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Dark Photon Sensitivity Study in an η Factory Experiment at HIAF

\documentclass{article}
\usepackage{amsmath}

\begin{document}

\title{Dark Photon Sensitivity Study in an η Factory Experiment at HIAF}
\date{}
\maketitle

A simulation study has been conducted on dark photon sensitivity for a proposed η factory experiment at Huizhou using the HIAF proton beam. The experiment, with a beam kinetic energy of 1.8 GeV, is expected to produce approximately 3.11×10^{11} η mesons in a one-month run, enabling a robust statistical analysis. A compact spectrometer, designed with a full silicon-pixel tracker, will detect final-state particles. Background estimation without the dark photon signal is performed using the GiBUU event generator, while a custom spectrometer simulation package, ChnsRoot, evaluates the spectrometer's performance. The study provides detailed analysis of the efficiency and resolution of the targeted η decay channel, along with the derived upper limit on the dark photon branching ratio and sensitivity to model parameters.

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