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## ***Interactive comment on “Experimental study of source of background noise in muon radiography using emulsion film detectors” by R. Nishiyama et al.***

### **Anonymous Referee #3**

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General comment: the article is well written and could be published provided some minor typo corrections are performed by the authors and the final discussion is further developed.

The article treats potential sources of background in the scope of muon tomography of geophysical targets such as volcanoes. The authors claim that low momentum particles are responsible for this background. These particles are not identified in this study but the authors mention potential candidates such as electromagnetic shower components or particles scattered in the volumes around the detector and crossing it

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randomly. This conclusion is drawn by the comparison of the response given by two different detectors with different rejection power. The first one, called "quartet" detector with only 4 detection planes and the second one, called "ECC" detector with 20 detection planes. The two detectors have very different particle momentum detection thresholds: 0.2 GeV/c and 2 GeV/c respectively. While the second detector gives an estimate of the rock density close to reality, the first one leads to a roughly 50% lower rock density, indicating a much higher detected particles flux than it should.

Although the methods is clearly detailed and explained throughout the paper, the conclusion should be further developed. Background sources are always difficult to identify and some complementary studies are mentioned in the paper. Nevertheless one could always suggest other sources of background. For instance there is no mention on the potential effect of ambient radioactivity which is affecting emulsions. There are other studies already published on the backward upward-going particle flux which could fake muons coming from the volcano in the absence of time-of-flight analysis (although it seems that there was a significant amount of rock behind the emulsions, please precise). Readers also would like to have an idea of the data taking conditions: environmental parameters effect, humidity/temperature controls in any, fog density in the emulsions etc. For instance the authors mention a measurement in underground conditions where soft particles barely penetrate and where the same low-value density was obtained with a "Quartet"-type detector. This looks rather suspicious that such low value may be caused by soft particles. More precisions could help clarifying and assessing the main conclusion of the paper which is otherwise of excellent quality. Question to the authors: is it foreseen to couple emulsion detectors with electronic detectors to check instrumental effects with different experimental techniques?

Corrections: - p 650: - l 17: of... of... (avoid too much repetitions) - l 22: equivalent -> equivalent - l 25: traverse -> cross - p 651: - l 14: constructed -> built - l 19: verify -> check - p 652: - l 15 and l 17: positions -> positrons - p 653: - l 21: emulsion -> emulsions - p 656: - l 5: please rewrite the first sentence which looks strange. - l 18:

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less independent: please precise - p 657: - paragraph 5.2.3: how if the "estimate" performed ? - p 660: - formula (10): missing x,y indexes on the solid angle interval - l 11: in -> is - p 661: please precise the entire paragraph as discussed in the general comments above - p 662 to 666: some references may be shortened (Author 1, et al) - p 671: - Fig. 4: please precise AMB and CMB signification (points A, B, C, D almost hidden in the left figure).

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Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 3, 649, 2013.

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