

# Exploring the potential of muon radiography for blast furnace assessments: advancements in non-invasive imaging and structural analysis

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Muon radiography is a non-invasive imaging technique that utilizes natural cosmic muons to probe the internal structure of dense materials. This abstract explores the application of muon radiography in the context of blast furnace analysis. Blast furnaces are crucial components in the iron and steel industry, responsible for the transformation of raw materials into molten iron. Maintaining the structural integrity of blast furnaces and a precise characterisation of the internal density is of paramount importance for ensuring efficient and safe operations. Traditional inspection methods for blast furnaces often involve invasive techniques that can be time-consuming, expensive, and potentially hazardous.

The BLEMAB European project (BLast furnace stack density Estimation through online Muon ABSorption measurements), evolution of the previous Mu-Blast European project, is designed to investigate in detail the capability of muon radiography techniques applied to the imaging of the inner zone of a blast furnace. In particular, the goal of this collaboration is to characterize the internal region (so called cohesive zone) where the slowly downward-moving material begins to soften and melt and which plays such an important role in the performance of the blast furnace itself.

In this contribution, we describe the state-of-the-art of the muon tracking system which is currently developed and installed at a blast furnace on the ArcelorMittal site in Bremen (Germany). The different requirements and installation issues will be also presented.

The status of the project and preliminary results after the first acquisition period will be shown. Moreover, we will present the GEANT4 simulation framework devised for this application together with the simulation results. Finally, we will show in detail the contribution of multiple scattering effects to such peculiar applications.

**Keywords:** muon transmission radiography, muon tracking system and multiple scattering, .