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Heavy Flavor Azimuthal Correlations in Cold Nuclear Matter

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It has been proposed that the azimuthal distributions of heavy quark-antiquark pairs may be modified in the medium of a heavy-ion collision. This assumption is tested through next-to-leading order (NLO) calculations of the azimuthal distribution, $d\sigma/d\phi$, including transverse momentum broadening, employing $\langle k_T^2 \rangle$ and fragmentation in exclusive $Q\overline{Q}$ pair production [1]. The differences between NLO calculations and heavy $Q\overline{Q}$ pair production in event generators are also discusssed.

First, single inclusive p_T distributions calculated with the exclusive HVQMNR code are compared to those calculated in the fixed-order next-to-leading logarithm approach. Next the azimuthal distributions are calculated and sensitivities to $\langle k_T^2 \rangle$, p_T cut, and rapidity are studied at $\sqrt{s} = 7$ TeV. Finally, calculations are compared to $Q\overline{Q}$ data in elementary $p + p$ and $p + \overline{p}$ collisions at $\sqrt{s} = 7$ TeV and 1.96 TeV as well as to the nuclear modification factor $R_{p\mathrm{Pb}}(p_T)$ in p+Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV measured by ALICE. While these studies were done for $p + p$, $p + \overline{p}$ and p+Pb collisions, understanding azimuthal angle correlations between heavy quarks in these smaller, colder systems is important for their interpretation in heavy-ion collisions.

The low p_T ($p_T < 10$ GeV) azimuthal distributions are very sensitive to the k_T broadening and rather insensitive to the fragmentation function. The NLO contributions can result in an enhancement at $\phi \sim 0$ absent any other effects. Agreement with the data was found to be good.

The NLO calculations, assuming collinear factorization and introducing k_T broadening, result in significant modifications of the azimuthal distribution at low p_T which must be taken into account in calculations of these distributions in heavy-ion collisions.

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Summary

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