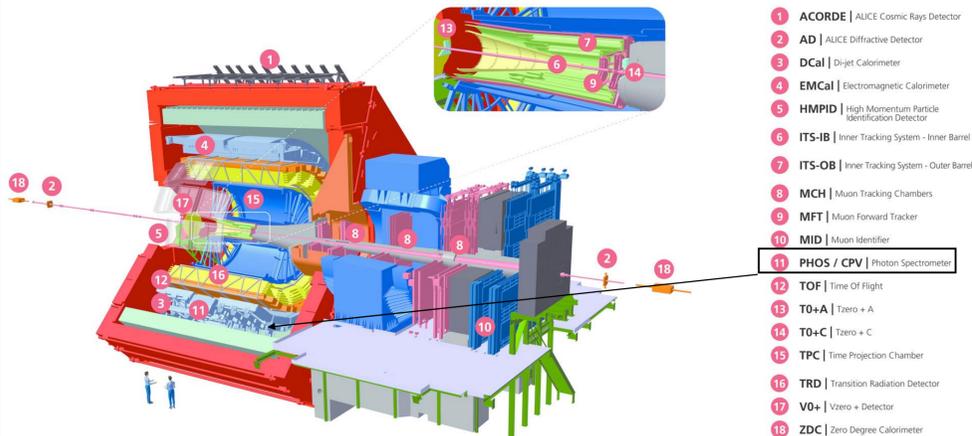


1. Motivation

In this poster performance of the upgraded PHOS detector [1] of the ALICE experiment in Run 3 is presented, as well as the results on the neutral mesons (π^0 , η , ω) in Run 2. In Run 3 so far collected integrated luminosity is 41.7 pb^{-1} for the pp collisions ($\sqrt{s} = 13.6 \text{ TeV}$; 3T collisions) and 1.54 nb^{-1} for the Pb-Pb collisions ($\sqrt{s_{NN}} = 5.36 \text{ TeV}$; 12B collisions). Increase of statistics by a factor of 50 is expected to decrease the uncertainties which is crucial for choosing the most adequate models describing neutral meson spectra, flows, etc.

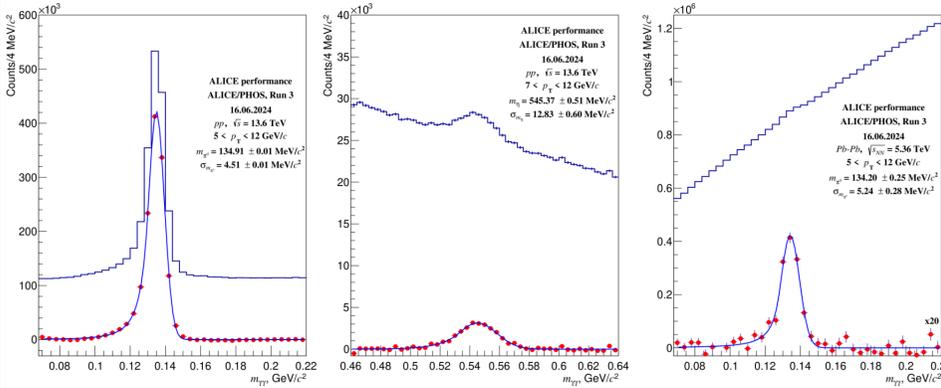
2. ALICE/PHOS



PHOS is a high-resolution electromagnetic calorimeter based on lead tungstate crystals (PbWO_4) and is designed to measure photon spectra from tens of MeV to 100 GeV. PHOS underwent electronics improvement, and 2 more CPV modules were mounted prior to Run 3 [2].

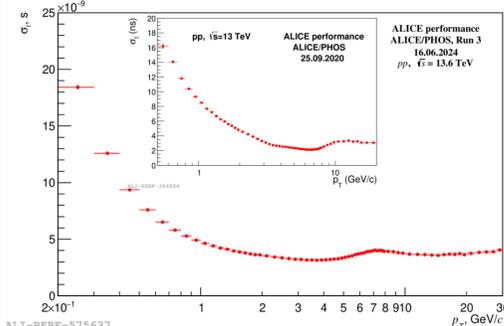
3. PHOS performance in Run 3

• Invariant mass spectra



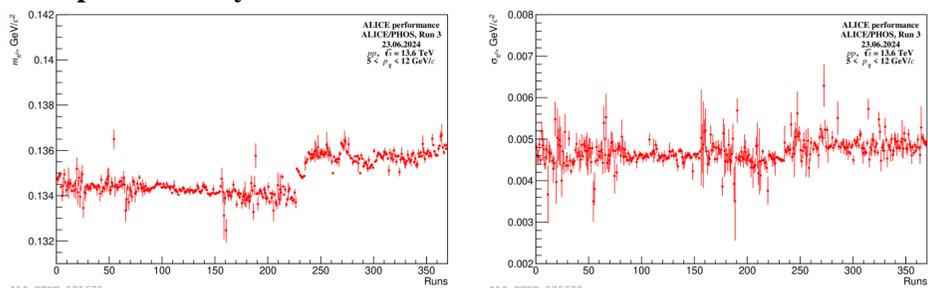
- Cluster selection is: $E_{\text{clu}} > 0.3 \text{ GeV}$, $t_{\text{clu}} \in [-50, 100] \text{ ns}$.
- Clear π^0 and η peaks are observed in pp and Pb-Pb collisions.
- π^0 peak is at its PDG position ($134.9 \text{ MeV}/c^2$) with good width.

• Time resolution



Time resolution remains modest in Run 3 (only suitable for pileup rejection from subsequent bunch crossings), although it improved below $2 \text{ GeV}/c$ due to better signal fitting techniques, which is a region of interest because of the TOF cut usage: $\sigma_t^{\text{Run 2}} = 8.5 \text{ ns}$, $\sigma_t^{\text{Run 3}} = 4.5 \text{ ns}$ at $p_T = 1 \text{ GeV}/c$.

• π^0 peak stability

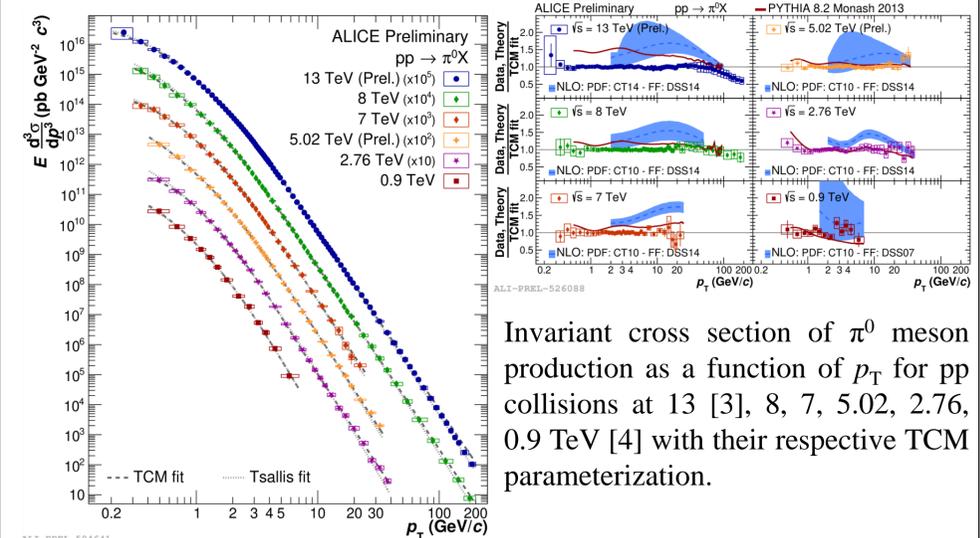


In order to check the long-term stability of the π^0 peak, its position and width were calculated in all available runs from 2023-2024. On average the peak position is stable (within $\sim 0.5 \text{ MeV}/c^2$), as well as its width ($\sim 4.6 \text{ MeV}/c^2$).

The achieved mass resolution for $p_T > 1.7 \text{ GeV}/c$ is $\sigma_m^{\pi^0} = 5.34 \pm 0.01 \text{ MeV}/c^2$.

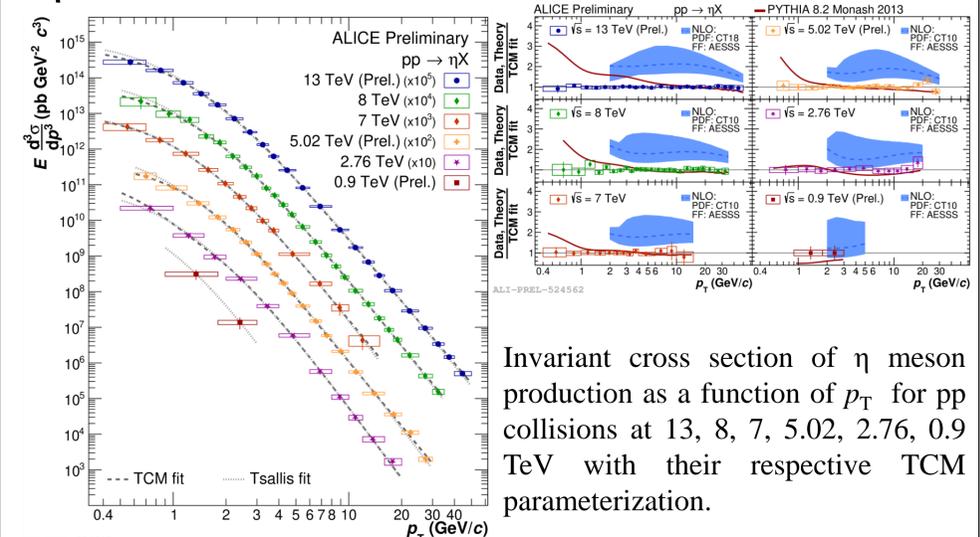
4. Neutral meson production results

• π^0 meson results



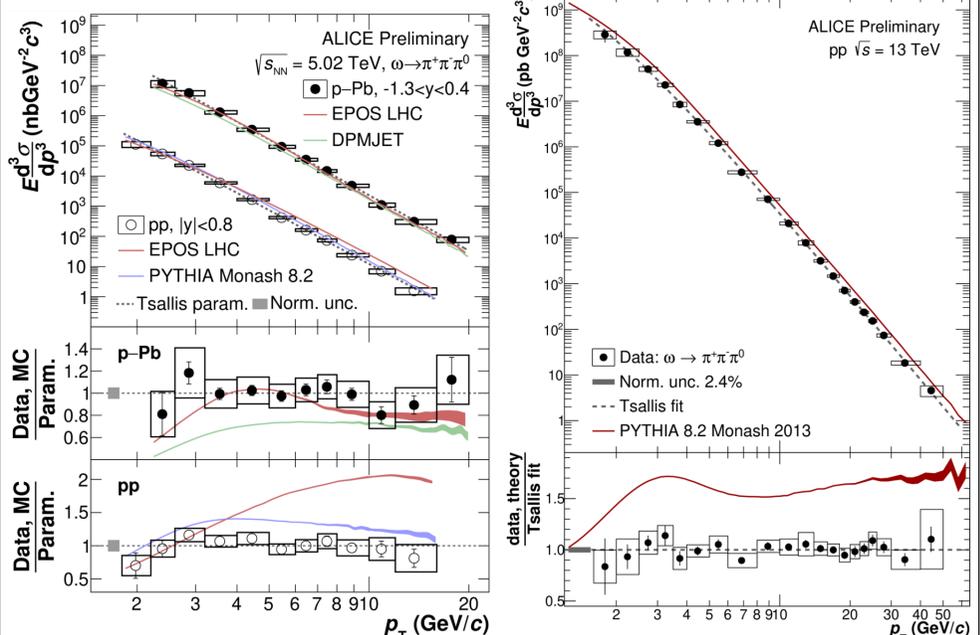
Invariant cross section of π^0 meson production as a function of p_T for pp collisions at 13 [3], 8, 7, 5.02, 2.76, 0.9 TeV [4] with their respective TCM parameterization.

• η meson results



Invariant cross section of η meson production as a function of p_T for pp collisions at 13, 8, 7, 5.02, 2.76, 0.9 TeV with their respective TCM parameterization.

• ω meson results



Measured production cross sections of omega meson in pp and p-Pb collisions at 5.02 TeV [5] and 13 TeV [6] as well as generator predictions by EPOS, PYTHIA 8.2 and DPMJet. The lower panel shows the ratio of the data points and the MC predictions to a Tsallis fit to the data.

5. Conclusion

- Promising performance of PHOS is achieved in Run 3.
- The first results of neutral meson reconstruction in Run 3 are presented.
- Invariant cross sections of neutral mesons (π^0 , η and ω) are obtained at different energies in different colliding systems (pp, p-Pb, and Pb-Pb). The data is fitted by the Tsallis and TCM parameterizations well, while MC generators and theory predictions tend to overestimate experimental data.

Literature

- G. Dellacasa (ALICE Collab.) // CERN-LHCC-99-004; Geneva, CERN, 1999
- D. Blau (for the ALICE Collab.) // J. Phys.: Conf. Ser. 1690 012044 (2020)
- V. Kuskov (for the ALICE Collab.) // Phys. Atom. Nuclei 86, 751–757 (2023)
- D. Peresunko (for the ALICE Collab.) // Phys.Part.Nucl. 53:2, 316-325 (2022)
- N. Strangmann (for the ALICE Collab.) // 11th International Conference on Hard and Electromagnetic Probes of High-Energy Nuclear Collisions, 438 (2024)
- J. Lühder // CERN-THESIS-2023-100 (2023)