# HepMC3 in JETSCAPE

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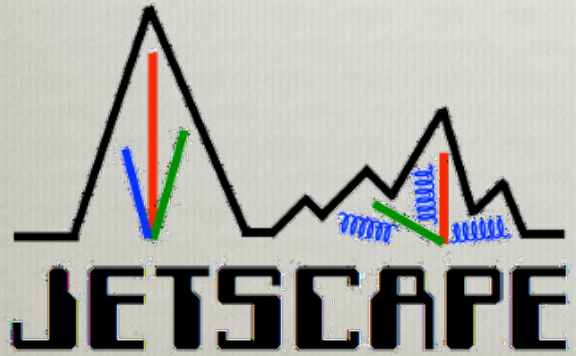


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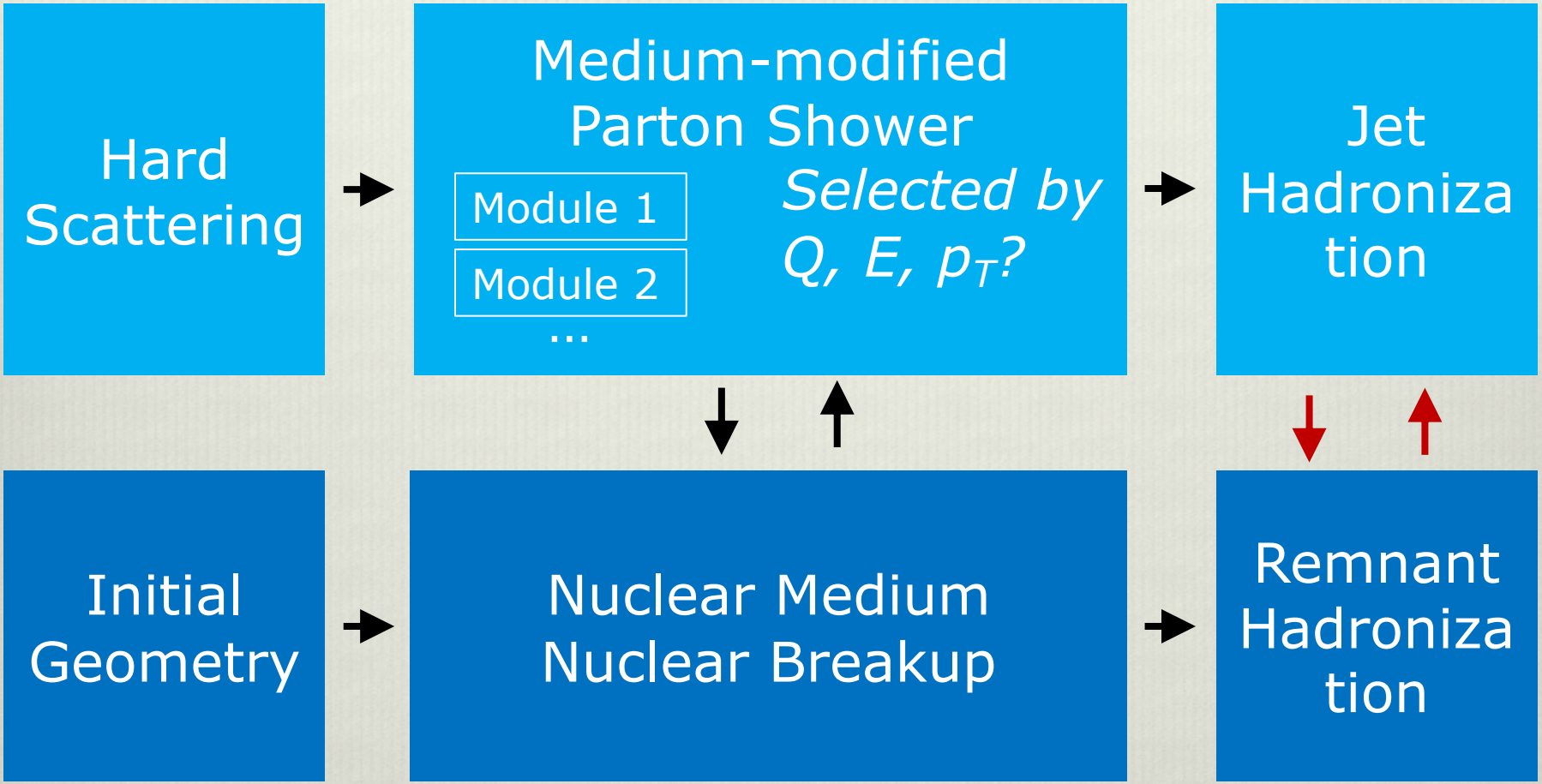
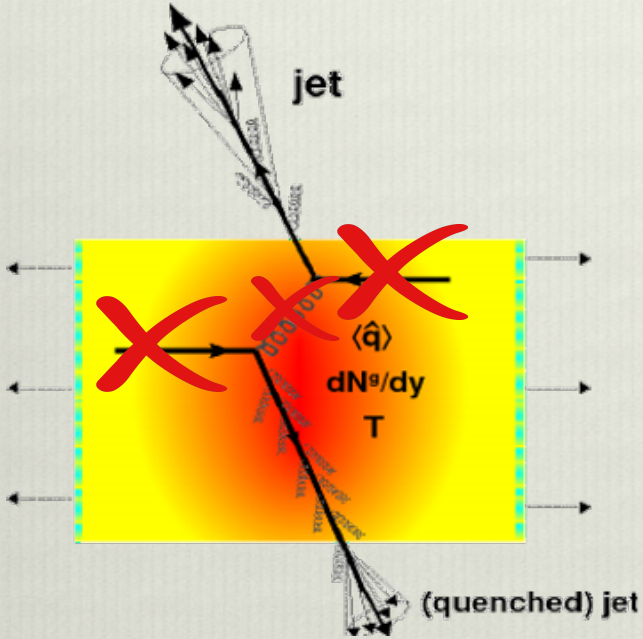
# JETSCAPE


Hard Scattering
Medium-modified Parton Shower
Module 1
Module 2
...
Selected by Q, E, $p_T$?
Jet Hadronization
Initial Geometry
Nuclear Medium Nuclear Breakup
Remnant Hadronization

# Beam Particles?

**Events consist of multiple unconnected parton showers**



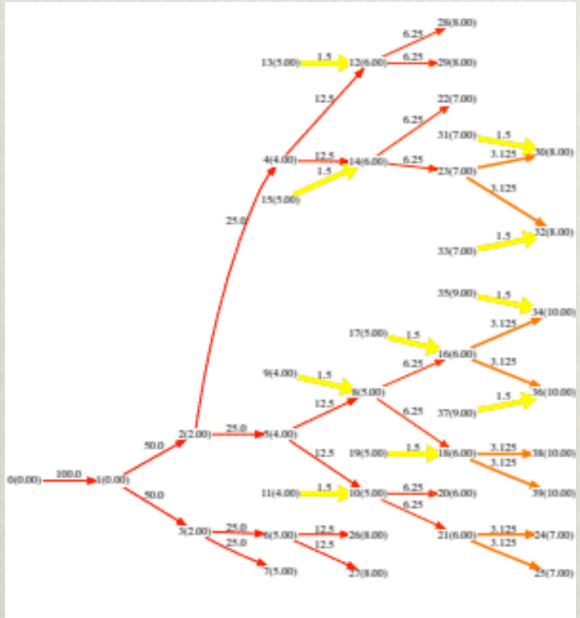

- No beam particles (as of yet)
- Any initial state module **can** add particles with `status=4`

→ JETSCAPE would need internal changes, but HepMC writer module would **treat beam particles correctly**

*(Unrelated side note to PYTHIA devs: DIS events have three beam particles)*

# Parton Showers

**Events consist of multiple unconnected parton showers**
in our own GTL-based graph format



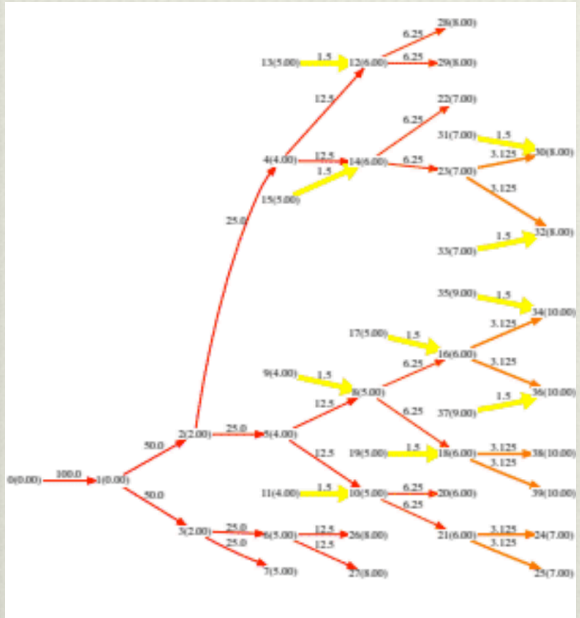
Technical notes:

- Use GTL methods like `is_acyclic()` and `topsort`
- HepMC requires in- and out-going edges for every vertex
  → need some dummies
- Supports incoming edges from medium

http://freshmeat.sourceforge.net/projects/thegraphtemplatelibrary/

# Parton Showers cont.

**Events consist of multiple unconnected parton showers**
in our own GTL-based graph format



Status codes:

- Without hadronization, final particles get `status=1`
- Otherwise, respect module choices
- Or, by default:
  "final" partons get `status=11`
  all others get `status=12`

# Hadrons

**Events consist of multiple unconnected parton showers**
and a list of **hadrons from many sources**

- Strings, Hybrid hadronization
- Cooper-Frye
- SMASH
- Exotic "negative" particles that need to be (statistically) subtracted

→ **Rudimentary at present**: One dummy, all hadrons have with `status=1`
→ Decays with `status=2`→`1` are in principle possible, but no JETSCAPE modules currently support them

# Event Variables

**Events consist of multiple unconnected parton showers**
and a list of **hadrons from many sources**
and lots of **IS and Hydro information**

Currently saving:

- `cross_section, weights`
- `Ncoll_hard, Ncoll` (what's the difference?)
- `Npart_proj` (used for total Npart)
- `event_plane_angle`

Missing: Impact parameter (could be added), total entropy

# File Size

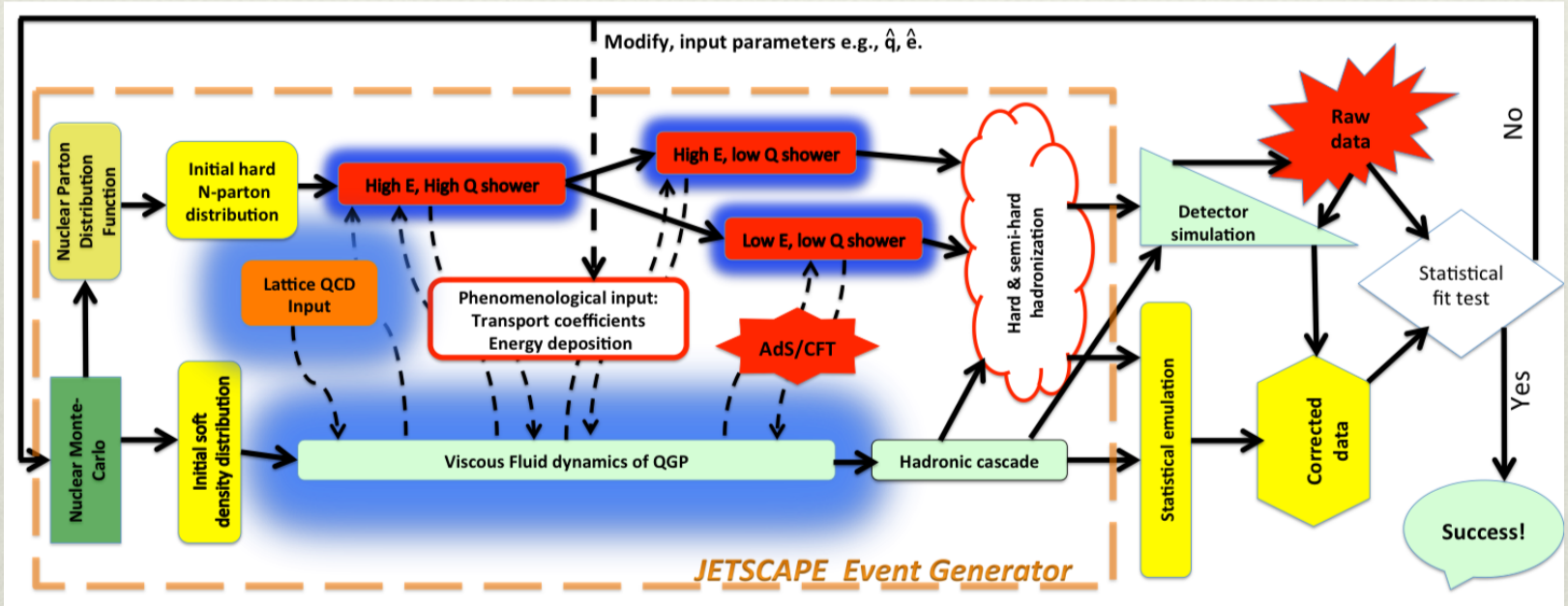
Our own ASCII format is large, we support gzip for reading and writing. I suggest HepMC should do the same ☺

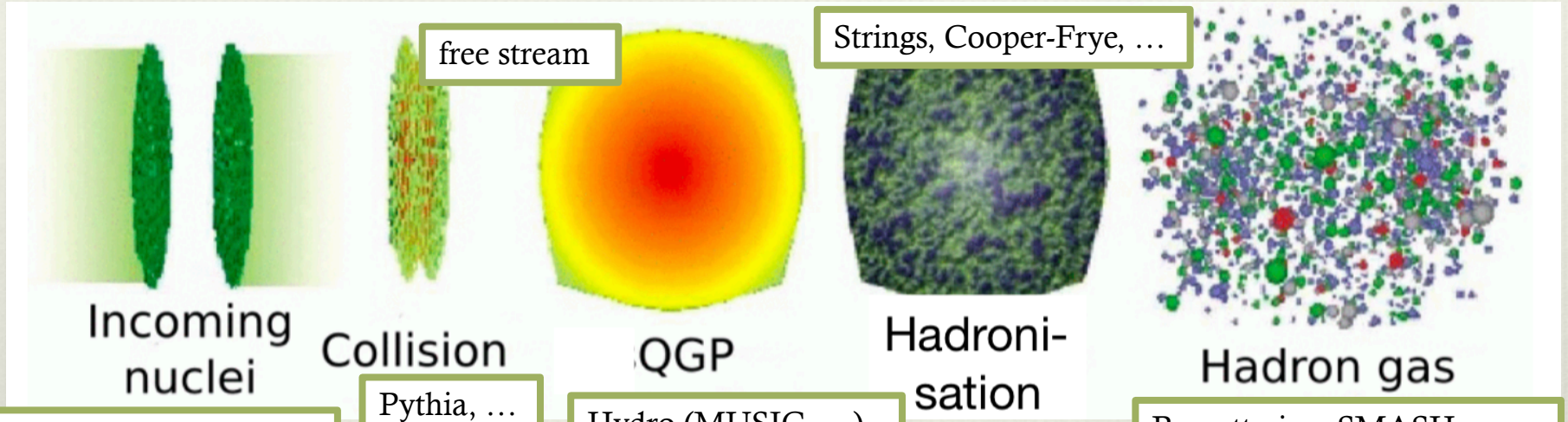
# Backup

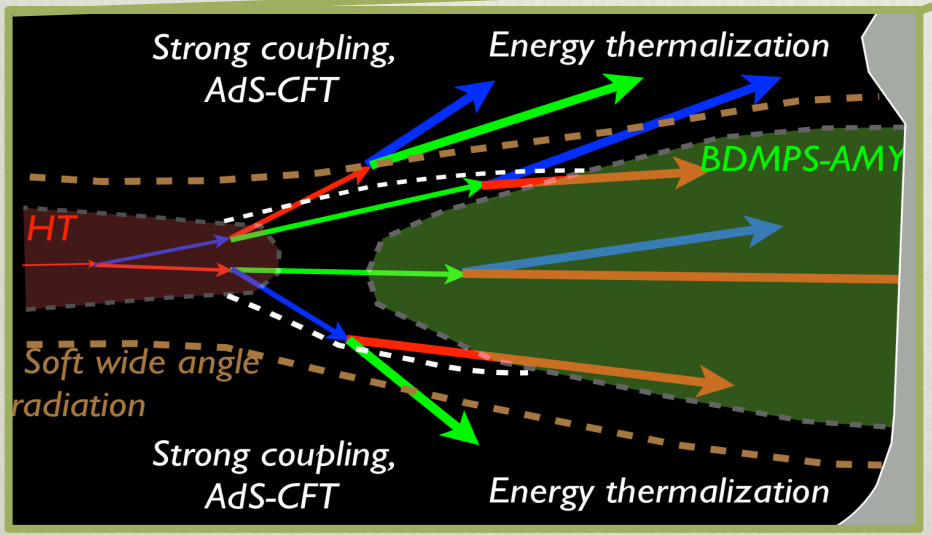
# Scope

v1: Released April 2018
v2: Released June 2019

*Manual: J Putschke, KK, + 43*
*arXiv:1903:0771906*






- Experts at every stage
- Multi-Stage Energy Loss
- … no one group can do it all

→ Unify in JETSCAPE

*A. Majumder, Hard Probes '15*