

Two-particle short-range correlations relative to the reaction plane in Au+Au collisions at 200 GeV at RHIC/STAR

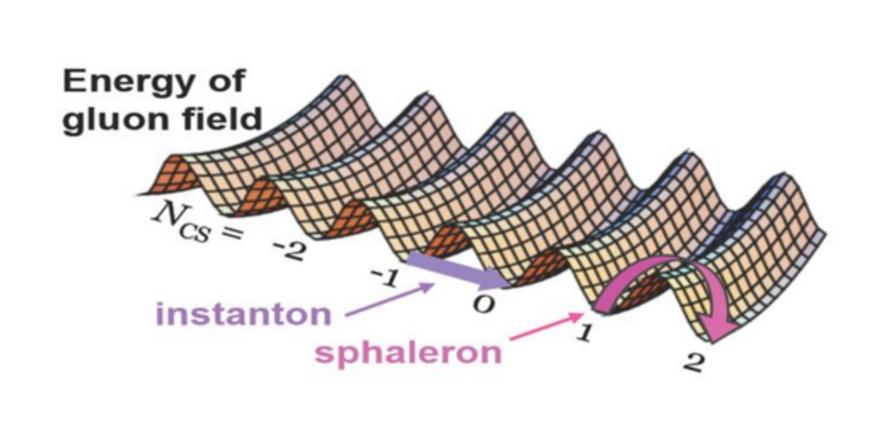
Haochen Yan(UCLA) for the STAR collaboration

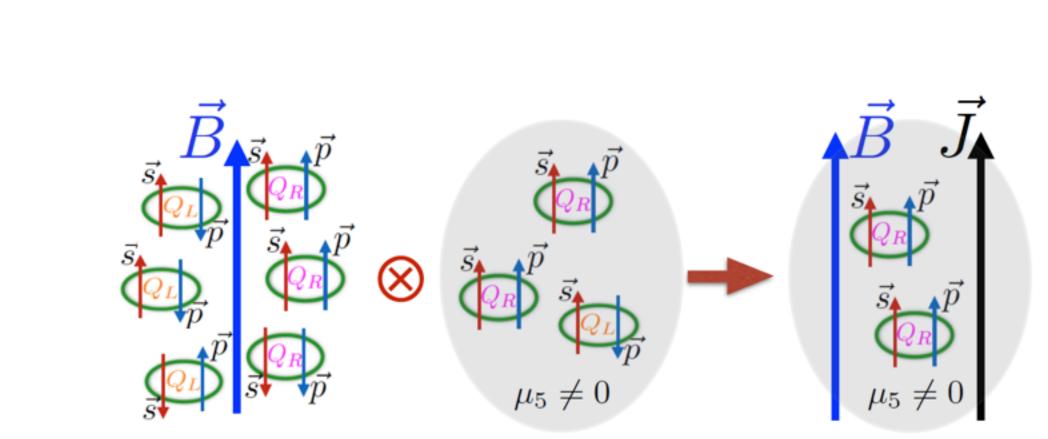
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High-energy heavy-ion collisions can create a hot and dense nuclear medium in which local domains could obtain a chirality imbalance. The chirality imbalance, together with a strong magnetic field, can induce an electric charge separation along the magnetic field direction, owing to the chiral magnetic effect (CME) [1]. The y correlator measures the two-particle azimuthal correlations relative to the reaction plane, and provides a probe to the electric charge separation due to the CME. However, the y correlator contains short-range correlations caused by other physics mechanisms, such as quantum effects, Coulomb interaction and resonance decays. In this poster, we decompose the \gamma correlator into two parts, along and across the reaction plane, respectively, and separate the contributions of particle pairs with small relative pseudorapidity (short range). The results will be presented for 200 GeV Au +Au collisions, and the physics implications on the short-range background will be discussed.

Motivation

Chiral Magnetic Effect(CME)





Local domains with chirality imbalance may be created in heavy-ion collisions on an event-by-event basis. A chiral system bears a non-zero axial chemical potential, μ_{κ} .

An electric current will be induced in chiral domains along the B field: Chiral Magnetic Effect (CME)

Observables!

y and δ definition

 $\gamma \equiv \langle \cos(\phi_1 + \phi_2 - 2\Psi_{\rm RP}) \rangle = \langle \cos(\phi_1 - \Psi_{\rm RP}) \cos(\phi_2 - \Psi_{\rm RP}) \rangle - \langle \sin(\phi_1 - \Psi_{\rm RP}) \sin(\phi_2 - \Psi_{\rm RP}) \rangle = \cos\cos\sin\sin\sin\theta$ $\delta \equiv \langle \cos(\phi_1 - \phi_2) \rangle = \langle \cos(\phi_1 - \Psi_{RP}) \cos(\phi_2 - \Psi_{RP}) \rangle + \langle \sin(\phi_1 - \Psi_{RP}) \sin(\phi_2 - \Psi_{RP}) \rangle = \cos\cos\cos + \sin\sin\sin\theta$

the sinsin and coscos terms as functions of Δη can be described by 3 Gaussian peaks and a pedestal.

$$f(\Delta \eta) = A_{\rm VSR} e^{-(\Delta \eta)^2 / 2\sigma_{\rm VSR}^2} + A_{\rm SR} e^{-(\Delta \eta)^2 / 2\sigma_{\rm SR}^2} + A_{\rm IR} e^{-(\Delta \eta)^2 / 2\sigma_{\rm IR}^2} + A_{\rm LR}$$

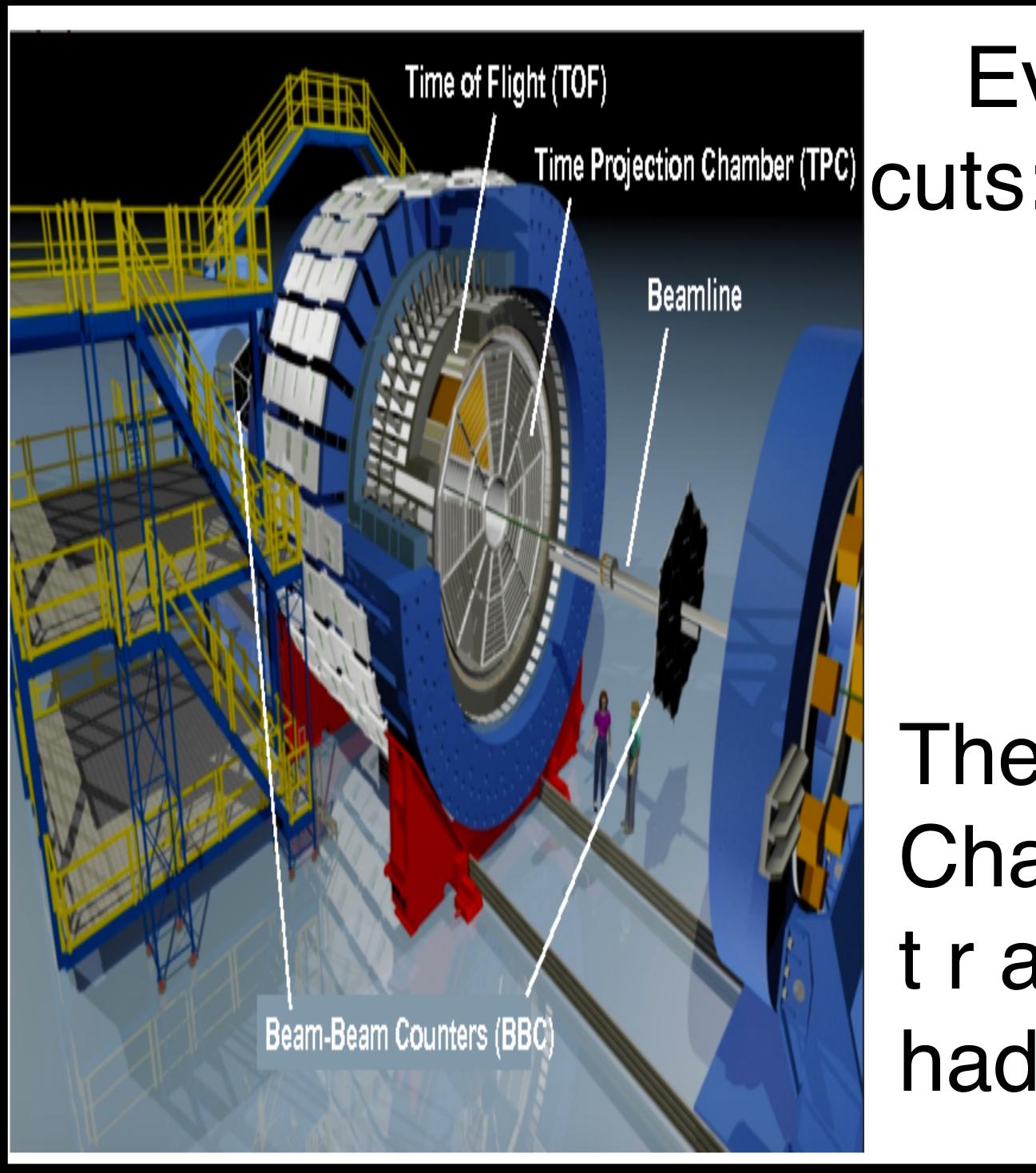
VSR:very-short-range SR: short-range IR: intermediate-range LR: pedestal

Although there are many contributions to the background, for now, we focus on the short-range correlations.

We fit the sinsin and coscos terms with the multi-Gaussian function, and remove the contributions from the very-short-range and significant contributions to the γ collaboration for this project. the short-range.

After the removal of the very-short-range and the short-range, we reconstruct γ with collisions could still come from other the new (coscos - sinsin).

Experiment



COSCOS

min.bias d+Au at 200 GeV

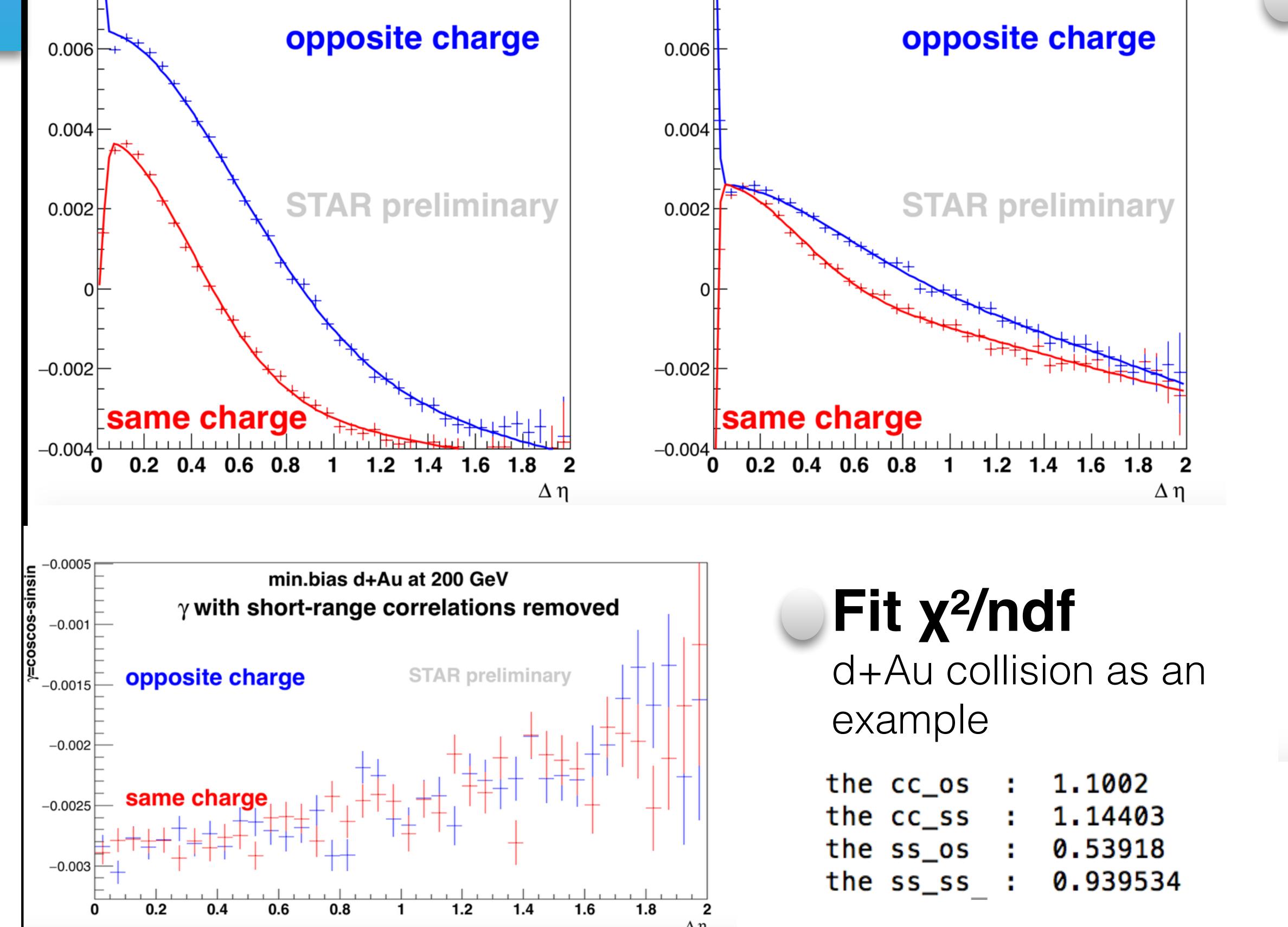
Event cuts and track IVertex ZI< 30 cm 0.2 < p₊< 2 GeV/c $|\eta|<1$

The Time Projection Chamber is used to track charged hadrons.

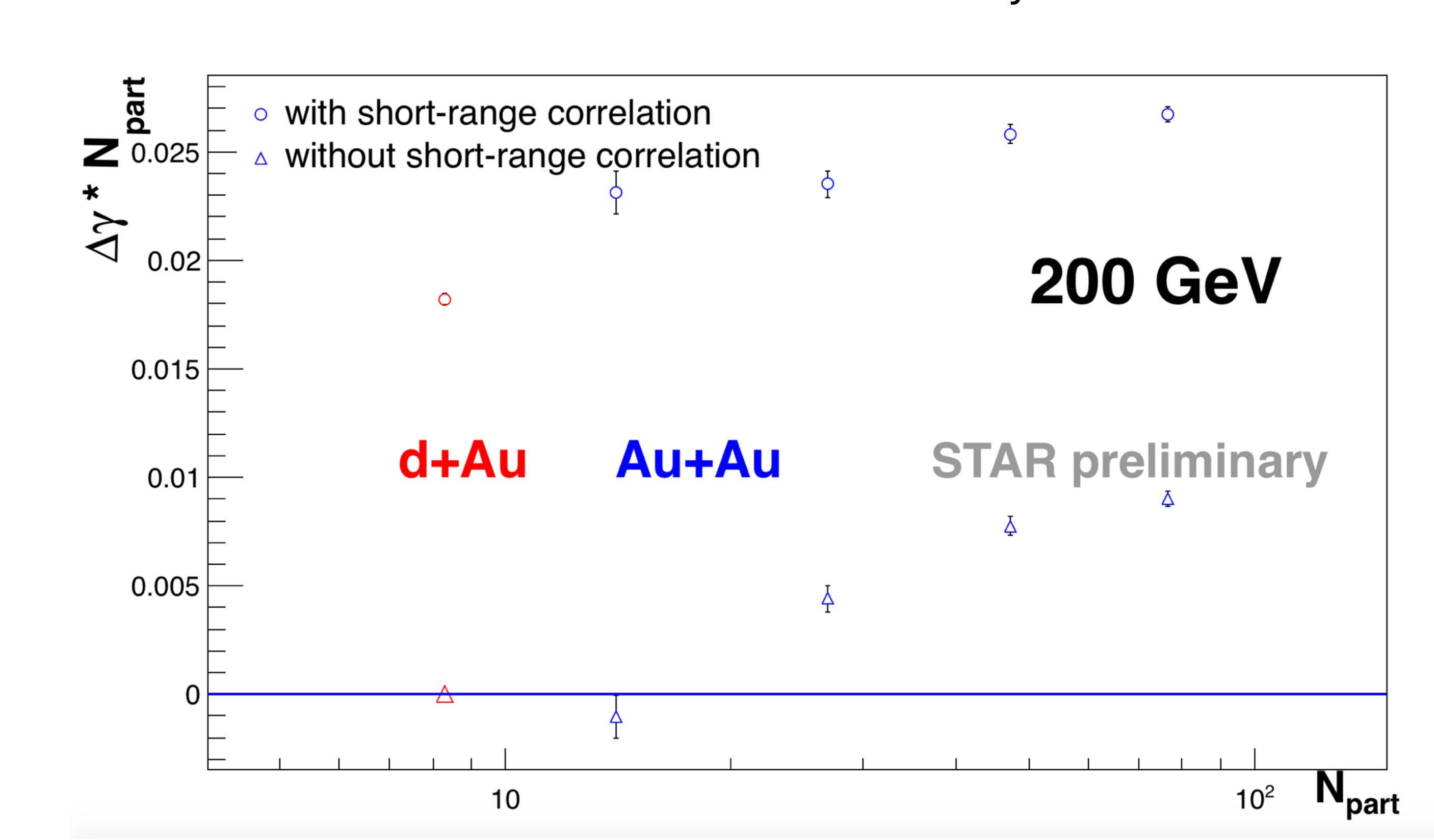
sinsin

min.bias d+Au at 200 GeV

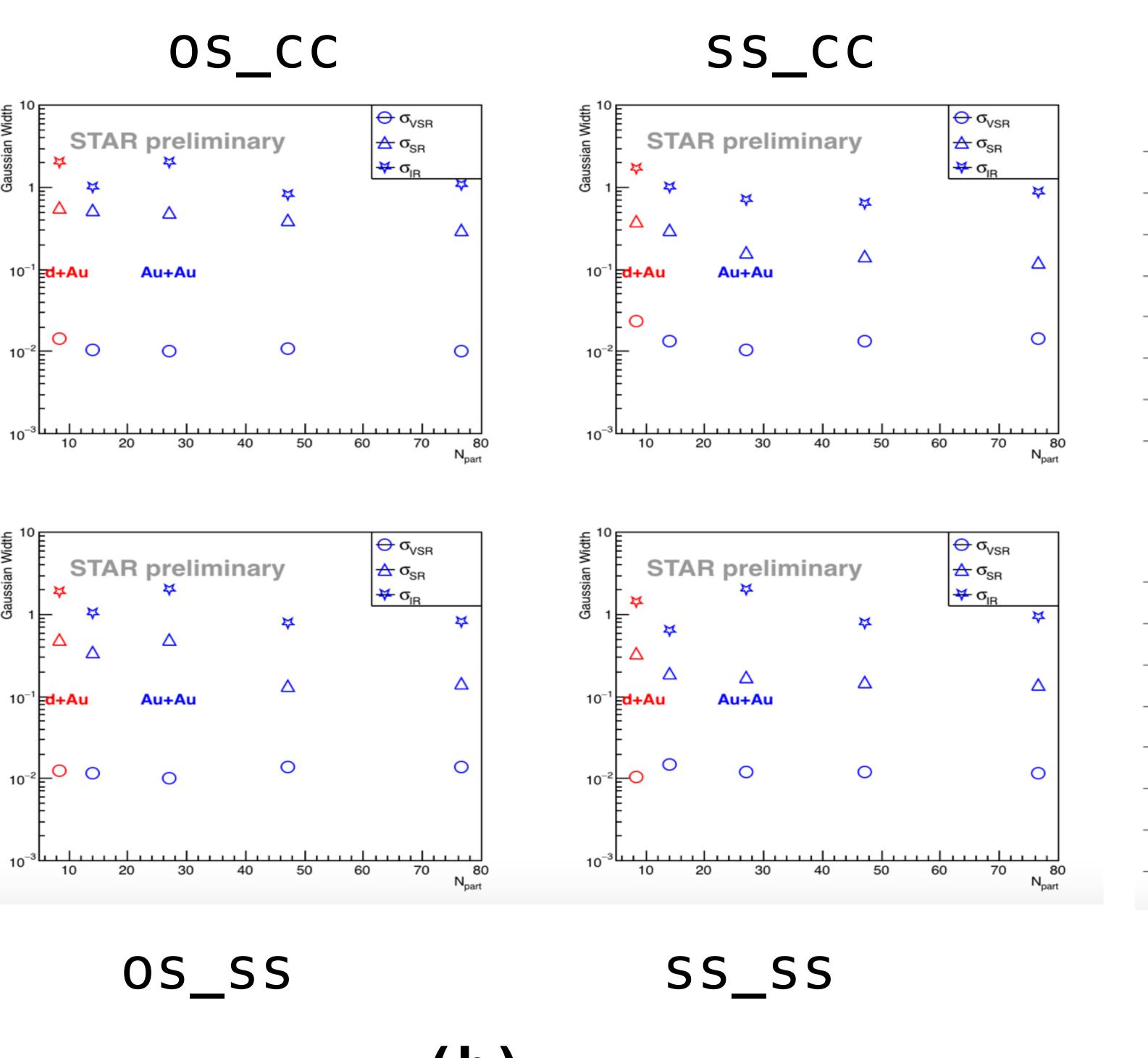
Fit example: d+Au collision at 200 GeV



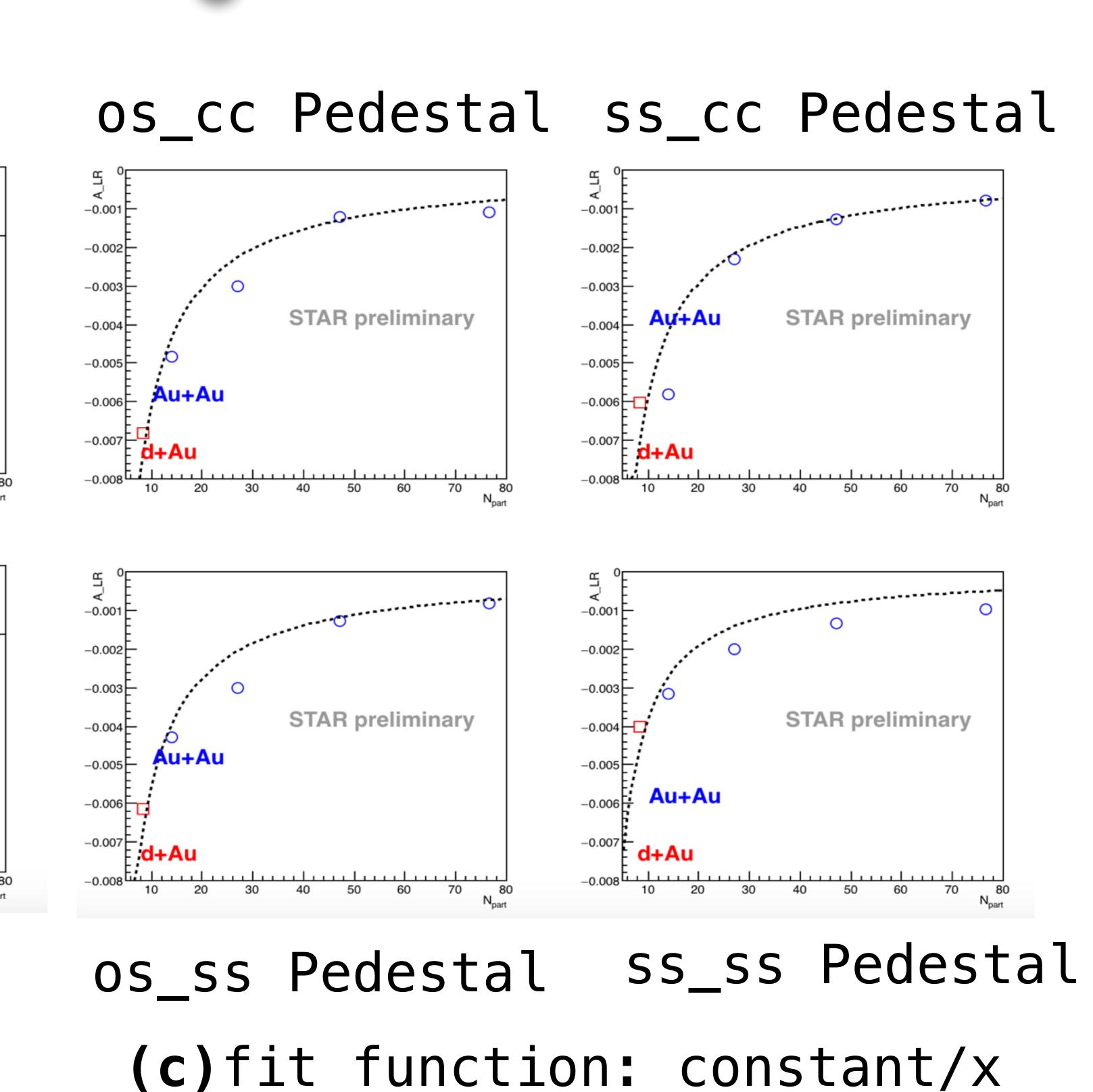
Δy with and without short-range correlation statistical errors only







Extracted pedestal



Summary

correlations, especially in the small systems.

Finite observables in more central backgrounds, which is under investigation.

Acknowledge

collaboration for this project. Thanks very much to Professor Huang and Dr. Wang's guidance and kind support.

Reference

[1]D. Kharzeev, Phys. Lett. B 633 (2006) 260

