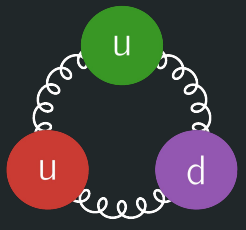


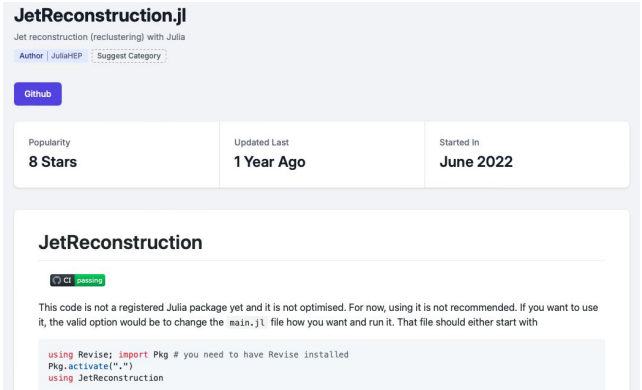
JetReconstruction.jl Update

Graeme Stewart

2024-06-20

Production!

- JetReconstruction.jl is in production
  - v0.3.0 (0.1 and 0.2 were used “internally”)
  - Registered as an package in the general registry now
  - `Pkg.add(“JetReconstruction”)` 😁
- Package registration on Julia Packages not yet updated
  - https://juliapackages.com/packages/jetreconstruction
  - Does this just take time?



Pre-release changes

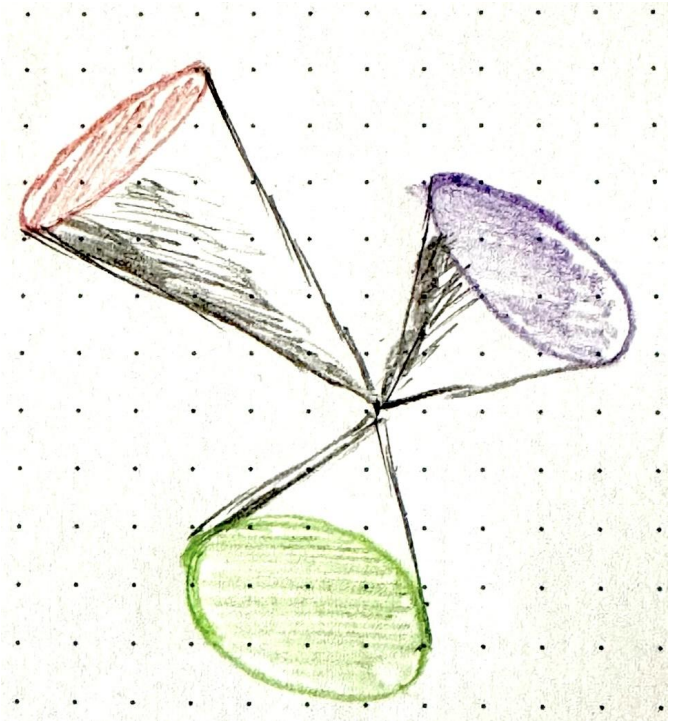
- Internal restructuring to uniformly use PseudoJets and return ClusterSequence objects
- Implemented exclusive jet selections (n_jet or dij_max cut)
- Fixes to visualisation
- Improved examples
- Significant improvements to documentation
  - Method and structure documentation
    - Thank you Co-pilot!
  - Documenter.jl setup
    - Now published at https://juliahep.github.io/JetReconstruction.jl/dev/
    - *Reminder to self* - enable GitHub Pages on the repository to close the loop!

Quick Fixes Coming Soon…

- Fixed examples
  - Examples used the uncompressed HepMC3 events file
    - Oops, this is not in the repository!
    - Added today automatic decompression of gzipped files
  - v0.3.1 to be tagged in the next day or so
- Also switched the graphics examples from WGLMakie to GLMakie
  - WGLMakie seems to be really flaky
    - Notebook cells would render, but then run on for minutes due to some backend connection issues to the http server
    - Reproduced this on two different machines (OS X, Windows 11) so it didn't seem to be a local glitch…
  - GLMakie seems very much more stable (VS Code with Jupyter, Pluto)

And of course

- Every good project needs a logo
- Jet Reconstruction has a very natural incarnation in the classical Julia colours



Benchmarks

- There are no core algorithm updates since JuliaHEP
  - But Julia 1.10 was released in December 2023 and now we're at 1.10.4...
  - Benchmarks on Apple M2 machine, standard event set of 14TeV pp collisions with p_T>20GeV with the Anti-kT algorithm

Jet Reconstruction in	Tiled Algorithm	Plain Algorithm
Julia 1.10.4	170	662
Julia 1.9.4	176	672
Fastjet 3.4.2	261	1899

- Speedups over FastJet arise from
  - Tiles and Plain - LoopVectorisation of the search for the closest jets
  - Plain - compact data layouts and SIMD
- N.B. on the M2 the advantage for Julia is large; on x86 more like +10%

Future Plans 1

- Upcoming JuliaCon presentation July 2024, Jet Reconstruction in Julia
- CHEP 2024 paper October 2024, Fast Jet Reconstruction in Julia
- Support FCC studies by implementing additional algorithms:
  - kT algorithm for e+e-
  - Generalised kT algorithm for e+e-
  - *Will allow more sophisticated FCCee analysis (beyond kinematic studies)*
  - Technically need to understand the best way to support different distance metrics
    - Can they be parameterised in the tiled and plain algorithms?
- Jet substructure and taggers
  - See Sattwamo's talk next

Future Plans 2

- Check support for and add examples for EDM4hep data inputs
  - This also supports FCCee workflows
- Some continued code restructuring
  - Better designed interface support for non-kT algorithms
  - More consistent naming internally (rapidity vs. eta is a bit muddled)
- Continued improvements to documentation
  - Better overview of the reconstruction process
  - Take best advantage of Documenter.jl features, e.g., reference manual
  - Contribution guide, code of conduct
- Visualisation: I would love an animation of the reconstruction process for JuliaCon!
- More speculative: interest in trying to implement algorithms on GPU