MIEP
MAXYMUS Image Evaluation Program

- Tutorial -

Introduction

This tutorial describes the basic function and utilities of the MIEP software package and should be seen as an introduction on how to use the software. For further assistance please contact us under fgross@is.mpg.de.

Requirements for this tutorial are

1. Matlab R2020a or Matlab R2020a (9.8) Runtime
2. Downloaded MIEP code from `https://gitlab.gwdg.de/moketeam/miep` or executable from `https://gitlab.gwdg.de/moketeam/miep/compiled`
3. A total of seven example data files obtained from `https://gitlab.gwdg.de/moketeam/miep/tutorial`

1 Installation

The first step is to get the software to run on your system. MIEP can be downloaded from its git repository at `https://gitlab.gwdg.de/moketeam/miep`.
It is possible to download to entire repository which allows for custom modifications to the software under the MIT license (non-compiled version). If you plan to only use the software without modifying it, we recommend to download the executable "miep.exe" file from the git repository which will run the latest version of the software without modifications.
In order to execute miep.exe please verify that version 9.8 (R2020a) of the MATLAB Runtime is installed which can be downloaded for the MATLAB homepage `https://www.mathworks.com/products/compiler/matlab-runtime.html`.
NOTE: You will need administrator rights in order to run the MATLAB Runtime installer.

2 Importing and Exporting Data, Settings, XMCD Tool, MIEP.xlsx

To start the software, enter

```
miep
```

into you MATLAB command line (non-compiled version) or start the executable file (miep.exe). After a few seconds a welcome screen should appear (Fig. 1).
To open the folder containing the downloaded example data, click

`File → Open Folder.`

After a short loading time the first image should appear in the right panel (Fig. 2). The tab displays important information such as current region of the scan (Region 1) and recording channel (APD). The different regions from the dropdown list display spectra containing decreasing amounts of material. The file selector list on the left allows to switch between different data files. For now, we will stick with "tutorial000000001". The

`Tools`

dropdown menu on the top left allows to calculate XMCD images/spectra, to export all data files or to clear cached files. Pressing CTRL-X opens the XMCD-tool.

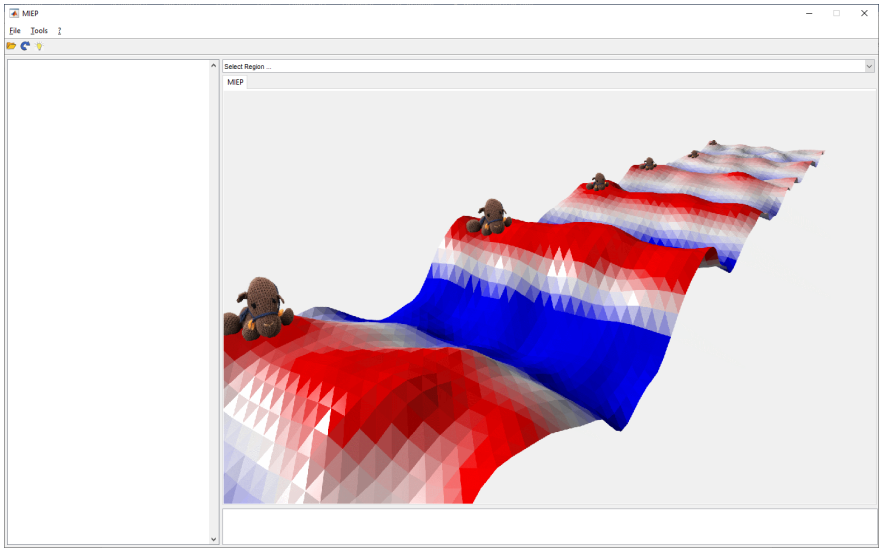

Figure 1: MIEP welcome screen.

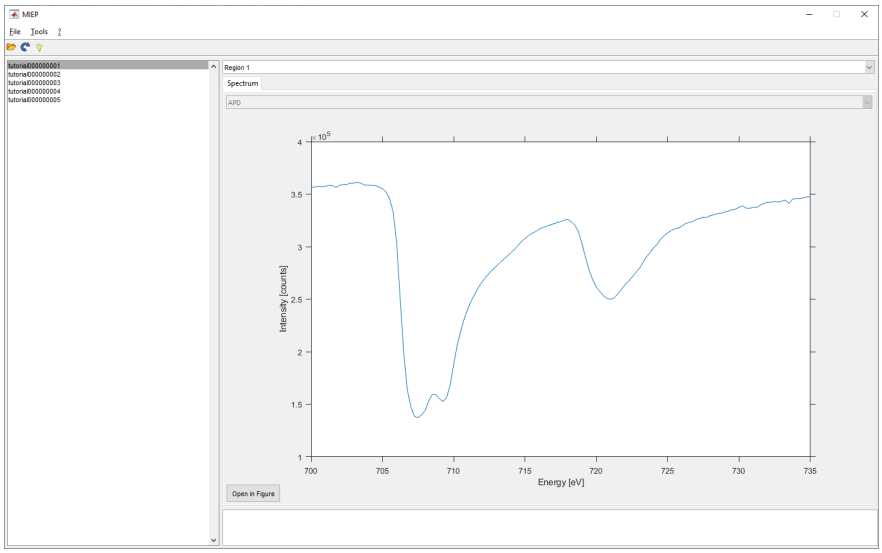

Figure 2: Data contained in tutorial000000001.

`tutorial000000001 / tutorial000000002 → next → APD / APD → next → Region 1 / Region 1 → next`

opens a panel which contains the measured spectra and the x-ray magnetic circular dichroism (XMCD) spectrum calculated from both of the scans (Fig. 3).
Clicking "tutorial000000003" in the main measurement list brings up an image scan containing magnetic data. Reopening the XMCD-tool and choosing

`tutorial000000003 / tutorial000000004 → next → APD / APD → next → monomodal / none → next`

opens a figure containing the XMCD signal calculated from both individual x-ray absorption pictures.

MATLAB also allows to adjust the colorbar limits, zoom into the pictures, mark data points, *ect.*

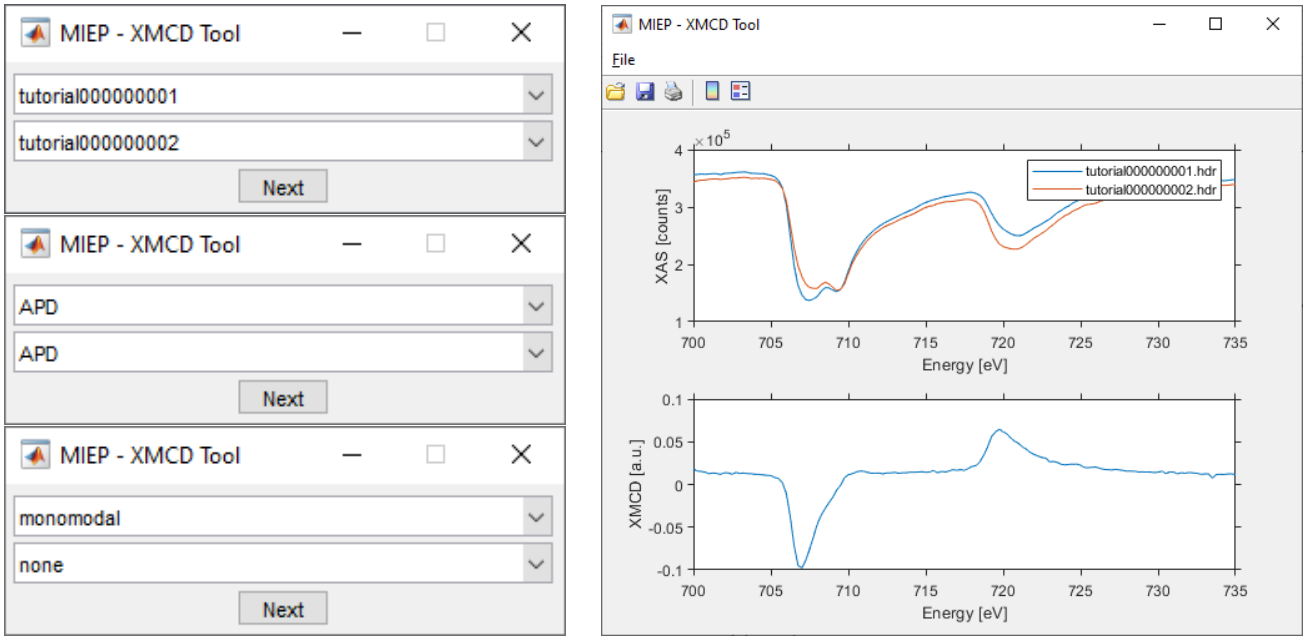

Figure 3: MIEP XMCD tool: The XMCD Tool can either calculate the XMCD signal from two spectra or pictures.

The standard colorbar and several other settings such as standard import and export folder can be changed in

`File → Settings.`

Additionally, the settings allow to change the location of the "MIEP.xlsx" file. The MIEP.xlsx file can be opened like any usual Excel file and contains measurement meta data such as saved comments, file location and scan number.
MIEP allows to export the displayed data to various file formats under

`File → Export SXM Data...`

Supported file formats for picture export are CSV and JPG.

3 Analyzing and Exporting Movies

Clicking the "tutorial000000005" movie file in the file selector list brings up a prompt asking for a "Magic Number". This is a measurement specific quantity needed to sort the individual images of the movie into its correct order. If the Magic Mumber is entered incorrectly, the movie frames will not be ordered properly. Entering "0" allows to skip the prompt and decide on a Magic Number later on. To correct a wrong Magic Number, first select a different file from the file selector list and remove the cached measurement file by using the

`Tools → Clear Cache`

utility. For "tutorial000000005" the correct Magic Number to enter is 59.
Confirming should bring up 4 different tabs. The "Image" tab displays the measured transmission, the "Movie" tab displays the normalized movie and allows to select different representations from the dropdown menu, the "FFT" tab displays the intensity of the time dependent fast Fourier transformation (FFT) and the "k-Space" tab displays the evaluated spatial FFT for different frequency components.
Movies allow for two additional export options under

`File → Export SXM Data...`

The first one is a standard export to a MP4 movie file while the other one support export to a 3D rendering program called "POV-Ray". The second option needs a POV-Ray engine installed on the machine. The engine can be downloaded from the POV-Ray website (`http://www.povray.org/download/`).
The MIEP will check whether it finds a POV-Ray engine on the local C: drive at

```
C:\Program Files\POV-Ray\v3.7\bin\pvengine64.exe
```

and otherwise ask the user for a valid path. After confirming the entered rendering parameters, the software will create an executable POV-Ray script in the export folder and subsequently call it with POV-Ray. Rendering a movie can take several minutes to hours, depending on the size of the movie, and the rendering parameters. Closing POV-Ray stops the rendering approach.
This tutorial is supposed to guide new users into the basic steps for using MIEP. Feel free to download the code from github and modify it for your personal use. In case you have any questions, do not hesitate to contact us via e-mail at fgross@is.mpg.de