Pythia 8: soft QCD model, news and updates

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MPI@LHC, October 2021

Overview

Outline

High and low energy hadronic interactions

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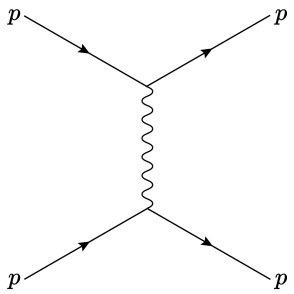
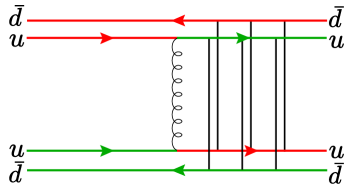
  - Hadronic rescattering (low energy) [arXiv:2005.05658, arXiv:2103.09665]
  - Hadronic cascades in media (both low and high) [arXiv:2108.03481]
- The necessary ingredients for generalized interactions are cross sections (both total and partial) and descriptions of the processes involved.

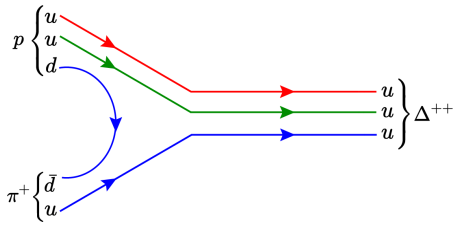
Low-energy interactions



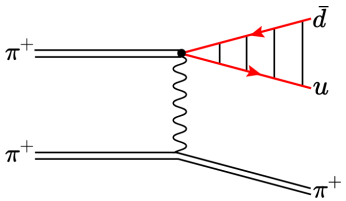
Elastic



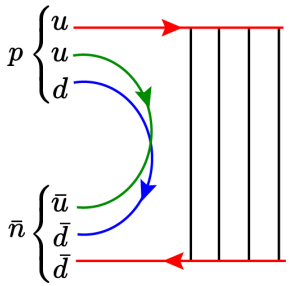
Non-diffractive



Resonant



Diffractive

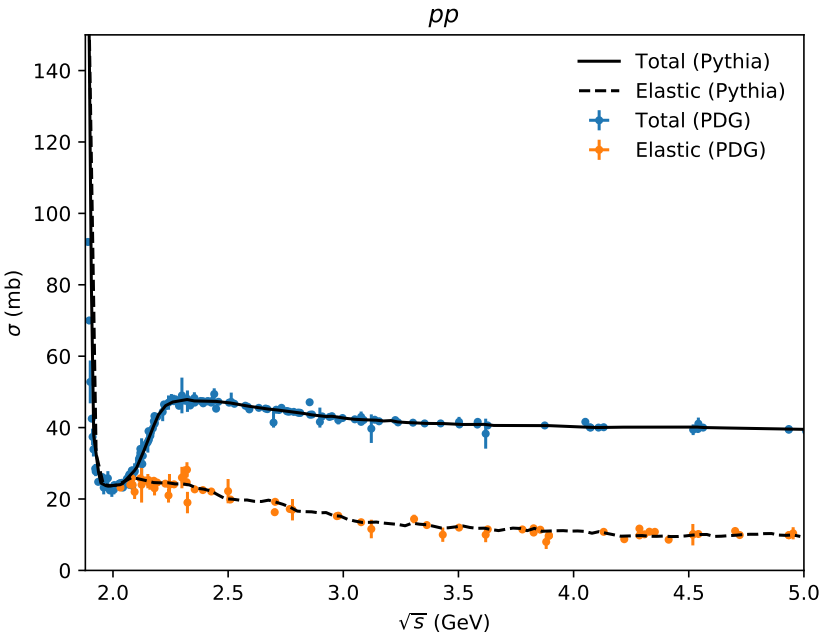


Annihilation

Low-energy collisions are simulated by turning on `LowEnergyQCD`.
Can combine with `SoftQCD` and `Beams:allowVariableEnergy`

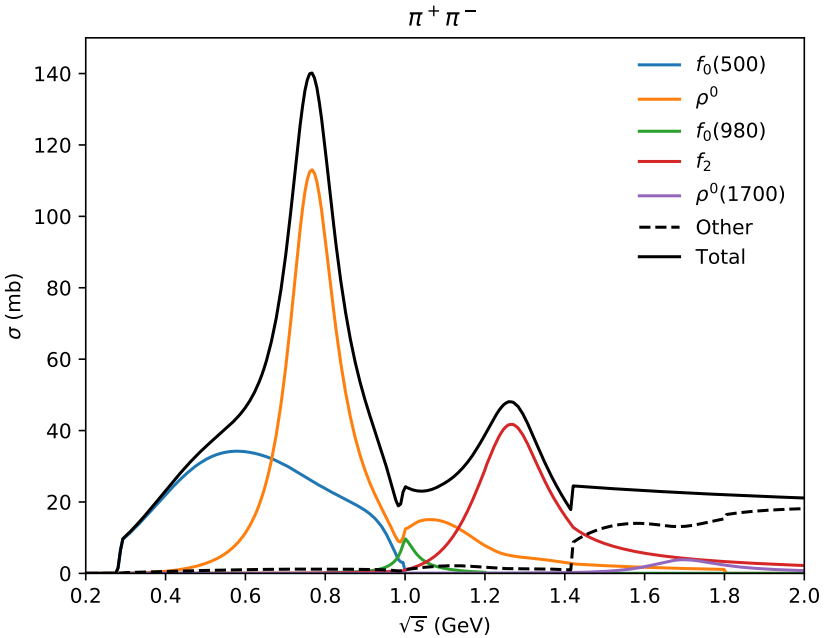
Cross sections

There are many special cases for low-energy cross sections.



Based on PDG data and HPR_1R_2 parameterization

(DOI: 10.1103/PhysRevD.98.030001)



Based on work by Pelaez, Rodas, Ruiz de Elvira et al. [arXiv:1102.2183, arXiv:1907.13162, arXiv:1602.08404]

High-energy processes

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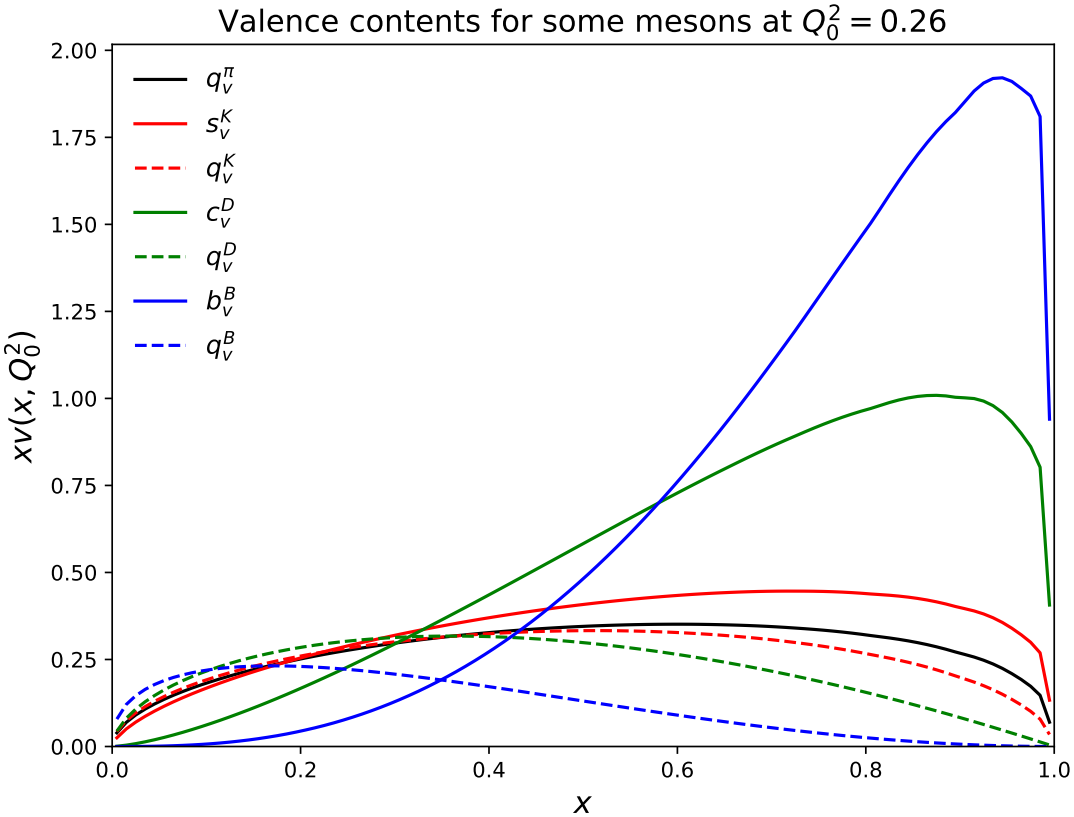

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Diffractive cross sections are based on the SaS ansatz, with parameters defined in terms of X^{pp} and X^{Ap}.

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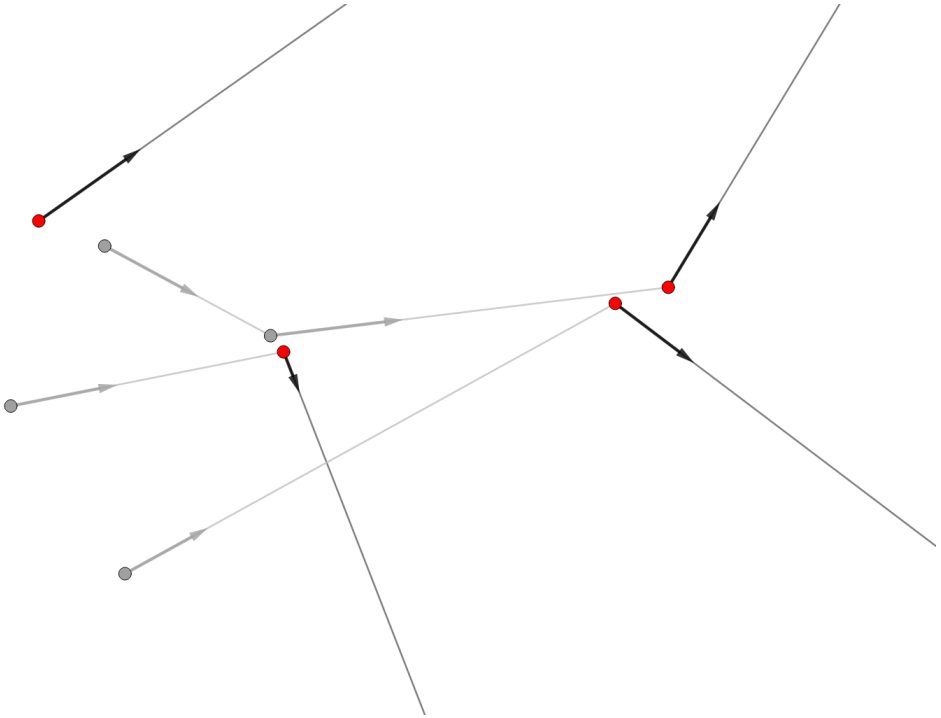

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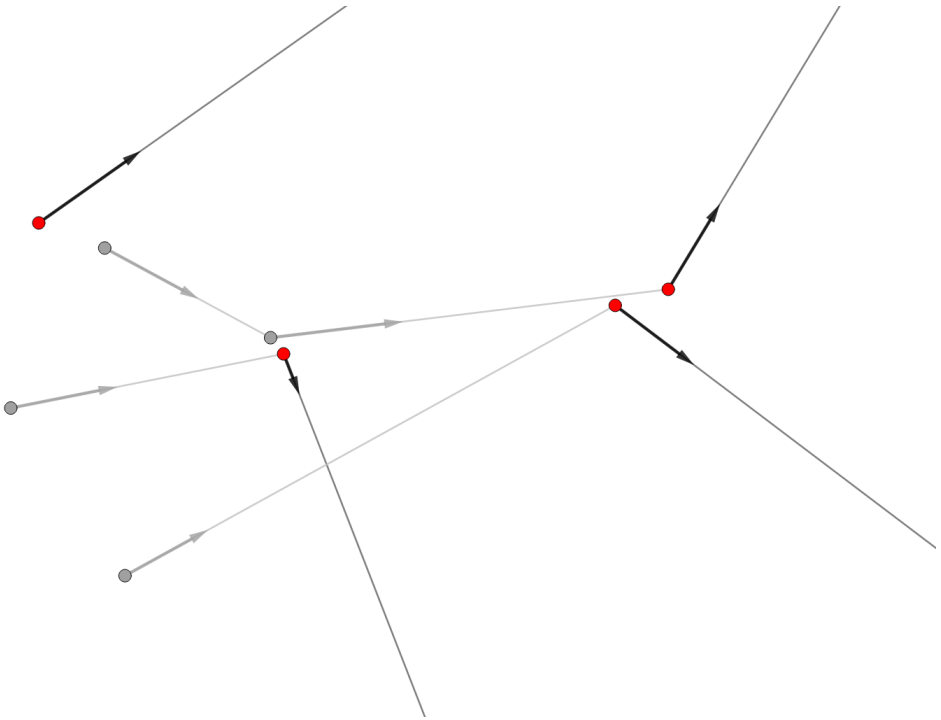

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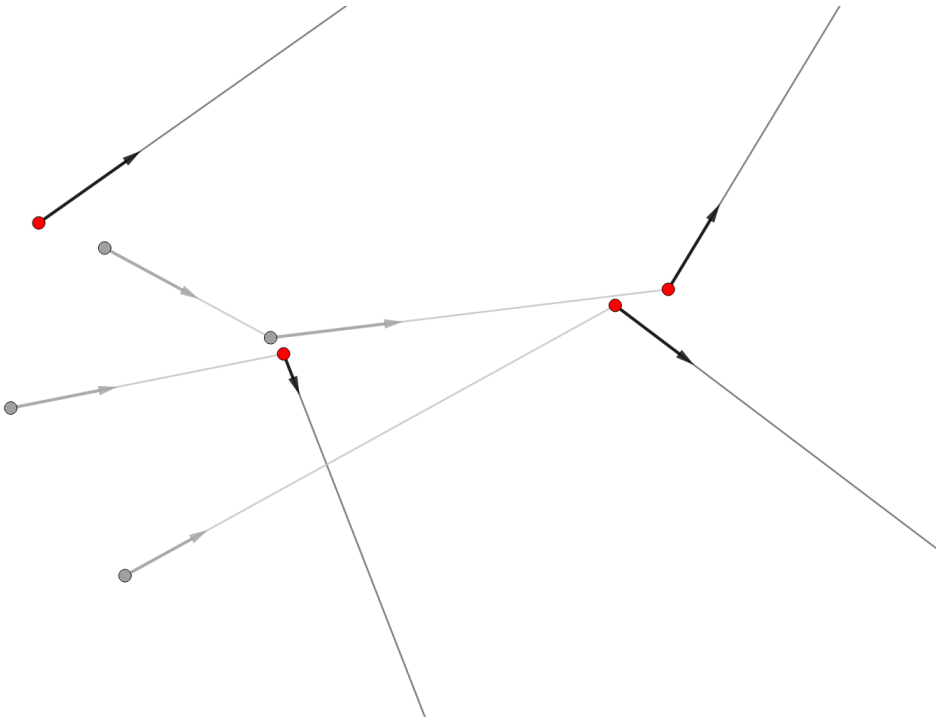

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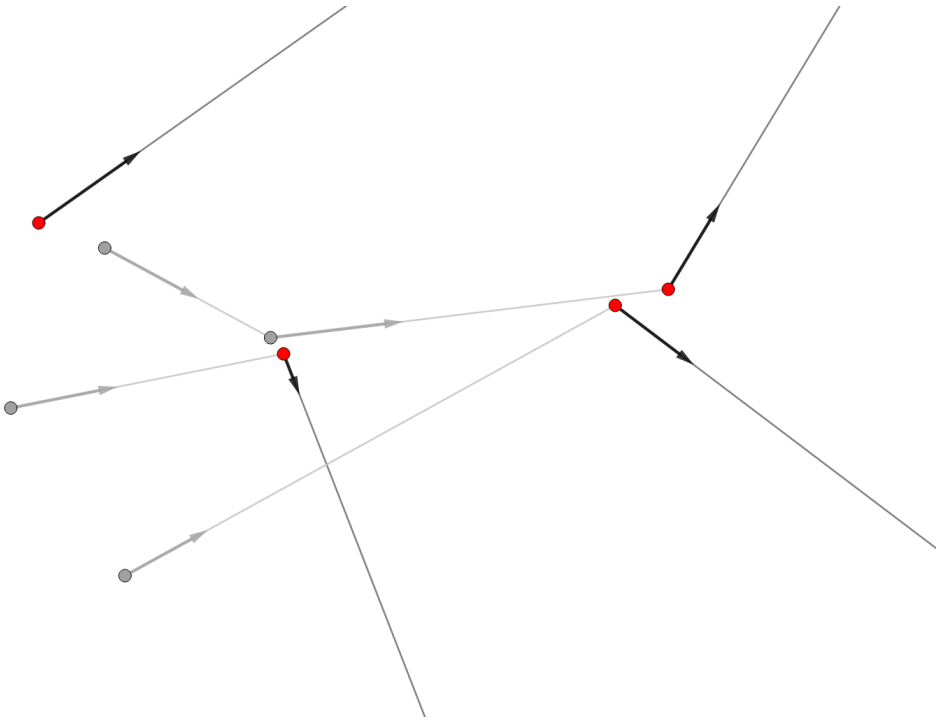

- PYTHIA offers a full spacetime picture, both for MPIs and hadronization
- Dynamic sized time-steps with interleaved decays of short-lived particles
- Geometric collision criterion. Interaction occurs at the time when particles pass each other in their rest frame

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- Simple to use, but relatively basic. For more sophisticated modelling, consider using e.g. the SMASH framework
- Open for future developments, but no specific features are currently in the works.

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- Planned feature: Electron–Ion Collider phenomenology

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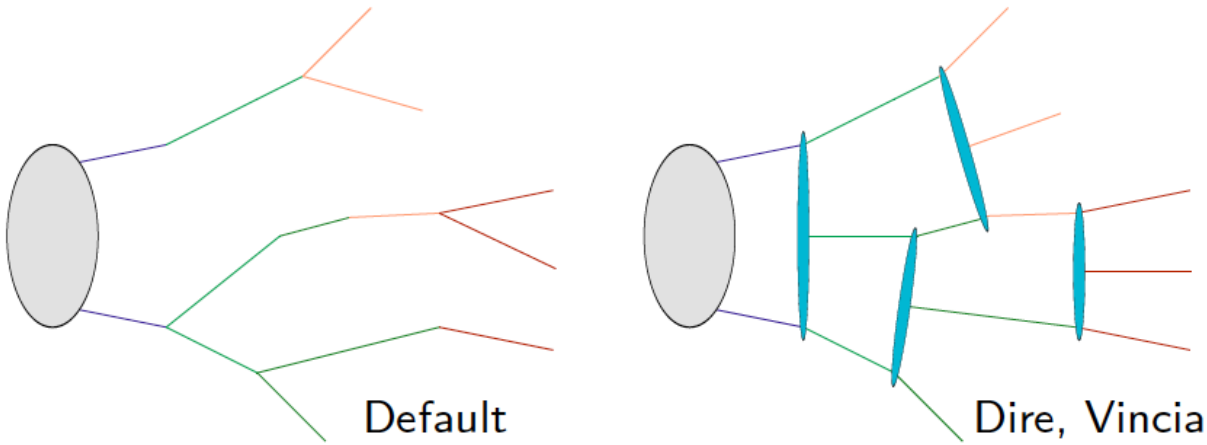
PYTHIA parton shower models

Starting from version 8.301, PYTHIA offers three built-in parton showers. Select which one by using the `PartonShowers:model` setting:

1. PYTHIA default
2. Vincia [`arXiv:2003.00702`]
3. Dire [`arXiv:1506.05057`]



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Future: NNLO + Parton Shower matching is on the todo-list for both Vincia [arXiv:2108.07133] and Dire

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Visit `pythia.org`!