

Introduction into BPMs (Beam Position Monitor)

V. L. Sargsyan, A. Liapine

May 2002

Abstract

Here we bring a survey of the BPM technique. Operation principles of the general type of BPMs are discussed. Their main advantages and disadvantages are summarized.

1 Introduction

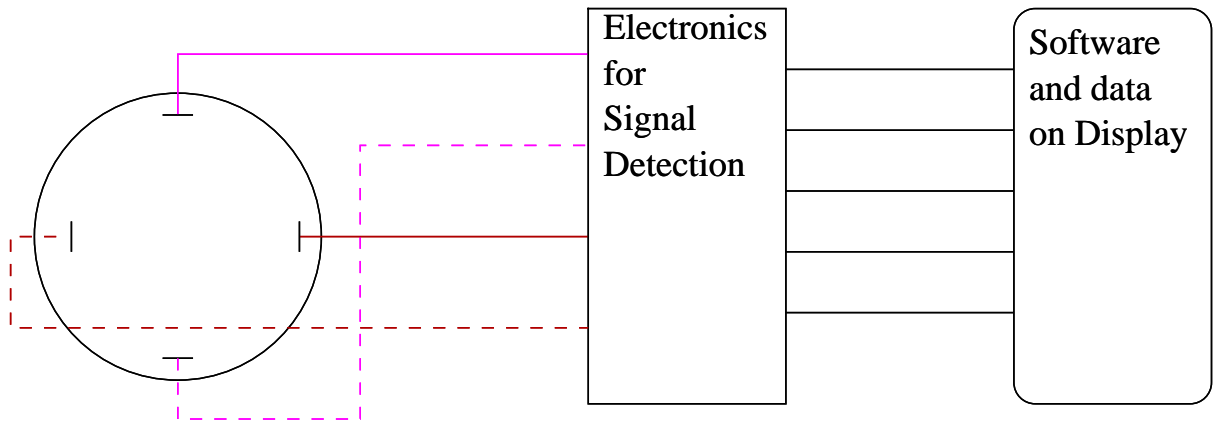


Figure 1: BPM architecture

Monitoring process passes the following three stages:

Pick-Up station

Signal detection electronics

2 Button Pick Up BPM

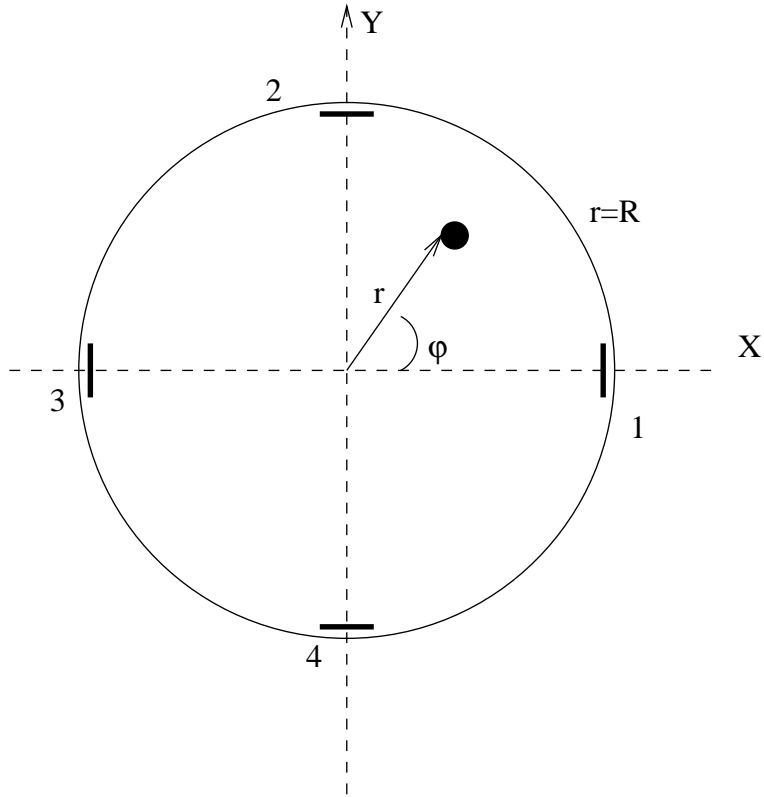


Figure 2: Cross-section of the beam-pipe with PickUps

$$P_x = R \frac{\Delta_x}{S_x} \quad (1)$$

$$\Delta_x = q_1 - q_3, S_x = q_1 + q_3.$$

3 Cylindrical Pill-box cavity BPM

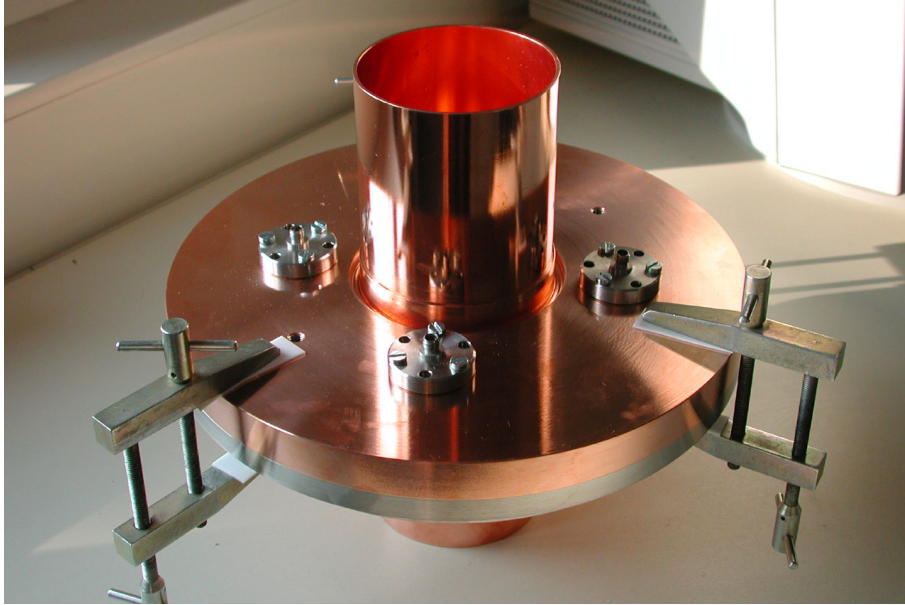


Figure 3: Cylindrical pick-up station and a part of the beam-pipe

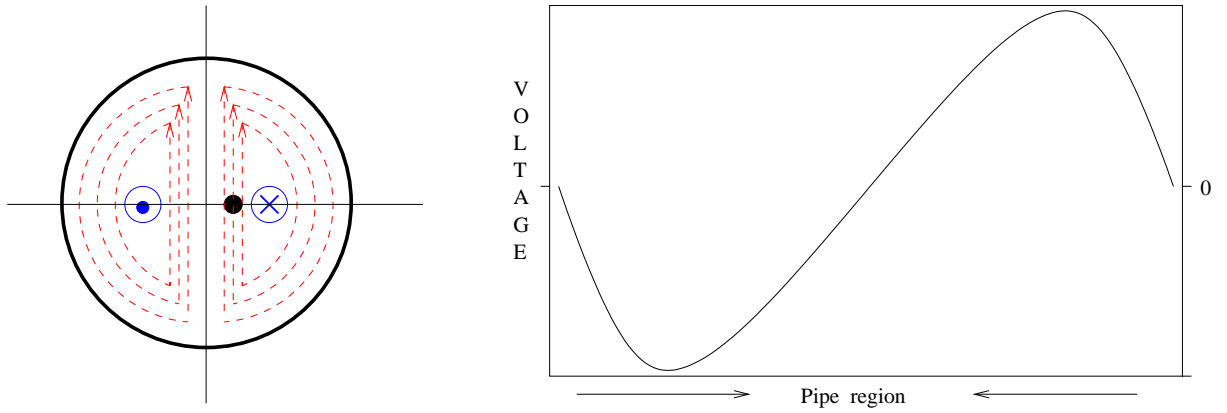


Figure 4: a) TM_{110} -mode pattern and b) voltage along oz axis of the TM_{110} -mode depending from the beam displacement

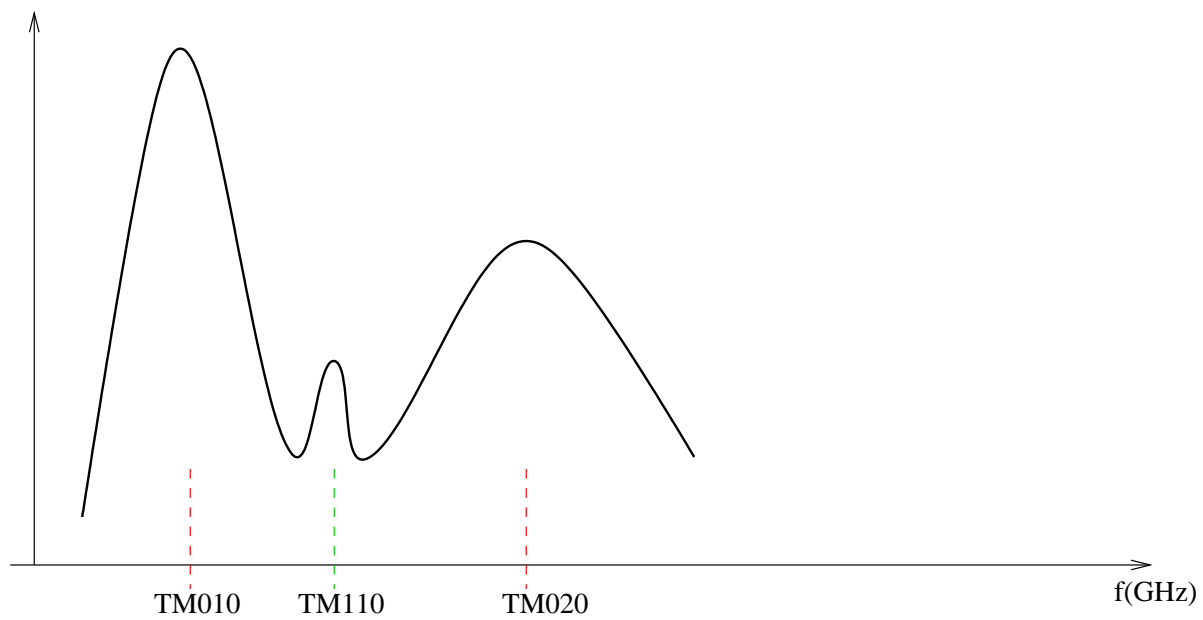


Figure 5: The first and second monopole modes compared with the dipole mode

4 Re-entrant

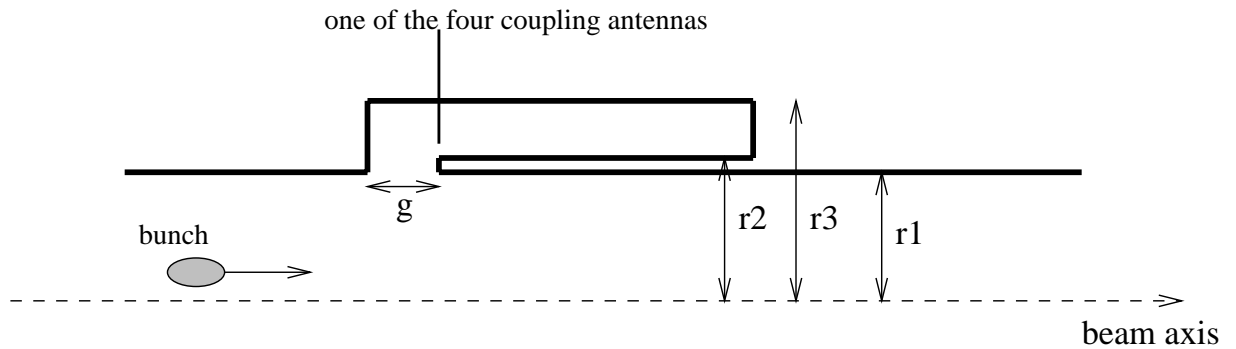


Figure 6: Re-entrant coaxial cavity (note a radial symmetry, around beam axis)

5 Stripline BPM

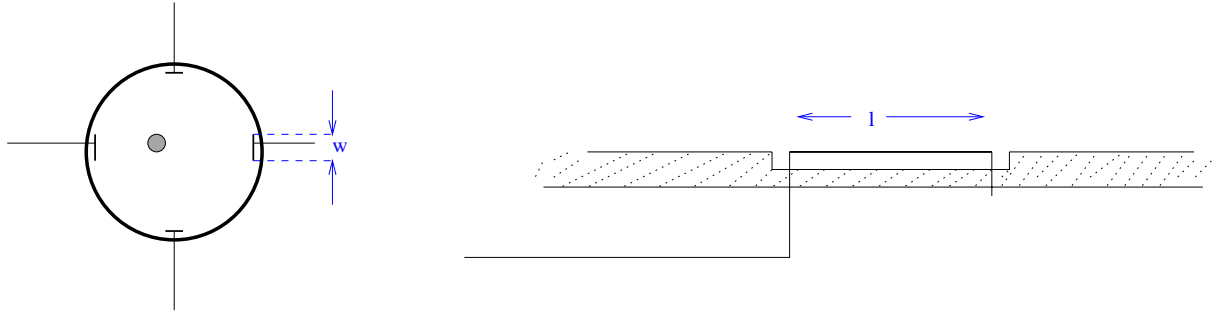


Figure 7: Cross-section of a stripline pick-up station and horizontal view of one electrode

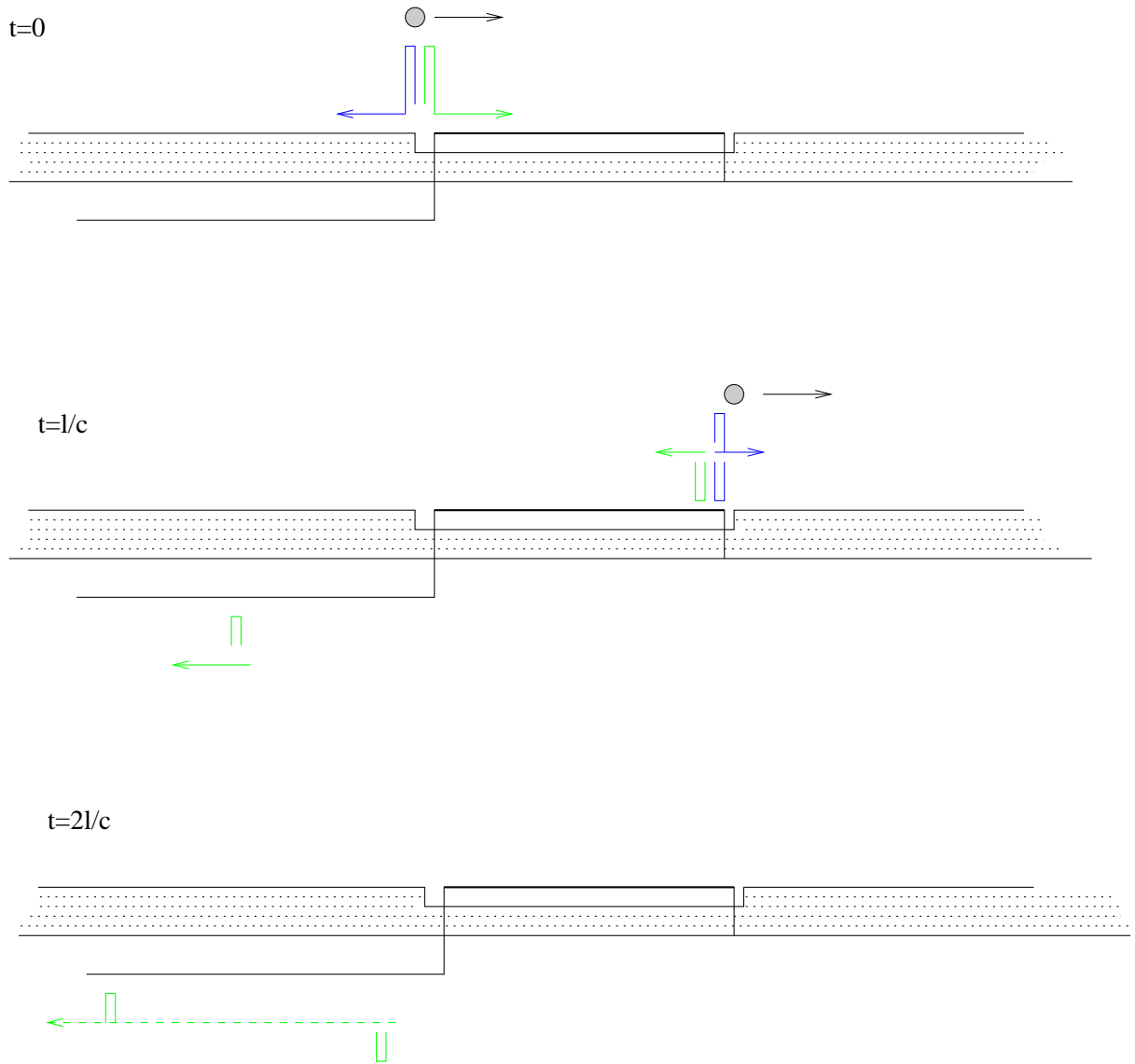


Figure 8: Operation principle of the stripline monitor

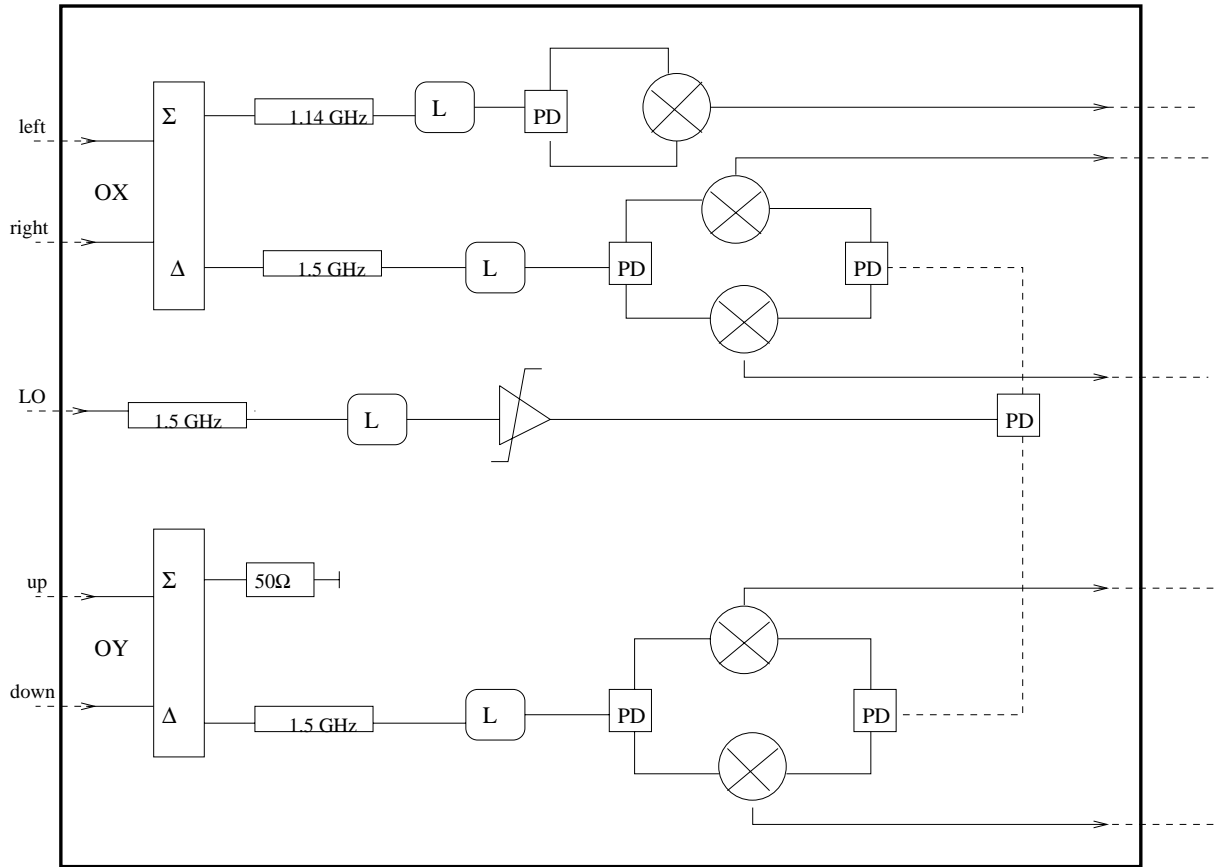


Figure 9: General layout of the BPM electronic

BPM	Bandbreite	Resolution	Time-Vorteil	Techn. Probleme	Techn.	Anwendungszweck
Button	reitbandig	resolution einige $\mu m - 100\mu m$	sehr schnell	relativ einfach Aufbau	Positionierung der Elektroden schwierig	
Resonant	schmalbandig	einige $10nm - 10\mu m$	langsamer als (1)	Einfacher und precieser		sehr preciese Messungen
Re-entrant	Breitbandig	-	relative schnell	radial symetry		
Stripline	moderat		relativ schnell	-	relativ compleciet	interaction ragon

Table 1: Vergleich der diskutierten Monitortypen.