

Neutrino Generators Workshop (NF06 / CompF2 / TF11)

- Plans originated in conversations between NF06 conveners and myself, involvement of CompF2 + TF11 also important
 - **Target date:** February 2021
- Envisioned as a follow-up to January 2020 “Generator Tools Workshop” at Fermilab
 - **Indico:** <https://indico.fnal.gov/event/22294>
 - **Summary white paper:** <https://arxiv.org/abs/2008.06566>
- Still working on draft agenda, see later slides for proposed topics
 - Will circulate to topical group conveners when ready
 - Please reach out (gardiner@fnal.gov) if you have feedback
- Workshop focus informed by related LOIs, discussions at Community Planning Meeting parallel session #99
 - “Advances in Event Generation and Detector Simulation”
 - <https://indico.fnal.gov/event/44870/sessions/16258/#20201007>

“At a glance” takeaways from relevant LOIs

- **Steven Gardiner**: Reiterates conclusions from Jan 2020 workshop and raises some additional issues. Focuses on specific community challenges that must be addressed soon.
- **Costas Andreopoulos**: GENIE has many advantages as a software product and ambitious plans for the future. It can be *the* universal platform but has a deliberately chosen development model that must be respected.
- **William Jay**: Generators and realistic uncertainties are important. Making neutrino generators modular like their LHC counterparts has several advantages (e.g., easy to compare to electron data, interoperability). QCD inputs for form factors, etc. should be leveraged by the community.
- **J Taylor Childers**: Raises important issues for generators in general (not neutrino-specific). Echoes some concerns from neutrino community about culture/incentives/tuning, need to be ready for new computing techniques (GPUs, etc.)

Survey in advance of the workshop

- We are considering a survey to gather input from the community about existing concerns and possible solutions
- Some possibilities for question topics (non-exhaustive, additions welcome)
 1. Difficulty in getting models of interest into generators
 2. Difficulty in support to maintain generators
 3. Difficulty for theorists to engage in generators
 4. HEP/NP funding divide
 5. What capabilities would you need/want in an ideal neutrino generator?

Rough draft for workshop discussion topics

- **What would our ideal neutrino generator (or “generator platform”) look like?**
 - Seed discussion with feedback from survey
 - What are the steps needed to get there? What are their priorities?
- **Generator usability / interoperability (consider use by experiments and theorists)**
 - Unified flux + geometry drivers: status, path forward
 - Common event format: status, path forward
 - What other issues are there that won't be covered by the plans for these two areas?

Rough draft for workshop discussion topics

- **Streamlining theory improvements: technical aspects**
 - Needs (kinds of theory input, uncertainties, etc.)
 - Strawman concrete proposal for “theory API”
 - Future plans
- **Streamlining theory improvements: sociological aspects**
 - Survey report: what are the pain points?
 - Discussion: what can we do to address them as a community?
- **Streamlining experimental involvement: sociological aspects**
 - Survey report: what are the pain points?
 - Discussion: what can we do to address them as a community?

Rough draft for workshop discussion topics

- **Comparisons, tuning, and uncertainties**

- What tools for comparing generators to data (and each other) do we have right now? Strengths/weaknesses?
- Survey report: pain points from users / developers
- Non-neutrino probes: what data are available? How best can we make it usable to improve neutrino generators?
- Tuning + uncertainty quantification
 - Existing tools & pain points
 - What are the hard-to-quantify uncertainties? How can we plan to assess them better / at all?
 - Do we want or expect interoperability for these?

Rough draft for workshop discussion topics

- **Future resource needs & new computing techniques**
 - LHC experience: event generation & uncertainties at scale
 - NOvA experience: NERSC for tuning + systematics
 - DUNE: how well can we currently estimate resource needs?
 - Planning to leverage new technologies: GPUs, machine learning, quantum computing, etc.
- **Brief summary presentations, whitepaper planning, assignments for “homework”**