HBT measurement with respect to event plane and jet axis in Pb-Pb 2.76 TeV collisions from ALICE

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Introduction

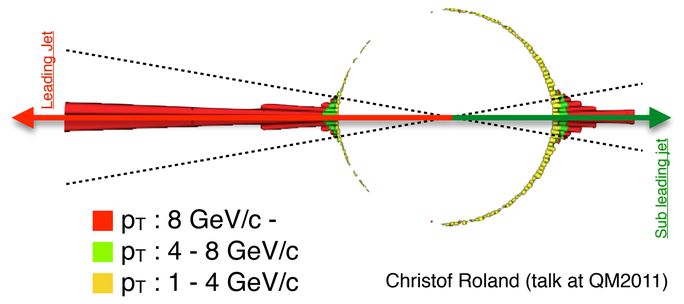
The jet energy deposition in the medium was found to result in an increased production of low p_T particles at large angles opposite to the survived jet or trigger γ direction[1][2].

What are the characteristics of the jet modification in the geometrical space ?

HBT correlations using quantum interferometry of identical particles provide a unique tool to measure the source size at kinetic freeze-out.

In particular, azimuthally sensitive HBT w.r.t. 2nd order event plane(Ψ_2) offers the detailed analysis of freeze-out source shape.

In this poster, a new method to measure the jet modification effect with HBT is presented



✦ Geometrical modification

- Impact of re-distributed energy on bulk size ??

➡ **Explore via HBT !**

Jet reconstruction

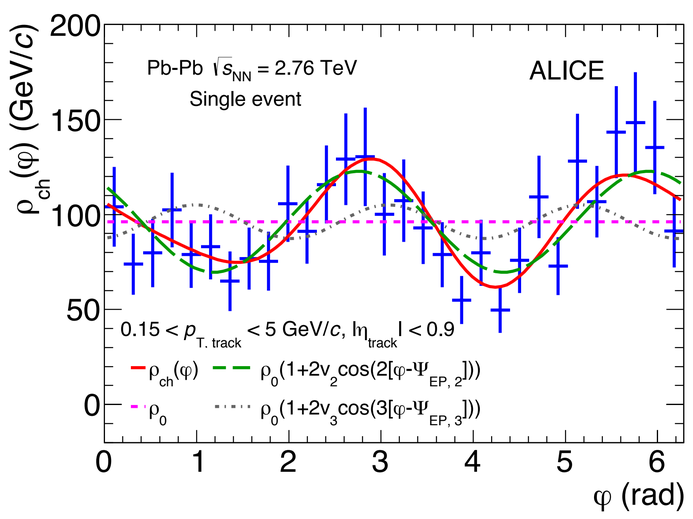
✓ Analysis uses Run1 Pb-Pb collisions in 2011

✓ Charged jets are reconstructed with TPC+ITS

- Resolution parameter : R = 0.2
- Jet background is calculated with **E-by-E estimation**
- p_T^{jet} > 20 GeV/c after bkg. subtraction
- leading hadron p_T > 5 GeV/c

✓ Event by event background subtraction

- Exclude leading jet area (R < 0.3)
- **2nd + 3rd order Fourier decomposition of azimuthal distribution of emitted particles in a given event**
- **Subtract the jet background including v_2 and v_3 modulation**



✓ **Background density** : $\rho(\varphi) = \rho_0 \times \left(1 + 2\{v_2^{obs}\cos(2\left[\varphi - \Psi_2\right]) + v_3^{obs}\cos(3\left[\varphi - \Psi_3\right])\}\right)$

✓ **Jet p_T after subtraction** : $p_T^{jet-sub} = p_T^{jet} - Area^{jet} \times \rho(\varphi^{jet})$

✦ Event planes(Ψ_2, Ψ_3) are determined with VZERO detector

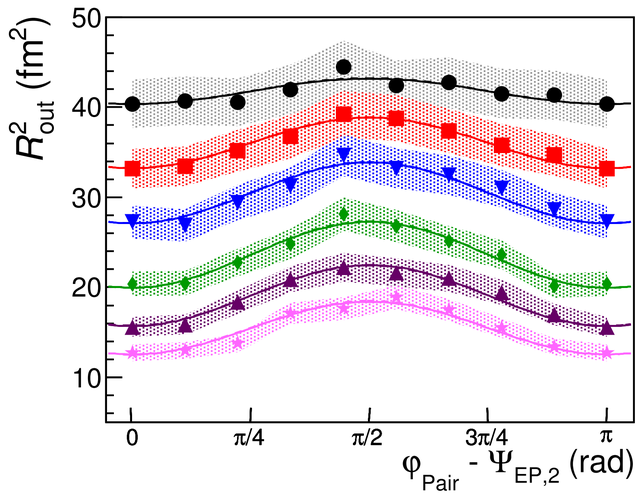
Azimuthally sensitive HBT

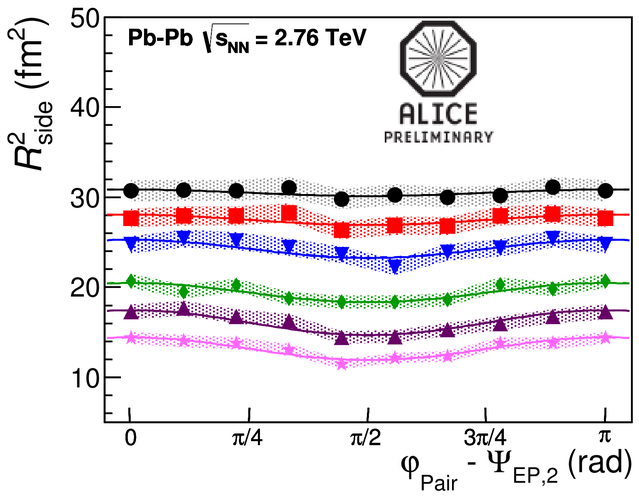
HBT w.r.t. Ψ_2 can measure **the source shape at freeze out** (Dividing pair emission angle w.r.t. Ψ_2 into several bins) .

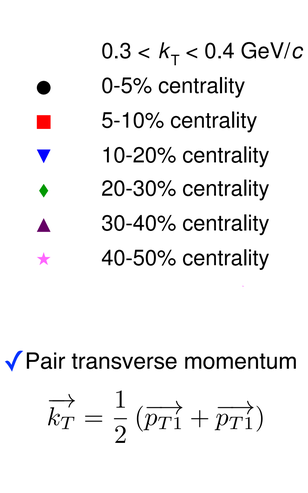
The results shows **explicit oscillation** and **opposite sign of R_{out} and R_{side}.**

This indicates the source keeps the initial elliptic shape until freeze-out.

Furthermore, comparing the initial and final source shape, system evolution can be investigated.







✓ Pair transverse momentum

$$\overrightarrow{k_T} = \frac{1}{2}\left(\overrightarrow{p_{T1}} + \overrightarrow{p_{T1}}\right)$$

Analysis method

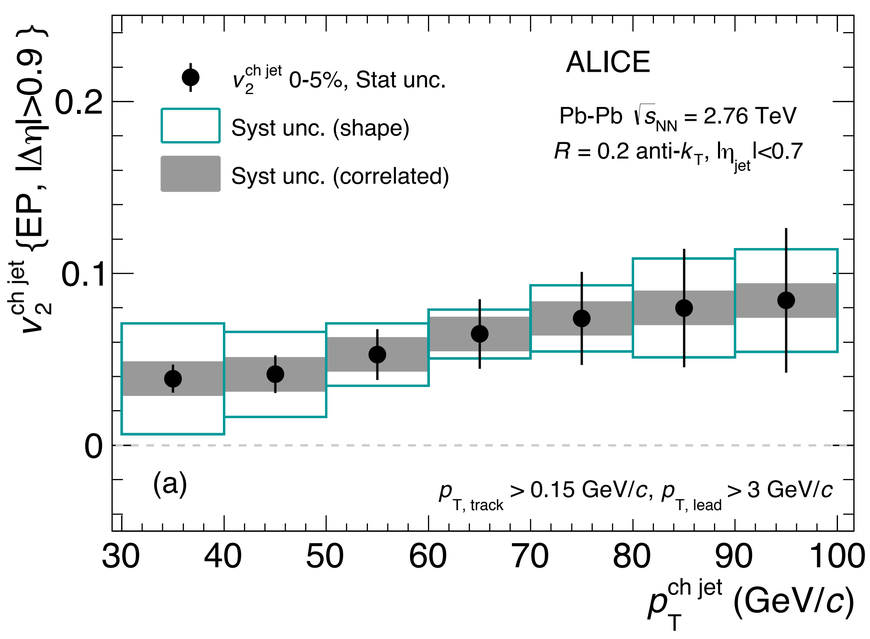
If jet modification affects medium shape, **azimuthally sensitive HBT should have the oscillation with respect to the leading jet axis.**

In HBT analysis, momentum range is very low(p_T:0.15-2.0 GeV/c). So **this analysis will be sensitive not to size of jet itself but to the bulk response and re-distributed hadrons.**

Recently **non zero jet v_2** is observed[3]. Therefore HBT w.r.t. jet axis will also include Ψ_2 HBT signal.

In order to understand jet modification in source shape, **Selecting jet axis w.r.t. Ψ_2 (Ψ_3) is important.**

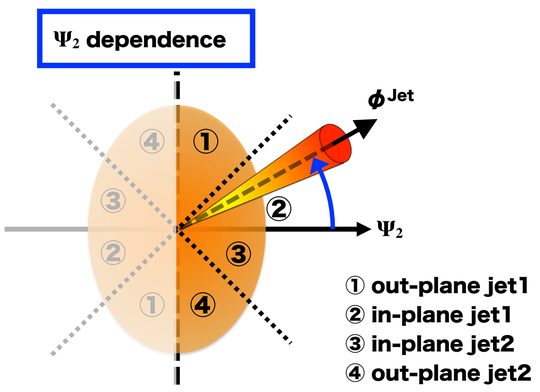
✳**HBT w.r.t. jet axis ①-④, ②-③ should be symmetric about jet axis**



HBT w.r.t. Jet axis
- **Jet medium interaction**
- **re-distribution of low p_T particles**
- **Jet background subtraction method**

Jet - Ψ_2 correlation

HBT w.r.t. Ψ_2
- **initial geometry**
- **collective flow**
- **(event plane resolution)**



Summary

✓ HBT w.r.t. jet axis is a new method to investigate the jet modification

✓ Momentum range is preferable to measure the bulk response

✓ Finite jet v_2 causes other contributing factors to HBT w.r.t. jet axis

➡ Selection of jet axis w.r.t. Ψ_2 is important

Outlook

✓ Azimuthally sensitive HBT w.r.t. jet axis

- k_T dependence
- Resolution parameter dependence

References

[1] S. Chatrchyan et al. (CMS Collaboration) Phys.Rev.C 84, 024906(2011)
[2] A. Adare et al. (PHENIX Collaboration) Phys. Rev. Lett. 111, 032301
[3] arXiv : 1509.07334 [nucl-ex]

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