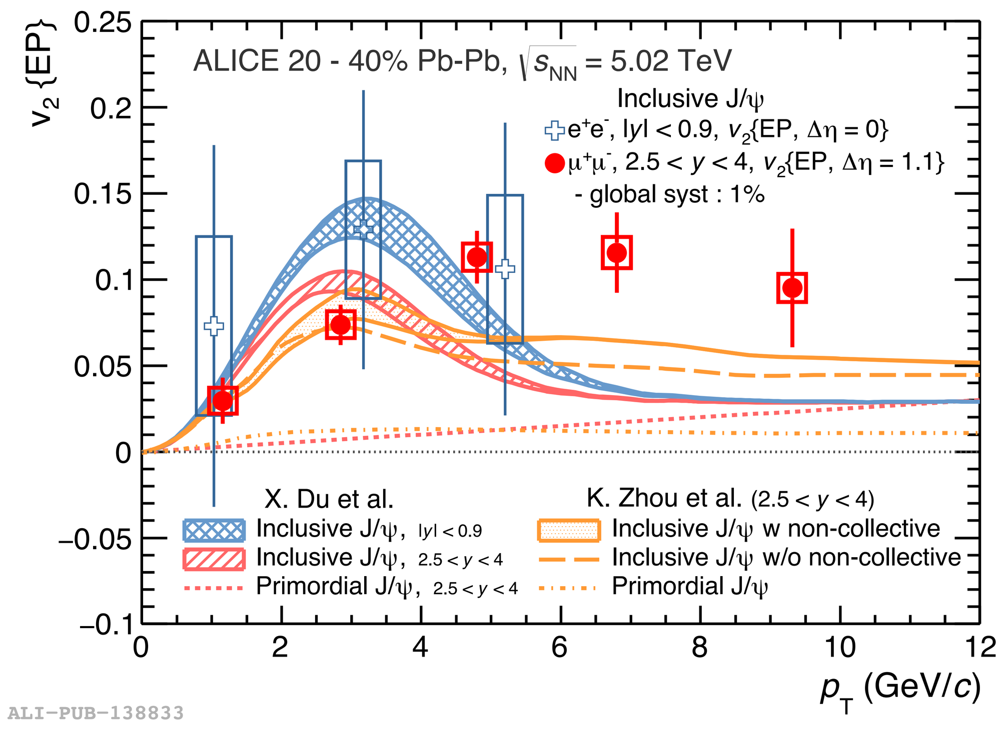
J/ψ elliptic flow

Audrey Francisco
for the ALICE Collaboration

Heavy quarks participate to the **collective expansion dynamics**

(Re)combined states should inherit their flow



Relevant observable for **quarkonium (re)generation study**

The J/ψ meson flows ! ALICE, PRL 119 (2017) 242301

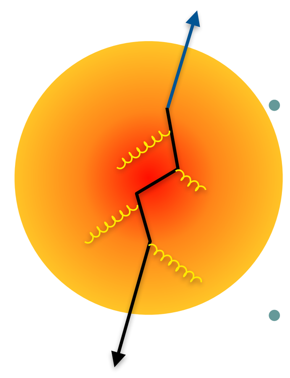
A positive J/ψ elliptic flow was measured in Pb-Pb collisions at $\sqrt{s_{NN}}$ =5.02TeV with a significance of 6σ

This favours transport models including charm thermalization

Lower energy measurements do not exhibit a sizeable v_2

At high p_T its origin is not quantitatively understood

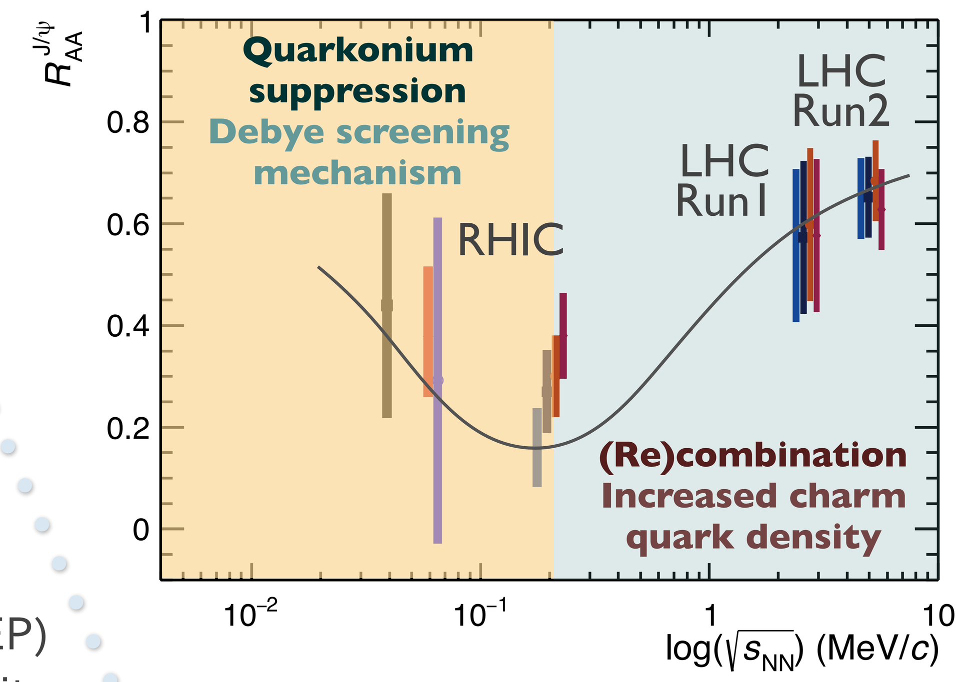
Heavy quarks in Pb-Pb collisions at the LHC



- early production (τ_c ~ 0.08 fm/c, τ_b ~ 0.02 fm/c vs. τ_{QGP} ~ 0.3 fm/c)
  → experience the full system evolution
- interact with the QGP : sensitive to the medium properties
- same number per binary collision produced in Pb-Pb and in pp

➡ Quarkonium in Pb-Pb collisions : hard probes of the QGP

Two antagonist mechanisms are required to reproduce experimental observations

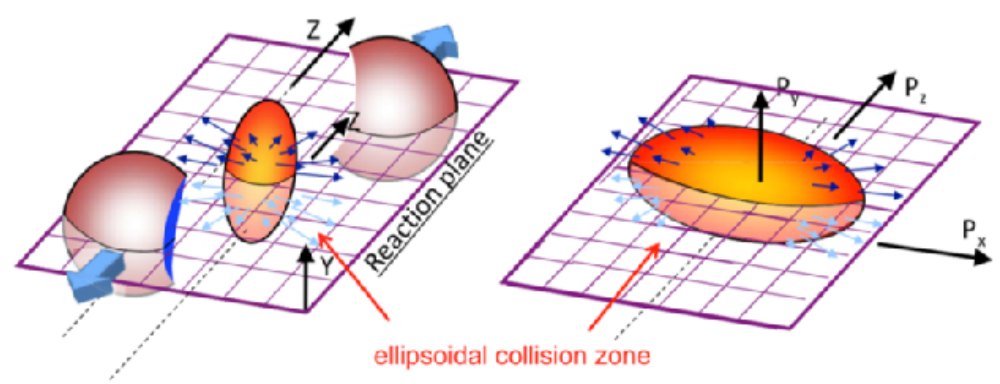


The flow observable

Anisotropic matter distribution around the collision converted into momentum distribution anisotropy described with a Fourier distribution

2nd coefficient: the elliptic flow $v_2 = \langle cos[2(\phi - \Psi_{2,R})] \rangle$

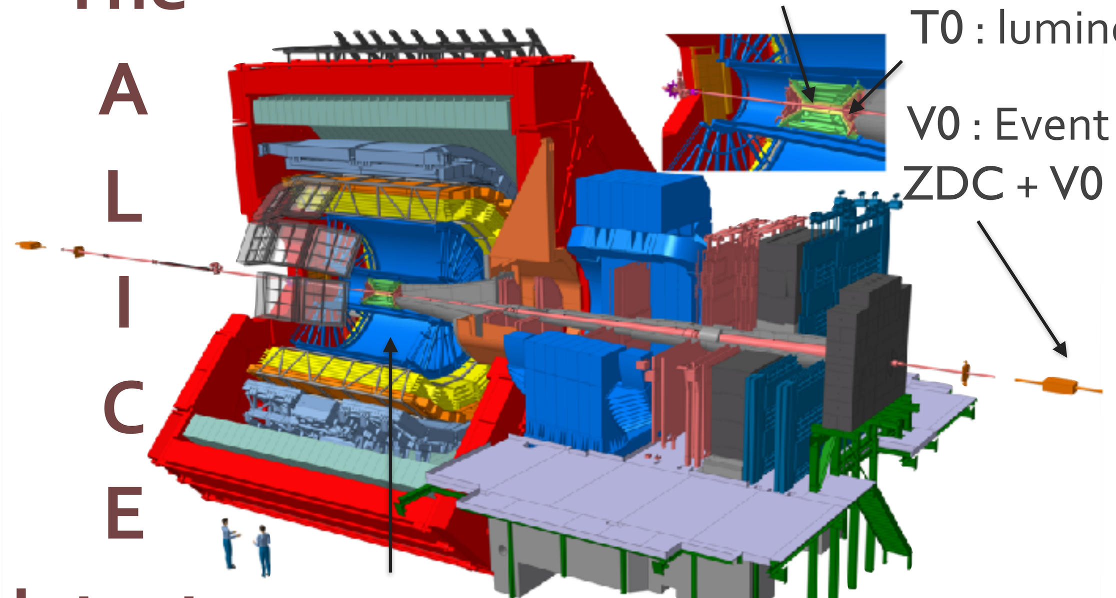
origin: early, partonic stages of the system



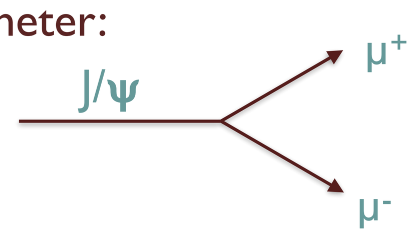
Run 2 (2015-2016) : Pb-Pb at $\sqrt{s_{NN}}$=5.02 TeV

$\mathcal{L}$ = 225μb^{-1}

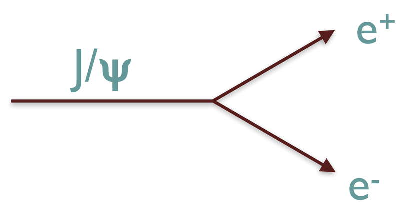
The ALICE detector



J/ψ study with the muon spectrometer:
- forward rapidity : 2.5 < y < 4
- down to p_T = 0



J/ψ study with the TPC:
- mid-rapidity : |y| < 0.9
- down to p_T = 0

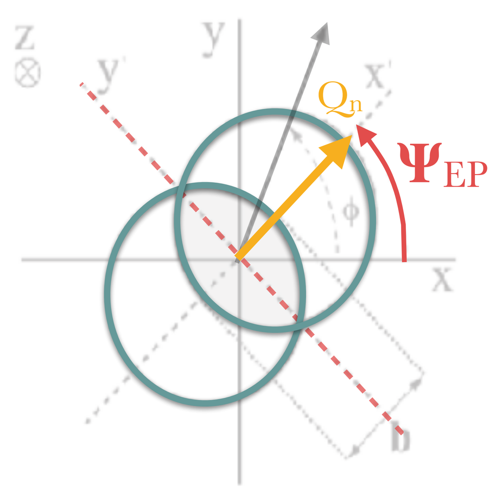


Analysis strategy

Methods based on event plane determination

From detector multiplicities : $\Psi_n = \frac{1}{n} arctan(Q_{n,x}, Q_{n,y})$

- Detector resolution computed using the 3 sub-event method
- Deal with non-uniform acceptance



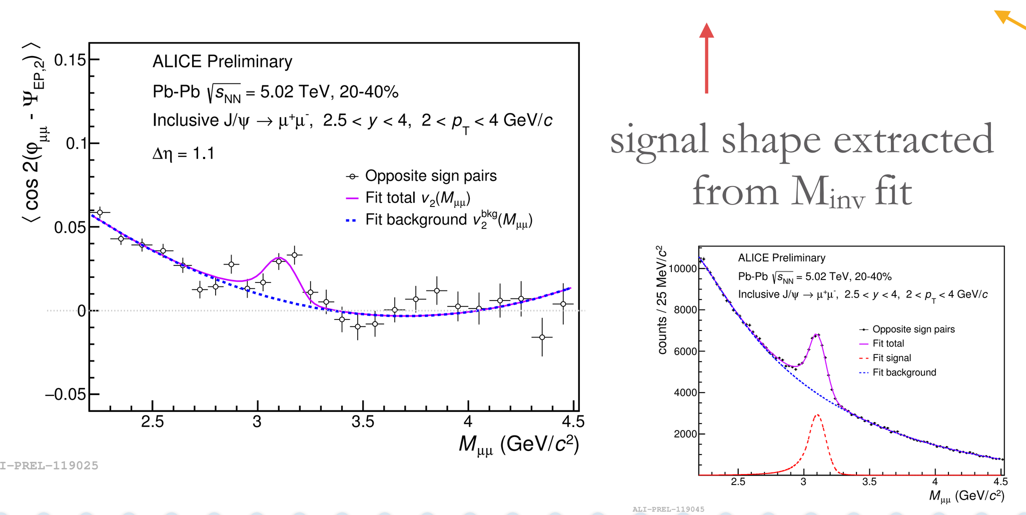
Fit of ⟨cos(2 Δφ)⟩ distribution vs inv. mass with Δφ = $\varphi_{\mu\mu}$ - $\Psi_{2,EP}$

Model total flow as

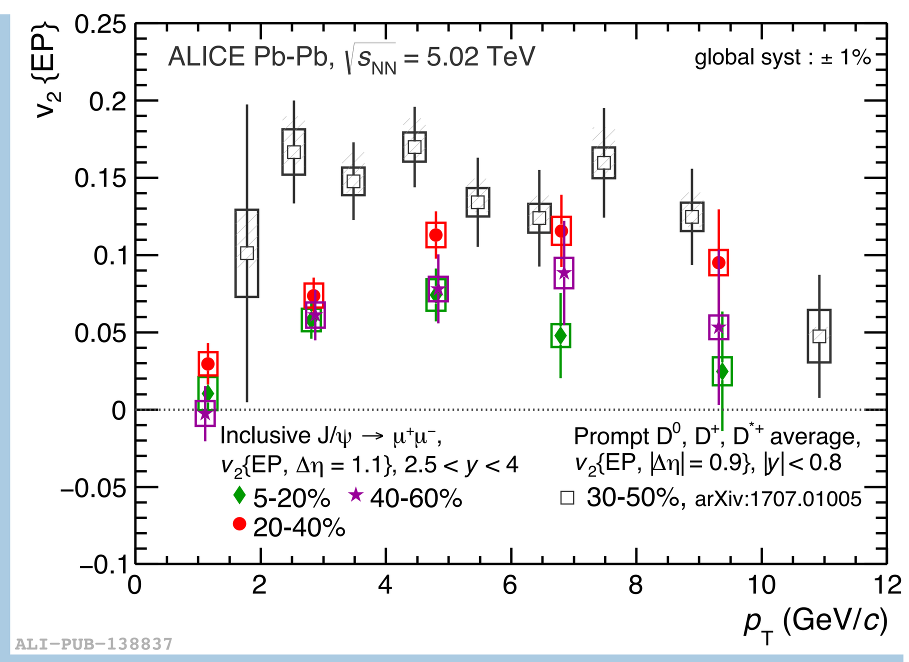
$$v_2(m_{\mu\mu}) = v_2^{sig}\alpha(m_{\mu\mu}) + v_2^{bck}(1-\alpha(m_{\mu\mu}))$$

signal shape extracted from M_{inv} fit

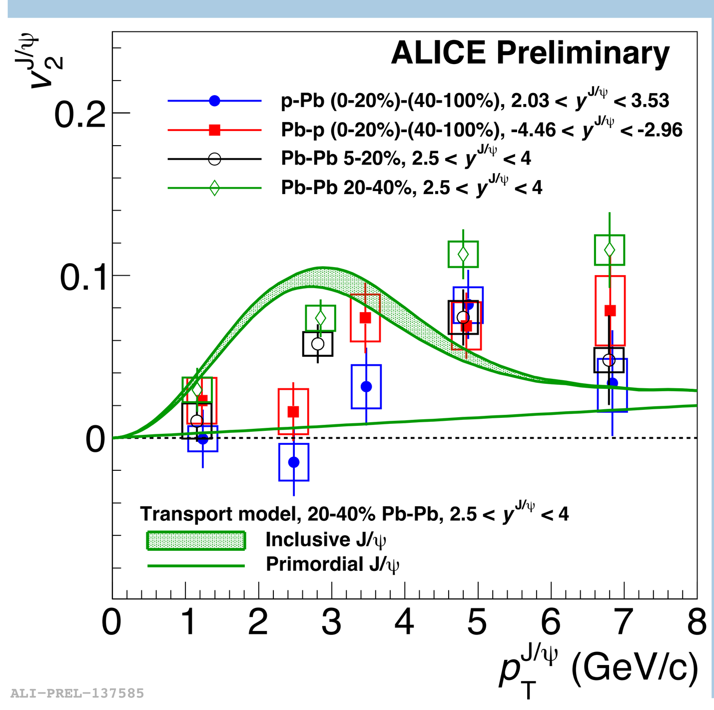
background : e.g. polynomial function



Results and interpretation



- Significant v_2 is observed
  - in 2 rapidity regions
  - and for different centrality ranges
- Clear indication of charm quark (re)combination
- Comparison to D mesons : strong hint of charm thermalisation
- Transport models do not reproduce the p_T dependence…



…and in p-Pb collisions a similar v_2 is observed at high p_T, suggesting a common missing mechanism

Thermal charm quark might not be the only source of J/ψ flow

→ path-length dependence, strong magnetic field, other ?

References

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