Event-by-Event correlations and fluctuations with strongly intensive quantities in heavy-ion collisions with ALICE

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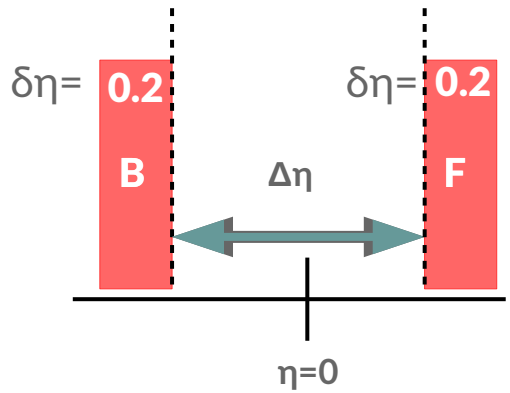
Introduction: Why do we study strongly intensive quantities?

- **The forward-backward (FB)** correlation coefficient b_{corr} is largely influenced by **geometrical (volume) fluctuations.**



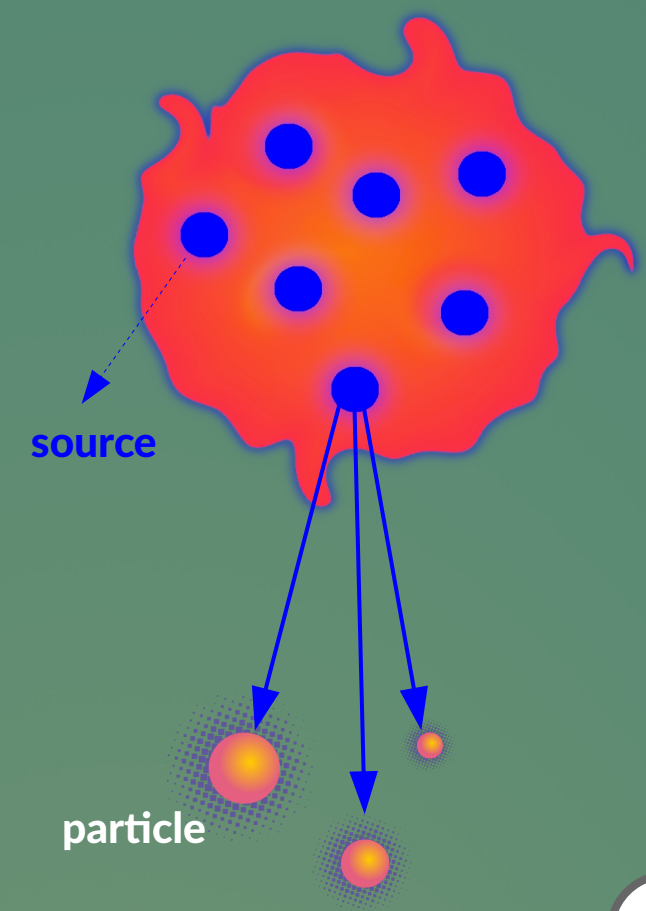
- **Strongly Intensive quantities** do not depend on system volume nor system volume fluctuations.

STRONGLY INTENSIVE QUANTITY Σ:

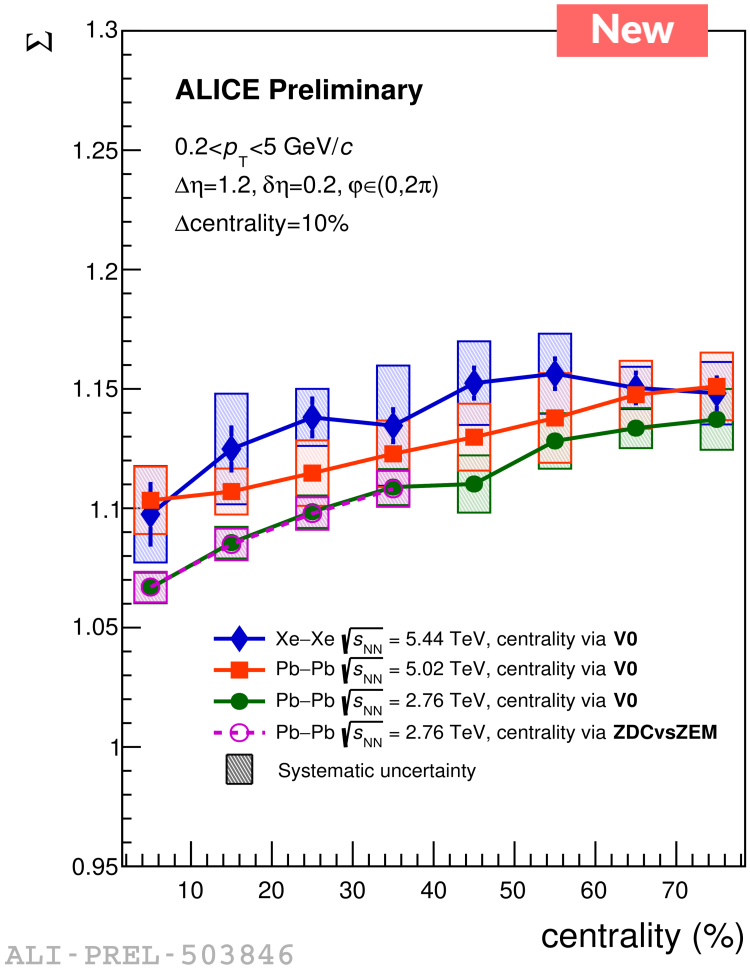
$$\Sigma = \frac{\langle n_F \rangle \omega_B + \langle n_B \rangle \omega_F - 2\mathrm{Cov}(n_F, n_B)}{\langle n_F \rangle + \langle n_B \rangle}$$

- For a symmetric collision: $\Sigma \approx \omega(1-b_{corr})$.

*Σ → gives direct information about characteristics of **the single source distribution!***



Results: Σ as a function of centrality



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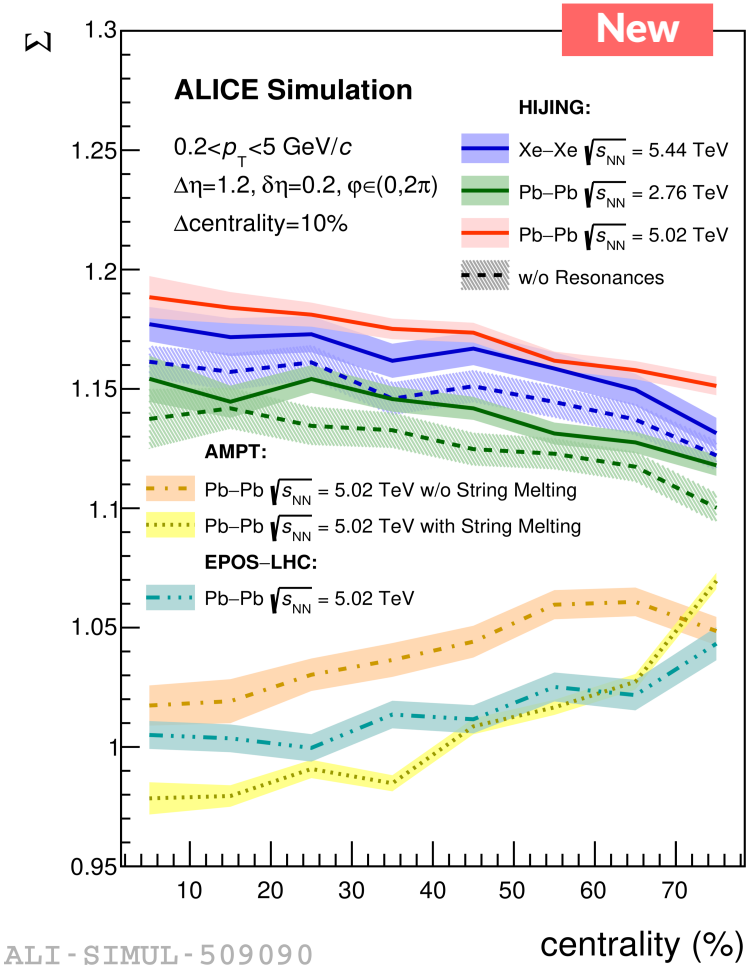

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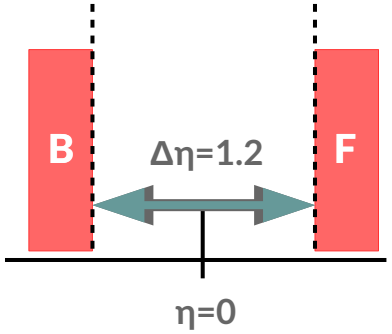
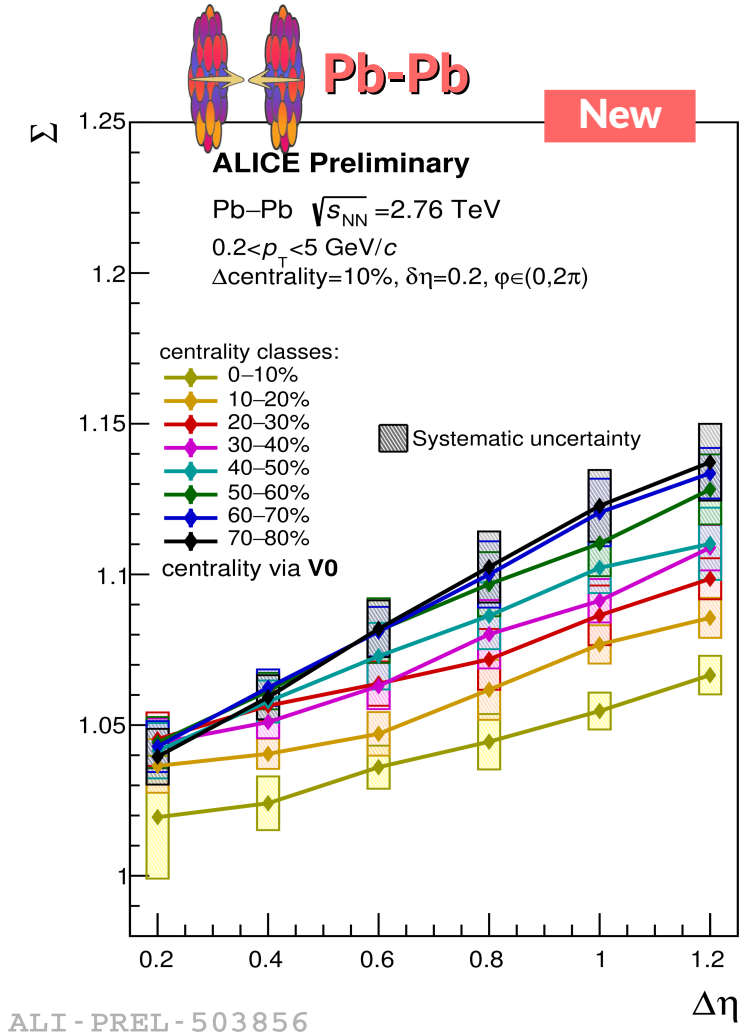


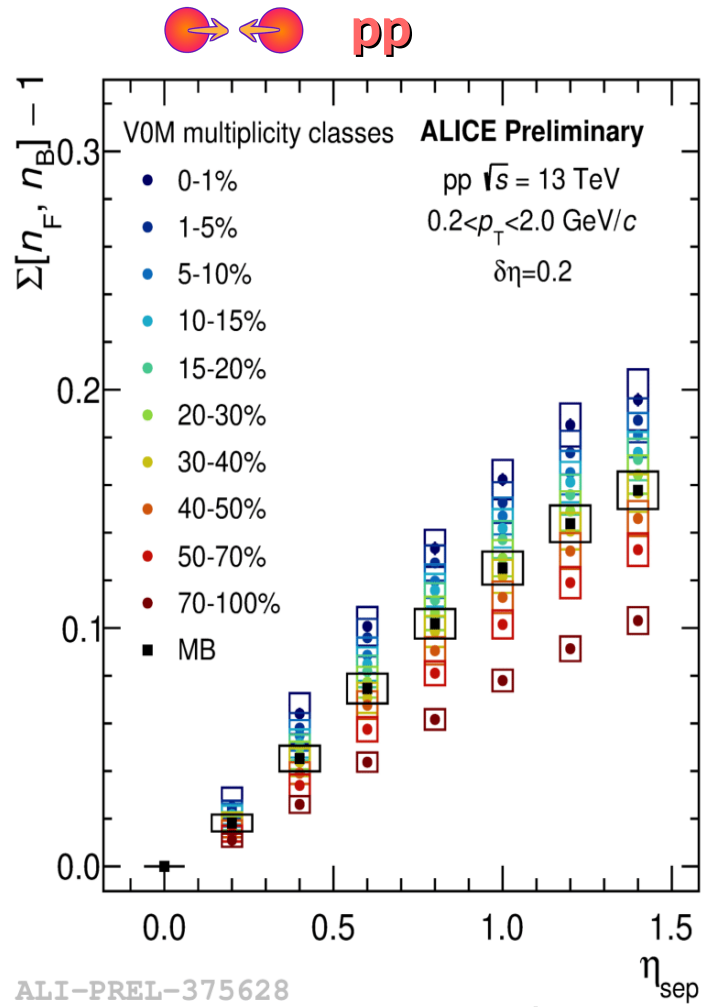
V0 ≈ ZDCvsZEM

→ Σ is independent on centrality estimator!

- Values of Σ **increase with energy** and **increase with decreasing centrality** in experimental data, contrary behavior noted for HIJING results.
- AMPT and EPOS reproduce dependence on centrality **qualitatively** but **not quantitatively.**
- The AMPT results show that Σ is sensitive to the initial conditions.

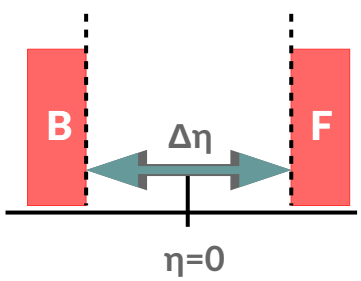
Results: Σ as a function of Δη



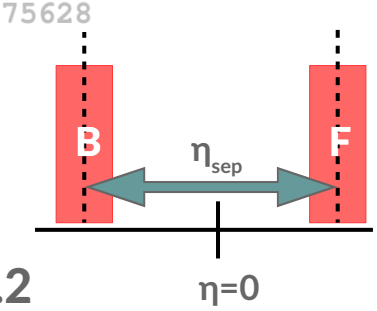


- **Increase** with Δη;
- **Pb-Pb: decrease** of Σ with increasing centrality class;
- **pp:** Σ **grows** with the increase of forward event multiplicity; contrary to Pb-Pb collisions.

Different ordering of Σ with centrality for Pb-Pb and pp collisions.

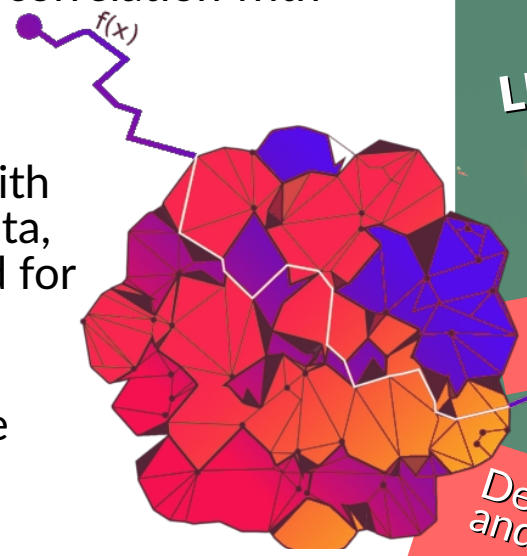


$\eta_{sep} = \Delta\eta + 0.2$



Summary

- New results for measurement of the FB correlation with **the strongly intensive quantity Σ** have been presented.
- Σ **increases** with collision energy, and with decreasing centrality in experimental data, **contrary** behavior noted for HIJING and for experimental pp collisions.
- Removal of resonances does not change the dependence of Σ on centrality.
- AMPT and EPOS reproduce the dependence on centrality **qualitatively**, but **not quantitatively**.
- In AMPT, Σ is sensitive to **the initial conditions** (string melting).
- The comparison of **centrality ordering** in A-A reactions versus theoretical models, and experimental pp data, may provide **new insight** into the underlying dynamics of the collision.
- **What model can reproduce Σ behavior?**



ALICE

LEARN MORE ABOUT Σ:
with one "click"

Strongly Intensive Quantities

Dependence on centrality selection and volume fluctuations

Σ in pp with ALICE

Σ in A-A with ALICE