Contribution ID: **44** Type: **poster**

The composition of the primary particles at energies 3·1017 -3·1019 eV

Calculations of signals in surface and underground scintillation detectors of the Yakutsk array from particles of extensive air showers in terms of QGSJET-II and GEISHA 2002 models with the help of the CORSIKA 6.616 and GEANT4 codes with parameter ε=10-8 of the thinning procedures have been carried out to estimate muon fraction at 600 m from the shower axis at energies 3·1017 -3·1019 eV. Comparison of results of these calculations with the Yakutsk data shows rather heavy composition of the primary radiation in this energy region. But it was shown that calculations in terms of the QGSJET-II model at energies above 100 GeV underestimate the number of muons by a factor of ~1.5. Besides, it was also shown that calculations in terms of the of GEISHA 2002 model at energies below 100 GeV underestimate the number of muons by a factor of ~1.1 comparing with the FLUCA results. To interpret data one has also to take into account results observed at the Telescope array which show 1.27 difference in calculated in terms of models and observed with help of fluorescent light energy estimates of extensive air showers. Taken together all these corrections show the proton composition of the primary radiation in the energy region 1018 -3·1019 eV. At energies in the interval of 3·1017 - 1018 eV composition is probably heavier. It is not excluded that at energies above 3·1019 eV composition may be also more heavier as illustrated by the trend of data.

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