Analysis Tools

Beautiful_And_Simple_Drawing_Atificer (BASDA)

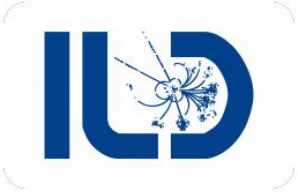
Yan Wang

11-04-2018

Motivation

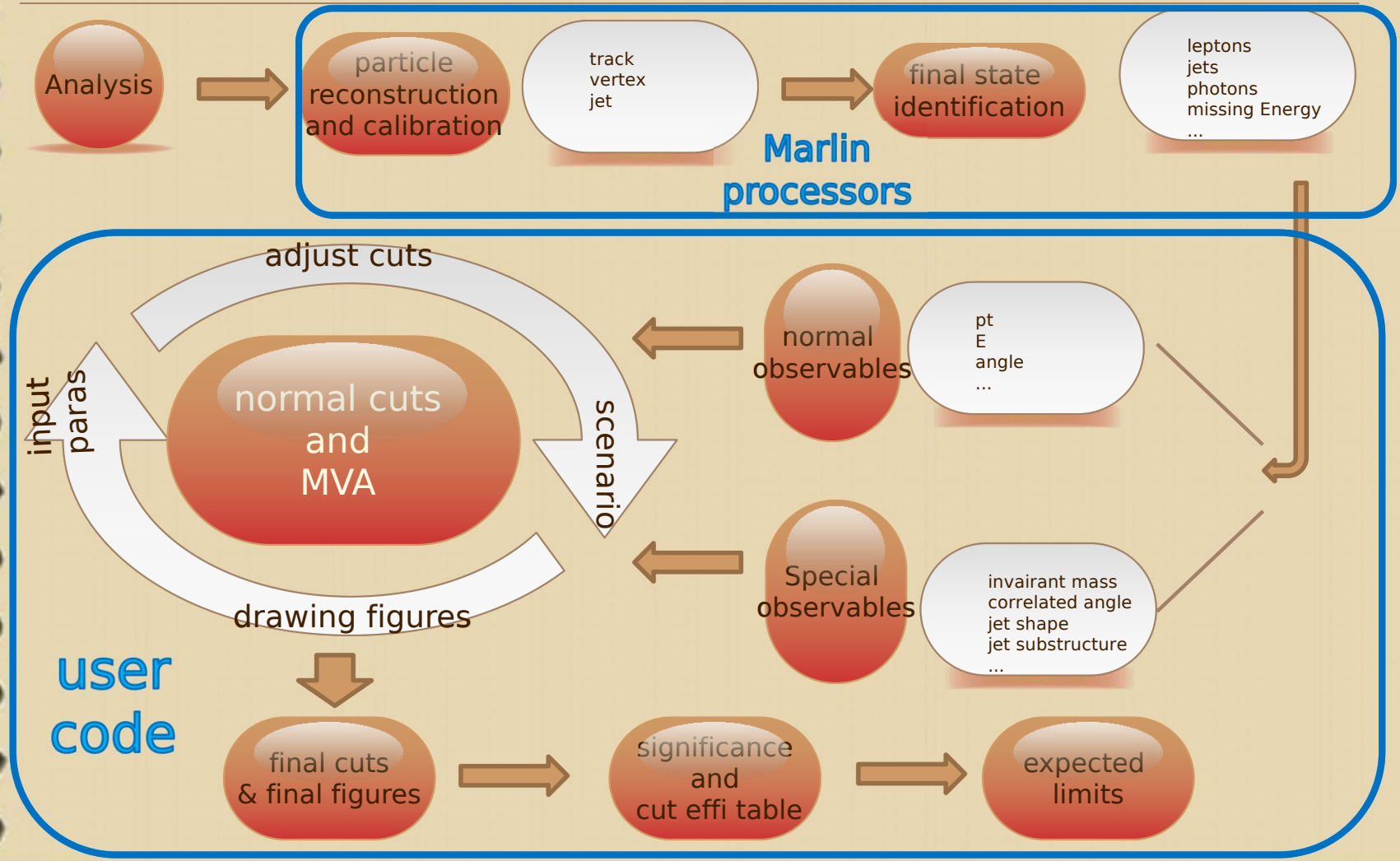
Motivation: a standard analysis code will be helpful!

Physics Benchmarks

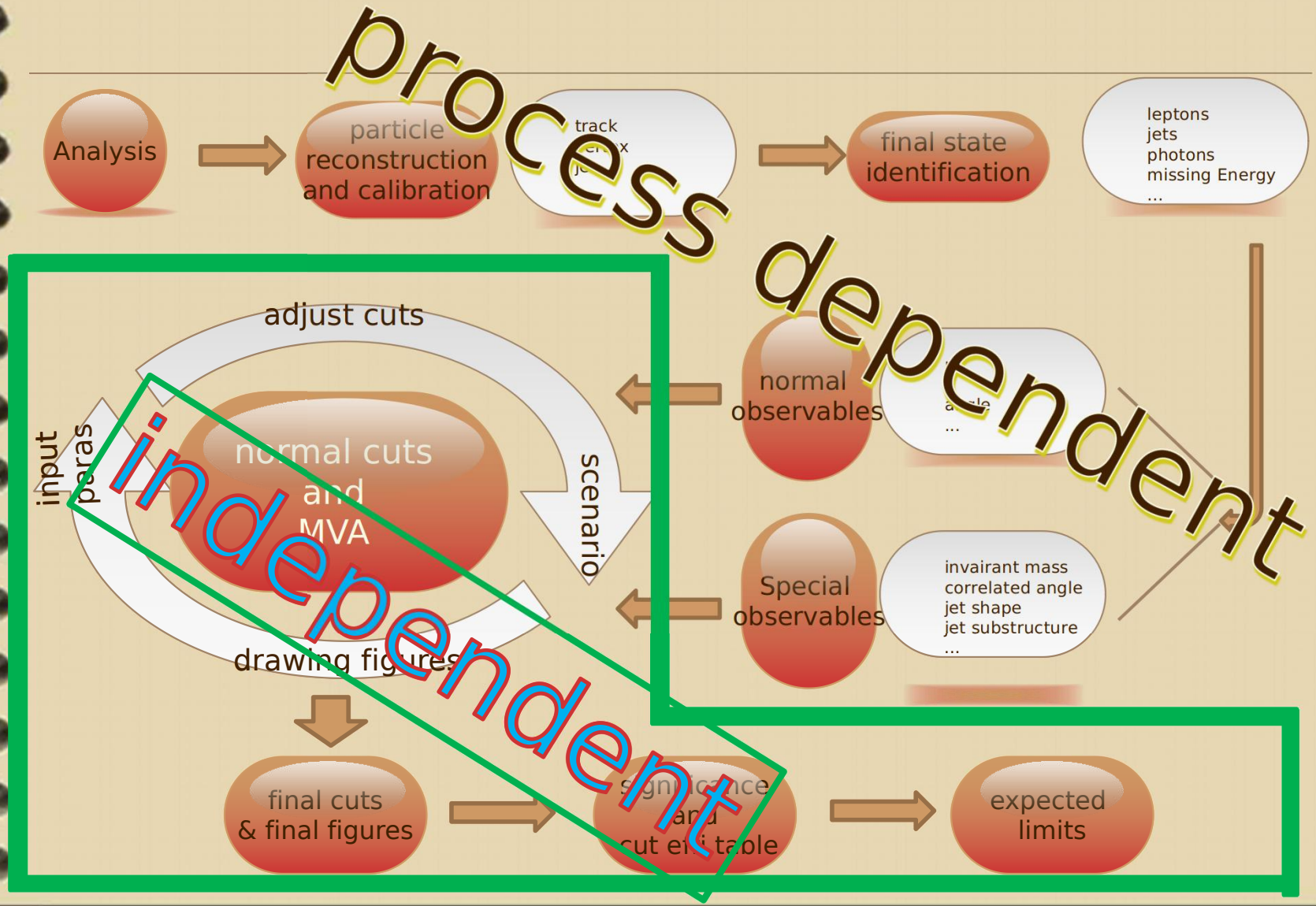


WG	Process	Physics	Detector	ECM	Who
Higgs & EW	**H->bb/cc/gg**	**BR**	**c-tag, b-tag, JER**	**500 GeV**	**NN + NN**
	H->bb	mass	JER, JES	500 GeV	Ali Ebrahimi (10%) + Junping Tian
	ee->tautau	A_FB, tau-pol, A_LR	tau-reco	500 GeV	Daniel Jeans + **NN**
	H->mumu	BR	momentum resolution	500 GeV	Shin-ichi Kawada + **NN**
	H->invisible	BR limit	JER, hermeticity	500 GeV	Yu Kato + **NN**
	WW->qqlv	MW, TGCs, beam pol.	JES, JER, electron, mu	500 GeV	Kostiantyn Shpak + **NN**
	vvqqqqq	**QGCs**	**JES / JER**	**1 TeV**	**Jakob Beyer + NN**
	gamma Z	**A_LR, sigma_tot, JES**	**photon, JER/JES, e, mu**	**500 GeV**	**NN + NN**
Top, Bottom & QCD	tt->bbqqqq	x-section, AFB	b-tag, vertex charge, PID	500 GeV	Amjad + **NN**
BSM	low deltaM Higgsinos	natural SUSY	low-p tracking, PID, hermeticity	500 GeV	Swathi Sasikumar + **NN**
	mono-photons	**WIMPs / WISPs**	**photon reco, BeamCal**	**500 GeV**	**NN + NN**
	Zh, mh < 125 GeV	limit on ZZh coupling	p res, e reco, JER, hermeticity	500 GeV	Yan Wang + **NN**

General Strategy for analysis

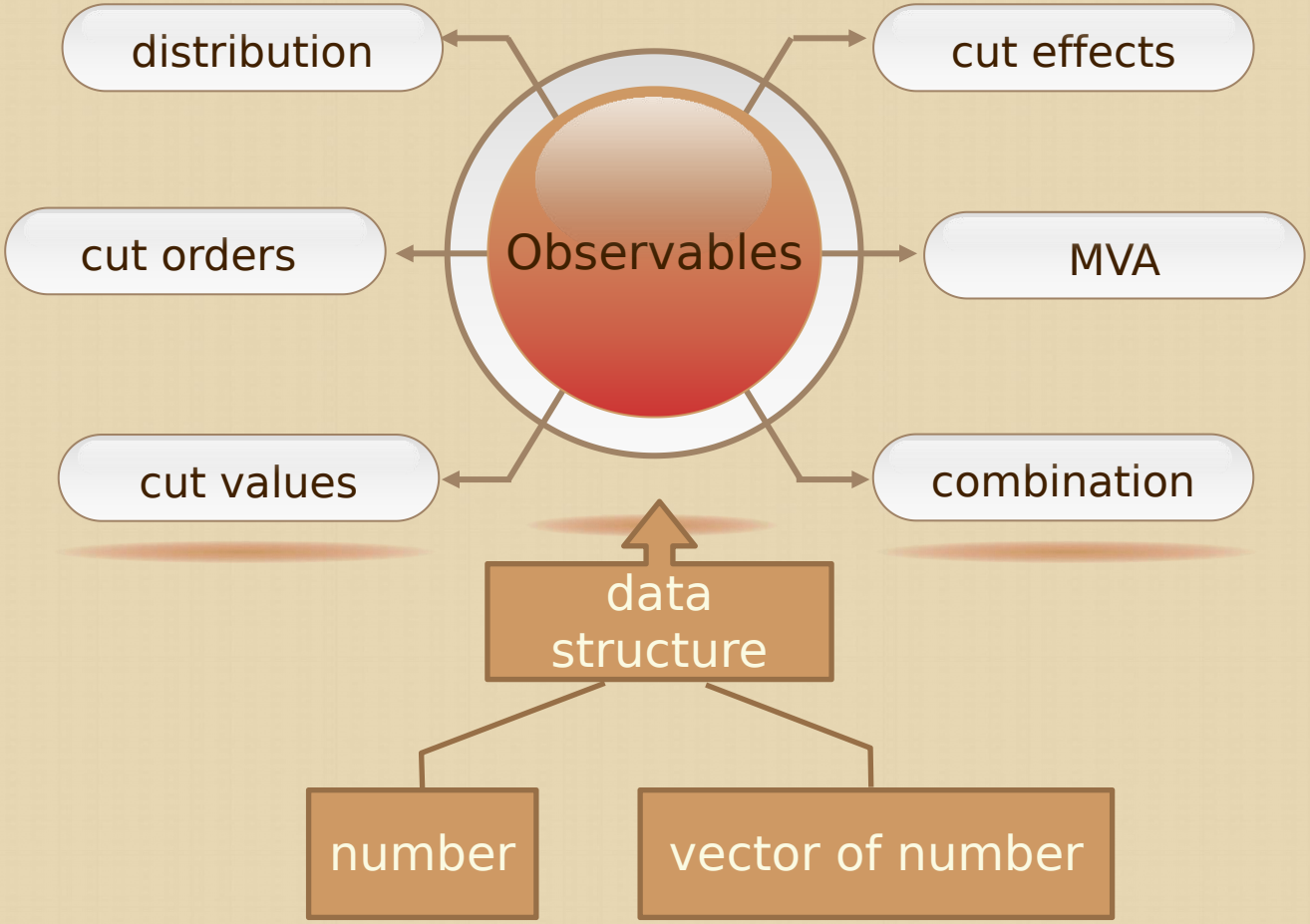


General Strategy for analysis

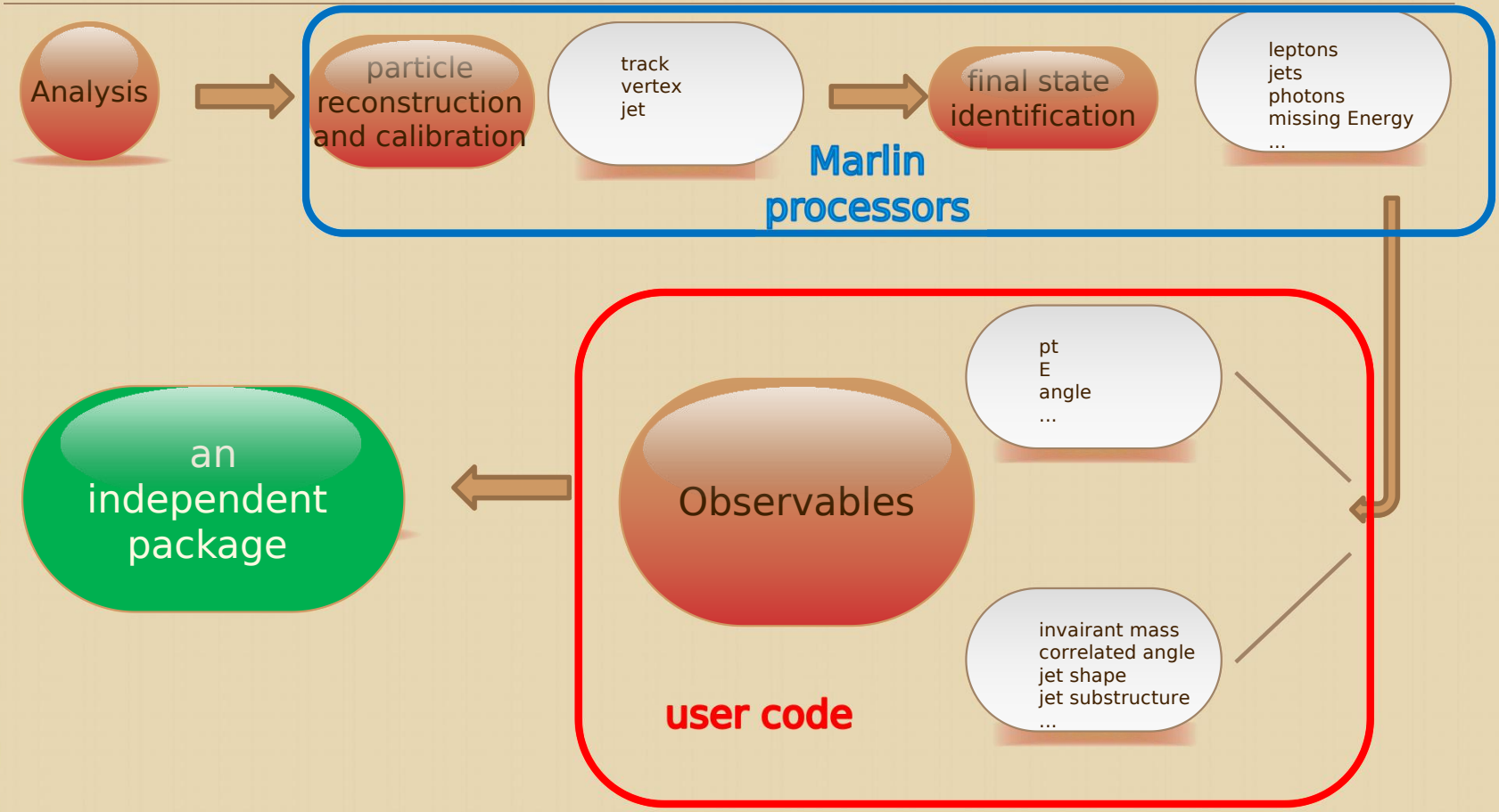


The key role

Bad programmers worry about the code.
Good programmers worry about data structures and their relationships.
--- Linus Torvalds



General Strategy for analysis

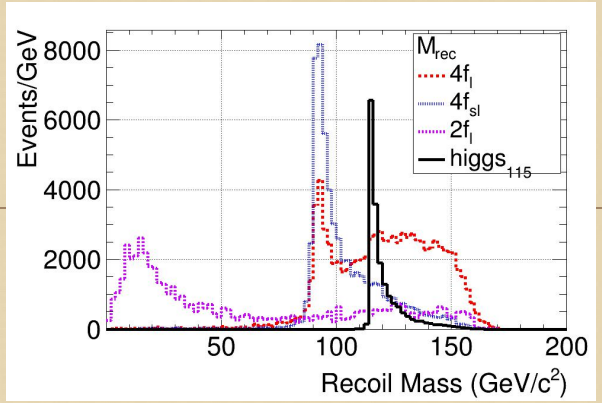


Beautiful_**A**nd_**S**imple_**D**rawing_**A**tificer
(BASDA)

BASDA

The beautiful figure

- plot templates --- easy to set
- a cohesive, unified style for the whole group



The simple operation

all with control files

Release time from programing.

Focus on **Physics**!

Easy to repeat

only need to preserve control files.

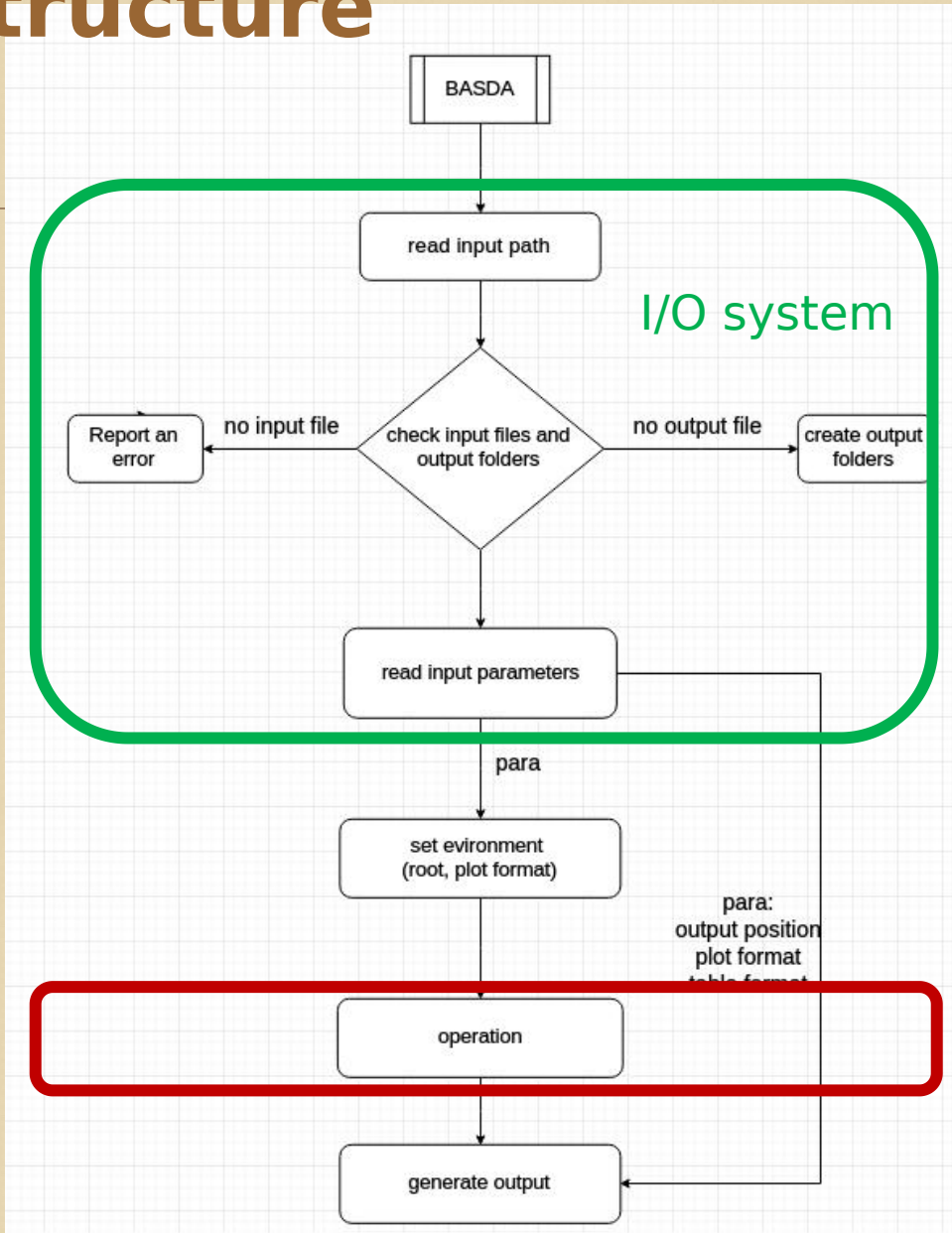
Easy for comparing and finding the differences

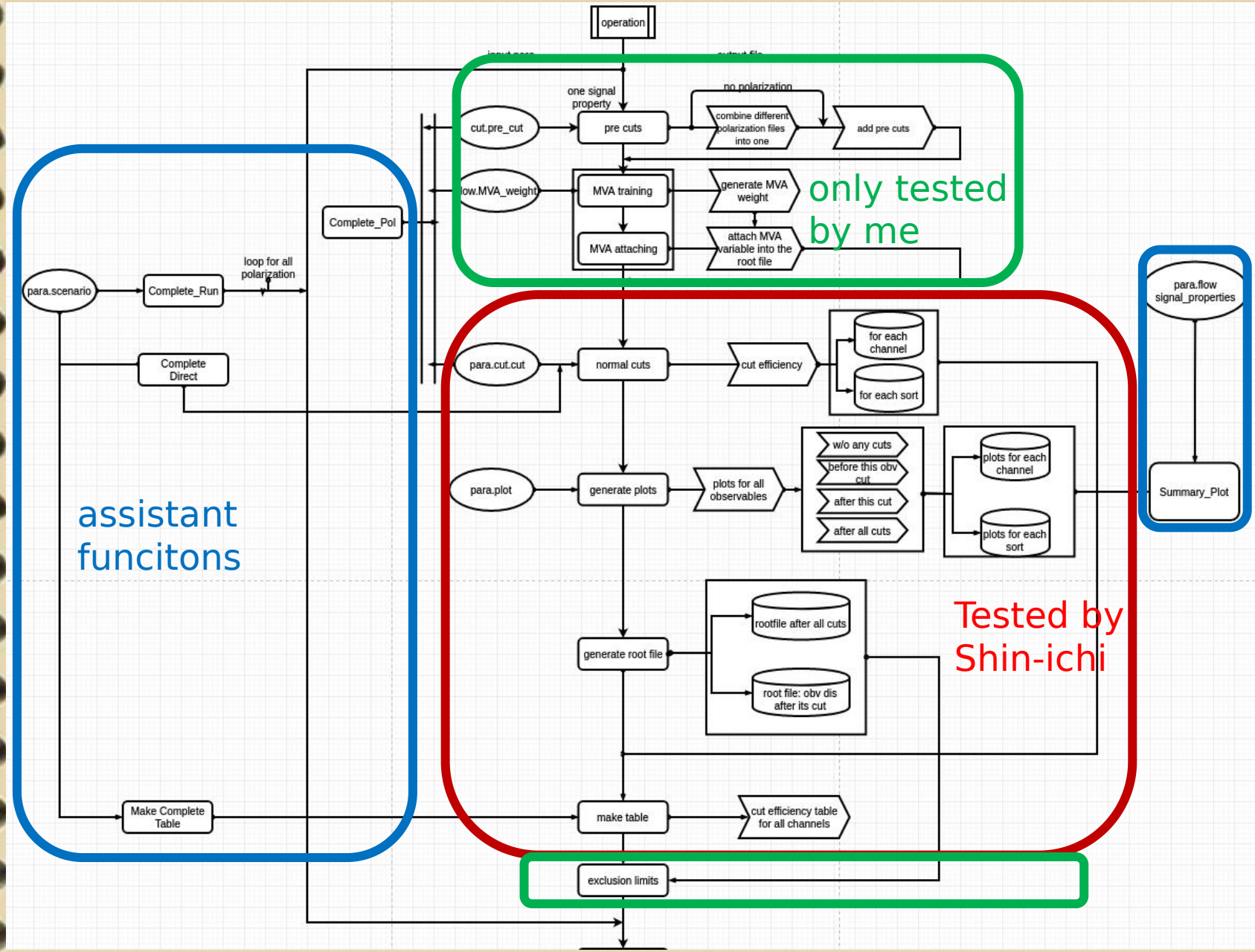
Complete tool sets

provide many analysis tools, fulfill most of requirements

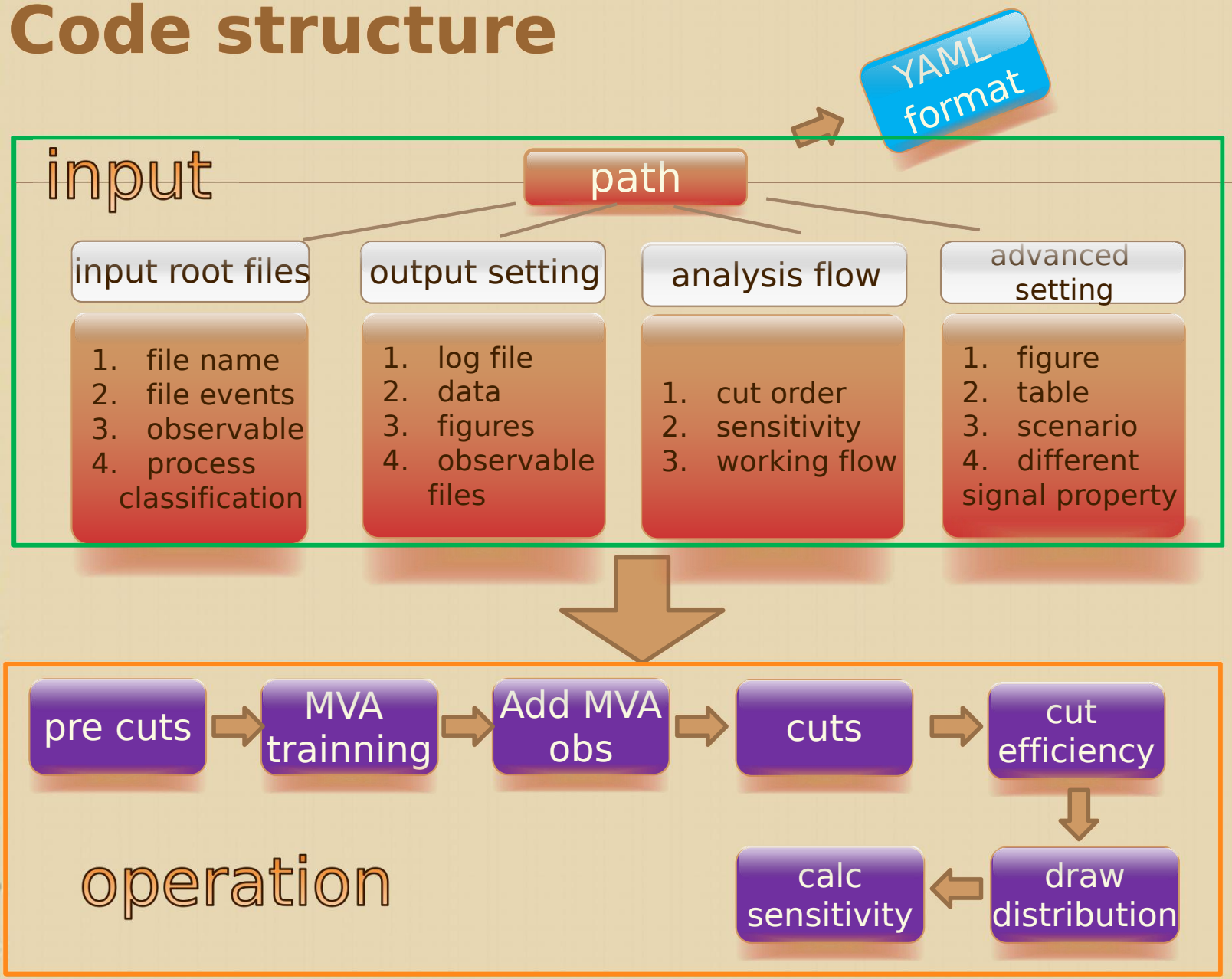
one-click for all analysis and the final results

Code structure

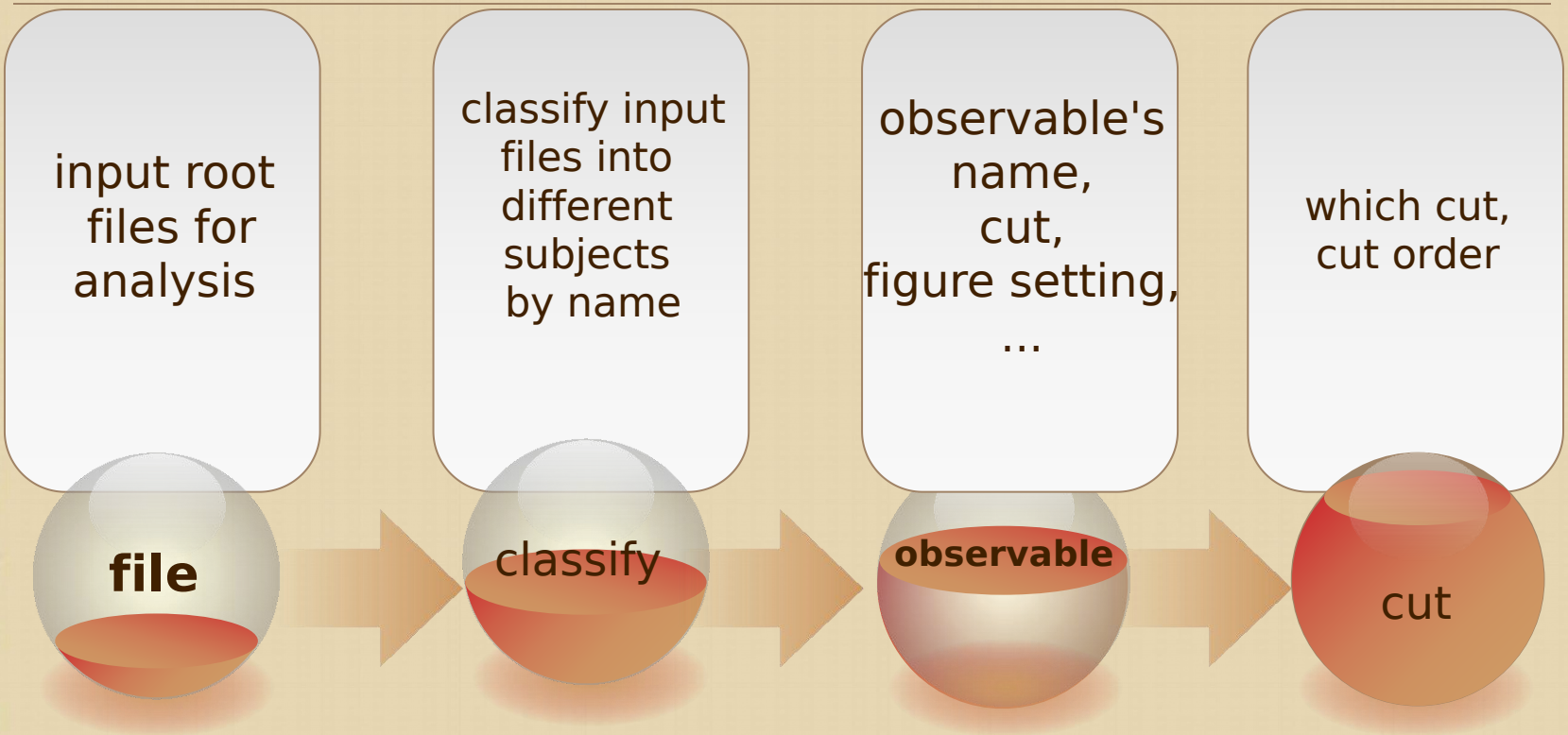



operation
one signal property
no polarization
cut.pre_cut
pre cuts
combine different polarization files into one
add pre cuts
low.MVA_weight
MVA training
generate MVA weight
MVA attaching
attach MVA variable into the root file
only tested by me
Complete_Pol
loop for all polarization
para.scenario
Complete_Run
Complete Direct
Make Complete Table
assistant funcitons
para.cut.cut
normal cuts
cut efficiency
for each channel
for each sort
para.plot
generate plots
plots for all observables
w/o any cuts
before this obv cut
after this cut
after all cuts
plots for each channel
plots for each sort
generate root file
rootfile after all cuts
root file: obv dis after its cut
Tested by Shin-ichi
make table
cut efficiency table for all channels
exclusion limits
para.flow signal_properties
Summary_Plot

Code structure

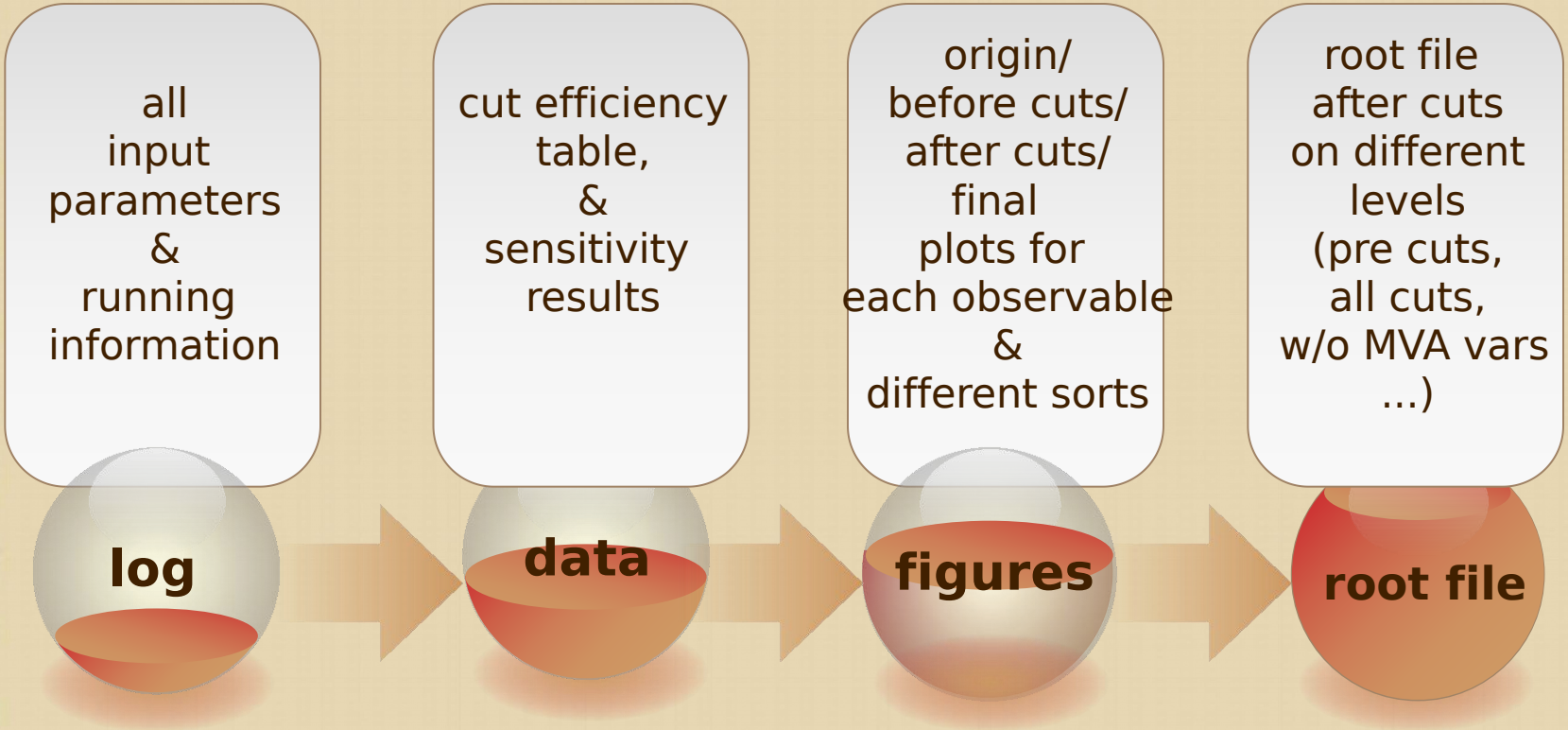


input data


input root files for analysis
classify input files into different subjects by name
observable's name, cut, figure setting, ...
which cut, cut order
file
classify
observable
cut

output

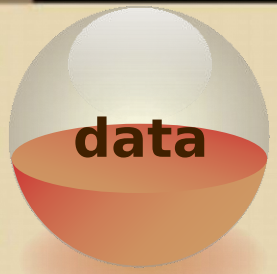
output data

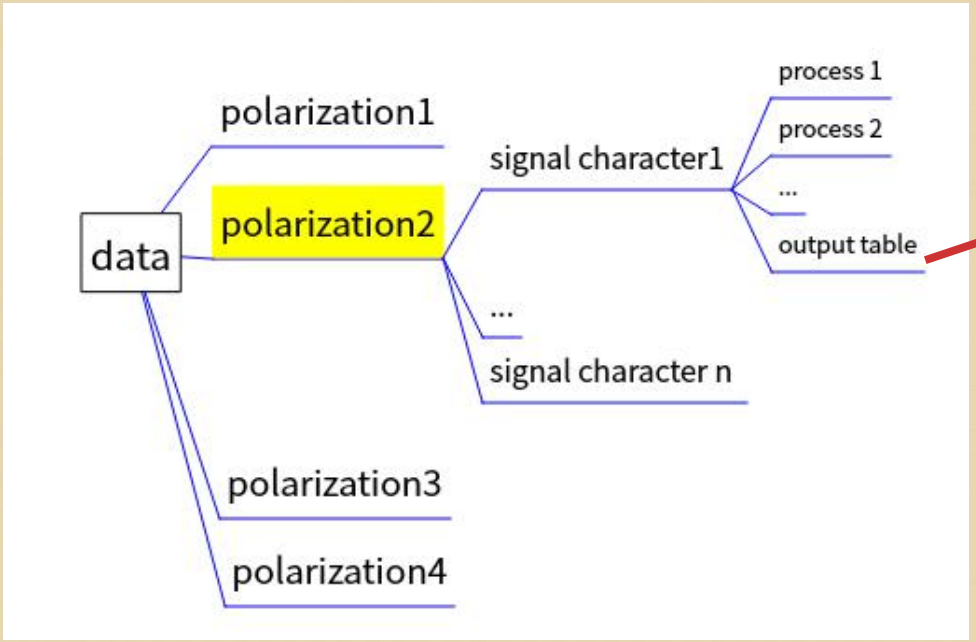


all temporary data are preserved for reuse.

for my light-higgs analysis:

23 higgs mass banchmark points, with four polarized results (--,-+,+-,++),
total output takes 8.3G hard-disk space



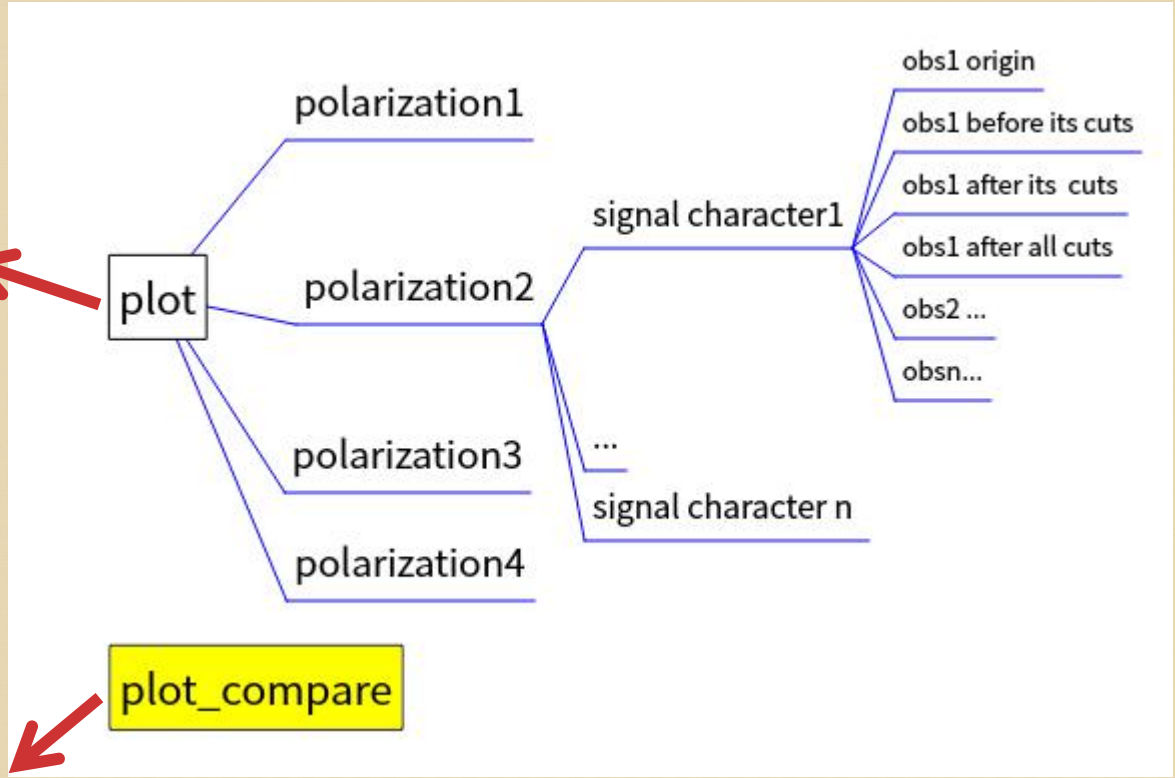


cut efficiency table with "Tex format",
directly used in latex file

$\int Ldt = 1fb^{-1}$	sig_{ij}^{HA}	$wtata_i^j$	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
$M^{HA} \in [0, 180]$	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
$\theta_*^l \in [0.8, 1]$	0.034474	0.158736	2.52002	0.00220014	0.020929
$P_T^l \in [0, 30]$	0.029773	0.142863	0	0.00190012	0.0716567
all cut	0.029773	0.142863	0	0.00190012	0.0716567

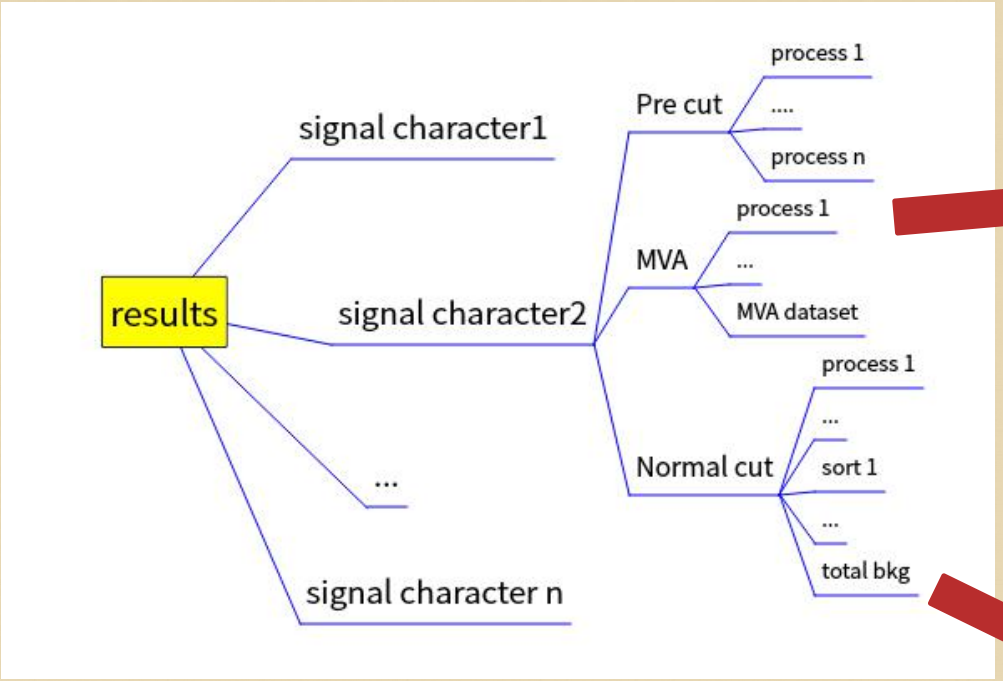
figures

all channel



all sorts in one figure (png format)

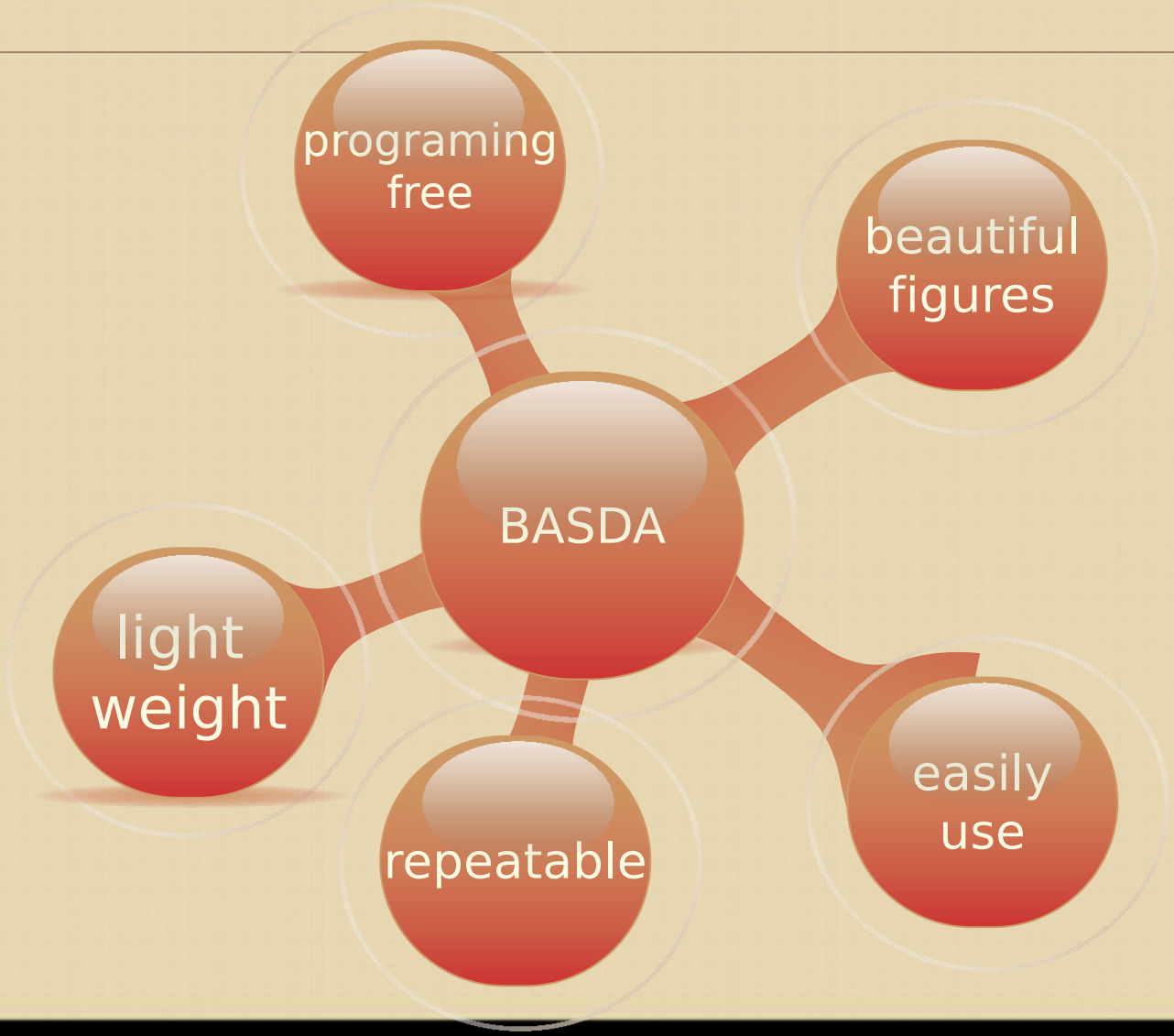
root file



1. root format
2. after cuts in different level
3. can be used independently

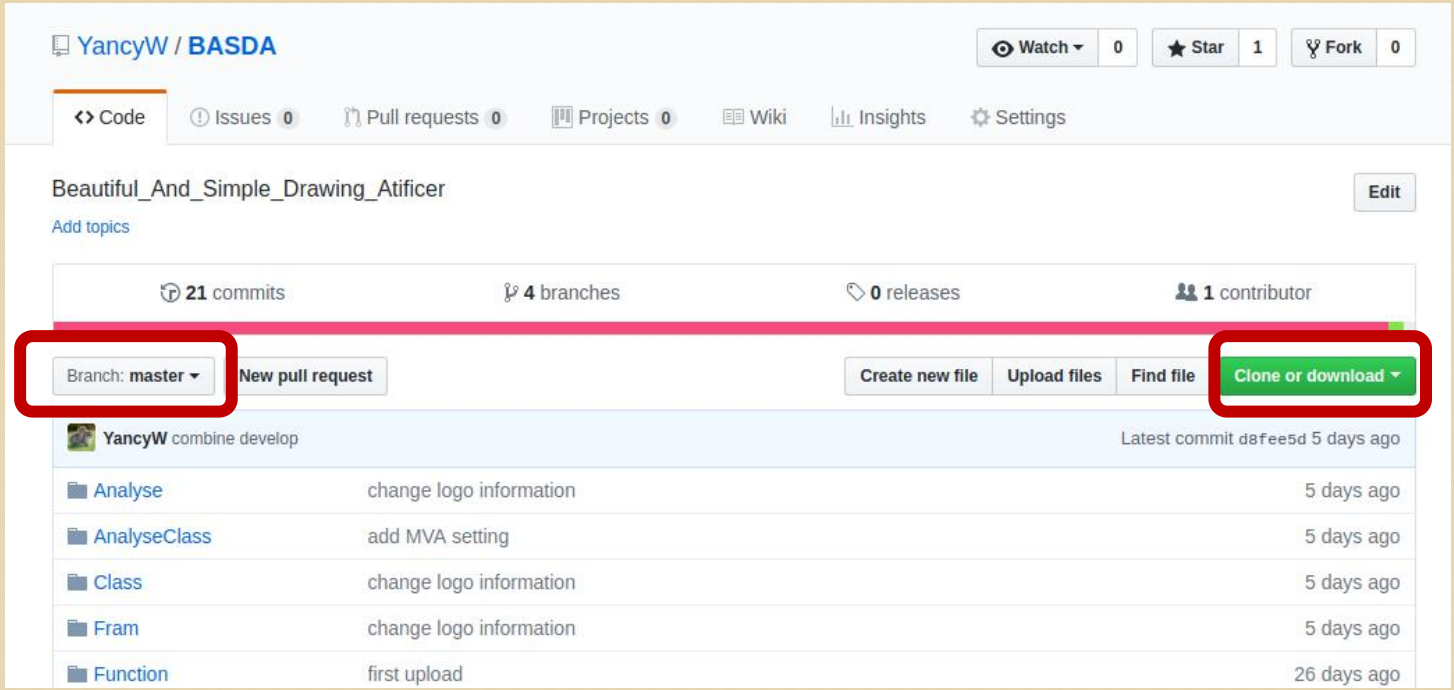
1. events after all cuts
2. all distributions
3. adjust diagrams directly

Short Conclusion



Installation

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



a quick example

searching charge Higgs at LHC

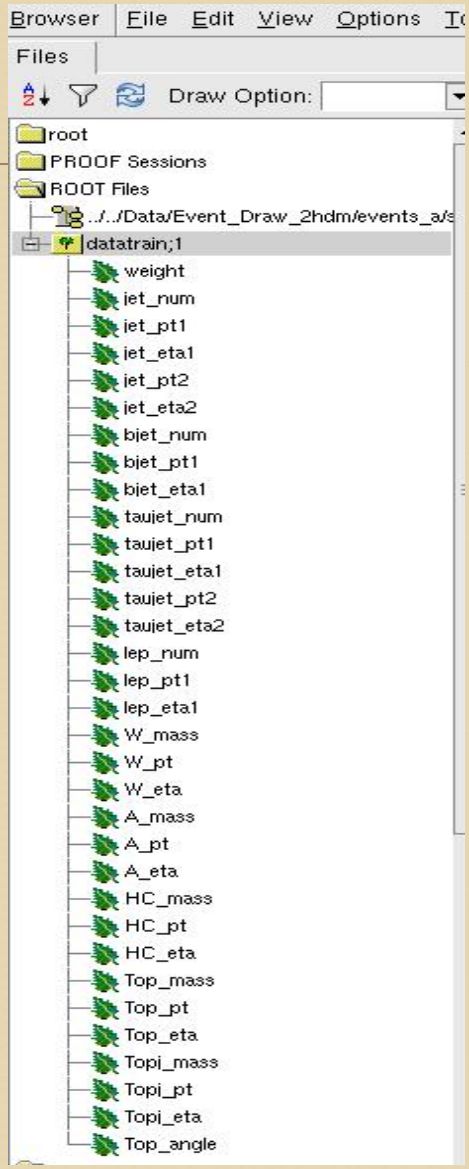
- sig: pp->tj->H^+bj->AWbj->ττWbj
- bkg: Wττ, tt(l,sl),tllj(tjττ,ttll)

- identification cuts
  - lep=1, τ jet=2, jet>=1,
  - their pt, eta cuts
- invariant mass cut
  - m_A , m_{H+-} cuts
- top angle between boosted tj and c.m. framework

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}

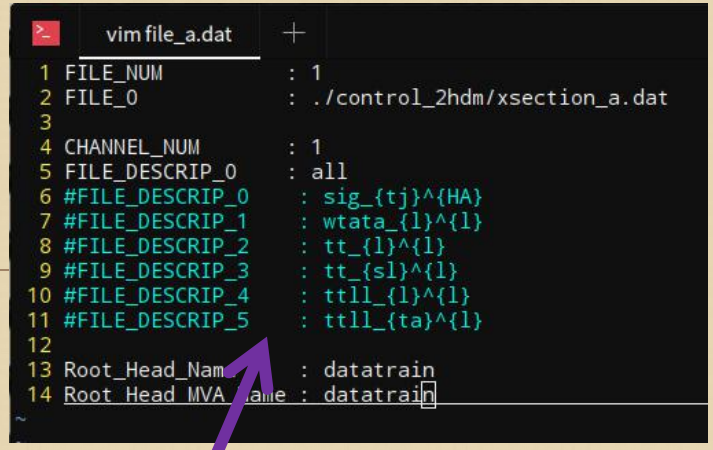
tt_{l}^{l} tt_{sl}^{l}

class name user name sub class name

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

input setting

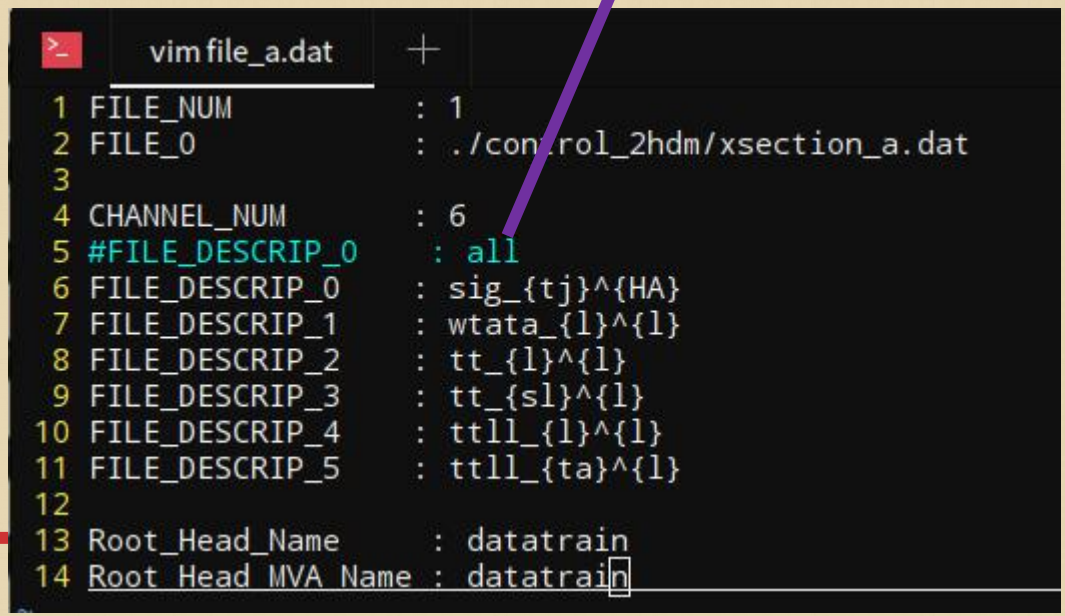
1. generate root file
2. edit xsection.dat
3. edit file.dat



this is also correct

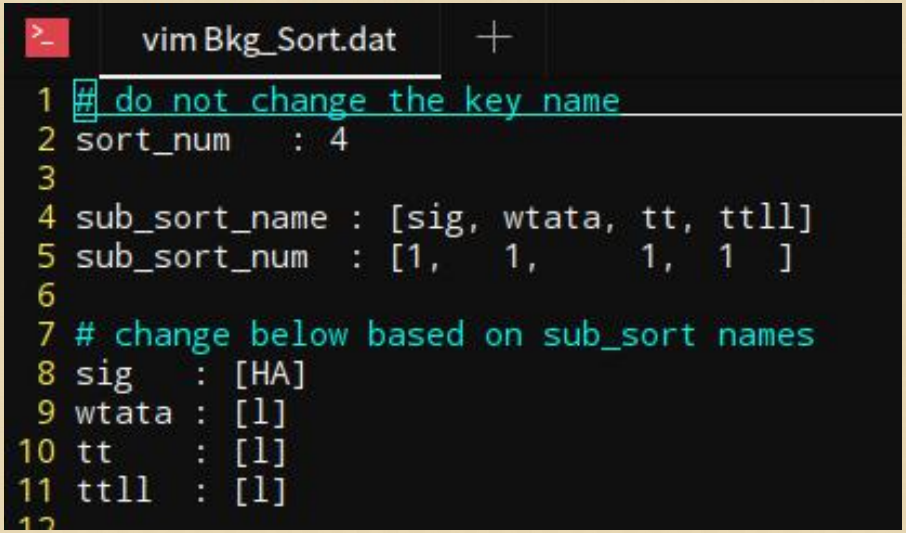
root tree name

root tree name



input setting

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



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

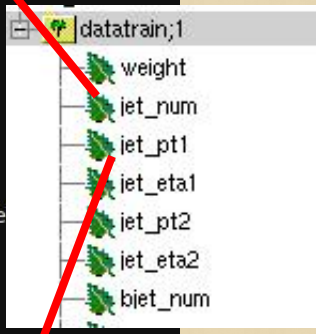
plot para

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

```
1 pre_cut_num : 0
2
3 pre_cut_order : []
4
5 cut_num : 17
6
7 cut_order : [0, 1, 2, 8, 9, 10, 11, 12, 13, 14, 15, 16, 19, 22, 28, 31, 29]
8
```

variable number in Var.dat

input setting

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

vim flow.dat

```
1  #operation
2
3  #BeginObject       : Complete_Run
4  #BeginObject       : Complete_Pol
5  #BeginObject       : Complete_Direct_Cut
6  #BeginObject       : Make_Complete_Table
7  #BeginObject       : Sensitivity
8  #BeginObject       : Pre_Cut
9  #BeginObject       : MVA_Train
10 #BeginObject       : MVA_Attach
11 #BeginObject       : Summarize_Plot
12 #BeginObject       : Direct_Cut
13 BeginObject        : Direct_Cut_NoMVA
14 #BeginObject       : Direct_Cut_ReWeight
15 #BeginObject       : Make_Table
16
17
18 # choose signal process and work scenario
19 signal_property    : 125
20 working_scenario   : running-lhc-1fb
21 MVA_method         : "BDTG"
22
23
24 # choose special setting
25
26 cut                : true
27 record_output      : false
28 plot               : true
29 plot_object        : before_cut
30 record_event       : true
31 MVA_training       : true
32 MVA_level          : 2
33 MVA_weight         : 1
34
35
36 #some keywords for future
37 level              : 5
```

Here, we only use cut directly

luminosity

MVA method, no used here

record everything in file, using when submit jobs

generate plot

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

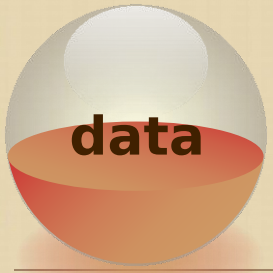
basic input

advanced input

run the code
./BASDA

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 ]
```




```
(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
```

$\int Ldt = 1 fb^{-1}$	sig_{tj}^{HA}	$wtata_t^l$	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

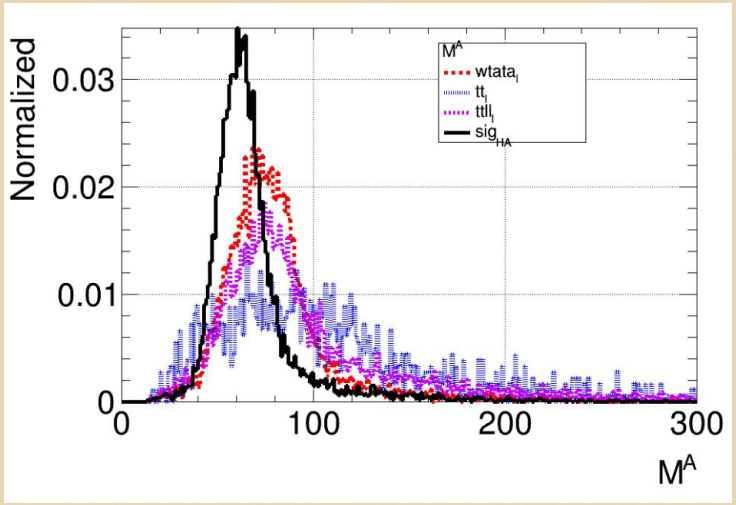
```
filenum                                                    :
    total result                                           :
        | sig_{tj}^{HA}                                    :    [ 0, 0 ]
        | no cut MC event                                  :    [ 310000, 310000 ]
        | no cut                                           :    [ 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

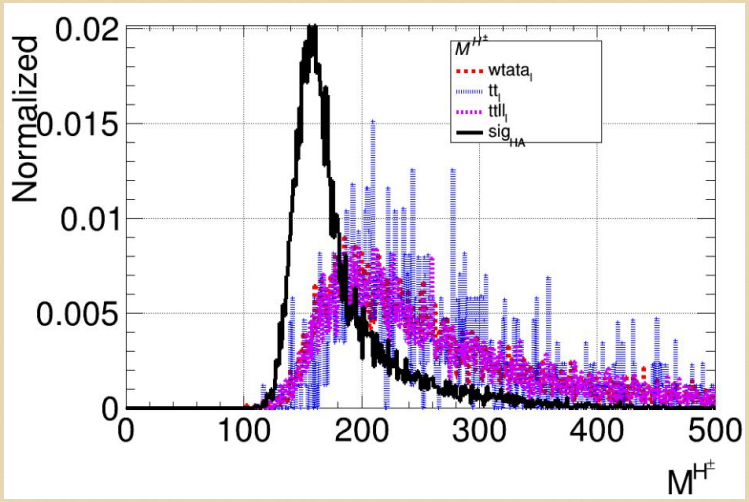
origin / before cuts / after cuts / final plots for each observable

```
(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

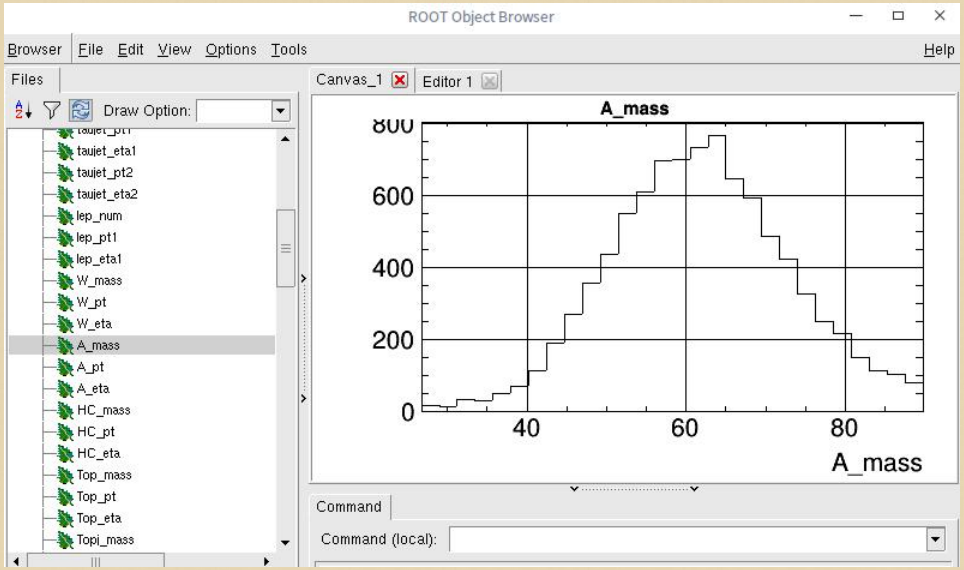


root file

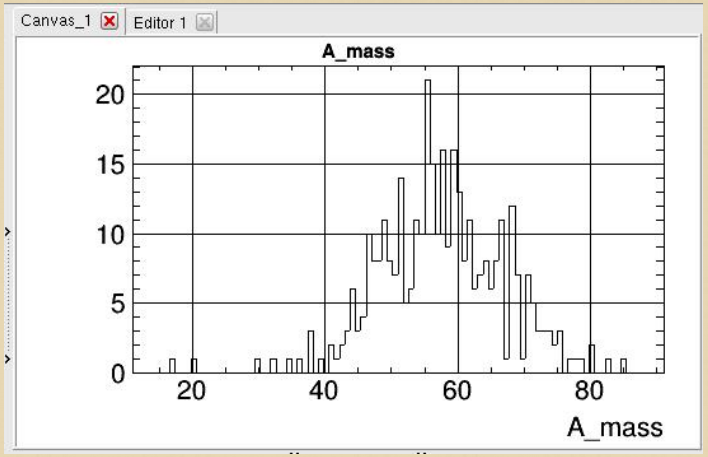
observable after its own cut,
and after all cuts are preserved
for further use

```
(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,

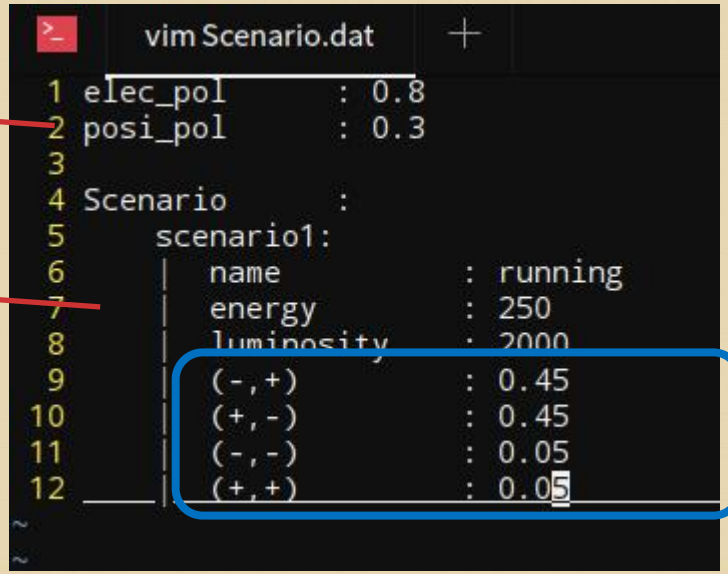


ILC scenario

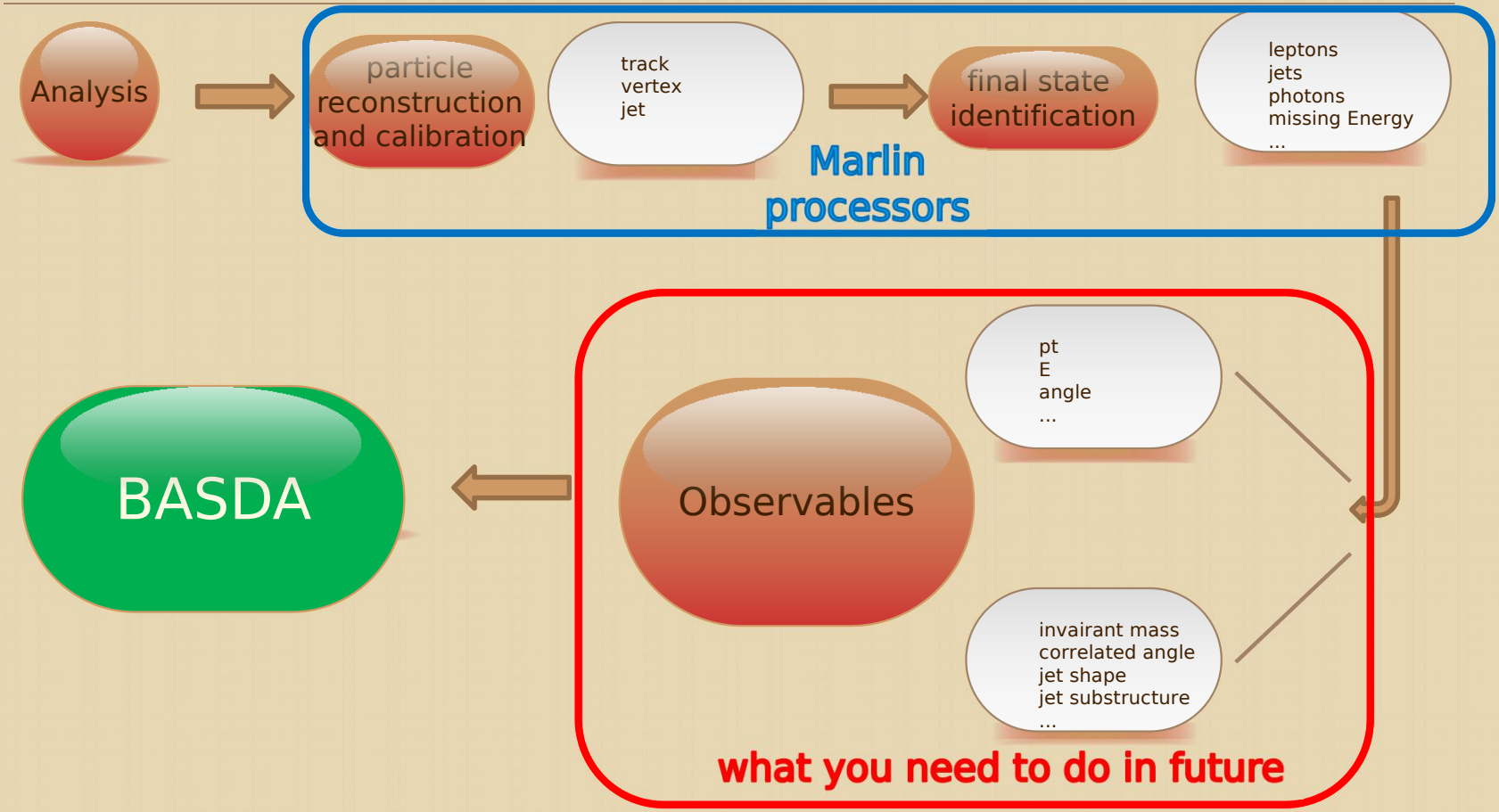
1. control/scenario.dat
2. can automatically combine different polarizations
3. re-use results in Pre_Cut when changing the polarization. (MVA variable need to be recalculated.)
4. re-use results in Cuts when changing the luminosity.

polarization value

luminosity
running polarization



General Strategy for analysis



Hope to Save 50% time

Summary & Future

- https://github.com/YancyW/BASDA
- Manuals/Examples:
  - mygithub/doc/BASDA_Usage_Example.pdf
  - mygithub/doc/Usage.md
- More tests:
  - MVA
  - Code consistency
- More functions:
  - 2-D plots
  - statistic (like wsmaker,nplot ... in ATLAS group).
- GUI for basic users

Thank you!