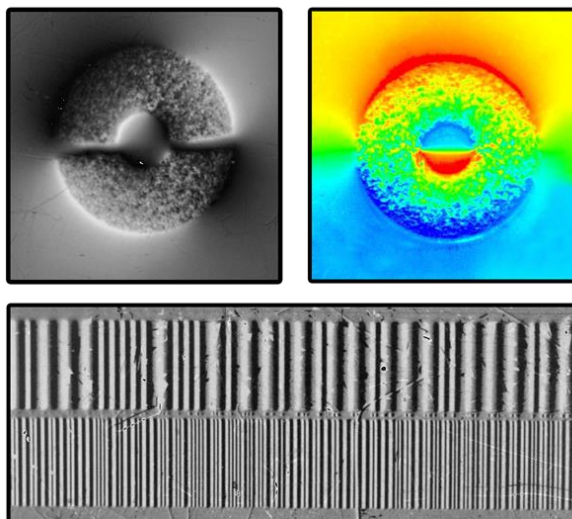


# Operating Manual

## *CMOS-MagView*



Distributed By:

**GMW Associates**

955 Industrial Road, San Carlos, CA, 94070 USA

PHONE: +1 650-802-8292 FAX: +1 650-802-8298

EMAIL: sales@gmw.com WEB: www.gmw.com

Version CMV\_UM\_201411

1

|            |  |           |
|------------|--|-----------|
| <b>1.</b>  | <b>Brief description</b>                       | <b>3</b>  |
| <b>2.</b>  | <b>Magneto-optical visualization</b>           | <b>3</b>  |
| <b>3.</b>  | <b>Function</b>                                | <b>4</b>  |
| <b>4.</b>  | <b>Technical features</b>                      | <b>4</b>  |
| <b>5.</b>  | <b>CMOS-Magview components and connections</b> | <b>5</b>  |
| <b>6.</b>  | <b>Application</b>                             | <b>6</b>  |
| <b>7.</b>  | <b>Software</b>                                | <b>7</b>  |
| 7.1.       | Installation                                   | 7         |
| 7.2.       | Start  | 10        |
| 7.3.       | Software sections                              | 12        |
| 7.4.       | Menu bar                                       | 13        |
| 7.5.       | Progress bar                                   | 13        |
| 7.6.       | Quick-start bar                                | 14        |
| 7.7.       | Status bar                                     | 15        |
| 7.8.       | Select language                                | 15        |
| 7.9.       | Device selection (capture)                     | 16        |
| 7.10.      | Image processing (capture)                     | 16        |
| 7.11.      | 3-D options (presentation)                     | 17        |
| 7.12.      | Gradient scale (presentation)                  | 18        |
| 7.13.      | Image markings (analysis)                      | 21        |
| 7.14.      | Statistics (analysis)                          | 22        |
| 7.15.      | Profiles (analysis)                            | 23        |
| 7.16.      | Grid settings                                  | 25        |
| 7.17.      | Ruler settings                                 | 26        |
| 7.18.      | Monitor  | 27        |
| 7.19.      | Image area                                     | 28        |
| 7.20.      | Saving images                                  | 29        |
| 7.21.      | Save/load a project                            | 31        |
| 7.22.      | Saving measuring data                          | 32        |
| <b>8.</b>  | <b>Sample application</b>                      | <b>33</b> |
| 8.1.       | Guide to quick use                             | 33        |
| 8.2.       | Example of a linear encoder                    | 34        |
| <b>9.</b>  | <b>Notes</b>                                   | <b>41</b> |
| <b>10.</b> | <b>Fault remedy</b>                            | <b>41</b> |
| <b>11</b>  | <b>Warranty</b>                                | <b>42</b> |
| <b>12.</b> | <b>Maintenance</b>                             | <b>42</b> |

## 1. Brief description

The CMOS-MagView is an innovative device for the optical visualization of magnetic fields. The highly engineered magneto-optical sensor technology visualizes the magnetic stray field of magnetic materials directly and at high optical resolution. The magneto-optical analysis of the test specimen provides concrete information about the field polarity, field homogeneity, distribution of the magnetic material and the magnetization properties.

The following are suitable for magneto-optical characterization by the CMOS-MagView:

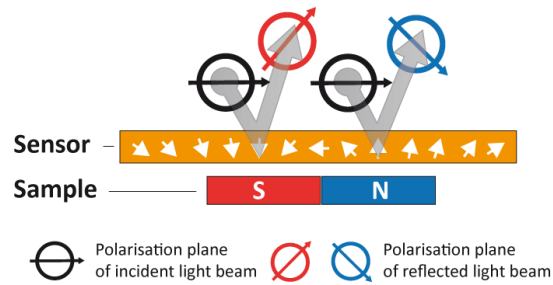
- Linear encoders, rotational encoders
- Dipol/multipol permanent magnets
- Compound materials (polymers + hard magnetics, ceramics + hard magnetis)
- Magnetic strip cards
- Magnetic inks
- Shape memory alloys
- Audio tapes
- Steel alloys
- Current-carrying conductors

## 2. Magneto-optical visualization

The magnetic field visualization is based on the magneto-optical sensor technology using the Faraday effect. The sensor produces a two-dimensional field image in the sensor plane. Because the sensor plane is covered by mirror coat only a few micrometers thick, the stray field near the surface of the test specimen can be detected.

Detected are the normal components of the test specimen's magnetic field relative to the magneto-optical sensor surface.

The following Figure 1 is a schematic representation of the magneto-optical Farady effect and its impact on linear polarized light passing the magneto-optical sensor.



**Figure 1: Schematic view of the magneto-optical effect**

Probe – Test specimen; Polarisationsebene des eingestrahnten Lichts – Polarization plane of the incident light; Polarisationsebene des reflektierten Lichts - Polarization plane of the reflected light;

### 3. Function

- Area illumination of the specimen's surface by linear polarized homogeneous light
- Rotation of the linear polarized light (Faraday effect) by the magneto-optical sensor as function of the local magnetic field (the Faraday effect provides intensity differences as a function of the local magnetic field)
  - Direct optical image of the stray field distribution
- Live presentation and recording of images by high-resolution digital CMOS camera
- Qualitative and quantitative data on field distribution in the sensor plane
- Geometrical measurements and data archiving

### 4. Technical features

- Magnetic field detector :      magneto-optical sensor, bismuth-substituted rare earth-iron-garnet film
- Optical resolution:      25  $\mu\text{m}$  (pixel resolution with 20,5 x 15,5 mm sensor area)  
    75  $\mu\text{m}$  (pixel resolution with 60 x 45 mm sensor area)
- Field range:                      depends on sensor type used:
  - A: +/- 2 kA/m,
  - B: +/- 31 kA/m
  - C: +/- 100 kA/m,
  - D: +/- 5 kA/m, with bias field of approx. 100 kA/m
- Sensor sizes:                      15,5 x 20,5 mm; sensors A,B,C,D  
    60 x 45 mm, sensors A,B,C

- Lighting: Homogeneous, monochromatic (approx. 590 nm), linear polarized light
- Dimensions: 230 mm x 150 mm x 60 mm ( L x W x H, 20,5 x 15,5 mm sensor)  
285 x 150 x 135 x mm (L x W x H, 60 x 45 mm sensor)
- Power supply: Input AC adapter: 100-240V 50-60Hz, 12 V, 3A DC
- Interface: USB
- Weight: 2 kg

## 5. CMOS-Magview components and connections

The CMOS-Magview is a compact system which is shipped with USB cable and power supply unit.

Additional components, e.g., yoke or permanent magnets for systematic magnetization are available on request.



Figure 2: 1" and 3" CMOS-Magview, top view, each with specimen mounted on sensor.

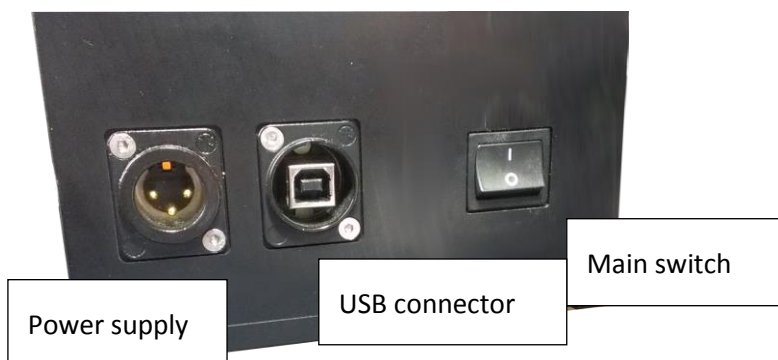


Figure 3: CMOS-Magview, rear connectors.

## 6. Application

The surface of the magneto-optical sensor is scratched easily and should therefore be handled with care. The systems can be in direct contact with the test specimen. The systems are shipped with a polymer film as protection. If possible, the polymer film should not be removed when the sensor is in use. If this is not possible because the required geometrical resolution cannot be obtained<sup>1</sup>, sliding movements primarily with sharp-edged objects must be avoided. The sensor may be stable but it is brittle. The sensor may break when the test specimen drops onto it.

If the protective film is worn, it should be replaced and a new film installed. Please do not press the test specimen against the magneto-optical sensor with too much force. The magneto-optical sensor must not be touched with a pointed object.

The CMOS-MagView can optionally be used with different magneto-optical sensors (a sensor change is not readily possible because the calibration is system related).

The device is designed for operation in dry indoor places and should only be used at room temperature (15-35 °C). It is recommended that the test specimen should also be at room temperature.

The CMOS-MagView should be turned on 15 minutes (for measurement tasks about 2 hours) before a measurement starts (warm-up period, may vary (from job to job)).

### **Start-up of the CMOS-MagView:**

- Ensure that the visualization device is set up on a firm base in a dry room.
- Use only the power supply unit shipped with the CMOS-MagView device. Plug the cable of the power supply unit in the device.
- Connect the CMOS-MagView to the PC using the supplied USB 2.0 cable.
- Load the supplied installation CD in the CD drive of your PC.
- Install the software by clicking on the *cmosmagviewsetup.exe* file.
- Follow the prompts during the installation.
- The system can be turned on and off using the main switch on the back side.

---

<sup>1</sup> The geometrical field resolution is proportional to the distance to the field source.

## 7. Software

The CMOS-MagView software is a multi-function software which actuates the CMOS-MagView device, present image data, outputs measuring values and analyzes captured data.

### 7.1. Installation

Normally, the software is installed on the target computer by the installation file. The installation file can be found on the supplied CD/DVD. After opening the installation file "Setup\_CMOS-MagView\_win\_x86x64\_i18n.exe" choose the installation language (Figure 4) and the start language of the CMOS-MagView software.



This dialog will not be displayed again after a language is selected unless the installation file is started again.

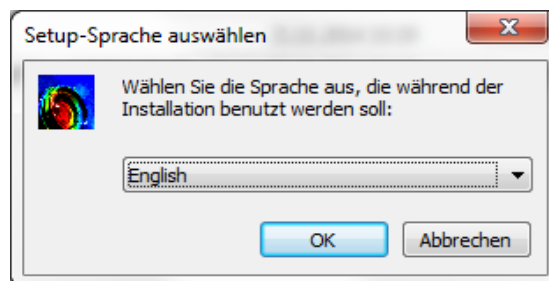


Figure 4: Installation start dialog (language selection)

The installation welcome dialog with information about the software version you are about to install (Figure 5) opens.



Figure 5: Welcome dialog (version)

The next dialog (Figure 6) informs you that the frame refresh rate of the image recorder may be slow if an anti-virus software provides real-time protection in the background. The fact that a USB2.0 interface is needed is also mentioned.

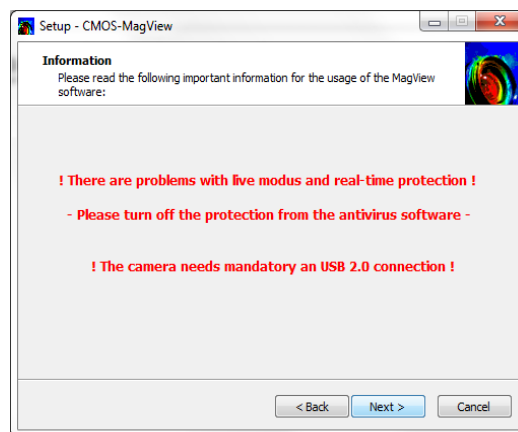


Figure 6: Installation information

Next, the license agreement for the CMOS-MagView software (Figure 7) is displayed, which you must accept to continue.

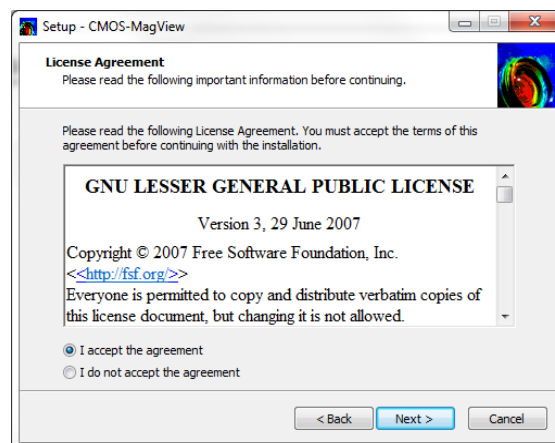


Figure 7: License agreement

As the next step in the installation routine you should define a target folder (Figure 8) in which the software is stored. All program files can be found in that folder after the installation.

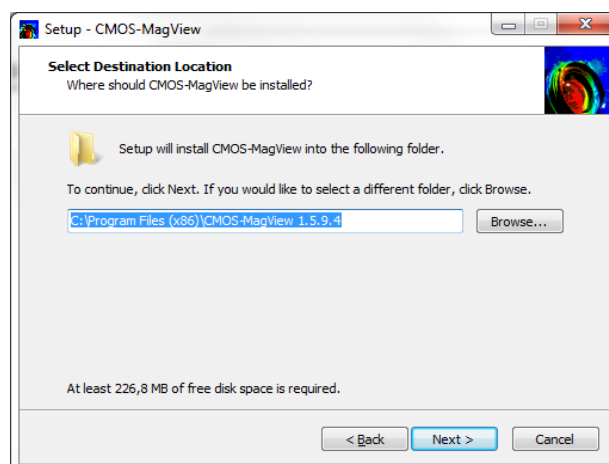


Figure 8: Select the target folder



After selecting the target folder you can define a name for the program folder of the CMOS-MagView software on the Windows start bar (Figure 9).

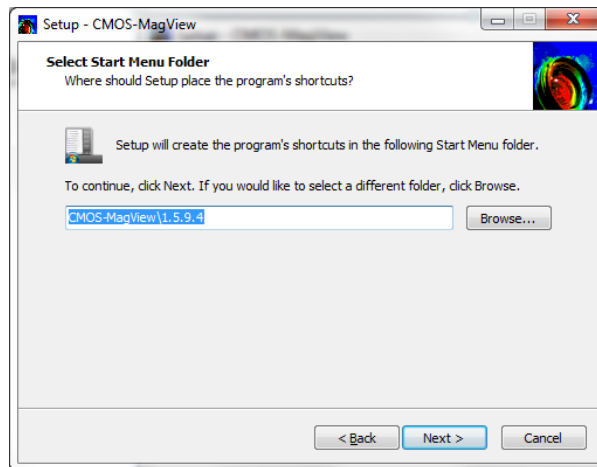



Figure 9: Folder name on the start bar

In the last configuration step of the installation routine you can choose the drivers that will be installed for the software and what links will be established (Figure 10).

|   |   |
|---|---|
|  | If you are not sure whether you have already installed the device driver, make sure you install it. |
|---|---|

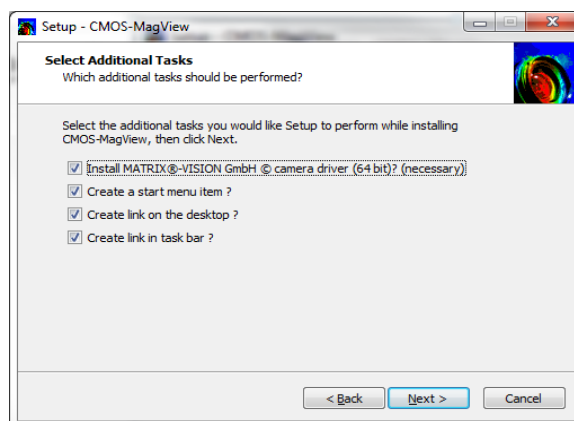


Figure 10: Additional functions during installation

After these steps, the installation of the software and the drivers start and the links will be set up. In the last dialog window you can start the CMOS-MagView software (Figure 11).

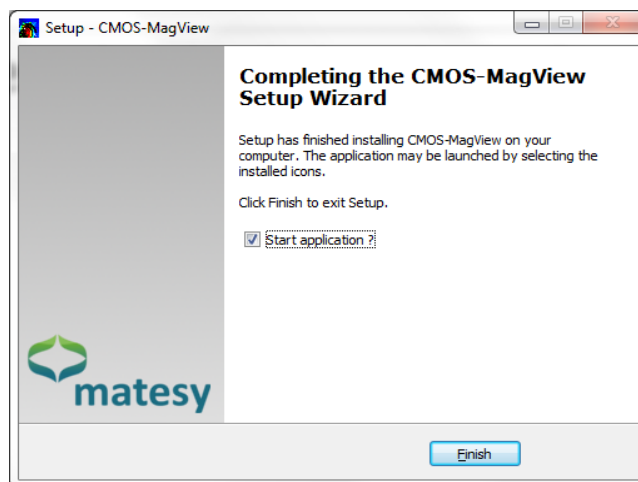


Figure 11: Installation complete dialog

## 7.2. Start

Start the CMOS-MagView software with the *cmos-magview.bat* file in the program directory or click on a link set up during the installation on the desktop, the task bar or the start bar.

After the successful start a welcome dialog opens once (Figure 12).

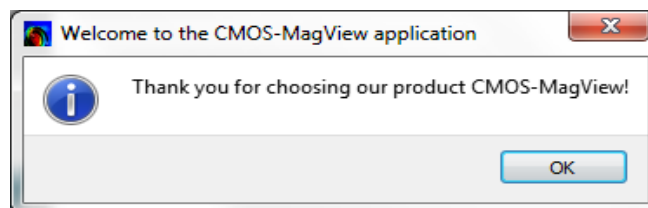


Figure 12: Welcome dialog

Next, the CMOS-MagView software is displayed as shown in Figure 13.

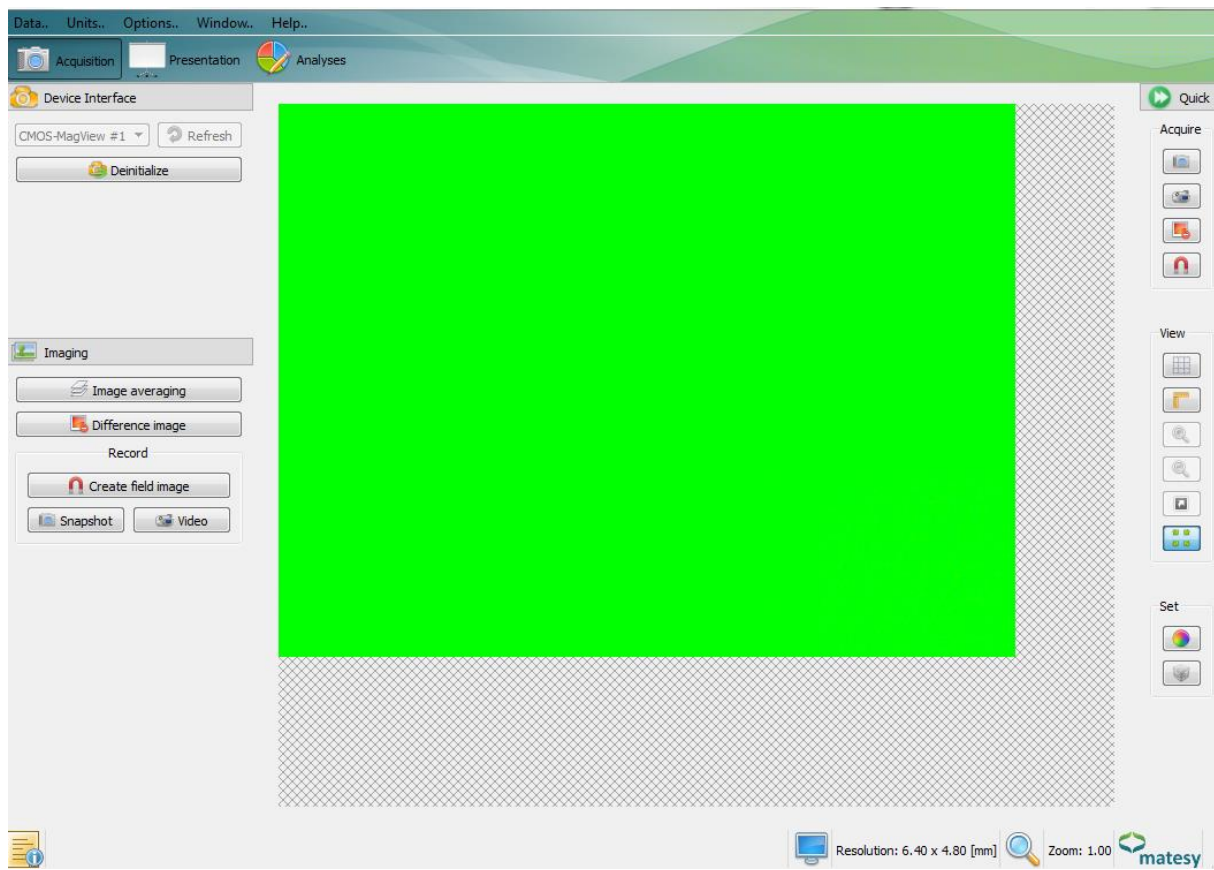


Figure 13: CMOS-MagView software

## 7.3. Software sections

The software is divided into 6 sections, as shown in Figure 14.

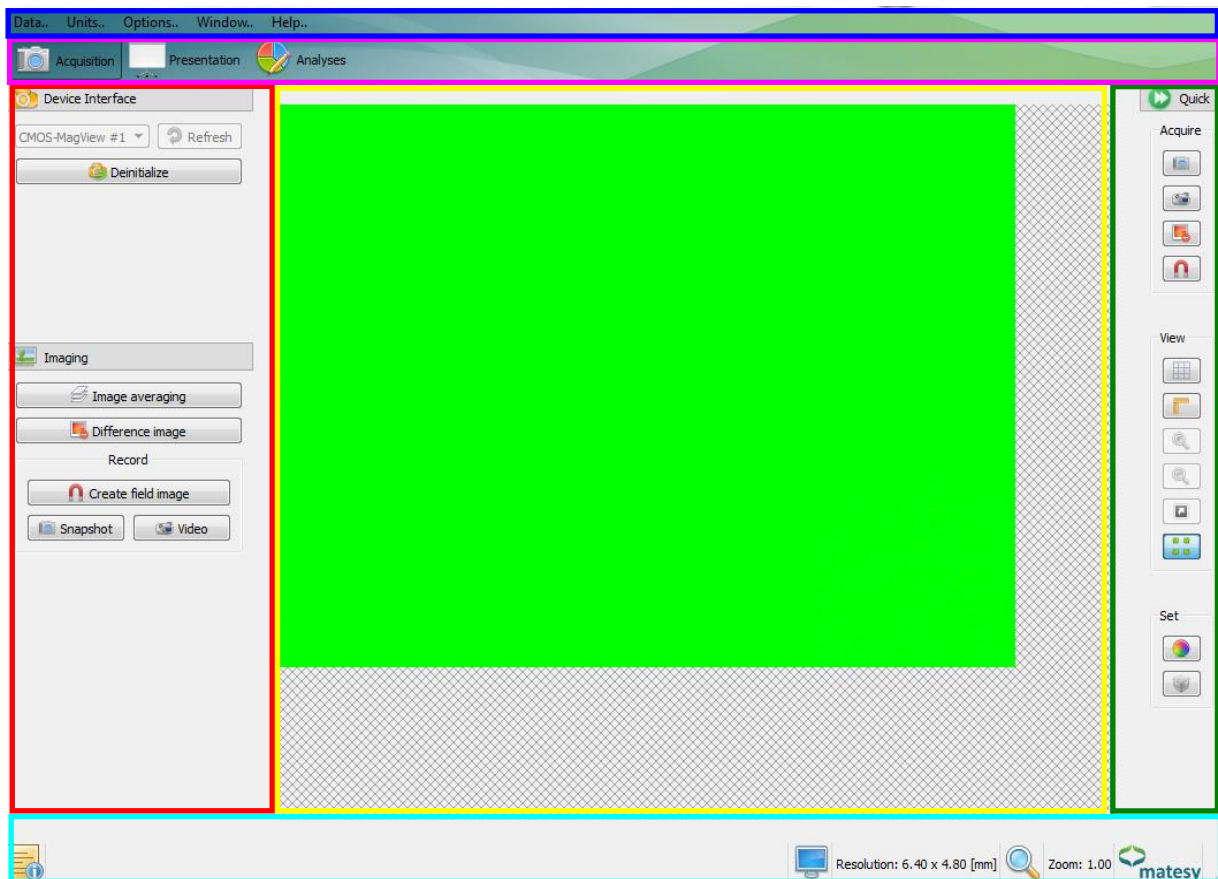


Figure 14: Software sections

| Legend | Meaning   |
|--------|---|
|        | Side bar (left), changes as the selected process advances.  |
|        | Displays the present image. Profiles are also captured in this section.   |
|        | Quick start bar (right) with the main functions of the software.  |
|        | Status bar displaying status tips of the graphic elements, the current image resolution and the magnification step.   |
|        | Progress bar divided into capture, presentation and analysis<br>Capture: Device interface and image capture<br>Presentation: 3-D presentation and color gradient scale<br>Analysis: Analysis of the image using profile tools |
|        | Menu bar with global settings   |

## 7.4. Menu bar

The program menu bar is located on top of the application (Figure 15). The menu bar contains 5 main menu items.



Figure 15: Menu bar

In the "Data" item the user can save images, data and the project, change the language or exit the program. The "Unit" item contains all units of the application. Field units, units of length and units of angle can be changed (Figure 16).

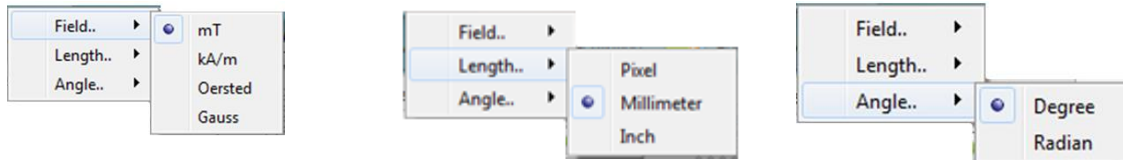


Figure 16: Available field/length/angle units

In the "Options" menu item, the user can open the configuration dialogs of the ruler or the grid. "Window" contains the items "Statusbar" and "Monitor", which enables or disables the appropriate dialogs.

The last item, "Help", opens the program help function and the "About" dialog.

## 7.5. Progress bar

The progress bar of the application (Figure 17) takes you through the different processes that can be handled with the application.

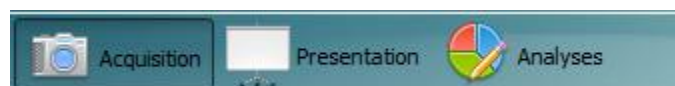


Figure 17: Progress bar


In "Acquisition", a device can be initialized, individual frames captured or the number of messages set for the image capture function.


In "Presentation", you can adapt the presentation of the image data. For example, you can obtain a 3-D rendering or the image data or adapt the color gradient profile.

The "Analyses" item provides a large number of measuring tools and tools for measuring objects or analyzing field values. In addition to the measuring tools, there are two evaluation dialogs, the status dialog and the profile dialog (line profile).

## 7.6. Quick-start bar

You can access the quick-start bar on the right at any time and from any mode (capture, presentation, or analysis). For example, this prevents frequent changes between the capture, presentation and analysis functions.

|   |  |
|---|--|
|  <p><b>Figure 18: Quick-start bar</b></p> | <p>Acquire:</p> <ul style="list-style-type: none"> <li>• Captures a single frame</li> <li>• Enables/disables the video mode</li> <li>• Prepares a difference image</li> <li>• Calculates the field image</li> </ul> <p>View:</p> <ul style="list-style-type: none"> <li>• Enables/disables the grid</li> <li>• Enables/disables the ruler</li> <li>• Zooms in</li> <li>• Zooms out</li> <li>• Resets zoom (x1.0)</li> <li>• Adapts the image size to the viewing size</li> </ul> <p>Set:</p> <ul style="list-style-type: none"> <li>• Opens the color gradient dialog</li> <li>• Displays a 3-D image</li> </ul> |
|---|--|

|   |   |
|---|---|
|  | <p>Please note that the viewing options “Adapt the image size to the viewing size”, “Enable/disable the grid” and “enable/disable the ruler” are only available on the quick-start bar.</p> |
|---|---|

## 7.7. Status bar

The status bar is located at the bottom of the application. (Starting left) the status bar contains summary information on the icons, the present image resolution, the present zoom and the company logo.

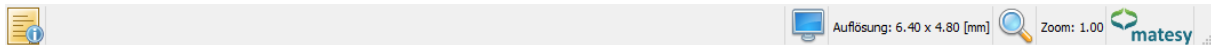


Figure 19: Status bar of the application

The summary information (so called status tips) show when you place the mouse pointer on them.

In addition to the quick-start bar, you can also set the zoom on the status bar (when the “Adapt the image size to the viewing size” is disabled). Click on the zoom to open the dialog in Figure 20.

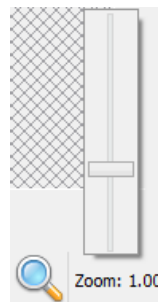


Figure 20: Zoom dialog on the status bar

## 7.8. Select language

You can choose the program language in the “Data” → “language” menu items (Figure 21).

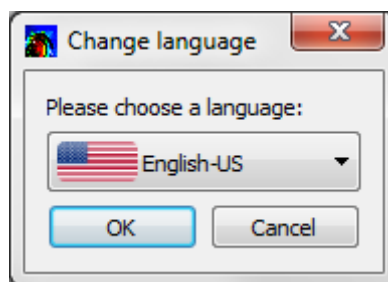



Figure 21: Language dialog window

At present, the CMOS-MagView software is available in German and English.

|   |  |
|---|--|
|  | <p>Please note that the language choice is stored in the background and that the language used last is restored automatically when the device software is started the next time.</p> |
|---|--|

## 7.9. Device selection (capture)

If you have not yet connected the magneto-optical measuring device CMOS-MagView or another magneto-optical measuring device that is also designed for this software to your PC, please do it now.

Figure 22 shows the device interface dialog with a list of all available devices in which new connected devices can also be found.

Click on “Refresh” for a list of all available devices.

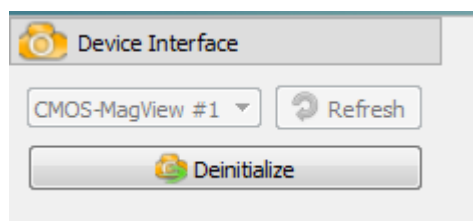



Figure 22: Device interface dialog of the software

Select a device and click on “Initialize” to enable its usage.

|  |   |
|--|---|
|  | <p>Following the initialization of the device, a difference image and an individual image will be generated automatically at first. Please take care that no magnetic specimen or other magnetic object is near the sensor while the images are being generated. If you have forgotten to remove the magnetic object from within the reach of the sensor, you can repeat the process manually (see chapter 7.10).</p> |
|--|---|

## 7.10. Image processing (capture)

The image processing dialog contains several functions required to generate images. A basic functionality is the “Snapshot” function which generates individual frames. In addition, the “Video” function when enabled captures single frames until it is disabled again.

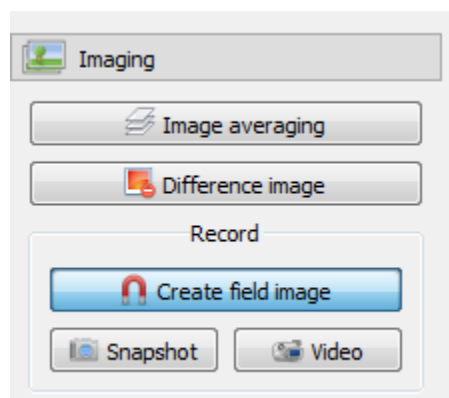




Figure 23: Image processing dialog



This dialog contains the options "Image averaging" which when enabled captures two images in succession and calculates the mean per pixel of both images. This function should be used if the noise level in the image is high.

|   |   |
|---|---|
|  | <p>The higher the averaging rate, the longer the user must wait for the display of a new image.</p> |
|---|---|


As mentioned in chapter 7.9, a new difference image can be generated manually or with the "Difference image" function.

|   |  |
|---|--|
|  | <p>The magneto-optical measuring device needs a warm-phase (thermal drift). For this reason, to compensate for this warm-up behavior, when the device is turned on, a difference image must be generated repeatedly during the warm-up phase prior to the image exposure with magnetic specimen. This is particularly important for the use of the measuring function.</p> <ul style="list-style-type: none"> <li>- 1-inch CMOS-MagView: 1 ½ hours</li> <li>- 3-inch CMOS-MagView: 3 hours</li> </ul> <p>It is recommended to see that the time window between two difference images during the warm-up phase is not longer than 30 seconds.</p> |
|---|--|

The "Create field image" function must be enabled if you want to display the measuring values in a field unit.

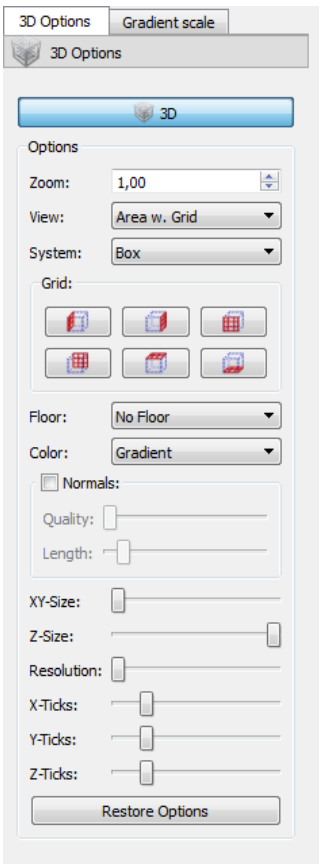
## 7.11. 3-D options (presentation)

In addition to viewing the measuring values in a 2-dimensional image, the CMOS-MagView software can also display them in 3-D.

|   |  |
|---|--|
|  | <p>For the 3-D display, the X- and Y-positions of each pixel are transferred into a three-axis coordinate system. The Z-component reflects the intensity / field values of the measuring data.</p> |
|---|--|

A 3-D view can only be generated if a single image is available. If this is the case, the 3-D view can be enabled by pressing the 3-D button (Figure 24). The 3-D view is displayed until the button is pressed again.

Enabling the 3-D display function also enables the controls for using the 3-D view.



**Figure 24: 3D-Dialog**

- “3D” enables/disables the 3-D of an individual image.
- The Zoom setting controls the enlargement of the display.
- The View option adapts the presentation of the 3-D data.
- The System option changes the display of the frame.
- The Grid option enables/disables the side grid.
- The Floor option displays data or an iso profile on the bottom of the coordinate system.
- The Color option changes the fill of the different areas.
- The “Normals” option displays the normal vectors of the areas and their quality / length adapted.
- The XY-Size spreads out the coordinate system in the plane.
- The Z-Size spreads the coordinate system along the Z-axis.
- The Resolution option increases the number of pixels.
- The X-Ticks option divides the X-axis into several sections.
- The Y-Ticks divides the X-axis into several sections.
- The Z-Ticks divides the X-axis into several sections.
- “Restore Options” restores all default settings.

## 7.12. Gradient scale (presentation)

The gradient scale in Figure 25 represents the colors of the image displayed. This dialog merely contains the graphical representation of the color scale.

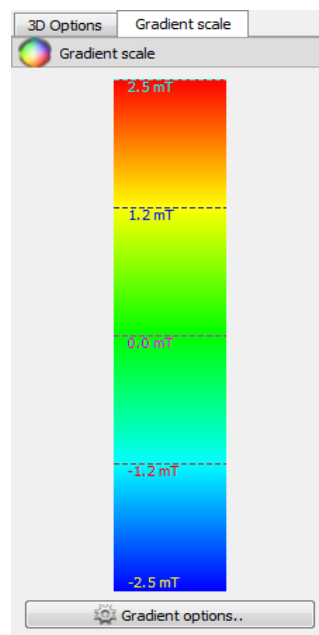


Figure 25: Gradient scale (dialog)

Press the “Gradient” button to open the configuration dialog for the color gradients (Figure 26).

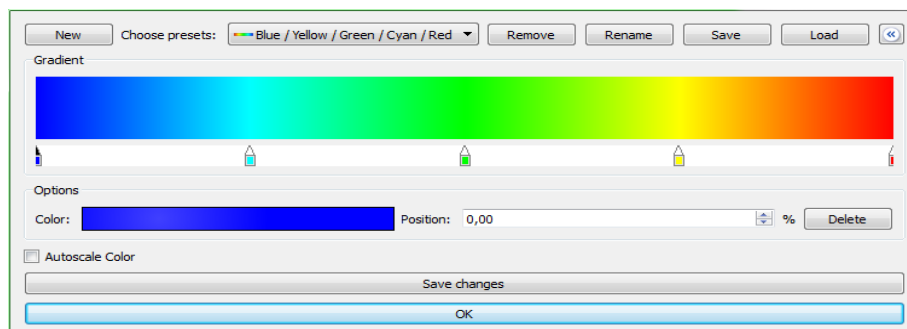


Figure 26: Color gradient dialog

As default, the configuration dialog has two predefined color profiles:

- False colors (blue, cyan, green, yellow, red)
- Gray scales (black, white)

If you dislike these profiles or the measuring data colors follow a different definition scheme in your firm, you can create a new profile with the “New” function. This opens the dialog in Figure 27 where you can give the new profile another name.

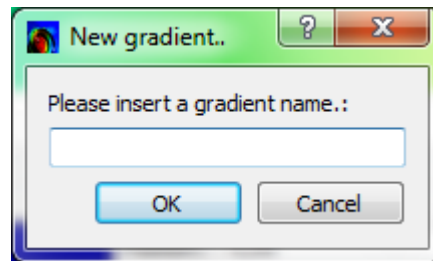


Figure 27: Color profile name



A name can only be used once. The maximum length of the name is limited to 255 characters. If a name already exists or is longer than 255 characters, the software will tell you. The same applies if you want to rename an available profile.

When a name for the profile has been fixed, the new profile is available under that name and can be adapted as needed. New profiles are pre-initialized with a black-to-white gradient.

For example, if you want to change the limits of the color gradient, highlight one of the position markers under the displayed color gradient with a left mouse click. A highlighted marker can be identified by black color of the tip. Every marker has a position and a color that can be changed. For that, click on the color field in the options group after highlighting the marker. This opens a dialog window in which you can define your new color. Besides, you can set the position of the marking (also within the options group) in per cent. You can reposition a marker also by dragging it to the new position with the left mouse key pressed.



Every change of the color profile is adopted and applied directly. The only exception is the position function, for which "Save changes" must be pressed.

You can add new markers to the color gradient by clicking on a free position on the marker bar. The default color of a new marker is black.

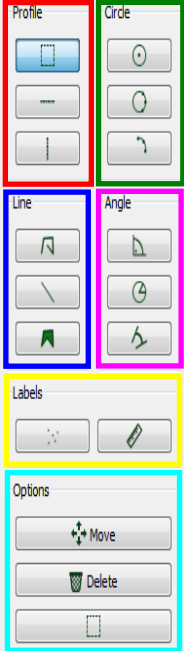
If you want to delete a marker, highlight the marker and click on "Delete" in the options group.



Please note that a color gradient must include at least two colors. When you try to delete a colour from a gradient with two colors, the software will tell you.

## 7.13. Image markings (analysis)

The image marking dialog can be found in the analysis sector. The dialog offers several options for analyzing the visualized magnetic field. Following below is a description of the groups.


| Image  | Section | Description   |
|--|---------|---|
|  |         | The Profile section serves three functions. The “free marking tool” can be positioned at random. The “horizontal/vertical marking tool” has a fixed height/width of 1 pixel. Generally, these functions are „pulled open” in the image when enabled with a right mouse click.   |
|  |         | The “Circle” section also comprises three functions. The first circular profile opens a circle from one corner (right mouse key pressed). The three-point circle draws a circle through the three points set with the right mouse button. The arc, like the three-point circle, is drawn from three points.                       |
|  |         | The “Line” section can be used for length and area measurements. The length of contours of any shape can be measured with the length measuring tool. The second tool measures distances between points (pull with the right mouse button pressed). Surface areas can be measured with the last tool.                              |
|  |         | The “Angle” section is needed for angle measurements. The first two tools define an angle from a center. This is done by drawing a radius with the depressed right mouse key and setting the angle position with another right mouse click. The last tool measures any angle by setting four individual points.                   |
|  |         | The “Labels” section contains two functions. The first tool is a counter tool and also acquires artefacts (right click). A scale bar can be drawn with the second tool (right mouse key pressed).   |
|  |         | The “Options” section comprises functions for shifting and deleting image markers. Both functions always relate to the enabled marker. Enable the shift function and shift the marker with the depressed left mouse key. The last function is a free marking tool by which an image section can be preselected for later storage. |

## 7.14. Statistics (analysis)

In addition to the image markers, which are displayed graphically in the image or marked off in the line profile, the Statistics function provides data relating to the active image marker (Figure 28).

| Statistics |                        |
|------------|------------------------|
| X-Pos:     | 1.28 mm                |
| Y-Pos:     | 1.69 mm                |
| Width:     | 16.29 mm               |
| Height:    | 9.04 mm                |
| Minimum:   | -1.9 mT                |
| Average:   | -1.0 mT                |
| Maximum:   | 1.7 mT                 |
| Acreage:   | 147.34 mm <sup>2</sup> |

Figure 28: Statistics

|  |   |
|--|---|
|  | <p>Values of minimum, average or maximum are <b>not</b> comparable with the values of the line profile. The Statistics dialog always displays the global maximum / global minimum within the marked area.</p> |
|--|---|

The Statistics dialog changes depending on the active image marker. For example, a circle marker displays radius and circumference values (Figure 29), a square marker, on the other hand, shows height and width data (Figure 30).

| Statistics     |                       |
|----------------|-----------------------|
| X-Pos:         | 0.94 mm               |
| Y-Pos:         | 2.10 mm               |
| Minimum:       | -1.9 mT               |
| Average:       | -0.6 mT               |
| Maximum:       | 1.7 mT                |
| Radius:        | 4.54 mm               |
| Diameter:      | 9.09 mm               |
| Circumference: | 28.56 mm              |
| Acreage:       | 64.90 mm <sup>2</sup> |

| Statistics |                        |
|------------|------------------------|
| X-Pos:     | 1.28 mm                |
| Y-Pos:     | 1.69 mm                |
| Width:     | 16.29 mm               |
| Height:    | 9.04 mm                |
| Minimum:   | -1.9 mT                |
| Average:   | -1.0 mT                |
| Maximum:   | 1.7 mT                 |
| Acreage:   | 147.34 mm <sup>2</sup> |

Figure 29: Statistics (circle profile)      Figure 30: Statistics (square profile)

## 7.15. Profiles (analysis)

A section with several analytical dialogs is located under the displayed image. You can toggle between the dialogs using the profile view in Figure 31.



Figure 31: Profile view

Depending on the enabled image marker, the line profile (horizontal / vertical) displays the image data in values in a 2-axis coordinate system.

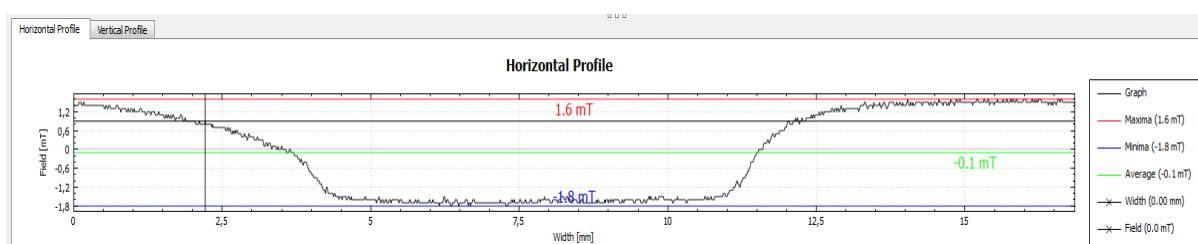




Figure 32: Line profile

As default, markings by the following tools mark off data within the dialogs:

- All tools from the **profile section**
- All tools from the **circle section**

|   |  |
|---|--|
|  | <p>Please note that a graph produced with the free marking tool always calculates a mean of the marked data if the profile is wider (f. vertical) or higher (f. horizontal) than 1 pixel.</p>  |
|  | <p>Please also note that circle profile data is marked off simultaneously without affiliation within the horizontal and vertical line profile. Thus in case of a circle profile there is no difference between the dialogs/values.</p> |
|   | <p>Circles are always drawn in clockwise direction, starting at 0 degrees (top center).</p>  |

Movement options:

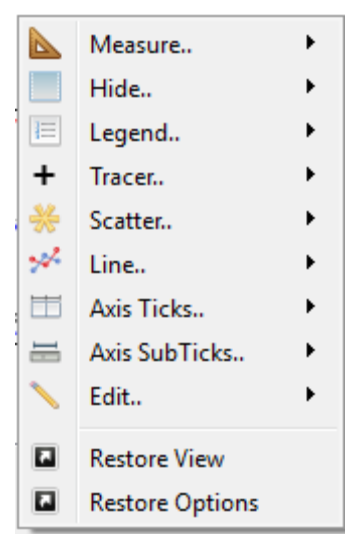
- The display of the line profile can be moved with the left mouse key depressed.
- Scrolling up (zooming in) the mouse wheel increases the viewing field Scrolling down (zooming out) the mouse wheel decreases the viewing field


Shortcut functions:

- A double-click on the title opens a dialog for changing the title
- A double-click on one of the Y-axes opens a dialog for scaling the respective Y-axis. The axis is scaled between the minimum and maximum entered.

- Double click on one of the X-axes opens a dialog for scaling the respective X-axis. The axis is scaled between the minimum and maximum entered.
- Right click on the line profile opens a menu for adapting the view.

The right click menu of the profile as seen in Figure 33 has several options for adapting the different graphical elements, e.g., scaling of axes and other helpful functions:

|   |   |
|---|---|
|  <p>Figure 33: Right click menu of the line profile</p> | <ul style="list-style-type: none"> <li>• Measure defines absolute or relative measuring mode</li> <li>• Hide: Elements not required can be hidden</li> <li>• Legend: Position of the legend (left / right)</li> <li>• Tracer: Shows the tracer</li> <li>• Scatter: Displays the measuring values</li> <li>• Line: Displays the graphs</li> <li>• Axis Ticks: Axial division increments</li> <li>• Axis Sub Ticks: Number of section of an axis</li> <li>• Edit: Edit title, adapt X- and Y-sections</li> <li>• Restore View (complete graph can be viewed)</li> <li>• Restore Options (restore default settings)</li> </ul> |
|---|---|

|   |  |
|---|--|
|  | <p>Please note that adaptations in the right click menu apply only to the profile in which you make the right click.</p> |
|---|--|



## 7.16. Grid settings

Open the grid settings on the menu bar "Options → "Grid settings". The grid settings in Figure 34 support the complete adaptation of the grid (Quick-start bar → Grid). In the first dialog, you can set the color, transparency, line style, line thickness, width and height as you want. In addition to the main grid, you can enable a sub-grid, which you can configure in the same way as the main grid.

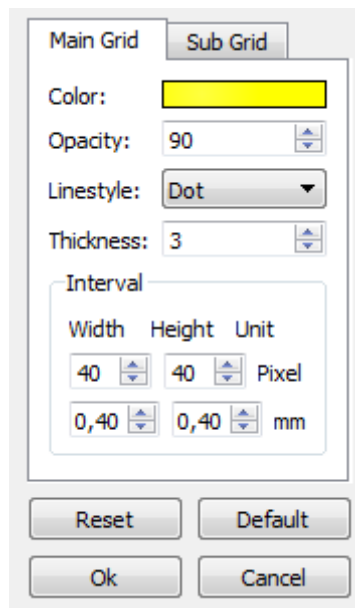




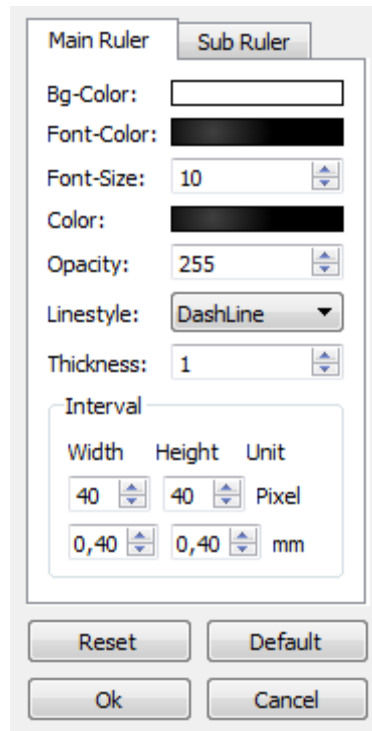
Figure 34: Grid setting dialog

|   |  |
|---|--|
|  | Please note that the width / height below the pixel setting depends on the length setting of the application. You can change to another length unit in the menu bar "Units" → "Length" |
|---|--|

|   |  |
|---|--|
|  | Ensure that the values entered for width/ height are sufficiently large; otherwise the application may be exited in uncontrolled fashion when the grid is enabled. |
|---|--|

## 7.17. Ruler settings

As with grid settings, you can also make settings for the ruler. On the menu bar, go to “Options” → “Ruler”. The ruler setting dialog in Figure 35 opens.



The dialog box for ruler settings is titled 'Main Ruler' and 'Sub Ruler'. It contains the following settings:

- Bg-Color: [Color selection box]
- Font-Color: [Color selection box]
- Font-Size: 10 [Spin box]
- Color: [Color selection box]
- Opacity: 255 [Spin box]
- Linestyle: DashLine [Dropdown menu]
- Thickness: 1 [Spin box]
- Interval section:
 

| Width           | Height          | Unit  |
|-----------------|-----------------|-------|
| 40 [Spin box]   | 40 [Spin box]   | Pixel |
| 0,40 [Spin box] | 0,40 [Spin box] | mm    |

Buttons at the bottom: Reset, Default, Ok, Cancel.

Figure 35: Ruler settings

The ruler settings comprise background/font/highlighting color, font size, transparency, line style and line thickness setting options. In the „Interval“ section, you can set the ruler increment. The “Width” option controls the ruler increment at the upper end of the application, and “Height” affects the ruler on the left edge of the application. In addition to the main ruler, a sub-ruler can be displayed which subdivides the main increment.



Please note that the width / height below the pixel setting depends on the length setting of the application. You can change to another length unit in the menu bar → “Units → “Length”.



Ensure that the values entered for width / height are sufficiently large; otherwise the application may be exited in uncontrolled fashion when the ruler is enabled.

## 7.18. Monitor

The image of the CMOS-MagView is often larger than the resolution of the monitor screen. For this reason, several viewing options are available to view the full image (see chapter 7.6). If you view the original size image you should enable the monitor window to know where in the image you are. The monitor window can be turned on and off on the menu bar under "Window" → "Monitor".

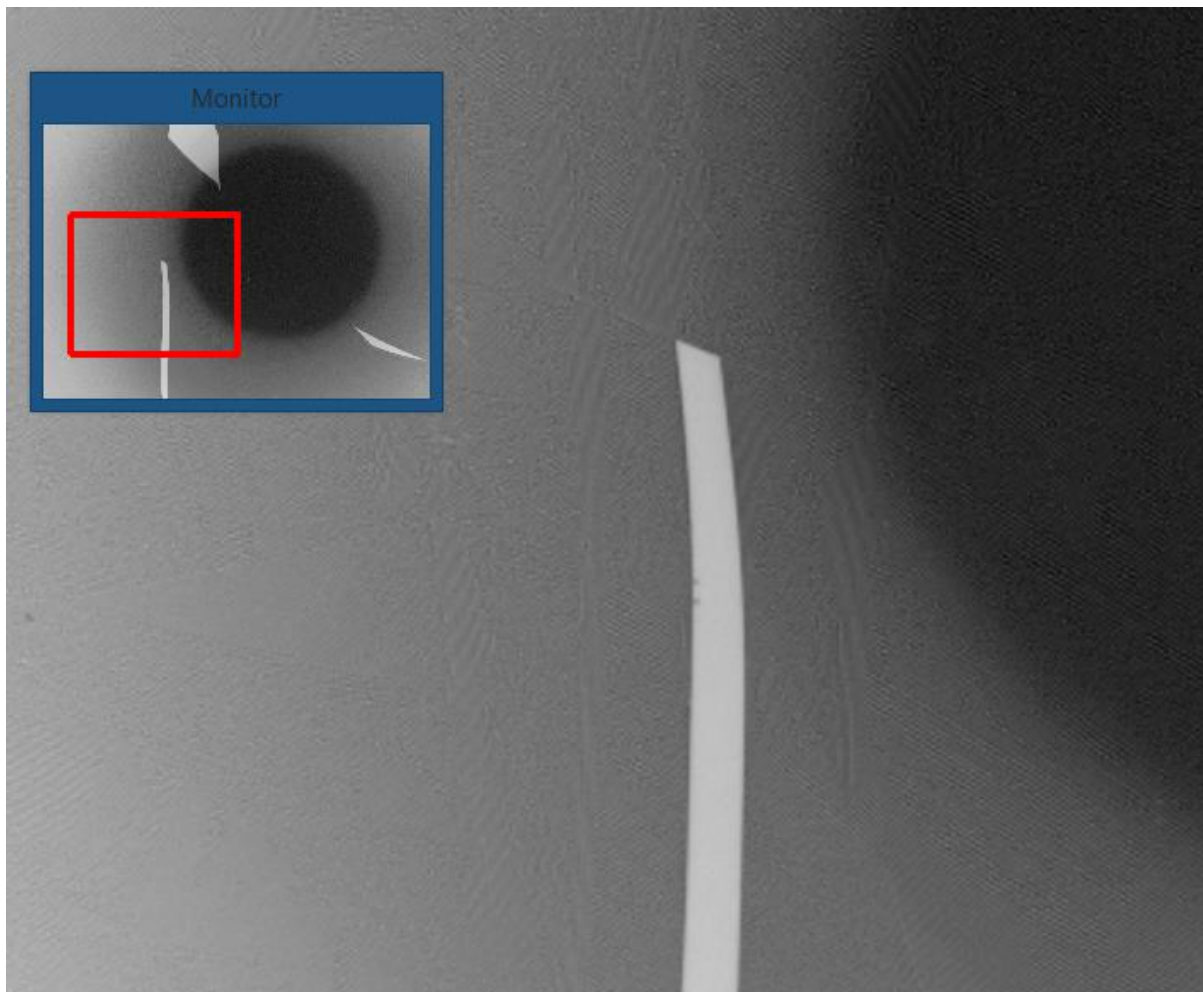


Figure 36: Monitor window

The field in the red frame within the monitor window marks the viewing range of the image. You can move the red frame with the depressed left mouse key. The position of the image section will change.



Please note that you cannot shift the position of the red frame in the window when the option "Adapt the image size to the viewing size" is active.

## 7.19. Image area

The image area in Figure 37 is located in the center of the application.

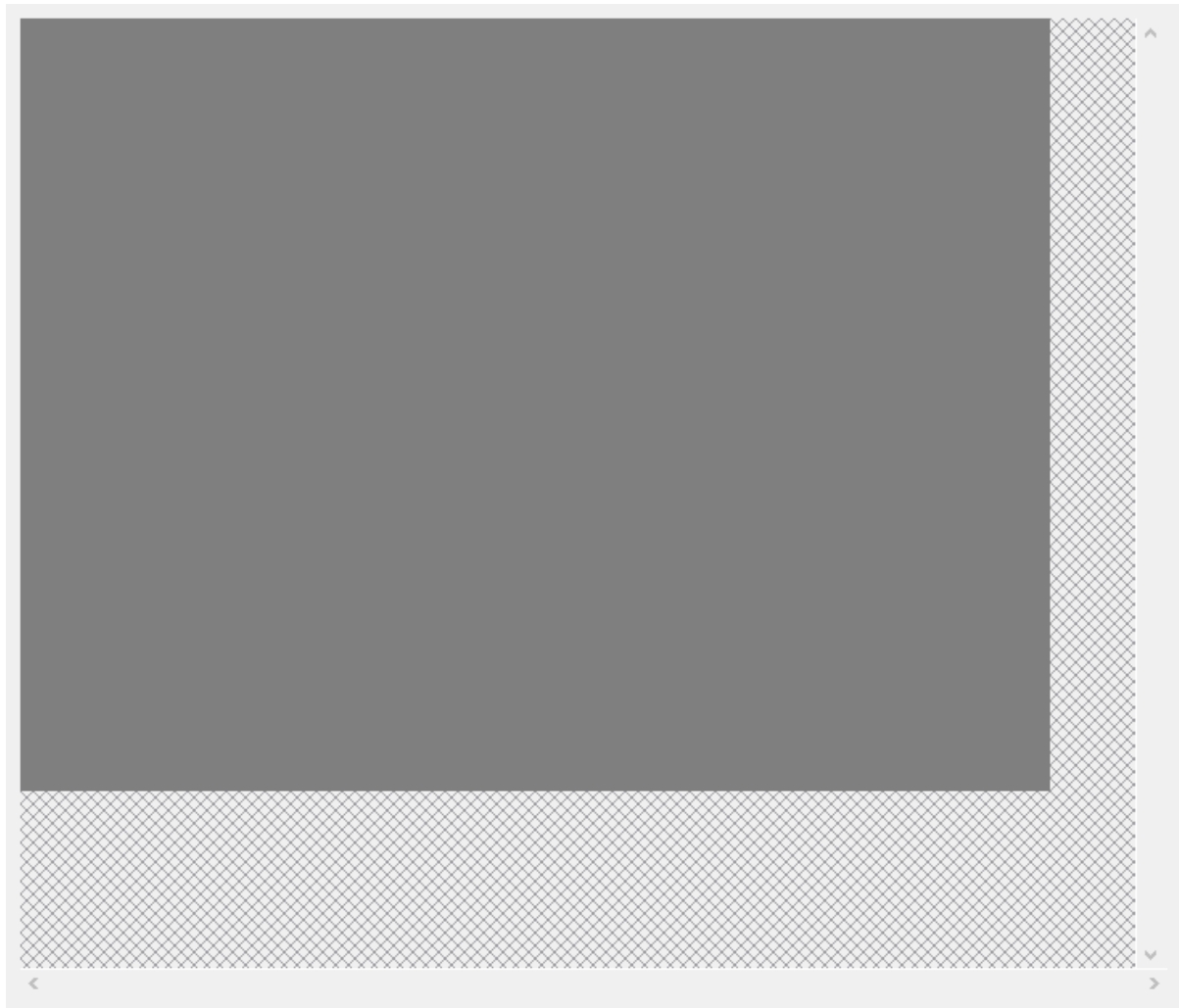




Figure 37: Image area of the software

The images captured are displayed in this area. There are two scroll bars on the right and at the bottom of the image area. The images can be shifted by means of the scroll bars. In addition, the image can be shifted with the depressed left mouse key.

|   |  |
|---|--|
|  | Please note that the image cannot be shifted with the left mouse key when the “Move” option in the analysis dialog is enabled. |
|---|--|

The zoom of the image can be changed with the mouse wheel.

|   |   |
|---|---|
|  | Please note that the image cannot be shifted by the scroll bars and the zoom cannot be changed with the mouse wheel when the “Adapt the image size to the viewing size “ option is enabled. |
|---|---|

For fine positioning of the marking within the image, press the shift key once with the "Adapt the image size to the viewing size" option enabled. A little red window opens within the image area – as shown in Figure 38. You can use the required marking tools as usual after enabling the local enlargement function. Press the shift key once more to disable the function.

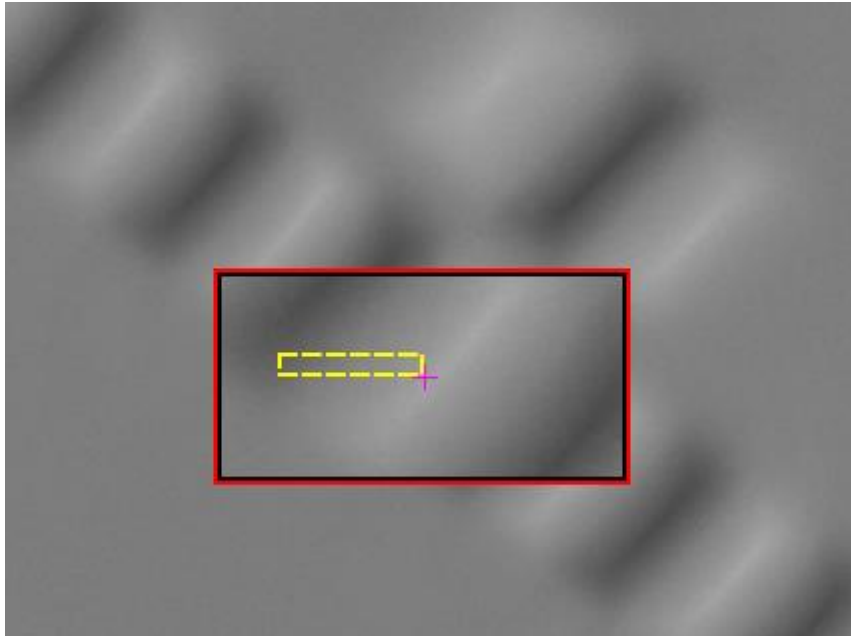


Figure 38: Local zoom function for fine positioning in the downsized image



Please note that this function can only be enabled/ disabled when the image has the focus. To obtain a focus on the image, click on the image with the left mouse key once.

## 7.20. Saving images



This chapter describes the procedure of saving images. Stored images (PNG/BMP/TIFF/JPEG) cannot be loaded/imported by the CMOS-MagView application. The image import is covered in the next chapter.

To save an image, open the save dialog (Figure 39) on the menu bar "Data" → "Save image".

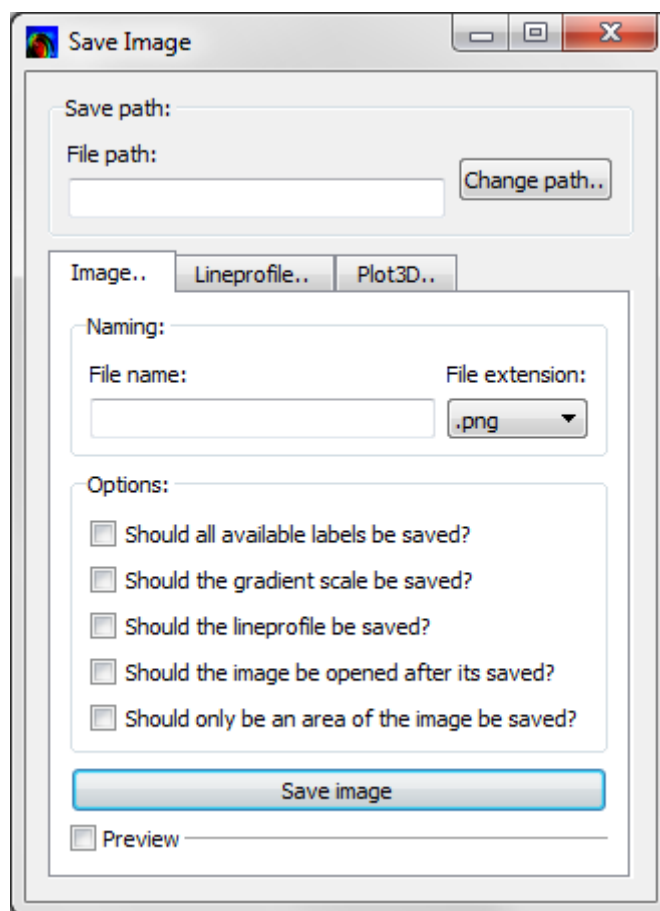


Figure 39: Image save dialog

The image save dialog has several settings, which will be explained below.

Please specify the destination folder at the top of the window. Click on “Change path” and select the target folder in which all images will be saved.

As the next step, enter a name of the image in “File name”. You can specify an image format in “File extension”. Then you can decide whether available labels will also be saved. “Labels” here refers to **all** additional information/markings which you have entered in the image via the software. You can also save the color distribution as “Gradient scale” on the left or right of the image. Next, you can save the “Lineprofile” above or below the image.

The option “Open image after saving” opens the image after it has been saved.

If you are interested only in certain sections of the image and you only want to save that area, use the option “Saving of an area of the image”. When you enable this option, a downsized view of the image is displayed in which you can mark the interesting area with the depressed right mouse key.

Finally, you can enable the “Preview” option to view the image at this point; you may want to make further changes before you save the image.

The image save dialog also has options for saving the “Lineprofile” or the “Plot 3D” separately, in addition to the conventional image save option (see Figure 40).

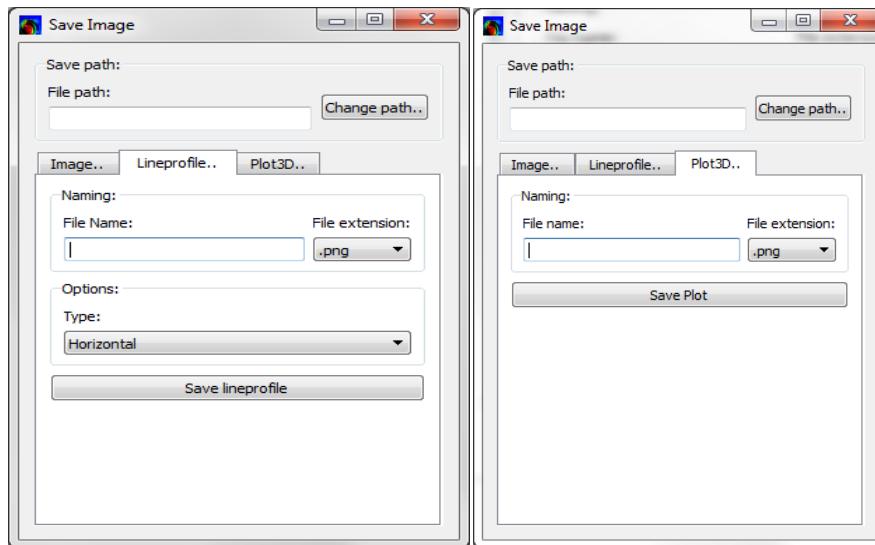



Figure 40: Save dialog for line profile and 3-D view

As with saving an image, you can enter a file name and a file format in the line profile dialog. You can save the horizontal profile and the vertical profile separately.

|   |   |
|---|---|
|  | <p>Please note that if you want to save the 3-D view of the image, you must at first render the image in 3-D format before you can save it.</p> |
|---|---|

## 7.21. Save/load a project

To load and edit an earlier measurement with the CMOS-MagView software, the current measuring values must be exported. For this, go to “Data” → “Export data” on the menu bar. A save dialog as in Figure 41 opens in which you can define the target folder and enter a target name. The file format is fixed.

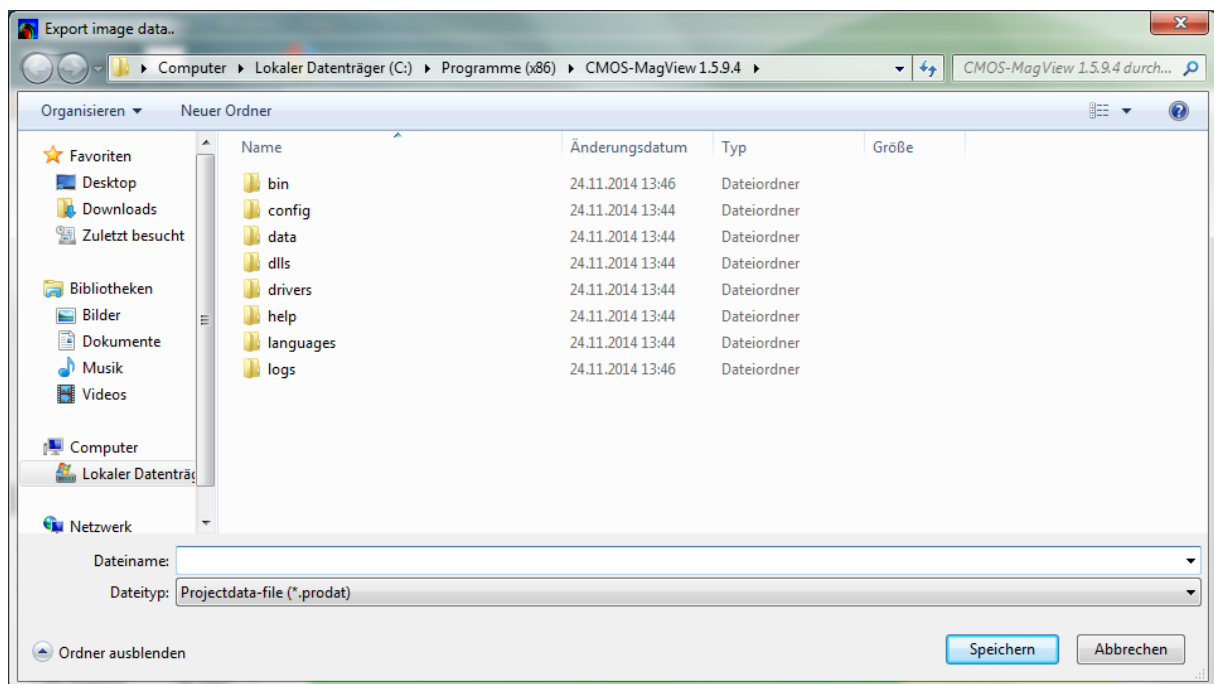


Figure 41: Saving a project (export)

After saving the project data (\*.prodatt), you can import the saved measuring values in the application at any time with "Data" → "Import data" on the menu bar. After importing the data you can analyze/edit the image in every respect the software supports.

## 7.22. Saving measuring data

In addition to saving the image (PNG/BMP/..) and saving a project, you can also save selected measuring data. For this, go to "Data" → "Save data" on the menu bar. A dialog as in Figure 42 opens in which you can select the measuring data you want to save.

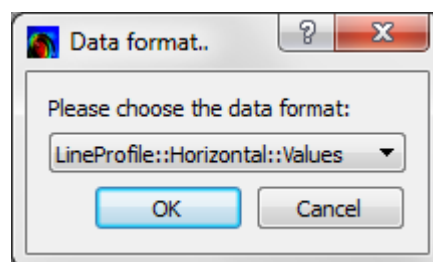


Figure 42: Saving measuring data

At present, there are four options to save the measuring data:

- Complete image as digit values
- Complete image as field values
- Measuring data of the line profile (horizontal)
- Measuring data of the line profile (vertical)

Measuring data files are saved in CSV format.



## 8. Sample application

After initializing the system and completing the warm-up phase<sup>2</sup>, you can start using the system.

Generally, to minimize possible defects, if any, of the sensor's mirror layer and any inhomogeneity of illumination, the system produces difference images.

A difference image is produced directly after the initialization and the user at first views a homogeneous area in the color set for the zero field.


### 8.1. Guide to quick use


All functions are described in detail in chapter 7. The most important functions will again be described briefly with reference to examples.




Images are captured and processed best in the tab where the viewable sectors "Acquire" and "View" and also the sector "Image Labels", statistics and the chart sector are available.

#### Acquire sector







By pressing the  key in the Acquire field, a new difference image can be generated at any time. This may be necessary when the system is still warming up, when the sensor displays remanent domain structures that disturb the image, or when a test specimen with several different magnetizations is analyzed.

The  key must be enabled for calculating fields when an appropriate calibration is available in the program. (The system can be recalibrated if necessary.)

For positioning a specimen and for making settings, the  key can be enabled. It takes care that individual images are generated continuously.

Finally, the  generates a single image.

#### View sector

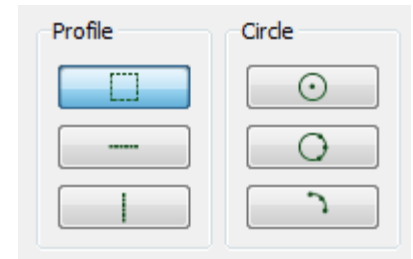
The switches , , , , ,  support direct settings of images by showing a grid, a ruler, an upsizing and a downsizing option, a 100% setting and an adaptation to the active window size.

The colors and a 3-D display of the measuring data are defined in the **Set** section.

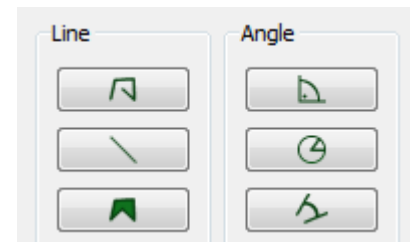
<sup>2</sup> For field measurements, wait for the completion of the warm-up phase, for qualitative images of the field distribution, merely take care that inhomogeneities and faults are not getting out of hand.

## The **Image Labels** section

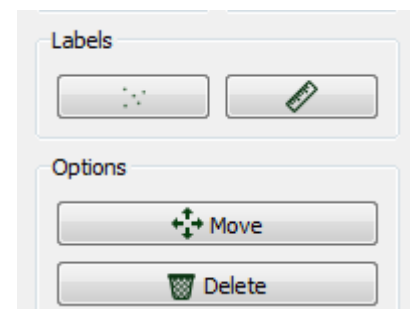
Profiles, vertical and horizontal lines as well as circles and arcs can be marked in the marking field. Data is then displayed in the chart section and in the statistics field.



In addition, lines, angles and areas can be defined. The appropriate data record is displayed in the statistics field.




Points and a scale can be inserted in Labels.




In the Options sector, all displayed markings can be shifted and deleted and a sector can be marked for later printing or saving.

## 8.2. Example of a linear encoder

The following Figure 43 and Figure 44 show a linear scale on four different sensors. Possible types sensor types: (1) D-sensor without bias field, (2) A-sensor, (3) B-sensor, and (4) C-sensor.

The presentation of the scale by the sensors depends on their properties. The color display is individual and can be changed with the  switch at any time.

The square tool  was used for marking an area. That area is then displayed in the bottom chart. "Horizontal profile", in this case, means that data is displayed from left to right. A message with all values for every measuring point is provided in a line, which is vertical in this case. Matters are reversed with the vertical profile. The presentation of the field information varies with respect to the different sensors. Therefore, a precondition is that the right sensor is selected for a particular task.

The C-sensor is used for fields over 31 kA/m. (Typical for near-surface examinations on permanent magnets on rare earth basis).

The B-sensor is preferred for fields up to 30 kA/m and for measuring fields (scales, fields at a distance above rare-earth based magnetic structures)

The A-sensor (2 kA/m) is good for small fields (magnetic steel sheet, forensic examinations)

The D-sensor (6 kA/m) is the sensor of choice for bias field applications (additional field in the sensor plane) (bank note examinations, forensic examinations)

Due to the hysteresis-low Faraday curve the D-sensor can replace the A-sensor (which has a stronger hysteresis near its saturation point).

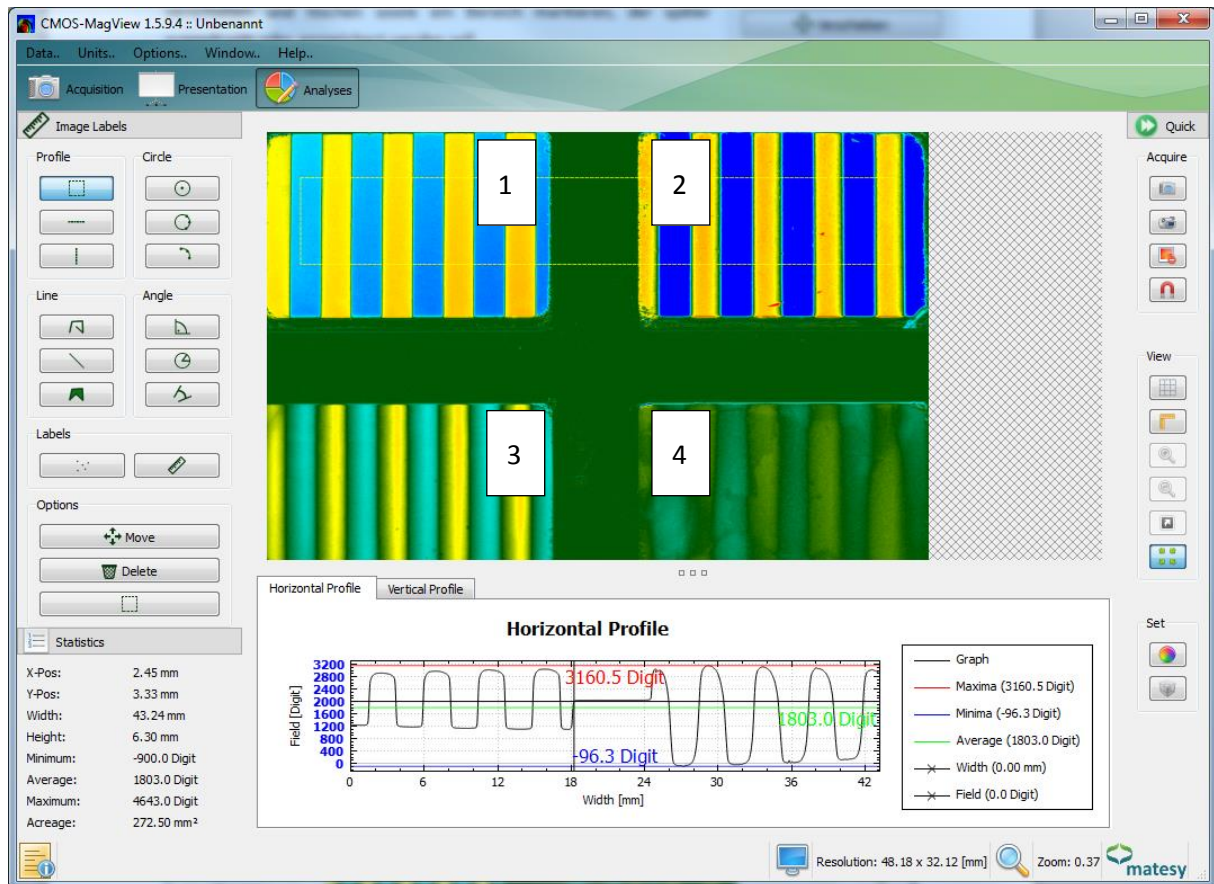


Figure 43: Linear scale on four different sensors.

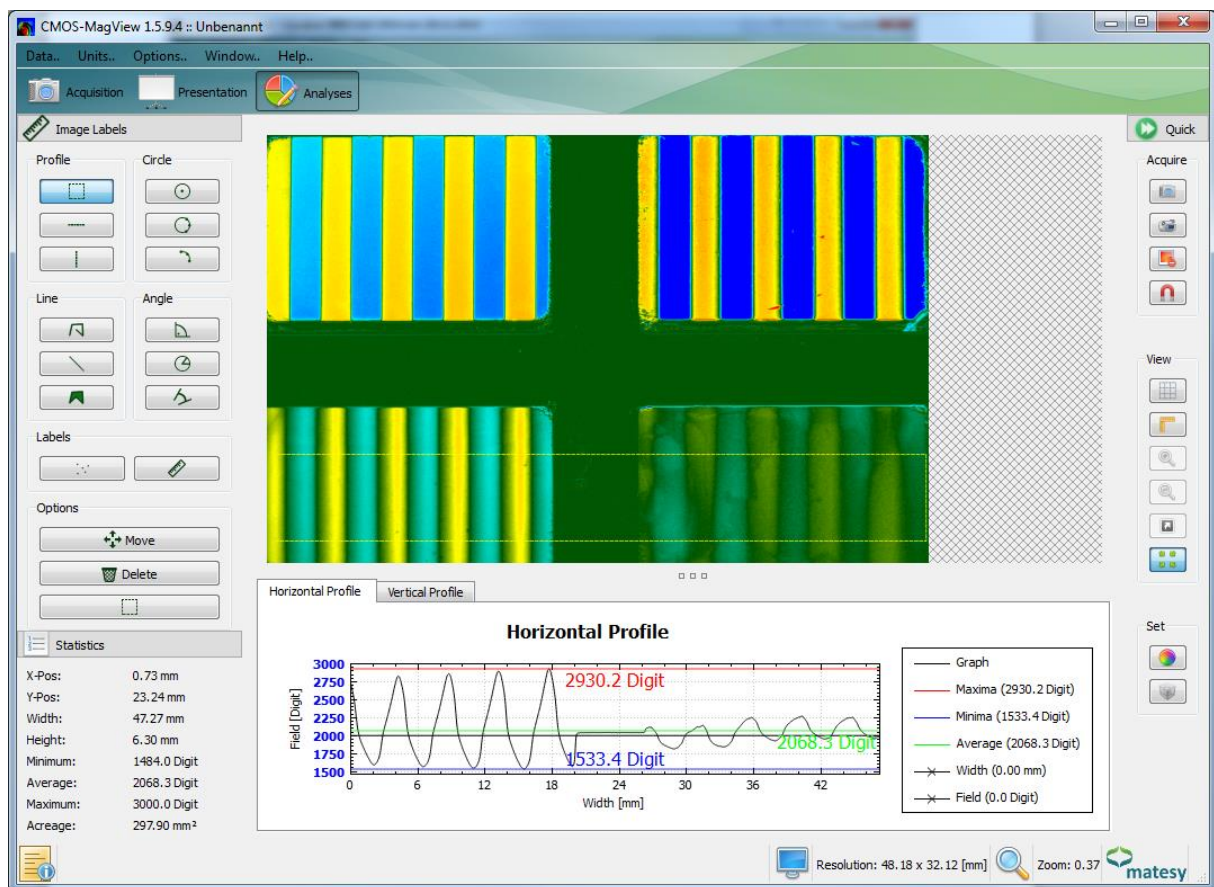


Figure 44: Linear scale with the display of the B- and C-sensors in the chart.

Table 1: Typical Faraday loops for the sensors D, A, B, and C.

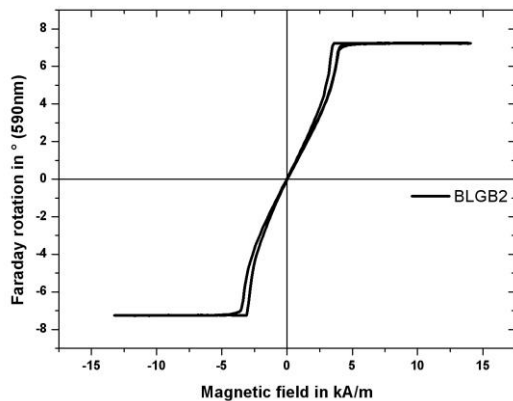


Figure 45: D-sensor with saturation at approx. 5 kA/m and with bias field option for analysis also of magnetically soft inks.

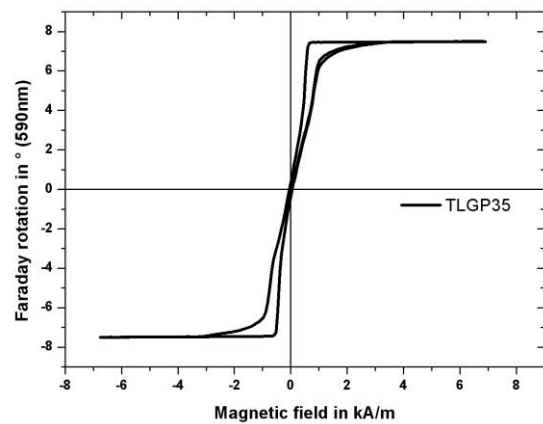


Figure 46: A-sensor with saturation at 1-2 kA/m for highest field sensitivity.

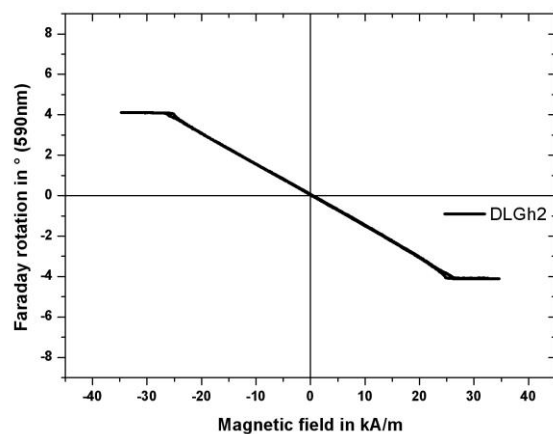


Figure 47: B-sensor with linear characteristics for fields up to 30 kA/m.

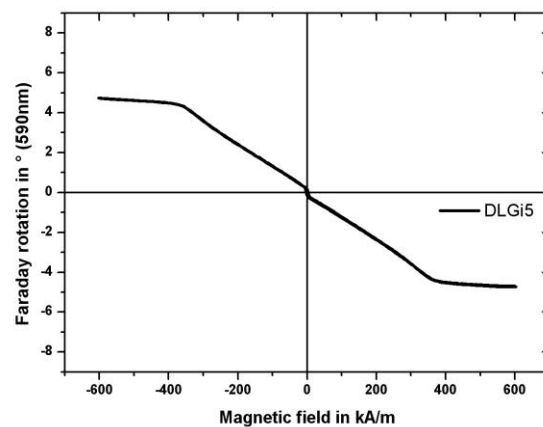


Figure 48: C-sensor with linear characteristic up to 130 kA/m for analysis of permanent magnetic structures.

In addition, circles and arc at the perimeters of which fields can be marked off in the chart can be defined with the circle tools.

Length, angle and area measurements are made intuitively using the appropriate buttons.

The angle measurement is illustrated in the following Figure 49.

This can be done by defining the center, a circle and the angle, or two straight lines between which the angle is defined.



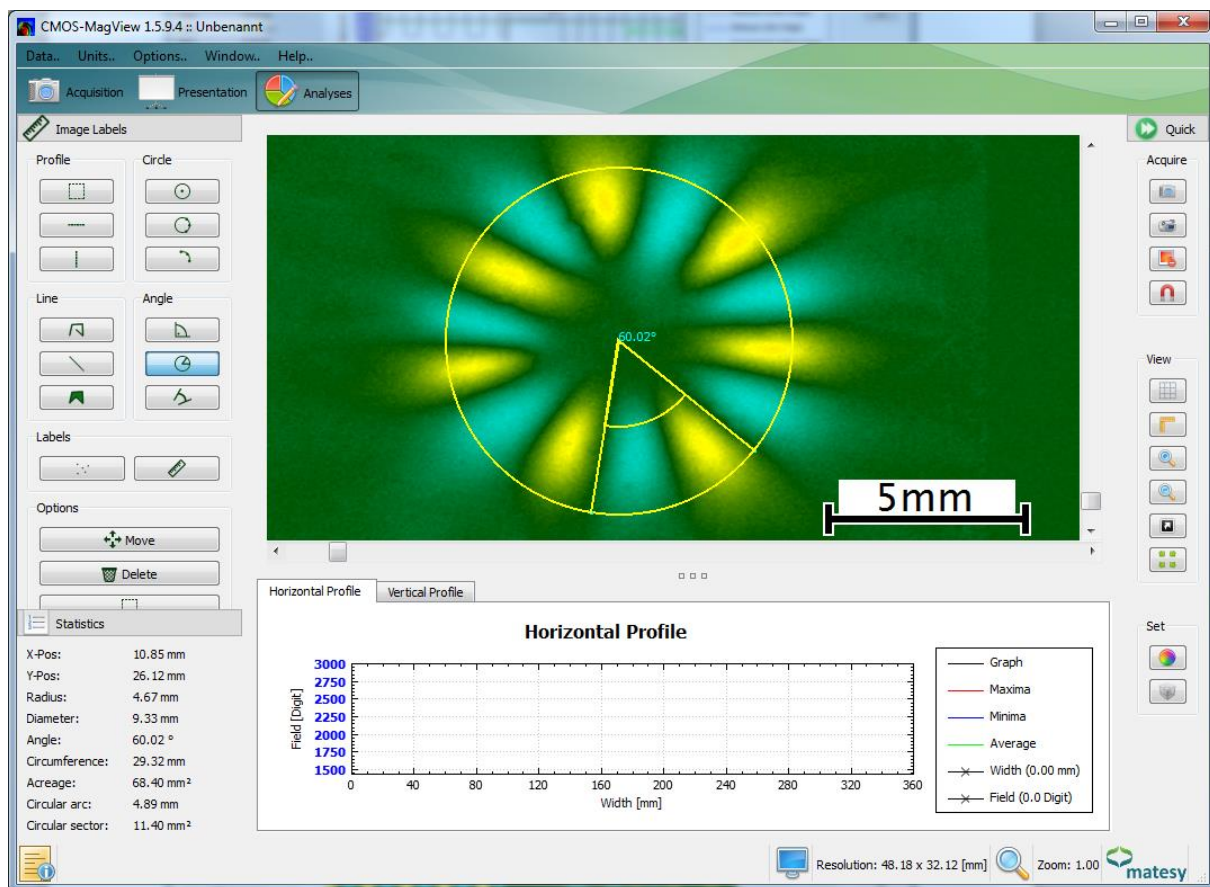


Figure 49: Angle measurement of a magnetic structure using the appropriate tool.

## Using the difference image

The purpose of the difference image is not only that of eliminating interference but it can also be used for amplifying weak information. The following Figure 50 shows the same linear scale on a C-sensor against a field-free measuring and in Figure 51 against itself shifted by half a period. In addition to the signal amplification by factor two the image lacks the interferences caused by the different domains.

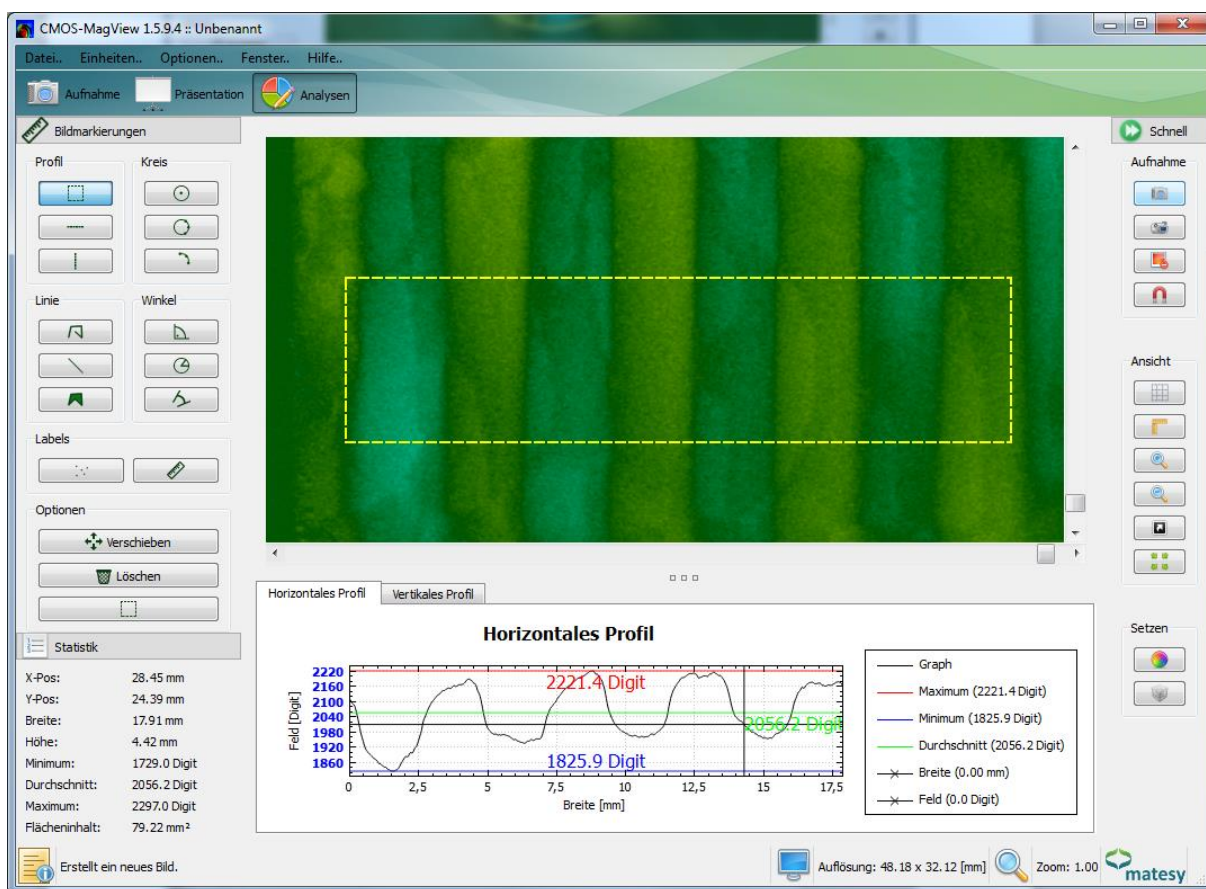
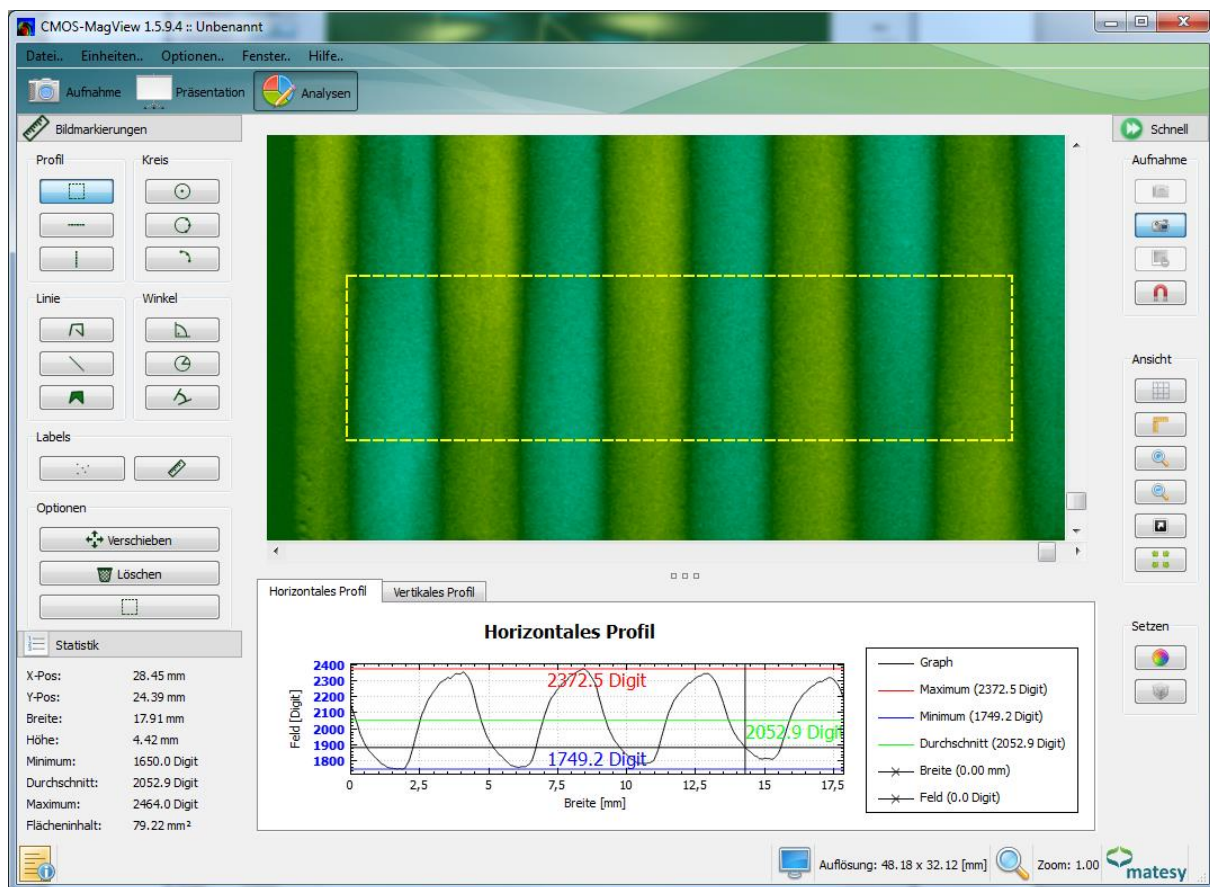


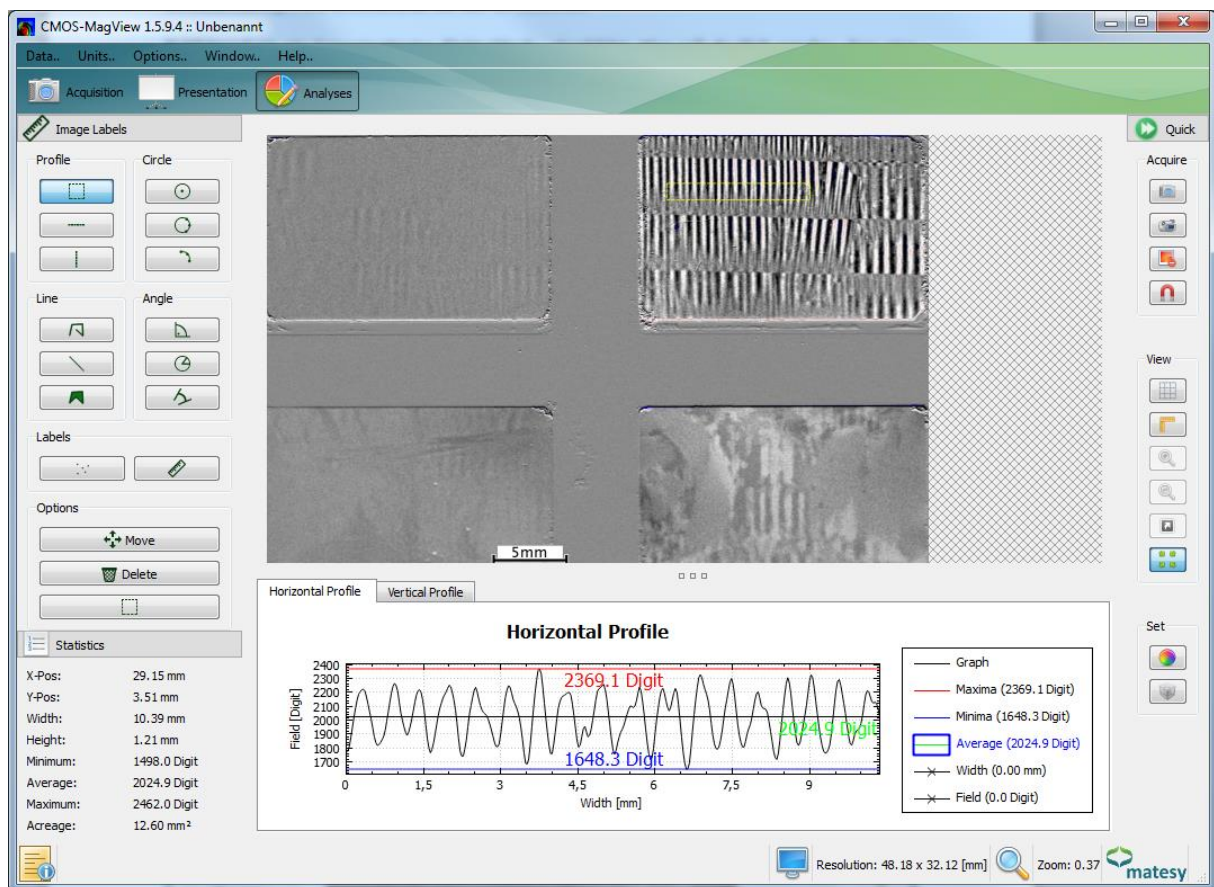
Figure 50: Linear scale against a field-free measurement as difference. Interference in the image and a weak signal can be seen.



**Figure 51: Linear scale as difference to a shift by half a period. The interference seen in the prior figure has vanished; the image can be analyzed.**

Shown in Figure 52 below is a grain oriented magnetic steel sheet. It should be understood that an application mostly requires a certain sensor type. The domain structure can only be visualized satisfactorily on the A-sensor.





**Figure 52: Grain oriented magnetic steel sheet. The inner domain structure can only be visualized with the most sensitive type.**

## 9. Notes

Please note that the CMOS-MagView software is updated regularly. Therefore, it is possible that the software structures in this manual may be slightly differ from those in your software version.

If you have further questions about the software, please contact us directly.

## 10. Fault remedy

- Camera initialization fails: The camera may already be used by another program.

Remedy: Stop the other program.

- Camera initialization is successful but no image is displayed.

Solution 1: Connect the camera to another USB interface.

Solution 2: Restart the program.

Solution 3: Quit the program; start the computer again

- "The selected camera cannot be initialized . Fault code: -2102"

Solution: The CMOS-MagView program has been opened twice and the camera has been initialized in one program. Quit one of the programs; you can also use the task manager for that.

**If possible connect the camera directly to the computer because USB hubs may occasionally cause interference noise.**

## 11. Warranty

The Matesy GmbH grants a manufacturer's warranty of 24 months as required by law in the Federal Republic of Germany. The warranty period for the integrated CMOS camera is 12 months. No warranty is available for the magneto-optical sensor.

The Matesy GmbH is not responsible for damage due to improper transportation, handling or mechanical impact.

## 12. Maintenance

The device should be maintained by the manufacturer once a year to ensure its continuous readiness of service, reliability and a long service life.