How to: Impact plots with HiggsCombine

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KU SUSY meeting
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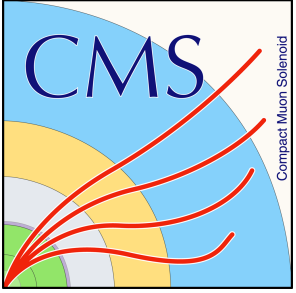
What are impacts?
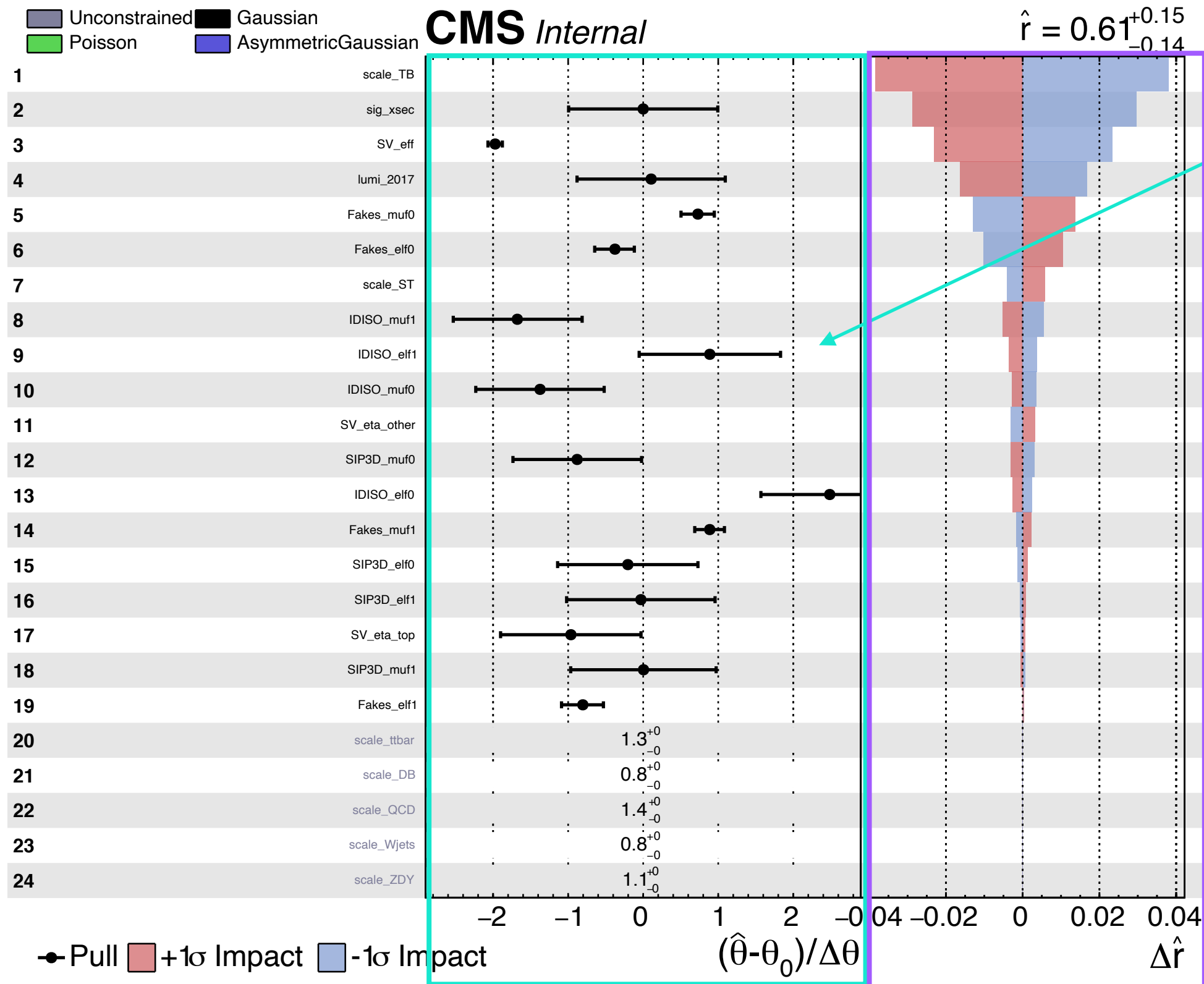
KUEwkino workflow

- see Zach's talk <u>here</u> about how to get from NANO to limits

- BuildFit(Condor) step will produce datacards in directories corresponding to signal mass splittings

- These datacards will be the input to the start of the impact plot workflow

- HiggsCombine makes the impact plots, installation instructions <u>here</u>

text2workspace

- Choose one mass point to convert the datacard to a RooWorkspace

  - text2workspace.py -d [datacard.txt] -o [workspace.root] -m [mass point]

  - Or combineTool.py -M T2W -i [datacard.txt] -m [mass point] -o [workspace.root]

    - Only need -m argument if running inside directory

 - Can be run on condor using --job-mode condor --sub-opts='request_memory = 8 GB'

doInitialFits
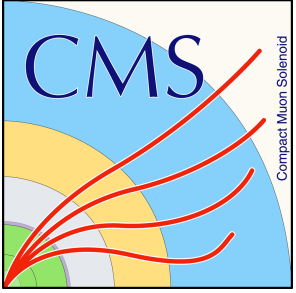
- Do fits to POI first

- combineTool.py -M Impacts -d [workspace.root] --doInitialFit --robustFit 1 -m [mass point]

  - robustFit flag does a more robust likelihood scan (fit more likely to converge, step size controlled with --stepSize argument)

- Output: higgsCombine_initialFit_Test.MultiDimFit.mH[mass].root file with limit TTree and toys TDirectory

- Can be run on condor using --job-mode condor --sub-opts='request_memory = 8 GB'

doFits

- Does likelihood scans for each nuisance parameter

- combineTool.py -M Impacts -d [workspace.root] --doFits --robustFit 1 -m [mass point]

  - Mass point must match mass in file name of initialFit root file

  - Output: higgsCombine_paramFit_Test_[NPname].MultiDimFit.mH[mass point].root with same structure as initialFit.root file

- Can be run on condor using --job-mode condor --sub-opts='request_memory = 8 GB'

Impacts + plotting
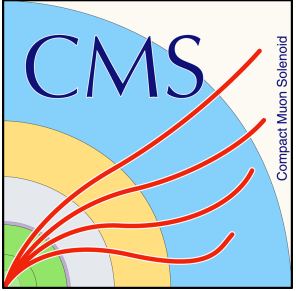
- combineTool.py -M Impacts -d [workspace] -m [mass point] -o impacts.json

  - Collects information from previous steps and outputs to json file

  - Mass point must match mass in file name of initialFit root file

- plotImpacts.py -i impacts.json -o impacts

 - Produces .pdf plot with NP pulls and impact on POI

Individual impacts
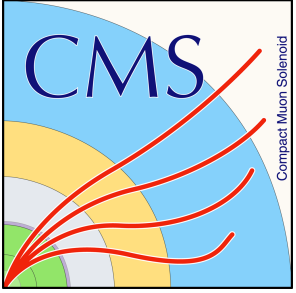
- python diffNuisances.py fitDiagnostics.root --all

  - Script is in HiggsAnalysis/CombinedLimit/test

  - To get fitDiganostics.root file:

    - combineTool.py -M FitDiagnostics -d [datacard.txt or workspace.root] -m [mass splitting]

    - Has information about output and behavior of bkg-only and s+b fits

- diffNuisances prints impacts and s+b and bkg-only pulls for all parameters (with --all flag)

Current issues
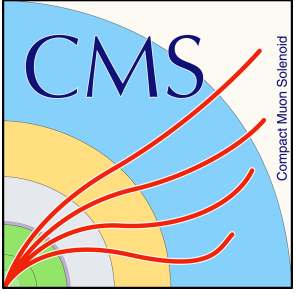
- Datacards with all shape systematics segfaulting during text2workspace

  - Separate by channel to run fits with all shape systematics

  - fakes+QCD systematics ok for all channels

  - MET Trig + BTag systematics not playing nice

  - Under investigation - run impacts for lnN systematics only

- flatParam cannot be added with CombineHarvester

Overview of steps
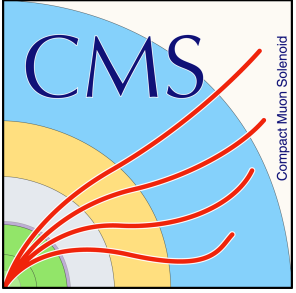
1. KUEwkino workflow

2. text2workspace.py [datacard.txt] -m [mass point] -o [workspace.root]

3. combineTool.py -M Impacts -d [workspace.root] --doInitialFit --robustFit 1 -m [mass point]

4. combineTool.py -M Impacts -d [workspace.root] --doFits --robustFit 1 -m [mass point]

5. combineTool.py -M Impacts -d [workspace.root] -m [mass point] -o impacts.json

6. plotImpacts.py -i impacts.json -o impacts