Disclaimer:
This talk represent my personal thoughts. They do NOT represent the views of the GENIE collaboration.

New Models in GENIE:

democracy vs consistency

Walter Giele, Fermilab, 12/2019

New theory model life cycle:

- When theorists develop new models, it is desirable to make some semi-realistic predictions for the relevant experimental observables to be used in a publication.
- This involves adding the model to a Monte Carlo which simulates all the additional physics needed for a more realistic prediction.
- Within the theoretical development cycle, this usually should not take too much time nor is it initially intended for general use. It is a low priority item intended to give a rough estimate of the impact of the model.
- If, after a publication, there is interest in the model one can consider a publicly available version of the model.

Current method of adding new models to GENIE:

- Start an incubator project with GENIE.
- Develop code within the GENIE development environment.
- Have a review process to assure the code is integrated properly in GENIE.

There are obvious advantages following this path:

- One can get help from the GENIE collaboration if implementation requires some structural changes within GENIE.
- Will ensure the code is not interfering with other parts of GENIE.
- Support for the code in future versions.
- It will be part of the next official GENIE update/version.
- As part of the official release experiments are more likely to use the model.

Incubators works for fully developed models:

- Implements the model into the official validated GENIE.
- An experiment can use the model with confidence.

Incubators do not work for developing models:

- What is needed is a possibility of quickly implementing a model by the theorists without any outside involvement.
- It should be sufficient for a theoretical publication but not for full fledged experimental use.
- This should be easy to implement within GENIE by simply adding generic processes which can filled in by a theorist for a prediction (i.e. inheritance of predefined functions within GENIE).
- This will motivate more theorists to use GENIE in publications and if there is interest further develop it within the incubator program to become part of the official validated version of GENIE.

Beyond GENIE:

- There is still the construction of the observable from the event record and comparisons to existing data to do.
- Here the neutrino community is behind the collider community.
- What is needed is the use of RIVET (or something similar) to archive data and analysis. This enables a theorist to run the Monte Carlo with its new model and use the archived RIVET analysis and date to make a comparison.
- For this to work using RIVET one needs the event records in HEPMC format. This would be most preferably be an optional format for GENIE output (but can be external to GENIE)
- Beyond comparing to existing data it would be good to be able to do model tuning. Yet again here tools like PROFESSOR have been developed in close conjunction with RIVET for fast tuning through parameterization-based optimization.

Conclusions:

- The incubator program works well to incorporate new models into GENIE ensuring a correct technical implementation.
- It fails as a tool for a more informal approach, making the use of GENIE within a theory environment limited. To be able to do a quick and easy implementation of a model. through inheritance will alleviate this short coming and would make GENIE a valuable tool in model development.
- The neutrino community should think about using tools like RIVET to further make data more accessible to theorists.
- Lastly, tools like PROFESSOR makes constructing model tunes pretty straightforward for both theorists and experimentalists.