

NOVEL ELECTROSTATIC BEAM POSITION MONITORS WITH ENHANCED SENSITIVITY

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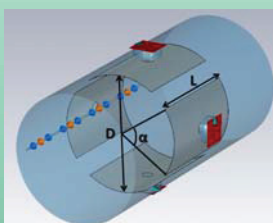
Abstract

Beam Position monitors (BPM) measure the beam transverse position, the beam phase with respect to the radiofrequency voltage and give an indication on beam transverse shape. Electrostatic BPMs are composed of four electrodes that transduce the associated electromagnetic field to the beam into electrical signals allowing the calculation of the beam parameters mentioned above. During commissioning and/or experiences phases that needs very low beam current, the precision of the BPM measurement is reduced due to the low sensitivity of electrostatic BPM to the beam current. This paper addresses the design, the realization and the testing of a new set of BPMs with large electrodes. It emphasizes the strong points of these BPMs in comparison with BPMs present in SPIRAL2 (SP2) facility.

BPM DESIGN

Beam is bunched due to RF accelerating signal at 176.105MHz, electrodes receive multi-tone signal, focus is pointed on the 1st and 2nd harmonic tones. BPM subtended lobe angle is set to 63deg as a trade-off between BPM position and current sensitivities. BPM length is optimized to maximize the current sensitivity.

BPM Parameter	SPIRAL2	OPTIMIZED
D:Diameter	48mm	40mm
α : Subtended lobe Angle	63deg	63deg
L: length	39mm	65mm



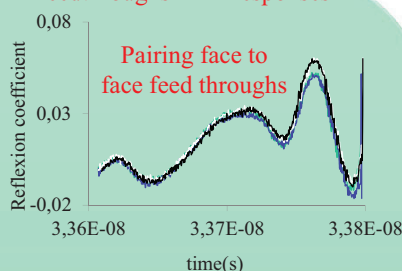
SIMULATIONS SHOW **10dB** ENHANCEMENT IN BPM CURRENT SENSITIVITY (1.5dB DUE TO SMALLER DIAMETER)

BPM CHARACTERIZATION

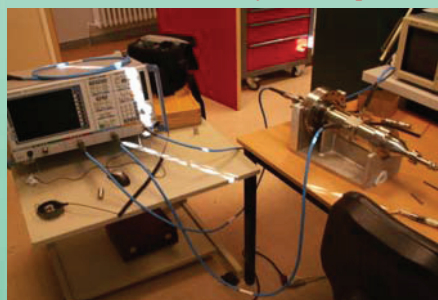
Electrodes capacitances

Position	Electrode	Feedthrough
Up (U)	13.66	1.31
Down (D)	13.61	1.36
Left (L)	13.96	1.34
Right (R)	13.62	1.37
U/D Diff	0.05	0.05
L/R Diff	0.34 (**)	0.03

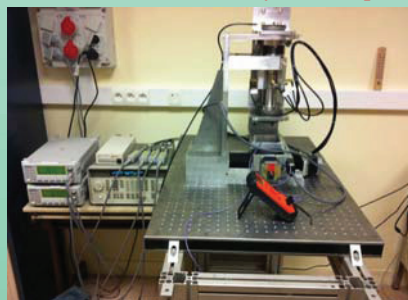
Feedthroughs TDR responses



Current sensitivity test setup



Position sensitivity test setup



RESULTS(*)

BPM	Current sensitivity(dB)			
	UP	DOWN	LEFT	RIGHT
New	-25.5	-25.5	-25.6	-25.5
SP2	UP	DOWN	LEFT	RIGHT
	-33.5	-33.4	-33.6	-33.4

(*) CENTRED CIRCULAR BEAM

RESULTS

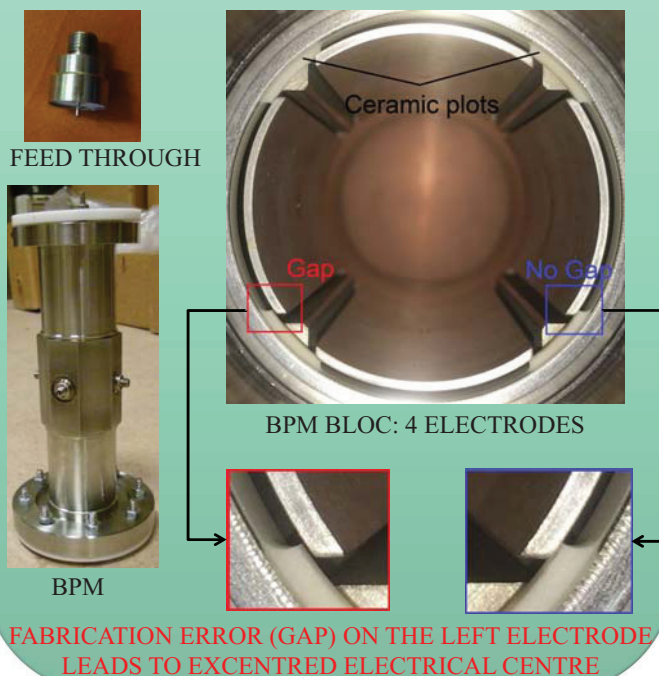
Electrical centre		Position sensitivity	
X(μm)	Y(μm)	Estimated	Measured
174(**)	18	1.68	1.62

(**) DUE TO LEFT ELECTRODE FABRICATION ERROR

BPM MECHANICAL REALIZATION

SP2 BPMs have a single connection between the feed-through and the electrodes, this drained defaults in BPM block cylindricity leading to off-center BPM electrical center (from 10μm to 400μm over the 20 SP2 BPMs). Longer electrodes would worsen the excentricity

SOLUTION: small Anti-gazing ceramic plots are inserted on the corners of the electrodes, they offer a better support to each electrode and a better cylindricity to the BPM block, therefore they reduce the difference between mechanical and electrical centers of the BPM



CONCLUSION

ACHIEVEMENTS

- ✓ 8dB Enhancement in BPM current sensitivity (1.5dB due to smaller BPM diameter)
- ✓ Robust and reproducible mechanical realization
- ✓ BPM position sensitivity remains almost unchanged

FOLLOWING STEPS

- ✓ Special care should be taken on electrode positioning
- ✓ Testing under real beam operation