Contribution ID: **11** Type: **Poster**

Particle identification with Machine Learning for ALICE ITS2

Wednesday 31 January 2024 16:15 (5 minutes)

Particle identification (PID) plays a pivotal role in numerous measurements performed by the ALICE Collaboration. Various ALICE detectors offer PID information through complementary experimental techniques. The former ALICE Inner Tracking System 1 (ITS1) provided PID information by measuring the specific energy loss of low-momentum charged particles during LHC Run 1 and Run 2. The upgraded ITS (ITS2) has higher granularity and lower material budget, resulting in a significant improvement of the spatial resolution. To cope with the high interaction rates of the LHC Run 3 (500 kHz and 50 kHz for pp and Pb-Pb collisions respectively), the ITS2 features a digital readout and therefore it lacks the capability to measure directly the energy loss. However, the cluster topology of the signal left by a charged particle traversing the layers of the ITS2
can be interpreted as a proxy of the particle energy loss.

In this contribution, a novel approach to perform particle identification with the ALICE ITS2 is presented. A Boosted Decision Tree (BDT) algorithm is employed to exploit the combination of cluster topology and the particle momentum to infer the particle species. Monte Carlo simulations are used to validate this technique which has been tested on the data samples collected at the beginning of the LHC Run 3. The internal parameters of the BDTs are optimised to enhance the separation between the different particle species by employing the Optuna package. In this way, a remarkable separation among different particle species at low momentum is achieved.

Finally, Machine Learning (ML) offers a viable avenue for PID determination between the Z = 1 and Z = 2 particles, independently on their momentum.
A study on the PID capabilities of the Muon Forward Tracker (MFT), a detector that shares the same technology as the ITS2, was performed. Using a ML-based method, it could be possible to distinguish Z > 1 (anti-)nuclei from Minimum Ionizing Particles by adopting unsupervised learning algorithms.

Author: LUCIA, Giorgio Alberto (Universita e INFN Torino (IT))

Presenter: LUCIA, Giorgio Alberto (Universita e INFN Torino (IT))

Session Classification: Poster Session

Track Classification: 1 ML for object identification and reconstruction