FiTQun Tutorial

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Download These Files

- http://trshare.triumf.ca/~wilking/nuprismfitqun/fitqun_20150316.tar.gz
- http://trshare.triumf.ca/~wilking/nuprismfitqun/particlegun_SuperK_e-_ene500_xpos0_12evts.root
- http://trshare.triumf.ca/~wilking/nuprismfitqun/particlegun_SuperK_mu-_ene500_xpos0_12evts.root

Compiling the Code

- Ensure that you are pointed to a valid, recent copy of WCSim with $WCSIMDIR
- Open the file: GNUmakefile
- Uncomment the line:
  NOSKLIBRARIES = 1
- Set your FITQUN_ROOT environment variable to be your fiTQun directory
- Run ./configure
- type “make”

fiTQun.parameters.dat

- Tunable parameters are controlled in fiTQun.parameters.dat
- The interesting parameters for running fiTQun on WCSim are listed here (note that WCSim uses SK1 electronics):
  - < fiTQun.Do*PARTICLE*1RFit = 0 >
    - This turns on the 1-ring fit for particle type *PARTICLE*
    - Set to 1 for non-hadronic particles (e & mu) and 2 for particles that hadronically scatter (pi, K, & p)
  - < fiTQun.DoPi0Fit = 1 >
    - Set to 1 to perform the standard pi0 fit
  - < fiTQun.DoMRFit = 1 >
    - < fiTQun.DoMoreMRFit = 11 >
    - Set to 1 & 11 respectively to run the multi-ring fitters
  - < fiTQun.WaterAttenuationLengthSK1 = 7280.73 >
    - This is the water attenuation length. Set to **5900** for WCSim
  - < fiTQun.UseScatteredLight = 4 >
    - Set this to **2** if you do not have a well-tuned 6D scattering table
  - < fiTQun.DoBiasCorrection = 1 > Set to 1 if you want to apply empirical bias corrections to fit results
    - Set this to **0** for WCSim (this function was only tuned for skdetsim)
  - < fiTQun.QEEffSK1 = 0.1126 >
    - This is the average PMT quantum efficiency. Set this to **0.083** for WCSim with 20” PMTs

Running the Code

- $FITQUN_ROOT/runfiTQunWC mywcsimfile.root -r myoutputfile.root
- Other options:
  -l <file> Set the name of an event list file.
  -n <cnt> Only read <cnt> events
  -o <file> Set the name of an output zbs file.
  -p <file> Set the name of a fiTQun parameter-override file
  -c <file> Set the name of a spliTChan parameter-override file
  -r <file> Set the name of an output root file.
  -s <cnt> Skip <cnt> events
- Note: -o only works for skdetsim (makes a zbs file)
- Note: You can override any of the default parameters in fiTQun.parameters.dat by making a new file with any parameters you want to change (i.e. not all parameters need to be specified) and using the -p flag
- Note: -n lets you run over a subset of events

Output Variables

- If you are a member of T2K, go here: http://www.t2k.org/t2ksk/code/fitqun/fitqunvariables_v4
- This will be ported to the fiTQun github page soon
- Important 1-ring variables:
  - fqnse: Number of subevents (time clusters)
  - fq1rmom[fqnse][7]: Fit momentum
    - 2nd index is particle type:
      0 = GAMMA, 1 = ELECTRON, 2 = MUON, 3 = PION, 4 = KAON, 5 = PROTON
  - fq1rnll[fqnse][7]: Best-fit -lnL
  - fq1rpos[fqnse][7][3]: Fit vertex (0=X, 1=Y, 2=Z)
  - fq1rdir[fqnse][7][3]: Fit direction (0=X, 1=Y, 2=Z)
  - fq1reloss[fqnse][7]: Energy lost in the upstream track segment before the hadronic interaction(for upstream tracks only)
  - fq1rpcflg[fqnse][7]: Flag to indicate whether fiTQun believes the particle is exiting the ID(<0 if MINUIT did not converge)
- Pi0 variables are similar (e.g. fqpi0mom1[2]), but only have a single index, which labels the 2 possible pi0 fits (usually you should use 0 for this index)
- The multiring fit output can get quite complicated, but the most useful variable is:
  - fqmrnring[fqnmrfit]: Number of rings for this fit [1-6]
    - This is fiTQun's best guess for the number of rings in this event
    - For NuPRISM, we will likely need to retune the cut values associated with this determination

Make some plots!

- electron-hypothesis momentum:
  fiTQun->Draw("fq1rmom[0][1]")
- muon-hypothesis momentum:
  fiTQun->Draw("fq1rmom[0][1]")
- electron/muon PID:
  fiTQun->Draw("fq1rnll[0][2]-fq1rnll[0][1]")
- muon-hypothesis y-position:
  fiTQun->Draw("fq1rpos[0][2][1]")
- electron-hypothesis z-direction:
  fiTQun->Draw("fq1rdir[0][1][2]")
- pi0/electron likelihood ratio
  fiTQun->Draw("fq1rnll[0][1]-fqpi0nll[0]")
- pi0 mass
  fiTQun->Draw("fqpi0mass[0]")