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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

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Abstract: Line 1: with atmospheric –> using atmospheric Line 3: by the air showers. –> by charged particles belonging to the air shower generated by the primary cosmic ray. Line 3: this background–>this background effect

Introduction lines 13-18: The first two sentences are slightly convoluted. I suggest modifying for instance in the following way: "Two aspects of muon tomography of volcanoes make relevant, if not necessary, the use of Monte-Carlo simulations to accurately evaluate the attenuation of the flux of atmospheric muons crossing the volcano. The first aspect is related to the fact that the muon flux has to be described with sufficient precision and analytical approximations cannot easily be used, in particular at low muon

energies and for nearly horizontal muons."

Line 23: remove "such" Line 25: Question on "Various particles produced in air showers can hit the detector coherently". In the following of the paper, only muons are considered in the Monte-Carlo as "background" signal. However, those atmospheric muons are the "signal", whose enhancement/attenuation gives the muon tomography. I expected that the background can be due also by other charged particles in the air shower (namely, electrons and positrons) faking a muon signal. Do you plan to insert these in the MC code in the future? Could you comment?

Section 2 Line 17: "Doing so, the most energetic component of their flux initiates events called" –> High energy cosmic rays initiates Line 23: photons or leptons–>photons and leptons Line 10 (decay of mesons): write 2.6 , 1.2 and 5.1 instead of 2,6 1,2 and 5,1

Section 3 Line 11: Such a code –> The full program chain Line 14: The setup of the simulation at present day –> The present simulation setup Line 18: The physics list used –> The used interaction model

Question on Fig. 1. According to other simulations, the average number of secondary muons per shower is much higher. For instance, from Fig. 8.11 of the Stanev book (High energy cosmic rays), about 100 muons with 1 GeV threshold and 10 muons with 30 GeV threshold are expected from a 10 TeV primary proton at sea level. If I integrate the solid line of Fig. 1, about 1 muon is obtained. Do the lines correspond to the average number of muons PER mesons? I suppose that the difference of about 2 orders of magnitude is not due to the 870 m. level.

Line 4 of an inclusive cosmic ray flux –> of a cosmic ray flux which includes all the nuclear species

Section 4 line 15: "realistic"?? You mean with a power law with the correct spectral index? line 19: Question: why do not you restrict only to proton primary? This could have an effect on the discrepancies on time distributions? line 23: and temporal distributions –> and arrival time distribution line 5: towards wider high energy showers. –> towards wider showers at high energies.

Conclusions line 14: in GEANT4 –> in the framework of the GEANT4 simulation code line 17: that we obtained with vertical –> produced by vertical line 18: a well-tested air shower simulation software: CORSIKA –> the well-tested CORSIKA air shower simulation code. line 23: again "an inclusive", which is not clear. See above

Please also note the supplement to this comment:
http://www.geosci-instrum-method-data-syst-discuss.net/2/C98/2012/gid-2-C98-2012-supplement.pdf

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