Evaluation of the identification efficiency of the ALICE HMPID detector in p-p collisions at √s = 7 TeV by means of V0 decays

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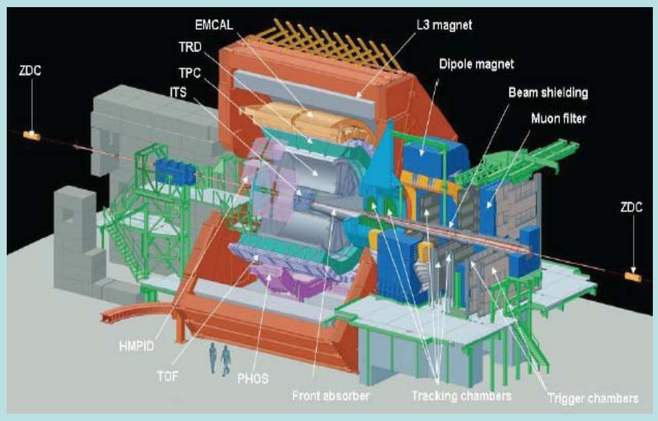
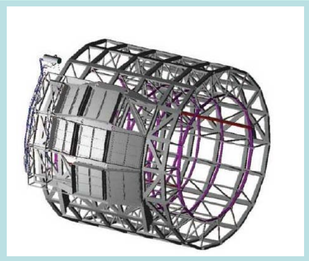
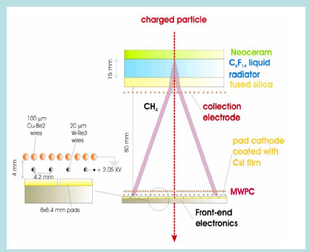
Introduction



The ALICE experiment, dedicated to the study of heavy-ion collisions at LHC energies, features a high-quality particle identification system in the central region exploiting the combination of several sub-detectors: the Inner Tracking System (ITS), the Time-Projection-Chamber (TPC), the Time-of-Flight (TOF) and the HMPID.

A study of the particle identification efficiency of the HMPID has been carried out with samples of protons and pions coming from reconstructed V0 (Λ/anti-Λ, K^0_S) decays in p-p collisions at √s = 7 TeV.



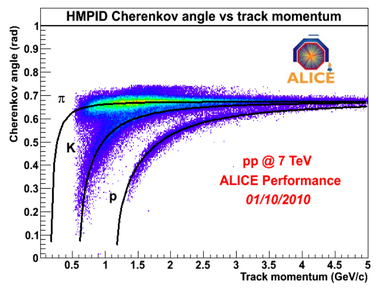


HMPID detector

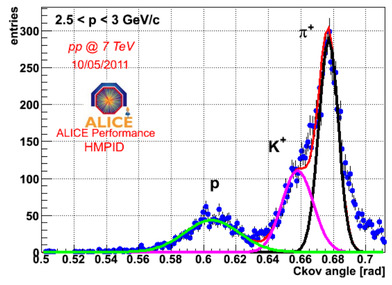
The High-Momentum Particle Identification Detector (HMPID), is devoted to inclusive measurements of charged hadrons for p_t >1 GeV/c. The HMPID is a single-arm array of seven identical Ring Imaging Cherenkov (RICH) detector modules with total acceptance of ~ 5 % of the central barrel phase space. The main tasks of the HMPID:

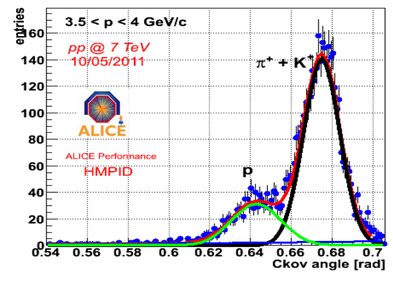
- Extension of the p, K, π spectra to high momentum range;
- Particle ratios vs p_t (p-bar/p, p/π, K/π);
- Measurement of resonance production such as Φ (1020) -> K^+ K^-;
- Jet physics:
  - Study of jet fragmentation with the identification of particle in the jet;
  - Study of the flavor of the leading particle;
- Identification of light nuclei (d, t, ^{3}He, α).

PID strategies:



Raw yield extraction:

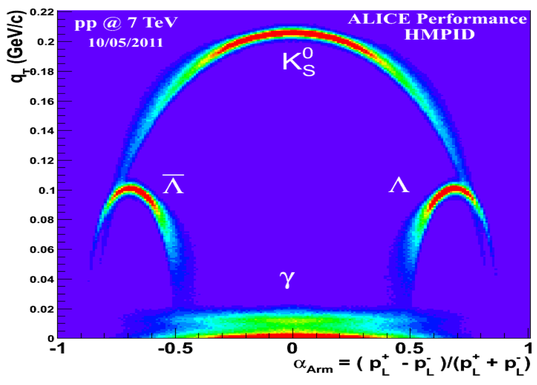




Identification efficiency by means of V0

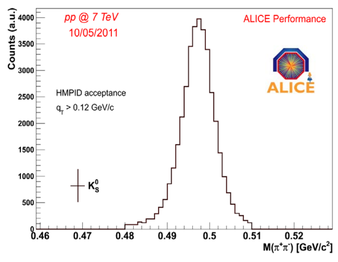
Armenteros-Podolanski distribution

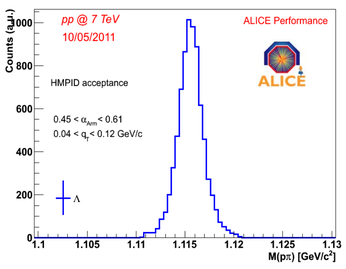
Armenteros-Podolanski distribution for V0 candidates in the ALICE-HMPID acceptance.



The invariant mass (Λ, anti-Λ, K^0_S) has been evaluated in the HMPID acceptance: at least a daughter particle is requested in the HMPID acceptance.

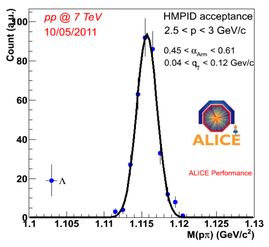
Selected regions from Armenteros-Podolanski distribution:
Λ: **$0.45<\alpha_{Arm}<0.61$, $0.04<q_T<0.12$ GeV/c;**
K^0_S: **$q_T>0.12$ GeV/c**.



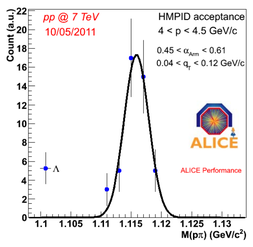


Invariant masses

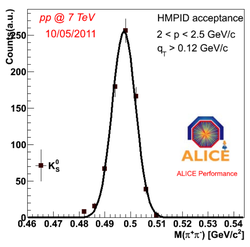
Extracted invariant mass of K^0_S,Λ anti-Λ given that the daughter V0 tracks falls in the HMPID acceptance for various momentum ranges.



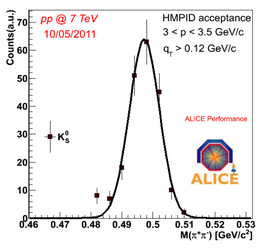
2.5<p<3 GeV/c



4<p<4.5 GeV/c

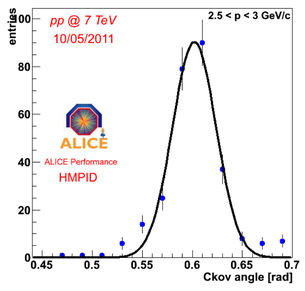


2<p<2.5 GeV/c

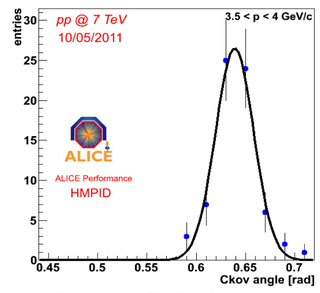


3<p<3.5 GeV/c

HMPID response

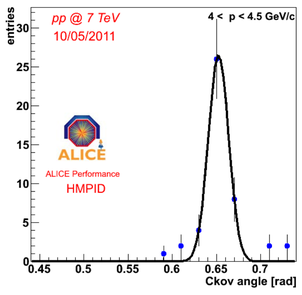


2.5<p<3 GeV/c



3<p<3.5 GeV/c

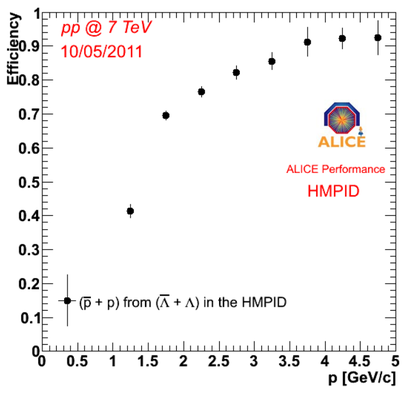
Examples of Cherenkov angle distributions for protons coming from Λ (2.5 < p < 3 GeV/c, 3.5 < p < 4 GeV/c and 4 < p < 4.5 GeV/c).

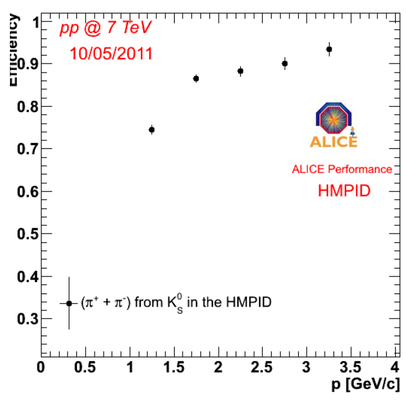


4<p<4.5 GeV/c

HMPID identification efficiency

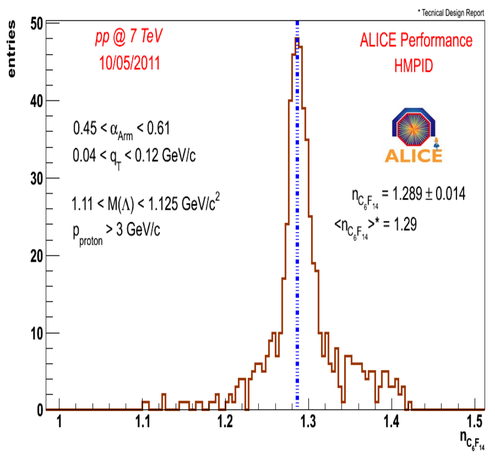
The efficiency has been evaluated as the ratio between the yield under the Gaussian of the Cherenkov angle divided by the yield of Gaussian fit of the mass distribution in momentum range (up to 5 GeV/c for protons, up to 3.5 GeV/c for pions).





C_6F_{14} refractive index measurement from identified protons

- A restricted sample of protons is selected from Λ ($0.45 < \alpha_{Arm} < 0.61$ and $0.04 < q_T < 0.12$ GeV/c);
- To clean the sample a cut on the Λ invariant mass ($1.11 < M_\Lambda < 1.125$ GeV/c) and on the track momentum is applied (p > 3 GeV/c);
- The average value of n_{C6F14} has been deducted using the Cherenkov relation $\cos\theta_C = 1 / (n_{C6F14}\ \beta)$;
- The n_{C6F14} value is in excellent agreement with the average value quoted in the HMPID Technical Design Report* (obtained by optical measurement).



* **Technical Design Report of the High Momentum Particle Identification Detector CERN/LHCC 98-19 ALICE TDR 1 14August1998.**

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