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Geoscientific Instrumentation Methods and Data Systems
Discussions

Interactive comment on "Air shower simulation for background estimation in muon tomography of volcanoes" *by* S. Béné

Anonymous Referee #2

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General comments ————————-

The paper "Air shower simulation for background estimation in muon tomography of volcanoes" addresses a Monte Carlo study to estimate the background in volcanoes tomography with cosmic muons. Fake tracks could in fact be reconstructed from wrong directions due to random coincidences of air shower particles hitting the detector. The paper in its present form reports a very preliminary stage of this work and cannot be considered mature for a publication. The benchmark of GEANT4 as an air shower simulation tool is performed in a rough way only for the muonic component. Moreover, the muon spectrum at sea level is one of the most well measured coscmic ray component. Why not to perform this benchmark also considering a comparison with real data?

Specific comments ————————

The author should first well define the problem, which is the energy range of interest for his study and which kind of background he is aiming to fight against. For instance, why so much attention is devoted to the muon energy loss in atmosphere? Are we interested at so low energies? But also solar modulation is important at these energy. But at the end the comparison is done removing the low energy region, cutting at 10 GeV.

What is completely not acceptable is the comparison of monochromatic proton showers of GEANT4 with another setup of CORSIKA. If the benchmark would have done with real data, the procedure could be accepted, but a Monte Carlo inter-comparison should be done exactly with the same setup, in order to disentangle any discrepancy from all other sources.

Could the author delve deeper into the gamma -> mu+ mu- process? Where these gammas come from? At which energies this channel starts to give an important contribution?

The comparison is done in terms of distribution of N/Ntot. Could the author exactly define what is reported on the vertical axes? Why not use a more familiare flux? (particles cm-2 s-1 sr-1 GeV-1) Please, also report in log(E) in the horizontal axis.

Fig. 4 of course hides a mistake in the analysis. GEANT4 and CORSIKA cannot produce a so big difference in a clear and simple variable as the time distribution of muons. This should be understood and corrected.

Technical corrections ————————

Pag. 564, line 17: "cannot easily account for it accurately enough" –> "are not accurate enough"

Pag. 564, line 23: remove "such"

Pag. 565, line 16: remove "come and"

Pag. 566, substitute commas with dots in the decay channel equations

Pag. 566, line 18: "being created: the muon high energy spectrum steepens" –> "and therefore to steep the spectrum."

Remove from pag. 566, line 27 up to pag. 567, line 5: Obvious statement, already said, not necessary here.

Pag. 567, line 14: "The setup of the simulation at present day" –> "The simulated geometry"

Pag. 658, line 3: "with expectations." Which expectations? Where are they shown in the figure?

Pag. 658, line 3: remove "At this point, and"

Pag. 658, line 9: "this field and which has been" –> "cosmic ray physics, mantained and"

Pag. 658, line 15-16: see comment in "general comments"

Pag. 658, line 22-23: "The muons at z =870m were characterised by three variables: their energy and their spatial and temporal distributions within the shower. The energy spectrum of the muons" –> "The muons at z =870m are characterised by their energy, their spatial and temporal distributions within the shower. The energy spectra of muons"

Pag. 569, line 20: "in agreement" –> "in coarse agreement" Pag. 569, line 21: "That point is to be investigated, but, nevertheless, GEANT4 seems well-suited for the simulation of the showers" –> Remove.

Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 2, 563, 2012.