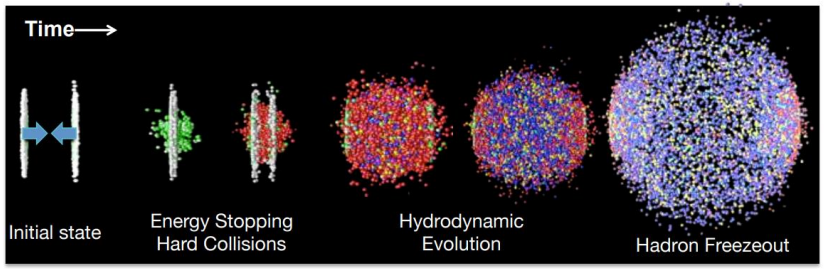
Measurement of the J/Ψ production in dense and hot nuclear medium at ultra-relativistic energies with ALICE

Jacek Biernat

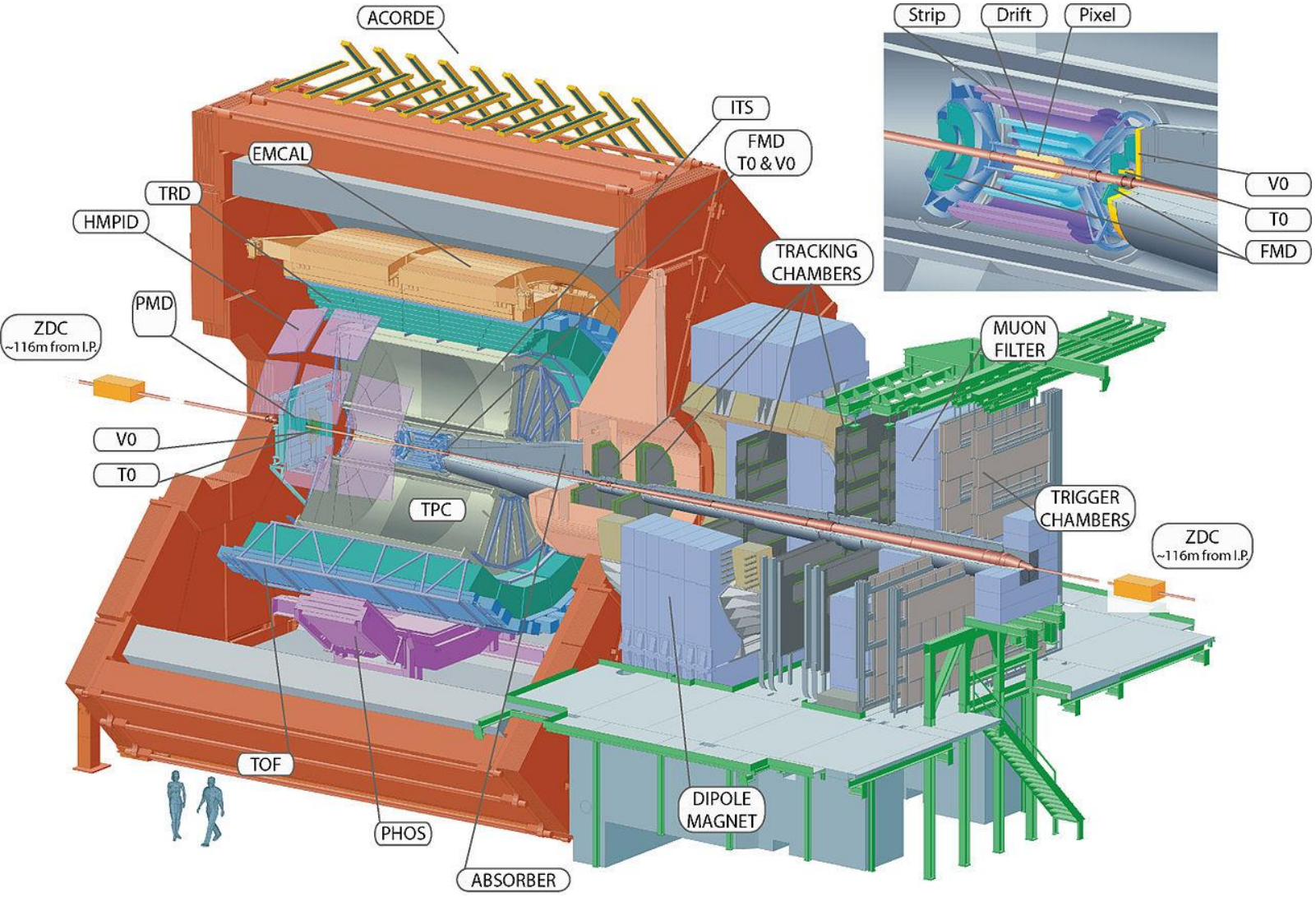
THE HENRYK NIEWODNICZAŃSKI
INSTITUTE OF NUCLEAR PHYSICS
POLISH ACADEMY OF SCIENCES

ALICE experiment at CERN

- ALICE (A Large Ion Collider Experiment) is a heavy-ion detector on the Large Hadron Collider (LHC) ring.
- It is designed to study the physics of strongly interacting matter at extreme energy densities, where a phase of matter called quark-gluon plasma forms.

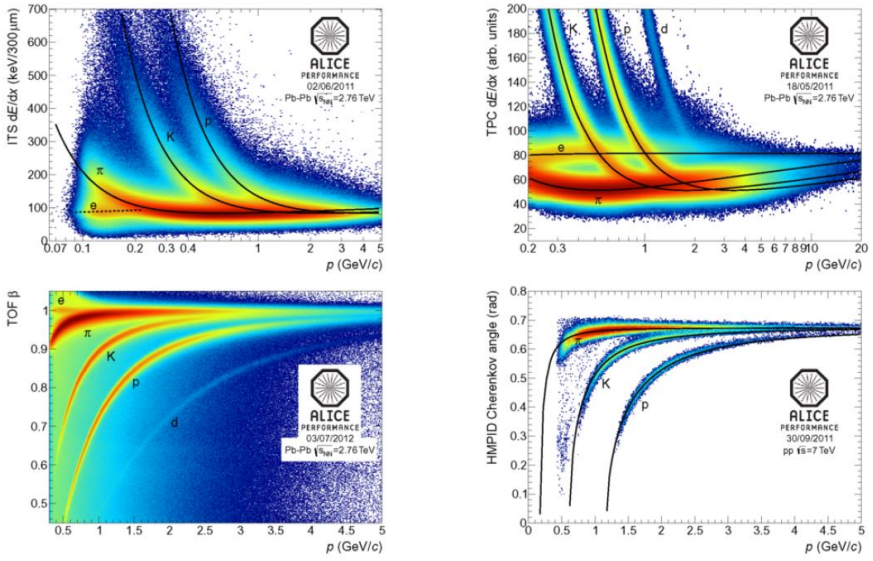


The ALICE experiment

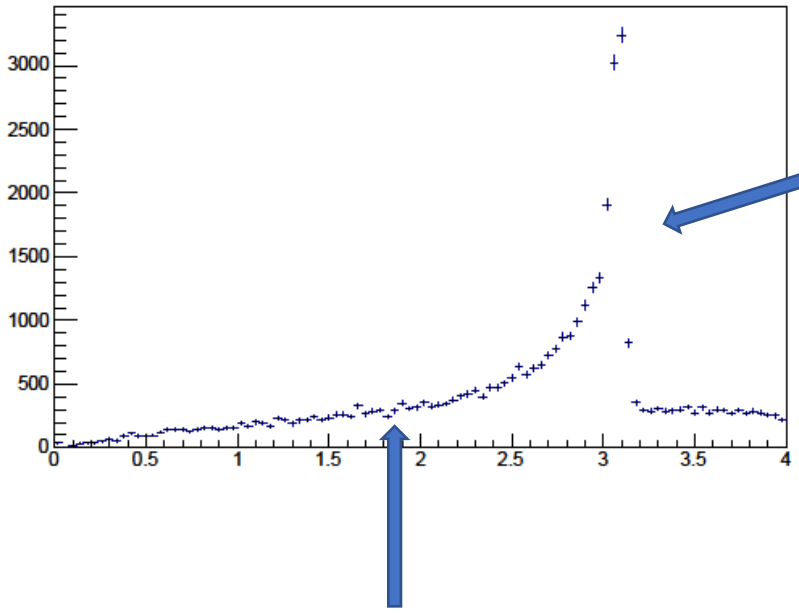


Key features:

- Excellent PID capabilities*
- High resolution tracking for low p_t tracks
- Low magnetic field (only 0.5 T)



Background subtraction/suppression



Signal

Background

Tensorflow and Keras

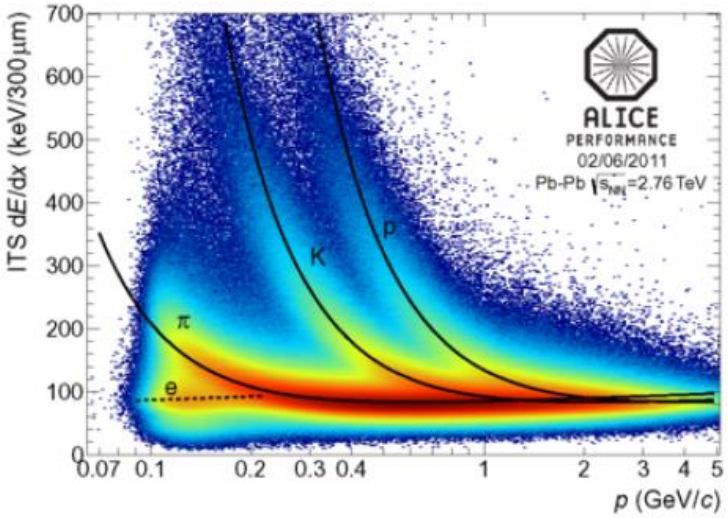
- Keras simplifies construction of NN-models
- in combination with Python: Quick way to test your model
- Additional Tensorflow Libraries for Bayesian Approach

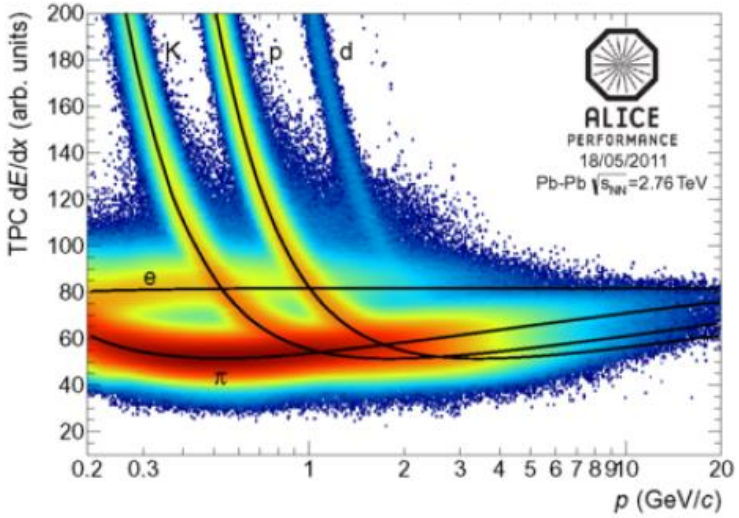
TensorFlow

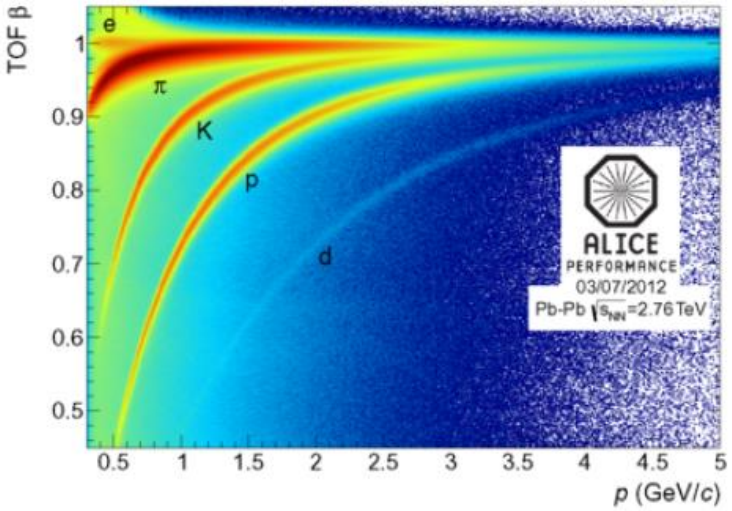
Keras

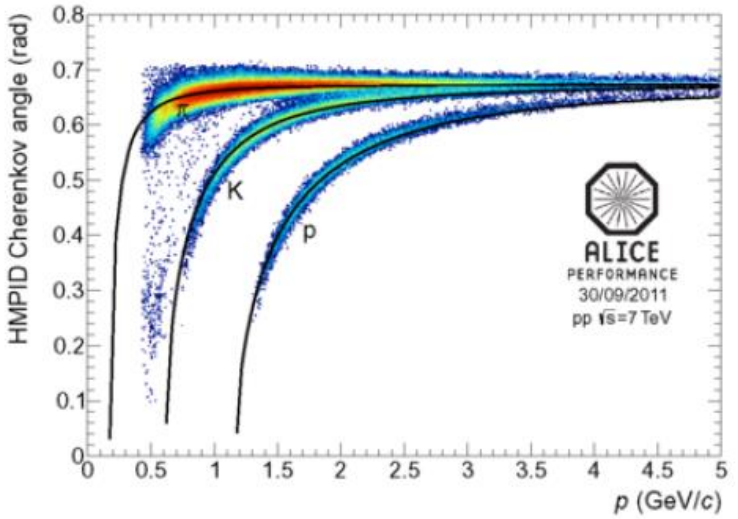
http://www.it.uu.se/edu/course/homepage/projektTDB/ht18/project09/Project09_report.pdf

Particle identification at ALICE









$J/\Psi \rightarrow e^+e^-$

- Particle identification (PID) in ALICE consists of many systems, based on energy loss, time of flight (TOF) and Cherenkov radiation
- At higher momenta (1 GeV/c and above) one can see an “overlap” of characteristic curves coming form different particle species ☹
- Can this be improved with ML ?

Summary (Goal of the project)

- Can ALICE particle identification system be improved, can we achieve higher efficiency thanks to ML in comparison to conventional “cut based” methods ?
- Can we suppress the detector background and combinatorial background ?
- Examples of ML algorithms (BDT and/or MLP) and Monte Carlo simulations will be provided