

# Precision luminosity measurement in proton-proton collisions with the CMS detector

## Content

The measurement of the integrated luminosity recorded by the CMS detector at the LHC in proton-proton collisions during Run 2 and Run 3 is reported. The absolute luminosity calibration is obtained with the van der Meer (vdM) method through beam separation scans that were performed in special accelerator conditions. Multiple independently-calibrated luminosity detectors (luminometers) are employed to derive the final integrated luminosity. In Run 2, a relative precision of 0.82 and 0.84% is achieved for the 2017 and 2018 data sets, respectively. When combined with the 2015–2016 data sets at the same center-of-mass energy, the relative precision of the total integrated luminosity is 0.73%, representing the most precise luminosity measurement ever achieved at bunched-beam hadron colliders. The dominant uncertainties are the luminometer nonlinearity and the assumption of transverse factorizability in the vdM method. For Run 3, the luminosity detectors have been upgraded. Preliminary results have been obtained for the integrated luminosity in the 2022-2024 data-taking periods with a precision ranging between 1.3% and 1.6%.

## Summary

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