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Analyzing sudden beam loss in the SuperKEKB/Belle-II experiment with RFSoc technology

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In the SuperKEKB/Belle-II experiment, a multitude of elementary particle reactions is initiated through the collision of 4 GeV positrons with 7 GeV electrons, paving the way for the exploration of new physics. The experiment includes plans for the substantial enhancement of luminosity in the future, aiming to achieve an integrated luminosity approximately 100 times the current level. However, the realization of this goal is impeded by a recurrent occurrence of a phenomenon known as “Sudden Beam Loss,” which entails the abrupt disappearance of the beam within tens of microseconds. The cause and location of these occurrences have not yet been identified.

To provide the tools to diagnose and debug these sudden beam loss events, a new Bunch Oscillation Recorder (BOR) has been developed to analyze this phenomenon, utilizing the Radio Frequency System on Chip (RFSoc) from AMD/Xilinx. The beam position of each individual bunch is measured and recorded by the BOR just prior to the onset of sudden beam loss. We will present how the signal from the button beam position monitor of the beam pipe is processed by RFSoc, along with the results obtained from observing the actual SuperKEKB beam using RFSoc.

Footnotes

Funding Agency

Paper preparation format

Region represented

Asia

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