Recent measurements[1] of the azimuthal anisotropy of prompt D^0 mesons in PbPb collisions with the CMS detector at the LHC

(on behalf of the CMS Collaboration)

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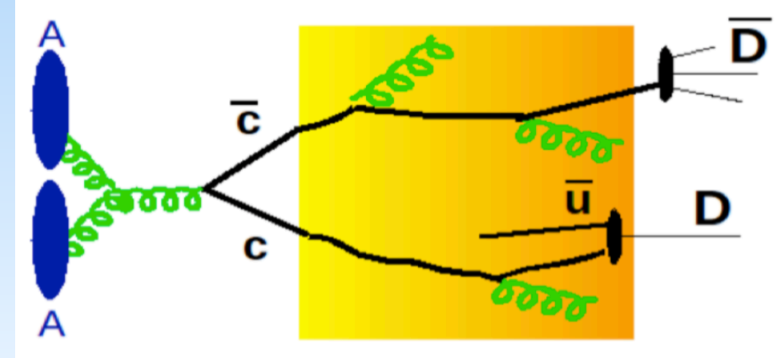
Physics motivation

- Mostly produced in primordial stages of collision (~0.1 fm/c).
  → sensitive probe of strongly-interacting medium.
  → Low probability of annihilation
- More data than the previous CMS publication[2].



Data sample

- 4.27×10^9 minimum-bias Events from PbPb collisions events at $\sqrt{s_{NN}}$ = 5.02 TeV at the LHC in 2018.
- Monto Carlo (MC) samples (D^0): based on Pythia8.

Event selection

- $|v_z| \leq 15$ cm .

Track selection

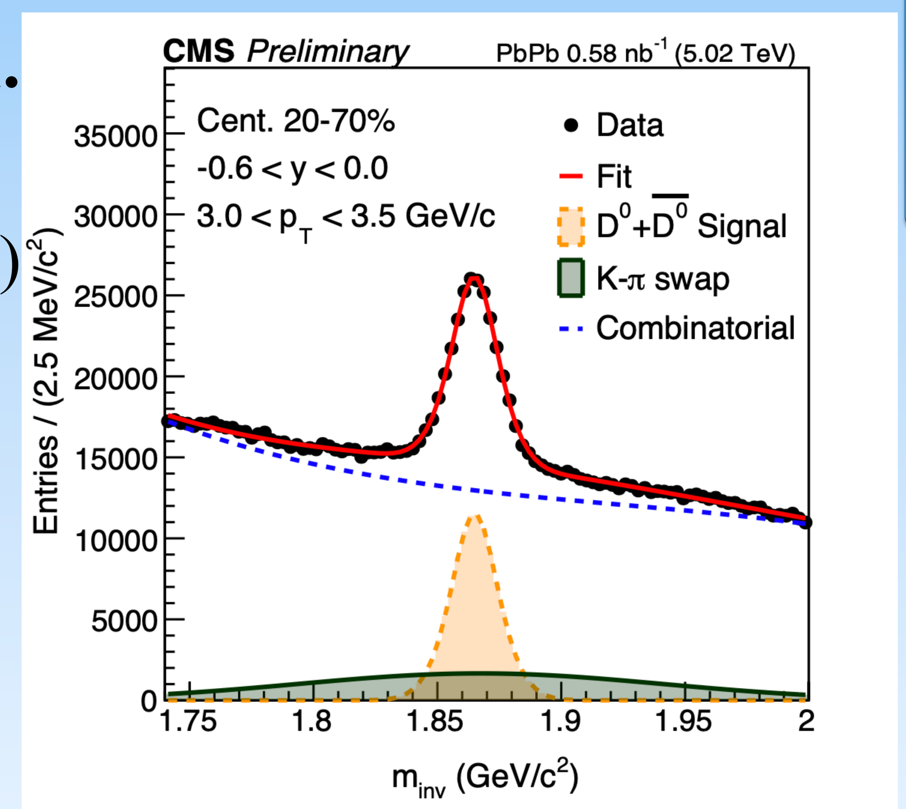
- $p_T > 1.0$ GeV
- $|\eta| < 2.4$

Prompt D^0 reconstruction and optimization.

Prompt D^0 meson reconstructed in fully hadronic decay channel: $D^0 \rightarrow K^- + \pi^+$ (total BR: 3.89% [3])

Invariant mass fit: 3 components.

- ➢ Signal: Double gaussian.
- ➢ Swap: Single gaussian.
- ➢ Combinatorial background: 3th polynomial.



Systematic uncertainty

- ✓ BDT selection.
- ✓ Bkg. mass PDF.
- ✓ Bkg. v_n PDF
- ✓ D^0 efficiency correction.
- ✓ Non-prompt contamination.

Analysis technique

1. Scalar product method.

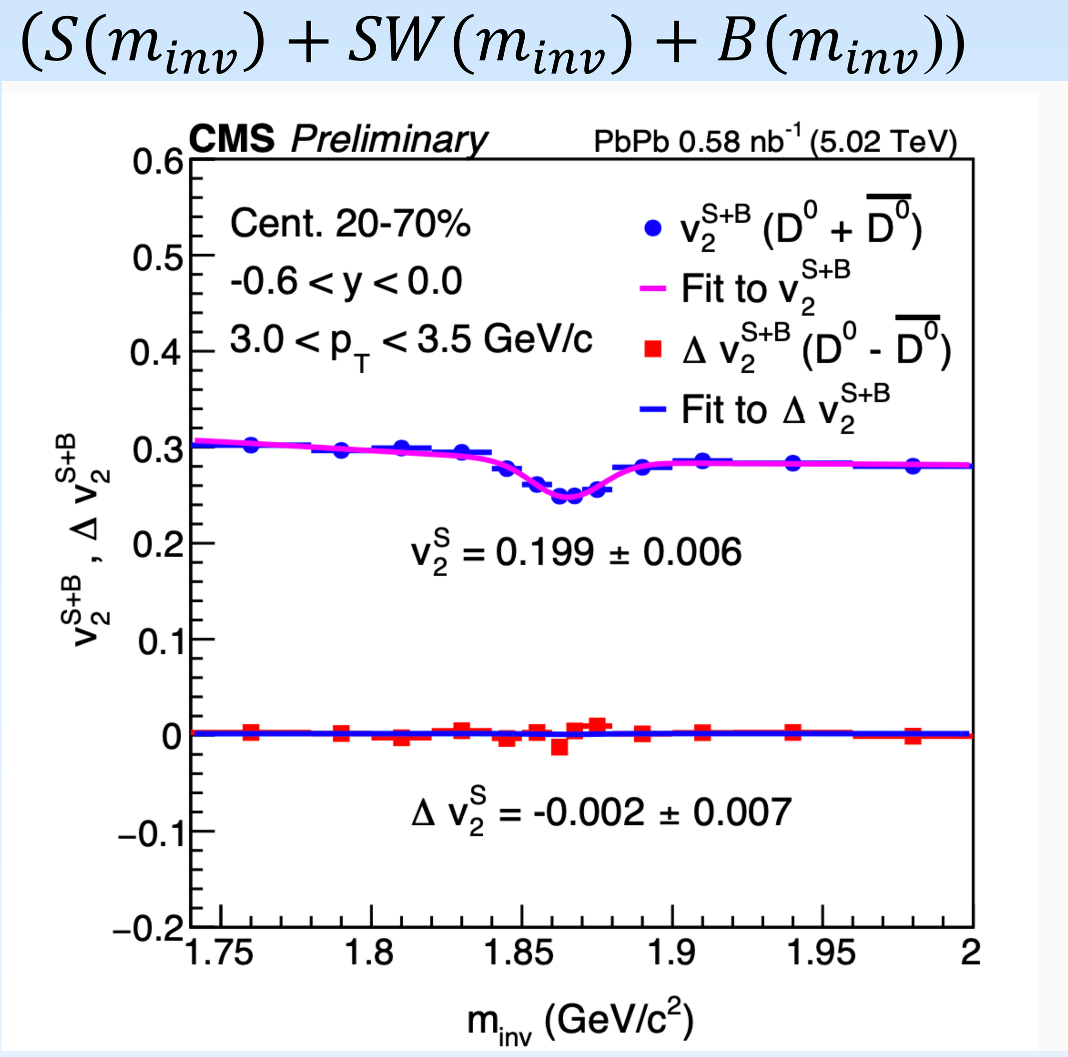
$$v_n\{SP\} \equiv \frac{< Q_n^{D^0}\, Q_{nA}^* >}{\sqrt{\frac{< Q_{nA} Q_{nB}^* >< Q_{nA} Q_{nC}^* >}{< Q_{nB} Q_{nC}^* >}}}$$

Where: Q_{nA}, Q_{nB} and Q_{nC} are Q-vectors.
Q_{nA}: $HF(-5 < \eta < -3)$,
Q_{nB}: $HF(3 < \eta < 5)$
Q_{nC}: $TRACKER\ (-0.75 < \eta < 0.75)$

2. Extraction of D^0 v_2

$$v_n^{sig+bkg}(m_{inv}) = \alpha(m_{inv}) v_n^{sig} + v_n^{bkg}(m_{inv})\ (1\text{-}\ \alpha(m_{inv}))$$

where:
m_{inv} : D^0 invariant mass,
$\alpha(m_{inv})$: D^0 signal fraction, is defined:
$\alpha(m_{inv}) = (S(m_{inv}) + SW(m_{inv}))/(S(m_{inv}) + SW(m_{inv}) + B(m_{inv}))$



Result.

- ➢ With a high precision data, new results showed in Fig. 1 are consistent with publication results[2] .
- ➢ Providing more differential information of v_2 and v_3 at low p_T.

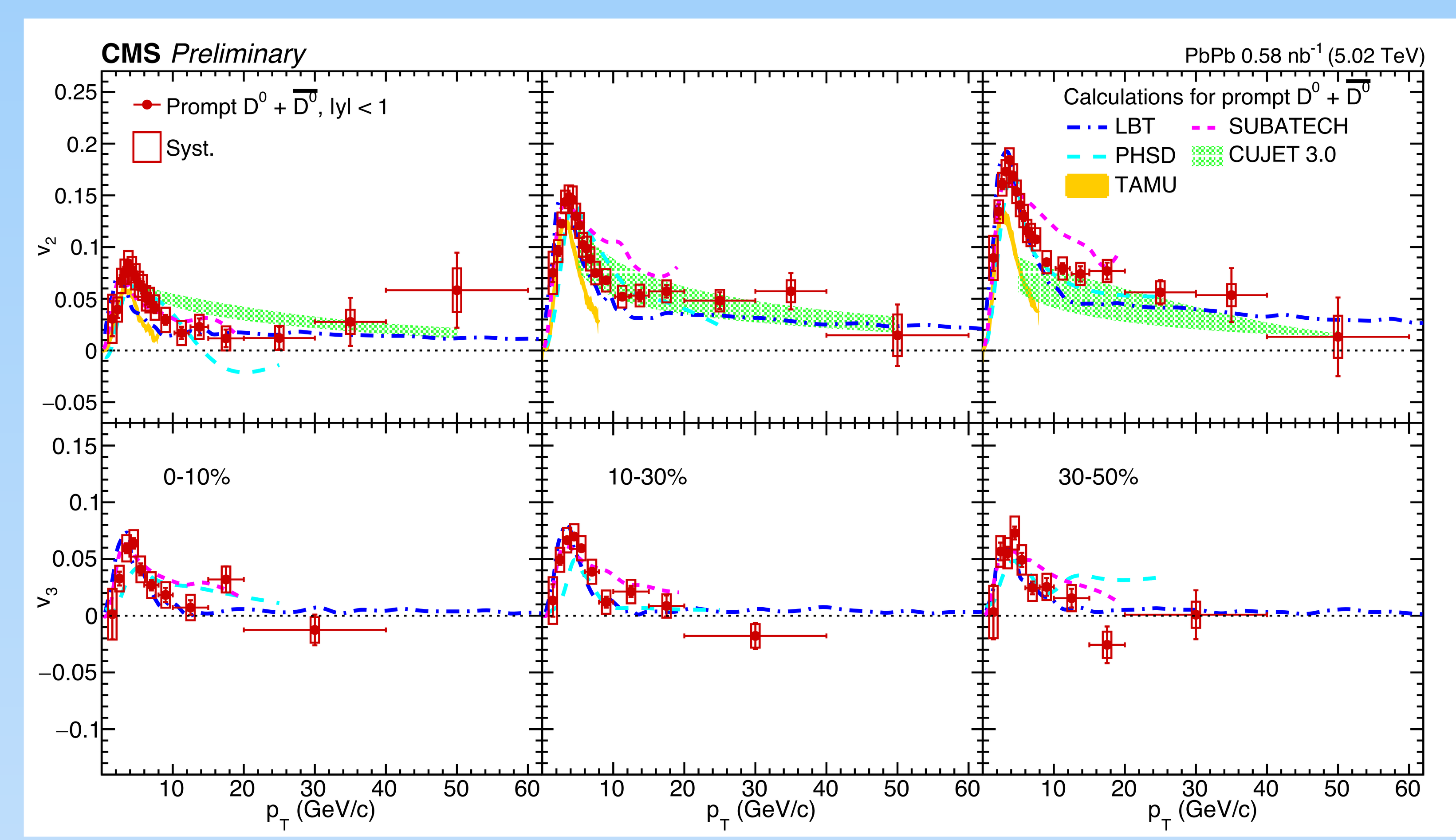


Fig. 1. v_2(top) and v_3(bottom) at| y| < 1.0 for 0-10% (left), 10-30% (middle) and 30-50% (right).

- ➢ Rapidity dependence of Heavy flavor collective flow is explored for the first time, as shown in Fig. 2, and no significant rapidity dependence is observed.

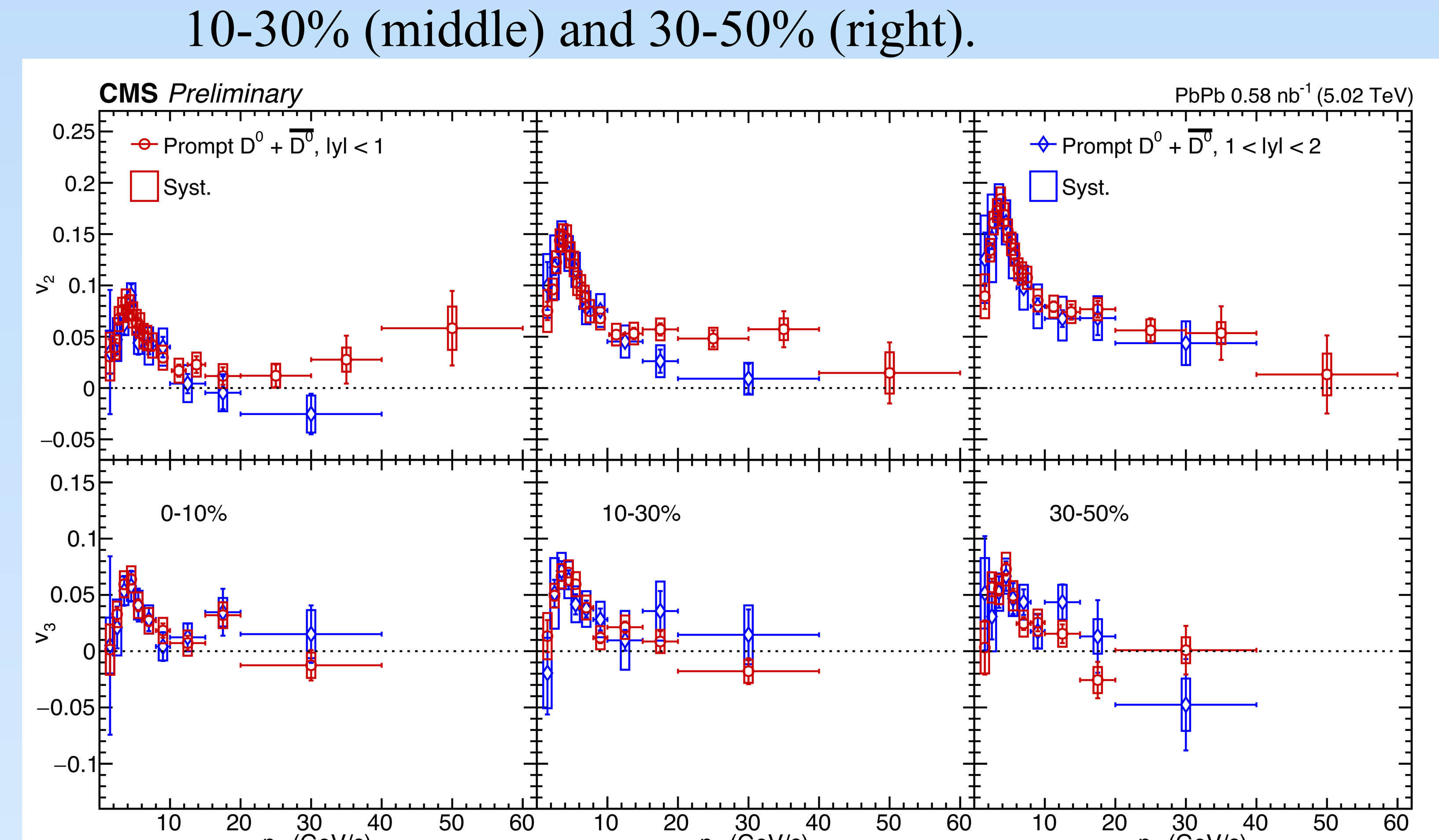


Fig. 2.v_2(top) and v_3(bottom) at |y| < 1.0 and at 1 < |y| < 2.0 for 0-10%, 10-30% and 30-50%.

- ➢ A clear increasing and then declining trend are shown in Fig. 3 from most central to mid-central and then to peripheral events, like charged particles.

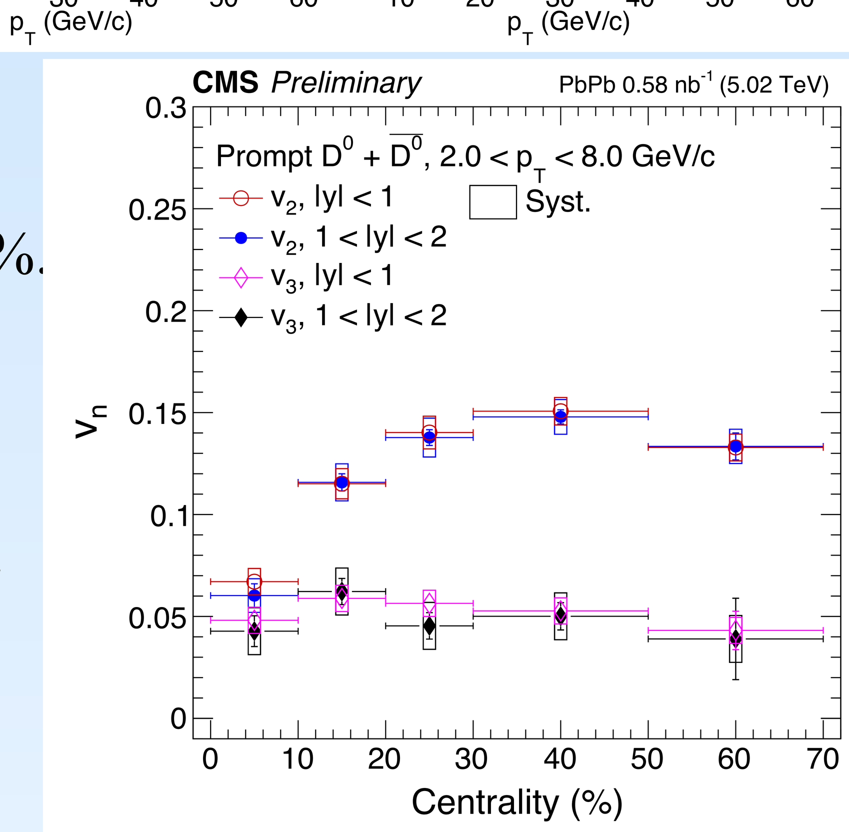


Fig. 3. v_2 and v_3 as functions of centrality, for $2.0 < p_T < 8.0$ GeV/c and for rapidity |y| < 1 and 1< |y| < 2.

[1] CMS-PAS-HIN-19-008 (2019), https://cds.cern.ch/record/2699493
[2] CMS Collaboration, Phys. Rev. Lett. 120 (2018) 202301.
[3] M. Tanabashi et al (Particle Data Group), Phys. Rev. D 98, 030001 (2018).

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