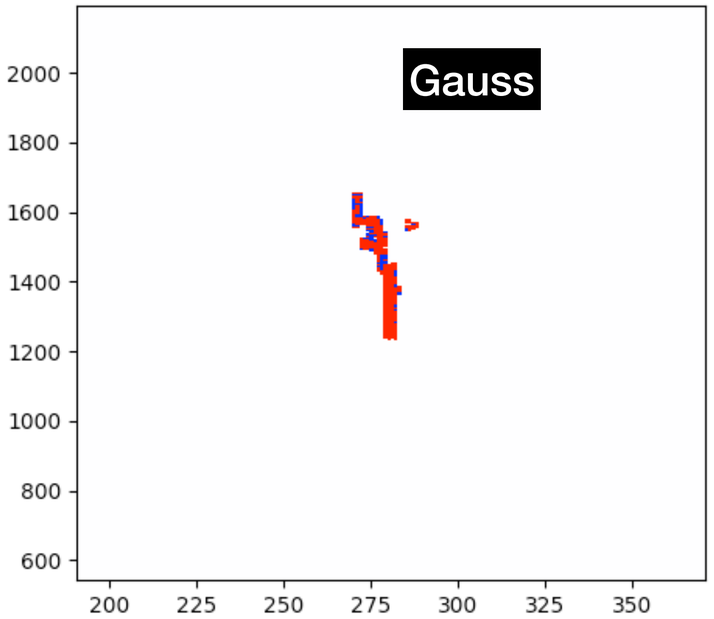
DNNROI for PDHD [showers]

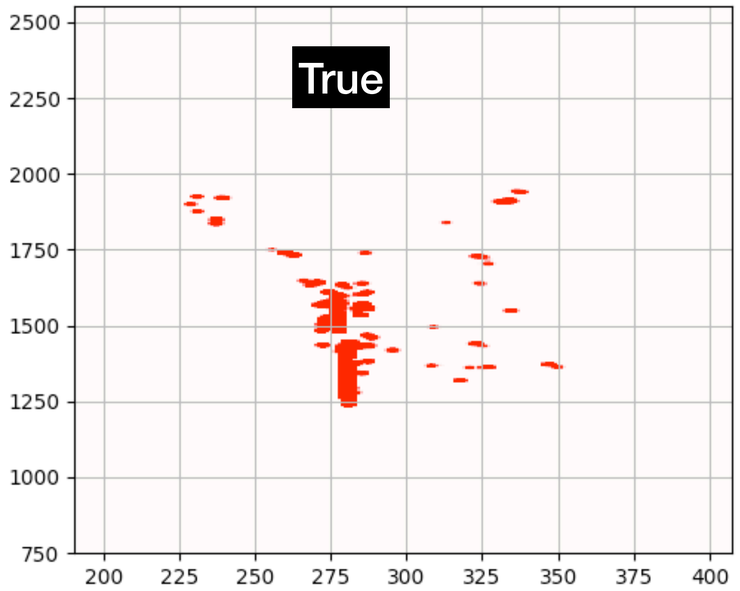
Sergey Martynenko

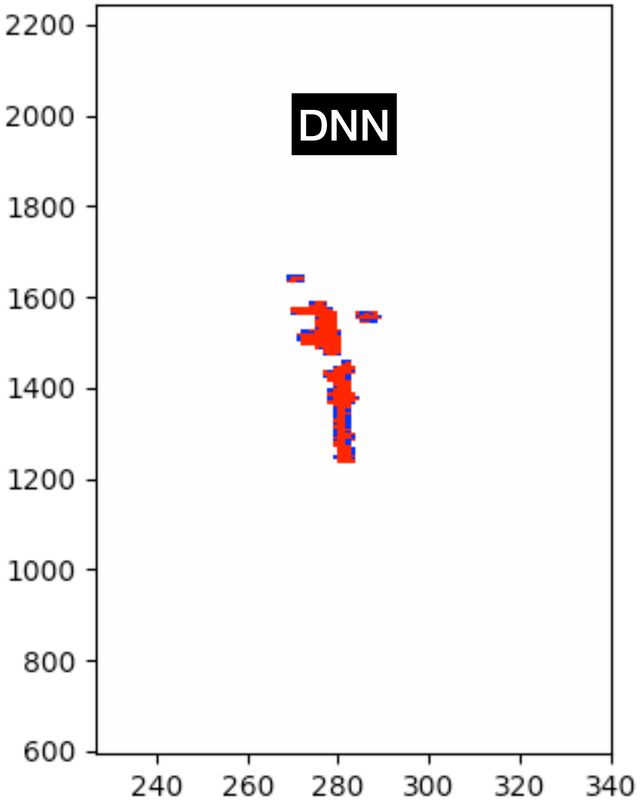
Evaluate showers

- Each event has single e- simulated in the ~middle of the detector
- Energy bins 100MeV, 500MeV, 1GeV, 1.5GeV
- Angles XY: 5deg, Angles XZ = 0,15,45,60,90deg [drift along X]
- Evaluate on total activity in the event per plane :
  - Simulate 20 event per Angle/Energy bin
  - Calculate quantile bias and resolution based on total energy seen by each plane $((E^{tot}_{true} - E^{tot}_{reco})/E^{tot}_{true})$

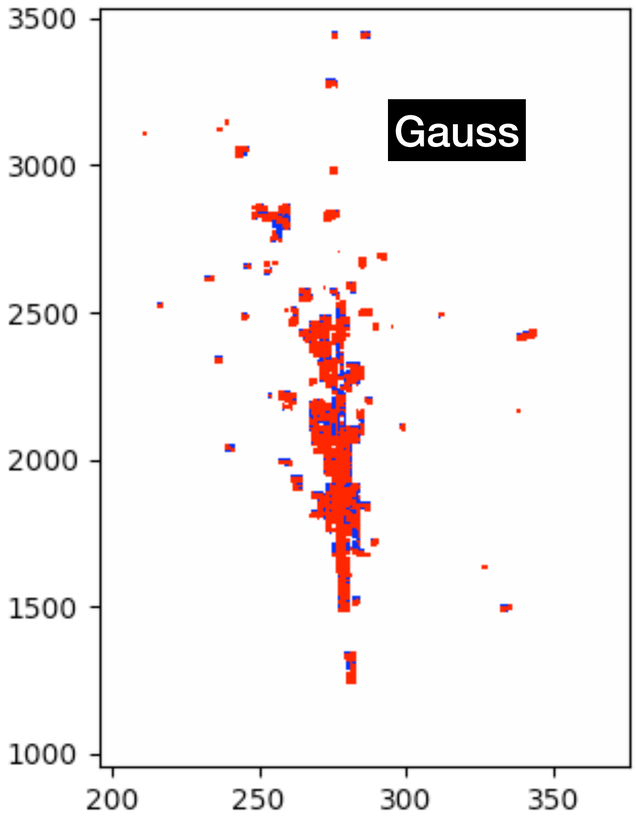
Example of 100MeV 90 deg XZ electron U-plane

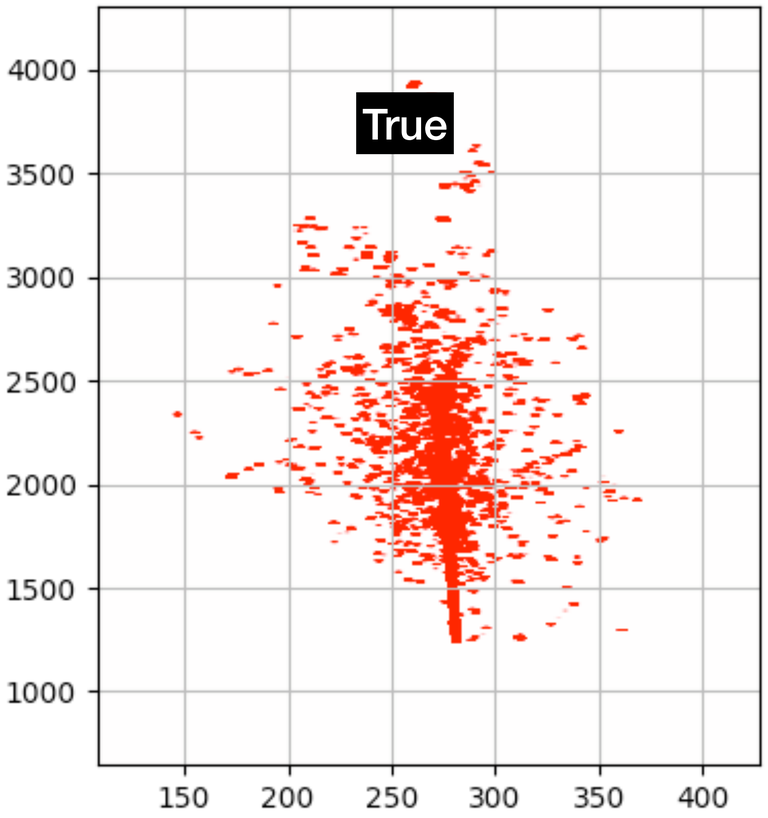


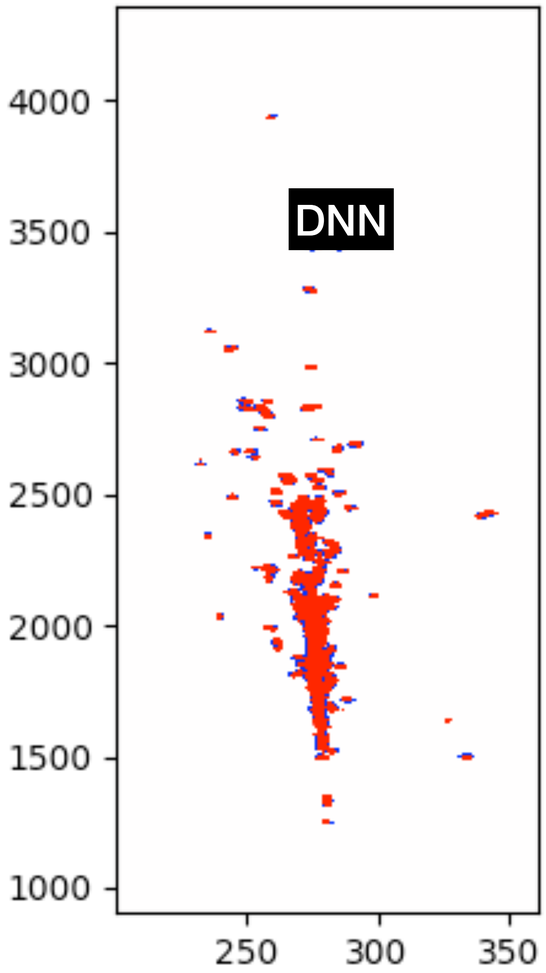


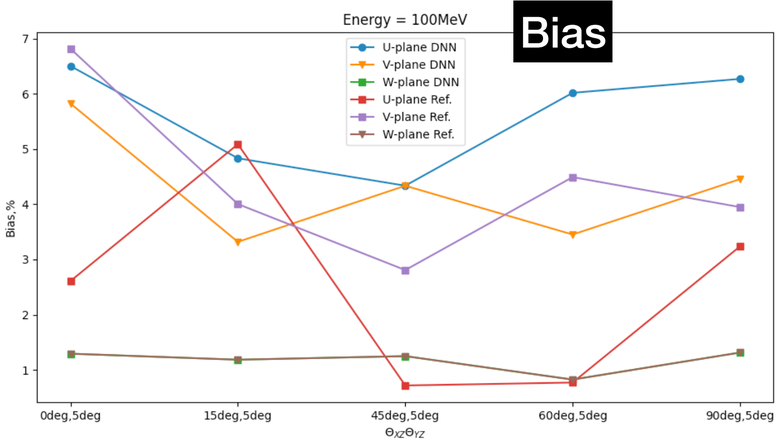


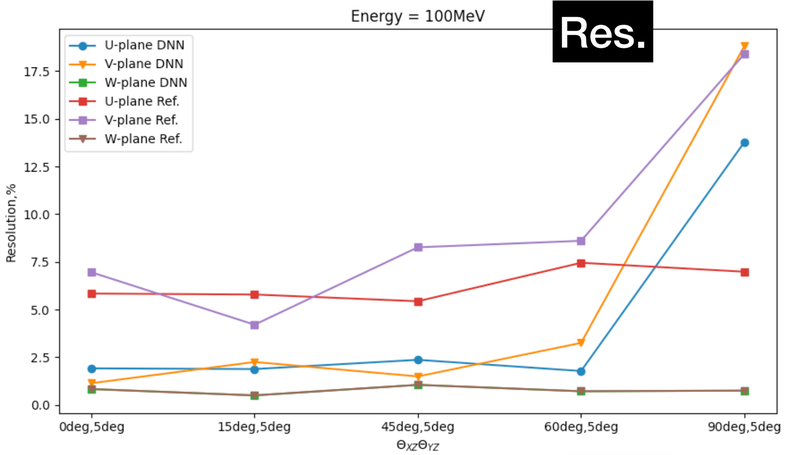
Example of 1.5GeV 90 deg XZ electron U-plane

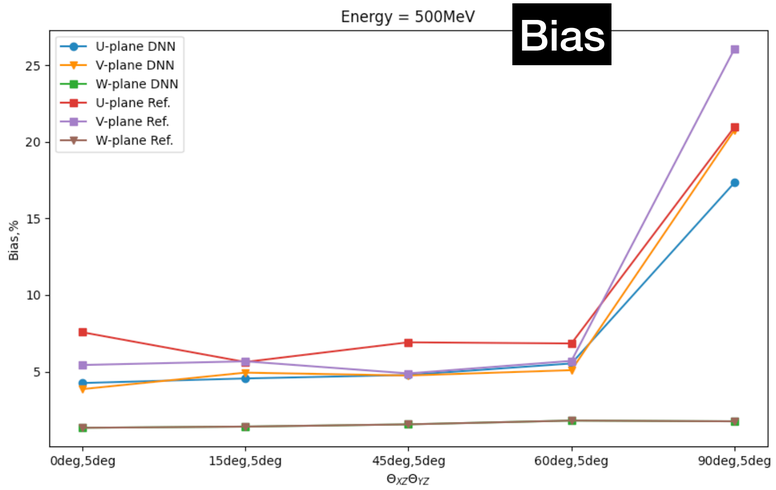


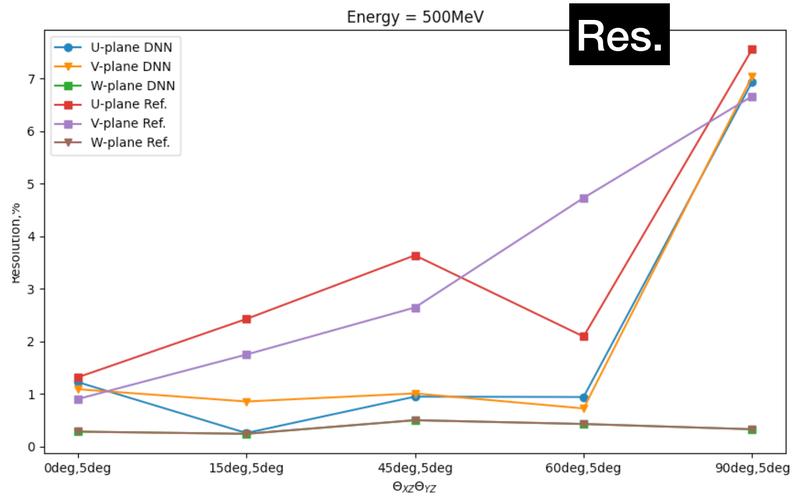


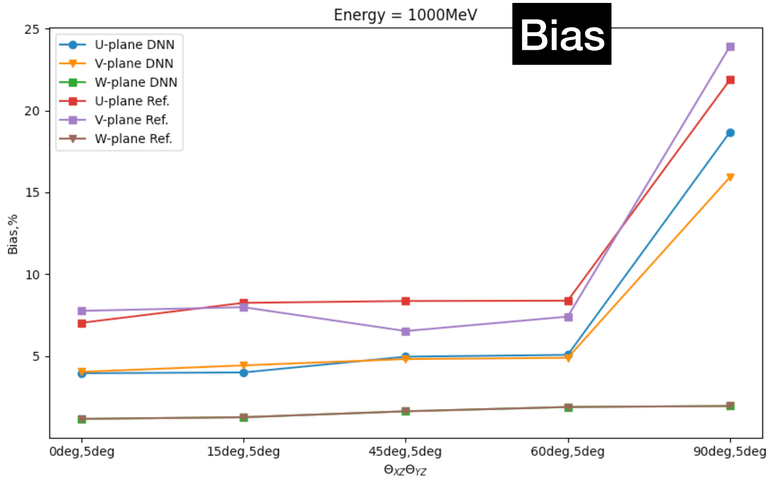


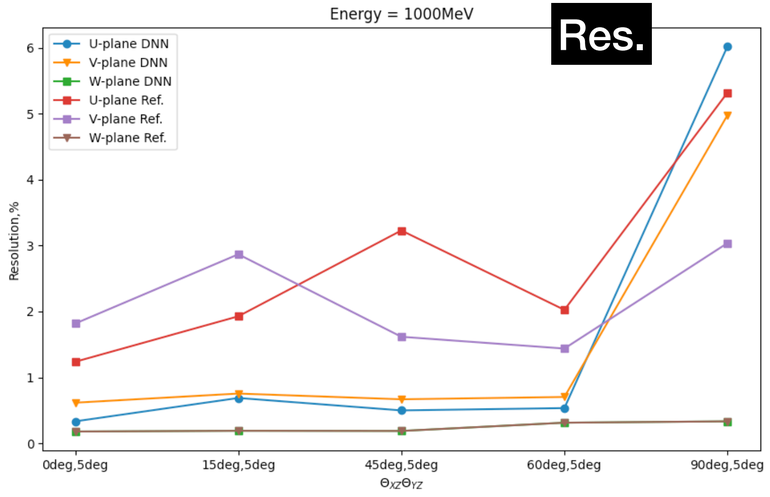




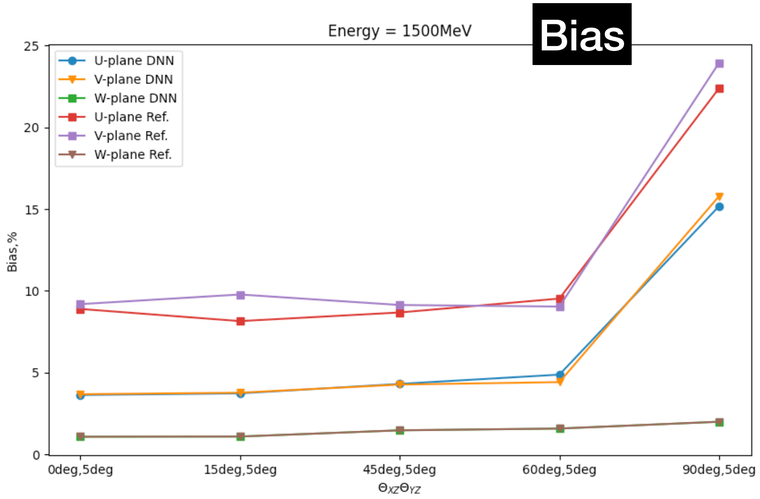


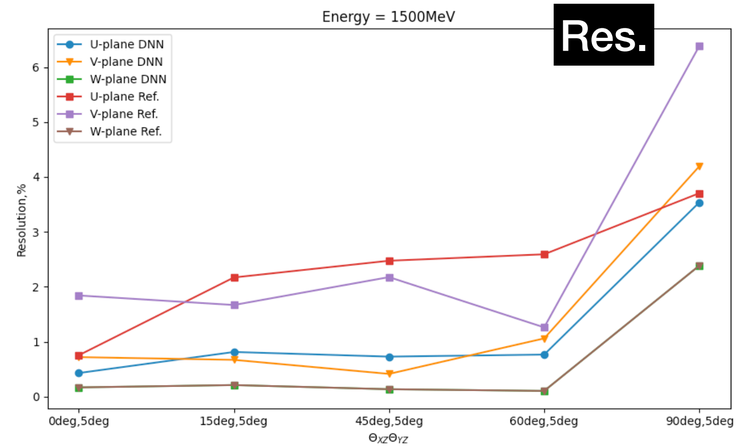






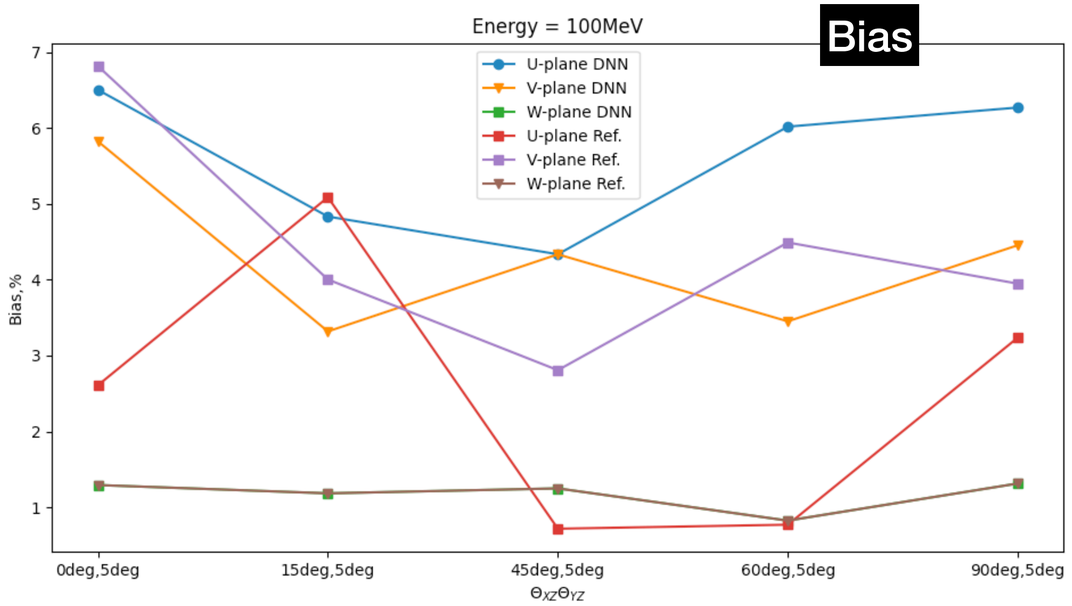
- Performance for DNN and Ref. are visually very close for all angles/ energies
- Bias is comparable between DNN and Ref. for lower energies with DNN outperforming Ref. at higher energies
- Resolution is generally smaller for DNN case (excluding 90deg angle)

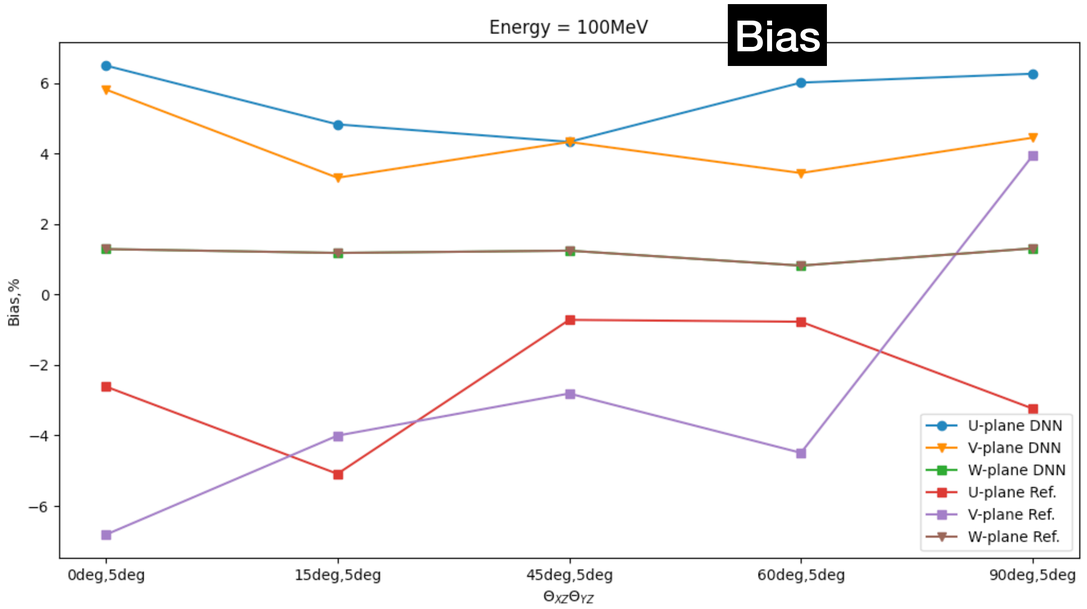




Check sign of the bias

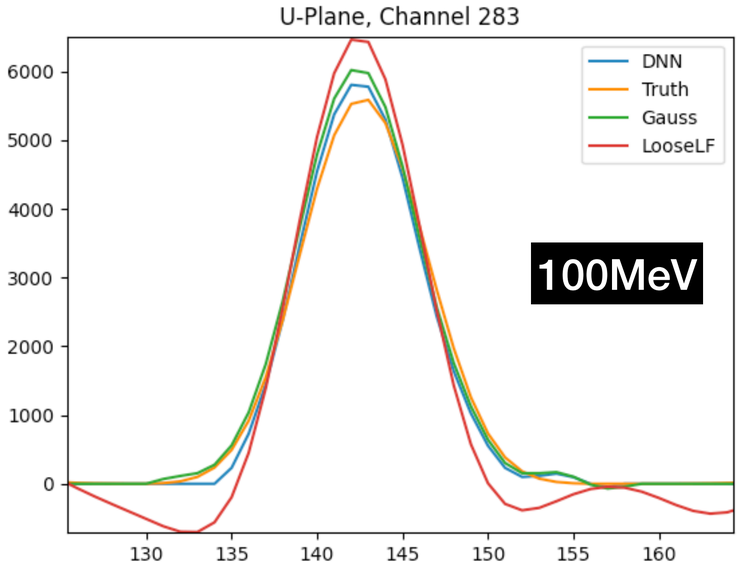
- Previously bias was plotted as absolute value
- Switching to signed value only 100MeV bin changes - > Reference bias becomes negative
- Lets check WF of one 15deg event

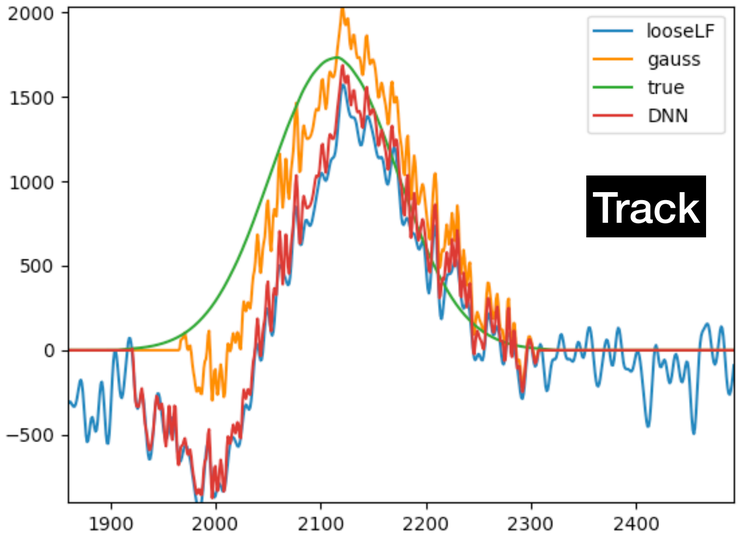


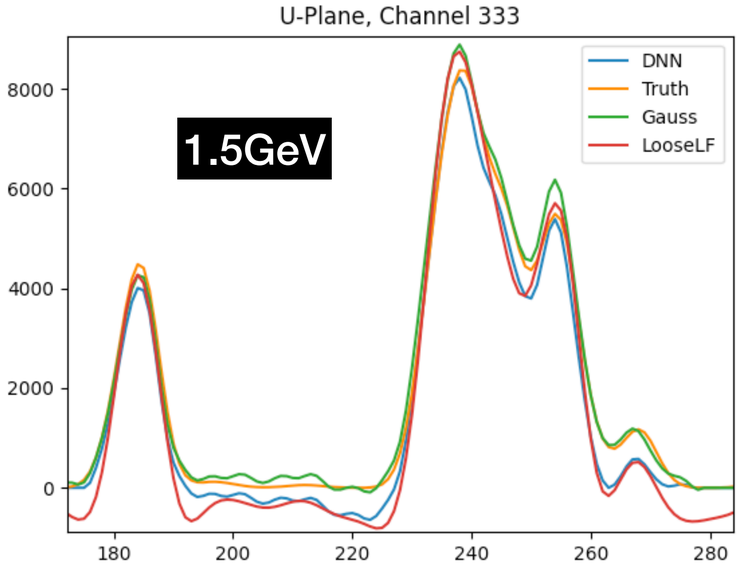


Look at WF on specific channel

- Lets check WF of one 15deg event
- Check 100MeV and 1.5GeV cases where channel has Reference reco. charge > True, but DNN reco. charge <= True
  - DNN generally follows LooseLF WF much close, especially **outside of the peak**
- Similar check for tracks is also performed



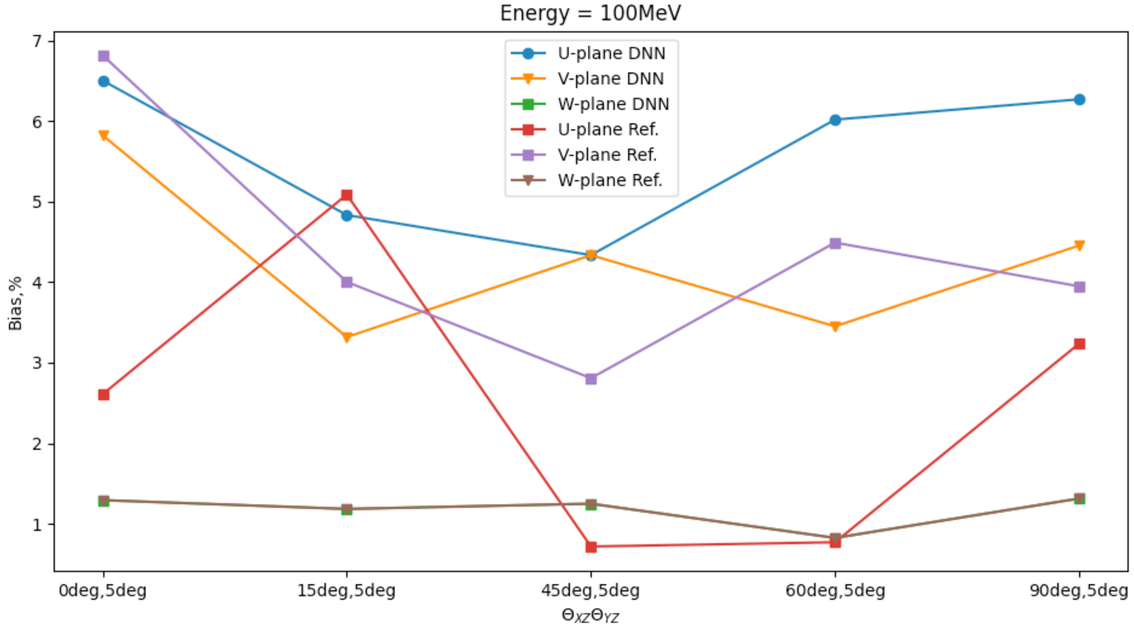


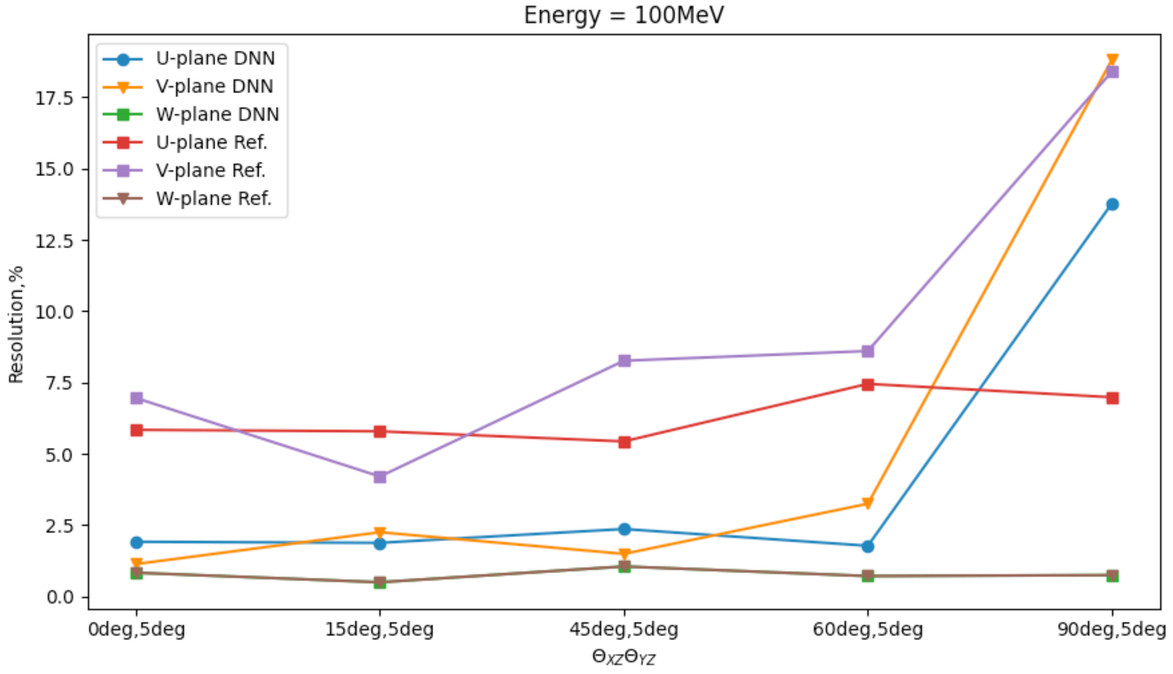


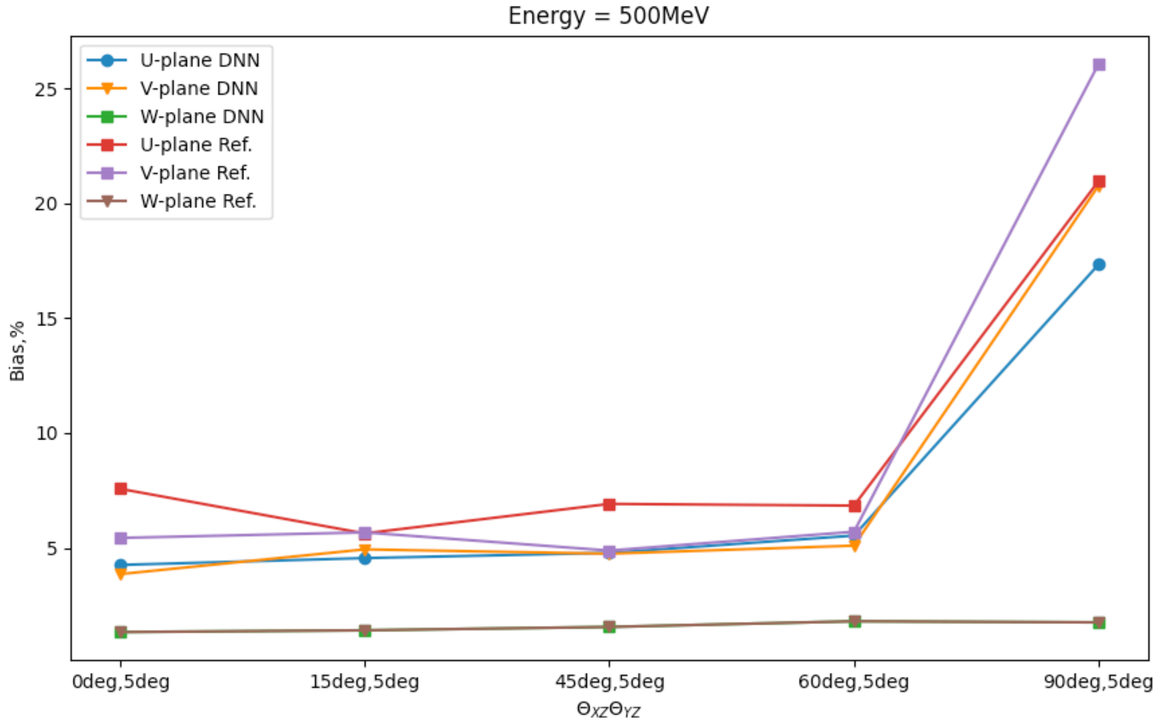
Summary

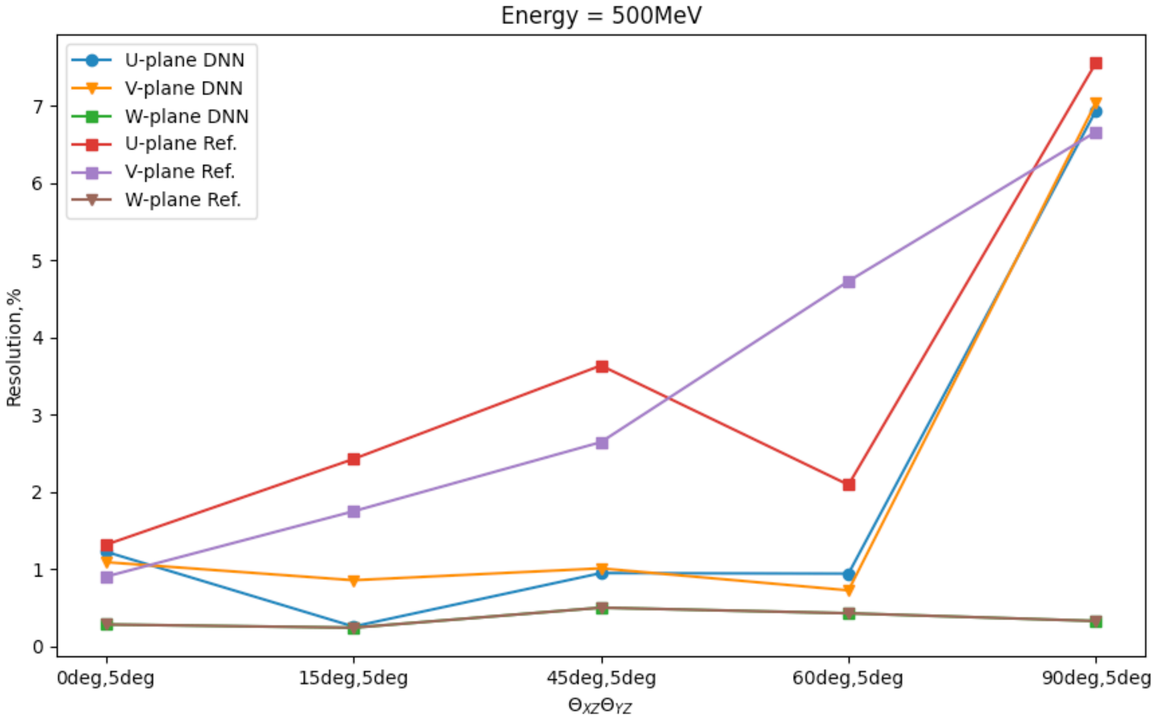
- Performance for DNN and Ref. are visually very close for all angles/ energies
- Bias is comparable between DNN and Ref. for lower energies with DNN outperforming Ref. at higher energies
- Resolution is generally smaller for DNN case (excluding 90deg angle)

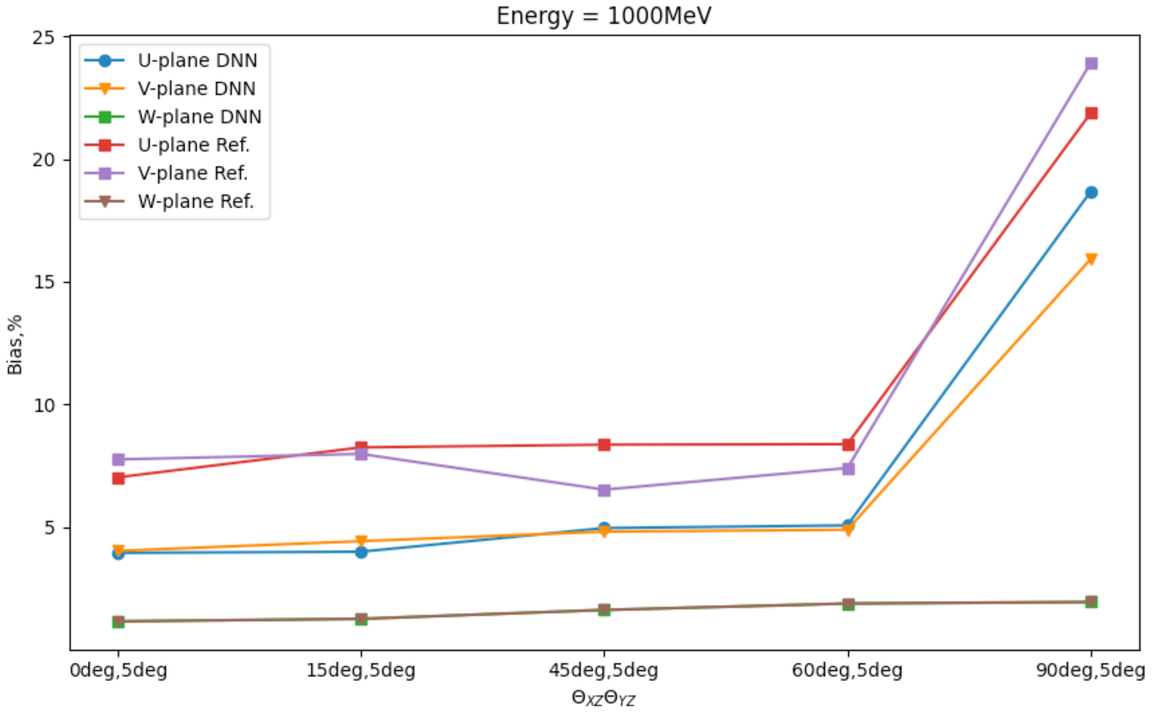
- DNN does not give much improvement for a single shower

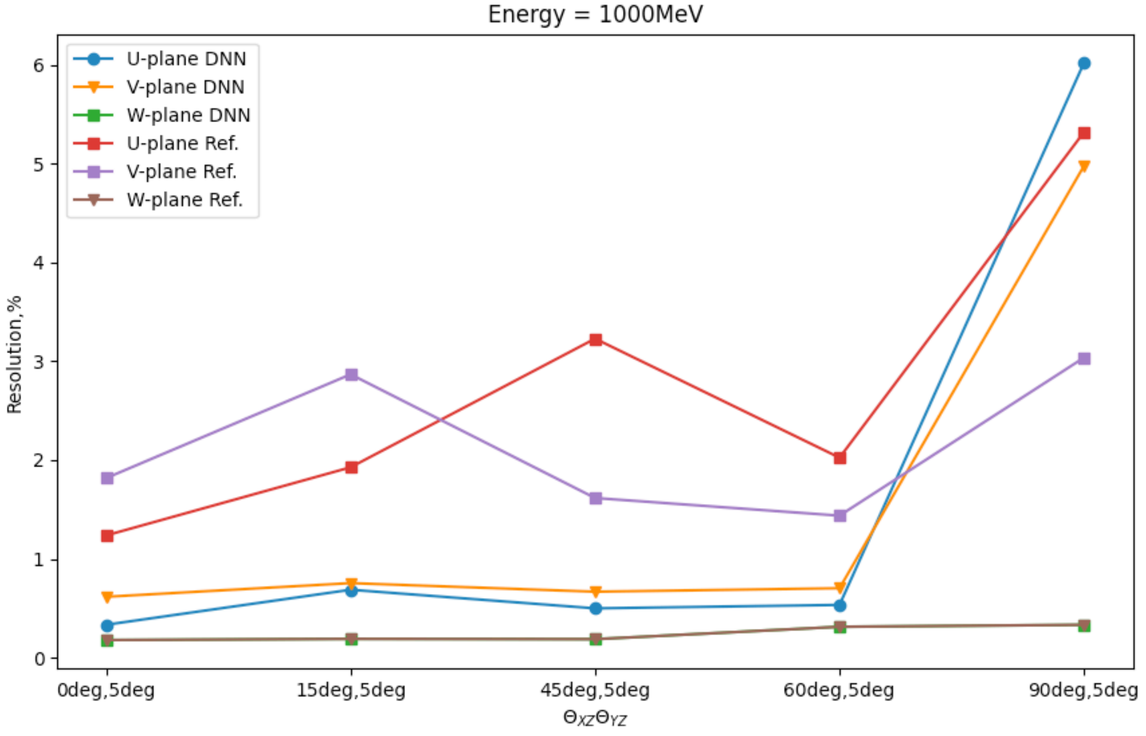

Energy = 100MeV
U-plane DNN
V-plane DNN
W-plane DNN
U-plane Ref.
V-plane Ref.
W-plane Ref.
Bias,%
0deg,5deg
15deg,5deg
45deg,5deg
60deg,5deg
90deg,5deg
ΘXZΘYZ

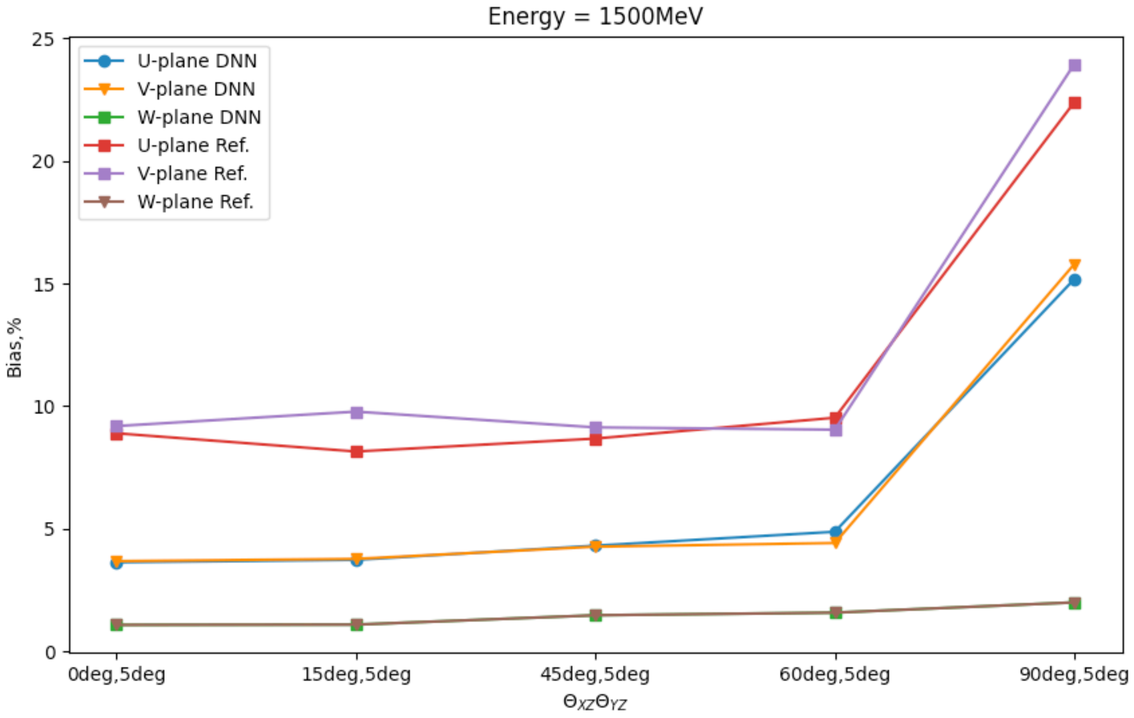

Energy = 100MeV
U-plane DNN
V-plane DNN
W-plane DNN
U-plane Ref.
V-plane Ref.
W-plane Ref.
Resolution,%
0deg,5deg
15deg,5deg
45deg,5deg
60deg,5deg
90deg,5deg
ΘXZΘYZ

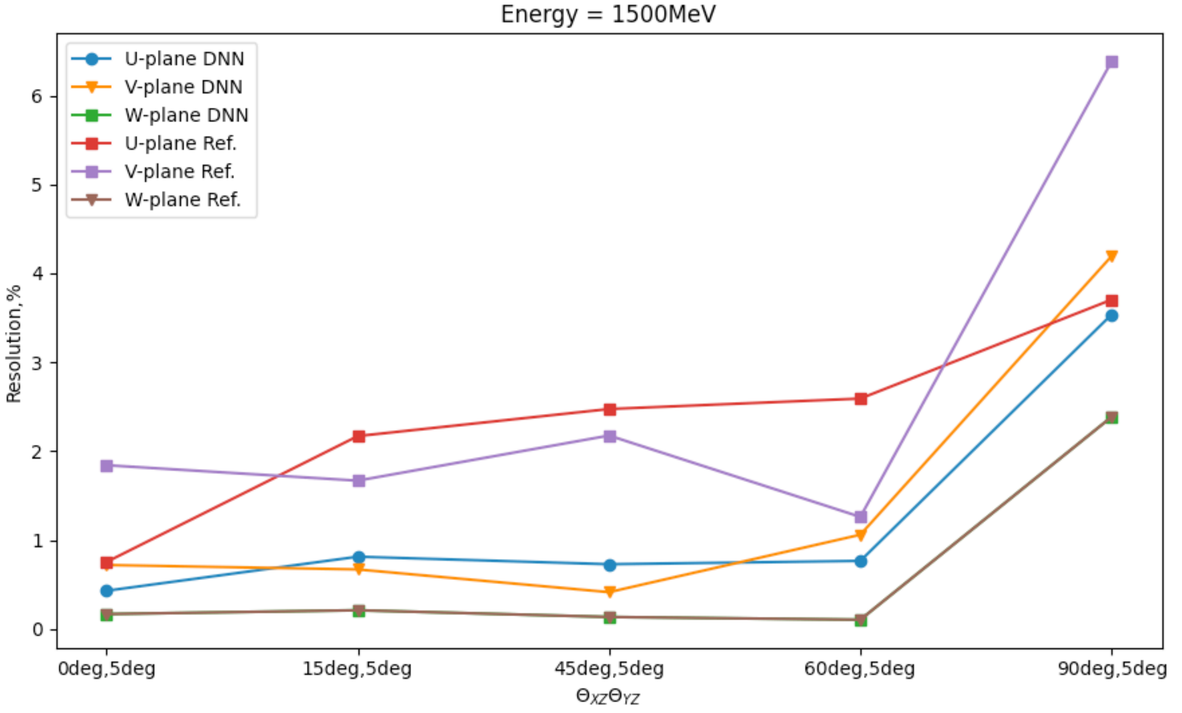

Energy = 500MeV
U-plane DNN
V-plane DNN
W-plane DNN
U-plane Ref.
V-plane Ref.
W-plane Ref.
Bias,%
25
20
15
10
5
0deg,5deg
15deg,5deg
45deg,5deg
60deg,5deg
90deg,5deg
ΘXZΘYZ


Energy = 500MeV
U-plane DNN
V-plane DNN
W-plane DNN
U-plane Ref.
V-plane Ref.
W-plane Ref.
Resolution,%
7
6
5
4
3
2
1
0
0deg,5deg
15deg,5deg
45deg,5deg
60deg,5deg
90deg,5deg
ΘXZΘYZ


Energy = 1000MeV
U-plane DNN
V-plane DNN
W-plane DNN
U-plane Ref.
V-plane Ref.
W-plane Ref.
Bias,%
25
20
15
10
5
0deg,5deg
15deg,5deg
45deg,5deg
60deg,5deg
90deg,5deg
ΘXZΘYZ


Energy = 1000MeV
U-plane DNN
V-plane DNN
W-plane DNN
U-plane Ref.
V-plane Ref.
W-plane Ref.
Resolution,%
6
5
4
3
2
1
0
0deg,5deg
15deg,5deg
45deg,5deg
60deg,5deg
90deg,5deg
ΘXZΘYZ


Energy = 1500MeV
U-plane DNN
V-plane DNN
W-plane DNN
U-plane Ref.
V-plane Ref.
W-plane Ref.
Bias,%
0
5
10
15
20
25
0deg,5deg
15deg,5deg
45deg,5deg
60deg,5deg
90deg,5deg
ΘXZΘYZ


Energy = 1500MeV
U-plane DNN
V-plane DNN
W-plane DNN
U-plane Ref.
V-plane Ref.
W-plane Ref.
Resolution,%
0
1
2
3
4
5
6
0deg,5deg
15deg,5deg
45deg,5deg
60deg,5deg
90deg,5deg
ΘXZΘYZ