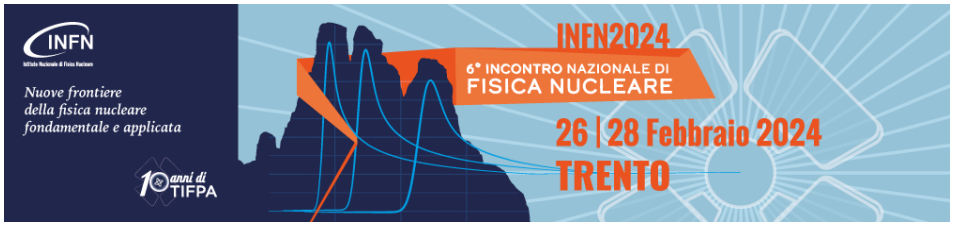

Contribution ID: **68** Type: **flash talk**

Measurements of the Birks-Onsager quenching parameters for the LYSO scintillator.

Monday, February 26, 2024 6:05 PM (5 minutes)

Lutetium-yttrium oxyorthosilicate (LYSO) is a high density, rugged/radiation tolerant, fast scintillator. For this reason LYSO crystal scintillators are used or planned in many High Energy Particle experiments (as e.g., KLOE-2, srEDM, COMET, CMS Barrel Timing Layer) in medical diagnostic devices (PET, TAC, CT) and in current and planned astroparticle physics space calorimeters (as e.g., HEPD-01, HEPD-02, NUSES, CrystalEye, HERD, ALADInO, AMS-100).
On the other hand, a relatively strong light quenching phenomena was observed in LYSO scintillators when irradiated with highly ionizing particles. The current uncertainties in the modeling and in the measurement of quenching parameters for LYSO could affect the capability of a precise determination of shower energy in LYSO-based hadronic calorimeters planned for future space experiments.
In this work, the scintillation response of a Ce-doped LYSO crystal is investigated with ion beams and with gamma radioactive sources in the INFN-TIFPA laboratory. A non-proportionality of the light yield for sub-MeV gamma rays is measured. The effect of the scintillation quenching of relatively slow electron recoils produced by low-energy gamma rays in the LYSO scintillator is evaluated with an high resolution GEANT4 simulation to describe the measured light yield non-proportionality.
In the framework of the Birks-Onsager model, the quenching parameters for low-energy electron recoils are inferred. The comparison with the measurements of LYSO quenching parameters, using nuclei at particle beam from proton to Argon, is a powerful test for the underlying quenching theory, that appears to be valid for different particles in a wide kinetic energy range from several GeV nuclei down to few keV electrons.

Primary author: LEGA, Alessandro (Istituto Nazionale di Fisica Nucleare)

Co-authors: RICCI, Ester (Istituto Nazionale di Fisica Nucleare); FOLLEGA, Francesco Maria (Università di Trento); NOZZOLI, Francesco (Istituto Nazionale di Fisica Nucleare); Mr ROSSI, Francesco (Istituto Nazionale di Fisica Nucleare); Dr ZUCCON, Paolo (TIFPA); NICOLAIDIS, Riccardo (Istituto Nazionale di Fisica Nucleare); IUPPA, Roberto (Istituto Nazionale di Fisica Nucleare)

Presenter: LEGA, Alessandro (Istituto Nazionale di Fisica Nucleare)

Session Classification: Applications of Nuclear Physics III