

Measurements of the Form Factor in $V\rho\gamma$ transitions and study of the $\eta \rightarrow \pi^+\pi^-\pi^0$ Dalitz plot at KLOE

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The KLOE experiment has collected 2.5 fb^{-1} at the peak of the ϕ resonance at the e^+e^- collider DAPHNE in Frascati. A new beam crossing scheme, allowing for a reduced beam size and increased luminosity, is operating at DAPHNE. The upgraded KLOE-2 detector is successfully rolled in inside this new interaction region and is ready to acquire collision data.

The $V \rightarrow \rho\gamma$ Dalitz decays, associated to internal conversion of the photon into a lepton pair, are not well described by the Vector Meson Dominance (VMD) models, as in the case of the process $\omega \rightarrow \pi^0 \mu^+ \mu^-$, measured by the NA60 collaboration. The only existing data on $\phi \rightarrow \eta e^+ e^-$ come from the SND experiment, which has measured the Mee invariant mass distribution on the basis of 213 events. At KLOE, a detailed study of this decay has been performed using both $\eta \rightarrow \pi^+\pi^-\pi^0$ final states. Simple analysis cuts provide clean signal events, with a residual background contamination of 2-3%. With the fully neutral η decay channel, we obtain the measurement of the branching fraction for the process $\phi \rightarrow \eta e^+ e^-$, with an accuracy improved by a factor of five with respect to the previous most precise measurement, and of the slope of the transition form factor, which is in agreement with VMD expectations.

We have also studied the decay $\phi \rightarrow \pi^0 e^+ e^-$, where no data are available on transition form factor. Dedicated analysis cuts strongly reduce the main background component of Bhabha events to ~20%, leading to ~4000 signal events in the whole KLOE data set.

We have also obtained a new, precise results on the isospin-violating decay $\eta \rightarrow \pi^+\pi^-\pi^0$, sensitive to the light-quark mass ratio. The first study, overcoming in precision previous results published in year 2008-2010, was suggested by the theoretical work: Leutwyler, Mod.Phys.Lett. A28 (2013) 1360014, aiming to a better determination of the light-quark mass ratio through the dispersive analysis of the $\eta \rightarrow 3 \pi$ decay.

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