

## On the cosmic ray muon positive excess problem

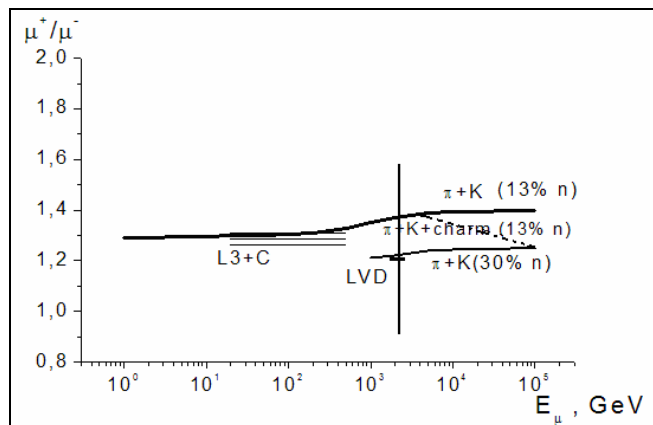
N Yu Agafonova, V V Boyarkin, E V Kaurova, A S Mal'gin, O G Ryazhskaya  
and L V Volkova<sup>1</sup> (for LVD collaboration)

Institute for Nuclear Research of RAS, 60th October pr. 7a, Moscow 117312, Russia

E-mail: volkova@inr.npd.ac.ru

**Abstract.** Predictions on the positive excess based on data from cosmic ray experiments, data from accelerators and on ideas in the frames of modern theoretical QCD models are given up to  $10^5$  GeV. An estimation of the accuracy of these calculations is better than 3% for a wide energy interval.

The calculated ratio of the number of positive muons to that of negative muons coming to the sea level in the vertical direction is given in the figure 1. The method of the calculation can be found in [1,2]:



**Figure 1.** Calculated  $\mu^+/\mu^-$  ratio coming to the sea level in the vertical direction.

the thick full curves are for muons from pion and kaon decays (neutrons are 13% and 30% of protons in primary nucleon radiation); dashed curve is for this ratio when charm is taken into account. We argue that a change of all the parameters used in the calculations in reasonable limits (index  $\gamma$  in the power law of primary nucleon spectrum, nuclear pion or kaon propagation lengths and so on) does not change the results given in the figure more than 3%. The data are [3,4].

### References

- [1] Volkova L V, Zatsepin G T and Kuz'michev L A 1979 *Yadernaya Fizika* **29** 1252-63
- [2] Volkova L V 2004 *Yadernaya Fizika* **67** 2083-6
- [3] The L3 Collaboration 2004 *Preprint* hep-ex/0408114 v1 23 Aug 2004
- [4] Aglietta M *et al* 1992 *Nuovo Cimento* **105A** 1793-804

<sup>1</sup> To whom any correspondence should be addressed