Ray tracing simulations are done with $10A^0$ surface roughness on the mirror surface. The meridional slope error was 4.8 μrad and sagittal slope error was 8.9 μrad. The height of heat bump on the first crystal of the monochromator was taken into consideration at photon energy of 3 keV. The calculations were done by considering 300mA current in Indus-2 storage ring with 2.5GeV electron energy. The detail ray tracing and calculations were done by RAY and SHADOW simulation programs and XOP.

(Contributed by : Arijeet Das; arijeet@cat.ernet.in, A.K. Sinha and R.V. Nandedkar)

A.7 Data acquisition system (DAS) for reflectivity beam line on Indus-1

A DAS has been developed for reflectivity beamline on Indus-1. Its function pertain to control/monitor the following components of beam line:

1. Rotation of the toridal grating in the grazing incidence monochromator tracked by an encoder on serial bus.
2. Goniometer motions involving three-axes movements of three stepper motors, one for rotating the sample, second for rotating the detector and third for providing translation motion to the sample. Software controls the motion of these stepper motors using a driver card residing on PCI bus.
3. Synchrotron radiation photon beam current monitors on GPIB bus
4. Synchrotron radiation electron beam current monitor on a serial bus.
5. Continuous scan mode, which has increased the data acquisition rate significantly, which in turn saves significant beam time.

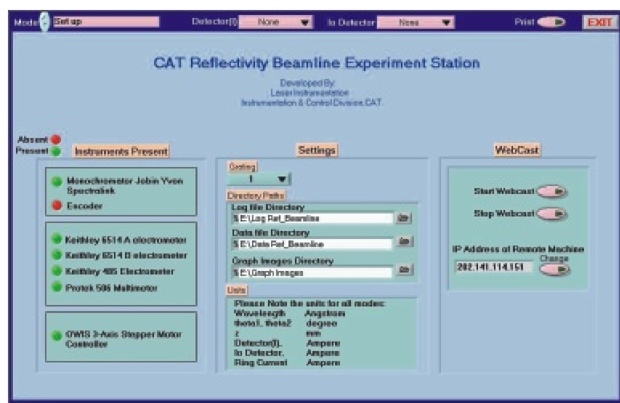

Fig. A.7.1 *Main control panel for reflectivity beam line software*

This LabView based software checks which of the instruments are connected and available. It further allows the user to select any of the following experiment modes:

i) Wavelength Scan ii) Angle Scan
iii) Time Scan iv) Continuous scan

The software acquires and on line plots of direct and reflected beam currents and ring current as a function of wavelength, angle or time depending on the mode. Various beamline, experiment and user defined parameters are stored in a log file. There is an option to store graph images for ready reference. File name is generated automatically based on experiment mode, date, time and user defined filename field. The experiment panel can be viewed on a remote PC anywhere on the network (fig. A.7.1). Earlier data can be overlaid on the graph for comparison purpose. Important parameters are saved in a configuration file for use in the successive runs.

(Contributed by : Shradha Palod; shradha@cat.ernet.in, P.P. Deshpande, V.P. Bhanage, M.H. Modi, A.G. Bhujle)

A.8 X-ray standing wave characterization of layered materials

Angle dependent grazing incidence X-ray fluorescence (GI-XRF), is another variant of total reflection X-ray fluorescence (TXRF) technique. By changing the incidence angle, the depth sensitivity of a layered material can be enlarged to nanometer regime. X-ray standing wave (XSW) effects occur in multilayer Bragg peak region as in perfect crystal.

Divergence of incident primary beam is one of the major sources of systematic error in X-ray standing wave characterization of single and multilayer thin films. Primary beam divergence significantly alters XSW profile of a layered material and can lead to large errors when used with higher excitation energies. These errors can be corrected by introducing beam divergence effects in the model calculations. In the present study we have evaluated optimum beam divergence below which the primary beam divergence effects need not be incorporated. For example, a primary beam of divergence 0.005^0 can be used with confidence in case of Mo-Kα excitation for XSW characterization of multilayers. On the other hand, this requirement of beam divergence can be relaxed up to 0.01^0 for Cu-Kα excitation.

Fig. A.8.1 shows the measured GI-XRF profile and reflectivity profile of a Fe/Si multilayer of parameters N = 10, d=16.8nm, Γ = 0.262 using Cu-Kα excitation energy. These ML samples were prepared using an ion beam sputtering system developed in-house. The measured GI-XRF profile