A measurement of the cross section for the production of isolated prompt photons in pp collisions at a center-of-mass energy of \( \sqrt{s} = 7 \) TeV is presented. The results are based on an integrated luminosity of 4.7 fb\(^{-1}\) collected with the ATLAS detector at the LHC. The cross section is measured as a function of photon transverse energy \( E_{\gamma} \) in the kinematic range of 100 \( \leq E_{\gamma} < 1000 \) GeV and in the pseudorapidity regions of \( |\eta| < 1.37 \) and 1.52 \( \leq |\eta| < 2.37 \). The results are compared to leading-order parton-shower Monte Carlo models and next-to-leading order perturbative QCD calculations.

Why are photons important?
They provide a colorless probe of the hard scattering process. The measurement is sensitive to the gluon content of the proton through the \( gg \rightarrow q\bar{q} \) process, which dominates the prompt photon production cross section at the LHC, and could thus be used to constrain parton density functions (PDFs).

Cross Section Definition

**Kinematic region:** 100 GeV \( \leq E_{\gamma} < 1000 \) GeV  
- \( |\eta| < 1.37 \) and 1.52 \( \leq |\eta| < 2.37 \)  
- \( E_{T} > 7 \) GeV

**Luminosity:** 4.71 \( \pm \) 0.09 fb\(^{-1}\)

All photons produced in pp collisions and not coming from hadron decays are considered as “prompt”. They include both “direct” photons, which originate from all the hard subprocesses calculated at fixed-order perturbation theory, and “fragmentation” photons, which are the result of the soft fragmentation of a colored high p\(_T\) parton.

Given these assumptions the eq. is:

\[
N_{\gamma}^{A} = N^{A} - N_{SBG}^{A} \\
N_{\gamma}^{B} = N^{A} - N_{SBG}^{A} \\
R = N_{\gamma}^{A} - R_{SBG}^{A} \\
N_{\gamma}^{A} = N^{A} - R_{SBG}^{A} (N_{C}^{A} - N_{SBG}^{A}) \\
N_{\gamma}^{B} = N^{B} - R_{SBG}^{B} (N_{C}^{B} - N_{SBG}^{B}) \\
\]

For this measurement R=1.

Photon Identification

**Tight**  
- Narrow energy in the first layer  
- One single maxima in the first layer

**Non-Tight**  
- Larger energy deposited in the first layer  
- Two separate maxima in that layer

Cone Isolation:
- Require that \( < 7 \) GeV be inside the cone radius after excluding the photon and contributions from underlying events and pileup

Cross Section Results

- **This cross section measurement extends the previous analysis from 400 GeV to 1 TeV**

<table>
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