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Rapid-time sequential muon radiography for repetitional phenomena

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The time resolution of dynamic muon radiography is defined by achieving the appropriate angular resolution, detection area, and cosmic ray muon flux (=70 muons/m2 sr sec). For example, at an angular resolution of 30 mrad, we need a detection area of 3.9 m2 to collect 100 muons in 8 hours for each bin. However, a space of this size in the correct position may be unavailable in an industrial plant system. In this work, we developed a new technique to dynamically image a high speed phenomenon using a more practically sized detector adapted to relieve some of these restraints on the present system . This technique can be applied to any repetitional phenomena by superimposing radiographs collected during different intervals of time. In the coarse of these experiments, we collected muon data every 10 minutes in order to analyze the internal density distribution of an electric furnace for different operating conditions. Here we report the results for different (a) electric load conditions, (b) electric resistance conditions, and (c) production efficiencies. We clearly distinguished the variation in the spatial distribution of the melt objects inside the furnace collected between the daytime and the nighttime.

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