

Summary of 1.1: Long-Term Generator Strategy

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ECT*: Testing and Improving Models
of Neutrino Nucleus Interactions in Generators

Proceedings of group

- Laura began with an summary of input from experiments of their needs and experiences that drive those needs
- Briefly those needs were:
 - A long list of new models desired in the generators
 - Better ability to interact with and compare multiple models and generators
 - Improved reweighting functionality and documentation of reweighting
 - More information about, and ability to interact with and modify, the tuning of the parameters in interactions
- Group met in several sessions, jointly with the “theory API” group.
 - Will echo, but not rehash discussions covered by Steven G. in API summary.

Laura's list of questions

- Questions to be discussed in the Working Group Parallel Session:
 - What problems are we trying to solve exactly?
 - Are there more pain points we should consider?
 - Are there additional advantages and disadvantages of a more factorized generator model?
 - Is factorizing generators something we should invest effort in?
 - Can we develop a first draft of (prioritized) 'factors' that would be needed?
 - What are the basic inputs and outputs of each of these?
 - What problem(s) would each piece solve?
 - Do we write this new generator from the ground up, or evolve one of the existing generators?
 - If so, are there generators that are open to becoming 'factorized'?
 - If a new common e.g. flux driver or FSI simulation were to appear, would you be willing to interface with it?
 - Are you willing to provide some piece of your generator as a common tool that can interface with many generators?
 - Is a new collaboration or other organizational structure necessary to get this done?
 - What should that organization structure look like?
 - What are the next steps after this workshop?
 - Are there other organization changes we could make to facilitate getting models and uncertainties to experiments

Questions we had time to discuss in detail...

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Separation of Components?

- We identified a number of components where there might be benefit to separating the components.
- An accord on a common format for all generators (“easy”)
 - Event history: initial state, hard scattering before application of FSI cascade
 - Currently several collaborations (NUISANCE, T2K, NOvA, MINERvA, etc.) develop their own solutions (mostly translators) for this independently.
 - Flux
 - Detector geometry
- Cascade FSI (“doable”): support FSI in a “second stage” in generators
 - Would allow cross-fertilization of FSI models. (The work we heard about in Steve Dytman’s summaries could be more easily compared, and we accelerate adaptation of best practices.)
 - There exist questions: consistency with initial state nuclear model, for example.

Separation of Components? (cont'd)

- Common flux and geometry driver (“harder” to “impossible”)
 - How difficult is something to debate. Everyone agrees there are many details to work out.
 - If the first three factorizations could be accomplished, then any theorist could put their model into a “mini-generator” using those common components, and experiments could easily run them for studies.
 - Huge benefit to both experiment and theory communities if this were used widely.
- Separation of initial state and hard scattering (“very difficult”)
 - Discussed in Steven Gardiner’s talk. Please see that for technical details.
- There was a little discussion of more speculative ideas (“difficult” to “fantastic”)
 - Common reweighting engines, or at least a standard interface for such. Some reason based on T2K work for NuWro and the DUNE reweighting interface suggests that this should be possible.
 - Common tuning infrastructure or project for models. (Already discussed this morning in generalities.) This would address some stated needs from the collaborations.

Next steps

- More Meetings!
 - Some of these topics have come up at previous workshops, but it is fair to note that there hasn't been a lot of progress between workshop.
 - Probably needs a dedicated meeting or set of meetings to work out these items.
- Documentation!
 - Great value in writing down at least a strawman plan for these directions.
 - Some of these items will require extensive and clear documentation, particularly interface issues affecting multiple generators.
- Collaboration!
 - It will be important to get acceptance for these projects from experiments since they will naturally provide much of the effort.
 - Theory colleagues also need to consider these items, and decide how they would like to be involved as this work progresses.

Thank you!



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