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Zero-bias new particle searches in UPCs

Ultra-peripheral collisions (UPC) are events characterised by large impact parameters between the two projectiles, larger than the sum of their radii. In UPCs, the protons and ions accelerated by the collider do not interact via the strong interaction and can be regarded as sources of quasireal photons, with minimal contamination from hadronic interactions.

In this talk, we present novel applications of machine learning techniques to enhance the identification of the low-multiplicity events which are characteristics of UPCs. Leveraging models for early event classification in continuous readout systems, we demonstrate the ability to significantly reduce data storage requirements while optimizing real-time event selection. We also explore the use of unsupervised learning, particularly autoencoder neural networks, to identify rare particle decays and exotic hadrons in UPCs and diffractive events. These techniques allow for the detection of anomalies in decay kinematics, potentially uncovering new exotic states and processes beyond the Standard Model.

Our approach offers a scalable solution for high-luminosity experiments like ALICE and ePIC, where managing the sheer volume of data is critical. By combining early event classification and anomaly detection, machine learning holds the promise of transforming data acquisition and analysis in the next generation of particle physics experiments.\\

Secondary track

T16 - AI for HEP (special topic 2025)

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