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Development and evaluation of a time-dependent radiographic technology by using a muon read out module

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We will present a real-time monitoring system for cosmic-ray muon radiography as an application of a readout module developed by T. Uchida et al [1,2]. The readout module was developed originally for probing the internal structure of volcanoes in 2008 [3]. Its features are small in size, low power consumption, and the capability to access remotely via Ethernet. The current statistics data of cosmic-ray muons can be read from a PC placed far from the module at anytime. By using this feature, we constructed a real-time monitoring system. As a test experiment, we observed fluid movement in a cylinder with a diameter of 112 meters water equivalent.

In this work, we succeeded to resolve the fluid movement in the cylinder. We varied the fluid level inside the cylinder and measured the muon intensity. We found that the muon intensity correlates inversely with the fluid level: the muon intensity increases for the lower fluid level and decreases for the higher fluid level. Although the time resolution of muon radiography was sufficient to resolve changes in the fluid level, an adequate time window has to be chosen for different operating conditions. We anticipate that this system will be applicable to exploring high-speed phenomena in a gigantic object.

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