Beautiful_And_Simple_Drawing_Atificer (BASDA)

usage --- example

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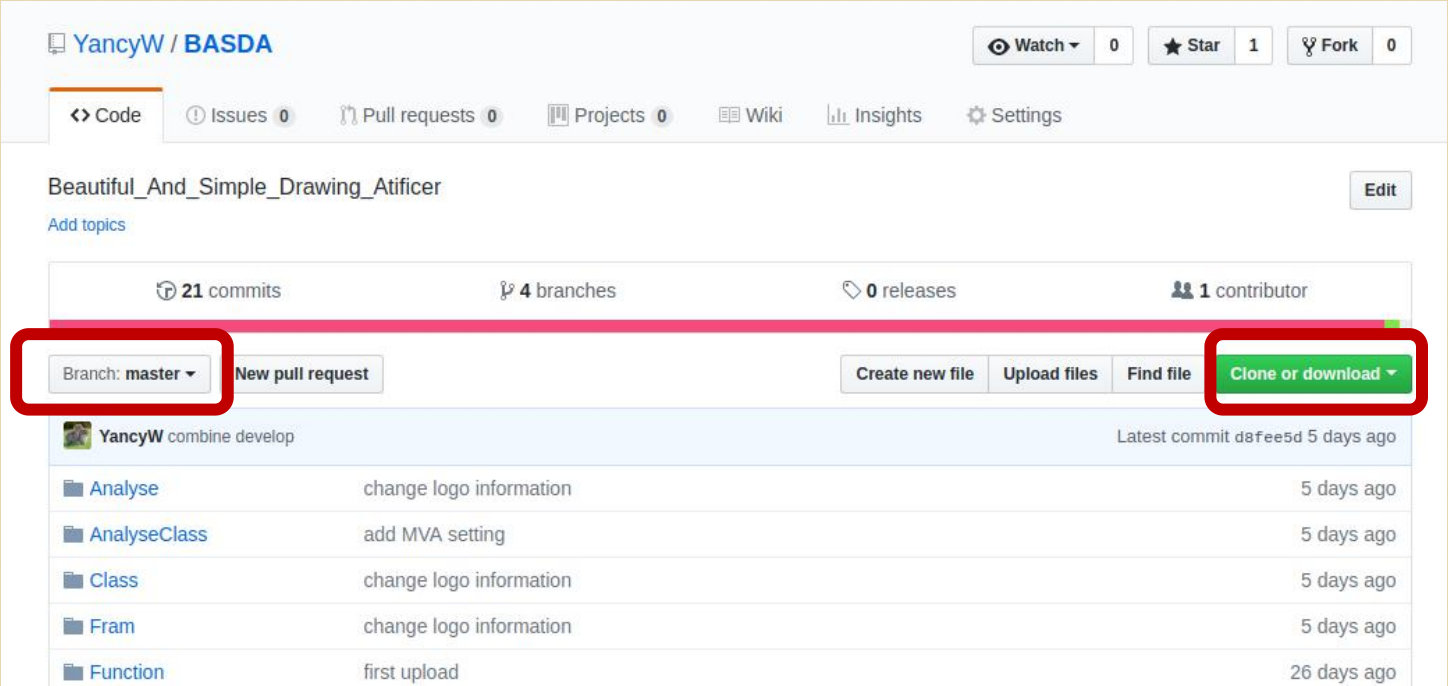
Installation

Installation

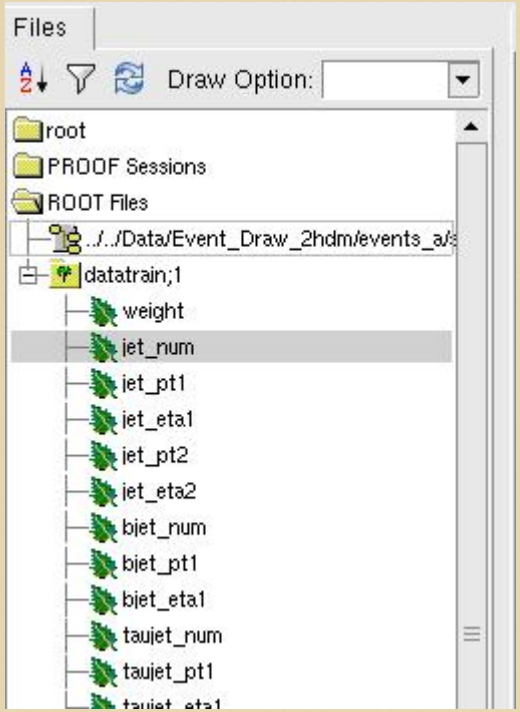
- https://github.com/YancyW/BASDA
  - four branches: master, release, develop, feature.

stable version



installation

- c++14 ⊕ root6 ⊕ boost_filesystem
- yaml-cpp
  - https://github.com/jbeder/yaml-cpp
- input root file structure
  - weight (not necessary)
  - observables



Installation (on NAF)

- initialize ilcsoft for gcc ≧ 4.8, root 6
- install YAML, change path for makefile_server
- in BASDA, cover makefile with makefile_server
  - mv makefile_server makefile

51 lines (40 sloc) | 1.92 KB Raw Blame History

```
TARGET=BASDA

CXX=g++
FLAGS=-std=c++14  -Wextra  -Wall ${shell root-config --cflags}

RootPath=/cvmfs/ilc.desy.de/sw/x86_64_gcc48_sl6/v01-17-11/root/6.08.00
YAMLPath=/afs/desy.de/user/y/ywang/Software/Lib/yaml-cpp-master/

INCLUDE = -I. -I..  -I$(RootPath)/include  \
                   -I${YAMLPath}/include

LIBS =  -L${YAMLPath} -lyaml-cpp -lboost_filesystem  -lboost_system -lTMVA -lTMVAGui
ROOTLIBS := $(shell root-config --libs) -lXMLIO

SRCS = \
$(TARGET).cpp \
Class/Path.cpp\
Fram/Fram.cpp Fram/Fsection.cpp \
Function/Fbasic.cpp Function/Fvector.cpp Function/Ffile.cpp Function/FCalc.cpp Function/FString.cpp \
Latex/LTable.cpp Latex/LItem.cpp\
Lib/MessageFormat.cpp Lib/PlotSetting.cpp Lib/Record.cpp Lib/YAML_Assistant.cpp\
RWpara/RWFile.cpp RWpara/RWFlow.cpp RWpara/RWPath.cpp RWpara/RWDebug.cpp RWpara/RWDraw.cpp RWpara/RWbasic.cpp RWpara/RWEvent.cpp
RWpara/RWSensitivity.cpp RWpara/RWCut.cpp RWpara/RWPlot.cpp RWpara/RWMass_Scan.cpp RWpara/RWBKG_Sort.cpp RWpara/RWScenario.cpp R
Analyse/Analyse_Find_Cut.cpp  Analyse/Make_Table.cpp \
Analyse/Make_Complete_Table.cpp \
Analyse/Analyse_Pre_Cut.cpp \
```

change YAML path

YAML

YAML format

- YAML---YAML Ain't Markup Language
  - download/manuals https://github.com/jbeder/yaml-cpp
- a human-readable data serialization language
- in BASDA, only use simplest command

```
key :  value
```

or,

```
key :
    key :  value
    key :
            key :  value
```

or list,

```
key: [value1,value2, value3...]
```

YAML format

it's space, NOT tab

note: DO NOT use tab in YAML.
DO NOT try to modify everything.
comments with #

vim Var_2hdm_a.dat

```
weight:
    Exist                    : False
    Weight_Type              : "F"
variable:
    v0:
      title_name             : "jet_num"
      cut_min                : 2.9
      cut_max                : 100
      latex_name             : "N^{j}"
      Canvas_name            : "c0"
      Canvas_width           : 1000
      Canvas_height          : 700
      leg_left               : 0.6
      leg_up                 : 0.7
      leg_right              : 0.8
```

vim Bkg_Sort.dat

```
# do not change the key name
sort_num    : 4

sub_sort_name : [sig, wtata, tt, txll]
sub_sort_num  : [1,   1,     2,  1   ]

# change below based on sub_sort names
sig   : [HA]
wtata : [l]
tt    : [l, sl]
txll  : [l]
```

```
<marlin>
  <execute>
    <processor name="MyAdd4MomCovMatrixCharged"/>
    <!--processor name="MyThrustReconstruction"/-->
    <processor name="MyIsolatedLeptonTaggingProcessor"/>
    <processor name="MyHiggsProcessor"/>
  </execute>

  <global>
    <parameter name="LCIOInputFiles">
/pnfs/desy.de/ilc/prod/ilc/mc-dbd/ild/dst-merged/250-TDR_ws/np-light-higgs/ILD_o1_v05/v01-16-p10_250
    </parameter>
    <parameter name="GearXMLFile"> GearOutput.xml </parameter>
    <parameter name="MaxRecordNumber" value="0" />
    <parameter name="SkipNEvents" value="0" />
    <parameter name="SupressCheck" value="false" />
    <parameter name="Verbosity" options="DEBUG0-4,MESSAGE0-4,WARNING0-4,ERROR0-4,SILENT">WARNING<
    <parameter name="AllowToModifyEvent" value="true" />
  </global>

  <processor name="MyAdd4MomCovMatrixCharged" type="Add4MomCovMatrixCharged">
    <parameter name="InputPandoraPFOsCollection" type="string"> PandoraPFOs </parameter>
    <parameter name="Verbosity" options="DEBUG0-4,MESSAGE0-4,WARNING0-4,ERROR0-4,SILENT"> MESSAGE
  </processor>
                                                                    4,1           Top
```

a quick example

searching charge Higgs at LHC

- sig: pp->tj->H^+bj->AWbj->ττWbj
- bkg: Wττ, tt(l,sl),tllj(tjττ,ttll)

- identification cuts
  - lep=1, τ jet=2, jet>=1, pt, eta cuts
- invariant mass cut
  - m_A , m_{H+-}

input example

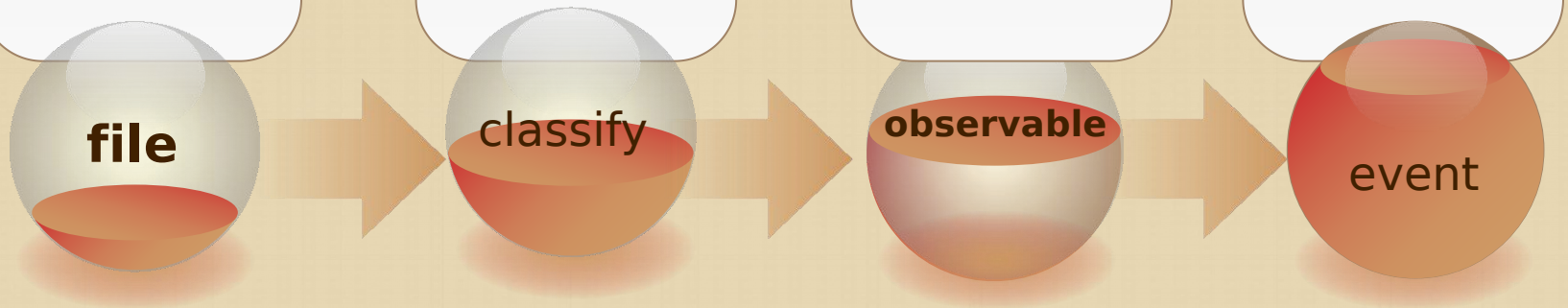
input data

which file for analysis

sort A: file 1,2
sortB: file 3,
sortC: file 4,5,6

name,
figure setting for this obs,
cut,

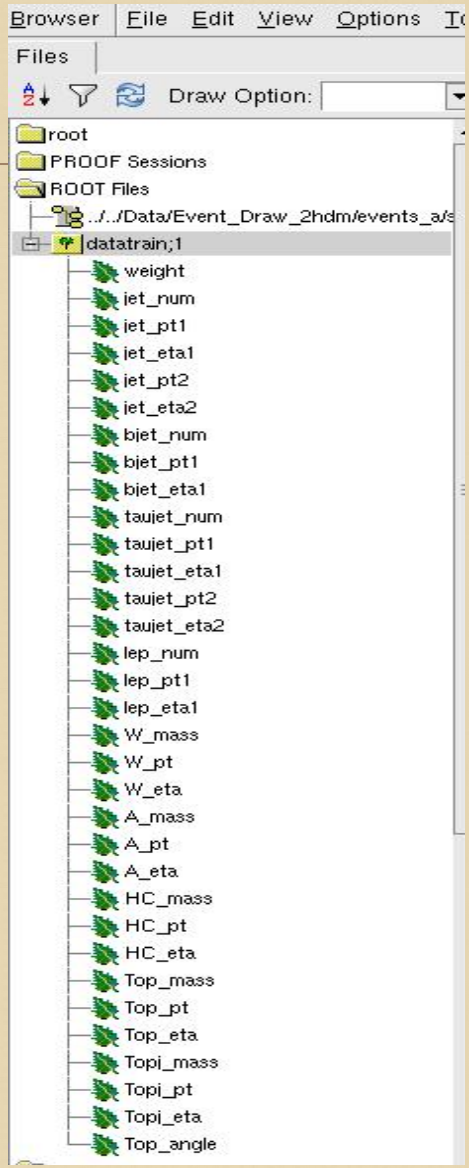
which event for running,
all,
the first 100,
101-303...



input setting

1. generate root files with observables for each channels.

Here, weight = 0 for this example



input setting

1. generate root file
2. edit input file: xection.dat

signal

bkgs

vim xsection_a.dat

```
root file 125:
    sig_{tj}^{HA}:
    |   /home/yancy/Code/Data/Event_Draw_2hdm//events_a/sig.root  :  15.67
    wtata_{l}^{l}:
    |   /home/yancy/Code/Data/Event_Draw_2hdm//events_a/wtata.root  :  410
    tt_{l}^{l}:
    |   /home/yancy/Code/Data/Event_Draw_2hdm//events_a/tt.root  : 62000
    tt_{sl}^{l}:
    |   /home/yancy/Code/Data/Event_Draw_2hdm//events_a/tt_semi.root  : 133980
    ttll_{l}^{l}:
    |   /home/yancy/Code/Data/Event_Draw_2hdm//events_a/ttll.root  :  6.19
    ttll_{ta}^{l}:
    |   /home/yancy/Code/Data/Event_Draw_2hdm//events_a/tjtata.root  :  2.36
```

channel name: format is a_{b}^{c}

tt_{l}^{l} tt_{sl}^{l}

class name user name sub class name

weight=0 in root file, so tell the xsection here.

xection file

signal property:

- **seperate different analysis processes**
- **every mh can different input files**

channel name: a_{b}^{c}

vim ection_aa.dat

```
root file 10:
    nh_{10}^{10}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/nh_10_eL.pR.root  :  79.026852
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/nh_10_eR.pL.root  :  50.415099
    4f_{ww}^{l}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_ww_l_eL.pR.root  :  1564.2091
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_ww_l_eR.pL.root  :  14.691728
    4f_{ww}^{sl}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_ww_sl_eL.pR.root  :  18780.976
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_ww_sl_eR.pL.root  :  172.73264
    4f_{zz}^{l}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zz_l_eL.pR.root  :  157.96041
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zz_l_eR.pL.root  :  99.506102
    4f_{zz}^{sl}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zz_sl_eL.pR.root  :  1422.1429
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zz_sl_eR.pL.root  :  713.52633
    4f_{zzww}^{l}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zzww_l_eL.pR.root  :  1636.0362
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zzww_l_eR.pL.root  :  53.955513
    4f_{zzww}^{sl}:
    |   no such class:  0
    4f_{szee}^{l}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_szee_l_eL.pR.root  :  1084.0173
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_szee_l_eR.pL.root  :  1019.228
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_szee_l_eL.pL.root  :  1009.6032
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_szee_l_eR.pR.root  :  100.4063
```

input file name with different polarizations:

- **1 file : no polarization**
- **2 files: lr/rl**
- **4 files: lr/rl/ll/rr**

cross section:

- **works when choosing no "weight"**
- **when really don't have "weight" in input files**
- **when hoping to reweight events**

input setting

1. generate root file
2. edit xsection.dat
3. edit file.dat

vim file_a.dat

```
FILE_NUM          : 1
FILE_0            : ./control_2hdm/xsection_a.dat

CHANNEL_NUM       : 1
FILE_DESCRIP_0    : all
#FILE_DESCRIP_0    : sig_{tj}^{HA}
#FILE_DESCRIP_1    : wtata_{l}^{l}
#FILE_DESCRIP_2    : tt_{l}^{l}
#FILE_DESCRIP_3    : tt_{sl}^{l}
#FILE_DESCRIP_4    : ttll_{l}^{l}
#FILE_DESCRIP_5    : ttll_{ta}^{l}

Root_Head_Name     : datatrain
Root_Head_MVA_Name : datatrain
```

this is also correct

root tree name

root tree name

vim file_a.dat

```
FILE_NUM          : 1
FILE_0            : ./control_2hdm/xsection_a.dat

CHANNEL_NUM       : 6
#FILE_DESCRIP_0    : all
FILE_DESCRIP_0    : sig_{tj}^{HA}
FILE_DESCRIP_1    : wtata_{l}^{l}
FILE_DESCRIP_2    : tt_{l}^{l}
FILE_DESCRIP_3    : tt_{sl}^{l}
FILE_DESCRIP_4    : ttll_{l}^{l}
FILE_DESCRIP_5    : ttll_{ta}^{l}

Root_Head_Name     : datatrain
Root_Head_MVA_Name : datatrain
```

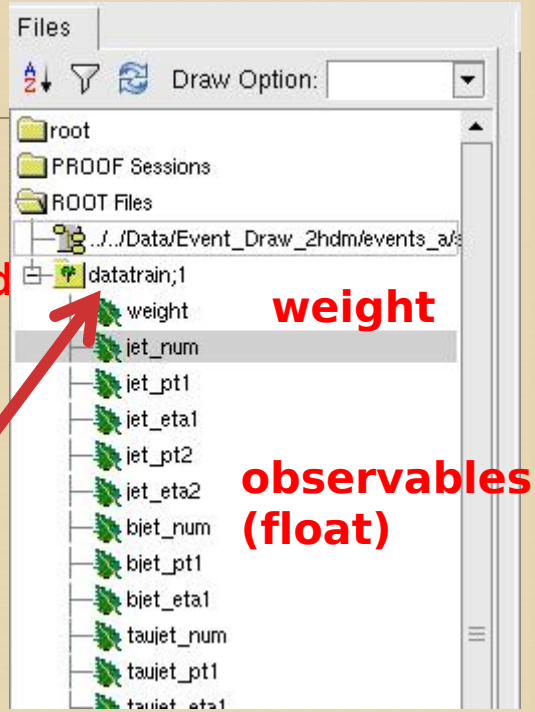
input file

```
FILE_NUM            : 1
FILE_0              :  ./control/xection_aa.dat

CHANNEL_NUM         : 1
FILE_DESCRIP_0      : all
#FILE_DESCRIP_0      : nh
#FILE_DESCRIP_1      : 4f_{zz}^{l}

Root_Head_Name      : datatest
Root_Head_BDT_Name  : datatrain
```

channel used in this time

root tree name

input root file structure



weight

observables (float)

xection file

```
vim xection_aa.dat
root file 10:
    nh_{10}^{10}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/nh_10_eL.pR.root  :  79.026852
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/nh_10_eR.pL.root  :  50.415099
    4f_{ww}^{l}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_ww_l_eL.pR.root  :  1564.2091
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_ww_l_eR.pL.root  :  14.691728
    4f_{ww}^{sl}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_ww_sl_eL.pR.root  :  18780.976
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_ww_sl_eR.pL.root  :  172.73264
    4f_{zz}^{l}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zz_l_eL.pR.root  :  157.96041
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zz_l_eR.pL.root  :  99.506102
    4f_{zz}^{sl}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zz_sl_eL.pR.root  :  1422.1429
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zz_sl_eR.pL.root  :  713.52633
    4f_{zzww}^{l}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zzww_l_eL.pR.root  :  1636.0362
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_zzww_l_eR.pL.root  :  53.955513
    4f_{zzww}^{sl}:
    |   no such class:  0
    4f_{szee}^{l}:
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_szee_l_eL.pR.root  :  1084.0873
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_szee_l_eR.pL.root  :  1019.5228
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_szee_l_eL.pL.root  :  1009.6032
    |   /home/yancy/Code/Data/Event_Light_Higgs/origin_data/results_10/4f_szee_l_eR.pR.root  :  1008.4063
```

support "integer", "float" and "double"

- currently force them into float
- use "I", "F", "D" in Var.dat file to tell the code datatype.

input setting

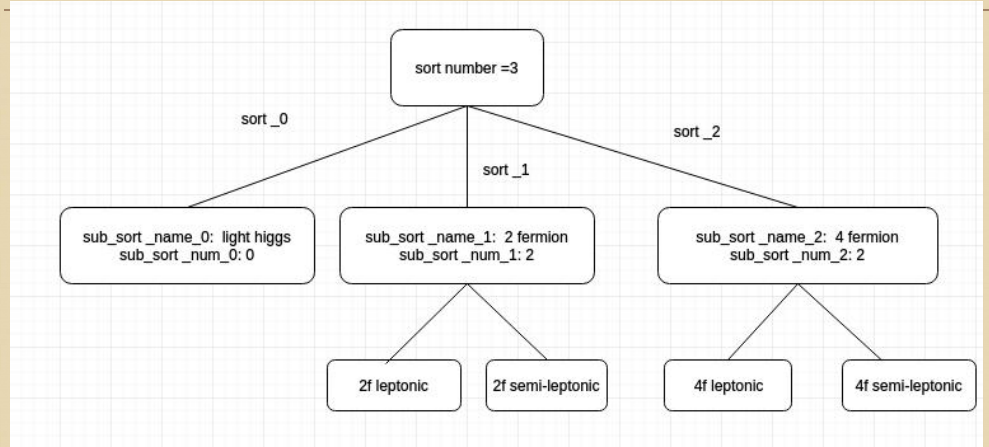
1. generate root file
2. edit input file
3. edit file.dat
4. edit Bkg_Sort.dat

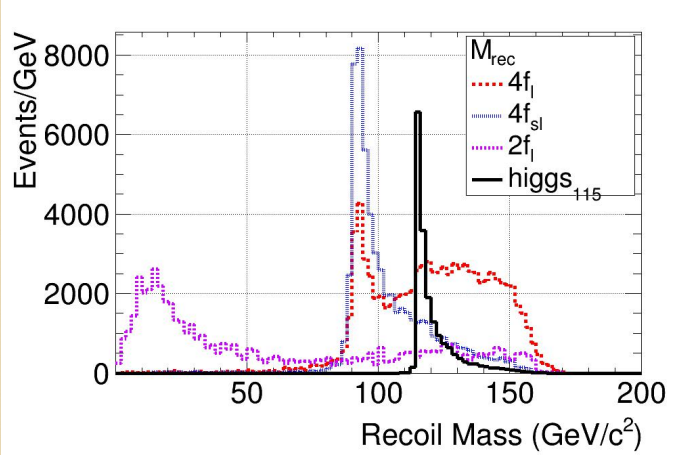
vim Bkg_Sort.dat

```
# do not change the key name
sort_num    : 4

sub_sort_name : [sig, wtata, tt, ttll]
sub_sort_num  : [1,   1,     1,  1   ]

# change below based on sub_sort names
sig   : [HA]
wtata : [l]
tt    : [l]
ttll  : [l]
```

classify

channel name: a_{b}^{c}
a : sort
c : sub_sort
b : some special label






```
vim Bkg_Sort.dat
1  # do not change the key name
2  sort_num    : 4
3
4  sub_sort_name : [sig, wtata, tt, txll]
5  sub_sort_num  : [1,   1,     2,  1   ]
6
7  # change below based on sub_sort names
8  sig   : [HA]
9  wtata : [l]
10 tt    : [l, sl]
11 txll  : [l]
12
```

input setting

1. generate root file
2. edit input file
3. edit file.dat
4. edit Bkg_Sort.dat
5. edit Var.dat

vim Var_2hdm_a.dat

```
weight:
    Exist                    : False
    Weight_Type              : "F"
variable:
   v0:
     |   title_name           : "jet_num"
     |   cut_min              : 2.9
     |   cut_max              : 100
     |   latex_name           : "N^{j}"
     |   Canvas_name          : "c0"
     |   Canvas_width         : 1000
     |   Canvas_height        : 700
     |   leg_left             : 0.6
     |   leg_up               : 0.7
     |   leg_right            : 0.8
     |   leg_down             : 0.9
     |   leg_header           : "HW/AW @ 14 TeV LHC"
     |   xaxis_name           : "N^{j}"
     |   xaxis_bin            : 20
     |   xaxis_min            : 0
     |   xaxis_max            : 20
     |   yaxis_name           : "Events"
     |   yaxis_bin            : 0
     |   yaxis_min            : 0
     |   yaxis_max            : 0
     |   cut_switch           : true
     |   plot_switch          : true
     |   log_yaxis            : false
     |   normalization_switch : true
     |   MVA                  : false
   v1:
     |   title_name           : "jet_pt1"
     |   cut_min              : 20
     |   cut_max              : 1000
     |   latex_name           : "P_{T}^{j1}"
     |   leg_left             : 0.6
     |   leg_up               : 0.7
     |   leg_right            : 0.8
     |   leg_down             : 0.9
     |   xaxis_name           : "P_{T}^{j1}"
     |   xaxis_bin            : 500
     |   xaxis_min            : 0
     |   xaxis_max            : 500
     |   cut_switch           : true
     |   plot_switch          : true
     |   normalization_switch : true
   v2:
```

weight=0 in root file, so choose False.

Variable type

obs name in code

obs name in input file

cut for this obs

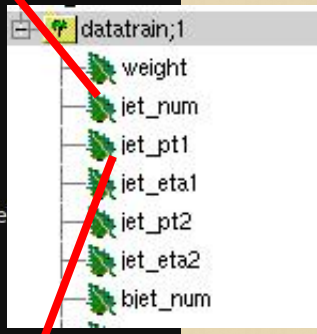
plot para

whether use this obs as MVA input

if some settings are missing, it will use the previous ones

vim Var_2hdm_a.dat

```
weight:
    Exist                    : False
    Weight_Type              : "F"
variable:
    v0:
        title_name           : "jet_num"
        cut_min              : 2.9
        cut_max              : 100
        latex_name           : "N^{j}"
        Canvas_name          : "c0"
        Canvas_width         : 1000
        Canvas_height        : 700
        leg_left             : 0.6
        leg_up               : 0.7
        leg_right            : 0.8
        leg_down             : 0.9
        leg_header           : "HW/AW @ 14 Te
        xaxis_name           : "N^{j}"
        xaxis_bin            : 20
        xaxis_min            : 0
        xaxis_max            : 20
        yaxis_name           : "Events"
        yaxis_bin            : 0
        yaxis_min            : 0
        yaxis_max            : 0
        cut_switch           : true
        plot_switch          : true
        log_yaxis            : false
        normalization_switch : true
        MVA                  : false
    v1:
        title_name           : "jet_pt1"
        cut_min              : 20
        cut_max              : 1000
        latex_name           : "P_{T}^{j1}"
        leg_left             : 0.6
        leg_up               : 0.7
        leg_right            : 0.8
        leg_down             : 0.9
        xaxis_name           : "P_{T}^{j1}"
        xaxis_bin            : 500
        xaxis_min            : 0
        xaxis_max            : 500
        cut_switch           : true
        plot_switch          : true
        normalization_switch : true
    v2:
```



input setting

1. generate root file
2. edit input file
3. edit file.dat
4. edit Bkg_Sort.dat
5. edit Var.dat
6. edit Cut.dat

vim Cut_test.dat

```
pre_cut_num : 0

pre_cut_order : []

cut_num : 17

cut_order : [0, 1, 2, 8, 9, 10, 11, 12, 13, 14, 15, 16, 19, 22, 28, 31, 29]

```

variable number in Var.dat

Cut

pre-cut order

no pre cuts for this case, after Pre-CUT, event should be applied with MVA

Cut_test.dat

```
pre_cut_num : 0

pre_cut_order : []

cut_num : 17

cut_order : [0, 1, 2, 8, 9, 10, 11, 12, 13, 14, 15, 16, 19, 22, 28, 31, 29]
```

for normal cut: 17 cuts

cut order

input setting

1. generate root
2. edit input file
3. edit file.dat
4. edit Bkg_Sort.c
5. edit Var.dat
6. edit Cut.dat
7. edit flow.dat

vim flow.dat

```
#operation

#BeginObject      : Complete_Run
#BeginObject      : Complete_Pol
#BeginObject      : Complete_Direct_Cut
#BeginObject      : Make_Complete_Table
#BeginObject      : Sensitivity
#BeginObject      : Pre_Cut
#BeginObject      : MVA_Train
#BeginObject      : MVA_Attach
#BeginObject      : Summarize_Plot
#BeginObject      : Direct_Cut
BeginObject       : Direct_Cut_NoMVA
#BeginObject      : Direct_Cut_ReWeight
#BeginObject      : Make_Table


# choose signal process and work scenario
signal_property   : 125
working_scenario  : running-lhc-1fb
MVA_method        : "BDTG"


# choose special setting

cut               : true
record_output     : false
plot              : true
plot_object       : before_cut
record_event      : true
MVA_training      : true
MVA_level         : 2
MVA_weight        : 1


#some keywords for future
level             : 5
```

Here, we only use cut directly

luminosity

MVA method, no used here

record everything in file, using when submit jobs

generate plot

Operation Flow

vim flow.dat

```
#operation

#BeginObject      : Complete_Run
#BeginObject      : Complete_Pol
#BeginObject      : Complete_Direct_Cut
#BeginObject      : Make_Complete_Table
#BeginObject      : Sensitivity
#BeginObject      : Pre_Cut
#BeginObject      : MVA_Train
#BeginObject      : MVA_Attach
#BeginObject      : Summarize_Plot
#BeginObject      : Direct_Cut
BeginObject       : Direct_Cut_NoMVA
#BeginObject      : Direct_Cut_ReWeight
#BeginObject      : Make_Table


# choose signal process and work scenario
signal_property   : 125
working_scenario  : running-lhc-1fb
MVA_method        : "BDTG"


# choose special setting

cut               : true
record_output     : false
plot              : true
plot_object       : before_cut
record_event      : true
MVA_training      : true
MVA_level         : 2
MVA_weight        : 1


#some keywords for future
level             : 5
```

use cut

record everything in log file

draw plots

only works for Summarize_Plot

generate events after all cuts

MVA setting

input setting

1. generate root file
2. edit input file
3. edit file.dat
4. edit Bkg_Sort.dat
5. edit Var.dat
6. edit Cut.dat
7. edit flow.dat
8. edit path.dat,

   include all above directories

vim path_a.dat

```
PROCESS                    : zh

# output folder
OUTPUT_FOLDER              : '../../Data/Event_Analyse_2hdm'

RECORD_FILE                : 'tmp/tmp_a.dat'
OUTPUT_FILE                : 'data_a'
EVENT_FILE                 : 'results_a'
SINGLE_PLOT                : 'plot_a'
COMBINE_PLOT               : 'plot_class_a'
HORIZONTAL_SUMMARY_PLOT    : 'plot_summary_a'


# input folder
INPUT_FOLDER               : './control_2hdm'

FLOW_FILE                  : 'flow.dat'
INPUT_FILE                 : 'file_a.dat'
BKG_SORT_FILE              : 'Bkg_Sort.dat'

CUT_FILE                   : 'Cut/Cut_test.dat'
VAR_FILE                   : 'Var/Var_2hdm_a.dat'


#Advanced input setting
PLOT_FILE                  : 'advanced/Plot.dat'
MVA_FILE                   : 'advanced/MVA.dat'
DEBUG_FILE                 : 'advanced/debug.dat'
ANALYSIS_FILE              : 'advanced/Event.dat'
SENSITIVITY_FILE           : 'advanced/Sensitivity.dat'
SCENARIO_FILE              : 'advanced/Scenario.dat'
SIGNAL_PROPERTY_SCAN_FILE  : 'advanced/Signal_Properties_Scan.dat'
```

output

basic input

advanced input

Path

process name

main output folder,

- **sub folders are under this**
- **if doesn't exist, code will create one**

sub output folder

input folder

- **if doesn't exist, report error**

advanced input folder

vim path.dat

```
PROCESS           : zh

# output folder
OUTPUT_FOLDER     : '../../Data/Event_Analyse'

RECORD_FILE       : 'tmp/nh_115.dat'
OUTPUT_FILE       : 'data'
EVENT_FILE        : 'results'
SINGLE_PLOT       : 'plot'
COMBINE_PLOT      : 'plot_compare'
HORIZONTAL_SUMMARY_PLOT : 'Event_Analyse/plot_summary'


# input folder
FLOW_FILE         : './control/flow.dat'
INPUT_FILE        : './control/file.dat'
BKG_SORT_FILE     : './control/Bkg_Sort.dat'

CUT_FILE          : './control/Cut/Cut_nh.dat'
VAR_FILE          : './control/Var/Var_nh_115.dat'

MASS_SCAN_FILE    : './control/Mass_Scan.dat'


#Advanced input setting
PLOT_FILE         : './control/advanced/Plot.dat'
DEBUG_FILE        : './control/advanced/debug.dat'
ANALYSIS_FILE     : './control/advanced/Event.dat'
SENSITIVITY_FILE  : './control/advanced/Sensitivity.dat'
SCENARIO_FILE     : './control/advanced/Scenario.dat'
```

run the code

output on screen

```
(python27) [~/Code/Git_package/BASDA]$ ./BASDA control_2hdm/path_a.dat

******* ------------------------------------------------------------------------------------------------------------------------ *******
******* -                                                    BASDA                                                               - *******
******* -                                     Beautiful_And_Simple_Drawing_Atificer                                              - *******
******* -                                                 release 0.0.5                                                          - *******
******* -                                                   Yan Wang                                                             - *******
******* -                                        email:wangyan728@ihep.ac.cn                                                     - *******
******* -                                           or:yan.wang@desy.de                                                          - *******
******* -                                                                                                                        - *******
******* -                                     A software package for analysis and plot.                                          - *******
******* -                                                                                                                        - *******
******* -                                 Please cite if you use this package or part of my code.                                - *******
******* -                                                                                                                        - *******
******* -                           BASDA is provided without warranty under the terms of the GNU GPLv2.                         - *******
******* -                                                                                                                        - *******
******* ------------------------------------------------------------------------------------------------------------------------ *******

******************************************************** load libraray ********************************************************

      ******************************************************** load file ************************************************
            input path file                                         :    control_2hdm/path_a.dat

                  INPUT_FOLDER is                                   :    ./control_2hdm
                  OUTPUT_FOLDER is                                  :    ../../Data/Event_Analyse_2hdm
                  RECORD_FILE is                                    :    tmp/tmp_a.dat
                  ************************** Please check the RECORD_FILE for detail arguments setting! *********

************************************************** begin to choose analysis mode **************************************************
      The begin time is                                             :    Wed Apr 11 09:46:18 2018

      ******************************************************** analyse events ***************************************************
      dealing with                                                  :    sig_tj_HA
      filenum                                                       :
            has dealed with number are                              :    10, %
            has dealed with number are                              :    20, %
            has dealed with number are                              :    30, %
            has dealed with number are                              :    40, %
            has dealed with number are                              :    50, %
            has dealed with number are                              :    60, %
            has dealed with number are                              :    70, %
            has dealed with number are                              :    80, %
            has dealed with number are                              :    90, %
            total result                                            :
                  sig_{tj}^{HA}                                     :    [ 0, 0 ]
                  no cut MC event                                   :    [ 310000, 310000 ]
                  no cut                                            :    [ 15.6689, 310000 ]
                  N^{j} \in [ 2.9 ,100 ]                            :    [ 8.65438, 171222 ]
                  P_{T}^{j1} \in [ 20 ,1000 ]                       :    [ 8.65438, 171222 ]
                  \eta^{j1} \in [ -5 ,5 ]                           :    [ 8.65438, 171222 ]
                  N^{\tau} \in [ 1.9 ,100 ]                         :    [ 0.756912, 14975 ]
                  P_{T}^{\tau1} \in [ 20 ,1000 ]                    :    [ 0.756912, 14975 ]
                  \eta^{\tau1} \in [ -2.5 ,2.5 ]                    :    [ 0.74468, 14733 ]
                  P_{T}^{\tau2} \in [ 20 ,1000 ]                    :    [ 0.74468, 14733 ]
                  \eta^{\tau2} \in [ -2.5 ,2.5 ]                    :    [ 0.73629, 14567 ]
```

data

```
(python27) [~/Code/Git_package/BASDA]$ ls ../../Data/Event_Analyse_2hdm/data_a/125
output_table_125.dat  sig_tj_HA_125.dat  tjtata_sl_l_125.dat  tt_l_l_125.dat    ttll_sl_l_125.dat  tt_sl_l_125.dat   txll_l_l_125.dat
significance_125.dat  s_sj_l_125.dat     total_bkg_125.dat    ttll_l_l_125.dat  ttll_ta_l_125.dat  tt_sl_sl_125.dat  wtata_l_l_125.dat
```

$\int Ldt = 1fb^{-1}$	sig_{tj}^{HA}	$wtata_l^l$	tt_{sl}^l	efficienty	significance
no cut	15.669	409.931	61989.6	1	0.0627186
$N^j \in [2.9, 100]$	12.2375	273.805	52783.2	0.781001	0.0531216
$P_T^{j1} \in [20, 1000]$	12.2375	273.805	52775.7	0.781001	0.0531254
$\eta^{j1} \in [-5, 5]$	12.2375	273.805	52775.7	0.781001	0.0531254
$P_T^{j2} \in [20, 1000]$	12.2375	273.805	52775.7	0.781001	0.0531254
$\eta^{j2} \in [-5, 5]$	12.2375	273.805	52775.7	0.781001	0.0531254
$N^\tau \in [1.9, 100]$	0.91043	17.334	1504.45	0.0581039	0.0233314
$P_T^{\tau 1} \in [20, 1000]$	0.91043	17.334	1504.45	0.0581039	0.0233314
$\eta^{\tau 1} \in [-2.5, 2.5]$	0.91043	17.334	1471.69	0.0581039	0.0235865
$P_T^{\tau 2} \in [20, 1000]$	0.91043	17.334	1471.69	0.0581039	0.0235865
$\eta^{\tau 2} \in [-2.5, 2.5]$	0.91043	17.334	1426.33	0.0581039	0.0239539
$N^{lep} \in [0.9, 100]$	0.239751	4.65097	451.083	0.015301	0.0112277
$P_T^{l1} \in [20, 1000]$	0.222514	4.20652	441.003	0.0142009	0.0105431
$\eta^{l1} \in [-2.5, 2.5]$	0.222514	4.20652	441.003	0.0142009	0.0105431
$M^W \in [70, 110]$	0.20371	2.63503	302.402	0.0130008	0.0116598
$M^A \in [0, 90]$	0.181772	2.0477	105.841	0.0116007	0.0174853
$M^{H^\pm} \in [0, 180]$	0.104989	0.603198	5.04004	0.00670043	0.0437902
$M^t \in [1, 500]$	0.103422	0.603198	5.04004	0.00660042	0.0431425
$M^t \in [0, 4000]$	0.092453	0.444462	2.52002	0.00590038	0.0528784
$\theta_*^t \in [0.8, 1]$	0.034474	0.158736	2.52002	0.00220014	0.020929
$P_T^t \in [0, 30]$	0.029773	0.142863	0	0.00190012	0.0716567
all cut	0.029773	0.142863	0	0.00190012	0.0716567

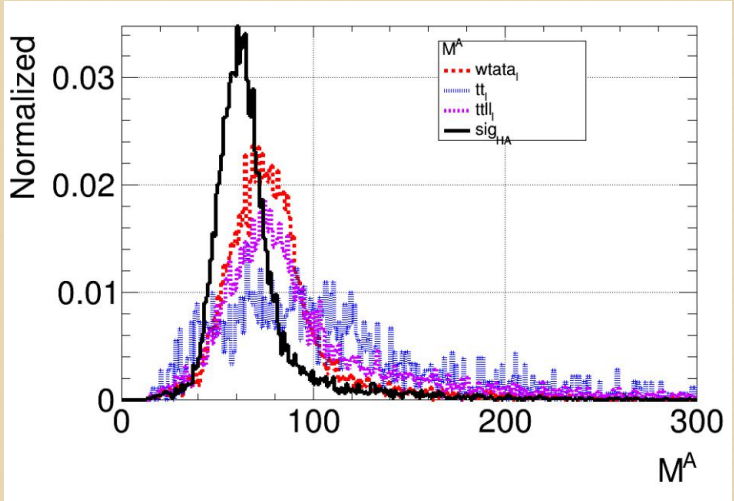
```
filenum                                                    :
    total result                                           :
        sig_{tj}^{HA}                                      :   [ 0, 0 ]
        no cut MC event                                    :   [ 310000, 310000 ]
        no cut                                             :   [ 15.6689, 310000 ]
        N^{j} \in [ 2.9 ,100 ]                             :   [ 8.65438, 171222 ]
        P_{T}^{j1} \in [ 20 ,1000 ]                        :   [ 8.65438, 171222 ]
        \eta^{j1} \in [ -5 ,5 ]                            :   [ 8.65438, 171222 ]
        N^{\tau} \in [ 1.9 ,100 ]                          :   [ 0.756912, 14975 ]
        P_{T}^{\tau1} \in [ 20 ,1000 ]                     :   [ 0.756912, 14975 ]
        \eta^{\tau1} \in [ -2.5 ,2.5 ]                     :   [ 0.74468, 14733 ]
        P_{T}^{\tau2} \in [ 20 ,1000 ]                     :   [ 0.74468, 14733 ]
        \eta^{\tau2} \in [ -2.5 ,2.5 ]                     :   [ 0.73629, 14567 ]
        N^{lep} \in [ 0.9 ,100 ]                           :   [ 0.588143, 11636 ]
        P_{T}^{l1} \in [ 20 ,1000 ]                        :   [ 0.515612, 10201 ]
        \eta^{l1} \in [ -2.5 ,2.5 ]                        :   [ 0.515612, 10201 ]
        M^{W} \in [ 70 ,110 ]                              :   [ 0.509192, 10074 ]
        M^{A} \in [ 0 ,95 ]                                :   [ 0.465926, 9218 ]
        M^{H^{\pm}} \in [ 0 ,170 ]                         :   [ 0.263191, 5207 ]
        M^{tj} \in [ 0 ,4000 ]                             :   [ 0.262837, 5200 ]
        \theta^{t}_{*} \in [ -1 ,-0.8 ]                    :   [ 0.0319466, 632 ]
        P_{T}^{tj} \in [ 0 ,30 ]                           :   [ 0.0175909, 348 ]
        all~cut                                            :   [ 0.0175909, 348 ]
```

figures

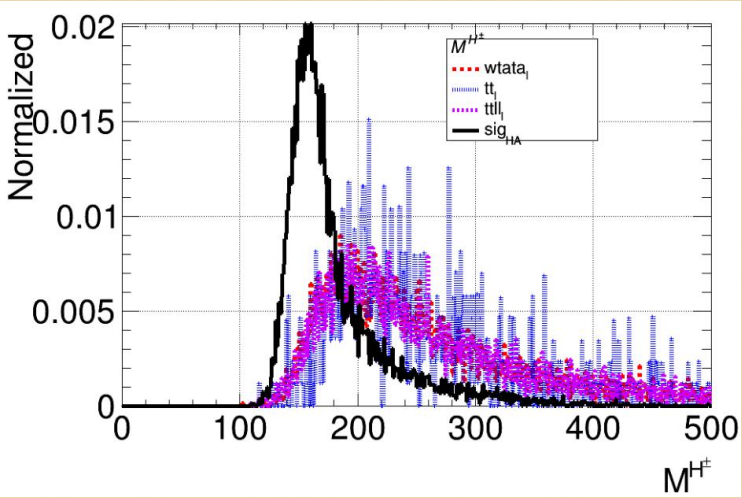
origin/before cuts/
after cuts/final
plots for
each observable

```
(python27) [~/Code/Git_package/BASDA]$ ls ../../Data/Event_Analyse_2hdm/plot_a/125/
A_eta_after.png        bjet_num_after.png     HC_eta_after.png       jet_eta2_after.png     lep_eta1_after.png     njets_final.png        taujet_pt1_after.png   Topj_eta_after.png     Top_pt_after.png
A_eta_before.png       bjet_num_before.png    HC_eta_before.png      jet_eta2_before.png    lep_eta1_before.png    nJets_final.png        taujet_pt1_before.png  Topj_eta_before.png    Top_pt_before.png
A_eta_final.png        bjet_num_final.png     HC_eta_final.png       jet_eta2_final.png     lep_eta1_final.png     njets_origin.png       taujet_pt1_final.png   Topj_eta_final.png     Top_pt_final.png
A_eta_origin.png       bjet_num_origin.png    HC_eta_origin.png      jet_eta2_origin.png    lep_eta1_origin.png    nJets_origin.png       taujet_pt1_origin.png  Topj_eta_origin.png    Top_pt_origin.png
A_mass_after.png       bjet_pt1_after.png     HC_mass_after.png      jet_num_after.png      lep_num_after.png      taujet_eta1_after.png  taujet_pt2_after.png   Topj_mass_after.png    W_eta_after.png
A_mass_before.png      bjet_pt1_before.png    HC_mass_before.png     jet_num_before.png     lep_num_before.png     taujet_eta1_before.png taujet_pt2_before.png  Topj_mass_before.png   W_eta_before.png
A_mass_final.png       bjet_pt1_final.png     HC_mass_final.png      jet_num_final.png      lep_num_final.png      taujet_eta1_final.png  taujet_pt2_final.png   Topj_mass_final.png    W_eta_final.png
A_mass_origin.png      bjet_pt1_origin.png    HC_mass_origin.png     jet_num_origin.png     lep_num_origin.png     taujet_eta1_origin.png taujet_pt2_origin.png  Topj_mass_origin.png   W_eta_origin.png
A_pt_after.png         costh_Z_after.png      HC_pt_after.png        jet_pt1_after.png      lep_pt1_after.png      taujet_eta2_after.png  Top_angle_after.png    Topj_pt_after.png      W_mass_after.png
A_pt_before.png        costh_Z_before.png     HC_pt_before.png       jet_pt1_before.png     lep_pt1_before.png     taujet_eta2_before.png Top_angle_before.png   Topj_pt_before.png     W_mass_before.png
A_pt_final.png         costh_Z_final.png      HC_pt_final.png        jet_pt1_final.png      lep_pt1_final.png      taujet_eta2_final.png  Top_angle_final.png    Topj_pt_final.png      W_mass_final.png
A_pt_origin.png        costh_Z_origin.png     HC_pt_origin.png       jet_pt1_origin.png     lep_pt1_origin.png     taujet_eta2_origin.png Top_angle_origin.png   Topj_pt_origin.png     W_mass_origin.png
bjet_eta1_after.png    E_jj_after.png         jet_eta1_after.png     jet_pt2_after.png      njets_after.png        taujet_num_after.png   Top_eta_after.png      Top_mass_after.png     W_pt_after.png
bjet_eta1_before.png   E_jj_before.png        jet_eta1_before.png    jet_pt2_before.png     nJets_after.png        taujet_num_before.png  Top_eta_before.png     Top_mass_before.png    W_pt_before.png
bjet_eta1_final.png    E_jj_final.png         jet_eta1_final.png     jet_pt2_final.png      njets_before.png       taujet_num_final.png   Top_eta_final.png      Top_mass_final.png     W_pt_final.png
bjet_eta1_origin.png   E_jj_origin.png        jet_eta1_origin.png    jet_pt2_origin.png     nJets_before.png       taujet_num_origin.png  Top_eta_origin.png     Top_mass_origin.png    W_pt_origin.png
```

before A mass cuts



before H+- mass cuts

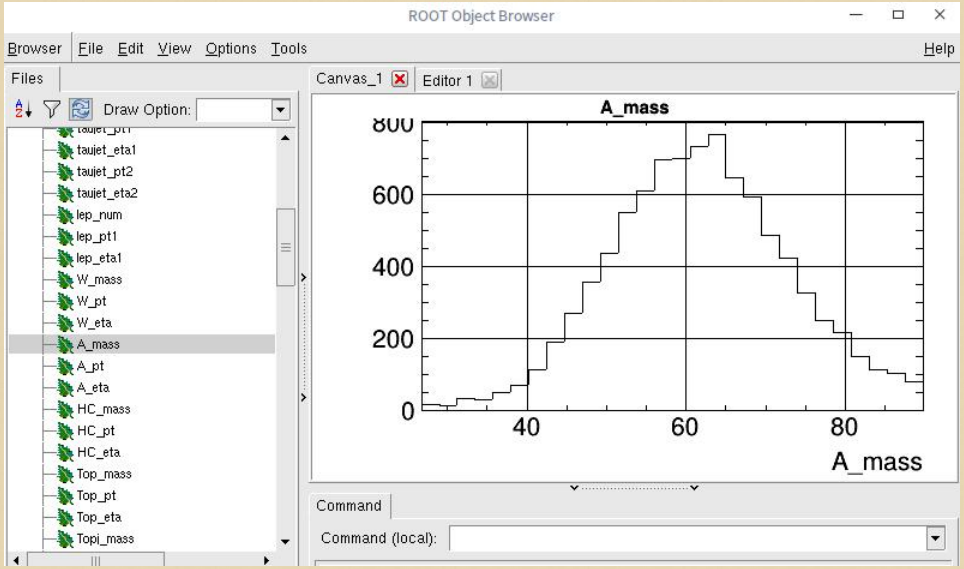


root file

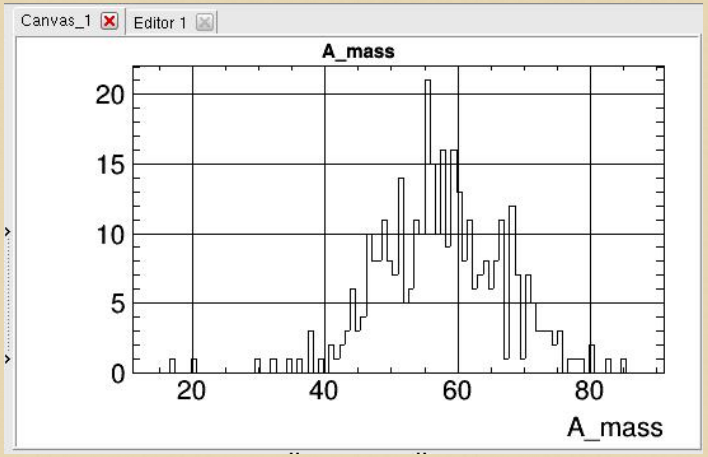
observable after its own cut,
and after all cuts are preserved
for further use

```
(python27) [~/Code/Git_package/BASDA]$ ls ../../Data/Event_Analyse_2hdm/results_a/125_CUT
all_plots.root      sort_sig_HA.root  sort_ttll_l.root  sort_tt_sl.root   sort_wtata_l.root
sig_tj_HA_125.root  sort_s_l.root     sort_tt_l.root    sort_txll_l.root  s_sj_l_125.root
(python27) [~/Code/Git_package/BASDA]$
```

after mA cut,



after all cuts,



other outputs

Pre cuts

sp is "signel property" set in the flow.dat
xxx is channel names set in the xection.dat

- related input: cut.pre_cut
- output:
  - data/sp/xxx_sp_Unpol.dat
    - cut efficiency for pre cuts
  - results/sp_Unpol/xxx_sp.dat
    - root file after applying pre cuts
  - results/sp_MVA/xxx_sp.dat
    - file for attaching MVA values
    - file for applying normal cuts

MVA trainning

- related input: flow.MVA
- output:
  - data/sp/dataset
    - MVA weight dataset

MVA value attaching

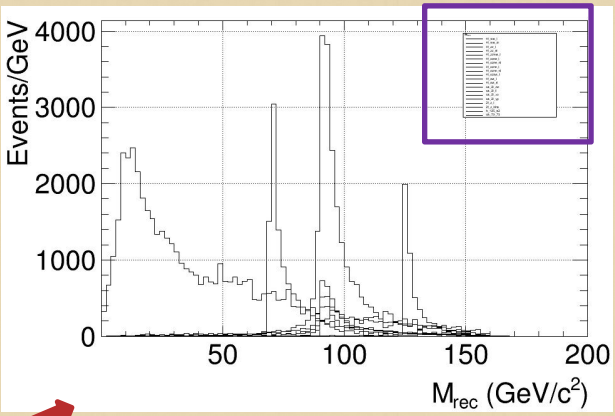
- related input: MVA weight file
- output:
  - results/sp_MVA/xxx_sp.dat
    - add MVA value for each channel

normal cuts

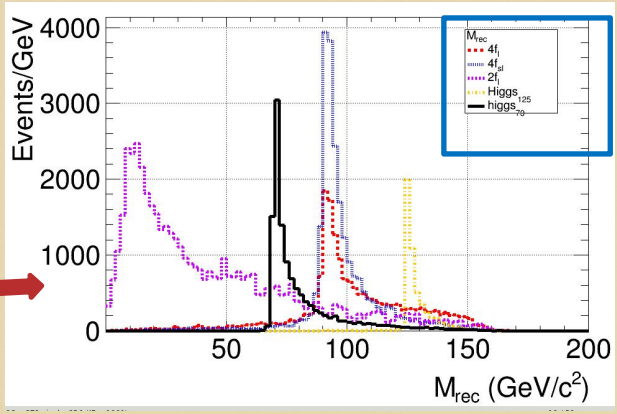
- related input: cut.pre_cut
- output:
  - data/sp/xxx_sp.dat
    - cut efficiency for pre cuts
  - results/sp_CUT/xxx_sp.dat

    file for applying normal cuts
  - plot/sp/obv.png
    - for each channel
  - plot_compare/sp/obv.png
    - for each sort

all channel



combined into sorts

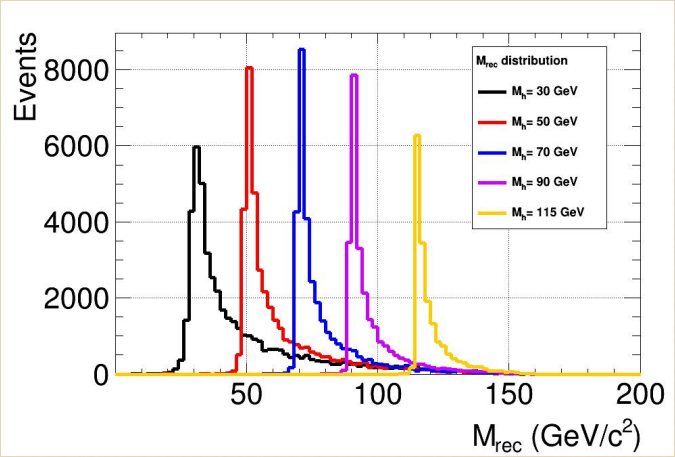


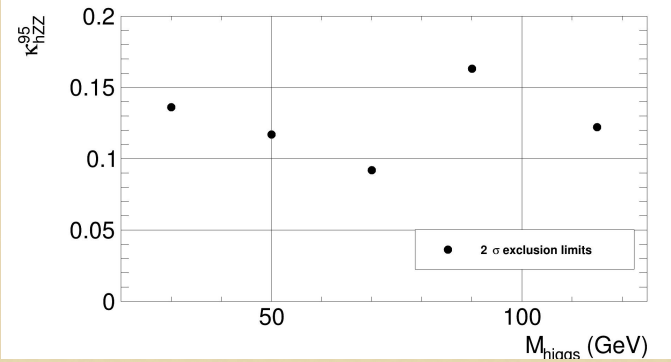
compare between different signal characters

after generate results for different signal characters

compare them by control/scan.dat

- signal distribution
- cut efficiency table
- sensitivity





advanced input example

Event

vim Event.dat

```
#show many first events want to be analyses
first_events_num    : -1

#which events want to analysse
special_events_num : -1

```

1. when first =-1, special=-1 => use all events
2. when first = n, special=-1 => use first n events
3. when first =-1, special= n => use the n-th event
4. when first =n1, special=n2 => use events from n1 to n2

where if n > total events, n = total events, and n1 < n2

Sensitivity

1. control/Sensitivity.dat
2. get data from root results
3. calculate sensitivities according to the control file.

rescale signal cross section

vim Sensitivity.dat

```
ExpCL              : 0.9545
sig_scale_switch   : true
sig_scale_factor   : 1000
sig_scale_pow      : 2
```

new scenario

1. control/scenario.dat
2. re-use results in Cuts_1 when changing the polarization. (MVA variable need to be recalculated.)
3. re-use results in Cuts_2 when changing the luminosity.

polarization value

luminosity
running polarization

vim Scenario.dat

```
elec_pol        : 0.8
posi_pol        : 0.3

Scenario        :
    scenario1:
        |  name          : running
        |  energy        : 250
        |  luminosity    : 2000
        |  (-,+)         : 0.45
        |  (+,-)         : 0.45
        |  (-,-)         : 0.05
        |  (+,+)         : 0.05
```

Thank you!