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Topological separation of dielectron signals using machine learning in Pb–Pb collisions with ALICE

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Dielectrons are an exceptional tool to study the evolution of the medium created in heavy-ion collisions. In central collisions, the energy densities are sufficient to create a quark-gluon plasma (QGP). At LHC energies, the dominant background process for the measurements of thermal e^+e^- pairs originating from the QGP are correlated HF hadron decays which dominate the dielectron yield for invariant masses above 1.1 GeV/c^2. Their contribution is modified in the medium compared to elementary collisions to an unknown extent, leading to large uncertainties in the subtraction of known hadronic sources.

Alternatively, a topological separation can be utilised to disentangle them from the contribution of thermal dielectrons originating from the primary vertex.
As machine learning (ML) algorithms have achieved state-of-the-art performance in a variety of high-energy physics analyses, deep neural networks (DNNs) can be applied to capture the complex multidimensional correlations in the tracking parameters to identify these pairs.

In this poster, a DNN to classify dielectron sources based on their decay topology with the ALICE detector will be presented for simulated Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV. Their performance will be compared to the established analysis on the distance-of-closes approach (DCA) to the primary vertex.
Finally, the way these ML techniques could be incorporated in future dielectron analysis will be discussed.

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