Decomposition of the Gamma correlator in 200GeV Au+Au, applied to small systems

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Outline

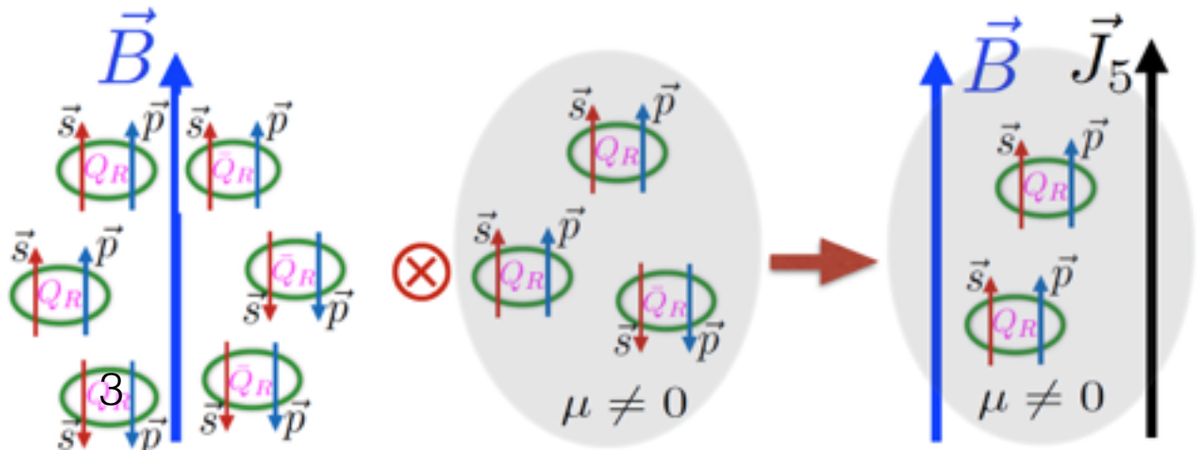
- Introduction to CME
- Method
- Result for small systems
- Future Work

Introduction to CME

- CME physics: In the magnetic field the current will be generated due to the unbalance of chiral quarks(right-handed or left-handed)
- Gamma and delta definiton:

$$\gamma \equiv \langle \cos(\phi_1 + \phi_2 - 2\Psi_{\mathrm{RP}}) \rangle = \kappa v_2 F - H \longrightarrow H^{\kappa} = (\kappa v_2 \delta - \gamma)/(1 + \kappa v_2)$$
$$\delta \equiv \langle \cos(\phi_1 - \phi_2) \rangle = F + H,$$

A. Bzdak, V. Koch and J. Liao, Lect. Notes Phys. 871, 503 (2013).



Background Study

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

- One method to study and reduce such effect is to fit the data with gaussians and then minus these narrow ones.

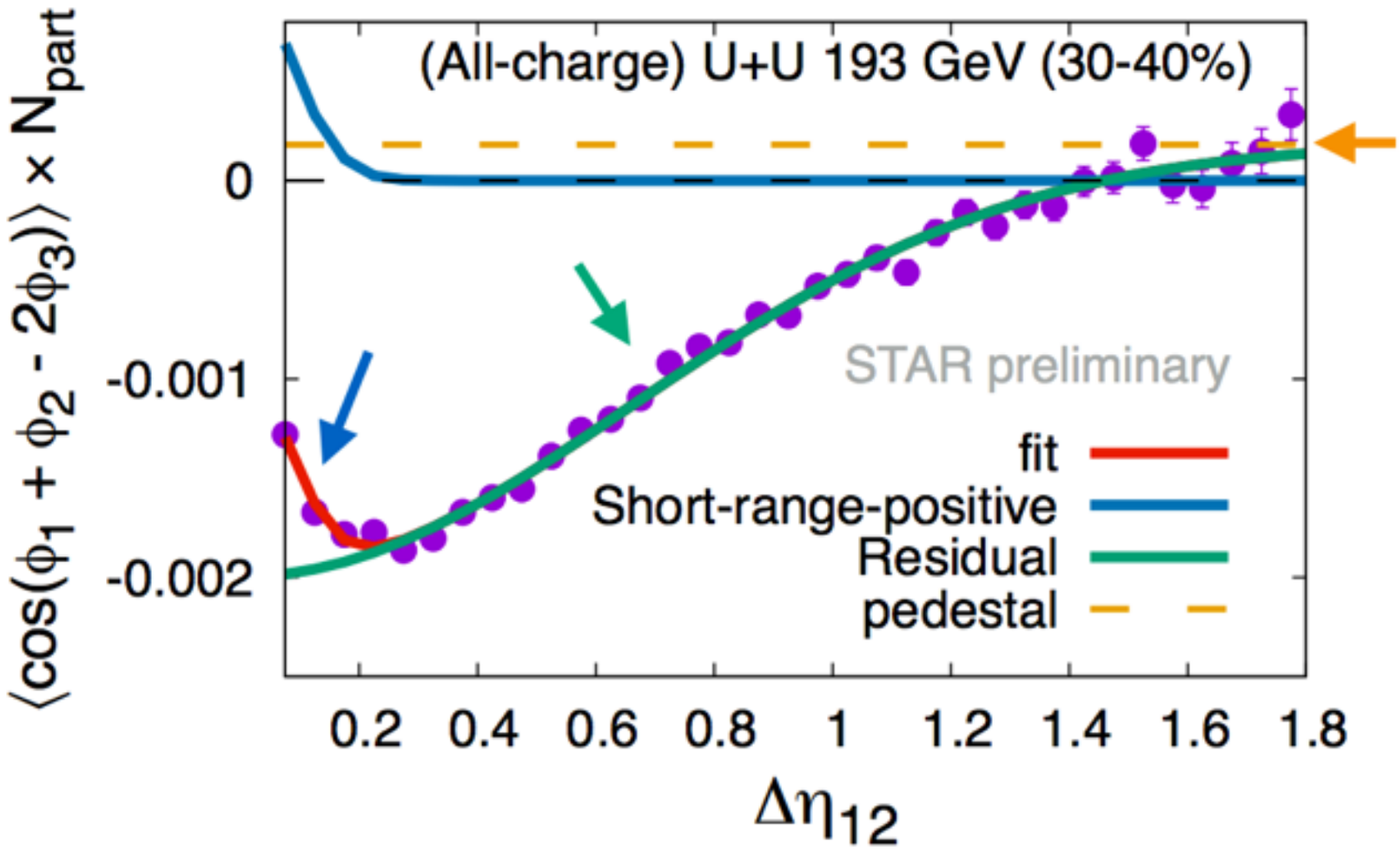
$$C_{112}(\Delta\eta_{12}) = A^{+}_{SR} e^{-(\Delta\eta)^2/2\sigma^2_{SR}} - A^{-}_{IR} e^{-(\Delta\eta)^2/2\sigma^2_{IR}} + A_{LR}$$

Short-range-positive

Residual

Pedestal

- Previous study from STAR(Prithwish)



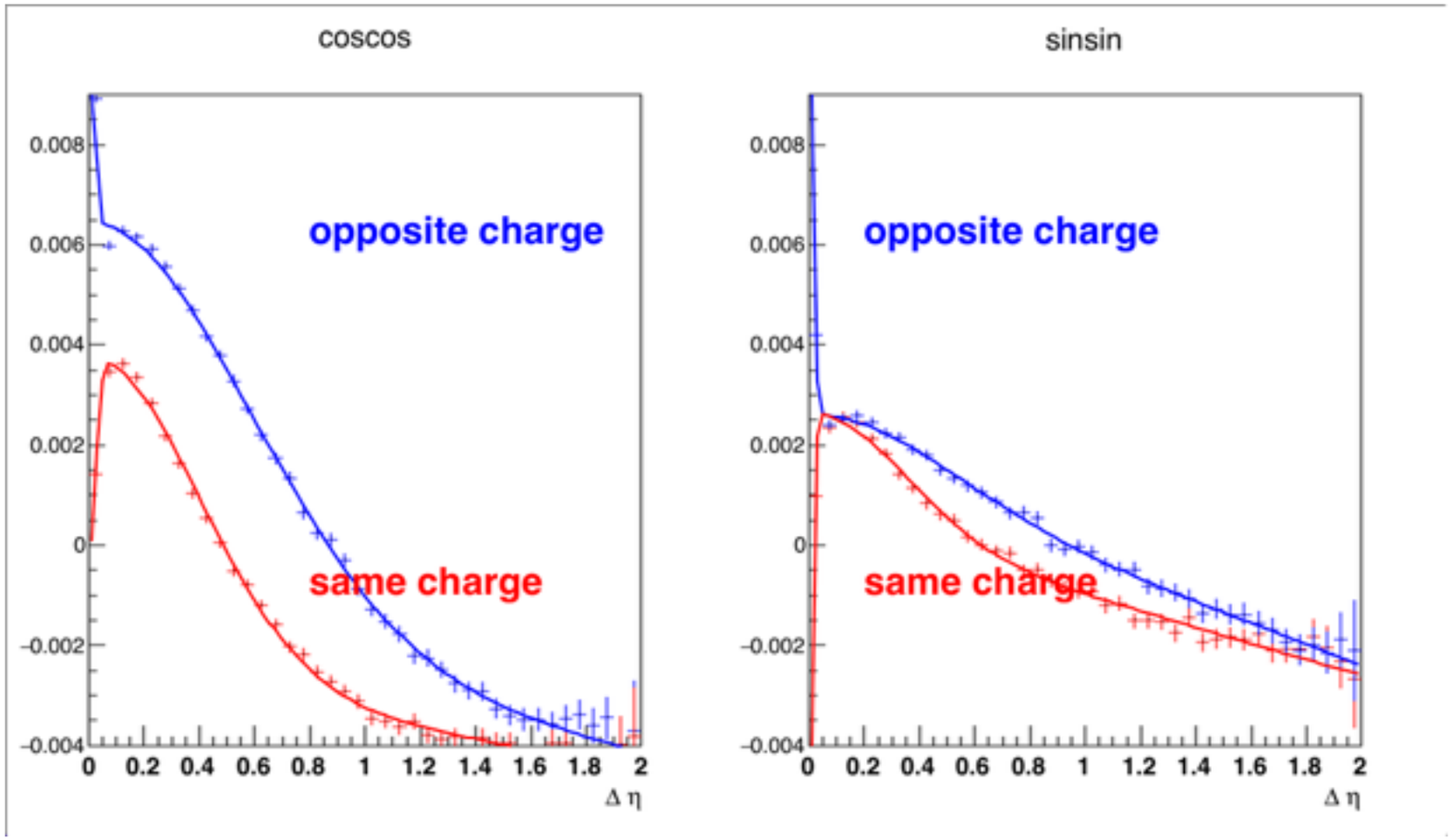
Modified method applied to reduce background

- We fit the data with multiple gaussian functions and then remove the narrow gaussians to eliminate the short-range contribution in the data.

- What's new: Instead of fitting the original signal, I try to fit the data sets by parts, i.e the OS_coscos,SS_coscos,OS_sinsin,SS_sinsin then rebuild the signal. All fittings use three gaussians in order to make sure even the very short range effect can be described

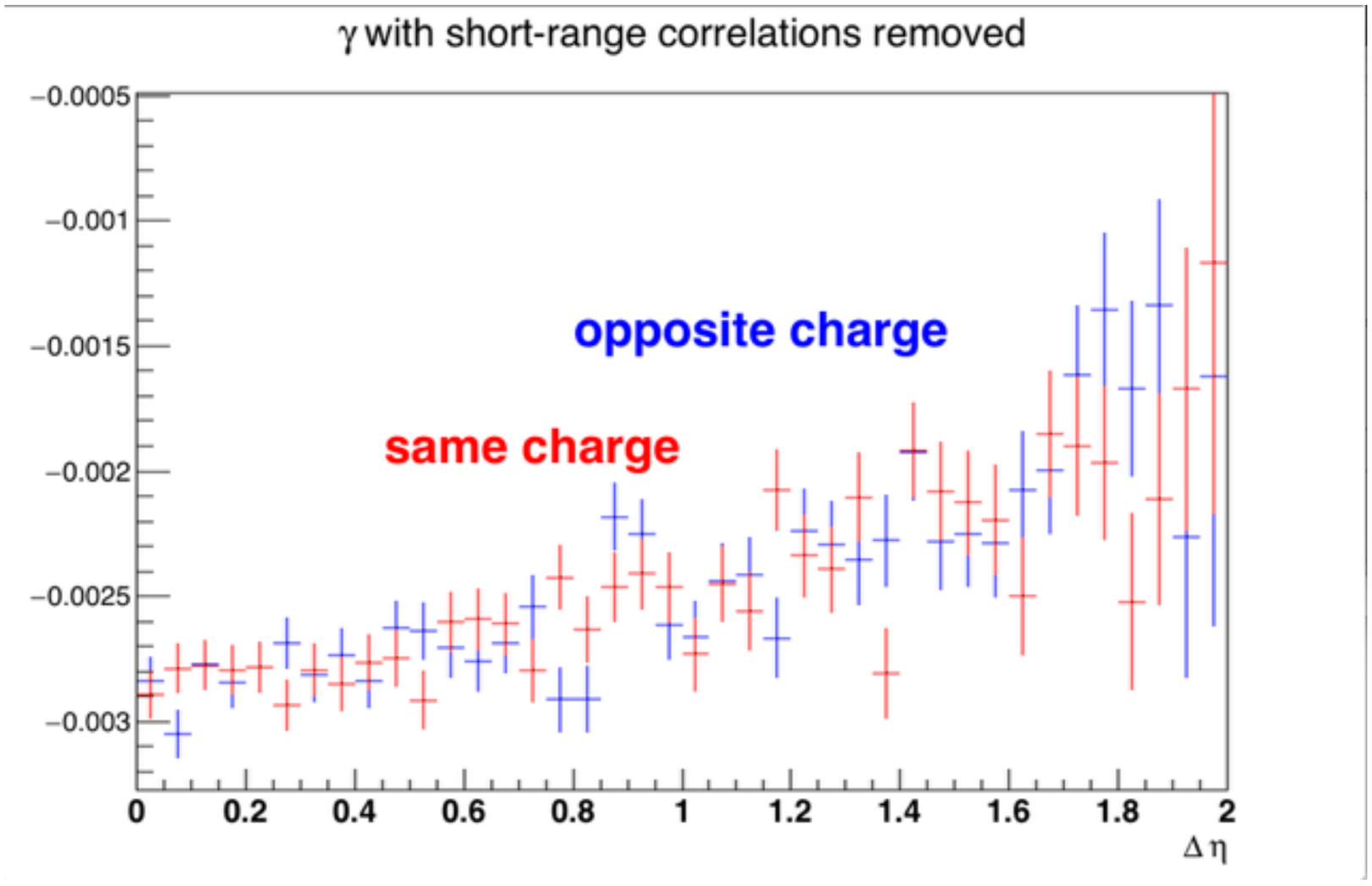
- Advantage: Much more smooth fit for data points and clear trend for the overall results.

- One fit example for d+Au collision



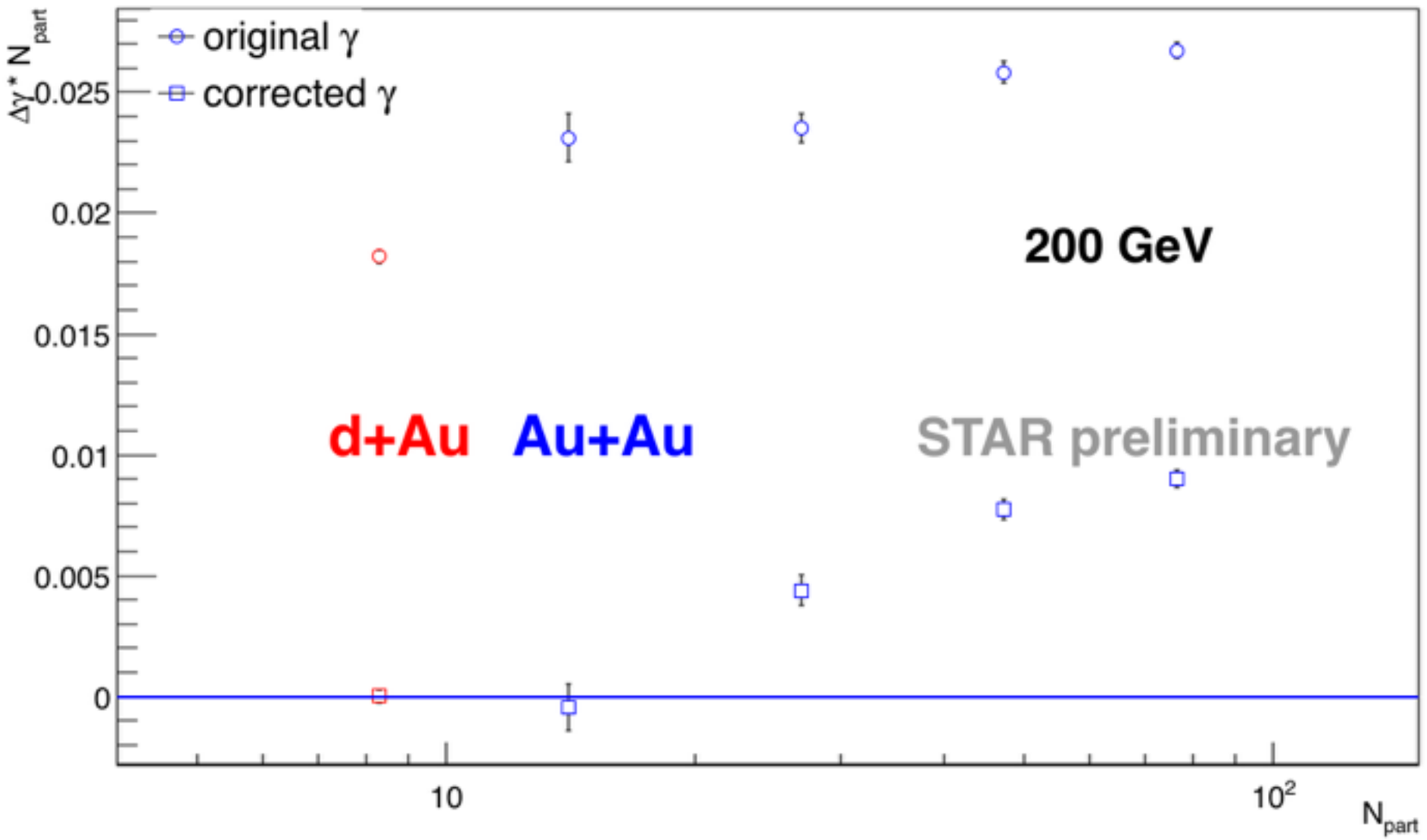
- It is clear to see the short-range contribution on this fit,and since we use three gaussians, the very short-range effect can also be described.

- Continued: Gamma after short-range removal



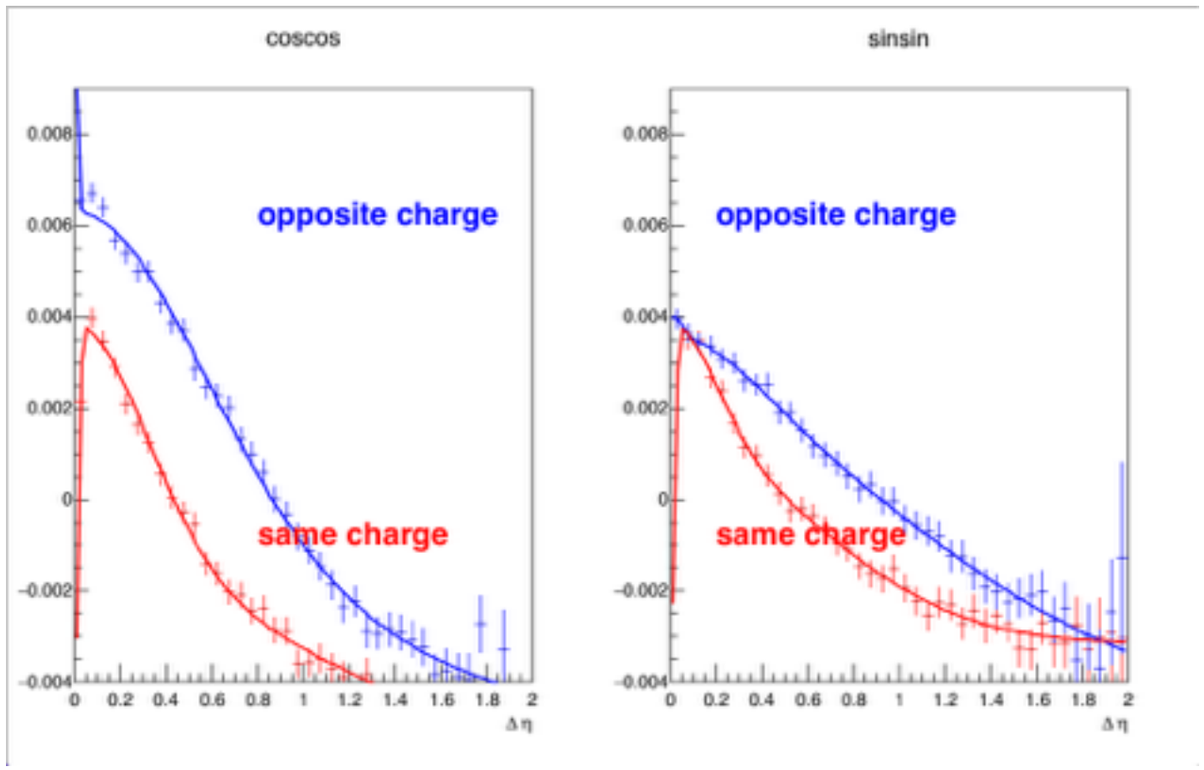
Results

Gamma trend for small system
Original vs Short range
removal



Systematics

- The method used to check the fit result is Chi^2/ndf
- I also plot the 3 gaussian peaks width via centrality to make sure there are not big jump or unreasonable values

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the cc_os chi^2 is  0.80494
the cc_ss chi^2 is  0.60924
the ss_os chi^2 is  0.277473
the ss_ss chi^2 is  0.290345
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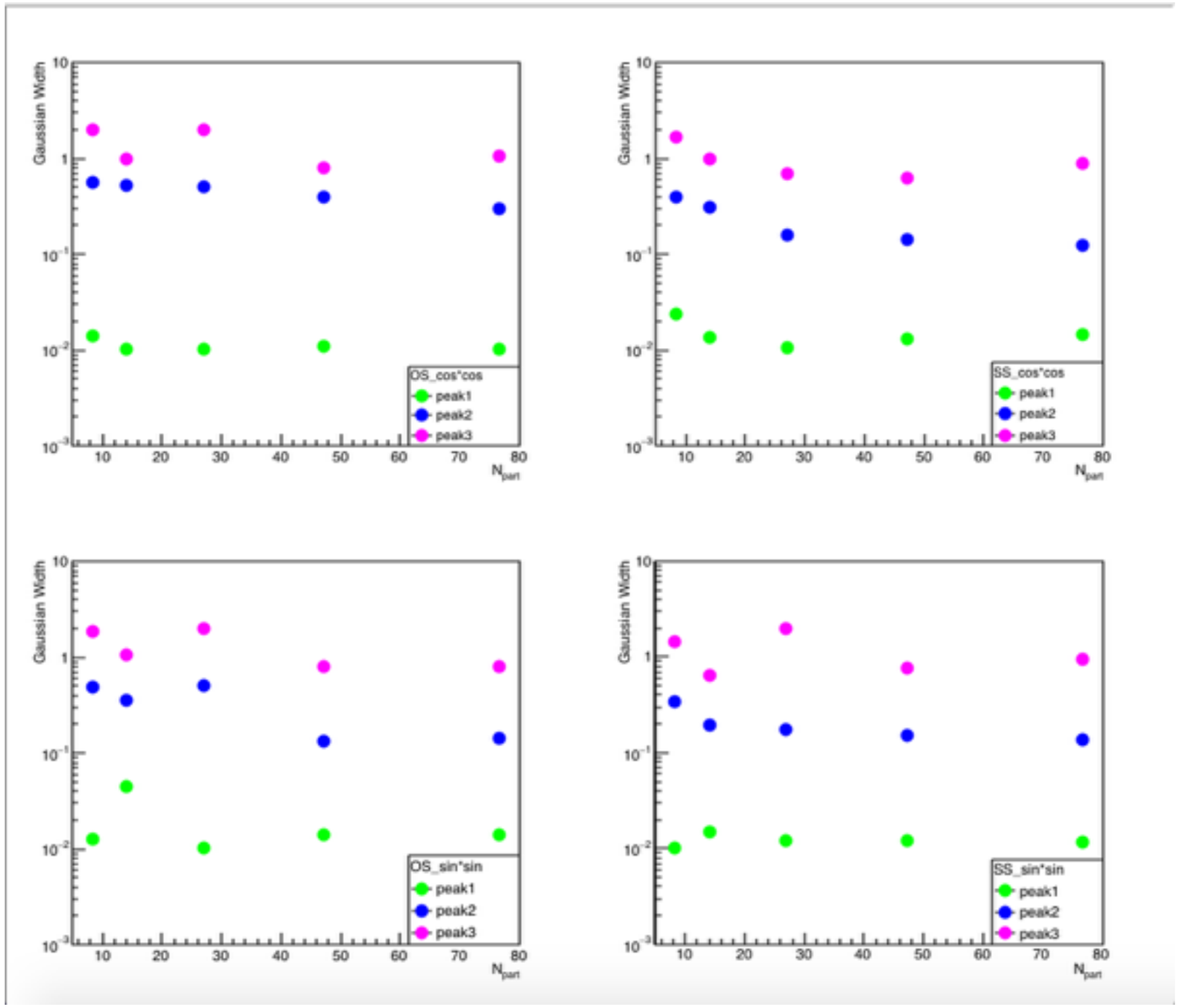
70-80% collision fit result and its chi^2/ndf

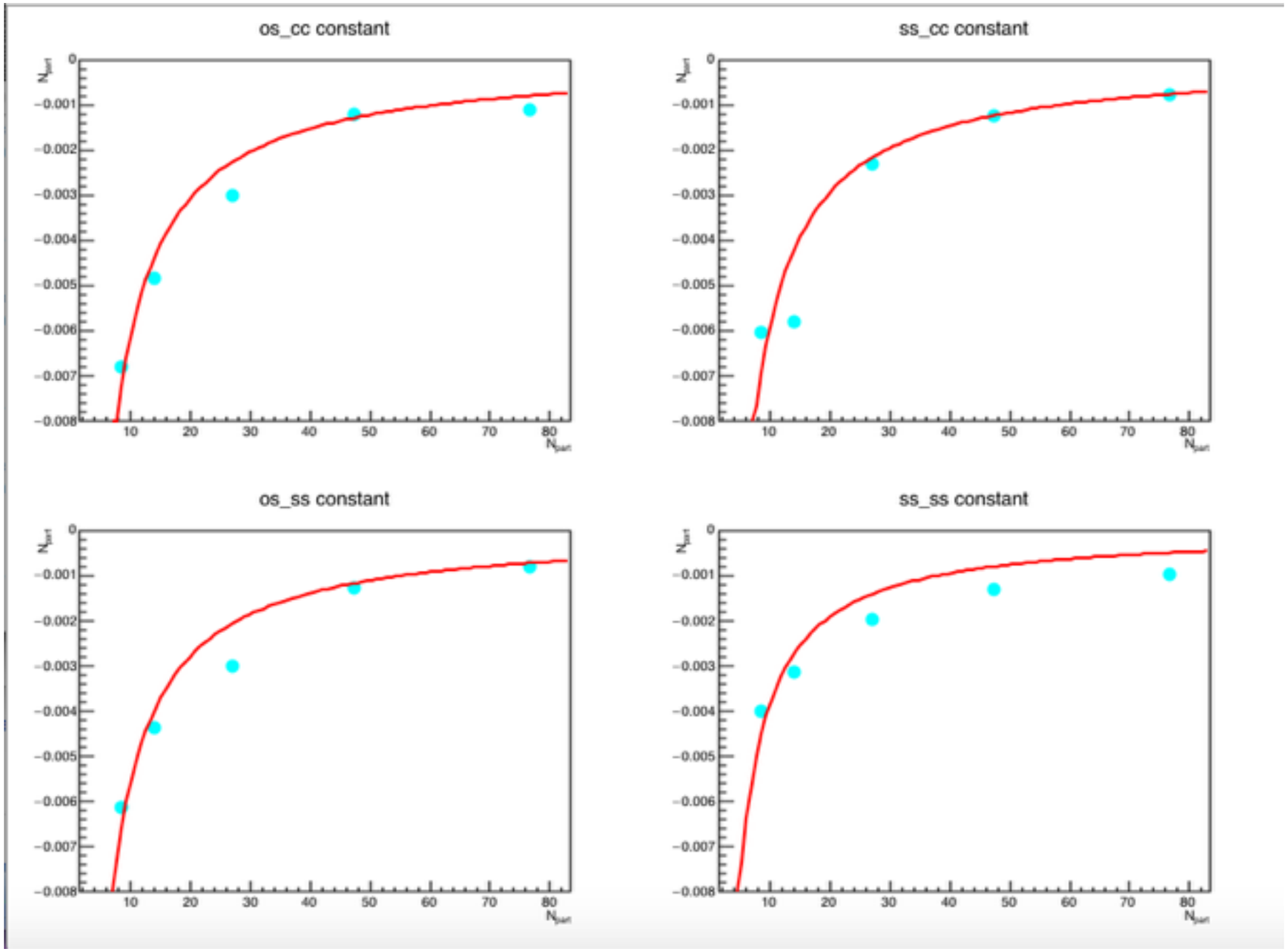
Systematics

Gaussian peak width vs centrality



Systematics

constant peak vis centrality



Future Work

- The short-range correlations have significant contributions to the gamma correlations,especially in the small systems

- We can further apply this method tomore centralities and to see whether there is a “signal” or not after removing the short-range background

- High δp_T case can also be studied with the same method to see whether there is a better result

- I am going to make a poster for the DNP meeting