



北京大学  
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高能物理研究中心

## LYSO:Ce scintillating crystals for precision timing at CMS during LHC Phase 2

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**Organizer:** Xiaohu SUN, Peking University

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**Location:** CHEP B105, [Zoom](#)

**Webpage:** <https://indico.ihep.ac.cn/event/25922/>



**Abstract:** In Phase 2, the Large Hadron Collider at CERN will increase its luminosity by a factor of 5–7, enabling unprecedented data collection for rare Higgs processes, precision measurements, and new physics searches. However, the rise in simultaneous proton-proton collisions—from 60 to 200—poses challenges such as increased radiation damage and reduced reconstruction performance.

To address this, the CMS detector is undergoing a major upgrade, including the addition of the MIP Timing Detector (MTD). This new layer will measure the time of flight of charged particles with a resolution of 30 ps at the start (60 ps at the end) of Phase 2. Such precision enables 4D collision reconstruction—adding time to spatial coordinates—improving vertex identification in high pile-up conditions by separating overlapping events in time. The central component, the Barrel Timing Layer (BTL), will use LYSO:Ce scintillating crystals, known from medical imaging for their high light yield, fast response, and radiation hardness.

The CMS Rome group led the LYSO procurement, from vendor selection to quality control. A sample of LYSO production was characterized for optical, mechanical, and radiation-resistance properties. With crystal production completed by end of 2024, the crucial assembly phase is now underway at four international centers, including Peking University (PKU). The collaboration here plays a key role in delivering this advanced timing technology for the HL-LHC era.

**Brief bio:** I did my Ph.D. at Sapienza University of Rome, graduating in 2022 with a thesis on the direct search for hadronic resonances in new final states. At the same time, I worked at the timing upgrade of the CMS electromagnetic calorimeter (ECAL) for the LHC Phase 2. In 2020 I was appointed Cooperation Associate at CERN. I then continued with Sapienza as a postdoc, focusing my primary activities on LYSO crystals for MTD, gradually becoming the reference person of the Rome lab for younger students and researchers. Then, my commitments with MTD expanded to software development and detector calibration, for which I was appointed convenor in 2023. Nowadays, I am excited to start a new postdoc with Peking University, pursuing and expanding my contribution to the MTD project.