PYTHIA8

a critical research infrastructure of national importance?

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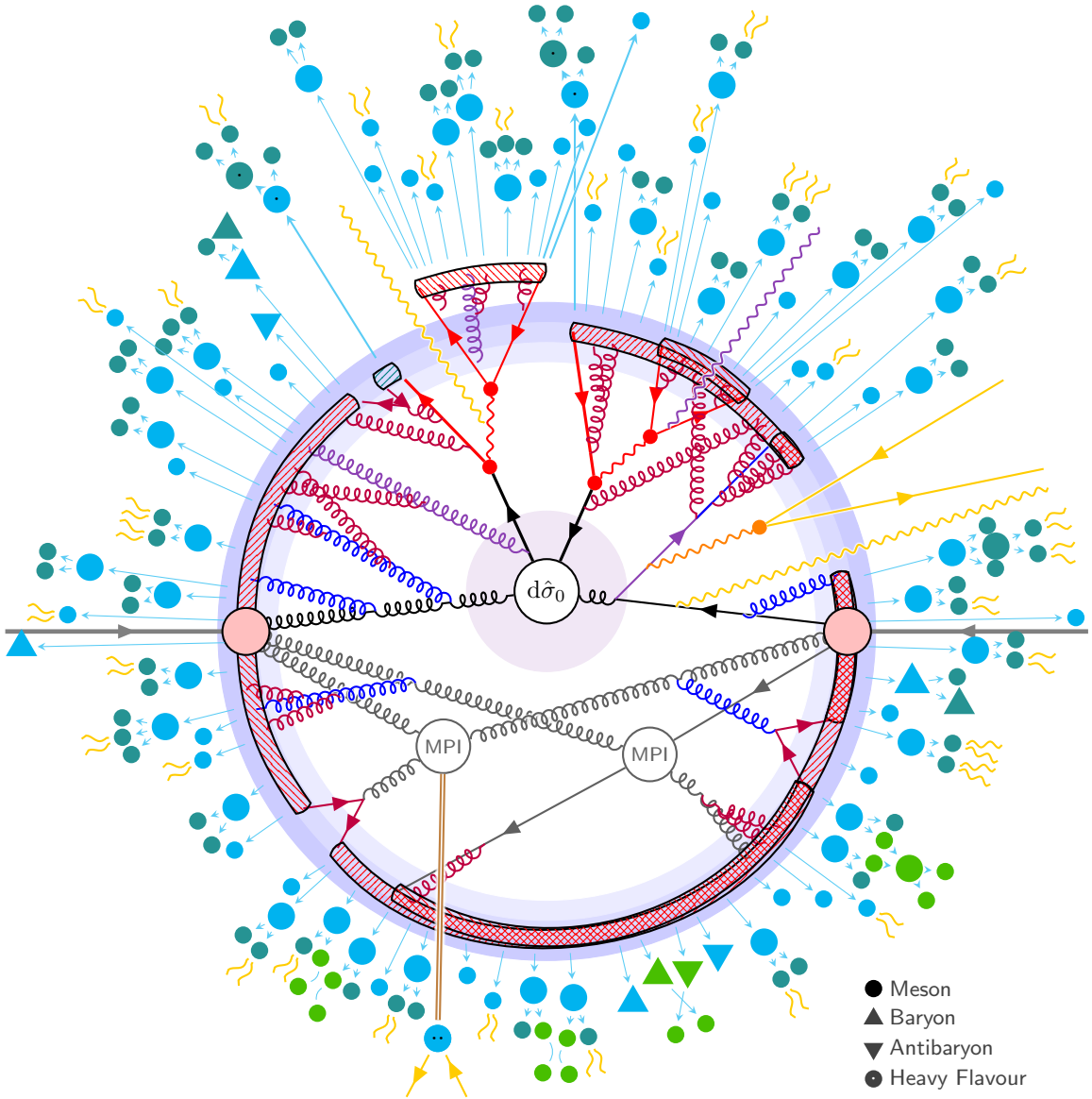
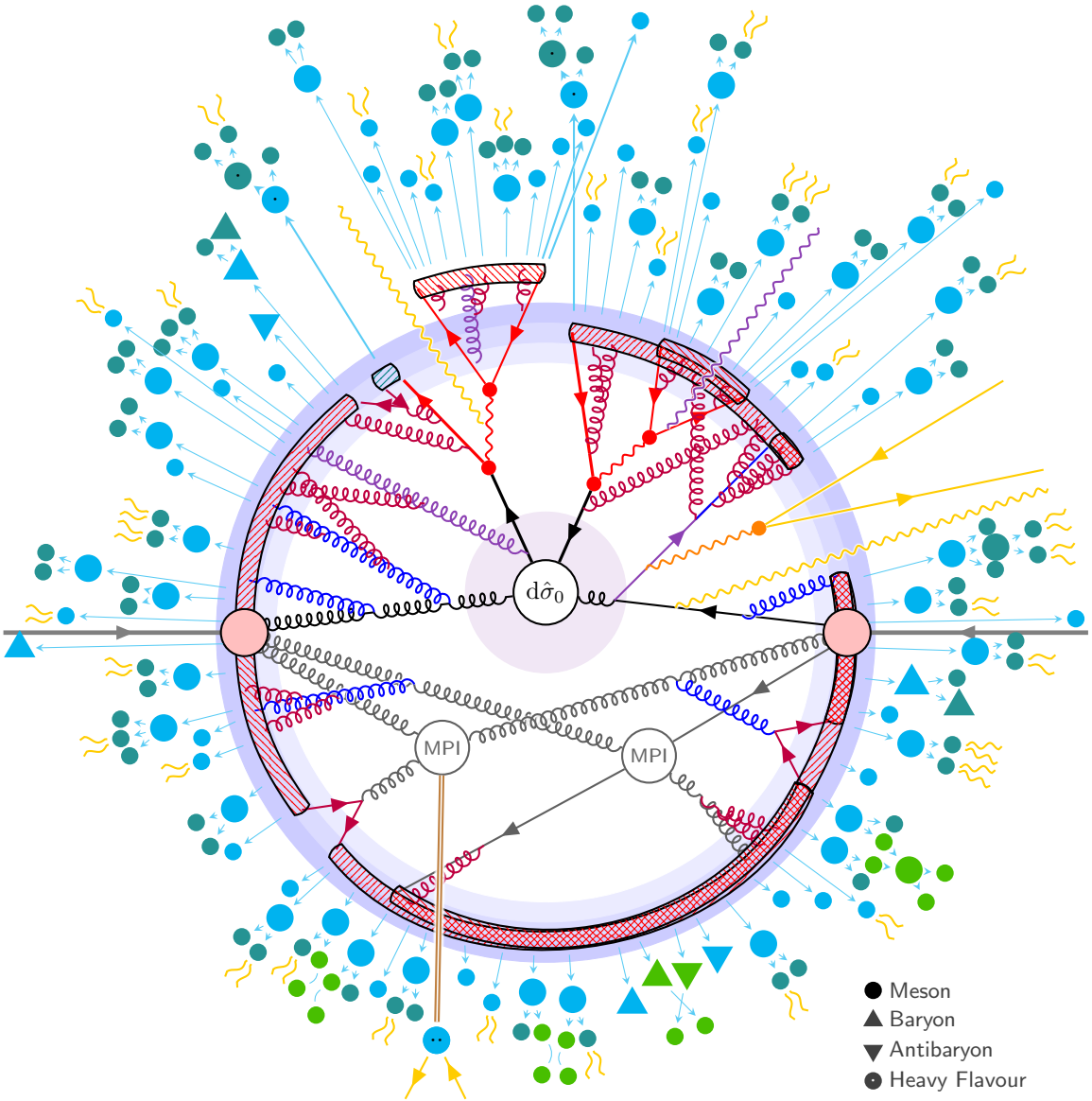


- Hard Interaction
- Resonance Decays
- MECs, Matching & Merging
- FSR
- ISR*
- QED
- Weak Showers
- Hard Onium
- Multiparton Interactions
- Beam Remnants*
- Strings
- Ministrings / Clusters
- Colour Reconnections
- String Interactions
- Bose-Einstein & Fermi-Dirac
- Primary Hadrons
- Secondary Hadrons
- Hadronic Reinteractions

(: incoming lines are crossed)*

[arXiv:2203.11601, A comprehensive guide to the physics and usage of PYTHIA8]



Encodes the whole (B)SM

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- The most used General Purpose Event generator in particle physics.
- How many users?
- 73% of all ATLAS papers refers to PYTHIA usage. (CMS: 72%, ALICE: 42%, LHCb: 75%) (HERWIG: 48%, SHERPA: 44%)
- Not only LHC. ALL collider experiments use PYTHIA, as well as several non-collider experiments.
- Many specialised simulation codes use PYTHIA
- Is it even conceivable to do collider experiments without PYTHIA?

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The PYTHIA8 Collaboration

Started out as a one-person (*i.e.* Torbjörn Sjöstrand) project.
Today there is $\sim$200k lines of code maintained and developed in a small collaboration:

J. Altmann (Monash), C. Bierlich (Lund), N. Cooke (Glasgow),
N .Desai (Mumbai), I. Hellenius (Jyväskylä),
P. Ilten (Cincinnati), L. Lönnblad (Lund), S. Mrenna(Fermilab),
C. Preuss (Zürich), T. Sjöstrand (Lund), P. Skands (Monash)

- Code maintenance
- Code improvements
- CI/CD
- User support
- User requests
- . . .

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Phenomenology research and model development

Event generator developers are first and foremost ***Physicists***

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THEORY

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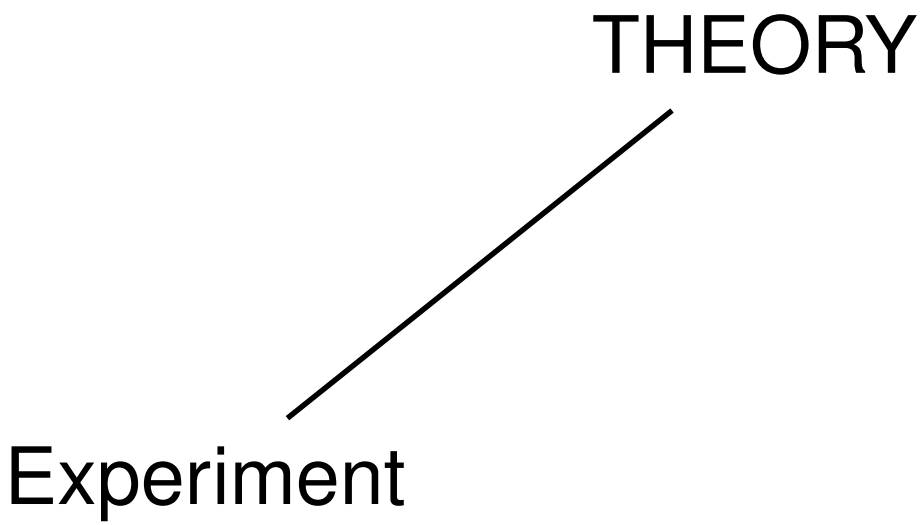

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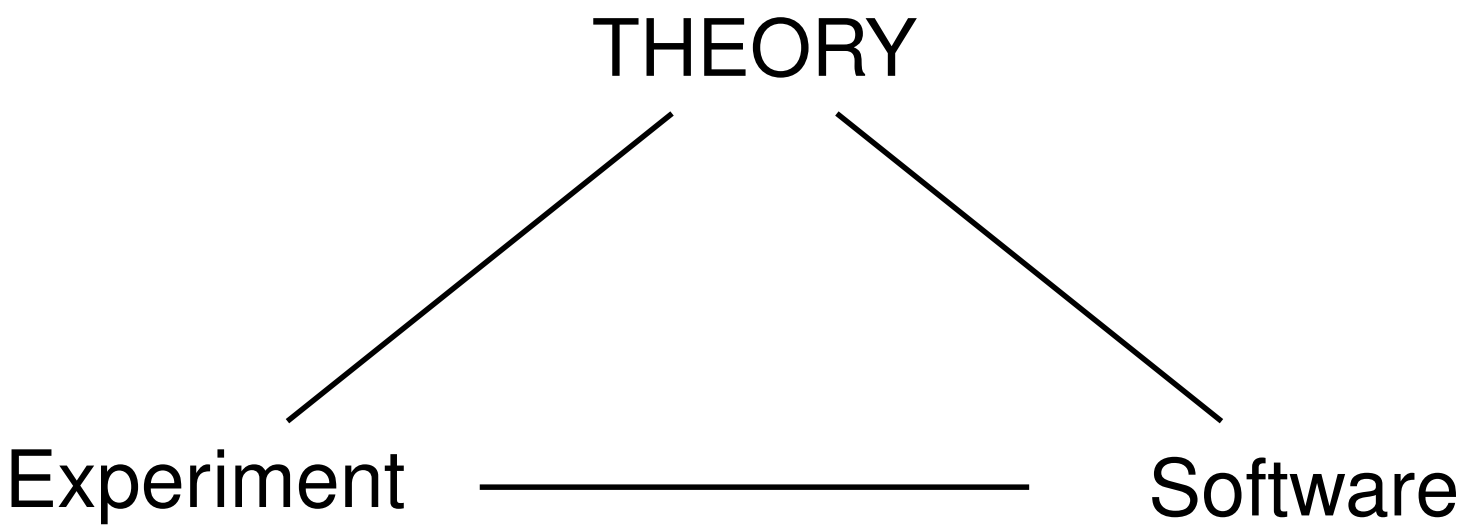

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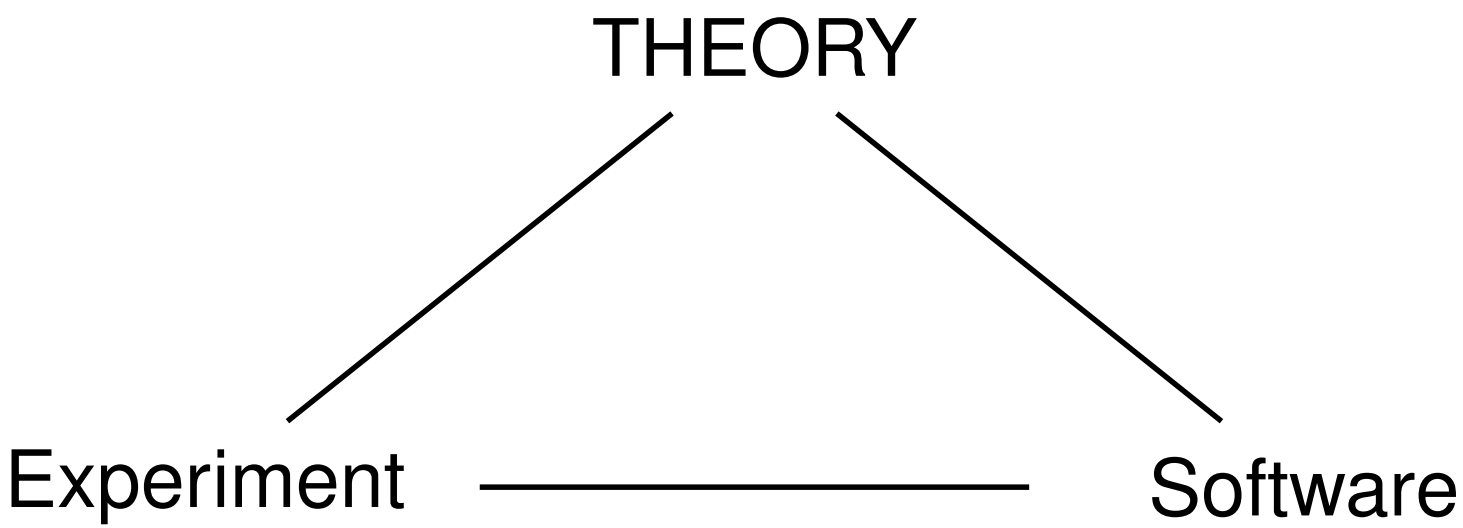
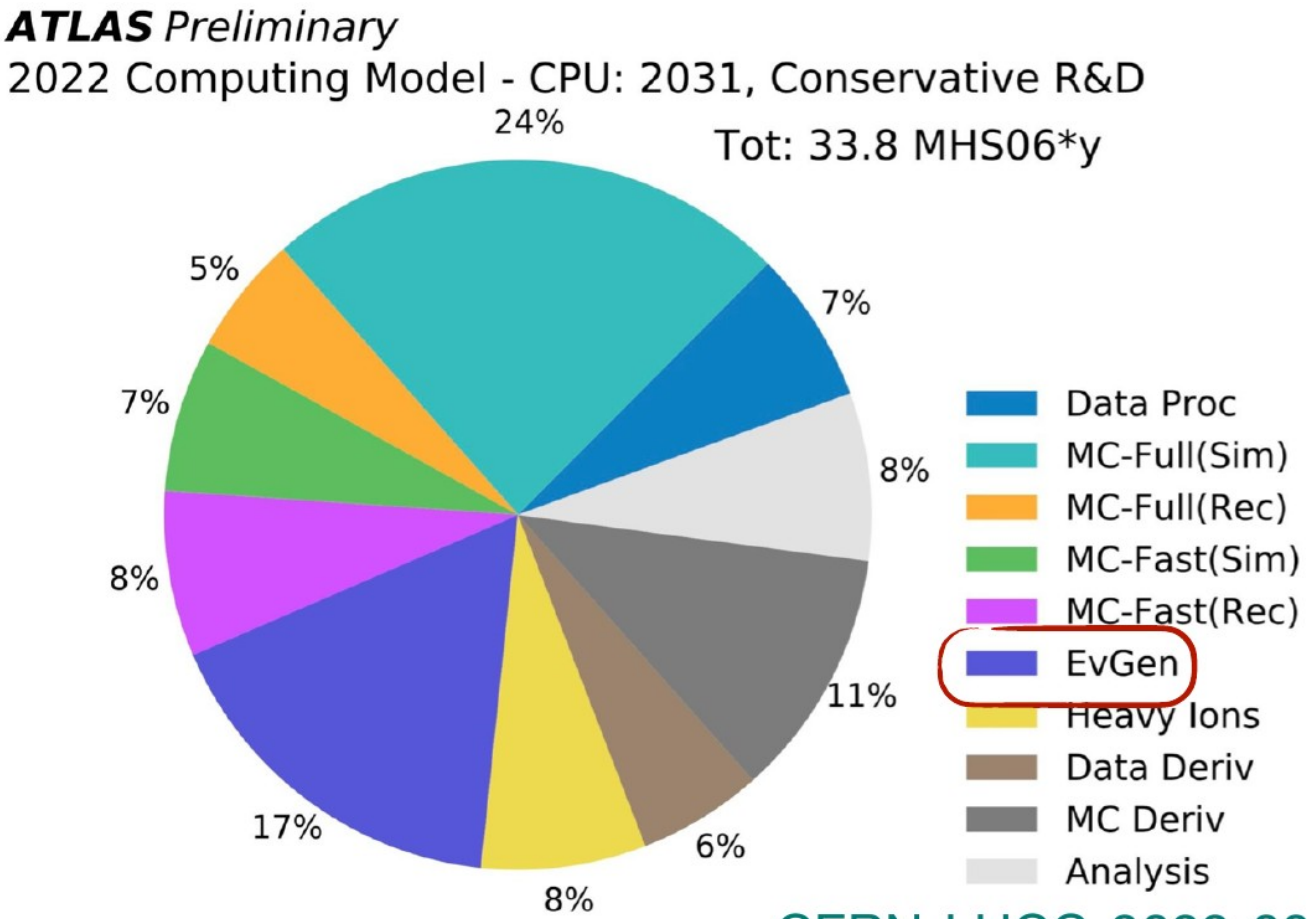


Academic career paths are tricky.
(Two PYTHIA authors in Lund recently left for industry.)



CERN-LHCC-2022-005

Funding

Everyone at CERN would agree that event generators in general and PYTHIA in particular belongs to the *critical infrastructure* necessary to do experiments.

And that they need to have stable, long-term support.

- Support for PYTHIA8 from CERN: ? MSEK/y
- Software licence fees from experiments: ? MSEK/y

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All funding for PYTHIA8 comes from individual, short-term research grants. (e.g. from VR)

The future of PYTHIA

- Will PYTHIA continue to be supported and developed?
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- Comments?
- Suggestions?
- Questions?