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GPUs for statistical data analysis in HEP: a performance study of GooFit on GPUs vs Roofit on CPUs

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In order to test the computing capabilities of GPUs with respect to traditional CPU cores a high-statistics toy Monte Carlo technique
has been implemented both in ROOT/RooFit and GooFit frameworks with the purpose to estimate the statistical significance of the
structure observed by CMS close to the kinematical boundary of the JPsiPhi invariant mass in the three-body decay B+ to JPsi Phi K+.
GooFit is a data analysis open tool under development that interfaces ROOT/RooFit to CUDA platform on nVidia GPU.
The optimized GooFit application running on GPUs hosted by servers in the Bari Tier2 provides striking speed-up performances
with respect to the RooFit application parallelised on multiple CPUs by means of PROOF-Lite tool.
The considerably resulting speed-up, while comparing concurrent GooFit processes allowed by CUDA Multi Process Service and a
RooFit/PROOF-Lite process with multiple CPU workers, is presented and discussed in detail.
By means of GooFit it has also been possible to explore the behaviour of a likelihood ratio test statistic in different situations
in which the Wilks Theorem may apply or does not apply because its regularity conditions are not satisfied.

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