

GRID_METHOD_GUI R1.5.X – MANUAL

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1 What is it?

This software is dedicated to the image processing of inplane grid method for two images or a series of images. It can be used to compute and visualize the phases, displacements, or strains. Also, it is possible to export the produced data in various formats. Fig. 1 details the data processing.

2 Requirements

This software has been developed using MATLAB r2010a and compiled using MATLAB COMPILER 7.13. It requires the installation of the appropriate MATLAB COMPILER RUNTIME (MCR). They are available at the following addresses.

Windows	32 bits	http://www.ecco-qua.tk/?fi=gZ0Ti9rgm6&fn=MCRInstaller_7.13_32.exe
Windows	64 bits	http://www.ecco-qua.tk/?fi=30tlhj13EH&fn=MCRInstaller_7.13_64.exe

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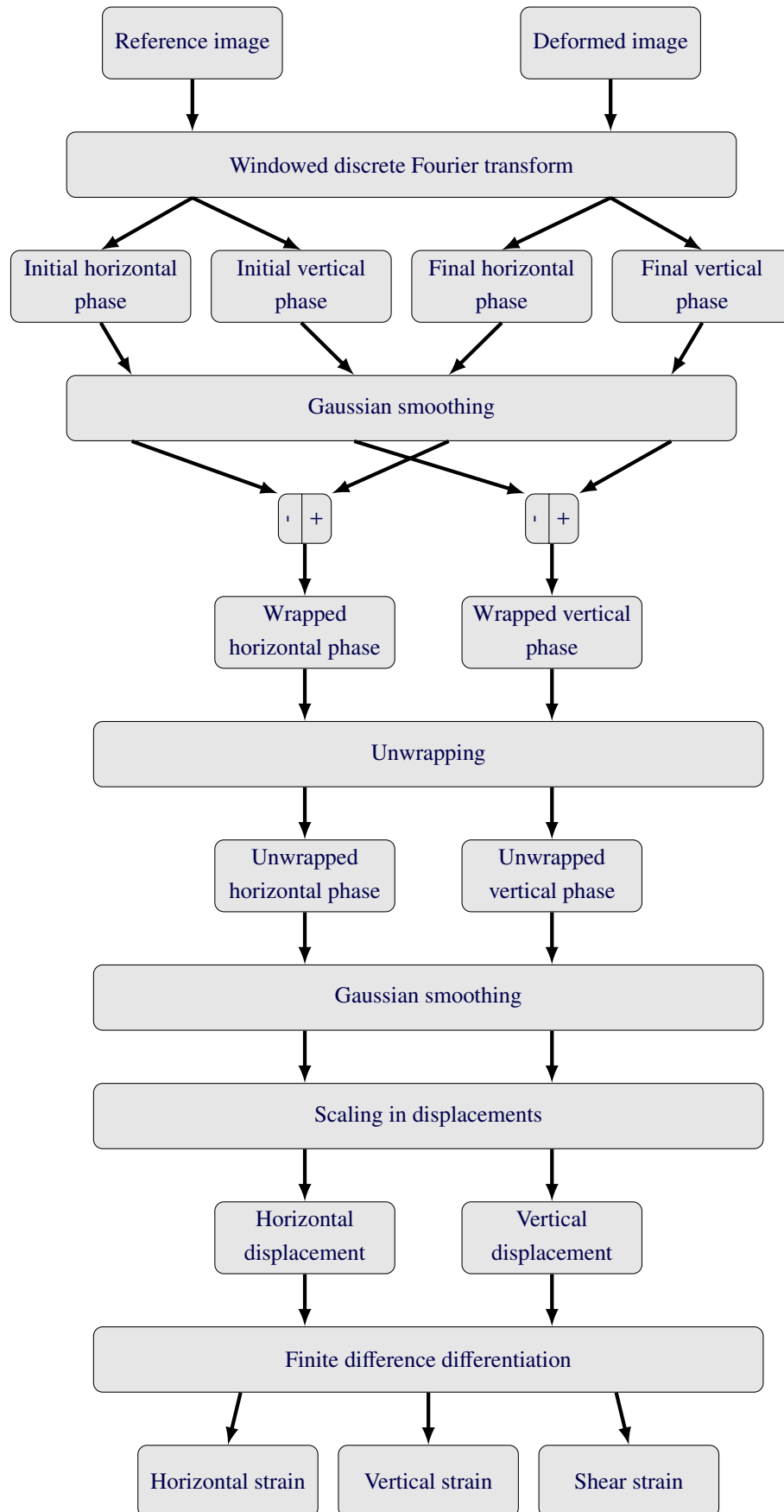


Figure 1. Processing flow chart

3 How to use it?

Once the MCR is installed, double click on the file. It may take time to show the main screen depending on the computer's specifications. The following sections will detail the different menus and parameters.

4 Main screen

Fig. 2 presents the main window. Several zones are circled in red as detailed below.

Zone 1 File menu,

Zone 2 Buttons to switch between panels,

Zone 3 Colour scales,

Zone 4 Text zone for feedback to user.

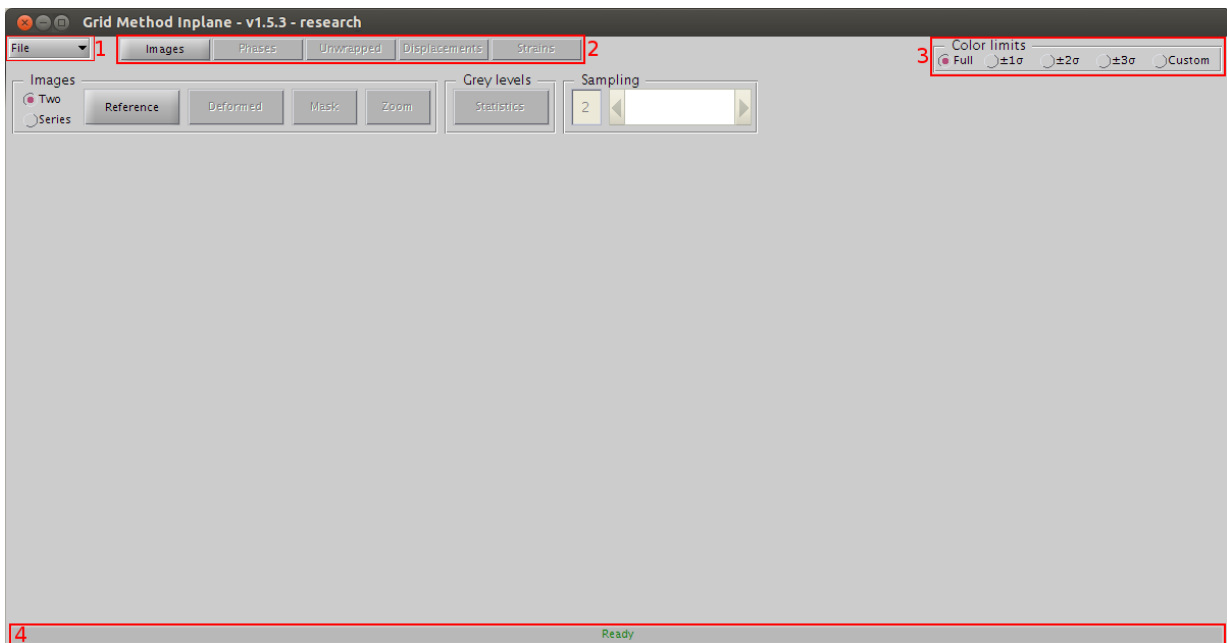


Figure 2. Main window

5 File menu

Reset Delete any loaded data from the memory and shows the initial screen,

Load Load a data set previously saved by this software using the extension **.GRD*,

Save Save a data set using the extension **.GRD*,

Export to file Export a data set to a text file or a *MAT*-file,

Export to image Save current viewport to a **.PNG* image file,

Export to movie Export currently displayed data set to an **.AVI* movie file,

About Shows information about the software,

Quit Quit.

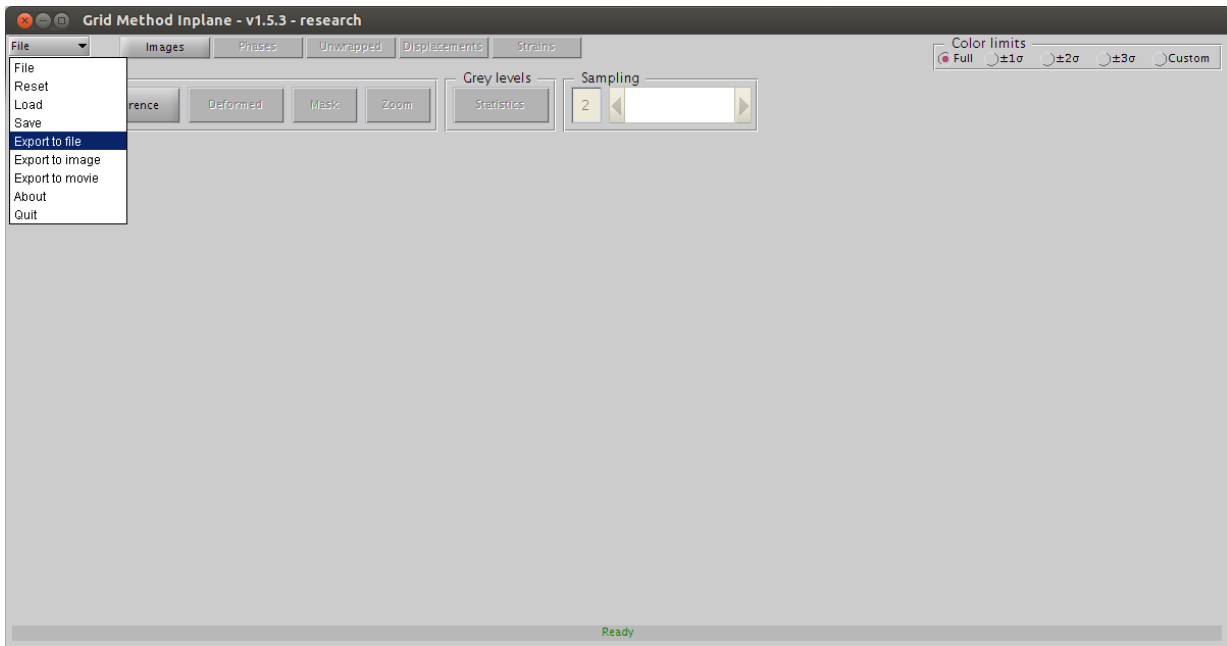


Figure 3. Filemenu opened

6 Images

The radio buttons *Two* and *Series* allows to change between the two-pictures mode and the series-of-images mode.

6.1 Two-pictures mode

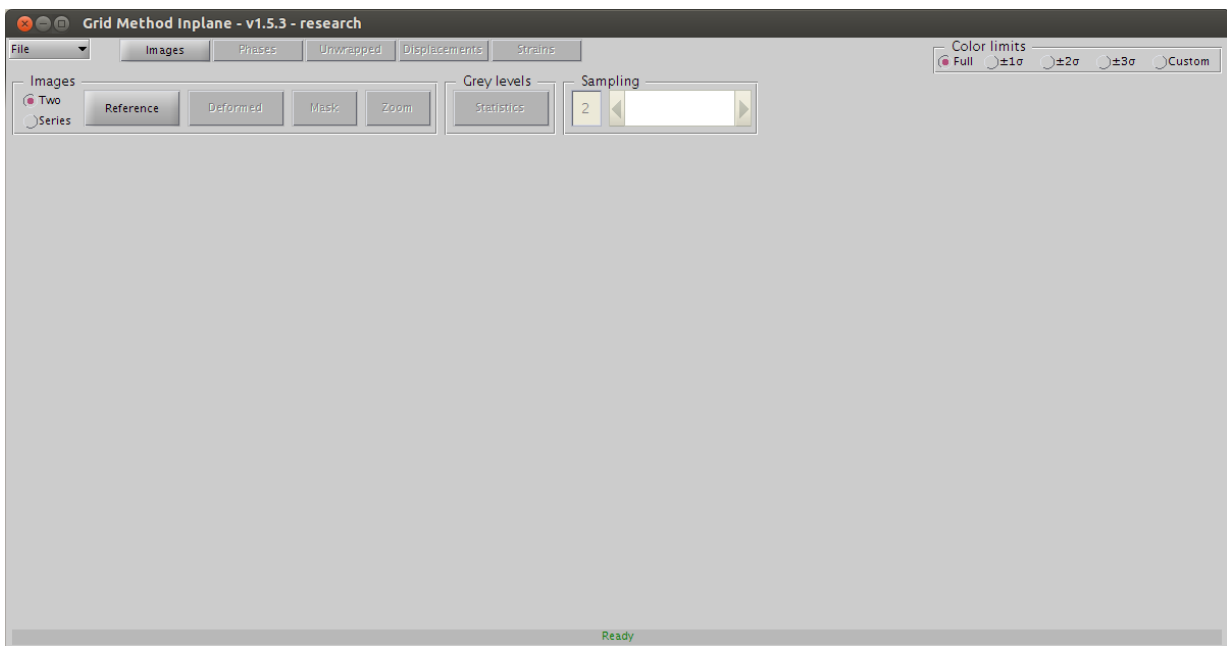


Figure 4. Images panel in two-pictures mode

Reference button Click to load image of sample under reference state.

Deformed button Click to load image of sample under loading.

Mask button Cf section 6.3 p. 5.

Zoom button Cf section 6.4 p. 6.

Statistics button Cf section 6.5 p. 7.

Sampling textbox and slider Cf section 6.6 p. 7.

6.2 Series-of-image mode

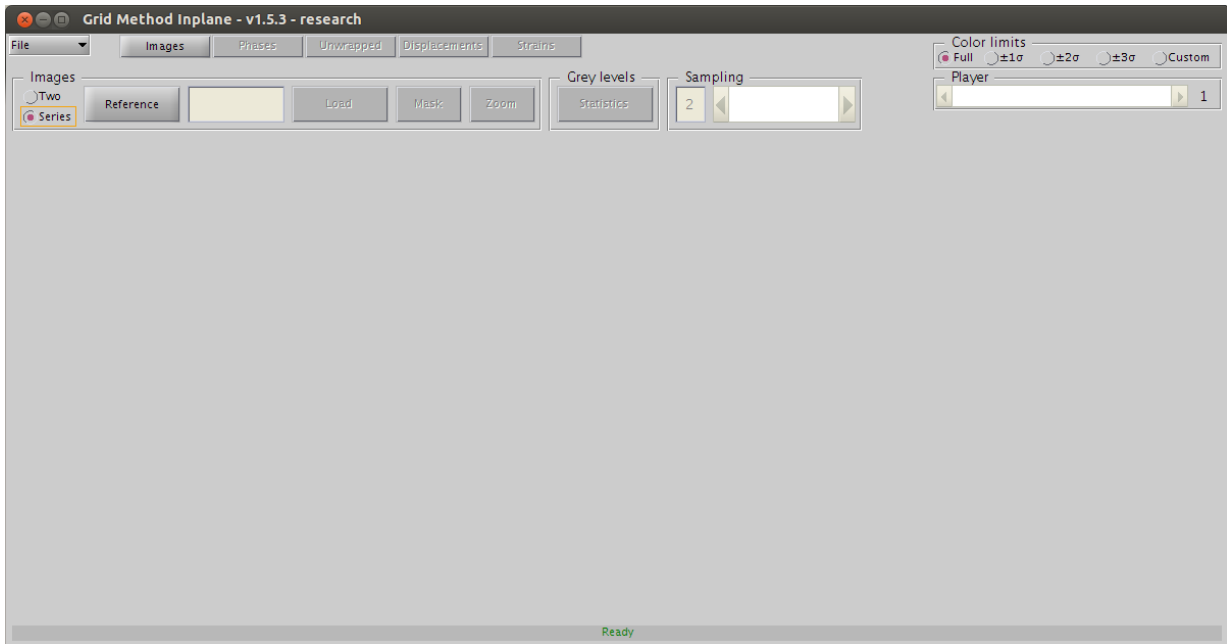


Figure 5. Images panel in series-of-image mode

Reference button Click to load reference image.

Pattern textbox It presents a string pattern that should match the series of images based on the reference filename.

Load button Load the series of picture. Pressing the **CONTROL** key while clicking allows to select the first image loaded. Pressing the **SHIFT** key while clicking allows to select the number of image to load. Both key can be pressed at the same time.

Mask button Cf section 6.3 p. 5.

Zoom button Cf section 6.4 p. 6.

Statistics button Cf section 6.5 p. 7.

Sampling textbox and slider Cf section 6.6 p. 7.

6.3 Mask

In this module, the user can create a mask also called Region Of Interest (ROI). If no mask has been created, the full image will be used. It is possible to create the mask before or after loading the deformed image but always after loading the reference image. The mask can be a collection of various shapes such as polygon, rectangles, and ellipses. The shapes are added on the viewport called *working area* on the right hand side of the window and the result is displayed on the viewport called *ROI preview* on the left hand side of the window. **Note:** There is sometimes a bug in Microsoft Windows OS where the preview is not updated. To force a preview, click anywhere on the *working area* viewport.

Player slider Allows to navigate between images.

Add and Subtract toggle buttons Select mode to keep or ignore a zone. The shape will have the same color as the selected mode during its creation.

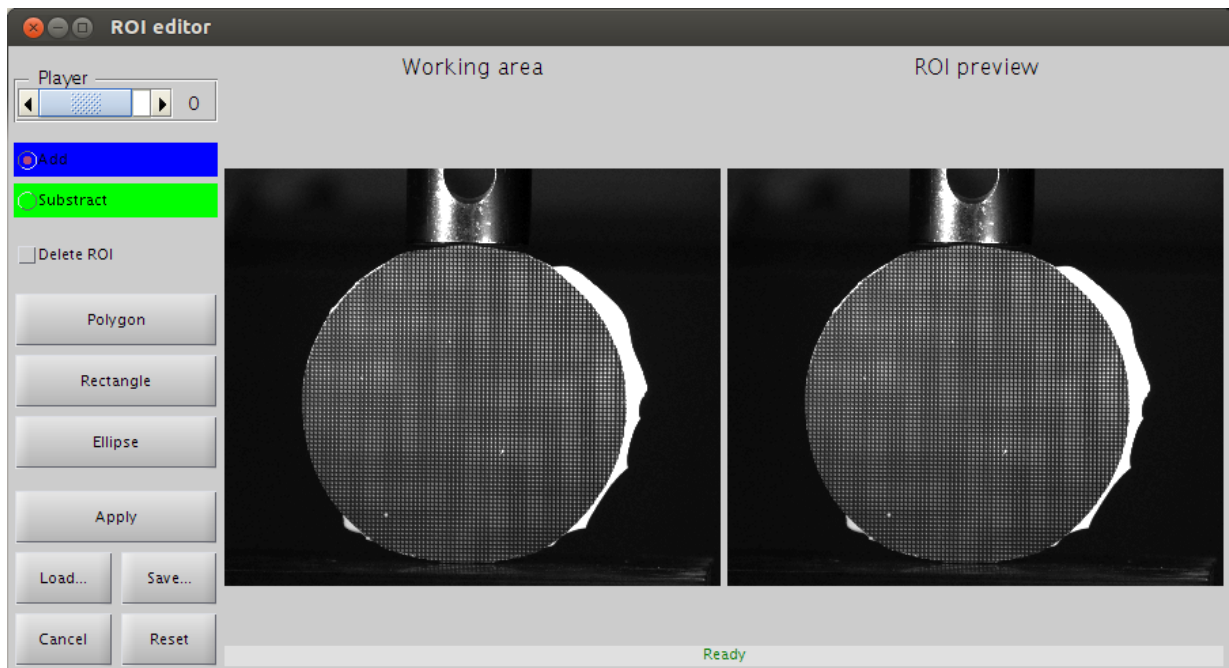


Figure 6. Masking module

Delete button Allows to delete a shape. Tick the checkbox and then click on the shape to delete.

Polygon button Creates a polygon by clicking on the points. Click back on the first point to close the polygon. A right-click will delete the last point. After creation, drag-n-drop a point will move this point and drag-n-drop a line will move the shape to which it belongs. **Note:** It is not possible to add a point while the mouse is moving.

Rectangle button Creates a rectangle by two corners. After creation, drag-n-drop a point will move this point and drag-n-drop a line will move the shape to which it belongs. Pressing the **CONTROL** key while drag-n-dropping a corner allows to rotate the shape. Pressing the **SHIFT** key while drag-n-dropping a corner allows to resize with constant aspect ratio the shape. Both key can not be pressed at the same time.

Ellipse button Creates an ellipse by centre and radius. After creation, drag-n-drop a point will move this point and drag-n-drop a line will move the shape to which it belongs. Pressing the **CONTROL** key while clicking a point not on an axis allows to rotate the shape. Pressing the **SHIFT** key while clicking allows to resize with constant aspect ratio the shape. Both key can not be pressed at the same time.

Apply button Closes this module to return to the main window and will apply the mask.

Load... button Loads a collection of shapes previously saved by this module using the extension **.MSK*.

Save... button Saves a collection of shapes using the extension **.MSK*.

Cancel button Cancels the current modifications brought to the mask. Closes the window and return to main window.

Reset button Deletes every shapes created.

6.4 Zoom

It opens a new window showing the reference image. In this window, it is possible to zoom, change the font size and much more. Pressing the **SHIFT** key while clicking makes the new window show the deformed image.

6.5 Statistics

It opens a new window showing the histogram of the reference and deformed images if loaded.

6.6 Sampling

This value is adjusted to the closest integer number that samples a single period.

7 Phases

This panel presents the phase maps as extracted by the Windowed Discrete Fourier Transform algorithm. It is only available when the deformed images have been loaded.

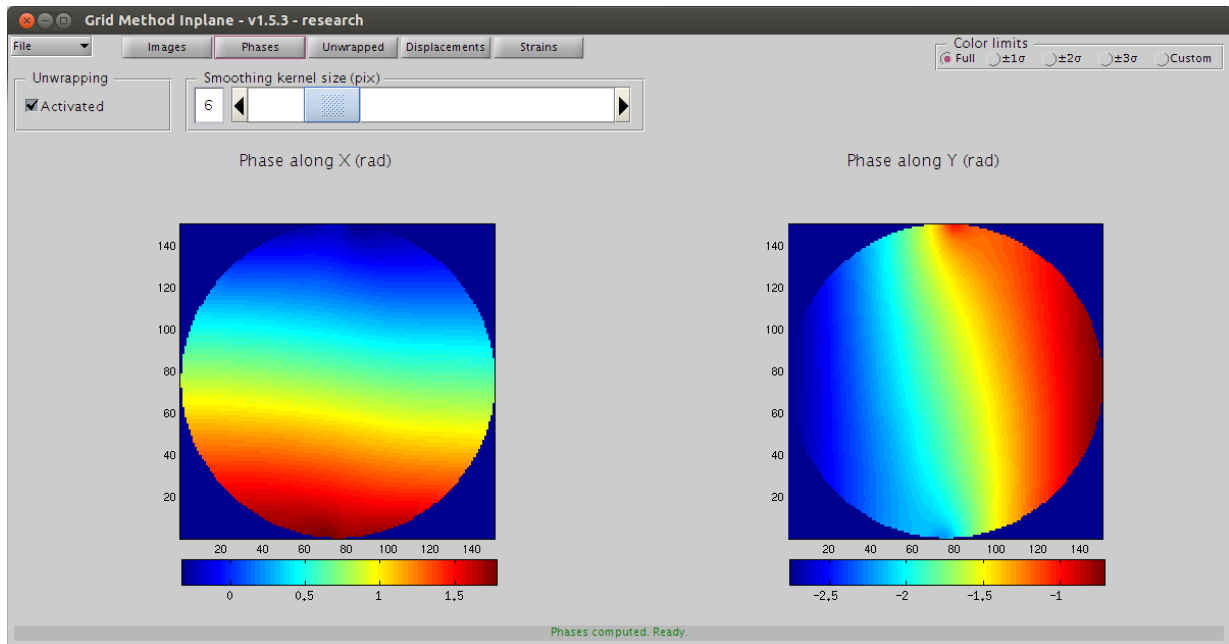


Figure 7. Phases module

Activated/Disactivated checkbox Allows to activate or not the unwrapping process for the next step.

Smoothing textbox and slider Introduces spatial smoothing during phase extraction using a Gaussian window if the kernel size is strictly larger than 1. **Note:** The larger the kernel size, the longer this step will take to finish.

8 Unwrapped phases

This panel presents the unwrapped phase maps. The algorithm is based on a noncontinuous path*.

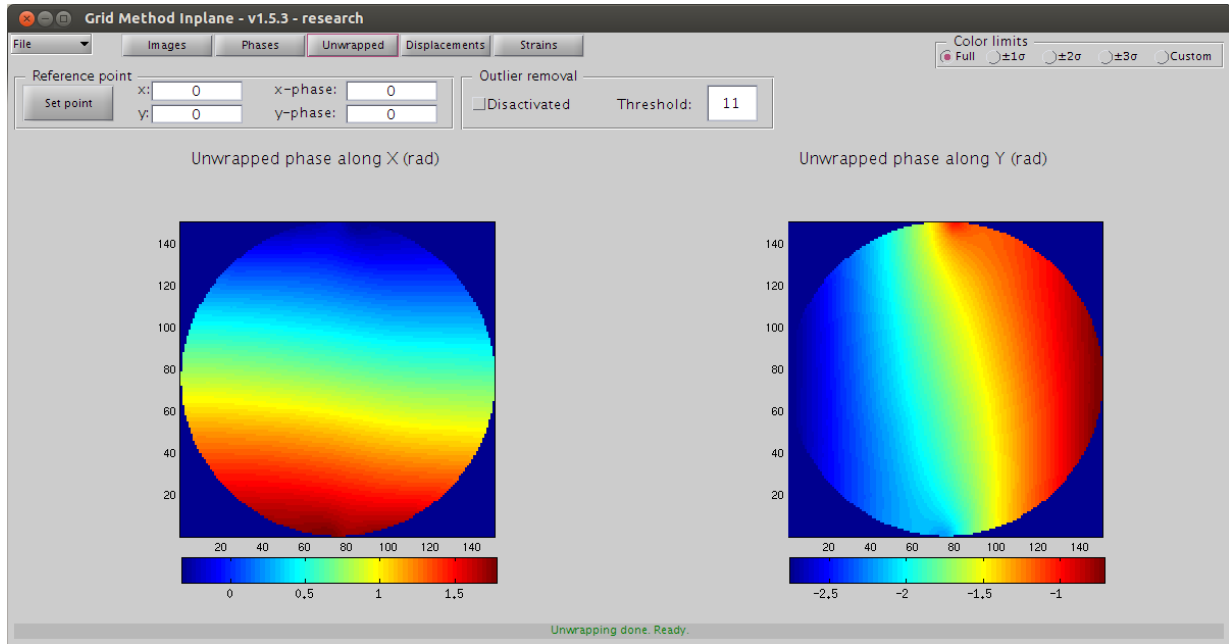


Figure 8. Unwrapped phases module

Set point button Allows to interactively select a point to set reference phase value.

x and y textbox Allows to specify exact coordinates for the reference point.

x-phase and y-phase textbox Allows to specify the phase value at the reference point.

Activated/Disactivated checkbox Allows to activate and deactivate the outlier removal process.

Threshold textbox Allows to tune the sensitivity of the outlier removal process. A large value will reduce the number of detected points and vice-versa.

*http://link.springer.com/chapter/10.1007%2F978-3-540-30463-0_14

9 Displacements

This panel presents the displacement maps.

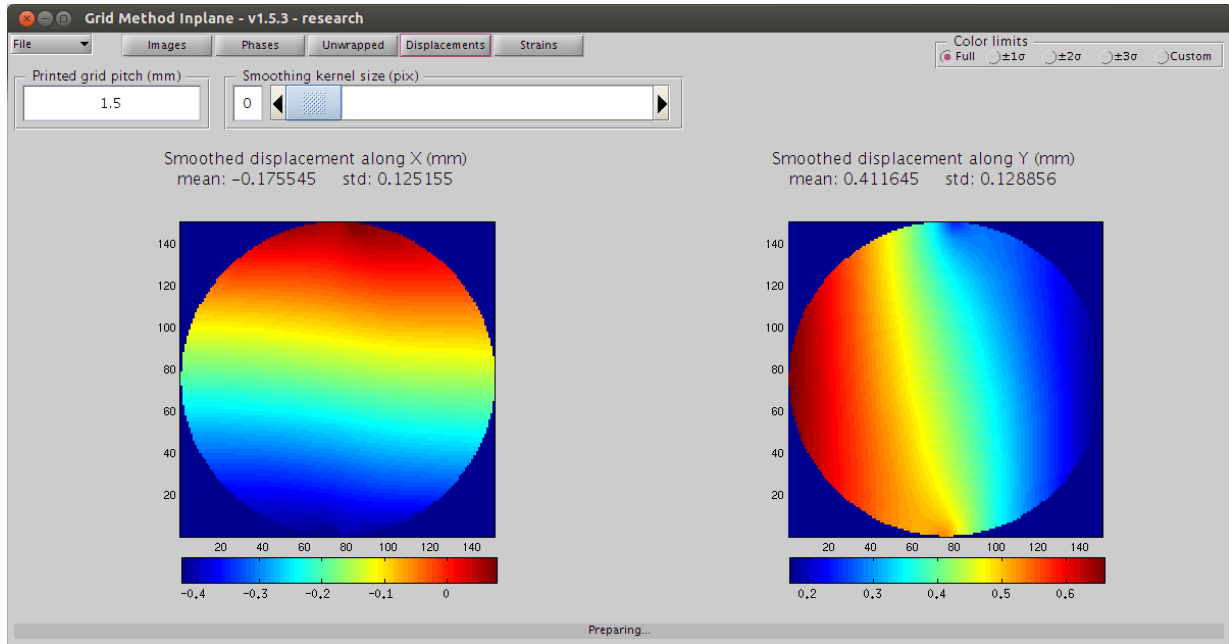


Figure 9. Displacements module

Printed grid pitch textbox Adjust the value to obtain displacement in millimetres.

Smoothing textbox and slider Introduces spatial smoothing in the displacement maps using a Gaussian window if the kernel size is strictly larger than 1. **Note:** The larger the kernel size, the longer this step will take to finish.

10 Strains

This panel presents the strain maps.

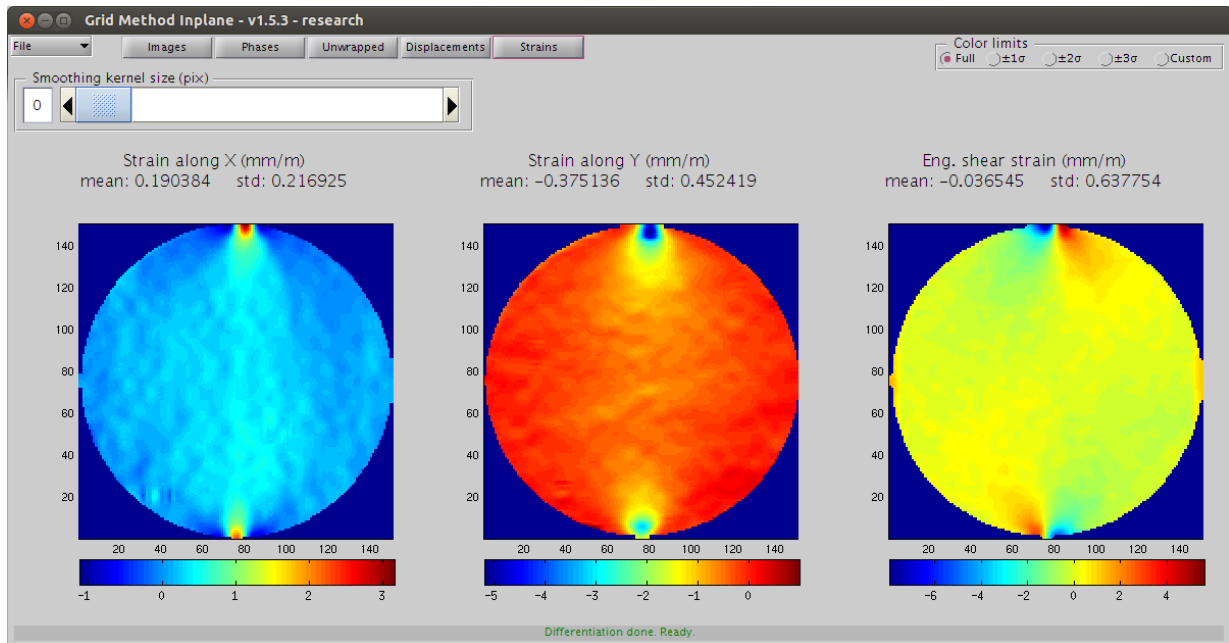


Figure 10. Strains module

Smoothing textbox and slider Introduces spatial smoothing in the displacement maps using a Gaussian window if the kernel size is strictly larger than 1. **Note:** The larger the kernel size, the longer this step will take to finish.

11 Tutorial

11.1 Two-pictures mode

This tutorial will guide you through the processing of images for a Brazilian disc.

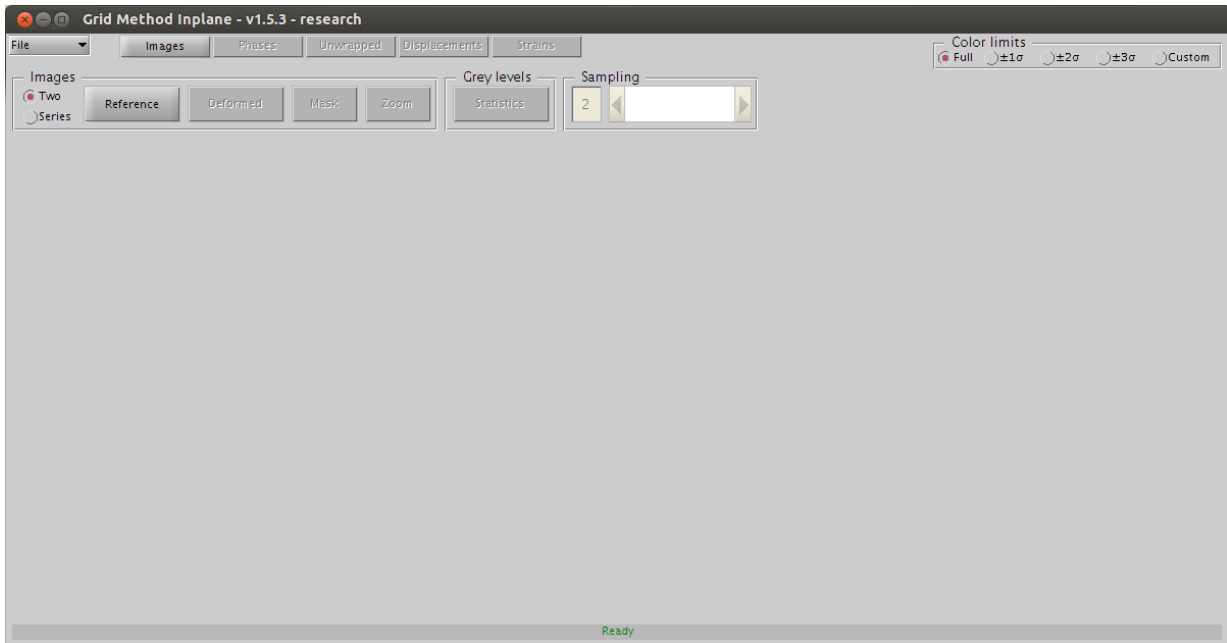


Figure 11. Main window.

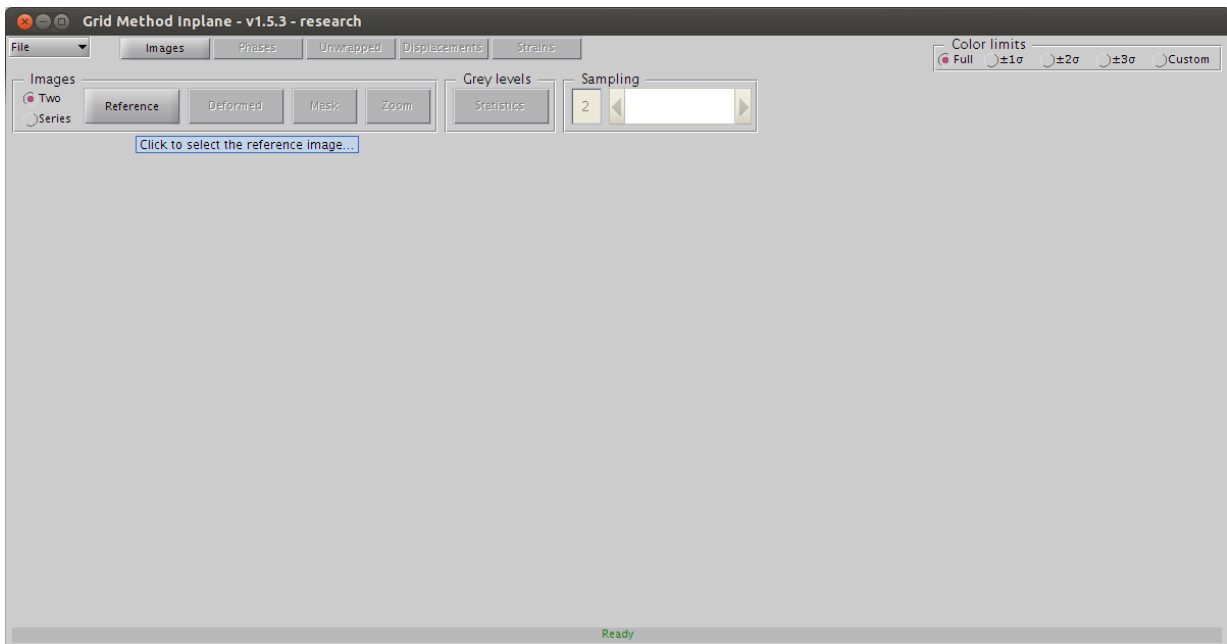


Figure 12. Click **REFERENCE** button to load the reference image.

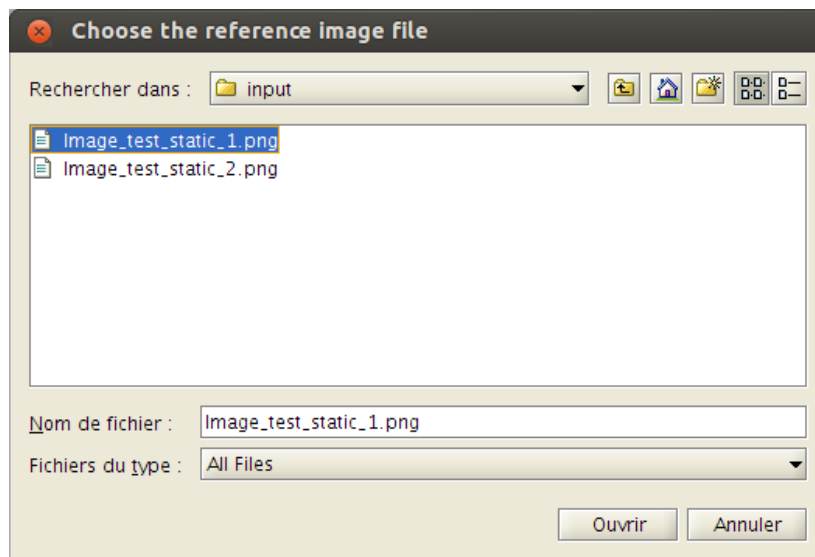


Figure 13. Select the file with the filename *Image_test_static_1.png*.

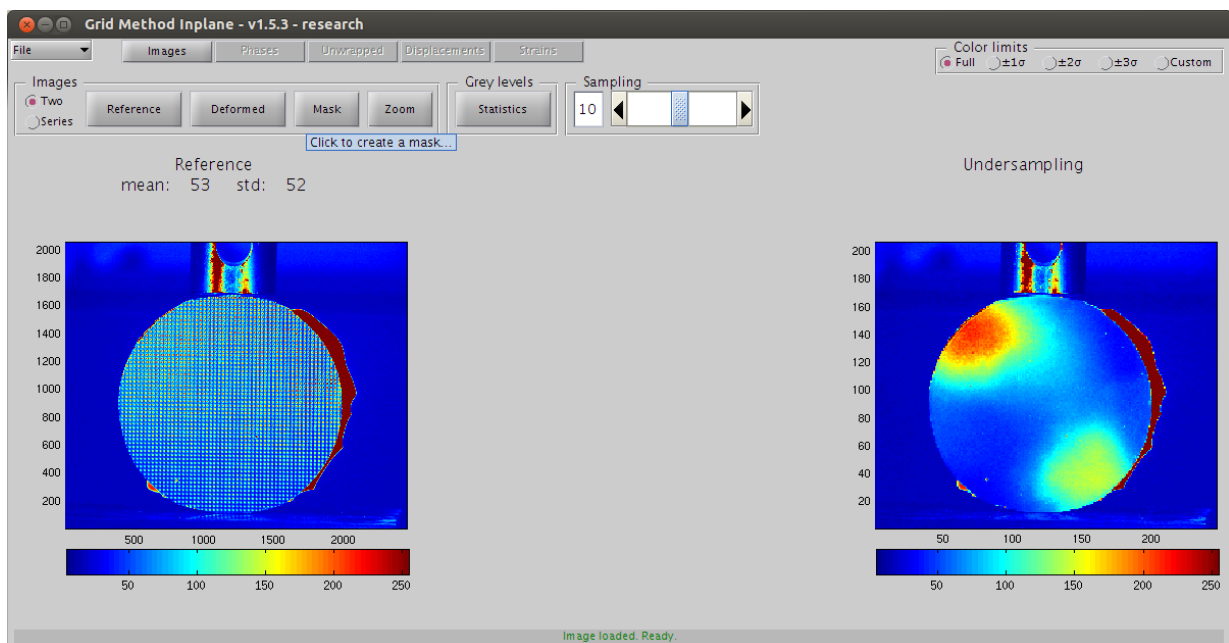


Figure 14. Click **MASK** button to open the masking module. Here you can note that the **SAMPLING** textbox has been automatically adjusted.

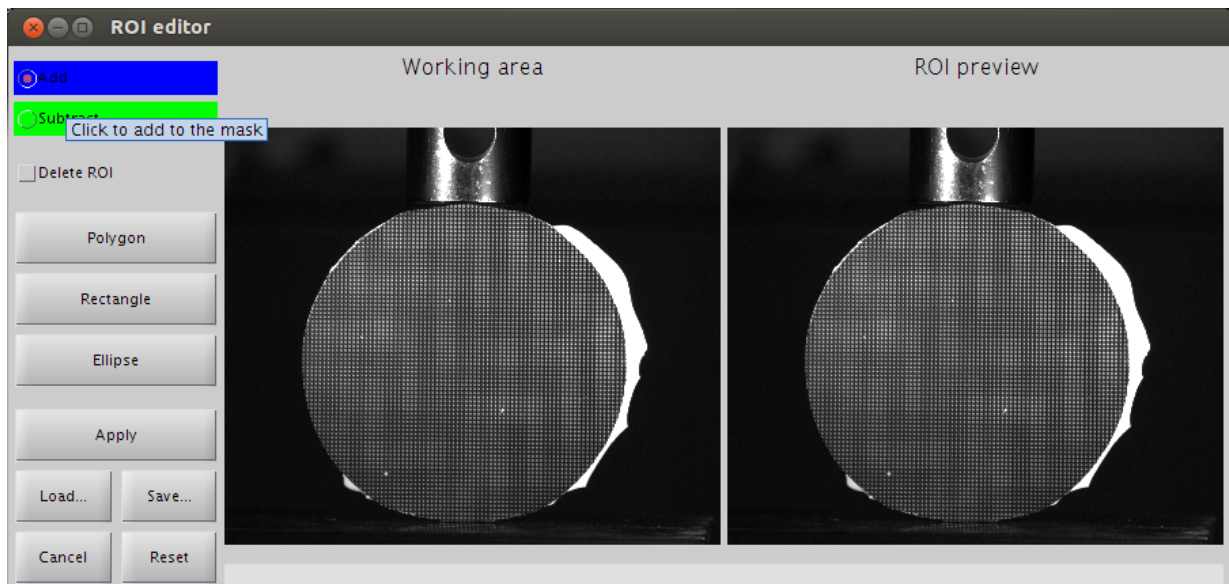


Figure 15. Click **ADD** radiobutton to keep the region defined by the shape.

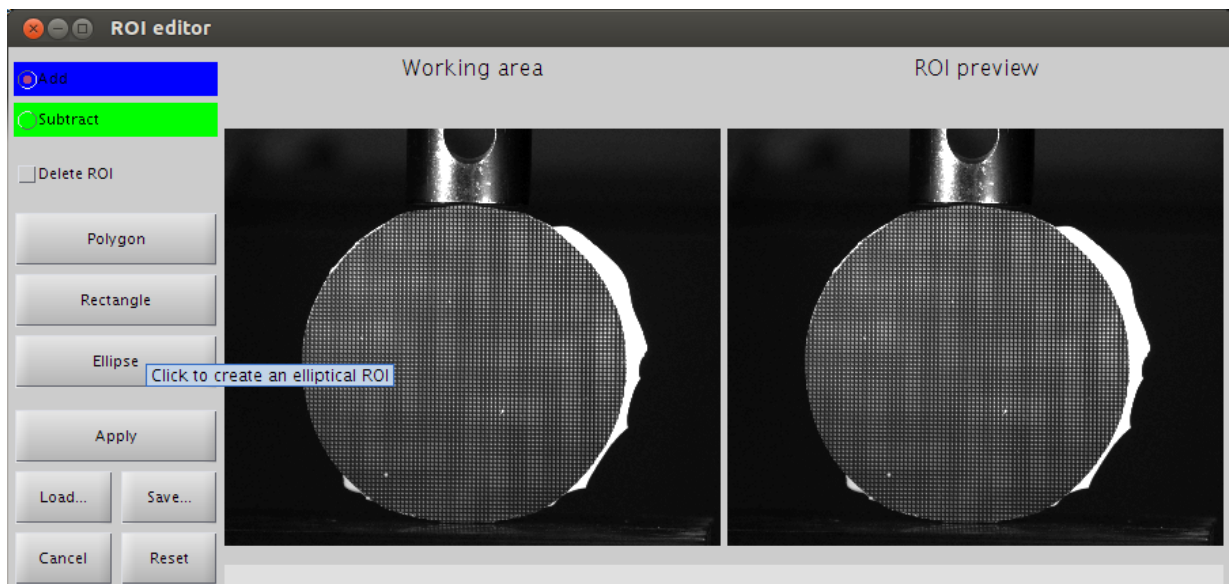


Figure 16. Click **ELLIPSE** button to add an elliptical shape.

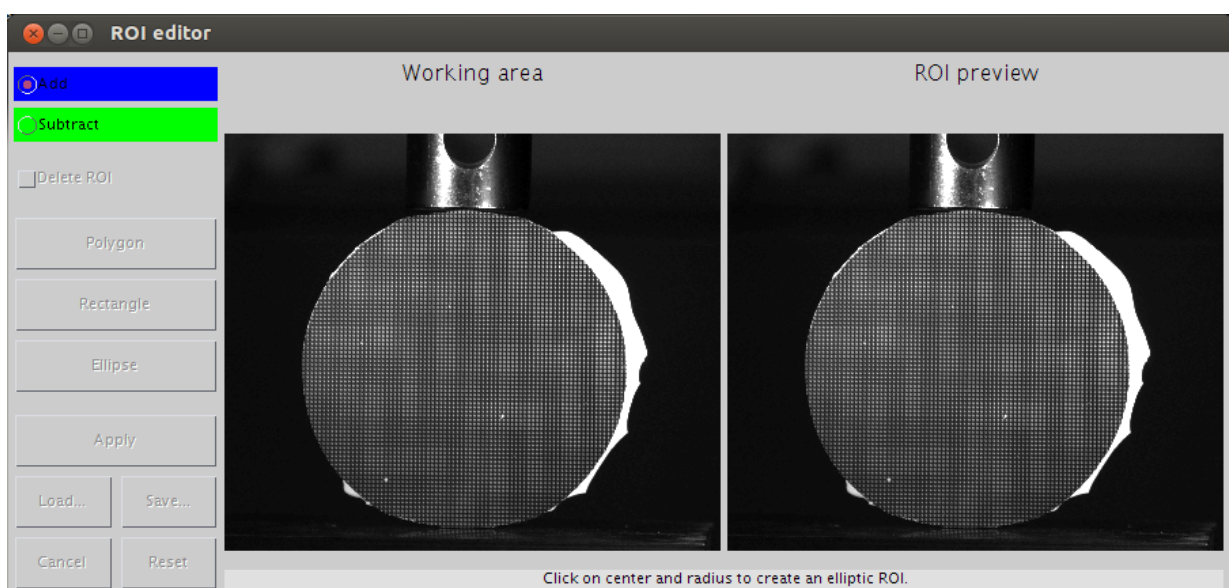


Figure 17. Click in the centre of the disc to add centre of ellipse.

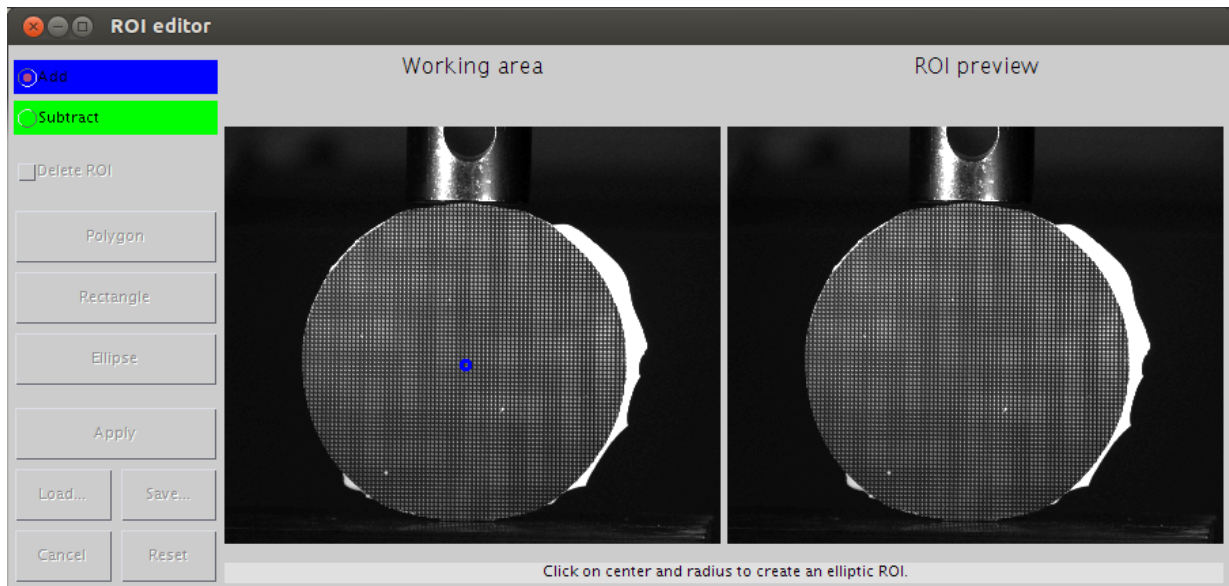


Figure 18. Click on the outer edge of the disc to define the radius point.

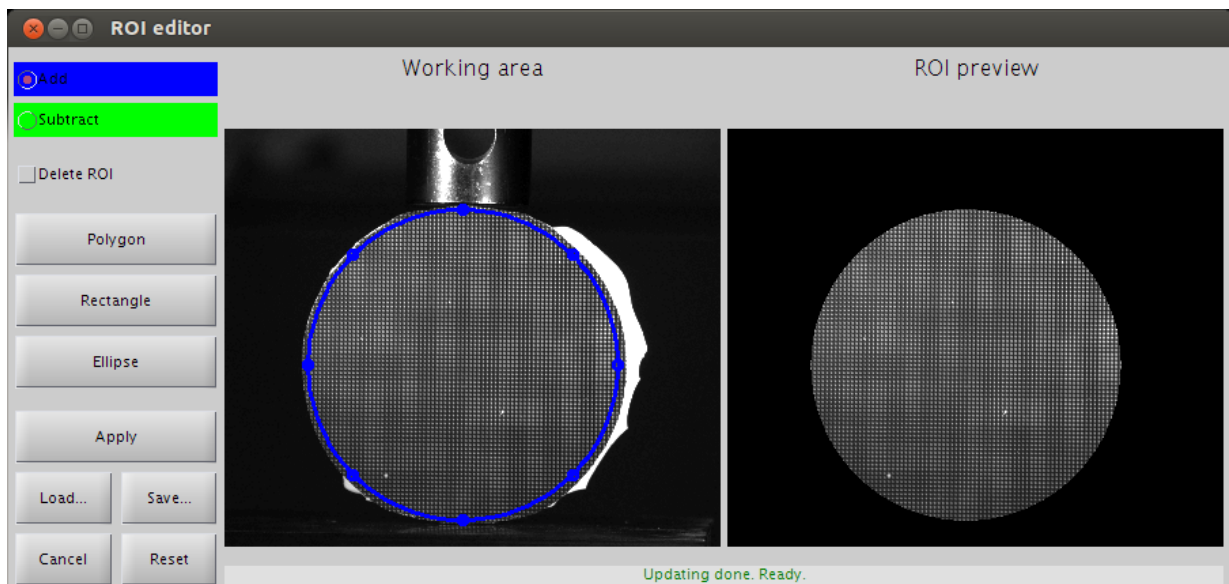


Figure 19. Adjust the position of the ellipse by clicking and dragging it to the new position. Adjust the fit of the ellipse to the disc by dragging the points.

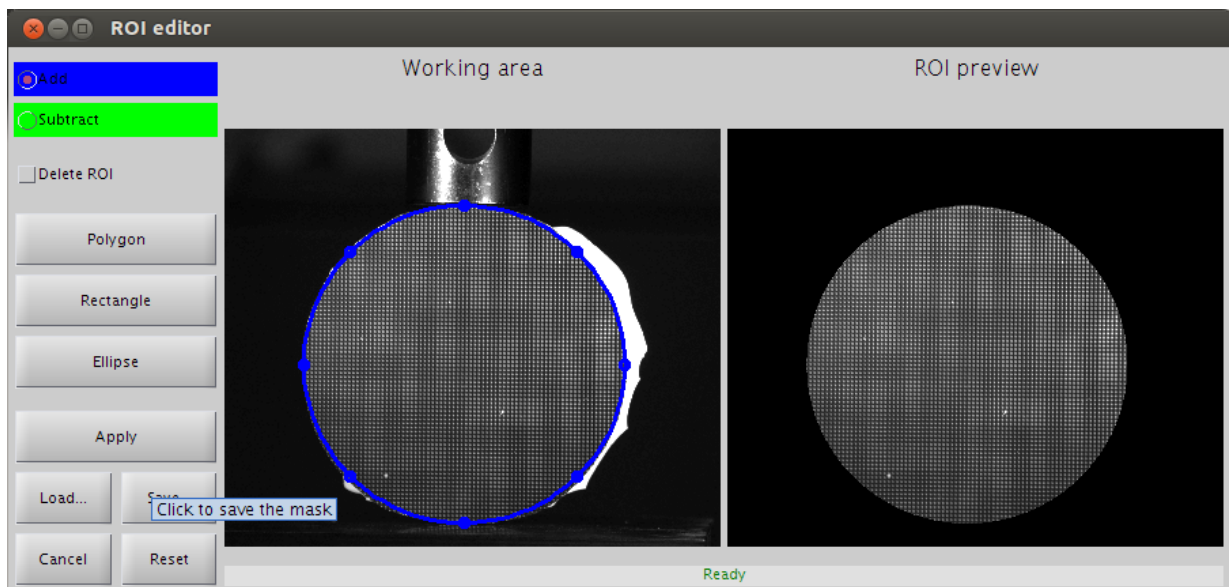


Figure 20. Click **SAVE** button to save the mask to a file.

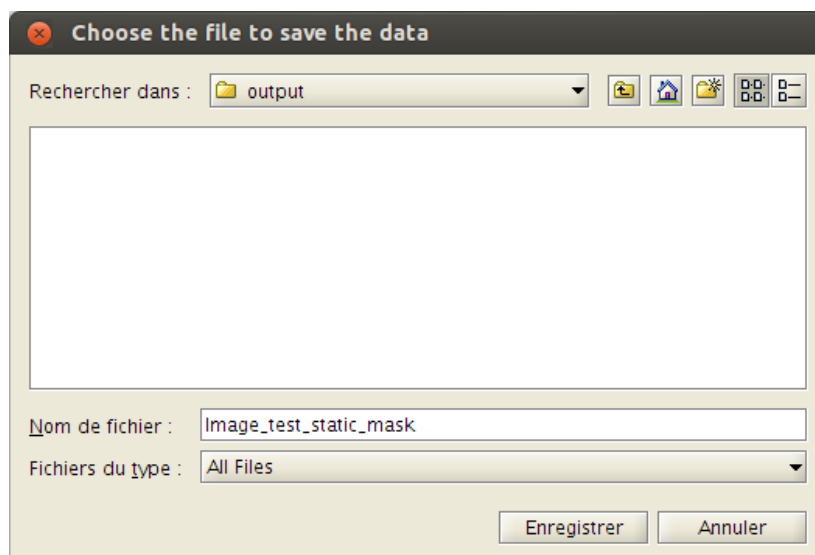


Figure 21. Enter filename.

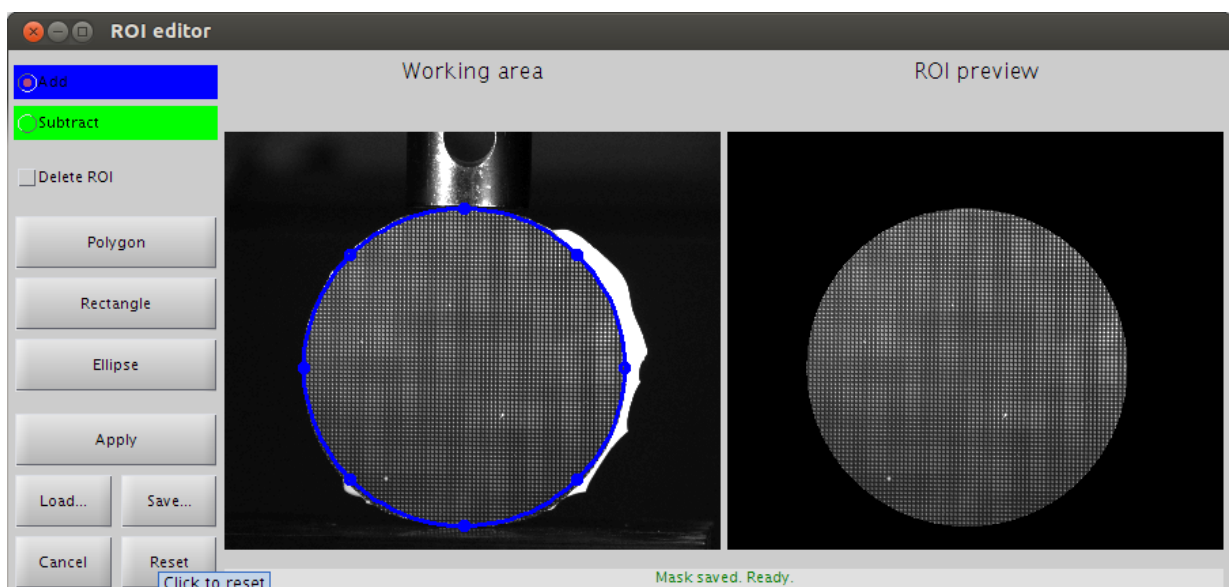


Figure 22. Click **RESET** to erase all shapes.



Figure 23. Click **LOAD** button to load the saved mask.

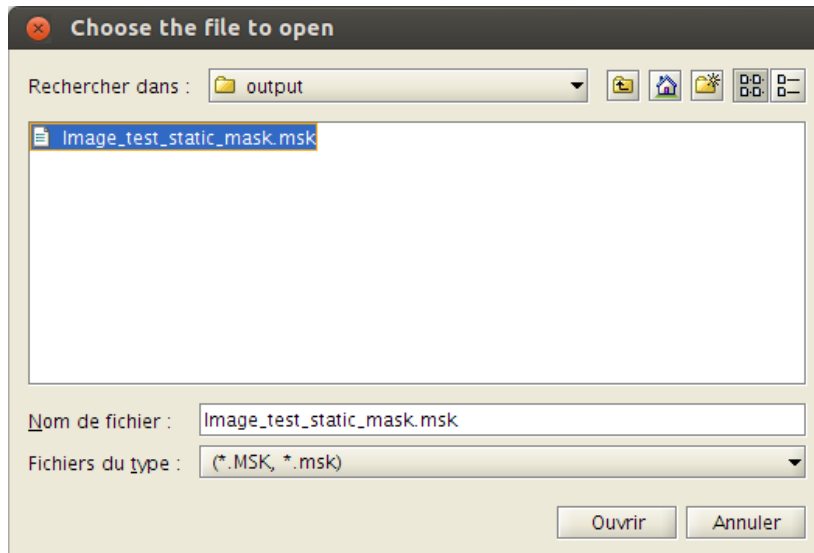


Figure 24. Select previously saved mask file.

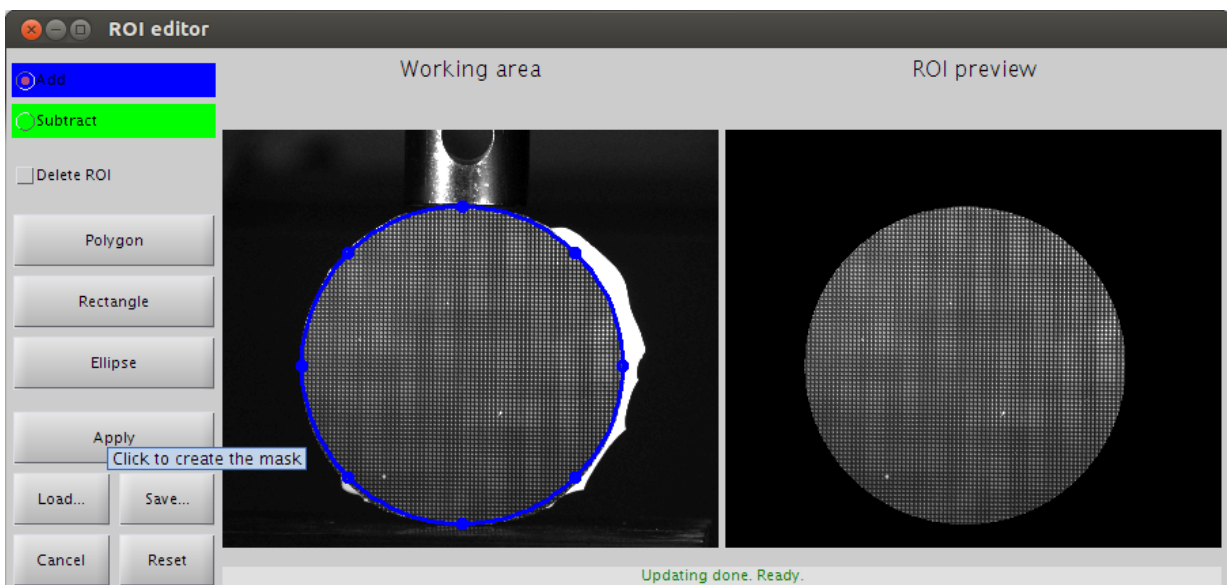


Figure 25. Click **APPLY** button to finalize the mask, close this module and return to the main window.

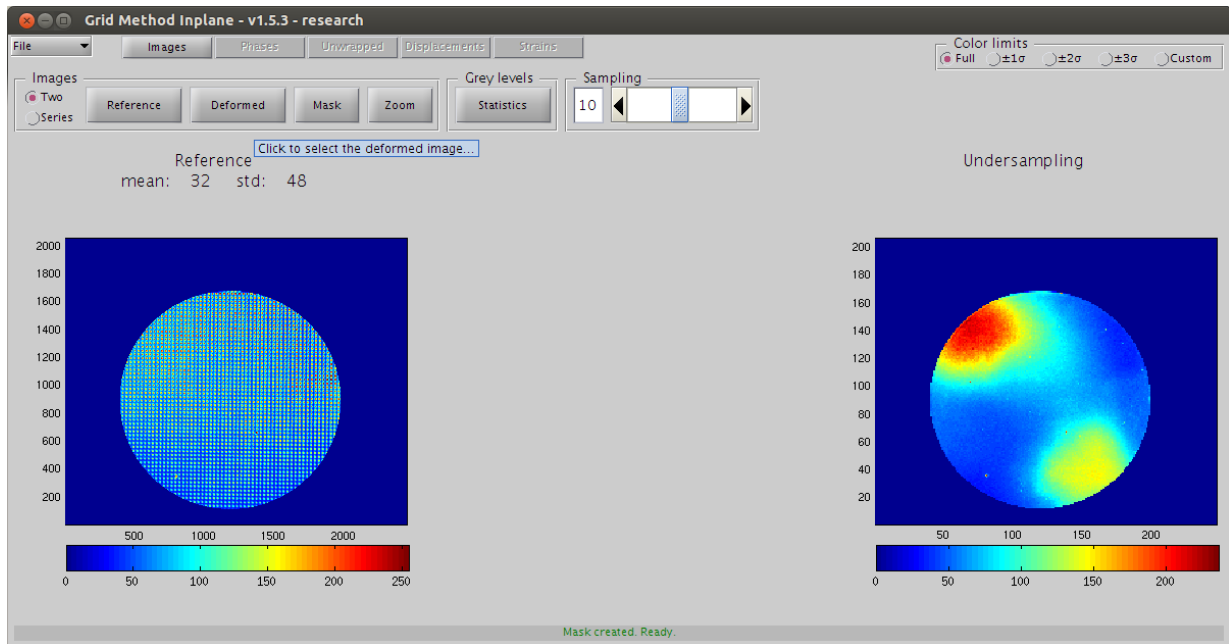


Figure 26. Click **DEFORMED** button to load image under loading.

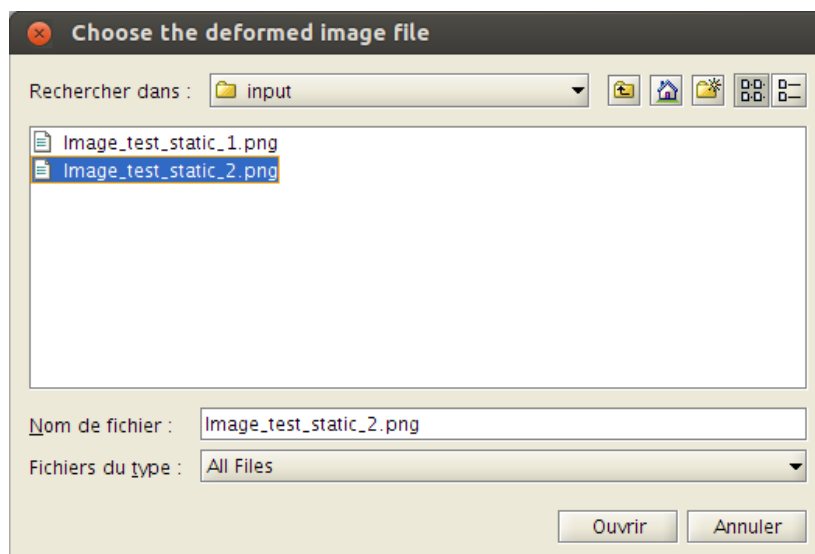


Figure 27. Select the file with the filename *Image.test.static.2.png*.

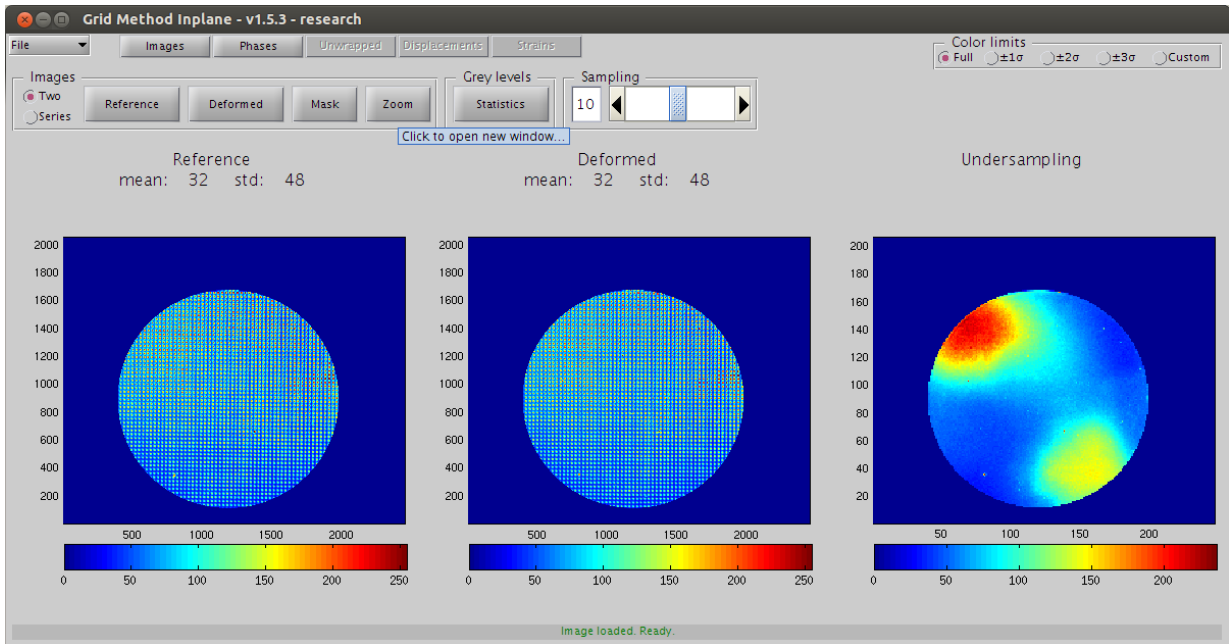


Figure 28. Click **ZOOM** button to open new window.

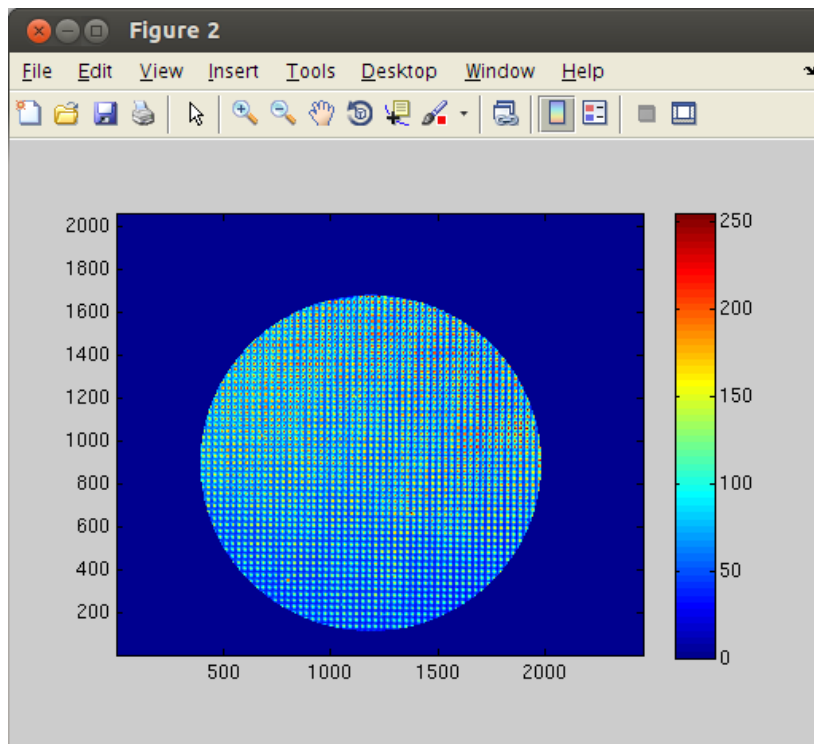


Figure 29. Traditionnal MATLAB figure window showing the undeformed image.

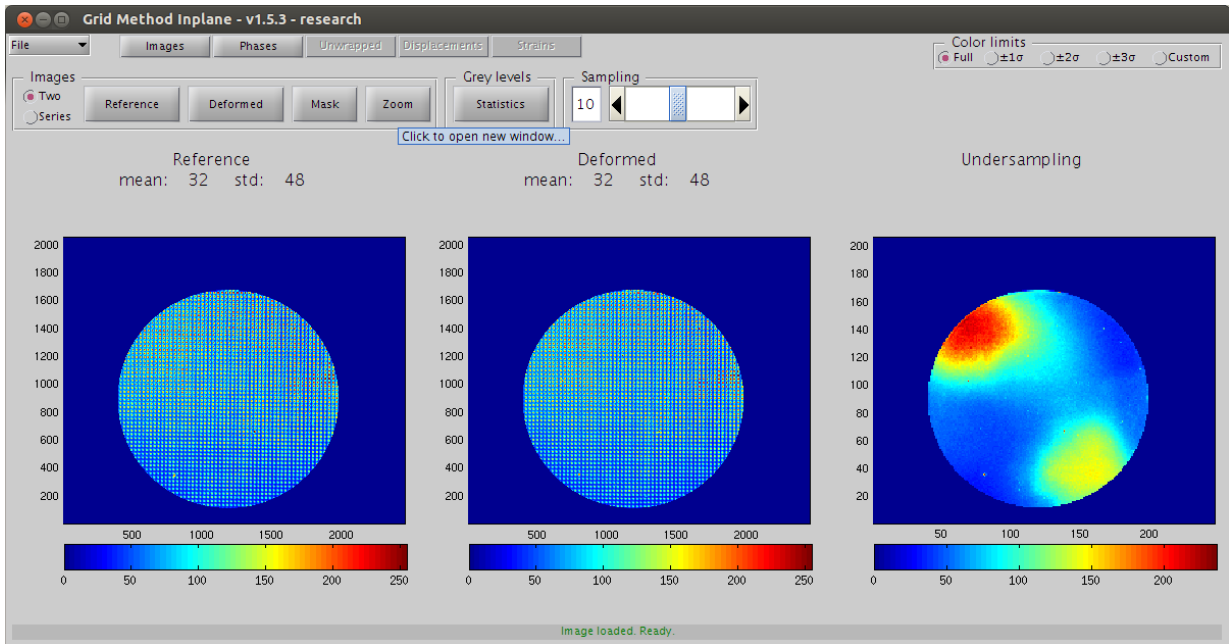


Figure 30. Press **SHIFT** and click **ZOOM** button to open new window.

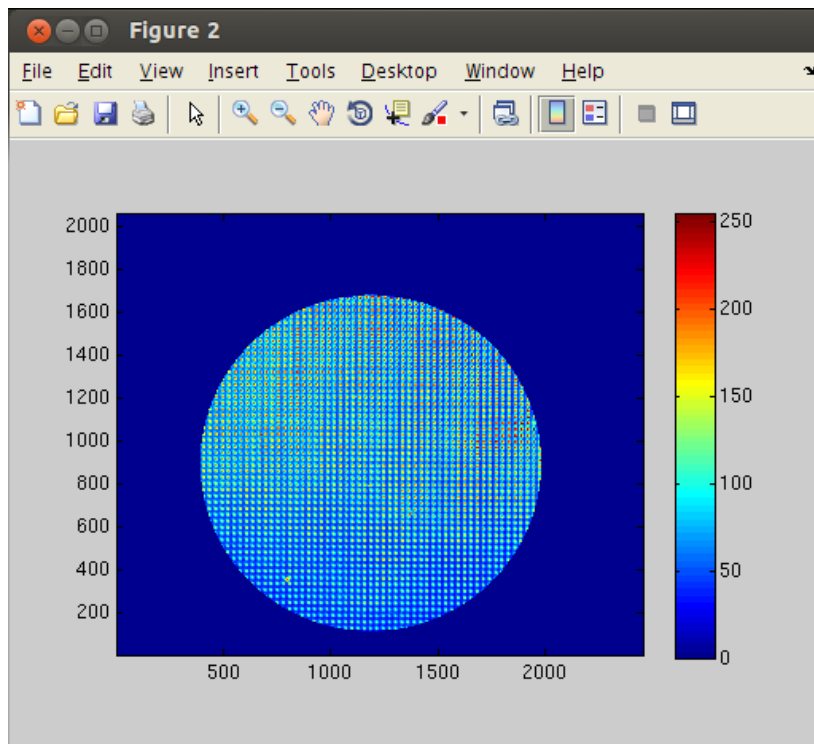


Figure 31. Traditionnal MATLAB figure window showing the deformed image.

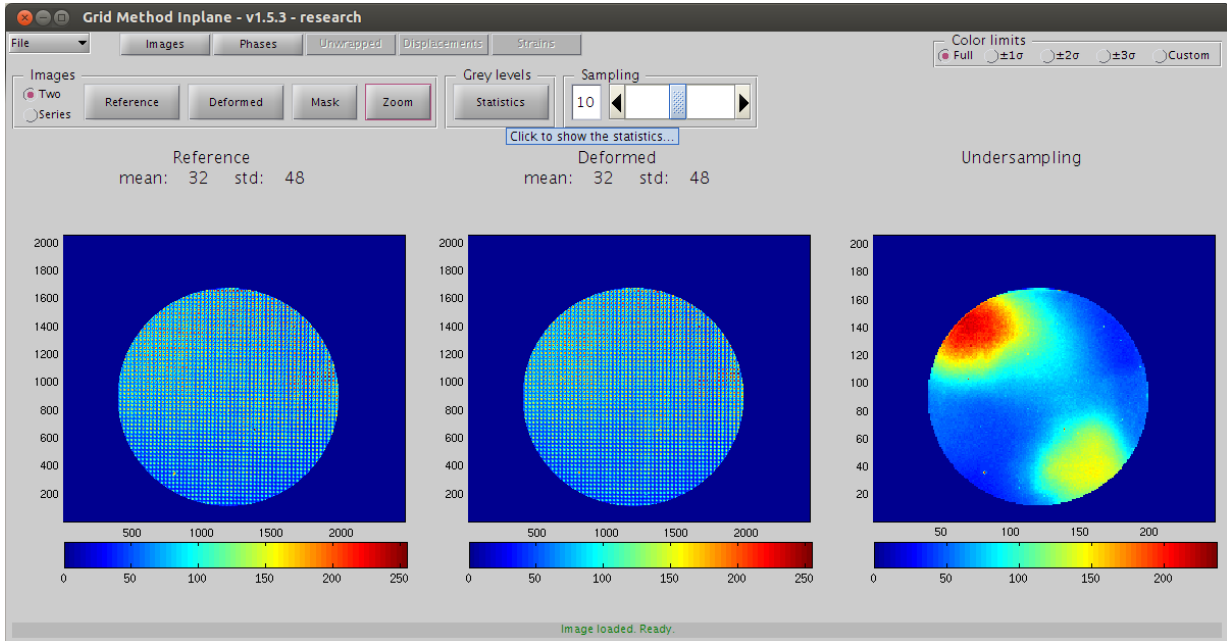


Figure 32. Click **STATISTICS** button to open new window.

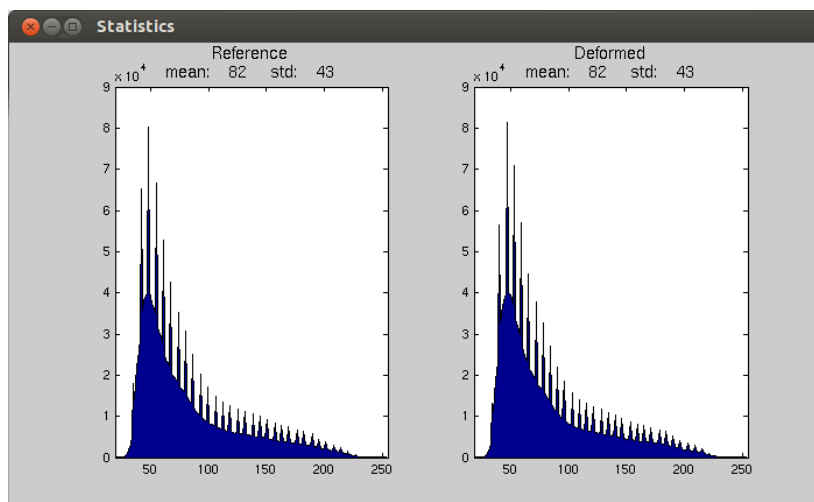


Figure 33. New window showing the grey levels statistics of both the undeformed and deformed images.

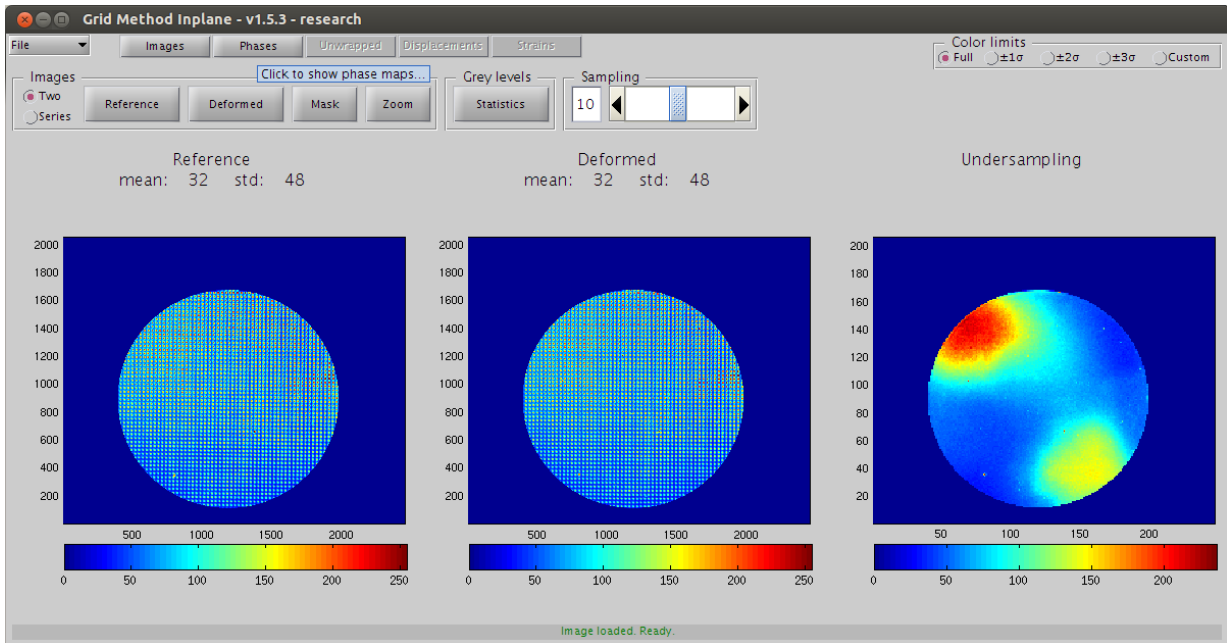


Figure 34. Click **PHASES** button to pass to the second panel.

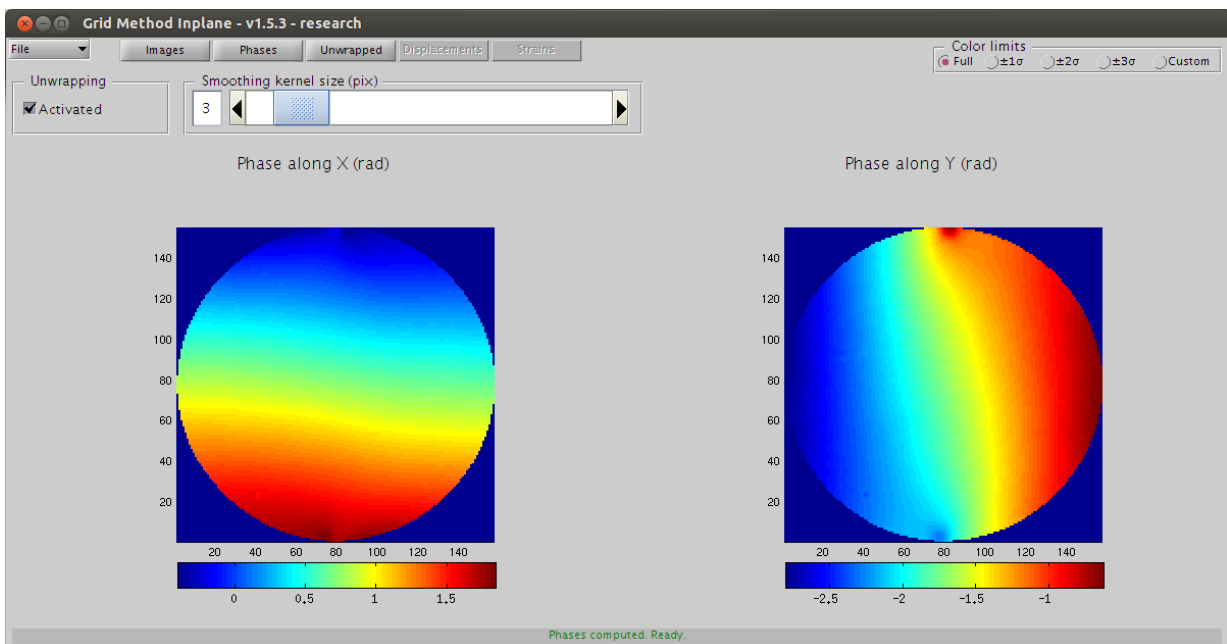


Figure 35. Change the **SMOOTHING** textbox to 3.

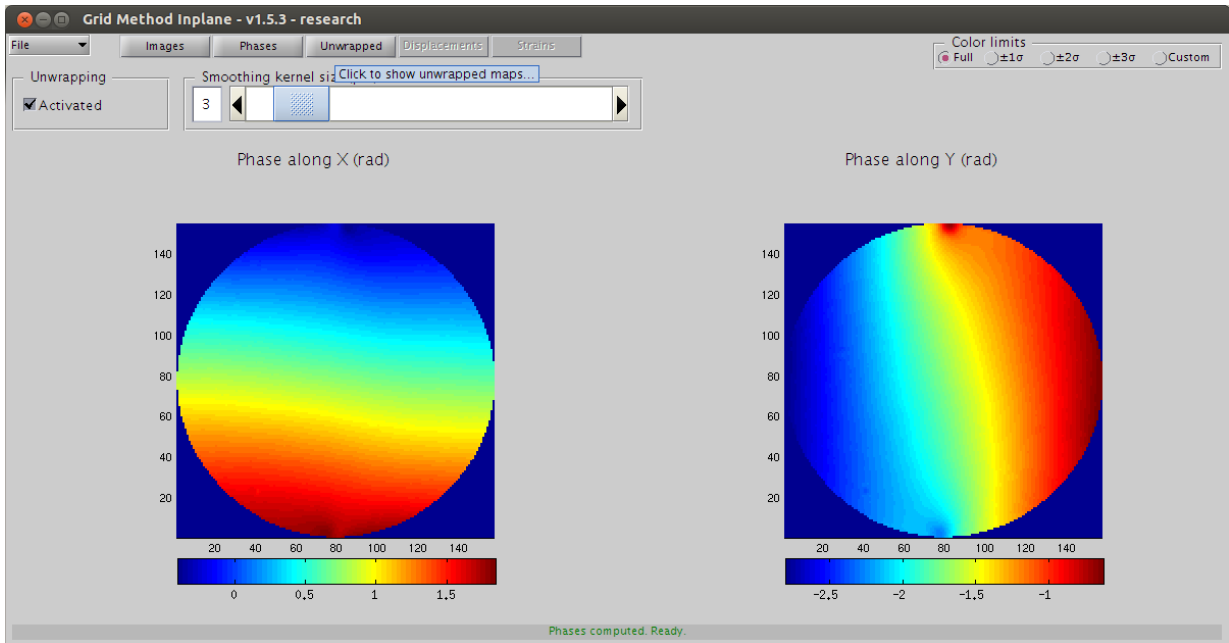


Figure 36. Click **UNWRAPPED** button to pass to the third panel.

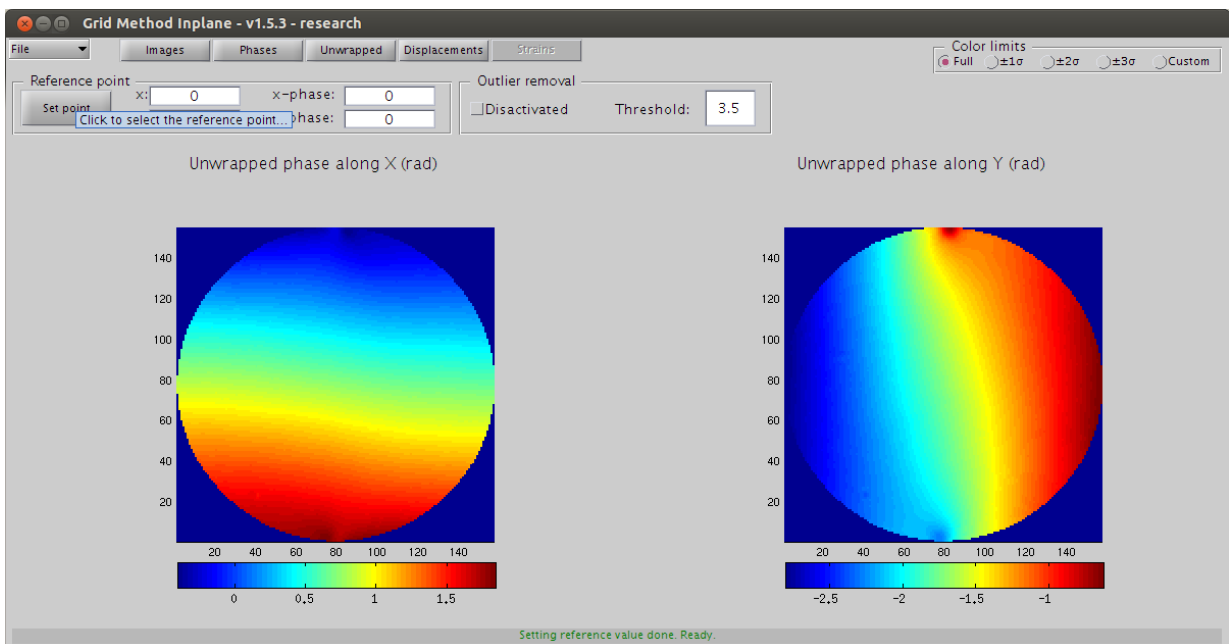


Figure 37. Click **SET POINT** button to add a reference point.

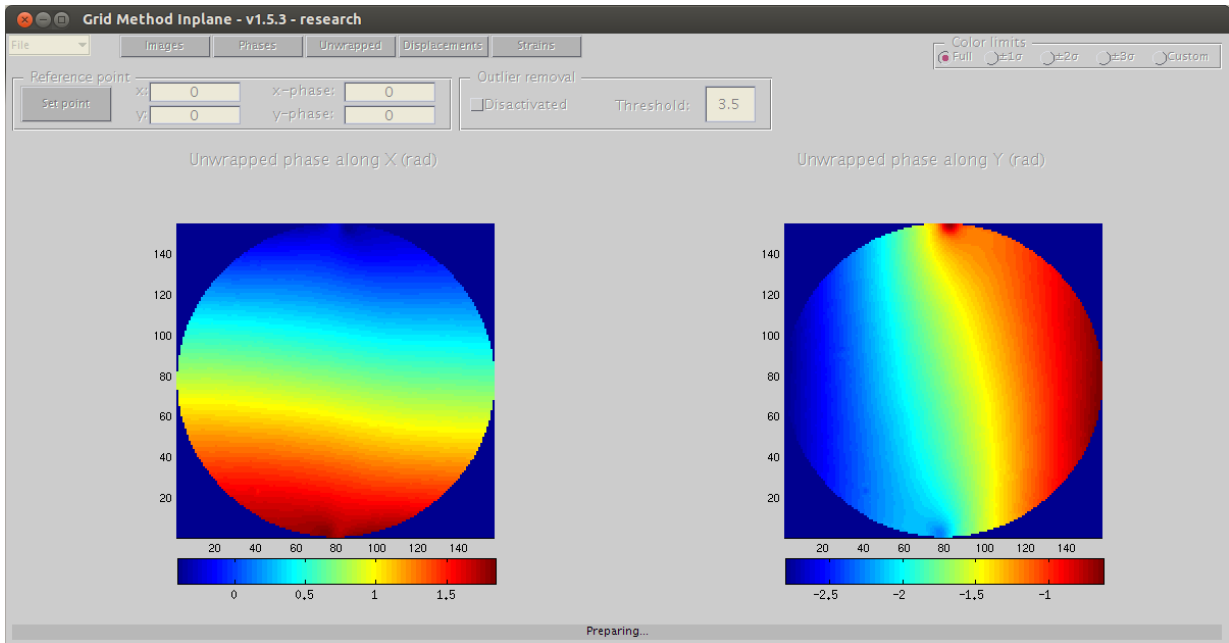


Figure 38. Select the point on the bottom of the disc. A black cross will appear where the point has been selected.

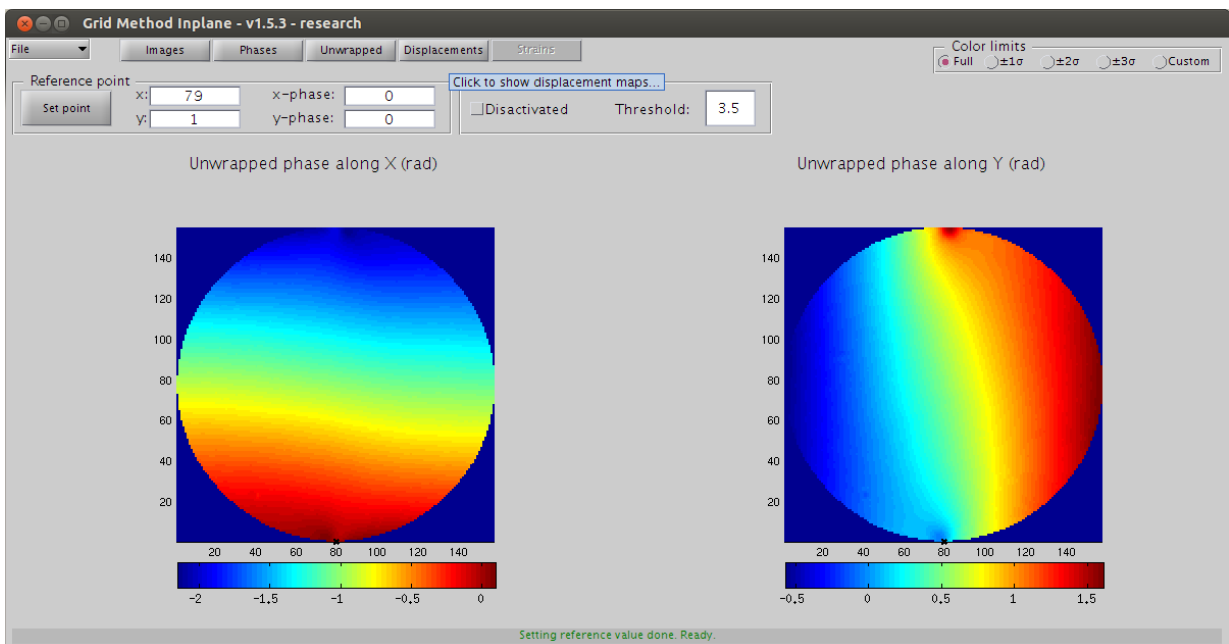


Figure 39. Click **DISPLACEMENTS** button to pass to the fourth panel.

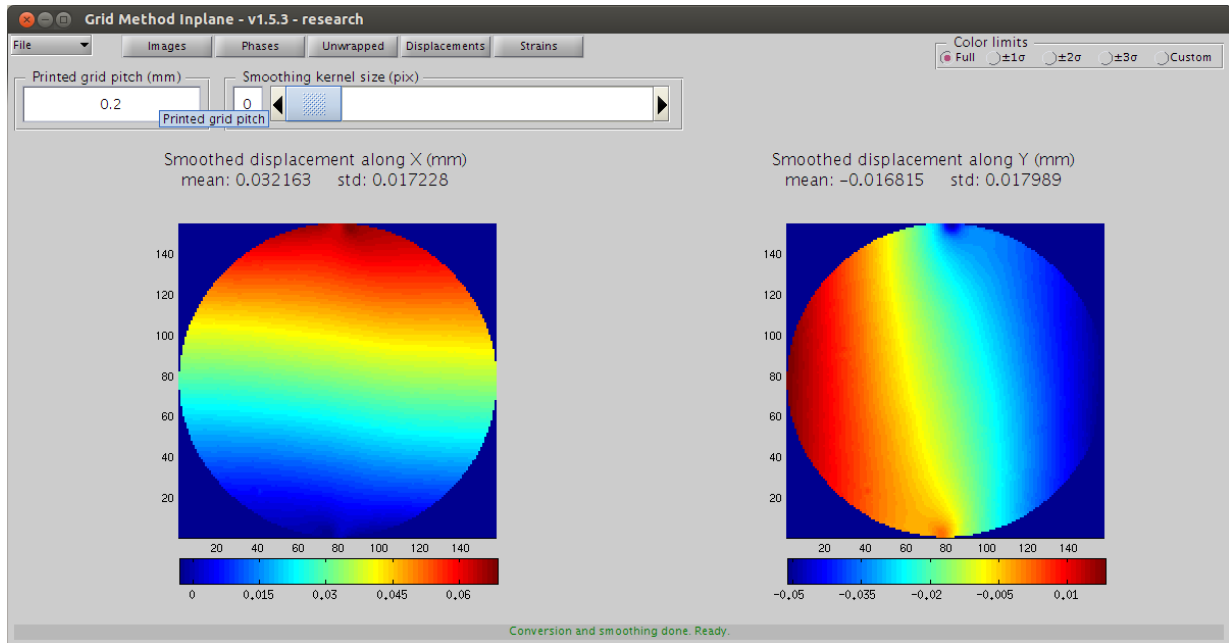


Figure 40. Adjust the **PRINTED GRID PITCH** textbox to 0.2 mm.

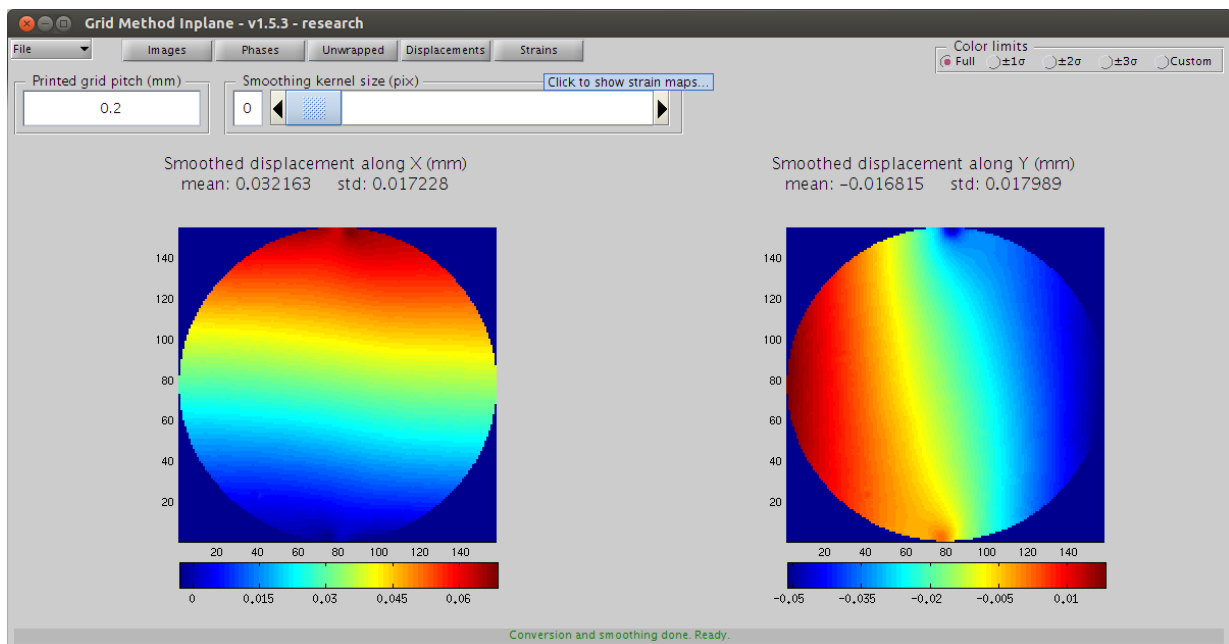


Figure 41. Click **STRAINS** button to load reference image.

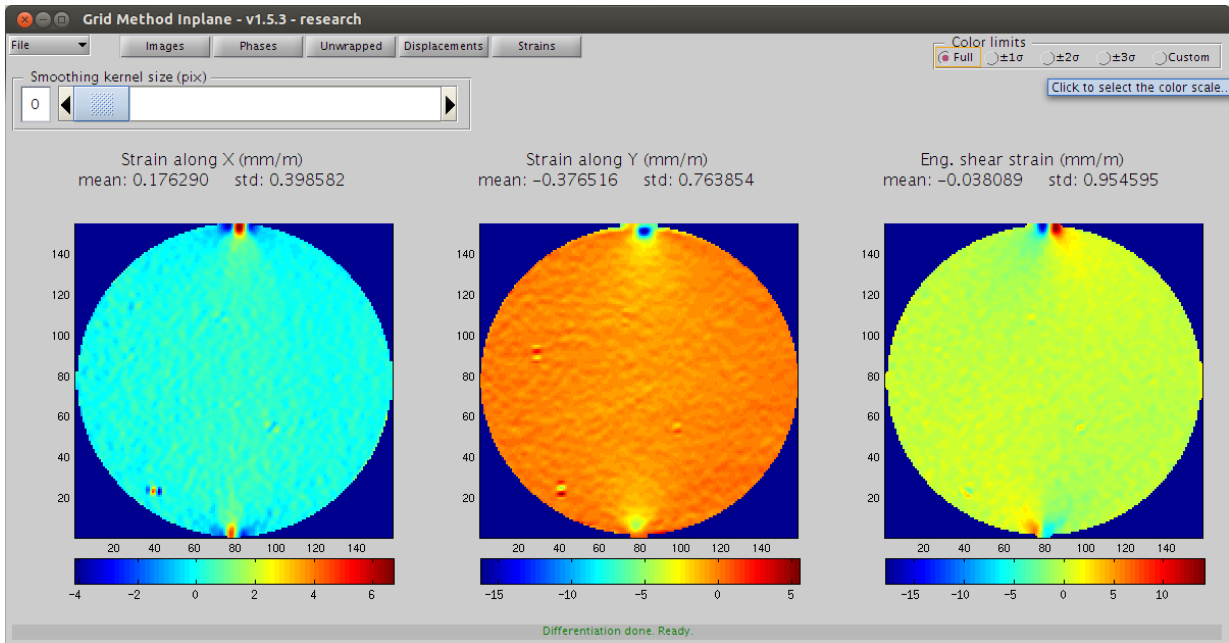


Figure 42. Click 2σ button to change the colour scale.

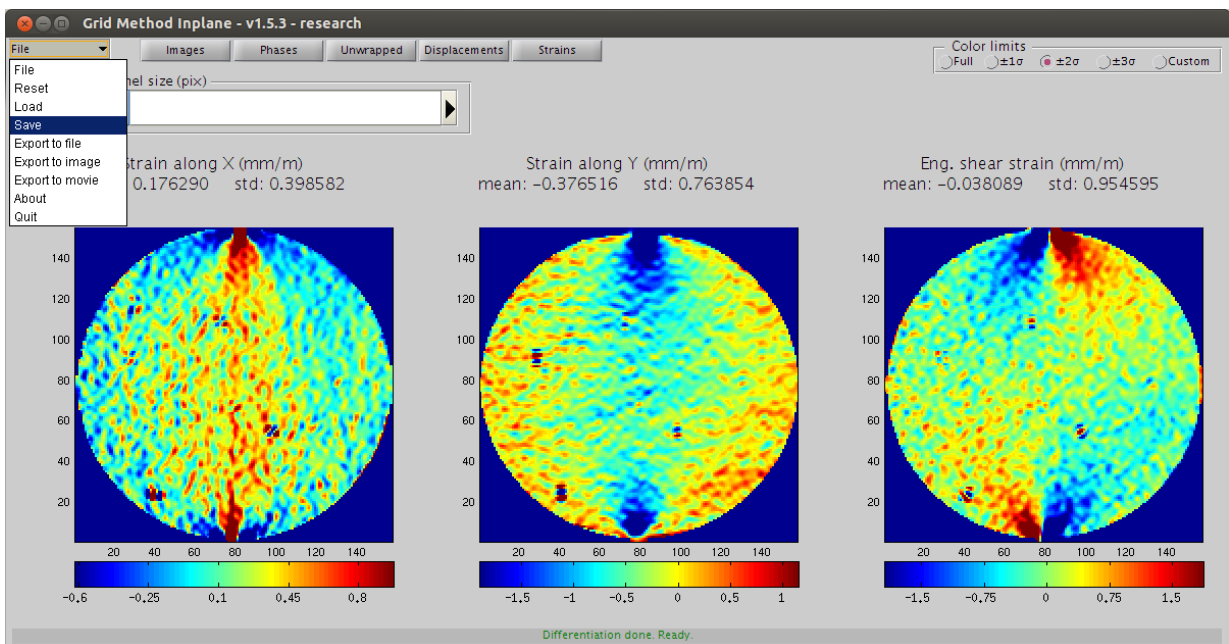


Figure 43. Click **FILE**→**SAVE** to save current dataset to a *.GRD file.

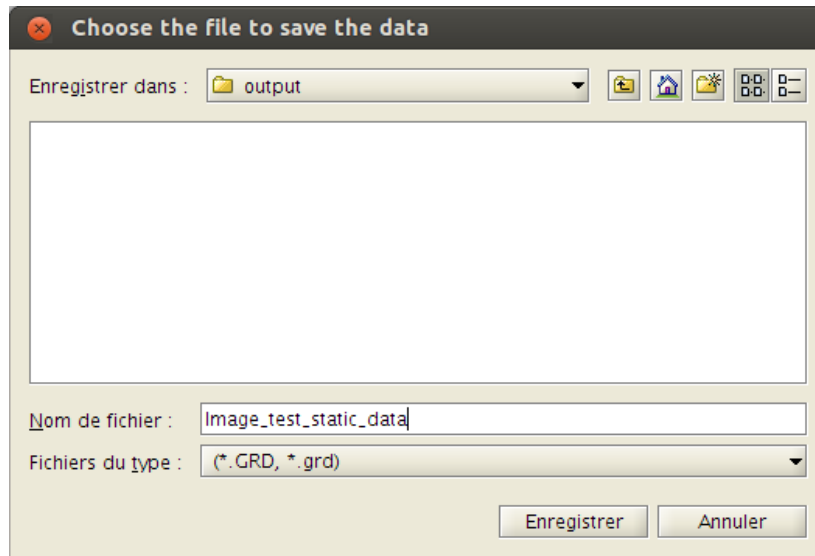


Figure 44. Enter a filename to save the current dataset.

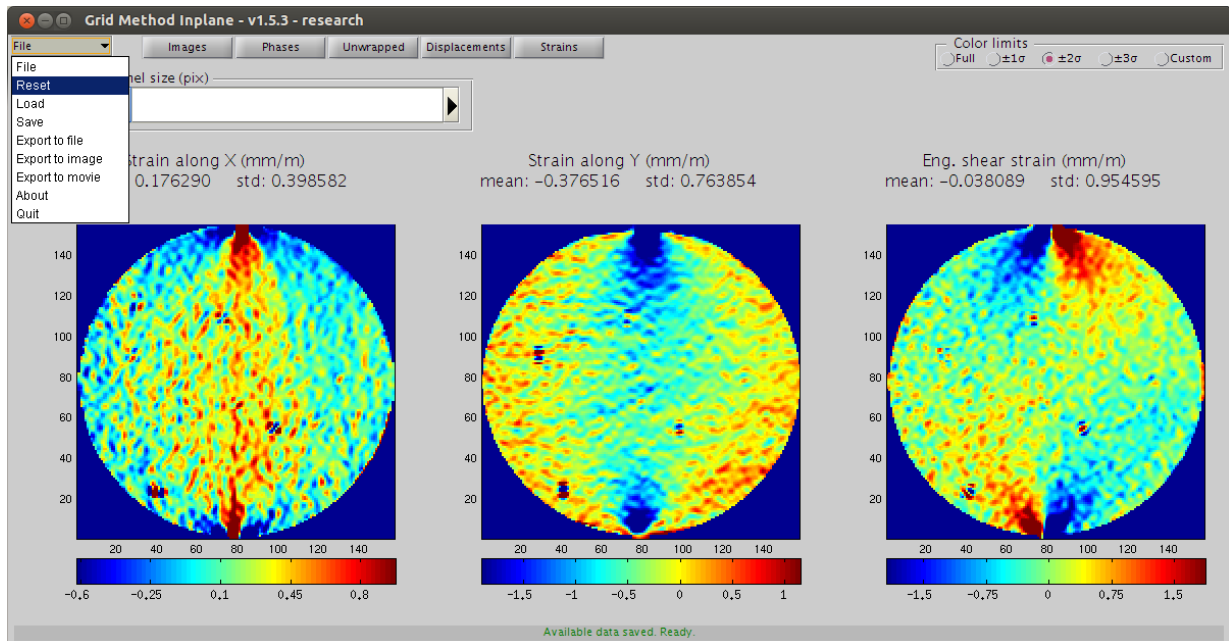


Figure 45. Click **FILE**→**RESET** to delete any currently loaded data.

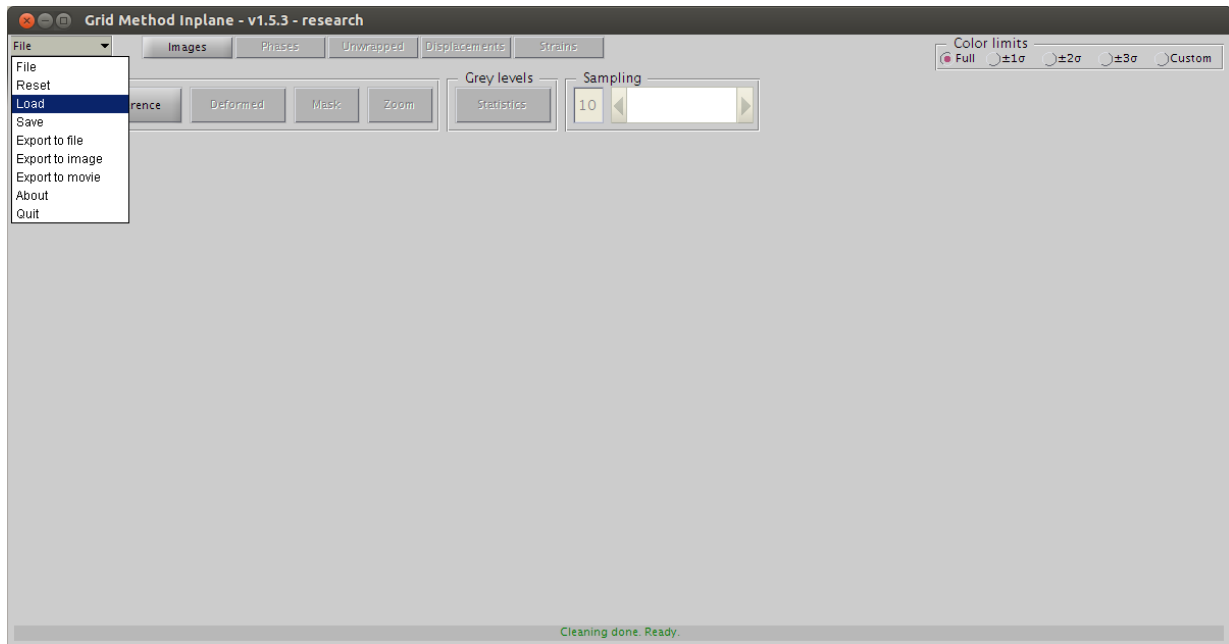


Figure 46. Click **FILE**→**LOAD** to load a previously saved data set.

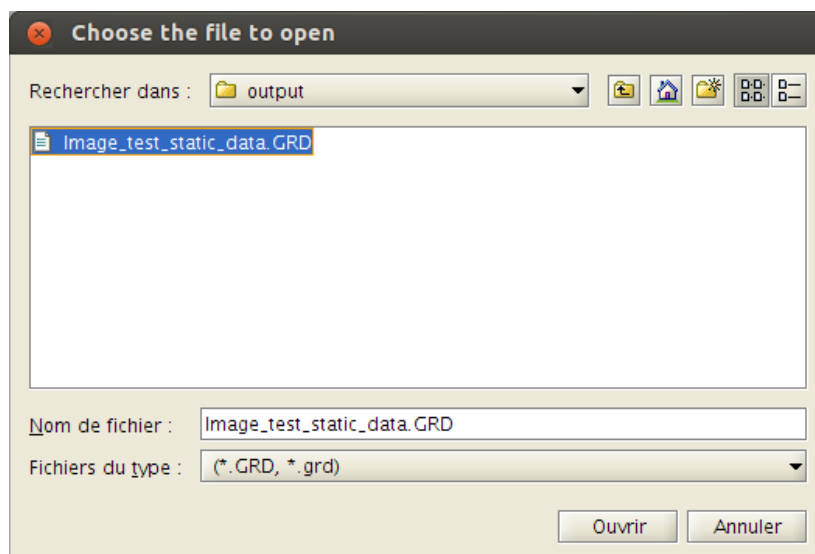


Figure 47. Select the file previously saved.

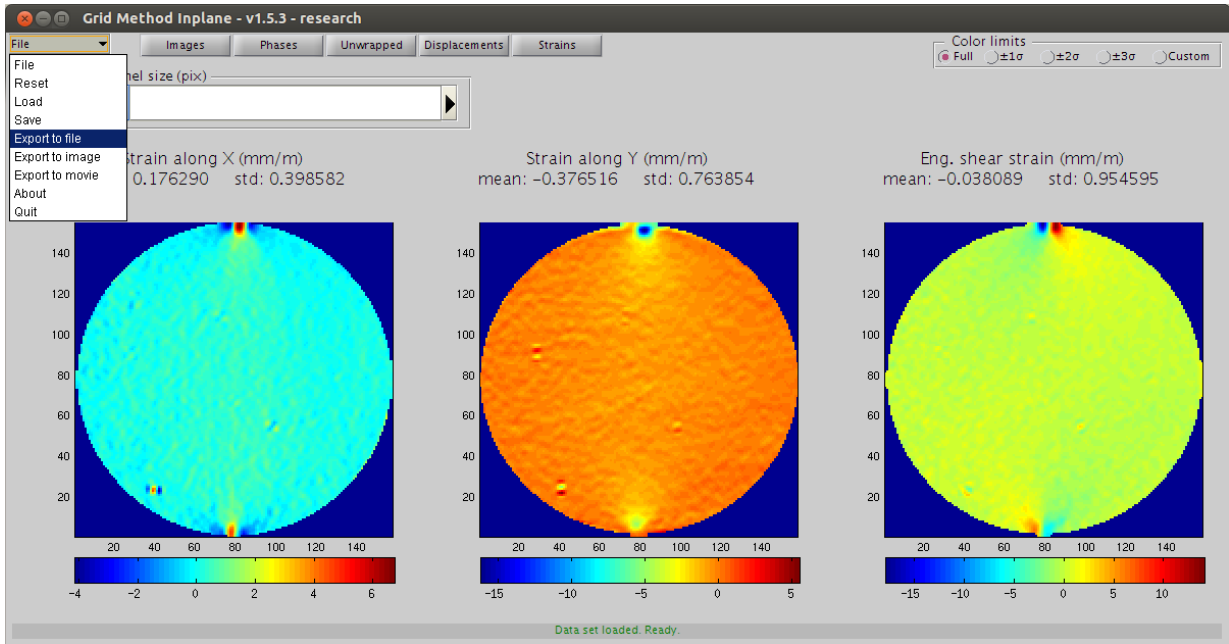


Figure 48. Click **FILE**→**EXPORT TO FILE** to export data to files.

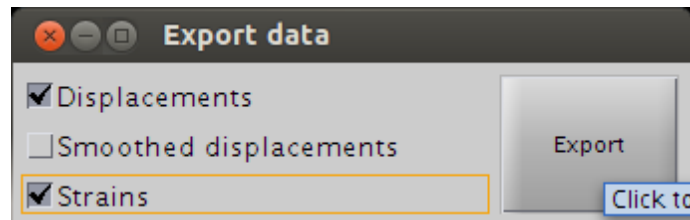


Figure 49. Check **DISPLACEMENTS** and **STRAINS** and click on **EXPORT**.

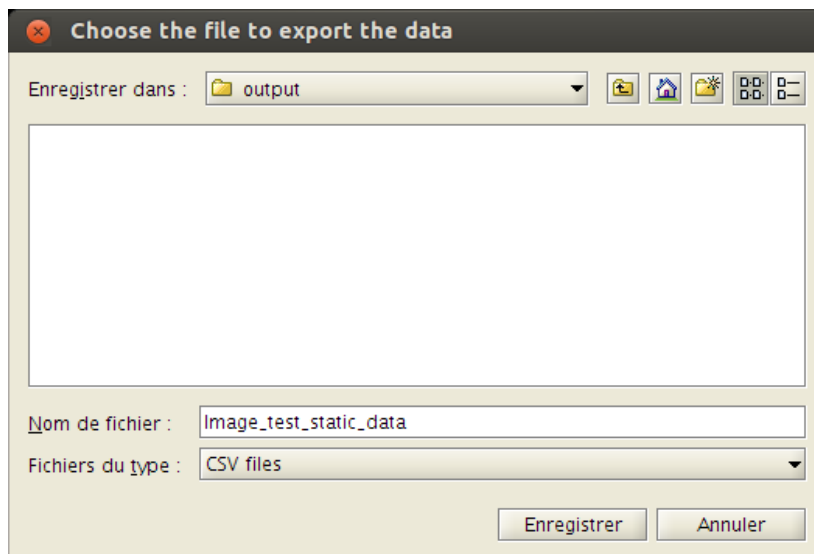


Figure 50. Enter a filename to save the data and select the file type.

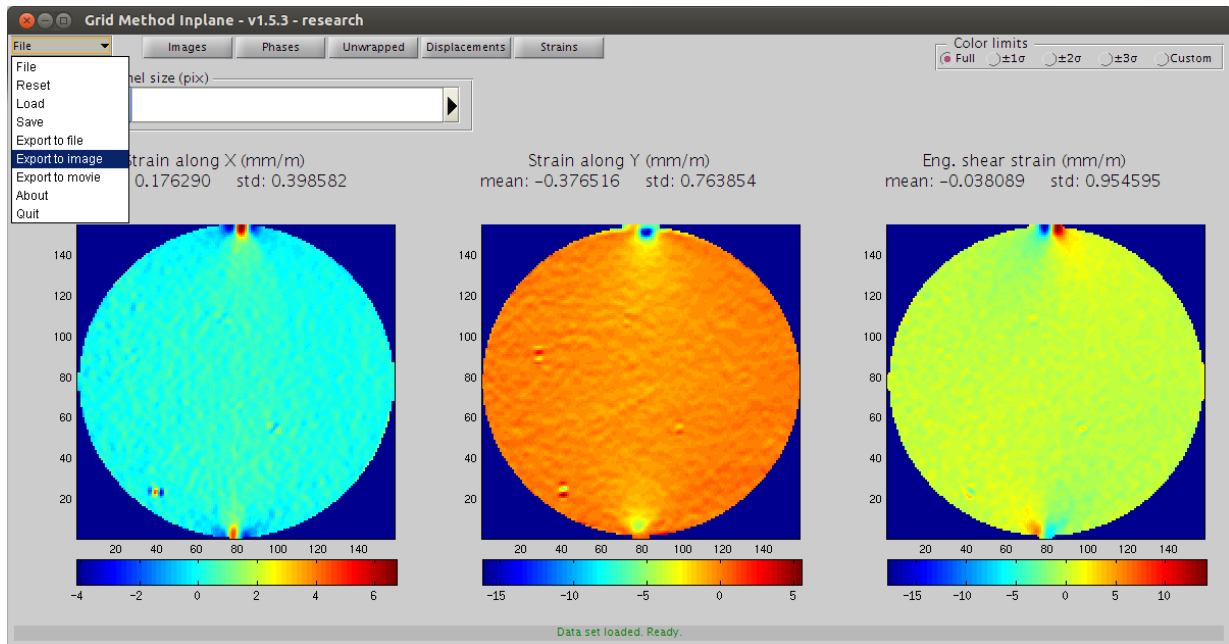


Figure 51. Click **FILE**→**EXPORT TO IMAGE** to export current viewport to a *.PNG file.

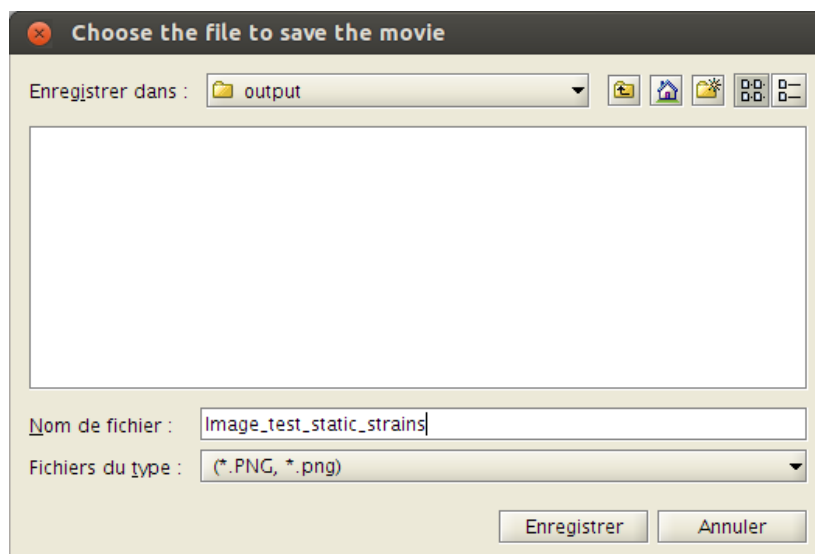


Figure 52. Enter a filename to save the image.

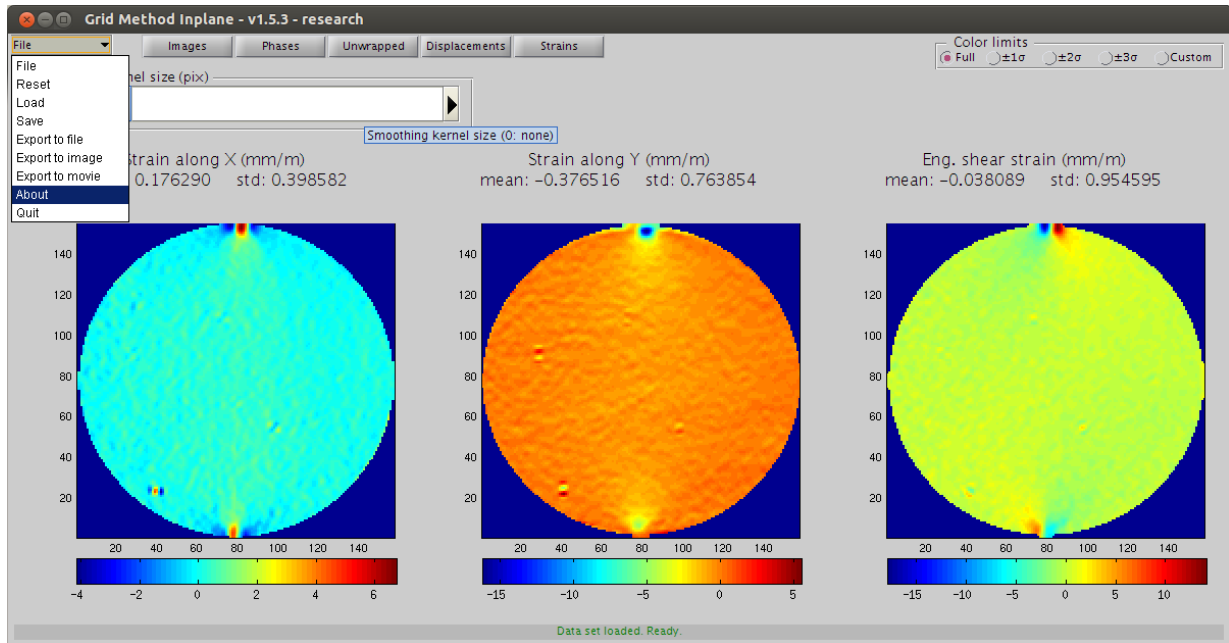


Figure 53. Click **FILE**→**ABOUT** to show information about the software.

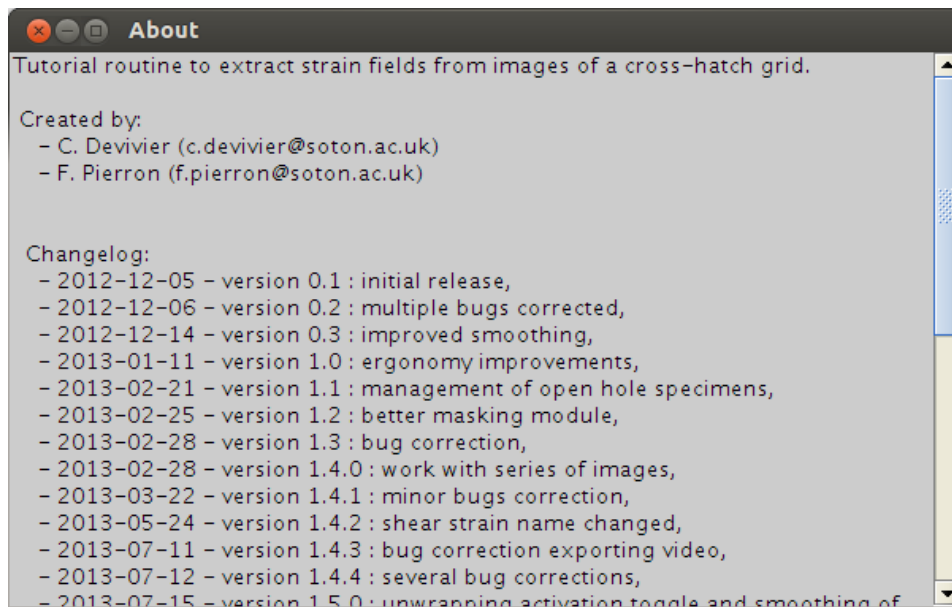


Figure 54. About dialog window.

11.2 Series-of-image mode

This tutorial will guide you through the processing of images for a test of an open hole specimen.

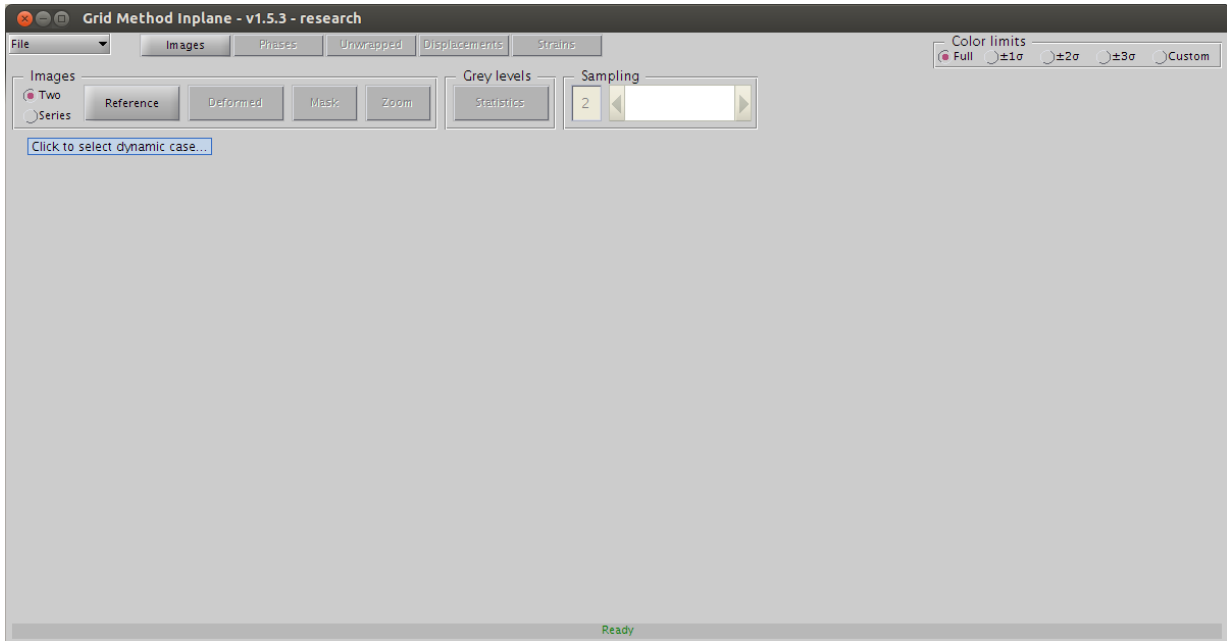


Figure 55. Click **SERIES** radiobutton to switch to series-of-image mode.

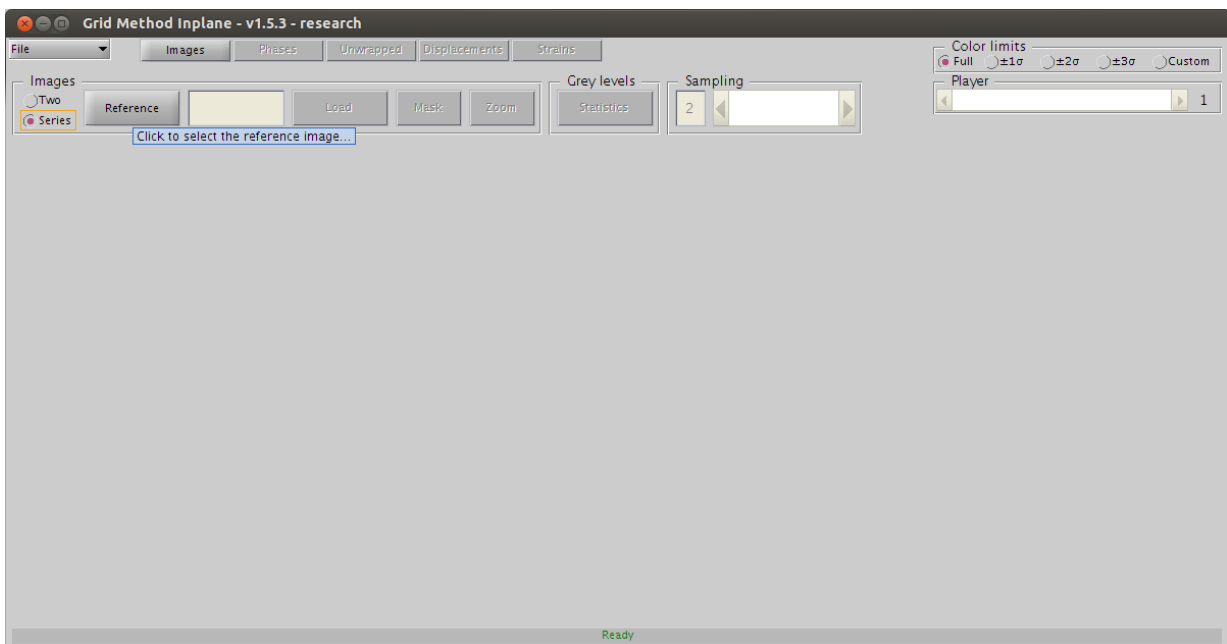


Figure 56. Click **REFERENCE** button to load the reference image.

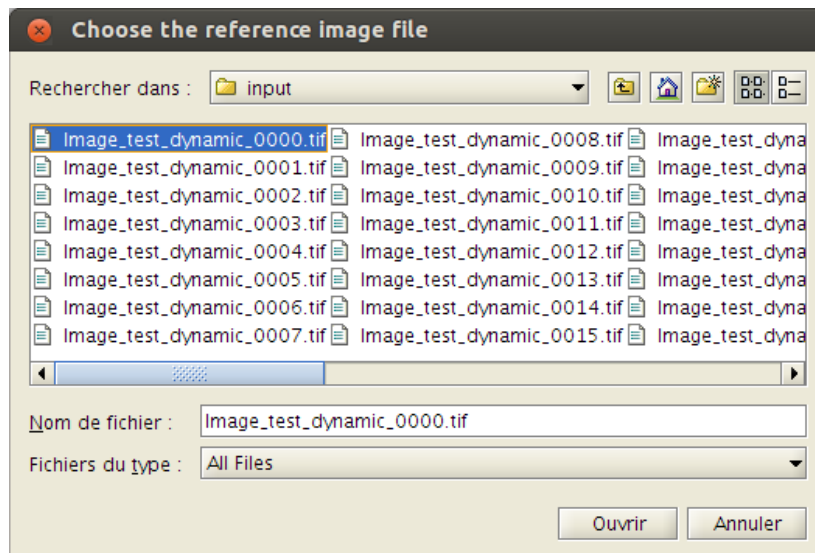


Figure 57. Select the file with the filename *Image_test_static_1.png*. You can note in the next image that the **PATTERN** and **SAMPLING** textboxes have been automatically updated.

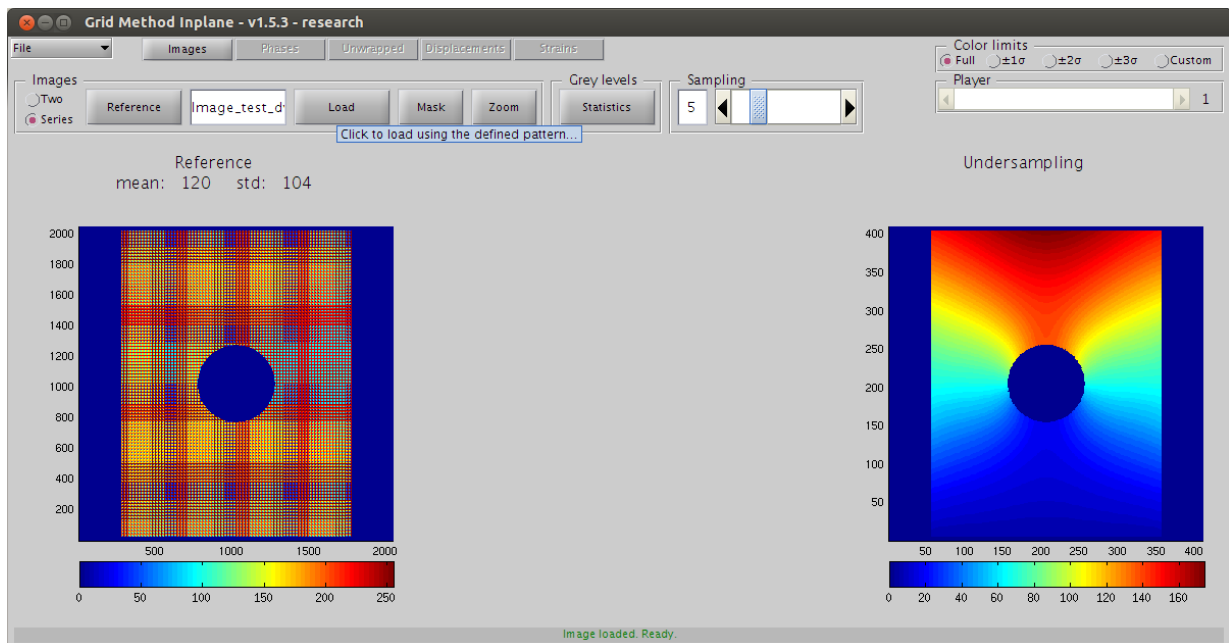


Figure 58. While pressing **CONTROL** and **SHIFT**, click **LOAD** button to load the series of pictures.

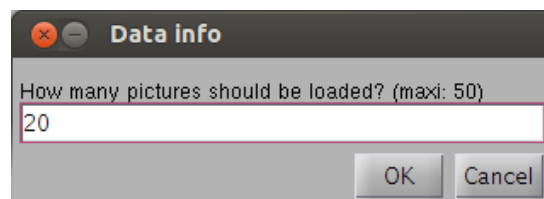


Figure 59. Enter the number of pictures to load.

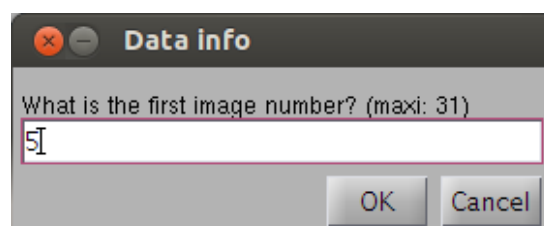


Figure 60. Enter the file number of the first picture to be loaded.

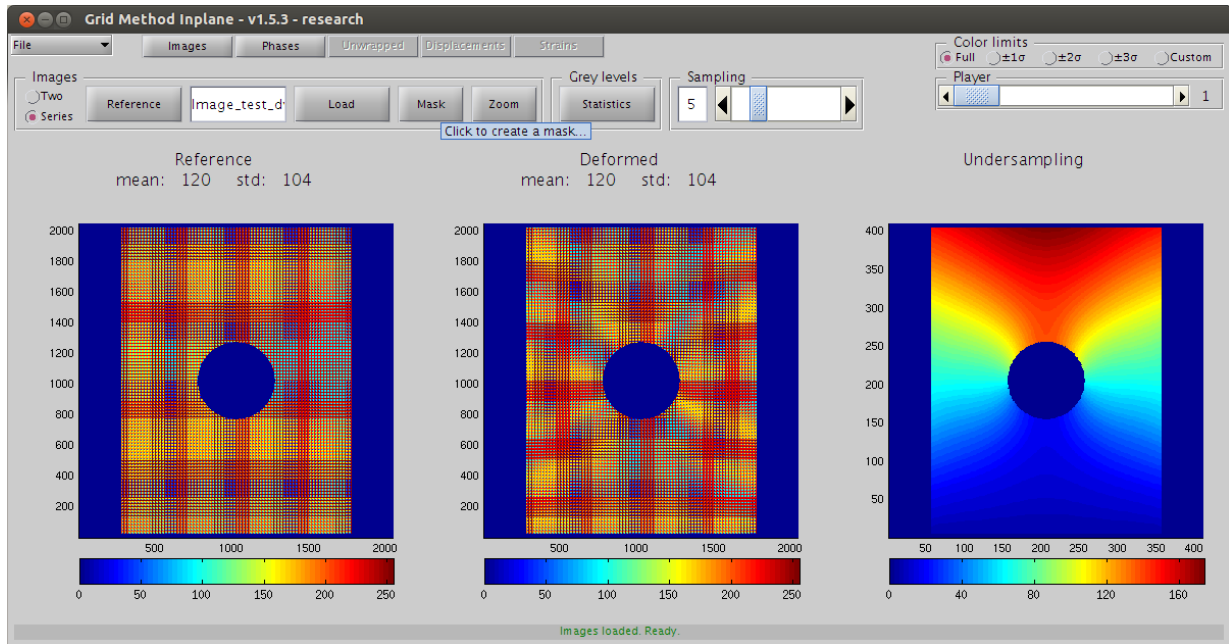


Figure 61. Click **MASK** button to open the masking module.

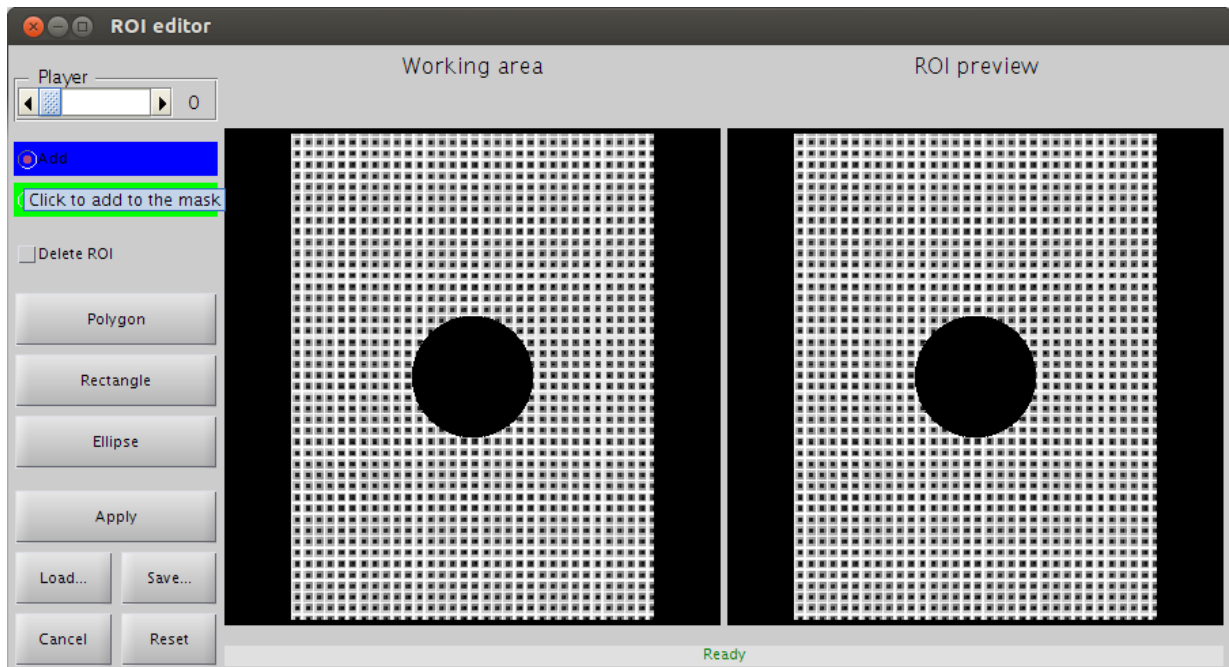


Figure 62. Click **ADD** radiobutton.

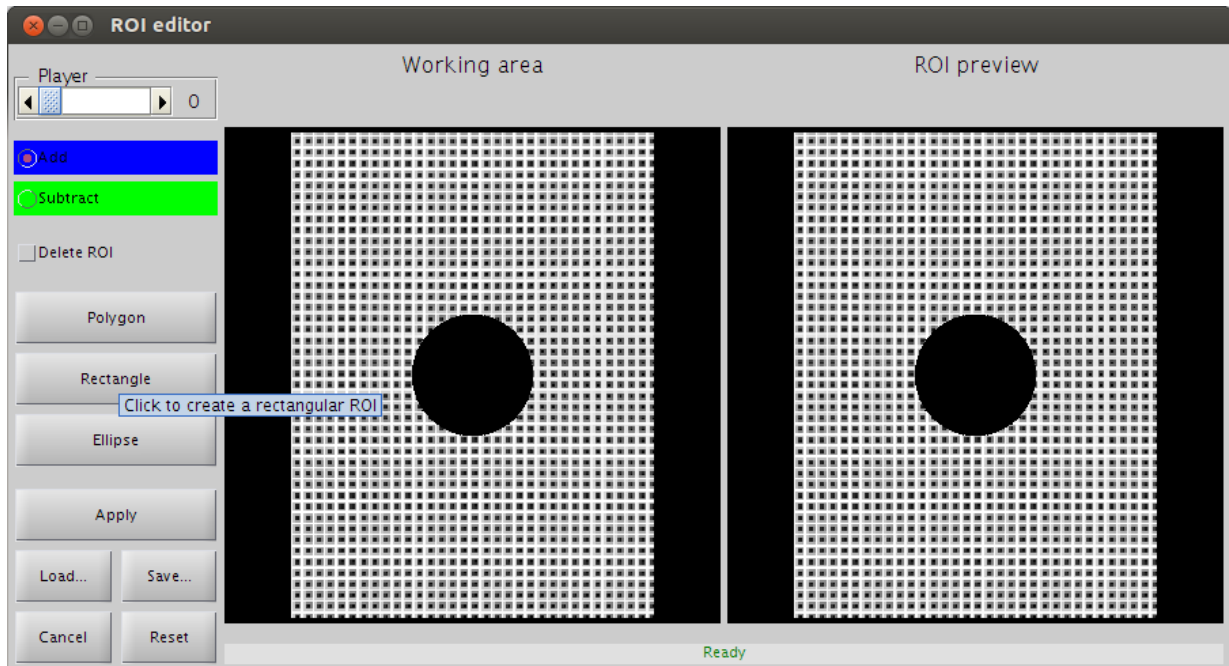


Figure 63. Click **RECTANGLE** button to create a rectangular shape.

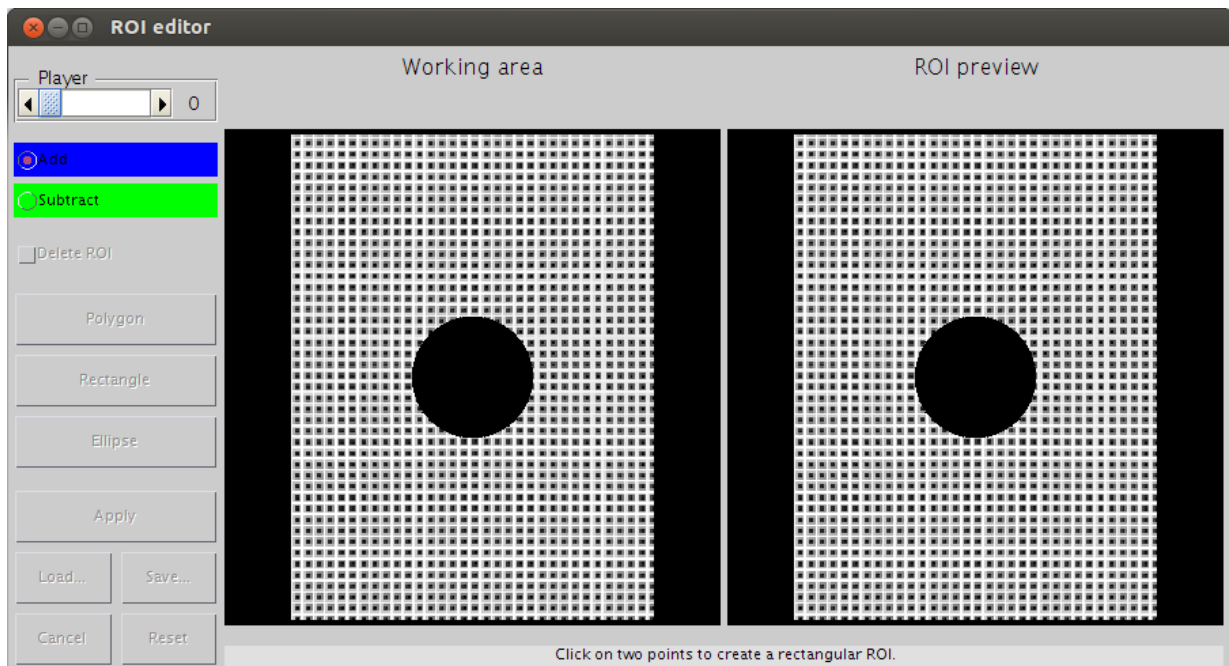


Figure 64. Click on the "working area" viewport to add a first corner.

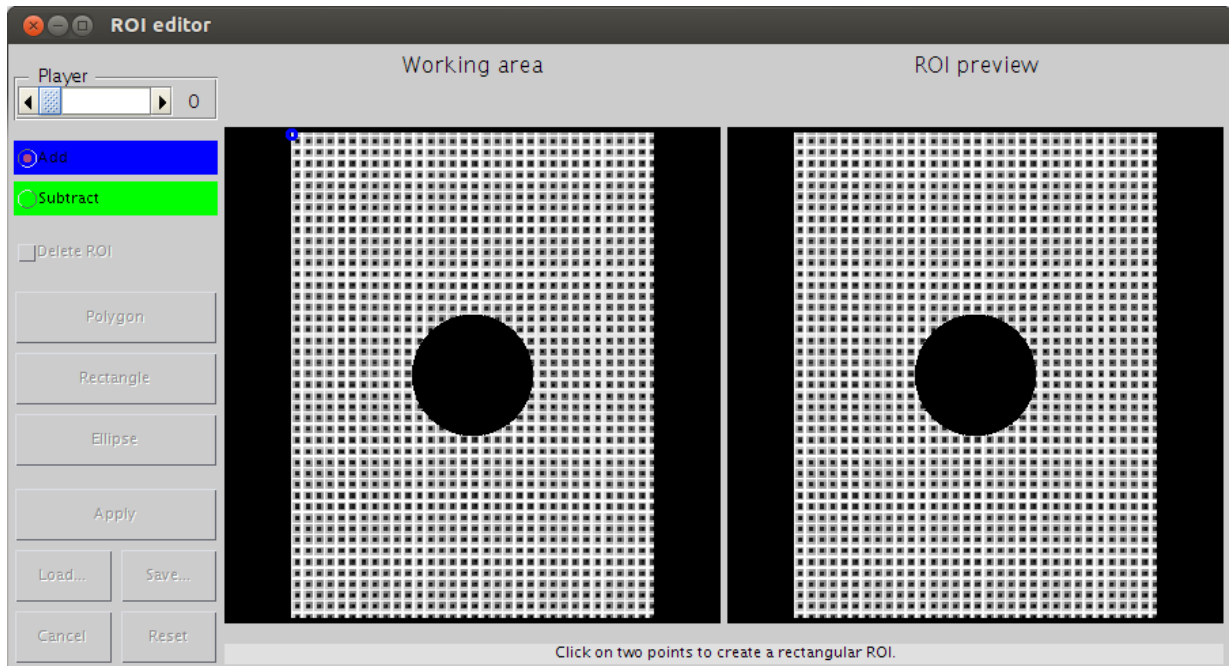


Figure 65. Click a second time to add the last corner.

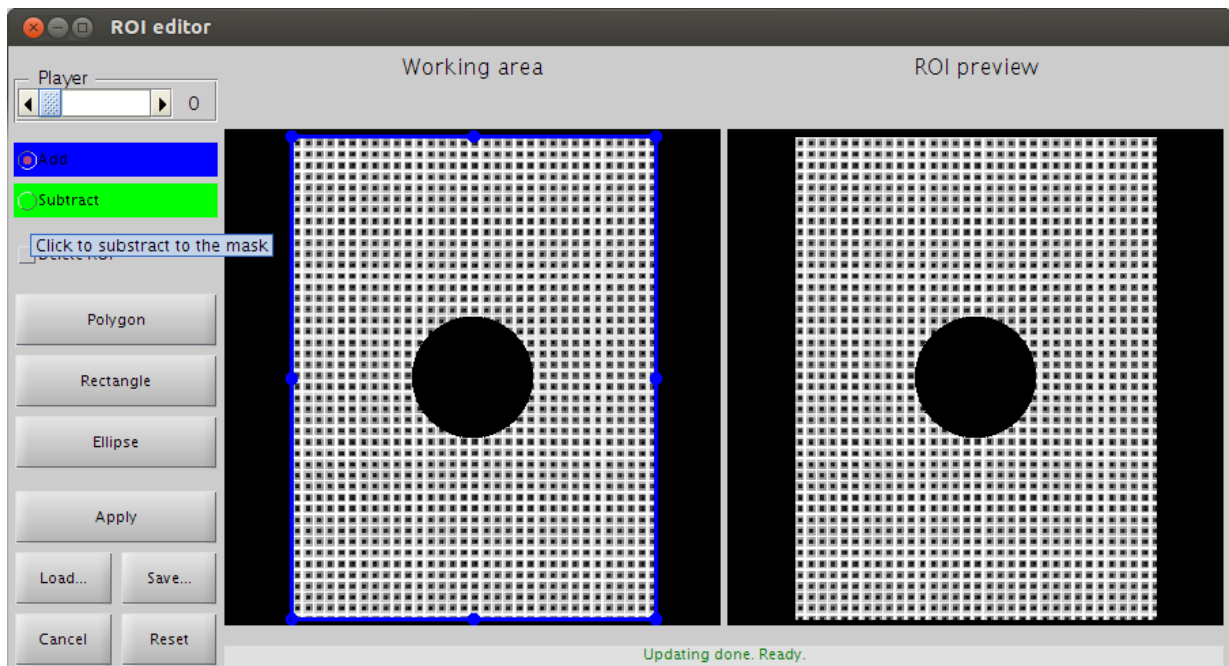


Figure 66. Click **SUBTRACT** radiobutton.

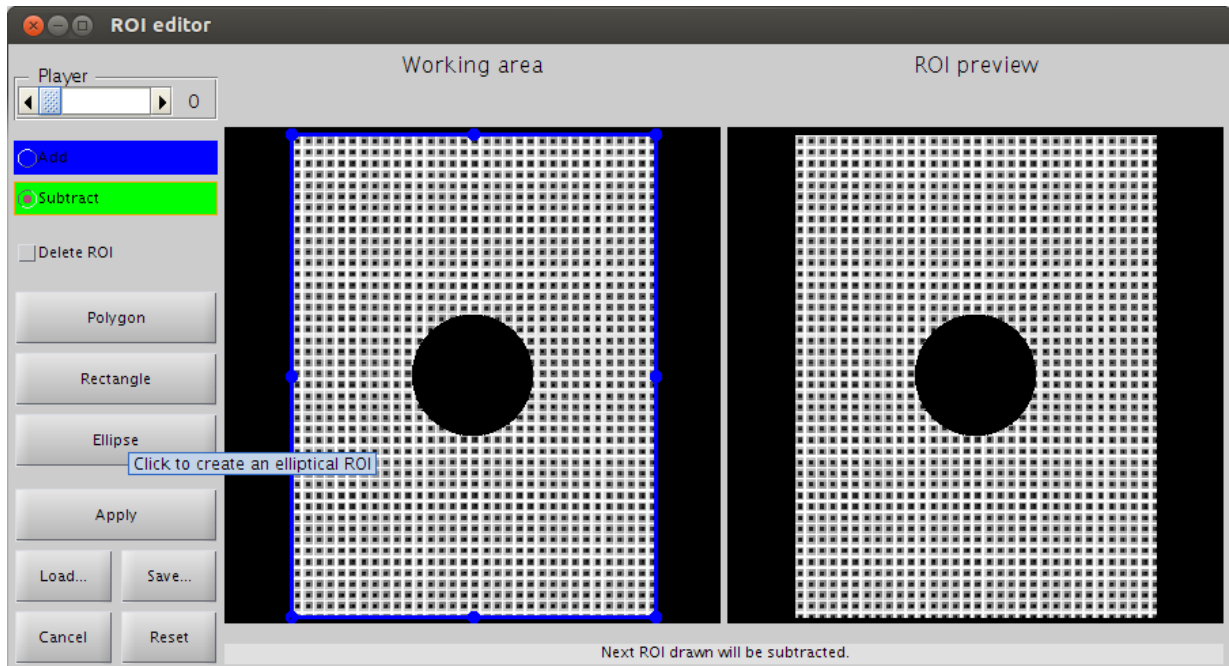


Figure 67. Click **ELLIPSE** button to create an ellipsoidal shape.

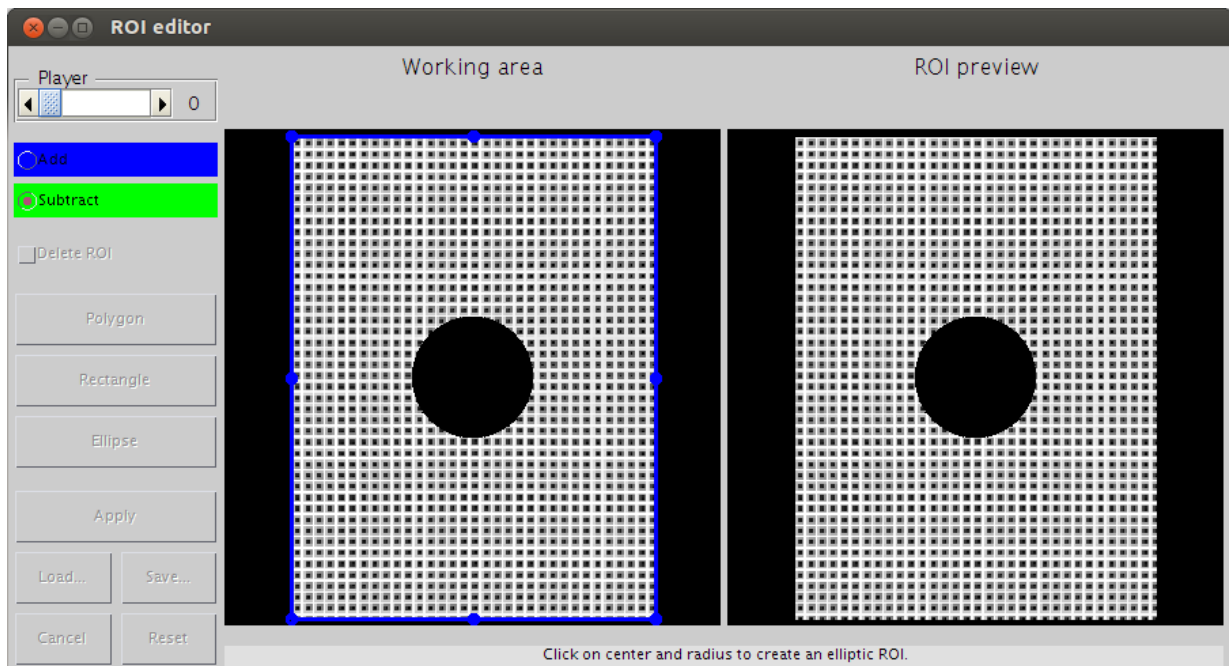


Figure 68. Click on the "working area" viewport to select the centre of the ellipse.

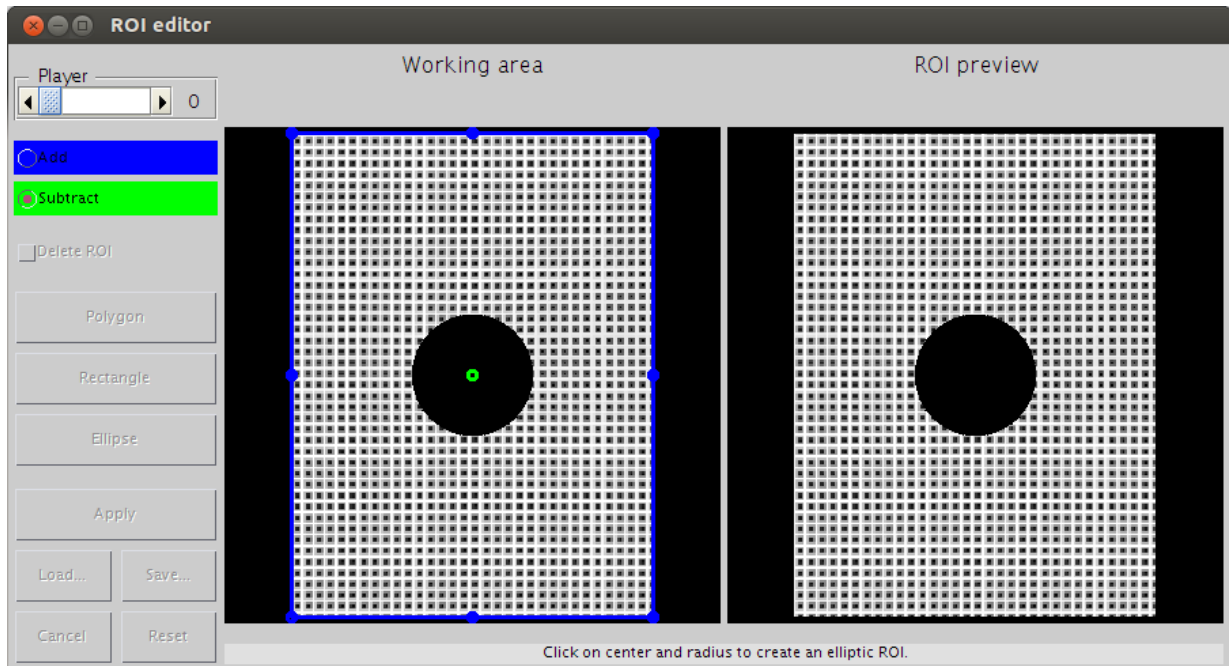


Figure 69. Click on the "working area" viewport to select the radius of the ellipse.

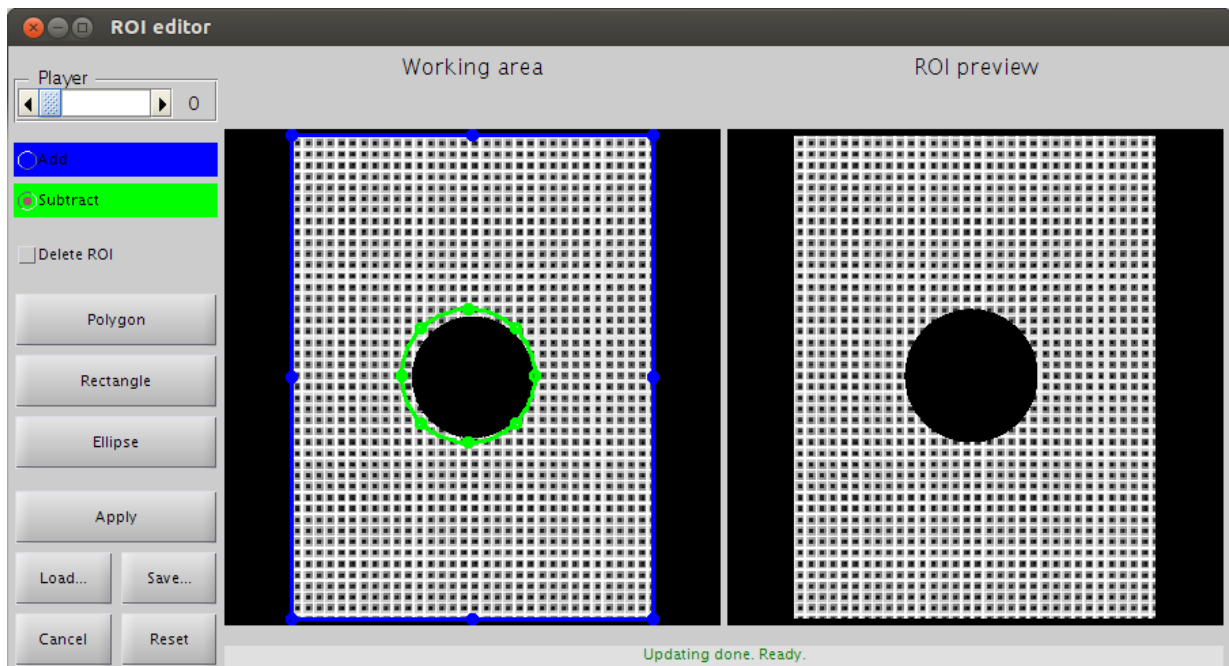


Figure 70. Adjust position and size of both shapes for best fit.

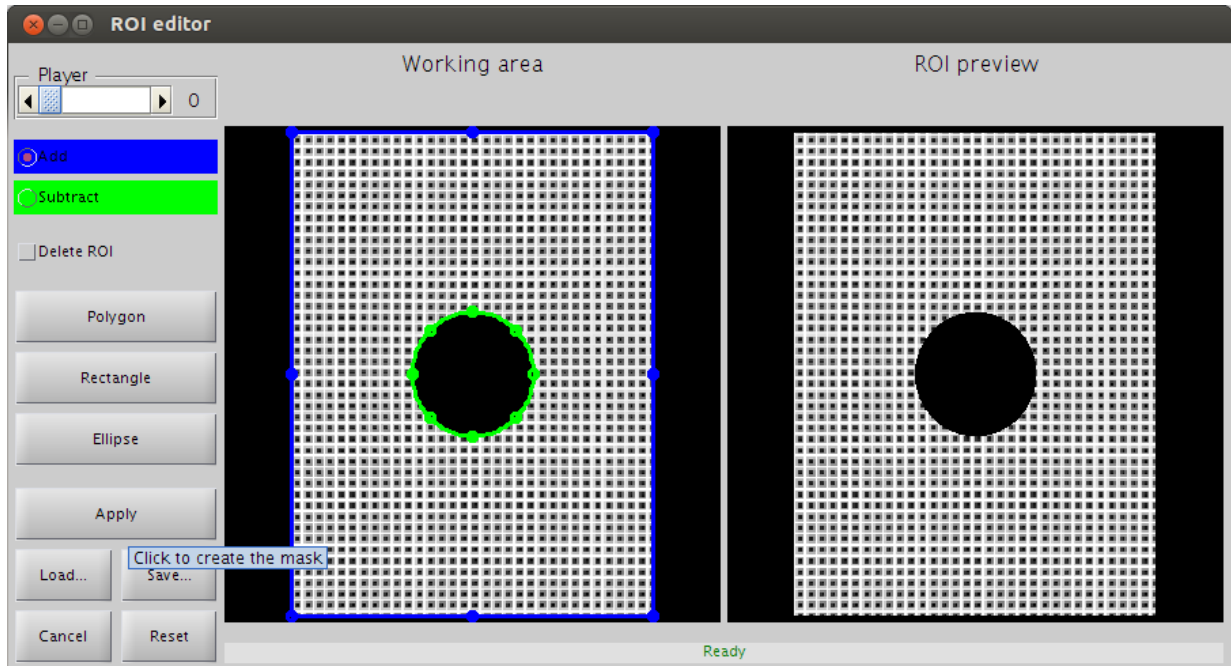


Figure 71. Click **APPLY** button to create the mask

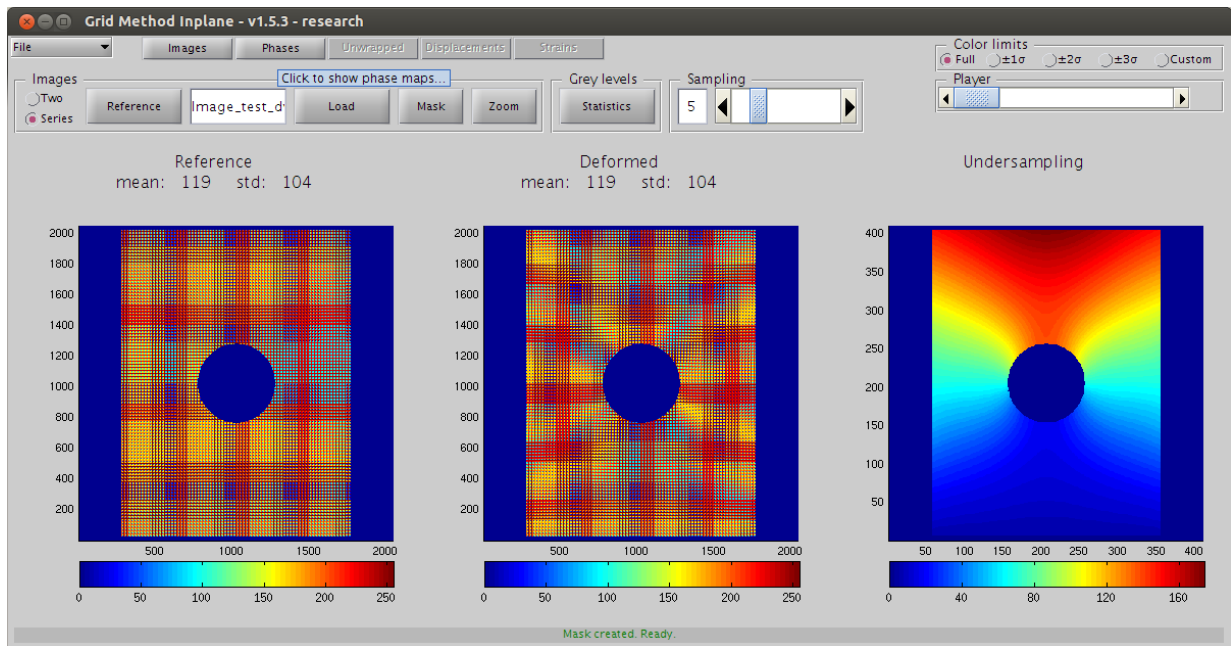


Figure 72. Click **PHASES** button to show the second panel.

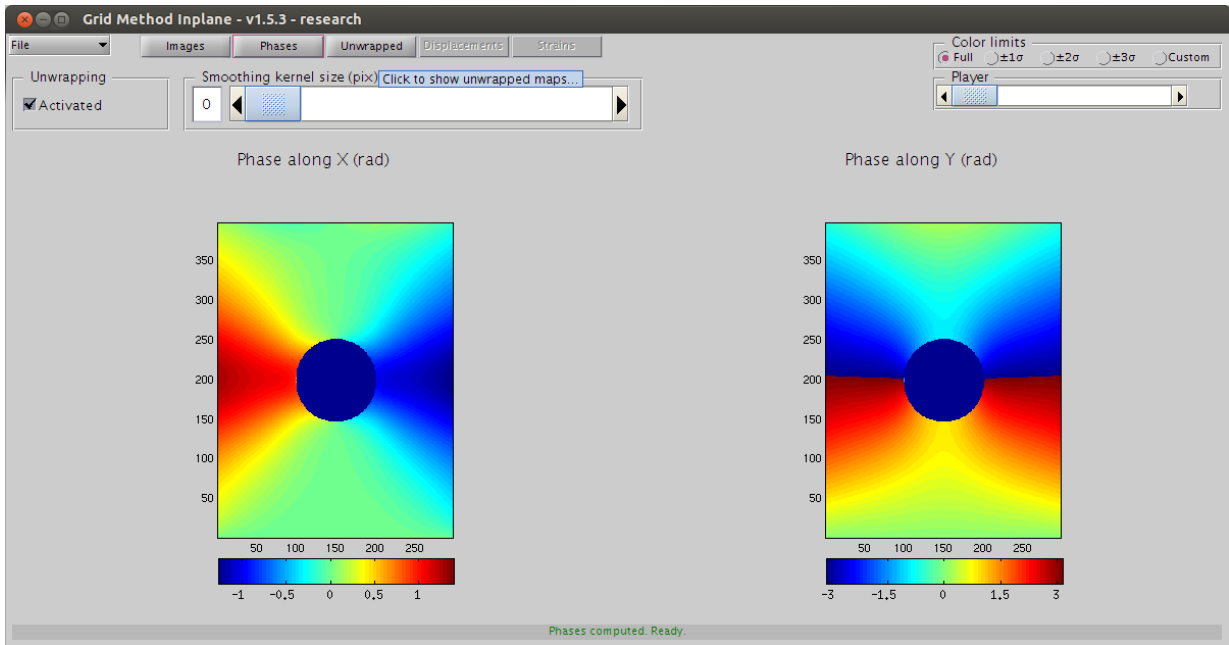


Figure 73. Click **UNWRAPPED** button to show the third panel.

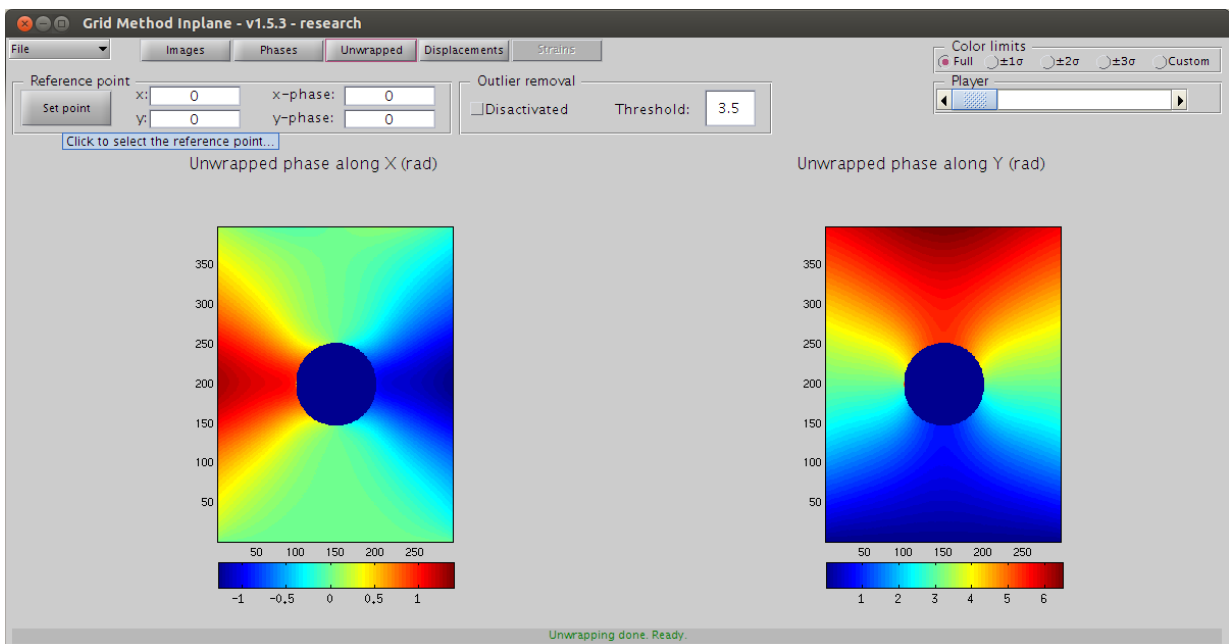


Figure 74. Click **SET POINT** button to select bottom middle point as a phase reference.

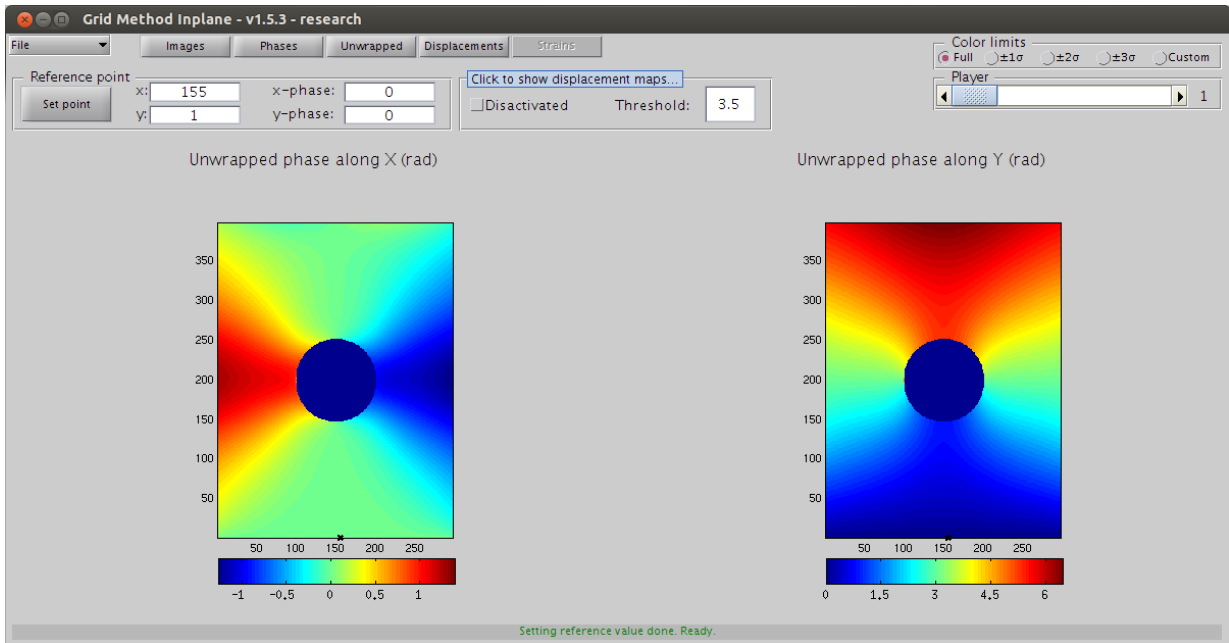


Figure 75. Click **DISPLACEMENTS** button to show the fourth panel.

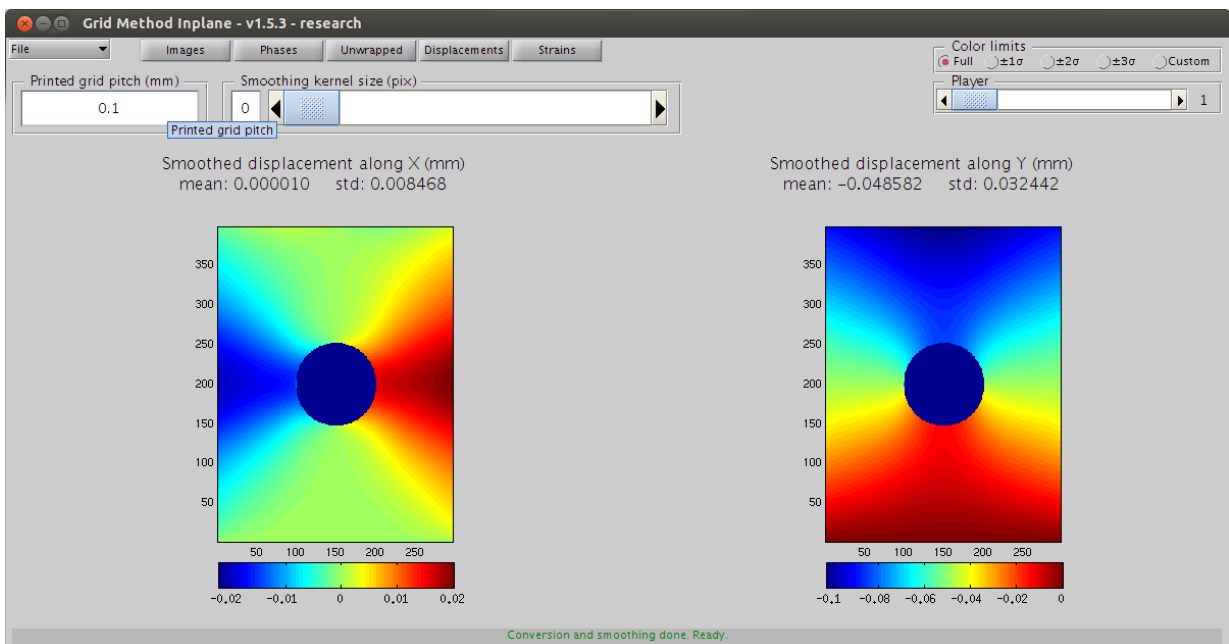


Figure 76. Adjust the **PRINTED GRID PITCH**.

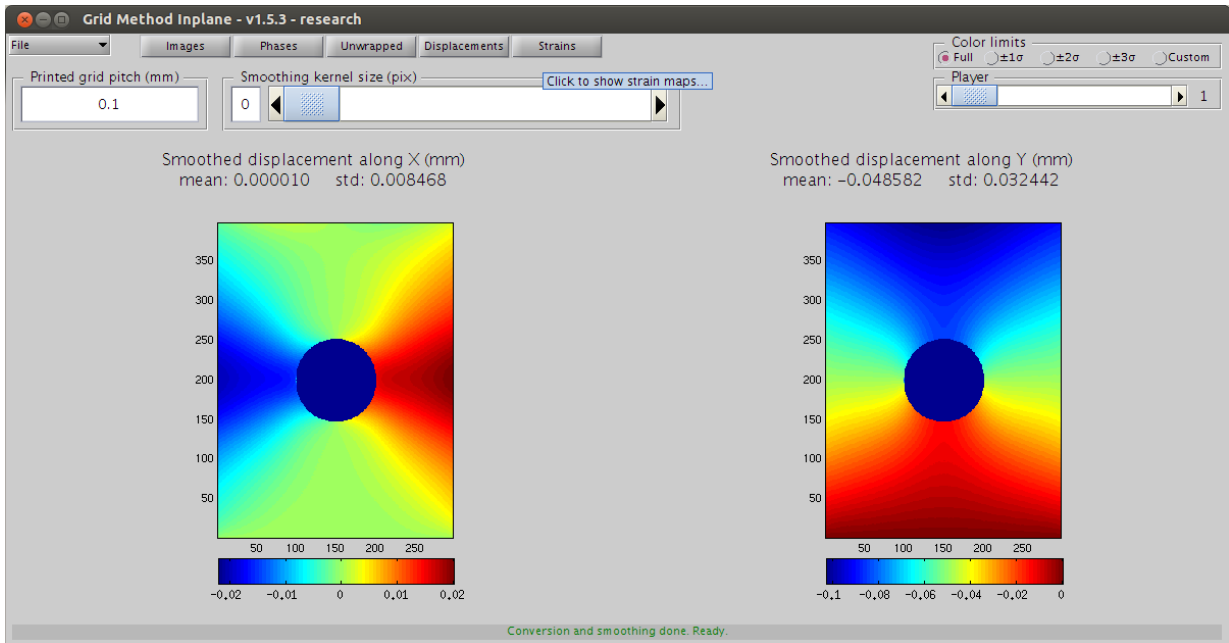


Figure 77. Click **STRAINS** button to show the last panel.

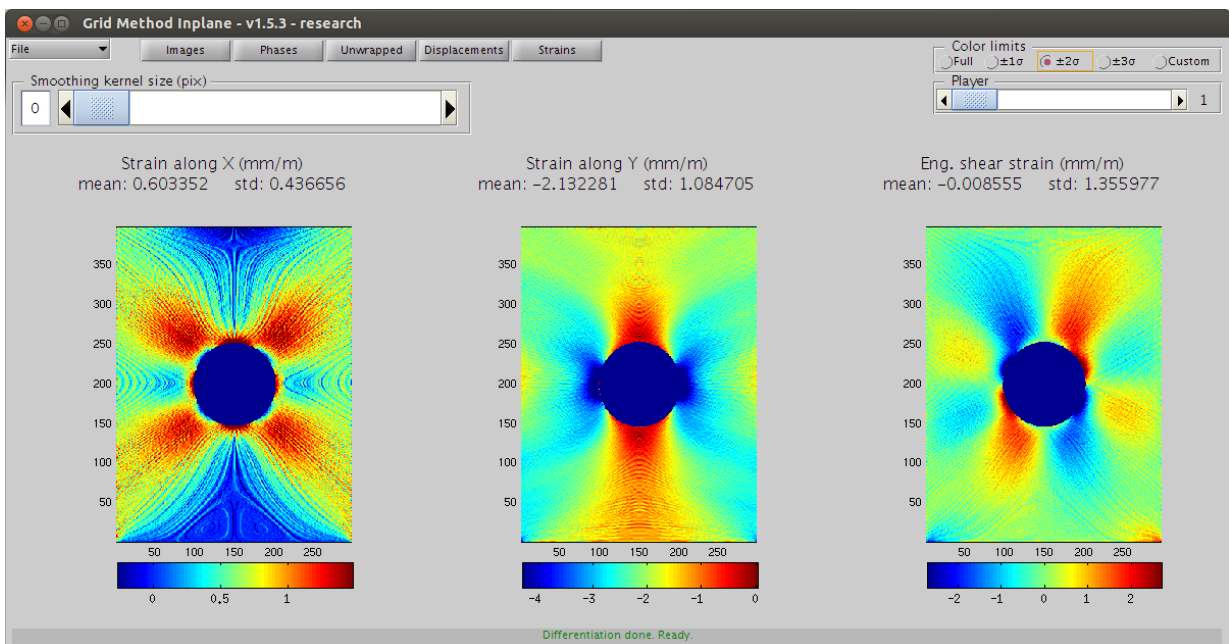


Figure 78. Click 2σ radiobutton to adjust the colour limits.

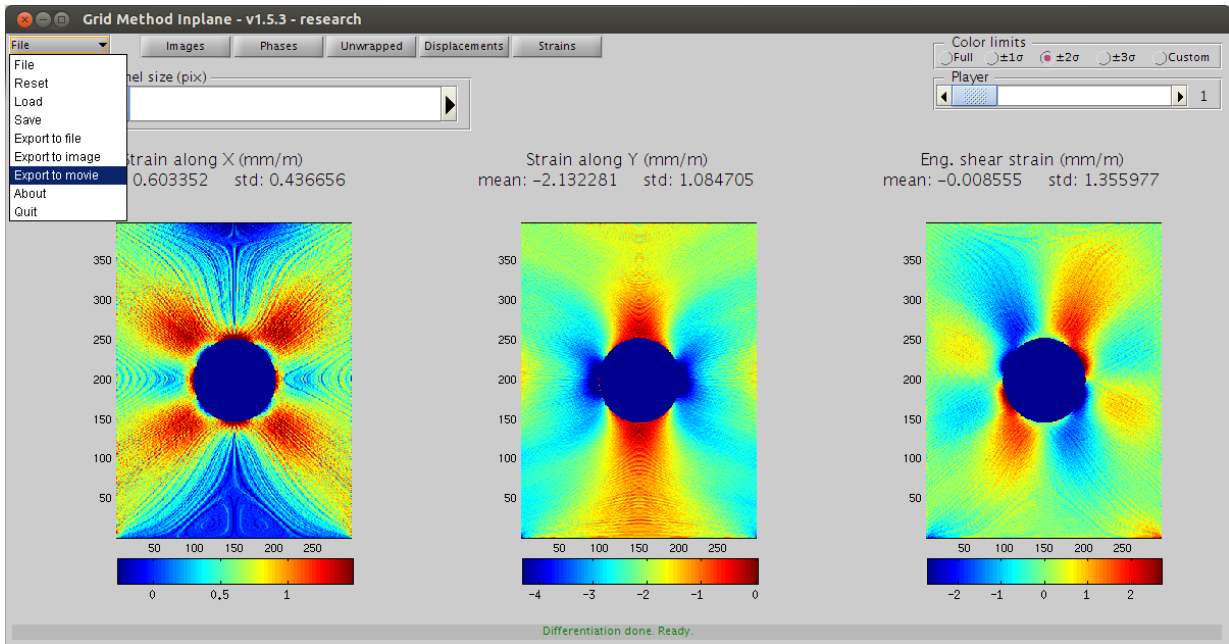


Figure 79. Click **FILE**→**EXPORT TO MOVIE** menu.

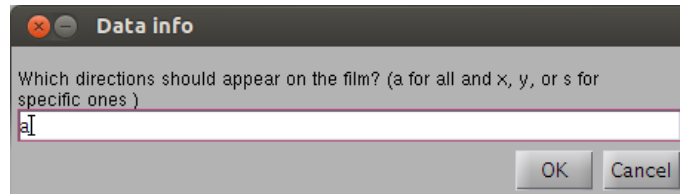


Figure 80. Adjust the **PRINTED GRID PITCH**.

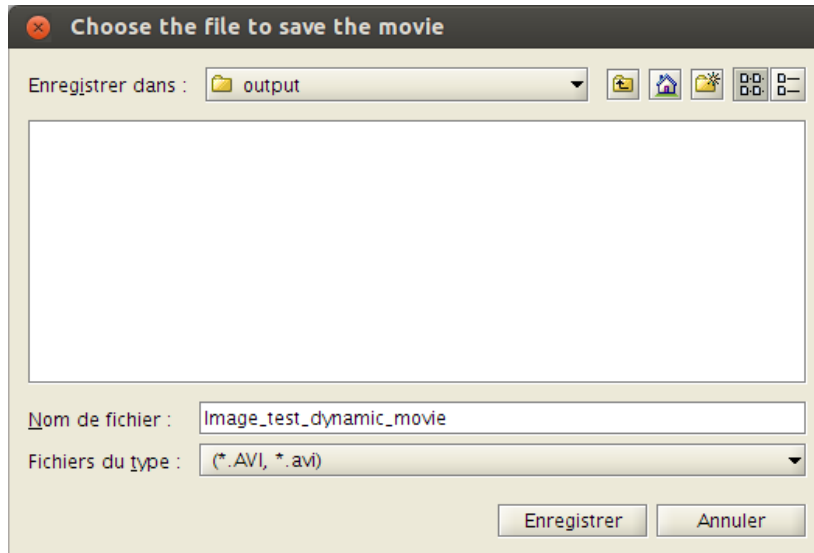


Figure 81. Enter a filename to save the movie.

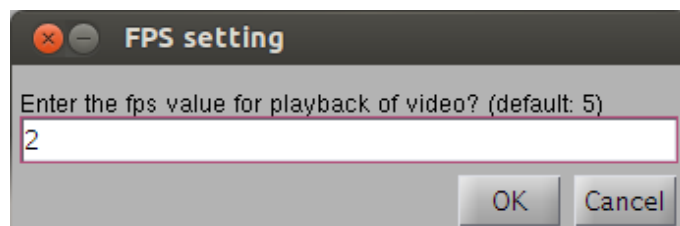


Figure 82. Adjust the **PRINTED GRID PITCH**.