

Extracting a semi-model independent composition from Xmax distributions

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The uncertainty when inferring the mass composition from Xmax distributions comes mainly from unknown uncertainties on $\langle X_{\max} \rangle$ predictions. Different hadronic models have different $\langle X_{\max} \rangle$ predictions for proton showers (the separation between proton and Iron $\langle X_{\max} \rangle$ is similar in all models). Therefore, the estimated mass composition has a strong dependence on the hadronic model used for interpreting Xmax distributions. In this work we will show that it is possible to fit at the same time for the cosmic ray composition and for the expected $\langle X_{\max} \rangle$ for protons (the $\langle X_{\max} \rangle$ for other elements is parametrized in terms of the proton one), reducing drastically the model dependence of the mass composition interpretation. This global fit is only possible if there is a rich enough mix of elements in the fitted cosmic ray composition. It will work even if we had a nearly pure composition within an energy range, as long as we have other elements in other energy ranges.

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