CHARACTERIZATION STUDY OF A BUTTON BPM WITH AN APPROACH TO AUTOMATED MEASUREMENTS

ID: THPP12

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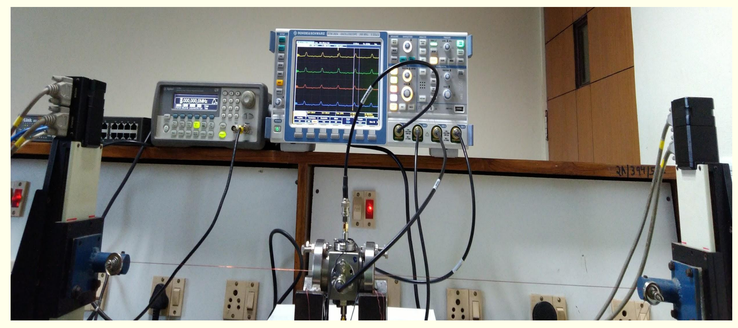
Introduction

- Beam Position Monitor provides crucial information of the beam.
- Idea to measure the charges induced by the time varying electric field of the beam.
- Characterization study of a button BPM with transfer impedance studies and position sensitivity measurements
- Development of automated test bench due to huge time consumption in manual measurements by generally available lab equipment

Test Bench Setup

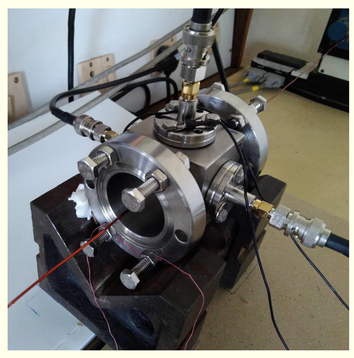
Test Bench Setup

- DSO : Signal Extraction
- Signal Generator: Signal through wire.
- DUT: Mounted Button BPM
- X,Y Scanner Motor Assembly controlled by Motion Controller



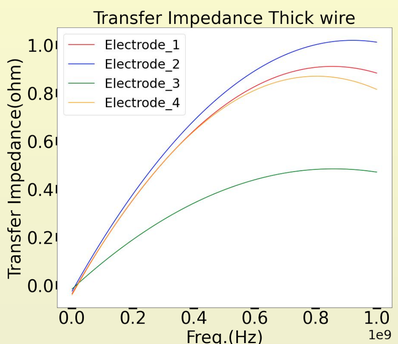
Device Under Test (DUT)

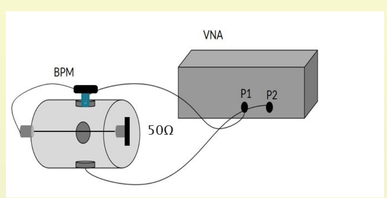
- DUT: Button BPM with cylindrical SS pipe of 88 mm length
- DN 63 flange with outer diameter = 63 mm and inner diameter = 35 mm
- 4 electrodes/button of Al each having radius = 6mm

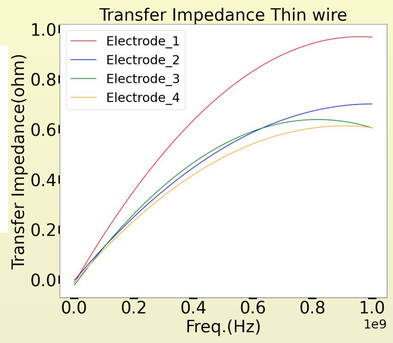


Transfer Impedance

- Transfer Impedance relates output signal to beam current
- Modified Co-axial Cable method is implemented.
- Difference between electrode impedance due to misalignment of geometric axis
- Bad coupling between input part and button electrodes

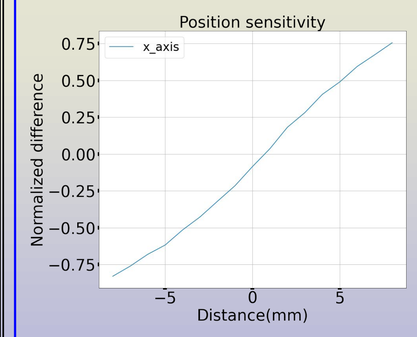


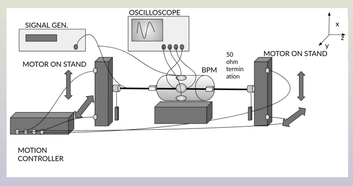


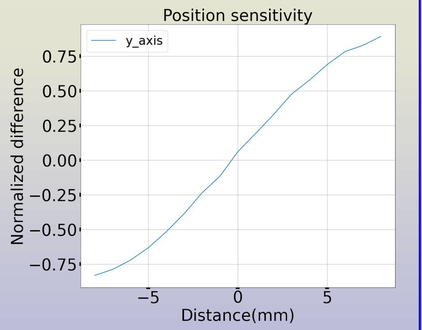


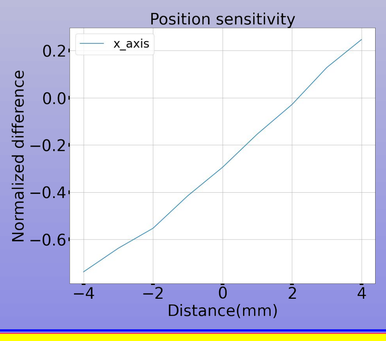
Position Sensitivity

- Stretched wire method is used
- Thick wire (D = 1mm) and Thin wire (D = 0.5 mm) is used
- The curves are in good agreement with the expected theoretical values of button BPM, with an offset in the geometrical and electrical centre.
- Due to miss-alignment of button normalized difference is not zero at origin
- Bad coupling between input part and button electrodes

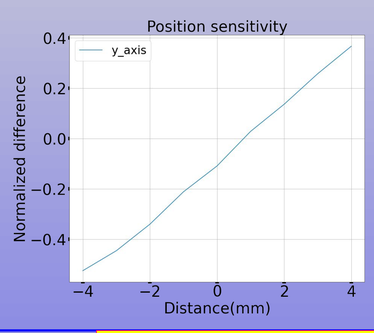




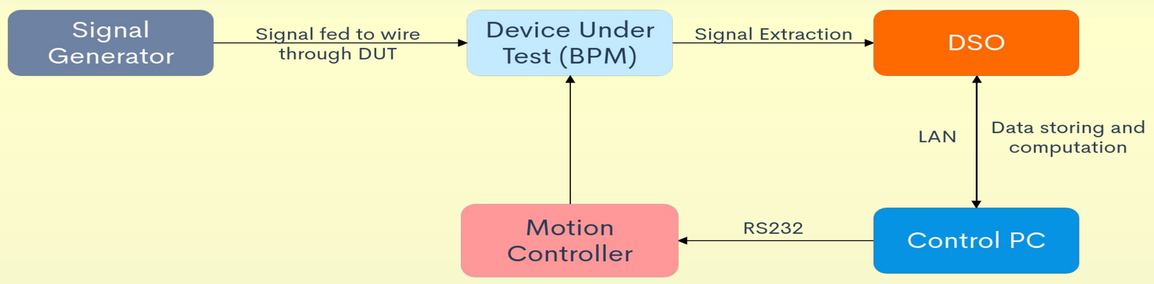




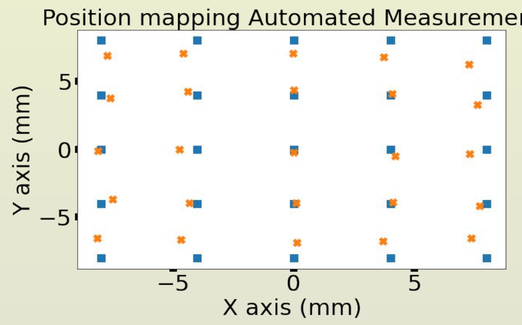
Wire	S_X(1/mm)	S_Y(1/mm)
Thin	0.81	0.64
Thick	0.73	0.43

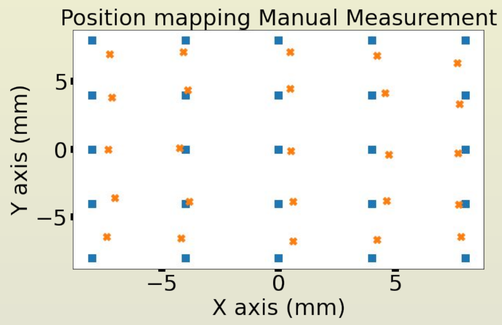


Automation and Position Mapping

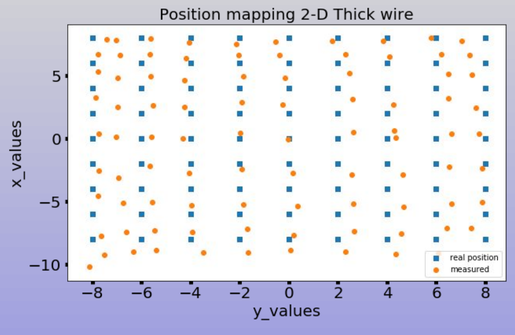


- Stretched wire method by moving wire from -8 mm to +8 mm in various step size
- Automated approach to measurements due to huge consumption of time
- Remote Interfacing over RS232 to Motion Controller and LAN to DSO
- Motion Controller Connected to X,Y Scanner Motor Assembly.
- Gclib and vxi11 is used to control Motion Controller and DSO for movement and signal extraction.
- Reduction in Measurement Error when used Automation test becnh measurement

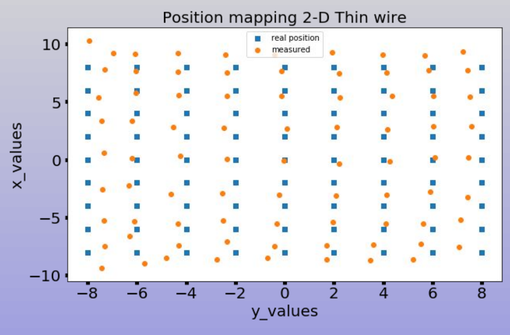




Error	X(mm)	Y(mm)
Manual	0.81	0.64
Automated	0.73	0.43



- 2-D position mapping with thick wire with step size = 2mm using automated test bench setup



- 2-D position mapping with thin wire with step size = 2mm using automated test bench setup

Hardware and Software used

- NSC-G Newmark Motion Controller
- Signal Generator (Agilent, 200 MHz)
- DSO (Rohde & Schwarz 200MHz)
- Gclib and vxi11 python libraries
- XY Scanner Motor Assembly

Conclusions

- Characterization study of a button BPM as DUT
- Development and testing of automated test bench
- Reduction in error by using automated test bench measurement
- Exemplary measurements of 2-D mapping of thick and thin wire with error measurements is performed
- Results are obtained quickly through automation

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References

[1] Shafer, Robert E. "Beam position monitoring", AIP Conf
[2] A. Molaee ,General Consideration for button-bpm", Proceedings of IPAC2014
[3] D. Lipka,Button bpm development for European XFEL, DIPAC2011
[4] M. Tural Gundogana,Design and Production Considerations on a Button Type Beam Position Monitor for Use of TAC-TARLA Facility", IBIC'16
[5] N. Eddy et al. "Beam Instrumentation at the Fermilab IOTA ring f IBIC2019
[6] S.Udrea, Beam Diagnostics Test bench for the commissioning of the proton LINAC at FAIR in Proceedings of IBIC2019
[7] M. Schwarz et al., "Development of an automated BPM test bench- f IBIC201
[8]S. Zorzetti, Stretched-Wire Techniques and Measurements for theAlignment of a 15GHz RF-BPM for CLIC, in Proc.4th Int. Beam Instrumentation Conf. (IBIC'15)
[9] Kumar, Mukesh, Modified coaxial wire method for measurement of transfer impedance of beam position monitors", Phys. Rev. Accel. Beams,
[10] S. Ghosh et al. "Status of the development of Delhi Light Source (DLS) at IUAC" Nucl. Instr. Meth. B