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Fast Jet Reconstruction in Julia

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Jet reconstruction remains a critical task in the analysis of data from HEP colliders. We describe in this paper a new, highly performant, Julia package for jet reconstruction, JetReconstruction.jl, which integrates into the growing ecosystem of Julia packages for HEP. With this package users can run sequential reconstruction algoritms for jets, In particular, for LHC events, the Anti-k_T, Cambridge/Aachen and Inclusive k_T algorithms can be used. For FCCee studies the use of alternative algorithms such as the generalised ee-k_T and Durham are also supported.

The full reconstruction history is made available, allowing inclusive and exclusive jets to be retrieved. The package also provides the means to visualise the reconstruction.

The implementation of the package in Julia is discussed, with an emphasis on the features of the language that allow for an easy to work with, ergonomic, code implementation, that achieves high-performance. Julia's ecosystem offers the possibility to vectorise code, using single-instruction-multiple-data processing, in way that is transparent for the developer and more flexible than optimization done via C and C++ compilers. Thanks to this feature, the performance of JetReconstuction.jl is better than the current Fastjet C++ implementation in jet clustering for p-p events produced at the LHC.

Finally, an example of an FCCee analysis using JetReconstruction.jl is shown.

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