

Advanced Picosecond Precision RF Timer of keV Electrons

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Abstract

A new type of radio frequency timer of keV energy electrons will be presented. It is based on a helical deflector, which performs circular or elliptical sweeps of keV electrons, by means of radio frequency fields in a frequency range of 500–1000 MHz. By converting a time distribution of incident electrons to a hit position distribution on a circle or ellipse, this device achieves extremely precise timing. Detection of scanned electrons by means of a position sensitive detector based on the microchannel plates, produced a timing resolution of 10 ps, which can be potentially improved to 1 ps and sub ps range. This ultra-high precision technique has potential applications in a large variety of scientific fields including fundamental physics (in particular, hypernuclear lifetime measurements, fission isomer studies) and medical applications (Diffuse Optical Tomography, Time-of-Flight Positron Emission Tomography). The device is highly suited for Time Correlated Single Photon Counting which is widely used in optical microscopy and tomography of biological samples.