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Measurement of the electromagnetic background radiation during SuperKEKB commissioning

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The SuperKEKB electron-positron collider, aiming to deliver an unprecedented peak instantaneous luminosity to the Belle-II experiment, was operated for the first time at the beginning of this year. The expected luminosity — 40 times that delivered to the Belle experiment — demands careful prediction and characterization of the machine-induced background radiation and its effect on the detector. Of particular interest is the prediction of the impacts on the performance and longevity of the electromagnetic calorimeter. To rely exclusively on simulation of the new and unknown SuperKEKB machine for such predictions would be rather daring, therefore the goal of the experiment is to measure the electromagnetic background rate and spectra in the so-called end-cap regions of the calorimeter, where it is predicted to be the largest.

We used six calorimeter units each containing three types of crystal scintillators, all read out by photo-multiplier tubes. These units were placed in the forward and in the backward regions of the interaction region, at positions reproducing those of the Belle-II calorimeter end-cap crystals. We record the arrival time and deposited energy for each hit, and the different crystal materials will provide sensitivity to different parts of the spectra.

We are taking data since February, during the accelerator commissioning and always changing beam conditions. We want to capture the relationships between the background observables and accelerator quantities such as the bunch size, the beam current, and the pressure in the vacuum chamber. It is the scaling of the background compared to the beam parameters that will enable us to disentangle the dominant physical processes behind observed beam loss events, and test how well each of these processes is simulated. The measurement campaign coincides with the first phase of SuperKEKB commissioning, and is planned to end on June 30th, 2016.

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