



Clocking the particle production and tracking radial flow effects at top LHC Run 3 energy with ALICE

Brian Hanley, Wayne State University
on behalf of the ALICE Collaboration



Motivation

Charge is conserved in heavy-ion collisions [1,2]

- The charge balance function measures correlations between balancing pairs of hadrons, giving insight on charged-particle production and transportation mechanisms
- Previous studies have shown that balance functions are sensitive to delayed hadronization and two-states quark production, the diffusivity of light quarks, and the charge susceptibility of QGP[1]
- Properties of measured balance functions evolve with collision energy, system size, and multiplicity[3]

Previous analysis measured the charge balance function of pp collisions at 7 TeV. New data is now available for pp collisions at 13.6 TeV

Charge Balance Function

$$B(\Delta\eta, \Delta\phi) = \frac{1}{2} [\rho_1^- R_2^{+-} + \rho_1^+ R_2^{-+} - \rho_1^+ R_2^{++} - \rho_1^- R_2^{--}] [4]$$

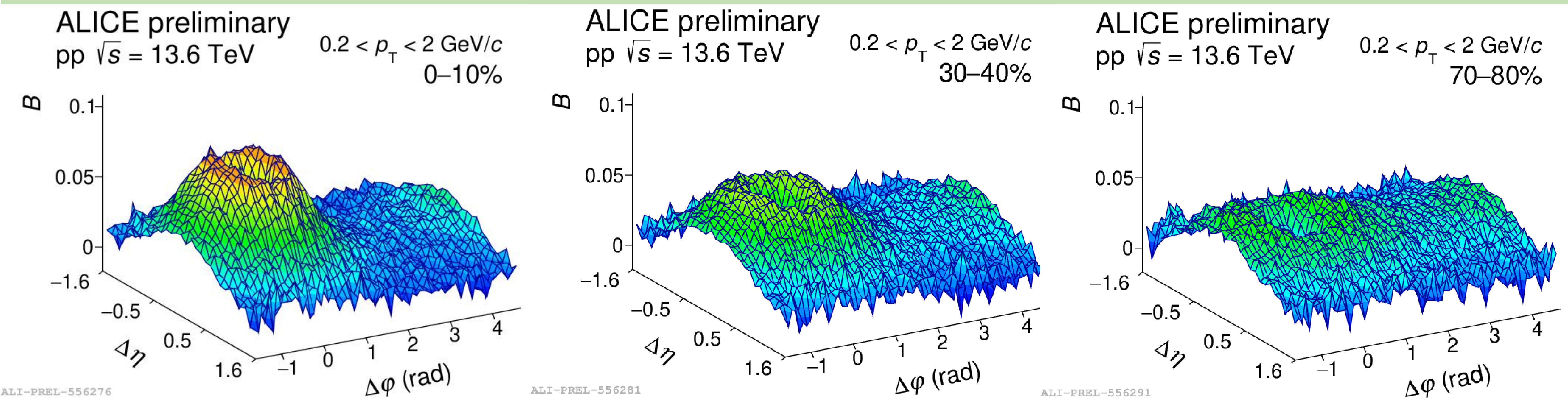
$$R_2^{\alpha\beta}(\Delta\eta, \Delta\phi) = \frac{\rho_2^{\alpha\beta}}{\rho_1^\alpha \rho_1^\beta} - 1$$

$$\rho_2^{\alpha\beta} = \frac{d^2 N^{\alpha\beta}}{d\Delta\eta d\Delta\phi}, \rho_1^\alpha = \frac{d^2 N^\alpha}{d\eta d\phi}$$

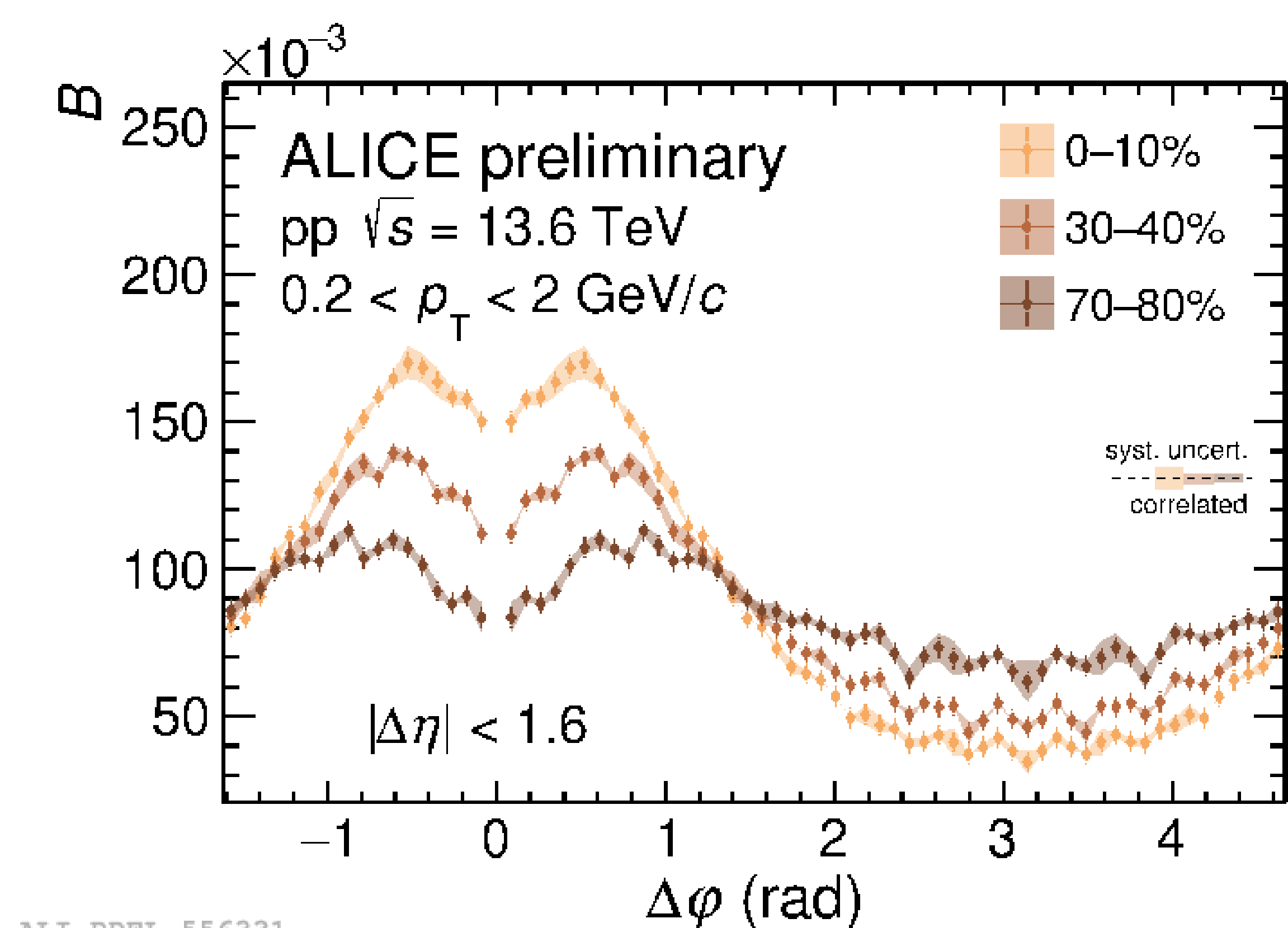
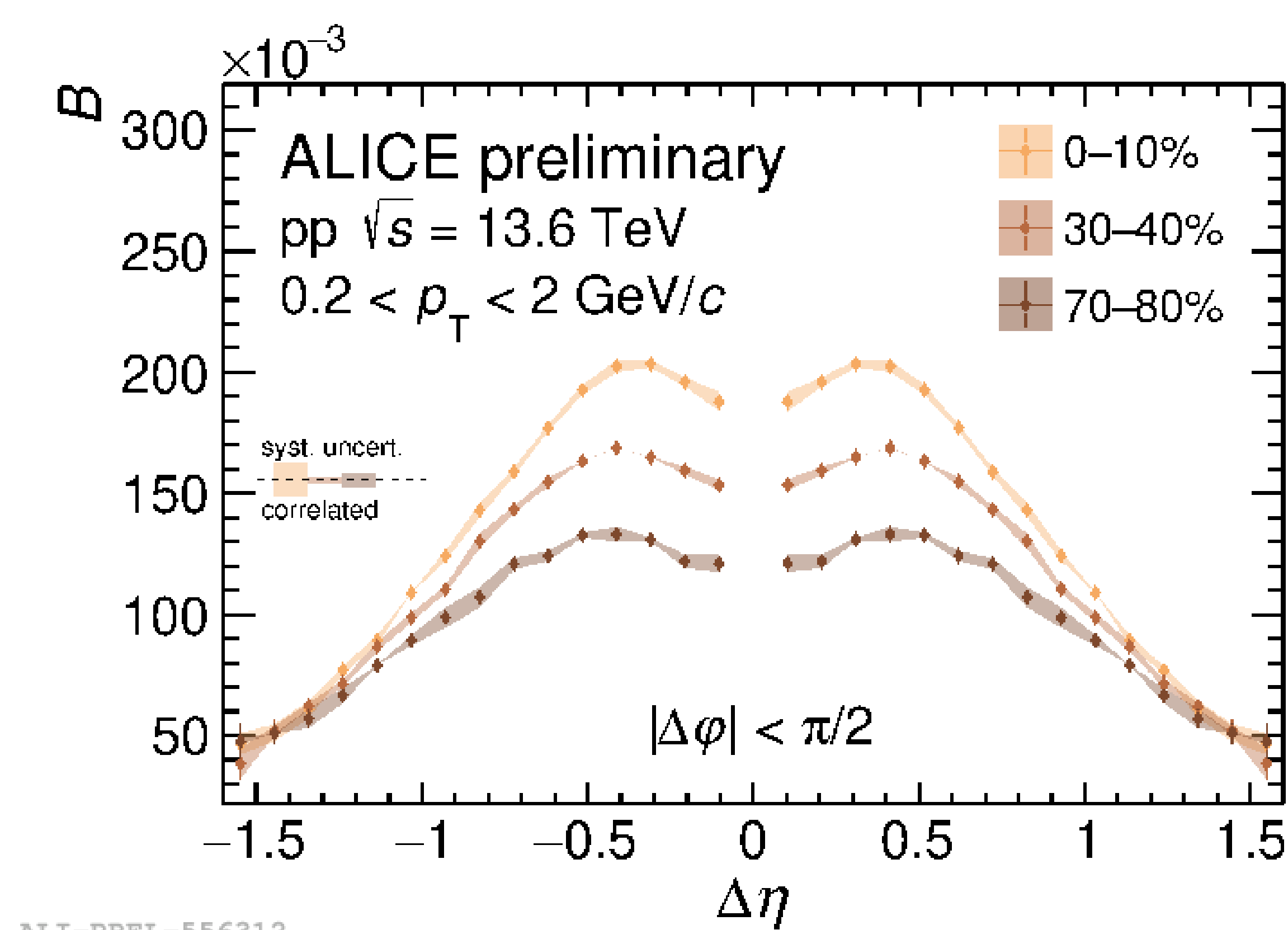
Analysis Details

- pp collisions at $\sqrt{s} = 13.6$ TeV
- Data acquired with min. bias trigger and studied as a function of produced multiplicity with the FT0 detector
- Track selection: $|\eta| < 0.8$; $0.2 < p_T < 2.0$ GeV/c

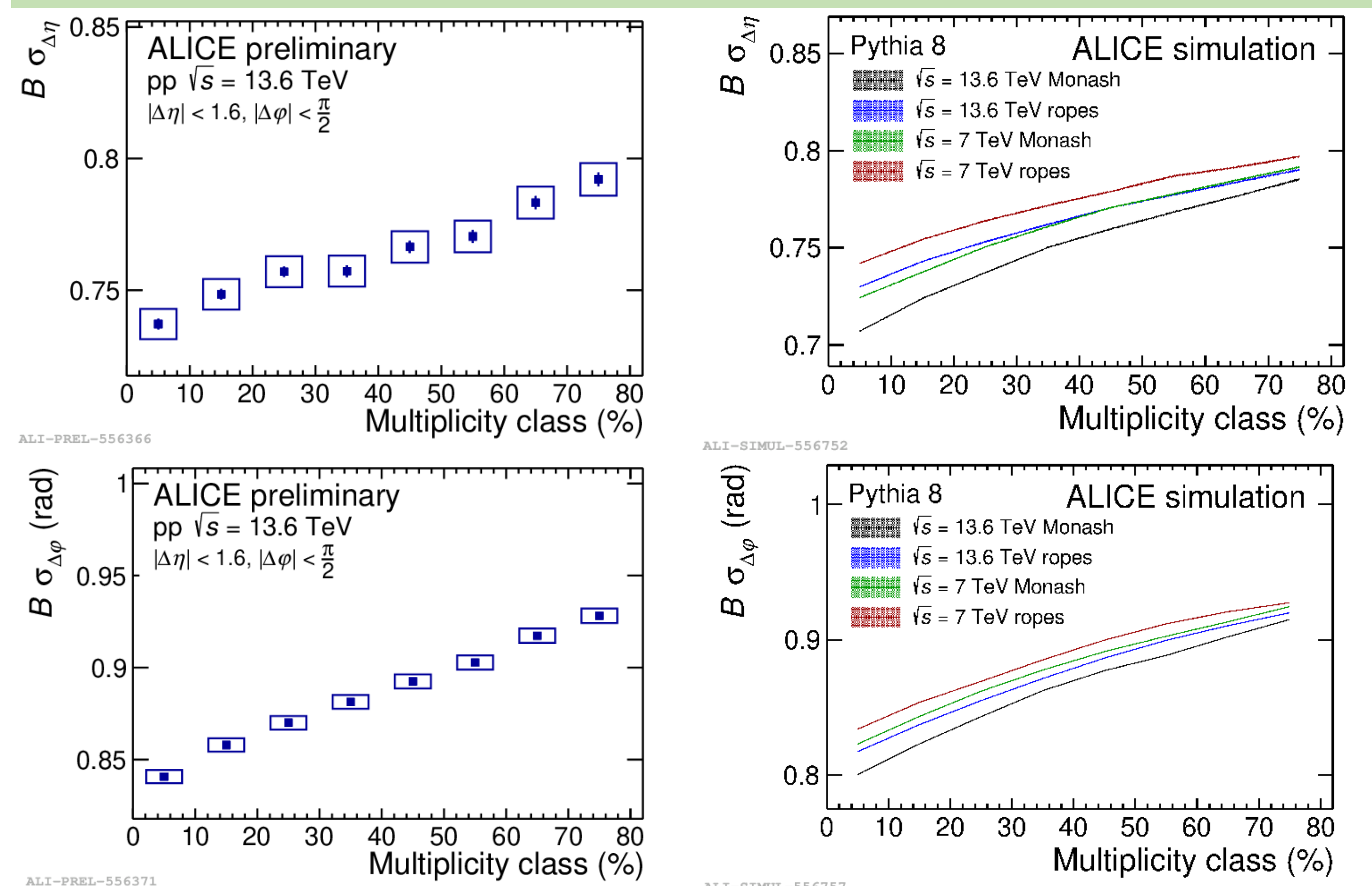
Balance Function Results



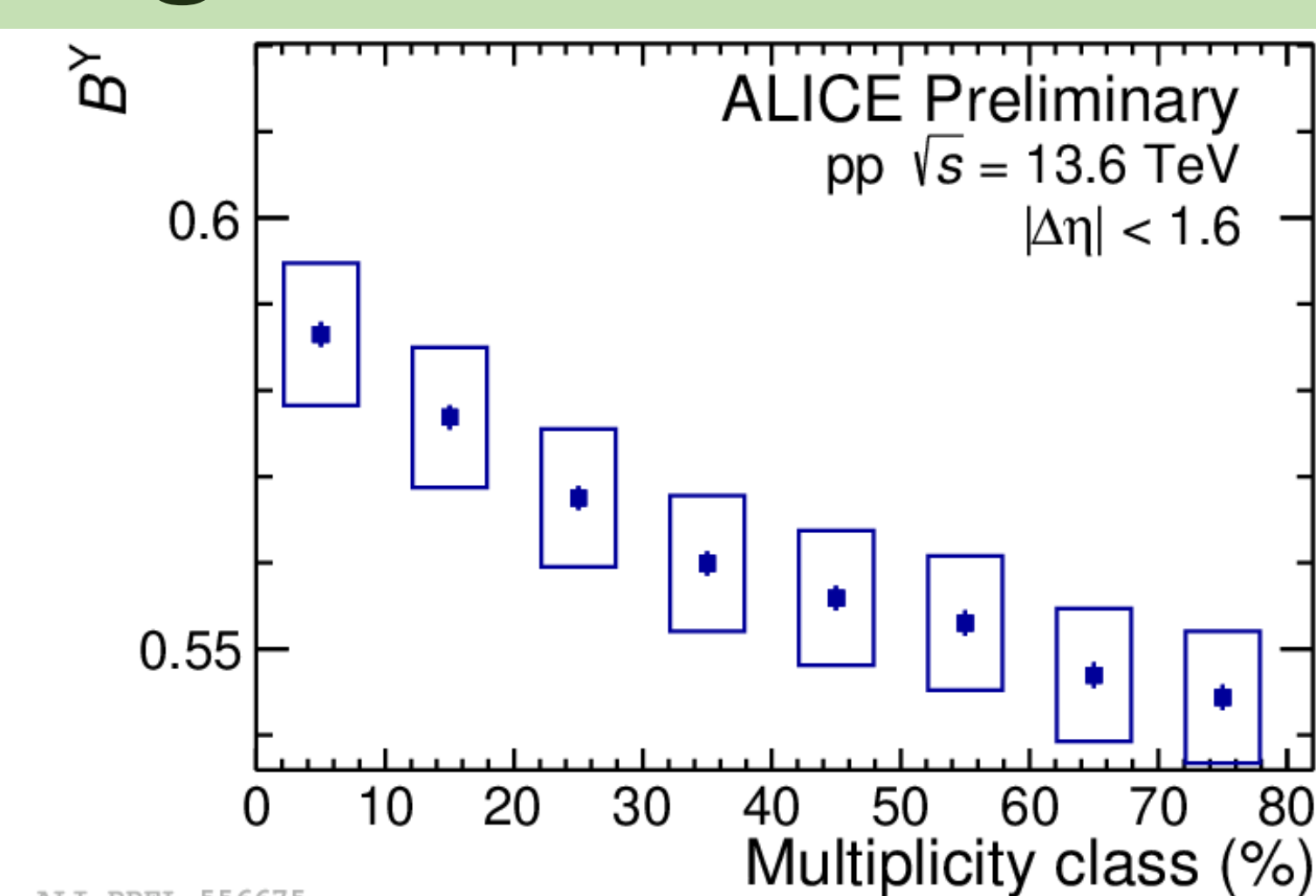
Projections in $\Delta\eta$ and $\Delta\phi$



Width of Balance Function



Integral of Balance Function



Summary

- Similar trends are seen in 13.6 TeV data as in 7 TeV
- Future analysis of Run 3 data will include balance functions of identified particles (proton, pions, & kaons) as well as Pb-Pb collision results at $\sqrt{s} = 2.76$ TeV

Citations

- 1) S. Pratt and C. Plumberg, Phys. Rev. C 104, 014906 (2021)
- 2) ALICE Collaboration, Phys. Lett. B 723 (2013)
- 3) ALICE Collaboration, Phys. Lett. B 833 (2022)
- 4) C. Pruneau, V. Gonzalez, et al, Phys. Rev. C 107, 054915 (2023)