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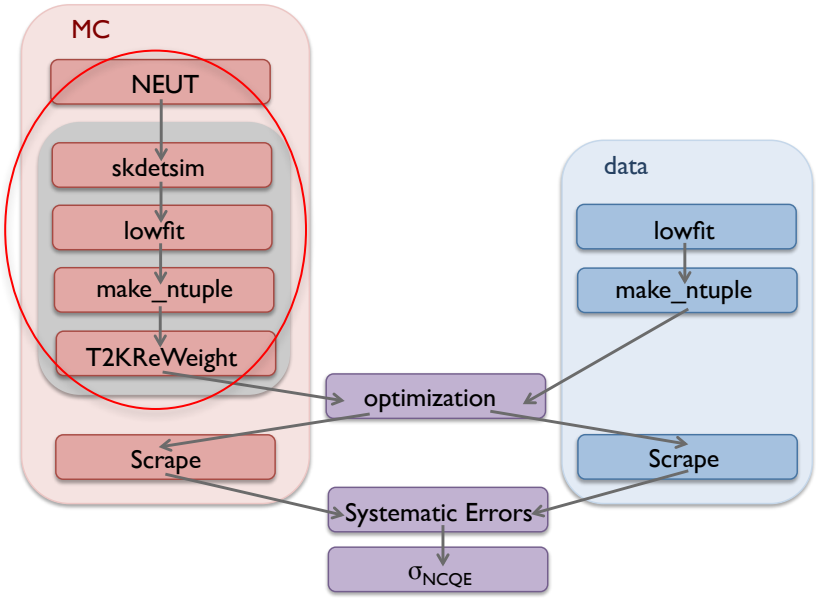
group meeting
20 September 2017

Repeated all Run 4 MC

- generated all 3000*100 for each of numu, nue, and nmb
- ran neut_select/ to cut high energy events
- processed for skdetsim, reconstruction, make_ntuple, and T2KReWeight
- (didn't look at results, but files looked fine)



Emailed Mark Scott about T2KReWeight

- would like to use dslist to disable dials in genWeights_SK_2016.cxx
- BANFF matrix

current BANFF matrix still not official

- the final BANFF matrix
- Simon Bienstock 22 June 2017
  "cannot be considered as final BANFF yet, we're still unsure since the pull studies problems are not fixed"
- DataFit_Postfit_1p1h_mirror_MAQEH_PionSI_170614_sk.root

- why is it named like that?
- still not stored anywhere official, I guess

Email from Mark Scott

- each T2KReWeight application includes reweight engines ("neut" or "niwg", generally), which correspond to the T2KNeutReWeight.cxx or T2KNIWGReWeight.cxx classes in the source code

- T2KReWeight_v1r27p3/src/ has
  - T2KNeutReWeight.cxx
  - T2KNIWGReWeight.cxx
  - (T2KGEANTReWeight.cxx)
  - (T2KJNuBeamReWeight.cxx)

Email from Mark Scott

- these engines apply certain types of weight,
  so NEUT can reweight all of the neut parameters,
  NIWG handles extra stuff that the NIWG group added
  (RPA corrections, for instance) that are not in NEUT
- once you have the right engines added to your T2KReWeight object, you can add the reweight dials – these control the individual parameters of interest.
  These are listed in T2KReWeight/src/T2KSyst.h
- enable engines in configure with ./config.sh (neut, niwg, jnubeam, geant)

- each dial has an identifier, kNIWG, kNXsec or kGXSec showing if it is a dial requiring NIWG, NEUT, or GENIE reweight engines. There is then a brief description of the dial.
- kJNA61pi for JNuBeam parameters

- where do you add the reweight dials?
  - to src/ T2KNeutReWeight.cxx or T2KNIWGReWeight.cxx classes?
  - to app/genWeights_SK_2016.cxx?

Email from Mark Scott

- for your case, NC_Coh from BANFF doesn't have a dial specific, since this is just a normalization parameter (?)
- there are specific coherent pion production dials though,
  such as kNXSec_NECOHEPI, which may affect neutral current interactions as well
- the same is true for NC_1gamma and NC_Other – these are just normalization parameters that we apply using the NEUT interaction code, without using T2KReWeight

- (I had asked about these parNames)

- do I adjust the normalization parameters?

Email from Mark Scott

- looking at the parameter list, I can see a number of NC elastic specific dials (line 174 of current code): kNXsec_MaNCEL, kNXsec_MaNCELshape, kNXec_AxIFFNCEL, etc.
- These are in addition to the CC version of these dials, so I would guess that the NC and CC dials are decoupled from one another

```
// NCEL tweaking parameters:
kNXSec_MaNCEL,           ///< tweak Ma NCEL, affects dsigma(NCEL)/dQ2 both in shape and normalization
kNXSec_NormNCEL,         ///< tweak NCEL normalization (energy independent)
kNXSec_MaNCELshape,      ///< tweak Ma NCEL, affects dsigma(NCEL)/dQ2 in shape
kNXSec_1overMaNCEL2,      ///< tweak 1/MaNCEL^2, affects dsigma(NCEL)/dQ2. More symmetric response in cross section when assuming Gaussian errors on this parameter
kNXSec_AxIFFNCEL,        ///< tweak elastic nucleon form factors (dipole/default -> BBBA07) NOT VALIDATED
kNXSec_VecFFNCEL,        ///< tweak elastic nucleon form factors (dipole/default -> BBBA05)
//kNXSec_EtaNCEL,          ///< tweak NCEL strange axial form factor eta, affects dsigma(NCEL)/dQ2 both in shape and normalization
```

Email from Mark Scott

- to really check what is going on, you have to look at the NEUT code directly (or just test it)
- the reweighting code is stored in: neut_5.3.4/src/reweight/ and is labelled according to the interactions it should reweight
- NReWeightNuXsecNCEL.cc, for example, controls all of the NC elastic reweighting. It also has the vector form factor reweighting in it (vecFF)
- you should be able to add these dials to the reweight class in the exact same way as we add the CC MaQE dials, and then apply variations in the same way again

```
~/ncgamma/mc/neut/neut_5.3.3_v1r27p3/src/reweight@sukap001[20]_% ls
Controls.h                    NReWeightNuXSecCCRES.cc   NReWeightUtils.cc
GNUmakefile                   NReWeightNuXSecCCRES.h    NReWeightUtils.h
LinkDef.h                     NReWeightNuXSecCOH.cc     NSyst.h
NFortFns.cc                   NReWeightNuXSecCOH.h      NSystSet.cc
NFortFns.h                    NReWeightNuXSecDIS.cc     NSystSet.h
NModeDefn.cc                  NReWeightNuXSecDIS.h      NSystUncertainty.cc
NModeDefn.h                   NReWeightNuXSecNC.cc      NSystUncertainty.h
NReWeight.cc                  NReWeightNuXSecNC.h       NTotCrs.cc
NReWeight.h                   NReWeightNuXSecNCEL.cc    NTotCrs.h
NReWeightBindingEnergy.cc     NReWeightNuXSecNCEL.h     PDGCodes.h
NReWeightBindingEnergy.h      NReWeightNuXSecNCRES.cc   inputs
NReWeightCasc.cc              NReWeightNuXSecNCRES.h    neutread.cc
NReWeightCasc.h               NReWeightNuXSecRES.cc     neutread.h
NReWeightI.h                  NReWeightNuXSecRES.h      old
NReWeightNuXSecCCQE.cc        NReWeightNuclPiless.cc
NReWeightNuXSecCCQE.h         NReWeightNuclPiless.h
```

add the dials to the T2KNeutReWeight.cxx or T2KNIWGReWeight.cxx classes?

Email from Mark Scott

- for the SF→RFG weight, this is a NIWG reweighting. Following the dial through the code you can find the actual reweighting method in NIWGReWeight/NIWGReWeight2014a.cc. This seems to be applied equally to CC and NC events, which I think makes sense but you could check with a NIWG person to make sure
- /home/sklb/software/GlobalAnalysisTools/NIWGReWeight/NIWGReWeight2014a.cc
- the default tune should apply the SF→RFG reweighting, an energy dependent coherent pion production weight. I think the NC_1gamma normalization is also set to 2. None of these are in the BANFF matrix, so should be applied by whichever SK code you have
- is this important?

Email from Mark Scott

- if I were you, I would try using the nominal SK T2KReWeight code and just look at the NC event weights. If you switch off the SF→RFG weight then they should not be reweighted by anything. If you see that they do have a weight, then perhaps we need to dig a bit deeper, removing dials to identify which is giving them weights.
- how to look at the NC event weights?

Alex's version of T2KReWeight

- /home/ahimmel/ana/T2K/T2KReWeight/TestVer/
- VERSION 1.15.1

Compare Alex with current

- src/T2KNeutReWeight.cxx

```
//********************************************************************
double T2KNeutReWeight::CalcWeight(const SK::SK__nc * sktree)
{
  double weight = 1.0;
#ifdef __T2KRW_NEUT_ENABLED__

  T2KNeutUtils::fill_neut_commons(sktree);

  weight = fNeutReWeight->CalcWeight();

#endif
  return weight;
}

//********************************************************************
```

I think Alex used SK__nc instead of SK__h1, but I don't really understand why
I can use SK__h1 as name, I think?

Compare Alex with current

- genWeights_2012a.cxx (genWeights_ncgamma is based on this)
- SK__nc.h instead of SK__h1.h
- parNames and parEnum don't have NEUT parameter "x_1overmaqe2"
  → I think this may have been added later because nPars comment is -1
- T2KRW_NEUT_ENABLED, probably nothing?

```
int main(int argc, char *argv[])
{
#if defined (__T2KRW_NEUT_ENABLED__) && defined (__T2KRW_JNUBEAM_ENABLED__) && defined (__T2KRW_NIWG_ENABLED__)
  ParseArgs(argc, argv);
```

genWeights continued

- I don't really understand this, from genWeights_ncgamma.cxx

```
for (int ithrow=0; ithrow<nThrows+1; ithrow++) {
```

```
// Enable and set T2KSyst values
// These come from the BANFF matrix
int nParsXnBins=0;
for (int ipar=0; ipar<nPars; ipar++) {

    if (!parIncluded[ipar]) {
        if (ithrow == 0) { // AIH
            cout << "--- Skipping sys " << parNames[ipar] << endl;
        }
        continue;
    }

  if (ithrow == 0) { // AIH
      cout << "+++ Including sys " << parNames[ipar] << endl;
  }

  t2krew::T2KSyst_t t2ksyst = t2krew::kSystNull;
```

parIncluded counted from –p BANFF postfit file, I think

if statements at same level?

Summary

- working with T2KReWeight, a lot of work to do!