Decomposition of the Gamma correlator in 200 GeV Au+Au collisions (run11)

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Outline

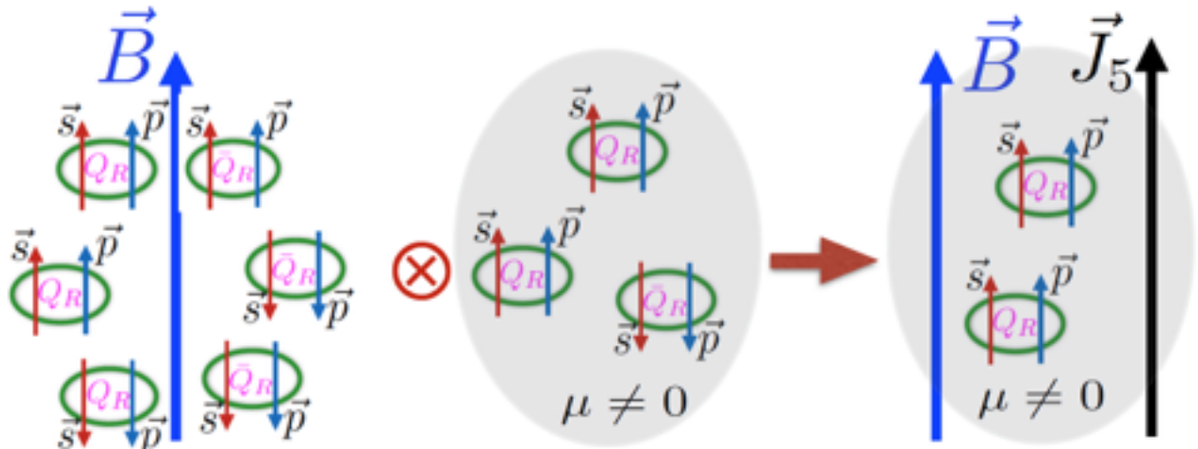
- Introduction to CME
- Method
- Result
- Future Work

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:

$$\gamma \equiv \langle \cos(\phi_1 + \phi_2 - 2\Psi_{\mathrm{RP}}) \rangle = \text{<cos*cos - sin*sin>}$$
$$\delta \equiv \langle \cos(\phi_1 - \phi_2) \rangle = \text{<cos*cos + sin*sin>}$$



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.

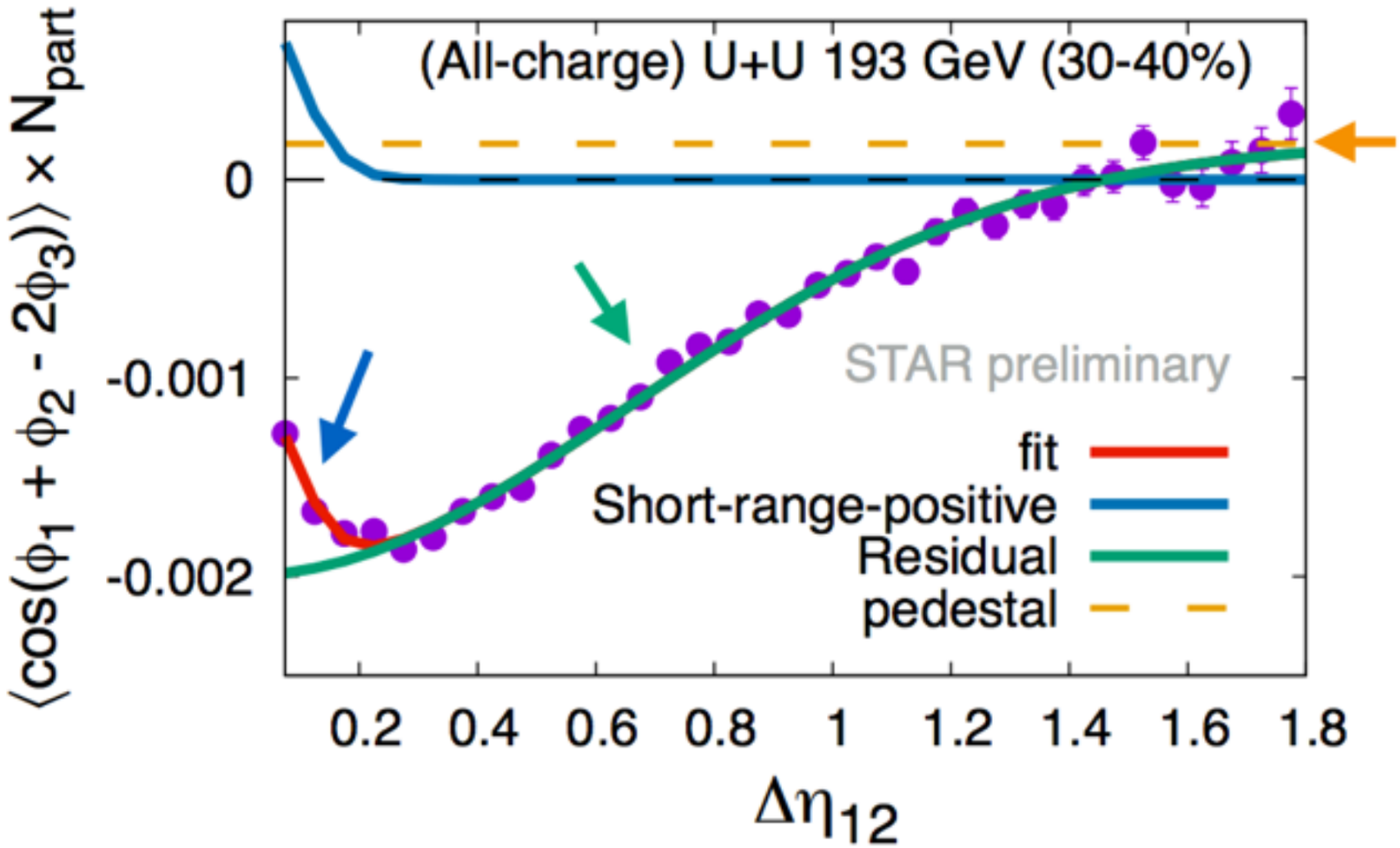
$$C_{112}(\Delta\eta_{12}) = A^{+}_{SR} e^{-(\Delta\eta)^2/2\sigma^2_{SR}} - A^{-}_{IR} e^{-(\Delta\eta)^2/2\sigma^2_{IR}} + A_{LR}$$

Short-range-positive

Residual

Pedestal

- Previous study from STAR(Prithwish)



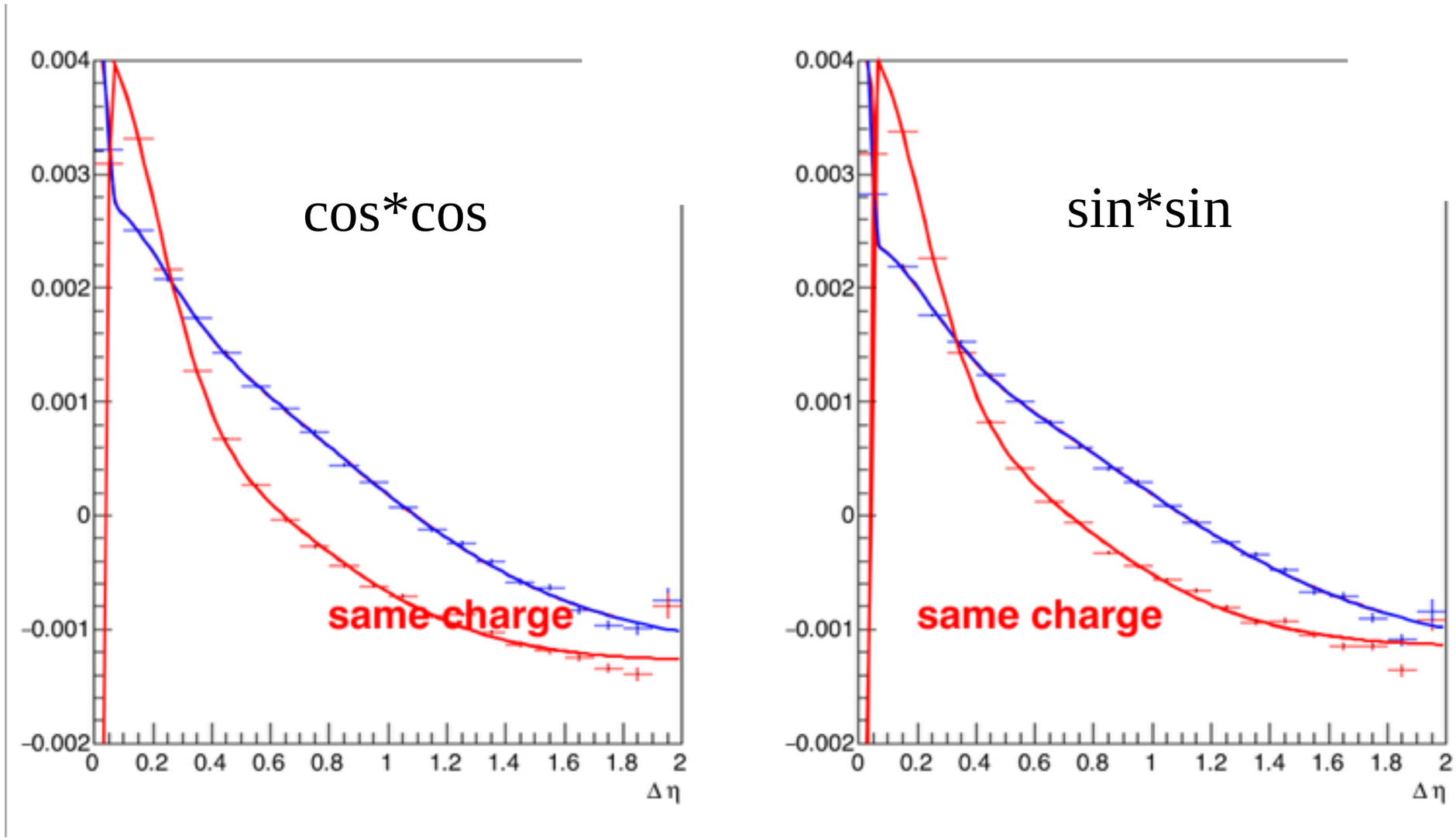
Modified method applied to reduce background

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

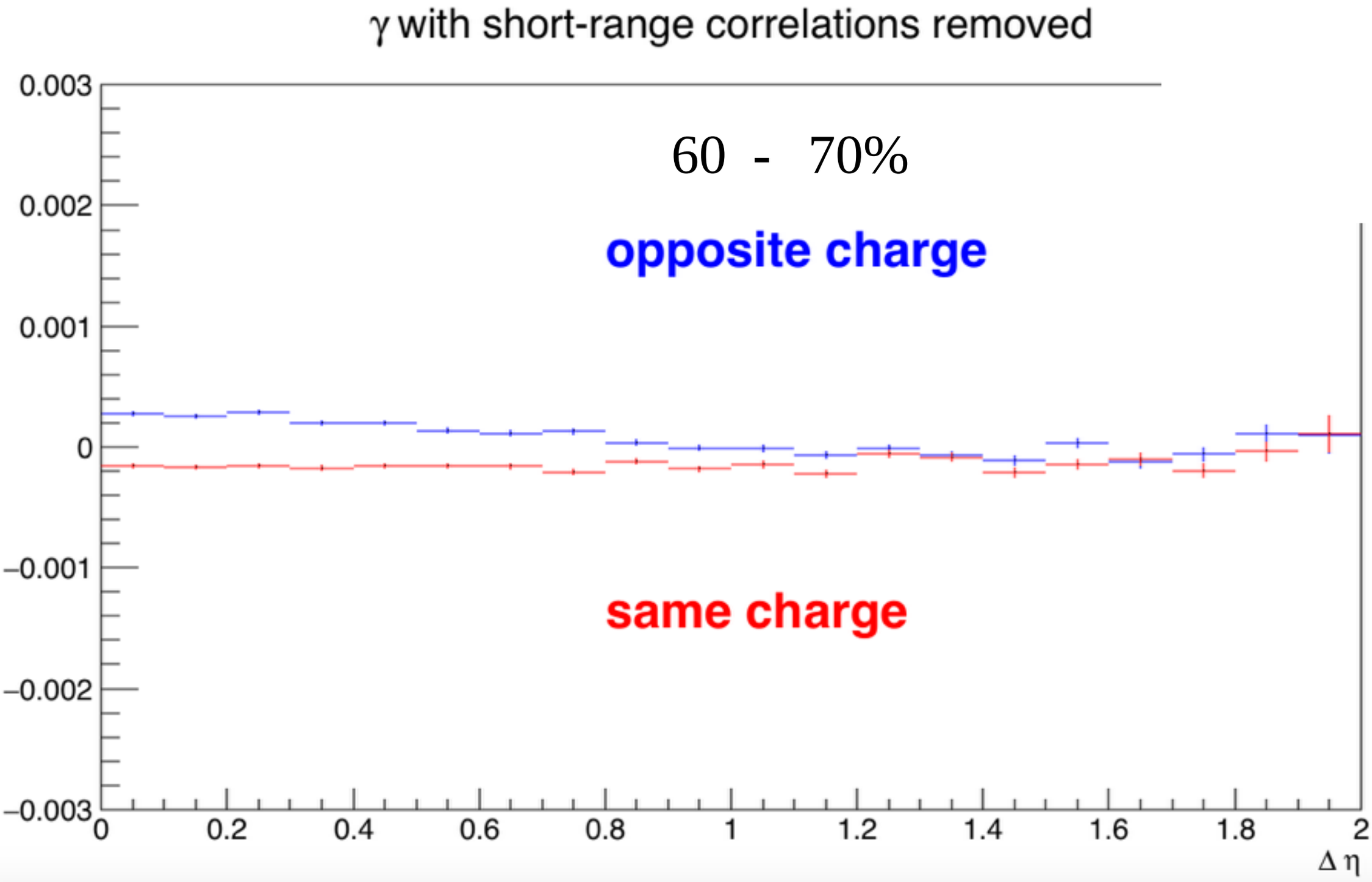
- What's new: Instead of fitting the original signal, I try to fit the data sets by parts, in-plane and out-of-plane separately OS_coscos,SS_coscos,OS_sinsin,SS_sinsin then rebuild the signal. All fittings use three gaussians in order to make sure even the very short range effect can be described

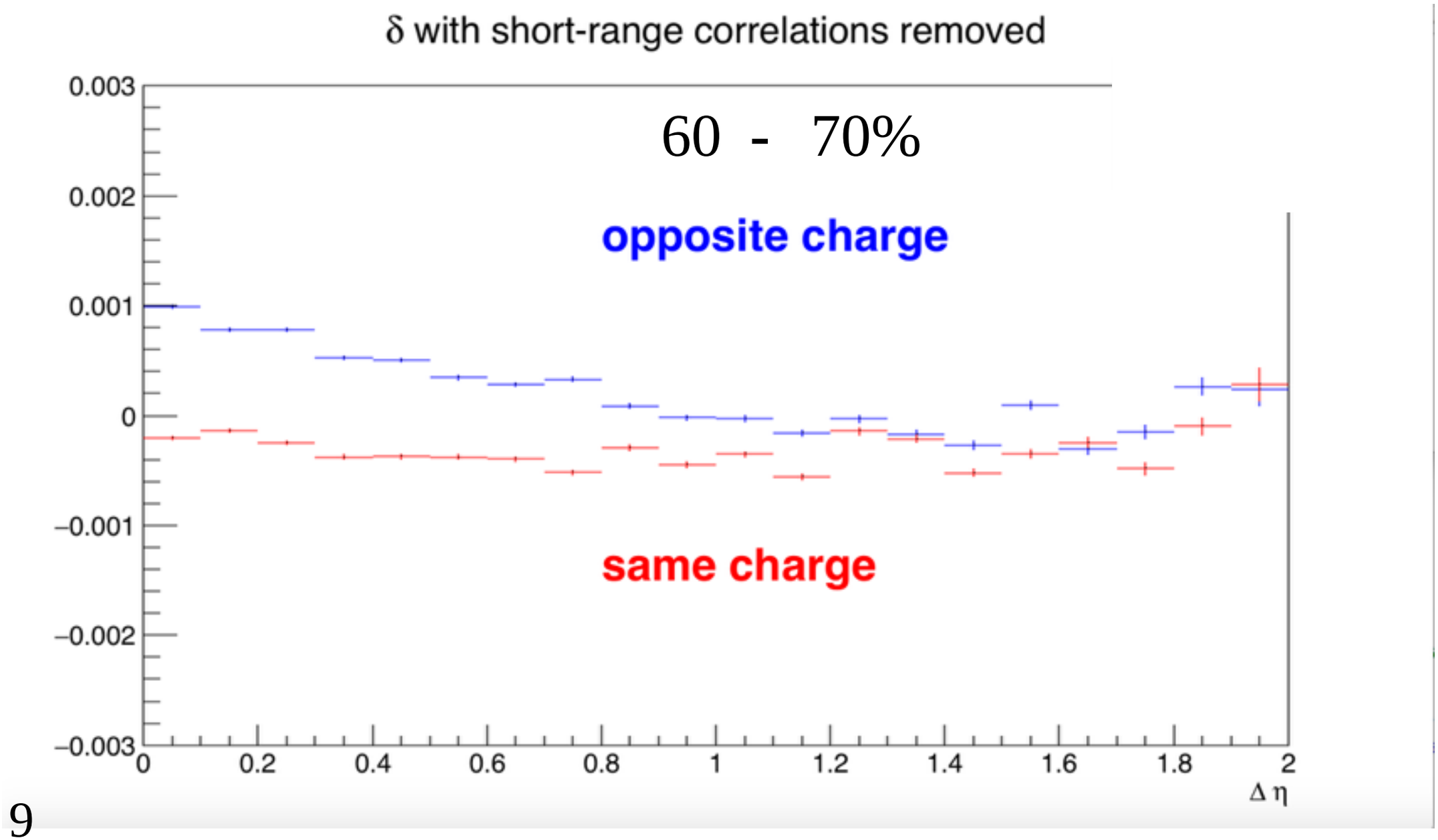
- Advantage: Much more smooth fit for data points and clear trend for the overall results.

- One fit example for 60%-70% 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.


γ with short-range correlations removed
60 - 70%
opposite charge
same charge
0.003
0.002
0.001
0
−0.001
−0.002
−0.003
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Δ η


δ with short-range correlations removed
60 - 70%
opposite charge
same charge
0.003
0.002
0.001
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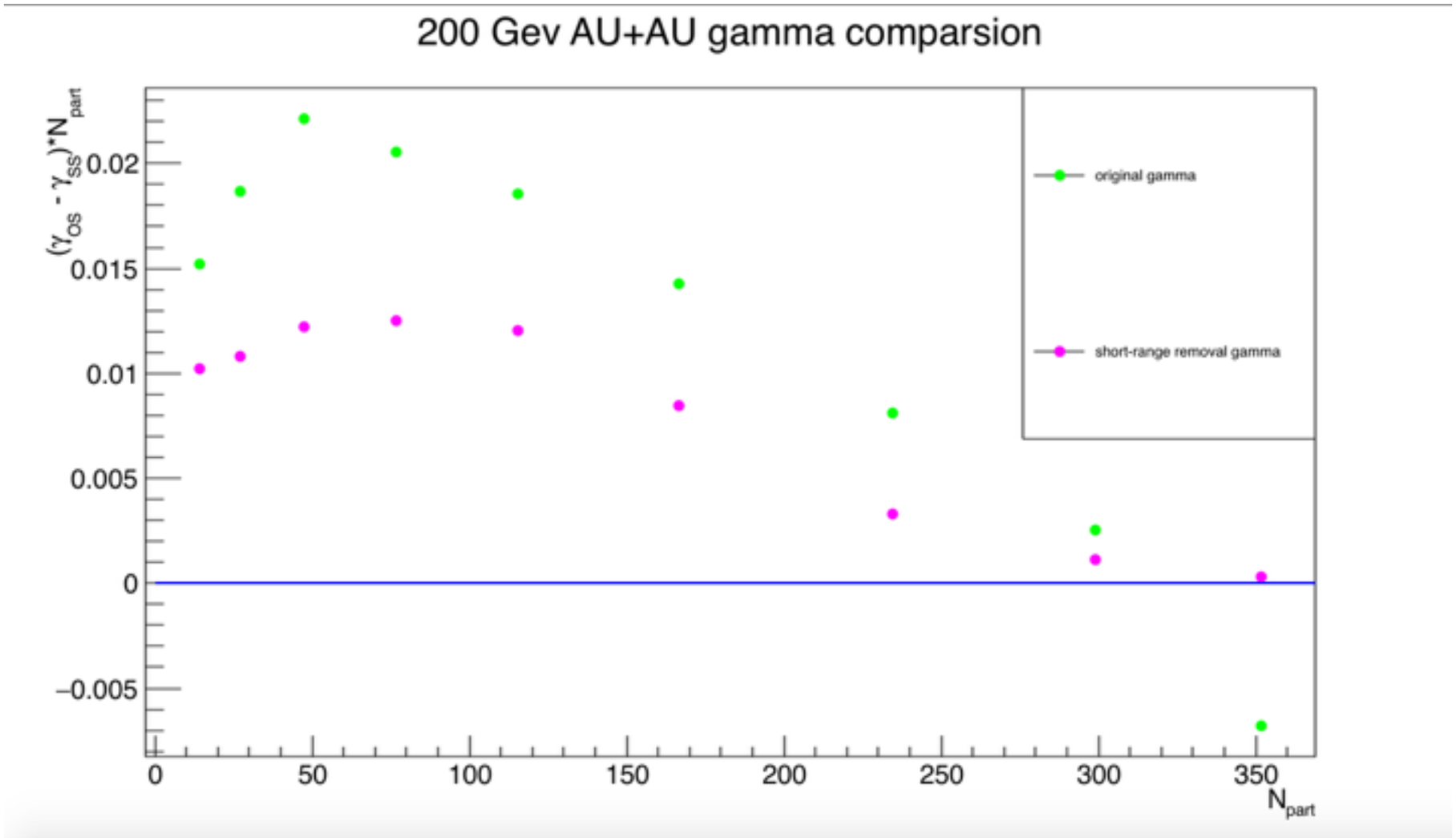
−0.001
−0.002
−0.003
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Δ η

Results

Gamma trend vs centrality

Original vs Short range removal

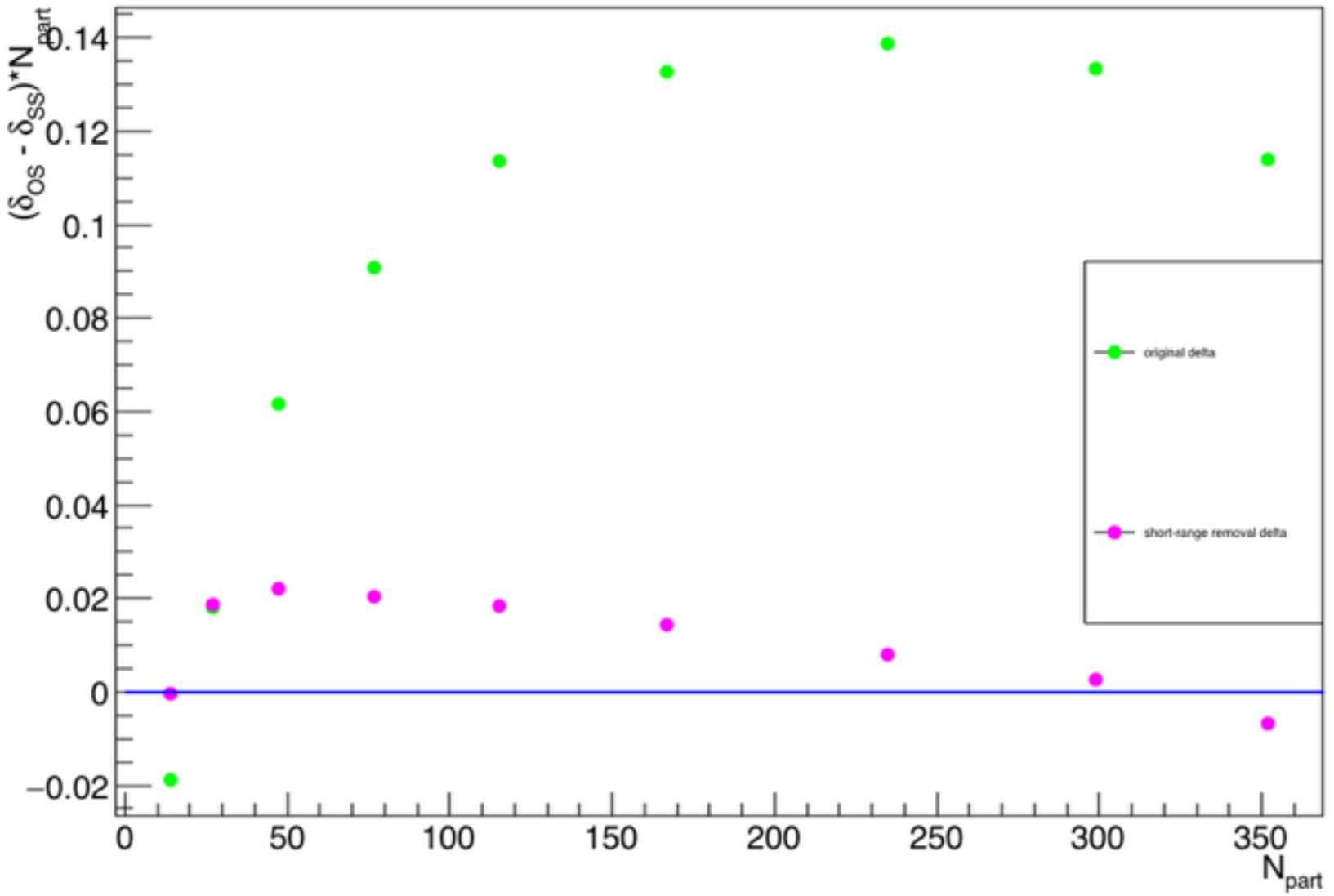


For the most central bin, after short-range removal, the result is more reasonable

Results

Delta trend vs centrality

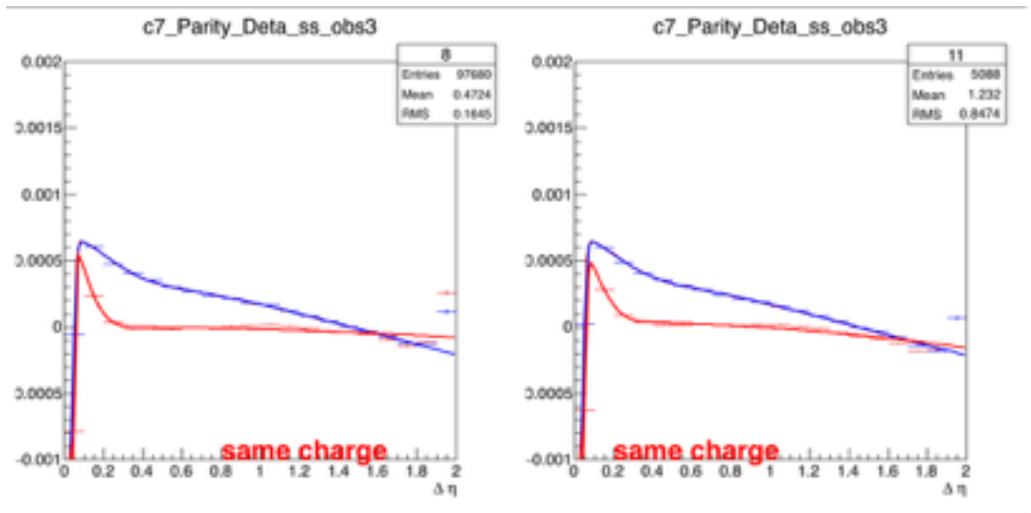
Original vs Short range removal



Systematics

- Two methods are used to check whether the fit results are reasonable: chi^2/ndf and the peak width vs centrality

- Numerically, chi^2/ndf is close to 1 for most cases, but they are also sensitive one or two bad points.




```
the cc_os chi^2 is  15.4882
the cc_ss chi^2 is  69.5363
the ss_os chi^2 is  11.005
the ss_ss chi^2 is  53.6317
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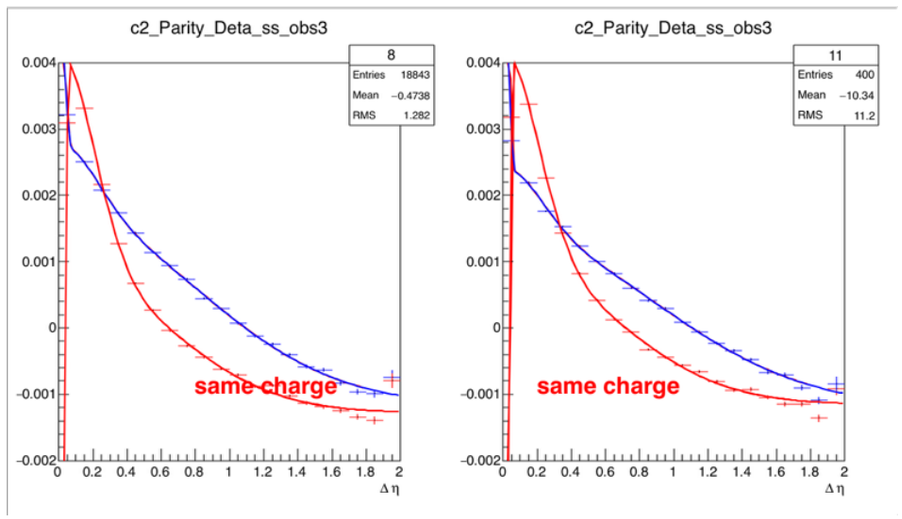
cen7 fit result and its chi^2/ndf

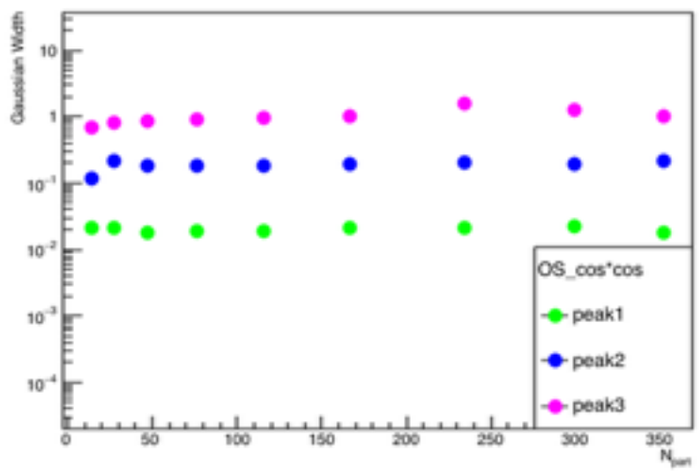


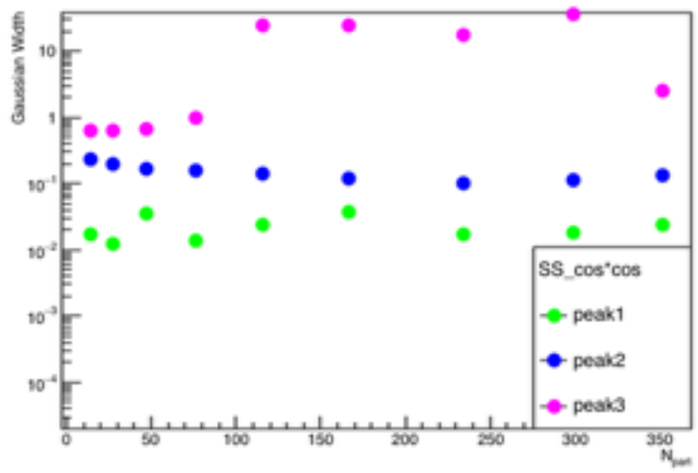

```
the cc_os chi^2 is  2.62406
the cc_ss chi^2 is  4.95332
the ss_os chi^2 is  4.30119
the ss_ss chi^2 is  4.86062
```

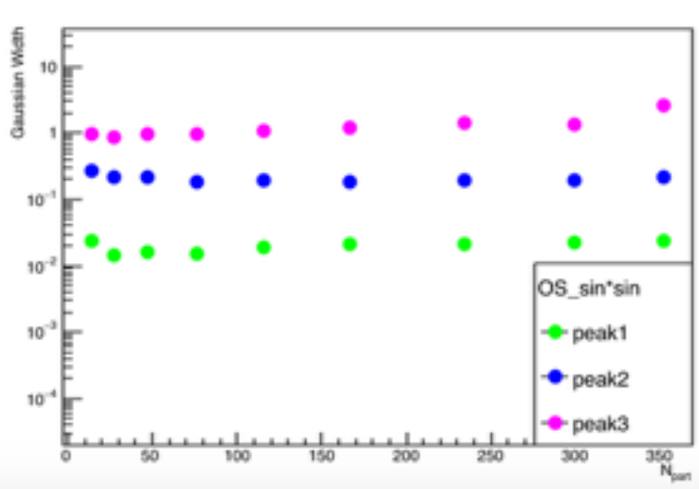
cen2 fit result and its chi^2/ndf

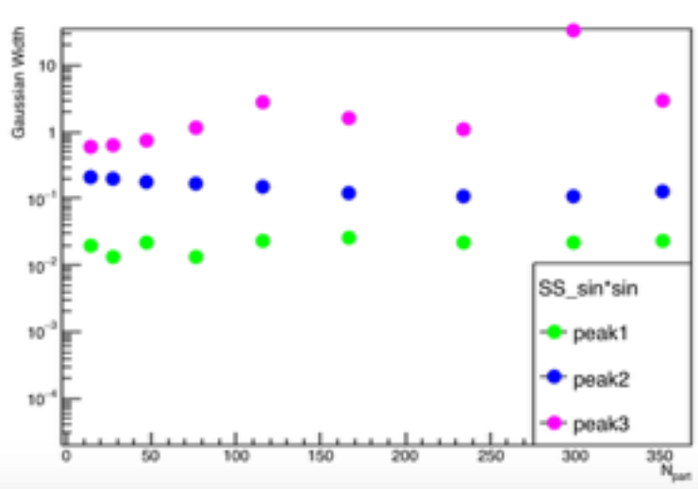
Results

Peak width vs centrality









The three peaks are well separated

Future Work

- For CME physics, better background model is needed to describe the data we have
- For this method, we can apply it to the AMPT model or p+Au(d+Au) data sets to future check whether it can work well.
- I am going to submit an abstract on this topic to DNP REU poster session this year.