

# Rare $\eta$ Decay Signal and Background Generation for JEF

*Sunday, 16 February 2025 11:00 (15 minutes)*

The Jefferson Lab  $\eta$  Factory (JEF) will start acquiring data in early 2025. The experiment aims to give insight into the connection between Dark Matter physics models and the Standard Model by investigating rare decay processes of  $\eta$  and  $\eta'$  mesons. Several other physics motivations are also a key factor of the experiment, such as probing  $C$  and/or  $P$  violation and aspects of chiral perturbation theory. For that purpose, the forward calorimeter (FCAL) of the GlueX experiment in Jefferson Lab (Virginia) was upgraded so that it provides greater positional and energy resolution. Understanding physics-motivated cuts and background removal methods is of great importance to achieving JEF goals. Several methods have been implemented to obtain invariant mass plots for the “golden” channel of interest  $\pi^0\gamma\gamma$ , while channels such as  $\pi^+\pi^-e^+e^-$  open a promising window into CP-violating physics. This effort promises significant background reduction and signal isolation for key rare decay channels. Compiling all of the obtained results gives a fair assessment on what analysis methods to prepare before data taking and the likeliness of probing specific BSM physics decays.

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