Vertex Tagging: Sanity Check

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NMSU Update
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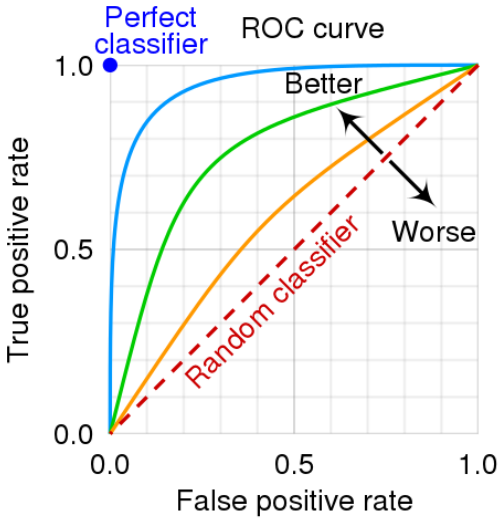
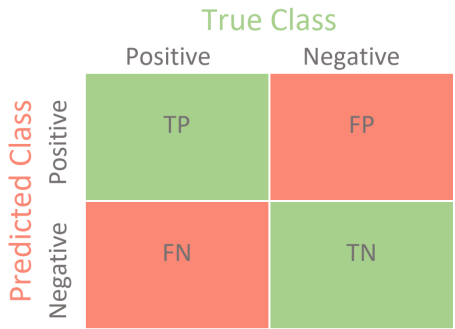
Receiver Operating Characteristic (ROC) Curve

- ROC curves typically feature true positive rate on the Y axis, and false positive rate on the X axis. This means that the top left corner of the plot is the "ideal" point - a false positive rate of zero, and a true positive rate of one. This is not very realistic, but it does mean that a larger area under the curve (AUC) is usually better.



Confusion Matrix

- Confusion matrix evaluate the accuracy of a classification.
- By definition a confusion matrix C is such that C_{ij} is equal to the number of observations known to be in group i and predicted to be in group j.
- Thus in binary classification, the count of true negatives is C_{00}, false negatives is C_{10}, true positives is C_{11} and false positives is C_{01}.

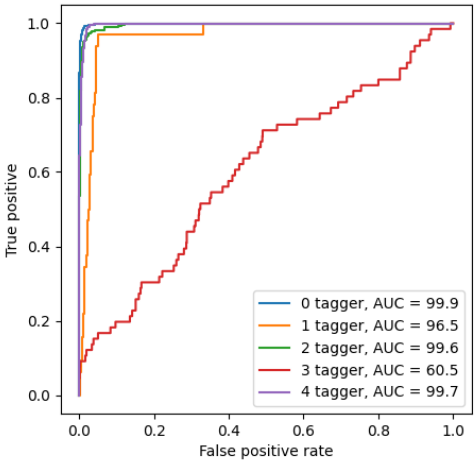


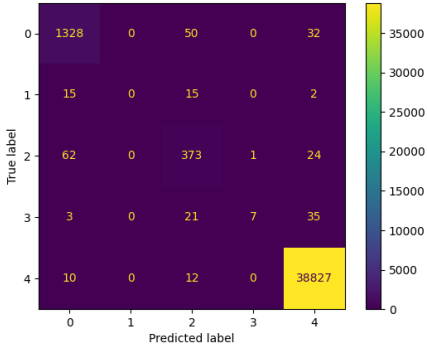
- Labels;

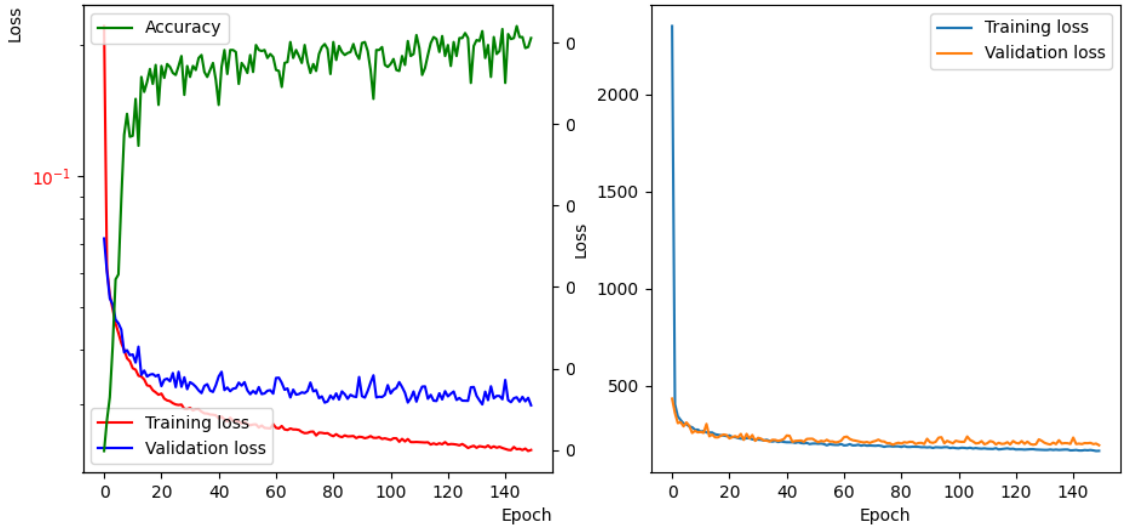
position	label	int
-800. < z < -500.	collimeter	0
-500. < z < -305.	air1	1
-305. < z < -295.	target	2
-295. < z < 0.	air2	3
0. < z < 300.	beam dump	4

- Hot encoding;

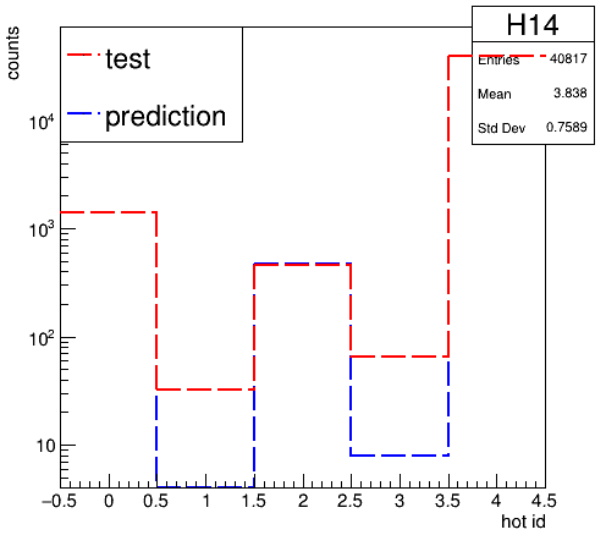
	collimeter	air1	target	air2	beam dump
collimeter	1	0	0	0	0
air1	0	1	0	0	0
target	0	0	1	0	0
air2	0	0	0	1	0
beam dump	0	0	0	0	1


True positive
False positive rate
0 tagger, AUC = 99.9
1 tagger, AUC = 96.5
2 tagger, AUC = 99.6
3 tagger, AUC = 60.5
4 tagger, AUC = 99.7

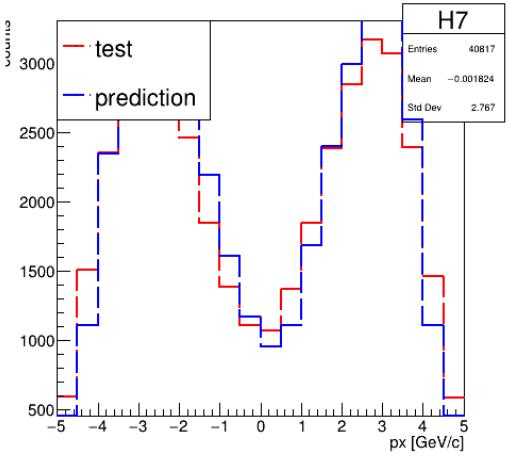

True label
Predicted label
1328 0 50 0 32
15 0 15 0 2
62 0 373 1 24
3 0 21 7 35
10 0 12 0 38827

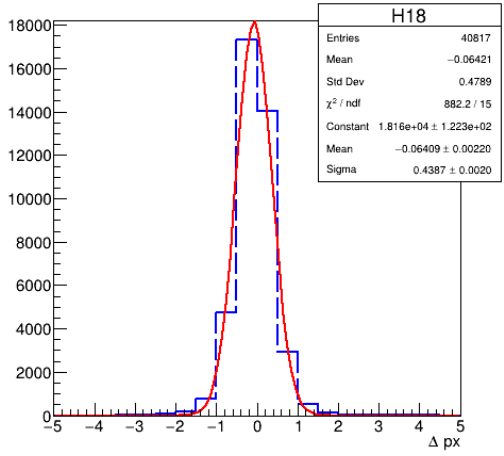

Loss
Accuracy
10^{-1}
Training loss
Validation loss
0
20
40
60
80
100
120
140
Epoch
Loss
Training loss
Validation loss
2000
1500
1000
500
0
20
40
60
80
100
120
140
Epoch

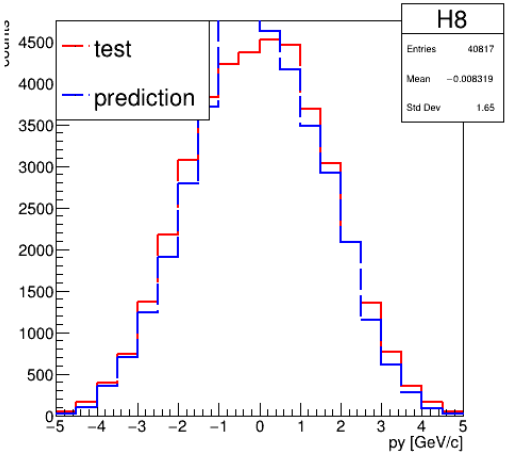
Tagging Task

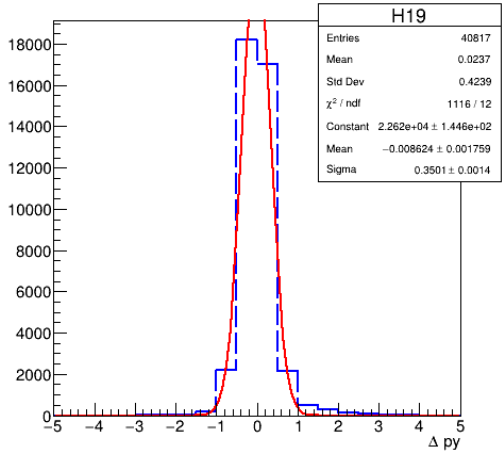


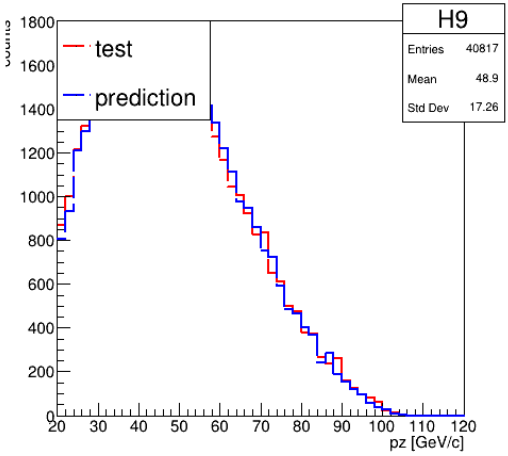
- Classification layer almost predict bins except for bin with `hot_id = 1, 3`, with `Accuracy for the test set: 0.9931`

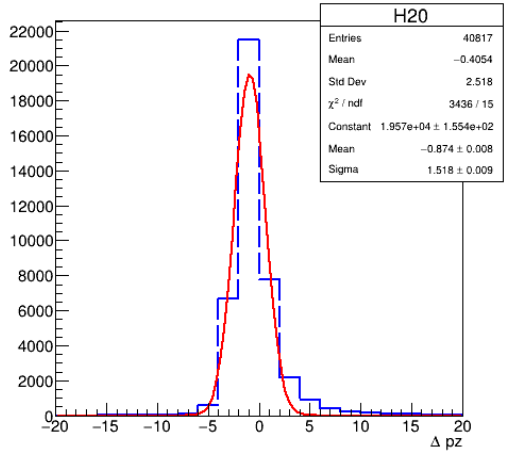

test
prediction
H7
Entries 40817
Mean −0.001824
Std Dev 2.767
px [GeV/c]

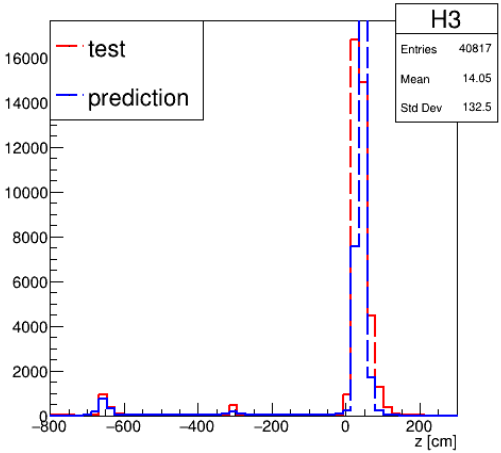

H18
Entries 40817
Mean −0.06421
Std Dev 0.4789
χ² / ndf 882.2 / 15
Constant 1.816e+04 ± 1.223e+02
Mean −0.06409 ± 0.00220
Sigma 0.4387 ± 0.0020
Δ px

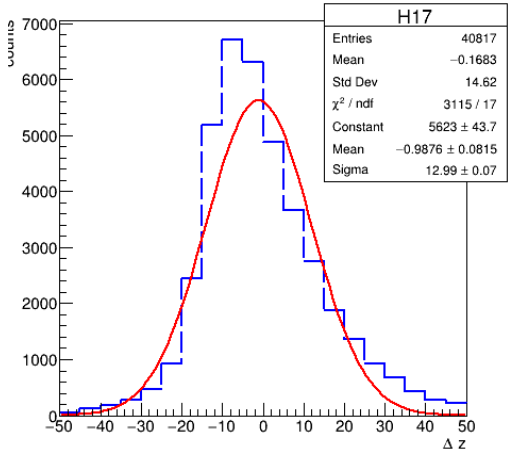

H8
test
prediction
Entries 40817
Mean −0.008319
Std Dev 1.65
py [GeV/c]

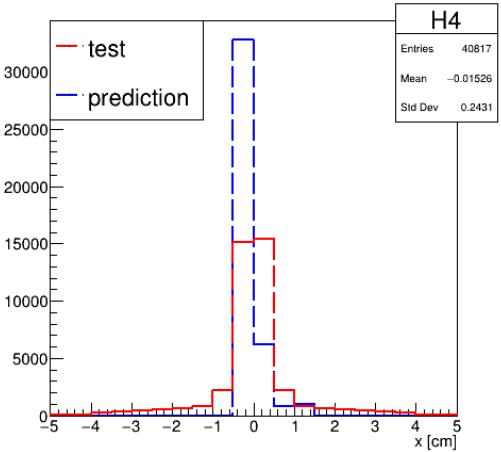

H19
Entries 40817
Mean 0.0237
Std Dev 0.4239
χ² / ndf 1116 / 12
Constant 2.262e+04 ± 1.446e+02
Mean −0.008624 ± 0.001759
Sigma 0.3501 ± 0.0014
Δ py

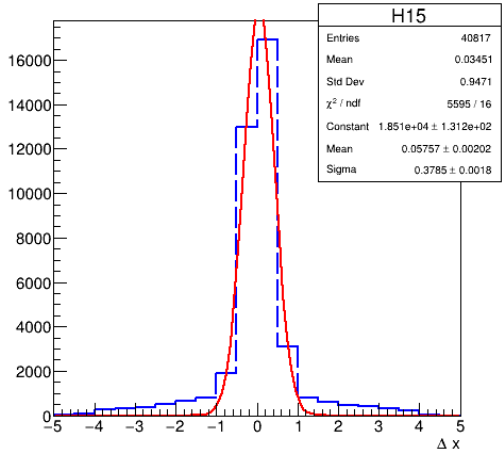

H9
Entries 40817
Mean 48.9
Std Dev 17.26
test
prediction
pz [GeV/c]

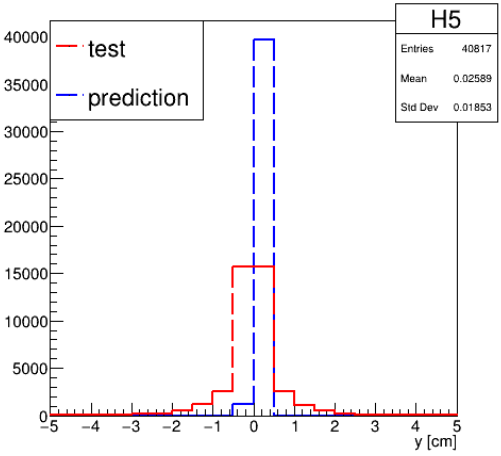

H20
Entries 40817
Mean −0.4054
Std Dev 2.518
χ² / ndf 3436 / 15
Constant 1.957e+04 ± 1.554e+02
Mean −0.874 ± 0.008
Sigma 1.518 ± 0.009
Δ pz

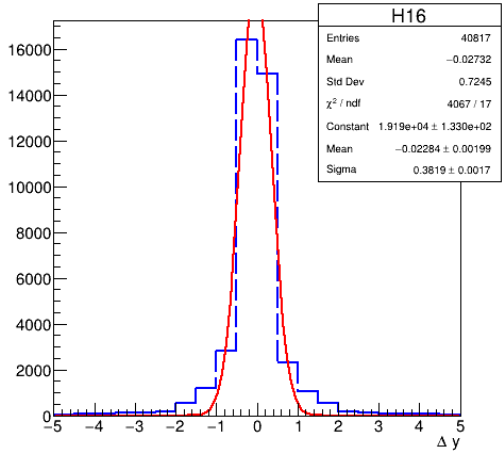

H3
Entries 40817
Mean 14.05
Std Dev 132.5
test
prediction
z [cm]


H17
Entries 40817
Mean −0.1683
Std Dev 14.62
χ² / ndf 3115 / 17
Constant 5623 ± 43.7
Mean −0.9876 ± 0.0815
Sigma 12.99 ± 0.07
Δ z


test
prediction
H4
Entries 40817
Mean −0.01526
Std Dev 0.2431
x [cm]


H15
Entries 40817
Mean 0.03451
Std Dev 0.9471
χ² / ndf 5595 / 16
Constant 1.851e+04 ± 1.312e+02
Mean 0.05757 ± 0.00202
Sigma 0.3785 ± 0.0018
Δ x


H5
Entries 40817
Mean 0.02589
Std Dev 0.01853
test
prediction
y [cm]


H16
Entries 40817
Mean −0.02732
Std Dev 0.7245
χ² / ndf 4067 / 17
Constant 1.919e+04 ± 1.330e+02
Mean −0.02284 ± 0.00199
Sigma 0.3819 ± 0.0017
Δ y

Preparation for Beam Time

- Forhad and I plan to test the spare modules and make a inventory.
- Optimising hodoscope efficiencies.
  - We have the software (Thanks to Forhad)
  - Online monitoring ?