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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 #2

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"General Comments"

This paper deals with new results about background sources in muon radiography, which were obtained by using emulsion film detectors. Probably this is the first time for an ECC type detector to be used in muon radiography. It has been used in studies of cosmic ray physics and neutrino physics. Authors brought it into the muon radiography and demonstrated that it is useful also in the field of geoscience. This is clearly relevant within the scope of GI and it will make a substantial contribution to scientific progress in this field. The methods and assumptions seem valid. The conclusion is supported

by the comparison between real data and expected values. The authors compared their results with earlier studies in the discussion. Related works are properly cited. Discussion seems reasonable and future prospects are also given. So this work is surely worth publishing. However there are some flaws in the paper. Some descriptions are too concise to explain the contents sufficiently. They need clarification. The authors should consider comments stated below.

"Specific Comments"

Section 3.2: Multiple scattering is known to be well described by Gaussian for small deflection angles, but at larger angles it behaves like Rutherford scattering, having larger tails. The chi-square cut should eliminate tracks in tails. It would be better to mention it here, or at least to add the word “approximately”.

Section 4: The inclination angle theta should be related with theta_x and theta_y by tan(theta) = sqrt{(tan(theta_x))ˆ2 + (tan(theta_y))ˆ2}, not by theta = sqrt{(theta_x)ˆ2 + (theta_y)ˆ2} as given in the paper.

Readers look at Fig. 4 here. I would suggest adding a sentence like the following in the caption of Fig. 4: The squares (a), (b) and (c) indicate three angular domains for which the particle fluxes are estimated.

Section 5.2.1: In the development process, silver halide (AgBr) crystals are chemically reduced and silver grains are left along the charged particle trajectory. So the grain density should be number of silver grains per unit length along the track. For example, I would suggest replacing "an average grain density (number of AgBr grains on track) higher threshold. The grain density is" by “grain densities higher than a certain threshold. The grain density is number of silver grains per unit length along the track and is”.

Section 5.2.2: "An example of the resultant chi-square distribution is shown in Fig. 6." What is this example? Isn’t it data from this experiment? It would be better to specify

GID
3, C240–C242, 2014

what it is or to present the real data from this experiment.

Fig. 6: It seems that there are some extra tracks (more than 1 %) in the tail (greater than the upper bound). Are they so called non-signal tracks? It would be worth mentioning.

Fig. 7: How did the authors estimate the shaded histograms in Fig. 7? Why do the tracks recorded during transportation have lower numbers of hits? Were the detectors fabricated just before the installation? Better to clarify experimental conditions.

Section 5.3.1: Are there some tracks which stop inside the ECC detector? If so, don't they affect the fitting and consequently the efficiency values?

Page 658 Line 15: "the single plate efficiency" -> the single film efficiency

Fig. 8a and 8b: Indicate the left panel is Fig. 8a and the right one is Fig. 8b respectively, since they appear in the text. "one plate efficiency" -> one film efficiency

Section 5.3.2: Are "epsilon_mom(p)" and "s(p)" the same?

"Technical Corrections"

Page 651 Line 4: "they have to passed" -> they have to pass

Page 655 Line 21: "fllms" -> films

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