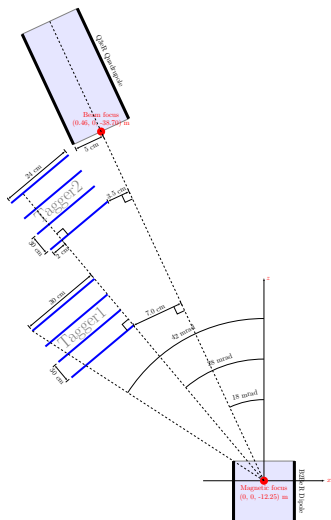


Reconstruction Method, Resolutions and Efficiencies

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EPIC Far Backwards Meeting
19 January 2023

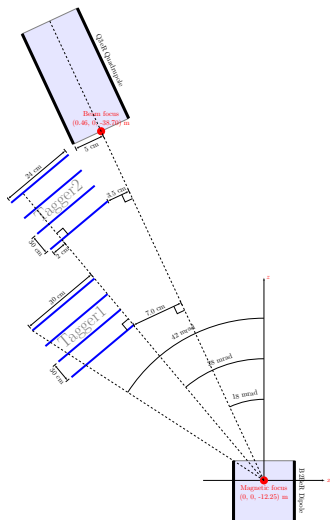
Simulation Layout



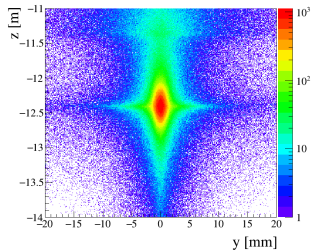
4 dimensions used to reconstruct initial parameters, common between 2 taggers:

- ▶ x component of unit vector
- ▶ y component of unit vector
- ▶ z pos, at $x=0$ plane
- ▶ y pos, at $x=0$ plane

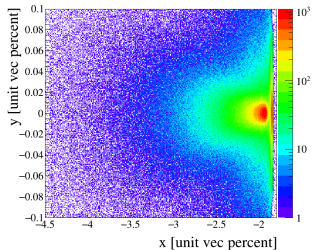
Simulation Layout



Input positions to neural net



Input vectors to neural net



Neural Network

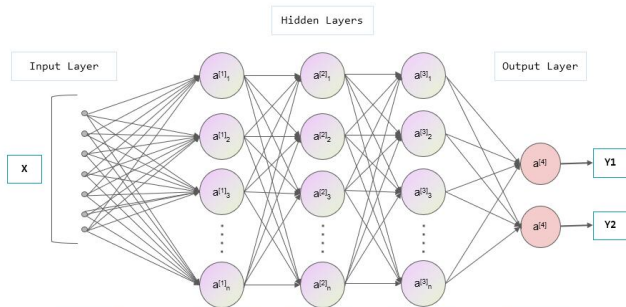
Learns the correlations between the 4 input variables and 3 output parameters.

Inputs

- ▶ x component of unit vector
- ▶ y component of unit vector
- ▶ z pos, at x=0 plane
- ▶ y pos, at x=0 plane

Outputs

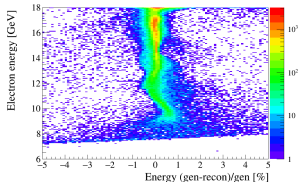
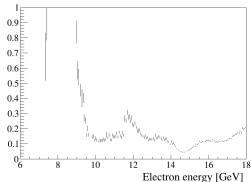
- ▶ Energy
- ▶ θ
- ▶ ϕ



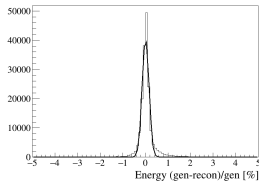
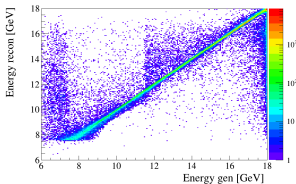
Energy Resolutions

Starting with just single variable reconstruction (energy)

Energy Resolutions [%]



Energy Reconstruction



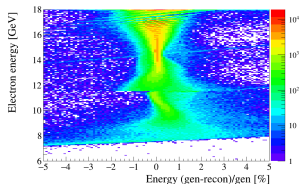
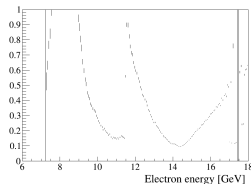
Based on perfect hit position of first recorded hit

Resolution across full range of energy $\sim 0.15\%$

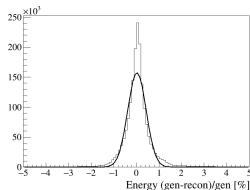
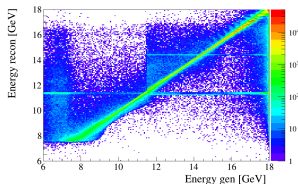
Improved from results shown at collaboration meeting by playing around with network parameters. Particularly performing decorrelation transformation of input parameters.

Add 55um pixels

Energy Resolutions [%]



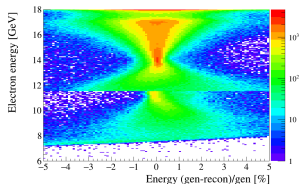
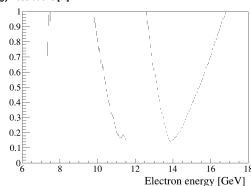
Energy Reconstruction



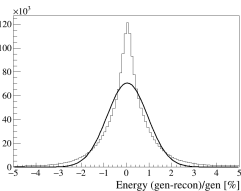
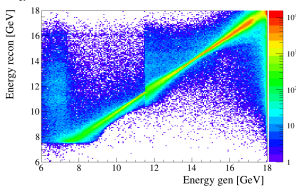
Disclaimer - Hit clustering and vector reconstruction very basic.
Hit in 4 layers but only take pixel position of first 2 hits to
construct vector.

Add 1mm copper vacuum window

Energy Resolutions [%]



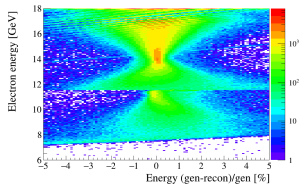
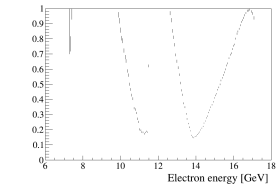
Energy Reconstruction



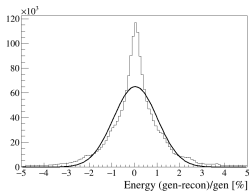
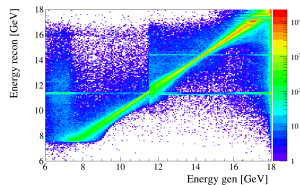
Disclaimer - I don't believe the wall along the edge of the tagger parallel to the beam is necessarily there. Hence full acceptance range.

Add vacuum window and pixels

Energy Resolutions [%]

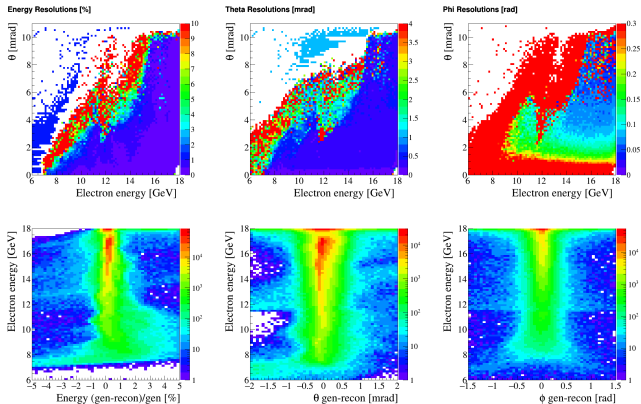


Energy Reconstruction



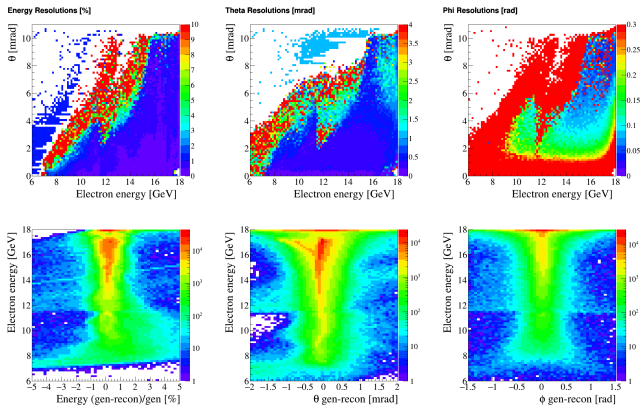
Other variables ideal

Older reconstruction technique, needs work to improve multiple variables/completely separately training.



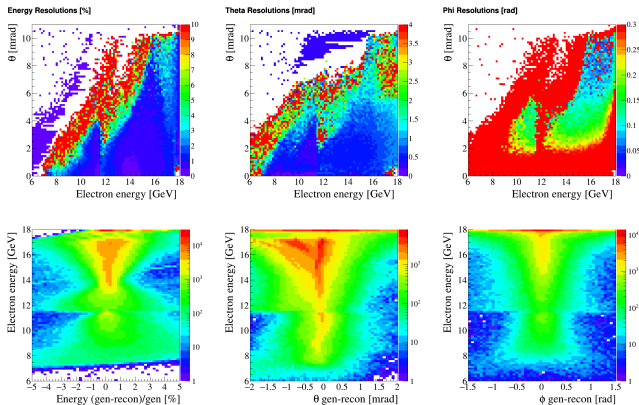
0.5 rad = 28 deg

Other variables 55um pixel



0.5 rad = 28 deg

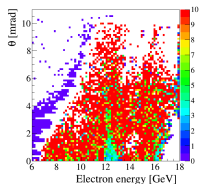
Other variables 55um pixel and 1mm copper



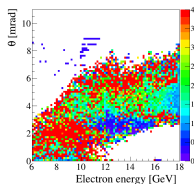
0.5 rad = 28 deg

Just beampipe-no shaped vacuum

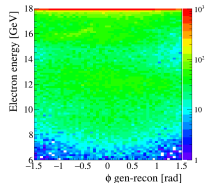
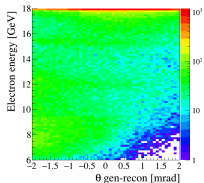
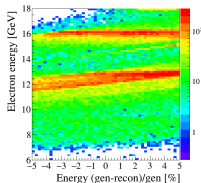
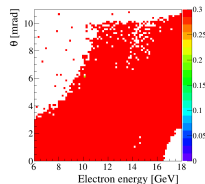
Energy Resolutions [%]



Theta Resolutions [mrad]



Phi Resolutions [rad]



0.5 rad = 28 deg