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Early QCD Analyses with Photons at CMS

The measurement of inclusive photon production is a crucial step for the understanding of Standard Model Physics at the Large Hadron Collider (LHC) and an important prerequisite for many new physics searches. The identification of photons' experimental signatures and their discrimination against instrumental background is a challenging task in the severe LHC environment. We present a technique to extract the content of true isolated photons in an inclusive sample based on the study of electromagnetic shower deposits. The technique is applied to proton-proton collision events at $\sqrt{s} = 7\text{TeV}$ recorded by the Compact Muon Solenoid (CMS) detector and the isolated photon spectrum is extracted. Various sources of systematic uncertainties are studied in detail.

Determination of the cross section of photon+jet and diphoton production are important tests of standard model physics. In addition, they are significant backgrounds to Higgs di-photon searches. We demonstrate the use of a linear fisher discriminant to determine the purity of photons in $pp \rightarrow \text{photon} + \text{jet}$ events with CMS at $\sqrt{s} = 7\text{TeV}$. It is based on a minimal number of isolation and cluster shape variables to reduce uncertainty in this small, early dataset. Finally, readiness for the diphoton cross section measurement is shown by the comparison, for key kinematical distributions, of proton-proton collisions events at $\sqrt{s} = 7\text{TeV}$ with Monte Carlo simulations.

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