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Measurements for beam size blowup in sudden beam loss events and analysis of the beam loss evolution mechanism

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The SuperKEKB electron-positron collider, which aims to achieve the world's highest luminosity, has suffered from "Sudden Beam Loss events (SBL)," in which several tens of percent of the beam current is lost and aborted within a few turns (20-30 μs). We have developed a new turn-by-turn beam size monitor to elucidate the cause and time evolution mechanism of the SBL events from a beam size variation point of view. The beam size monitor has two features: 1) it can measure the beam size variation over dozens of turns just before an SBL-induced beam aborts, and 2) it can measure independently in two different wavelength regions, X-ray and visible light, to ensure redundancy. In the SuperKEKB operation in 2024, we found that the vertical beam size blew up rapidly before a few turns of the abort, up to about ten times larger than the usual beam size. We also found that the size blowup started earlier than the beam position oscillation. In this presentation, we will discuss the mechanism of the beam size monitor we have developed, the analysis results of the measured beam size blowup, and finally, the possible cause and time evolution mechanism of the SBL events.

Footnotes

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