Contribution ID: **467** Type: **Parallel**

Radiative corrections to $e^+e^- \to \pi^+\pi^-$ charge asymmetry

The $e^+e^- \to \pi^+\pi^-$ process at flavour factories plays a crucial role in the data-driven determination of the hadronic contribution to the muon $g-2$. The recent CMD-3 measurement of the pion form factor via energy scan displays a significant discrepancy with the previous experimental determinations. In this contribution, a new fully differential calculation of the $e^+e^- \to \pi^+\pi^-$ scattering, including next-to-leading order corrections matched to a fully exclusive parton shower, is presented. The calculation is implemented in an updated version of the BabaYaga@NLO event generator. To achieve a correct combination between perturbative QED corrections and non-perturbative QCD contributions, particular attention is paid in the treatment of the pion form factor in the computation of loop amplitudes, going beyond the commonly used factorised sQED approach. This is obtained by employing two alternative approaches, one based on the generalised vector meson dominance model, the other on the dispersion relation. In particular, both methods lead to a consistent theoretical description of the forward-backward (or charge) asymmetry, which perfectly agrees with the CMD-3 data, unlike the prediction obtained through the traditional factorised sQED method. This is a crucial step forward in understanding the discrepancy between the data-driven determinations of the muon $g-2$ and the lattice predictions.

References:
[1] E. Budassi et al., Pion pair production in e^+e^- annihilation at next-to-leading order matched to Parton Shower [2409.03469].
[2] R. Aliberti et al., Radiative corrections and Monte Carlo tools for low-energy hadronic cross sections in e^+e^- collisions [2410.22882].

Secondary track

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Session Classification: T05

Track Classification: T05 - QCD and Hadronic Physics