The Sherpa Monte Carlo

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The Sherpa project

brief history

- independent approach to provide full C++ LHC Monte Carlo
- first version 1.0α released during MC4LHC workshop 2003 [Gleisberg et. al '04]
- integrated in DØ, CDF, ATLAS, CMS and LHCb software
- versions available on Genser or from `http://www.sherpa-mc.de`

➔ **current release Sherpa-1.2.0** [Gleisberg et. al '08]

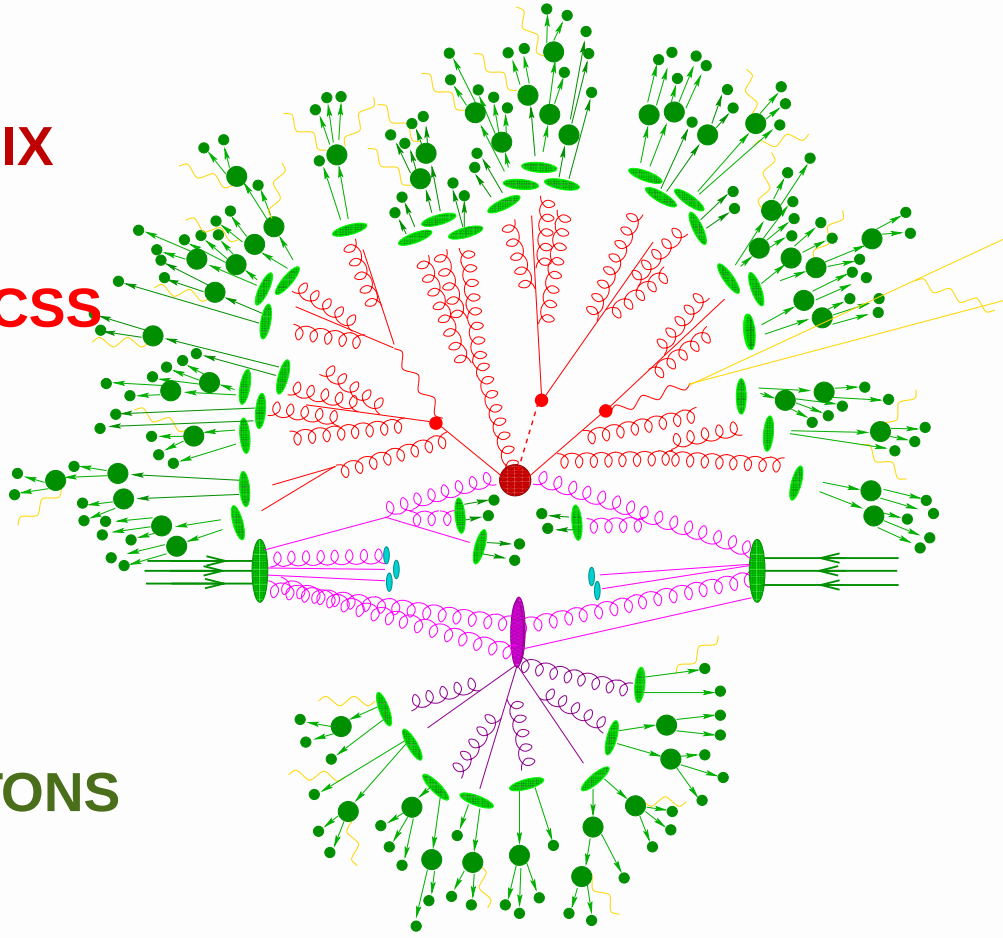
development team

- Tanju Gleisberg (PostDoc/SLAC)
- Stefan Höche (PostDoc/Zurich)
- Frank Krauss (staff), Jennifer Archibald, Frank Siegert (PhD) (Durham)
- Marek Schönherr (PhD/Dresden)
- Steffen Schumann (PostDoc/Heidelberg)
- Jan Winter (PostDoc/FNAL)

Physics of Sherpa 1.2.X

split simulation in phases

- **Hard interaction: AMEGIC & COMIX**
  exact matrix elements $|\mathcal{M}|^2$
- **QCD bremsstrahlung: APACIC & CSS**
  parton showers in the initial and final state
- **Multiple Interactions: AMISIC**
  beyond factorisation: Sjöstrand, Zijl model
- **Hadronisation: AHADIC**
  non perturbative QCD: cluster model
- **Hadron Decays: HADRONS/PHOTONS**
  matrix elements or phase space / YFS



Sherpa is the framework that steers event generation

Latest achievements

- shower based on Catani–Seymour dipole factorisation [Krauss, S. '07]
- new ME generator relying on Berends-Giele recursion [Gleisberg, Höche '08]

  $\Rightarrow$ faster and higher multiplicities [e.g. $V + 6j$, $t\bar{t} + 6j$, $8j$]
- new merging algorithm (truncated shower algorithm) [Höche, Krauss, S., Siegert '09]
- on-the-flight BSM model implementations through FeynRules [Duhr et. al '09]
- automated generation of dipole-subtraction terms [Gleisberg, Krauss '07]
  - integrated into BlackHat, applied for W+3jet @ NLO [Berger et. al '09]
  - standalone, applied e.g. for $ZZ + 1$jet @ NLO [Binoth et. al '09]
  - provide Les Houches interface for NLO calculations
- pending: new underlying event model [Krauss, Höche, Teubner '07]
- pending: color-dipole shower [Krauss, Winter '07]

Current activities/future directions

Ongoing

- ME+PS @ NLO
- ME's @ NLO [Rodrigo et. al '08; Giele, Kunszt, Winter '09]
- electroweak corrections
- ...

Heidelberg activities

- focus on QCD issues & BSM physics
  - matrix elements & parton showers
  - QCD effects in heavy particle production
  - FeynRules development

Summary

Sherpa (hopefully) well equipped for the LHC challenge

- sophisticated description of perturbative physics
  - built-in matrix-element generator(s) for multi-leg processes [SM + BSM]
  - consistent merging of MEs with parton shower
- wide coverage of soft-physics aspects
  - cluster hadronisation model
  - extensive τ and hadron decays package
  - multiple photon emission in YFS formalism

prerequisites

- tuning of hadronization parameters [Professor collab.]
- validation against Tevatron/HERA data [in-house (using Rivet), DØ]

funding issues

- application for Marie Curie Initial Training Network: MCnetITN

  tools: Pythia, Herwig, Adriadne, Sherpa, MadGraph, CEDAR

  nodes: Manchester, IPPP, UCL, CERN, Lund, Louvain, Karlsruhe, Heidelberg