Multiplicity dependence of light neutral meson production in pp collisions at $\sqrt{s} = 13$ TeV with ALICE

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Motivation

$\pi^0$ and $\eta$ mesons in pp collisions

- Test scaling properties: $x_T$, $m_T$
- Comparisons between different collision energies
- Input for theory calculations: Fragmentation functions (FF)
  Parton distribution functions (PDF)
- Essential input for direct photon analyses

Multiplicity dependence

- Collective effects observed in high mult. pp collisions
- Modification of particle production with rising multiplicity
  $\Rightarrow$ Study universality of $\eta/\pi^0$ ratio
Neutral Meson Measurements with ALICE

Invariant mass based:
- Pair-wise combination of photons
- Background described by mixed events or rotation technique
- Integration around estimated mass position → raw yield
- 6 partially independent reconstruction techniques

Purity based (π⁰ only):
- Utilizing merged clusters in EMCal
  → Differentiation between single and merged clusters via shower shape
- High π⁰ purity (> 70%)

 Corrections for detector effects and normalizations applied on raw yields:

Invariant cross-section of π⁰ and η in pp collisions at \( \sqrt{s} = 13 \) TeV

Detailed information: Poster T14_1 (A. Mechler)
Multiplicity dependence — $\pi^0$ $p_T$-spectra

**Comparison to PYTHIA:**
- General ordering and magnitude described by PYTHIA
- Slightly different $p_T$ dependence

$\pi^0$ $p_T$-spectra:
- Combination of all reconstruction techniques
- Large $p_T$ reach: $0.4 \leq p_T < (50$ to $200)$ GeV/c (depending on multiplicity)
- Hardening of $p_T$ spectra with rising multiplicity

High Multiplicity Triggered Data: Enhancement of events above 0.1% ($\approx x200$ more events)
Multiplicity dependence — $\eta/\pi^0$ ratio

- $\eta/\pi^0$ ratio extracted in 12 multiplicity intervals
- Combination of 3 individual reconstruction techniques
- Dependence of $\eta/\pi^0$ on the event multiplicity
- Large $p_T$ coverage

Ratio to $\eta/\pi^0$ in INEL>0:
- Probe possible modification of $\eta/\pi^0$ as function of $p_T$
- PYTHIA: Clear deviation from unity below $p_T \approx 2$ GeV/c
Multiplicity dependence — $\eta/\pi^0$ ratio

Deviation of $\eta/\pi^0$ in 3 $p_T$ intervals as function of the normalized charged particle multiplicity $\langle dN_{ch}/d\eta \rangle$

**Low multiplicity:**
- Slight enhancement at low $p_T$
- Described by PYTHIA
- No modification for mid and high $p_T$

**High multiplicity:**
- Suppression at low and mid $p_T$
- Underestimated by PYTHIA
- Slight suppression at high $p_T$