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Baryons and Evidence for Direct Hadron Production in Heavy Ion Collisions

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Baryon and anti-baryon production in heavy ion collisions is enhanced compared to pion production for transverse momentum greater than 2GeV/c. Conventionally, hadron production at these momenta is thought to be dominated by fragmentation of partons from 2→2 scattering into final state hadrons. The particle composition in heavy ion collisions should then be similar to p+p collisions, in contrast to the observed increased fraction of baryons in heavy ion collisions. However, there is evidence that an alternate method of hadron production, from color transparent higher-twist QCD processes where the final state hadron is produced directly in the hard subprocess, is important over a wide momentum range. The color transparent hadrons traverse the hot nuclear matter without interacting with it, in contrast to colored partons. Pions, which are abundantly produced in fragmentation, are observed to be suppressed in heavy ion collisions because the parent partons interact with the matter and lose some of their energy. Thus, the matter produced in heavy ion collisions could act as a filter, enhancing the fraction of observed hadrons which were produced in higher-twist subprocesses. Baryon and anti-baryon production, heavily suppressed in fragmentation, is naturally enhanced by this mechanism. We discuss the evidence for this from RHIC data including x_T scaling of particle yields and correlations, and discuss how measurements in the near future can help understand the role of higher-twist effects in heavy ion collisions and also provide insight into hadron production in p+p collisions.