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# Development of a novel high granularity crystal electromagnetic calorimeter for future lepton collider experiments.

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Following the demand for precise measurements of the Higgs, Z/W bosons and the top quark, future lepton colliders, e.g. the Circular Electron Positron Collider (CEPC), are required 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 utilising the Particle Flow Approach (PFA) with other optimised sub-detectors, this 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 undertaken in the design of this crystal ECAL. Geant4 full simulations have been carried out to assess the impact of light yield and time response of the crystal. Laboratory measurements with characterisations of crystal, silicon photo-multipliers (SiPMs) and readout electronics have been conducted, providing validation of the simulations and evidence on the hardware feasibility. Besides, a small-scale crystal module has been developed and tested under beam conditions for performance studies and system-level investigations.

Moreover, a dedicated particle flow algorithm is under development in parallel to solve the major challenges from shower overlapping and ambiguity of pattern recognitions, which are introduced from the layout of orthogonally arranged crystal bars.

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.

## Collaboration

## Role of Submitter

The presenter will be selected later by the Collaboration

**Primary authors:** Mr QI, Baohua (IHEP, CAS); DU, Dejing (Institute of High Energy Physics, Chinese Academy of Sciences); Dr GUO, Fangyi (Institute of High Energy Physics, CAS); LIU, Yong (Institute of High Energy Physics, CAS); ZHAO, Zhiyu (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

**Presenter:** Dr GUO, Fangyi (Institute of High Energy Physics, CAS)

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