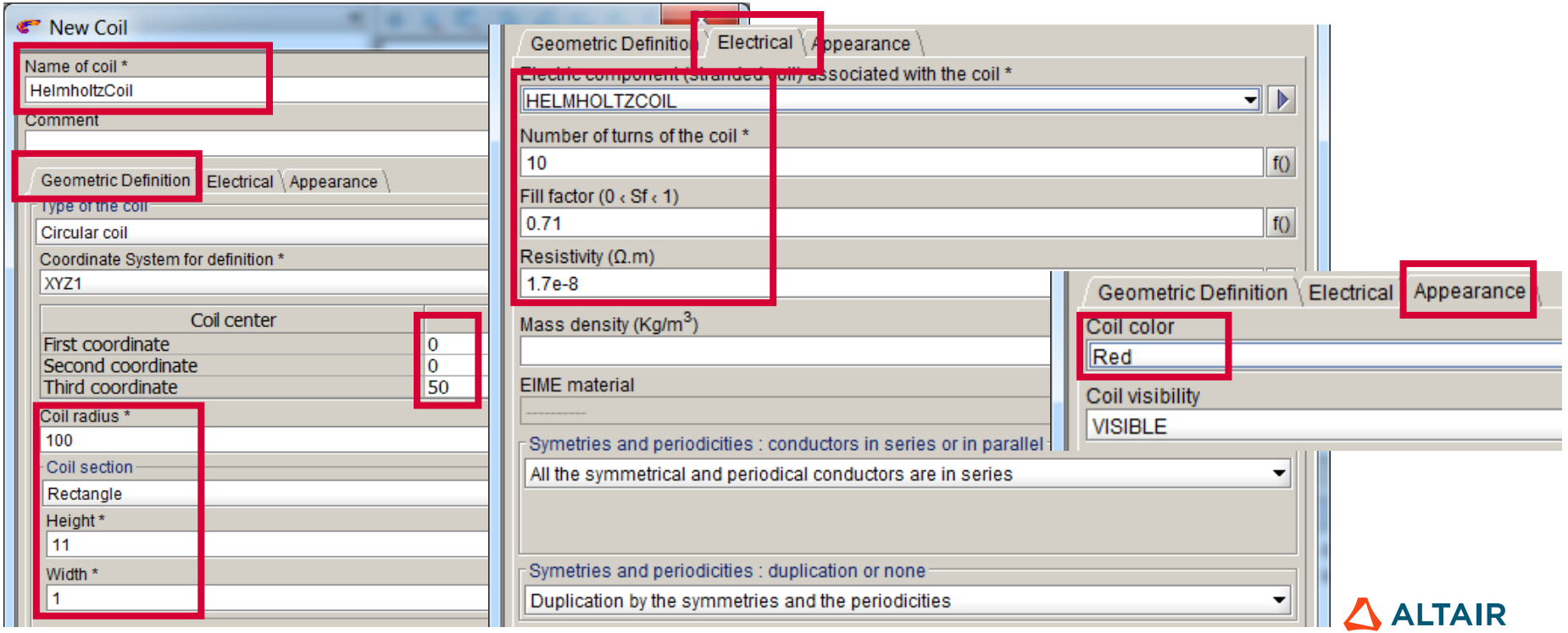
Create a new stranded coil conductor (Physics > Electrical components > Stranded coil conductor > New)



ALTAIR

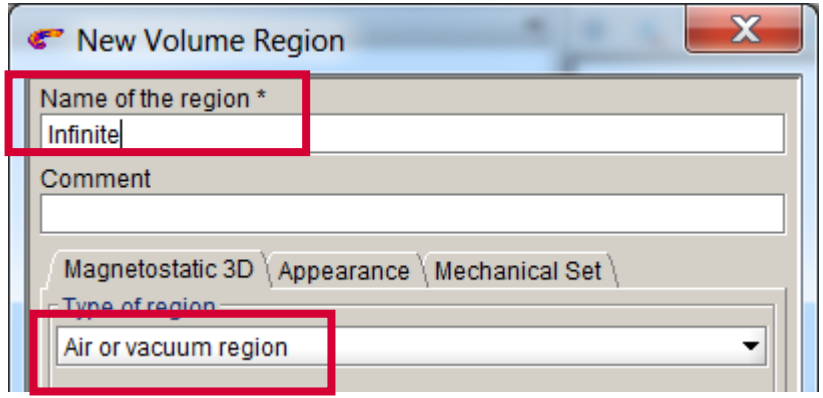
Physics : create a new non meshed coil

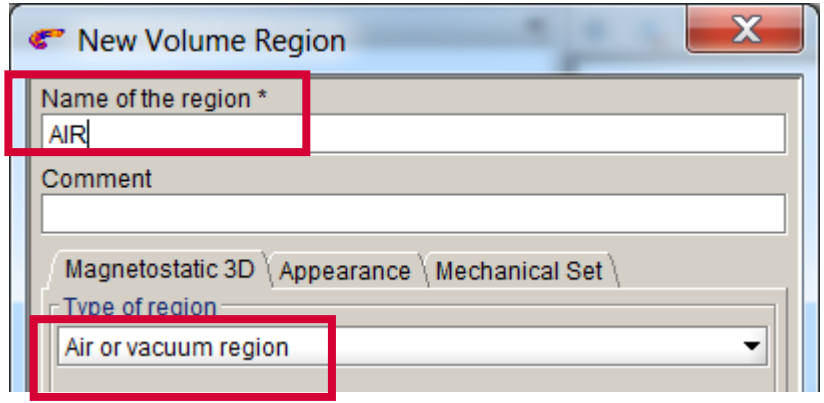
Create a new non meshed coil (Physics > Non meshed coil > New)



Physics : create volume regions to describe the physics

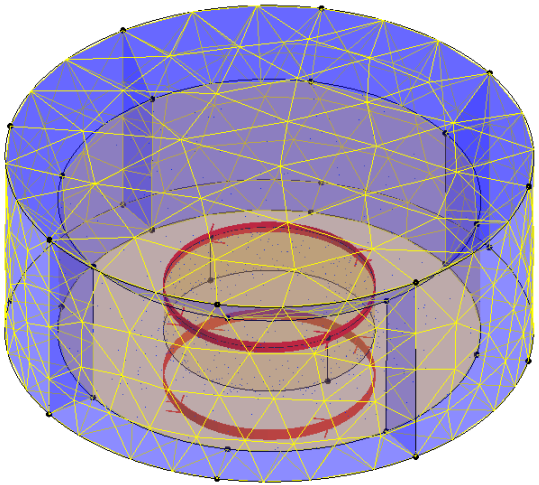
Create two volume regions for the air and the coil (Physics > Volume region > New)

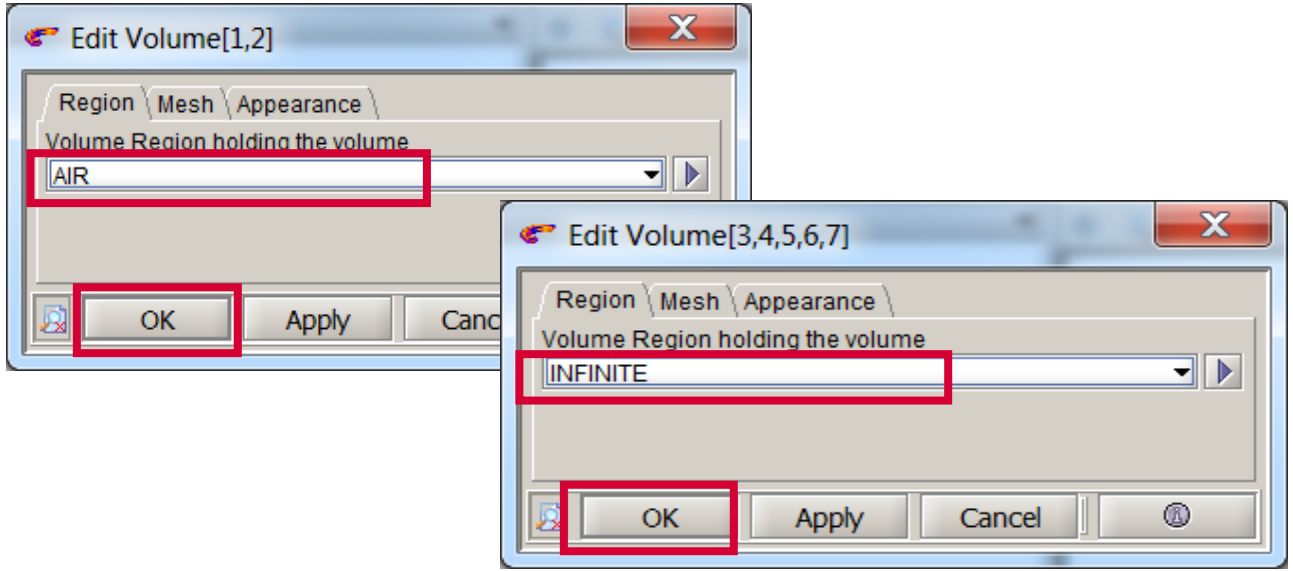




Physics : assign volume regions

Assign AIR volume region to volumes 1 and 2,and INFINITE volume region to volumes 3,4,5,6,7 (CTRL + click on all volumes with the same volume region to assign in the data tree > right click on one of the selected volumes > Edit)





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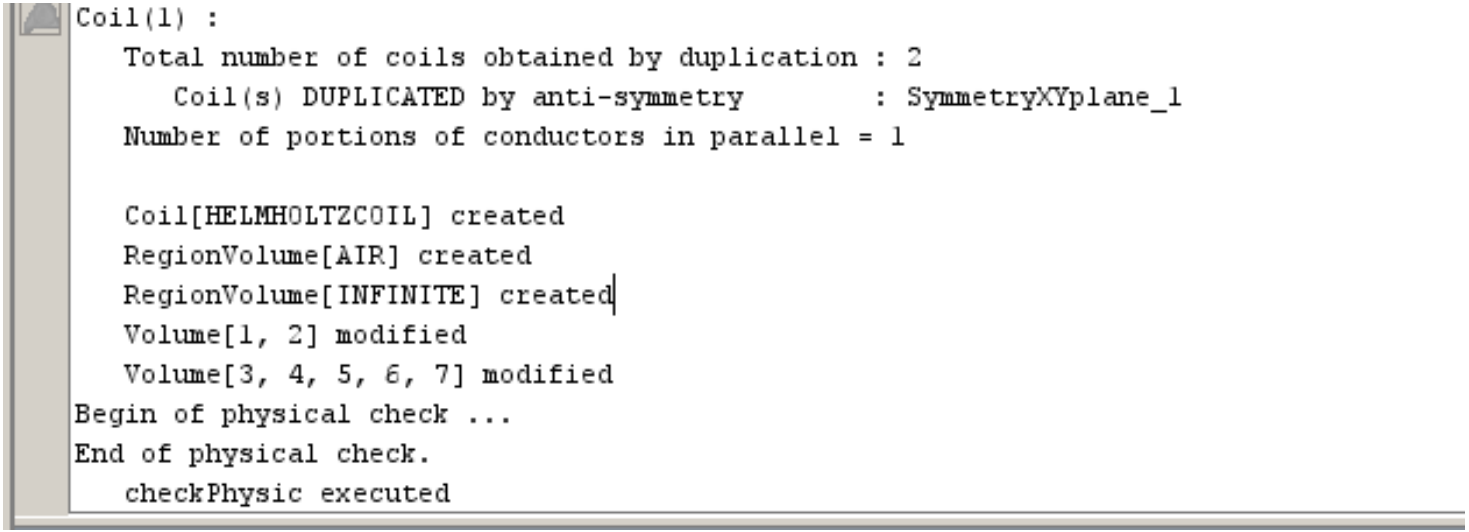
Physics : check the physics

Check the physics (Physics > Check physics)

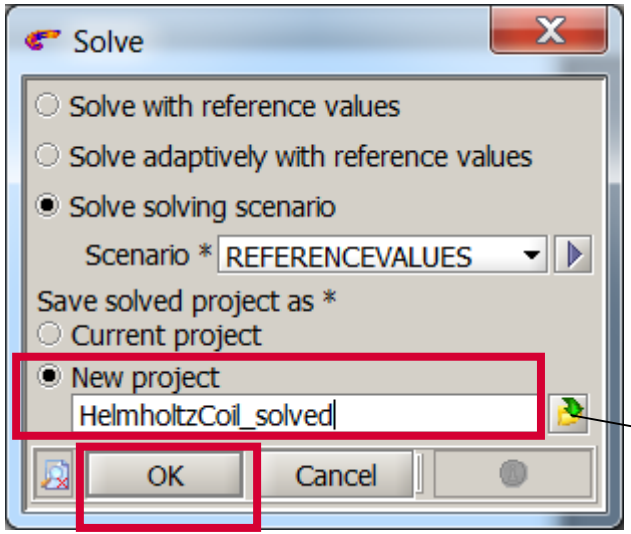
The results appears in the output window



SOLVING

Solving : solve a scenario

Solve the reference scenario (Solving > Solve)



Choose the directory where store the solved file

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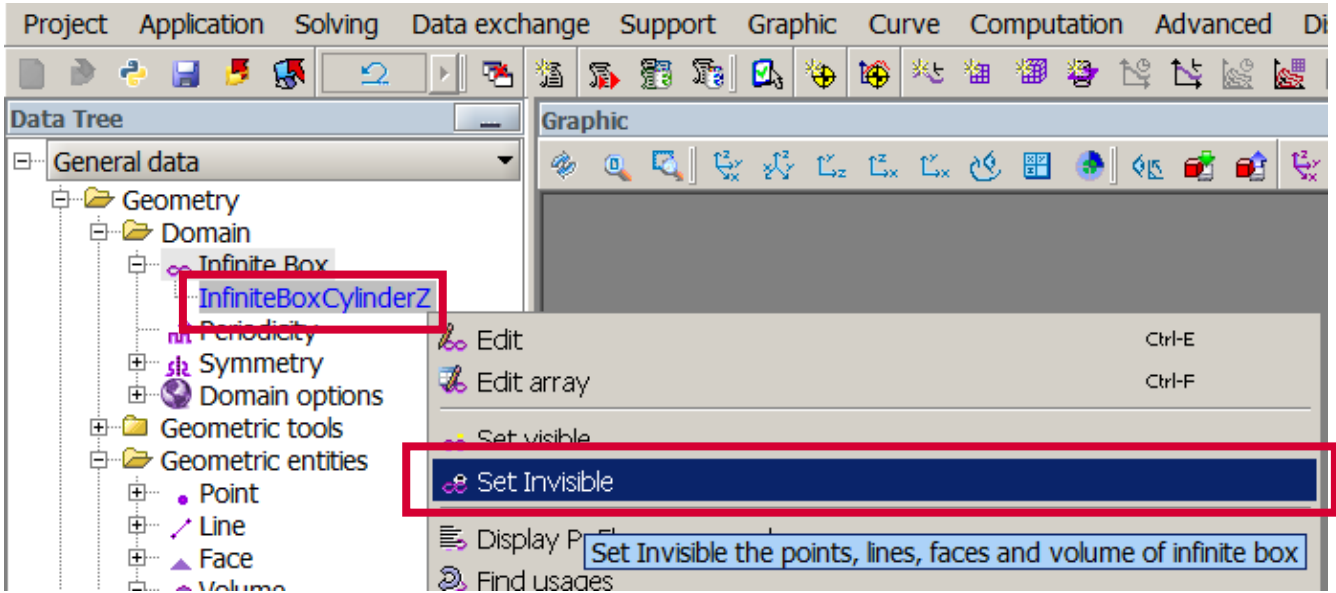
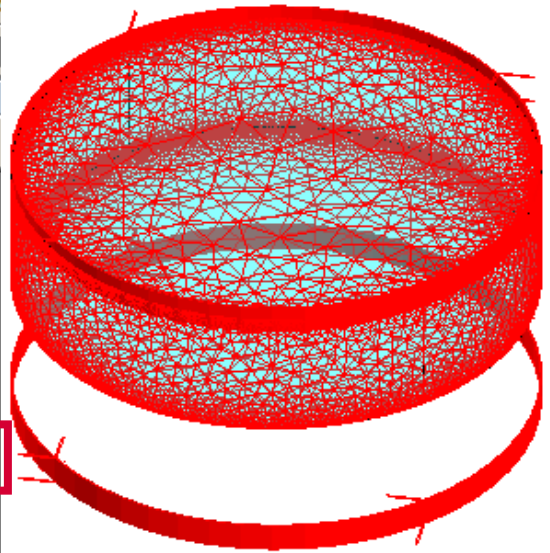
POSTPROCESSING

Post processing : set the infinite box invisible

Set the infinite box invisible (right click on the Infinite box in the data tree > Set Invisible)





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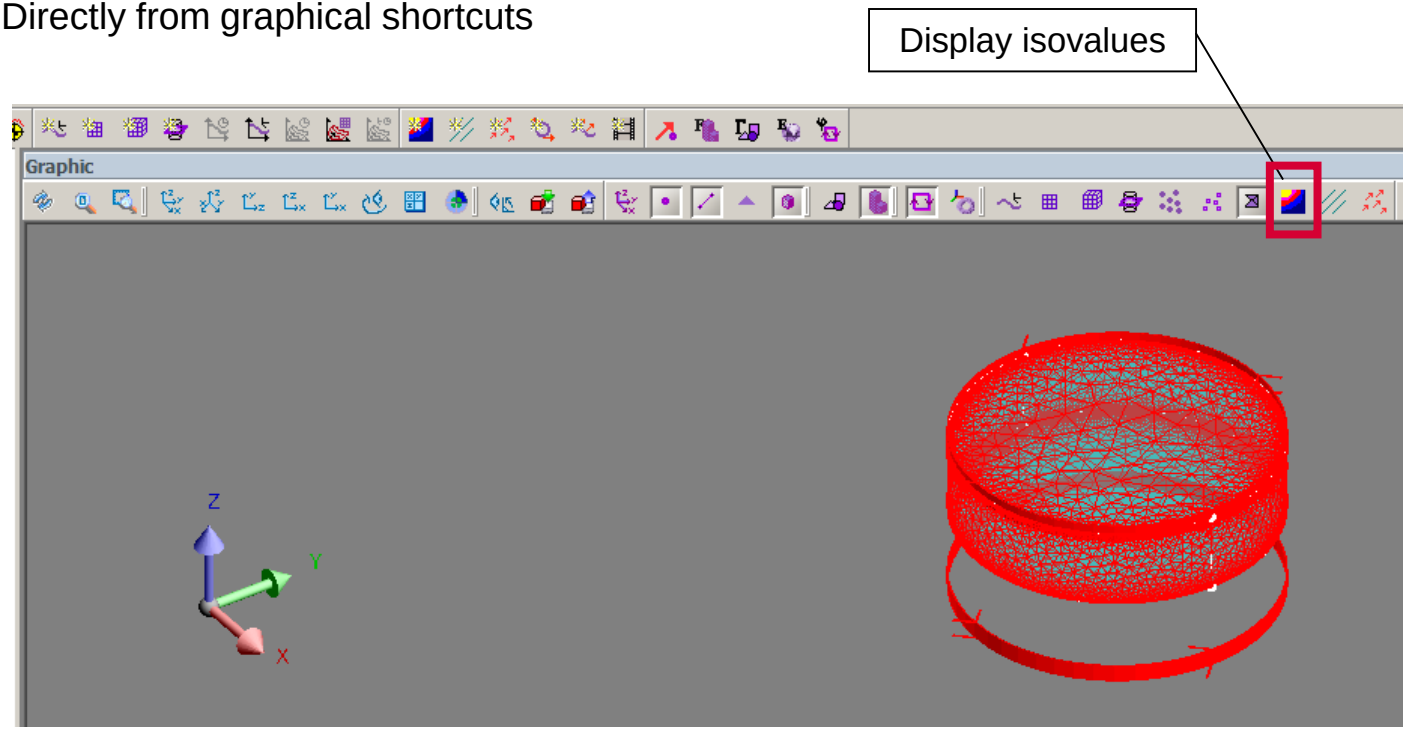
Post processing : display isovalues of the magnetic flux density

Directly from graphical shortcuts



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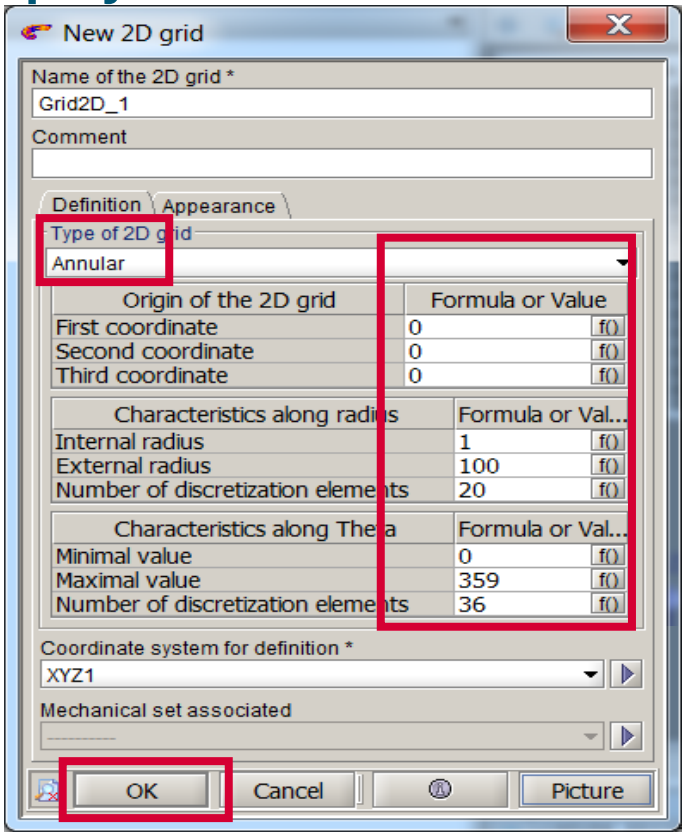
Post processing : create a 2D grid to display results

Create a new 2D grid to display the magnetic flux density on the symmetry plane inside the coil (Support > 2D grid > New)



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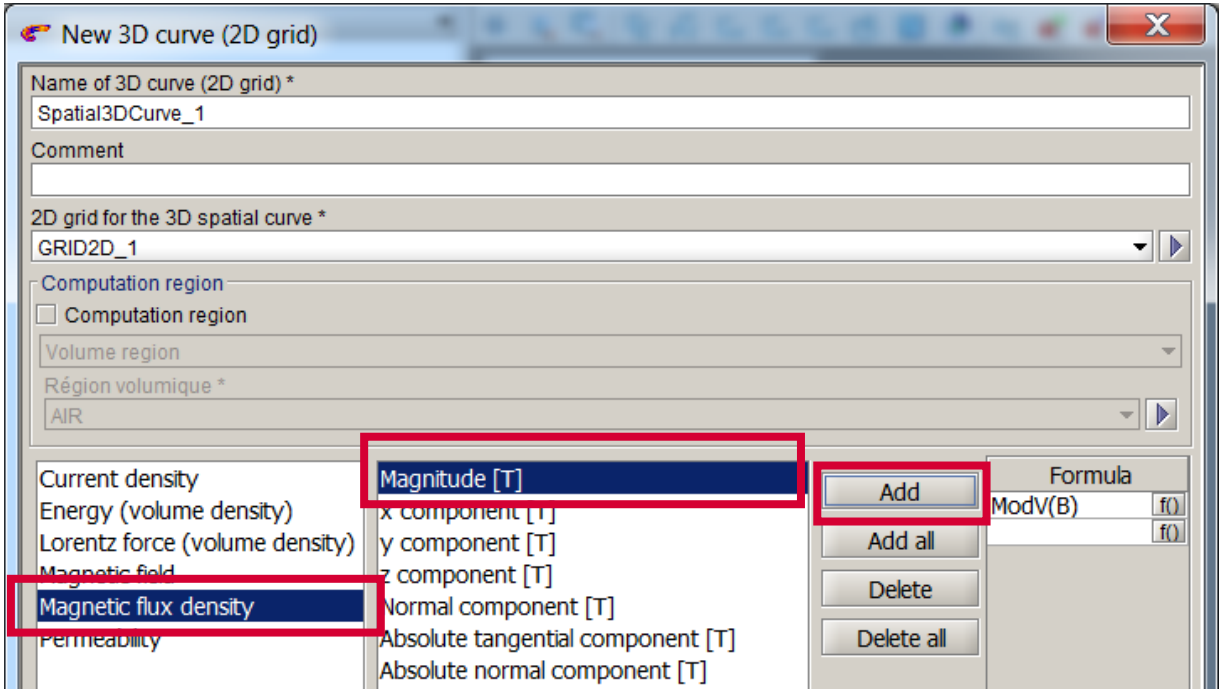
Post processing : plot the magnetic flux density on a 2D grid

Create a 3D curve (Curve > 3D Curve (2D grid) > New 3D Curve (2D grid))



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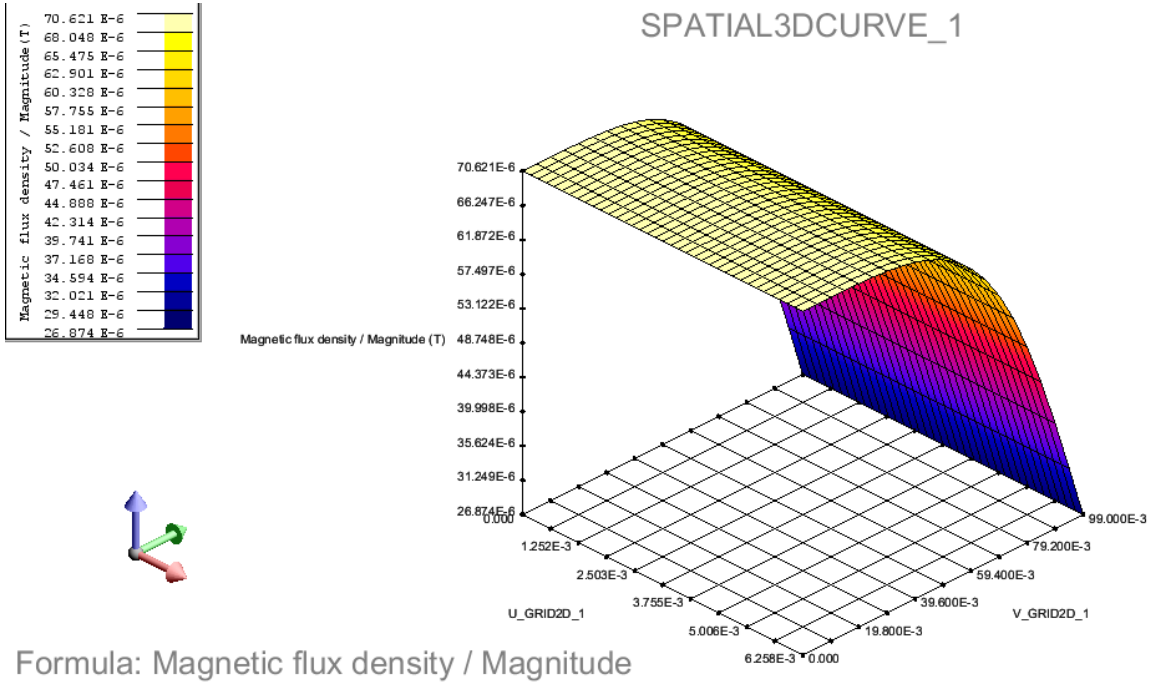
Post processing : plot the magnetic flux density on a 2D grid

Validate the box, to see the curve as below:



Formula: Magnetic flux density / Magnitude

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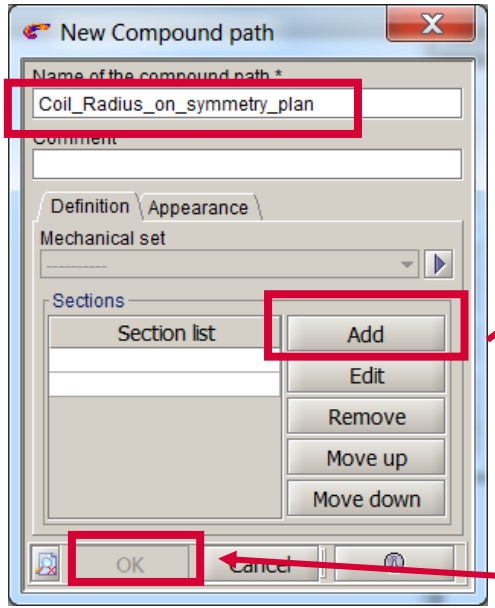
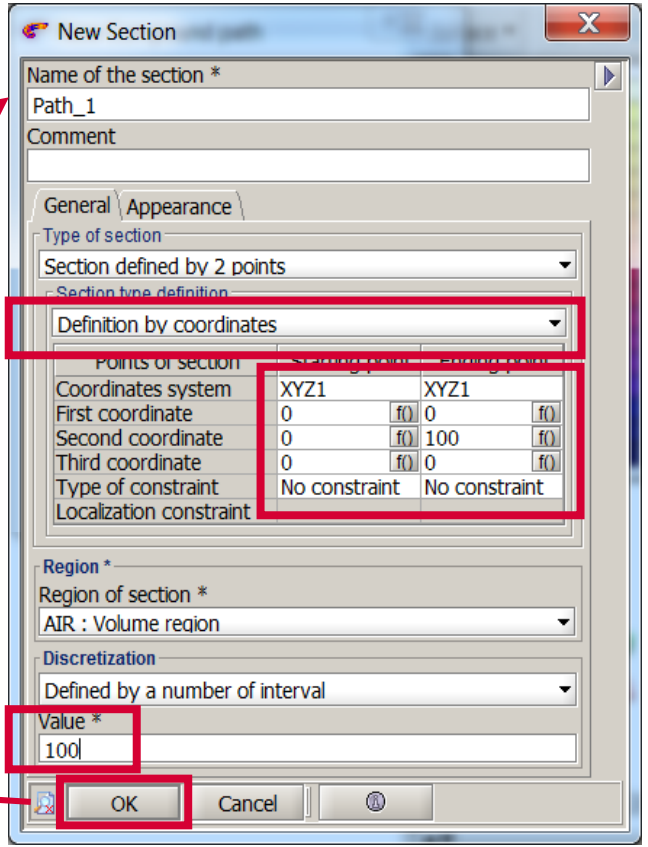
Post processing : Create a path

Create a new path (Support > Path > New)



Hit « Add » to open the window for a new section



Hit « OK » and then cancel the window automatically opened for a second section

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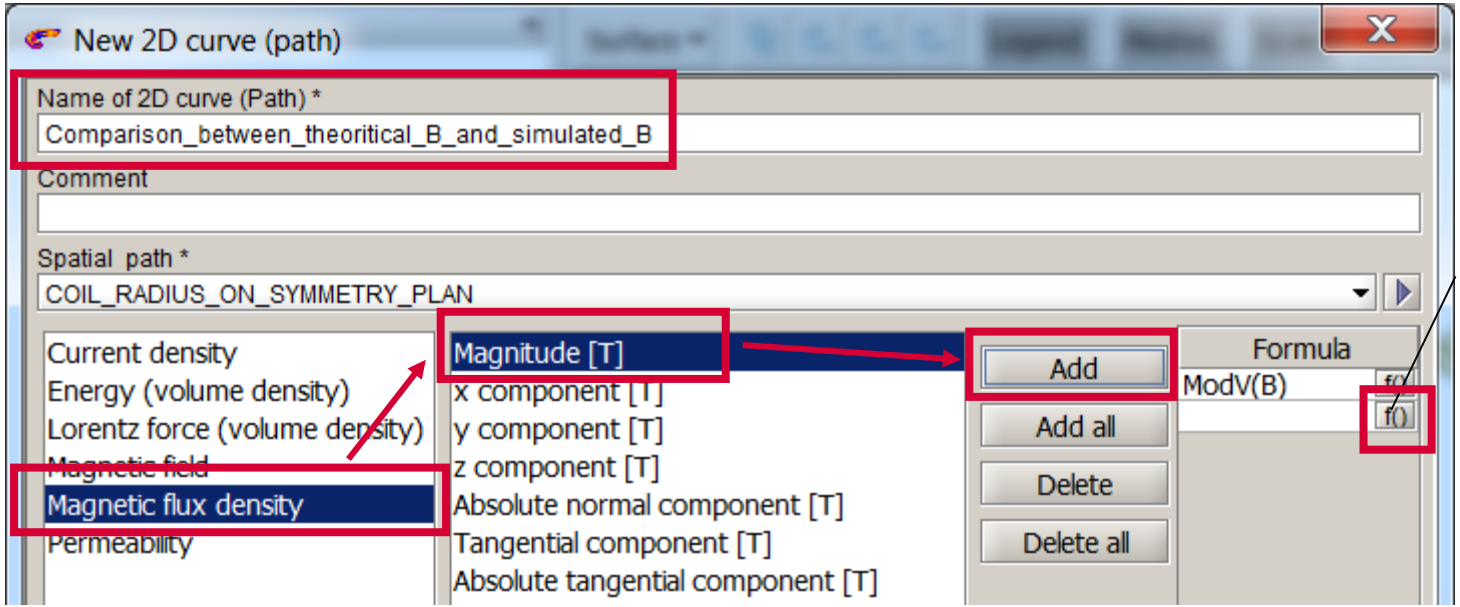
Postprocessing : plot B values on the created path

Create a curve along a path (Curve > 2D curve (Path) > New 2D Curve (Path))



Open the formula box to type the formula of the theoretical B

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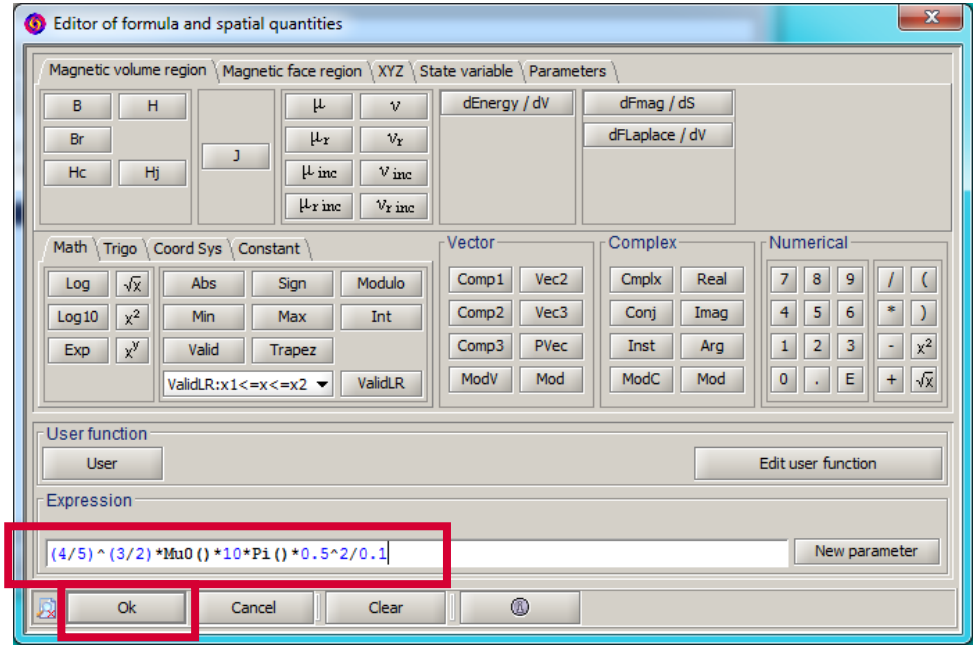
Postprocessing : plot B values on the created path

Type the formula `(4/5)^(3/2)*Mu0()*10*Pi()*0.5^2/0.1`

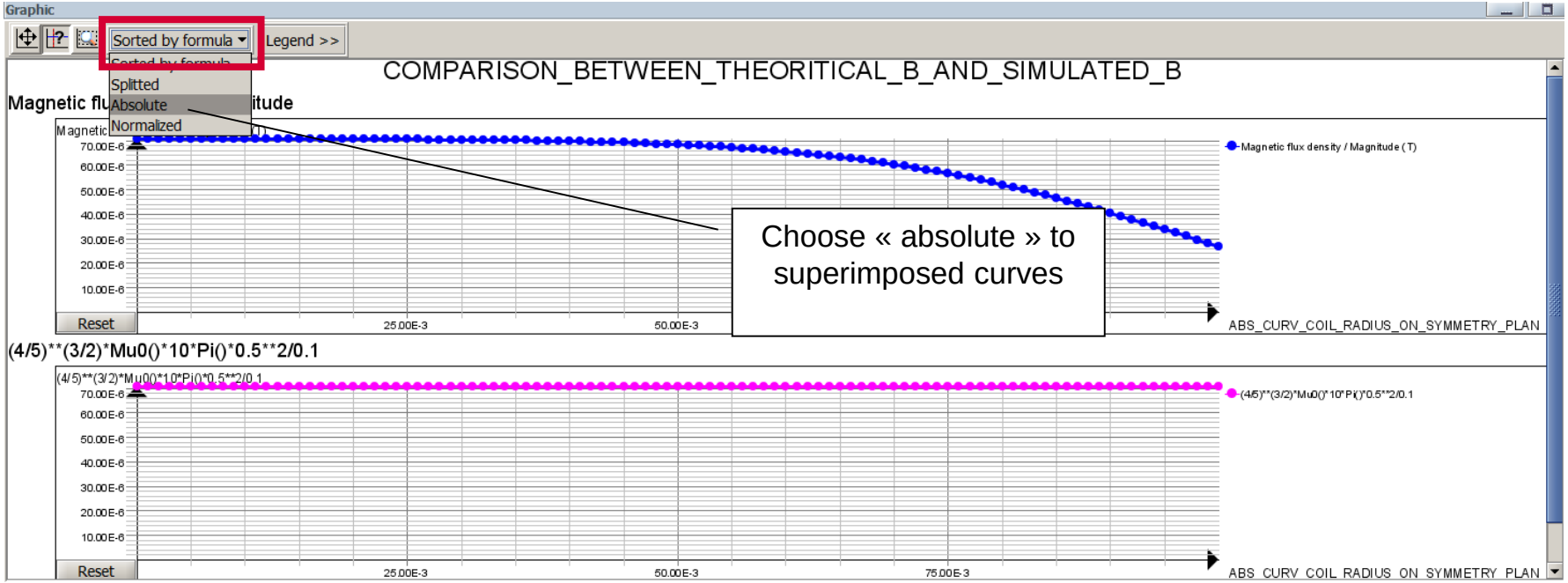
Validate the box



ALTAIR

Postprocessing : plot B values on the created path

Validate the box to plot curves as below



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THANK YOU

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#ONLYFORWARD

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