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Development of next-generation calorimeter combining high-granularity and dual-readout calorimeter with psec-timing

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Several future collider experiments are proposed for precise measurement of Higgs that require calorimeter technology with excellent jet energy resolution. To fulfill the requirement, this study aims to develop next-generation calorimetry that combines "particle flow calorimetry" and "dual-readout calorimetry". For the aspect of particle flow calorimetry, highly segmented readouts are implemented in the active layers. At the same time, for the aspect of dual-readout calorimetry, two different kinds of signal generation: scintillation and Cherenkov radiation are used to improve energy reconstruction for hadrons. This study also turns the spotlight on the timing measurement of the calorimeter. It is to establish a detector technology of picosecond-level time resolution for a large detection area and to investigate the impact of timing information as additional input for particle flow or cut for background reduction. As a result, the proposed calorimetry precisely measures not only energy but also position and timing and opens access to the "5D calorimeter".
To realize such a concept, a Cherenkov detector with highly segmented readouts and picosecond-level timing resolution that can cover a large area is required. Cherenkov light generated by charged particles is converted to photoelectrons by a photocathode and subsequently amplified by the Resistive Plate Chamber (RPC) is one candidate for such a detector. Notably, the amplification layer utilizes an RPC with a Diamond-like Carbon (DLC) electrode, providing high-rate capability overcoming the conventional drawbacks of RPCs.
This presentation describes the demonstration of the detector concept of the Cherenkov detector.

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Primary author: LI, Weiyuan (The University of Tokyo)

Co-authors: GATTO, Corrado; JEANS, Daniel; HAHN, Eileen; OGAWA, Hiroyasu; MATSUOKA, Kodai; LOS, Sergey; SUEHARA, Taikan (ICEPP, The University of Tokyo); KAMIYAMA, Taiki (University of Tokyo); TAKESHITA, Tohru; Dr OOTANI, Wataru (ICEPP, Univ. of Tokyo)

Presenter: LI, Weiyuan (The University of Tokyo)

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