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# Studying time-like electromagnetic baryonic transitions with HADES in pion induced reactions

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A dedicated programme to study electromagnetic baryonic transitions in the time-like region has started using the pion beam and the HADES (High Acceptance Di-Electron Spectrometer) set-up at GSI [1].
First measurements have been performed in the second resonance region, at a center-of-mass energy of 1.49 GeV, using carbon and polyethylene targets, allowing for an analysis of the inclusive $e^+e^-$ production and of the exclusive quasi-free $\pi^- p \to n e^+ e^-$ reaction. The $e^+e^-$ yield at invariant masses larger than 300 MeV/c$^2$ strongly exceeds expectations based on real photon couplings, signaling the effect of baryon transition form factors of the Vector Dominance type. A quantitative description of the observed $e^+e^-$ yield is achieved by estimating the contribution from off-shell $\rho$s deduced from a Partial Wave Analysis [2] of the two-pion production channels, which were measured simultaneously in our experiment. The angular distributions for the $e^+e^-$ production contain additional selective information on the electromagnetic structure of the different transitions. An analysis based on the spin density matrix formalism, providing in particular quantitative information on the contribution of longitudinal virtual photons will be presented. The predictions of several models for the $\pi^- p \to n e^+ e^-$ reaction [3, 4, 5, 6, 7] will also be discussed.
Finally, the prospects for future experiments focusing on the third resonance region or on hyperon Dalitz decays will also be shortly presented.
References
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