



Contribution ID: 869

Type: Experimental poster

Determination of the strong-coupling constant from the Z-boson transverse-momentum distribution

Tuesday, May 17, 2022 7:00 PM (1 hour)

The strong force is the least known fundamental force of nature, and the effort of precisely measuring its coupling constant has a long history of at least 30 years. This contribution presents a new experimental method for determining the strong-coupling constant from the Sudakov region of the transverse-momentum distribution of Z bosons produced in hadron collisions through the Drell-Yan process. The analysis is based on predictions at third order in perturbative QCD, and employs a measurement performed in proton-proton collisions with the CDF experiment. The determined value of the strong coupling at the reference scale corresponding to the Z-boson mass is $\alpha_S(m_Z) = 0.1185^{+0.0014}_{-0.0015}$. This is the most precise determination achieved so far at a hadron collider. The application of this methodology at the LHC has the potential to reach sub-percent precision.

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Session Classification: Poster Session I

Track Classification: QCD Physics