Contribution ID: **32** Type: **talks**

Studying The Constant Terms Of The Energy Resolution Of The GRAiNITA Electromagnetic Calorimeter

Tuesday, January 21, 2025 3:10 PM (20 minutes)

The GRAiNITA is a novel type of electromagnetic calorimeter with a detection volume filled with high atomic number scintillator grains of about millimetre in size, interfiled with high-density liquid and wavelength shifting (WLS) optical fibres. The calorimeter is being developed to meet the requirements of future collider experiments.

The energy resolution (R = $\frac{E}{E}$) of the calorimeter can be represented by the following formula

$$R = \sqrt{\left(\frac{A}{\sqrt{E}}\right)^2 + B^2}$$

Where ** $\frac{A}{\sqrt{E}}$ ** is a stochastic term, it is due to fluctuation in shower development and statistics of scintillation photons. Previous studies indicate that the stochastic term of $\frac{1\%}{\sqrt{E\ [GeV]}}$ is at reach for the GRAiNITA calorimeter. **B** is the constant term, representing contributions that do not depend on the energy of the incoming particle. Previous analysis of constant terms based on the assumption of the scintillation light capturing efficiency indicates that its contribution to energy resolution of about 1 % can be expected for the detection of a shower caused by 25 GeV gamma quants. In this study, we used data on light-capturing efficiency obtained from muon beam test measurements with the GRAiNITA prototype alongside the Geant4 simulation to estimate constant terms.

The results of the study show that the energy resolution for 25 GeV gammas stays under 1 %. Also, the map of the detector sensitivity depending on the position of the hit was obtained and showed that its deviation from the mean value stays under 1 %.

Author: KLEKOTS, Denys (Taras Shevchenko National University of Kyiv)

Co-authors: BOYARINTSEV, A. (Institute for Scintillation Materials of the National Academy of Sciences of Ukraine); DUBOVIK, A. M. (Institute for Scintillation Materials of the National Academy of Sciences of Ukraine); BRETON, D. (Université Paris-Saclay, CNRS/IN2P3, IJCLab); PICARD, D. (Université Clermont Auvergne, CNRS/IN2P3, LPCA); HULL, G. (Université Paris-Saclay, CNRS/IN2P3, IJCLab); CHANAL, H. (Université Clermont Auvergne, CNRS/IN2P3, LPCA); BOYARINTSEVA, I. (Université Paris-Saclay, CNRS/IN2P3, IJCLab; Institute for Scintillation Materials of the National Academy of Sciences of Ukraine); TUPITSYNA, I. (Institute for Scintillation Materials of the National Academy of Sciences of Ukraine); LEFRANCOIS, J. (Université Paris-Saclay, CNRS/IN2P3, IJCLab); MAALMI, J. (Université Paris-Saclay, CNRS/IN2P3, IJCLab); GOLINKA-BEZSHYYKO, L. (Taras Shevchenko National University of Kyiv); MAGNE, M. (Université Clermont Auvergne, CNRS/IN2P3, LPCA); YERESKO, M. (Université Clermont Auvergne, CNRS/IN2P3, LPCA); SCHUNE, M.-H. (Université Paris-Saclay, CNRS/IN2P3, IJCLab); BEZSHYYKO, O. (Taras Shevchenko National University of Kyiv); BARSUK, S. (Université Paris-Saclay, CNRS/IN2P3, IJCLab); MONTEIL, S. (Université Clermont Auvergne, CNRS/IN2P3, LPCA); HOU, Y. (Université Clermont Auvergne, CNRS/IN2P3, LPCA)

Presenter: KLEKOTS, Denys (Taras Shevchenko National University of Kyiv)

Session Classification: Session INVITED TALKS. "Ukraine for ESPP Update-2025"