Luminosity monitoring in pp collisions using $Z \to \ell\ell$ events at $\sqrt{s} = 13$ TeV with the ATLAS detector

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on behalf of the ATLAS Collaboration

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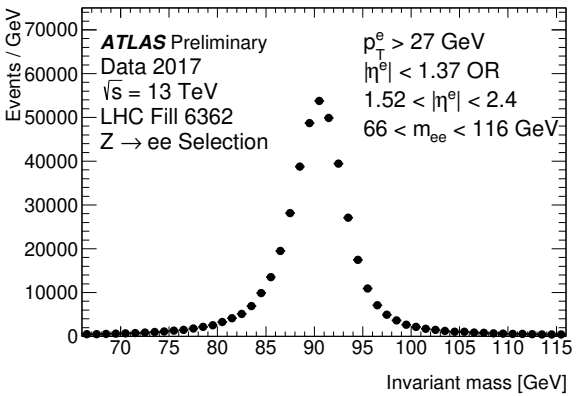
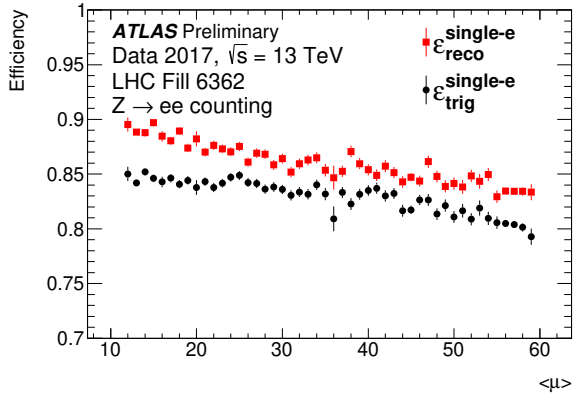
Z-counting can be used to monitor the stability of the ATLAS-preferred luminosity measurement

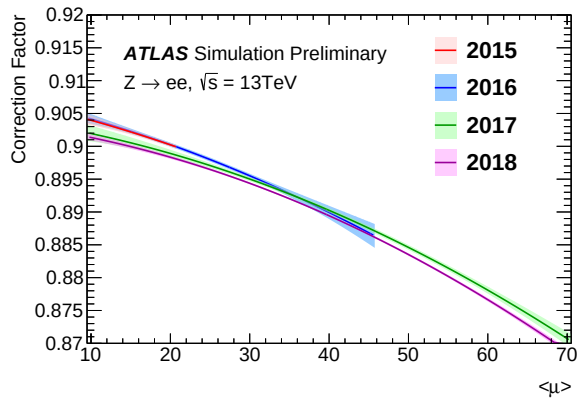
$$\mathcal{L}_{Z\to\ell^+\ell^-} = \frac{\overbrace{N_{Z\to\ell^+\ell^-}(t)}^{\text{(1) Z production rate}} \cdot \overbrace{(1-0.005)}^{\text{background correction}}}{\underbrace{\varepsilon^{\mathrm{T\&P}}_{Z\to\ell^+\ell^-}}_{\text{(2) data-driven efficiency}} \cdot \underbrace{F^{\mathrm{MC}}(\langle\mu\rangle)}_{\text{(3) MC correction}} \times \underbrace{A^{MC}}_{\text{acceptance}} \cdot \underbrace{\sigma_{\mathrm{theory}}}_{\text{theory cross section}}}$$



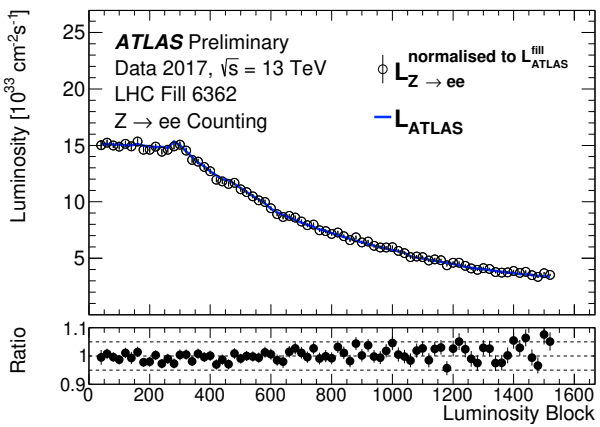
(1) Measure Z production rate in electron and muon channels



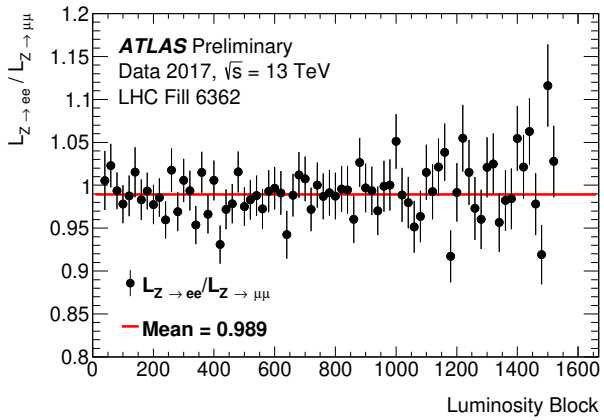
(2) Data-driven correction for detector inefficiencies



(3) Monte Carlo correction for residual detector effects



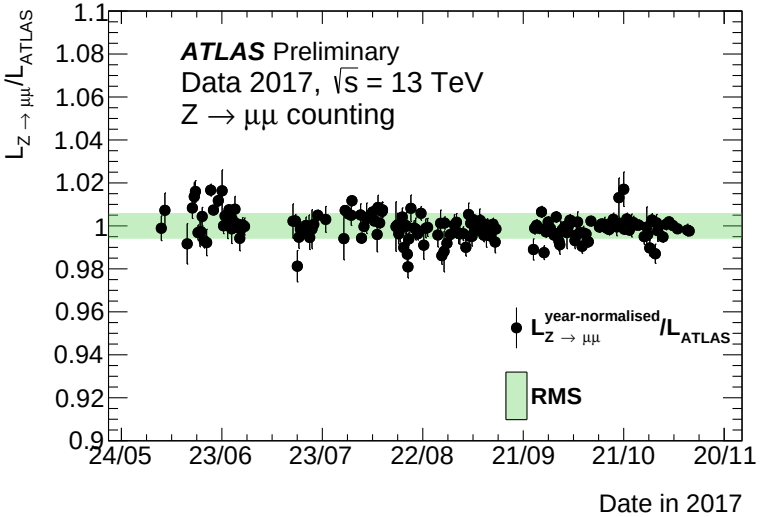
Compare Z-counting to ATLAS-preferred luminosity

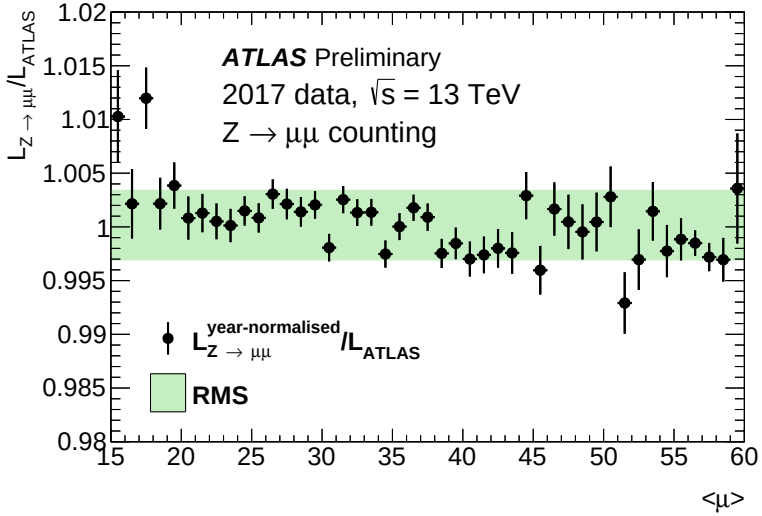


Compare $Z \to ee$ and $Z \to \mu\mu$ channels

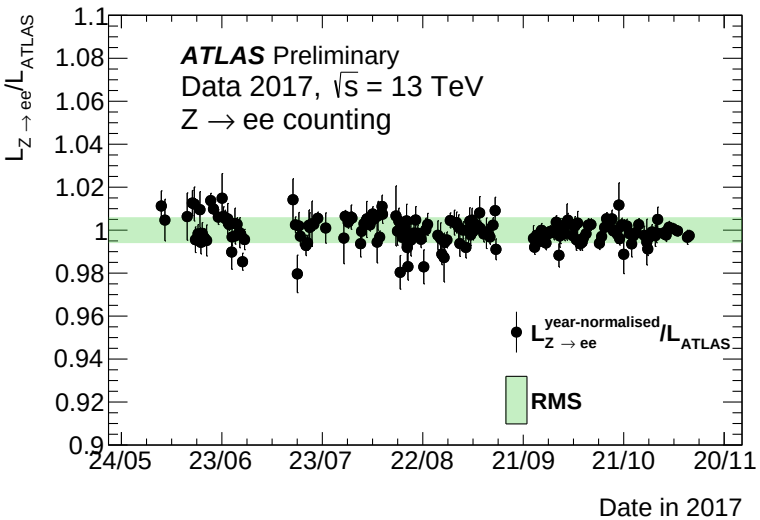
The analysis is done for the entire Run-2 dataset, which consists of 139 fb^{-1} of $\sqrt{s} = 13$ TeV pp data
The ATLAS-preferred luminosity comes primarily from LUCID, with corrections from other luminosity algorithms
Presented is the normalised Z-counting to ATLAS-preferred comparison for the 2017 data-taking period as a function of time (left) and pileup (right)

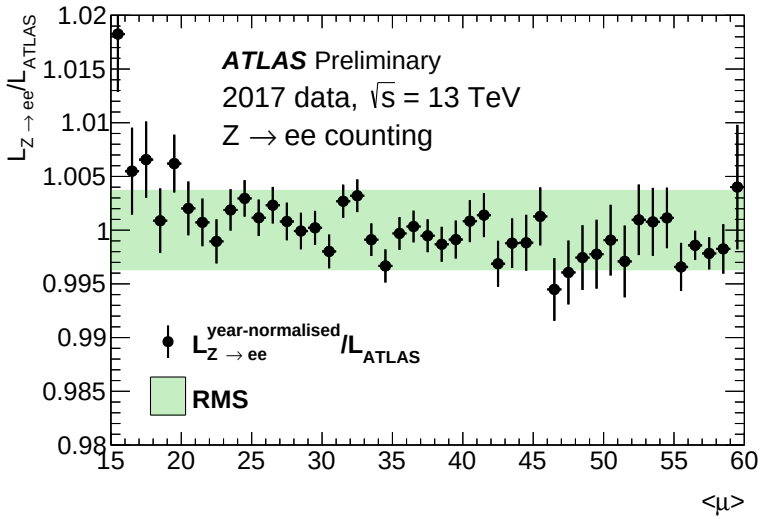
Muon channel





Electron channel





As we perform the measurement in both the electron and muon channels, we are able to cross-check the results internally, where we see agreement at the 1% level