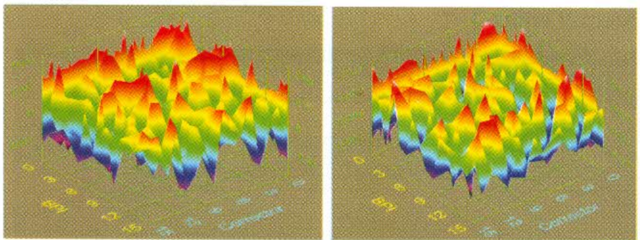
A.3: Global fast orbit feedback control system for Indus-2

To increase electron beam orbit stability above the level achieved by global slow orbit feedback (SOFB) system, a global fast orbit feedback (FOFB) system has been developed in its initial phase with 16 BPIs and 32 correctors, integrated and tested in Indus-2 storage ring. This helped attenuating orbit changes starting from nearly DC upto 50Hz in both horizontal as well as vertical plane.



(a) (b)

Fig.A.3.1: Measured systems response matrix (a) Vertical plane (b) Horizontal Plane

The developed system is 16 input 16 output type control system for each plane with Singular Value Decomposition (SVD) based parameter decoupling. After initial integration testing, hardware reconfiguration and calibration the system's steady state response matrix is measured (Fig.A.3.1). This response matrix data is then used for calculating parameter decoupling matrix using SVD algorithm. Then the normalized channel wise transfer function is calculated from the average of 100 step responses for each channel to formulate the overall channel wise system model as shown in fig A.3.2.

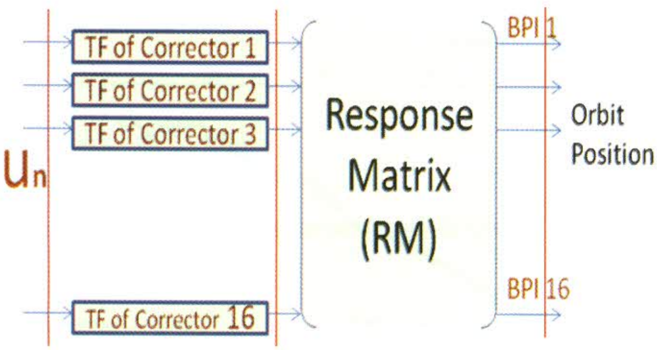
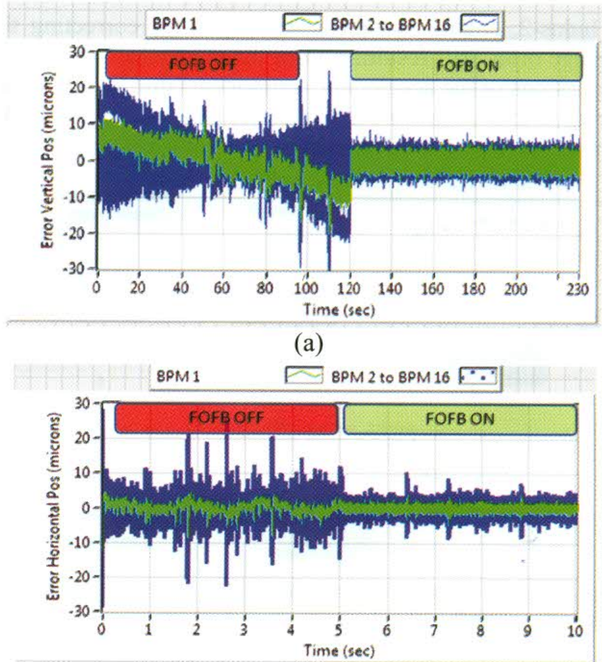


Fig.A.3.2 FOFB system model structure in one plane

Using the formulated model, the initial PID controller values are calculated and then in an iterative manner the final PID controller values along with the pre-filter parameters are adjusted such that the system noise up to 50 Hz is corrected as desired. Different pre-filter settings and PID settings are tried to judge the system's ability and the best noise attenuation that can be obtained with the present configuration. Fig.A.3.3 and Fig.A.3.4 show the results from one of such trial for horizontal and vertical plane.



(b)

Fig.A.3.3 Measured beam position on different BPI's with Global FOFB system OFF and ON (a) horizontal Plane (b) vertical plane

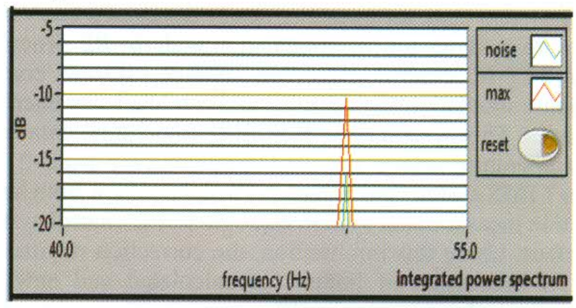


Fig.A.3.4 Attenuation at 50Hz with FOFB OFF(red) and FOFB ON(green) for the purposefully injected noise of 50Hz in the system using spare fast corrector.

The developed system successfully confined the beam position variations (pk-pk) from ~ ±40μm to ~ ±12μm in horizontal plane and from ~ ±30μm to ~ ±10μm in vertical plane. With the worked-out best controller tuning parameters the noise attenuation of ~5dB at 50Hz has been achieved in both the planes.

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