Development Of Nanometer Resolution C-Band Radio Frequency Beam Position Monitors In The Final Focus Test Beam

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Abstract. Using a 47 GeV electron beam, the Final Focus Test Beam (FFTB) produces vertical spot sizes around 70 nm. These small beam sizes introduce an excellent opportunity to develop and test high resolution Radio Frequency Beam Position Monitors (RF-BPMs). These BPMs are designed to measure pulse to pulse beam motion (jitter) at a theoretical resolution of approximately 1 nm. The beam induces a TM110 mode with an amplitude linearly proportional to its charge and displacement from the BPM's (cylindrical cavity) axis. The C-band (5712 MHz) TM110 signal is processed and converted into beam position for use by the Stanford Linear Collider (SLC) control system. Presented are the experimental procedures, acquisition, and analysis of data demonstrating resolution of jitter near 25 nm. With the design of future e+e- linear colliders requiring spot sizes close to 3 nm, understanding and developing RF-BPMs will be essential in resolving and controlling jitter.

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