The ALICE detector

Main detectors for PID:
- Inner tracking system (ITS)
- Time projection chamber (TPC)
- Time of flight (TOF)
- High momentum PID (HMPID)

Measuring the event multiplicity

VZERO percentiles
Event multiplicity at forward-rapidity obtained measuring the signal in the two V0 detectors and dividing its distribution into percentile-based classes.

Counting tracks
Event multiplicity at mid-rapidity ($|y| < 0.8$) obtained by counting tracks reconstructed in the barrel detectors and segments of tracks reconstructed with the SPD detector to increase the acceptance.

PID strategies

ITS
- Specific energy-loss in the ITS vs momentum
- dE/dx resolution for the ITS $\sim 10\%$ (Pb-Pb)

TPC
- Specific energy-loss in the TPC vs momentum
- dE/dx resolution for the TPC $\sim 2\%$ (Pb-Pb)

TOF
- Particle velocity measured by TOF vs momentum
- TOF time resolution $\sim 85 - 120$ ps depending on multiplicity (Pb-Pb)

HMPID
- Mean Cherenkov angle vs momentum
- $\Delta p$ separation for $\pi$-$K$ for $p_T < 3$ TeV/c
- $\Delta p$ separation for $p$-$K$ for $p_T < 5$ TeV/c

Results

Spectra in pp

- The multiplicity in pp can be quantified by the ratio:

  \[ \left( \frac{N_{\text{pp}}}{N_{\text{p}}^4} \right) = 9.6 \quad (p < 0.8) \]

- Multiplicity dependence of the spectral shape:
  - Spectra become progressively harder as a function of multiplicity and particle mass.
  - Mass ordering as expected from hydrodynamics.

Spectra in p–Pb

- Spectra evolution with multiplicity in p–Pb: shown to exhibit behaviour that is qualitatively similar to both pp and Pb-Pb.

Particle ratios

- Heavy particles have larger $p_T$ for all the colliding systems.
- Same trend for pp and p–Pb.
- Higher increase in Pb–Pb.

The Blast-Wave fits

The blast-wave model is a simplified hydro model with the following functional form:

\[ p_T^{\text{FW}} \sim f(p_T) \left( \frac{p_T}{m} \right) \exp \left( \frac{p_T}{m} \right) \left( \frac{g_T}{m} \right)^{1/2} \left( \frac{p_T}{m} \right)^{1/2} \beta \left( p_T^0 \right) \]

Results from BW fits

- $p_T$ for $K_0$ and $p$ spectra measured in pp collisions at 7 TeV and p–Pb collisions at 5.02 TeV are presented.
- The comparison of pp, p–Pb and Pb–Pb shows similarities for the three systems as a function of multiplicity.
- Similar trends are observed for the three colliding systems and hint at collective effects in p–Pb and pp.

Summary and conclusions

- $p$, $K$ and $p$ spectra measured in pp collisions at 7 TeV and p–Pb collisions at 5.02 TeV are presented.
- The comparison of pp, p–Pb and Pb–Pb shows similarities for the three systems as a function of multiplicity.
- Similar trends are observed for the three colliding systems and hint at collective effects in p–Pb and pp.
- Serves as input for further theoretical investigation of the phenomena seen at the LHC.

References

4. ALICE-PUBLIC-2013-001