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Search for bottlenecks in SpdRoot code

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In modern scientific computing, optimizing software performance is critical, especially for resource-intensive processes such as event reconstruction in high-energy physics experiments. The SpdRoot package, based on FairRoot, faces challenges with slow event processing, increasing the needs in computing time and resources. This study is aimed to identify and eliminate bottlenecks in SpdRoot's source code to improve event reconstruction speed and computational resource usage. The methodology includes static code analysis using PVS-Studio, and Python libraries (pandas, matplotlib) for data processing and visualization. Key issues identified in the code include: integer overflow risks, unsafe type casting, memory leaks, missing copy constructors, and logical errors in control structures. Proposed fixes, such as memory operation optimization and elimination of undefined behavior, slightly reduced average reconstruction time per event without compromising output integrity. These results highlight the potential for further code optimization based on the proposed methodology, particularly relevant for NICA experiments, where processing speed directly impacts research efficiency.

Authors: DIDORENKO, Aleksei (Meshcheryakov Laboratory of Information Technologies); Dr VOYTISHIN, Nikolay (JINR)

Presenter: DIDORENKO, Aleksei (Meshcheryakov Laboratory of Information Technologies)

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