Table A.1.1:
Measured fractional betatron tunes with beam current at different energy on 16th June, 2006

E (GeV)	I_{beam} (mA)	v_x	v_z
0.550	4.3	0.3199	0.2152
1.0	3.4	0.298	0.1352
1.56	2.6	0.3026	0.1174
2.01	1.7	0.325	0.1099

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A.2 Indus-2 control system during commissioning

The commissioning of the machine from control system's perspective may be categorized in phases like successful injection, build-up of required current, energy ramping, beam storage at final energy, orbit corrections and operation with predefined bunch filling patterns. So far, we have stepped in the injection, current build up, ramping and beam storage phases. Each phase has its typical requirements. Most of these have been already implemented. However, there are some eventual requirements as per the need of system diagnostics in the initial stages of each phase of commissioning. Many new features were also demanded and added to the control system. The modular design of control system has greatly facilitated the addition of new hardware and software components as per the commission requirements without much alteration in the system. Apart from these requirements, the regular operation of Indus-1 has to go on with minimum switch over time. The booster is the common entity for both Indus-1 and Indus-2 and switching the operation between Indus-1 and Indus-2 posed some timing related problems initially. The modular approach of the Indus-2 control system played a key role in combating these problems. Another issue in the commissioning was the augmentation of new hardware and software modules, their online testing and induction into the operation. The layered and modular approach made the online testing of the 'ramping scheme' an easy affair. Teething troubles were however faced with respect to high common mode conducted noise, data integrity across layers etc. but with more and more understanding of the behavior of system, such problems could be solved.

The database has played a vital role in the commissioning. Apart from providing the regular data of the system parameters, the database is made capable of serving the data for diagnosis of the faults at various layers. Most of the times the problems could be located and separated layer wise by a careful observation of the stored data. With every passing day, the usefulness of the history data in analyzing the machine performance and its easy access over intranet is appreciated more and more.

Controls for the first front end of the beam line 12 of Indus-2 were integrated successfully with the machine controls. This essentially caters to monitoring of the beam line front end status in the main control room and enabling use of beam lines by the users in a safe and secured manner The system presently includes all necessary signals for status and control, does the logging of all critical events in the central machine database and alarm handling and logging is done for all the signals. User authentication is enforced opening the safety shutter and for changing the alarm limits. The system has been made operational. Based on the operational experience and feedback, a common strategy would be evolved for applying to all the front ends on Indus2.

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A.3 Interface characteristics of Fe/Si bilayers

Interface studies in metal/semiconductors systems are important due to their potential technological applications in microelectronics, spintronics, thermionic conversion devices, photodetectors etc. These studies become more interesting in transition metal/semiconductor systems, because of the presence of magnetic materials as Fe, Co, Ni. In transition metal/semiconductor systems, Fe/Si thin films shows abnormal magnetic and transport behaviours at low thickness of Fe and Si, as a function of Si layer thickness. For low thickness, interface characteristics become significant and play an important role in thin film properties. Interface characteristics in thin films are dictated by interdiffusion thickness, uniformity of interdiffusion parallel to interface and structural properties at interfaces

[for details please see S. R. Naik, S. Rai, G. S. Lodha, R. Brajpuriya, J. Appl. Phys. 100, (2006), 013514.]

Depth profile ultra violet photoelectron measurement of Fe/Si bilayer at energy 134eV, at synchrotron radiation source Indus-1 is shown in fig. A.3.1. In this spectra Si and Fe valence bands, and Oxygen peak are clearly distinguishable. In 20 min sputtered sample density of states corresponds to Si valence band is obtained. No density of states for Fe is obtained in this scan. 40 and 70min sputtered sample show density of states corresponds to Fe3d band. Density of states for Fe3d band (Peak at 0 .7eV) is broader for 40min sputtered sample, compared with 70min sputtered sample (inset of fig. A.3.1) shows the presence of iron silicide at Si/Fe interface. Figure A.3.2 shows GIXRR measurements results on bilayers, along with the model fitted results, as a function of wave vector transfer. By considering interlayer model in Fe-Si system, values of thicknesses and roughnesses for pure Fe, pure Si layer and interlayer were obtained. Interlayer forms due to the strong interdiffusion of Fe and Si into each other. Thickness of interlayer is related to the depth of interdiffusion. Roughness of interlayer is related to the uniformity of interdiffusion. Obtained thickness of interlayer is ~13Å with 4-6Å roughness in each case. This indicates that interlayer formation at Si/Fe interface is independent from the Fe and Si layer thickness. After this interlayer formation no further interdiffusion takes place across Si/Fe interface.

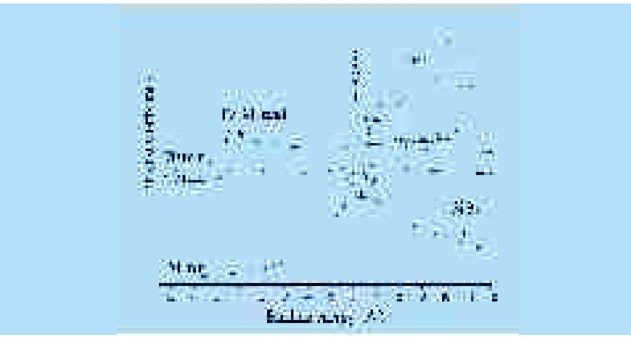

Fig. A.3.1 *Depth profile valence band spectra of bilayer taken at synchrotron Indus-1.*

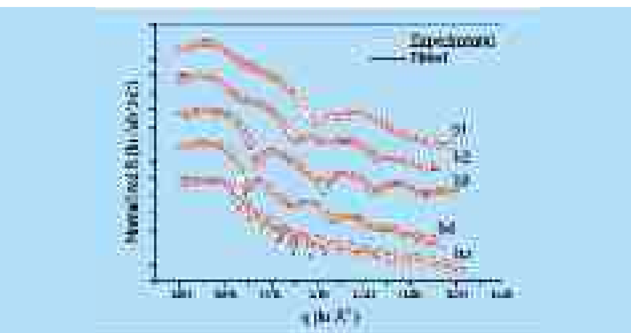

Fig. A.3.2 *GIXRR measurements of bilayers taken at CuKα source.*

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A.4 Design of vacuum ultraviolet polarimeter for Indus-1

Ellipsometric experiments with synchrotron radiation (SR) gives element specific magnetic information about material. To perform these experiments on Indus-1, a VUV polarimeter is designed [*for details please see S. R. Naik, G. S. Lodha, Nuclear Instruments and Methods in Physics Research A, 560 (2006), 211*]. This polarimeter will be installed after the post mirror of toridal grating monochromator based CAT-TGM beamline. To reduce the higher order contamination of SR beam filters will be used. Optical design of polarimeter is completed, which is shown in fig. A.4.1. Polarimeter consists of four-mirror reflector phase retarder and three-mirror reflector linear polarizer.

Polarimetry and ellipsometry require to azimuthally rotate phase retarder and linear polarizer around beam axis. Azimuthal rotation is such that the out going beam position remain unchanged during rotation. In a complete azimuthal rotation phase retarder generates linearly, circularly and elliptically polarized beam, which is shown in fig. A.4.2. In complete azimuthal rotation linear polarizer generates different outgoing intensity pattern, from which the information about the material can be extracted.

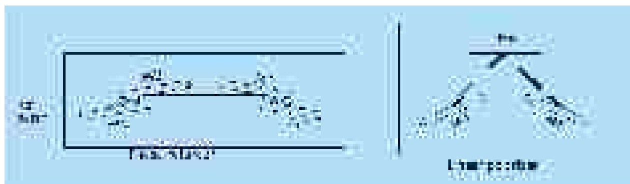

Fig. A.4.1: *Schematic diagram of VUV polarimeter to be installed on CAT-TGM beamline on Indus-1.*

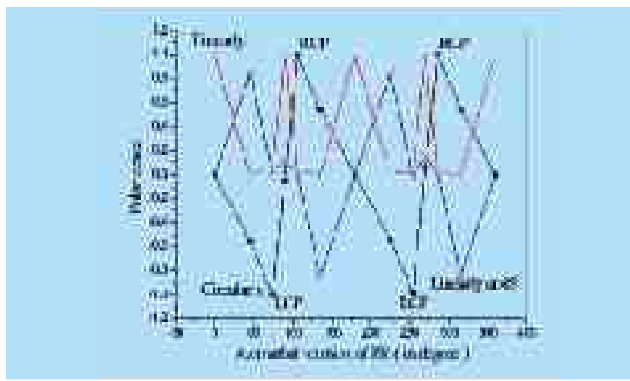

Fig. A.4.2: *Linearly and circularly polarized component of SR beam after PR is drawn as a function of azimuthal rotation of PR.*

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A.5 Analyses of composition at buried interfaces using resonant soft x-ray reflectivity

Normally in x-ray reflectivity (XRR), X-ray photon energy is far away from absorption edges of materials of interest, and the poor contrast in optical constants is not