**Title**

Spin-spin correlations in $Λ\overline{Λ}$ pairs production

**Abstract**

Spin correlations of $Λ\overline{Λ}$ pairs produced in pp and dd collisions can provide unique insight into the locality and entanglement effects in hadronization process. it is expected that the maximum effect should be observed at small multiplicities of secondary particles, i.e., at low energies. The possible dependence of the effect on collision energy, hyperon pair energy and relative momentum, beam polarization, and type of colliding particles is supposed to be studied. High-luminosity polarized and unpolarized pp and dd collisions at NICA energies are the optimal tool for such studies.

**General information**

**Observables:** two-particle ($p\overline{p}$) angular correlation function (angle between $p$ $\overline{p}$ momenta taken in the $Λ$ and $\overline{Λ}$ rest frames, respectively

**Physics being addressed:** possible quantum entanglement and nonlocality effects in hadronization processes

**Theoretical motivation papers:** [1],[2]

**Competitiveness:** low-energy collisions at SPD are the optimal tool for the proposed studies

**Complementarity:**

**Previous results:** STAR (preliminary) [3]

**Actuality:** actual

**Importance:** ???

**Keywords** spin correlations, quantum entanglement, nonlocality, hadronization

**Experimental requirements:**

**Beam** s**pecies:** dd, pp

**Collision** e**nergy:** 5 -13 GeV

**Luminosity:** 1031 cm-2 s-1 (13 GeV)

**Polarization:** preferably but not necessarily

**Involved SPD subsystems:** MCT, Straw tracker

**Optimal duration of data taking:** 1 month

**Minimal duration of data taking:**  3 days

**Expected performance:**

**Simulation information used:** Pythia8-based MC**,** acceptance for $Λ$ is estimated as 0.2

**Total statistics:** 60M $Λ\overline{Λ}$ pairs for dd collisions at 13 GeV

S**tatistical accuracy:** for $P\_{Λ\overline{Λ}}$-10-3

**Main sources of systematics:** incorrectness of the setup description in MC, combinatorial background subtraction

**References**

[1] W. Gong, G. Parida, Z. Tu and R. Venugopalan, Measurement of Bell-type inequalities and quantum entanglement from$Λ$-hyperon spin correlations at high energy colliders, Phys. Rev. D **106** (2022) no.3, L031501

[2] A. Hayrapetyan et al. [CMS], Observation of quantum entanglement in top quark pair production in proton-proton collisions at $\sqrt{s}$ = 13 TeV, Rept. Prog. Phys. **87** (2024) no.11, 117801

[3] J. Vanek, Measurement of $Λ$ hyperon spin-spin correlations in p+p collisions by the STAR experiment, PoS **DIS2024** (2025), 217