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Measurement of the branching ratio of a rare decay $\eta \rightarrow \pi^0 \gamma \gamma$ with WASA-at-COSY

Content :

The branching ratio of a rare decay $\eta \rightarrow \pi^0 \gamma \gamma$ has fundamental implications for intermediate energy physics, where perturbative QCD breaks down. Here effective field theory are used to describe and reproduce experimental observables. The interest in this decay stems from the fact that it tests Chiral Perturbation Theory (χ PTh) to order $O(p^6)$. Calculations of the decay width using various theoretical models yield widely differing results. Similarly experimental results, by different collaborations, on the branching ratio of this channel also do not agree with each other. This is primarily, because of significant background coming from other decay channels. The tenuous agreement between theory and existing measurements motivated the measurement of BR ($\eta \rightarrow \pi^0 \gamma \gamma$) with the Wide Angle Shower Apparatus (WASA) at COSY.

The WASA detector facility is an internal experiment at the COoler SYNchrotron COSY in Juelich, Germany [1]. WASA is a 4π multi detector system with capability of detecting both neutral as well as charged particles. It consists of a forward part for measurement of scattered particles and a central part to measure the decay products of the mesons. COSY delivers phase space cooled protons and deuterons in the momentum range between 0.3 GeV/c to 3.7 GeV/c. η mesons were produced in the reaction $pd \rightarrow 3He \eta$ obtained by tagging $3He$ in the Forward Detector, resulting in approximately 10^7 η 's during the four week production run taken in September-November 2008. Analysis of the data, to extract the branching ratio has been done. In this presentation, we would like to show a promising preliminary result on the measurement of branching ratio of this rare decay $\eta \rightarrow \pi^0 \gamma \gamma$ with WASA-at-COSY.

References: [1] www.fz-juelich.de/ikp/wasa and nucl-ex/0411038

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