

# **X-Ray Calc**

v. 2.4

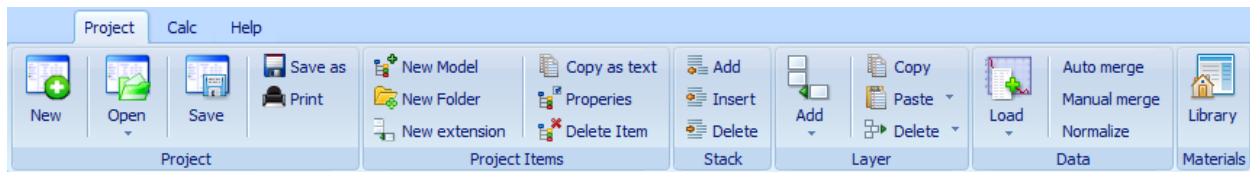
## **Getting Started**

**X-Ray Calc** is a software for computer simulation of X-ray reflectivity, including normal incidence and grazing incidence X-ray reflectometry (NIXR and GIXR).

The X-Ray Calc distribution contents several demonstration projects located in the **Examples** folder:

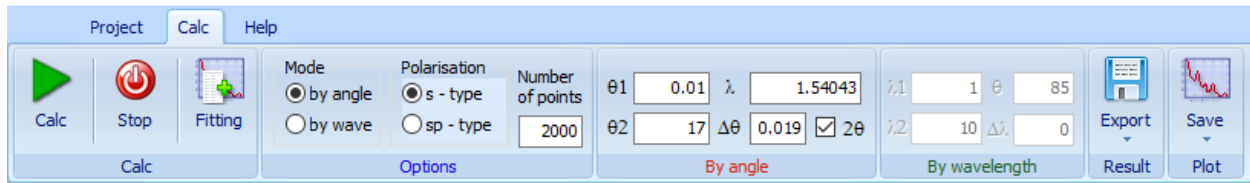
- **mo-si\_multilayer.xrcx** contents a simplified model of Mo/Si X-Ray mirror (**Model 1**). It demonstrates the effect of the layer's thickness on GIXR. **Data1.dat** and **Data2.dat** content computed diffraction curves for thinner and thicker Si layers.
- **mo-b4c\_multilayer\_67.xrcx** contents a simplified model of Mo/B X-ray mirror. It demonstrates the calculation of reflectivity as a function of wavelength (NIXR). The project also contents a reference curve (Mo-B).
- **mo-b.xrcx** demonstrates how to work with several different models and data-files in the same project.
- **n\_stacks.xrcx** demonstrates the effect of the number of bilayers in a stack on GIXR.
- **roughness.xrcx** shows how the surface roughness changes GIXR of a silicon wafer.

To see the demos, click the **Open** button, navigate to the **Examples** folder, and select a project. Go to the **Calc** tab and click the **Calc** button (Or press F5).



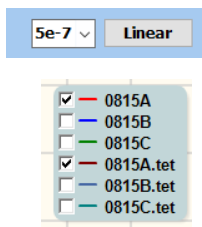
The projects items could be easily modified:

- **Double-click** on a model in the **Project Items** list will show **Properties** dialog, which allows changing its name, color, and description. Or the dialog could be called from the right-click menu
- **Double-click** on a layer will show **Layer Properties** dialog. The dialog allows changing of material, thickness, roughness, and density of the layer.
- To change the number of stacks, **double-click** on it. **Stack Properties** dialog allows renaming the stack and changing its name.
- Commands on **Stack** and **Layer** panes allow manipulating the structure of a model (add or delete stacks and layers).



**Options pane** of the **Calc tab** allows for choosing the calculation mode. Reflectivity could be calculated as a function of grazing angle or wavelength. Depending on the selected **Mode**, one of the panes **By angle** or **By wavelength** would be activated. These panes allow changing the parameters of calculation.

- **Polarization** – should be both types of polarization used in the calculation. Using of s polarization is preferable when the calculation is performed at hard x-rays and low grazing angles (below 20°). In this case, the calculation speed would be significantly faster. In the cases of larger angles and softer irradiation, **sp** mode should be used.
- **Number of points** defines the precision of calculation. The time of calculation linearly increased with the rising of the number.
- **θ<sub>1</sub>** and **θ<sub>2</sub>** define the range of angles for calculation. The **2θ** check-box enables calculation for θ-2θ geometry. **Δθ** implements the instrumental divergence of the incident beam.
- The similar settings for adjustment of the wavelength range are used in the **Wavelength** mode.



These controls allow switching between the Linear/Log scale of the reflectivity plot and set the background level.

The **Legend** on the **Plot** could be used to control the visibility of curves.

The **Export** button on the **Result** pane allowed to export the calculated curve to an ASCII file or copy it to the clipboard. The **Save** button on the **Plot** pane saves the graph as a graphical file (\*.bmp).