Implication of the soft pion theorem at high energy to the light sea quarks in the nucleon

The soft pion theorem at high energy can have a physical effect under a suitable condition. We define the smoothness assumption in the sigle soft pion observed inclusive reaction as follows. In the center of the mass system, the differential cross section divided by the total cross section for the directly produced pion with the low transverse momentum behaves smoothly near $x_F = 0$ for each energy. An important point is that a theoretical ambiguous part in the infra-red behavior in the hadronic reaction originating from the soft pion has been replaced by the experimental value through this assumption, and that its applicability is extended to the high energy region. It should be noted that the soft pion can not be identified as all pions in the central region with the low transverse momentum. This is because the pion in this region is dominated by the ones from the decay of the resonance. The directly produced means that we exclude these pions from the resonance decay.

Now, through the analysis in the works(S.Koretune, Prog. Theor. Phys. **103**(2000) 127. S.Koretune, hep-ph/0004149.), the soft pion at high energy has been found to give an important contribution to the sea quark distributions. It can account for a part of the Gottfried defect and explains why the strange sea quark is suppressed in the medium and large x region compared with the up and the down sea quarks. Thus the soft pion can explain a part of the flavor asymmetry of the sea quarks. Further, it predicts that the strange sea quark begins to become large below $x \sim 0.01$. The main reason is the fact that the pole term which comes from the pion emission from the final nucleon(anti-nucleon) becomes very large at high energy in accord with the increase of the nucleon multiplicity. By explicitly deriving the up, down, and strange sea quarks and using the sum rule constraint(S.Koretune, Prog. Theor. Phys. **98**(1997) 749.), we discuss how the soft pion contribution enters to the sea quarks in the small x region which can be accesible in the experiment.