

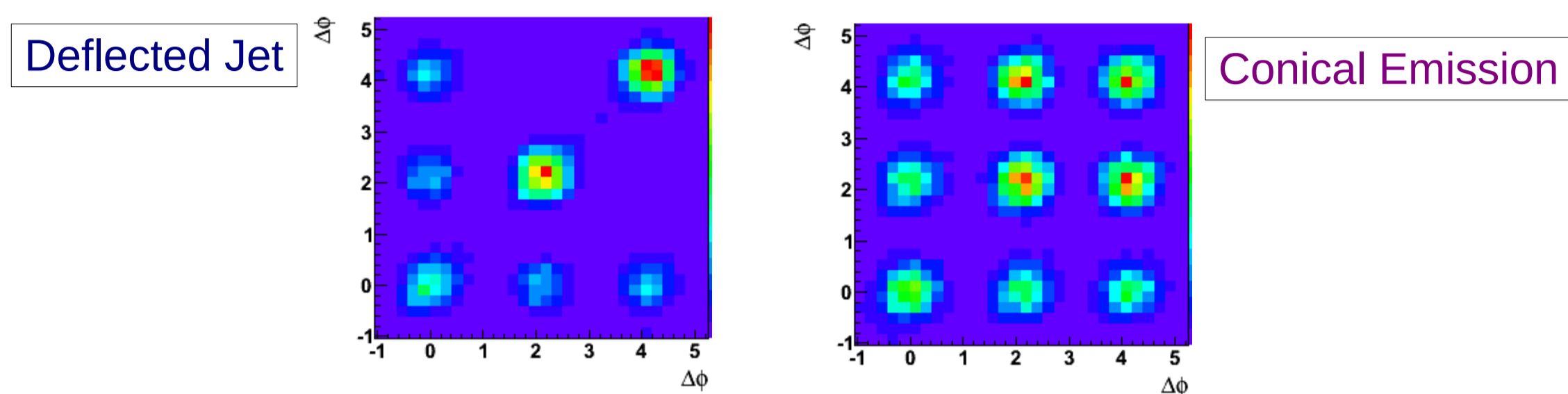
# Three-Particle Azimuthal Correlations with an Intermediate- $p_T$ Trigger in Pb-Pb at $\sqrt{s_{NN}}=2.76$ TeV in ALICE

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## Motivation

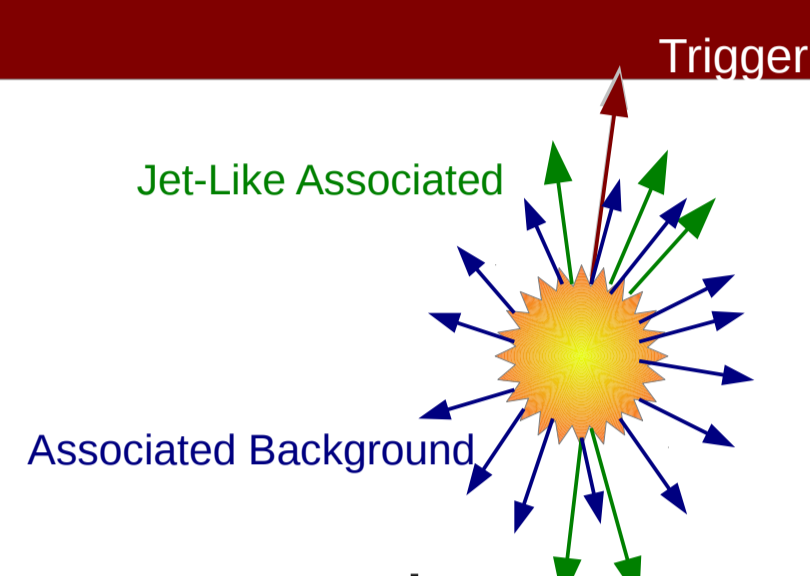
- Study interaction between jets and medium on the away-side.
- 3-particle correlations provide more information than two-particle correlations.
  - Three-particle correlations can distinguish between different physics scenarios such as:
    - **Conical Emission** from Mach-cone shock waves or Čerenkov gluon radiation.
    - **Deflected Jets**, jets not back-to-back due to radial flow, path-length dependent energy loss, or  $k_T$ .

### Simulated 3-Particle Toy Model Signals With Same Two-Particle Correlation Signal



## Analysis Method

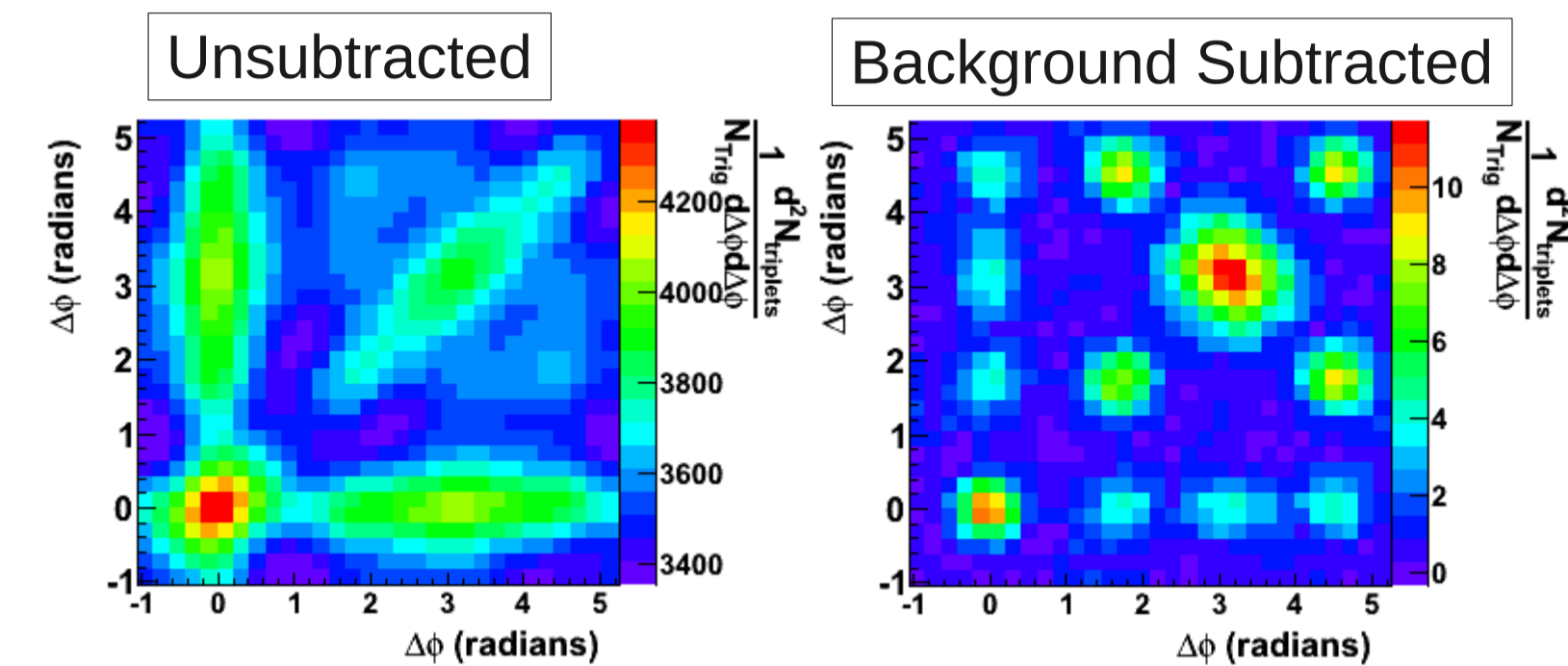
- Unsubtracted signal from triplets of charged particles in the TPC.
  - one  $3 < p_{T, \text{trig}} < 4$  GeV/c trigger particle
  - two  $1 < p_{T, \text{assoc}} < 2$  GeV/c associated particles
- 2- and 3-particle backgrounds constructed and subtracted under the assumptions:
  - Zero Yield At Minimum background normalization.
  - Can decompose signal into jet-like correlations and background.
- **Trigger-Associated Background**
  - Made from measured 2-particle correlation between trigger and one associated.
  - Contains all 2-particle correlations between trigger and associated including:
    - flow
    - resonances
    - jet-like correlations
- **Associated-Associated Background**
  - Made from the measured 2-particle correlation from the associated particles.
  - Contains all 2-particle correlations between the two associated particles.
- **Three-Particle Flow Background**
  - Dominant three-particle flow from  $v_2 v_2 v_4$ .
    - $2v_{2,T}v_{2,1}v_{4,2}\cos(4\Delta\varphi_2 - 2\Delta\varphi_1) + 2v_{2,T}v_{2,2}v_{4,1}\cos(4\Delta\varphi_1 - 2\Delta\varphi_2) + 2v_{2,1}v_{2,2}v_{4,T}\cos(2\Delta\varphi_1 + 2\Delta\varphi_2)$
  - Small relative to the background subtracted signal. Higher order flow terms even smaller.
- **Jet  $\otimes$  Flow**
  - Non-flow components of Trigger-Associated and Associated-Associated backgrounds might flow with the other particle..
  - ALICE flow measurements for the 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> harmonics were used.



## Simulations

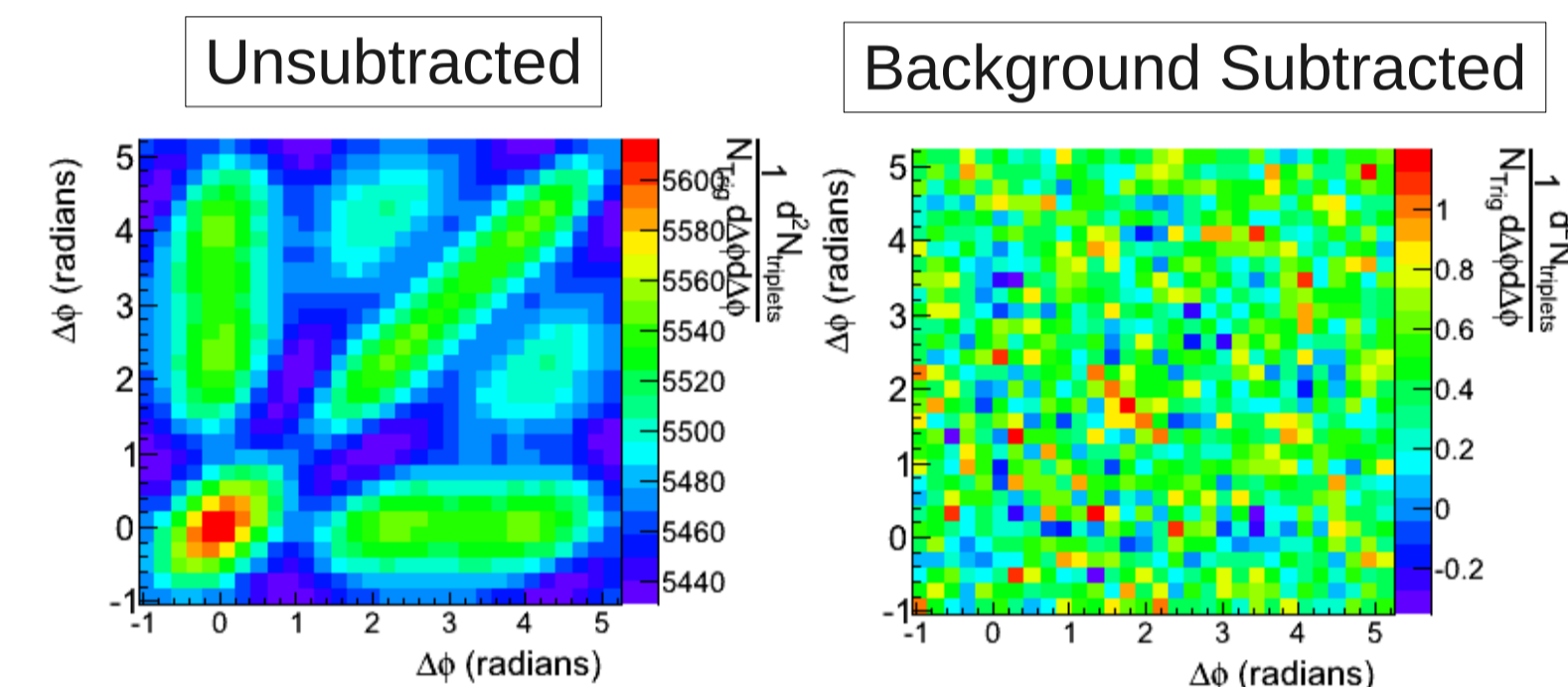
### Toy Model Di-Jets and Cones on Flowing Background

- Jet simulated on background with  $v_2, v_3$ , and  $v_4$ .
- 50% of the time away side is back-to-back with trigger.
- 50% of the time away side is a cone.
- Both di-jet and cone away-side structures are recovered.



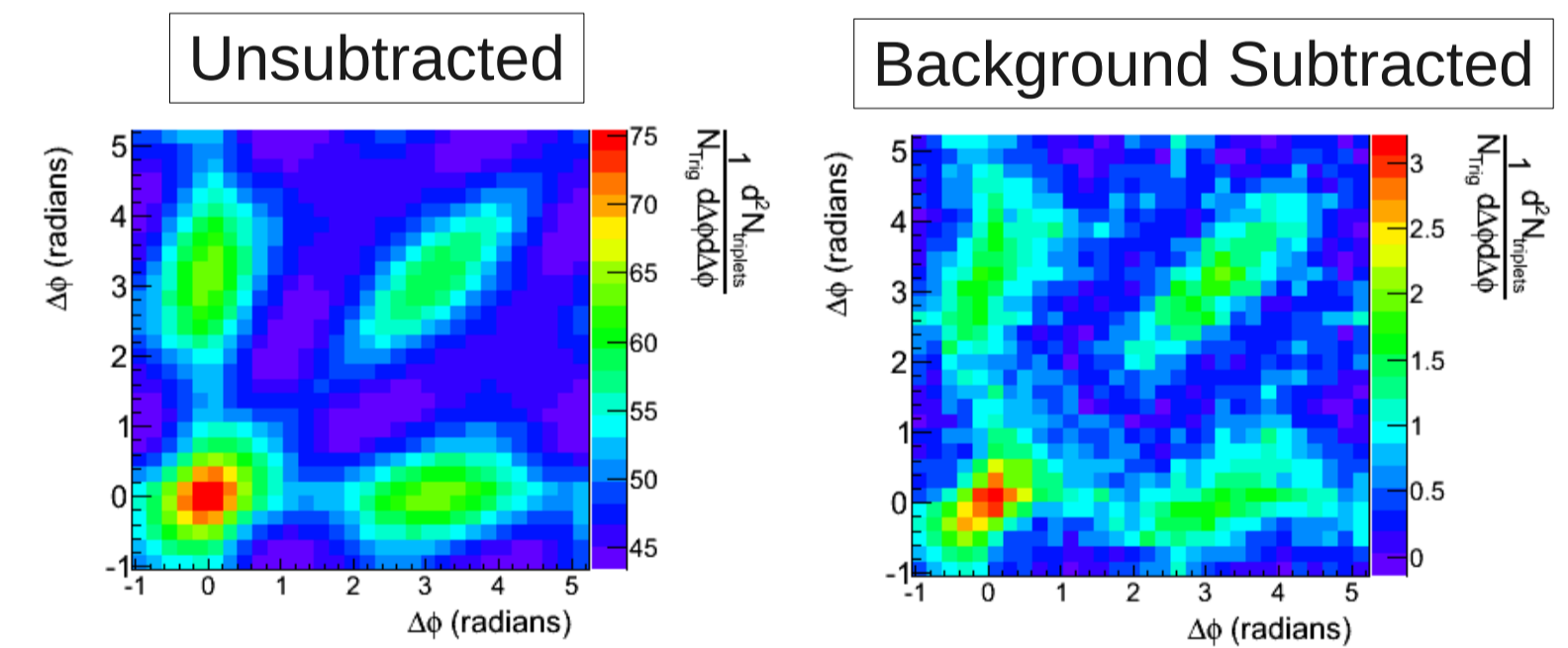
## Glauber Model

- Event-by-event  $v_2, v_3, v_4, v_5$ , and their respective event planes from Glauber model.
  - Gives realistic event-by-event flow fluctuations.
  - No statistically significant signal.
    - No 3-particle signal from flow fluctuations.
    - $v_2 v_3 v_5$  term is negligible for this analysis.

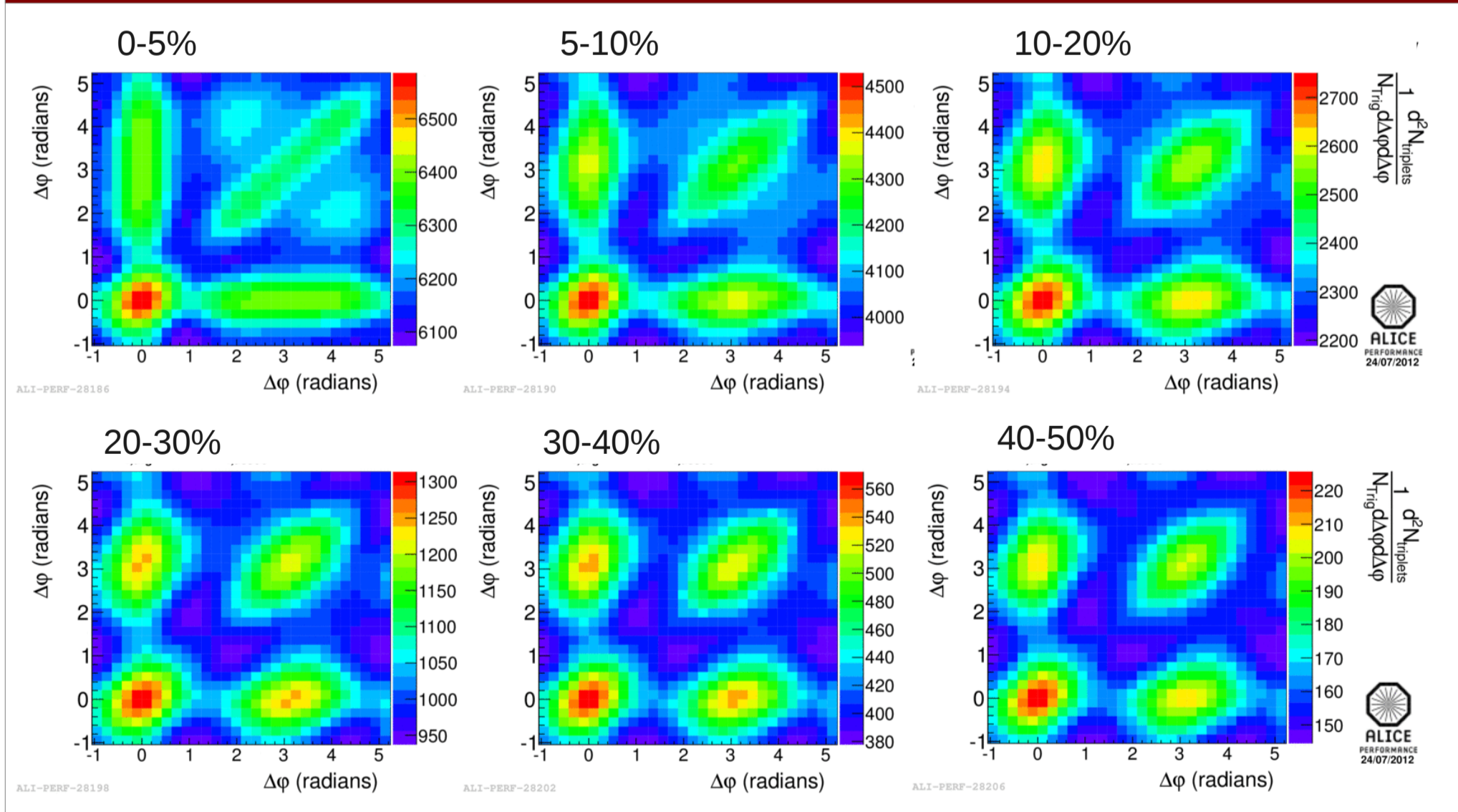


## AMPT 40-50%

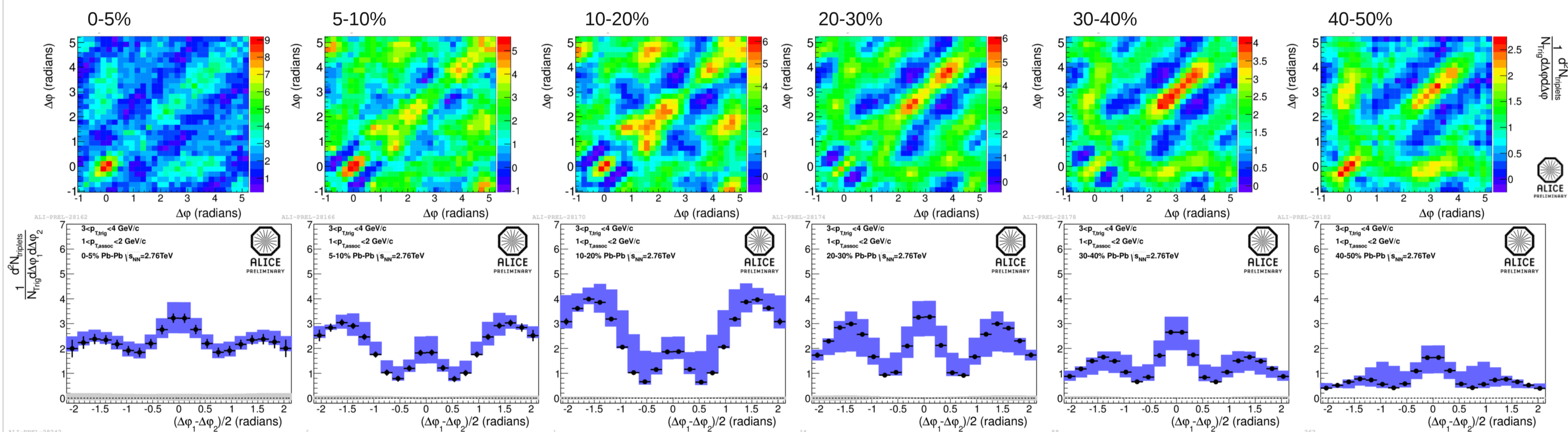
- Currently only enough statistics in the 40-50% centrality bin.
- Backgrounds are lower than in real data.
- Background subtracted signal:
  - consistent with data
  - consistent with  $k_T$  broadened almost back-to-back jet.



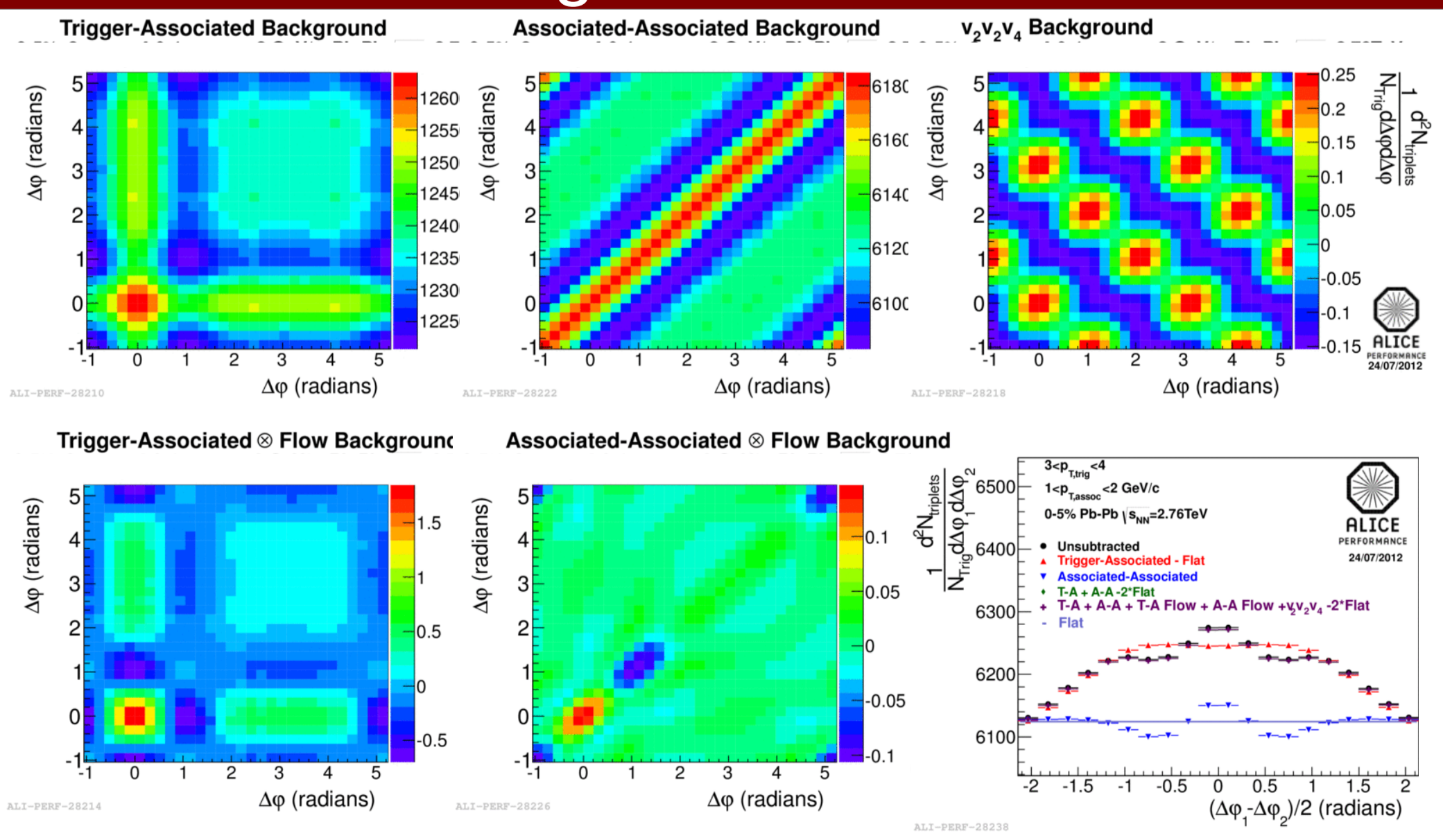
## Unsubtracted 3-Particle Correlations



## Background Subtracted Results in 6 Centrality Bins



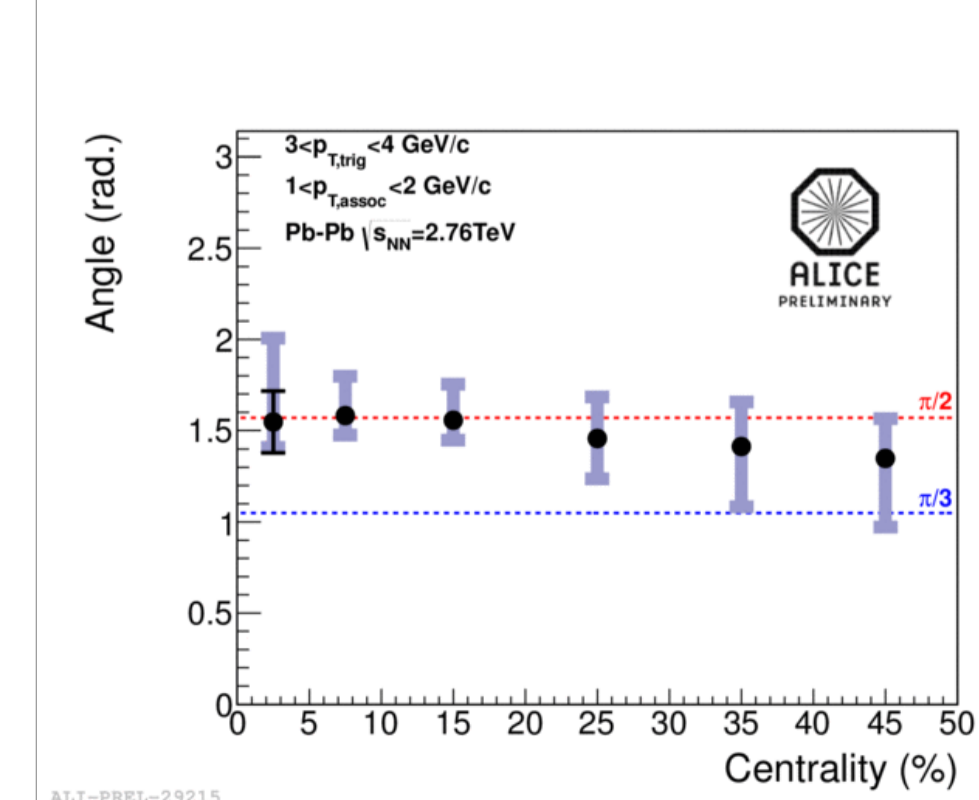
## 3-Particle Backgrounds For 0-5% Pb+Pb



## Conclusions

- 40-50% Pb-Pb:
  - Consistent with  $k_T$  broadened di-jet.
  - Consistent with 40-50% AMPT.
- 0-20% Pb-Pb shows significant off-diagonal peaks:
  - Non-di-jet residual signal
  - Peak angle from Gaussian fit  $\sim \pi/2$ .
  - Not a  $v_3$  peak, would be at  $\pi/3$ .

## Side-Peak Angle



## pp at 7 TeV

