MILO VERMEULEN — 5-3-2019

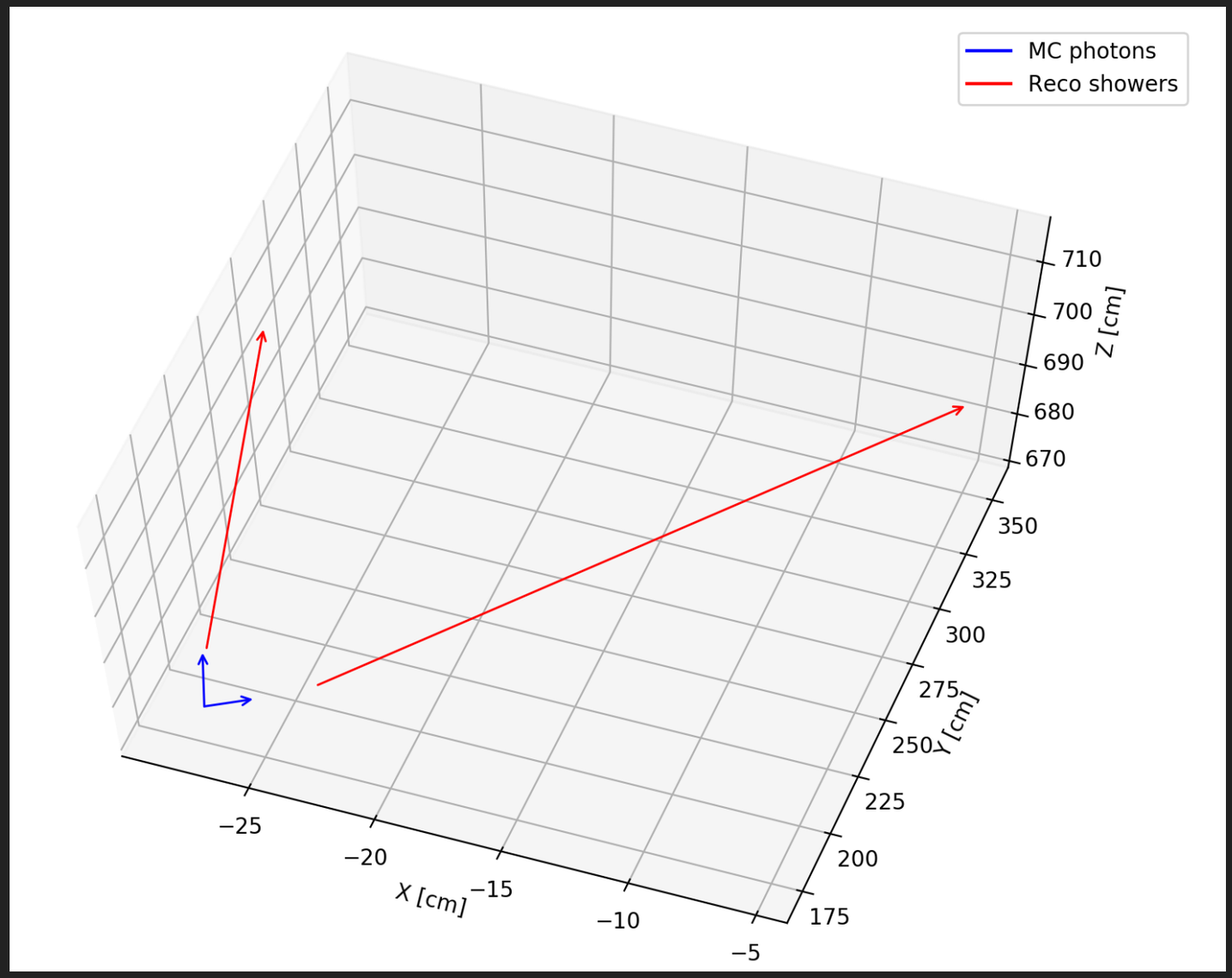
PANDORA SHOWER RECONSTRUCTION SUMMARY

BACKGROUND

- Good shower reconstruction necessary for π^0 reconstruction
- Pandora currently the standard
- This presentation: First looks at π^0 shower accuracy in 10kt and ProtoDUNE models from analyst's perspective
- Also starting on π^0s: Fatih Bay

VERY FIRST LOOK

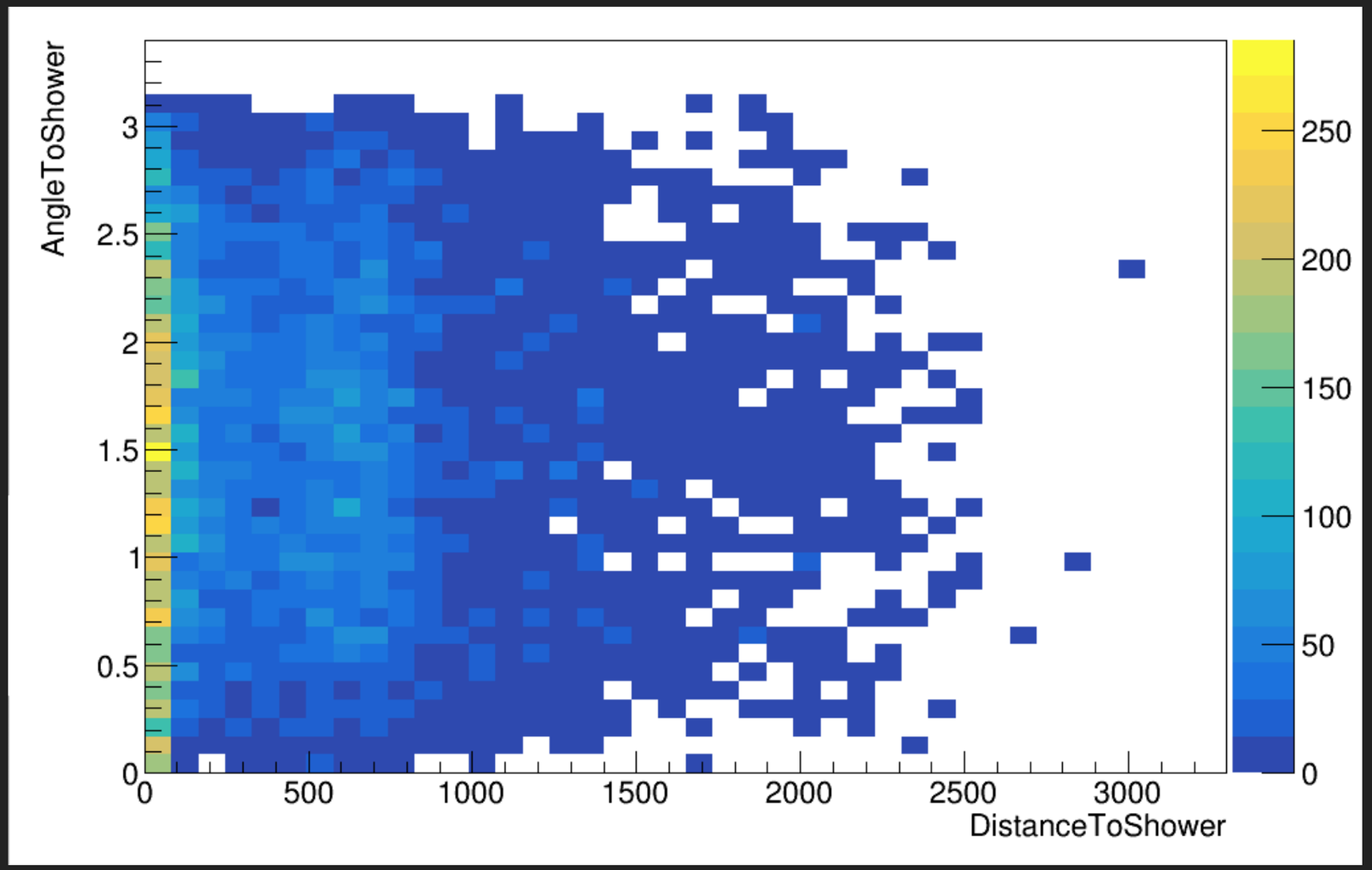
- Simply compare MC photon and reco shower
- Record distance, relative angle



1 GeV π^0 in DUNE

VERY FIRST LOOK

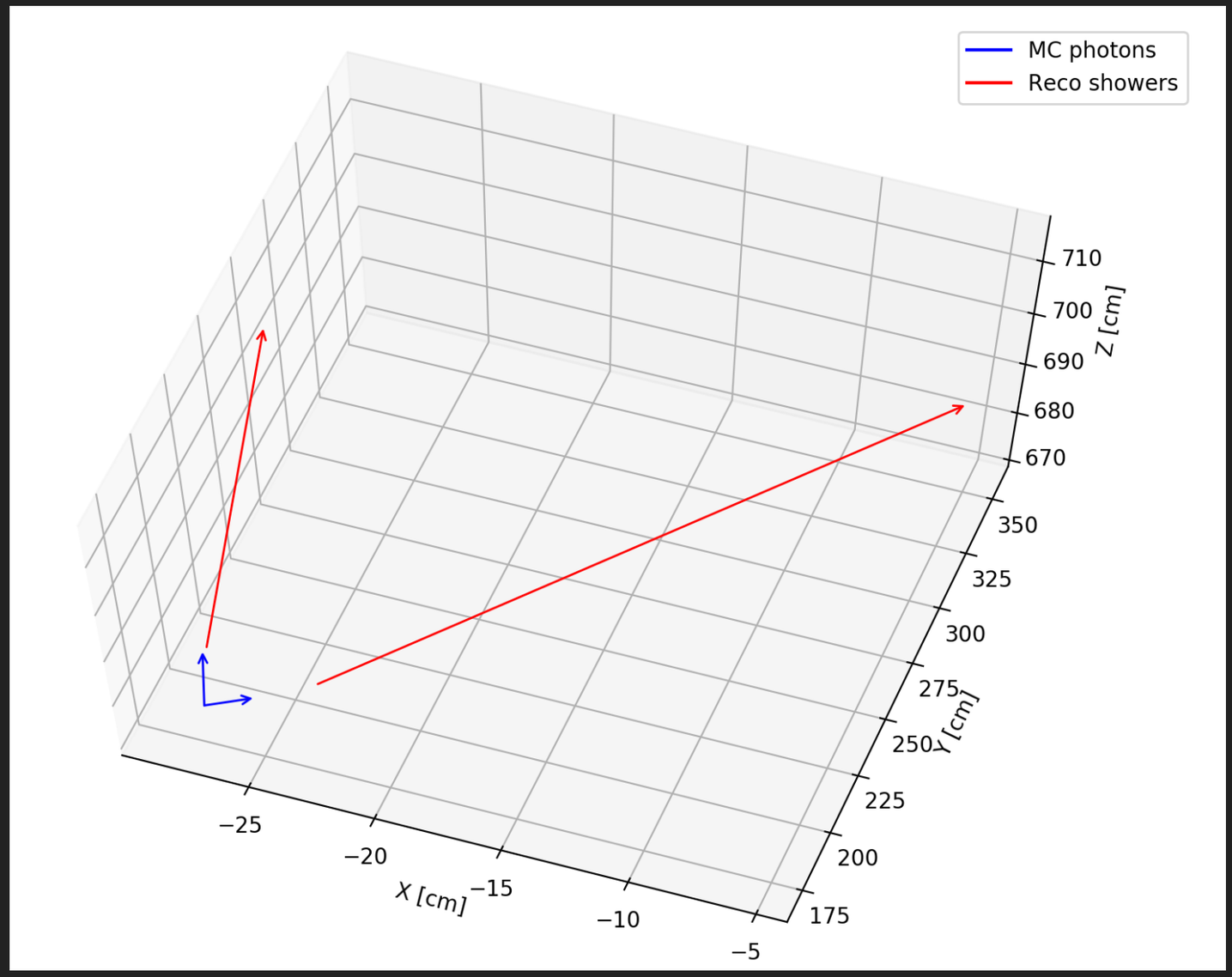
- Did not go very well
- Shower matching looked to be more or less random



ProtoDUNE mcc11

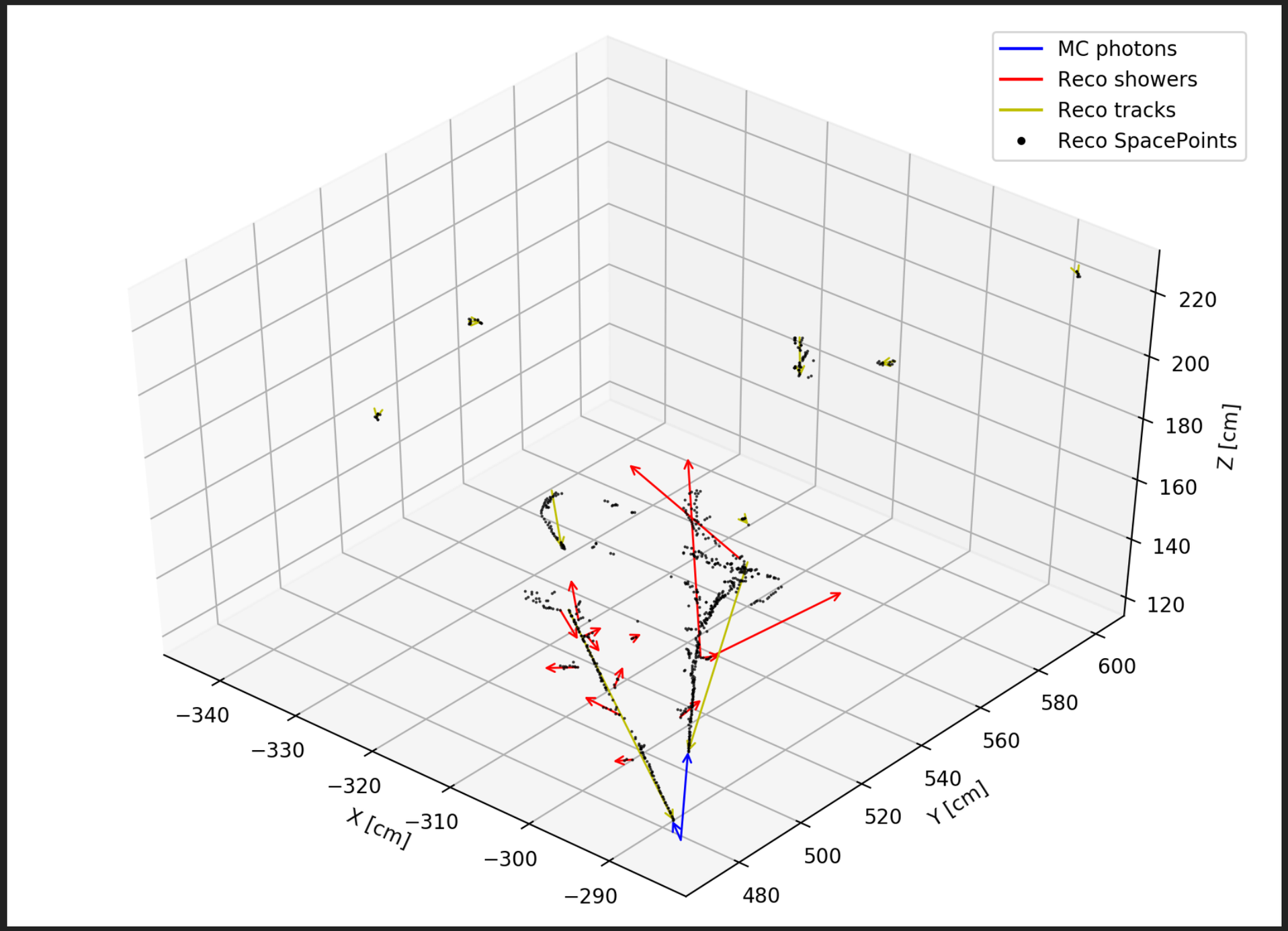
A CLOSER LOOK

- Look at individual showers in 3D
- Generate a few single π^0 events



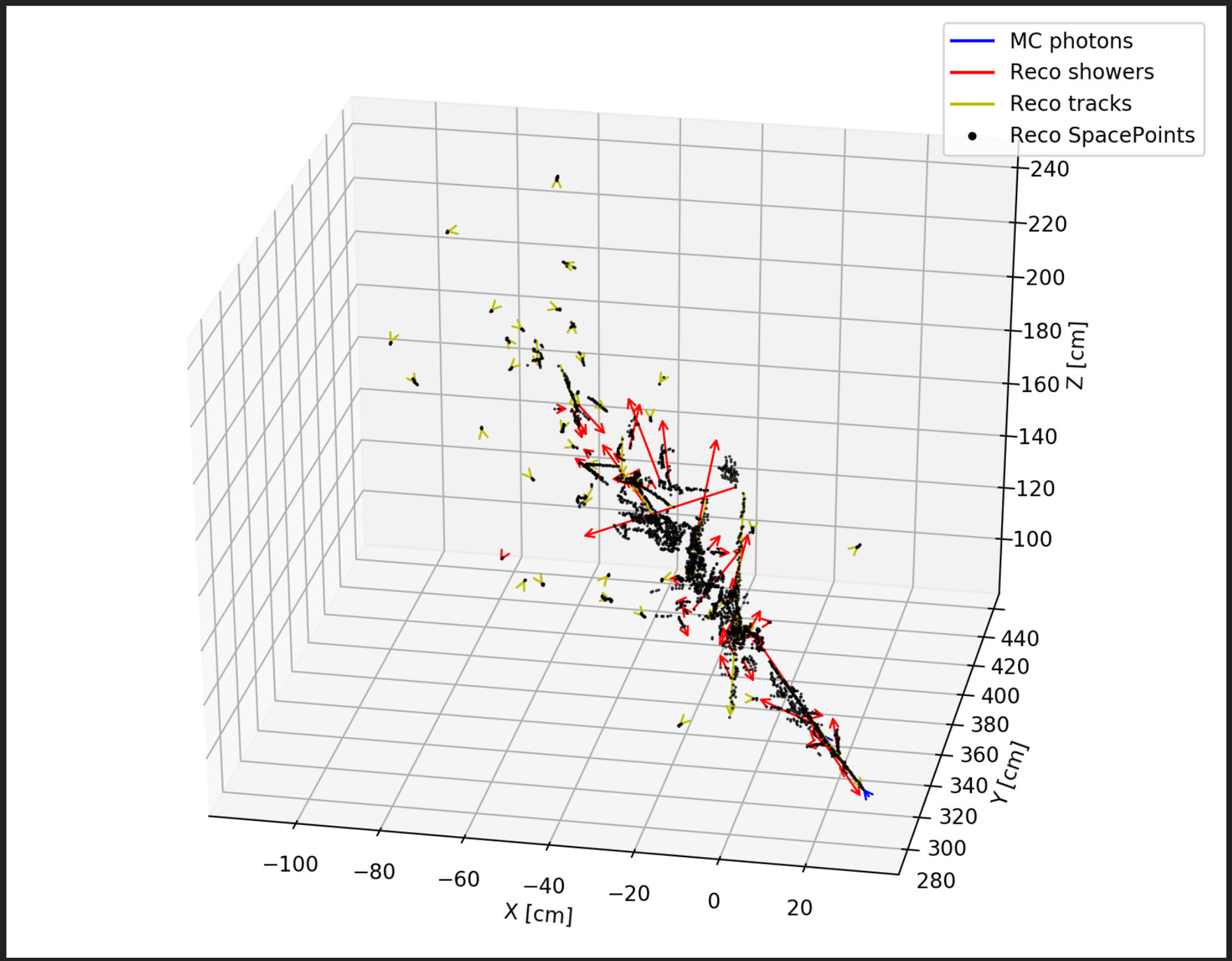
1 GeV π^0 in DUNE

A CLOSER LOOK



1 GeV π⁰ in ProtoDUNE

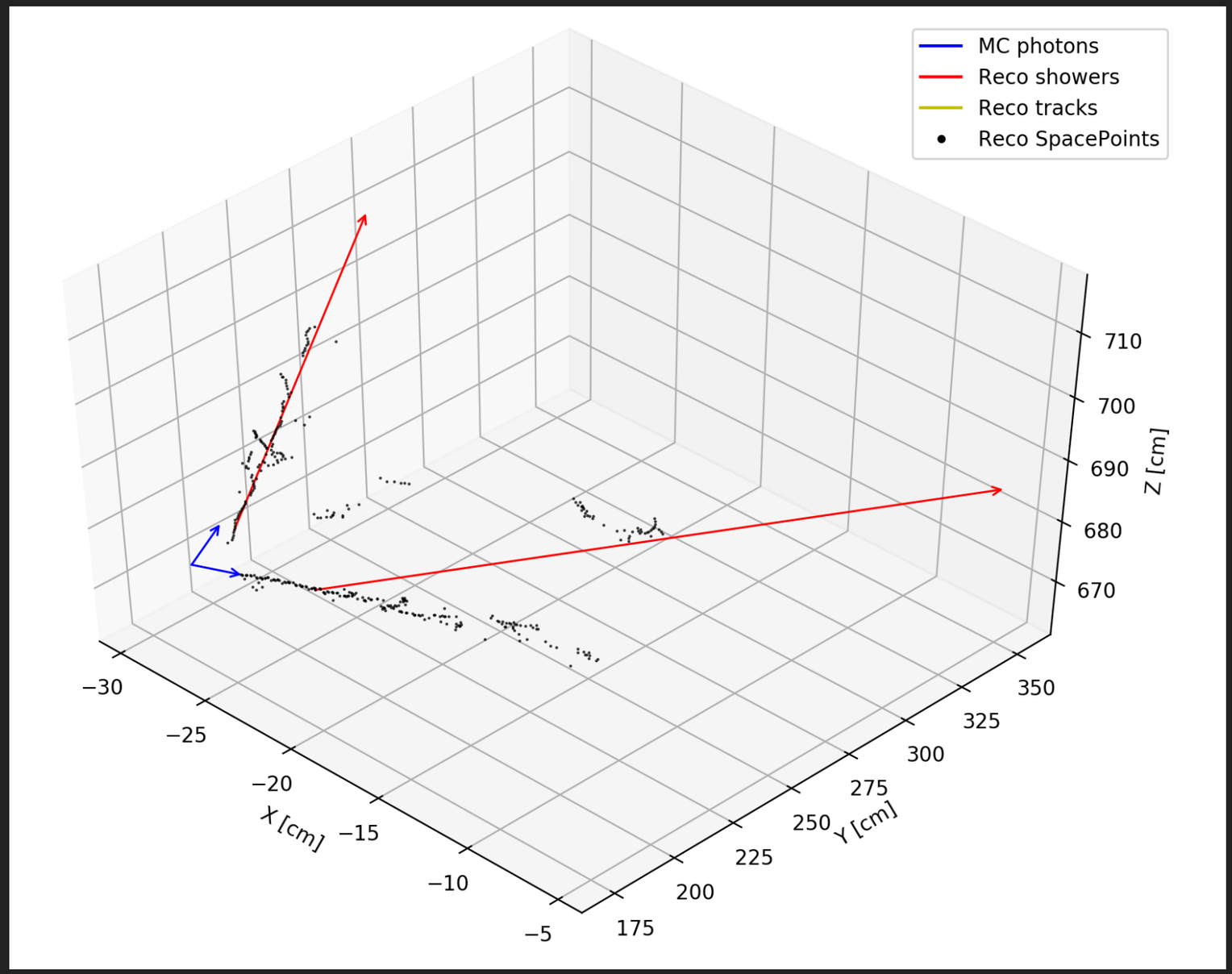
A CLOSER LOOK



5 GeV π^0 in ProtoDUNE

A CLOSER LOOK

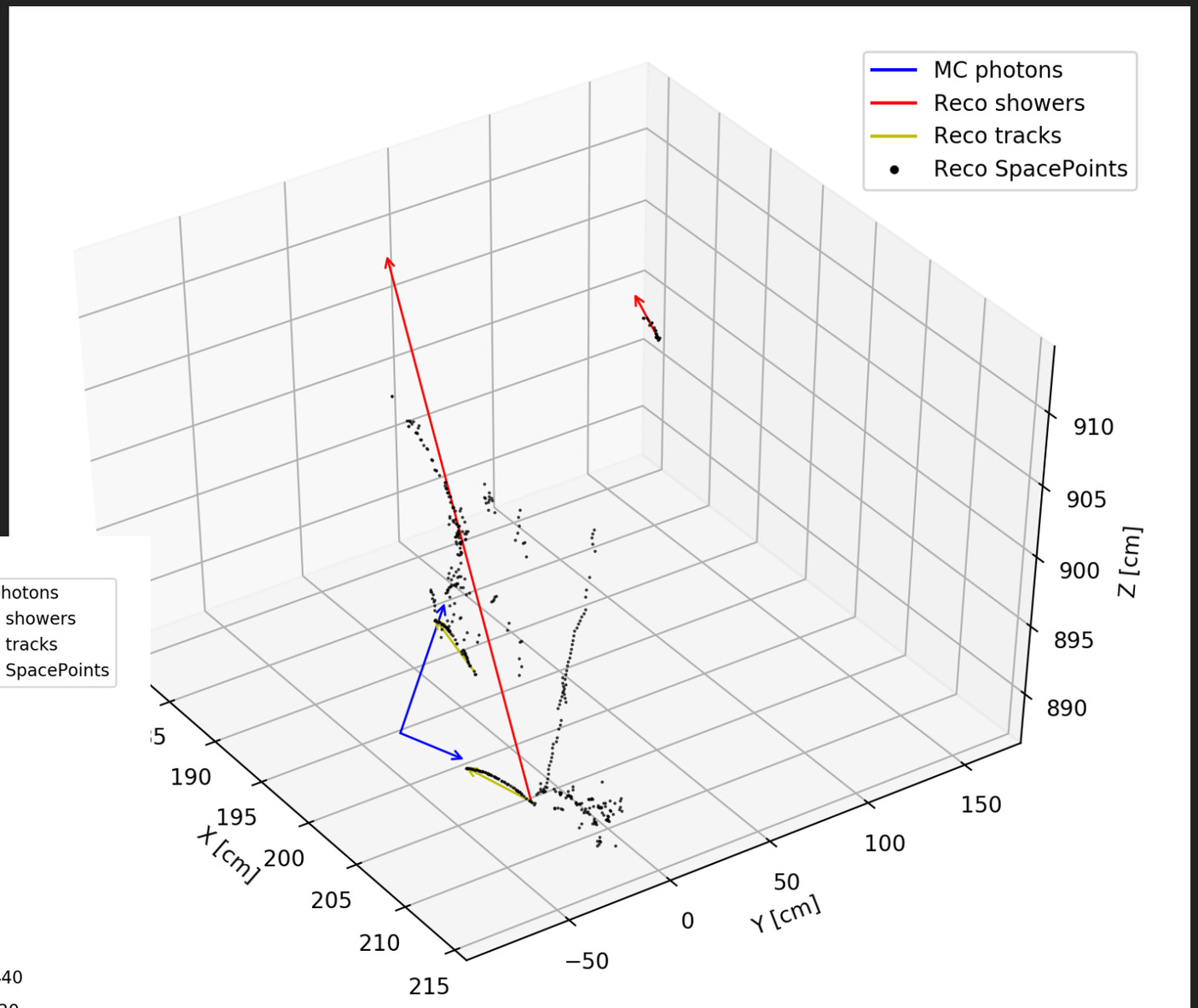
- Pandora considers particles outside beam window as cosmic
- Removing this gives slightly better results



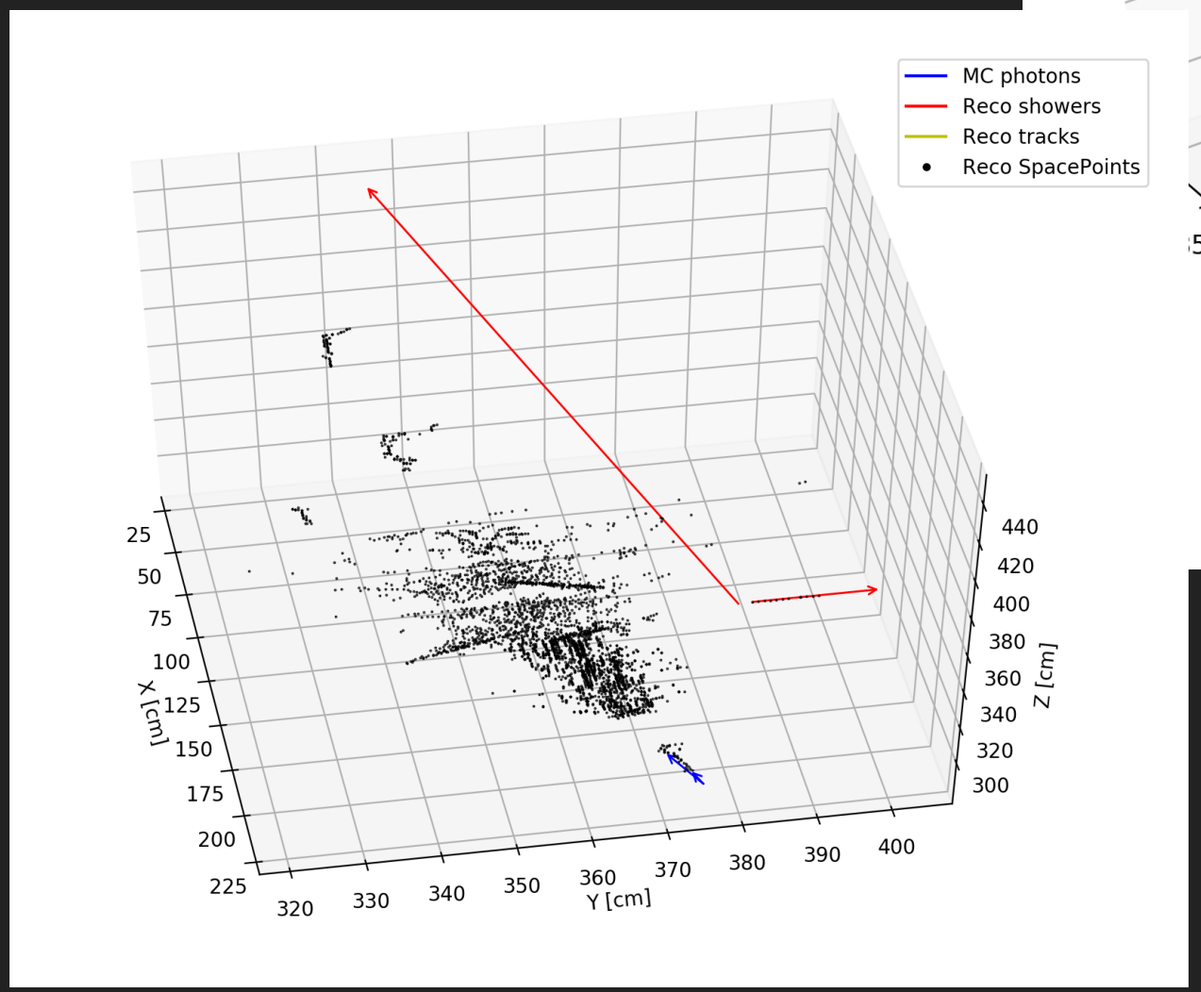
1 GeV π^0 in DUNE

A CLOSER LOOK

- Still many crossovers and mismatches



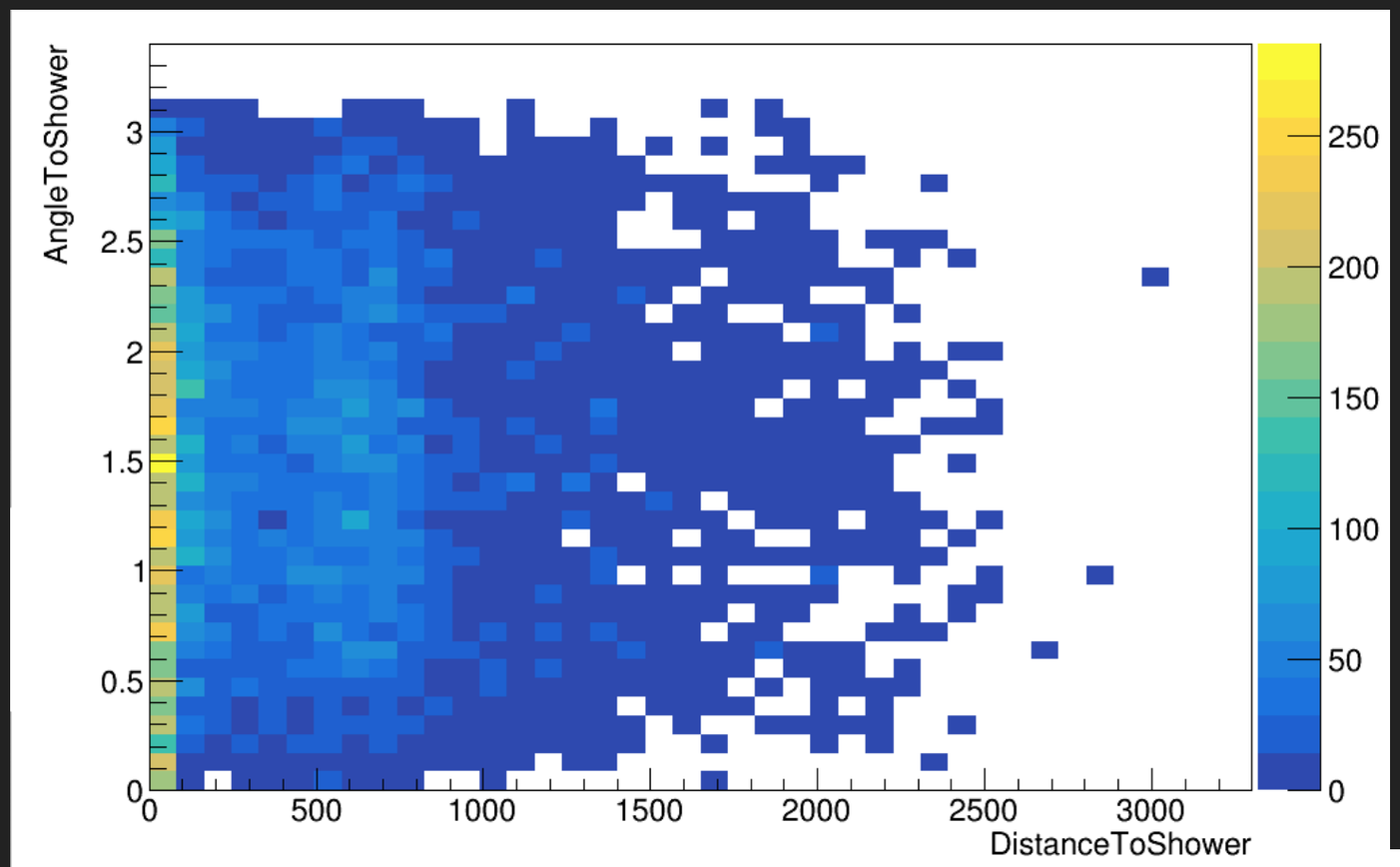
1 GeV π^0 in DUNE



5 GeV π^0 in DUNE

MOVE TO QUANTIFICATION

- Can’t look at 3D plots forever
- Exclude MC π^0s outside of detector volume
- Collect data from thousands of mcc11 events



Including external π^0s

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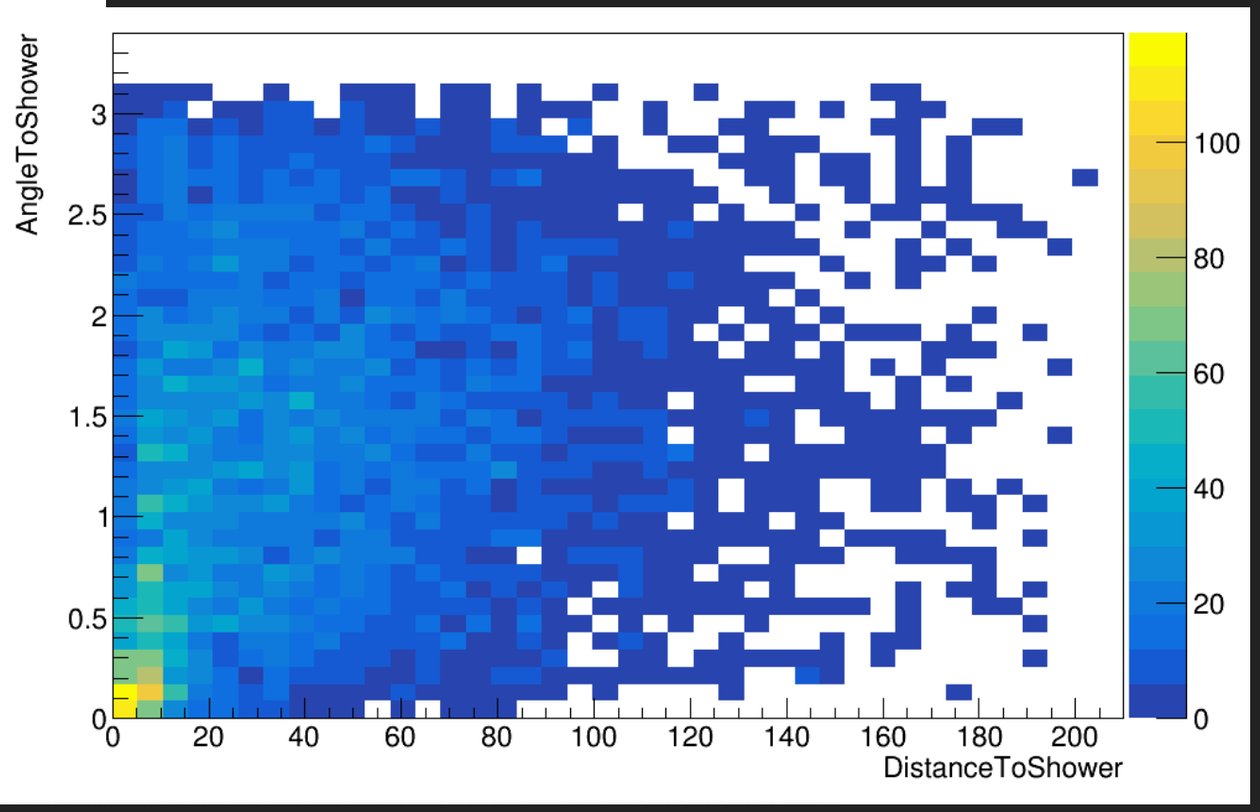
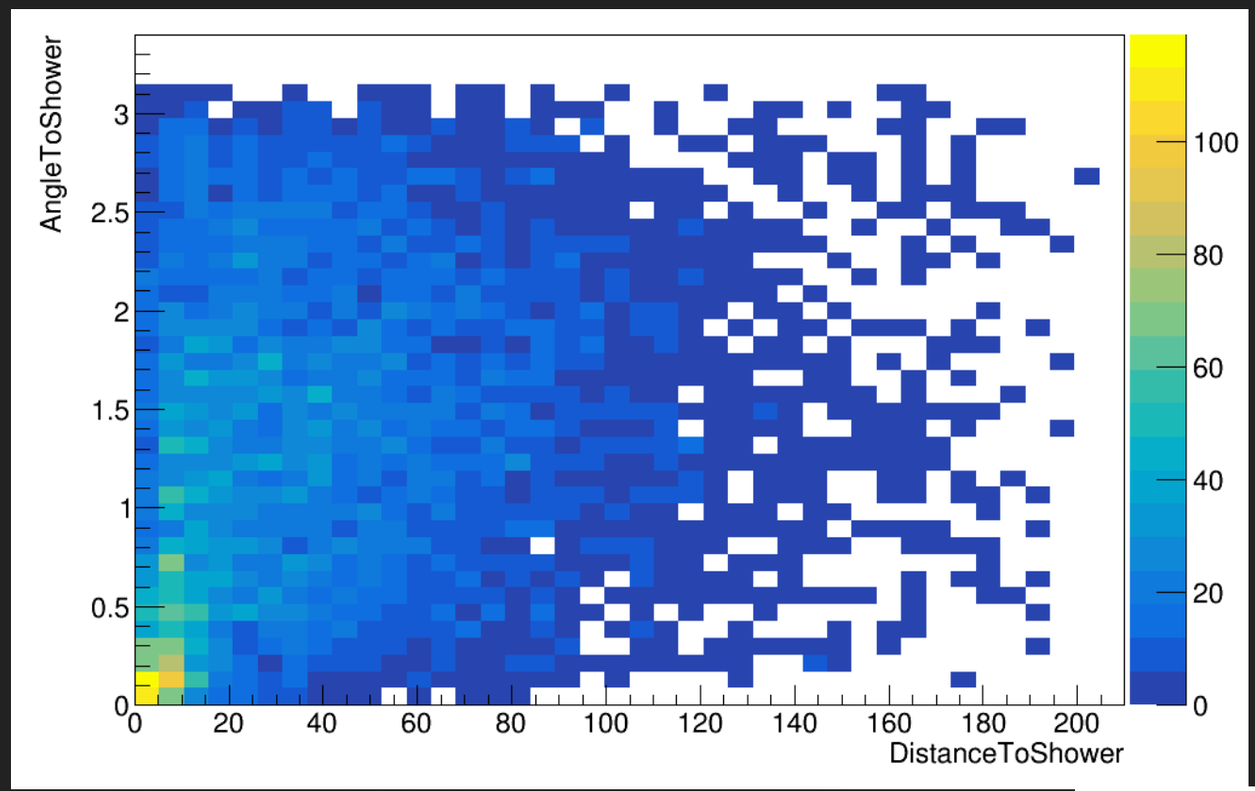
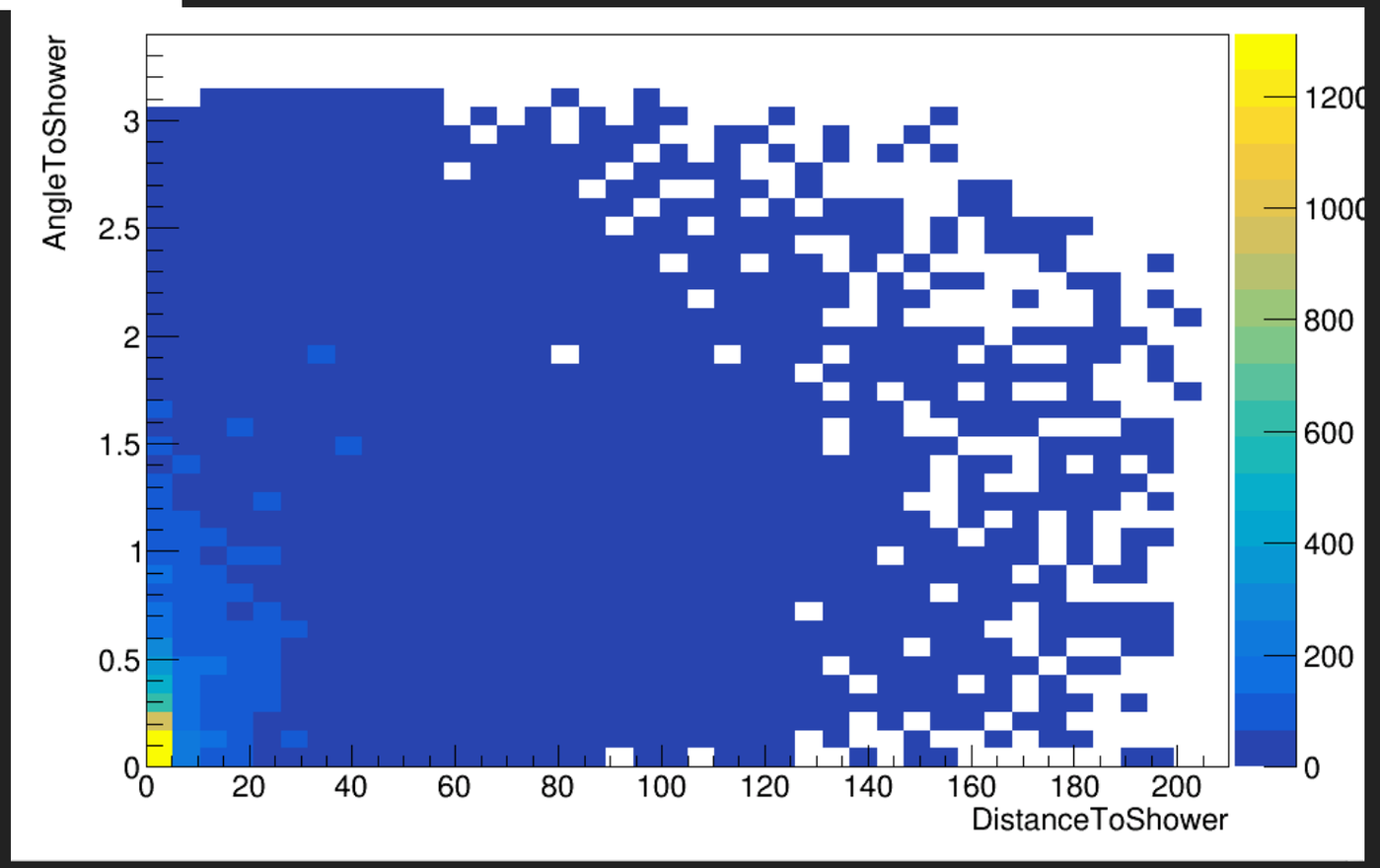
ProtoDUNE mcc11

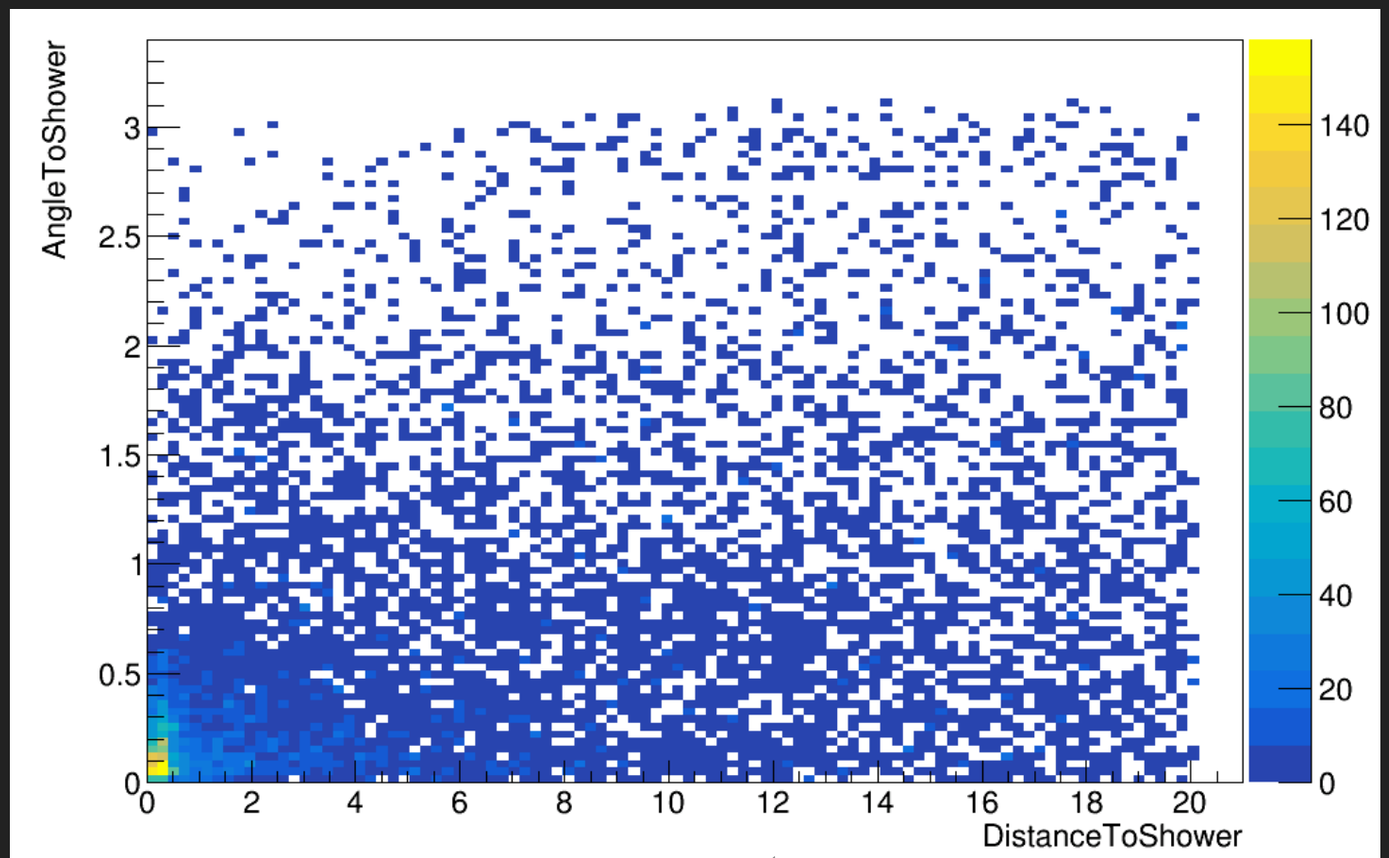




DUNE mcc11

ProtoDUNE mcc11

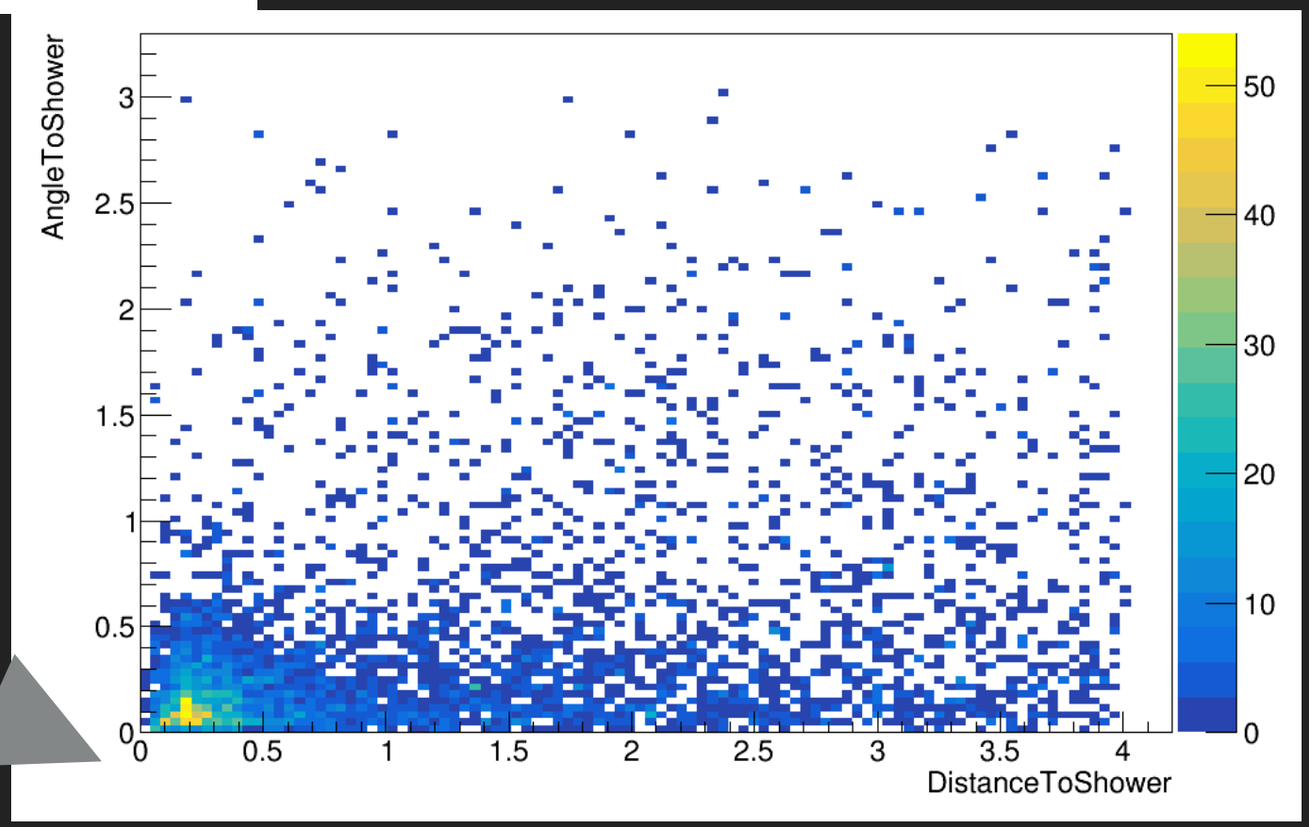




ZOOM AND ENHANCE!

DUNE mcc11

Same data, different range



FUTURE PLANS

- Invariant mass comparison between MC and reco
- π^0 vertex reconstruction / MC comparison
- Develop shower matching algorithm
  - Distinguish photon showers from electron shower
- Test other reconstruction algorithms