SPD physics at the first phase

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1st phase of SPD

Physics of the 1st stage of SPD running will be constrained by the completeness of detector and the possibilities of the NICA collider (energy of the beams, their polarization values, etc).
More details from SPD TDR:

The SPD operation should start a few years after the collider starts operating using the possibilities of polarized p-p and d-d collisions at $\sqrt{s} < 9.4$ GeV and $\sqrt{s} < 4.5$ GeV/nucleon, respectively, as well as A-A collisions. The starting configuration should consist of the Range System, solenoidal superconducting magnet, Straw tube-based Tracker, a pair of Zero Degree Calorimeters, and a pair of Beam-Beam Counters. A simple Micromegas-based Central Tracker (MCT) will be installed in the central region instead of the sophisticated silicone vertex detector to keep a reasonable momentum resolution. Partial installation of other detectors (ECal, TOF, etc.) is also possible in the first stage.

We expect that for the first stage, the collider will be able to operate with polarized protons and deuterons in the spin transparency mode. The absolute value of the beam polarization should be not less than 0.5 for protons and 0.6 for deuterons. Collisions of longitudinally and transversely polarized particles, p-p and d-d (in all combinations: LL, TT, TL, and LT), will be available at energy up to $\sqrt{s} = 9.4$ GeV for protons and $\sqrt{s} = 4.5$ GeV/nucleon for deuterons. The corresponding luminosity is up to about 10^{31} cm^{-2} s^{-1} and 10^{30} cm^{-2} s^{-1}, respectively. Both vertical and radial directions will be possible for the transverse polarization. Tensor polarization for deuteron will also be available. Absolute polarimetry is expected to be provided with accuracy not worse than 5% for both vertical and radial directions. We also expect that it will be possible to operate in the mode of heavy-ion collision.

1st phase of SPD

The **first stage** of the SPD experiment will be devoted to the study of polarized and non-polarized phenomena at low energies and reduced luminosity using heavy ion (up to Ca) and polarized proton and deuteron beams such as polarized phenomena in elastic p-p and d-d scattering and other exclusive reactions, spin effects in hyperon production, production of dibaryon resonances and hypernuclei, near-threshold charmonia production, etc. The duration of the first stage can be up to two years [1]. It implies the construction of a minimum setup configuration that should include (see Fig. 2.1):

- a Range System (RS) – supporting structure of the entire installation and a magnet yoke, muon identification;
- a Superconducting Solenoid (SS) – charged particle momentum reconstruction;
- a Straw-based Tracking system (ST) – charged particle momentum reconstruction, PID via dE/dx measurement;
- a simple Micromegas-based Central Tracker (MCT) – to improve charged particle momentum reconstruction;
- a system of two Beam-Beam Counters (BBC), inner and outer – local polarimetry, luminosity control, and, possibly, timing;
- a system of two Zero Degree Calorimeters (ZDC) – local polarimetry and luminosity control).

It could also include some elements of an Electromagnetic Calorimeter (ECal) for physics with photons and a local π^0-based polarimetry.

Goal of the meetings

- Understand where we are, what we have
- Organize the effort (meetings, working groups, publications)
- Update the physics program of the first stage (initial plan is here). Possible workshop can take place during the spring of 2025
- Timeslot:

We can have it on Tuesday alternating with usual physics meeting, 3pm Moscow time