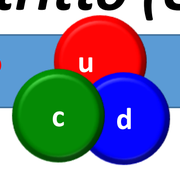
Λ_c production in pp collisions at $\sqrt{s} = 13$ TeV with ALICE at the LHC

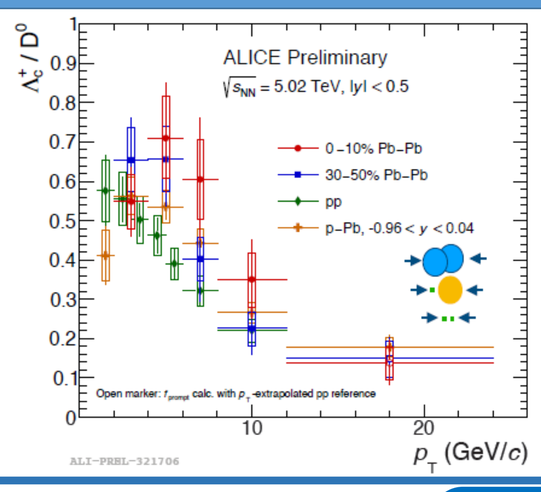
L. Dello Stritto (University of Salerno and INFN) on behalf of ALICE collaboration

Why Λ_c measurement?



- Charmed hadron ratio is an excellent tool to investigate hadronization mechanism (vacuum fragmentation, recombination with thermal partons).
- Baryon over meson ratio enhancement is expected if recombination has a dominant influence.

Λ_c/D^0 **enhancement in A–A w.r.t. pp collisions.**



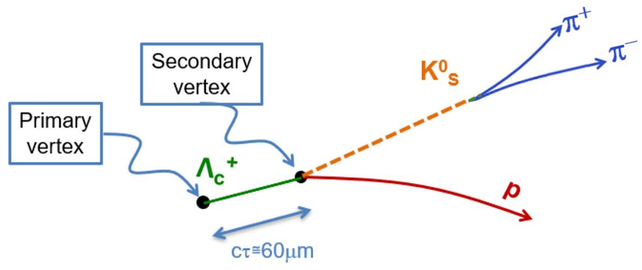
- Λ_c/D^0 ratio in pp collisions higher than results in e^+e^- and ep collisions.
- Similar Λ_c/D^0 ratio in pp and p–Pb collisions. Hint of larger baryon-over-meson ratio in Pb–Pb collisions.

Formation of a hot deconfined medium also in small systems?

Reconstruction of Λ_c candidates in the decay channel $\Lambda_c \rightarrow pK^0_s$

Building Λ_c candidates from p-K^0_s pairs:

- **K^0_s candidates** selected from pairs of opposite charge tracks forming a vertex displaced from the interaction vertex.
- **Proton candidates** selected according to track quality selection.
- **K^0_s** and **proton** candidates are combined to build a Λ_c candidates .

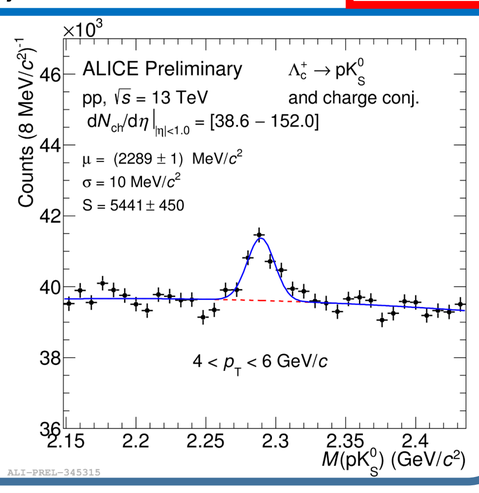


ML (Machine Learning) probability cut application to reject the combinatorial background and invariant mass plot extraction.

Data Sample: ***MB=Minimum Bias, HM=High Multiplicity***

- **MB pp collision at $\sqrt{s} = 13$ TeV , 1.6 x 10^9 events**
- **HM pp collision at $\sqrt{s} = 13$ TeV , 1.15 x 10^6 events** NEW

- **Λ_c is reconstructed in a wide momentum range in 1-24 GeV/*c* in 4 different multiplicity bins.**



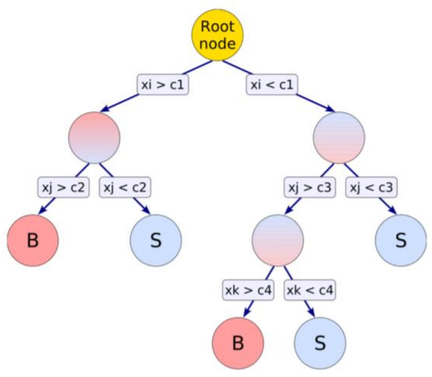
Machine Learning: Boosted Decision Tree

N-dimensional input dataframe with **signal** and **background** distribution of the **training variables**:

- *N*σ TOF
- *N*σ TPC
- *c*τ K^0_s
- Decay length K^0_s
- Proton imp. par.
- K^0_s Inv. Mass
- K^0_s pointing angle

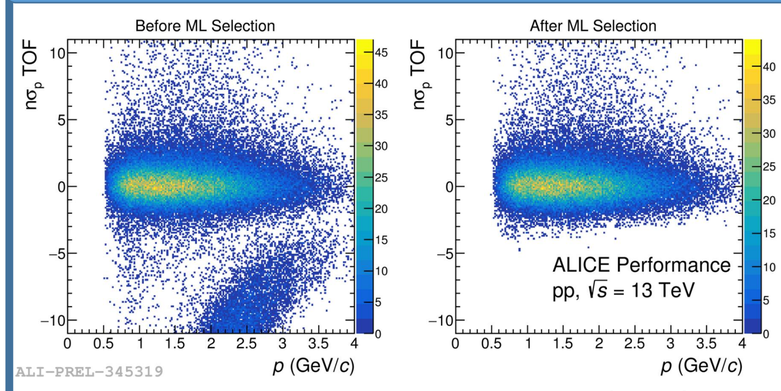
Decision Tree building

At each node the variable and its value that maximize the separation between signal and background is selected.



A probability to be signal is associated to each Λ_c candidate.

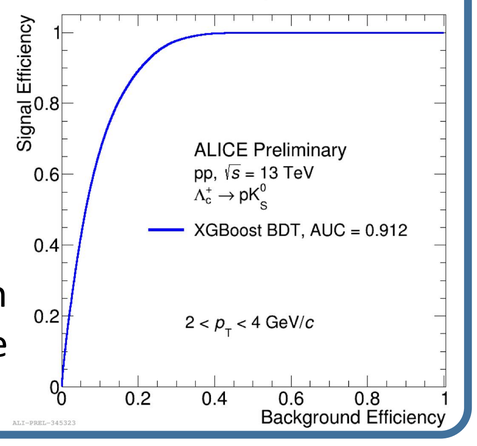
Machine Learning: Performance Plots



*N*σ TOF distribution before the Machine Learning selection.

*N*σ TOF distribution after the Machine Learning selection.

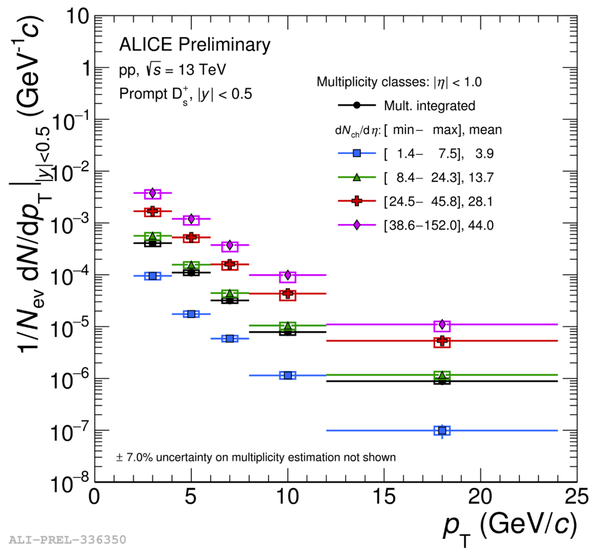
ROC (Receiver Operating Characteristic) Curve.



Λ_c corrected yield and Λ_c/D_0 ratio as function of multiplicity

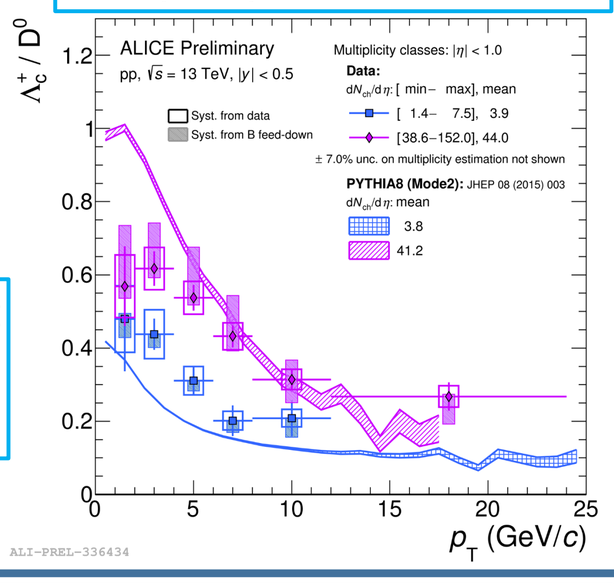
Analysis Strategy:

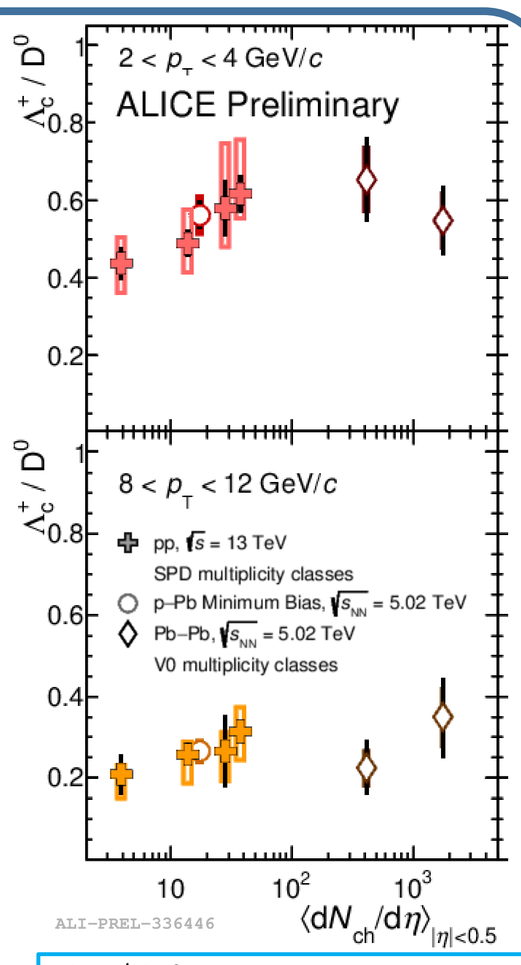
- Signal extraction through invariant mass analysis.
- Acceptance and efficiency corrections.
- Subtraction of Λ_c from baryon from B decays based on FONLL predictions.
- Multiplicity estimator:
  Number of charged primary particles in ranges $dN_{ch}/d\eta$ (in η<1):
  [1.4-7.5], **[8.4-24.3]**, **[24.5-45.8]**, **[38.6-152.0]**. NEW
- The MB results are obtained from the $\Lambda_c \rightarrow pK^-\pi^+$ decay channel.
- The HM results are obtained merging the $\Lambda_c \rightarrow pK^0_s$ and $\Lambda_c \rightarrow pK^-\pi^+$ decay channels.



Λ_c corrected yields per event show an increase from low to high multiplicity.

Enhancement of the Λ_c/D^0 ratio going towards higher multiplicities.
Pythia8 SoftQCD (Mode2) describes the trend vs multiplicity.





Λ_c/D^0 ratio in pp collisions at HM are compatible with the Pb–Pb results.

Conclusions

- Baryon over meson ratio production in the HM pp collisions similar in shape (vs p_T) and magnitude than the Pb–Pb collision results. **Hint of a hot deconfined medium also in HM pp collisions?**
- More differential measurements required to have a better understanding.