Contribution ID: **218** Type: **Parallel Talk**

Measurement of heavy flavor production and azimuthal anisotropy in small and large systems with ATLAS

Wednesday 16 May 2018 15:00 (20 minutes)

Measurements of heavy flavor hadron production and their correlations in A+A collisions provide insight into the energy loss mechanism and transport properties of heavy quarks in the QGP. From this perspective, the same measurements in p+A collisions thus serve as a necessary baseline for understanding the observations in A+A collisions. Additionally, detailed studies of the azimuthal anisotropy for heavy flavor hadrons in p+A may help address the question of whether the observed long-range "ridge" correlation arises from hard or semi-hard processes, or if it is the result of mechanisms unrelated to the initial hardness scale. This talk presents ATLAS measurements of heavy flavor production, via their semi-leptonic decay to muons in $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV Pb+Pb and pp collisions, and via identified prompt D mesons in $\sqrt{s_{\mathrm{NN}}} = 8.16$ TeV p+Pb collisions. Heavy flavor muon yields are observed to be strongly suppressed in Pb+Pb collisions compared to that in pp collisions. On the other hand, the prompt D meson production in p+Pb collisions shows no obvious modification compared to the theoretical predictions for pp collisions, indicating relatively small cold nuclear matter effects for D meson production. The p_{T} and centrality dependence of flow harmonics v_2–v_4 associated with heavy-flavor muons in Pb+Pb are also presented. The measured v_2 decreases over the p_{T} range of 4–14 GeV, and shows a systematic variation with centrality that was observed in other v_2 measurements. The anisotropy measurements are extended to 8.16 TeV p+Pb collisions, where the azimuthal modulations of heavy-flavor muons, prompt D mesons and J/ψ are studied using two-particle correlations. The statistical significance of the presence or absence of long range correlations involving heavy flavor production in p+Pb events is quantified.

Content type

Experiment

Collaboration

ATLAS

Centralised submission by Collaboration

Presenter name already specified

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Session Classification: Open heavy flavour

Track Classification: Open heavy flavour