Measurements of Diffractive Vector-Meson Photoproduction at High Momentum Transfer from the ZEUS Experiment HERA

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We present measurements of the diffractive photoproduction of ρ^0, ϕ and J/ψ mesons at high momentum transfer using the ZEUS detector at HERA. A special-purpose tungsten/scintillator calorimeter served to tag the quasi-real photons ($Q^2 < 0.01$ GeV^2) in the process $\gamma + p \rightarrow \mathrm{VM} + N$, resulting in a selected kinematic region of $80 < W < 120$ GeV, $-11 < t < -1.5$ GeV^2, where W is the photon-proton center-of-mass energy and t is the squared momentum transfer to the dissociated proton system N. Offline event selection criteria included the reconstruction of exactly two tracks from the interaction vertex and rejected events with calorimetric energy deposits in the rear and barrel sections of the calorimeter which were not associated with the extrapolation of either track. The selected events exhibit a rapidity gap between the dissociated nucleonic system and the two tracks of at least two units. The differential cross sections $\mathrm{d}\sigma/\mathrm{d}t$ obtained for ρ^0, ϕ and J/ψ mesons show a power-law dependence $\mathrm{d}\sigma/\mathrm{d}t \propto t^n$, where $n \simeq -3$. Information on the polarization of the ρ^0 mesons has been obtained from the decay-pion angular distributions and is discussed in the context of earlier measurements at lower energy and lower momentum transfer.