

Genie User Forum

20 November 2019




UNIVERSAL NEUTRINO GENERATOR
& GLOBAL FIT

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On behalf of the GENIE collaboration



Genie Updates



20 Nov 2019

GENIE Forum - M. Roda

Toward v3.2

- Things keep getting into the master branch in preparation for v3.2
- Specifically
 - RES bug fixed – see last week
 - Update to Boosted dark matter modules
 - new FSI models
 - INCL
 - Geant4
- The complete report (as of today) is available at the usual link <http://releases.genie-mc.org/>



Description of tune output material

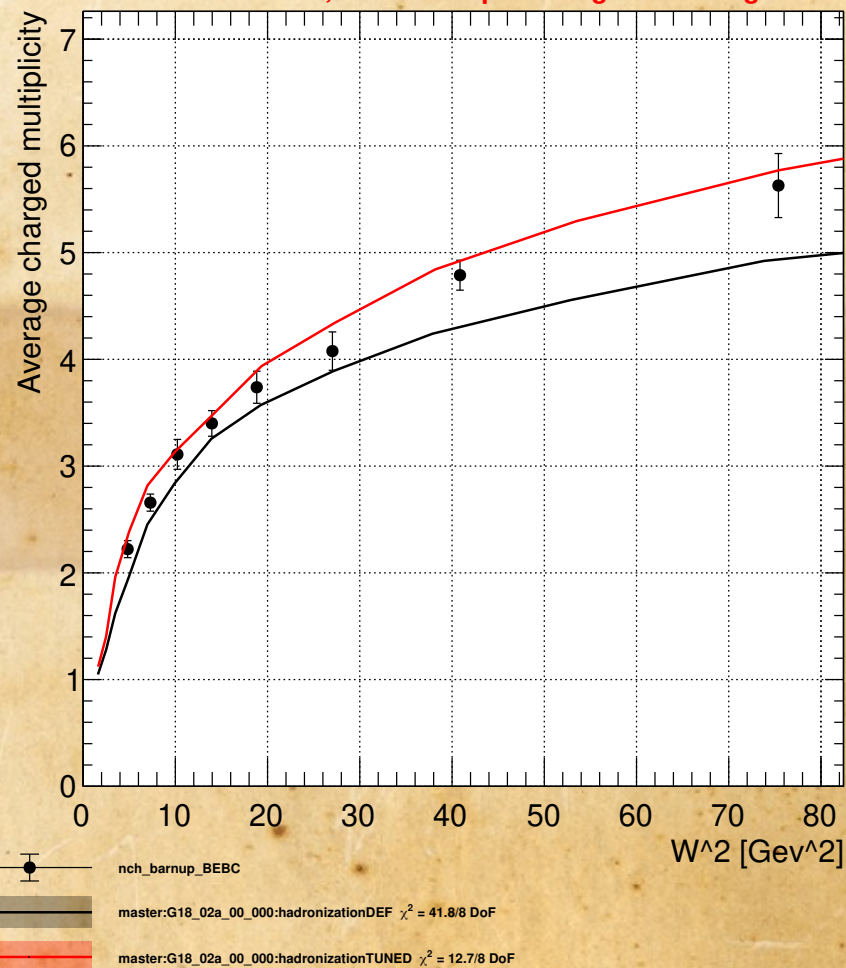
This is not an official data release

- A full tune release is not something we believe a good thing to do at this stage
 - General reasons
 - There is no full support as some parameters are not reweightable
 - Whatever error treatment will not be complete
 - Tune Specific reason
 - In this specific tune, one of the parameter is at the edge, so the Jacobian is no zero
 - Errors might not be extracted properly from the fit
- Should not be used in any official context
 - Happy to let you experiment
 - We would like to encourage the development of systems that could reweight all the parameters

A look toward the future

2003-2019, GENIE - <http://www.genie-mc.org>

- We strongly believe a systematic tuning system is necessary
 - The more models we need to combine the more this becomes crucial
 - List of external dependencies is already not trivial in v3.2
 - Some of them are cascades
 - Whose parameters are not reweightable
- Examples from Pythia 8 and AGKY hadronization models
 - Activity already on going
 - Far from being completed / released
 - Yet it should give the right context for this kind of developments



What is available

- To describe a tune output we don't need lots of material
 - Results – relatively simple ROOT file
 - Some files that can give you the possibility of understanding exactly which points have been used for the fit
 - It is a bit tricky
 - As I said all this material is not supposed to be released
- The material is available at the docdb of today's forum
- I'd like to iterate again that these files are not a tune release
 - The complete results will come with a paper and DOI to be citable

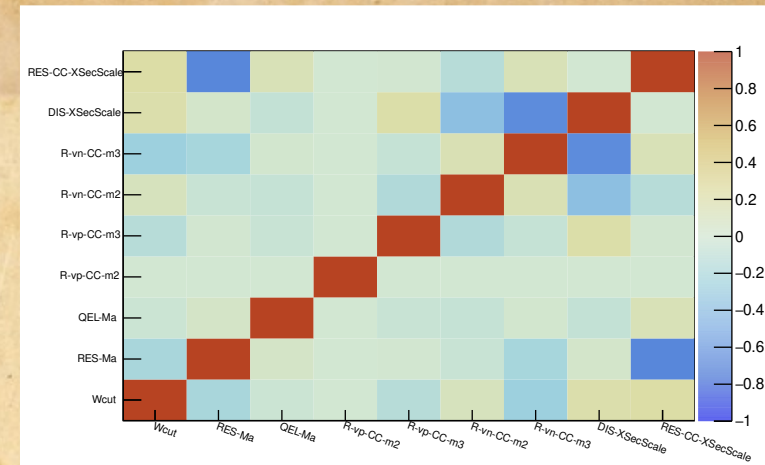
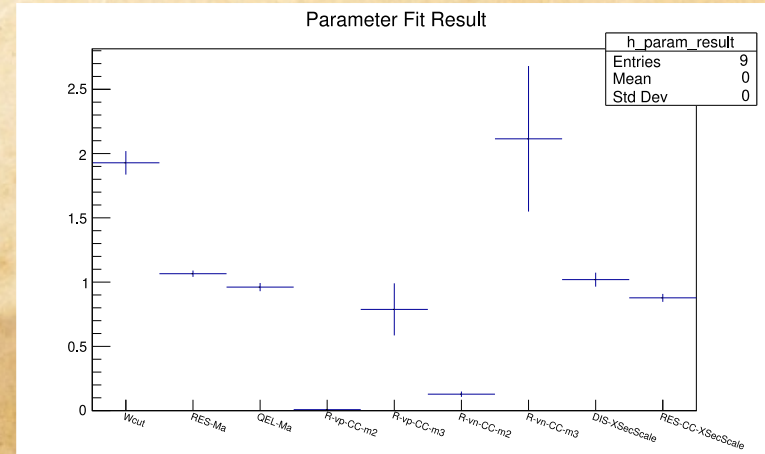
Tune results

- Tune – G18_02a_02_11a

- What you already have is the central values
- Available in
\$GENIE/config/G18_02a/G18_02a_02_11a/CommonParam.xml

- Wcut 1.927882 +/- 0.091380
- RES-Ma 1.065041 +/- 0.024707
- QEL-Ma 0.961288 +/- 0.031771
- R-vp-CC-m2 0.007600 +/- 0.000000 (+/- 0.000010)
- R-vp-CC-m3 0.787691 +/- 0.202721
- R-vn-CC-m2 0.127861 +/- 0.020716
- R-vn-CC-m3 2.114811 +/- 0.565942
- DIS-XSecScale 1.019012 +/- 0.054536
- RES-CC-XSecScale 0.877296 +/- 0.030771

- R-vp-CC-m2 is the parameter that is at the limit



The tuned parameters

- One parameter in the fit might correspond to more parameters at the generator level
 - The multiplicity issue arises for the R parameters
 - The parameters are implemented as different parameters in the generator
 - Theory suggests that they are supposed to be the same
 - The present fit follow this idea
 - Things might change in the future

- R-vp-CC-m2
 - DIS-HmultWgt-vp-CC-m2
 - DIS-HmultWgt-vbn-CC-m2

- R-vn-CC-m2
 - DIS-HmultWgt-vn-CC-m2
 - DIS-HmultWgt-vbp-CC-m2

- R-vp-CC-m3
 - DIS-HmultWgt-vp-CC-m3
 - DIS-HmultWgt-vbn-CC-m3

- R-vn-CC-m3
 - DIS-HmultWgt-vn-CC-m3
 - DIS-HMultWgt-vbp-CC-m3

Content of the ROOT file

- Central values for each parameter
 - h_param_result (the error is the error coming from the fit, see slide 7)
 - Also TvectorD called param_result
- Full covariance
 - param_covariance (TmatrixSymD)
 - Histogram format in which the entries are more clear – h_param_covariance
 - Also available the correlation in h_param_correlation
- The predictions of the fit result for each point for which we have the prediction
 - h_global_pred_MC_err
 - h_global_pred_sys_err
- Full covariance from the propagation of the errors on the parameters
 - h_global_pred_cov and h_global_pred_cor

Decoding the data we used

- Observables in those files are only identified by a number - the bin number
- The key for the decoding if a point is used and which point it is (according to a paper) is in the weight file
 - This is one of the inputs of our fit
 - It is what specifies the weight for each data point we use
 - For the time being we simply use to switch data on and off (weight 1 or 0)
 - Yet the data in the file are presented in the order found in the histogram

• Examples

```
# /global#19:32      0. # BNL_7FT,4      : 0. : 2. # BNL_7FT,4
/global#32:44      0. # CCFR,2        : 0. : 2. # CCFR,2
```

- The first line is commented out so the weight of 0 is not assigned. Those points are used in the fit. It identifies the bins from 19 to 31 included
- The second line is used so those points are assigned a null weight in the fit, they are not used.
- The important things is that both have a key at the end BNL_7FT,4 and CCFR,2
 - The key is based on our database which is not public
 - But you can get to a paper citation using the pdf file with the plots as the keys are there as well together with the citations

Release plan

- Full support for reweight and hence full support for tune release is expected with v4
 - Yet, the release of the tune itself can be done earlier
- Standard practice to be developed
 - Each tune will have a Peer-reviewed paper
 - more precisely each new tuning procedure → More sustainable
 - Each set of tuning results will have a dedicated data release
 - corresponding to paper
 - re-runs or minor variations for which we may not write full new papers
 - there may be info on tech notes
 - The data releases will be citable and have a DOI number
 - We can maintain a GENIE web page with list and links to all our data releases and the corresponding papers