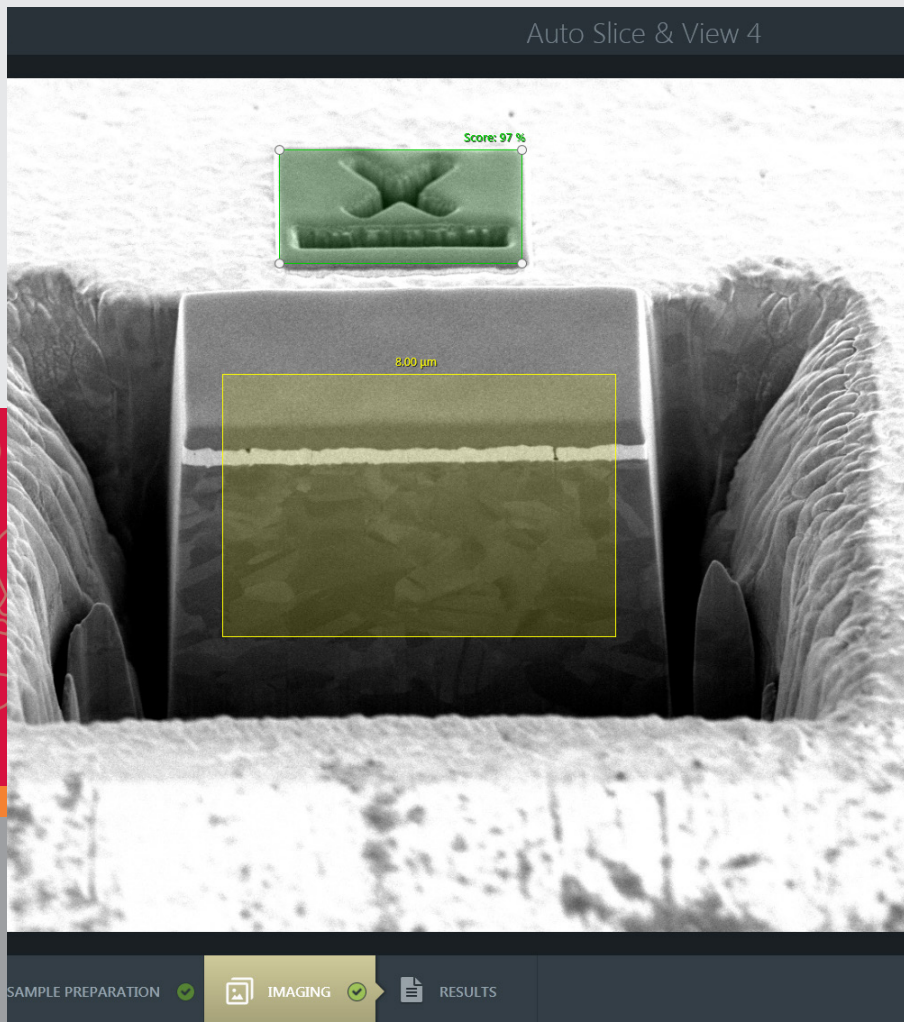
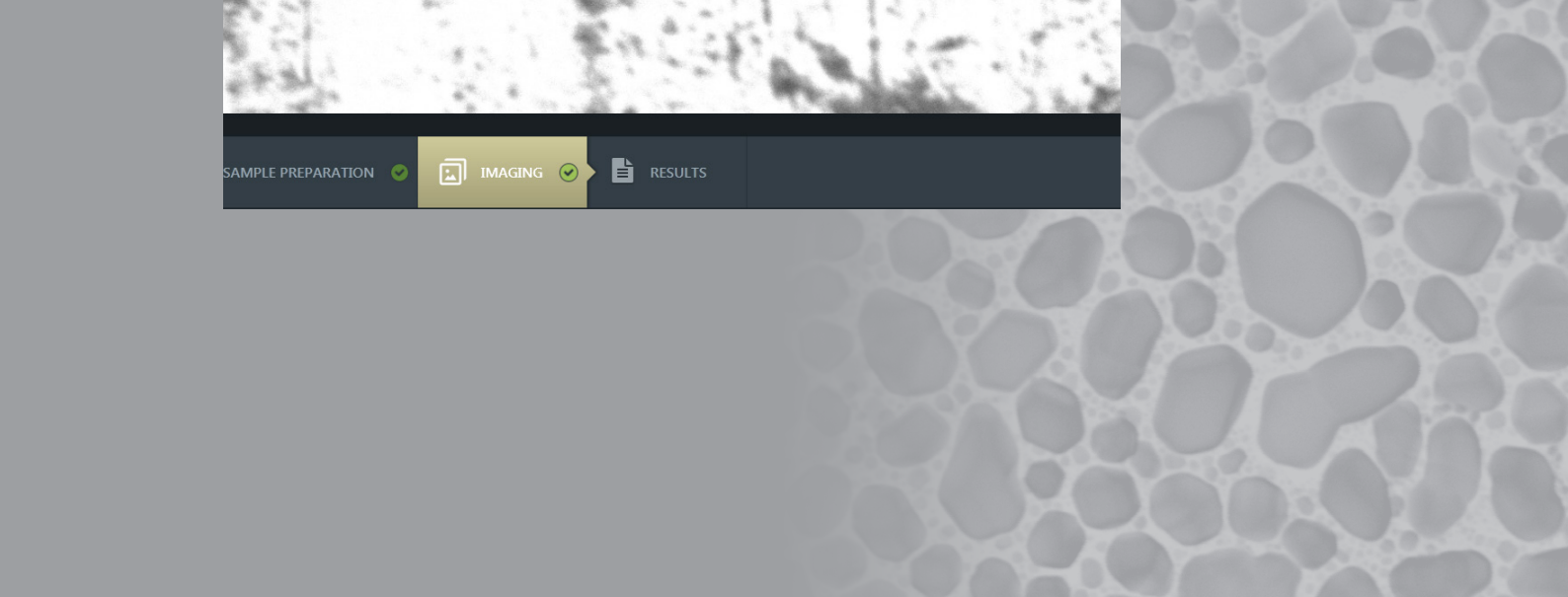




# Auto Slice & View 4 User Operation Manual



Edition 2  
Jun-2016



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# Table of Contents

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## Chapter 1 Overview

Options: Auto Slice & View Analytical Package . . . . .	1-1
Prerequisites . . . . .	1-1
Auto Slice & View Analytical Package (option). . . . .	1-1
Projects processing . . . . .	1-1
<b>User interface elements . . . . .</b>	<b>1-2</b>
Tabbed screens. . . . .	1-2
Modules. . . . .	1-3
Dialogs . . . . .	1-3
Progress bars. . . . .	1-3
Pull-down menus . . . . .	1-3
Informational elements. . . . .	1-4
Tooltips . . . . .	1-4
Edit boxes. . . . .	1-4
Radio buttons / Check boxes . . . . .	1-5
Command buttons . . . . .	1-5
Update button . . . . .	1-5

## Chapter 2 Settings

<b>Launching Auto Slice &amp; View 4.0 . . . . .</b>	<b>2-1</b>
Start page. . . . .	2-1
Menu bar . . . . .	2-2
PROJECTS and QUEUE tabs bar. . . . .	2-3
Status bar . . . . .	2-4
Running a project . . . . .	2-5
Settings window. . . . .	2-6
Project . . . . .	2-6
Analysis . . . . .	2-7
Fiducial. . . . .	2-8
Deposition. . . . .	2-9
Notifications . . . . .	2-10

## Chapter 3 Configuration

<b>Setting up new project . . . . .</b>	<b>3-1</b>
MILLING page . . . . .	3-2
MILLING controls . . . . .	3-2
DRIFT CORRECTION module . . . . .	3-3
Fiducial point . . . . .	3-3
ROCKING MILL module . . . . .	3-5
SAMPLE PREPARATION page. . . . .	3-6
Green Clean Pattern. . . . .	3-7
IMAGING page . . . . .	3-9
IMAGING controls – acquisition types. . . . .	3-9
ALIGNMENT module . . . . .	3-13
Y-SHIFT CORRECTION module . . . . .	3-13
AUTO FOCUS module . . . . .	3-14
AUTO CONTRAST BRIGHTNESS module. . . . .	3-15
TILING module. . . . .	3-15
RESULTS page . . . . .	3-16
Image series modules . . . . .	3-16





FEI® Auto Slice & View™ software application provides information about a feature of a sample obtained by examining its entire three-dimensional profile. It minimizes the time required to collect this information for any sample where a feature needs to be cut and imaged. The application automatically mills consecutive slices through a feature, while collecting electron beam images of each slice.



After setting up a process, the automated slicing and image acquisition session can be left unattended.

On completion of the process, the acquired images are available for review either one-by-one or in an animated sequence. A series of images can also be transformed into a movie (AVI format) for viewing outside of the Auto Slice and View application.

## Options: Auto Slice & View Analytical Package

The EBSD and EDS image acquisitions types (third-party applications) are necessary to be licensed. In other case, they are not visible within the application.

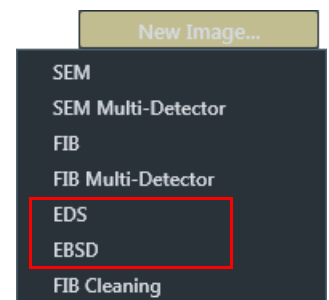
The FEI® energy dispersive X-ray spectrometry in 3D (EDS acquisition type) combines EDS analysis into the slice and view sequence, collecting a per pixel spectral map on every slice of the sequence.

EDS acquisition minimizes the time required to collect this information for any sample where a feature needs to be cut and imaged. The application automatically mills consecutive slices through a feature, while collecting electron beam images of each slice.

The FEI® electron backscatter diffraction combines EBSD analysis into the slice and view sequence, collecting a per pixel crystal orientation map on every slice of the sequence.

The EBSD acquisition minimizes the time required to collect this information for any sample where a feature needs to be cut and imaged. The application automatically mills consecutive slices through a feature, while collecting electron beam images of each slice.

Contact your FEI representative for licensing information on the Extended version.



## Prerequisites

- A supporting FEI xT DualBeam™ system
- Understanding of FEI xT DualBeam operation
- Gas injection system or MultiChem system
- At least 2 GB of microscope PC RAM is available for acquiring 4K x 4K and 8K x 8K images. (Unless your system does not support these image resolutions.)
- Turn off all GIS heaters

### Auto Slice & View Analytical Package (option)

- EBSD and EDS detector-provider software must be connected and configured (see Settings / Analysis) prior to project execution.

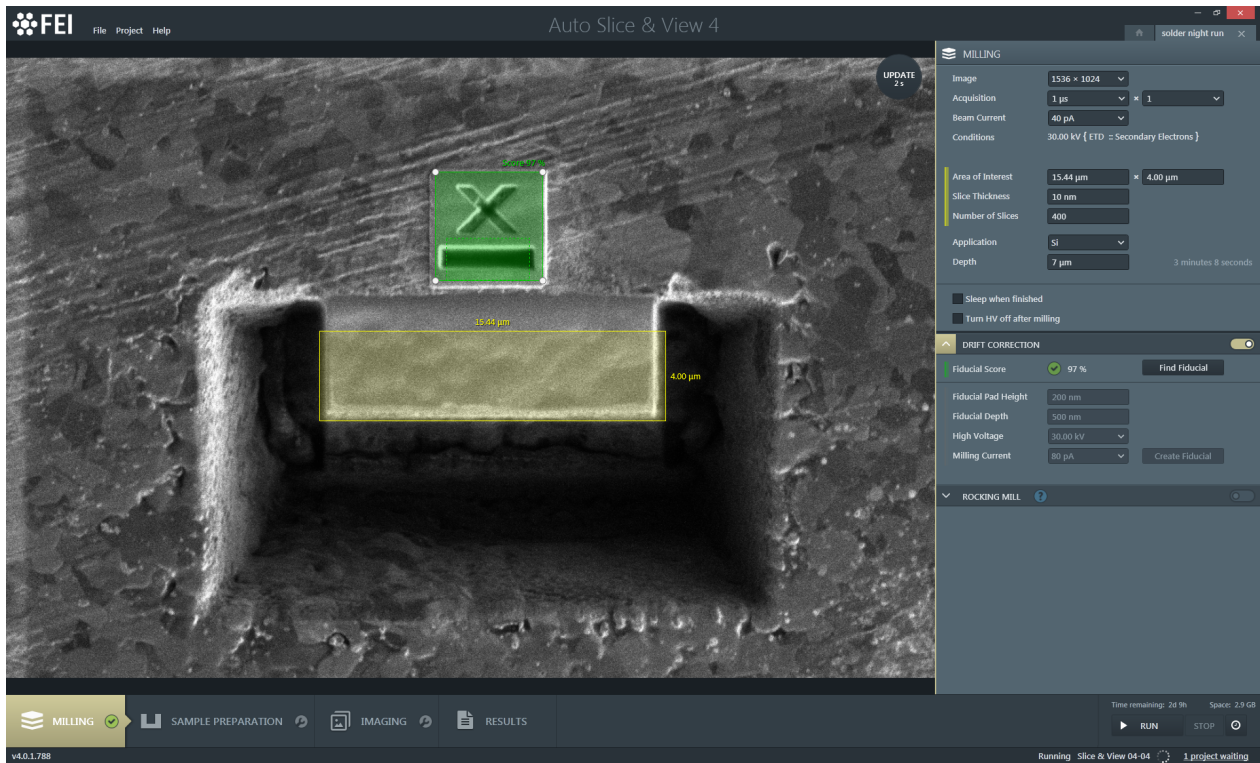
## Projects processing

A project can be seen as an experiment on one particular sample at one particular area of interest. There are no restrictions to have many consecutive projects working on the same sample, likely at different areas, but that is (also) not a restriction.

# User interface elements

The application UI focus changes depending on the selected page at the UI bottom left (Milling, Sample preparation, Imaging, Results). On the right side of the window the corresponding modules can be found from the top to bottom. The imaging area reflects actual page and module activation selection. When control elements are not accessible, the graphics and its labels are grayed.

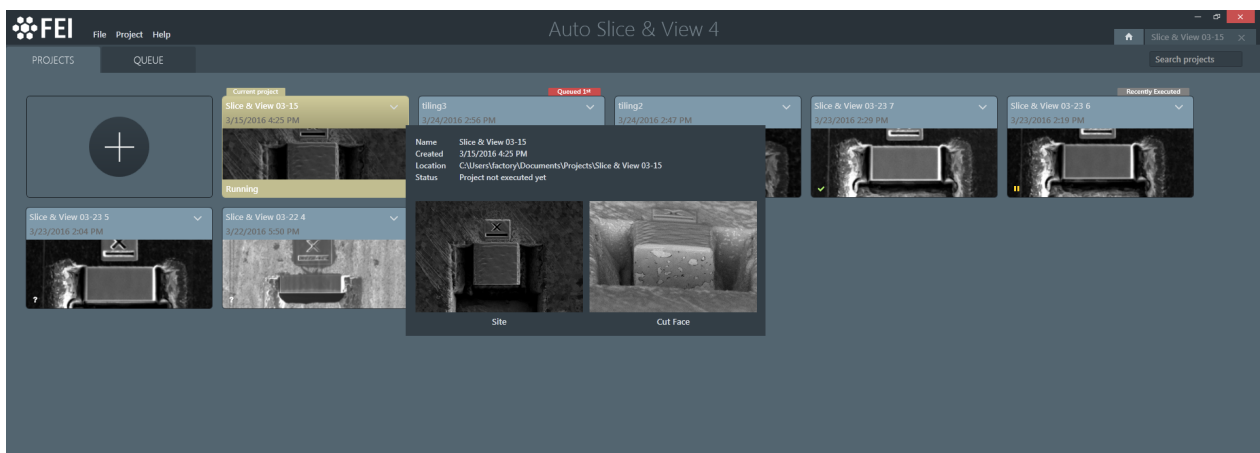
Figure 1-1: Auto Slice & View UI



## Tabbed screens

Each project has the dedicated Project tile, visible on the *PROJECTS* and the *QUEUE* tabs, and giving basic information about the project status by means of informational icons and as a tooltip. The tab on the right side of the screen with the project name in the header belongs to the opened project (only one can be opened at a time). Clicking the icon with a house pictogram shows the UI Start page (see Chapter 2).

Figure 1-2: Auto Slice & View basic UI screen



## Modules

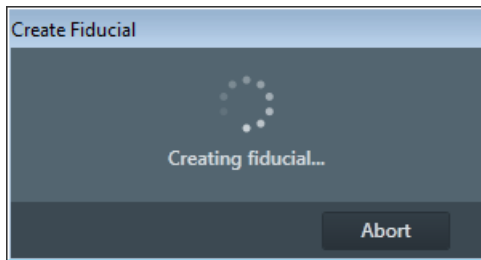
Modules visually combine various software elements, that are related into a labeled group. Clicking on the module's header selects it and expands down / contract up its controls, which is also depicted by the beige up arrow / gray down arrow on the left module side. Only one module can be selected at a time.

To activate / deactivate settings within the module click the gray / beige switch on the right module side.



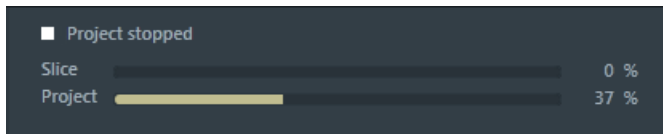
## Dialogs

A dialog appears when the system needs more information from you before it can carry out a command, or when the system wants to give you some important information. Some dialogs do not let you access other functions until you close them or when a process ends. Others let you perform other tasks while they remain on-screen and running (for example, the Settings dialog can remain opened while performing other tasks).



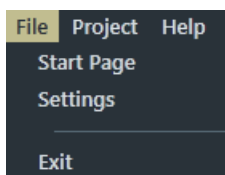
## Progress bars

The progress of long, ongoing procedures is indicated at the bottom of some screens.



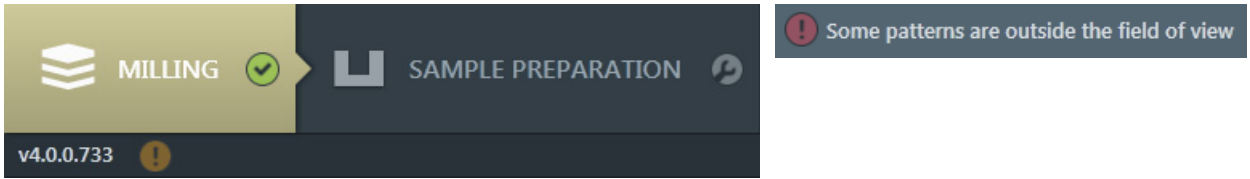
## Pull-down menus

The *Menu bar* contains pull-down menus that show grouped listings of available commands or settings. Some menu items are shown in gray and are not accessible because of the system's immediate condition.



## Informational elements

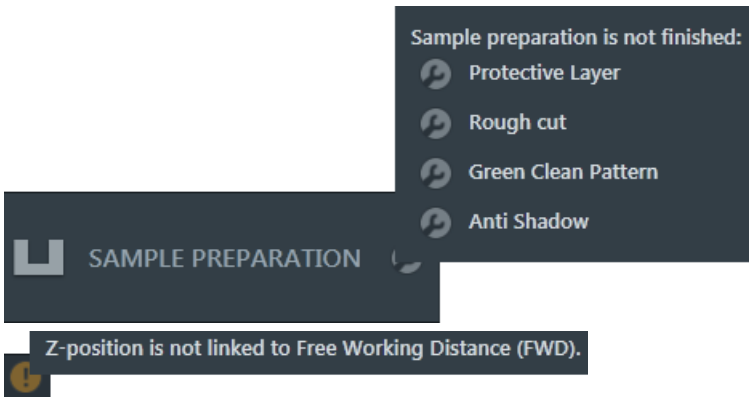
The icons with a different color inform the user about the status:



- Green color indicates, that all settings are done.
- Gray color indicates, that the setting(s) is/are needed.
- Red / orange color indicates, that a serious trouble blocks follow-up to settings. The description is given next to it.

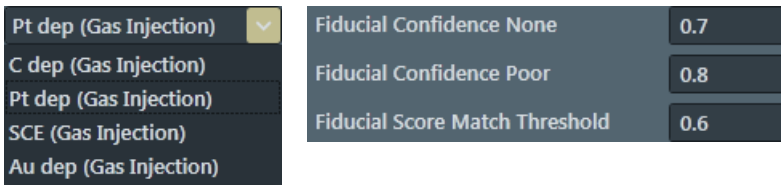
## Tooltips

The Tooltips functionality activates when the cursor is left over an item (informational icon, control element, etc.) on the user interface for more than two seconds. A short explanation of the item or a hint appears.



## Edit boxes

There are several ways to enter the text information or values (labels or precise numbers):



- Using the keyboard within a corresponding edit box. Some edit boxes require confirming the input by pressing the *Enter* key. If you press the *Esc* key before leaving the edit box, its previous value will be restored.
- Clicking a down arrow on the right side of the Project tile, and on the right side to the actual label of some Edit boxes shows a pull-down list of choices. Select an item; if it is a parameter value, it is updated immediately.
- When entering a parameter values, for some edit boxes they can be selected from the preset list, or entered more specifically by the keyboard.

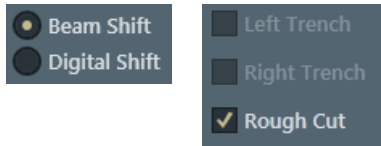
If just entered value is incorrect, it turns red and blinks. The last correct value is entered automatically.

To cover large ranges of parameters, the value can be entered followed by its unit (nm,  $\mu\text{m}$ , etc.).

## Radio buttons / Check boxes

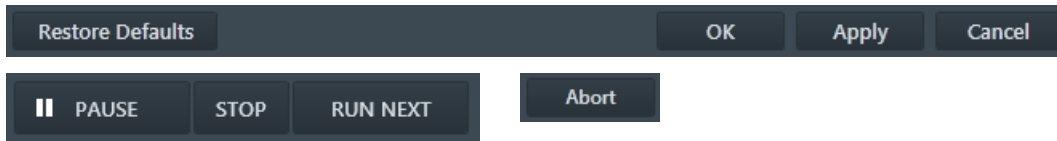
Within a group of related round *Radio buttons*, only one selection can be active at any time by clicking on the individual box.

One square *Check box* or a group of boxes can be ticked / cleared by clicking on the individual square box.



## Command buttons

Command buttons carry out or cancel functions. They activate when clicked if accessible (not grayed). Command buttons have labels that describe the actions performed by clicking on them:



- *Restore Defaults* button – restores the factory preset *Settings* values
- *OK* button – applies all changes made, saves them to disk and closes it. These settings will be used for the opened project and all subsequent projects until they are changed.
- *Apply* button – saves and applies new settings at that point without closing the dialog.
- *Cancel* button – discards all changes (made from the last save) and closes the dialog. It has the same effect as closing the dialog by clicking the red cross (Alt + F4).
- *Run* button – starts execution of the opened / queued project
- *Pause / Resume* button – pauses / resumes execution of the running / paused project
- *Stop* button – stops running project
- *Run Next* button – stops execution of the running project and starts another one in the queue
- *Abort* button – stops the running process

## Update button

Clicking this button captures corresponding settings, that were set to acquire an image, and starts acquiring of the image to show actual situation; time value informs about the estimated acquisition time. Make sure the image is optimized before it is acquired for best results.



The application monitors if changes in focus, astigmatism, beam shift, BC, etc. are made within the ASV, that could affect the automated run. If a change is detected, the text changes to red indicating, that image should be updated to implement last changes. If multiple acquisitions are configured, each one must be updated separately.

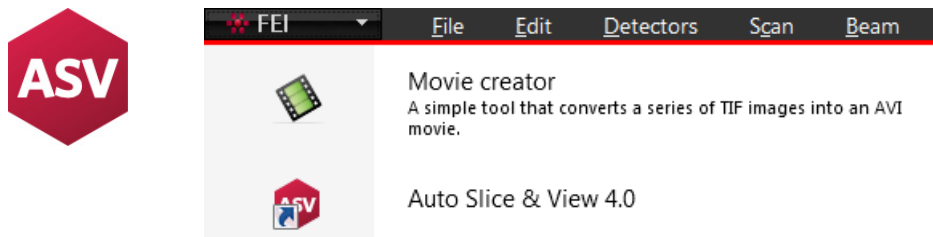
Update has to be done as well for “on-the-fly” edits. Just changing any parameter during a slice acquisition does not influence the subsequent slice(s). It is necessary to pause project execution, to make desired changes, and then to click the Update button to implement new adjustments.



## Launching Auto Slice & View 4.0

Before launching the application, make sure that the xT microscope Server application is running. The Microscope Control software (UI) does not need to be running at this time, although it will be needed during setup of a project. Only one Auto Slice & View application can be run at a time.

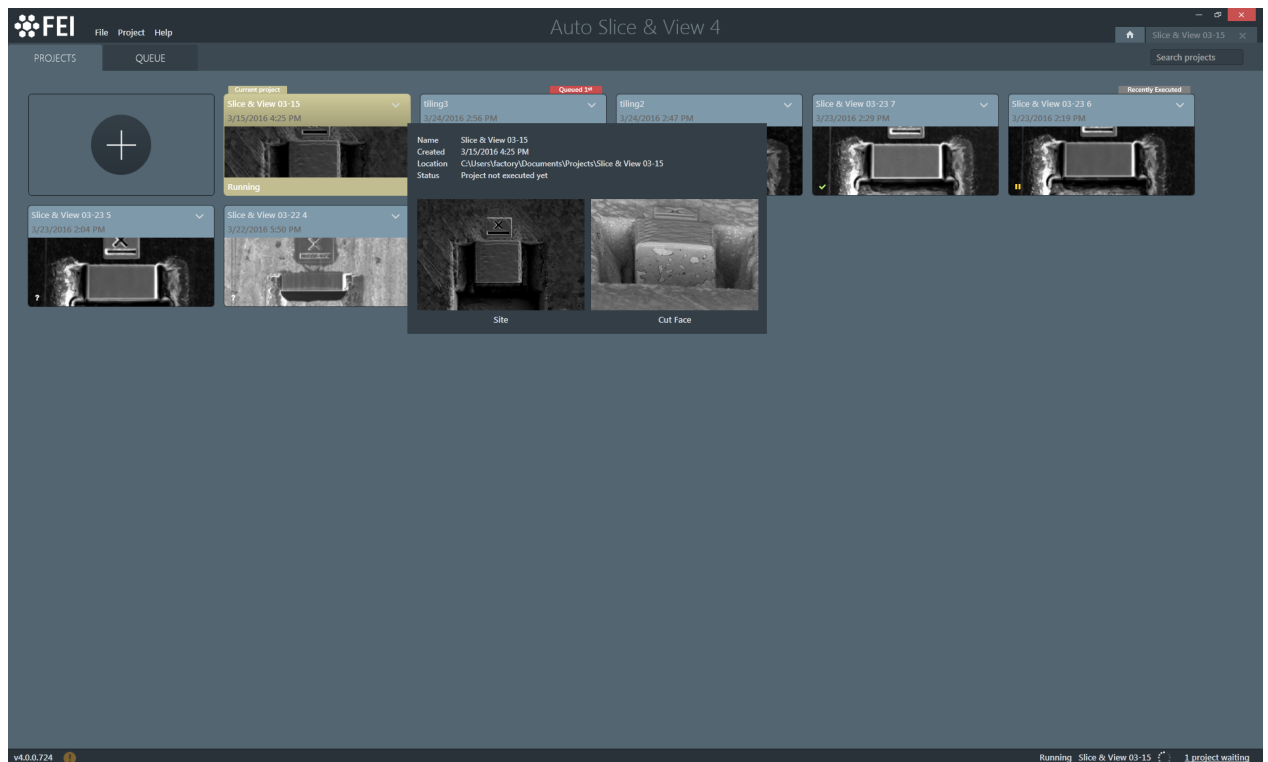
To launch the application, double-click the ASV icon on the Windows desktop, or select the *FEI* toolbar button / *Auto Slice & View 4.0* item (this is added when the application is installed), or select the *Windows® Start / Programs / FEI Company / Applications / Auto Slice & View 4.0*,



## Start page

On the launch of the application, the *Start page* is presented.

**Figure 2-1:** *Auto Slice & View Start page*

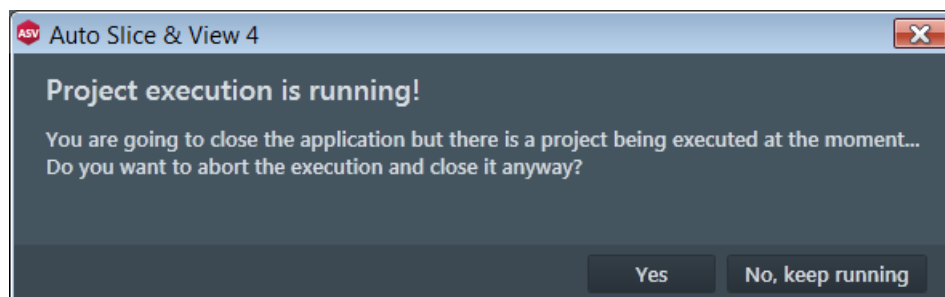
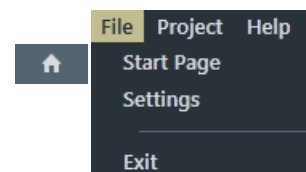


## Menu bar

Here are the *File*, *Project* and *Help* pull-down menus. On the right side of the bar there are the Start page icon (a house pictogram), and the tab of the opened project (with its name); if no project is opened, the icon is not shown. Clicking this tab takes you to the project settings (see Chapter 3).

### File menu

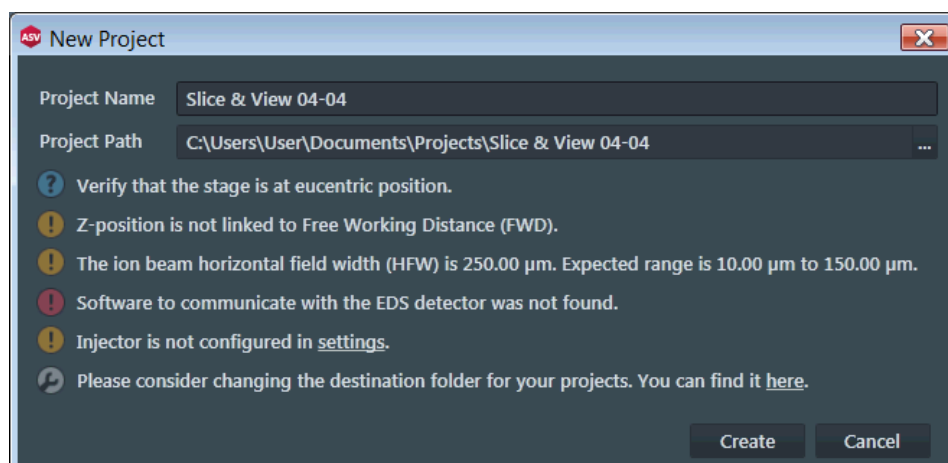
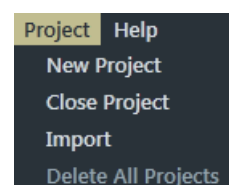
- *Start Page* item shows the Start page.  
Clicking the icon with a house pictogram has the same effect.
- *Settings* item shows the Settings window for configuring application user settings (see further).
- *Exit* item closes the application. If there is no danger of losing data, the item simply closes the application without prompting. If a project is running, the confirmation dialog appears.



Pressing the *Alt + F4* keys simultaneously has the same effect.

### Project menu

- Clicking the *New Project* item starts the new project creation process by initiating the *New Project* window. Clicking the icon with the large + sign (within the PROJECTS tab) has the same effect.



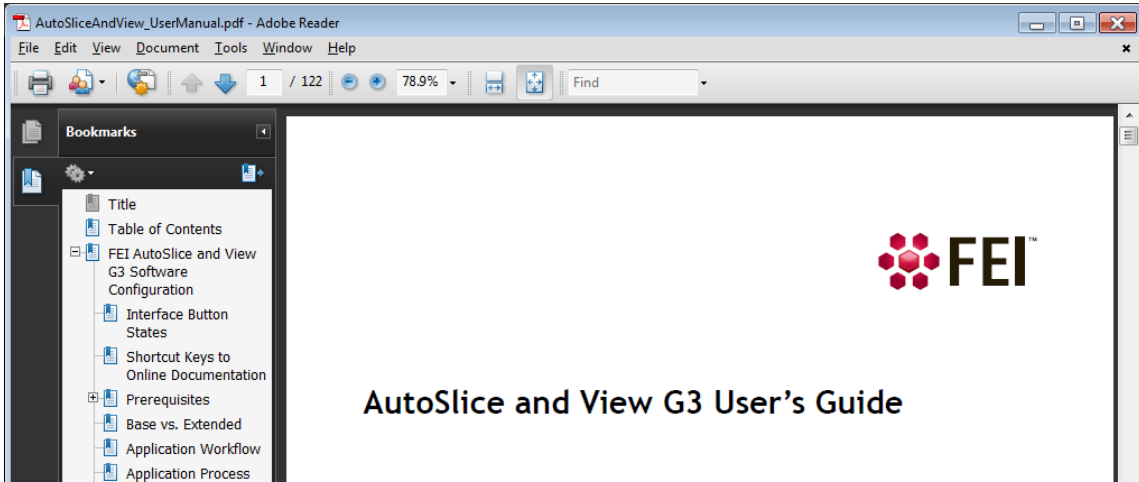
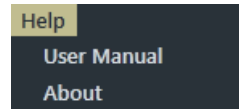
Enter a *Project Name* and a *Project Path*. The application provides a default name, that can be used or changed, and offers the *Project Path* as set within the *Settings / Project* window. Click the *Create* button to begin setting up your new project (see Chapter 3).

- Clicking the *Close Project* item closes the opened project.
- Clicking the *Import* item imports a project from different locations, archives etc., that is not already in the list. All imported project data are copied to the actual project path. You can then view it or manage it like any other project in the list.
- Clicking the *Delete All Projects* item deletes all projects, which Project tiles are listed within the *PROJECTS* tab. It not only removes the projects from the list, but also from disk. Therefore, it displays a dialog asking you to confirm the deletion. If you want to remove the project from the list but not from disk, use the Project tile menu (see below).

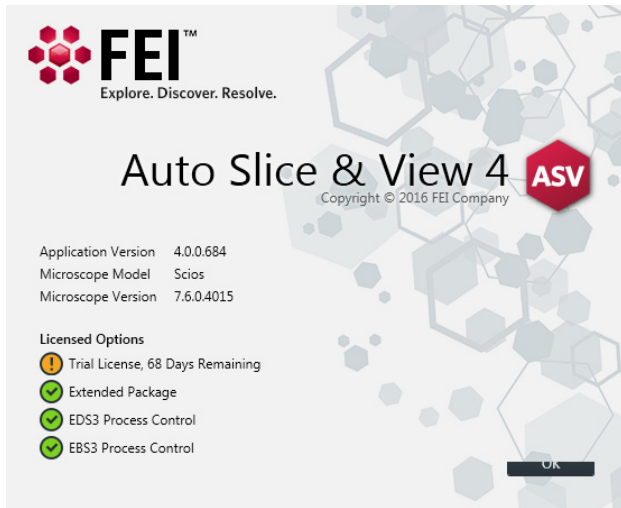


### Help menu

- Clicking the *User Manual* item starts the Adobe Reader application and opens the User's operational manual (this document). Pressing the *F1* key has the same effect.



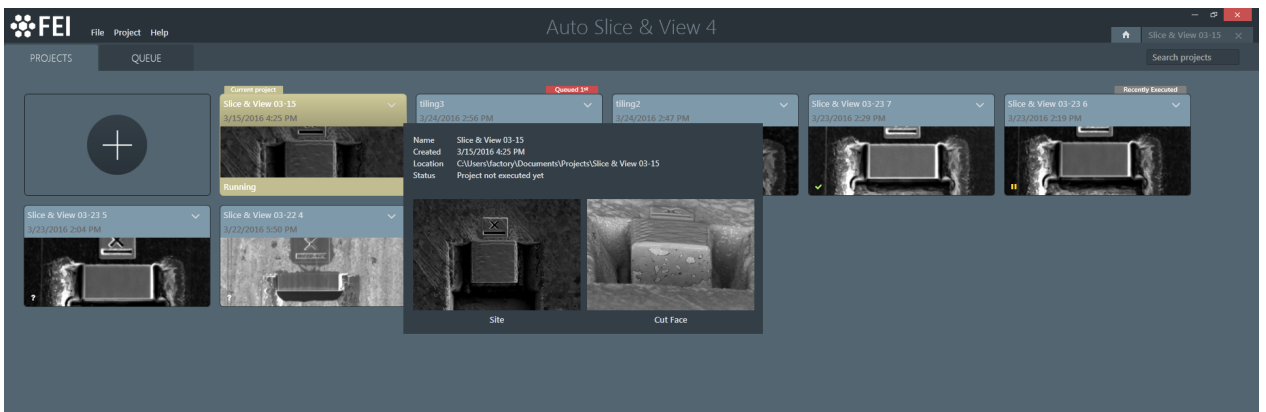
- Clicking the *About* item shows an informational dialog box about this application, with version and licence information. Click the *OK* button or press the *Esc* key to dismiss it.



### PROJECTS and QUEUE tabs bar

Within the PROJECTS tab there is a list of all projects shown as Project tiles with site preview. Within the QUEUE tab are listed only projects set and prepared for the execution. On the right side of the bar there is the edit field used for searching of a project.

Figure 2-2: Project tile information tooltip



Leaving the cursor over the Project tile initiates a tooltip with additional information about the project and with the preview of site and cut-face images.

Project tiles offer information about:

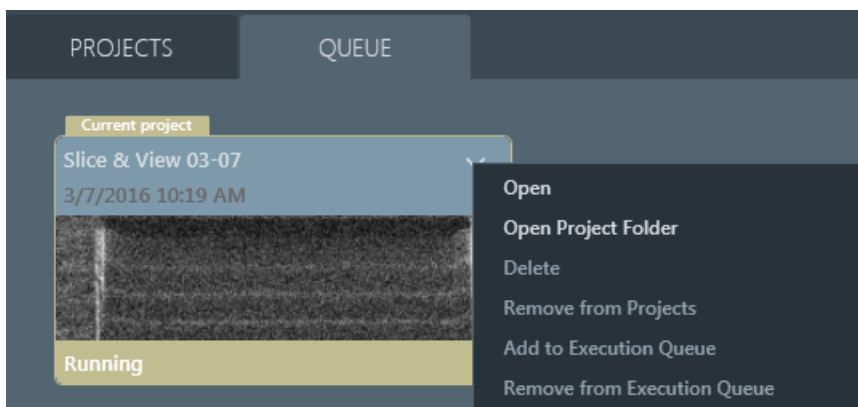
- Name of a project as entered when the project was created.
- Date and time when a project was created.
- *Current Project*: indicates, that the project is opened (only one at a time can be opened).
- *Queued*: indicates, that the project is queued and its position within the queue.
- *Recently Executed*: indicates, that the project was executed recently.

Project status indicates the completion status of a project by means of informational icons and tooltips:

- *Not executed*: the project was not run yet.
- *Running*: this indicates that the application was terminated abnormally while a project was active. Any resulting images, depending on the phase the project was in, are available for viewing.
- *Paused*: the project was paused by the user; it is possible to *Resume* it.
- *Stopped*: the project was stopped by the user. If the project was stopped during the slicing phase, any obtained results prior to stopping are available for viewing.
- *Completed Successfully*: the project ran to completion without any issues.
- *Completed with Failures*: the project completed, but encountered problems during execution. Result may be available for viewing.
- Watch icon adds / removes a project to / from the queue.
- Left / Right arrow changes project's position within the queue.
- Trash icon removes a project from the queue.

Clicking the down arrow on the top-right side of the project tile shows the additional project menu:

**Figure 2-3:** Project tile menu



Select any item with the following actions:

- *Open* - opens the project (closes an opened one if any), and enables browsing the project's images and viewing a report of various data that were collected when your project ran.
- *Open Project Folder* - opens a windows explorer window in the selected project's folder. This is a quick way to locate the project's contents on disk without having to search for the project.
- *Delete* - deletes the project and all its data from the disk.
- *Remove from Projects* - deletes the project, but leaves data on the disk.
- *Add to Execution Queue* - adds the project to the last position of the execution queue (same as the watch icon).
- *Remove from Execution Queue* - removes a project from the execution queue (same as the trash icon).

## Status bar

The basic informational bar at the bottom of the page offers an information about the software version (left side). On the right side of the screen there is an information about the running project, and about the number of waiting projects - clicking this item shows the QUEUE tab.



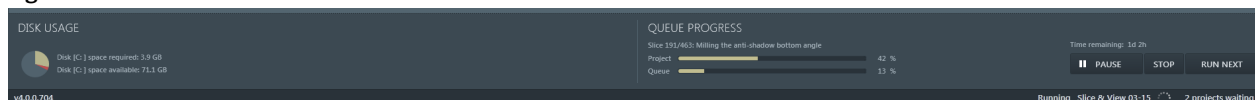
## Running a project

To run, pause / resume or stop executing of the project(s), use the controls within the extended status bar, that is available within the QUEUE tab. Here the dynamic information about the status and progress of the running project, like the actual activity, and the *Slice / Project / Queue* progress (the progress bar and the percentage next to it) can be found.

The user can take advantages of changing imaging settings of the paused / stopped projects. When changes are done, the project can be resumed / started again with new settings provided, that affected acquisitions were updated (update button).

Changes can be made to most of the parameters, but this functionality is mainly intended for the IMAGING page. If other changes are made, particularly in the MILLING page, the project can led to unpredictable results, for instance during 3D reconstruction.

**Figure 2-4:** *Auto Slice & View extended Status bar*



- **DISK USAGE:** *disk space required* for the opened project according to its settings, and *Disk space available*

The right side of the extended status bar is also available on pages of an opened project.

- **QUEUE PROGRESS:** *Project* – progress of the running project, *Queue* – progress of the entire queue
- **Time remaining** gives an indication about how long the remaining part of the project will take, when viewing from the opened and running project pages. In case the QUEUE tab is shown, this figure informs about how long all project within the queue will take. The estimated time will be recalculated every slice and takes the duration of the last slice into account; this makes the number more reliable after a few slices.
- **RUN** button starts execution of the first project in the queue.

The button changes to **PAUSE**; clicking it now interrupts processing at the next convenient, safe state in the slicing process. Because the automated slicing process spends most of its time in the milling slice activity, the next convenient safe state is usually between two slices, that is, after completion of a slice and before starting the next.

The button changes to **RESUME**; clicking it now continues a paused project where it left of. Pause allows you to adjust parameters and tune contrast, brightness, and focus within the IMAGING page. The best way to adjust contrast, brightness, and focus is during the final image grab. Use the Reduced area (F7) option in microscope UI to pause the image grab. When the settings are adjusted, press F7 again, then grab an image with the new settings.

- **STOP** button stops processing at the next convenient, safe state in the slicing process.
- **RUN NEXT** button stops execution of the running project and starts execution of the next one in the queue.

## Settings window

---

Here the definition of some global settings is allowed. Some settings must be configured before the application can run any further: the *Injector*, the patterning *Application file*, and the *Project path*.

### Project

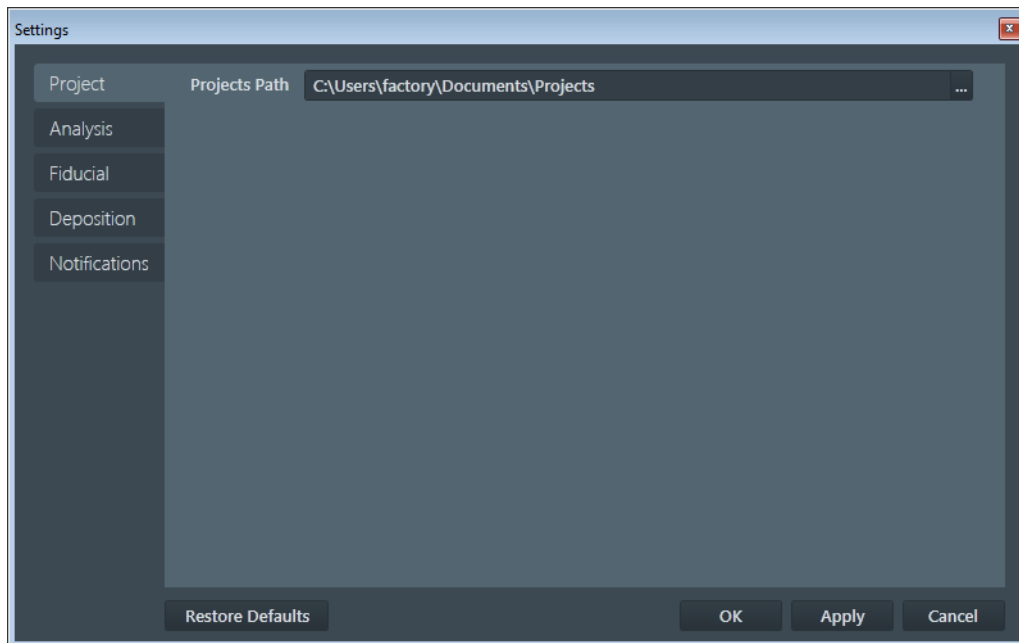
Projects and their results are stored in a directory with the project's name under the *Project Path*. You must have read and write access to this directory.

Acquired images are stored in following folders:

- *LogImages* folder contains the FIB images (and pre and post SEM images – EDS acquisition) that were acquired for milling alignment.
- *ReducedImages* folder contains lower-resolution versions of corresponding images in the *TiffImages* folder. These reduced-resolution images are used in parts of the user interface to reduce memory usage by the software.
- *TiffImages* folder contains the full-resolution SEM images.
- *StitchedImages* folder contains tiled images, when the *TILLING* module / *Enable Stitching* check box is ticked.

The *ProjectData.dat* file holds all other data for the project.

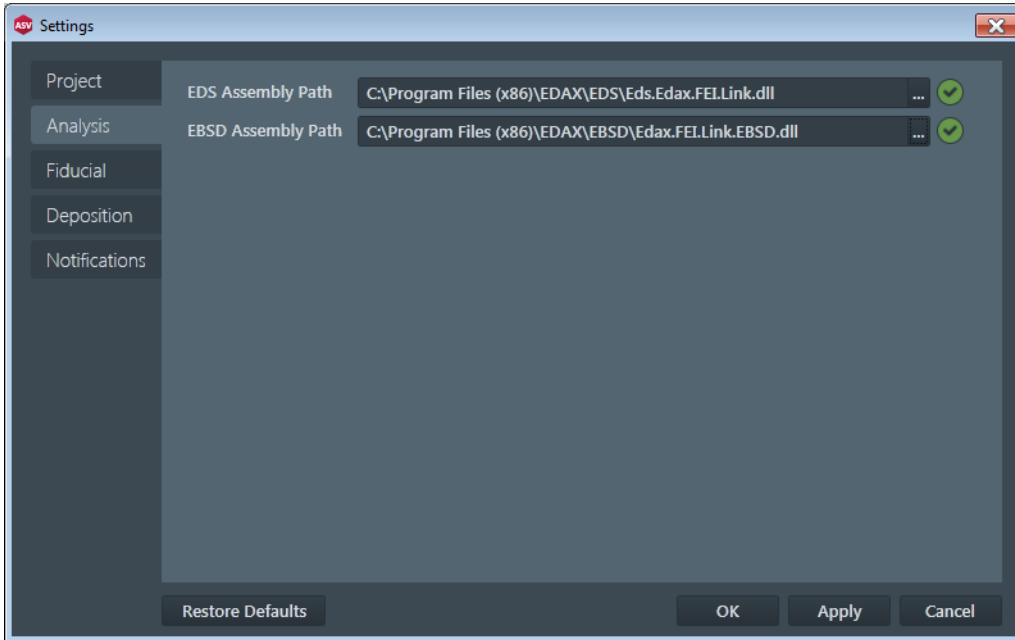
**Figure 2-5:** Settings / Project window



## Analysis

Use this tab to configure the EBSD and/or EDS detector(s) - optional Analytical package applications. When you run the project it will execute the third-party acquisition application for each slice.

**Figure 2-6:** Settings / Analysis window



- ### Assembly Path

When the third-party application is started for the first time, the *EDS Assembly Path* / *EBSD Assembly Path* is empty and an informational icon is shown indicating that the actual Assembly Path is not valid. By clicking the ... button to the right of the field, a file browser will be shown allowing the selection of the third-party assembly that should be associated with the selected Acquisition Type.

Each time you create a project, detector's assembly path is validated. If assembly path is invalid, you will not be able to add related acquisition type into the project.

This assembly is installed separately from the application. The detector provider will supply an installer for it. Each provider has a different assembly name and location, so take note during the installation process and use that information here.

The detector interface assembly should be installed in a directory matching the following pattern:

C:\Program Files\<<Company>\EDS / C:\Program Files\<<Company>\EBSD

The detector interface assembly file name should have the following pattern:

EDS.<Company>.FEI.Link.dll / EBSD.<Company>.FEI.Link.dll

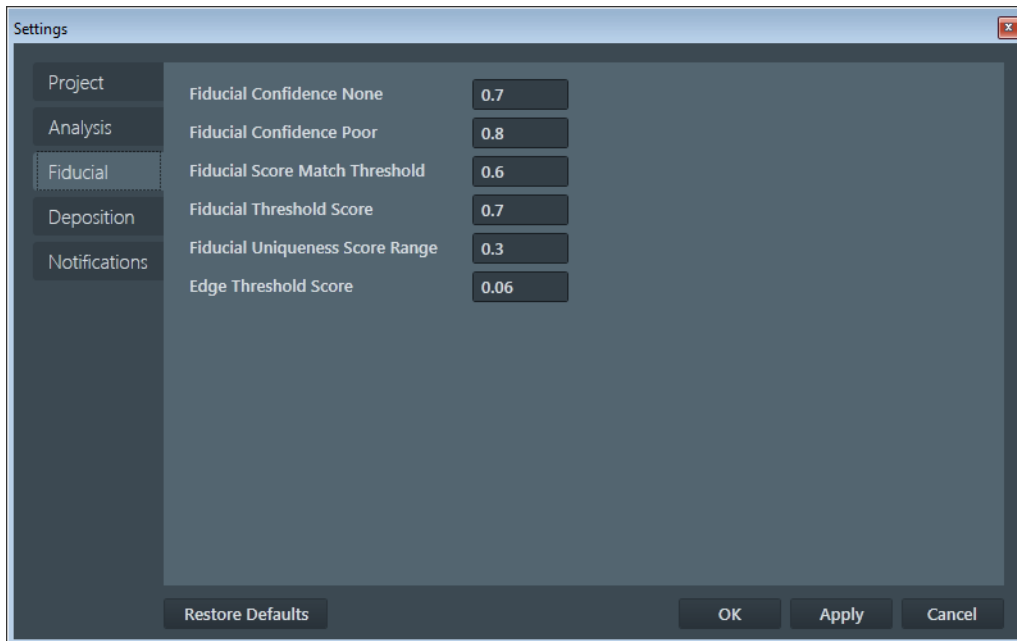
<Company> will be replaced with the name of the detector provider.

The file browser mentioned above will attempt to locate the detector interface directory and file name based on the patterns above. If it cannot do so, it will open to C:\Program Files and you can browse to wherever the detector interface assembly was actually installed.

## Fiducial

Settings within this window are in the range 0.1 - 1.0.

**Figure 2-7:** Settings / Fiducial window



- Fiducial Confidence None / Poor**  
 When you click the *Find Fiducial* button on the *Drift Correction* module, or during the *EBS*D acquisition configuration, or on the *Alignment* module, the None and Poor settings define the ranges within which the software has either no confidence or poor confidence, that what it found is really the fiducial point you told it to look for.
- Fiducial Score Match Threshold**  
 During the automated run, whenever the software looks for a fiducial point, it calculates a match score on whatever it found. If the score is below this threshold setting, it is rejected and the software responds appropriately. If it was looking for the FIB fiducial point for milling alignment, it will pause the run. If it was looking for the SEM fiducial point at the milling location or at the EDS data collection location after a stage rotation, it zooms out to a wider field of view and looks for the fiducial point again. This usually works to identify it with high confidence.
- Fiducial Threshold Score**  
 During the automated run, the software repeatedly looks for the fiducial point you told it to use to align either patterns for milling or the cut face for imaging (or both). A small cutout image of the fiducial point is used as a reference that the software uses to find that fiducial point in a full size image. If the score returned by the software when it finds the fiducial point is less than the value of this setting, the software will make another cutout of the fiducial point at the actual image settings and look for the fiducial point again. This greatly improves the likelihood that the fiducial point will be found with a very high confidence score.
- Fiducial Uniqueness Score Range**  
 When the software looks for a fiducial point, it tries to ensure that what it is looking for will work well in the automated run. A fiducial point will work well if it is unique or sufficiently different from other similar formations in the field of view that the software will not mistakenly align on the wrong location. If the software finds multiple formations that might be the target fiducial point, it assigns a match score (or confidence level) to each formation. The formation with the highest match score is considered to be the target fiducial point. The Fiducial Uniqueness Score Range setting defines how different the other formations' match scores must be before the target fiducial point cannot be considered sufficiently different enough to work well. It is not sufficiently different if the match score of any other formation differs by less than the value in this setting.
- Edge Threshold Score**  
 When the software looks for the FIB fiducial, it tries to find horizontal edges in the fiducial to increase fiducial location precision. This value defines the lowest possible edge score value to be considered as sufficient for edge based cut placement.

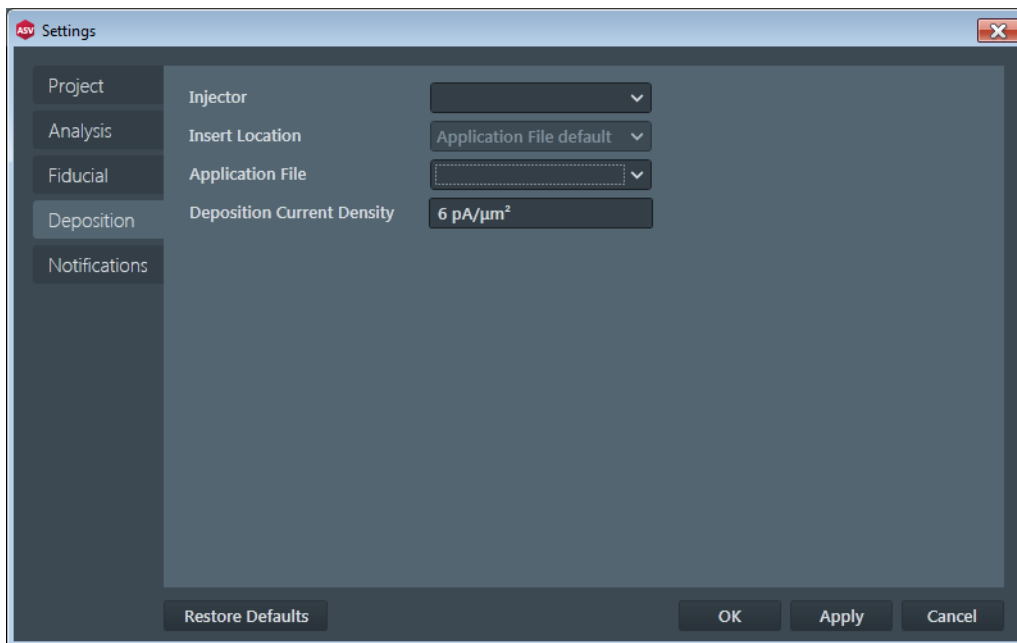
## Deposition

Select the *Injector* (GIS or MultiChem) to be used for deposition of the fiducial point and protective layer from the drop-down list.

### Note

The selections are provided by the system installation, but be sure the one you select matches with the physical configuration of the gas injection system (GIS) on the microscope.

**Figure 2-8:** Settings / Deposition window



Select the appropriate patterning *Application File* for the deposition and the *Deposition Current Density*, that specifies the volume per dose used to set the current for depositing the selected material. Enter a value appropriate to the selected deposition material.

When a MultiChem is selected, the *Insert Location* drop-down list becomes enabled, specifying the existing and configured MultiChem insert locations during deposition, plus an addition entry of *Application File*, allowing to use the insert location in the application file, similarly to the GIS Injector.

## Notifications

Here you can manage email addresses where job status change notifications should be sent. Email recipients can be notified of significant events that occur during the automation run. Notifications will be sent for the following events:

- Job complete
- Job faulted
- Job auto-paused, including reason for pause
- Job stopped by the user

### Email Notification Service

The email notification feature is designed to use the network connection between the microscope PC and the support PC to send email updates. Typically, the microscope PC is not connected to the Internet or even to the corporate network, so it cannot send out email notifications. However, the support PC usually does have that ability, so it can act as a proxy for the microscope PC to send out email notifications. In order for that to work, a small software program called the Email Notification Service must be installed on the support PC, and the microscope PC must be configured to communicate with that service.

### Installing the Email Notification Service on the Support PC

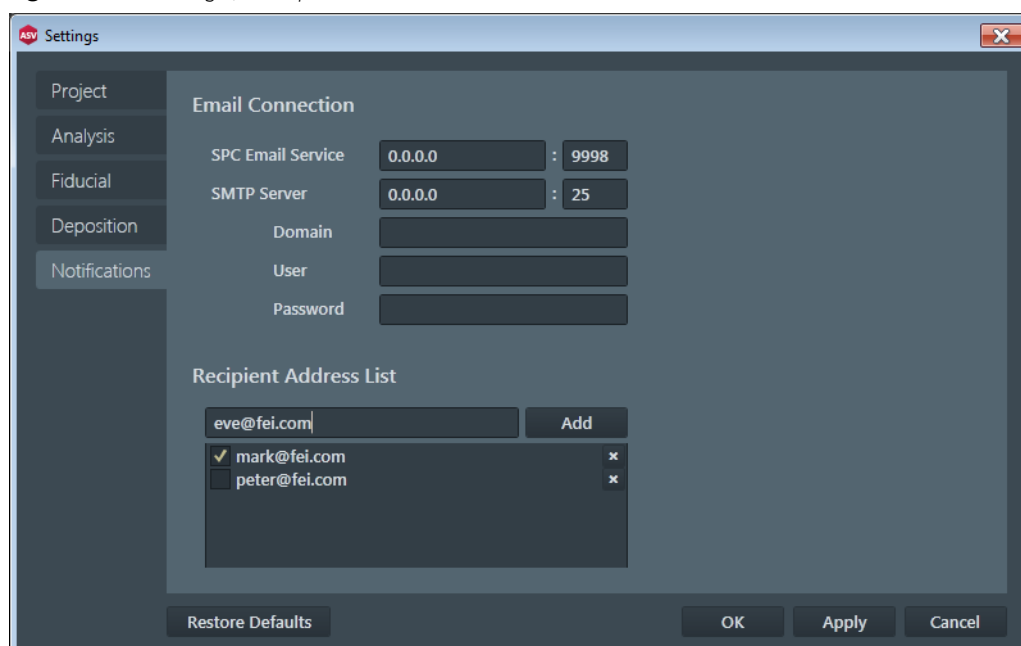
The installer for the email notification service is on the Auto Slice & View 4 installation CD in the following folder:  
SupportPC\EmailService\setup.exe

Run this setup program on the support PC. This is a very simple setup, with no configuration, and takes less than a minute to run. It will install the service and start it up, so that it is ready to communicate with the microscope PC.

### Configuring the Email Notification Service on the Microscope PC

This information is passed to the email notification service on the support PC so that it can contact an outgoing email server (SMTP server) to send email notifications.

Figure 2-9: Settings / Notification window



- SPC Email Service Address  
This is the IP address of the computer running the email notification service (typically the Support PC). This can be localhost if the Email Notification Service is installed on the microscope PC. This is atypical as most installations do not connect the microscope PC to the corporate network.
- SMTP Server  
This is the TCP port where the email notification service is listening. This only needs to be changed if some other service is using the same TCP port. If this is changed, the RemotingTcpPort setting in C:\Program Files\FEI\EmailNotificationService\FEI.Applications.NotificationService.exe.config on the support PC must be changed to the same value. The service must also be restarted as follows.

### Note

You must have administrator rights to restart the email notification service.



1. Open a Command Prompt window.
    - a.) Start >Run
    - b.) Type cmd in the Run dialog.
  2. Stop the email notification service by typing the following in the Command Prompt window:  
net stop FeiEmailNotificationService
  3. Restart the email notification service by typing the following in the Command Prompt window:  
net start FeiEmailNotificationService
- **SMTP Server Address**  
This is the address of the outgoing email server. Enter the name of the outgoing email server for your location. This is the server the Email Notification Service will use to send notifications.
  - **SMTP Server TCP Port**  
This is the TCP port where the email server is listening. By default this is the standard SMTP server port; however, your SMTP server may use a different one. If so, enter the appropriate port number here.
  - **Domain**  
This is the domain of the user name to authenticate with the SMTP server. The pattern for this is usually yourcompanyname.com.
  - **User**  
This is the user name to authenticate with the SMTP server. The user name and the password combined are the authentication credentials presented to the SMTP server to send notification emails.
  - **Password**  
This is the user password for authentication with the SMTP server. The password is masked in the user interface control and is encrypted before it is stored in the user settings file.

**Note**

*The email address cannot have spaces. The default is "AutoSlice and View <demo@demo.com>". The email address in between the <>'s doesn't have to be real, but it does need to be a valid email format, so it cannot contain any spaces. Whatever you enter here may subsequently be identified as junk by your email software, so if notifications don't appear when you expect them, check your junk email folder and your junk email settings to tell your client to accept these notifications.*

**Recipients Address List**

This area enables managing of email addresses (the contacts list), where job status change notifications should be sent.

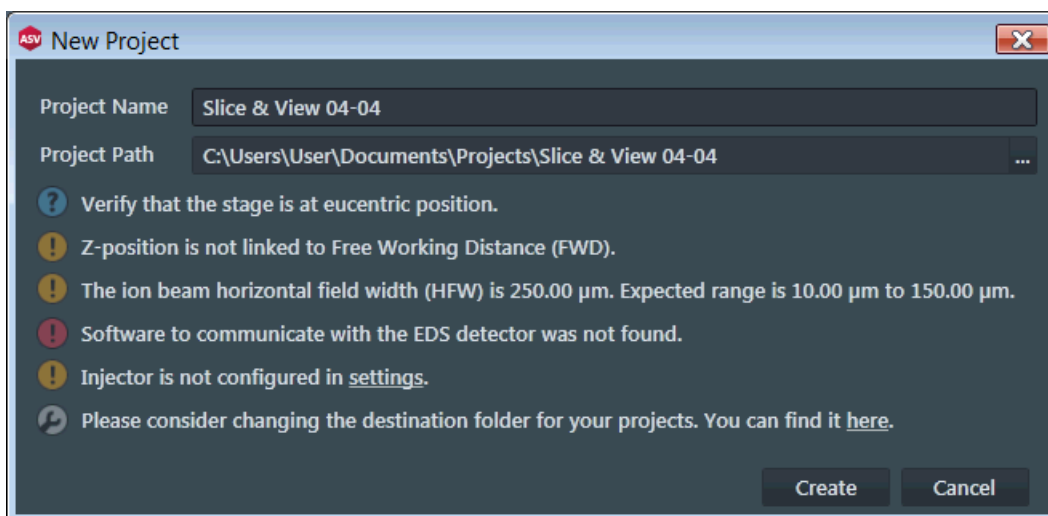
Once an address is added, click the *Add* button to store an e-mail for use by future projects. Only addresses that are checked (check box) will receive notifications.

To delete an address, click the cross next to its name.



## Setting up new project

During this stage of the project setup, the microscope and sample need to be prepared for subsequent setup stages and the automated slice and image acquisition phase. The *New Project* window with a project name and a project path entered gives information on necessary configurations by means of the informational icons and its explanatory text. As long as these are not done, it is possible to create a project, but often not to start its execution.



To resolve the tasks within the microscope UI, refer to the corresponding microscope system user operational manual. Look for the following subjects:

- Eucentric position
- Link Z to FWD
- Horizontal field width (HFW)

To setup the microscope UI, follow the procedure:

1. Load the sample onto the stage.
2. Navigate to the feature of interest and place it in the center of the field of view.
3. Set the sample to the eucentric position.
4. Tilt the stage to the desired angle, usually 52°. Use 16° when using the FEI pre-tilted stub holder. Initial tilt must be < 32°. Other values are possible when using other pre-tilted stub holders.
5. Ensure that the electron and ion beams are coincident.
6. Verify that the image shift, when changing ion column aperture is minimized.
7. Optimize electron beam focus.
8. Run the *Link Z to FWD* procedure.
9. Set the ion beam horizontal field width within the range 10 – 150 µm.
10. To avoid obstructions during shuttling (making a single stage move), select the *Stage* menu / *Enable Safe Stage Moves* item on the microscope UI if that feature is supported in your version.

Some tasks relate to the *Settings* within the Auto Slice & View application (see Chapter 2):

- Analytical package application configuration – *Analysis* window  
If one or more of the third-party detectors is not configured or not communicating, it is an error preventing you from using related image acquisitions. This can occur for several reasons:

## Configuration: Setting up new project

- The third-party application destination folder(s) has been deleted or renamed.
  - The third-party PC is not turned on, or the application is not running.
  - The microscope PC and the third-party PC are not communicating for some reason.
- More specific information is contained in the project log file in the project's results folder.

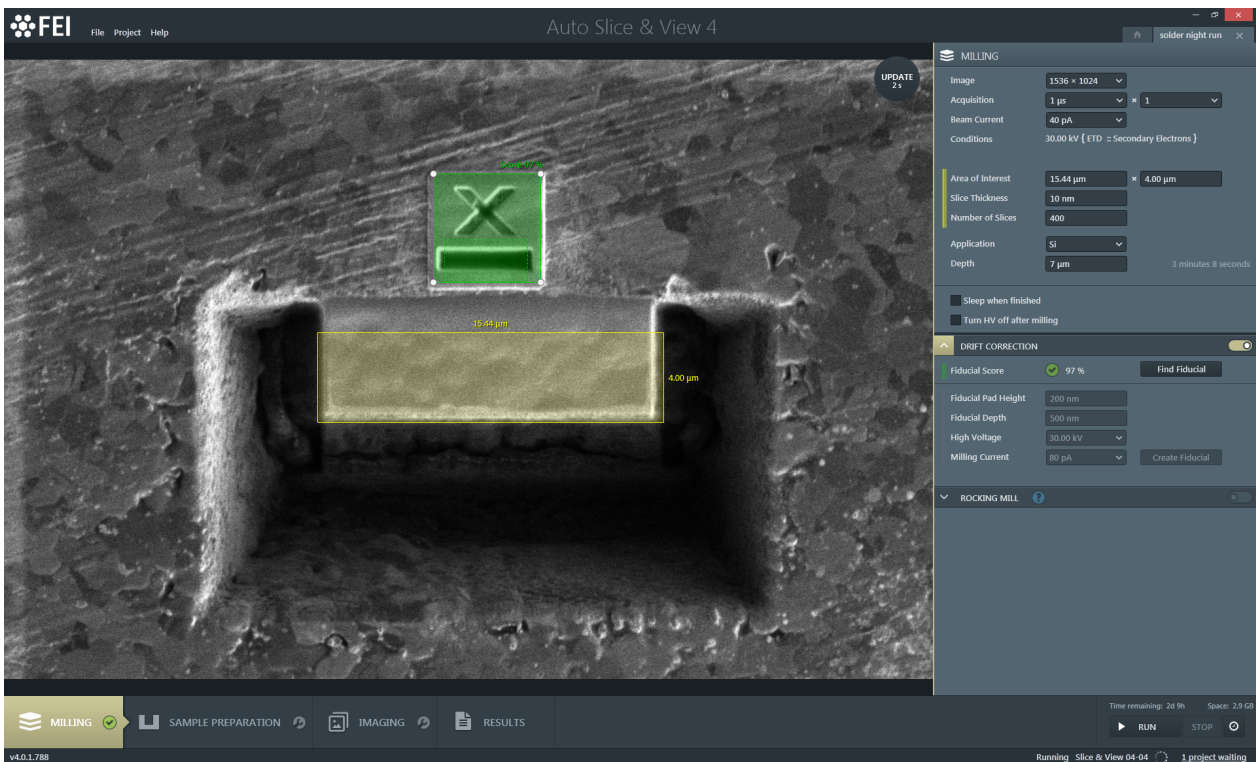
- Injector configuration - *Deposition* window
- Destination folder - *Project* window

## MILLING page

Within the MILLING page set up the MILLING controls and the DRIFT CORRECTION module parameters.

In the ion image, the slicing/milling area is indicated by a yellow rectangle. The fiducial point area is indicated by a red rectangle; when the fiducial point is defined, this area changes to green.

Figure 3-1: MILLING page



## MILLING controls

- *Image* - specifies the amount of detail to be used to grab the drift correction images. It is described by the pixel count in an image as: number of pixel columns × number of pixel rows. The higher the resolution, the more image detail can be seen. Consider selecting a higher resolution if milling < 20 nm slice thickness.
- *Acquisition* - specifies the dwell time to be used to acquire the images × number of frame Integration.
- *Beam Current* - specifies an ion beam current. Select a current high enough to mill the sample in a reasonable time, but low enough to guard against sample damage and loss of image resolution. Estimated milling time for one slice is indicated at the bottom right of the module.
- *Conditions* (informational field) - informs about the ion beam accelerating voltage, the detector and its mode used etc.
- *Area of Interest* (width × height) - shows the width and height of the slicing area as defined by the yellow rectangle. For fine tuning (or by preference), define the values by typing a value in the edit field. The slicing area will be adjusted to the value entered. Changing the height will adapt the number of slices to height/slice thickness.
- *Slice Thickness* - represents the targeted thickness of each slice. The default is 20 nm. Changing this value will adapt the number of slices to match the new thickness.
- *Number of Slices* - specifies the number of slices to be made in the automated slicing phase. Changing this value will adapt the height of the milling site to match slice thickness \* number slices.
- *Application* - specifies a GIS material application that is appropriate for the sample under investigation.

**Caution!**

Do not move the stage with a GIS inserted.

- *Depth* - specifies the relative depth of the slicing area, depending on the kind of sample, sample geometry, etc. The depth is set by application, but it can be changed by typing a value, typically between 0.5 and 100 μm.
- *Sleep when finished* - ticking this check box will force the system to sleep after the project has been finished (see the microscope UI *Sleep* button behavior). This functionality can be switched on during running a project.
- The *Turn HV off after milling* check box is used with ROCKING MILL (see below). It switches of the ion beam accelerating voltage during a long lasting electron beam imaging (when the screen resolution and dwell time are set high).

**Note**

When there is a queue of projects to be executed, ensure this option to be set only for the last project. Otherwise the system is put to sleep, and subsequent system wake up cancels the Links Z to FWD, therefore a next project does not start.

**DRIFT CORRECTION module**

FIB drift correction is used for more accurate processing results: a higher slice thickness accuracy and placement of individual slices can be achieved. It refers to the placement of the pattern for milling, not image drift.

**Note**

The Drift Correction must be activated when the Anti-Shadow Side Wall is going to be used.

**Fiducial point**

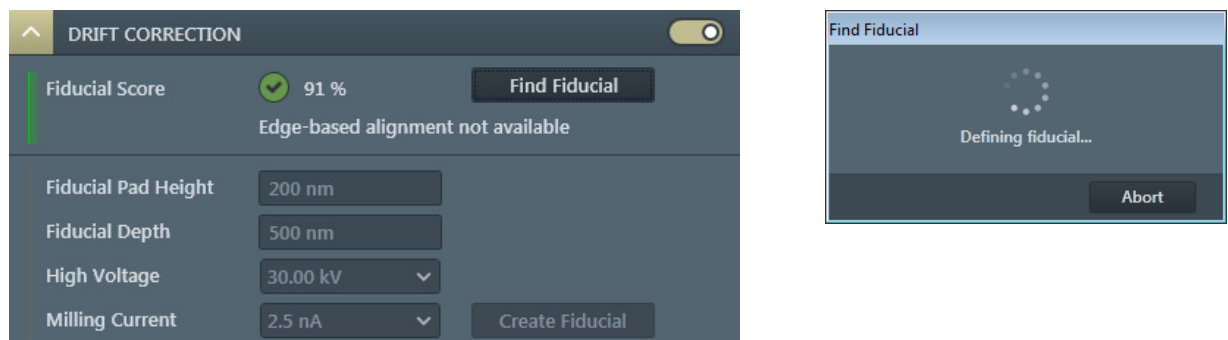
A fiducial point is used for FIB drift correction during the slicing process, automatic alignment (Alignment module), and during the EBSD analytical application configuration (option).

The position of the fiducial point has to be some distance apart from the milling, and also from the imaging area borders. Trying to place the fiducial point to a not allowed location within the HFW shows a red bordered rectangle, delimiting of an allowed area.

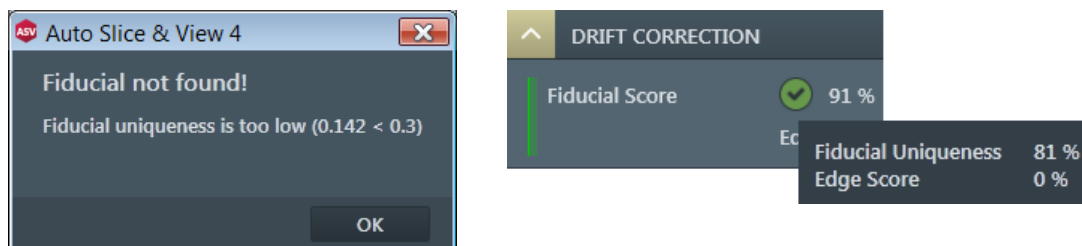
**Finding fiducial point**

Although there can be several fiducial points within a project, the process of finding a pre-existing one is always the same. Limits determining success (score) of finding fiducial points are set in the *Settings* window / *Fiducial* item.

1. In the microscope UI, optimize imaging parameters while imaging the cut face.  
Adjust stage position and magnification so the cut face is centered and a suitable formation you want to use as a fiducial point is visible.
2. In the AS&V UI, set the desired acquisition type image series (see further).
3. Click the update button to refresh the image.
4. Resize and reposition the red box to cover the intended fiducial point entirely.
5. Resize and reposition the yellow box to cover the cut face area of interest.
6. When you are satisfied, click the *Find Fiducial* button. A new image will be grabbed to determine the *Fiducial Score* (in %) of the selected fiducial point. The higher the score, the better the fiducial point.



If the fiducial point is not found, a message gives an information why the software failed to find it. Otherwise a tooltip gives detailed information about fiducial scores.



You must change image acquisition settings or adjust the fiducial point location and try again.

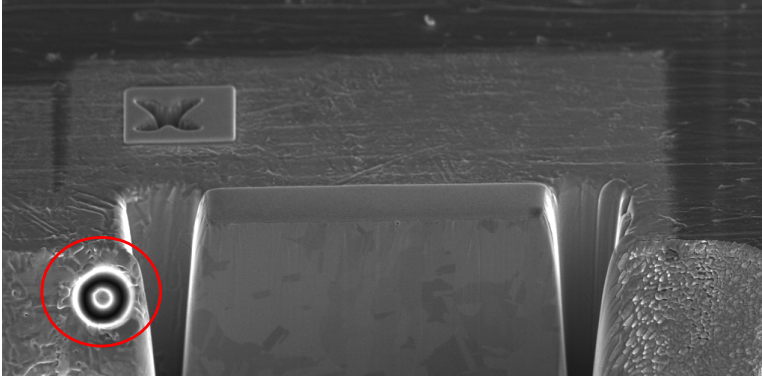
If the fiducial point is found, the software stores acquisition settings to use when locating the fiducial point during the automated run. From now on the fiducial point is locked in, the yellow box can be resized but cannot be moved.

If there are no horizontal lines within the fiducial, information about *Edge-based alignment* unavailability is shown, but this does not prevent to continue.

If there are any changes that require an image update, click and drag the green area within the acquired image (green changes to red). It allows you to make changes to the fiducial point location and to image settings if desired. Then find the fiducial point again.

### Best Practices

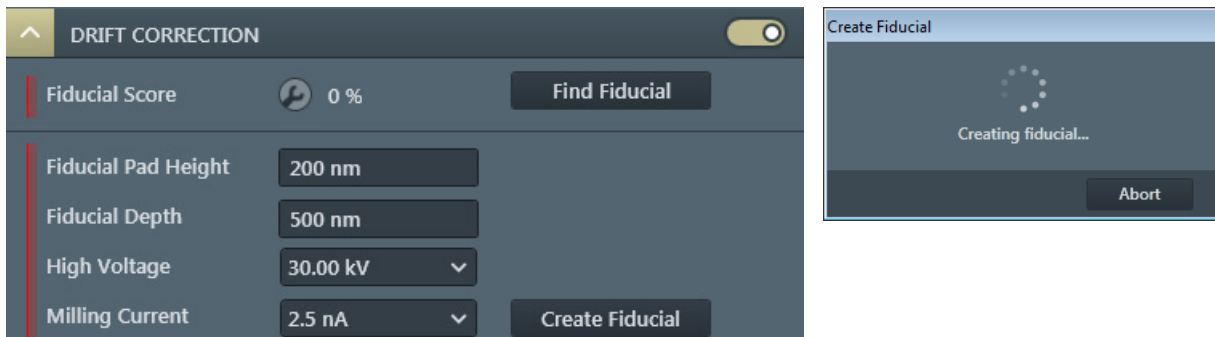
- The fiducial point should have good contrast.



- Fiducial point saturation should be low. If the fiducial point's edges are saturated, this will reduce accuracy.
- Use a fiducial point as close to the cut face as possible. A large change in magnification between the alignment images and the final image will reduce accuracy.
- Take care to ensure intended fiducial point is unique if selecting any existing formation. Creating your own fiducial point within the microscope UI is the best course. This ensures also contrast.

### Creating fiducial point

When there is no suitable existing formation, the fiducial point must be created on the sample surface either in the microscope UI, or in the AS&V application by clicking the *Create Fiducial* button.



The informational window will show a progress of creation with following parameters:

- *Fiducial Pad Height* - the deposited height of the protective layer, where the fiducial point will be milled.
- *Fiducial Depth* - the depth of the cross patterns.
- *High Voltage* - the ion beam voltage used to mill the cross patterns; select a voltage high enough to mill the sample in a reasonable time, but low enough to guard against sample damage and loss of image resolution.
- *Milling Current* - application suggests suitable milling current according to the fiducial rectangle size.

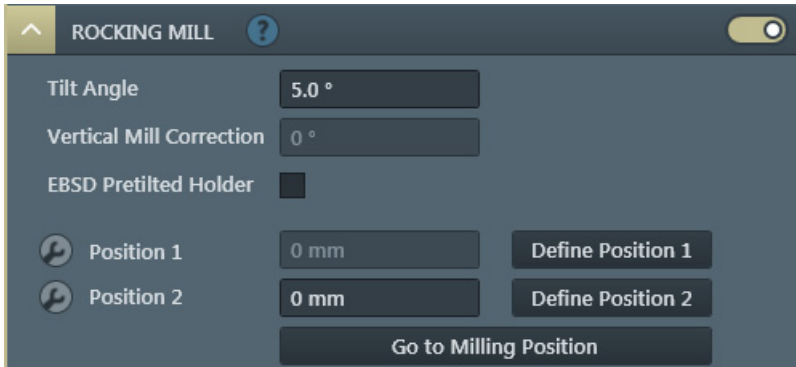
When milling is complete and the fiducial point is successfully found, proceed with the *Sample Preparation* page. If the fiducial point cannot be found after milling is complete, optimize the fiducial point image by using the microscope UI and use the *resh* functionality to continue.

### Note

*If the fiducial point appears dark, consider using a different deposition material to improve contrast with the fiducial point.*

## ROCKING MILL module

Vertical direction milling is a common practice used by FIB for milling series of 2D slices. Rocking mill technique is required in general when using high current plasma FIB. It achieves mill in two different directions alternatively with a defined angle away from either side of the vertical milling direction to suppress a curtain effect.



Setup Rocking mill parameters should follow this sequences:

- *Tilt Angle* defines Rocking mill half angle (default has been 5° pre-selected), which is an angle away from vertical mill direction. The maximum allowed tilt angle is 20° no matter the sample whether is on a pre-tilted or a non-pre-tilted holder.
- *Vertical Mill Correction* angle is set to 0° by default; in some cases a user can add a small amount of this angle up to 1°.
- *EBSD Pretilted Holder* check box refers to a holder used for FEI EBS3 applications. Generally, Rocking mill starts from a sample mounted on a non-pre-tilted holder with the stage has been already tilted to 52° at the eucentric position. However the method also supports a sample mounted on a FEI EBS3 holder laid on the smaller slope side, which is 36° pre-tilted.

*Position 1 / Position 2* are two stage positions for Rocking mill.

- *Define Position 1 / Position 2* button – use this until the positions 1 and then 2 are defined (green check mark) and FIB image matching is successful. When software is unable to define the position automatically (for example the fiducial cannot be found), user can adjust FIB image contrast/brightness, focus, astigmatism correction, and stage position/beam within the microscope UI and to move fiducial into field of view. Then click the button again. FIB beam scan rotation is automatically applied.

The two stage positions are different and FIB beam scan rotations may be different as well.

- *Go to Milling Position* – A good practice is to set the stage back to the standard vertical (non-Rocking mill position) after positions 1 and 2 have been successfully defined.

There are two methods to achieve Rocking mill positions. The application software will choose either Tilt or Rotation Rocking mill method automatically based on the required half angle or pre-tilted holder.

- **Tilt Rocking mill method** involves stage tilting between two rocking mill slice positions, i.e., *Position 1* and *Position 2*. Actual stage movements will be: a relative rotation of +90°, then rocking positions between a relatively -5° tilt of position 1 and a relatively +5° tilt of position 2. This method gives a good co-planarity between rocking mill position 1 and rocking mill position 2 but rocking half angle is limited up to 6°.
- **Rotation Rocking mill method** involves stage rotation between two rocking mill slice positions. You can tilt the stage from 52° to a relatively "-" angle up to 20°, which is the defined *Tilt Angle* (rocking half angle).

Using a pre-tilted holder, Rotation method is always used, no matter how much rocking angle is required.

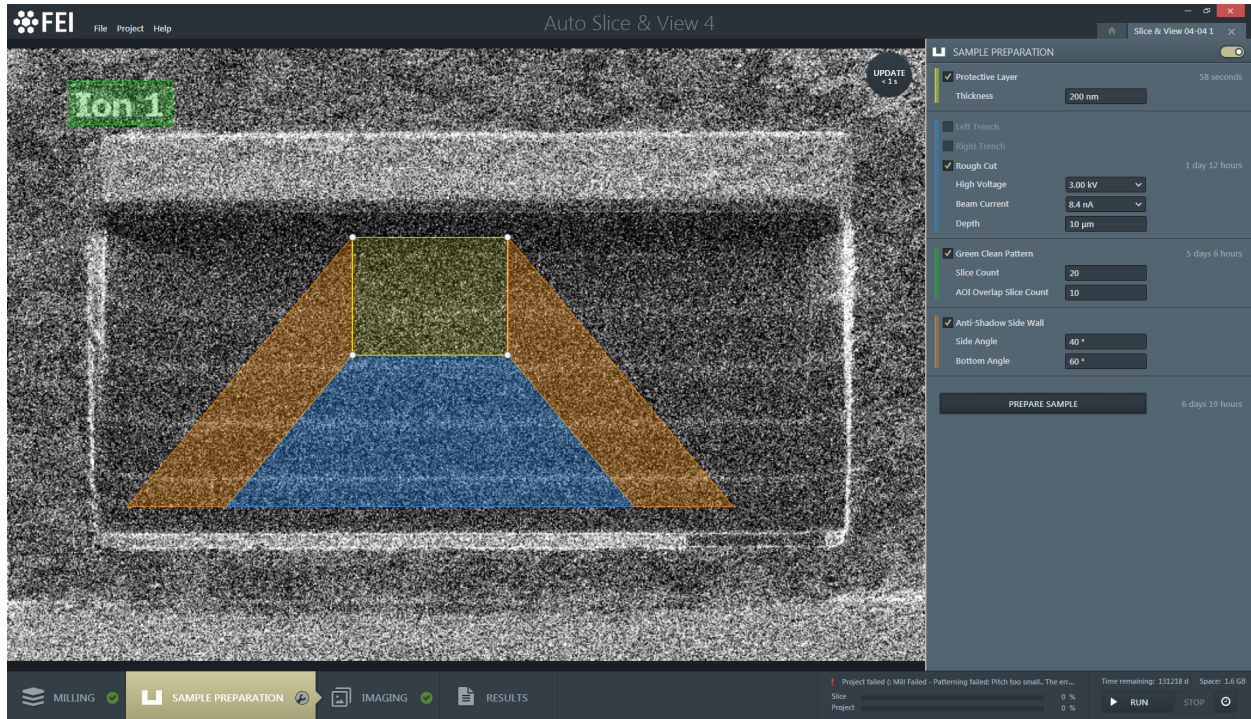


## SAMPLE PREPARATION page

The sample preparation settings are available on this window. The multiple controls for different milling options can be used separately, together, or not at all (in case the user has prepared sample area of interest in the microscope UI). Ticking the corresponding check box(es) enables the option(s), corresponding areas within the image are colored in the same way as in the SAMPLE PREPARATION module. The time value on the right side next to the corresponding items shows the estimated milling time in context of the actual setup properties. The Beam current and milling area dimensions are main factors which influence the time.

The blue rough cut and trench cut areas, just as the yellow area of interest (or Protective layer area) can be modified graphically by dragging and dropping the selection boxes on the corners and sides of each rectangle. The *Left Trench* and *Right Trench* can not be used simultaneously with the *Anti-Shadow Side Wall*.

Figure 3-2: SAMPLE PREPARATION page



- Protective Layer** check box – selecting this option deposits a protective coating over the intended milling area. The coating is used to protect surface features or to ensure that a potentially mobile feature remains fixed. The ion beam current for the deposition layer will be calculated as a function of the area and the volume per dose value on the Settings / Deposition window. Make sure that the correct Injector and Application File (usually platinum) port are selected in the Settings / Deposition window (see Chapter 2).
- Thickness** – specifies the height of the deposition layer.
- Left / Right Trench** check box – the trench cuts provide a place for material to be deposited as slices are milled away from the area of interest during the automated run. They are represented as blue rectangles to the right and left of the yellow milling area rectangle. Mills standard cross sections to produce the rough cut and trench cuts.
- Rough Cut** – the rough cut exposes the face of the feature of interest for electron beam imaging. Its size and location are represented as a blue rectangle on the ion image.
- High Voltage / Beam Current** – specifies the ion beam voltage / current to use when milling the Trench cuts, Rough cut, and Anti-Shadow Side Wall.

### Note

*Green Clean Pattern High Voltage / Beam Current is set on the Milling page.*

- Depth** – specifies the depth of the selected milling pattern area
- Clicking the *Prepare Sample* button starts milling of all selected options; the informational window will show the progress.
- Anti-Shadow Side Wall** – enables milling of anti-shadow angles for the EBSD / EDS processing. *Side / Bottom Angle* may be edited with values between 0° and 75° (integer).

### Note

*The Drift Correction must be activated when the Anti-Shadow Side Wall is going to be used.*



## Green Clean Pattern

A Green Clean Pattern (GCP) prepares the sample cut-face for immediate data acquisition during automation by milling away a user-defined number of slices at low voltage and current. The depth is the same as the standard slice depth. The GCP area is represented by a green box in the image area.

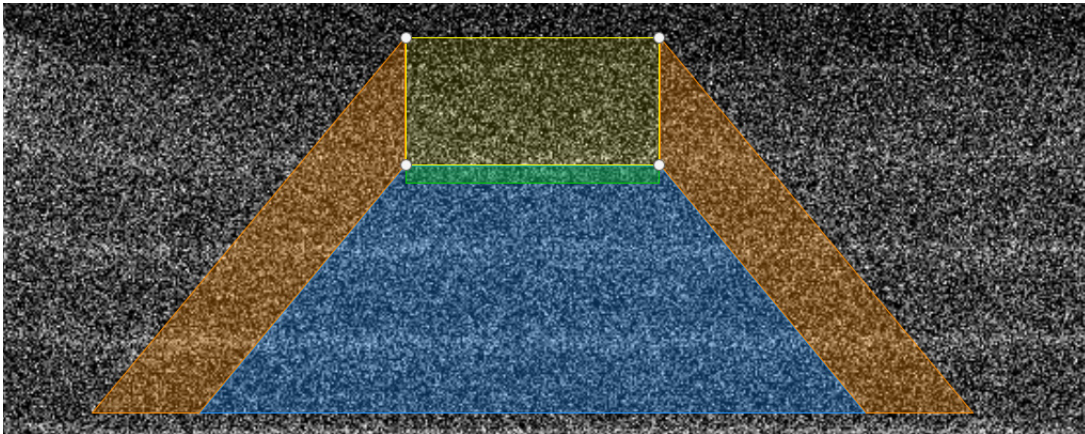
- The milling occurs at the voltage, current, and depth specified on the Milling page.
- The width of the green box is restricted to be the same width as the yellow area of interest (AOI) box.
- The height of the green box is unrestricted, but typically it will be very small. It represents the *Slice Count* - number of slices (text box), that will be milled.
- The *AOI Overlap Slice Count* text area specifies the number of GCP slices, that overlap the bottom of the area of interest.

If you are watching the milling process on the microscope UI and you decide that enough of the GCP has been milled, you can stop the milling at the end of the actual slice by clicking the *Abort* button.

- If you stop the milling within the area of interest, the software will know where to begin during the automated slicing process.
- If the *Anti-Shadow Side Wall* is enabled and you click *Abort* while the anti-shadow side wall is being milled, you might have an unprepared area of interest. You must go back to the Sample Preparation page, reset the GCP and Anti-Shadow controls, and choose the appropriate milling options to prepare your area of interest.

### Example 1: GCP overlaps only rough cut area

Dark green trapezoids are used to show the part of the anti-shadow wall that will be milled during the setup phase. Although it is not shown, the anti-shadow bottom angle will also be milled after the green clean pattern mill to avoid a shelf.

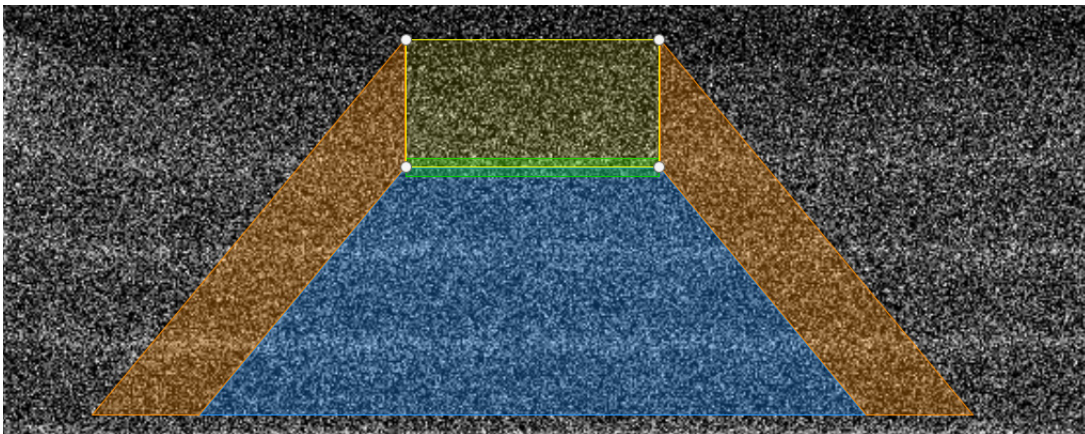


No anti-shadow side wall milling will take place.

- Milling sequence: For every GCP slice milling, bottom angle milling also happens.
- Abort button action: Stops the GCP milling at the finish of a actual slice and the total number of AOI slices will not change.

### Example 2: GCP overlaps rough cut and AOI

Anti-shadow side wall milling will be performed as shown.

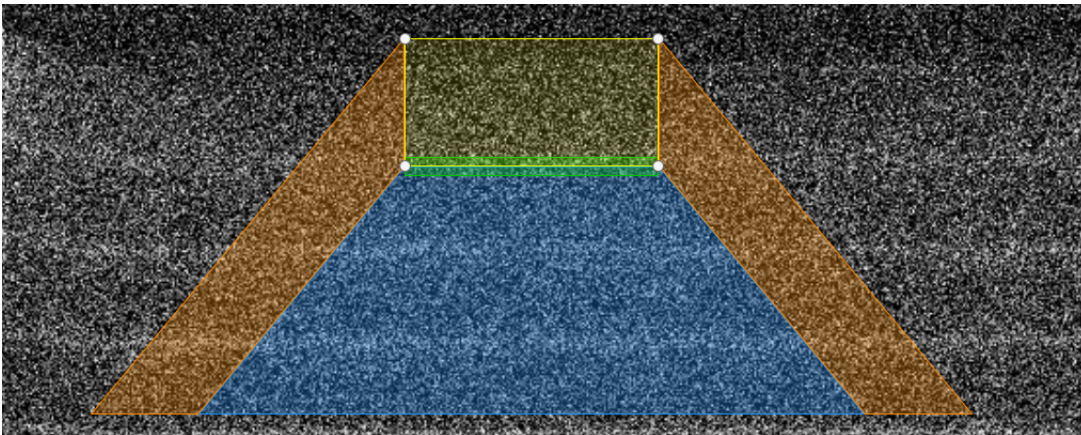


- Milling sequence: For the GCP overlap area, anti-shadow area is calculated both for the left and right side of AOI as shown in the diagram by the green area with thick stroke. This area is divided into a smaller area by dividing it with the given GCP overlap slice count.

- First, the left side anti-shadow milling happens in a loop of GCP overlap count.
- Second, the right side anti-shadow milling happens in a loop of GCP overlap count.
- Third, the GCP milling happens from the bottom towards the top. For each GCP slice milled, the bottom angle is also milled.
- Abort button action: The action depends on where you were in the whole milling sequence.
  - If you click Stop while the GCP milling process was in the GCP overlap area, the total AOI slice count will be affected by how many GCP overlap slices were milled.
  - If you let the whole GCP milling process continue until the end, the total AOI slice count will be reduced by the GCP overlap slice count.

**Example 3: no rough cut selected; GCP is below AOI**

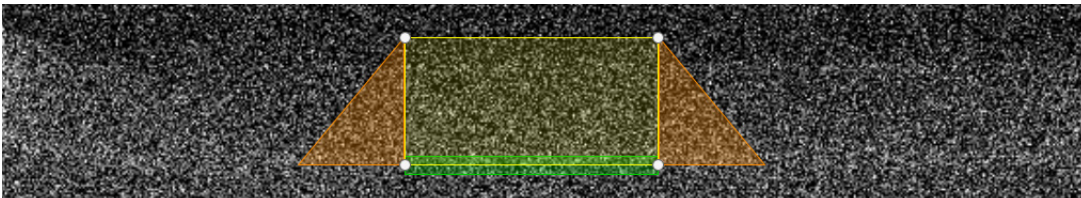
No anti-shadow side wall milling will take place.



- Milling sequence: For every GCP slice milling, Bottom angle milling also happens.
- Abort button action: Stops the GCP milling at the finish of a actual slice and the total number of AOI slices will not change.

**Example 4: no rough cut selected; GCP partially overlaps AOI**

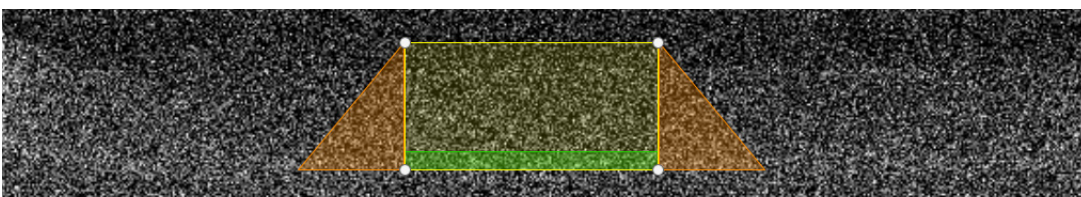
Anti-shadow wall will be milled as shown.



- Milling sequence: For the GCP area, anti-shadow area is calculated both for the left and right side of the AOI as shown in the diagram by the green area with thick stroke.
  1. The left side anti-shadow and bottom angle milling happens.
  2. The right side anti-shadow and bottom angle milling happens.
  3. The GCP milling happens from the bottom towards the top. For each GCP slice that happens, the bottom angle also happens
- Abort button action: The action depends on where you were in the whole milling sequence.
  - If you click Stop while the GCP milling process was in the GCP overlap area, the total AOI slice count will be affected by how many GCP overlap slices was milled.
  - If you let the whole GCP milling process continue to the end, the total AOI slice count will be reduced by the GCP overlap slice count.

**Example 5: no rough cut selected; GCP completely overlaps AOI**

Anti-shadow side wall will be milled as shown.



- Milling sequence: For the GCP area, anti-shadow area is calculated both for the left and right side of the AOI as shown in the diagram by the green area with thick stroke.



## Configuration: Setting up new project

1. The left side anti-shadow and bottom angle milling happens.
  - Second, the right side anti-shadow and bottom angle milling happens.
2. The GCP milling happens from the bottom towards the top. For each GCP slice that happens, the bottom angle also happens
  - Abort button action: The action depends on where you were in the whole milling sequence.
    - If you click Stop while the GCP milling process was in the GCP overlap area, the total AOI slice count will be affected by how many GCP overlap slices was milled.
    - If you let the whole GCP milling process continue to the end, the total AOI slice count will be reduced by the GCP overlap slice count.

## IMAGING page

Before proceeding with the items on the Imaging page, prepare the site for imaging.

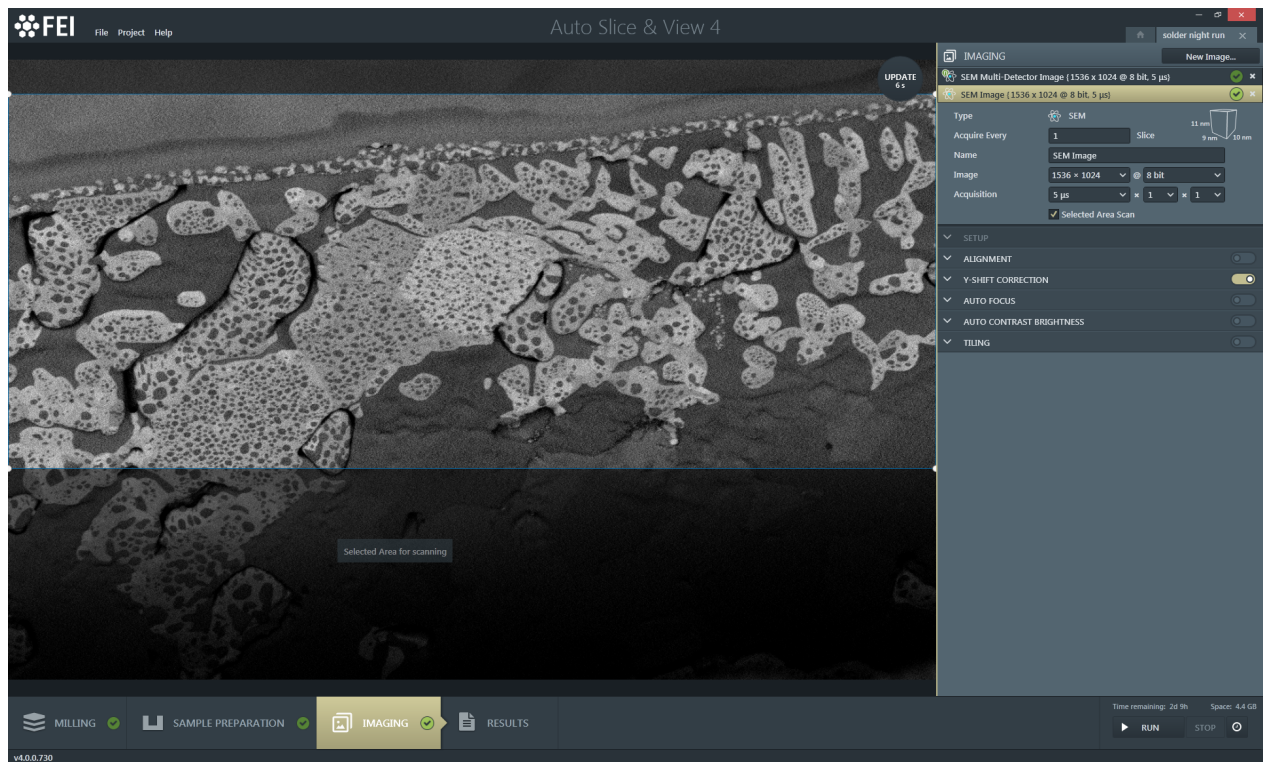
1. Move the stage to the imaging position and set up the imaging conditions such as accelerating voltage, beam current, and detectors for each display.
2. Optimize the imaging parameters such as lens alignment, focus, astigmatism correction, and brightness & contrast.

Note:

*For better electron beam resolution and signal detection, move the sample to a smaller working distance. The EBSD acquisitions (option) use a pre-tilted stub, allowing for electron beam imaging perpendicular to the cut face. If the Charge control is enabled, it will be turned off automatically, so that you can acquire electron beam images. This does not affect how the Charge control is used during the automated run.*

There are several modules within this page on the right side of the window. Here the final data acquisition is configured.

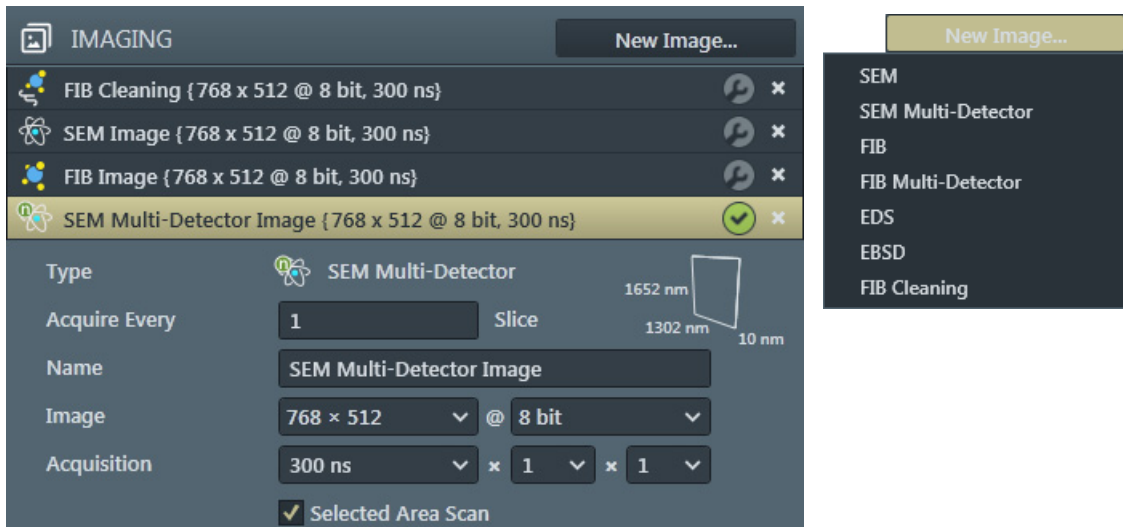
Figure 3-3: IMAGING page



### IMAGING controls - acquisition types

There are several possible types of acquisition selectable from the drop-down menu when clicking the *New Image...* button. By selecting any item, a new line (an image series, that will be taken every slice) is added to the list, with the corresponding settings.

Figure 3-4: Image series

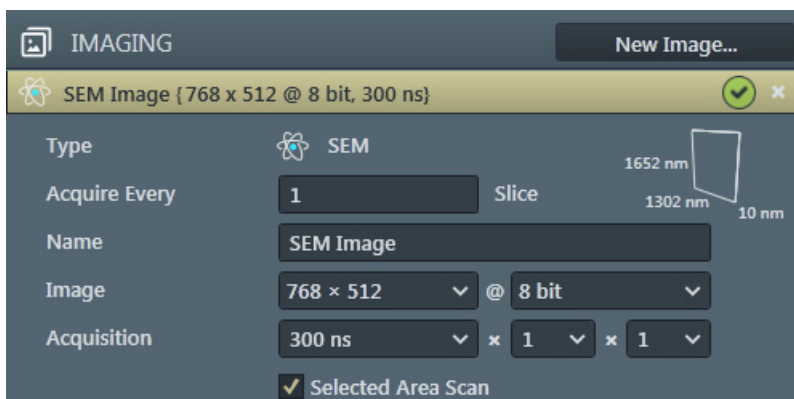


The image series acquisition type is stated in the header – a selected one is highlighted by the beige header background and module controls are shown. By clicking the cross on the right side of the image header deletes that image series from the list.

### SEM / FIB acquisition

There are some common imaging module controls described here:

Figure 3-5: SEM image series



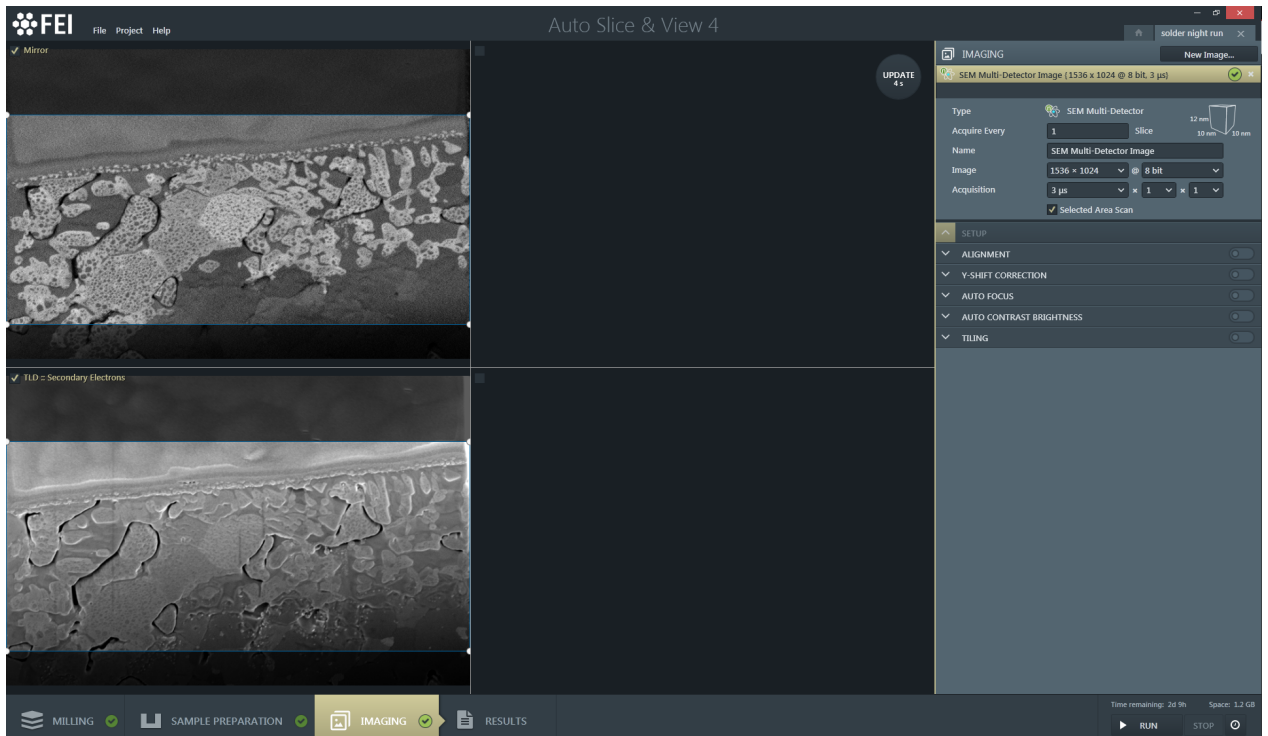
- *Type* – shows the beam used by this acquisition type.
- *Voxel cube* – its size dimensions are dependent on the resolution, HFW, slice thickness, stage position and tilt correction settings. A tooltip gives a hint about setting of the isometric (cubic) voxel.
- *Acquire Every # Slice* – specifies the interval between slices to be acquired.
- *Name* – enter a meaningful name for the actual image series.
- *Image* – specifies the image resolution and its bit depth.
- *Acquisition* – specifies the dwell time × number of lines integration × number of frames integration to be used for this image series.
- *Selected Area Scanning* – if checked, only selected area will be scanned for imaging.

### SEM / FIB Multi-Detector acquisition

After the detectors are set up in the microscope UI, select the desired display(s) to include by checking its check box at the top-left corner; a detector name set for this display is shown next to it. All selected displays must have the same beam. By clicking the update button, the settings are updated and the image(s) is/are acquired in it's associated display.

If one of the detectors is not compatible, a message appears to alert you to the problem. Deselect the appropriate display, or set a suitable detector within the microscope UI; then click the update button.

**Figure 3-6:** SEM Multi-Detector display settings



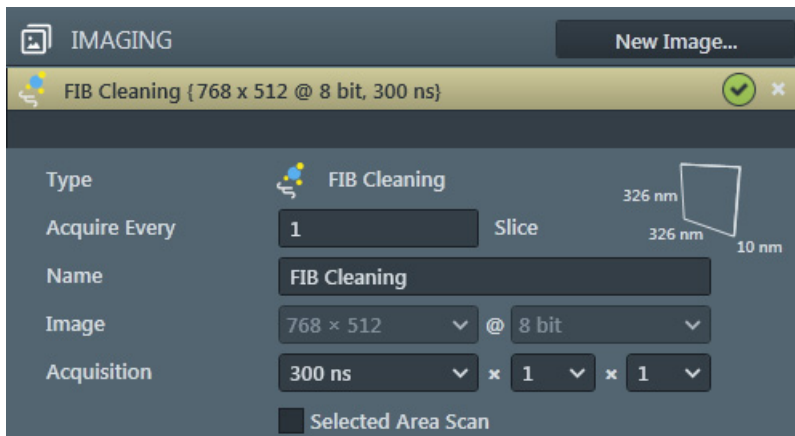
**Note**

The auto functions and ACB are performed on the SEM image defined in display 1, and on the FIB image in display 2.

**FIB Cleaning acquisition**

The FIB Cleaning cleans the area of interest surface (cut face) by exposing it to a low voltage ion beam before imaging, that provides up to a 50% improvement in the EBSD and EDS images.

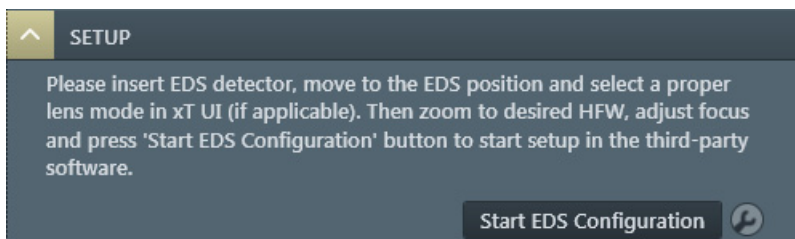
**Figure 3-7:** SEM image series



The beam type is switched to ion beam, a new image series is inserted as the first one in the list.

**EDS acquisition (option)**

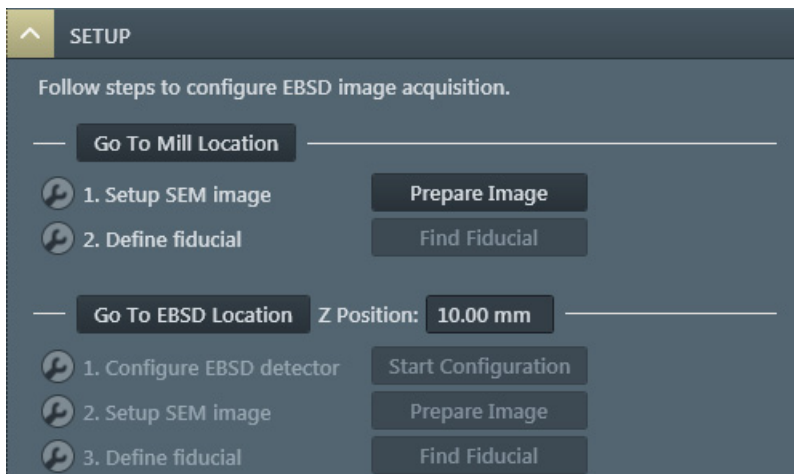
The third-party application must be configured first. Follow the instruction in the *SETUP* module.



After clicking the *SETUP* module / *Start EDS Configuration* button, the EDS stage position is locked in and EDS configuration begins within the third party software. The process can require a user intervention,

### EBSD acquisition (option)

The controls on this screen are enabled in sequence to walk you through the process of configuring alignment at the milling location, setting up the third-party application, and configuring alignment at the EBSD mapping location.



- **Go To Mill Location** button drives the stage to the milling location configured on the Milling page.
- Step 1. / **Prepare Image** button acquires a SEM image in preparation for locating the fiducial point at the mill location.
- Step 2. / **Find Fiducial** button (enabled after the SEM image has been acquired) attempts to find the fiducial point you have indicated (see above).
- **Go To EBSD Location** button drives the stage to the required working distance, rotates the cross section 180° towards the EBSD camera, and adjusts the tilt angle to get a 70° incidence angle of the SEM. If the mill location uses a 12° tilt angle, the tilt angle will be corrected to 20° at the EBSD location.  
If a non-pretilted holder is being used and the stage is at 52° (or any angle which is > 32°), the stage tilt will fail and you will get an error message.

#### Note

*It is recommended that you use microscope UI to move the stage and not use the Go To EBSD Location button.*

- The **Z Position** sets the working distance at the EBSD location. It defaults to what is set in microscope UI, but can be changed by the user. It is locked in when you click the step 3. / **Find Fiducial** button.
- Step 1. / **Start Configuration** button is enabled after the fiducial point at the mill location has been successfully found. When this button is clicked, you must set up the third-party application on the third-party PC if needed. When that is complete, the software stores the actual image settings to use during automation.
- Step 2. / **Prepare Image** button for the EBSD Location acquires a SEM image in preparation for locating the fiducial point at the EBSD location.
- Step 3. / **Find Fiducial** button – see above.

### EBSD fiducial points

Two fiducial points must be selected, one at the milling location and one at the EBSD mapping location. Each fiducial point is from an electron beam (SEM) image. Both fiducial points are used during the automated run.

- The SEM fiducial point at the milling location is used to roughly ensure that the stage moves correctly to the milling location from the EBSD location.
- The FIB fiducial point should be as close to the milling location as possible. It is used to fine tune the stage position to ensure that the anti-shadow mill patterns are entirely in the field of view so they can be milled.
- The SEM fiducial point at the EBSD location is used to ensure that the stage moves correctly to the EBSD mapping location from the milling location.

#### Caution!

*Do not move the stage when configuring the fiducial area after returning from the Start EBSD setup. The automated run uses this stage position to move to the EBSD location, find the fiducial point, and then zoom in to the data collection HFW. If the software detects a stage move, you will have to redo the Start EBSD, so that the only difference between finding the fiducial point at the EBSD location and doing EBSD data collection is the HFW. All other image settings and the stage position are the same.*

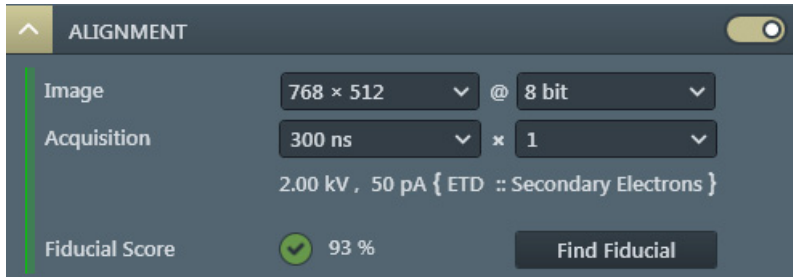
If you want low-vacuum mode, you should switch to low-vacuum mode in microscope UI before starting the EBSD configuration, so that the entire configuration process is done in that mode.

If you have a FIB Cleaning image in your project and it still needs to be configured, be sure to move the stage to the desired location before configuring the FIB cleaning settings.



## ALIGNMENT module

An automatic image stack alignment is enabled here. It is used to get all of the images lined up smoothly with one another.

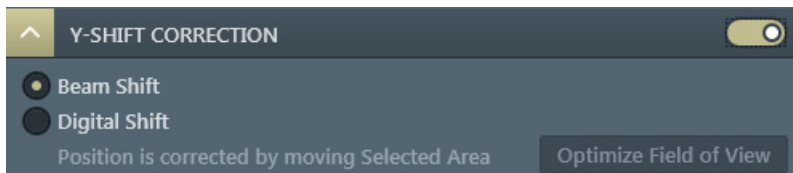


The user specifies a unique feature to look for (the fiducial point) and then for each slice it shifts the image so that the fiducial point always appears in the same spot. Otherwise, due to sample movements and drift, the image features would jump around from slice to slice.

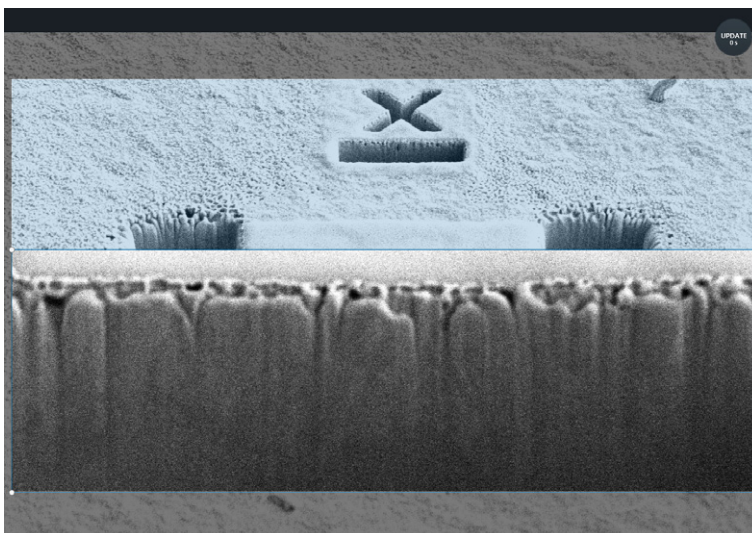
- *Image* – specifies the image resolution and its bit depth.
- *Acquisition* – specifies the dwell time × number of frames to be integrated for the images used to align the final cut face area during the automated run.
- Clicking the *Find Fiducial* button positions the sample, performs auto-contrast and brightness if activated, and finds the fiducial point (see above). Alignment configuration is not complete until you click this button.

## Y-SHIFT CORRECTION module

In perpendicular SEM imaging, the sample is tilted in such a way, that the plane of the cut face is perpendicular to the electron beam, that results in the most accurate image. Normally an electron beam imaging is under 52°, so each slice causes a little image shift. To compensate this behavior for every slice, activate this module and select a desired method by checking the radio button.



- *Beam Shift* compensates an image shift by changing the beam focus. There is limited beam shift to make use of, and the detector mode also affects available beam shift.
- *Digital Shift* starts the *Selected Area Scan* for a corresponding image series, and compensates an image shift by shifting of this area.



The lower (clear) area is the actual selected area, the area above (bluish haze) delineates, where the digital shift will take place. Dimensions of these areas are set by an application, they are influenced by AOI dimensions.

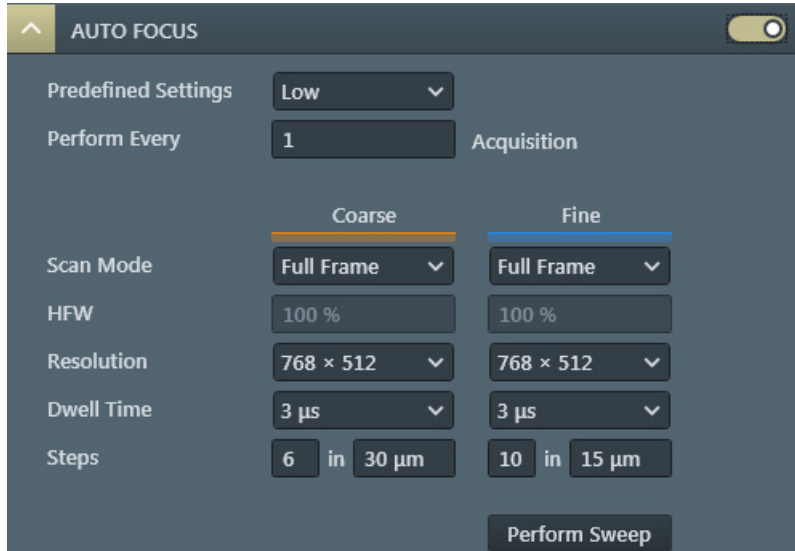
The image above shows situation after clicking the *Optimize Field of View* button, causing extending of the AOI to fill the display optimally.

## AUTO FOCUS module

When activated, the auto focus functionality is performed before every Nth acquisition of this series. It is based on “sweeping” the working distance over a specified range while measuring image sharpness. In practice, a two-step approach is more efficient than a single sweep: first a *Coarse* sweep (orange color) to get close to focus, then a *Fine* sweep (blue color) to optimize it. Both sweeps are set independently.

In addition, there are a number of parameters that affect the accuracy, speed, and success rate of this approach. At the same time, these settings may also be sample and magnification dependent.

Best results are obtained by tuning these parameters prior to starting a project execution:



- *Predefined Settings* (Low / Medium / High / Custom)  
The different preset settings to the multiple controls are applied. This selection gives a good starting point, affecting final accuracy, speed, and success of the project. The Custom preset is shown, when actual settings are different from any preset.
- *Perform Every # Acquisition* – specifies, if autofocus should be performed before each (= 1) / Nth (> 1) image acquisition.
- *Scan Mode* (Full Frame / Reduced Area) – determines the size of the images acquired in a focus sweep. If a reduced area is selected, it will use the HFW (%) reduction for the size. When imaging uses reduced area, full frame selection is not available.
- *HFW* – specifies the percentage of the frame (horizontal field width), if the reduced area scan mode is selected. The size will be scaled from the middle of the frame.
- *Resolution* – specifies the pixel resolution of images acquired during the focus sweep.
- *Dwell Time* – specifies the amount of time the beam dwells on each pixel when images are acquired during the focus sweep.
- *Steps* – specifies the number of working distance (WD) steps in which the range will be sampled:  
WD step size = range / steps.
- *Perform Sweep* button – performs an auto focus sweep with the configured settings and shows image series of both sweeps distinguished by the color. This is an opportunity to test the auto focus and make changes, if needed.

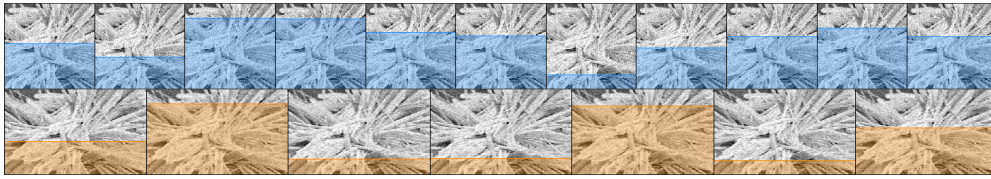
### Best Practices

When configuring auto focus, there is always a trade-off between accuracy, speed, robustness, and sample exposure. The auto focus functionality is designed to work well even when the images it uses as it runs appear “noisy” to the human eye. This typically occurs when auto focus is configured with low dwell times and low resolutions so that it runs as fast as possible.

- The time it takes to perform auto focus is mainly determined by acquisition speed and number of steps.
- Using lower image resolution and smaller dwell times will increase acquisition speed at the slight cost of accuracy and robustness.
- Using reduced area imaging speeds up acquisition, but increases the risk of looking at an area that has no features on which to focus.
- A higher number of steps increases the accuracy (up to a certain limit); this comes at the price of speed. Note that the coarse / fine sweep helps out here.
- As a rule of thumb, the range of the fine sweep should be a few times the step size (i.e., range divided by steps) of the coarse sweep.

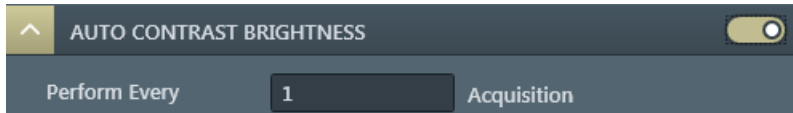


The key indicator of a successful auto focus setup is the partially colored resulting images obtained after clicking the *Perform Sweep* button. The bigger the colored area, the better the focus. The application selects automatically the best settings.



### AUTO CONTRAST BRIGHTNESS module

When enabled, applies ACB (Auto Contrast Brightness) to each image acquisition set in the *Perform Every # Acquisition*. It determines whether or not an ACB is done before acquiring the image during the automated run. It works for high-vacuum and low-vacuum images.



#### Note

*This is intended to be used for the EBSD acquisition type when doing low-vacuum mapping. ACB is allowed for all third-party acquisition types.*

*Be sure the third-party software is able to be called multiple times (once per tile) instead of just once per slice, especially if it does any sort of drift correction. It may interpret the tiling as drifting and correct for it, producing unexpected results.*

### TILING module

When activated, a set of tiles of the cut face area is grabbed instead of a single image.



- *Columns / Rows* – defines the number of columns and rows of the grid used for tiling. An image / map will be acquired for each tile.
- *Tile Overlap* defines the percentage of each tile that will be overlapped during image acquisition to provide a reference area in the images for reconstructing a composite image of all tiles.
- *Final Image Resolution* (informal field) shows the microscope UI settings of the image resolution.
- *Enable Stitching* check box – when enabled (ticked), this service stitches the image tiles to produce one large image.

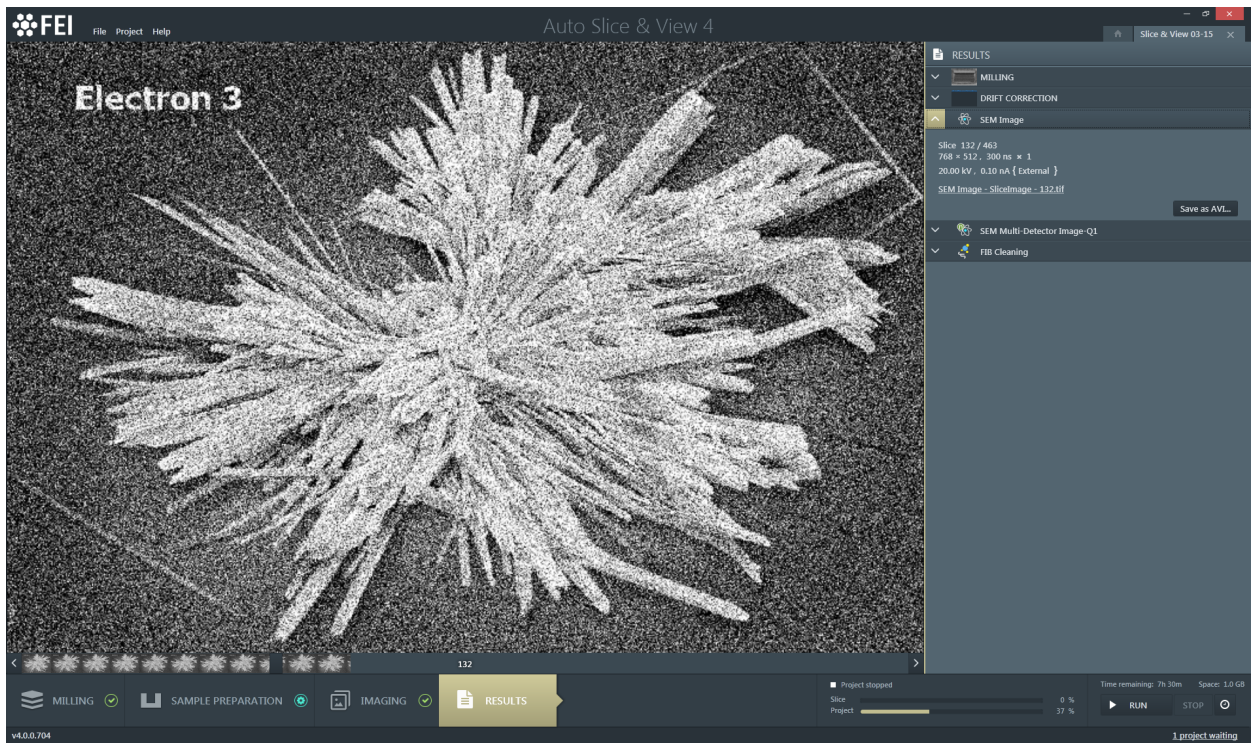
#### Note

*Tiling can only be enabled for SEM images and is recommended only for imaging with the beam perpendicular to the cut face.*

## RESULTS page

This page is the same for viewing the results (mostly images) as they come in during processing as well as for viewing a previously executed project.

Figure 3-8: RESULTS page



The modules on the right side of the page shows each resulting image series (see the IMAGING page) by clicking its corresponding header.

The imaging area shows any image from the series by moving the slider at the bottom; an actual image number is stated also.

### Image series modules

The controls / information within these modules have the same meaning.



Configuration: Setting up new project

- *Slice* - gives the serial number of shown image / number of all images.
- Image resolution, Dwell time × number of frames integration for this image
- Accelerating voltage, Beam current {detector type and its mode}
- Active item with the image series name - redirects you to the corresponding images folder.
- *Save as AVI...* button - clicking this button enables the creation of an AVI type movie from the image stack. A File dialog appears to specify a file name and select a directory for the resulting AVI file.
- *AF / ACB* button informs, that the auto focus / auto contrast brightness image processing is in progress for the actual slice.
- *Export to CSV...* button is used to export acquisition data to the format readable by most table processor applications.

