

# Status of ProtoDUNE Pi0 ML

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Patrick Tsang (SLAC)

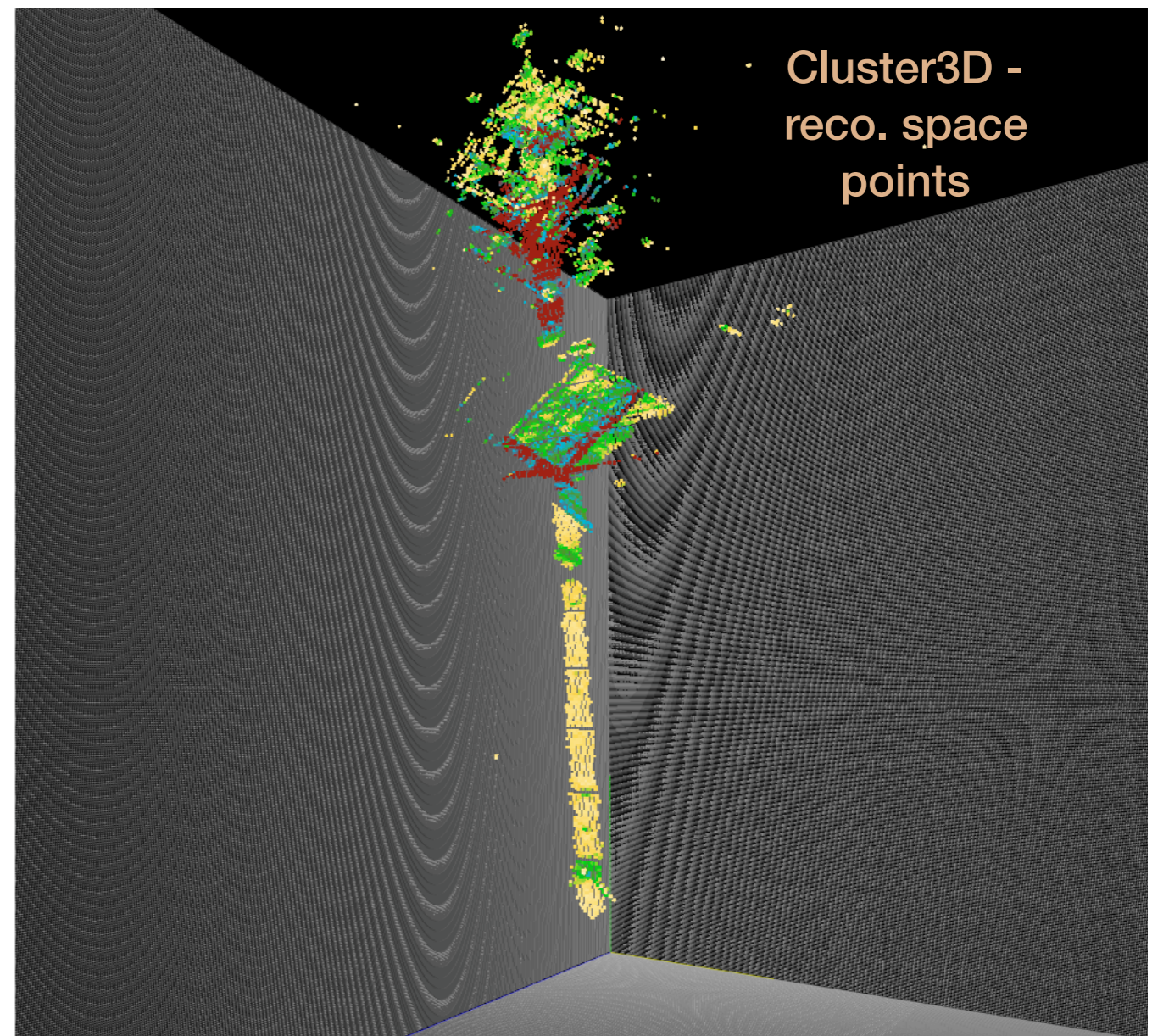
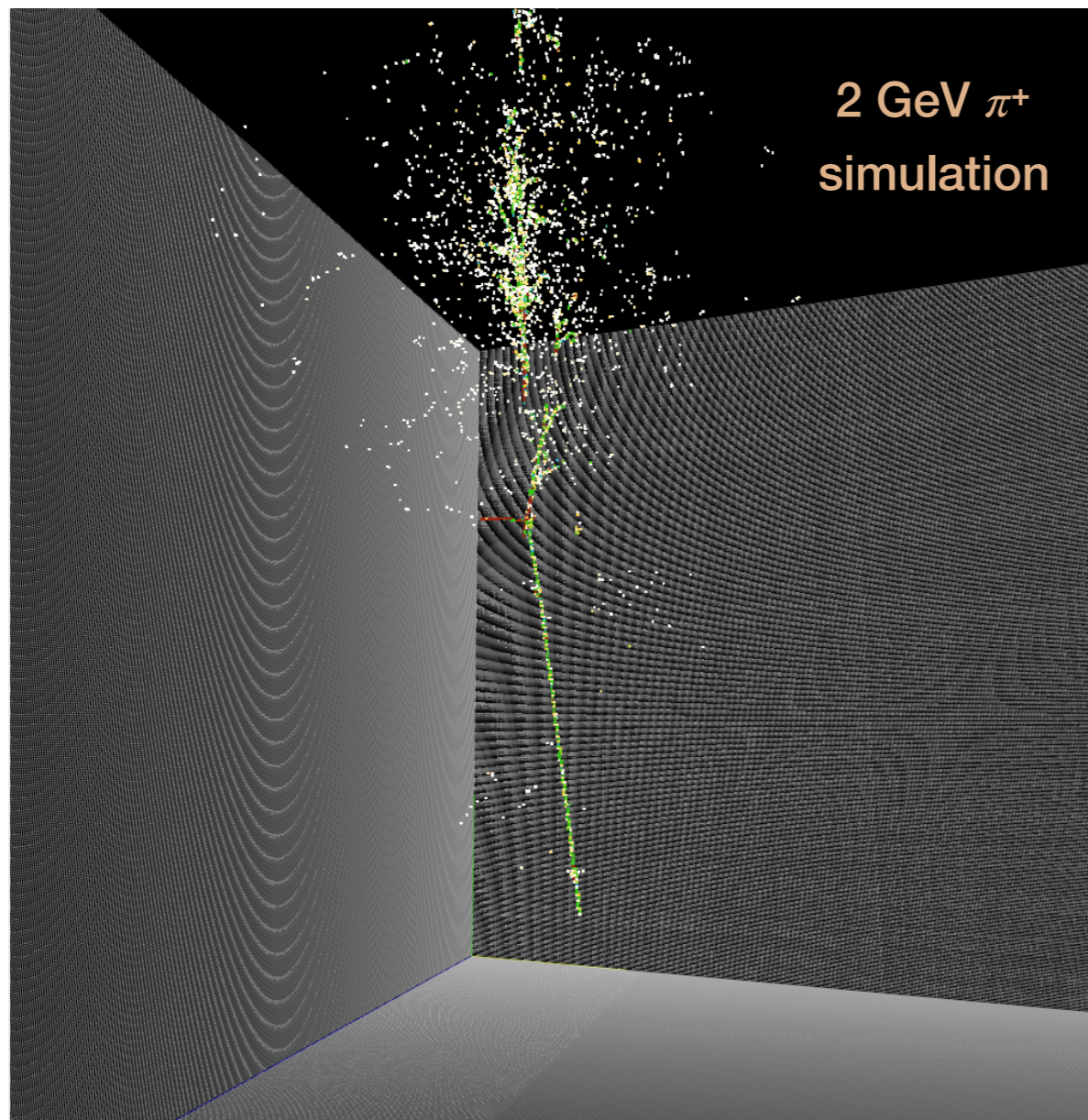
26 March 2019

# Recap from last meeting

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- need to convert *larsoft* data to ML-ready format (*larcv*)
- current framework (*Supera*) + minor fixes works for protoDUNE simulation
- adding reconstructed space points using *Cluster3D* algo. (this talk)
- Note: there is an issue on building *larcv* + *larsoft* together in MacOS. *Standalone* *larcv* (w/o *larsoft*) works fine.

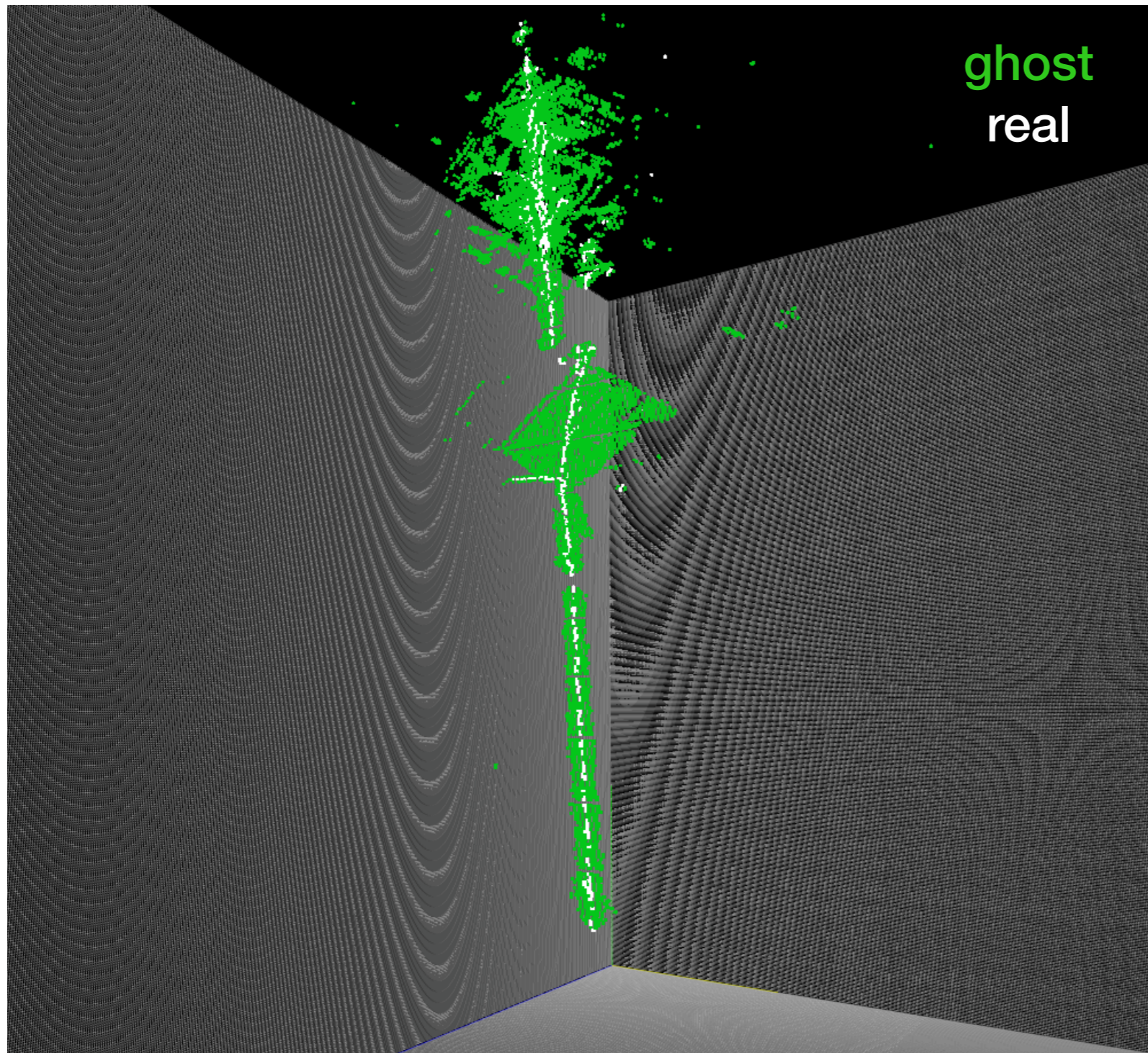
# Cluster3D: 3-dim Space Points



Space point: a triplet of U/V/X hits overlapping in time

# Ghost: Fake Space Point

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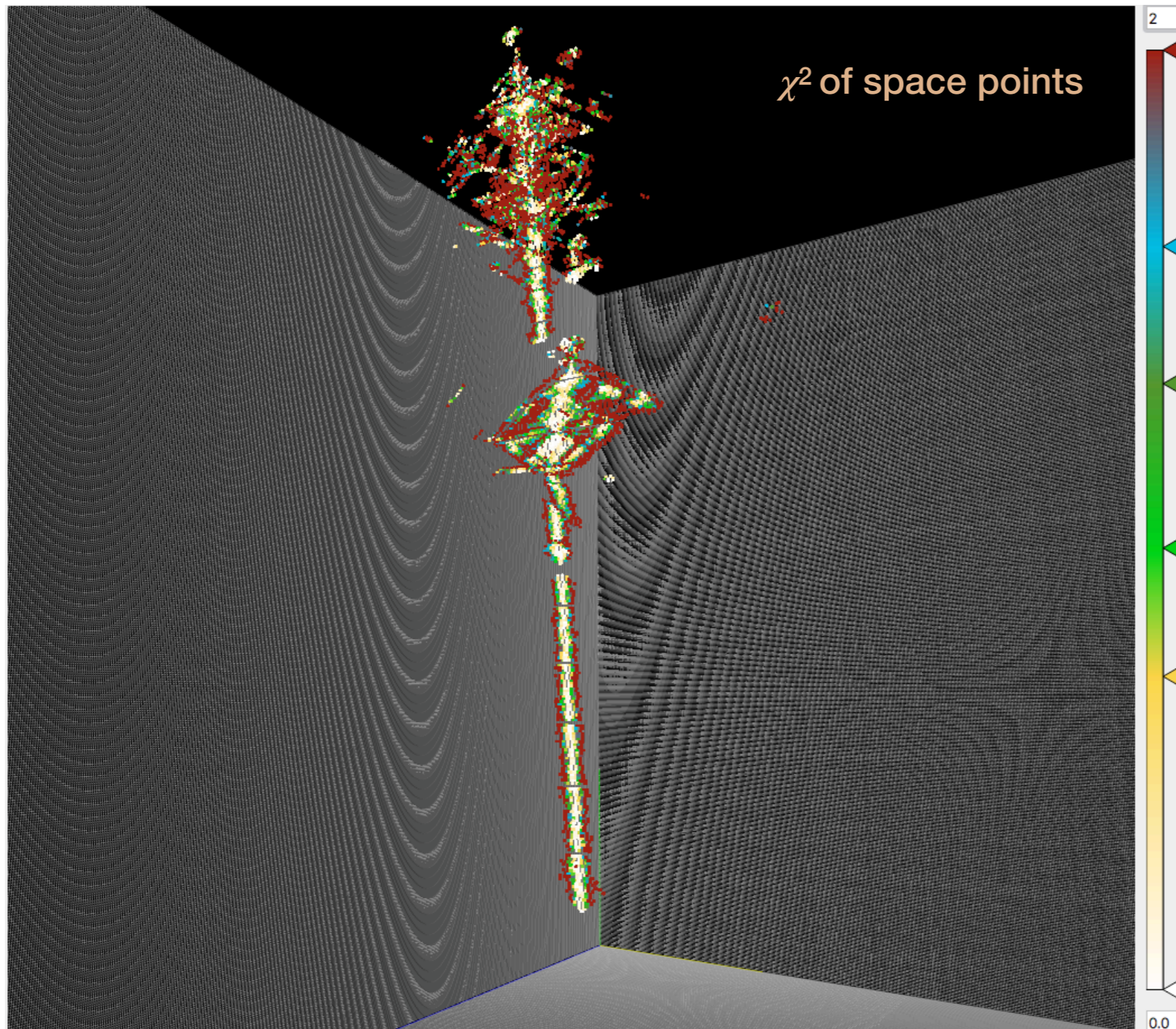
Good:

Reconstructed  
space points match  
simulation in 3-dim  
space

Bad:

Tons of fakes

# $\chi^2$ : A Poor Man De-ghosting method

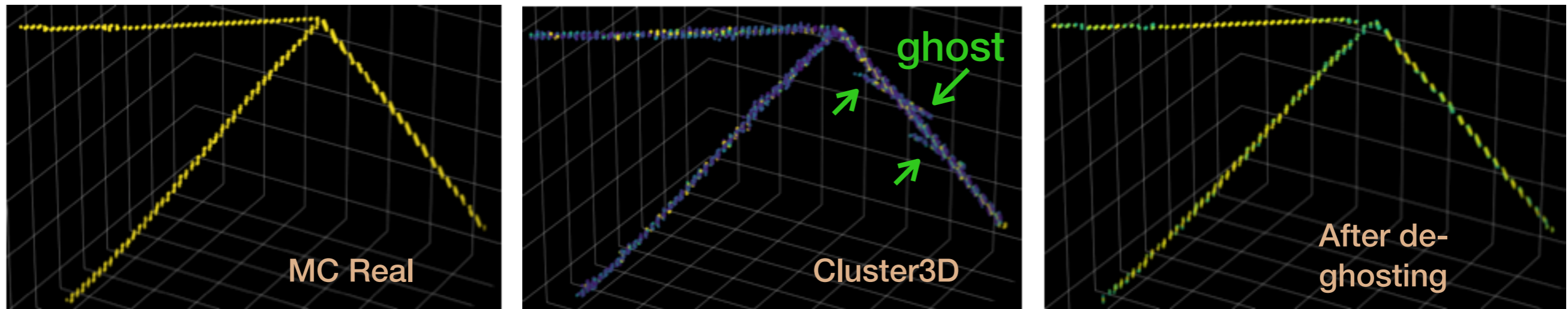


$\chi^2$  - measures the time spread of hits from U/V/X wires

Expected *in-time* inductions + collection hits for real ionization signal

# ML-based De-ghosting Algo.

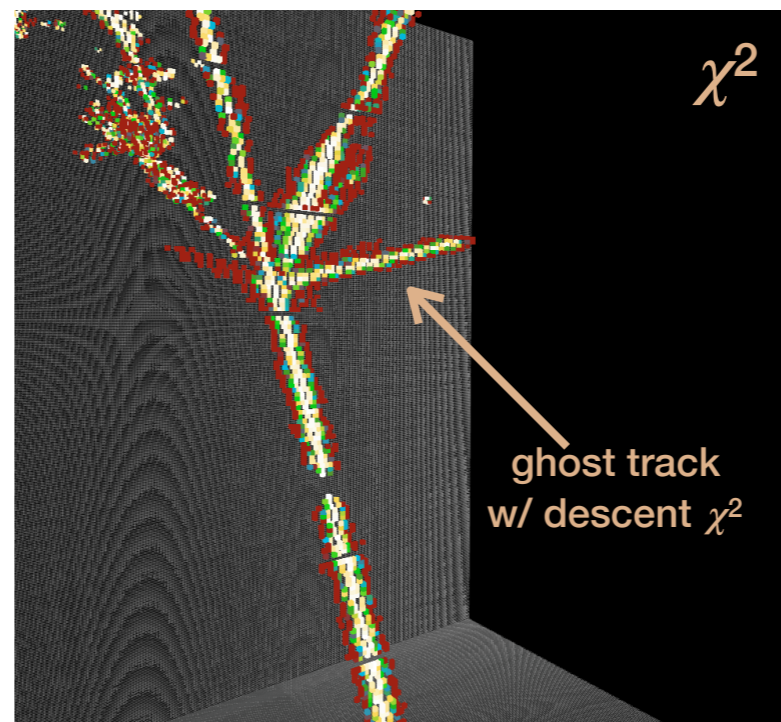
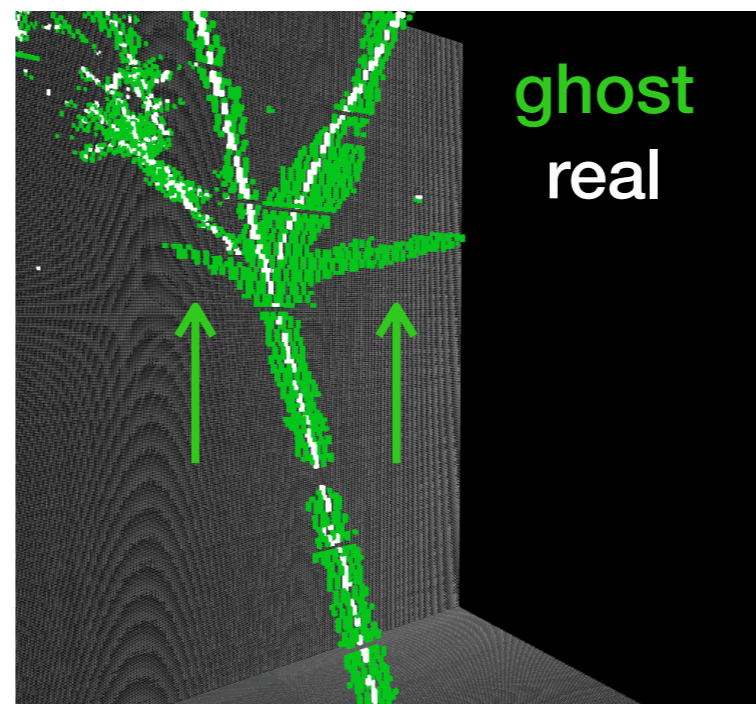
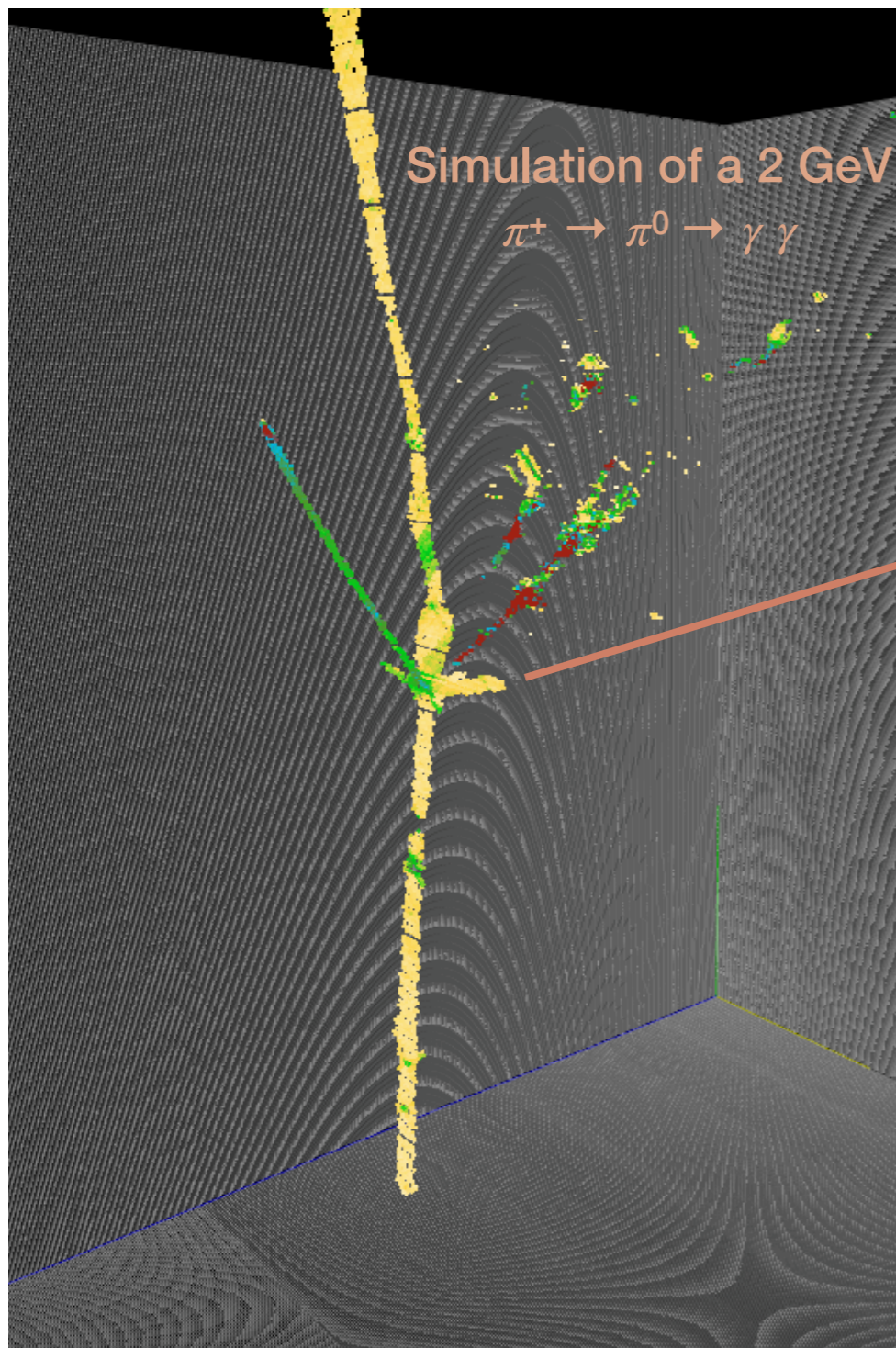
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Extracted from *Tomaso Tedeschi's* report

A proof-of-concept approach to remove fake space points using  $\chi^2 + U\text{-ResNet}$ , demonstrated by *Tomaso Tedeschi* (a summer student at SLAC).

# A Bad Example



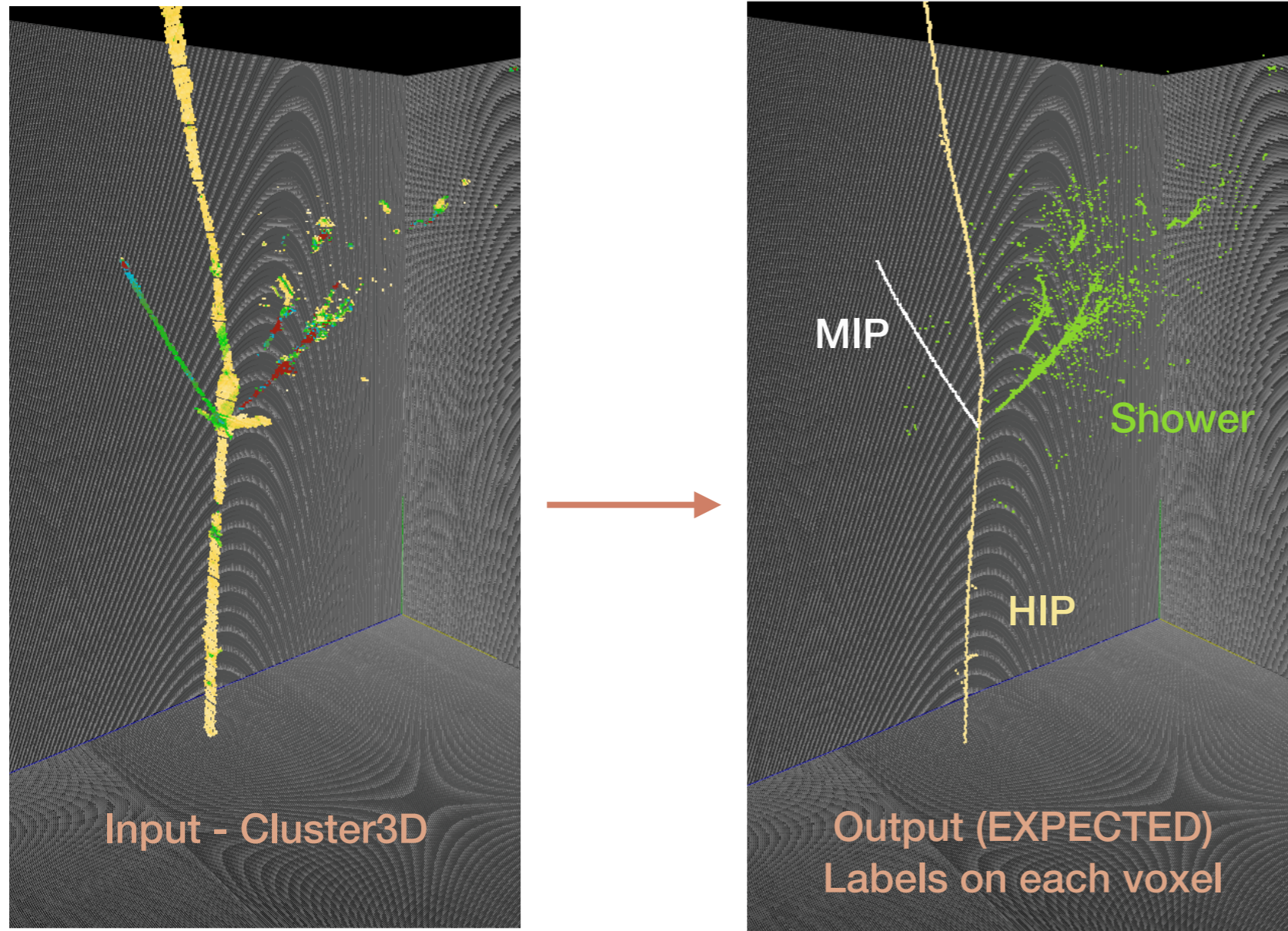
Majority of fake space points are removed by  $\chi^2$ -based de-ghosting algo.

Some are not so obvious by  $\chi^2$  alone (ML may do better).

*Tracy's comment*  
“ $\chi^2$  is only one of the metrics to tackle this problem”

Plan to include  $n$ -dim input to the training network.

# Roadmap: A Conceptual View



Near term goal

Train a network

- to take Cluster3D as input
- to remove ghost
- to label type of interactions