Study of low multiplicity subtraction of jet contribution on Fourrier harmonics

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Abstract

Some abstract there. The first ridge discovery in p-p is here: Ref. [3]

Introduction

Some text is needed here

1 ATLAS template fit method

A new template fit function is used by ATLAS [1] to extract elliptical flow harmonic v_2 from two-particle correlation in pp collisions, as

$$Y^{templ}(\Delta\phi) = FY^{periph}(\Delta\phi) + Y^{ridge}(\Delta\phi), \tag{1}$$

where

$$Y^{ridge}(\Delta\phi) = G(1 + 2V_{2\Delta}^{fit} cos(2\Delta\phi)). \quad (2)$$

Here $Y(\Delta\phi)$ is the 1D per-trigger-particle yield extracted from 2D correlation functions and $V_{2\Delta}^{fit}$ is the collective flow signal extracted. The per-trigger-particle yield $Y(\Delta\phi)$ can be Fourier decomposed,

$$Y(\Delta\phi) = N\left\{1 + \sum_n 2V_{n\Delta}\cos(n\Delta\phi)\right\}. \quad (3)$$

Expand Eq. 1 using Fourier decomposition, relations between various variables can be extracted,

$$G = N - FN^{periph}, \quad (4)$$

$$GV_{n\Delta}^{fit} = NV_{n\Delta} - FN^{periph}V_{n\Delta}^{periph}. \quad (5)$$

Previous ATLAS pPb analyses use the peripheral-subtraction method with the peripheral reference after applying the ZYAM procedure, i.e. $Y^{periph}(\Delta\phi) - Y^{periph}(0)$. The ZYAM procedure is similar to subtract out the 0th order term in the Fourier decomposition, FN^{periph} in Eq. 4, which explicitly forces G to be equal to N. As N represents the number of particle pairs involved in the correlation, $G = N$ implies that the extracted $V_{n\Delta}$ and $V_{n\Delta}^{fit}$ are from the same group of particles. A similar procedure has also been used by the CMS Collaboration [2].

In ATLAS's new method, G is required to be smaller than N, which would indicate that $V_{n\Delta}^{fit}$ quantifies the correlation of a smaller set of particle pairs, although it is not clear how to distinguish sets of particles involved in collective correlation with those involved in few-body correlation. Therefore, comparison between anisotropy harmonics results is not meaningful as there is fundamental difference in the definition.

Summary

References and Notes

[1] Georges Aad et al. Observation of long-range elliptic anisotropies in $\sqrt{s}$ =13 and 2.76 TeV pp collisions with the ATLAS detector. *Phys. Rev. Lett.*, 116:172301, 2016.

[2] Serguei Chatrchyan et al. Multiplicity and transverse momentum dependence of two- and four-particle correlations in pPb and PbPb collisions. *Phys. Lett.*, B724:213–240, 2013.

[3] Vardan Khachatryan et al. Observation of Long-Range Near-Side Angular Correlations in Proton-Proton Collisions at the LHC. *JHEP*, 09:091, 2010.