

Novel Phase space integration (with Terrance Figy):

- Current paradigm is integrating over partonic phase space.
- Instead integrating over reconstructed objects times partonic configurations leading to the given objects.
- E.g. at NLO integrate over mass of jet while keeping rapidity and transverse momentum vector invariant.
- This leads to a natural factorization of the bremsstrahlung radiation and better control.
- Natural to put on computer farms (we use open science grid)
- Ultimate goal is to apply this to NNLO calculations (instead of using tens of thousand nodes on NERSC).

DIS in neutrino experiments (with Stefan Prestel):

- Neutrino experiments rely on (outdated) PYTHIA for DIS.
- PYTHIA is not tuned at those energies (tuned to HERA experiments).
- We added Electro-Weak showers to DIRE (plugin to PYTHIA) for better photonic description
- Added Matrix element matching to the EW shower (photon quantum interference,...)
- Constructing useful DIS observables for neutrino experiment (e.g. jet \rightarrow jettiness).

Genie code maintenance (Computer Division work):

- Genie is complicated software with thousands of interdependent functions/classes.
- Code is added/changed daily by many contributors, how to maintain code integrity?
- Unit-tests for each individual class/function are performed after each submission to GITHUB.
- Unit-test \rightarrow Is the output of function the same given a known input?
- If any existing function changes a notification is send out over SLACK (or submitter).
- This ensures that the GENIE Monte Carlo does not change unexpectedly.