Contribution ID: **18** Type: **Talk**

Studies of radioactive background from environment for a potential LXe dark matter experiment at Boulby

Friday, 4 October 2024 15:50 (20 minutes)

Rare event searches, such as those targeting dark matter interactions and neutrinoless double beta decay ($0\nu\beta\beta$), face challenges from gamma-rays originating in rock, contributing to electron recoil background. This report presents a dual investigation: measurements of natural radioactivity in rock samples from Boulby Mine and a simulation assessing shielding thickness for a future detector. The measurements provide data for normalising conditions in prospective experiments at Boulby. The simulation studies the effectiveness of water shielding around a detector, focusing on the Weakly Interacting Massive Particle (WIMP) energy range (0 –20 keV) and the energy range near the $0\nu\beta\beta$ Q-value (2.458 MeV for Xe-136).

The study design features a simplified xenon-based detector with a 70-tonne active mass, encompassed by veto systems and water shielding. Our findings indicate that the gamma-ray background from rock is unlikely to persist through analysis cuts in the WIMP energy range with water/scintillator thickenss of > 3 m thanks to a powerful discrimination between potential WIMP signals and gamma-ray background. For $0\nu\beta\beta$ decay signal searches fiducial mass of the detector may need to be reduced to keep the background from rock below 1 event in 10 years of running.

Primary author: TRANTER, Jemima (University of Sheffield)

Co-authors: SCOVELL, Paul (Boulby Underground Laboratory, STFC); KUDRYAVTSEV, Vitaly (University of Sheffield)

Presenter: TRANTER, Jemima (University of Sheffield)

Session Classification: Experiments Background, Models & Simulations