Jets and Heavy Flavor Simulation Request

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Synopsis:

By the time of CD2/3A, the most obvious goals for the Jets and HF group are to be able to do full jet and heavy flavor reconstruction in whatever software framework is ultimately chosen. This should done with the absolute minimum of 'truth level cheating', using realistic clustering, some form strategy for logically combining track and calorimeter (and PID) information, PID, and tracking / vertex finding. This ability should be in place well enough in advance of CD2/3A that necessary validations and studies can be carried out in time for the reviews and pre-TDR. By CD2/3A we should also have a reasonably mature set of physics performance studies which 'span the space' of potential jet and HF analyses. On a more near term timescale, we will need jet / HR reconstruction techniques, performance metrics, and appropriate simulation samples necessary to evaluate potential alternate detector designs / technology choices.

Our strategy for transitioning to a single software stack involves working as much as possible in a framework agnostic way. Analyses should strive to work with reconstructed final state particles stored in (flat) tree structures which are ideally as similar as possible between the two frameworks. We may also move (or work to make available as an option) to the use of an intermediate analysis software structure (SIDIS framework) which can handle input from either framework. We will work with the software group to ensure that the both software frameworks contain the tools / algorithms necessary to do our analyses and that they are as similar as possible between frameworks.

We would also like to take this opportunity to request a strong versioning system to keep track of both generator level settings (steering card settings and choice of high divergence or high acceptance beam effects) and detector geometries. We think this is important not only on the production side, but on the analysis side as well. We would like to see some framework by which the simulation version is propagated down to the physics and detector working groups so that individual analyses and plots can be associated unambiguously with a particular generator / detector geometry. This will be important in the short term when there will be many potential detector configurations under consideration, but even more important in a ~year when we are preparing for reviews and trying to write a pre-TDR and we don't remember what plots go with what configuration.

Current Requests:

I. Neutral Current DIS:
    1. Number of Events: 5M events in each energy/Q2 bin. [18x275, 10x100, 5x41]*[Q2>1, Q2>10, Q2>100]
    2. Event Generator: Pythia8[1] with beam effects included
    3. Geometry to be Simulated: Reference design central detector[2] (-4<eta<4) and any technology/design variations
    4. Required Reconstructed Quantities: Tracks, photons, neutral hadron clusters, secondary vertices, and PID for central detector (-4<eta<4)

II. Charged Current DIS:
    1. Number of Events: 5M events in each energy/Q2 bin. [18x275, 10x100, 5x41]*[Q2>100]
    2. See above
    3. See above
    4. See above

Future Requests:

I. Further statistics for NC and CC DIS samples outlined above
II. Simulation of remaining energy bins (10x275 and 5x100) and possible inclusion of Q2>1000 bin
III. Simulation of a photoproduction jet sample
    - Will likely need to be filtered to allow sizable jet sample in a reasonable number of events
    - May need to be Pythia6
IV. Simulation of diffractive dijet sample
V. Possible dedicated heavy flavor simulations looking at specific channels and/or final states

[1] We strongly suggest that there is coordination and review of steering file settings between the Inclusive, SIDIS, and Jets/HF working groups so all is consistent, and everyone is happy with what is included

[2] Most jet and HF analyses require only the central detector, but diffractive dijets are an exception. We would like to know if there is a large penalty in simulation time or space involved with simulating the far-forward/backward regions. If the answer is no, then we may as well simulate the full detector for all our simulations