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The Phase 2 Upgrade of the LHCb Calorimeter system

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The Phase 2 LHCb Upgrade, which is now being developed by the LHCb Collaboration,
is supposed to make LHCb able to work at high luminosity, up to 2*10^34 /cm^2/s.
The plan is to collect ~300 fb^{-1} of data in a few years.
The Phase 2 Upgrade will require a major revision of the LHCb Calorimeter system.

The increased instantaneous and integrated luminosity will result in
very high particle density and radiation doses in the areas close to the beam pipe. In these conditions, ECAL has to provide high quality energy and position measurements for electromagnetic showers, as well as separation of two closely lying showers. Another requirement for the LHCb Phase 2 Upgrade ECAL is the ability to measure the time of arrival of the photon or electron with an accuracy of few tens of picosecond. At high luminosity, such time measurement is a powerful tool helping to correctly assign electromagnetic showers to primary vertices.

The choice for the central part of ECAL can be a sampling calorimeter
with dense tungsten-based converter and radiation hard crystal scintillator.
Concerning the particular structure type, it was found that the Spaghetti Calorimeter (SPACAL) concept meets all the requirements, including limits on radiation degradation, if its active elements are made of GAGG:Ce or YAG:Ce scintillators. The peripheral areas with moderate radiation doses can be instrumented with calorimeter modules based on plastic scintillator.

An R&D campaign was started to optimize the Upgrade 2 ECAL structure. It includes:
- studies of scintillating materials, in particular irradiation measurements;
- beam test studies of the performance of various ECAL module prototypes, both for central (SPACAL) and peripheral areas;
- simulation studies to find the optimal detector layout, longitudinal segmentation and granularity.

In this talk we present the R&D results and the current status of the LHCb Calorimeter upgrade.

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