

## JLab Experiments E12-09-017`

### Transverse Momentum Dependence of Semi-Inclusive Pion and Kaon Production

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The 21st century holds great promise for reaching a new era for unlocking the mysteries of the structure of the atomic nucleus and the nucleons inside it governed by the theory of strong interactions (QCD). The experimental program at the upgraded 12 GeV Jefferson Laboratory plays an important role in this quest exploring the dynamical basis of the structure of hadrons and nuclei in terms of the fundamental quarks and gluons. This experiment is aimed to confirm the potential for studies of the 3D structure of the proton, in terms of momentum imaging (tomography). **E12-09-017** will provide precise measurements of the probabilities to produce charged pions and kaons following electron-quark scattering, and compare this with our theoretical understanding of this process - this will be critical in validating the entire 12-GeV science program of 3D momentum tomography.

The **E12-09-017** experiment plans to make precise measurements of the semi-inclusive DIS (SIDIS) cross sections for  $\pi^+$  and  $\pi^-$  at low transverse momentum  $\mathbf{p}_T$  from hydrogen and deuterium targets. The cross section measurements will provide a strong test of the theoretical understanding of SIDIS in terms of parton distributions convoluted with fragmentation functions. This will play a critical role in establishing the entire SIDIS program at a 12-GeV JLab of studying the partonic structure of the nucleon. The data will further be analyzed in order to extract measures of the mean transverse momentum of up and down quarks in the nucleon. Charged-kaon data will be simultaneously collected that provide insight into the same issues of factorization as planned for pions. The use of longitudinally polarized beam will simultaneously allow measurements of the azimuthal single beam spin asymmetries at low  $\mathbf{p}_T$ .