Towards chromatic calorimetry using nanocomposites

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The development of advanced detector technologies is key to the success of next-generation high-energy physics experiments, such as at the FCC-ee. In this context, quantum-engineered scintillating materials open new opportunities for innovative detector designs. One such concept is chromatic calorimetry, a novel approach to homogeneous electromagnetic calorimetry that reconciles detector homogeneity with longitudinal segmentation of particle showers.

In this seminar, I first present the experimental validation of a proof-of-concept chromatic calorimeter. The detector is based on standard scintillating materials emitting in distinct wavelength ranges, combined with a spectrally dependent readout system. Results on shower profile reconstruction and energy calibration are discussed, demonstrating the potential of this approach.

I then present prospects for implementing chromatic calorimetry using nanocomposite scintillators, consisting of quantum dots embedded in a polymer matrix. These materials are particularly promising due to their narrow, tunable emission spectra and their exceptionally fast timing capabilities. I review the current status of the production of nanocomposites based on cesium lead halide and discuss their scintillation properties in view of future applications in calorimetry.