CNN Vertex Reconstruction: Summer Work Summarized

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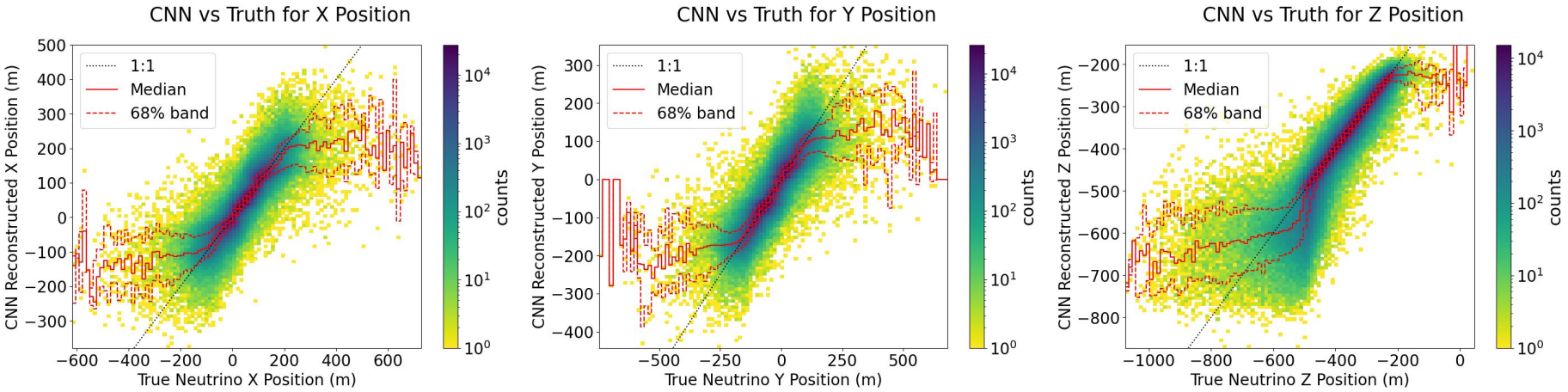
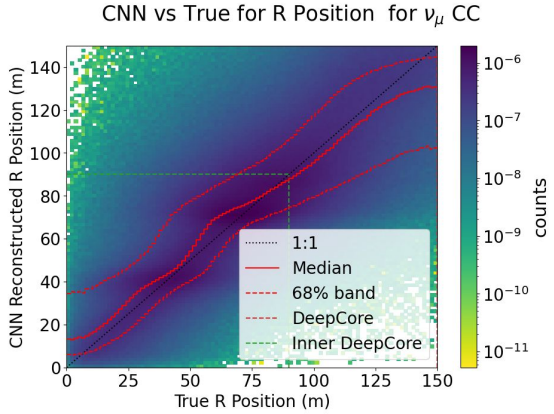
Initial Training and Testing: A Success!

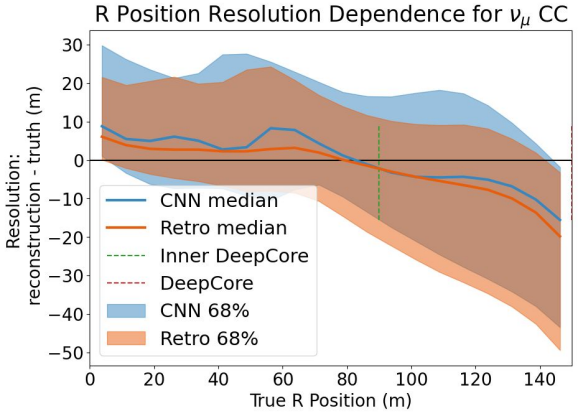


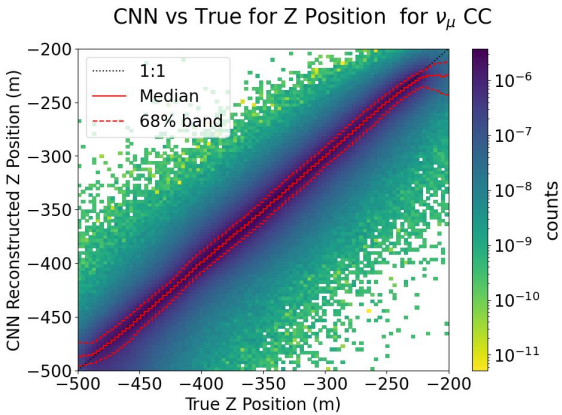
- Similar results as Retro Reco
- Success reconstructing within DeepCore
- As expected, less successful reconstructing outside DeepCore

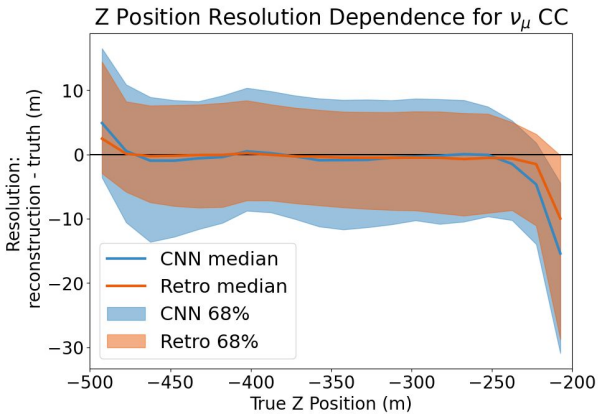
Calculating R and Working on Containment Cuts

- Very Pretty Plots
  - No Really look at that Z
- Results comparable to Retro
- Yay Go Go DeepCore!
- Could we improve by training for R?
  - Current version: train XYZ, calculate R
  - Maybe, we didn't get to try that



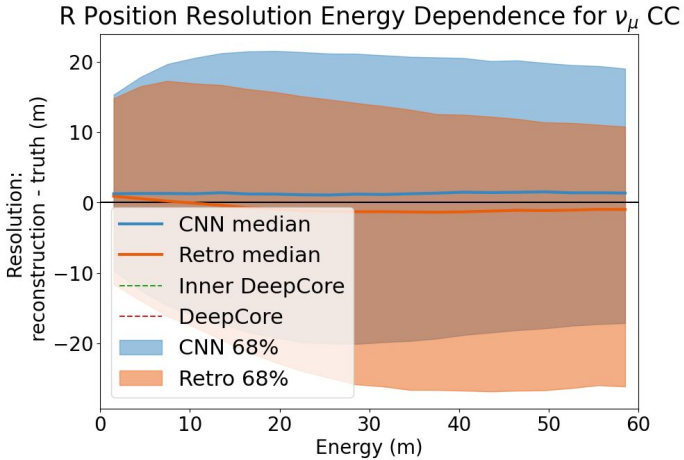


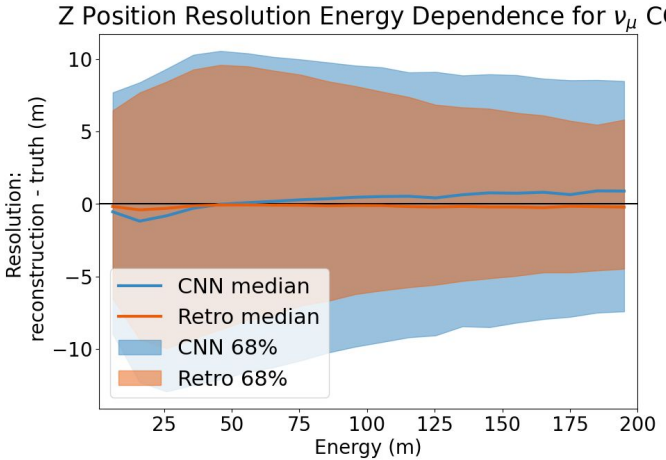




Checking for Energy Dependence

- Showed no significant dependence on Energy in R or Z
- Yay! That's what we were hoping





Playing with Confusion Matrices

CNN R < 150	*True Contained*	*True Cut*
CNN Contained	85.4914%	2.5628%
CNN Cut	3.1182%	8.8277%

Retro R < 150	*True Contained*	*True Cut*
Retro Contained	86.7657%	3.3193%
Retro Cut	1.8439%	8.0712%

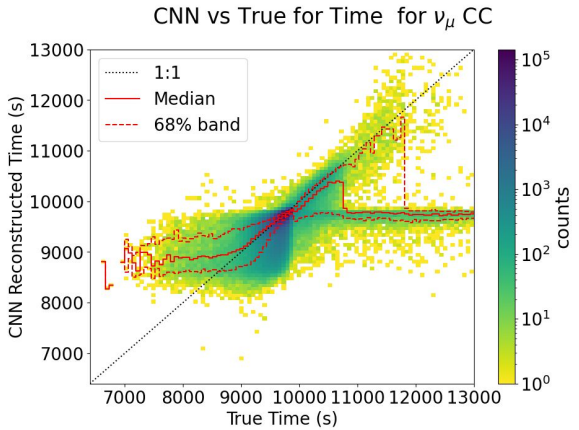
CNN -500 < Z < -200	*True Contained*	*True Cut*
CNN Contained	87.0742%	0.4471%
CNN Cut	3.9193%	8.5595%

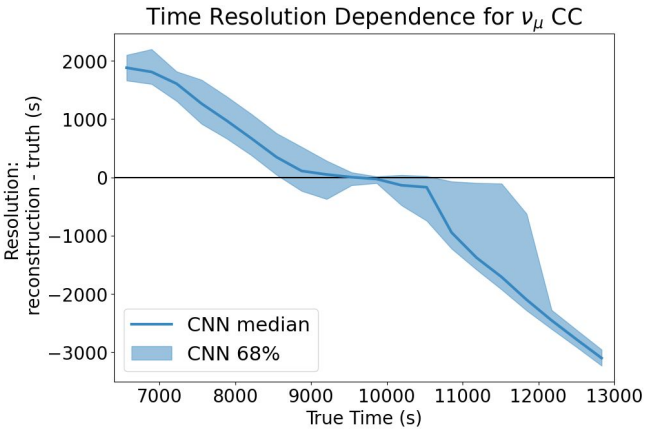
Retro -500 < Z < -200	*True Contained*	*True Cut*
Retro Contained	90.1845%	1.3630%
Retro Cut	0.8089%	7.6436%

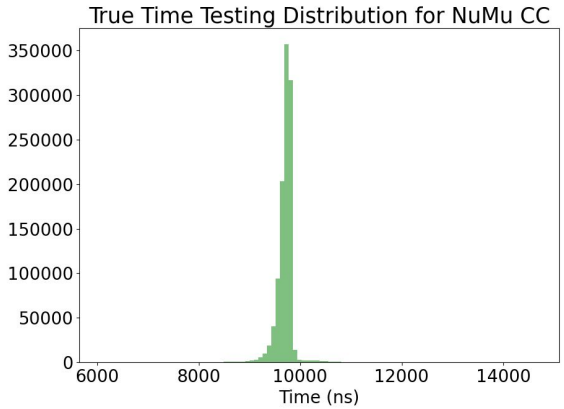
- Gave us a better picture of how we compare with Retro
- CNN taking out more events than Retro
  - Tending to cut true contained events rather than leave in uncontained events
  - Retro tends to leave in uncontained events rather than cut true events

Training and Testing for Time

- A struggle
- Distribution of true time was too clustered to get a “good” resolution
- Possible fixes: Adding random time offsets to the time to get a better distribution to give to the CNN to train and test

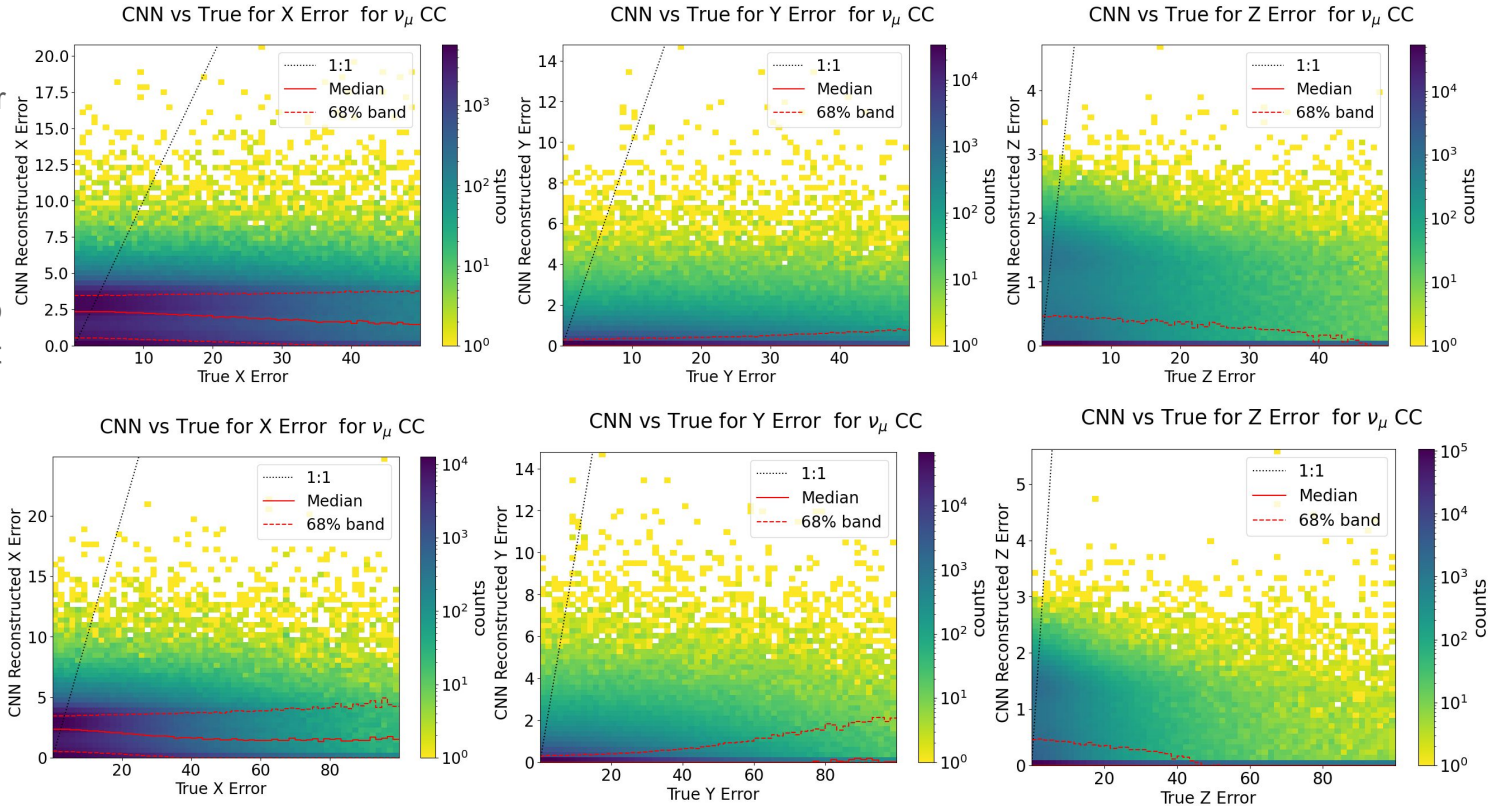






Training and Testing for Vertex Error

- Not doing great “predicting” the error
- Hoping for prediction trends (if not 1:1) to make cuts
- Needs more work to be effective for what we want



Summarizing the Summer Summary

Project Advancements

- Vertex successfully reconstructed
  - Good resolution
  - No explicit energy dependence
- Containment cuts are able to made relatively accurately
  - Ultimate goal of applying containment cuts to events while reconstructing energy, zenith, etc
- Reconstructing time thus far unsuccessful
  - Potential for future work
- Predicting vertex error thus far unsuccessful
  - Potential for future work here as well

Personal Advancements

- Gained a lot of coding experience
  - First job that involved programming!!
  - Python! Python! Python!
  - Some Bash too!
  - First time remoting into a large server!
  - Plots! Plots! Plots!
- Presented at APS DPF 2021
  - Good experience presenting outside of my typical field
- Met a lot of awesome people
  - Unfortunately only virtually :(

Thank you all for your help and support!

Have a lovely semester!