PROCEEDINGS OF SCIENCE

Two-particle correlation via Bremsstrahlung

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The Ridge structure discovered in the high-energy heavy-ion collision experiments is well understood by the hydrodynamics. This structure has been regarded as one of the strongest evidence of the Quark-Gluon Plasma (QGP). However, recently, the Ridge structure is also observed in small systems such as high multiplicity proton-proton collisions, which can not be expected to generate QGP. In this work, we try to understand this behavior resulted from collisions of jet particles and medium partons. Jet particles lose their energies mostly through photon/gluon Bremsstrahlung and therefore, we concentrate on the photon Bremsstrahlung at the first step since gluon Bremsstrahlung needs extra color degrees of freedom. In the Bremsstrahlung process, we consider two cases: one is that a photon is emitted before collision between a jet particle and an medium parton and the other is after collision. We expect that the constructive interference from these symmetric processes can describe the Ridge structure. In our calculation, we adopt the Maxwell-Boltzmann function, Juttñer-Synge function and Juttñer-Synge with flow effects for the momentum distributions of initial medium partons and compare these calculational results with each other. We also compare the calculational results depending on angles between beam direction and jet plane, 0° , 30° and 60°.

We check that peaks appear at $\Delta\varphi \approx 180^\circ$ because of the four momentum convervation. And the calculational result with Juttñer-Synge distribution is widely extended in a pseudo-rapidity than with Maxwell-Boltzmann, which is expected from the shape of distribution functions along the pseudo-rapidity. Besides, we find out that a position of peaks is changed depending on the angle between beam direction. And also jet plane is decreasing in the scales of peaks when angle between beam direction and jet plane is increasing. From these results, we expect that the Ridge structure is obtained by integrating over whole angles between beam direction and jet plane.

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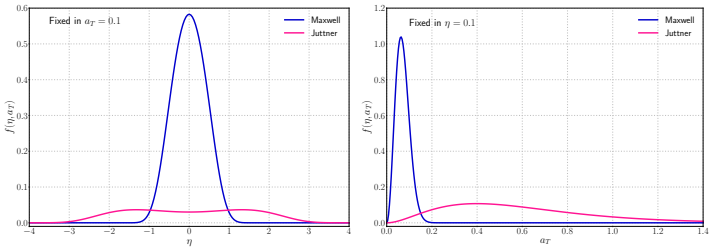

Figure 1: Two figures are Maxwell-Boltzmann (Blue) & Juttñer-Synge (Magenta) distribution functions vs. pseudo-rapidity (Left) and vs. transverse momentum (Right). Based on Left plot, we expect that calculational result with Juttñer-Synge function is wider in η than with Maxwell-Boltzmann function.

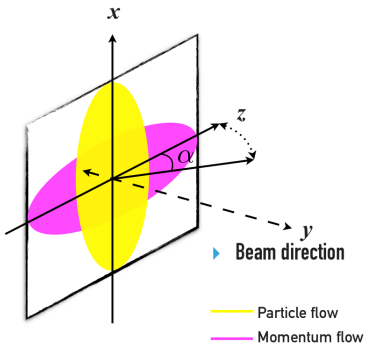

Figure 2: The geometrical shape of flow produced.

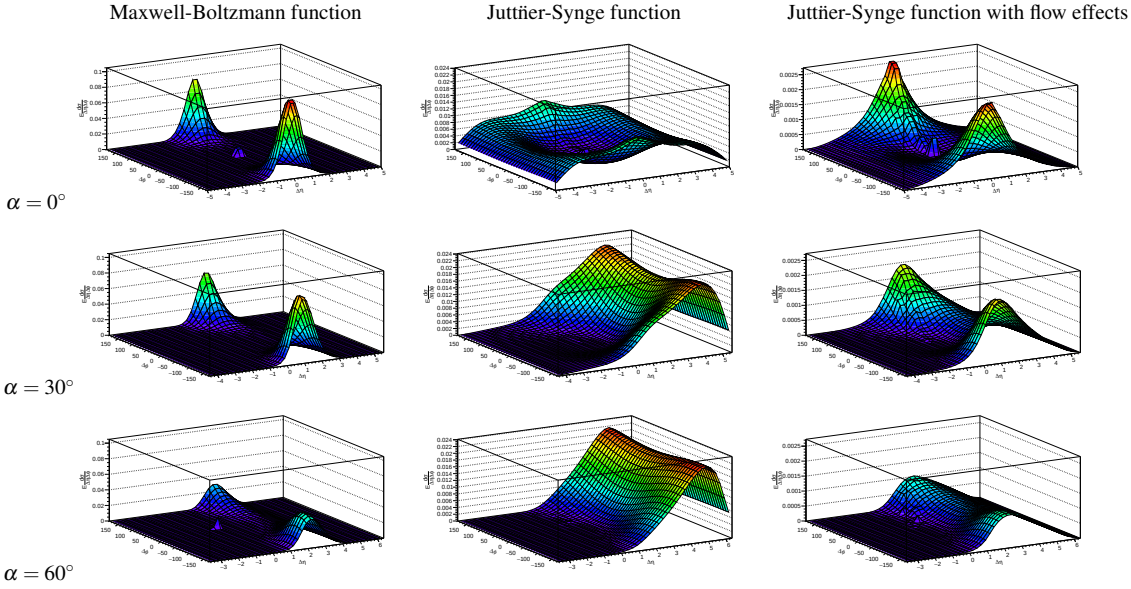

Figure 3: $E\frac{d\sigma}{\Delta\eta\Delta\varphi}$ with various distribution functions (Left $\rightarrow$ Right) and with different angles between beam direction and jet plane (Top $\rightarrow$ Bottom). We set the initial jet energy as 10 GeV, final jet energy as 5 GeV and angle between each other as $10°$.

References

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