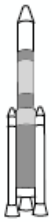

CALOR 2024

第２０回 素粒子・原子核物理学
カロリメータ検出器国際会議
（つくば国際会議場, 2024年5月20日～２４日）

Contribution ID: **74** Type: **Oral**

Development of a novel high granularity crystal electromagnetic calorimeter

Monday 20 May 2024 16:20 (20 minutes)

Motivated by the physics programs of precision measurements of the Higgs, W/Z bosons, and the top quark, future lepton colliders, e.g. the Circular Electron Positron Collider (CEPC), have to meet stringent requirements on the calorimetry systems to achieve unprecedented jet energy resolutions. As part of CEPC's "4th detector concept", a novel high-granularity crystal electromagnetic calorimeter (ECAL) has been proposed, with an optimal EM resolution of $2-3\%/\sqrt{E(GeV)}$ and sufficiently low detection limit of photons. By utilizing the Particle Flow Algorithm (PFA) with other optimized sub-detectors, the new ECAL design concept is expected to improve the Boson Mass Resolution (BMR) from 4% in the CEPC CDR to 3% level.

Significant R&D efforts have been made in the design of this crystal ECAL. Geant4 full simulations have been conducted to assess the impact of light yield and time response of the crystal. Laboratory measurements with characterizations of crystal, silicon photo-multipliers (SiPMs), and readout electronics have been carried out to validate the simulations and demonstrate the feasibility of the hardware. A small-scale crystal module has been developed and tested under beam conditions for performance studies and system-level investigations.

This report introduces the design of the novel high-granularity crystal ECAL, outlines its physics potential, and presents the latest progress on module-level tests and PFA performance studies.

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Session Classification: Future colliders 2