Spectrum Imager

software for processing EELS and EDX spectrum-images

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Contents

1 What is Spectrum Imager?

Spectrum Imager is a stand-alone tool for processing, conversion and interpretation of 3D datasets obtaind by Scanning Transmission Electron Microscopy (STEM) in combination with Electron Energy-Loss (EELS) or Energy-Dispersive X-ray (EDX) spectroscopy.

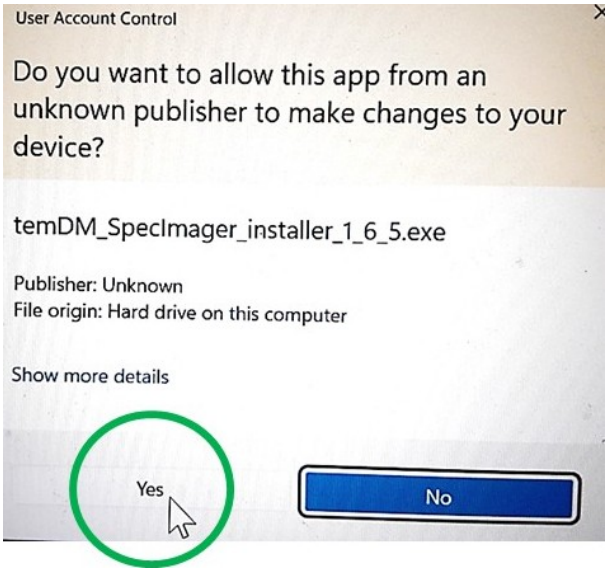
The **target group**: physicists and material scientists that use STEM in their research and process control. Spectrum Imager helps to

- import/export data from most common formats,
- inspect data,
- denoise data via dedicated PCA procedure,
- recast data in intuitively clear components (under development).
- calculate elemental maps (under development).

2 Install Spectrum Imager

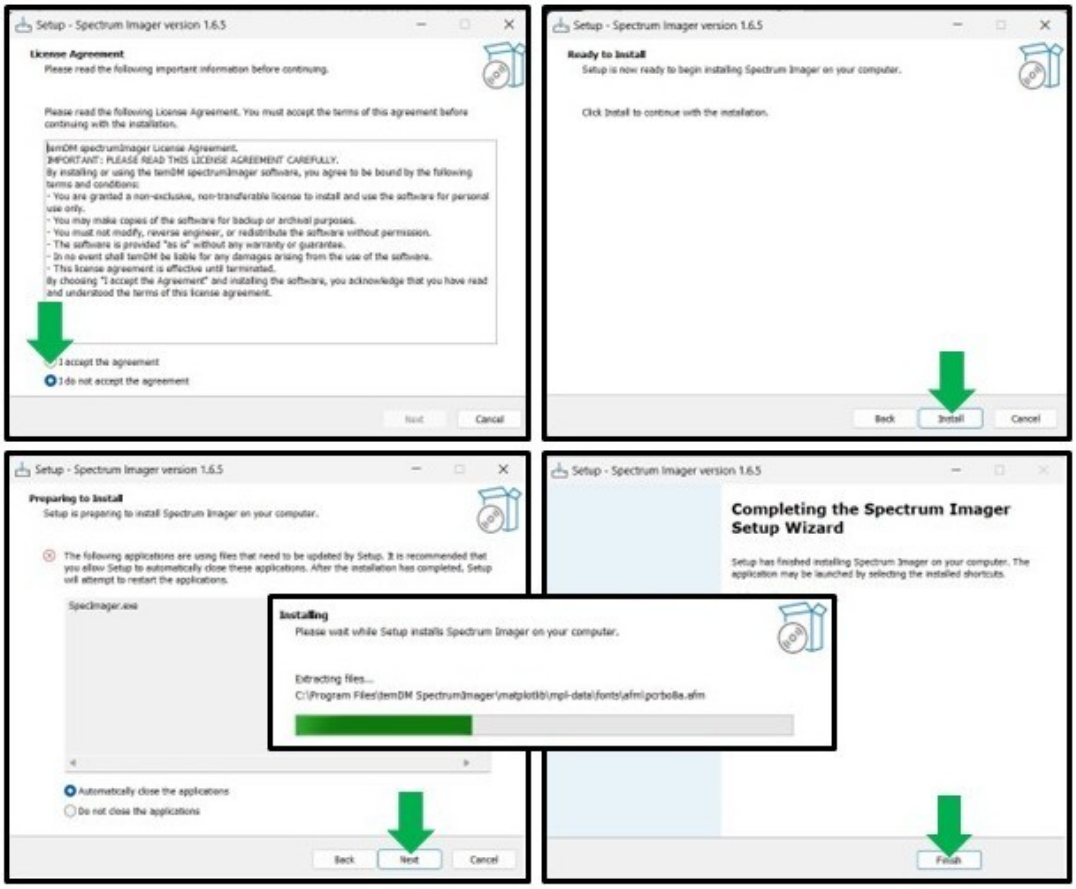
Windows: Auto-installer (most convenient)

Download and run temDM_specImager_installer_1_6_X.exe under the admin rights. You might be confused by a terrifying warning:



That is because Microsoft does not know TEMDM. As you are at this side, you most probably know our products and trust them. Simply press "Yes".

Then you must read and confirm the license agreement and press few times the confirmation button.



After the procedure is finished, the package is installed at your "C:\Program Files" (unless you changed the default directory) under the name "temDM SpectrumImager". The License.txt file is also stored in this folder. If installation went smoothly, you can also find the Spectrum Imager on your desktop.

Updating the version works exactly the same way. The installer will automatically replace the updated units for the new ones.

Windows: manual installation

- Download and unzip “temDM SpectrumImager_1.#.#.zip” file. Copy the “temDM SpectrumImager” folder to the directory “C:\Program Files” of your PC (admin rights needed). Actually, you can place it at any other destination but then the admin confirmation might be needed for each launching the program.
- Find the file “specImager.exe” in the “temDM SpectrumImager” folder and place its shortcut at any place where you can easily find it, for instance at the desktop.
- Run the program by double-clicking the file or shortcut icon.

For both auto- and manual Windows installations, after the first launch, the program creates the “temDM SpectrumImager” folder in the "C:\ProgramData" directory where your personal settings, the current path for opening/storing files and the log file are kept.

Linux installation

- Unzip the downloaded “temDM SpectrumImager_linux_1.#.#.zip” file into any folder of your Linux file system. *Caution*: The ’_internal’ folder consists of dynamic link, thus cannot be transferred via, for instance, standard USB sticks.
- Launch the program by double-clicking at Spectrum Imager icon. Alternatively, you can launch it via console typing: FolderWhereYouPlacedIt/SpecImager .
- Optionally: Register the app in your Linux Menu.
  - Create a file ’SpecImager.desktop’ with the following content:

Listing 1: SpecImager.desktop

```
[Desktop Entry]
Name=SpecImager
Comment=Treatment of EELS and EDX spectrum-images
Exec=FolderWhereYouPlacedIt/temDM\_SpecrumImager/SpecImager
Icon=FolderWhereYouPlacedIt/temDM\_SpectrumImager/SpectrumImager\_icon.png
Terminal=false
Type=Application
Categories=Science;Utility;
```

  - Store the ’SpecImager.desktop’ file at ∼/.local/share/applications/ folder,
  - make it executable via console: chmod +x ∼/.local/share/applications/SpecImager.desktop;
  - refresh application via console: update-desktop-database ∼/.local/share/applications/;
  - restart the system. Then, you should find the Spectrum Imager icon in the list of your applications.

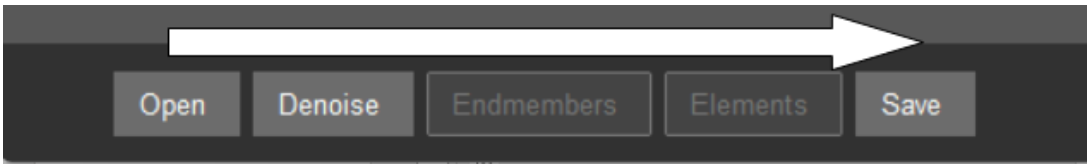
After the first launch, the program creates the “temDM SpectrumImager” folder in the ".config" directory where your personal settings, the current path for opening/storing files and the log file are kept.

3 Quick Start

Spectrum Imager is designed with a minimalistic concept — keeping the interface as simple as possible while still providing the full range of functionality. If you believe the workflow could be made even easier or more convenient, please share your feedback with us.

3.1 Basic Flow

The basic workflow proceeds by pressing the buttons in the lower band of the tool, from left to right.



3.2 Open Dataset

Click the **Open** button and choose the spectrum-image file you wish to process. SpectrumImager can open files in Gatan (EELS and EDX), Velox (EDX), PantaRhei (EELS), Bruker (EDX), and other formats. The list of supported formats is continuously expanding; consult our website for the most up-to-date information.

SpectrumImager can handle only one dataset at a time. If you wish to work with several datasets in parallel, start another instance of Spectrum Imager.

3.3 Review Dataset

After loading a file, you can inspect it in several ways:

- View a selected energy slice or integrate several energy slices.
- View complementary images (e.g., dark-field or bright-field) if they are available in the dataset.
- Inspect a specific spatial area selecting a rectangular or oval region. The average spectrum of the selected area will be shown.
- Create a line plot over the currently displayed energy slices.
- Change brightness, contrast, gamma and save the currently displayed image as a jpeg at any time.

3.4 Using SpectrumImager as a Format Converter

SpectrumImager can import and export many spectrum-image formats. Even if you don't use its analytical capabilities, you can use it as a format converter.

SpectrumImager also supports conversion of 2D images and 1D spectra.

3.5 Data Denoising

A key focus of data processing in Spectrum Imager is denoising with a highly efficient proprietary PCA algorithm. After this step, you will have both the original dataset and its denoised copy. You can conveniently switch between them and observe the difference.

Additionally, you can navigate in the retrieved PCA latent space - an alternative and powerful way to explore your data.

4 FAQ

1. **Is Spectrum Imager free?** Yes, it is free. After complete debugging and refinement, the code is planned to be published as open source. However, few options may be available on paid subscription basis in order to fuel TEMDM projects.

2. **Does it require any other software like DigitalMicrograph or Python?** No, it is stand-alone application that is compiled to work in Windows or Linux quite independently of any other packages. However it can import and export formats of most common microscopy suites, like DigitalMicrograph, Velox, PantaRhei, Bruker et cet.

3. **Is Spectrum Imager a successor of temDM DigitalMicrograph MSA plugin?** Yes, it inherits many features of the temDM MSA plugin but introduces new options. Also, it is faster and robuster than the old plugin. Those who still use temDM MSA are strongly recommended to migrate to Spectrum Imager.

4. **Does it use internet connection?** No, Spectrum Imager does not consist of internet commands and does not requires connection. The help of Spectrum Imager might use your default internet browser but solely for navigating through the help html files stored locally within the Spectrum Imager package.

5. **Where are logs and settings?** They are stored in [Windows] C:/ProgramData/temDM SpectrumImager/ and [Linux] ~/.config/temDM SpectrumImager/.