geometry of vacuum envelop, adjustable orientation of monitor, removal of fluorescent screen without breaking vacuum.

Fig.A.6.1 Profile monitor

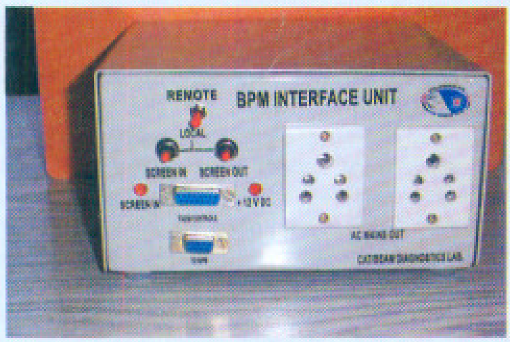

Fig.A.6.2 BPM interface unit

Fig.A.6.1 shows photograph of a profile monitor. It comprises of a chromium doped alumina ceramic screen which is to be inserted into the vacuum envelop of storage ring. When the electron beam falls on the screen it produces fluorescence, which is viewed through a CCD camera. A pneumatic cylinder actuated mechanism is used to move the screen in and out of beam path. An edge welded diaphragm bellow provides vacuum–air interface during screen movement.

It is planned to install eight BPM in TL-3 and ten BPM in the storage ring. Apart from these BPM, there will be one septum beam viewer, two hole monitors, and a synchrotron light monitor, making the total number of video signals as twenty-two. To multiplex these video signals, a VME based video multiplexer card has been designed and developed. The card takes eight video inputs and multiplexes them to one output. The multiplexer card will be housed in the VME-EIU (Equipment Interface Unit) rack of the Indus-2 control system and controlled by the VME controller. The multiplexer outputs will be transported to the control room, where the beam profile will be displayed on video monitors.

A BPM interface unit has been made which takes the commands from the control system in the form of momentary contacts as the input and actuates various components of the BPM viz. solenoid valve, the CCD camera, and the lamp power supply. It also reads the BPM status signals like screen in/out position, power supply status etc. and gives them to the control system. The circuit is housed in a small box that will be kept near each BPM(Fig.A.6.2).

(Contributed by: Anil Banerji; anilban@cat.ernet.in)

A.7 Precision magnet positioning system jacks for large hadron collider project of CERN

Under an agreement between Department of Atomic Energy (DAE) and the European Organization for Nuclear Research (CERN), Centre for Advanced Technology is developing a number of subsystems for the world's largest particle accelerator, the Large Hadron Collider (LHC). LHC is scheduled to become operational in 2007. The LHC is housed in a tunnel having a circumference of 27km about 100 meters below the ground. It has more than 1600 superconducting magnets along its circumference for bending and focusing the beams. These huge magnet assemblies, each weighing more than 32 tons with a length of 15 meters, need to be positioned with a precision of 50 micrometer all along the 27km length. CAT, has conceptualized, designed & developed precision-positioning devices that allow precise positioning of these huge magnets in the tunnel and maintenance of these devices. These devices called precision magnet positioning system (PMPS) jacks enable one person to move the huge magnet and position it with a very high setting resolution. The jacks have to maintain these positions for a long time under the action of variable transverse forces. In fact the set position should remain within 100 micrometer when the transverse force reaches a value of 0.5 ton and within 1mm under a very severe transverse load of 8 tons.

Fig. A.7.1 The prototype jacks under a cryo-dipole at LHC test string-1 at CERN

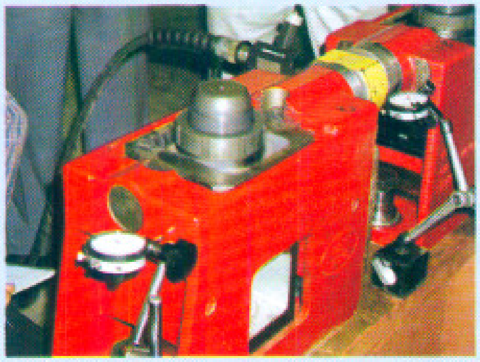

Fig.A.7.2 Two jacks under transverse load test

Three jacks in a tripod configuration with proper layout are used under one magnet, which yield the required freedom as well as control for the alignment. A total of 6800 numbers of these devices are being made in Indian industry and being supplied to CERN under this agreement.

More than 2400 jacks have been shipped to CERN, after successful manufacture and testing from Indo-German Tool Room, Indore and Avasarala Automation Limited, Bangalore. All 6800 PMPS jacks will be supplied by the mid of 2005.

(Contributed by: Jishnu Dwivedi; jishnu@cat.ernet.in)

A.8 Compound motion precision jacks for Indus-2

The Indus-2 jacks have been designed with in built vertical screw, which is an extension of LHC jack system of CERN, for supporting and alignment of 12MT dipole magnets and the common girders of quadrupole and sextupole magnets. The combined motion of three jacks provides the required degrees of freedom for alignment of the magnets and the common girders. The magnets will be placed within 0.1mm in the linear axes and 0.1mrads in the rotational axes with respect to its true position in the Indus-2 ring, using these jacks. These jacks have already been tested under actual dipole magnets and the common girders supporting QP/SP magnets and meet the alignment requirements. Total 120 units of these jacks will be required for alignment of Indus-2 ring of which 30 units have been made ready for installation in the ring. The manufacture of balance quantity of the jacks is in progress.

Fig. A.8.1 Compound motion precision jack for Indus-2

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A.9 High-resolution powder diffraction beamline design on Indus-2

A high- resolution powder diffraction beamline on Indus-2 is being constructed. Detailed designs of the beamline as well as the experimental station have been done. The beamline has been designed primarily for 5T superconducting wavelength shifter (WLS) source. Care has been taken in the design that the beamline could be installed on a bending magnet source without any alteration in the beamline hardware, in the first phase when the WLS source is not available. Depending upon the requirements of the planned experiments, the beamline can be operated in high flux, high-energy resolution, moderate angular resolution (Mode A) or moderate flux, high-energy resolution, moderate angular resolution (Mode C) modes. Also, high angular resolution mode (mode B) can be selected. At 10keV we get an energy resolution (E/ΔE) of 12,000 (mode A), 17,000 (mode B) and 1000 (mode C). The corresponding flux (Photons/s/0.1mA/0.02%bw), are 3 x 10^9 (mode A), 3 x 10^9 (mode B) and 4 x 10^9 (mode C). The beam sizes are 0.7 x 0.2 mm^2 (mode A), 0.7 x 0.8 mm^2 (mode B) and 0.7 x 0.2 mm^2 (mode C). The beam sizes are independent of photon energy. It is possible to operate the beamline in so many modes because we have opted for bendable pre and post mirrors. A double crystal monochromator with 3:1 sagitally focusing second crystal, have been used as the dispersing element. The optical lay out of the beamline has been shown in fig. A.9.1. Performance of the beamline (in the photon energy range of 5-25keV) in all the above modes of operation for WLS as well as bending magnet sources have been calculated using ray tracing program 'Ray'. Thermal deformations due to heat loads on the optical elements (pre-mirror and the first crystal of the double crystal monochromator) have been taken into account, as calculated using finite element software 'Ansys'. Fig. A.9.2 shows the ray tracing result for 10keV photons for mode A.

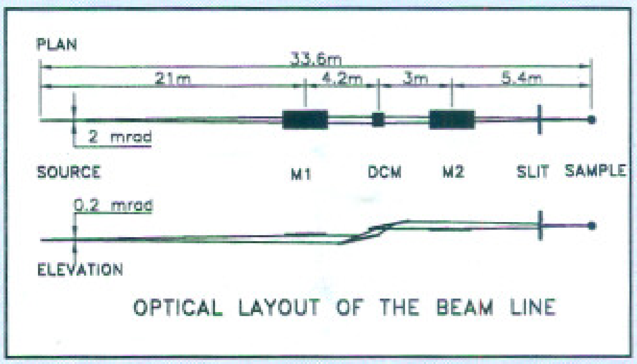

Fig. A.9.1 Optical layout of the beamline, showing plan and elevation