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Design and Prototype Test of the Homogeneous Crystal Calorimeter for STCF

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The Super Tau-Charm Facility (STCF) is the next generation high luminosity e^+e^- collider concentrating on the tau-charm physics. STCF will reach a luminosity over $0.5 \times 10^{34} cm^{-2} s^{-1}$ at 4 GeV, which brings high event rate and high beam background to the detector system. The background count rate over 1 MHz per module places new demands on the electromagnetic calorimeter (EMC): maintaining good energy and position resolution under severe pileup condition. Meanwhile, the development of event timing and particle identification capability is also an important aspect of calorimeter R&D, where a time resolution of better than hundreds of picoseconds is expected.

In this talk, the simulation and optimization of the calorimeter system, the prototype manufacture and test results on the prototype are summarized. The STCF EMC is based on fast pure CsI crystal and read out by avalanche photodiodes (APD). By considering the effect of crystal and electronics response, as well as the pileup condition, a full chain of simulation and reconstruction is implemented into the Offline Software of Super Tau-Charm Facility (OSCAR). The architecture and module geometry of EMC are constructed by optimizing physics performance under OSCAR. Based on the module design, a novel wavelength shifter (WLS) enhanced prototype is manufactured, which highlights fast time response and good signal to noise ratio under a reasonable cost. The comprehensive test results on the prototype, especially on the radiation hardness of the prototype, the uniformity of light collection and the timing performance of the electronics, will also be presented.

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