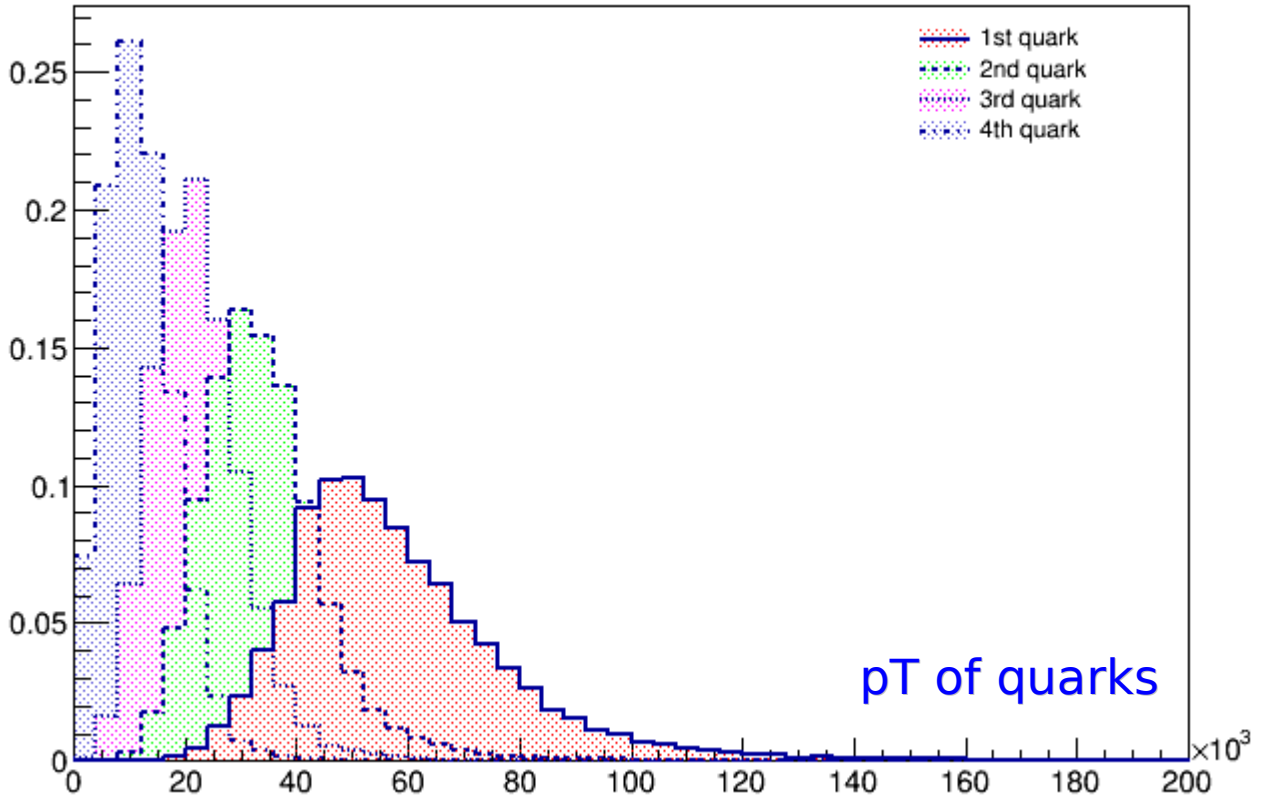
WhadWhadyy truth analysis

Xiaohu SUN, IHEP, Beijing, 29-04-2014

WW → jjjj: pT of quarks

- First of all check the pT distributions of all quarks at parton level
- pT of 1st, 2nd , 3rd, 4th quarks are shown
  - 4th quark has pT peak at ~10GeV
  - Cut at 25GeV will leave us only a tail of 4th quark



*the stats of private MC samples used in this talk is ~20K

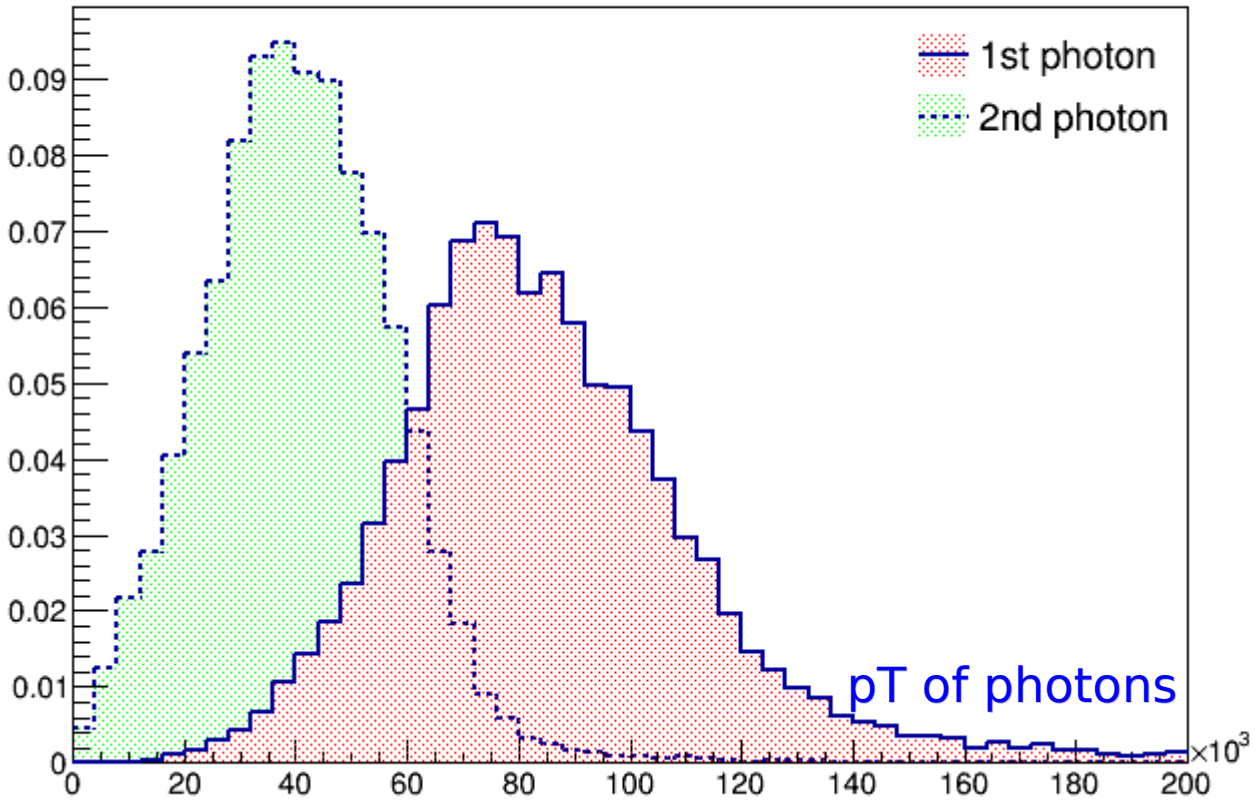
WW → jjjj: pT of quarks

- Apply pT cut on four leading quarks at parton level, calculate efficiencies
- If one uses 20/25GeV, the signal will be killed significantly!
- NEED to low down pT threshold as far as possible while keeping the plateau of trigger efficiency

pT threshold	events	efficiencies
non	19430	100%
5 GeV	17168	88%
10 GeV	11389	59%
15 GeV	5437	28%
20 GeV	1963	10%
25 GeV	594	3%

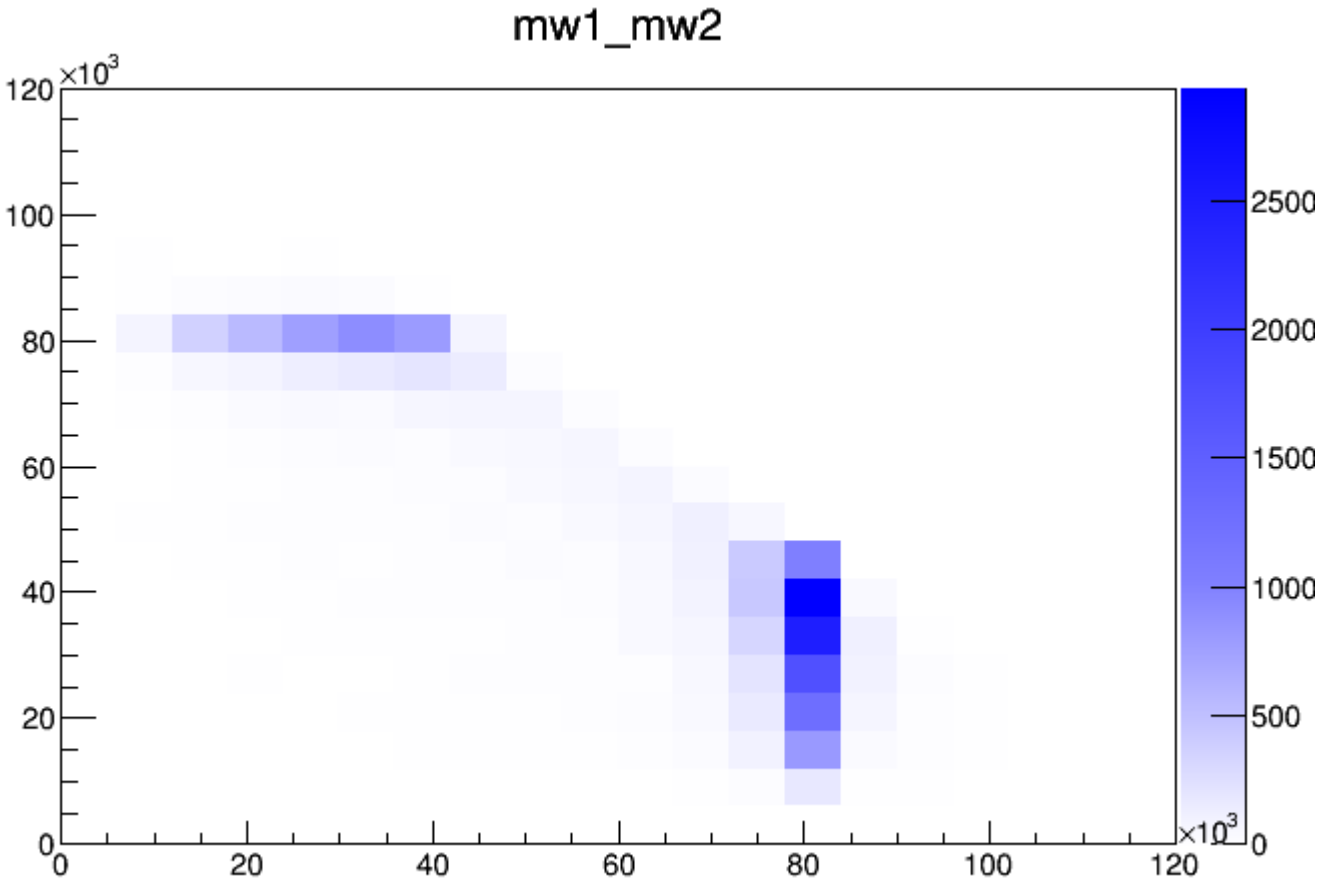
pT of photons

- Just to check what they look like
- It seems that cutting at 25GeV or more is safe



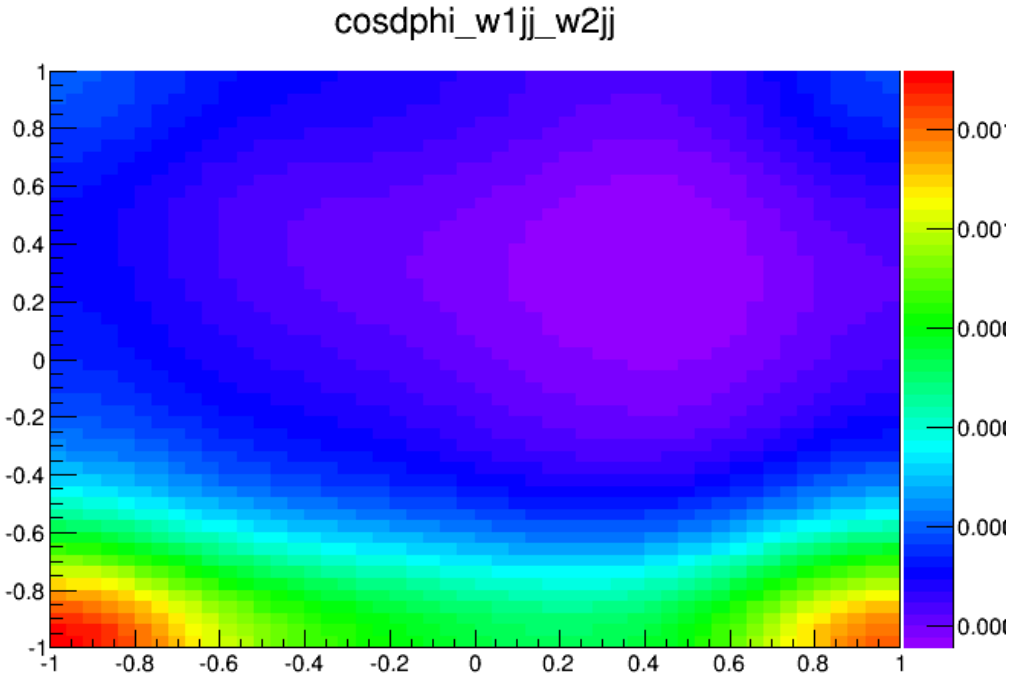
On/off-shell W bosons

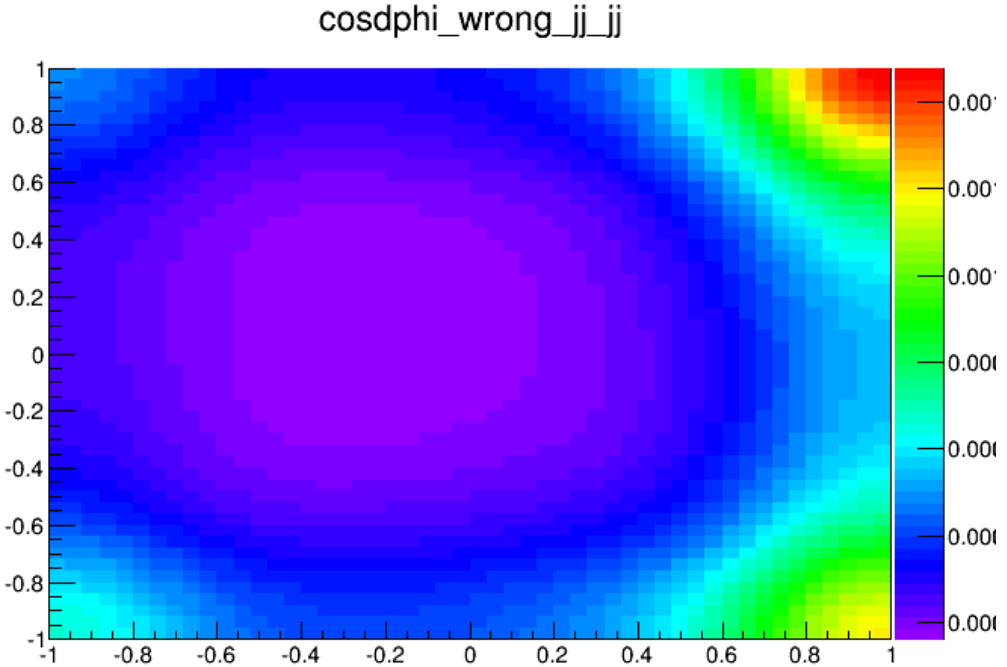
- Plot the mass for leading and second leading W bosons in the same event in parton level
- En fait, m(H)^2=m(W1)^2+m(W2)^2+2(E(W1)E(W2)-p(W1)p(W2)cos(theta))

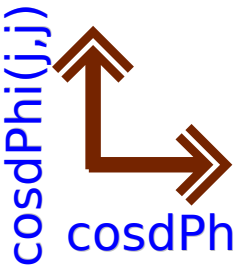


Jet combination

- To find the best combination of two jets decaying from the same W bosons:
  - Fixed comb or Adaptive comb (using cosDeltaPhi(jj))





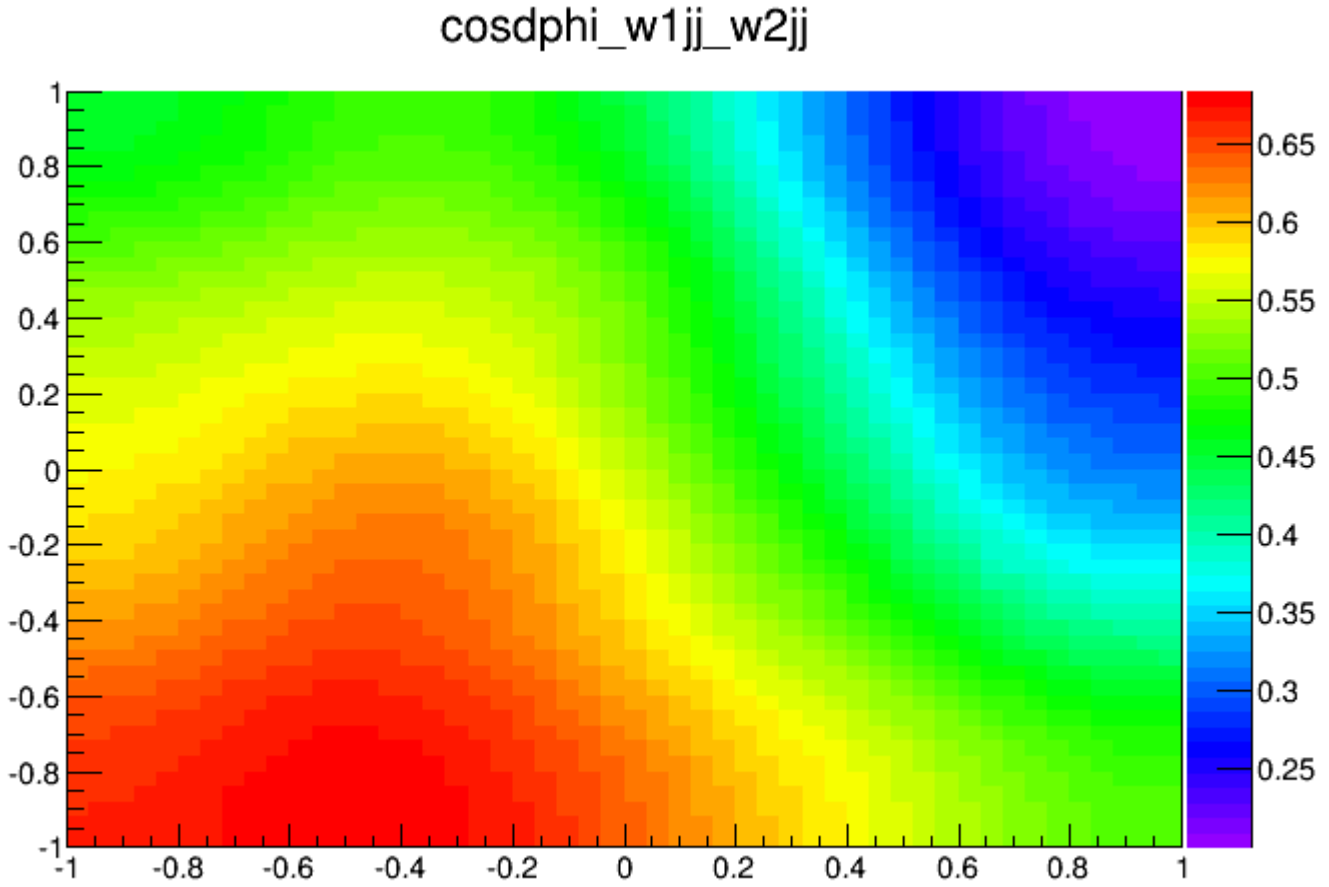


Use these two pdfs to comstruct a 2-D likelihood which could be used as an classifier to distringuish the correct and the incorrect combinations

$$y_{\mathcal{L}}(i) = \frac{\mathcal{L}_S(i)}{\mathcal{L}_S(i) + \mathcal{L}_B(i)}$$

Likelihood histogram

- Using the two histograms to build up a likelihood histogram
- Calculate likelihood values for each combination of jets and order them by this value, then choose the combination with the highest likelihood value



*use 50x50 bins in likelihood histogram

Jet combination

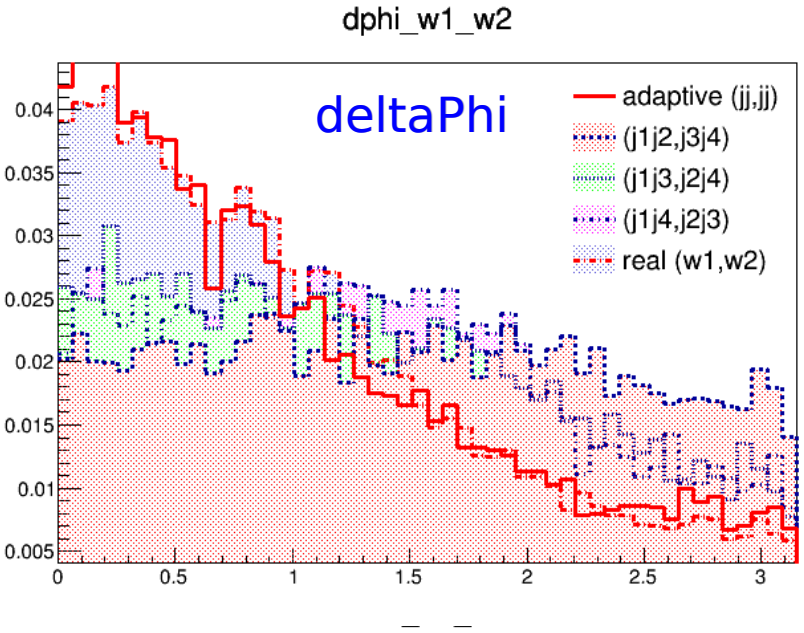
- To find the best combination of two jets decaying from the same W boson, extract the purities from truth information
  - Nb of evts with correctly reconstructed W(jj) / Nb of tot evts
  - Note: jets are ordered by pT

	(j1j2) (j3j4)	(j1j3) (j2j4)	(j1j4) (j2j3)	Adaptive
correctness	44%	35%	21%	43%

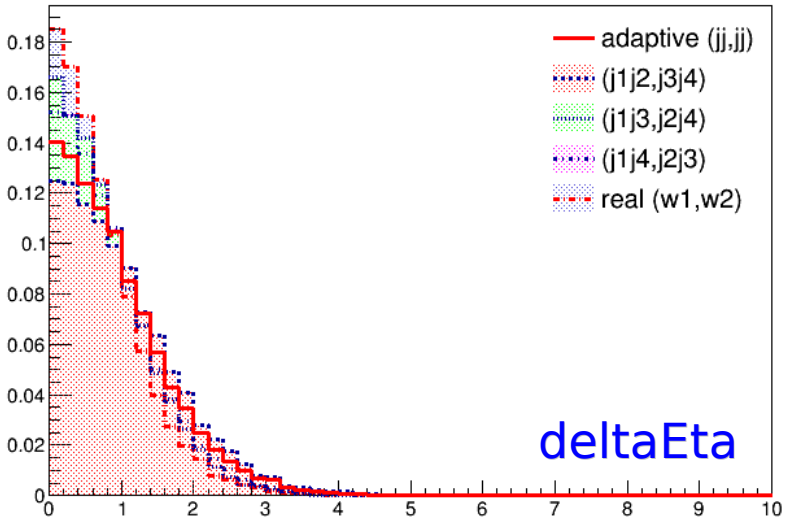
# of bins	correctness
10x10	43%
20x20	44%
50x50	43%

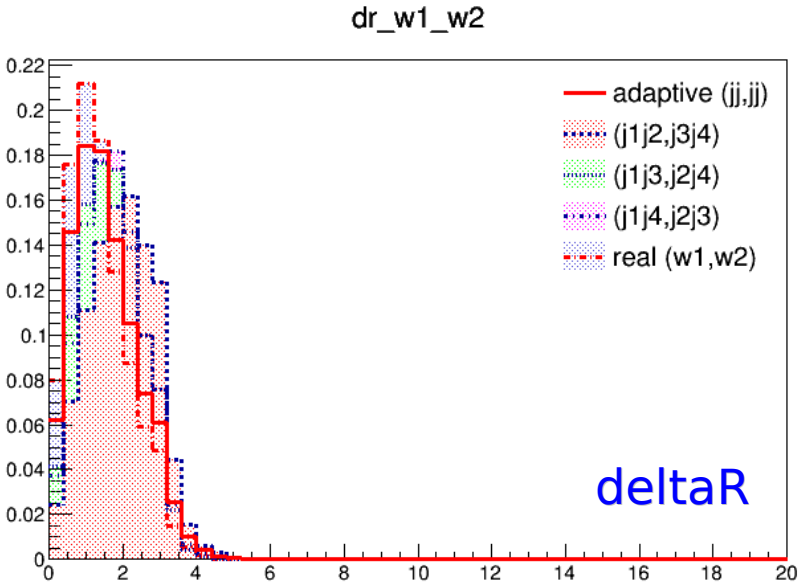
Jet combination

- Compare deltaPhi/Eta/R for different jjjj combination and real WW pair



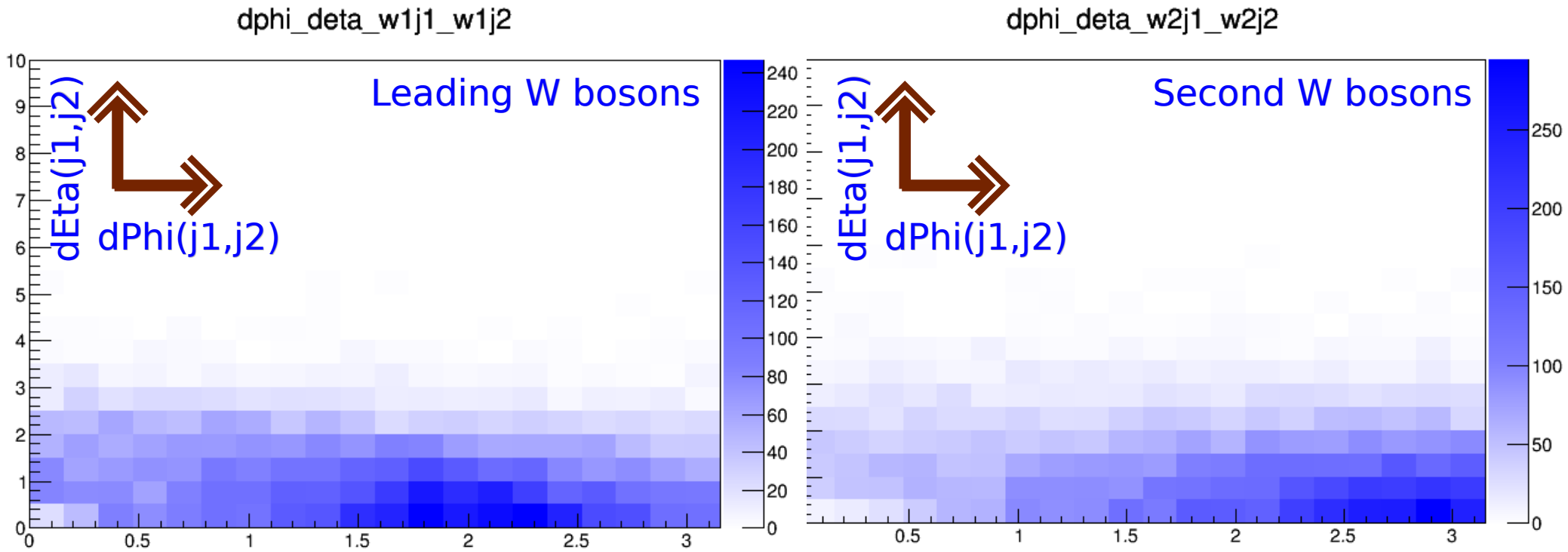
Although adaptive gives the similar correctness as comb(12,34), the kines are actually better than comb(12,34)



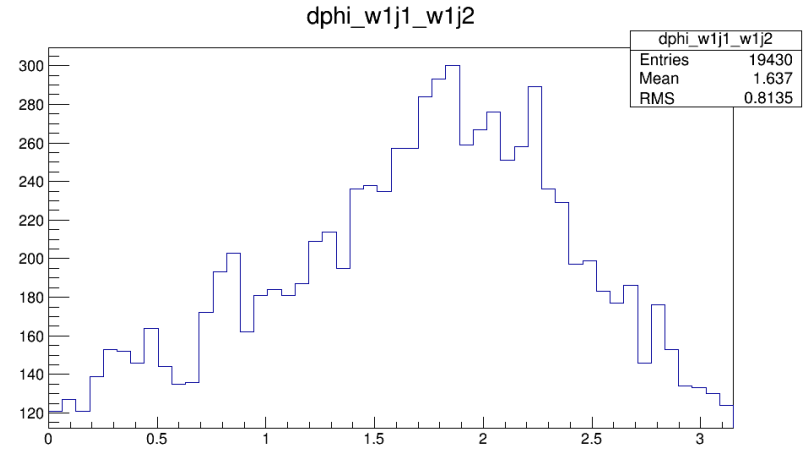


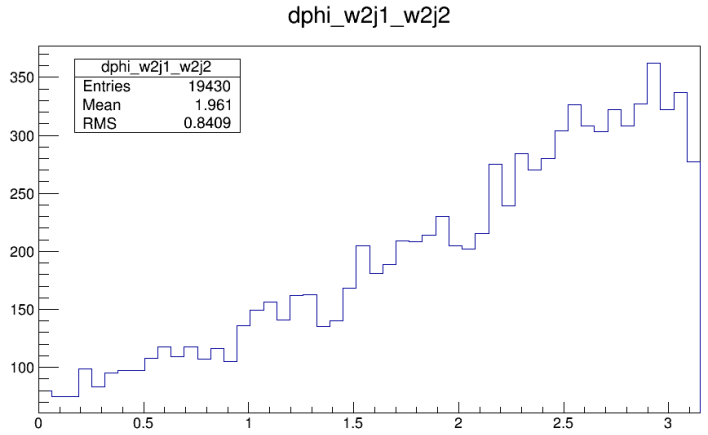
DeltaPhi/Eta(j,j)

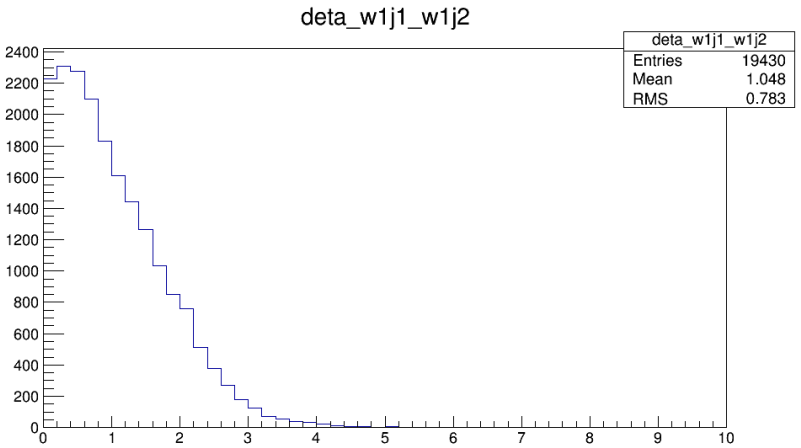
- The purpose of looking at these variables are to find a way to make the more proper combination of jjjj in order to reconstruct W bosons
- Making the constraint on invariant mass would be an intuitive idea, but in our case jjjj lead to very bad mass resolution
- Instead, the angle measurements shed a light on it

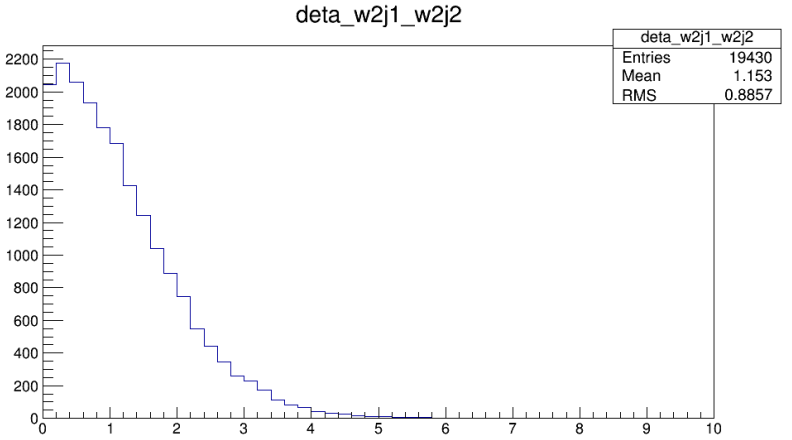


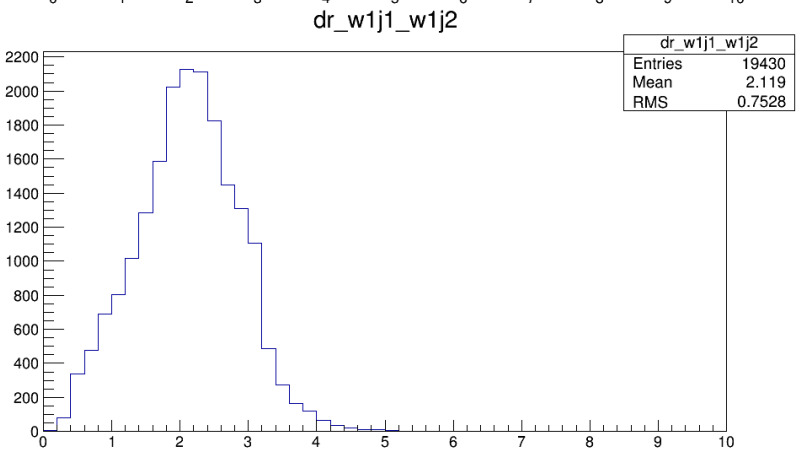
DeltaPhi/Eta/R(j,j)

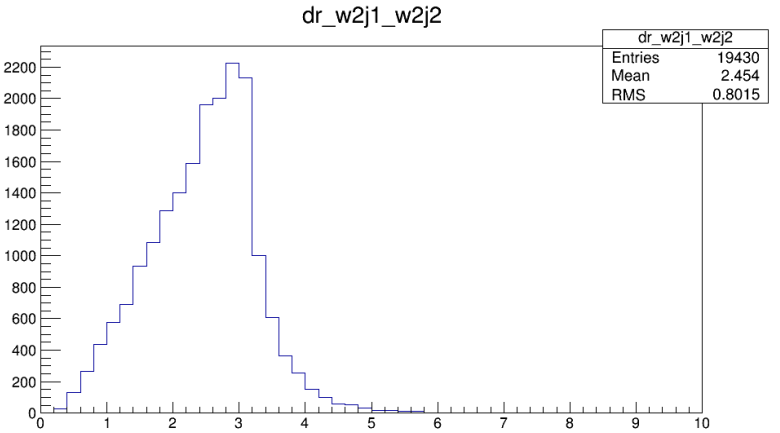




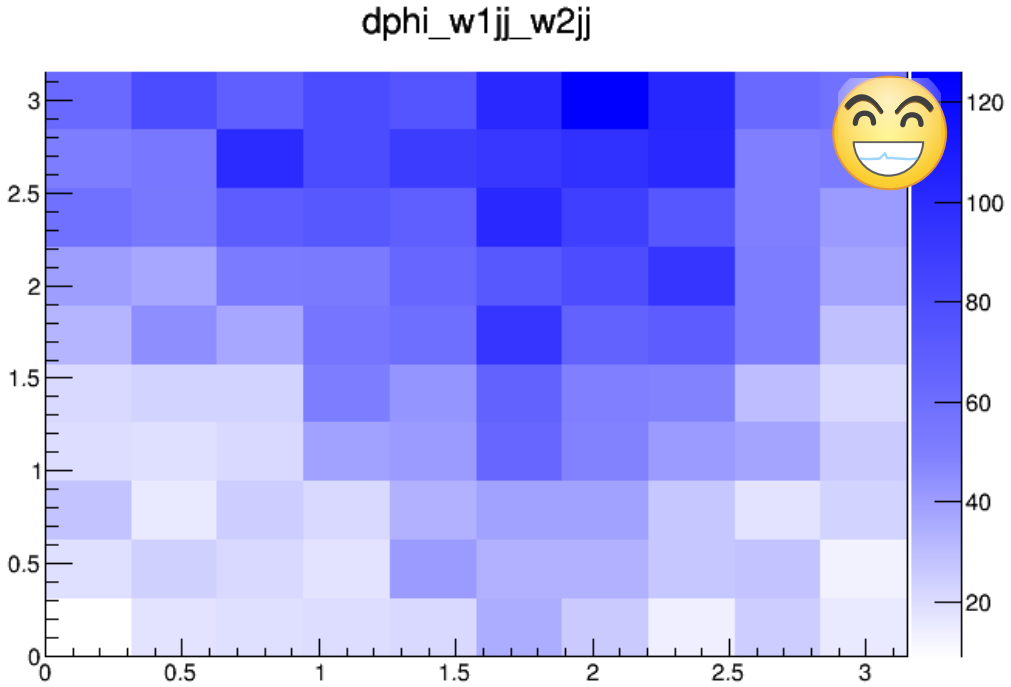




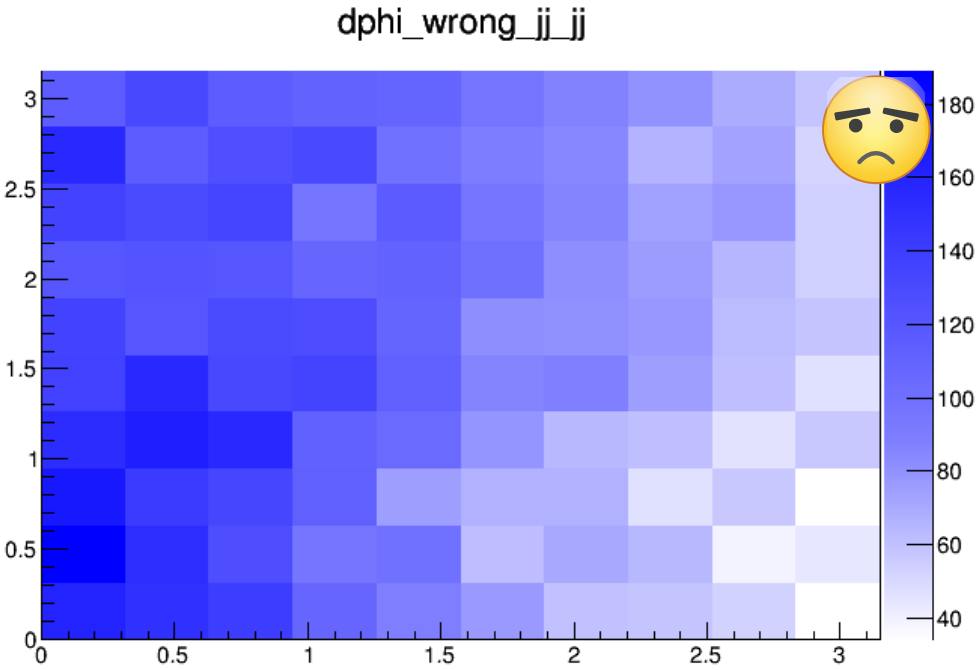




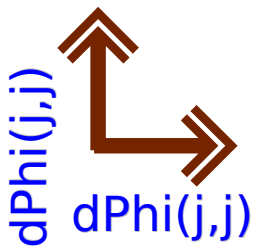
DeltaPhi(j,j)



Leading true W boson



Leading wrongly-reco W boson



Jet combination

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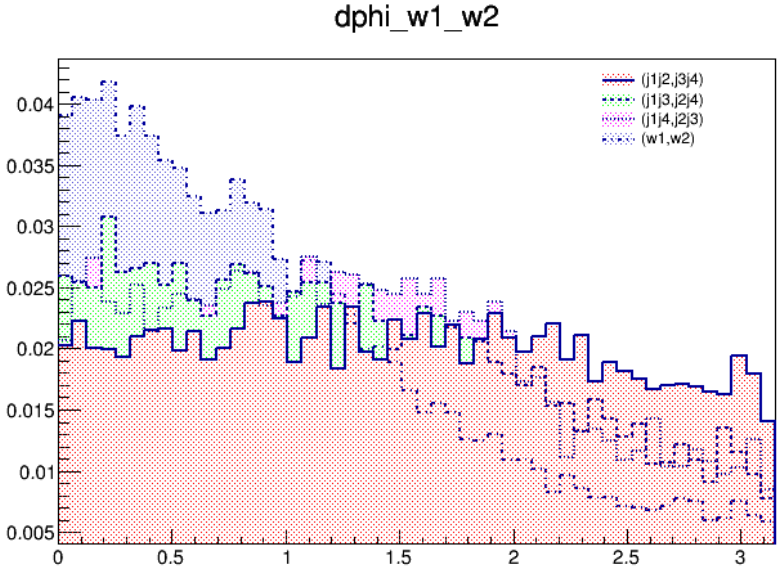

Although comb (j1j2,j3j4) gives the highest correctness, its kinematic distributions are not as good as other combinations