IPAC'23 - 14th International Particle Accelerator Conference



Contribution ID: 1798 Contribution code: WEPL108

Type: Poster Presentation

Experimental 4D tracking of a single electron in IOTA

Wednesday, 10 May 2023 16:30 (2 hours)

We present the results of the first experiments on 4-dimensional phase-space tracking of a single electron in a storage ring, using a linear multi-anode photomultiplier tube for simultaneously measuring transverse coordinates and arrival times of synchrotron-radiation pulses. During the next few months, full 6D tracking will be implemented. This technology makes it possible to characterize the motion of a single particle, i.e. simultaneously tracking of amplitudes and phases for slow synchrotron oscillations and fast betatron oscillations. Complete tracking of a single particle enables the first direct measurements of dynamical properties, including invariants, amplitude-dependent tunes, and chaotic behavior.

Funding Agency

This work is supported by the U.S. Department of Energy under contract No. DE-AC02-07CH11359 and by Fermilab's Laboratory Directed Research and Development grant FNAL-LDRD-2022-041.

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Session Classification: Wednesday Poster Session

Track Classification: MC5: Beam Dynamics and EM Fields: MC5.D02: Non linear Single Particle Dynamics Resonances, Tracking, Higher Order, Dynamic Aperture, Code Deve