sockets to house 16 KB [8 KB (Even) + 8 KB (Odd)] of memory. Either 8 or 16 KB RAM or EPROM can be used as optional memory. Various optional memory usages are jumper configurable. 512 KB memory space is reserved for onboard memory and devices. Rest of the 16 MB is available for use on VME bus.

Serial Ports: The board is equipped with two serial ports. Both can have independent baud rates in binary starting from 1200 baud up to 76.3 Kb. Baud rates are set by DIP switch. The RS232 drivers for both the ports are powered from isolated power generated onboard. The ports can be configured as independent RS232 ports or any of the two ports can be used as RS485 port for 2-wire variant. DIP switches and some of the jumpers are configured for this option. RS485 port is also driven by isolated power. Both the ports can work in normal as well as in interrupt mode.

Timers: The board has three onboard timers. One of the timers is fed with 4.9152 MHz clock whereas other two are available as general purpose timers. They can be cascaded, used independently or can be used as dividers for generating other clocks. The clock out from these two timers is also available on facia. These can be programmed to divide the TTL square wave input from the facia connectors. Timer clock O/P can be used to generate events for triggering any I/O boards for synchronized reading. The timers can be used to interrupt the CPU like timer tick, or on multiples of external events. The timer operation can be enabled or disabled. All the options are jumper selectable.

Parallel Ports: Two parallel ports and some bit programmable (generally used as hand shake) signals are provided.

Interrupts: Normally interrupts on seven priority levels are supported, when no onboard interrupts are used. If onboard interrupts are used, for example interrupts from the serial ports (ACIAs) or timers etc, then interrupts on some of the priorities are reserved. In this case the internal interrupts are used as auto-vectored interrupts. All the options for interrupt usage are set by jumpers.

The CPU card was thoroughly tested in lab and deployed for regular use in some of the Indus-1 control sub systems.

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A.6: X-Ray beam position monitor on Indus-2

X-ray beam position monitors (XBPM) are widely used for photon beam diagnostics in SR source facilities. They give sub-micron accuracy in beam position and micro-rad sensitivity in its angular divergence. A staggered pair XBPM based on photoelectron emission principle is designed, developed in Indus Synchrotron Utlisation Division and installed on Indus-2 frontend of bending magnet beamline BL-12. The vertical beam position is calculated by measuring asymmetry in currents between four detector blades. The principle and schematic of staggered XBPM is shown in Fig. A.6.1(a) and 1(b) respectively. Fig. A.6.1(c) shows the photograph of installed XBPM on BL-12 frontend, 10^0 port in DP-5 of Indus-2 at a distance of 4.95m from the tangent point. The formulae for determining vertical beam position are given in reference [V.P. Dhamgaye et al., Proceedings of DAE-BRNS InPAC 2009, RRCAT (2009)].

Calibration: XBPM is calibrated by two schemes: (1) by scanning the XBPM in the vertical direction in stationary path of the SR beam and (2) by giving controlled bump to electron beam keeping XBPM fixed. First scheme has given the calibration curve and second scheme has helped to check the linearity of the system.

Beam Stability: The beam position stability between injection to injection (storage to storage) have been observed for intraday and compared with other days. Fig. A.6.2 shows the intraday beam stability consisting of 8 injections and 2 storage events. All injections except 7 are within the 110μm position value. During the injection 7, there was a problem reported with one of the quadrupole power supply which resulted in beam position shift during the injection process. The two storage (s1-s2) beam positions are different because of the reported problem in quadrupole settings.

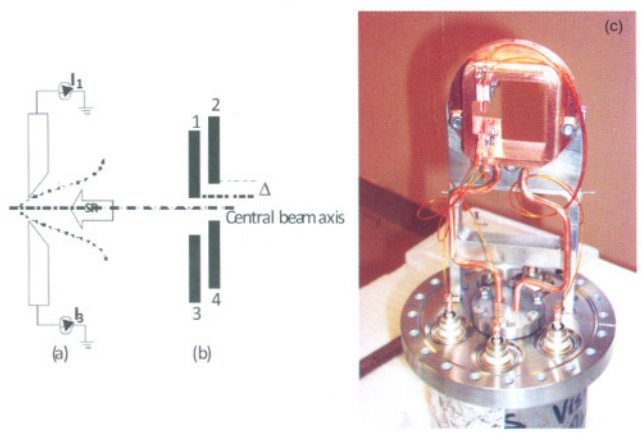

Fig. A.6.1: (a) XBPM principle (b) staggered pairs of blades fixed at known distances from centre of gravity of SR (c) photograph of installed XBPM on BL-12.

Figs. A.6.3(a) and (b) show the stability of the beam during one of the injections and storages respectively. For stable beam during injection, situation is confirmed with respect to the beam position monitoring of the beam on the particular day. During the storage of 2.5 GeV electron beam, the beam stability is observed around 25µm.

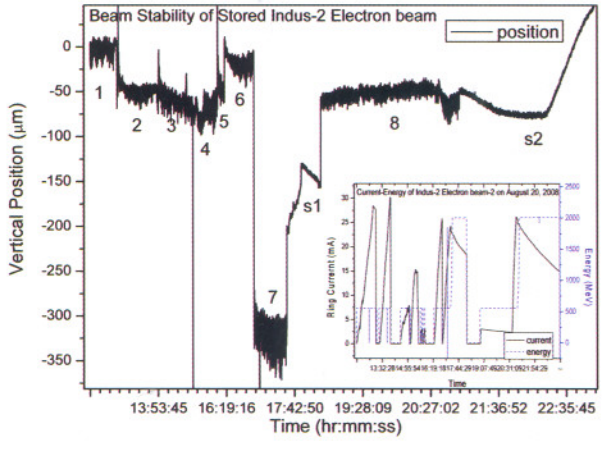

Fig. A.6.2: Intraday beam stability during several injections (number. 1-8) and storage events (number s1-s2), (inset) current energy profile of Indus-2 SR source.

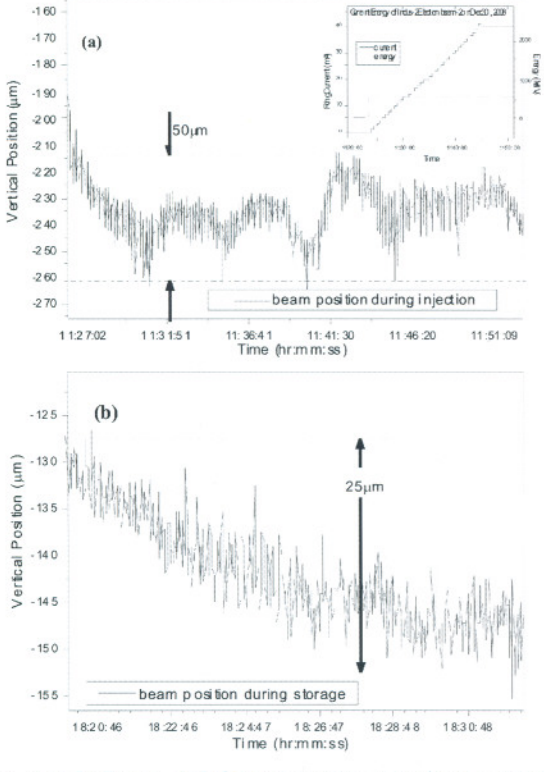

Fig. A 6.3: Beam stability measurements during (a) the injection of 0.5GeV electron beam (inset) current filling rate and (b) the storage of 2.5GeV electron beam.

It is possible to track the movement of electron beam position with designed and installed XBPM on BL-12. The careful optimisation of XBPM leads us to achieve a beam position resolution of less than 5µm in the dynamic range of ± 500 µm. Regular monitoring of beam position using XBPM is in progress, to further qualify the beam position on intraday basis.

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A.7: Utility Modules For Indus-2 Control System Layer 3 Monitoring

Utility Module (UM) was developed by Accelerator Controls Section (ACS) for supervising Equipment Controllers(EC) installed at layer-3 in Indus-2 Control system. UM is a microcontroller based unit consisting of 8 channels for digital outputs, 8 channels for digital inputs, 8 channel for Analog inputs, three RS-232 ports and one RS-485 port. Different UMs connect to PC with RS-485 port in a multi-drop fashion on RS-485 link. PC acts as a master and various UM units as slaves. The basic functions performed by the UMs are as follows-

Controls- ON/OFF control of the Equipment Control Stations (ECS) enclosing the Equipment Controllers (EC) and Reset activation of the ECs.
Status- Mains ON/OFF status of the ECS, EC P/S ON/OFF status.

Analog Parameters Monitoring- It has facilitated Mains voltage monitoring, EC's temperature monitoring, EC VME P/S voltage monitoring and other Linear P/S voltage monitoring.

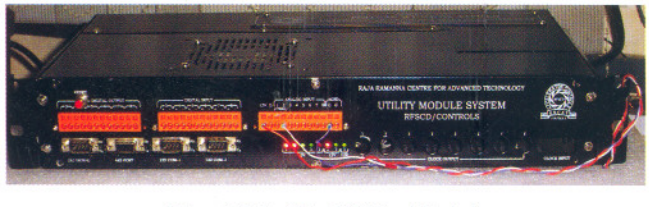

Fig. A.7.1: The Utility Module

Serial Port Connectivity with ECs at Layer 3 – It has provided connection with L3 VME master controller serial port and facilitated downloading of OS-9 modules to VME master controller from control room.

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