

Live simulator and data analysis tool for multilayer reflectivity using LABVIEW

Mohammed H. Modi^{1,2*}, G.S. Lodha², P. Mercere¹, Mourad Idir¹

¹Synchrotron SOLEIL, L'Orme des Merisiers, 91192 Gif Sur Yvette CEDEX France.

²Raja Ramanna Centre for Advanced Technology, Indore 452 013 INDIA.

Nowadays design efficiency of any scientific instruments depends on the strength of a computer program. For this purpose a high level language like C or FORTRAN is commonly used to write a simulation and data analysis code. In last few years the trend has been changed as LABVIEW has emerged as a powerful programming tool for instrumentation control, data acquisition and on line data analysis. It offers a versatile graphical interface and code flexibility thereby significantly reduces the programming time.

X-ray multilayer is a periodic arrangement of two materials (or some time more) which has different variables like thickness, roughness, density, interlayer, gamma ratio etc. To design a good multilayer or to analyze a measured data one needs to optimize/fit these parameters. It is important for a software tool to provide a sufficient flexibility to interplay with these parameters.

Using the novel features of LABVIEW an interactive software tool is developed for reflectivity simulation and data analysis. The interactive feature provides a real time change in reflectivity profile upon any change in dependent parameters. For a given wavelength, all

parameters need to be a good multilayer combination can be freeze in effectively no time. The program is very useful for optimizing the material combination also. It can be used to calculate a reflectivity pattern for any combination of nanoscale layered structure comprised of different materials. During the course of data analysis it calculates the depth versus optical index profile to give a better insight into the buried layer structure of a given sample. The program can easily be integrated with online data acquisition and control software of a reflectometer. This feature

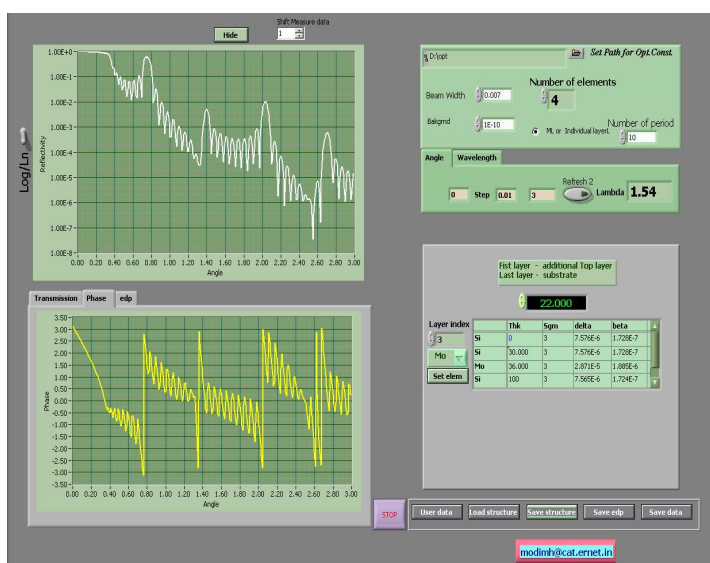


Figure: Front panel of multilayer reflectivity live simulator developed using LABVIEW.

greatly helps in interpretation of a reflectivity profile during measurement.

The software is designed for simulation and analysis of angle and energy versus reflectivity data. The graphical user interface provides a convenient platform to work with experimental data, simulate x-ray reflectivity pattern and simultaneously fit the measurements. The program calculates both *s* and *p* type reflectivity along with transmission and phase. Reflectivity for mixed polarization state can also be calculated. Different experimental condition like background, beam width etc can be taken into account. The program responds interactively with all dependent parameters which makes it a live simulator.

* The Author is on leave from X-ray Optics Section, Indus Synchrotron Facility, RRCAT Indore (India), Email: modi@synchrotron-soleil.fr