

# G10 CAA: Extraction of $\phi$ -N total cross section from $\phi$ photoproduction on deuteron

Multi-gluon exchange between hadrons, known as Pomeron exchange, is a fundamental process and plays an important role in high-energy interactions. At lower energies, this exchange manifests itself in a QCD van der Waals interaction. Studying multi-gluon exchange at lower energies is challenging because at low energies hadron-hadron interactions are dominated by quark exchange. However, multi-gluon exchange is expected to be dominant in the interaction between two hadrons when they have no common quarks. The  $\phi$  meson is unique in that it is nearly a  $|s\bar{s}\rangle$  state and hence gluon exchange is expected to dominate the  $\phi$ -N scattering process. However, direct measurement of the  $\phi$ -N cross section is not possible due to lack of  $\phi$ -meson beams. Previous data show that the extracted  $\phi$ -N cross section through final state interaction in heavy nuclei is larger than that obtained from phi meson photoproduction from nucleon based on Vector Meson Dominance (VMD). Using phi meson photoproduction from a deuteron target, we extracted a value of  $\phi$ -N total cross section that is also larger than that from VMD. This result has been published in a letter in Physics Letters B (X. Qian *et al.* PLB 680 417, 2009) recently. Some of the results are shown in Fig. 2.

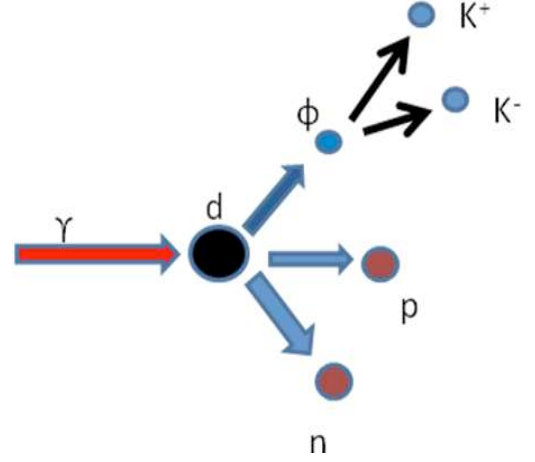


Figure 1: The  $\phi$ -meson photoproduction from deuteron:  $d(\gamma, pK^+K^-)n$  channel.

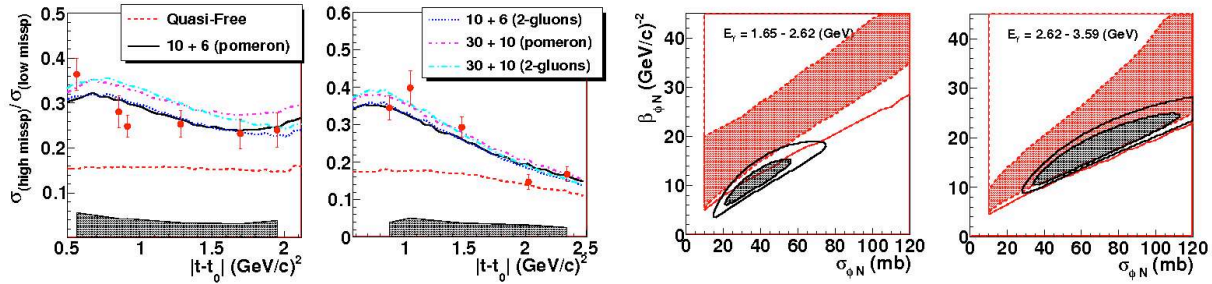


Figure 2: Cross section ratio between the high and the low missing momentum regions for photon energies of 1.65-2.62 GeV (left most) and 2.62-3.59 GeV (second to the left). The results of this work are shown in red solid circles. The black bands represent the systematic uncertainties. The label “30 + 10” indicates the calculation from Laget with  $\sigma_{tot}^{\phi N} = 30$  mb and  $\beta_{\phi N} = 10$  (GeV/c) $^{-2}$ . The 70% (shaded area) and the 95% (open area) confidence level plots are shown for the  $\gamma + d \rightarrow \phi + p + n$  channel (red), the  $\gamma + d \rightarrow \phi + d$  coherent channel (black) for photon energies of 1.65-2.62 GeV (second to the right) and 2.62-3.59 GeV (right most).