

Measurement of Nanometer Electron Beamsizes using Laser Interference by Shintake Monitor

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One of ATF2's major goals is to verify the Local Chromaticity Correction scheme by focusing the vertical e-beam size (σ_y) down to its design 37 nm. Indispensable for this mission and for R&D of future linear colliders is the Shintake Monitor installed at ATF2's virtual IP. It is the only existing beam size monitor capable of measuring $\sigma_y < 100$ nm. , The e- beam is collided against laser interference fringes, and σ_y is derived from the modulation depth of the resulting Compton scattered photons. A wide measurable range from 20 nm to a few μm , is enabled by switching between several laser crossing angle modes.

$\sigma_y < 150$ nm have been achieved by Feb, 2012. Major upgrades in the laser optics suppressed various systematic errors and signal jitters, improved resolution, and led to remarkably stable contribution during continuous ATF2 beam runs in 2012 winter, during which the smallest σ_y ever of about 70 nm had been confirmed. This record was renewed in spring 2013 to stable measurements of $\sigma_y < 60$ nm. Further hardware upgrades and dedicated error studies are ongoing to realize focusing and stable measurement of $\sigma_y < 50$ nm.

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