## A.3 Calibration System for Indus-2 Beam Position Indicators

The Beam Position Indicators (BPI) plays a very important and useful role in all synchrotron radiation facilities. Their importance arises from the fact that they allow us to measure beam orbit in a non-destructive manner and their effect on beam health is very negligible. One of the most important issues in particle accelerator operation is the efficient control of closed orbit. Measurement, correction and stability of closed orbit are very much essential in high brightness sources like Indus-2. The same is closely related to the performance of the BPIs.

To provide precise and accurate transverse position of electron beam in the Indus-2 storage ring, 56 Beam Position Indicators (BPI) will be installed in Indus-2 machine. Out of 56 BPIs, 40 BPIs are of individual type and rest 16 are integrated with dipole magnet vacuum chamber. The BPIs are of capacitive type having a disk (button) of SS 304L as sensor or electrode. The Beam Position Indicators are required to be calibrated before they can be installed in Indus-2 machine. The calibration is done to determine electrical offset with respect to defined mechanical centre, to determine displacement sensitivities as well as non-linearties of BPI. Ideally when beam passes through the geometrical center of BPIs, all electrodes should have same signal strength. However due to different capacitances and mechanical variation in the areas of the electrodes, the electrical centre (mechanical x, y, where all electrodes show same signal strength) differs from mechanical centre of BPI. A fully automatic calibration system has been developed (fig.A.3.1) to carry out the calibration of Beam Position Indicators. Calibration software has been developed which has necessary utilities to process and display calibration data and results.

The beam position indicator has four electrodes, which allows us to measure both horizontal and vertical beam positions simultaneously. An antenna is used to simulate the field of electron beam. The antenna is mounted on a X-Y motion stage and two stepper motors coupled to the stage provide movement to the antenna. The movement of antenna is controlled by a microprocessor-based controller, which ensures precise positioning of antenna. A 100 KHz sinusoidal signal generator is used as the excitation source. The generator output is stepped up by a 1:5 HF transformer before feeding it to antenna. Typically a signal of 100 V peak to peak is applied to antenna. A wide band voltage follower (buffer) is connected to each button electrode output to sense the signal induced on the button without loading it. RF switches are used to multiplex the four button outputs. The output of the multiplexer is read by a RF milivoltmeter. The stepper motors and RF switches are controlled by a micro processor based system. The data from milivoltmeter is read into PC over GPIB interface. The software developed in house controls the full calibration process.

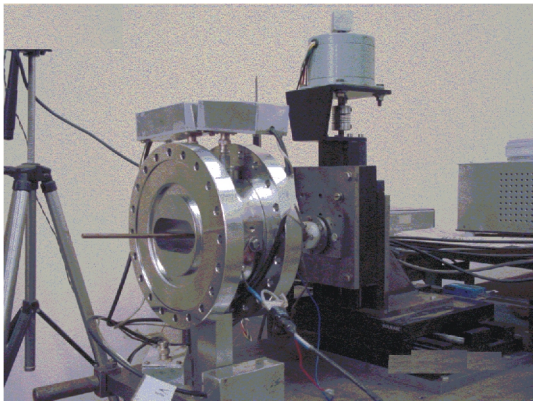

*Fig.A.3.1 Calibration Setup for Beam position Indicators (close view)*

The system has successfully calibrated the Beam Position Indicators of Indus-1. The system is presently being used for the calibration of BPIs of Indus-2.

(Contributed by: Y.Tyagi, Anil Banerji, Lokesh Babbar, T.A. Puntambekar and S.Kotaiah; anilban@cat.ernet.in)

## A.4 Versatile driver for laser diodes

A versatile laser diode driver power supply has been developed with varied operational requirements. The important specifications are: wide range variation in pulse width (500 ns to CW), frequency (single-shot to 1 kHz) and output current (10 mA to 5 A). Moreover, it should also be possible to bias the pulse current to the diode by a DC current. The driver power supply developed to meet these specifications follows the principle depicted in Fig.A.4.1. Two current sources Io and Ip are used to independently set the amplitudes of offset (or, bias) current and pulse current, respectively. Schottky diodes Do and Dp isolate the two current-flow paths. A low-resistance pulsar switch is switched on and off in programmed manner to generate pulse current in laser diode stack of desired duration and frequency. Note that the pulse current flows in laser diodes only when the switch is off.