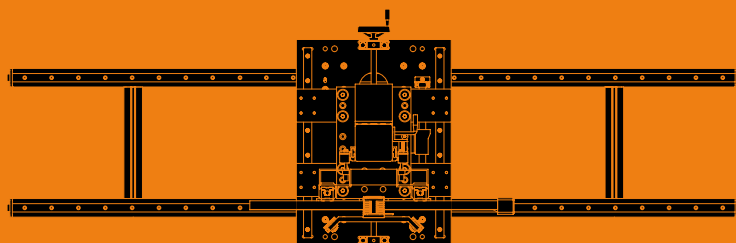
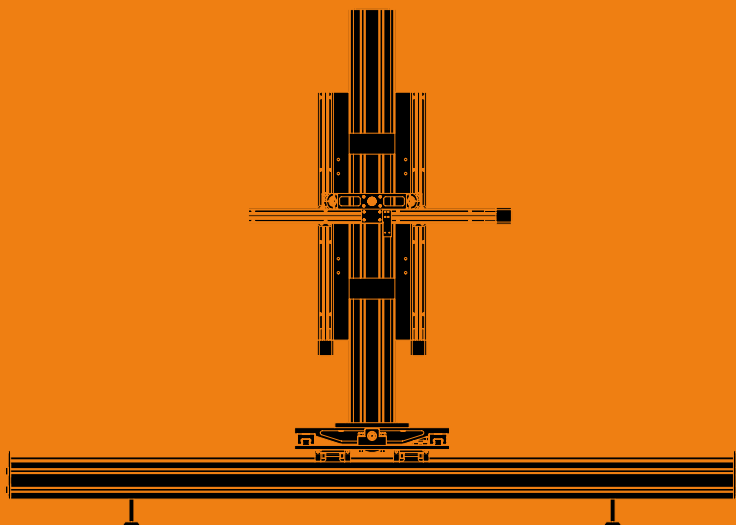
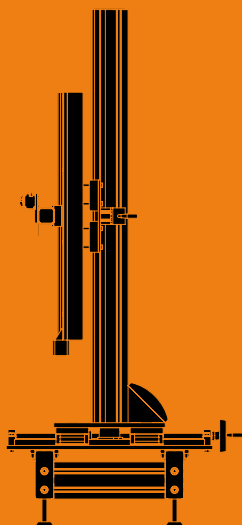


# Lucida 3D Scanner

Factum Foundation



Training guide II: Operator's manual



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# 4

## The Scanning Application

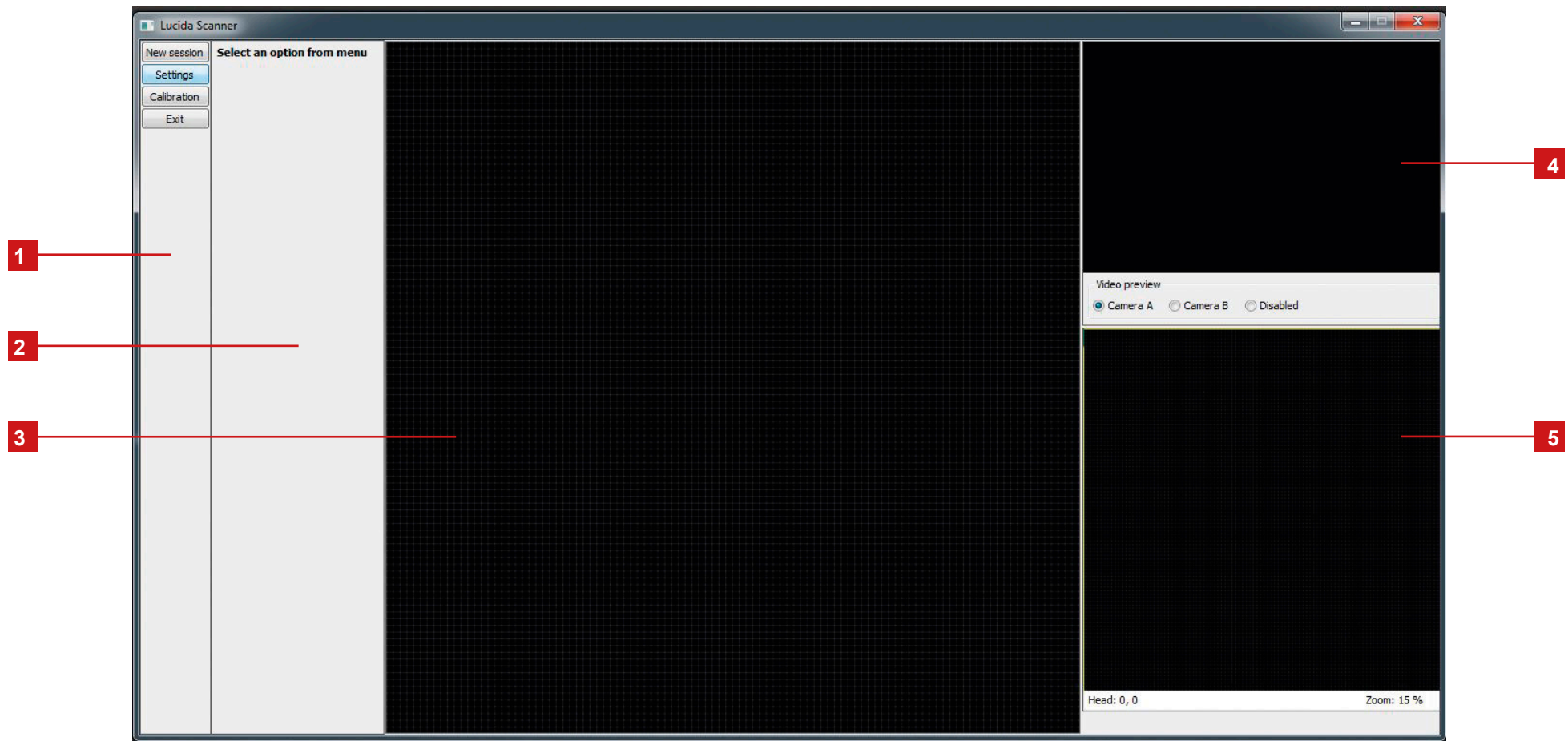
<<<

Francesco del Cossa, *San Vincenzo (Polittico Griffoni)*,  
1472-1473, tempera on poplar, 153 x 60 cm (detail).  
3D scanned in 2013 in The National Gallery, London.

## The user interface

### Home menu

The graphic user interface of the Scanning Application has been designed to guide the operator step by step throughout the process.



New session: create a new scanning session and movement control.  
Settings: adjust settings, movement control and live video streaming.  
Calibration: wizard-assisted calibration process.

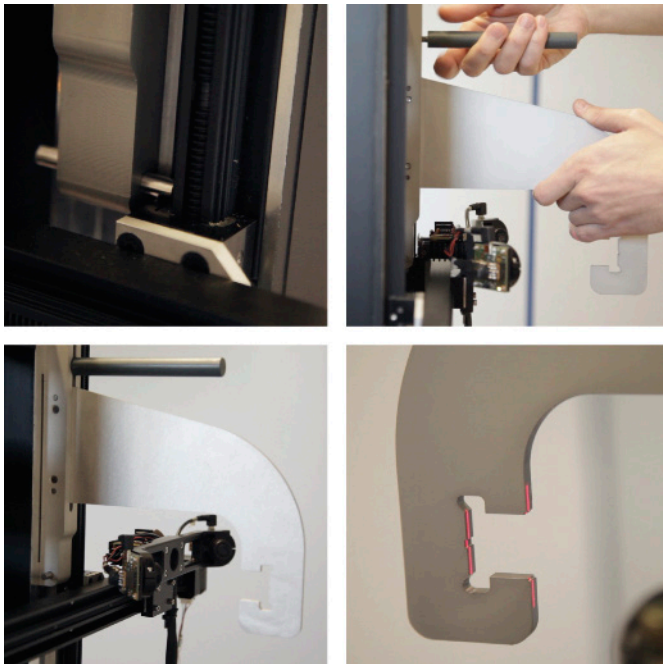
- 1 Menu I: buttons console, first level options (see opposite page)
- 2 Menu II: buttons console, second level options.
- 3 Main window: it shows the 3D data as shaded as it is processed.
- 4 Streaming window: it shows the frames captured by each camera.
- 5 Navigation window: it shows the progress the scanning session.

Recommended screen resolution: 1920 x 1080 px.

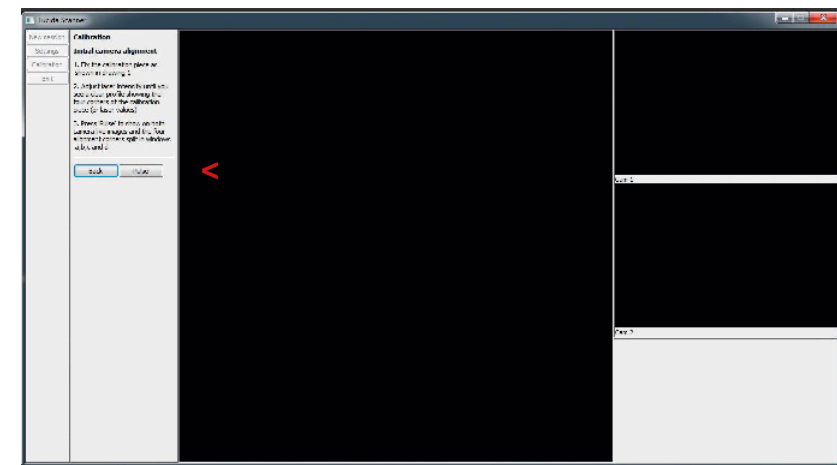


## How to attach the calibration tool

01. Align the calibration tool parallel to one of the vertical guides and make sure that both flat sides are fully in contact.
02. Insert the threaded handle and gently tighten the calibration tool to the backing frame through the slot.
03. Move the scanner head upwards (-Y) until the carriage touches the positioning rod of the calibration tool. (See Settings, page 00).
04. IMPORTANT: Once the calibration tool is fixed do not move the scanner head upwards (-Y) as one of the carriages is now locked!
05. Move the scanner head horizontally (-X or +X) until the laser beam hits the centre of the edge of the calibration profile.
06. Adjust the laser intensity until you see a thin, defined line. Keep the tool fixed. Now you are ready to initiate the calibration process.
07. Once the calibration process is done simply release the threaded rod and carefully remove the calibration tool from the backing frame.



## Calibration



01. Open the Calibration menu and follow the on screen instructions.
02. Press 'Pulse' to trigger one shot from each of the two cameras.



03. Check on Cam 1 and Cam 2 that the calibration profile can be seen completely and the line is clearly defined.
04. If necessary, press 'Back' and open the Settings menu to adjust the Laser intensity to a middle level (4-6).
05. Press 'Back' and open the Calibration menu again. Press 'Pulse'.

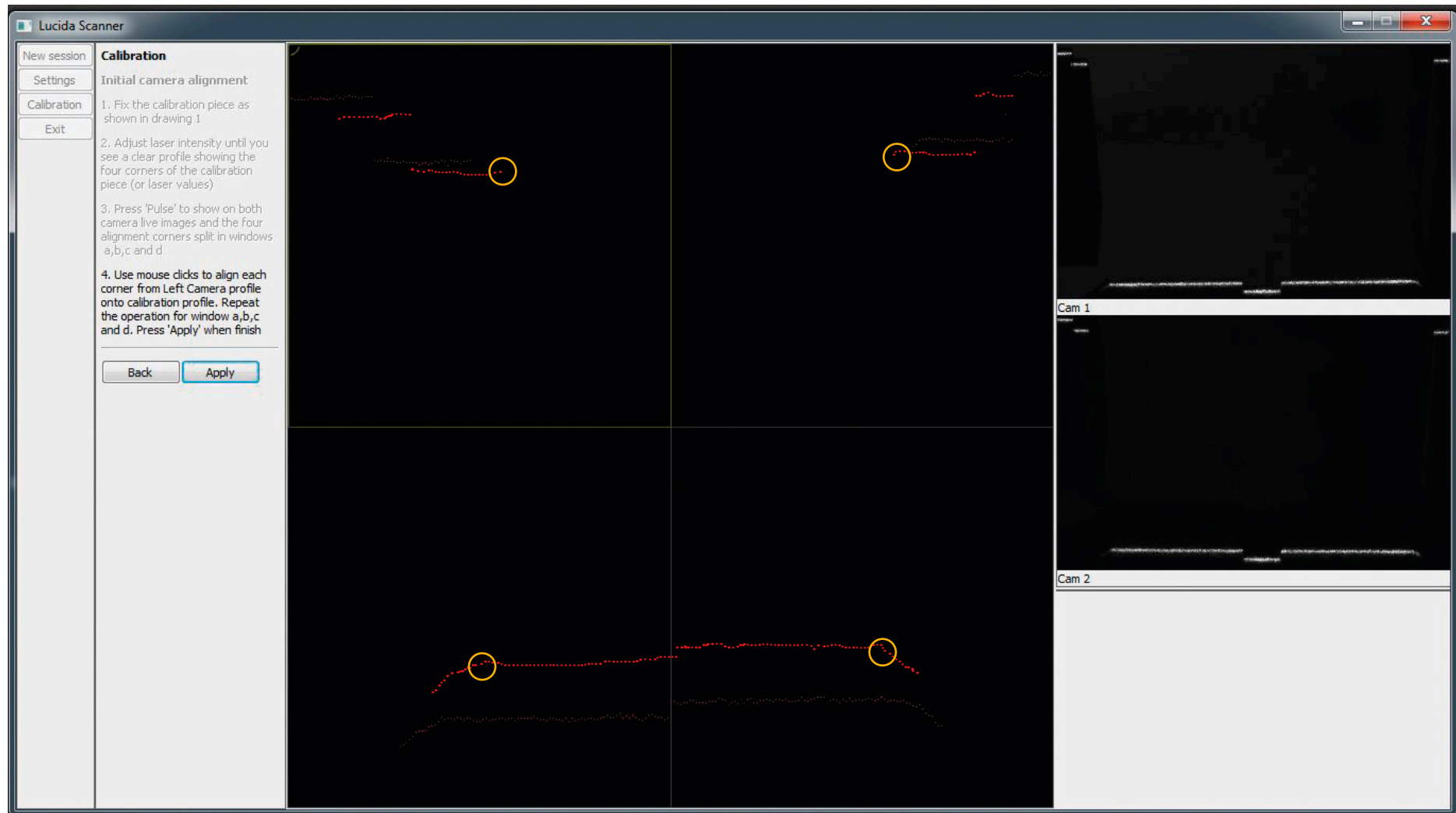
## Calibration

06. The four sections in the main window show the four corners of the calibration profile. Red dots represent the view from Camera 1.

07. Mark on the screen the 4 corners for the profile and press 'Apply'

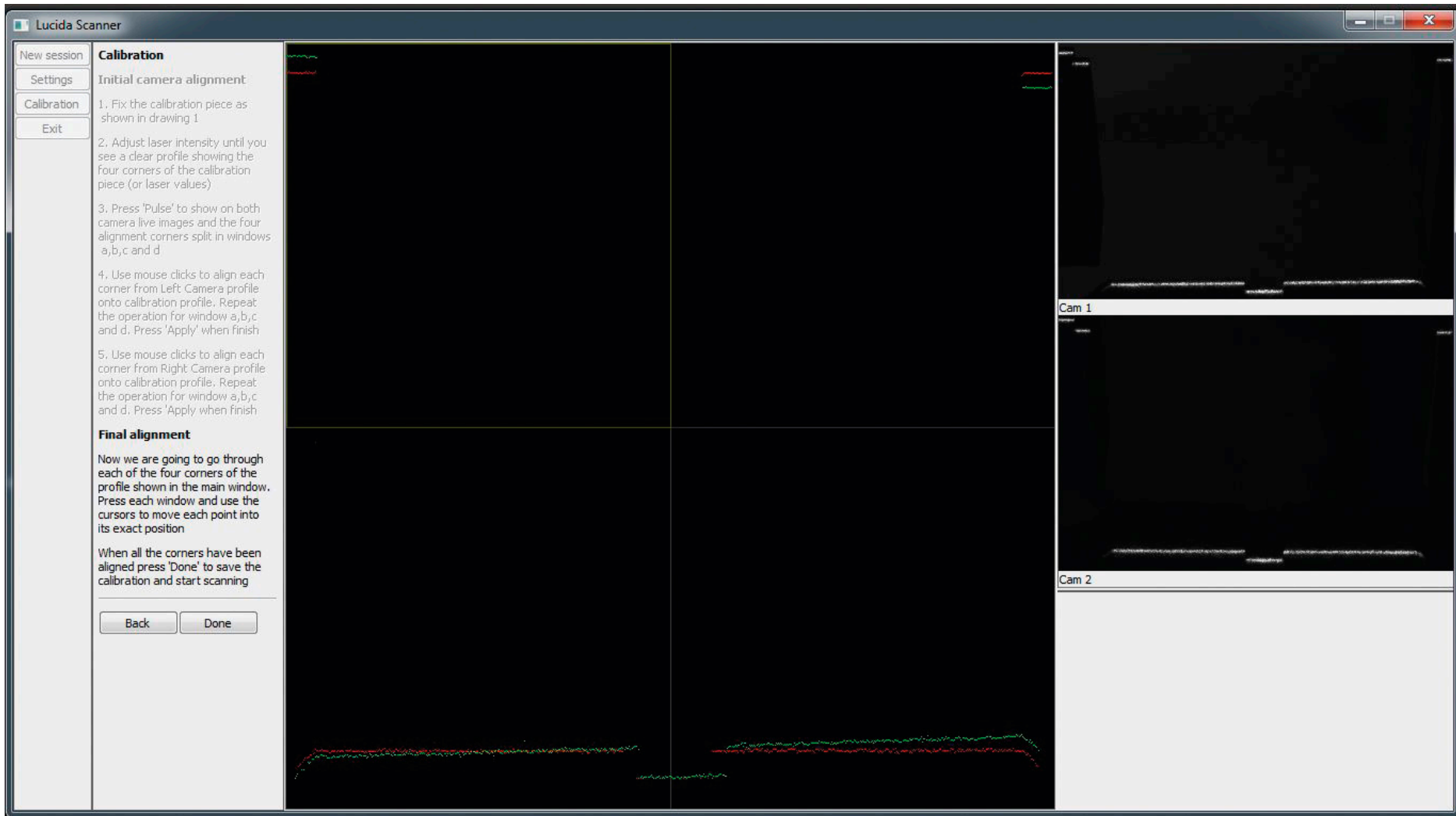
08. Now repeat the operation. Green dots represent the view of the calibration profile as seen from Camera 2.

09. Mark on the screen the 4 corners for the profile and press 'Apply'



## Calibration

10. The final alignment consists of manually overlapping and aligning the homography (dots) of Cam 2 (green dots) as closely as possible over the homography from Cam 1 (red dots) on each of the 4 corners

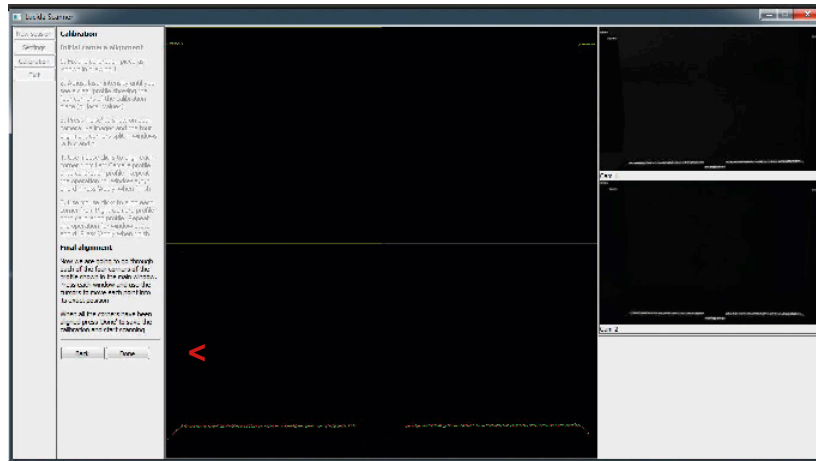


11. Click on one of the 4 boxes of the main window and use the arrow keys to place the green dots precisely on top of the red dots.

12. Repeat this operation for each corner as many times as needed.

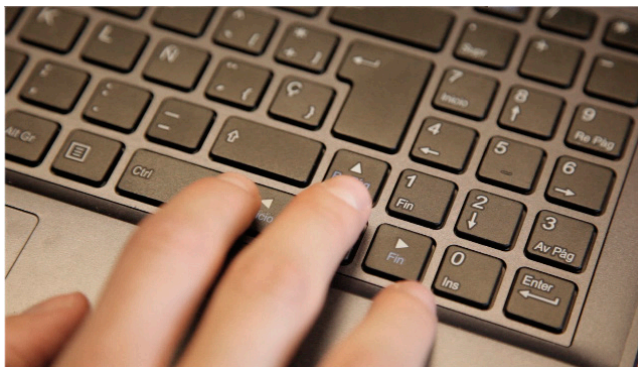


## Calibration



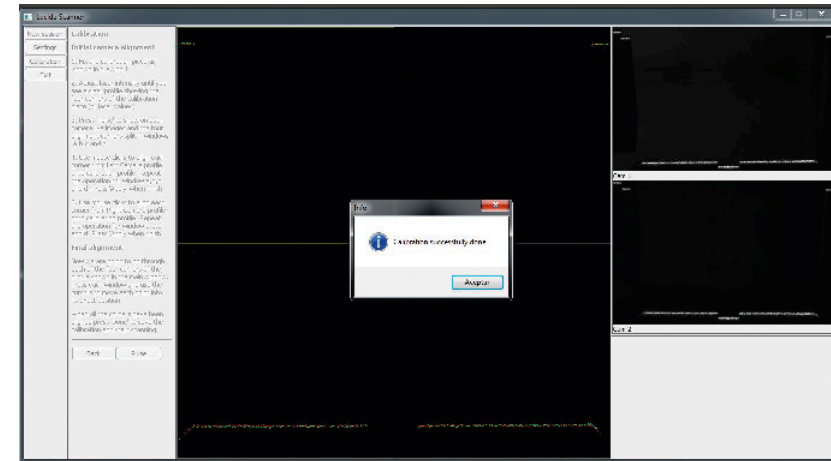
13. The final alignment step should be done carefully and the two homographies must be as precisely overlapped as possible.

14. Take your time to adjust each corner and then press 'Done'.



If you want to watch videos about the Calibration process please visit: [www.factum-arte.com](http://www.factum-arte.com)

## Calibration



15. 'Calibration successfully done' will appear on screen.

16. Press 'Accept'. The new calibration matrix has been saved.

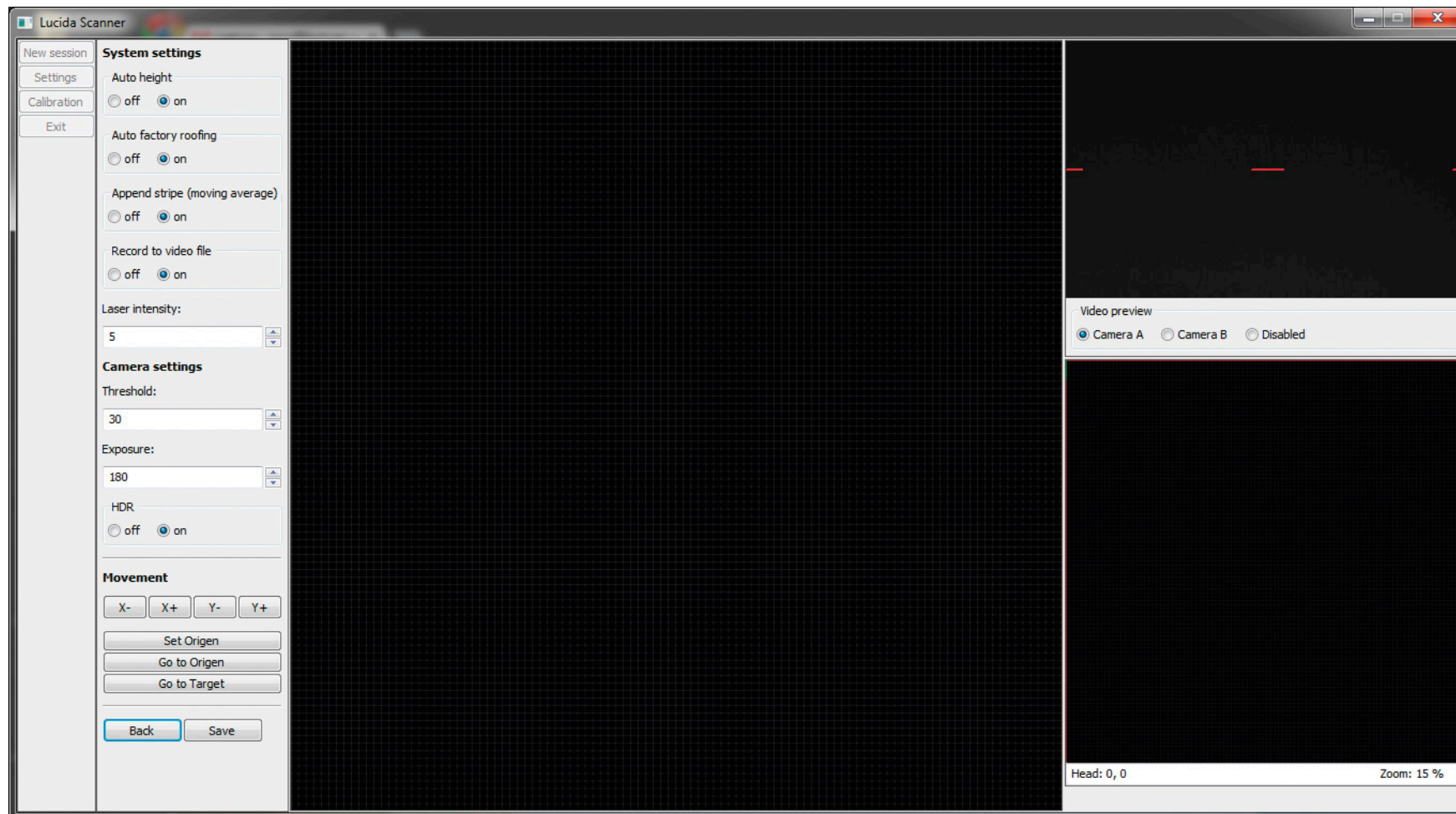
17. The scanning application will go back to the Home menu.

18. The calibration matrix is saved as an XML file in the folder Data.

```
librationFile>
omography_a>
<h1>0.365121</h1>
<h2>-0.0398668</h2>
<h3>-8.71091</h3>
<h4>0.00298134</h4>
<h5>0.481645</h5>
<h6>-8.08913</h6>
<h7>4.56469e-007</h7>
<h8>-0.000282602</h8>
<h9>1</h9>
Homography_a>
omography_b>
<h1>0.368153</h1>
<h2>-0.0386434</h2>
<h3>-8.05935</h3>
<h4>0.00261111</h4>
<h5>0.484864</h5>
<h6>-9.88766</h6>
<h7>4.82451e-006</h7>
<h8>-0.000283553</h8>
<h9>1</h9>
Homography_b>
librationFile>
```

## Settings

From the Settings menu you can modify certain parameters before starting a New Session. The Settings are set by default as shown in the image below. The Video preview window shows live streaming from each of the two cameras in order to check parameters like the Laser intensity, etc. The red lines help to determine the centre of the depth of field.



**System settings:** to turn Off/On internal processes in the application  
**Camera settings:** to adjust parameters of the video capture.  
**Movement:** to control the displacement of the scanner head.

Press 'Save' or 'Back' to go the Home menu once you have finished.

## System settings

### Auto height

Options: Off / On (default: On).

### Auto factory roofing

Options: Off / On (default: On).

### Append stripe

Options: Off / On (default: On).

### Record to video file

Options: Off / On (default: On).

### Laser intensity

Range: 1 to 10.

### What is the correct Laser intensity level?

The Laser intensity level should be set according to the surface characteristics of the object to scan and its capacity to absorb light. Lower levels of Laser intensity make the laser beam thinner (Fig. 1), which can result in loss of data. Higher levels make the laser beam thicker and brighter (Fig. 2) but increase the amount of so called speckle-noise, which can reduce the quality of the scan. Therefore, the correct Laser intensity level for a particular object is the minimum possible to record all data without loss.

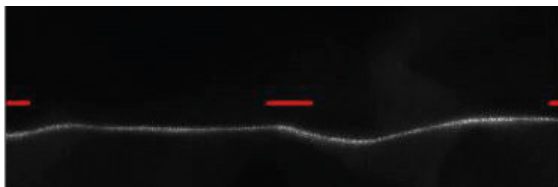


Fig.1

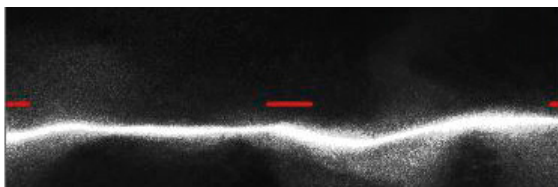


Fig.2

## Camera settings

### Threshold

Sets the segmentation from the grey scale image.

Range: 1 to 000 (default: 030).

### Exposure

Sets the quantity of light reaching the camera sensor.

Range: 1 to 000 (default: 180).

### HDR

Captures two frames at different exposure levels and combines them to produce an image representative of a broader tonal range.

Options: Off / On (default: On).

## Movement

### X- / X+ / Y- / Y+

Moves the scanner head in the four directions of the scanning plane

### Set origin

Sets the current position of the scanner as the new 0,0 position

### Go to origin

Moves the scanner head to the current 0,0 position

### Go to target

Moves the scanner head to an X,Y position marked on the window

The position of the scanner head is shown in the Navigation window.

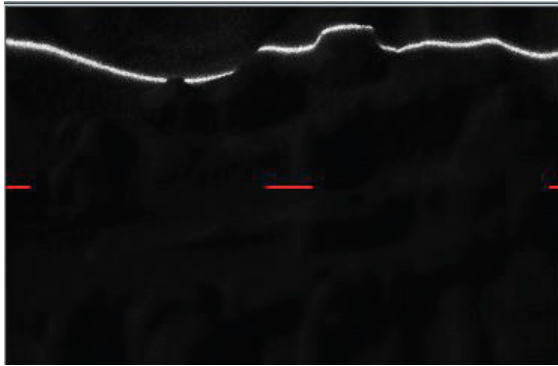
### IMPORTANT:

The Scanning Application remembers the origin (0,0 position) if you start a New Session and even if you Exit the Application. The original position will only be *forgotten* if the Arduino cable is disconnected.

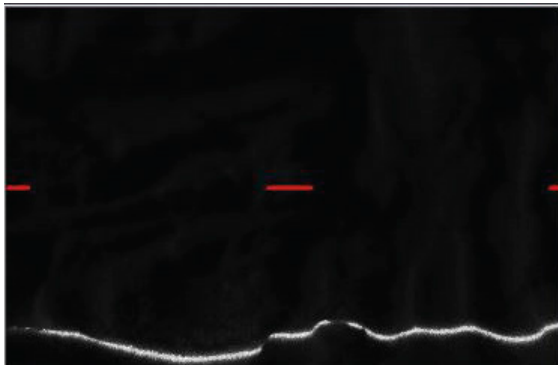
Therefore, do not disconnect the Arduino cable if you intend to do successive recording sessions and keeping the scanner head at the same 0,0 position.

## Planning a New session

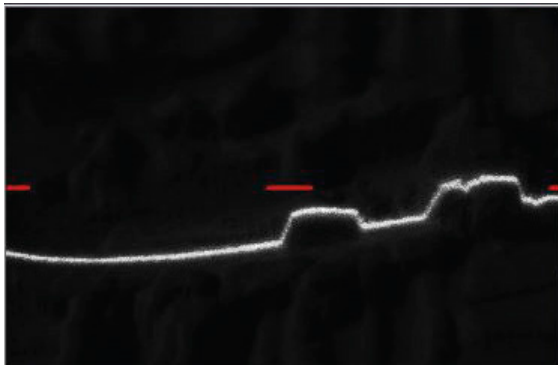
01. Set the scanner at the right distance to the object, so the laser beam is always visible within the Preview window:



Too close...



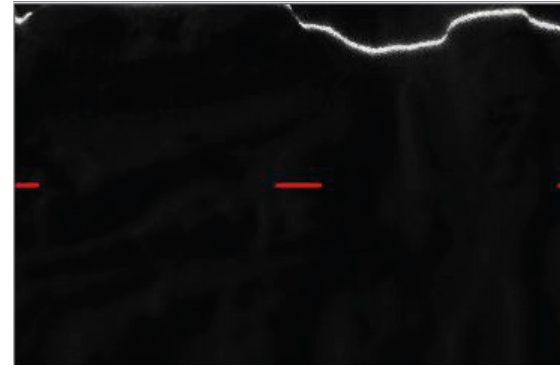
Too far...



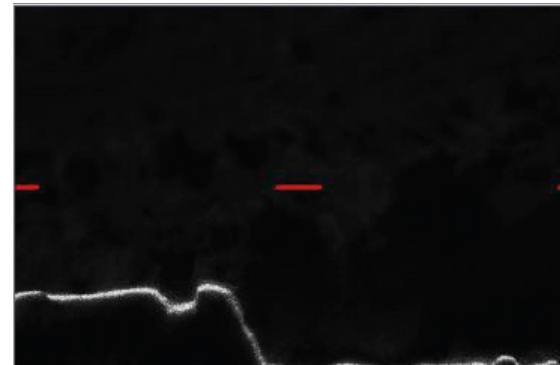
Correct distance!

## Planning a New session

02. If the laser beam disappears from the Preview window this means the recording is out of the 25 mm (depth of field) range:



Out of range.  
Too close.



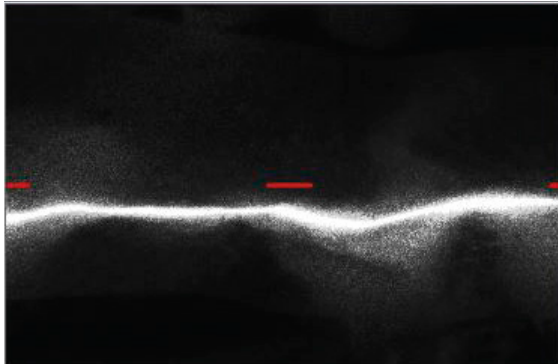
Out of range.  
Too far.

**IMPORTANT:** Before starting a New Session check the distance to the painting on the whole area you wish to scan. Use the Preview window in the Settings menu to make sure that the laser beam is always within the cameras' depth of field.

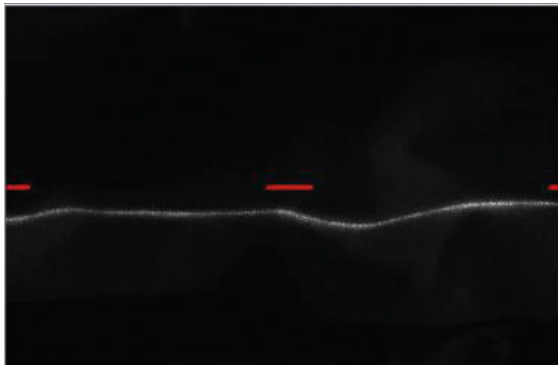
03. Confirm that the backing frame of the scanner is parallel to the object and then rotate the hand-wheel to move the scanner forward or backwards along the Z axis, until you get to the right distance.

## Planning a New session

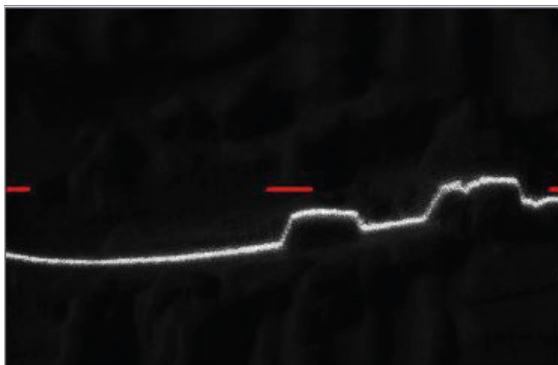
04. Now set the Laser intensity at the correct level for the object that you wish to scan - it changes with each material -, for example:



Laser intensity: 10  
Too high...



Laser intensity: 1  
Too low...



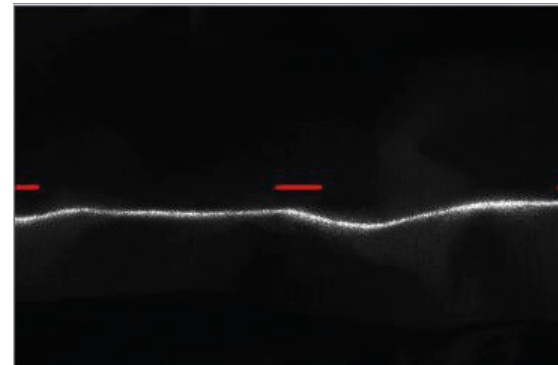
Laser intensity: 3  
Good!

## Planning a New session

05. You can also adjust the Camera settings (default values are Threshold: 30, Exposure: 180) for different results, for example:



Laser intensity: 3  
Threshold: 30  
Exposure: 20



Laser intensity: 3  
Threshold: 255  
Exposure: 180

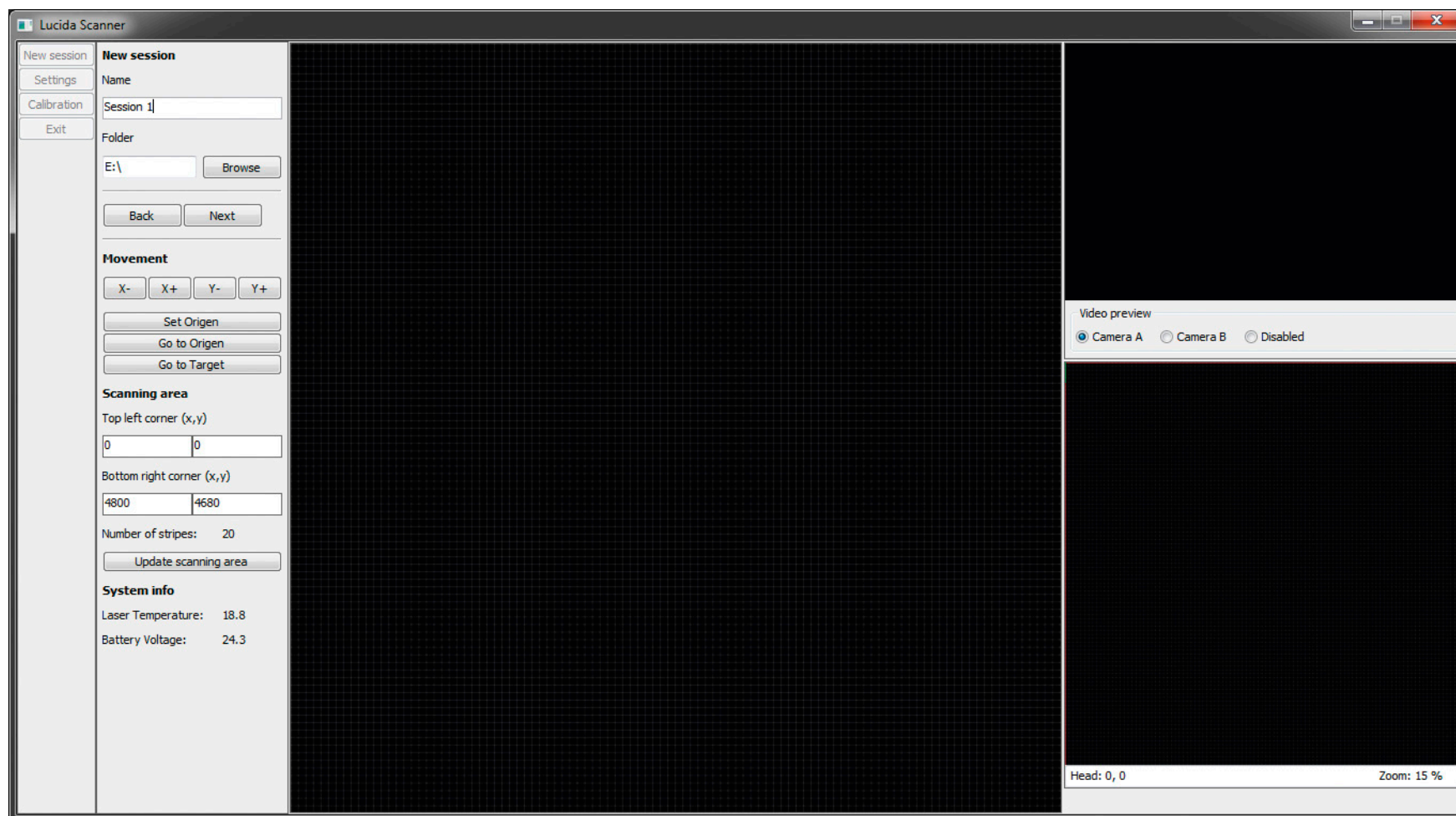
**IMPORTANT:** Before starting a New Session check the Laser intensity and the Camera settings on the whole area you wish to scan. Slight variations in the material, colour, tone, shine, etc. may result in loss of data or excess speckle noise. If there is large variation in the different areas, choose values that will allow you to scan the most area in one tile.



## New session

Before starting a New Session make sure that the Calibration and the Settings are properly saved. Press 'New session' to record a new scan. The Scanning Application will guide you through the process.

**IMPORTANT:** Make sure that the laptop and the scanner are properly connected to mains and/or the batteries are fully charged before starting a New Session.



The screenshot shows the 'Lucida Scanner' application window. On the left is a sidebar with buttons: 'New session', 'Settings', 'Calibration', and 'Exit'. The main area is titled 'New session' and contains the following fields and controls:

- Name:** A text input field containing 'Session 1'.
- Folder:** A text input field showing 'E:\' with a 'Browse' button next to it.
- Navigation:** 'Back' and 'Next' buttons.
- Movement:**
  - Directional buttons: 'X-', 'X+', 'Y-', 'Y+'.
  - Action buttons: 'Set Origen', 'Go to Origen', and 'Go to Target'.
- Scanning area:**
  - 'Top left corner (x,y)': Two input fields, both containing '0'.
  - 'Bottom right corner (x,y)': Two input fields, containing '4800' and '4680' respectively.
  - 'Number of stripes': A text input field containing '20'.
  - 'Update scanning area': A button.
- System info:**
  - 'Laser Temperature: 18.8'
  - 'Battery Voltage: 24.3'

The central part of the window is a large black grid representing the scanning area. On the right side, there is a 'Video preview' section with radio buttons for 'Camera A' (selected), 'Camera B', and 'Disabled'. Below this, a status bar shows 'Head: 0, 0' and 'Zoom: 15 %'.

**New session:** inserts Name and path in the session Folder.

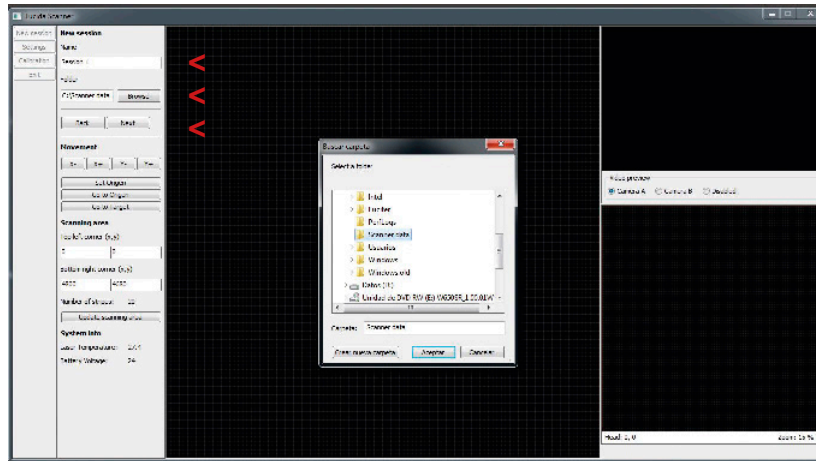
**Movement:** controls the Movement of the scanning head.

**Scanning area:** controls the Scanning area and Number of stripes.

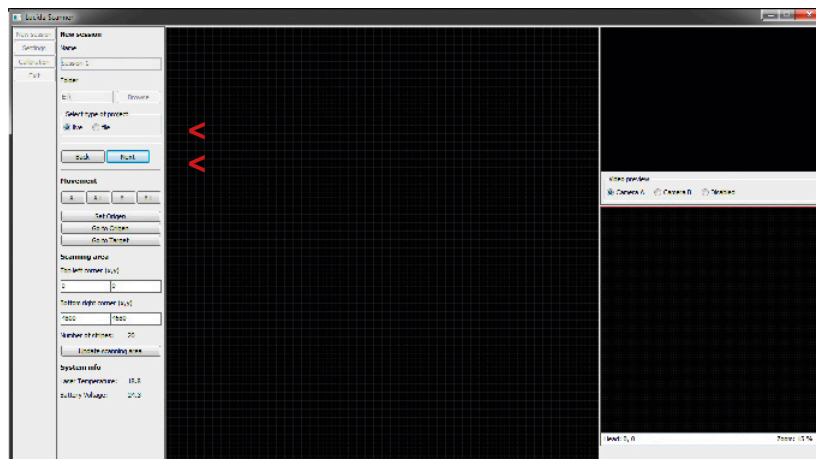
**System info:** indicates Laser temperature and Battery voltage.

Press 'Back' to go to the Home menu if you wish to modify Settings.

## Scanning a tile



01. Type the name of the new scanning session.
02. Press 'Browse' to select the folder where the session will be saved.
03. Press 'Next'.

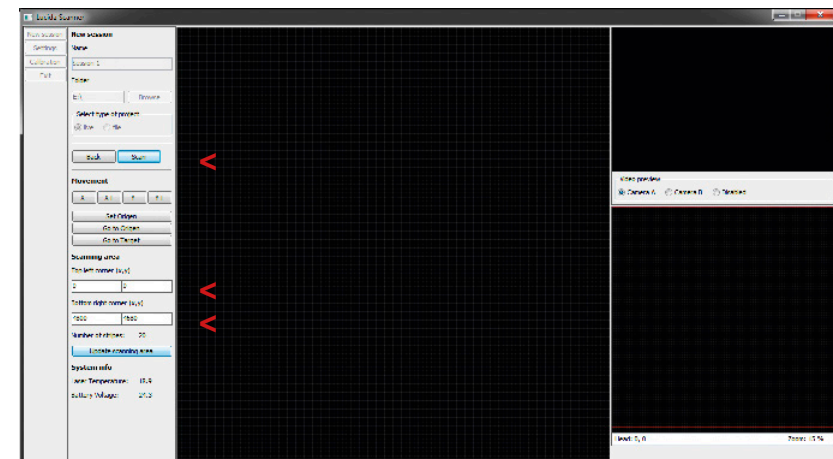


04. 'Select type of project'. Click 'Live' if you want to create a session with live video. Click 'File' if you want to create a session using a pre-recorded video file (default: Live). Press 'Next'.

## Scanning a tile



05. Use the arrow keys to position the scanner head at the beginning (top-left corner from the user's point of view) of the scanning area.
06. Press 'Set origin'. The position of the head is now set to 0,0.



07. Scanning area. The default scanning area is set to one tile:  
Top left corner (x, y): 0,0; Bottom right corner (x, y): 4800, 4680.
08. For scanning a tile don't modify the Scanning area. Press 'Scan'.

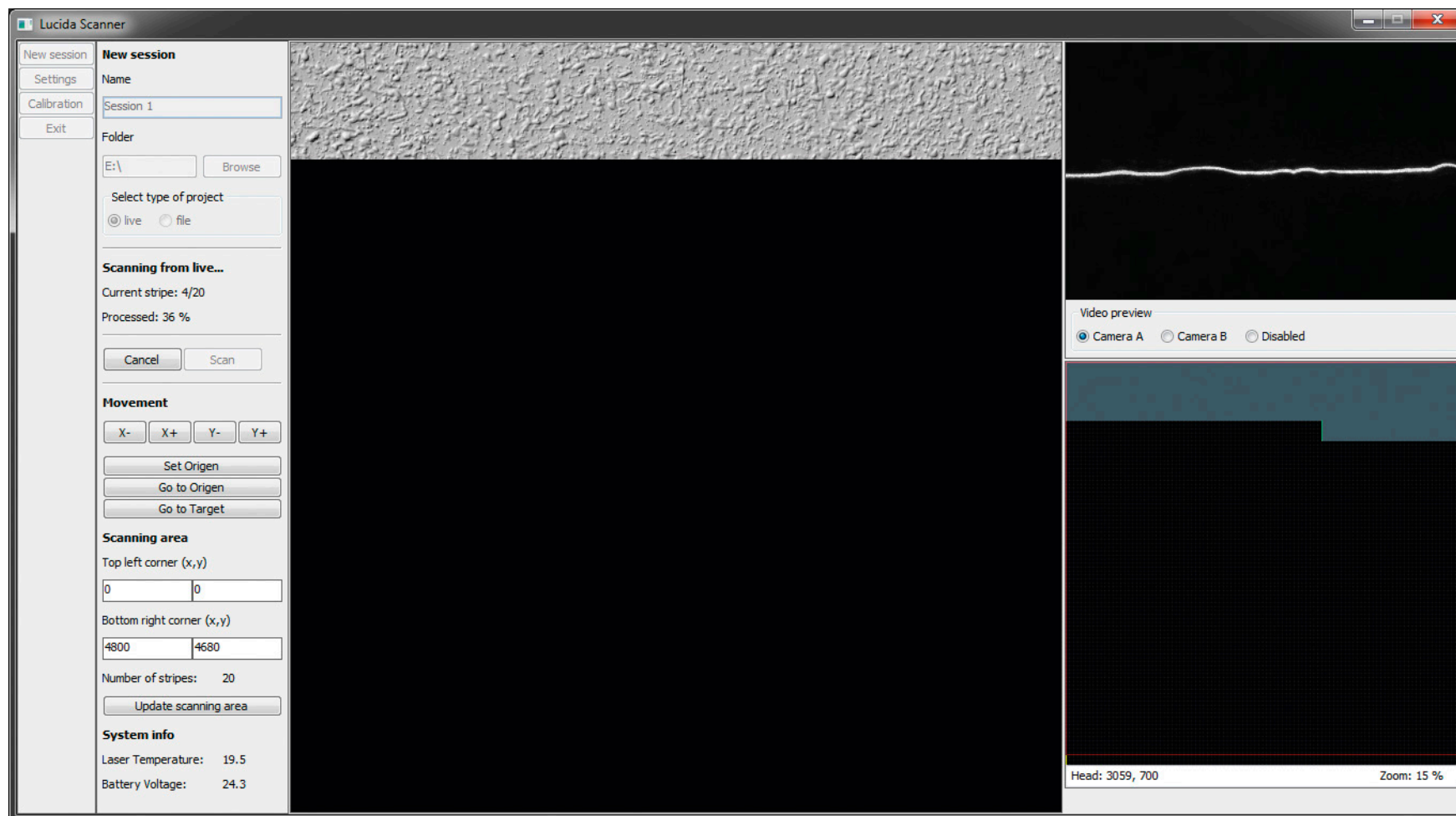
## Scanning a tile

Once you press Scan the message 'Scanning from live...' will appear on screen and a full tile of 20 stripes will be recorded automatically. This process will take approximately 1 hour to complete.

The Application will indicate the progress of the session as follows:

'Current stripe': from 1 to 20 and

'Processed': percentage of stripe recorded.



Live information of the progress of the session:

Streaming window: shows the frames captured by each camera.

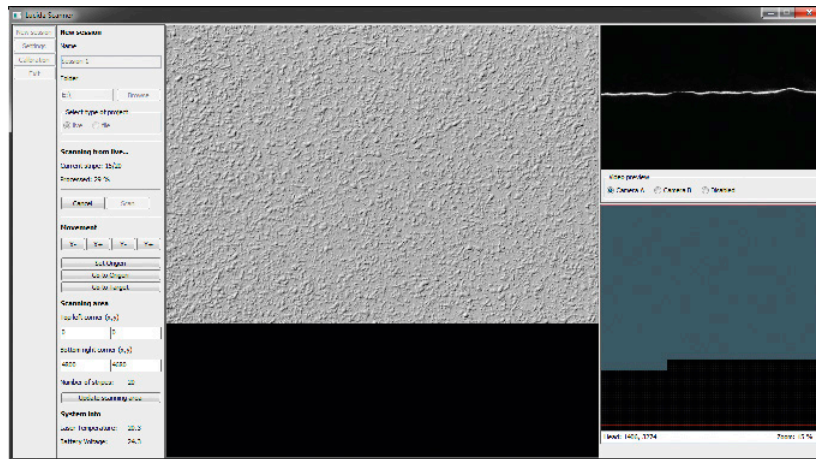
Navigation window: shows the progress the scanning session.

Main window: shows a rendering of the 3D data as it is processed

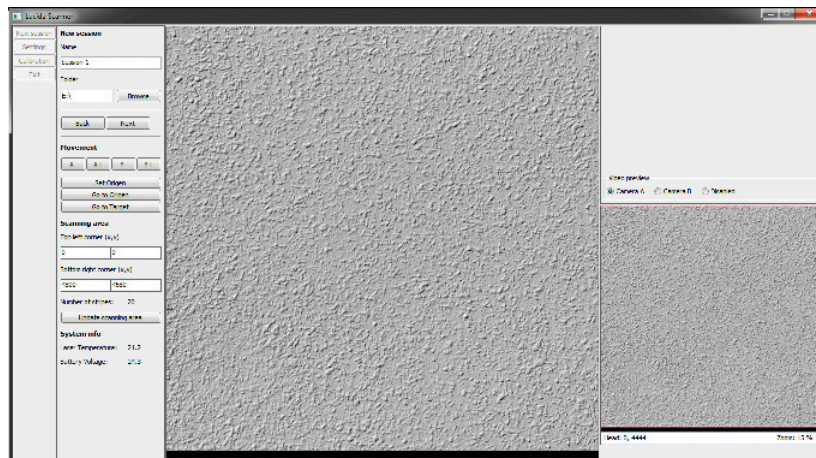
IMPORTANT: Do not press any button in the Application while scanning. If you want to stop the process at any time press 'Cancel'. You will need to start a New session if you wish to continue scanning.



## Scanning a tile

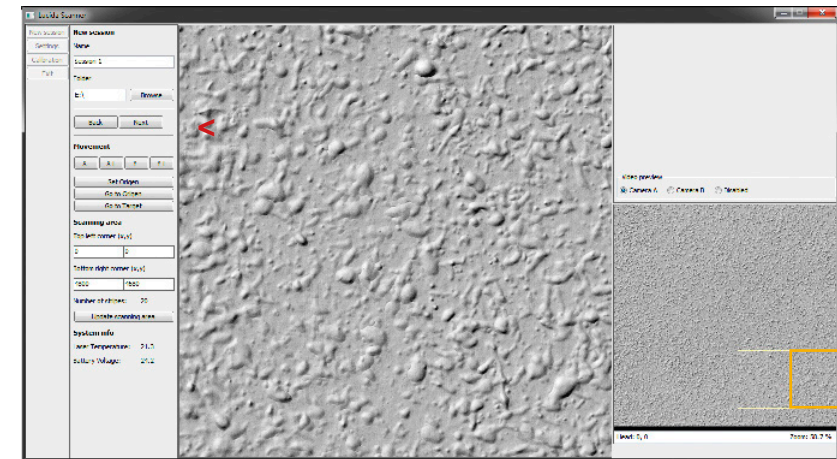


09. The rendering of the processed 3D data is shown in the Main window at the end of each stripe. If you Cancel a session you will lose the data of the current stripe, but the previous stripes are saved.



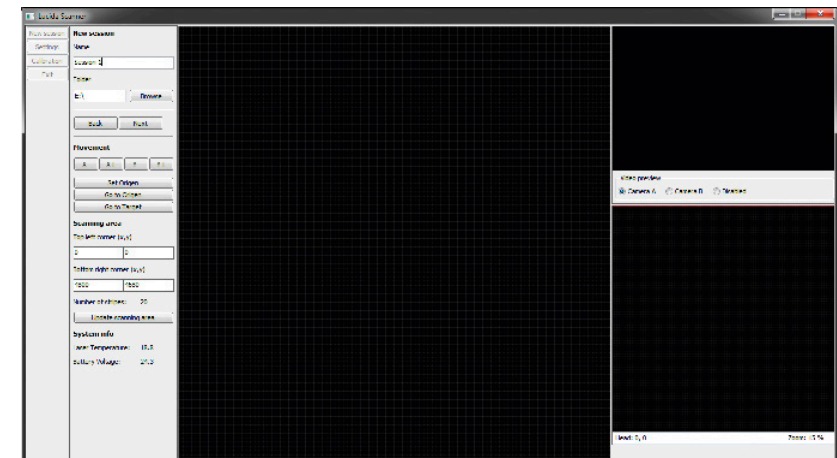
10. When the tile is finished, the full rendering of the scanned tile will also appear in the Navigation window, as well as in the Main window. At this point the data is already saved, no further action is needed.

## Scanning a tile



11. Click in the Navigation window to zoom on the scanned data and use the mouse wheel to zoom in and out the rendered image.

12. Drag in the Navigation window to pan through the rendered image.



13. Press 'Back' to go to the Home menu. The rendered images in the Navigation window will remain and the Main image will disappear.

14. If you press 'New Session' all the windows will reset.

## What's in the session folder

The session folder after scanning a tile contains the following files:

### Session 1.ris

3D data of the tile in RIS format.

### Session 1.xml

Text information about the session.

### Session 1\_00.avi

(...)

### Session 1\_19.avi

Raw video files of each of the 20 stripes recorded by the 2 cameras.

### Session 1\_depthMap\_16b.tiff

3D data of the tile in a depth map format in 16 bits.

### Session 1\_depthMap\_32b.tiff

3D data of the tile in a depth map format in 32 bits.

### Session 1\_shaded.tiff

3D data of the tile as a render with simulation of relief.

### homography\_calibration.xml

Homography matrix of this session's calibration.

### system.txt

Text information about the session.

## Re-scanning a specific area

### When is it necessary to re-scan a specific area?

A good scan captures as much information as possible. Captured data is represented on the screen with a grey tone whereas absence of data is shown as black.

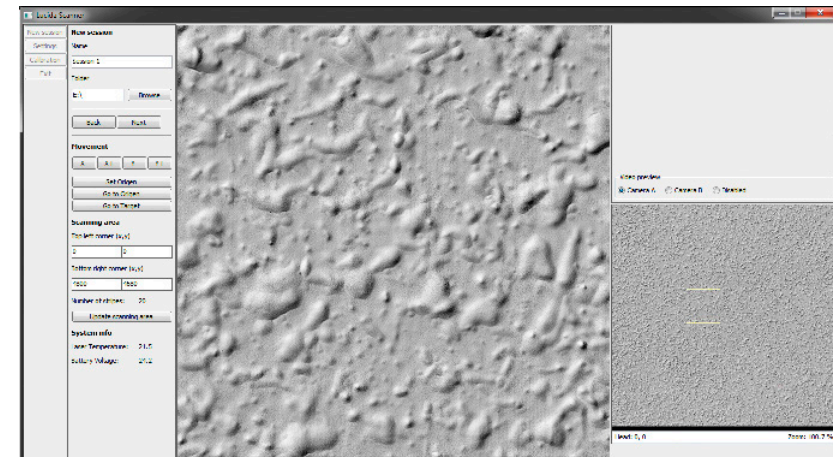
If you see a black area in your data it is necessary to re-scan.

The most common reasons for data loss that are:

- The area is out of the depth-of-field (either too close or too far from the scanner). Solution: move the Z axis accordingly and re-scan it.
- The Laser intensity level is too low to capture the particular colour or material (usually dark tones). Solution: increase the Laser intensity level and re-scan.

Other common reasons for re-scanning a specific area could be:

- A strong vibration caused local distortion of data (vertical pattern).
- An area presents too much speckle noise so it needs to be re-scanned with a lower laser intensity.

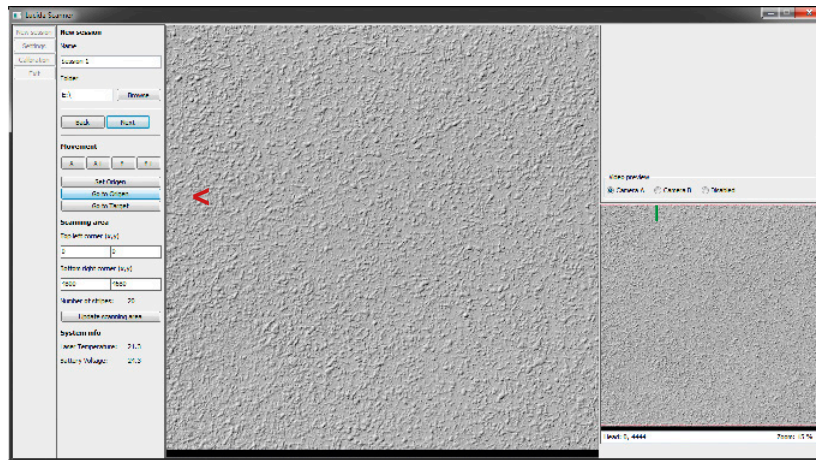


15. Do not press 'Back'. This will take you to the Home menu and the renders will disappear. You will need them for referencing.

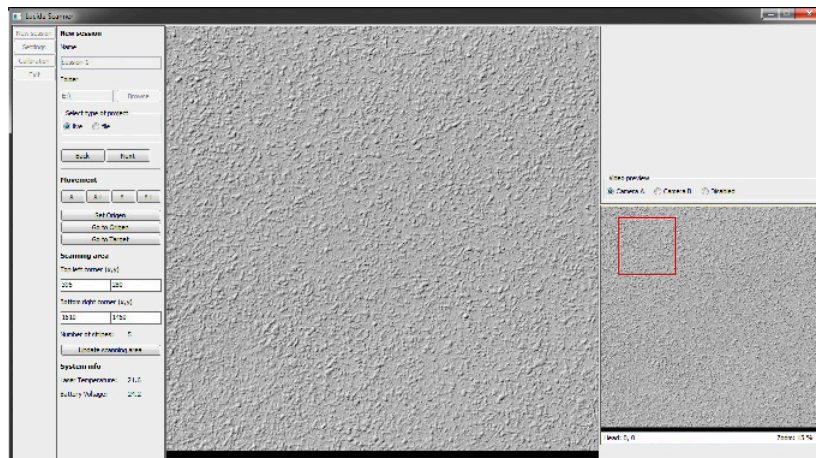
16. Repeat steps 01 to 04. Do not repeat an existing Folder name.



## Re-scanning a specific area



17. Click 'Go to origin'. The head will go to the last session's origin. Do not disconnect the Arduino or you will lose the origin 0,0.
18. Click on the Navigation window and zoom out completely.

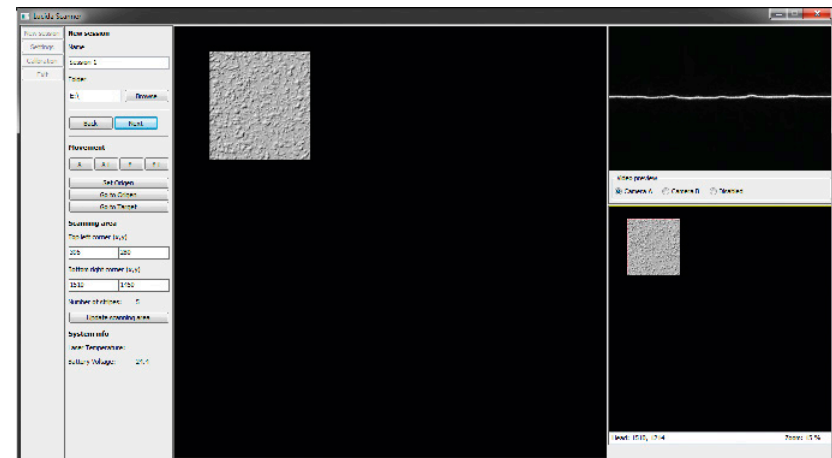


19. Select a specific area to scan: you can do this by clicking in the Navigation window and dragging to draw a rectangle or by typing the (x, y) coordinates of the 'Top left corner' and 'Bottom right corner'.

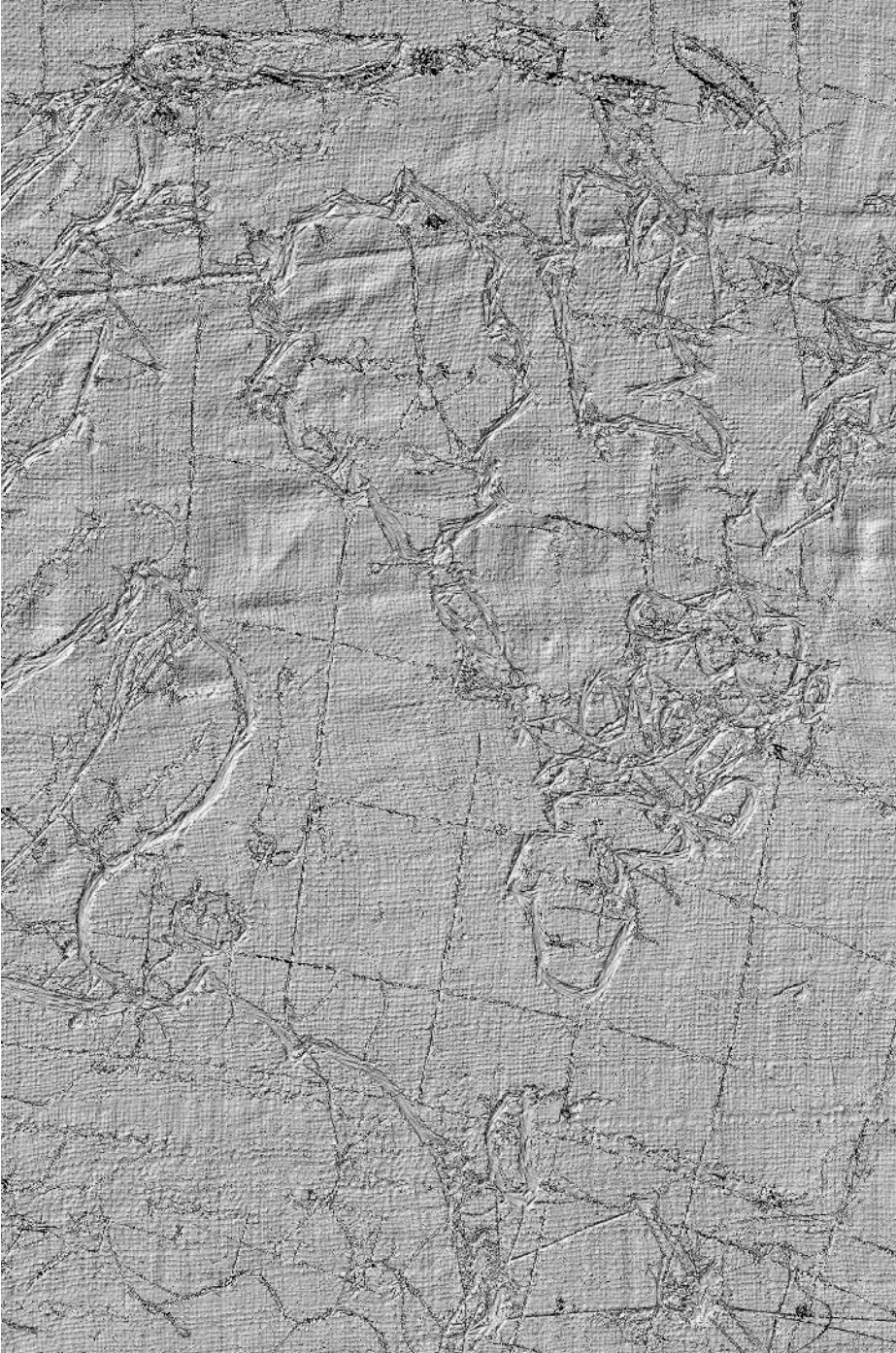
## Re-scanning a specific area



20. Note that the (y) coordinate of the 'Bottom right corner' will be automatically increased to match a certain 'Number of stripes'.
21. Press 'Update scanning area'. Press 'Scan'.



22. The specific area being recorded will appear in both the Main and the Navigation window at its relative location within the tile.
23. When the scanning process is finished, repeat steps 11 to 14.



# 5

## Troubleshooting

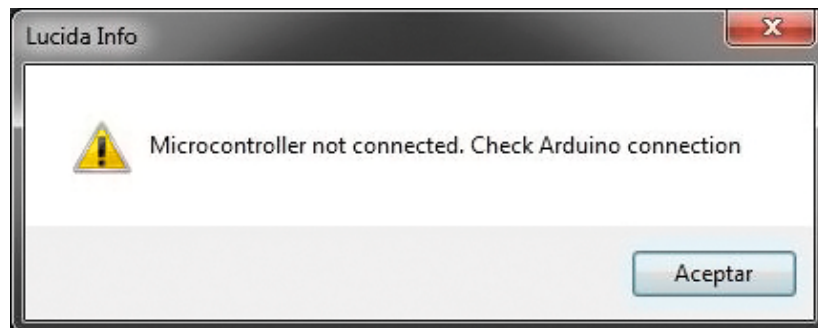
<<<

World Map, anonymous, C17th or early C18th, embroidered silk, 54.5 x 49.5 cm (detail).  
3D scanned in 2011 in Factum Arte, Madrid.

## Arduino not connected

If the Arduino board is assigned to a COM port in the laptop different to the one which is configured in the **system\_settings** file an error message (below) will pop up when opening the Scanning Application:

**'Microcontroller not connected. Check Arduino connection'.**



01. Press 'Accept'. The Scanning Application will open. Press 'Exit'.
02. Heck in the 'Devices and printers' menu in the laptop which port has been assigned to the Arduino (in the example: COM3) (Fig. 1).
03. Open the system\_settings file as a text file.
04. Look for the line '<SerialPortName>COM3</SerialPortName>' and match the port number to that assigned by the laptop (Fig. 2).
05. You may have to do this again if you change the laptop.

```
<!-- Serial port name (for the arduino).  
<!-- Type: string -->  
<SerialPortName>COM3</SerialPortName>
```

Fig. 2

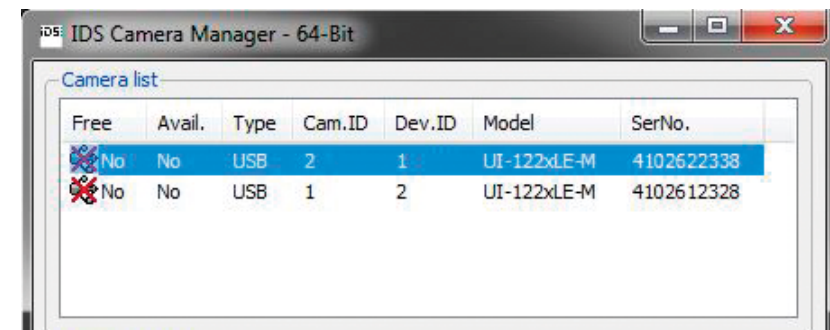


Fig. 1

## Cameras not connected

If the Scanning Application is closed without pressing 'Exit' button, the access to the USB cameras may remain open. If that is the case, when you open the Scanning Application again the cameras may not be detected.

01. Open the IDS Camera Manager application that is installed with the camera drivers to check the status of the cameras.



02. In order to solve this problem, unplug the cameras from their USB ports and plug them again after a few seconds. This should make the laptop reset the status of the cameras to this:

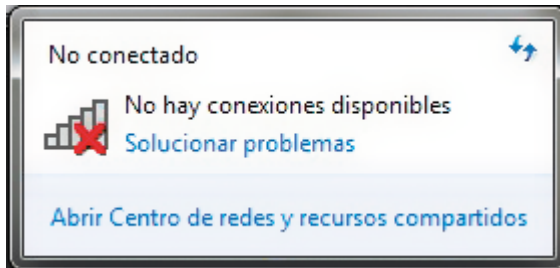
Free	Avail.	Type	Cam. ID	Dev. ID	Model	SerNo.
Yes	Yes	USB	1	1	UI-122xLE-M	...
Yes	Yes	USB	2	2	UI-122xLE-M	...

3. If the problem is not solved, unplug cameras again, restart the computer and plug cameras back in.

## Trigger not responding

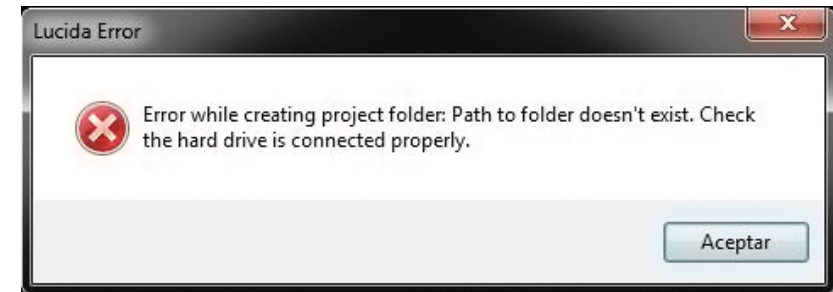
01. If after pressing the 'Pulse' button in the Calibration process nothing appears on the Preview windows it may be because no signal has been sent to the trigger of the cameras.
02. This could be caused by a failure in the wiring connections.
03. In order to solve this, whether the trigger cables, which connect the PCB on top of the scanner head to the cameras, are properly connected and/or damaged.
04. Open the Calibration menu and press 'Pulse' again.
05. If the problem is not solved check if the ribbon cable which connects the Arduino board with the PCB on top of the scanner head is properly connected and/or damaged.
06. Open the Calibration menu and press 'Pulse' again.

## Wifi not available



01. Lucida Scanning Application automatically turns off the Wifi connectivity of the laptop when you open it and turns it on when you exit.
02. If the Scanning Application is closed without pressing 'Exit' button the Wifi adaptor will remain disconnected.
03. In order to solve this open the Scanning Application again and press 'Exit'. This will re-enable the laptop Wifi adaptor.

## Incorrect folder path



01. When the name of a session folder already exists, an error will pop up: 'Error while creating project folder. Path to the folder doesn't exist. Check the hard drive is connected properly'.
02. To solve the problem just give a new name to the session folder.
03. Also, when the Folder path does not exist in the computer drive the same pop up error window will appear. To solve the problem just change the path to an existing one.

## Calibration tool incorrectly placed

01. If after pressing the 'Pulse' button in the Calibration process the laser stripes in the two Preview windows don't look as they should this could be due a badly fixed calibration tool.
02. In order to solve the problem, make sure the positioning dowel pin of the calibration assembly is resting straight/true on the top side of the vertical carriage. Check also that the back surface of the calibration assembly is in flat contact with the milled surface of the backing board, without touching any bolts from the board (see section Calibration).



## Glossary

**Alignment.** Last step of the Calibration process that consists of overlapping the homographies (dots) from both cameras by hand.

**Backing frame.** Structural support made from aluminium profiles to which three motorized guides and the scanning head are attached. As a mechanical set, it defines a scanning area of 480 x 468 mm.

**Beam.** Laser beam. The strip of vertical light projected by the red laser diode. It has a total length of about 50 mm although the effective length captured by the cameras is 26 mm (width of a stripe).

**Calibration.** Comparison between measurements - one of known magnitude made with one device (Lucida's calibration profile) and another measurement made in as similar way as possible with a second device (homography of each camera's view).

**Depth of field.** Distance between the nearest and the farthest objects in a frame that appear acceptably sharp in image. In the case of Lucida, the depth of field often refers to the maximum relief that can be recorded in a particular scanning session: 25 mm. For deeper relief surfaces it is possible to move the scanner along the Z axis.

**Depth map.** One of the output files created automatically in a session, consisting on a render of the 3D data which has been captured and processed. The format of the Shaded file is a TIFF.

**Exposure.** Parameter in the Camera settings that sets the quantity of light reaching the camera sensor (default: 180).

**File.** Session created out of pre-recorded video files, as opposed to 'Live', a session created from live video from the cameras (default).

**Frames.** Each of the 4800 shots captured by each of the 2 video cameras in one stripe. The resolution of each frame is 752 x 480 px.

**Guides.** Each of the linear motion slides that allow the movement of the scanner. The scanning head is moved by a system of motorized linear guides. The other guides correspond to the X, Y, Z movement.

## Glossary

**HDR.** High Dynamic Range. Function that captures two frames at different exposure levels and combines them to produce an image representative of a broader tonal range.

**Head.** Scanning head. Assembly of parts that form the main core of the Lucida scanner. It includes the laser diode and the two cameras.

**Homography.** In the field of computer vision, any two images of the same planar surface in space are related by a homography. This is used in our Calibration process to correct the camera perspectives.

**Laser.** Laser diode. Device that emits light coherently. In Lucida, spatial coherency allows the laser to be focused in a tight spot which, thanks to a system of lenses, is projected as a linear beam.

**Live.** Session created out of live video from the cameras (default), as opposed to 'File', a session created from pre-recorded video files.

**Micron.** Micrometer or  $\mu\text{m}$ . 1/1000 of a millimetre. Lucida 3D scanner records at a resolution of 100 microns, that is, 1/10 of a millimetre.

**Noise.** When an image is formed by a rough surface which is illuminated by a coherent light such as a laser beam, a speckle pattern is observed in the image plane.

**Origin.** Home position (x, y = 0,0) of a scanning session. The Scanning Application *remembers* the origin (0,0 position) when you start a New session and even if you Exit the Application. The origin will only be *forgotten* if the Arduino cable is disconnected.

**Processed data.** Digital information that has been transformed from one format to another one. The Scanning Application processes the raw video footage from the cameras to convert it into 3D information.

**Profile.** Calibration profile. Square of 23 x 23 mm formed by the four corners defined in the calibration tool, necessary for the Calibration.

**Raw data.** Data collected from a source that has not been subjected to processing or any other manipulation. Lucida stores raw video as one of the most valuable tools for the digital preservation of objects.



## Glossary

**Resolution.** Resolution is used here to mean the number of points per surface unit present in the processed 3D data. In Lucida, depth map files contain 100 dots per cm<sup>2</sup> - 254 dpi. This is equivalent to saying that the resolution of the Lucida scanner is 100 µm.

**Scanner.** Lucida. System developed to obtain contact-free high-resolution 3D data from the surface of paintings and low-reliefs objects. Lucida projects a thin beam of red light onto the surface of the painting. As the beam moves across the object the distortions caused by the surface fluctuation are recorded by two video cameras positioned adjacent on the assembly either side of the laser. The video footage is archived as raw data as well as processed as a 3D depth map file.

**Settings.** In the Scanning Application, the Settings menu permits the control of certain parameters to optimise the scanning session. They are divided into System settings and Camera settings.

**Shaded.** One of the output files created automatically in a session made up of a render of the 3D data which has been captured and processed. The format of the Shaded file is a TIFF.

**Stripe.** Set of 3D data composed by 2x 4800 video frames along a distance of 480 mm. The width of a stripe is 26 mm. A tile of data is composed by 20 horizontal stripes with an overlap of 10%.

**Threshold.** Parameter of the Camera settings that sets the segmentation from the grey scale image (default: 030).

**TIFF.** Tagged Image File Format. File format for handling and storing images and data within a single file by including the header tags defining the image's geometry.

**Tile.** Set of 3D data composed by 20 stripes of 2x 4800 frames each. A tile determines Lucida's standard scanning area: 480 x 468 mm.

## Glossary

**XML.** Extensive Markup Language. Markup language that defines a set of rules for encoding documents (text) in a format that is both human-readable and machine-readable.

**(x, y) coordinates.** Position of a point within the tile. The coordinates help to determine the position of the scanning head in a session, as well as the four corners of a selected area for scanning.

**X axis movement.** Placement of the scanner (left-right) along the horizontal guides that run parallel to the scanning plane.

**Y axis movement.** Placement of the scanner (up-down) along the vertical guides that run parallel to the scanning plane.

**Z axis movement.** Placement of the scanner (forward-backwards) along the horizontal guides that run perpendicular to the surface of the scanning plane.

## Contact us

### Support

[factum@factum-arte.com](mailto:factum@factum-arte.com)

If you ever need help with your Lucida, email the address above. To help us understand the problem it is very helpful to include pictures or a video as attachments with your email.

You can also telephone us: +34 915 500 978

### Feedback

[factum@factum-arte.com](mailto:factum@factum-arte.com)

For general questions or for your comments and ideas send an email to the address above.

### For more information

[www.factum-arte.com](http://www.factum-arte.com)

[www.factumfoundation.org](http://www.factumfoundation.org)

### Resources

Lucida user's manuals can be downloaded from Factum Arte's website:

Assembly Instructions

[factum-arte.com/lib/kcfinder/upload/files/Lucida/manuals/2015\\_Lucida\\_A5\\_Assembly\\_Final.pdf](http://factum-arte.com/lib/kcfinder/upload/files/Lucida/manuals/2015_Lucida_A5_Assembly_Final.pdf)

<https://vimeo.com/8261186> (password: factum53)

Operator's manual

[factum-arte.com/lib/kcfinder/upload/files/Lucida/manuals/2015\\_Lucida\\_A5\\_Operator\\_Final.pdf](http://factum-arte.com/lib/kcfinder/upload/files/Lucida/manuals/2015_Lucida_A5_Operator_Final.pdf)

Processing applications

[factum-arte.com/lib/kcfinder/upload/files/Lucida/manuals/2017\\_Lucida\\_A5\\_processing\\_Final.pdf](http://factum-arte.com/lib/kcfinder/upload/files/Lucida/manuals/2017_Lucida_A5_processing_Final.pdf)



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