Further study of Roy/Ajit's correlator

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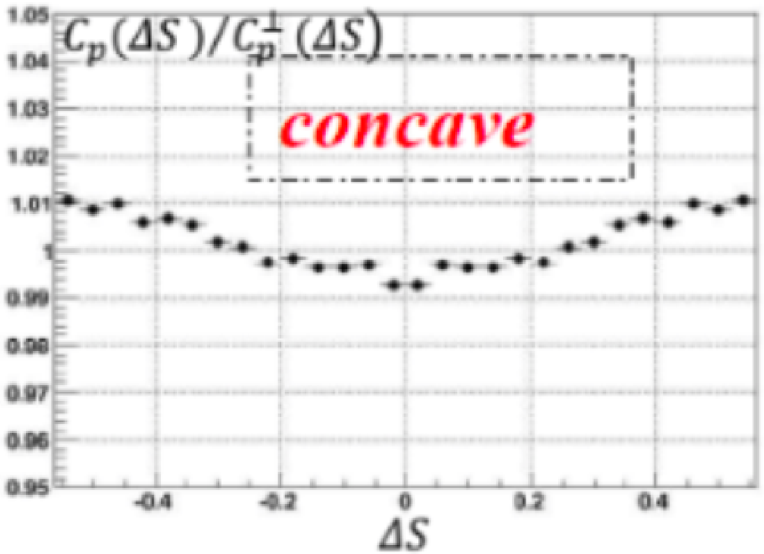
Roy's/Ajit Correlator

The Roy's/Ajit Correlator uses a double ratio to determine if the charge separation is CME-driven.

$$R(\Delta S) = C_p(\Delta S) / C_p^{\perp}(\Delta S)$$



- CME-drive charge separation creates a "concave" shape
- Non-CME driven charge creates a "flat" or "convex" shaped graph

Where Charge separation is defined as (ΔS) and is measured using a multi-particle charge-sensitive in-event correlator.

$$C_p(\Delta S) = \frac{N_{\text{real}}(\Delta S)}{N_{\text{shuffled}}(\Delta S)}$$

- Event-by-event distribution
- Carries charge separation response

- Random shuffling of charges within an event
- Carries the "null" or charge averaged response

$$\Delta S = \frac{\sum_i \sin \Delta\phi_i^+}{p} - \frac{\sum_i \sin \Delta\phi_i^-}{n}$$

Event Cuts:

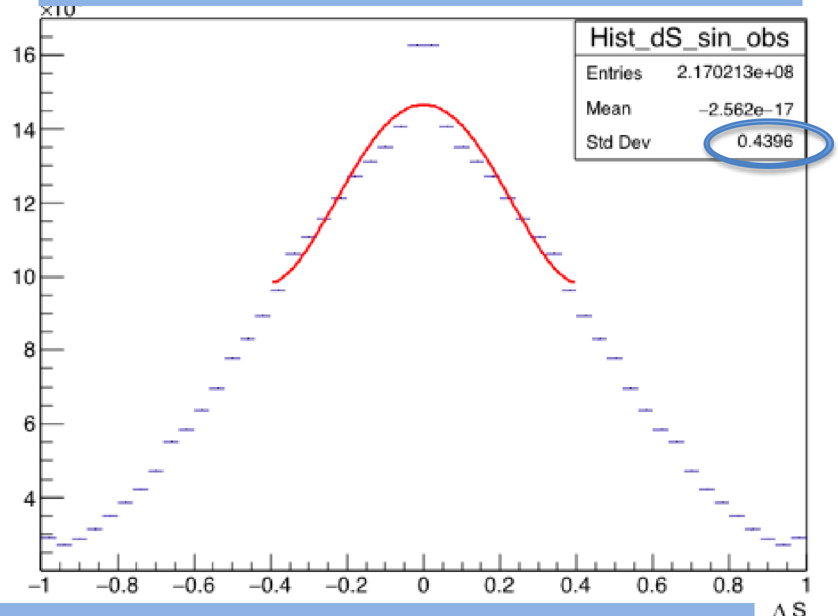
- vertex Z: ± 40 cm

Particle Cuts:

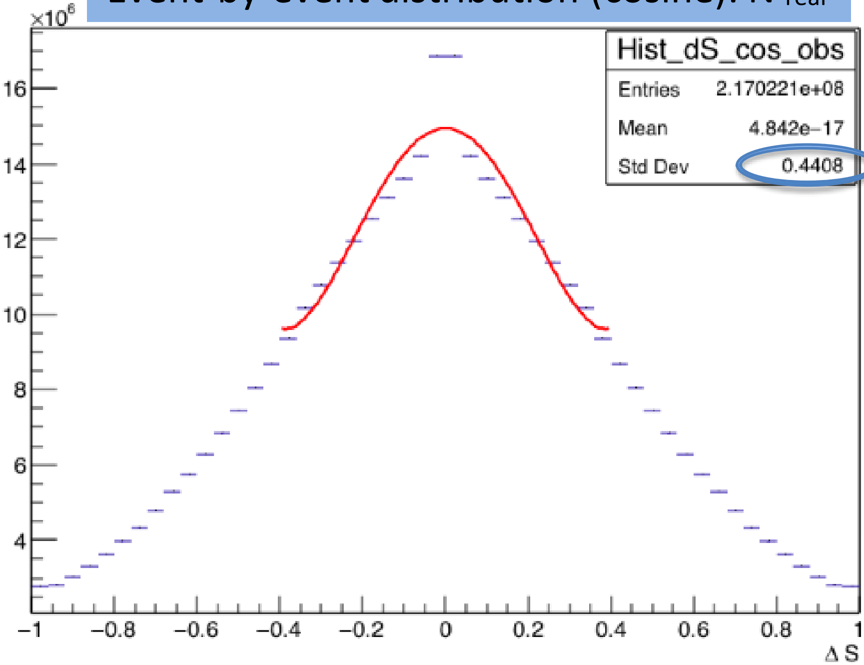
- pT : (0.2 – 2) GeV/c
- η : ± 1
- DCA (distance of closest approach): less that 2cm
- All tracks have matching TOF (time of flight)

p+Au collision high-tower trigger (0-100% events)

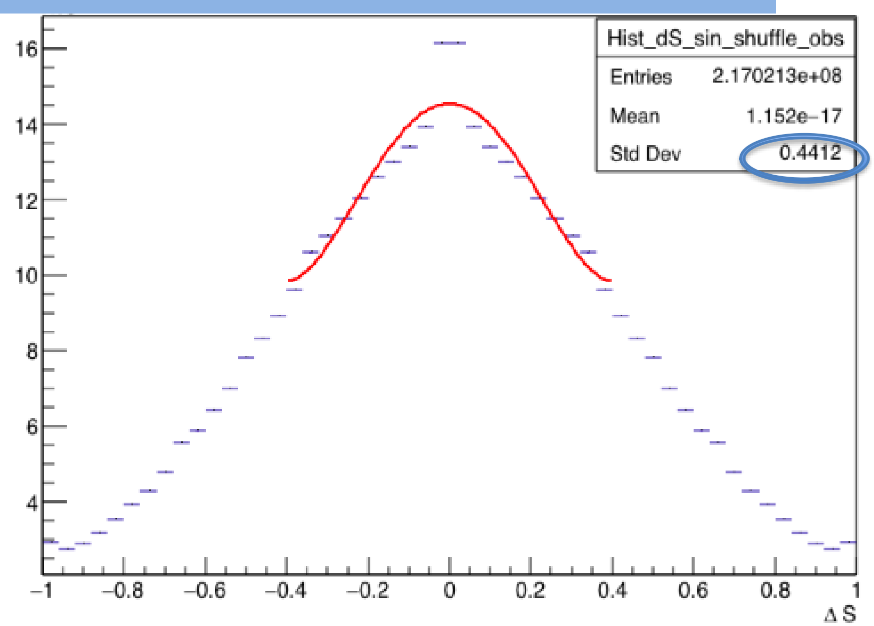
Event-by-event distribution (sine): N $_{real}$



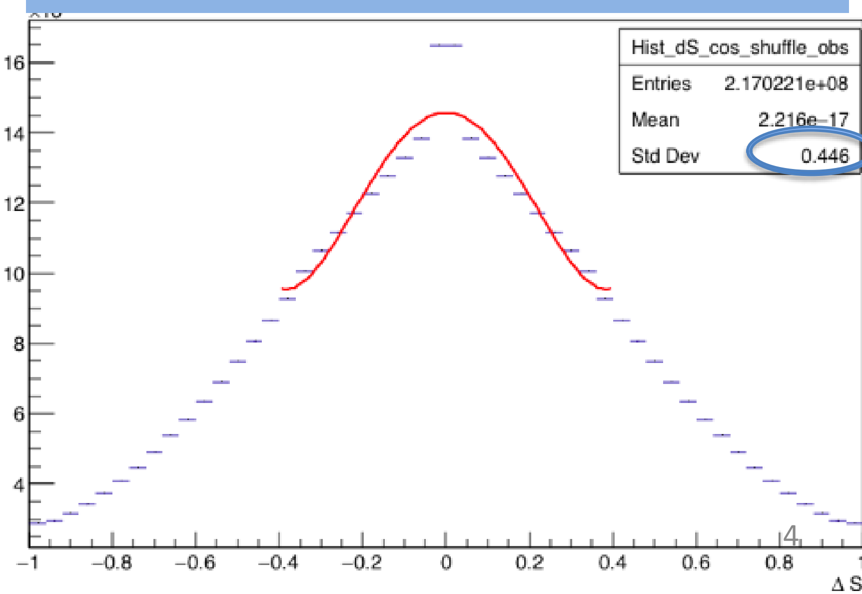
Event-by-event distribution (cosine): N $_{real}$



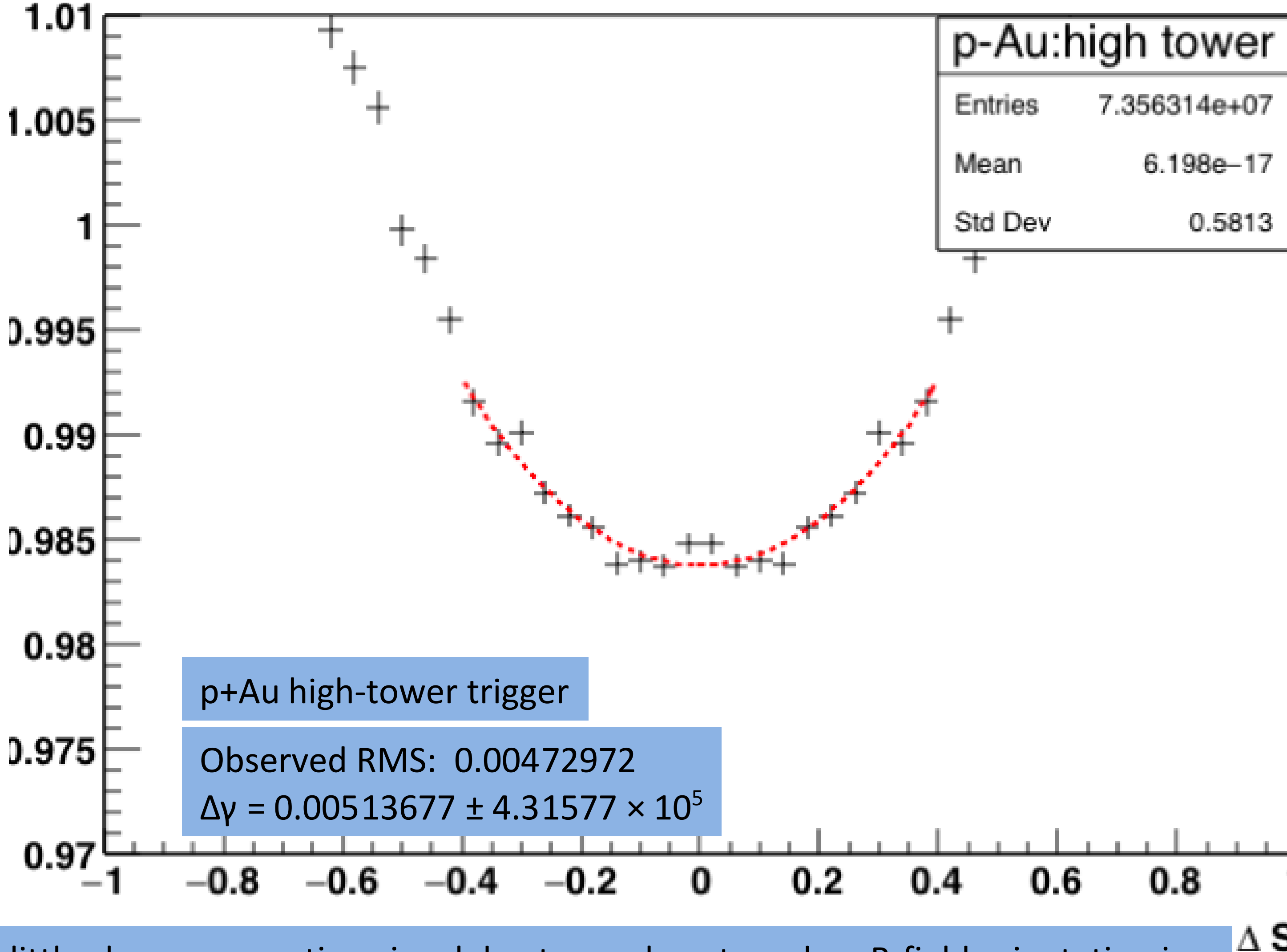
Random shuffling of charges(sine): N $_{shuffle}$



Random shuffling of charges(cosine): N $_{shuffle}$



p+Au collision (0-100% events)



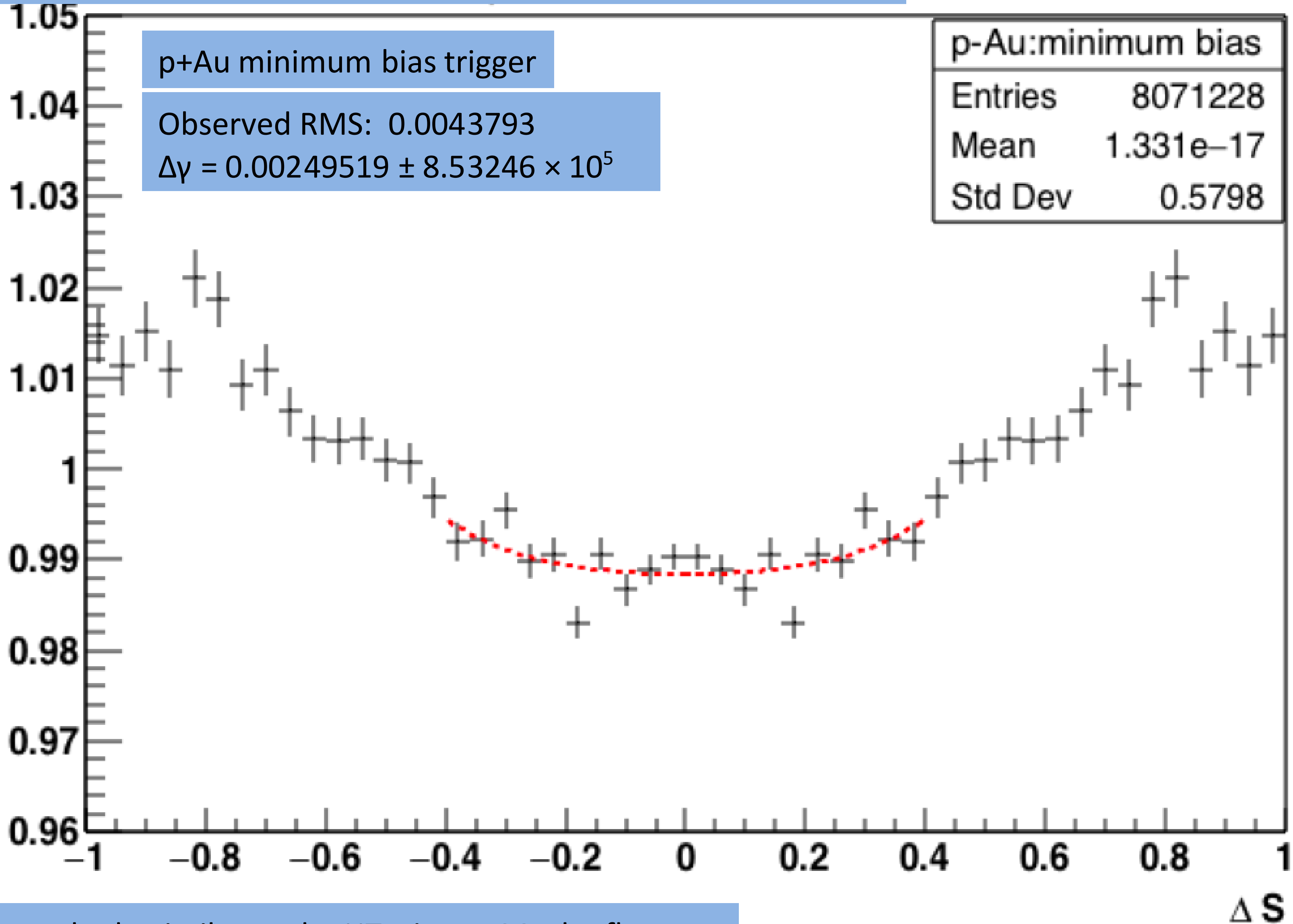
p+Au high-tower trigger

Observed RMS: 0.00472972

$\Delta\gamma = 0.00513677 \pm 4.31577 \times 10^{5}$

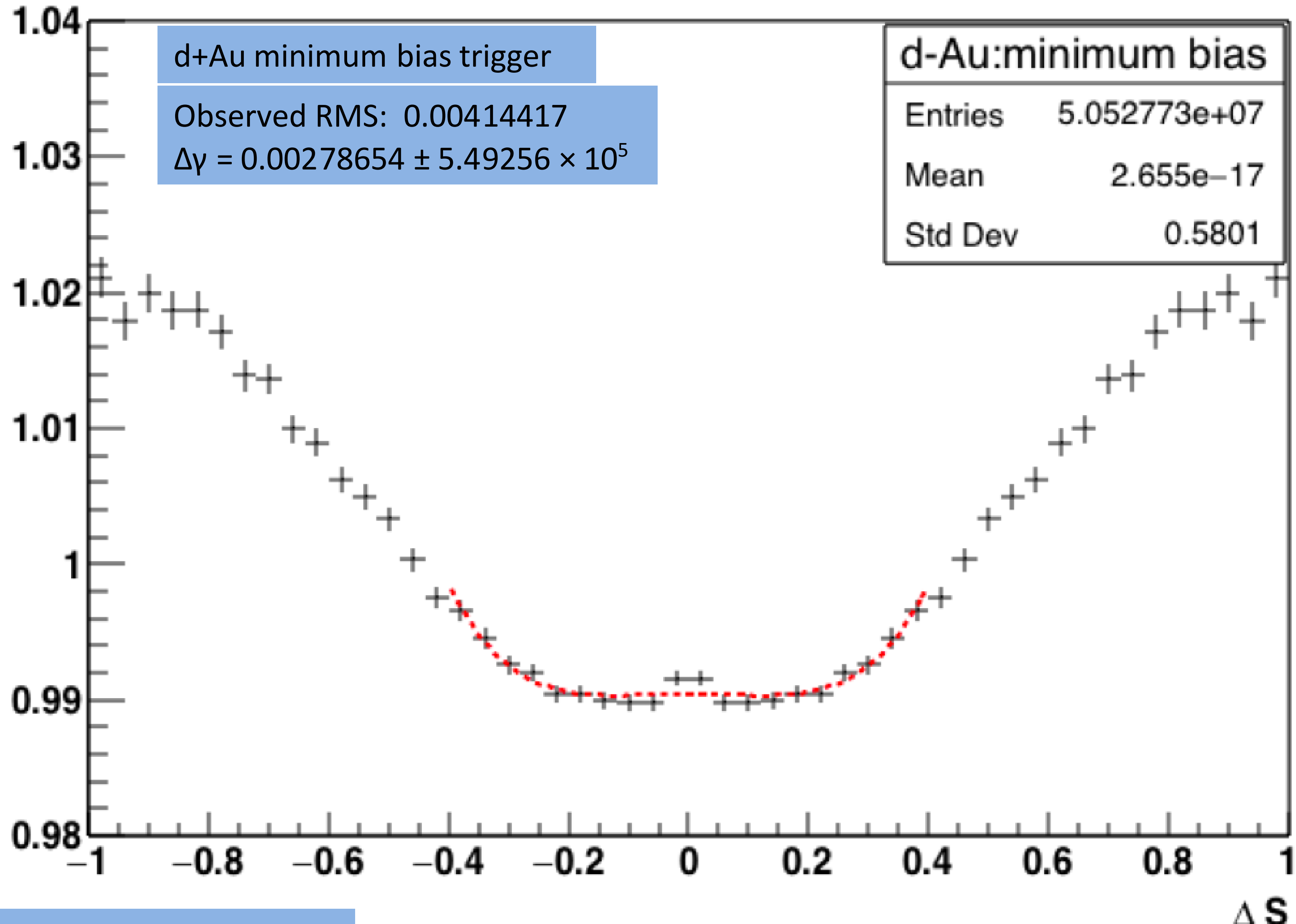
- p+Au has very little charge separation signal due to an almost random B-field orientation in these collisions
- The double ratio should be a flat or convex shape, but we see a concave shape (indicating a CME-driven charge separation?)

p+Au collision (0-100% events)



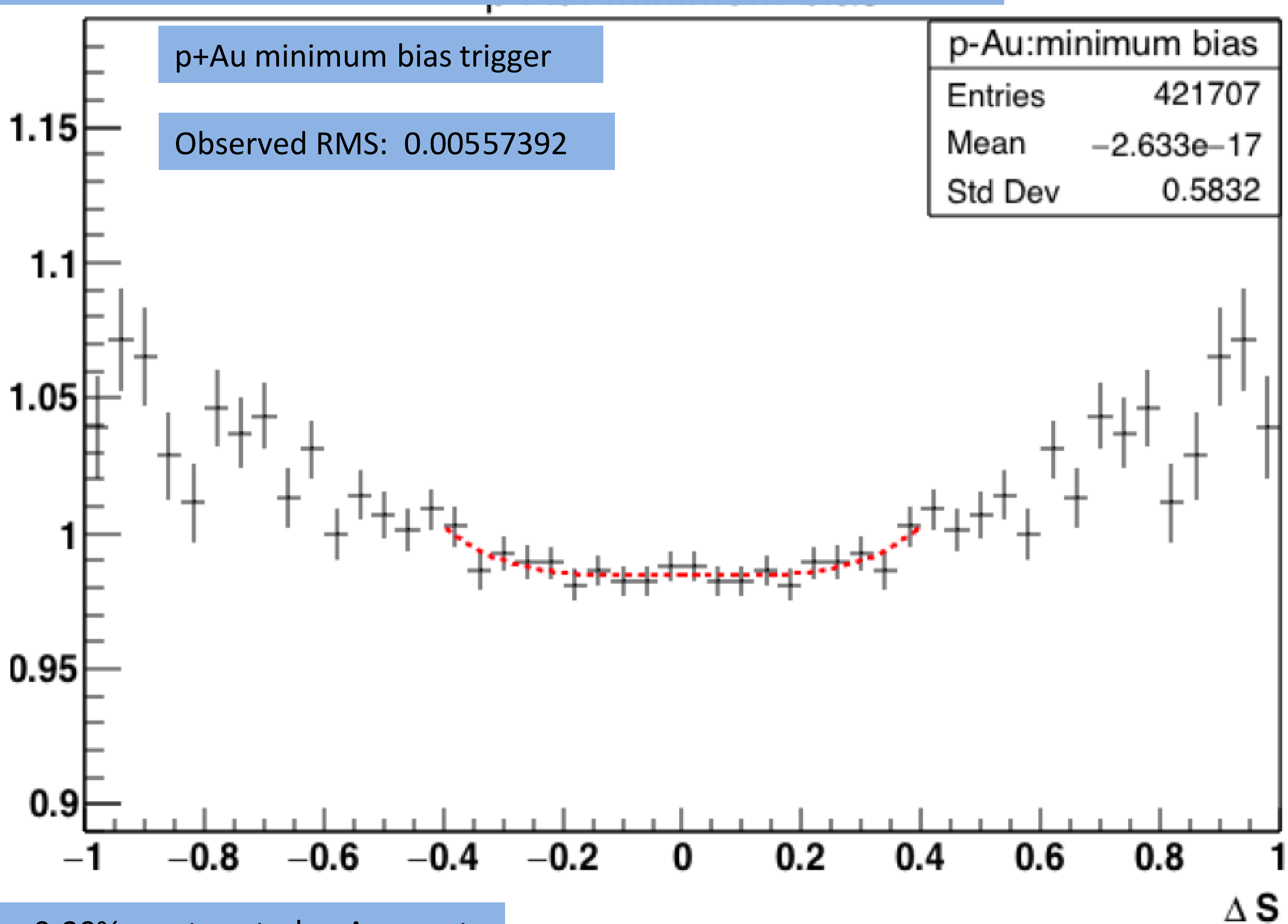
- The MB trigger looks similar to the HT trigger. Maybe flatter.

d+Au collision (0-100% events)



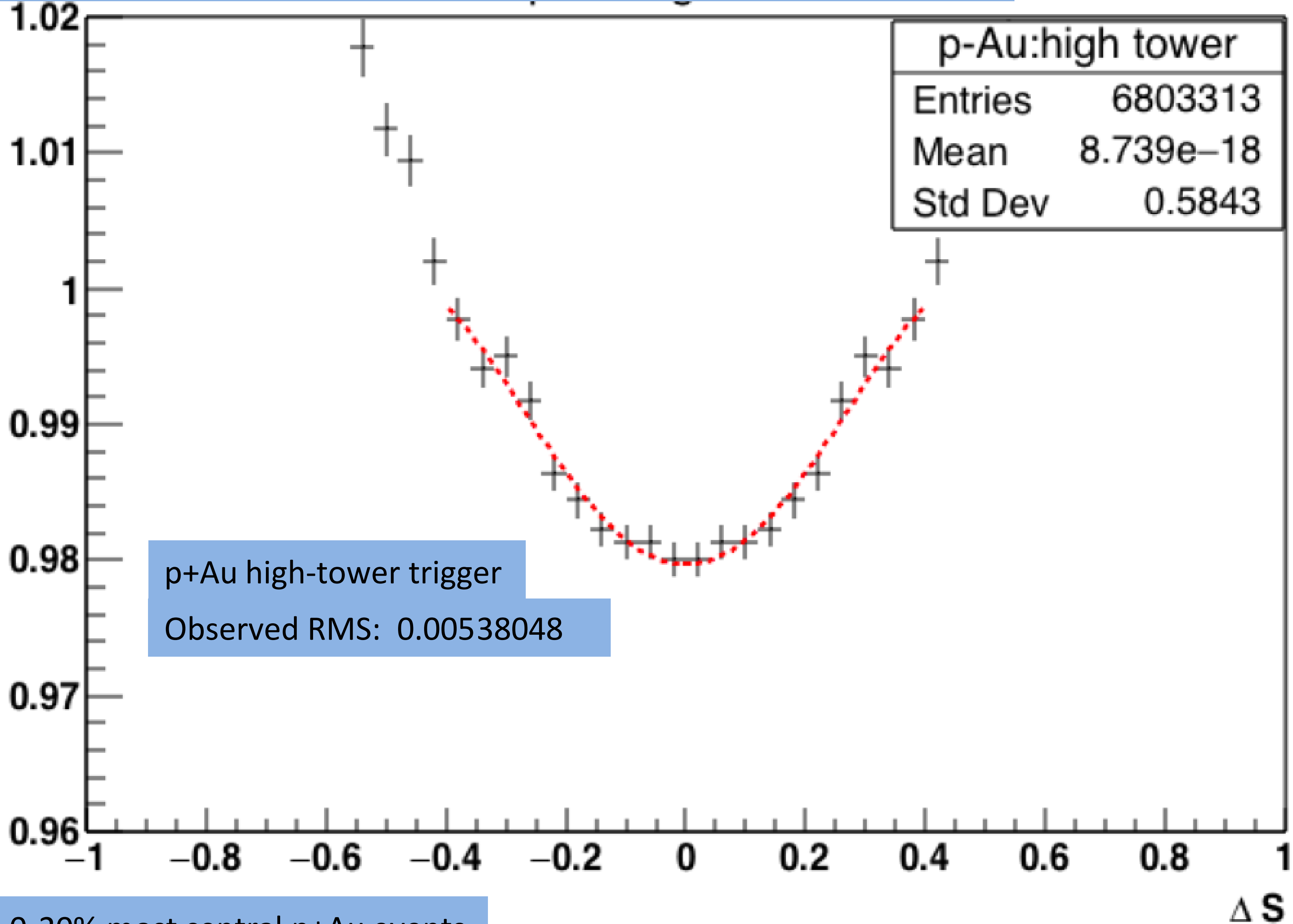
- d+Au show a similar case as p+Au

p+Au collision (0-20% most central events)



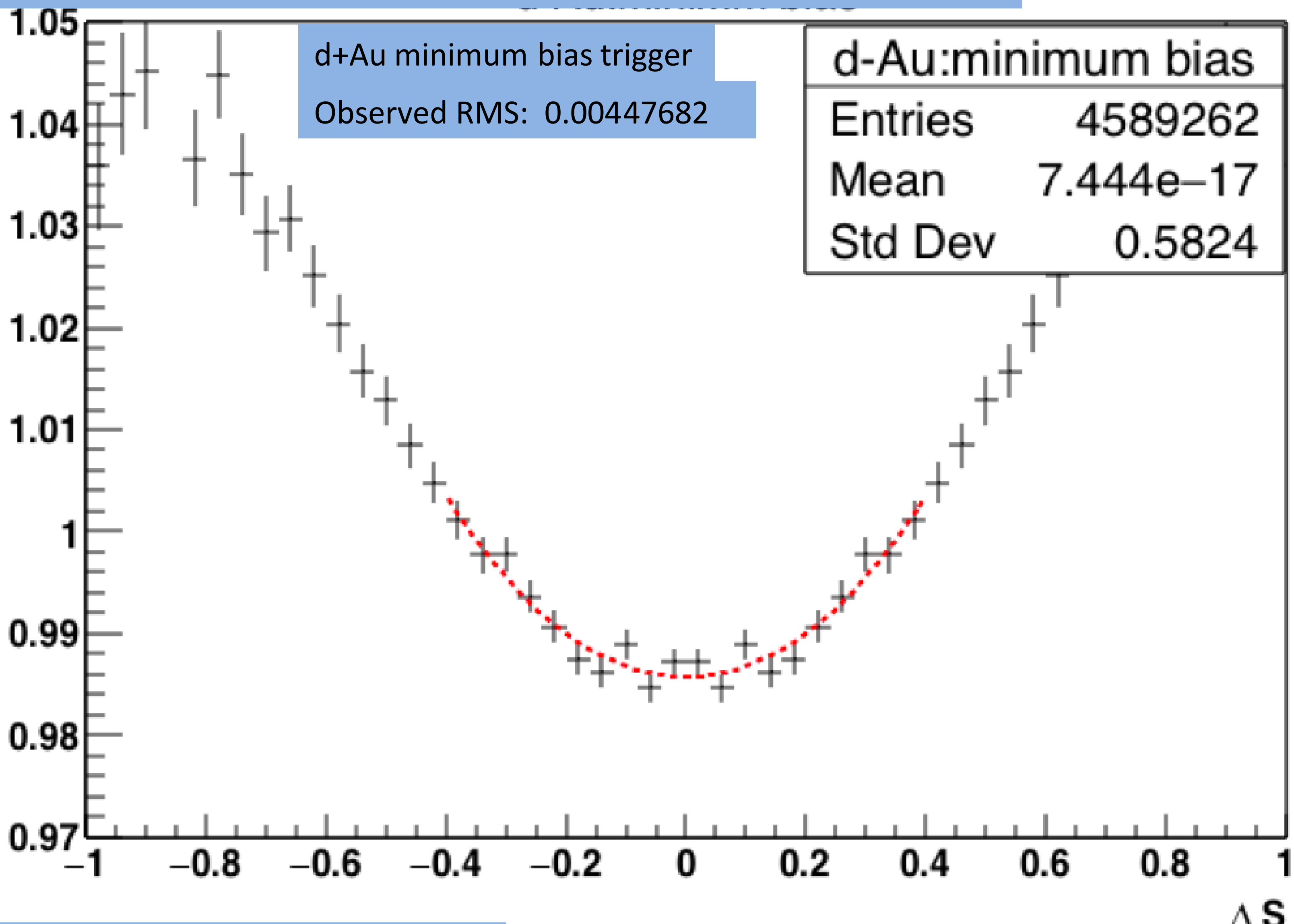
This shows the 0-20% most central p+Au events

p+Au collision (0-20% most central events)



This shows the 0-20% most central p+Au events

d+Au collision (0-20% most central events)



This shows the 0-20% most central d+Au events

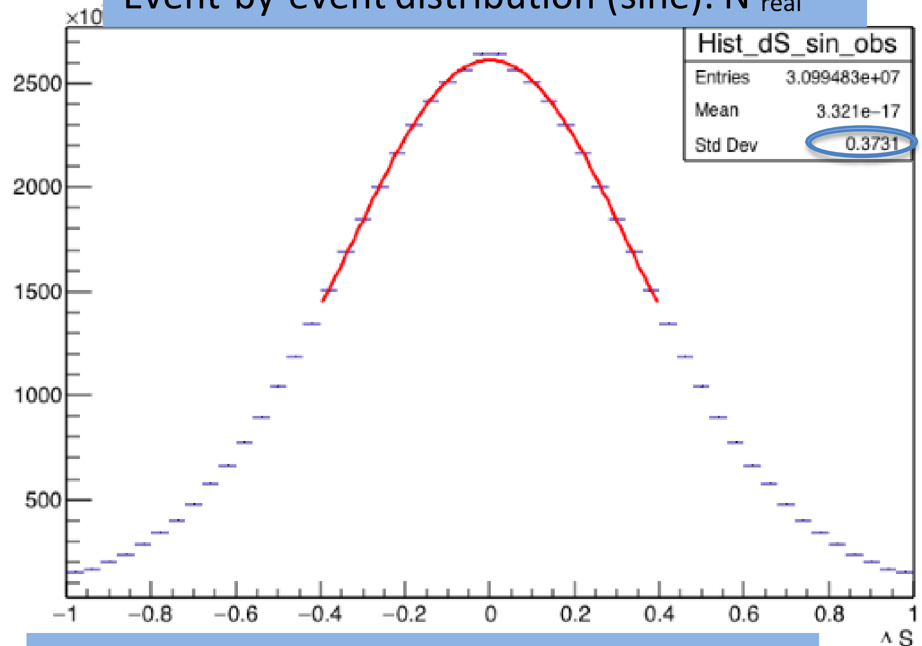
Summery

- We tested this method on p+Au and d+Au collisions of both high-tower and minimum bias triggers and of different centralities.
  - They seem to show a signal.
- These figures are different than Niseem's figures.
  - We need to further investigate what is causing this difference
- We want to look into larger systems, for example peripheral Au+Au collisions.

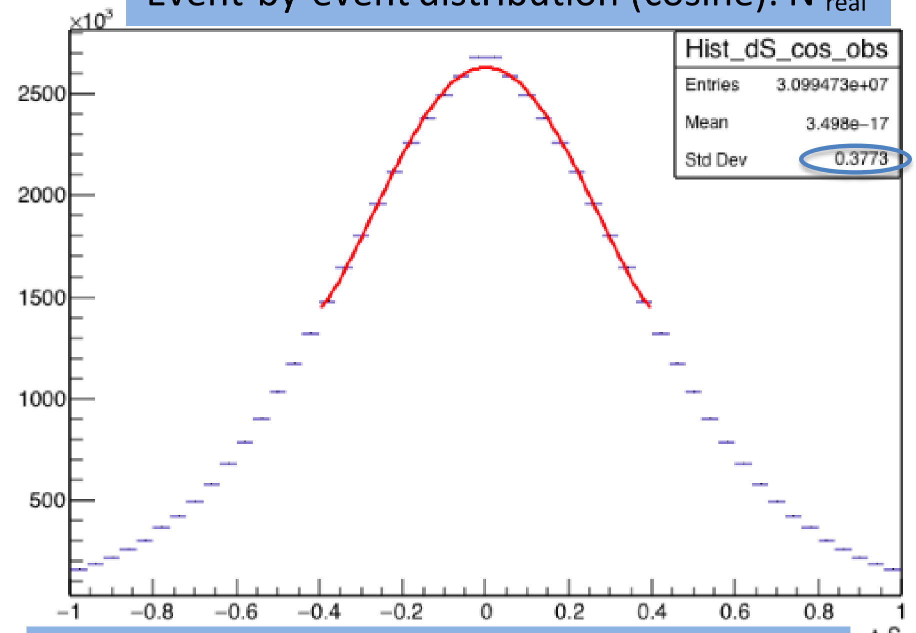
Backup Slides

p+Au collision high-tower trigger (0-20% events)

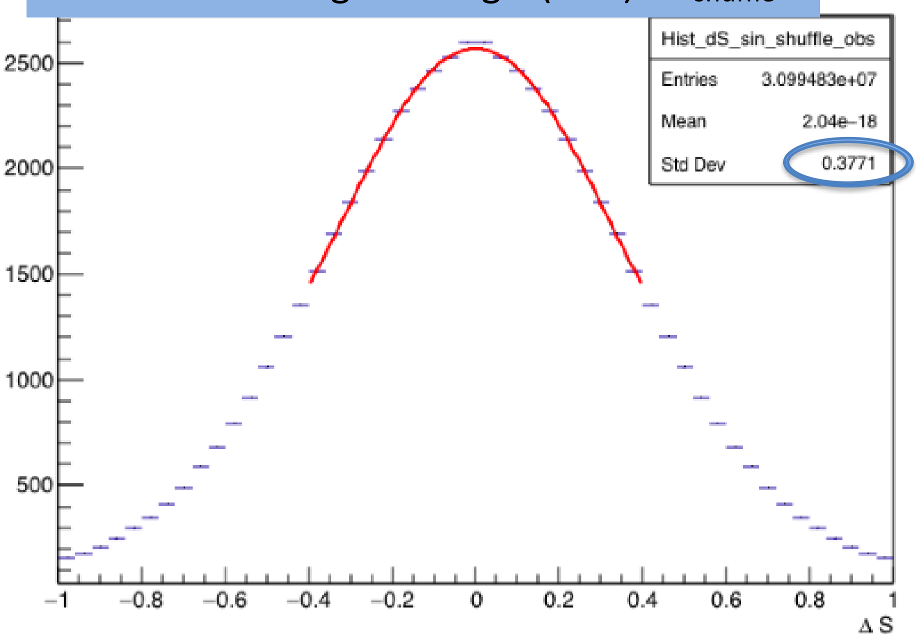
Event-by-event distribution (sine): N $_{real}$



Event-by-event distribution (cosine): N $_{real}$



Random shuffling of charges(sine): N $_{shuffle}$



Random shuffling of charges(cosine): N $_{shuffle}$