CEPC calorimeter updates

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Recent instrumentation conferences

- CEPC calorimetry R&D: well represented in CALOR2024 and PM2024
- 20th International Conference on Calorimetry in Particle Physics (CALOR2024)
  - 9 oral talks and 6 posters
- 16th Pisa Meeting on Advanced Detectors (PM2024)
  - 1 oral talk and 2 posters

Messages from CALOR/PM 2024

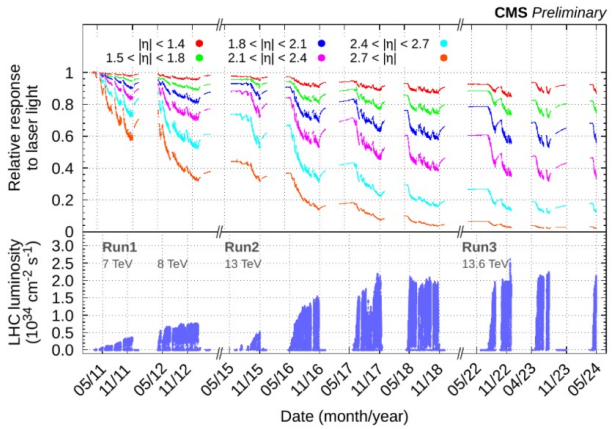
- Calibration scheme is especially important for crystal calorimeters
  - CMS PWO4 calorimeter: laser calibration system plays a key role in its success

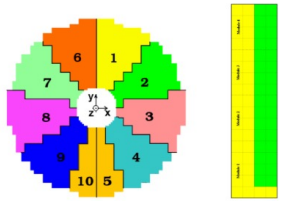
The **Laser Monitoring system** constantly monitors and allows to correct for changes in the crystals transparency to ensure an excellent energy resolution

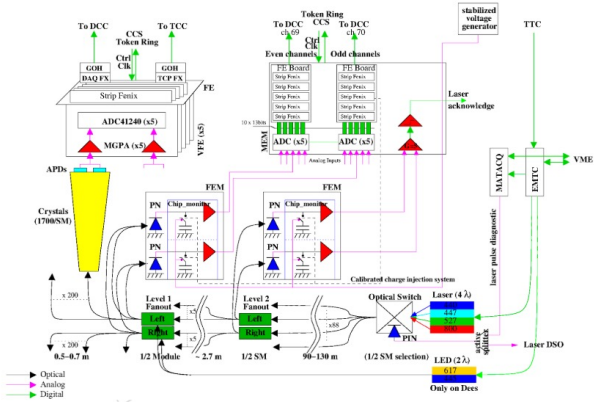
Light from a **laser source** is sent to each crystal with a **multi-level system of optical fibres** and a **two-level distribution system** on detector

The same light is sent simultaneously to **reference PN diodes**, readout by an **electronic chain specifically designed** (FEM cards + MEM board)

Plot from CMS DP-2024/022





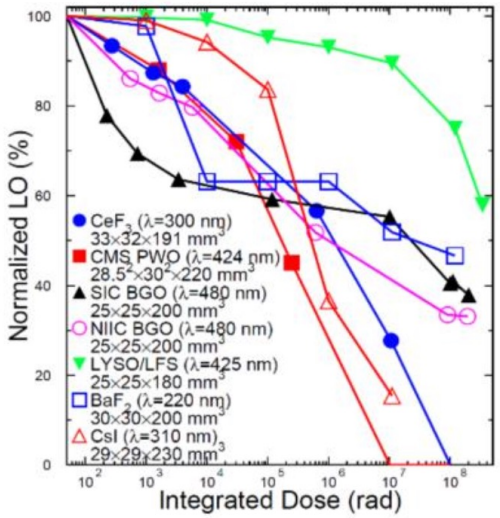


ECAL is divided in 88 laser monitoring regions, 2 in each EB SuperModule and 10 radial sectors in each Endcap

Two lasers (blue and green) **continuously sweep the 88 ECAL laser monitoring regions** and provide a measurement every ~40 minutes

The ratio between signals from crystals and from PNs (APD/PN) **is used to apply quasi-real-time corrections** to the data, taking into account the actual transparency

Plans



- Crucial and urgent task: estimates of beam backgrounds for the crystal calorimeter
  - High radiation and high pile-up can significantly impact energy resolution and particle flow algorithm reconstruction
  - Performance degrading of BGO crystals under irradiation, which would require a very precise calibration system
- Calo hardware taskforce will strengthen efforts of implementation calorimeters geometry in CEPCSW
  - Crystal calorimeter and scintillating glass HCAL
  - Further discussions on common parameters and settings in geometry construction, such as modeling of PCBs, SiPMs, etc.

Plans

- Electronics design
  - The primary task is to discuss and clarify the electronics requirements for each calorimeter. Wei has sent out a template, and each calorimeter option should fill out the template for discussion at the group meeting.
- Calorimeter TDR meeting plans to be shifted to 2:00 PM on Friday
  - No objections were raised during the last meeting, allowing for more discussion time
- To organize a mini-workshop and review of calorimeter options
  - Aim for the option down-select for the reference detector

Considerations on irradiation and calibration

- Radiation damages in endcap regions
  - Damages to both crystals and photo-sensors
    - Lower transparency (in crystals), lower PDE and higher noise level (in photo-sensor), higher power dissipation (impacting to cooling + power supply)
  - Short-term and long-term damages
    - Beam injection, beam collision; (long) shutdown
    - Requires frequent monitoring and calibration during collisions
  - Requires dedicated calibration schemes respectively
    - Crystal, photo-sensor, ASIC