The main parameters for the FCS are:

Closing Time	:	8.6msec (Total closing time)
Shutter Opening	:	35mm x 50mm (rectangular)
Leak rate (seat)	:	~1mbar.lit/sec
Leak rate (body)	:	better than 1 x 10^{-9}mbar.lit/sec
Air Pressure	:	5-7 bar
Connecting Flange	:	DN 63 CF
Material	:	SS 304L

Fig.A.14.1 shows the output screen of storage scope. Curve 'A' shows the current characteristics of the Actuating Solenoid and Curve 'B' shows the shutter timing indication from timing measurement setup. Total time from triggering (external) to closing of shutter is 8.6ms, which includes electronic delay, system inertia and shutter traversing time. Fig. A.14.2 shows the photograph of FCS.

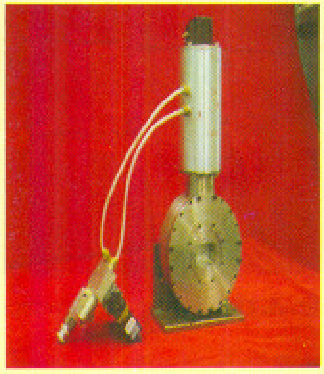

Fig. A.14.2 Fast Closing shutter

Reported by: S C Joshi; scjoshi@cat.ernet.in

A.15 Magnetic measurement of Indus-2 magnets

Indus-2 is a 2.5GeV synchrotron light source under construction at CAT, Indore. The storage ring has a circumference of 172.2781m. Storage ring has 8 unit cells. Each unit cell consists of 2 dipole, 9 quadrupole and 4 sextupole magnets. Thus the whole magnet system consists of 16 Dipole (Bending Magnet), 72 Quadrupole, 32 Sextupole and about 100 Corrector magnets. The fabrication of magnets is complete. At present magnetic measurements of various magnets are being carried out in the laboratory. All the close type Quadrupole magnets have been qualified (magnetic) successfully. All the corrector magnets are also tested. Magnetic measurements of the Dipole Magnets are being carried out.

Dipole magnet

A computer controlled 3-D CMM with a Hall probe attachment is being used for the measurements of the Dipole magnet. The scanning volume of this system is 3000x800x600mm^3. The prototype Dipole magnet at the measurement bench is shown in fig.A.15.1.

Fig.A.15.1 Prototype Dipole magnet with the CMM at the location of measurement.

In the year of 2001, the results of the magnetic measurement for the prototype Dipole Magnet were reported. This time the results of the series Dipole magnets of Indus-2 are being presented. The field quality observed so far for the Dipole Magnets is well within the limit of beam physics requirements. Fig.A.15.2 shows the variation of the integrated field with radius at the highest beam energy level of 2.5GeV. The highest beam energy of 2.5GeV corresponds to dipole field value of 1.5T. The integrated $\Delta B/B$ at the injection level (0.6GeV) is ~ 4 x 10^{-4} whereas at the highest level of energy it is ~7.3 x 10^{-4} over the (horizontal) good field region of ±32mm.

The maximum variation in the effective length with excitation is found <10 mm. Fig.A.15.3 shows the transfer function (ratio of integrated field to current) at different current level. The magnet core shows 8.6% saturation at the highest excitation level.

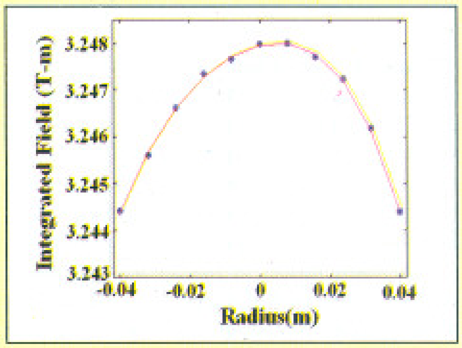

Fig.A.15.2 Integrated Field Vs. Radius at the Highest Energy level.

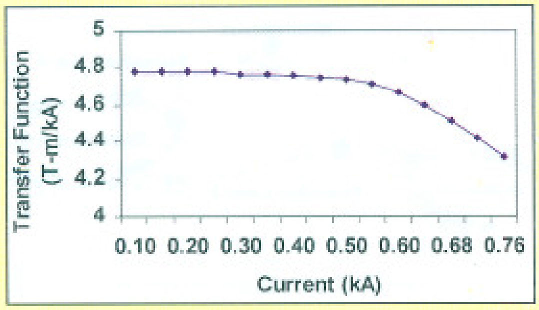

Fig A.15.3 Transfer function for Dipole Magnet.

Quadrupole magnets

The Indus-2 storage ring consists of a total 72-quadrupole magnets, out of which 40 are closed type magnets and 32 are open type quadrupole magnets. Quadrupole magnets are being tested using the rotating coil bench constructed by Danfysik (obtained on loan basis from ESRF, France). Closed type quadrupole magnets are further divided into 3 groups (Q1, Q2, Q5) depending upon their magnetic lengths. Results of magnetic measurements of Q2 type magnets are presented here.

The nominal gradient of 16T/m is achieved at a current of 150A. The required current is 2.3% higher with respect to the ideal value. This is due to the saturation of the steel.

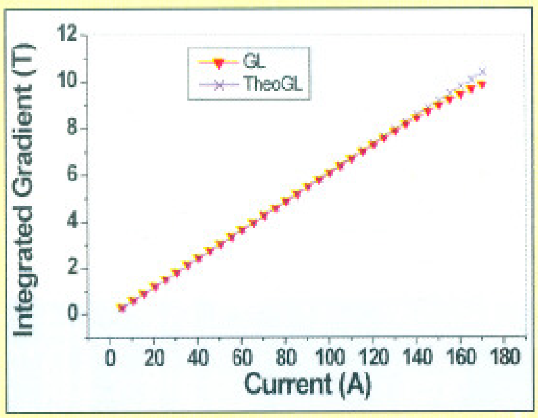

Fig.A.15.4 Integrated Field gradient at various excitation level for Q2 type Quadrupole Magnets.

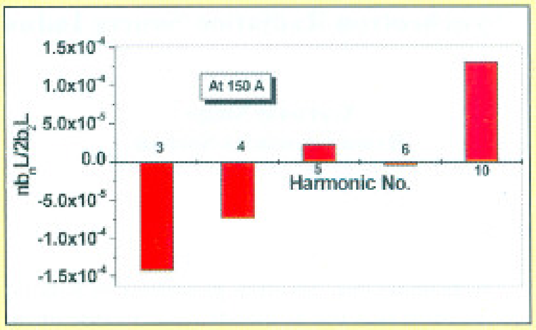

Fig.A.15. 5 Harmonic contents in Q2 type Quadrupole Magnets.

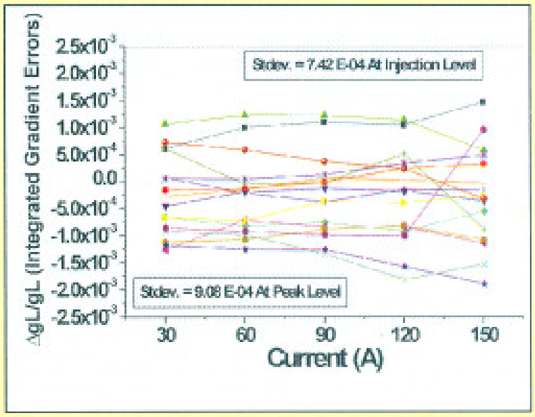

Fig.A.15.6 ΔgL/gL plot at various excitation level for Q2 type Quadrupole Magnets.

Fig.A.15.4 shows the integrated gradient as a function of current. As the non-linearity is low, tracking of the magnets will be easier during the ramping and will also help in minimizing tune excursion during ramping. Fig.A.15.5 shows the strength of higher order multipoles, which are low and meet the beam dynamics requirements. The strength of the higher order multipoles does not change significantly with excitation level. Fig. A.15.6 shows the relative variation in the integrated gradient of all the magnets in Q2 family. The standard deviation of the strength of integrated gradient at injection level is 7.42×10^{-4} and that at peak level is 9.08×10^{-4}.

(Reported by: S. P. Mhaskar; mhaskar@cat.ernet.in)