Automated object detection for muon tomography data analysis

A.Sh. Georgadze
Institute for Nuclear Research of the National Academy of Sciences of Ukraine, Kyiv, Ukraine

Abstract.

In recent years, there have been continuous efforts to improve screening technologies in order to enhance security and prevent terrorist threats. The most widely used technology for scanning shipping containers is gamma-ray and X-ray radiography. New technologies are required for higher penetration to reduce insufficient penetration alarms, for improved image quality and material discrimination. Muon tomography screening systems is considered as a potential tool for enhancing border security and prevention of terrorist threats or smuggling, particularly in the context of shipping container inspections. Muon tomography is a technique that uses naturally occurring cosmic ray muons to create detailed images of the interior of objects, such as shipping containers, without the need for physical intrusion.

In this article, we describe the automatic detection in shipping containers of illegal dangerous objects hidden inside of legal cargo. We have used the Point of Closest Approach (PoCA) reconstruction algorithm to reconstruct the three-dimensional image of a shipping container and have applied k-nearest neighboring algorithm to separate and differentiate thread materials from the complex structure of surrounding common materials. Using these techniques, threats or contraband hidden within legal cargo can be detected within minutes' time scale.