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Evolution of special LHC optics configurations: Run 3 update

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The Large Hadron Collider (LHC) employs special optics and configurations, alongside low-beta collision optics, to address specific experimental requirements. These include calibrating luminosity monitors (vdM) and facilitating forward physics measurements in TOTEM and ALFA experiments (high-beta). The special optics have been in use since Run 1, and for Run 3, they have been updated for compatibility with standard low-beta collision optics to ensure streamlined commissioning and reduced setup time. For vdM optics in Run 3, beam de-squeezing yields beta values of 19 to 24 m, while in the high-beta optics, beams are de-squeezed to round beams with beta of 120 m, followed by a second step to asymmetric optics with beta of 3 km and 6 km in the horizontal and vertical planes. The 2023 high-beta optics run with the km beta* optics, incorporates tight collimation settings and the use of crystals at top energy for the first time, aiming to substantially reduce backgrounds in the experiments. This publication introduces and discusses the updated optics for Run 3, covering their validation, optics measurement results, and operational insights.

Footnotes

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