Contribution ID: **37** Type: **Poster**

Muon Scattering Tomography using Drift Chamber Detectors

Muon scattering tomography (MST) allows the identification of shielded high atomic number, or Z materials by measuring the scattering angle of atmospheric cosmic ray muons passing through an inspection region. Materials of different densities can be differentiated using this technique as muons interacting with high-Z materials are scattered to a greater degree by multiple Coulomb scattering than low-Z materials. This scattering is determined experimentally by detecting the incoming and outgoing trajectory of the muon as it enters and exits the inspection volume. This technique is particularly useful for visualising volumes that are difficult to inspect visually. AWE is primarily interested in investigating the use of MST for scanning cargo containers, as it could be used for the detection the presence of radiological material without introducing an artificial radiation source.

AWE is currently testing and developing two MST experimental systems based on drift chamber technology. One of the experiments is constructed using six layers of three adjacent drift chambers positioned above and below an inspection volume. The second system is a similar configuration and is constructed of drift tubes. The technical challenges of producing the experimental system with a resolution capable of accurately determining the muon scattering angle within a few milliradians will be detailed and the experimental results obtained compared with Monte Carlo models.

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Track Classification: Sensors: 1c) Gaseous Detectors