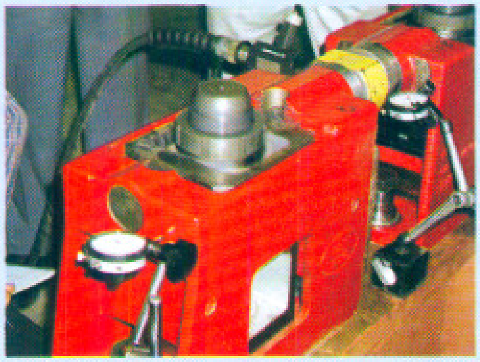

Fig.A.7.2 Two jacks under transverse load test

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

(Contributed by: K. Sreeramulu; sreeram@cat.ernet.in)

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 ($E/\Delta E$) of 12,000 (mode A), 17,000 (mode B) and 1000 (mode C). The corresponding flux (Photons/s/0.1mA/0.02%bw), are 3×10^9 (mode A), 3×10^9 (mode B) and 4×10^9 (mode C). The beam sizes are 0.7×0.2 mm^2 (mode A), 0.7×0.8 mm^2 (mode B) and 0.7×0.2 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.

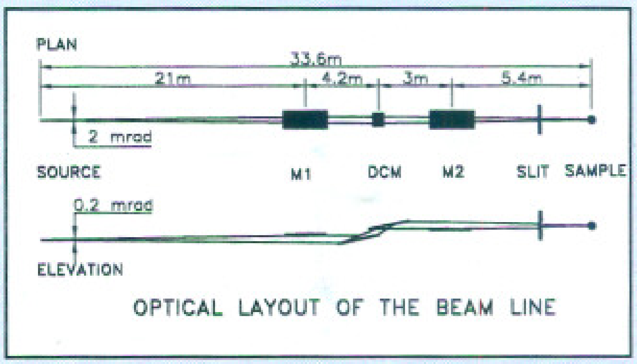

Fig. A.9.1 Optical layout of the beamline, showing plan and elevation

The experimental station will consist of a six-circle diffractometer. Four main circles are in the incident beam while two circles are in the scattered beam, and contain the analyzer crystal. The experimental station sits on a stand with five degrees of freedom for sample adjustments. The 2θ resolution of 0.15^0(mode A), 0.02^0 (mode B) and 0.15^0 (mode C) will be achieved in the set up. There will be scintillation counter as well as area x-ray detectors.

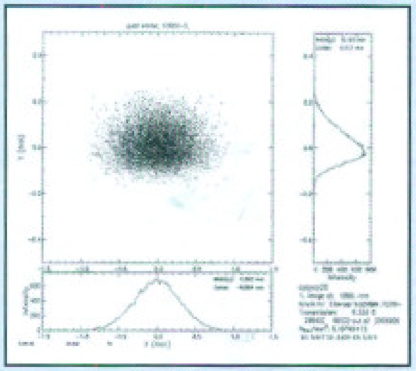

Fig. A.9.2 The spot diagram for 5-element configuration, WLS source and the angle of incidence of the photon beam on the mirror is 3 mrad for mode A

(Contributed by: Dr. RV Nandedkar; nrv@cat.ernet.in)

A.10 Radiation safety in Indus-1

Due to interaction of electrons with vacuum components, structural materials and residual gas molecules in vacuum envelope, ionizing radiation is produced which is the main occupational hazard in Indus-1. The prompt radiations, which are present, only when accelerator is 'ON' are Bremsstrahlung x-rays and photo-neutrons. Bremsstrahlung x-rays have a broad spectrum with energies extending up to the primary electron energy and are highly angle dependent. Intensity of these x-rays peak in the forward direction of the beam. Dose due to photo-neutrons is insignificant in comparison with x-ray dose rates.

Bremsstrahlung x-ray spectrum measurements were carried out at experimental hall of Indus-1 using a 2" x 2" BGO detector, in search for any high-energy photons reaching the experimental area. The measurements indicated that the photons reaching at most of the experimental stations are within 10MeV. The injection and storage mode operation did not indicate significant change in the spectra (fig. A.10.1). Besides, the comparison of direct (without any shield) and transmitted (with 8 cm lead shield) at the high-resolution beam line showed that the spectra extends up to several hundreds of MeV. Various measurements have proved that all the experimental stations in use have a radiation level ~ 0.1μSv/hr (10μRem/hr), similar to background radiation levels.

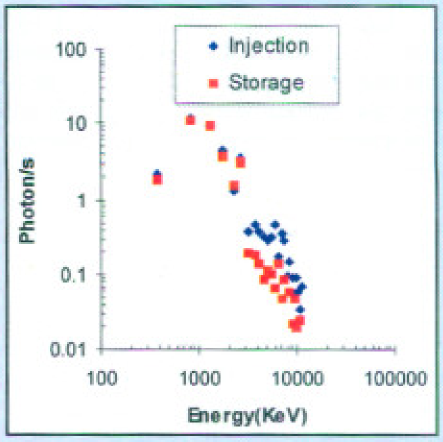

Fig.A.10.1 Bremsstrahlung spectra at reflectivity beam line during injection & storage

(Contributed by: Haridas G Nair; haridas@cat.ernet.in)

A.11 Gas phase multiple ionisation experiments at Indus-1

Photoionisation cross-sections of rare gases have been measured in the past, but there is a paucity of accurate experimental data for higher charge-states. The aim of this series of experiments is to generate a systematic data set for thresholds of multiple ionisation and for energy dependence of ionisation cross-sections. These measurements are important for understanding the correlated behavior of multi-electron systems.

A time-of-flight mass spectrometer (TOF) was designed and indigenously built for these measurements. The spectrometer uses two uniform, linear electric fields, conforming to the Wiley-McLaren geometry (fig. A.11.1). Ion charge states are separated on the basis of their flight times. Ions formed in a small overlap volume of the crossed neutral beam and photon beam. The neutral beam is formed by effusion of a gas through a capillary, whose position is fixed with respect to the other spectrometer components.

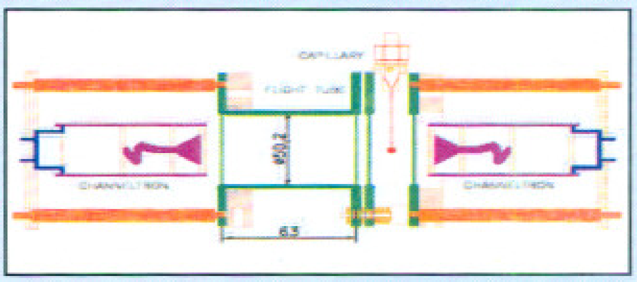

Fig. A.11.1 Spectrometer field layout