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## The Crystal Zero Degree Detector at BESIII

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### Content

The BESIII experiment at the BEPCII electron positron collider at IHEP (Beijing) is collecting data in the charm- $\tau$  mass region. Electron positron collisions are a very well suited environment for the study of initial state radiation (ISR). However, the photons from ISR are strongly peaked towards small polar angles and are currently detected with limited efficiency.

In order to increase the detection efficiency of ISR photons, we are developing small-size calorimeters to be placed in the very forward and backward regions. Each detector will consist of two  $4 \times 3$  arrays of  $1 \times 1 \times 14 \text{ cm}^3$  LYSO crystals. A  $1 \text{ cm}$  gap separating each of the two arrays will reduce the contamination from background at very low angles. The scintillation light will be collected by silicon photomultipliers (SiPMs). The expected event rate in the MHz range requires flash ADCs recording the preamplified SiPM outputs. The digitized waveforms will be analyzed in realtime yielding data reduction and pile-up detection. This high bandwidth data stream will be transmitted via optical fibers to FPGA-based hardware performing sub-event building, buffering, and event correlation with the BESIII trigger. The sub-events with a corresponding trigger will be sent to the BESIII event builder via TCP/IP.

The performance of the detectors and the impact of the beam pipe material in front of the detectors are currently studied in Geant4-based simulations. A single crystal equipped with a SiPM was instrumented as a prototype detector. Tests with sources and in electron beam at the MAMI facility were performed successfully.

### Summary

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