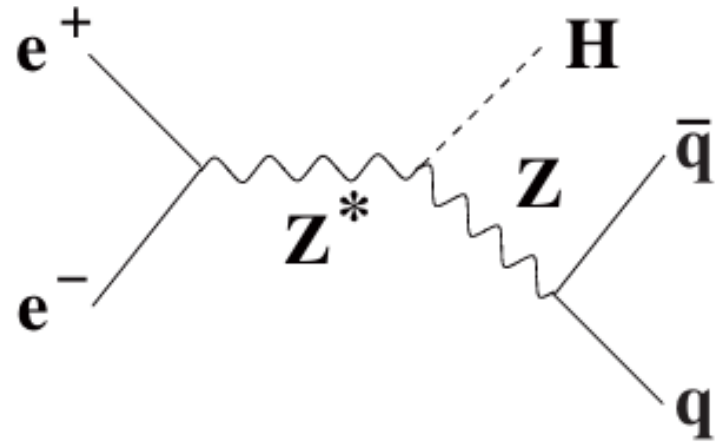


Higgs to ss study

First year graduate student at Iwate University
Ryuki Sugawara

Hadronic channel (qqH)



This is the signal event

Although the number of signal events is larger than in other processes, the number of background events is also larger, and efficient removal of background events is required.

There are four jets, two from the Higgs and two from the boson, and it is also important to correctly select the Higgs-decayed jet in the reconstruction.

信号事象	反応断面積 (fb^{-1})	事象数
$e^+e^- \rightarrow ZH \rightarrow q\bar{q}H$	210.028	52,507
背景事象	反応断面積 (fb^{-1})	事象数
$e^+e^- \rightarrow \nu\bar{\nu}q\bar{q}$	600	149,979
$e^+e^- \rightarrow q\bar{q}q\bar{q}$	16200	4,048,386
$e^+e^- \rightarrow \nu\ell q\bar{q}$	16500	4,114,190
$e^+e^- \rightarrow \ell^+\ell^-q\bar{q}$	1590	398,324
$e^+e^- \rightarrow \nu\bar{\nu}\ell^+\ell^-$	4450	1,113,076
$e^+e^- \rightarrow \ell^+\ell^-\ell^+\ell^-$	3050	762,973
$e^+e^- \rightarrow q\bar{q}$	141000	35,353,277
$e^+e^- \rightarrow gg$	34000	8,505,840

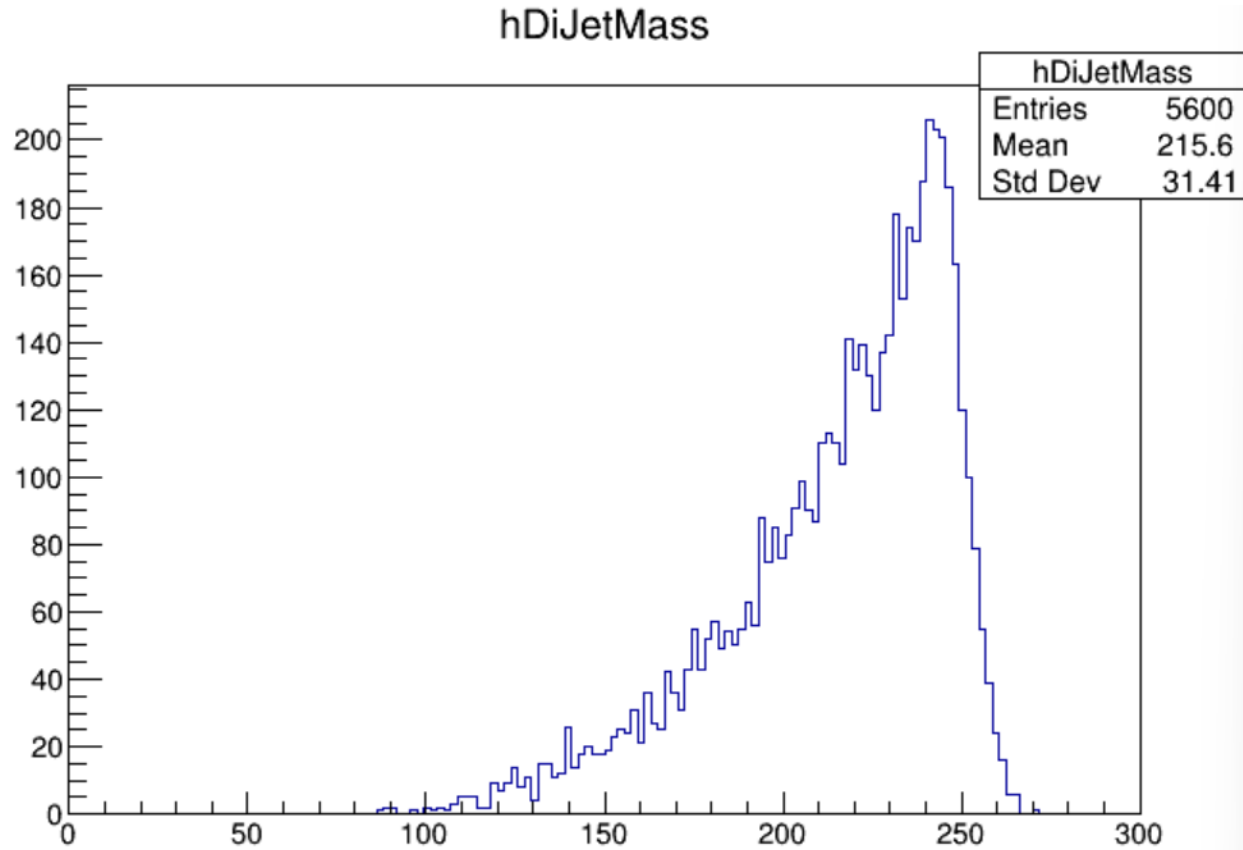
reference document : 東北大学大学院理学研究科 物理学専攻 吉田幸平 「国際リニアコライダーにおける ヒッグス粒子の崩壊分岐比測定の研究」

Hadronic channel Analysis Process (qqH)

- (1) Thrust processor is used for signal events.
- (2) Reconstruct with 4 jets.
- (3) Put data in a root file.
- (4) Perform analysis on that root file.
- (5) Analyze in the same way in the background.

Hadronic channel (qqH)

Used Data:rv02-02.sv02-02.mILD_I5_o1_v02.E250-SetA.I402011.Pqqh.eL.pR.n000.d_dstm_15095_0.slcio



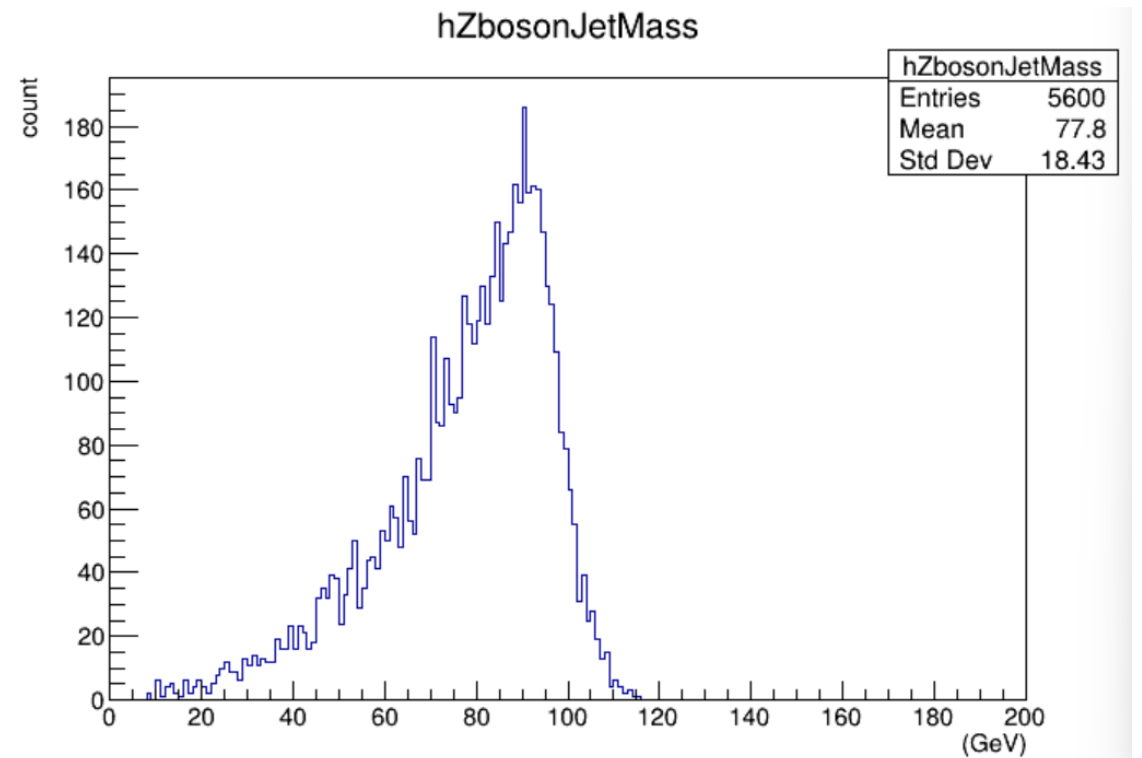
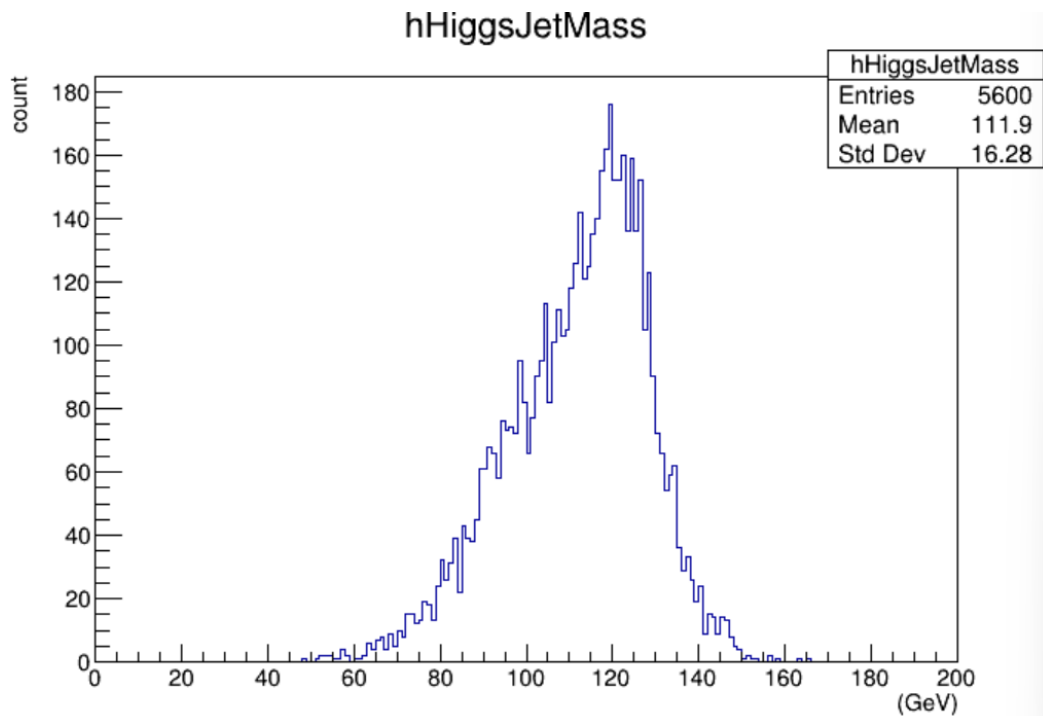
It is reconstructed with 4 jets, so the peak is at 250 GeV.

4-jet sorting

The jets were chosen so that χ^2 in this equation is the smallest.

$$\chi^2 = \left(\frac{M_{j_1 j_2} - M_Z}{\sigma_Z} \right)^2 + \left(\frac{M_{j_3 j_4} - M_H}{\sigma_H} \right)^2,$$

$$\begin{aligned} \times M_Z &= 91.2 \text{ GeV}, M_H = 120 \text{ GeV} \\ \sigma_H &= 4.4 \text{ GeV}, \sigma_Z = 4.7 \text{ GeV} \end{aligned}$$



Type of Cut

CM energy (GeV)	250		
Cut names	condition	Sig.	Bkg.
Generated		52507	45904900
χ^2	$\chi^2 < 10$	32447	2608980
# of charged tracks	$N_{chd} > 4$	25281	1120950
Y_{34} value	$-\log(Y_{34}) > 2.7$	25065	1002125
thrust	$\text{thrust} < 0.9$	24688	935950
thrust angle	$ \cos \theta_{\text{thrust}} < 0.9$	21892	696201
Higgs jets angle	$105^\circ < \theta_H < 160^\circ$	20062	622143
Z di-jet mass (GeV)	$80 < M_Z < 100$	16359	411863
H di-jet mass (GeV)	$105 < M_H < 130$	16359	411863
Likelihood ratio	$LR > 0.375$	13726	166807
Significance (Efficiency)	$S/\sqrt{S+B}$	32.3 (26.1%)	

These are the cuts in this issue of the Hadron Channel.

made the cut this time χ squared

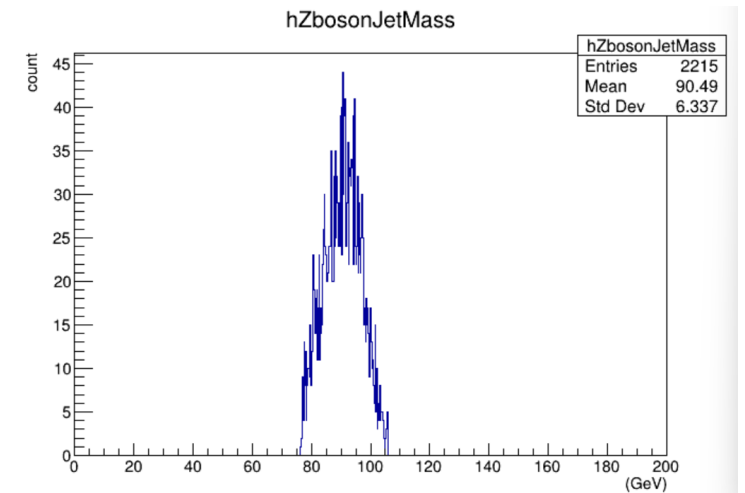
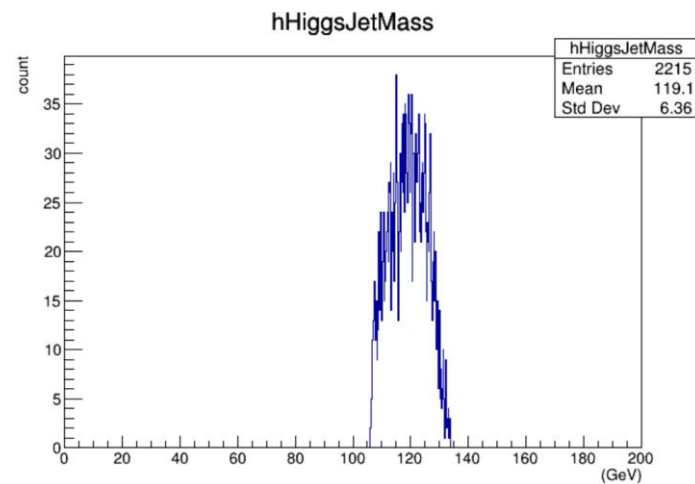
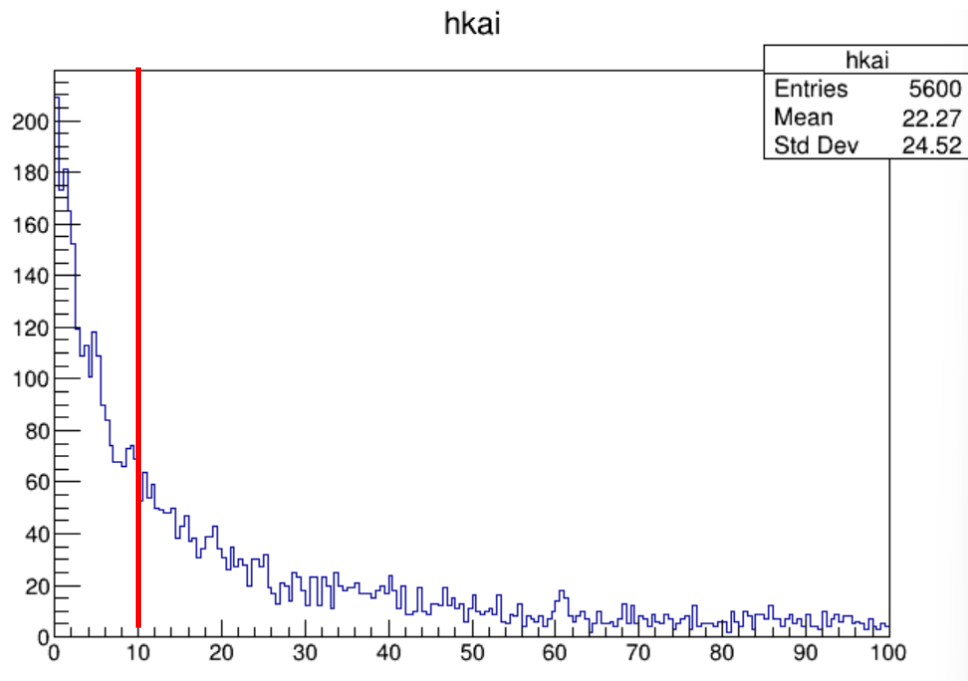
$$\underline{\chi^2 < 10}$$

Cuts were made with a χ -square of this equation less than 10.

Mr.Ono data shows a 38% reduction with this cut, whereas my data shows a reduction of about 60%.

$$\chi^2 = \left(\frac{M_{j_1 j_2} - M_Z}{\sigma_Z} \right)^2 + \left(\frac{M_{j_3 j_4} - M_H}{\sigma_H} \right)^2,$$

	reference	mydata
generated	52507	5600
χ^2 cut	32447	2215
decrease	38%	60%



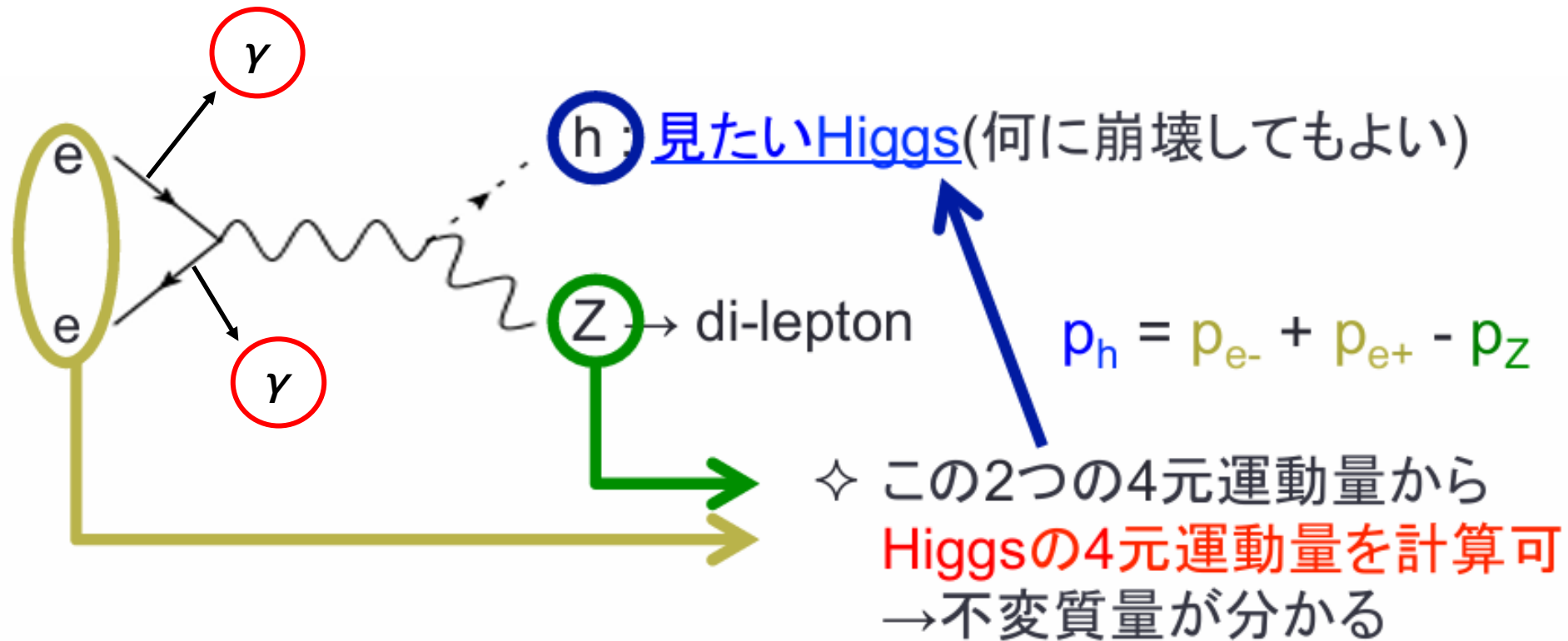
Consider that electrons and positrons drop photons before collisions

To account for energy loss before impact

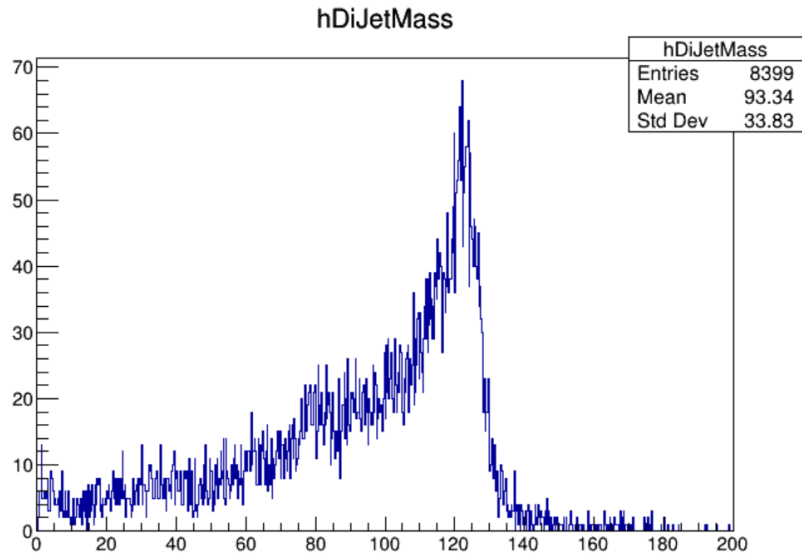
The following sentence was added to the Jet Clustering steering file.

```
<parameter name="JetClustering.AlphaParameter" type="double" value="1.3" />
```

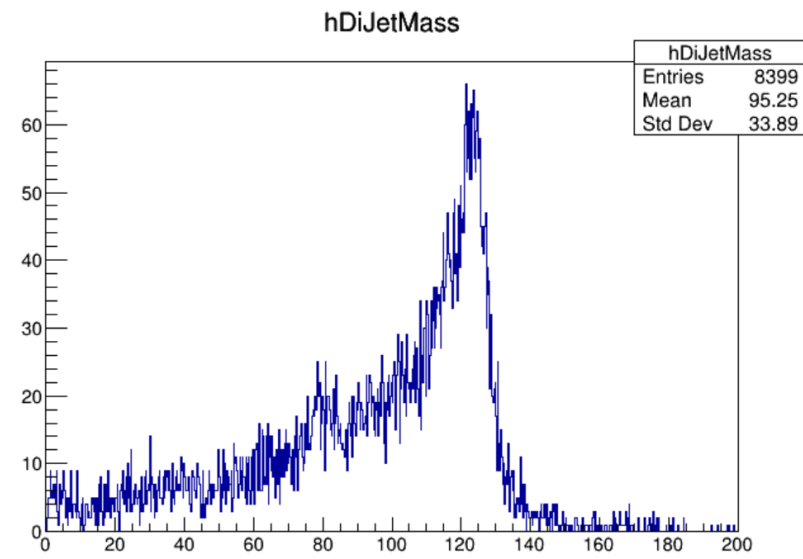
Change this parameter from 1.0 to 1.6 and see the distribution of each.



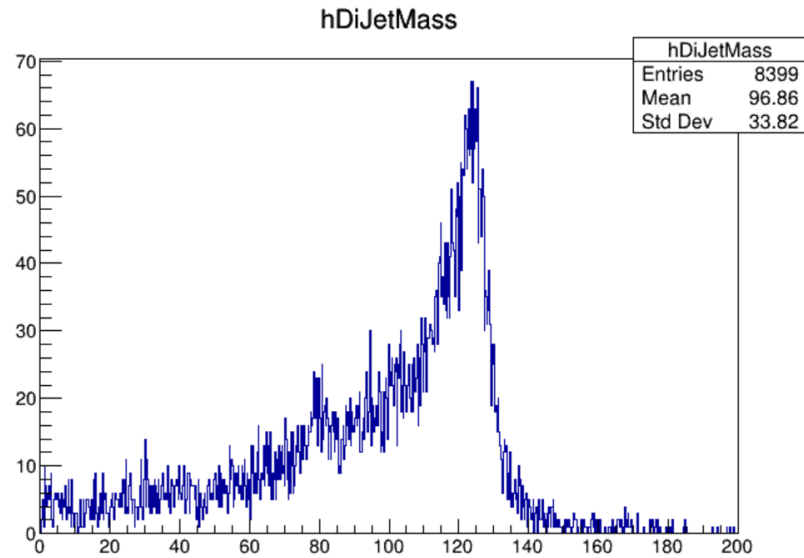
Alpha parameter change result 1 to 1.3



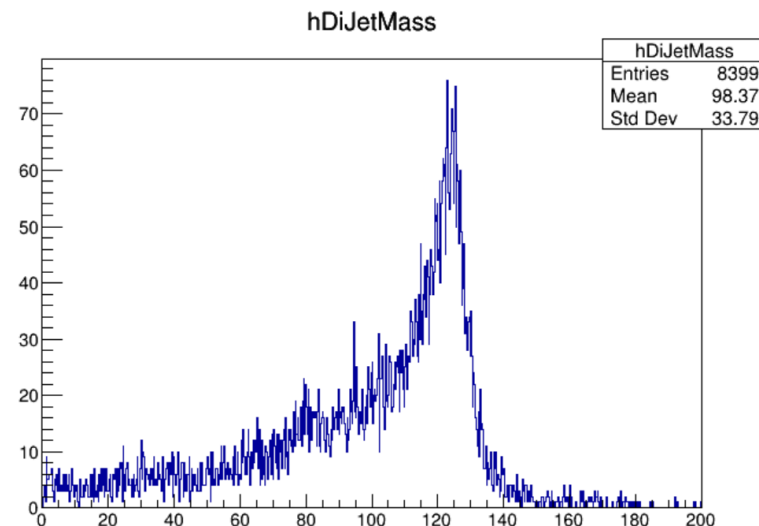
1.0



1.1

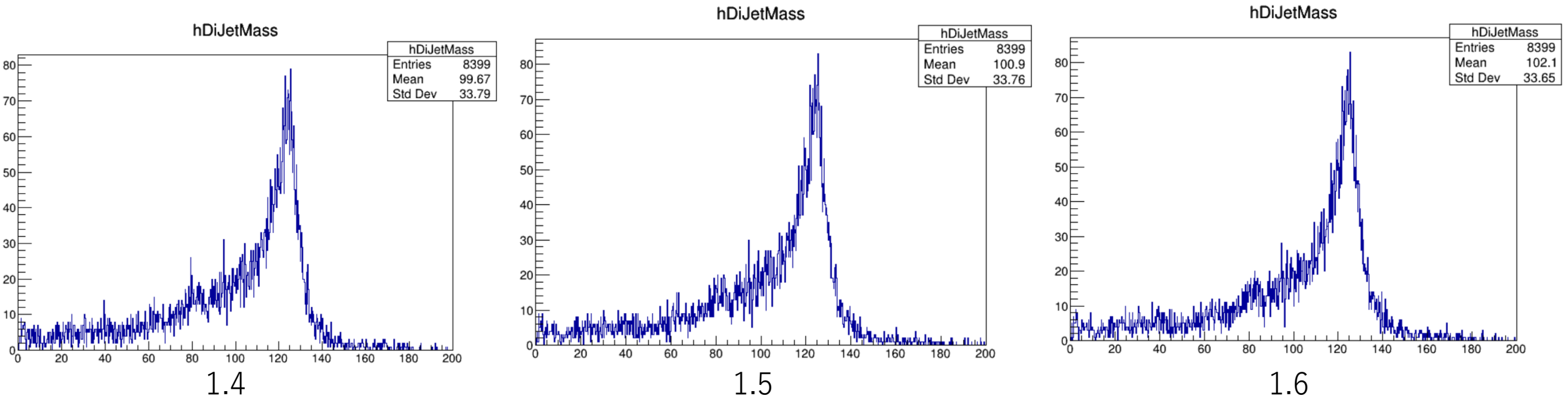


1.2



1.3

Alpha parameter change result 1.4 to 1.6



As the parameter increases, the number of locations above 140 GeV gradually decreases.

Next

- Make all cuts in the hadron process

Back up

Another pattern H=Jet(1,2) Z=Jet(3,4)

