

Ncorr_post – open-source Digital Image
Correlation (DIC) post-processing tool

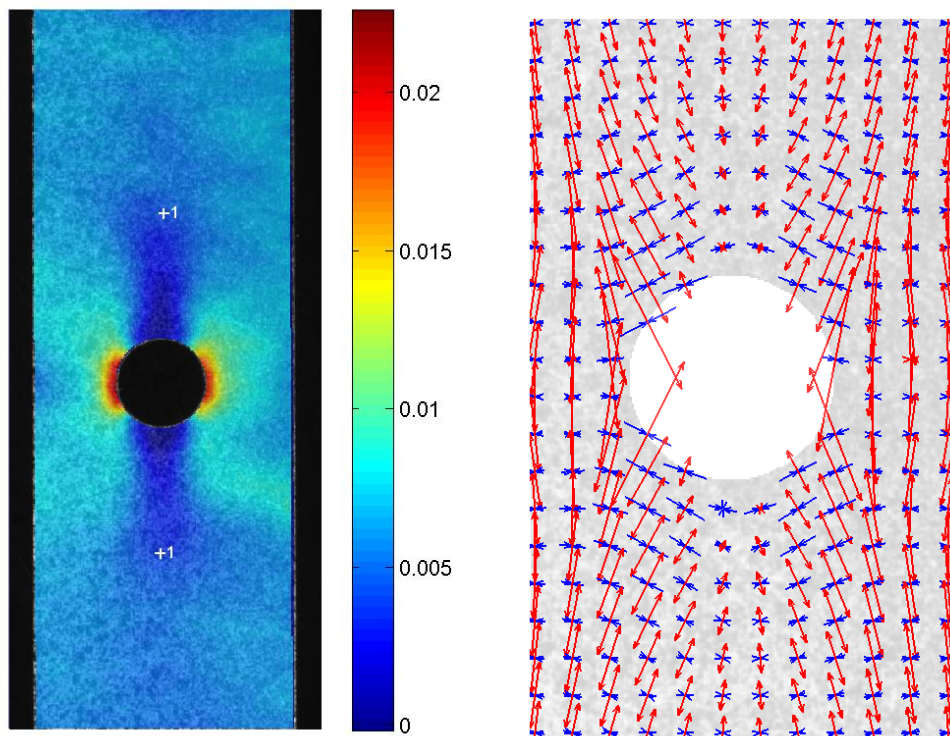
Instruction Manual

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Introduction

Ncorr_post is a post-processing application tailored for processing, visualization and export of the data provided by [Ncorr DIC tool](#), which has been developed by Justin Blaber and Antonia Antoniou at the Georgia Institute of Technology. **The effort and guidance of the authors providing Ncorr DIC tool in the form of user-friendly open source software is gratefully acknowledged.** Both, Ncorr and Ncorr_post were developed and run in the [MATLAB environment](#). For an optimal performance it is recommended to use MATLAB R2011a or higher.

The DIC process and formatting of displacements and strains is thoroughly described in the [Ncorr Instruction Manual](#). Only the post-processing of the Ncorr data is dealt with in the following text, using the Plate Hole example provided by the Ncorr authors.

1. Program Structure

The program initiates after running the Ncorr_post.m file, located in the root program folder (Figure 1). Exported data from virtual extensometers or figures can be found in the “export”, while folders “files” and “functions” store the program auxiliary scripts and functions, and do not need to be accessed by the user. The “savedProjects” folder contains the entire saved projects and the “scaleImages” folder contains the images with a scale (e.g. photo of the tested body with a measuring tape attached to it) to obtain true displacements for the post-processing.

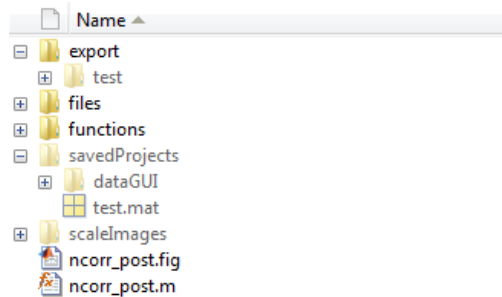


Figure 1: Structure of the program folders and files.

2. Data Acquisition

When initiating the program, data from DIC analysis can be loaded in two ways: 1. using “Load a project” button and choosing the previously saved project, or 2. using the “Load data from Ncorr” button (Figure 2). In the latter case the Ncorr must be called using the “handles_ncorr = ncorr” command (as advised in the [Ncorr Instruction Manual](#)) and after the DIC analysis is finished the MATLAB workspace must contain the handles_ncorr structure (Figure 3). Therefore, it is advised not to close Ncorr before opening Ncorr_post and loading the Ncorr data.

Prior to loading the Ncorr data, Ncorr_post asks for the project name (Figure 4). The project name is consequently used for saving of the work, and exporting plots and figures. After loading the Ncorr data, the program provides only limited capabilities (Figure 5) until the displacements are scaled using the “Scale displacements” button.

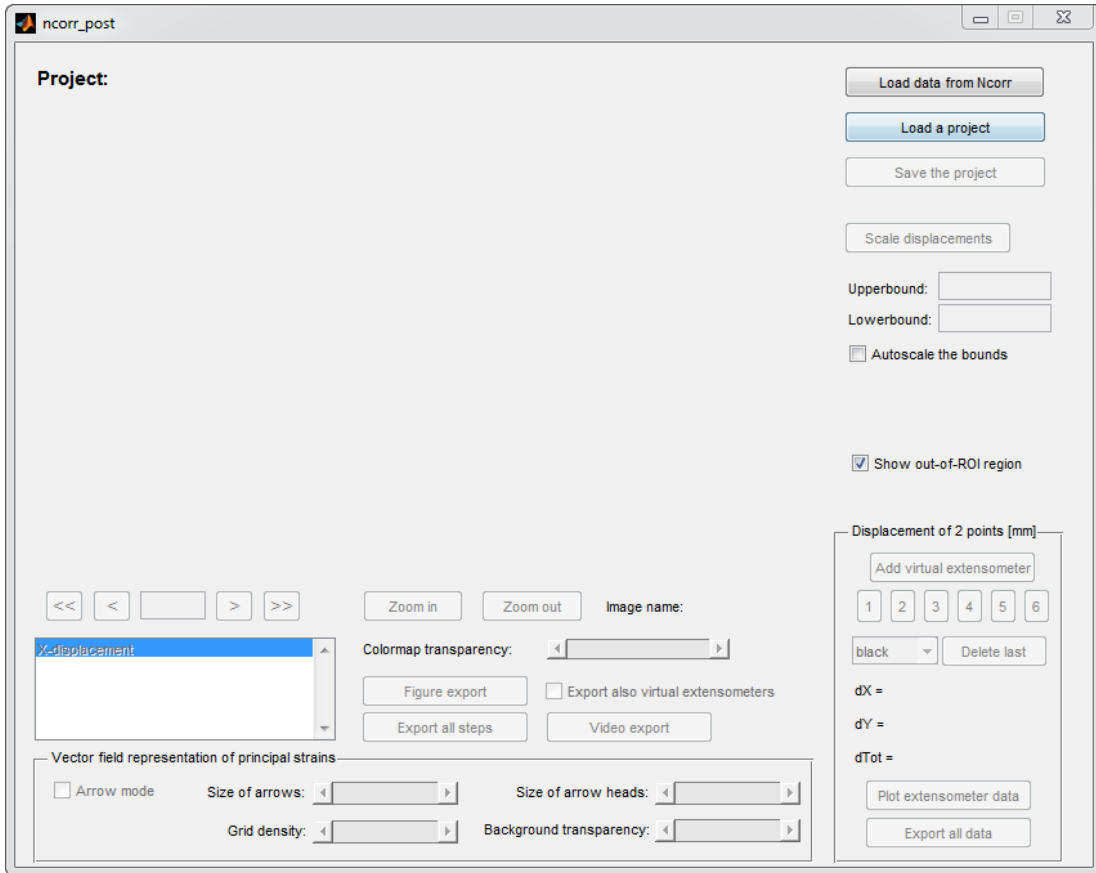


Figure 2: Initial GUI after opening Ncorr_post.

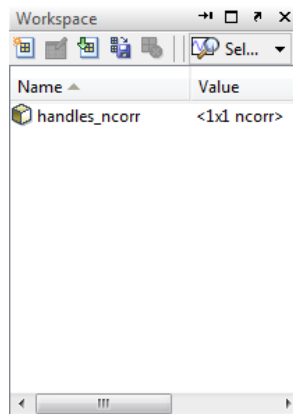


Figure 3: MATLAB workspace containing handles_ncorr structure.

3. Displacements Scaling

When selecting this option, a user is asked to choose an image with a scale (Figure 4), e.g. measuring tape attached to the specimen, of the same size as the reference image used for DIC analysis in Ncorr, located in the "scaleImages" folder (Figure 1). The user is asked to choose two points on the scale with a defined distance (Figure 5) which are chosen by the right mouse button clicking while the image magnification can be accomplished by the left mouse button (Figure 6). When the picking of the two points is completed, a user is asked for the distance between the points (Figure 7).

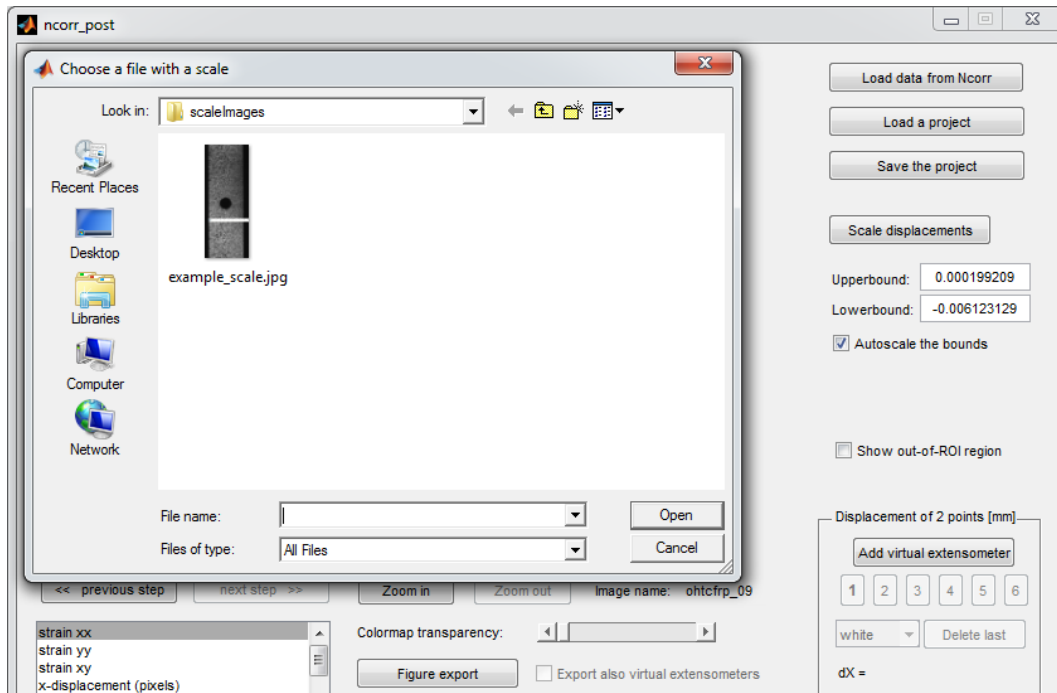


Figure 4: Choosing an image with the scale.

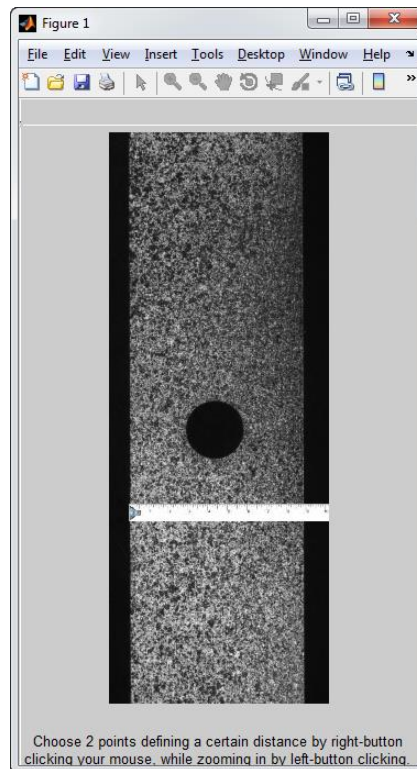


Figure 5: Choosing 2 points with a defined distance on the scaling image.

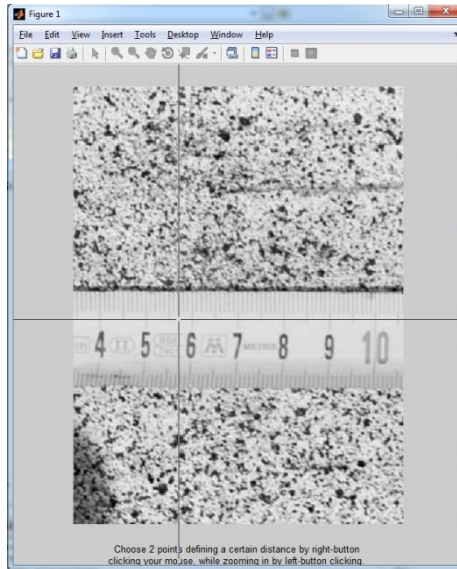


Figure 6: Image magnification for more accurate image scaling.

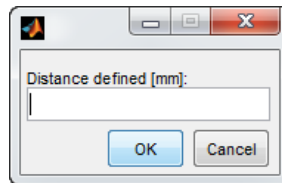


Figure 7: Input dialog to define the physical specimen size.

After the displacements are scaled, the virtual extensometer can be attached to the specimen and plotting of true displacements becomes available.

4. Adjustment of Graphics and Plotting Options

The individual panels controlling plotting, graphics adjustment, exporting of figures and virtual extensometers are described in Figure 8. The individual images (deformation stages) can be accessed using the buttons and input-box located in the panel 1, while the text-box located in panel 3 provides the current image name.

Panel 2 contains zooming options – when selecting the “Zoom in” option, a figure window pops up so that the user can choose a rectangle of interest by dragging the mouse when holding the left mouse button (Figure 9).

The plotted quantity can be chosen from the list-box (panel 4) and colormap transparency (controlling the background visibility) adjusted using the slider located in panel 5. The background located out of the region of interest (ROI), determined during the DIC analysis in Ncorr, can be switched on and off using the check-box in the panel 9.

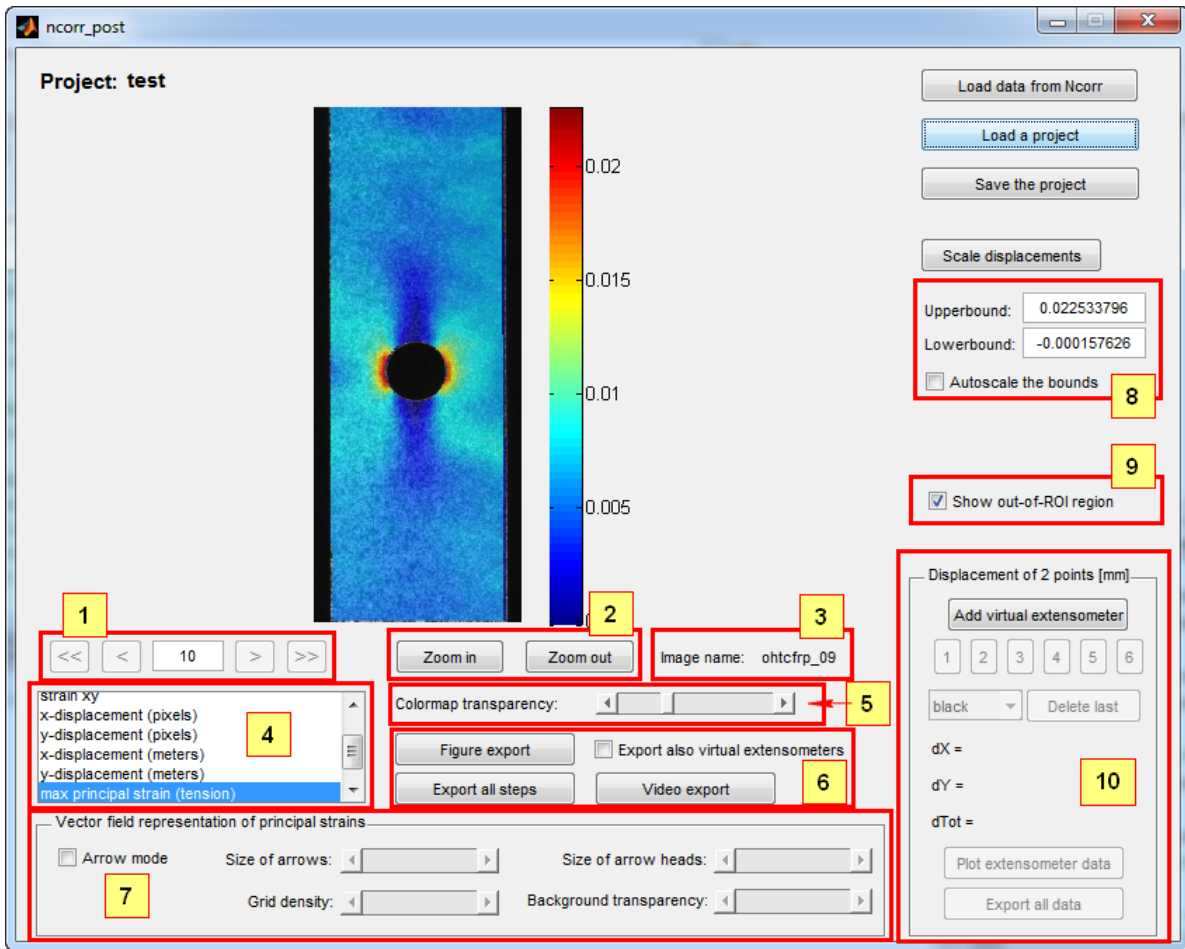


Figure 8: Control panels to adjust the plotting, set the virtual extensometers and export the figures.

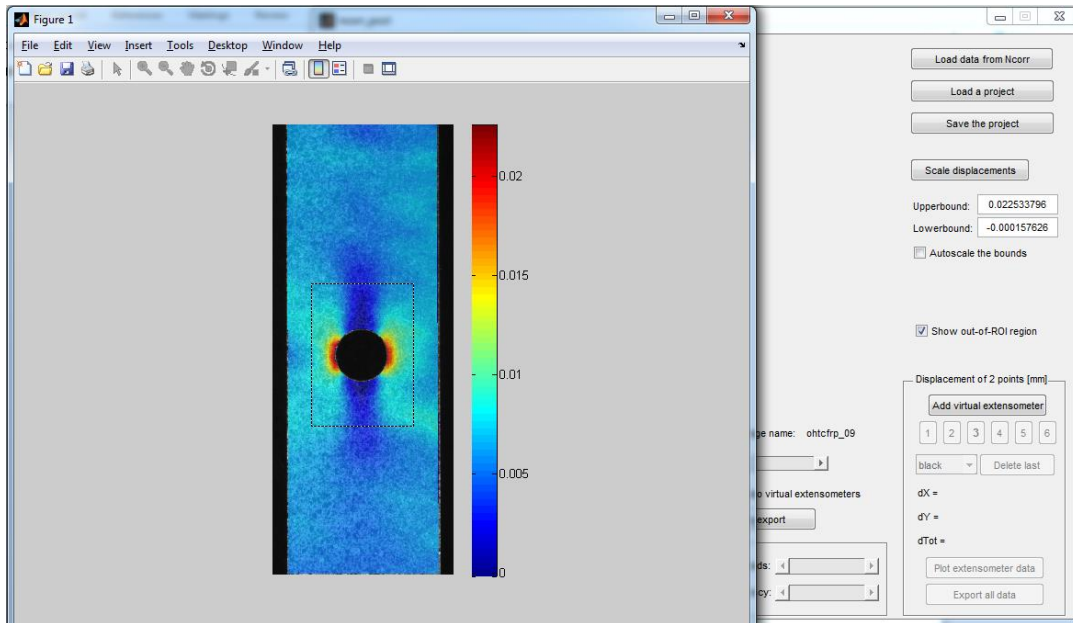


Figure 9: Selection of the region to zoom in.

5. Colormap Scaling

The “Autoscale the bounds” option in panel 8 (Figure 8) scales the displayed colormap and rescales also the zoomed region if the autoscale option is checked.

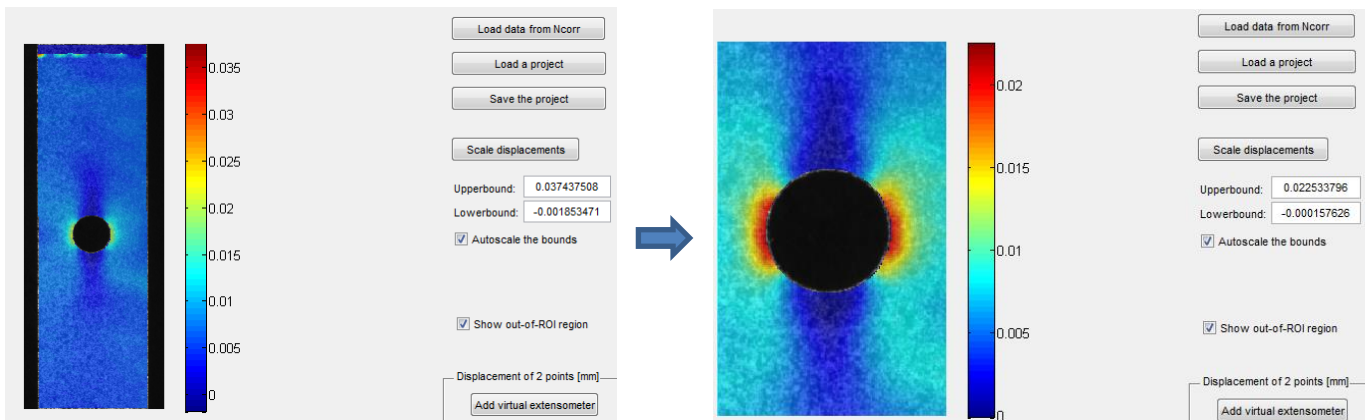


Figure 10: Colormap autoscaling to the current section after zooming in.

However, the bounds can be adjusted also manually when the “Autoscale the bounds” is unchecked.

6. Magnitude and Direction of Principal Strains

The magnitude and direction of the principal strains can be displayed using the “Arrow mode” check-box located in panel 7 (see Figure 8). Using the sliders located in panel 7, the size of arrows, grid density, size of arrow heads, and background transparency can be adjusted (Figure 11).

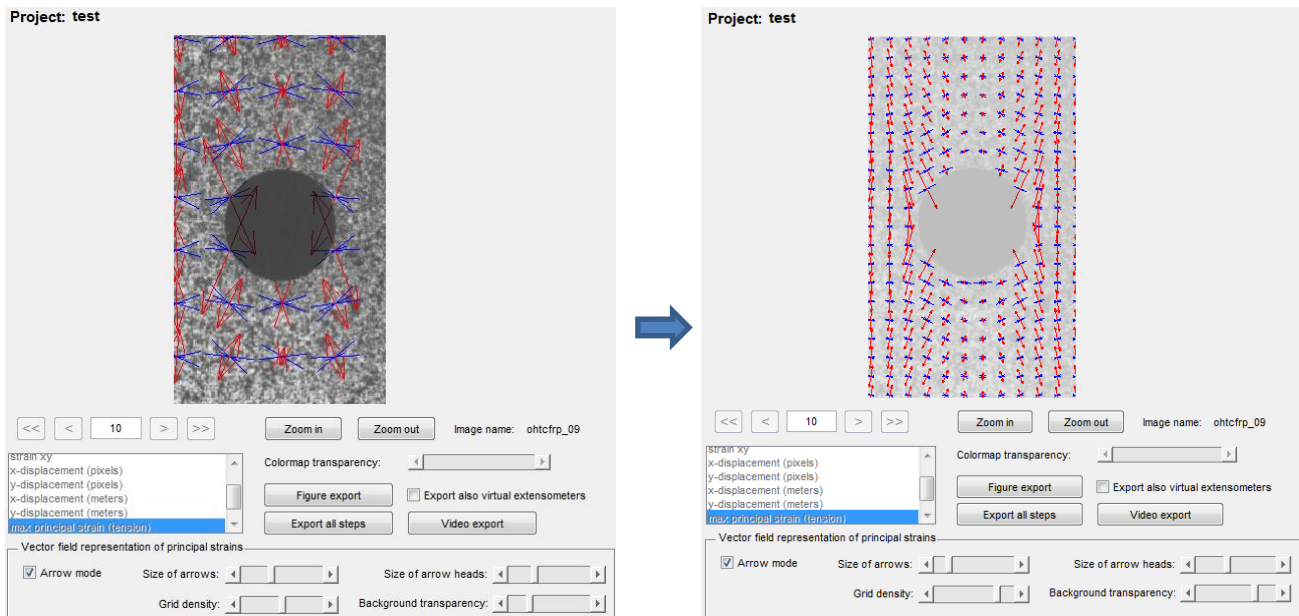


Figure 11: Adjustment of vector field plotting.

7. Virtual Extensometers

After the displacements scaling, up to 6 virtual extensometers can be attached to a specimen using the “Add virtual extensometer” button, located in panel 10 (Figure 8). After the placement of virtual extensometers, following the same procedure as the point-picking when scaling the displacements (section 3 of this manual), marks indicating their location appear in the plot (Figure 12).

When more extensometers are placed, the user can switch between them using the “1” to “6” buttons, located in panel 10, and see the relative displacement (dX, dY and dTot) of the two points with respect to the reference (non-deformed) state.

The individual extensometers can be deleted using the “Delete last” button, and the color of marks can be changed using the pop-up menu in order to reach the desired visibility.

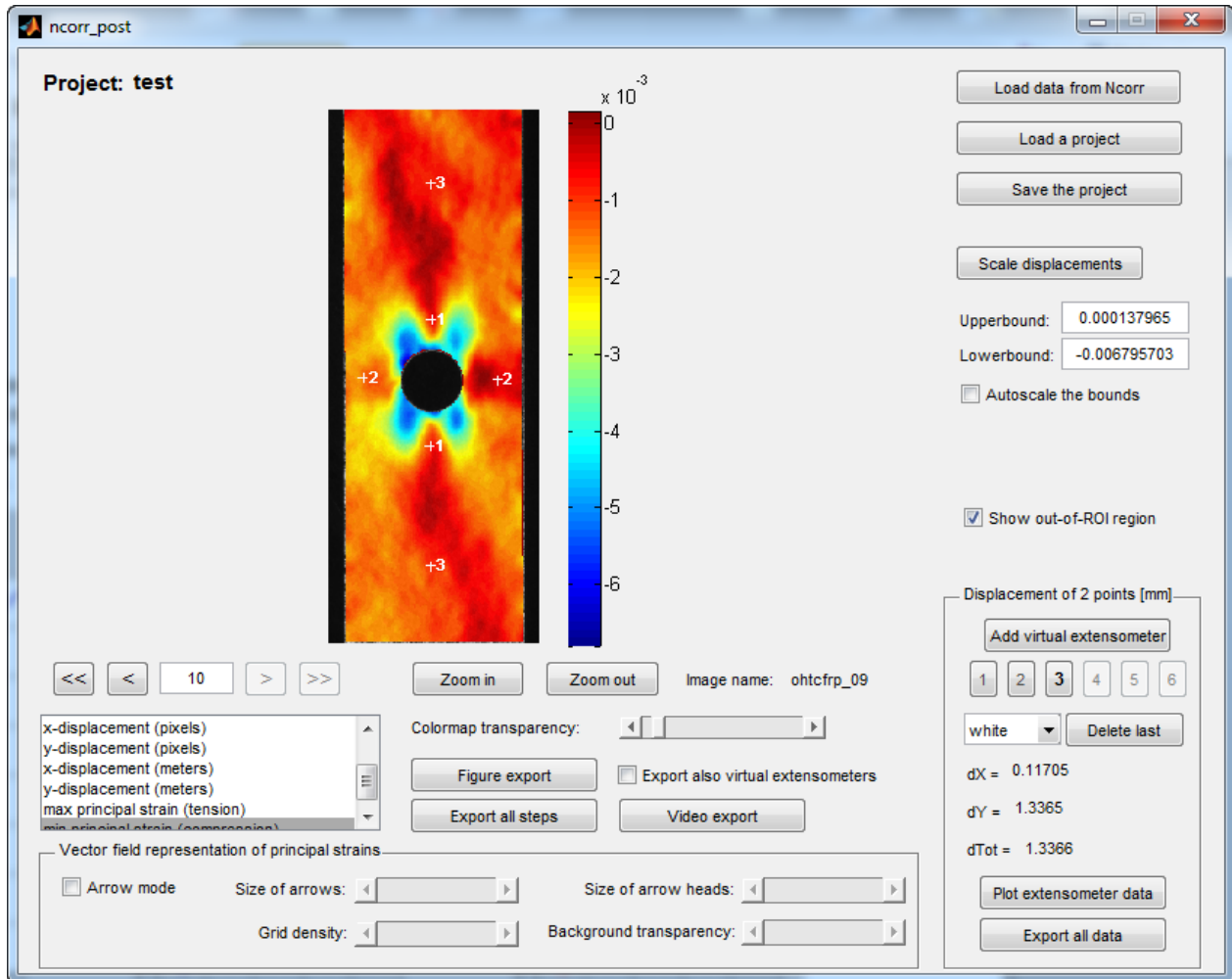


Figure 14: Placement of virtual extensometers.

The plot of displacement development for the selected extensometer (indicated by the bold face of the button “1” up to “6”) can be exported using the “Export the data” button into a “/export/project name/virtualExtensometer_#” folder in ascii (text) format. The data can be also plotted using the “Plot extensometer data” button to obtain loading stage-displacement diagrams as illustrated in Figure 13.

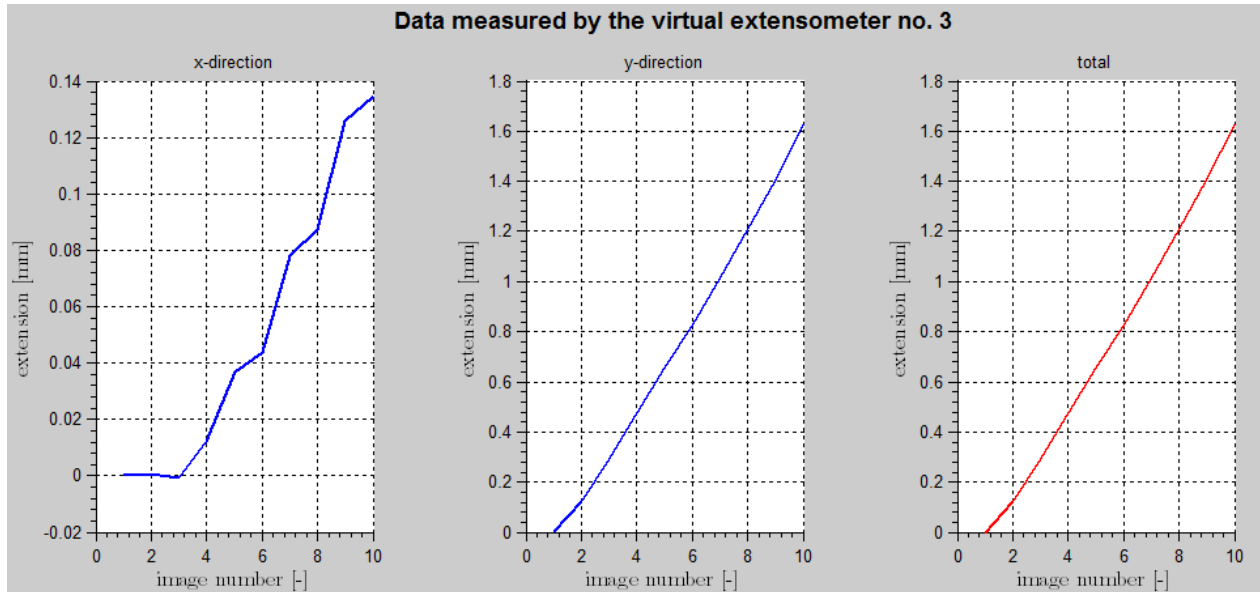


Figure 13: Development of displacement obtained using virtual extensometers.

8. Export of Figures

The actual plot can be exported using the “Figure export” button located in panel 6 (see Figure 8) into the “/export/project name/plotted quantity_zooming option/” folder under the file name in the following form: “project name-image name for the Ncorr analysis-plotted quantity-zooming option.png” (e. g. \export\test\strain-xx_zoom\test-image_09-strain-xx-zoom.png).

The “Export all steps” button enables a bulk export of all steps and the development of deformation or displacement field illustrated by the colormap can be captured if the “Autoscale the bounds” option is unchecked.

The “Export also virtual extensometer” option in panel 6 enables to include also the virtual extensometer location marks in the exported figures.

9. Video Export

The video export can be accomplished by “Video export” button, located in panel 6 (see Figure 8), by creating a series of images representing individual steps (the same as “Export all steps” button) and merges these into a single video file (extension *.avi). Consequently, a MATLAB built-in player shows the exported video, located in the “/export/project name/video_plotted quantity_zooming option/” folder under the file name in the following format: “project name- plotted quantity-zooming option.png”. An example of such file can be seen in Figure 14.

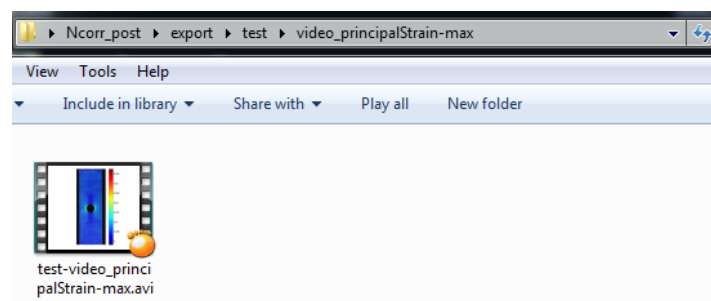


Figure 14: Location of the generated and exported video (in Windows Explorer window).

10. Project Saving and Loading

The project can be saved for the future work using the “Save the project” button (Figure 8) and restored using the “Load a project” button to the state at the time of saving, including the GUI options.

Acknowledgement

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