Cross sections and forward multiplicities measurements with TOTEM

The TOTEM experiment at the LHC has performed the first luminosity-independent measurements of the total proton-proton cross-section at $\sqrt{s} = 7$ TeV and 8 TeV. These measurements are based on the optical theorem and require simultaneous measurements of the elastic rate by measuring the outgoing protons with Roman Pots and of the inelastic rate, accomplished with the forward charged-particle telescopes T1 and T2 in the range $3.1 < |\eta| < 6.5$.

TOTEM has also determined the total pp cross-section using the CMS luminosity measurement in various ways and the results were found in excellent agreement with the luminosity-independent measurement, despite having very different systematic dependencies. Moreover, since TOTEM is capable to detect inelastic events with diffractive masses down to 3.4 GeV, a limit on the cross section for low mass diffraction was set from the difference between the overall inelastic cross section (measured only using elastic scattering) and visible inelastic cross section (measured using T1 and T2).

The differential elastic cross section has been measured in the range $5 \times 10^{-3} < |t| < 2.5$ GeV$^2$ for pp collisions at the center of mass energy of 7 TeV and down to $|t|=0.01$ GeV$^2$ for collisions at 8 TeV. The measurement of the forward charged particle eta-density has been performed at 7 TeV in the range $5.3 < |\eta| < 6.4$. This measurement constitutes the most forward pseudorapidity density measurement ever obtained at LHC. This analysis is also repeated at 8 TeV by using a dedicated run taken with a common CMS/TOTEM trigger.

A summary of these measurements is here reported, as well as the preliminary results on single and double diffractive cross section.

Summary

Primary author: BERRETTI, Mirko (Sezione di Pisa (IT))

Presenter: BERRETTI, Mirko (Sezione di Pisa (IT))

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