

First Bunch Length Measurements From the SLAC Linac Transverse Deflecting Cavity

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Abstract

A 2.4 m long S-Band Transverse Deflecting Structure has been installed in the SLAC linac as a bunch length diagnostic. For the first commissioning tests reported here the structure was fed with 20 MW of RF power in order to streak a 46 GeV test beam in the linac. Profile monitor measurements of the streaked beam were analyzed to reconstruct the bunch length distribution of the beam. Results are presented for measurements of an uncompressed, large-emittance 46 GeV witness pulse, accelerated directly from the gun, that is used for fixed target experiments, and also a compressed low-emittance bunch from the damping rings that is designated as the standby pulse for PEP II B-Factory injection. Bunch length measurements of the damping ring beam as a function of the compressor amplitude show a characteristic minimum at the transition from under- to over-compression. It is also clearly apparent in the measurement that the bunch length distribution becomes steeply non-gaussian as the beam is over-compressed, as was always anticipated in particle tracking simulations. These first commissioning results with the transverse cavity indicate its suitability for tuning ultra-short bunches in the Short Pulse Particle Source, SPPS, later this year and in the future Linac Coherent Light Source, LCLS.