LHCP2021

Online

The Ninth Annual Conference on Large Hadron Collider Physics

7-12 June 2021 Paris (France), Sorbonne Université (IN2P3/CNRS,IRFU/CEA)

Angular correlations of heavy-flavour decay electrons and charged particles in pp collision at $\sqrt{s}$ = 5.02 TeV with ALICE at LHC

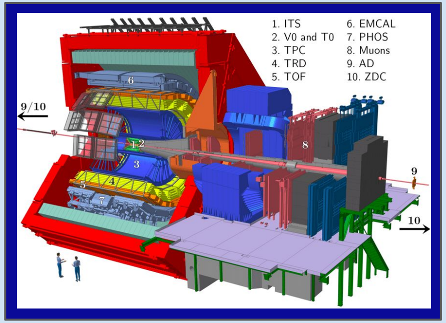
Ravindra Singh Indian Institute of Technology Indore (IN)
(for the ALICE collaboration) ravindra.singh@cern.ch

Measurement and Motivation:

- Two particle azimuthal angular correlations are triggered by electrons from heavy-flavour hadron decays and can be used for heavy-flavour jet studies.
- By changing the momentum scales of the trigger and associated particle, one can study the heavy-flavour jet structure, interplay of soft and hard processes[1].
- In pp collisions, heavy-flavour correlations can be used to study the production and fragmentation of heavy-quarks.

1. PLB 763 (2016) 238-250

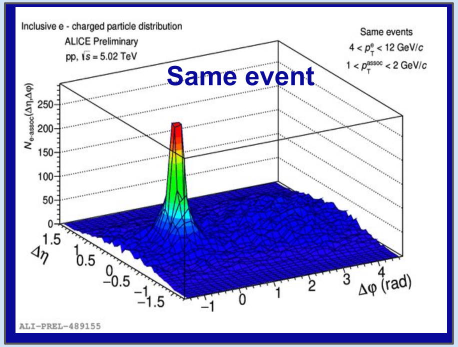
ALICE Apparatus:

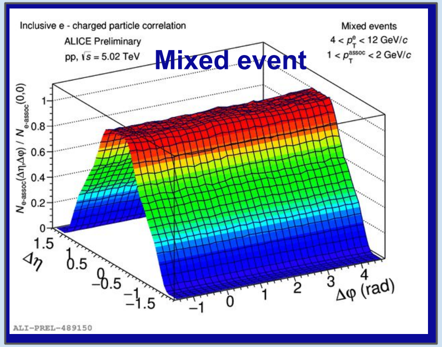


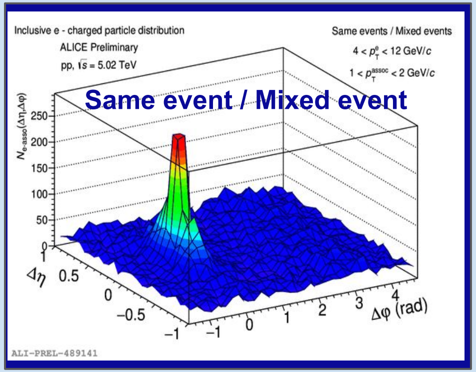
- Inner tracking system (ITS) and Time Projection Chamber (TPC): $|\eta| < 0.9$.
- Electromagnetic calorimeter (EMCal): $|\eta| < 0.7$, $80^o < \varphi < 187^o$.
- Di-jet calorimeter (DCal): $|\eta| < 0.7$, $320^o < \varphi < 327^o$, $0.22 < \eta < 0.7$, $260^o < \varphi < 320^o$

Analysis procedure:

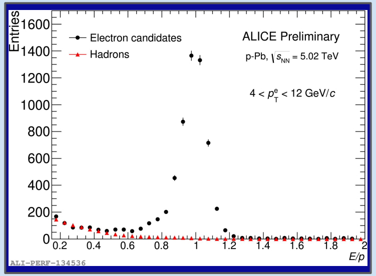
- Inclusive electrons (IncE) are identified by TPC and EMCal + DCal detectors.
- Obtain ($\Delta\varphi$, $\Delta\eta$) distribution between inclusive electrons and charged particles.
- Detector effects are corrected using mixed event technique.







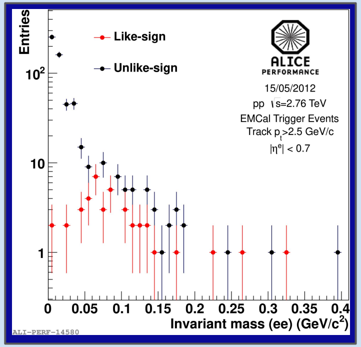
- Hadron contamination is removed in the electron sample by using E/p distribution.



- Non-HF decay electrons extracted from invariant mass distribution of like and unlike-sign electron pairs.

$$\Delta\varphi_{\mathrm{NonHFE}} = (1/\epsilon_{\mathrm{NHFE}})\Delta\varphi_{\mathrm{Reco-NonHFE}}$$

Where, ϵ_{NHFE} → Tagging efficiency

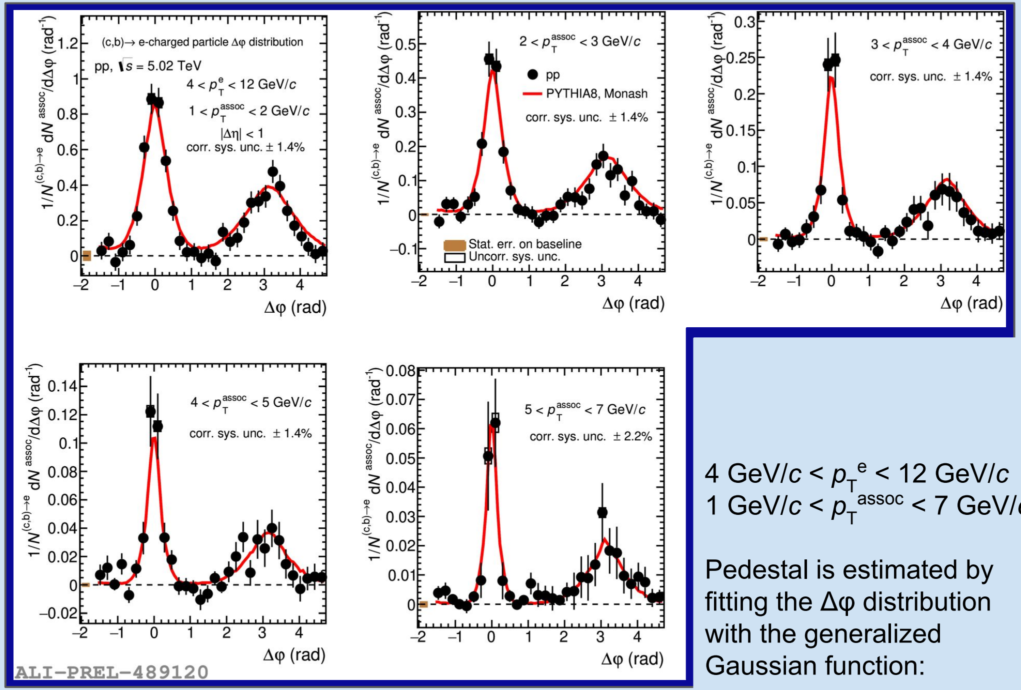


- Correlations between c,b→ e and charged particles:

$$\Delta\varphi_{\mathrm{HFE}} = \Delta\varphi_{\mathrm{IncE}} - \Delta\varphi_{\mathrm{NonHFE}}$$

- Tracking efficiency and purity correction for secondary particles are implemented → normalized with the number of triggered heavy-flavour decay electrons.

$\Delta\varphi$ distribution of heavy-flavour electrons and charged particles:



4 GeV/c < p_T^e < 12 GeV/c
1 GeV/c < p_T^{assoc} < 7 GeV/c

Pedestal is estimated by fitting the $\Delta\varphi$ distribution with the generalized Gaussian function:

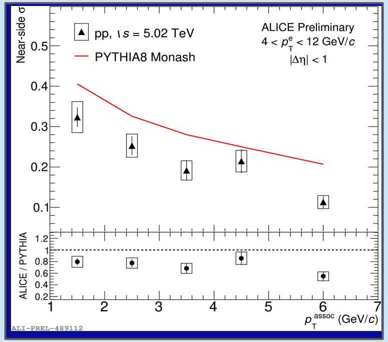
$$f(\Delta\varphi) = b + \frac{Y_{NS} \times \beta_{NS}}{2\alpha_{NS}\Gamma(1/\beta_{NS})} \times e^{-\left(\frac{\Delta\varphi}{\alpha_{NS}}\right)^{\beta_{NS}}} + \frac{Y_{AS} \times \beta_{AS}}{2\alpha_{AS}\Gamma(1/\beta_{AS})} \times e^{-\left(\frac{\Delta\varphi-\pi}{\alpha_{AS}}\right)^{\beta_{AS}}}$$

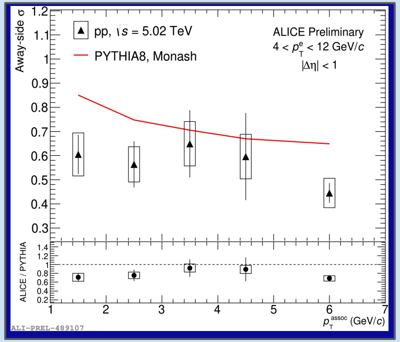
b = Baseline (Pedestal)
α = Related to width of peaks

Y = Yields
β = Related to shape of peaks

➢ The $\Delta\varphi$ distribution from PYTHIA8 + Monash is consistent with data.

Near and away-side sigma (σ):





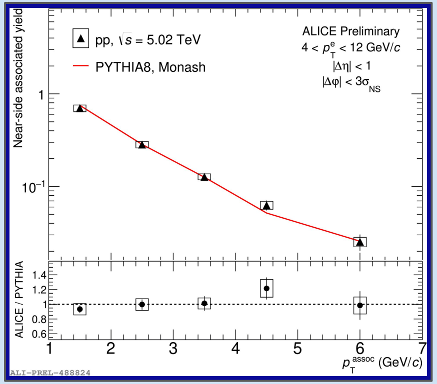
❖ Near and away-side sigma is extracted from the fitting parameters (α,β) with the relation[2]:

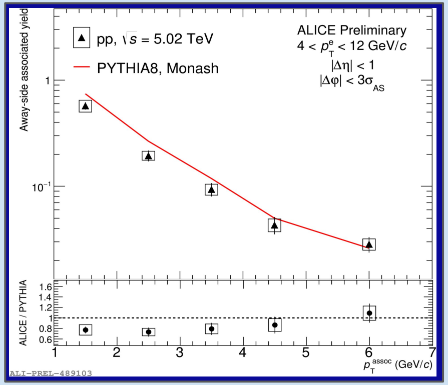
$$\sigma = \sqrt{\alpha\Gamma(1/\beta)\Gamma(3/\beta)}$$

➢ The near and away-side sigma are compared with PYTHIA → consistent within 1-2σ

2. EPJC 80 (2020) 10, 979

Near and away-side yields:



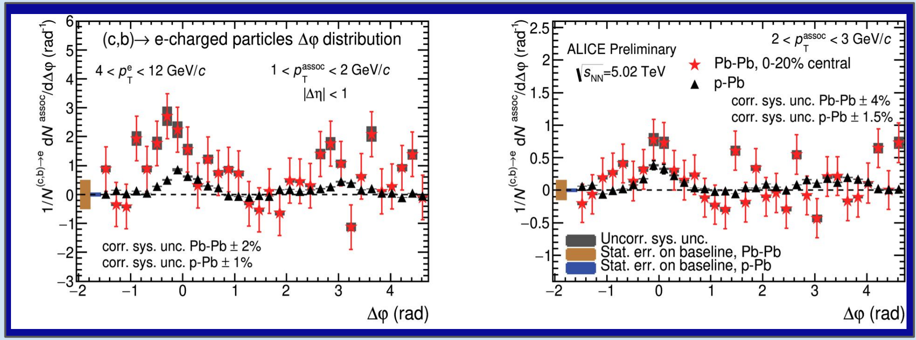


- ➢ Near and away-side yields are measured by the bin counting method in the region of $|\Delta\varphi| < 3\sigma$.
- ➢ Near-side yield is consistent with PYTHIA.
- ➢ Away-side yield is consistent with PYTHIA at higher p_T and overestimates by 20% at lower p_T.

PYTHIA predictions of fragmentation processes in heavy-flavours are in good agreement with data.

Outlook:

- ❖ $\Delta\varphi$ distribution of p-Pb and central Pb-Pb collisions:



- ❖ Enhancement observed at near-side peak in Pb-Pb compared to p-Pb, although the large uncertainties in Pb-Pb analysis do not allow for a firm conclusion.

New measurements from p-Pb and Pb-Pb will improve the precision of the results.