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# Are scalar mesons visible in B+- –> pi+ pi- pi+- decays?

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The two-pion effective mass and helicity angle distributions in the charged B-meson decays into three charged pions are studied. The weak decay amplitudes are calculated in the QCD factorization framework. The final state interactions between the produced pairs of pions are described using strong pion-pion scalar and vector form factors. The scalar form factors are constrained by pion-pion, kaon-antikaon and four pion production data incorporated into a multichannel model of the corresponding coupled amplitudes. The pion-pion vector form factor is parametrized as in the Belle Collaboration analysis of their high statistics data on $\tau \to \pi^- \pi^0 \nu_\tau$ decays [Phys. Rev. D78 (2008) 072006].

The theoretical distributions of the dipion effective masses are compared with the corresponding results of the recent Dalitz plot analysis of $B^\pm \to \pi^+ \pi^- \pi^\pm$ decays done by the BaBar Collaboration [Phys. Rev. D79 (2009) 072006].

We show that the S-wave dipion amplitude, although much smaller than the P-wave amplitude corresponding to the $\rho(770)$ resonance, plays, nevertheless, an important role in the $\rho(770)$ mass range. As a matter of fact, the interference term between the S and P dipion amplitudes can reach a value as high as 30% of the dominating $\rho(770)$ contribution. This effect can be attributed to the broad $f_0(600)$ ($\sigma$) meson. The S-wave is also sizeable above 1 GeV where higher scalar resonances exist.

The signal of the $B^\pm \to f_0(980) \pi^\pm$ decay has not been seen in the experimental analysis, but this can be easily explained in the present model since the relevant B decay amplitude is proportional to the scalar form factor which has a characteristic dip at the $f_0(980)$ mass. We show that the helicity angle (theta) distribution is strongly asymmetric in the $\rho(770)$ meson range. This effect is confirmed by the comparison of our results with the BaBar data integrated over $\cos(\theta)>0$ or over $\cos(\theta)<0$.

It would be quite interesting to compare our model with the high statistics data already obtained by the Belle Collaboration and with future data from super B-factories.

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