Measurement of photon multiplicity at forward rapidities in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV with ALICE

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Physics Motivation

Particle production in high energy collisions is governed by

- Hard processes
  - Momentum transfer is large
  - Described by pQCD
- Soft processes
  - p_T < ~ 1-2 GeV
  - Description relies on non pQCD based model calculations

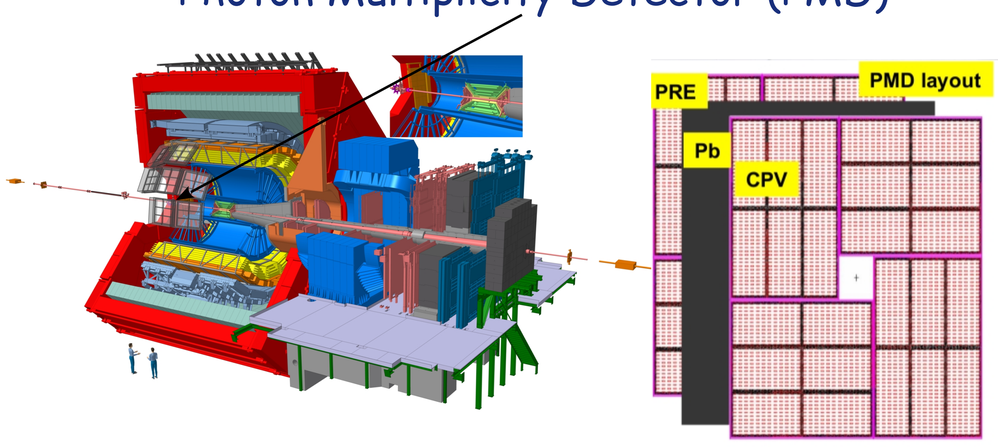
Observables sensitive to particle production

1. Multiplicity distribution: P(N)
2. Pseudorapidity distributions: dN/dη

- Put constraint and help improve phenomenological model calculations
- Measurements in p-Pb collisions serve as a baseline to interpret Pb–Pb results
- Inclusive photon (mostly from π^0) measurement is complementary to the charged-particle measurement

Detection of photons

Photon Multiplicity Detector (PMD)



Sensitive medium: Gas ($Ar+CO_2$ in the ratio 70:30)

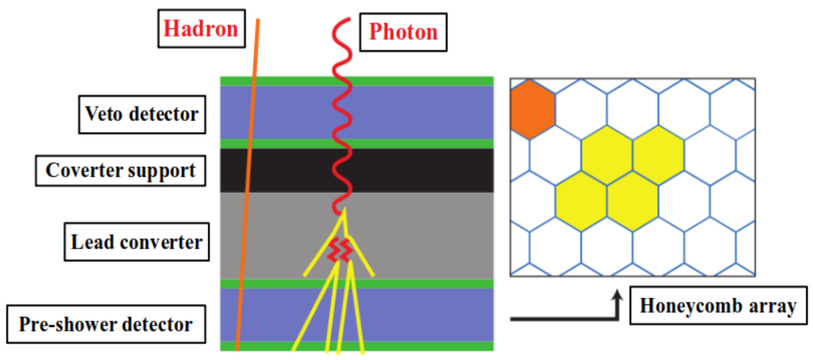
Two planes:
1. Preshower plane (PRE)
2. Charged particle veto (CPV)

Total no. of cells: 152 k

Coverage: $2.3 < \eta < 3.9$ (full Φ)

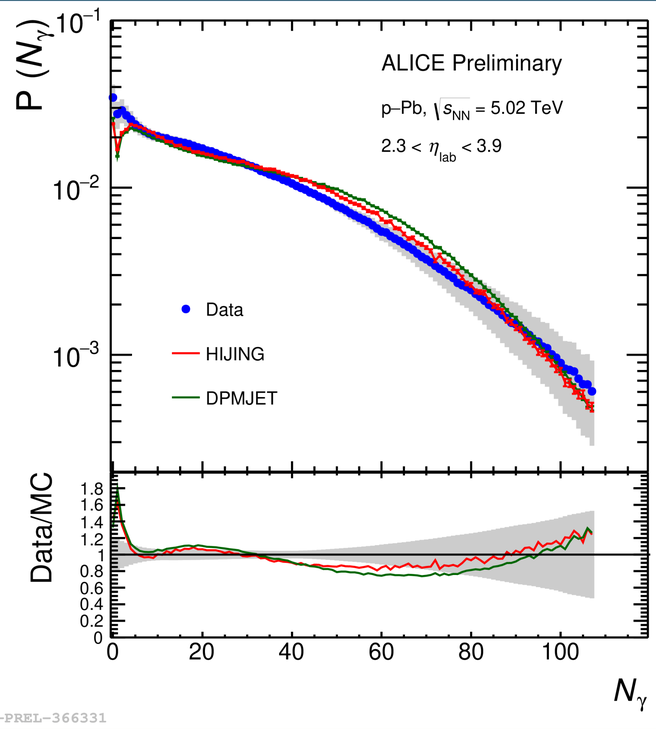
Converter: $3X_0$ thick Pb plate

Working Principle



- Photons initiate EM shower in Pb converter and produce signals on several cells of the PRE plane
- Hadrons normally affect only one cell in PRE plane and produce a signal representing minimum ionizing particles

Multiplicity distribution

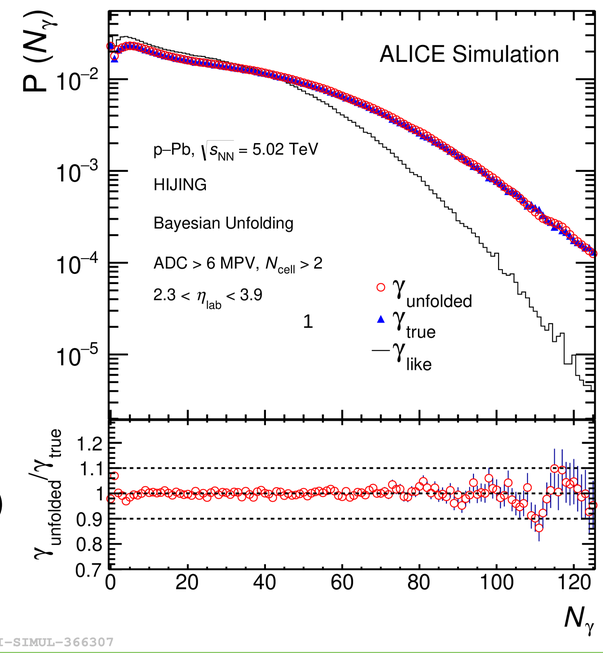


Models describe the data in the intermediate to higher multiplicity bins within uncertainties however underestimate the same at low multiplicity (N_γ < 10)

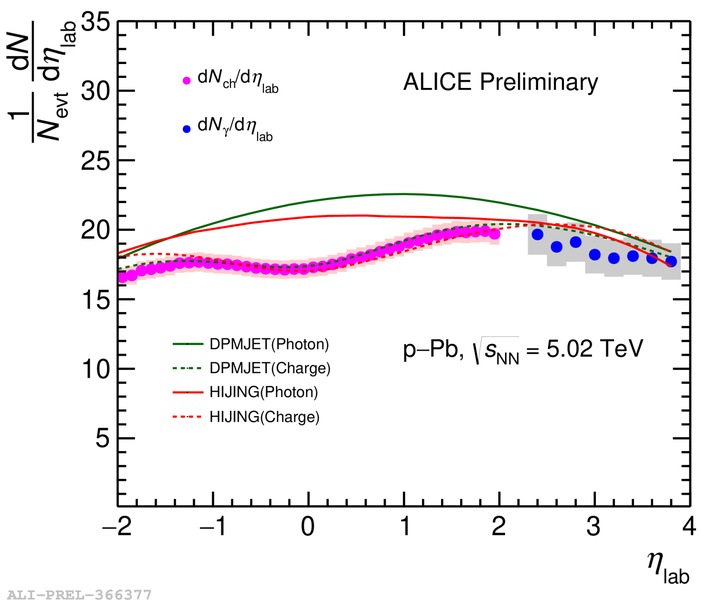
Analysis details

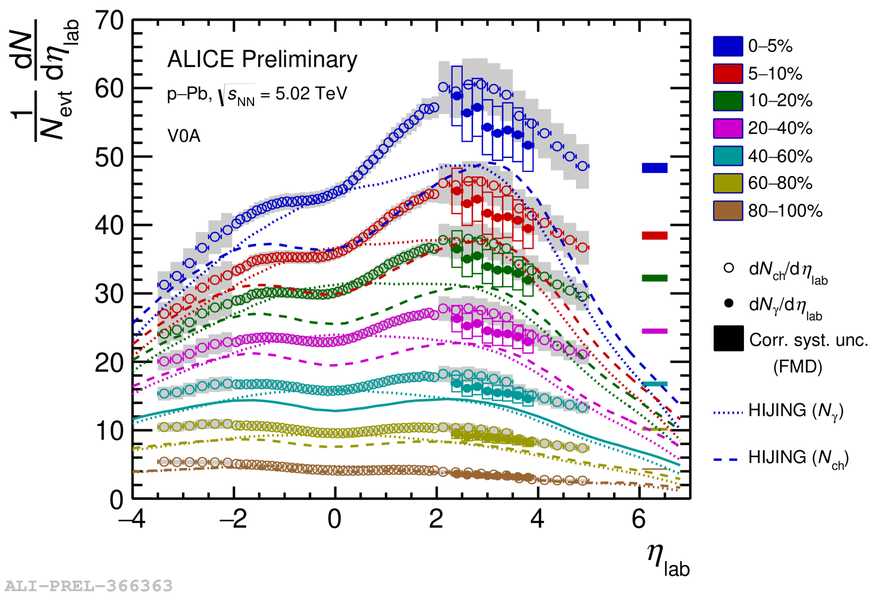
- System: p-Pb
- Energy: 5.02 TeV
- Centrality selection: Forward Scintillator Detector (V0A)
- Correction for instrumental effects: Bayesian unfolding method
- Systematic uncertainty:
  - vary from 4.4% to 57% for P(N_γ)
  - ~ 7.4% for dN_γ/dη

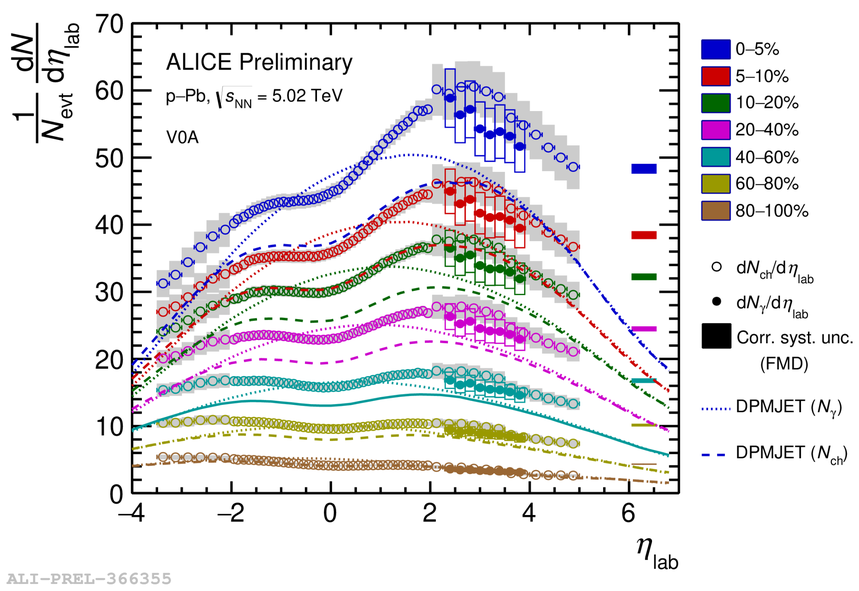
Performance of unfolding



Pseudorapidity distribution for MB and various centrality classes







- dN_{ch}/dη is well described by both MC models whereas dN_γ/dη is slightly overestimated by DPMJET in lower pseudorapidity region
- None of the models considered could explain the centrality dependent evolution of photon and charged-particle production
- Photon (mostly from π^0) and charged-particle production have similar dependence on centrality

Summary

- Multiplicity and pseudorapidity distributions of inclusive photons and their centrality dependence at forward rapidities in p-Pb collisions at $\sqrt{s_{NN}}$=5.02 TeV are presented
- Both HIJING and DPMJET fail to explain the P (N_γ) for N_γ < 10
- HIJING is able to describe the dN_γ/dη within uncertainties
- Both models are unable to describe the centrality dependent dN/dη for both photons and charged particles

References

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