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Searching for the chiral magnetic effect in heavy-ion collisions with the sliding dumbbell method

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The deconfined state of matter created in hot and dense medium at ultra relativistic heavy-ion collision causes back-to-back charge separation along the direction of magnetic field produced due to energetic spectator protons, a
phenomena known as the chiral magnetic effect (CME). A new technique, the Sliding Dumbbell Method (SDM), is developed to search for back-to-back charge separation on event-by-event basis. The SDM is applied to AMPT generated Au + Au collisions at $\sqrt{s}_{\mathrm{NN}}$ = 200 GeV. The CME like signal is externally injected in each event by flipping the charges (one/two) of particles perpendicular to the reaction plane. Here, whole azimuthal plane is scanned by sliding the dumbbell of 90° in steps of 1°, searching for the maximum of the sum, $Db_{\pm}^{max}$, of the positive charge fraction on one side and the negative charge fraction on the other side of the dumbbell. The fractional dumbbell charge separation is sliced into 10 percentile bins for each centrality to get sample of events enriched with CME like signal. Two- and three- particle correlations will be presented for different charge separations in each collision centrality along
with those of the charge reshuffled background. A significant enhancement of
the CME-sensitive γ-correlator is reported for the top percentile bin of the $Db_{\pm}^{max}$ distribution in each centrality, which bacame possible using the SDM. The CME-sensitive γ-correlator is also estimated for the particles inside the dumbbell. The γ-correlator dependence on fractional dumbbell charge separation will also be discussed.

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