LHCb strange and identified particle results

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First LHCb public physics results - light hadron production - exploiting the interest for measurements in the forward region where production models were extrapolated not only in energy but also in rapidity.

LHCb fully instrumented in the forward region: tracking, ECAL, HCAL, counters lumi, muon, hadron PID
Ideal first measurement for LHCb - high-purity selection without requiring particle identification

2009 Data

Using the 6.8 $\mu$b$^{-1}$ recorded in the pilot run;

$K^0_S$ cross-section not measured before at 0.9 TeV;

$y$ and $p_T$ range were extended;

Main systematic contributions: luminosity $\sim$ 12%, tracking efficiency $\sim$ 10%
$K^0_S$ production

Important input for hadronization models, measured in bins of $y$ and $p_T$ and compared to LHCb MC and Perugia 0 (arXiv:1005.3457).

$V^0$ ratio measurements

High-purity, prompt $K^0_s$ and $\Lambda$ samples selection based on a combination of impact parameters (IP):

$$\nu = \ln IP^+ + \ln IP^- - \ln IP^{V^0}$$

PV requirement ensures that only the $V^0$ coming from non-diffractive events are kept (model based definition PYTHIA 6 & PYTHIA 8).

Efficiency from LHCb-MC (PYTHIA & EvtGen) and GEANT simulation for prompt, non-diffractive events.

Ratios benefit from reduced systematic uncertainties since absolute luminosity not required.

0.31 nb$^{-1}$ @ 0.9 TeV and 0.2 nb$^{-1}$ @ 7 TeV as $V^0$s abound in minimum bias data: 5 $K^0_s$ & 1 $\Lambda$ selected per 100 triggers in data at $\sqrt{s} = 7$ TeV.
Ratio of $\bar{\Lambda}/K_S^0$ higher than expectation at both energies.
Measurements lie significantly under MC predictions at 0.9 TeV;

Reasonable agreement farther from the beam (in $y$), at 7 TeV, where the ratio must be very close to the unity.
Big deviation in ratio from unity at low energy. Much less so at 7 TeV. Reasonable agreement observed with Perugia 0.
Comparing rapidity bins equally away from the beam

\[ y_1 = y_2 + \ln \left( \frac{E_{b1}}{E_{b2}} \right) \]

probes scaling violations.

Consistency between the two energy measurements and previous result.

\[ \Delta y = y_b - y \]
Reasonable consistency with previous measurements.

Good agreement if the same $p_t$ range is covered (high $p_t$).
Summary

- LHCb produced very interesting minimum bias physics results exploiting the unique rapidity and transverse momentum acceptance of the experiment;

- Preliminary results for ratios of $V^0$ and protons suggest lower baryon suppression and higher baryon transport in data than in the MC models investigated.

- Reasonable consistency with previous measurements.

- $\phi$ cross-section preliminary results will be made public soon.