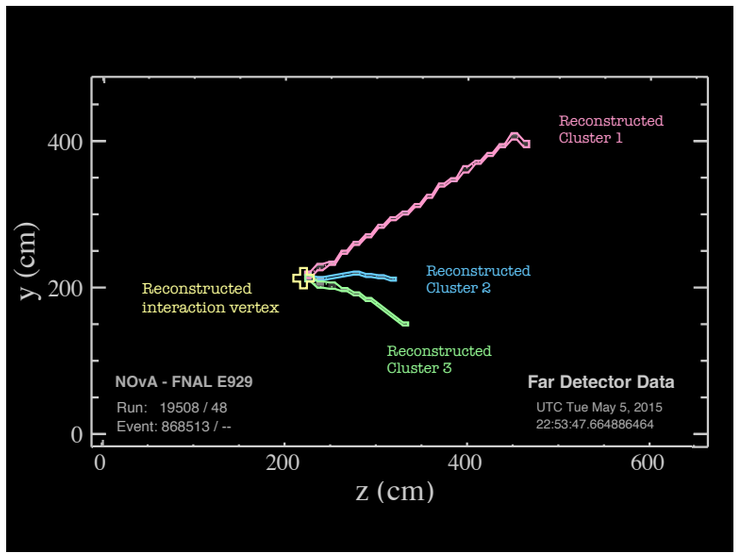
Neutrino Physics with Deep Learning on NOvA

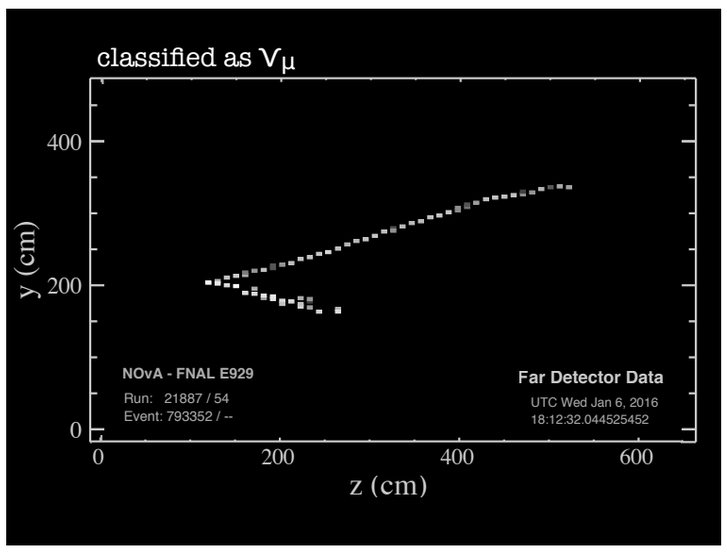
Fernanda Psihas , *Micah Groh*

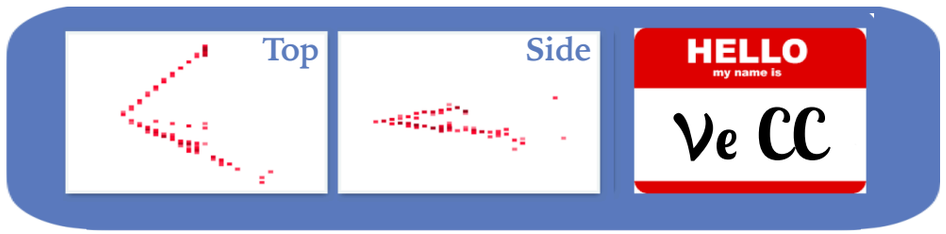
For the NOvA Collaboration

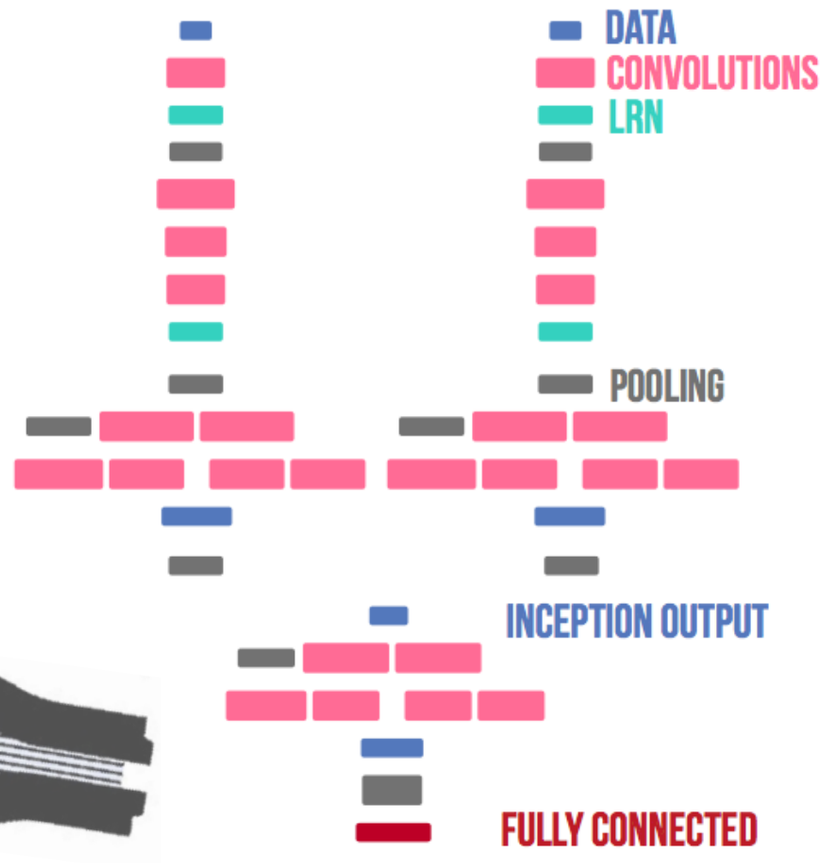
The study of oscillations relies on:

Flavor Identification &
Energy Reconstruction









NOvA's Event ID uses Convolutional Neural Networks (CNNs) trained with 2 views of the event to classify.

Training on neutrinos and antineutrinos independently yields further improvements*

$\bar{\nu}$ Efficiency Improvement (ID>0.9)		
$\bar{\nu}_e$CC Signal	$\bar{\nu}_\mu$CC Signal	$\bar{\nu}$ NC Signal
Blind until Monday's plenary		

Table showing improvements in efficiency obtained for antineutrino selection for antineutrino vs neutrino trained networks.

*Improvements in our training sample, composition and preselection does not reflect analysis conditions.

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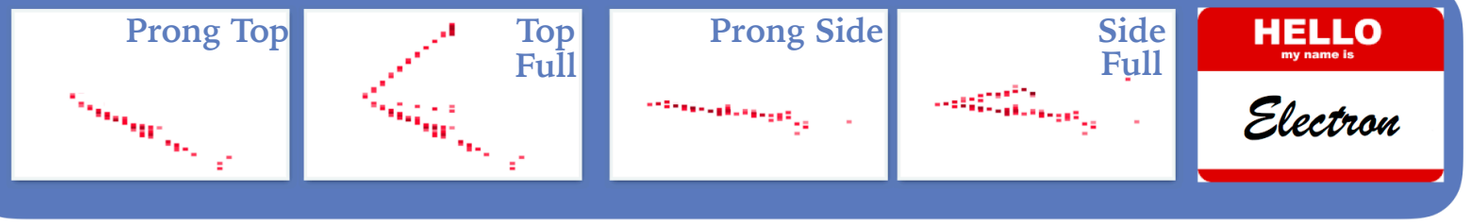
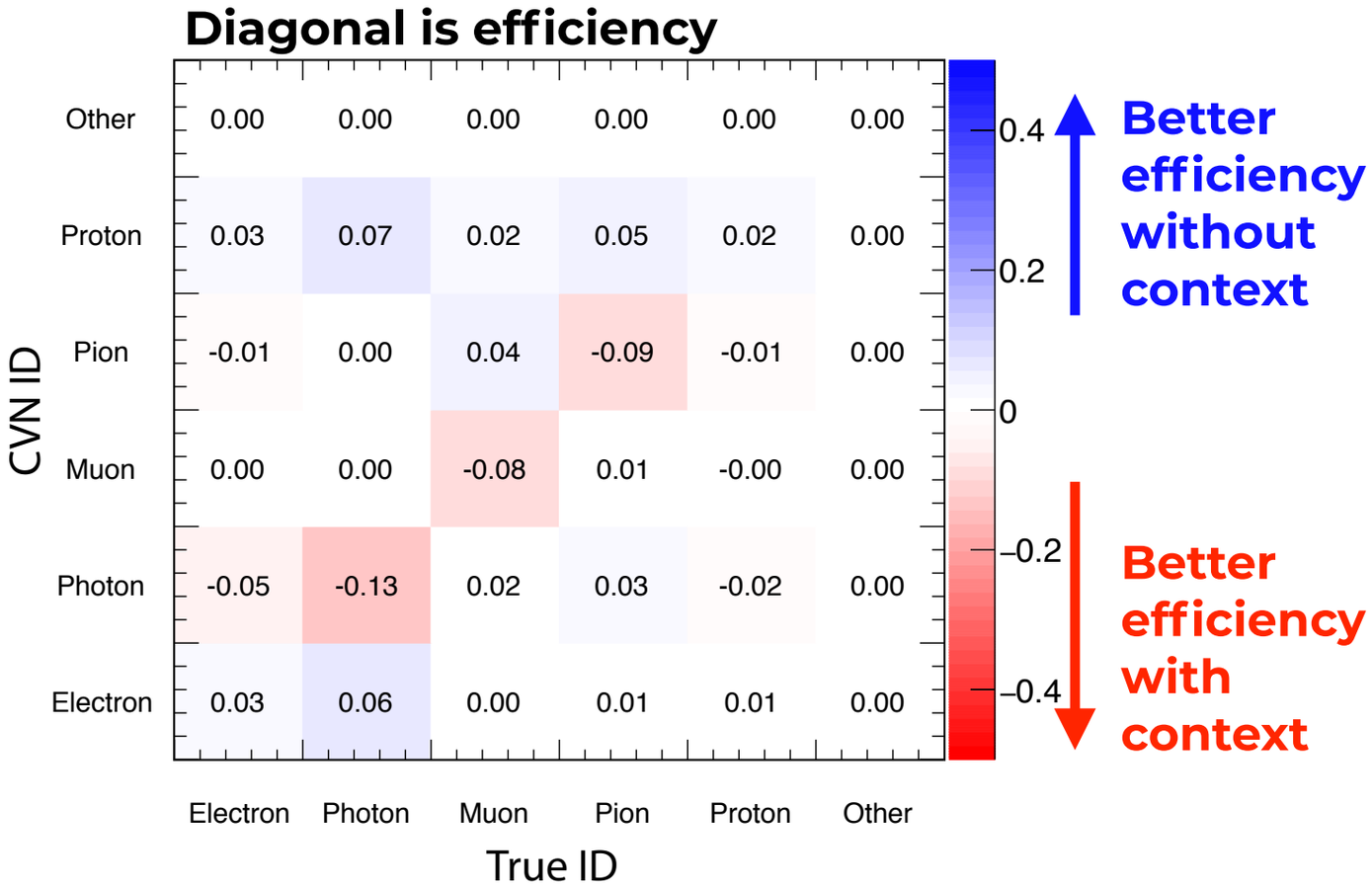
Identifying final states for energy reconstruction and cross sections:

Single particle CNN classifier input



Adding context information enhances discrimination power.



NEW:
Classification, and reconstruction of clusters in the same network.

Can you beat our Neural Networks?
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