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Genetic Algorithm for determination of event collision time and particle identification by Time-Of-Flight at SPD NICA

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Studying spin-related phenomena will help uncover information about internal structure of nucleon. It can be done using polarized beams of protons and deuterons. To study those effects on NICA collider it is proposed to install the Spin Physics Detector(SPD) in one of two interaction points.

In this work two problems were studied. First is developing a fast and accurate algorithm for determination of pp-collision time(t_0) for the SPD experiment [1]. Second is developing particle a identification(PID) procedure based on TOF signals.

Usage of TOF detectors to identify particles is one of the most reliable technique. To reconstruct the particle mass only three values are needed: $\vec{p}$ - momentum of the particle, L - arc length of the particle trajectory and TOF - Time-Of-Flight. To measure TOF one needs start(t_0) and stop signals. While stop signals are obtained with TOF detector, t_0 cannot be measured directly. Main idea for t_0 determination: for tracks in the event find a set of masses that minimises sum of the squares of the residuals (χ^2).

To solve χ^2 minimisation problem Differential Evolution-inspired [2] Genetic Algorithm(GA) was developed and it's results were compared to Brute Force Algorithm(BFA). BFA have very slow run time, but it provides the exact solution to the χ^2 minimisation problem. So main requirements to GA was to decrease run time while keeping high accuracy.

With a reliable method for t_0 determination, particle identification can be performed. There are several approaches that can be used for PID procedure [3]. In this work Bayesian approach, "n-sigma" criteria and solution for χ^2 minimisation problem were compared.

1. Conceptual design of the Spin Physics Detector. arXiv:2102.00442
2. E. Zhabitskaya and M. Zhabitsky, Proceedings of the 15th annual conference on Genetic and evolutionary computation, GECCO'13, ACM, 455–462 (2013)
3. The ALICE Collaboration., Adam, J., Adamová, D. et al. Particle identification in ALICE: a Bayesian approach. Eur. Phys. J. Plus 131, 168 (2016). https://doi.org/10.1140/epjp/i2016-16168-5

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