FAST-RA1: Validating the datacards (WIP)

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Motivation

◎ In RA1, transitioning from using AlphaTools + AlphaStats to FAST-RA1

◎ Datacards are a crucial part of analysis – store information about the fitting, systematics, background contribution, signal contamination for each mass point in a signal model

◎ In RA1, take flat trees → AlphaTools generates TH2Ds → AlphaStats transforms to datacards

◎ In FAST-RA1, flat trees → dataframes → datacards

◎ Need to validate the datacards created in FAST framework by running them through AlphaStats

◎ Compared to a test sample so, at each stage, we could verify the datacards were performing correctly

Difficulties and setbacks

◎ Most of the problems were related to formatting – had to make sure the file names, layout of datacards, etc. were exactly correct

◎ Testament to the rigidity of AlphaStats (although, not a problem if running through the AlphaTools + AlphaStats workflow in entirety)

◎ Some issues with histograms in root files not being filled

◎ Essentially, a back-and-forth between myself and Olivier to iterate over the datacards and make sure they were correct

◎ Then, after they passed the first step, everything worked properly

◎ Needed the datacards for just a few mass points to get limits

Comparisons

◎ Currently a work-in-progress

◎ Currently have datacards and HiggsCombine files from using FAST-RA1 and can compare to test sample

◎ Need more mass points to make limit plane and extract numerical values for a proper comparison

Future plans

◎ Make comparisons as detailed in previous slide

◎ Olivier has noticed some issues with his normalisation/histogram filling, so values may not be accurate at the moment

◎ Once sorted, will make more in-depth and meaningful comparisons to validate FAST-RA1 datacards

◎ Longer term: make sure we don't fall into the same traps as AlphaStats (i.e., rigidity, unruly nature w.r.t. changing parameters, large monolithic scripts)

Backup

Datacard example

```
imax    *     number of categories
jmax    *     number of samples minus one
kmax    *     number of nuisance parameters
--------------------------------------------------------------------------------
shapes * * SMS-T2tt_mStop-450_mLSP-400_25ns_nht_category_eq0b_eq1j_htBin_200_400_shapes.root $CHANNEL/$PROCESS $CHANNEL/$PROCESS_$SYSTEMATIC
--------------------------------------------------------------------------------

bin     Signal  Mu200_250eq0b_eq1j  MuMu200_250eq0b_eq1j    Mu250_300eq0b_eq1j  MuMu250_300eq0b_eq1j    Mu300_350eq0b_eq1j  MuMu300_350eq0b_eq1j    Mu350_400eq0b_eq1j  MuMu350_400eq0b_eq1
observation 291353  67914   7796    25895   3048    10462   1400    4026    693
--------------------------------------------------------------------------------
bin     Signal  Signal  Signal  Signal  Signal  Signal  Signal  Signal  Signal  Signal  Signal  Signal  Signal  Mu200_250eq0b_eq1j  Mu200_250eq0b_eq1j  MuMu200_250eq0b_eq1j    MuMu200_250


process     sig Ttw200_250eq0b_eq1j Zinv200_250eq0b_eq1j    Qcd200_250eq0b_eq1j Ttw250_300eq0b_eq1j Zinv250_300eq0b_eq1j    Qcd250_300eq0b_eq1j Ttw300_350eq0b_eq1j Zinv300_350eq0b_eq1j
process     0   1   2   3   4   5   6   7   8   9   10  11  12      0   1       0   1       0   1       0   1       0   1       0   1       0   1       0   1
rate        811.419767852   78151.4671893   100131.316849   70.7645859533   23726.9173001   36870.9720581   23.7351739007   7818.87603959   14410.9190872   8.82328544765   2809.79950452
--------------------------------------------------------------------------------

lumiSyst    lnN     1.026   -   -   -   -   -   -   -   -   -   -   -   -   1.026   -   1.026   -   1.026   -   1.026   -   1.026   -   1.026   -   1.026   -   1.026   -
qcdSyst_200_250_eq1j    lnN     -   -   -   2   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
qcdSyst_250_300_eq1j    lnN     -   -   -   -   -   -   2   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
qcdSyst_300_350_eq1j    lnN     -   -   -   -   -   -   -   -   -   -   2   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
qcdSyst_350_400_eq1j    lnN     -   -   -   -   -   -   -   -   -   -   -   -   2   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
leptonVetoSystFullSim   lnN     -   1.02    -   -   1.02    -   -   1.02    -   -   1.02    -   -   1.02    -   -   0.98    -   -   0.98    -   -   0.98    -   -   0.98    -   -
puWeight    shape   1   1   -   1   1   -   1   1   -   1   1   -   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -
triggerWeight   shape   1   1   1   -   1   1   -   1   1   -   1   1   -   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1
jecWeight   shape   1   1   1   -   1   1   -   1   1   -   1   1   -   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1
btfWeight   shape   1   1   1   -   1   1   -   1   1   -   1   1   -   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1
btfLightWeight  shape   1   1   1   -   1   1   -   1   1   -   1   1   -   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1
muonSfWeight    shape   1   1   1   -   1   1   -   1   1   -   1   1   -   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1
elarWeight  shape   1   1   1   -   1   1   -   1   1   -   1   1   -   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1
btfCFbWeight    shape   1   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
btfCFlWeight    shape   1   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
btfCFcWeight    shape   1   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -
xsWeightTt  shape   -   1   1   -   1   1   -   1   1   -   1   1   -   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1
xsWeightW   shape   -   1   1   -   1   1   -   1   1   -   1   1   -   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1
bosonPtQcdWeight    shape   -   1   1   -   1   1   -   1   1   -   1   1   -   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1
bosonPtEwkWeight    shape   -   1   1   -   1   1   -   1   1   -   1   1   -   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1   -   1
genMetSyst  lnU     0.980920625081  -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -   -

MuMu200Ewk200Rateeq0b_eq1j_200  rateParam   MuMu200_250eq0b_eq1j    Ewk200_250eq0b_eq1j 1. [0,20]
Mu200_250eq0b_eq1jEwk200_250eq0b_eq1jRateeq0b_eq1j_200_250  rateParam   Mu200_250eq0b_eq1j  Ewk200_250eq0b_eq1j 1. [0,20]
SignalZinv200_250eq0b_eq1jRateeq0b_eq1j_200 rateParam   Signal  Zinv200_250eq0b_eq1j ((1+0.052)^(@1)*(1+0.001)^(@2)*(1+0.001)^(@3)*(1+0.031)^(@4))*(@0) MuMu200Ewk200Rateeq0b_eq1j_200,alph
SignalTtw200_250eq0b_eq1jRateeq0b_eq1j_200_250  rateParam   Signal  Ttw200_250eq0b_eq1j ((1+0.052)^(@1)*(1+0.051)^(@2)*(1+0.047)^(@3)*(1+0.031)^(@4)*(1+0.025)^(@5)*(1+0.015)^(@6))*(@0) Mu
MuMu250Ewk250Rateeq0b_eq1j_250  rateParam   MuMu250_300eq0b_eq1j    Ewk250_300eq0b_eq1j 1. [0,20]
Mu250_300eq0b_eq1jEwk250_300eq0b_eq1jRateeq0b_eq1j_250_300  rateParam   Mu250_300eq0b_eq1j  Ewk250_300eq0b_eq1j 1. [0,20]
SignalTtw250_300eq0b_eq1jRateeq0b_eq1j_250_300  rateParam   Signal  Ttw250_300eq0b_eq1j ((1+0.047)^(@1)*(1+0.051)^(@2)*(1+0.044)^(@3)*(1+0.046)^(@4)*(1+0.025)^(@5)*(1+0.015)^(@6))*(@0) Mu
SignalZinv250_300eq0b_eq1jRateeq0b_eq1j_250 rateParam   Signal  Zinv250_300eq0b_eq1j ((1+0.047)^(@1)*(1+0.001)^(@2)*(1+0.000)^(@3)*(1+0.048)^(@4))*(@0) MuMu250Ewk250Rateeq0b_eq1j_250,alph
MuMu300Ewk300Rateeq0b_eq1j_300  rateParam   MuMu300_350eq0b_eq1j    Ewk300_350eq0b_eq1j 1. [0,20]
Mu300_350eq0b_eq1jEwk300_350eq0b_eq1jRateeq0b_eq1j_300_350  rateParam   Mu300_350eq0b_eq1j  Ewk300_350eq0b_eq1j 1. [0,20]
SignalZinv300_350eq0b_eq1jRateeq0b_eq1j_300 rateParam   Signal  Zinv300_350eq0b_eq1j ((1+0.050)^(@1)*(1+0.001)^(@2)*(1+0.001)^(@3)*(1+0.051)^(@4))*(@0) MuMu300Ewk300Rateeq0b_eq1j_300,alph
SignalTtw300_350eq0b_eq1jRateeq0b_eq1j_300_350  rateParam   Signal  Ttw300_350eq0b_eq1j ((1+0.050)^(@1)*(1+0.051)^(@2)*(1+0.050)^(@3)*(1+0.051)^(@4)*(1+0.025)^(@5)*(1+0.027)^(@6))*(@0) Mu
MuMu350Ewk350Rateeq0b_eq1j_350  rateParam   MuMu350_400eq0b_eq1j    Ewk350_400eq0b_eq1j 1. [0,20]
Mu350_400eq0b_eq1jEwk350_400eq0b_eq1jRateeq0b_eq1j_350_400  rateParam   Mu350_400eq0b_eq1j  Ewk350_400eq0b_eq1j 1. [0,20]
SignalTtw350_400eq0b_eq1jRateeq0b_eq1j_350_400  rateParam   Signal  Ttw350_400eq0b_eq1j ((1+0.025)^(@1)*(1+0.051)^(@2)*(1+0.072)^(@3)*(1+0.029)^(@4)*(1+0.025)^(@5)*(1+0.019)^(@6))*(@0) Mu
```