Do fragmentation functions in factorization theorems correctly treat non-perturbative effects?

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Current all-orders proofs of factorization of hard processes are made by extracting the leading power behavior of Feynman graphs, i.e., by working strictly order-by-order in perturbation theory. The resulting parton densities and fragmentation functions include non-perturbative effects. I discuss how there could be loopholes in the proof such that other non-perturbative and semi-perturbative effects could be important. My discussion is motivated by string and cluster models of hadronization.

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