

Overview of GENIE

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Costas Andreopoulos and Hugh Gallagher started GENIE

Overview talk

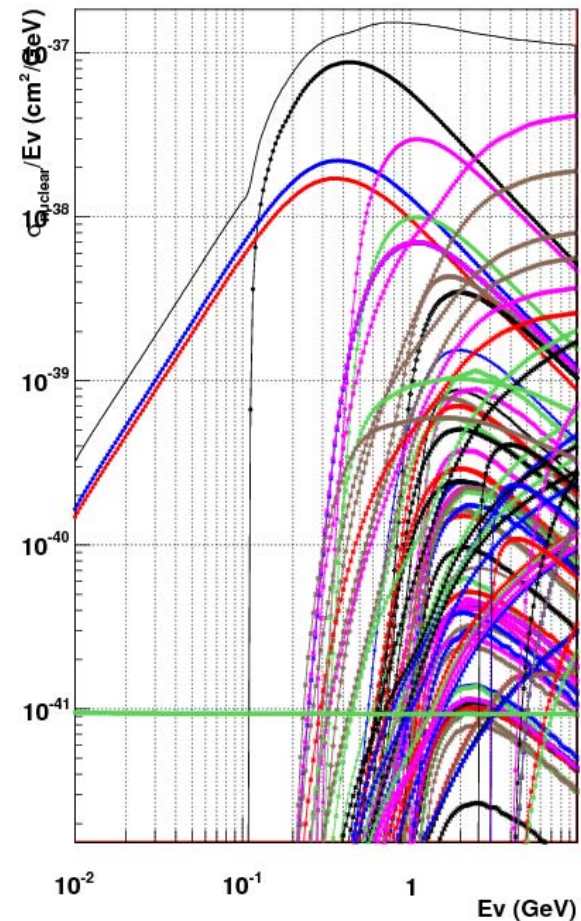
- ▶ GENIE is the most common code in use, has many structural features that will be hard to develop again.
- ▶ It tries to be the Universal Generator requested at NUINT
- ▶ Major tasks
 - ▶ Code development
 - ▶ Code validation, releases
 - ▶ Interactions with experiments, theorists
- ▶ Existing manpower, fractions of CA, SD, HG, GP, and RH + fractions of undergrads (~2), grad students (~6), postdocs (~5) with help from theorists. [total ~2 FTE] (30% increase in last year – FNAL staff, workshop)

Physics Models

- ▶ All flavors, all targets, all processes
- ▶ Physics models are not *universal*, need significant work!
 - ▶ Model development too slow (bad funding, slow action)
- ▶ Models for success
 - ▶ Theorists work more directly with developers
 - ▶ Each experiment provides ~1/3 time of a few students
 - ▶ Developers get more resources
 - ▶ Fermilab devotes personnel to technical tasks
 - ~~▶ Some group decides to build a new generator~~

cross sections in GENIE

- ▶ GENIE has complete kinematics for all final state particles for all cross sections at all energies.
- ▶ Here, we show ν_μ Carbon:
 - ▶ qe
 - ▶ All resonances
 - ▶ coherent
 - ▶ DIS of all flavors
 - ▶ Many others
- ▶ Input spline functions + many PDF's used to generate events.
- ▶ Works because models are simple.



Development

- ▶ **Success-** major advance in 1-2 years
 - ▶ Jarek Novak did research, testing, and coding for new Δ model.
 - ▶ Tinjun Yang did AGKY model with CA, HG, and Pauli Kehiyas (Tufts)
- ▶ **Slow success-**major advance in 3-4 years
 - ▶ Coherent model with Warwick students, Luis Alvarez-Ruso, CA, SD
 - ▶ FSI model with Pitt undergrads, SD
- ▶ **No success-**
 - ▶ GIBUU
 - ▶ Sato-Lee Δ model
- ▶ **Problems**
 - ▶ Theorists provide no model, formulas (exception is Paschos)
 - ▶ Theorists provide FORTRAN code
 - ▶ Not enough time commitment, training to do conversion/coding

Lessons learned

- ▶ GENIE is excellent, sophisticated code with new bylaws
- ▶ Core of a truly universal code is there
 - ▶ 2-4 QE models, 2 FSI codes, 3 coherent models, 2 Δ models 'soon'
- ▶ CA, SD, GP, and HG are team leaders of good coders.
 - ▶ New interest, structure should diffuse effort in good way.
 - ▶ New efforts encouraged, but early connection with us very helpful.
- ▶ Small existing group means time delays can be long
- ▶ Recent progress
 - ▶ New staff at FNAL – Gabe Perdue (~50%), Julia Yarba (~10%)
 - ▶ New postdoc at FNAL – Tomasz Golan (PhD with NuWro)
 - ▶ New postdoc at Liverpool (50% FNAL), new PhD student funding
 - ▶ First developers' workshop – FNAL – Mar, 2014