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Dalitz plot analysis for $\eta \to \pi^+\pi^-\pi^0$ at KLOE

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The isospin-violating process $\eta \to \pi^+\pi^-\pi^0$ is sensitive to the light quark mass ratio:

$$Q^2 = \frac{m_s^2 - \hat{m}^2}{m_d^2 - m_u^2}, \text{ where} \quad \hat{m} = \frac{1}{2}(m_d + m_u) \tag{1}$$

in that the decay rate is proportional to Q^{-4}. The values for this decay rate, calculated at leading order ($\Gamma_{LO} \sim 70$ eV) and next-to-leading order ($\Gamma_{NLO} = 160 \pm 50$ eV) in χPT are significantly lower than the experimental value $\Gamma_{exp} = 296 \pm 16$ eV , obtained from a fit to all the available data[1]. This points to a slow convergence of the χPT series, due to strong pion rescattering effects in the final state, wich can be treated by means of dispersion relations[2].

In 2008, the KLOE collaboration published the Dalitz plot analysis of the $\eta \to \pi^+\pi^-\pi^0$ with the most statistics to date[3]. The results have been used to fix the parameters of the dispersion relations[4] and in analytic dispersive analysis[5]. More data on $\eta \to \pi^+\pi^-\pi^0$ Dalitz plot are needed to understand the origin of the residual tension between data and theoretical calculations.

A new analysis by KLOE is in progress to improve on the statistical sample and to overcome some limitations of the previous analysis. For this, a new selection scheme is used. The selection efficiency is planned to be measured directly from minimum bias events, to reduce systematic errors. The analysis is performed on an independent, larger data sample. The status of this analysis will be presented.

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[2] G. Colangelo, S. Lanz and E. Passemar *Proceedings of Science*, arXiv:0910.0765 (2009).
[3] Ambrosino *et al.* (The KLOE collaboration), *JHEP*, **Vol 5**, page 006, arXiv:1102.4999 (2008);
[4] S. Lanz, "Berne-Lund-Valencia Dispersive Treatment of $\eta \to 3\pi$", talk at International PrimeNet Workshop, Jülich, September 26-28 2011, and contribution to these Proceedings;
[5] M. Zdrahal, "Prague-Lund-Marseille Dispersive Treatment of $\eta \to 3\pi$", talk at International PrimeNet Workshop, Jülich, September 26-28 2011, and contribution to these Proceedings.