Measurement of angular correlations in proton-lead collisions at LHCb

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Event selection and definition of event-activity

- Event selection
  - 1 primary vertex (PV) per event
  - PV must be in a luminous region, defined as 3π-range around the core interaction point

- Definition of event-activity
  - Use Velo-hit multiplicity to measure the event activity
  - VELO surrounds the interaction point
  - Most comprehensive measure of event activity
  - Proportional to number of charged particles
  - Hit-multiplicities in Pb+Pb greater than in p+Pb
  - Relative activity classes
    -> from low (50-100%) to very high (0-3%) event activity.
  - Common absolute activity classes for Pb+Pb and p+Pb
    -> 5 bins from 2200-3500 Velo hits

Two-particle correlations

- The correlation function is defined as per-trigger particle associated yield,
  \[ \frac{1}{N_{\text{trig}}} \frac{d^2 N_{\text{pair}}}{d\Delta\eta \, d\Delta\phi} = S(\Delta\eta, \Delta\phi) \times B(0, 0) \]

- Signal \( S(\Delta\eta, \Delta\phi) = \frac{1}{N_{\text{trig}}} \frac{d^2 N_{\text{same}}}{d\Delta\eta \, d\Delta\phi} \)
- Background \( B(\Delta\eta, \Delta\phi) = \frac{1}{N_{\text{trig}}} \frac{d^2 N_{\text{mix}}}{d\Delta\eta \, d\Delta\phi} \)
  Mix particles of event with particles of five similar, but different events

Results in the p+Pb configuration:
P_T range: 1.0 - 2.0 GeV/C
- Near-side ridge elongated over large \( \Delta\eta \)
- Towards high event-activity (0-3%):
  \( \Delta\phi = 0 \}: Near-side ridge is evolving!
  \( \Delta\phi \neq 0 \}: The ridge is clearly visible

Results in the Pb+Pb configuration:
P_T range: 1.0 - 2.0 GeV/C
- Near-side ridge elongated over large \( \Delta\eta \)
- At low event-activity (50-100%):
  \( \Delta\phi = 0 \}: Away-side ridge present
  \( \Delta\phi \neq 0 \}: No sign of a near-side ridge
- Comparison with p+Pb shows no sizable effect!