

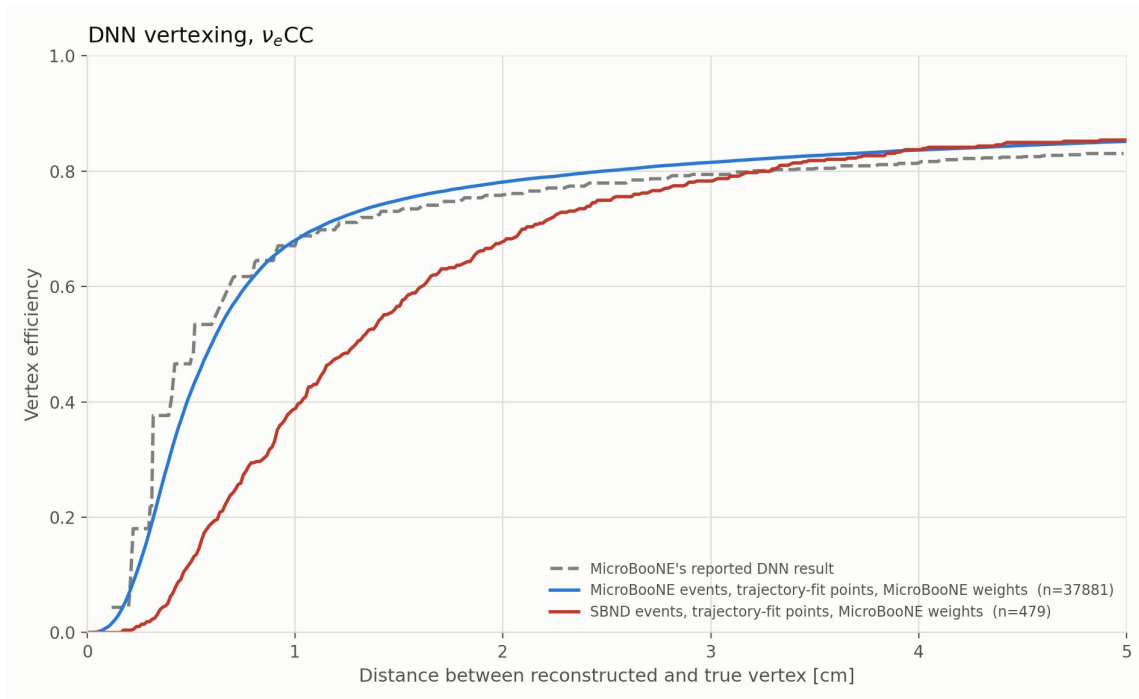
WireCell 9/8

DL-Vertexing and SCE update

DNN Parameters

- Unchanged from MicroBooNE's model
- 0.5cm voxel size
- Trajectory fit points used on all training and testing runs, except open data fine tuning, which was trained on blobs (trec training still ongoing)

MicroBooNE weights on SBND events are worse than on MicroBooNE events, as expected (same story for all samples)



MicroBooNE (blue) used provided 48k weights

MicroBooNE (blue) valued on whole dataset (37,881 ν_e events)

SBND (red) evaluated on 479 ν_e events

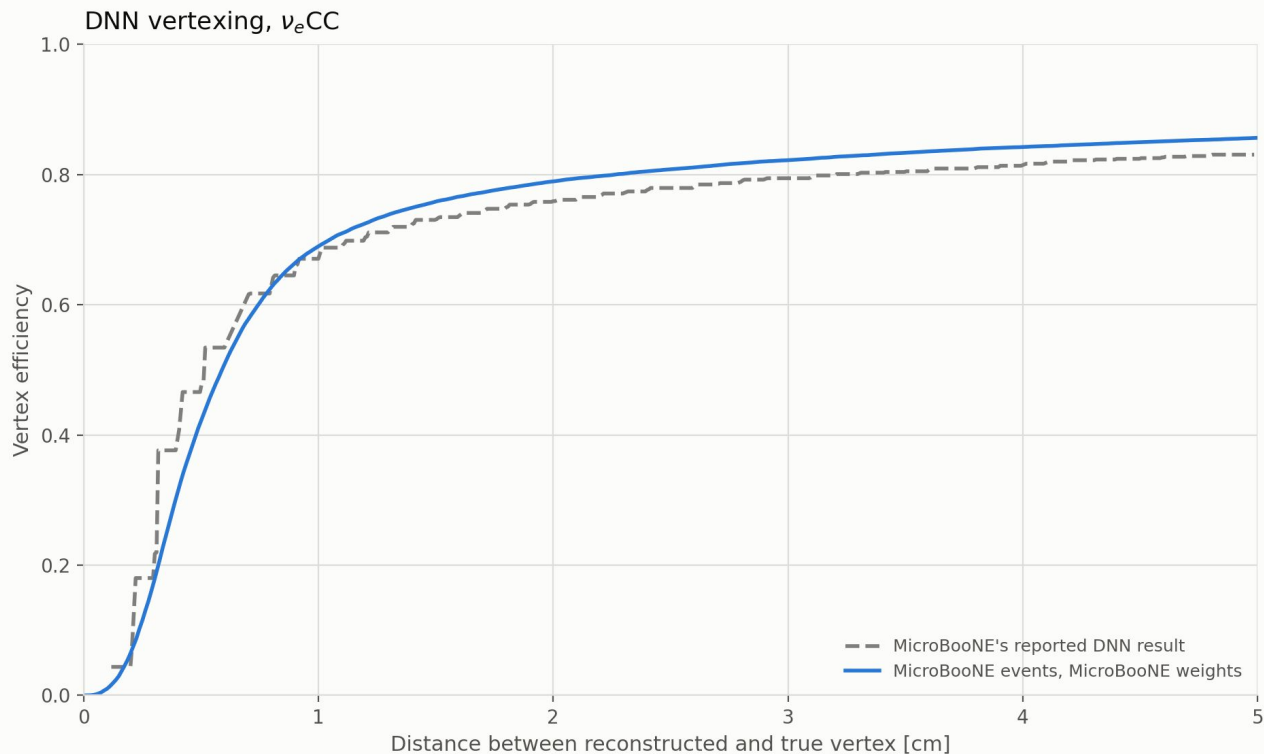
Input is trajectory-fit points and charge

DNN ν_e replication is good, but I was given a 62k set of events - I don't know which 48k was used to train it, so this is over-optimistic

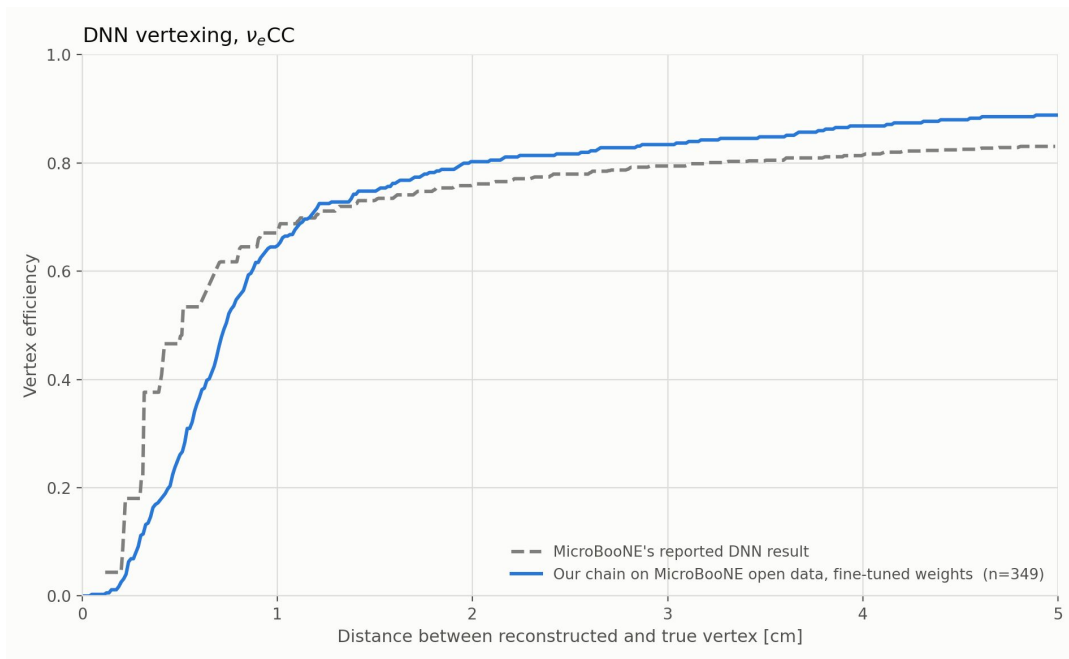
Used MicroBooNE
provided 48k weights

Evaluated on whole
dataset (37,881 ν_e
events)

Input is trajectory-fit
points and charge



DNN ν_e on open data is worse for $<1\text{cm}$, even with fine tuning



MicroBooNE (blue) used provided 48k weights, finetuned on 10,561 events

MicroBooNE (blue) valuated on 349 unseen open-data ν_e events

Input is blob-charge points and candidate voxels

Table 1: The performance with the distance between reconstructed neutrino vertex and true neutrino vertex less than 1 cm. The performance are estimated with a BNB ν overlay sample, while charged-current ν_e event efficiency are estimated with a BNB intrinsic ν_e overlay sample.

	Pandora reconstruction	Wire-Cell Traditional	Wire-Cell DNN Hybrid
Charged-current ν_μ	70.3%	67.1%	72.9%
Neutral-current	49.3%	50.6%	52.1%
Charged-current ν_e	65.2%	50.1%	65.8%

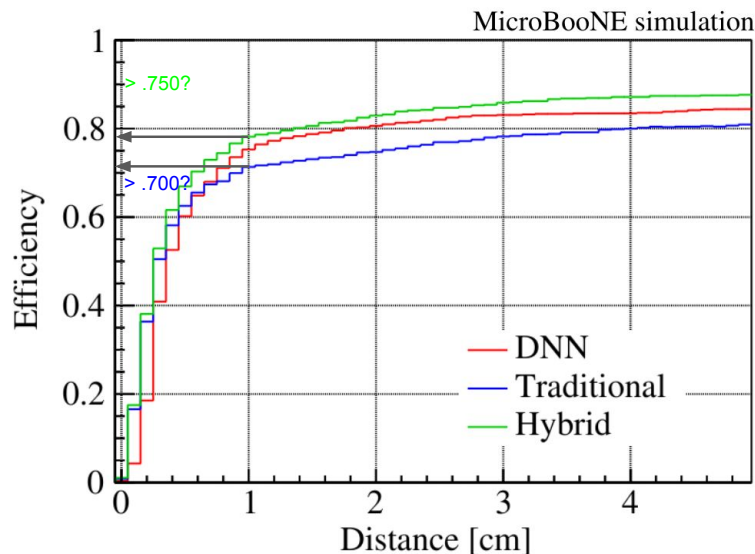
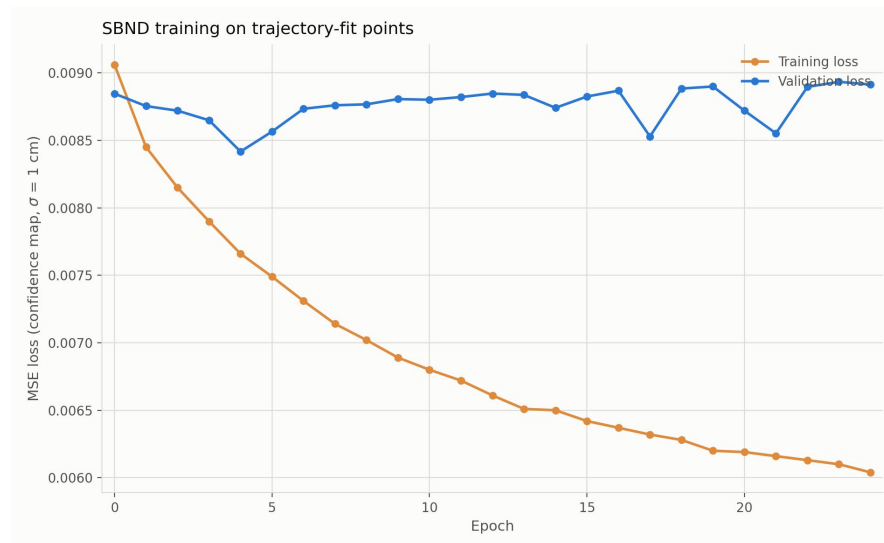


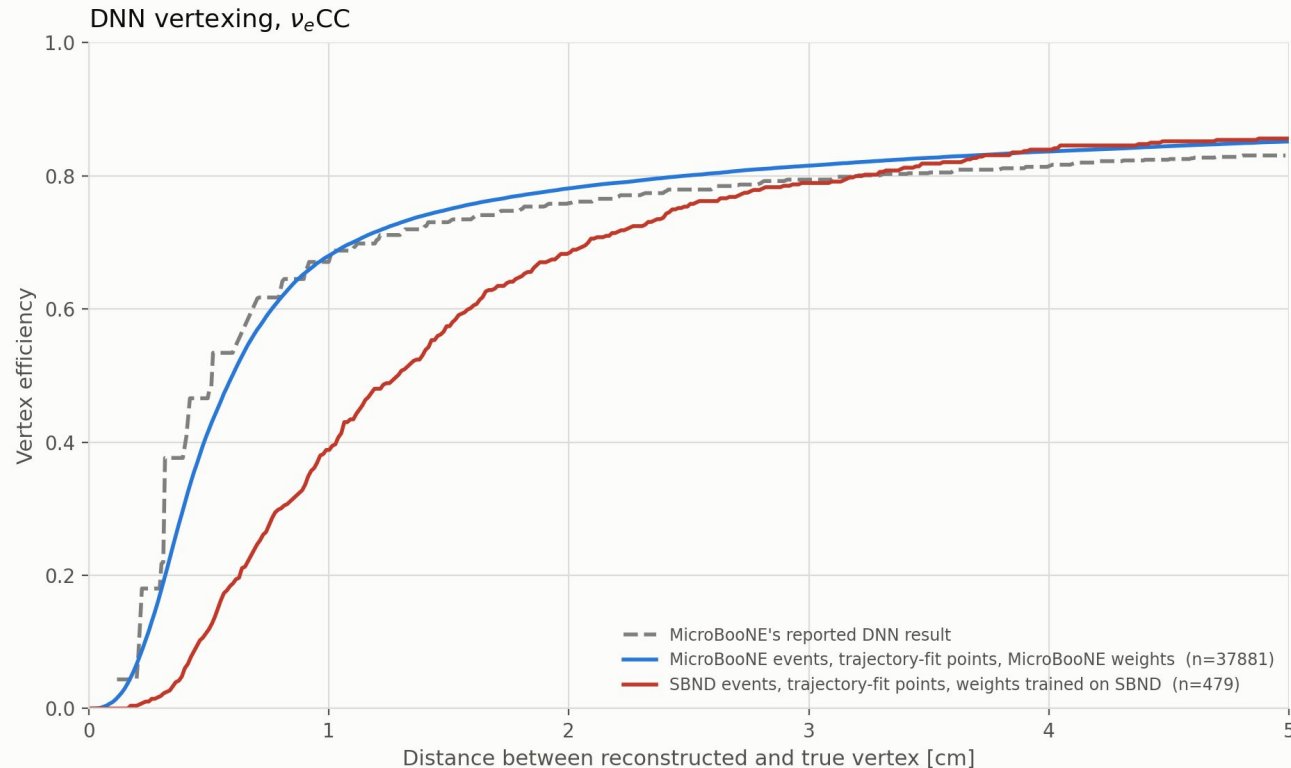
Figure 16: ν_μ CC neutrino vertex identification efficiency as a function of the maximum distance between the reconstructed and the truth, i.e., the numerator of the efficiency is defined as the number of events with a neutrino vertex reconstructed within X cm of the truth, where X is the horizontal coordinate of the plot. Three algorithms are compared: Traditional, DNN and Hybrid.

SBND Training Parameters

- Fine-tuned from MicroBooNE weights on 4,296 ν_e events, 1,041 $\nu\mu$ CC events, 406 $\nu\mu$ NC
 - Cuts on vertex in active volume, ≥ 10 fit points on training
 - Single ν events upon evaluation
- Optimizer is Adam
- Learning rate is $(10^{-4}) * e^{(-0.08 * \text{epoch})}$
- Batch size is 1



DNN ν_e replication is good, SBND is not as good (yet)



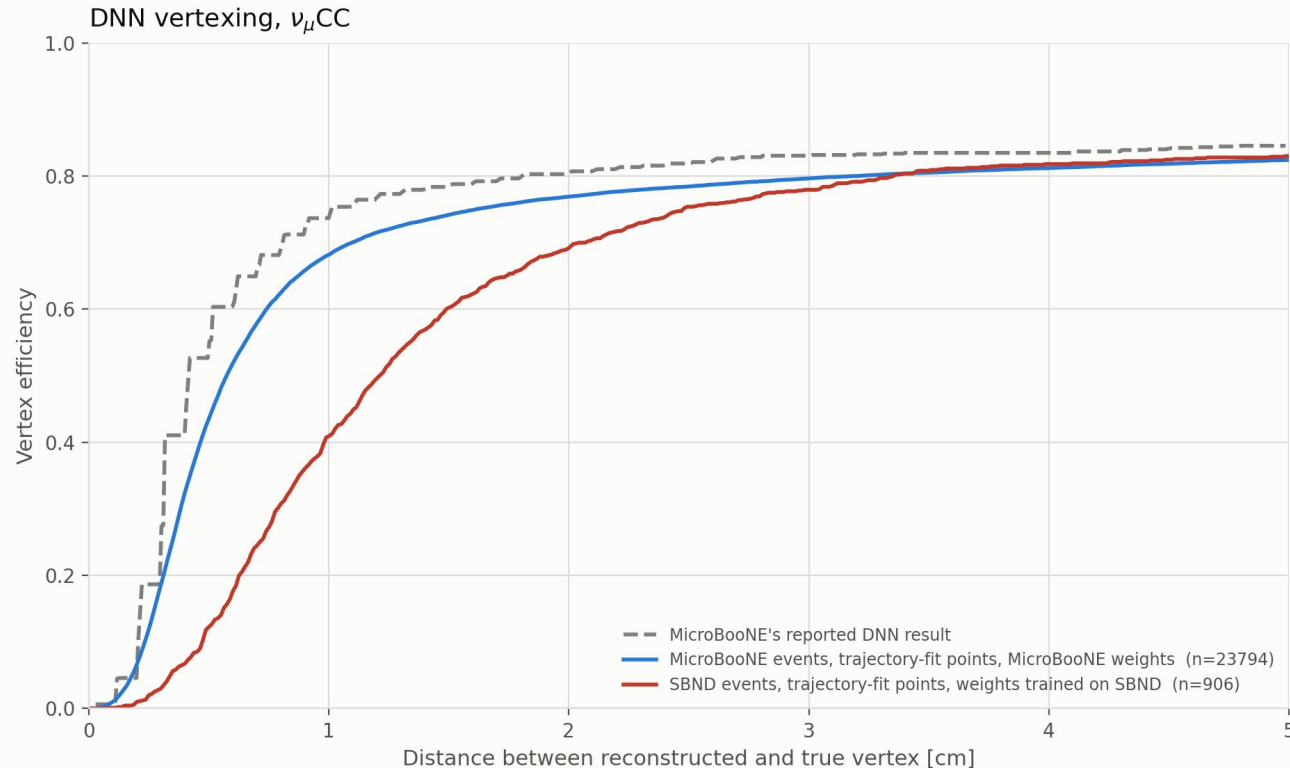
Used MicroBooNE
provided 48k weights

Microboone (blue)
evaluated on whole
dataset (37,881 ν_e
events)

SBND (red)
evaluated on 479
 ν_e events

Input is trajectory-fit
points and charge

DNN ν_μ replication is good, SBND is not as good (yet)



Used MicroBooNE
provided 48k weights

Microboone (blue)
evaluated on whole
dataset (23,794
nu_mu events)

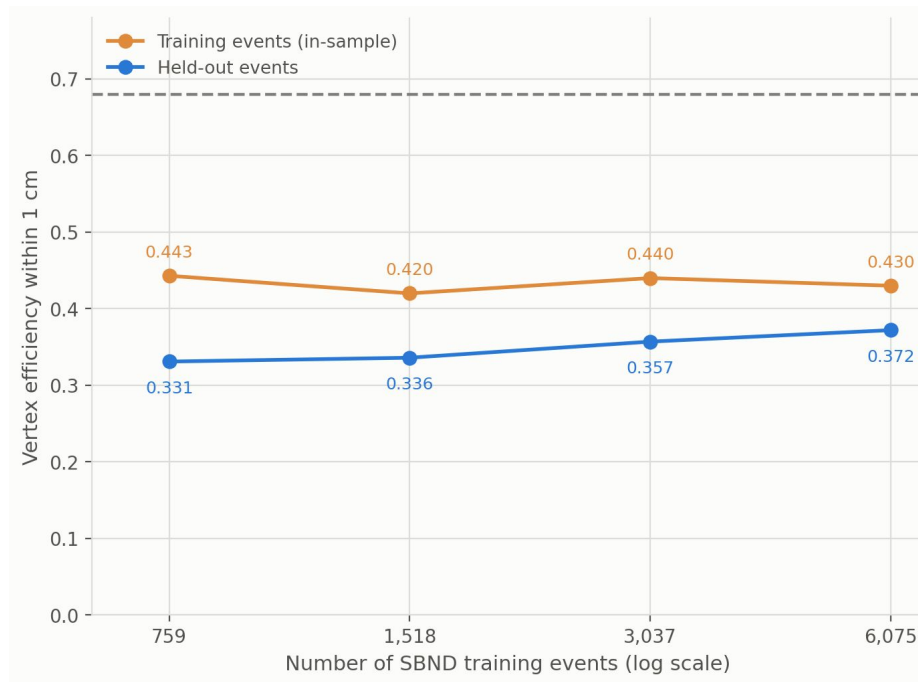
SBND (red)
evaluated on 906
nu_mu events

Input is trajectory-fit
points and charge

SBND DNN efficiency does not seem data limited

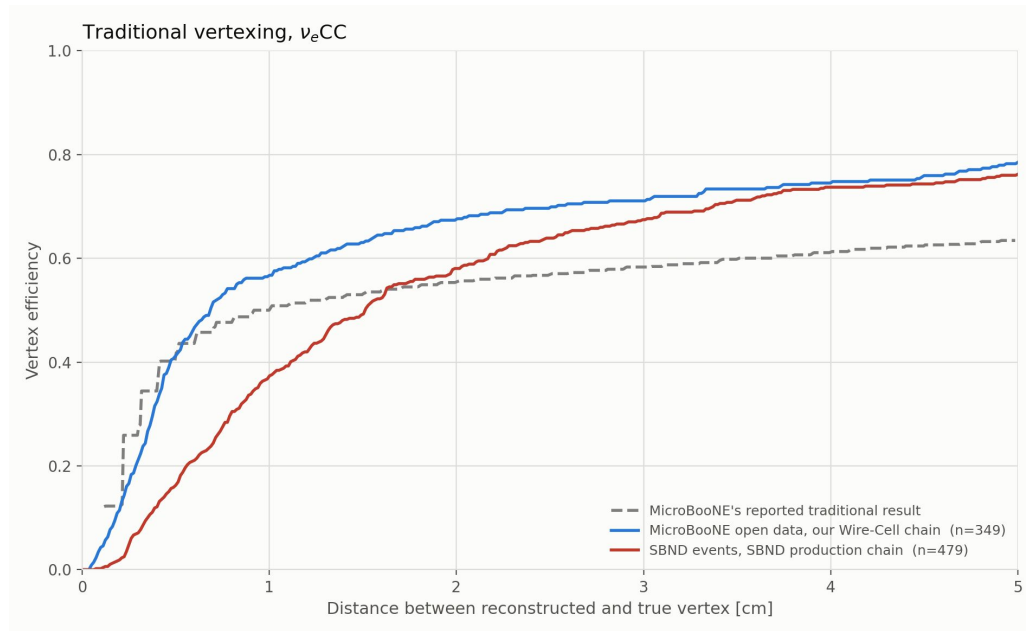
- Next steps

- Do single-nu only training on SBND events only (job is submitted now), right now during training the truth vertex is just chosen as the first one
- Hand-scan to see what's failing with SBND-trained weights in single-nu cases
- Look deeper at SBND sample, distribution of vertices in training, etc.

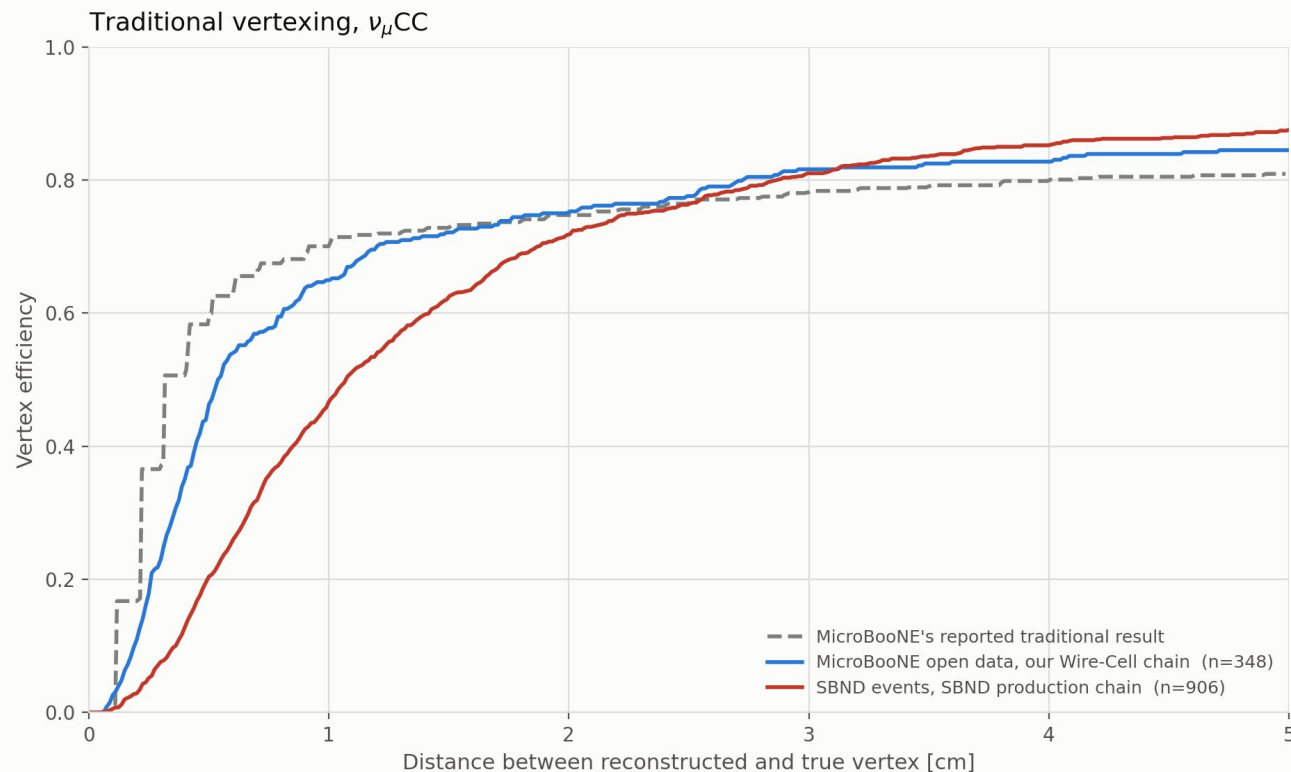


Traditional vertexing, with Xin's knobs does better on open data that MicroBooNE's reported traditional result

- If the original data was plotted, it would overlap the reported result, as we can only read that out of the file, and not run our own traditional vertexing on it as the file only contains reconstructed data



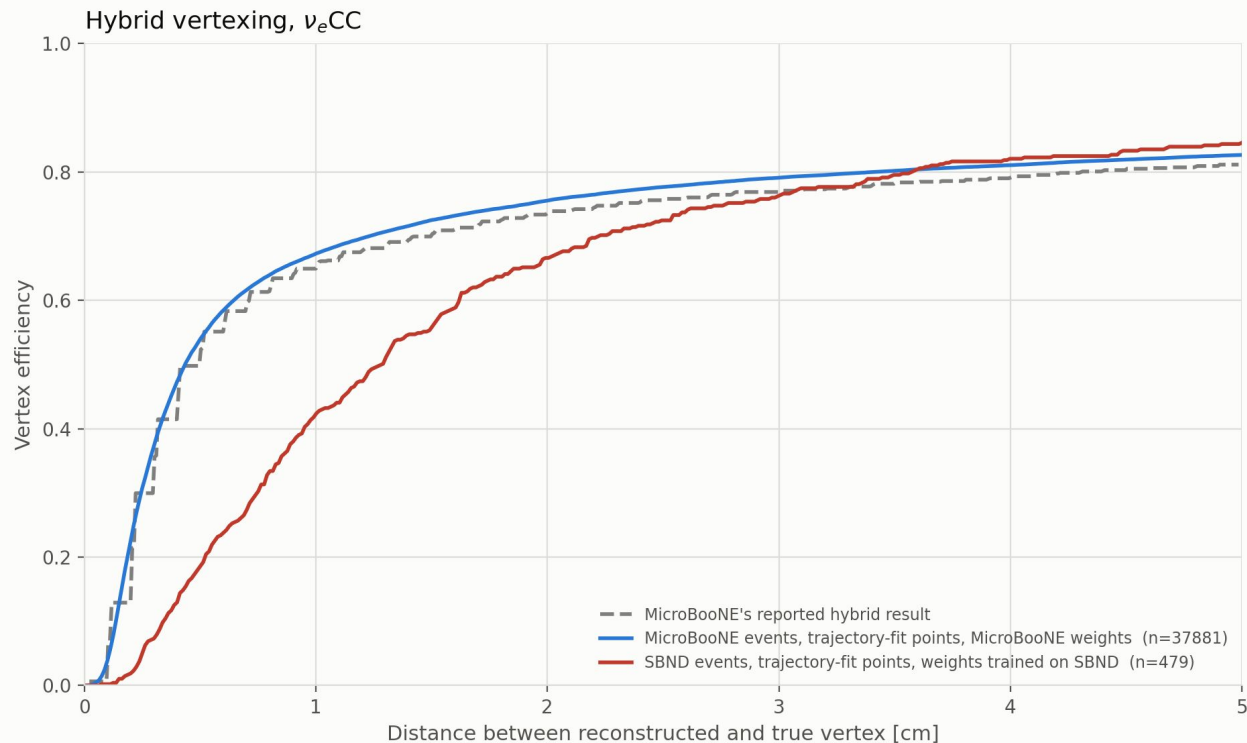
Traditional ν_μ performance on open data is similar to reported results, SBND is not as good (yet)



Microboone (blue)
evaluated on open
dataset (348 ν_μ
events)

SBND (red)
evaluated on 906
 ν_μ events, just
read off the
production dataset

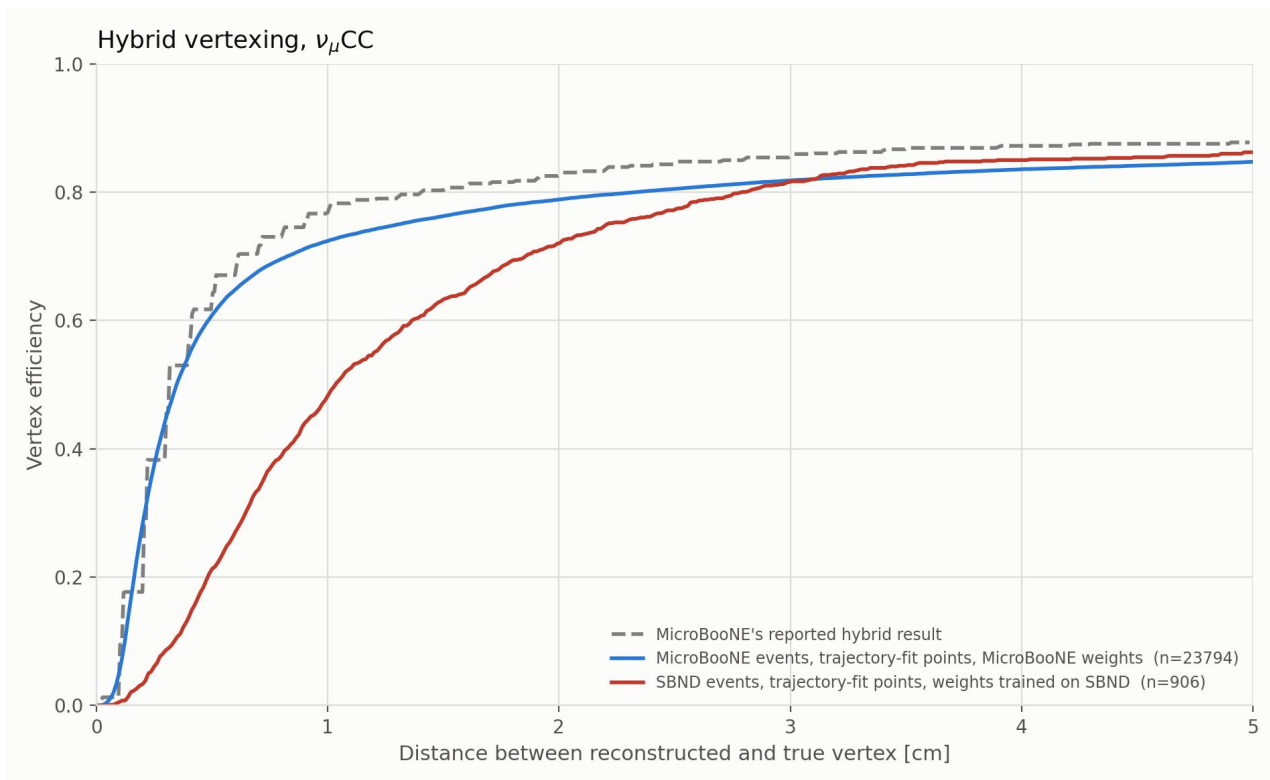
Hybrid ν_e performance is similar to reported results, SBND is not as good (yet)



Hybrid logic is:

- If DNN vertex agrees to a traditional candidate within 2cm, pick that candidate; otherwise take traditional top choice

Hybrid ν_μ is similar to reported results, SBND is not as good (yet)



Hybrid logic is:

- If DNN vertex agrees to a traditional candidate within 2cm, pick that candidate; otherwise take traditional top choice

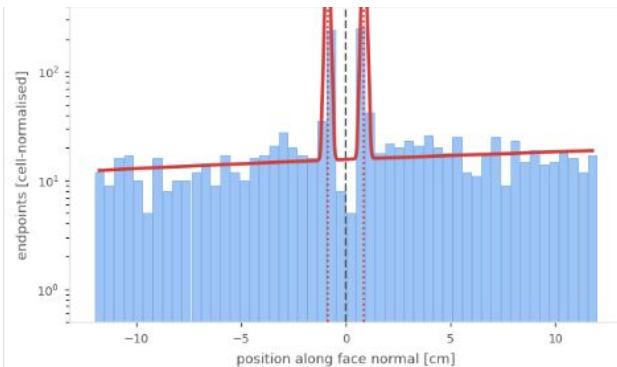
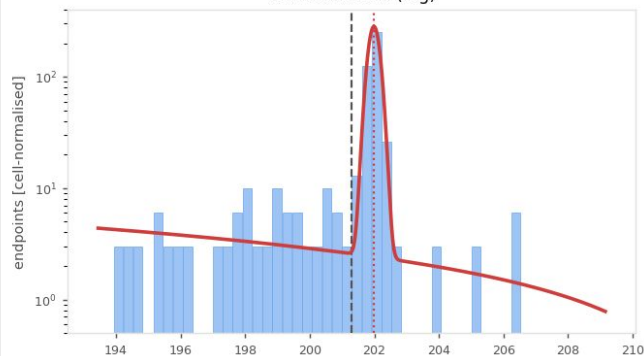
MC-DATA Boundary Fitting

Fit to $A + B(\text{nom} - n) + N \exp\left(-\frac{1}{2}\left(\frac{n-\mu}{\sigma}\right)^2\right)$

boundary offset [cm]

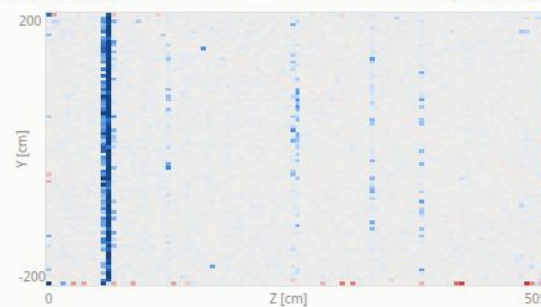


full fit window (log)



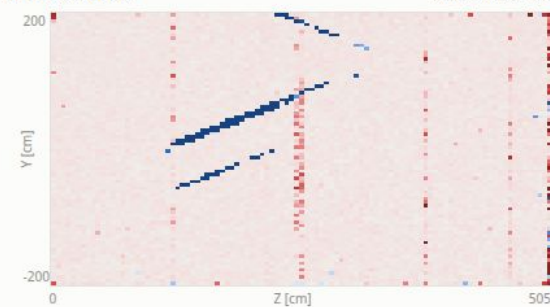
anode x=-201.3

MAD = 0.021 cm



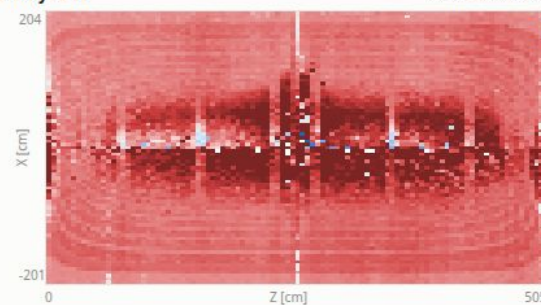
anode x=+201.3

MAD = 0.027 cm



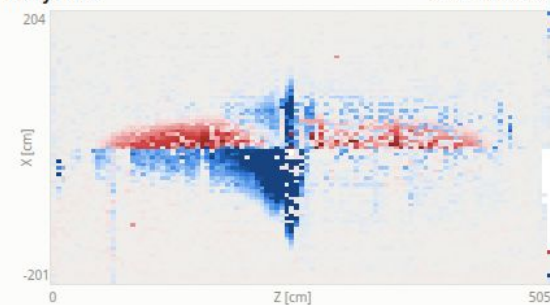
wall y=-200

MAD = 0.098 cm



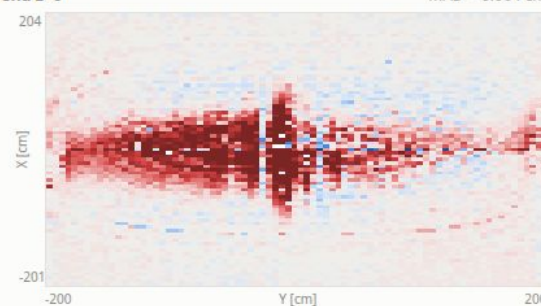
wall y=+200

MAD = 0.023 cm



end z=0

MAD = 0.064 cm



end z=501

MAD = 0.046 cm

