

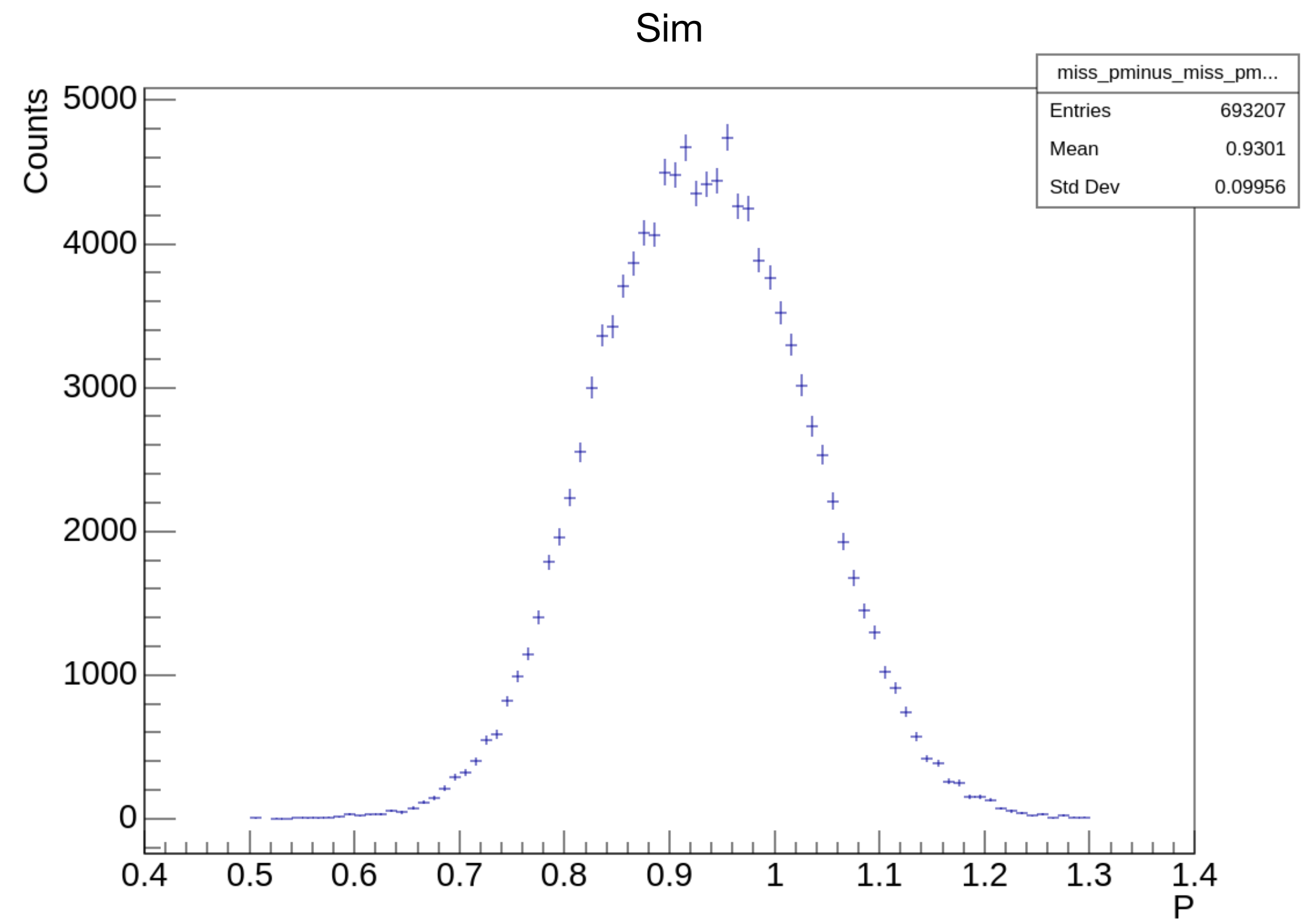
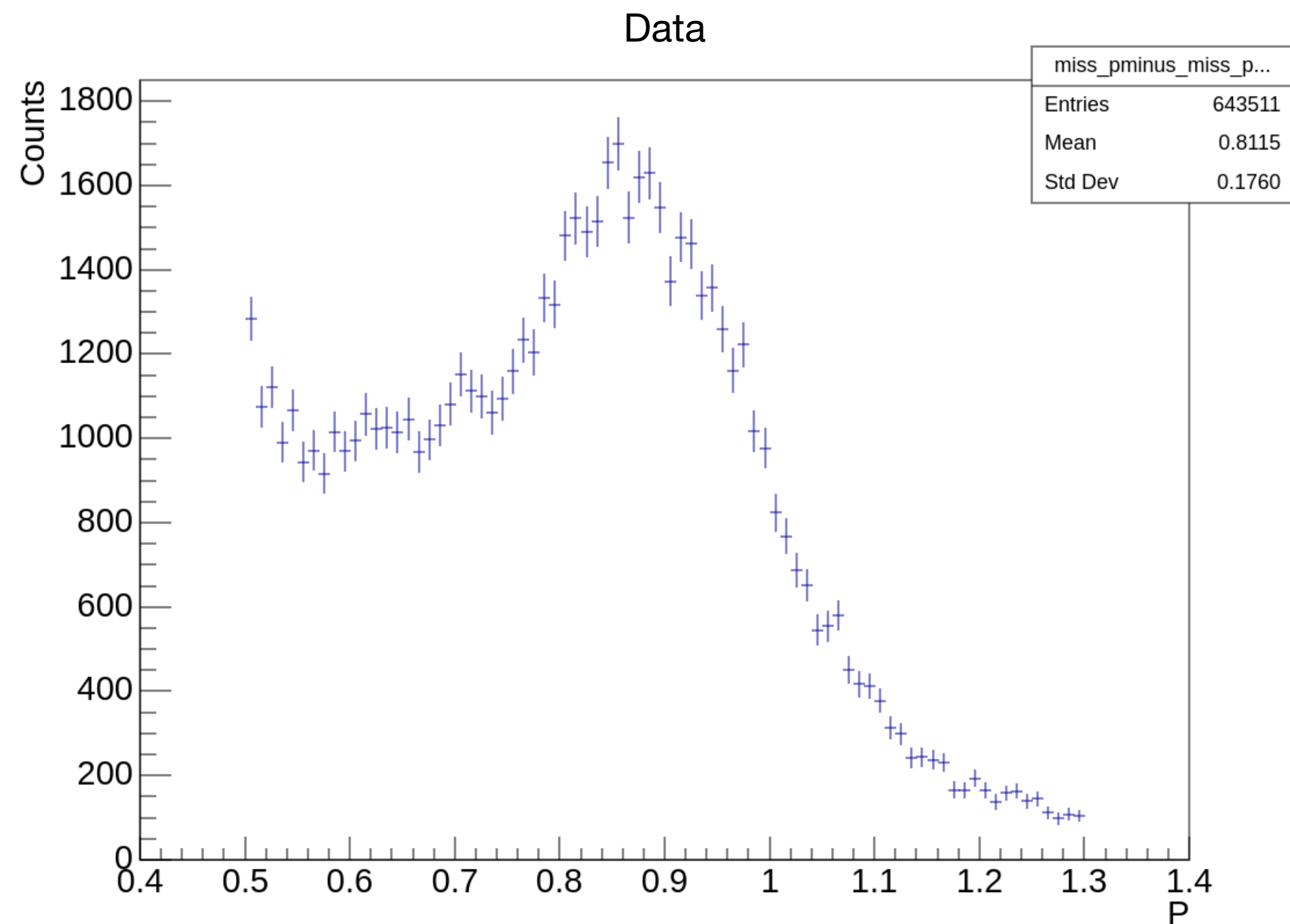
$\gamma n \rightarrow \pi^- p$ channel on carbon target

- Event selection
 - 1 positive and 1 negative tracks, no extra tracks or showers
 - kinematic fitting and vertex constraint, figure of merit (FOM) > 0.01
 - tagger accidental subtracted with 4 beam bunches on each side
 - standard GlueX PID cuts (timing and dE/dx)
 - photon energy: $5.8 \text{ GeV} < E_\gamma < 10.7 \text{ GeV}$
 - cuts on vertex to constrain to the target region
 - PIDFOM of charged tracks > 0.01

$\gamma n \rightarrow \pi^- p$ channel on carbon target

- Observable: Minus momentum component of the initial neutron

- $P_{miss}^- = E_{miss} - P_{miss}^z$

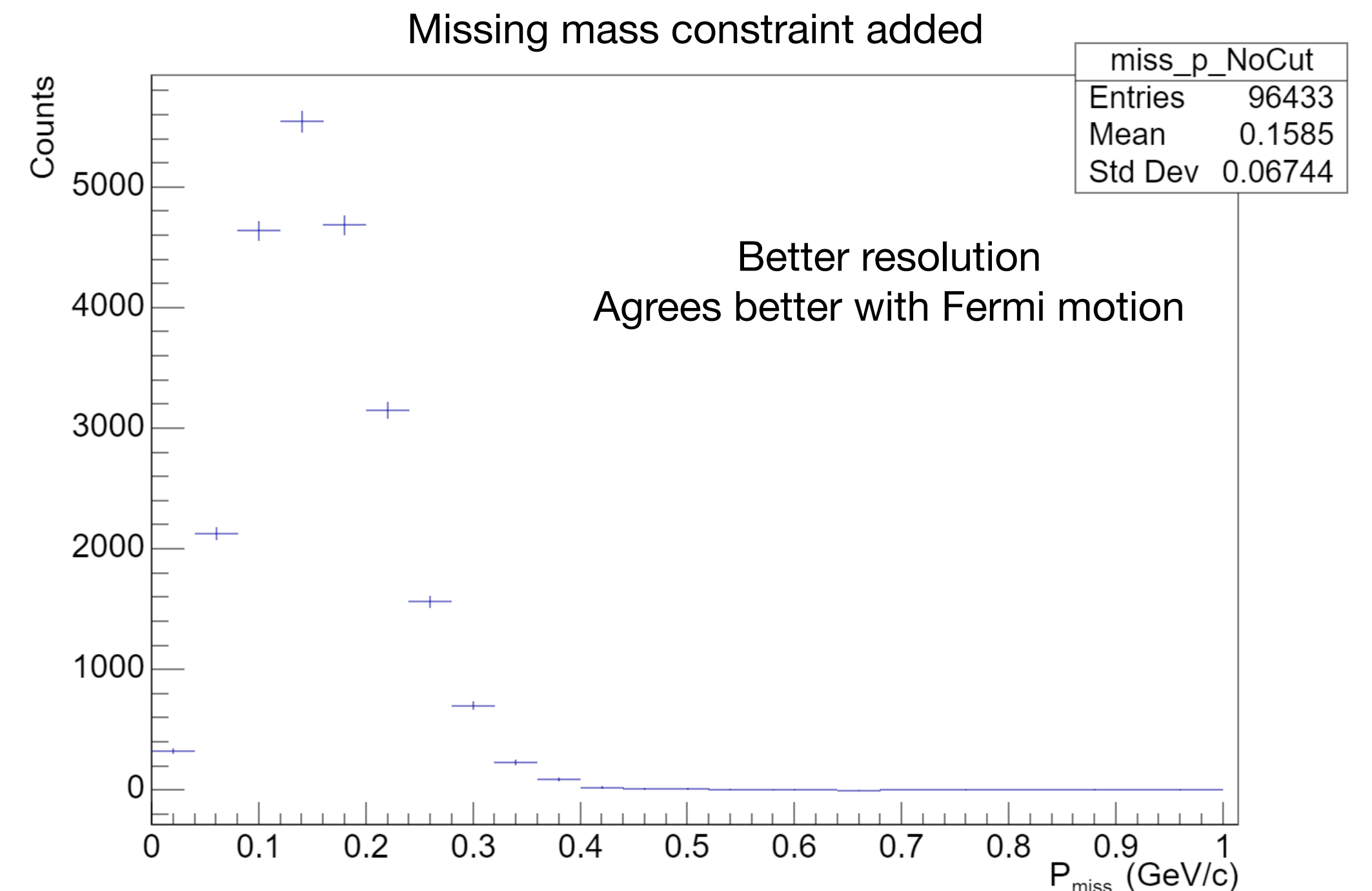
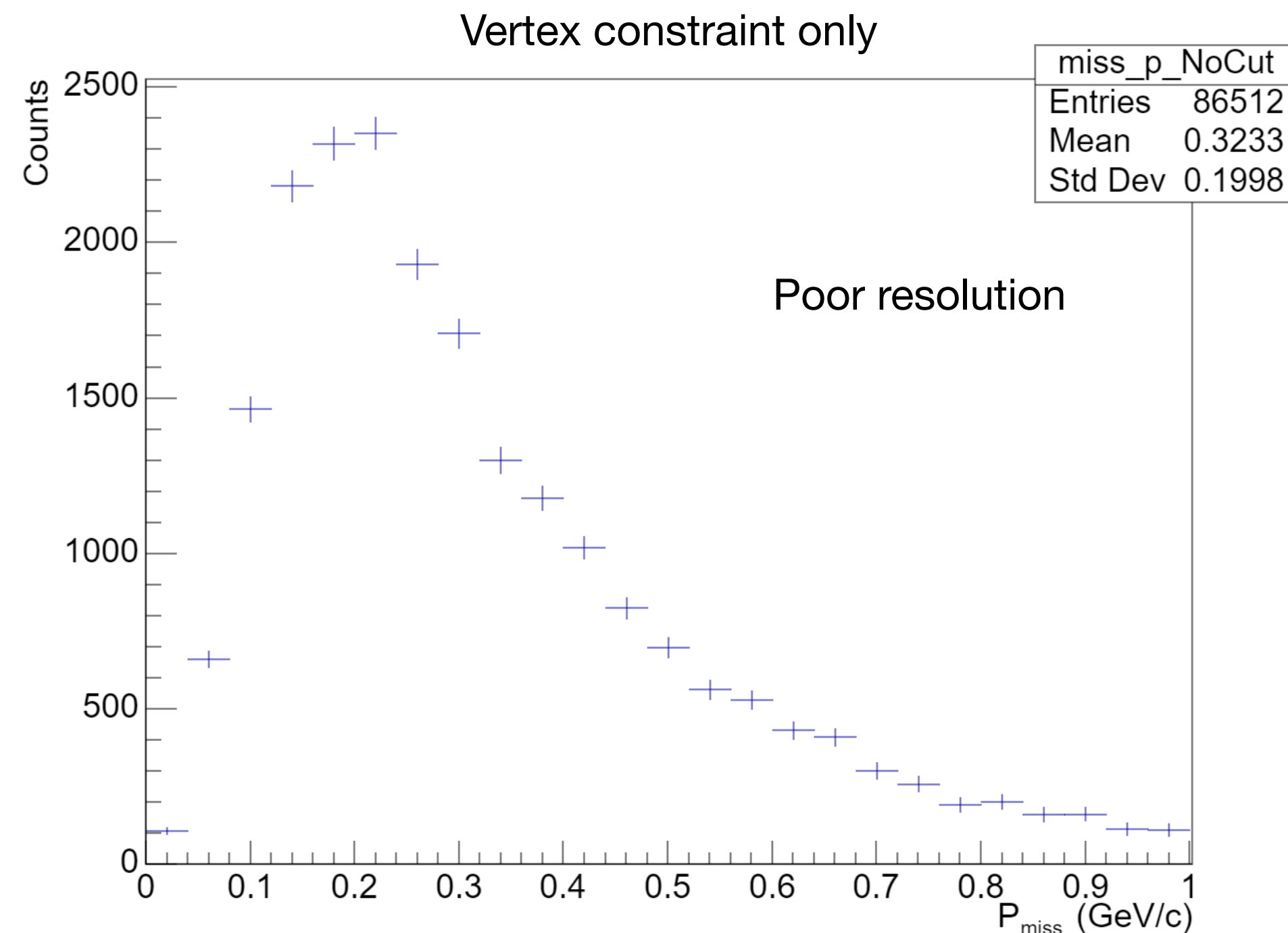


$\gamma n \rightarrow \pi^- p$ channel on carbon target

- Kinematic fitting
 - To improve the resolution of the experimental measurements
 - Predict new values given the measured ones and known constraints
 - Based on least means squared minimization with Lagrange multipliers
 - χ^2 of the fit can tell the goodness of the hypothesis
 - Vertex constraint: all final state particles originate from the same vertex
 - Mass constraint: A decayed particle or missing particle has specific mass

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- Previously: only vertex constraint, poor resolution
- Adding the constraint on the missing particle
- Assume to be A-1 (PWIA), only valid for quasi free nucleons



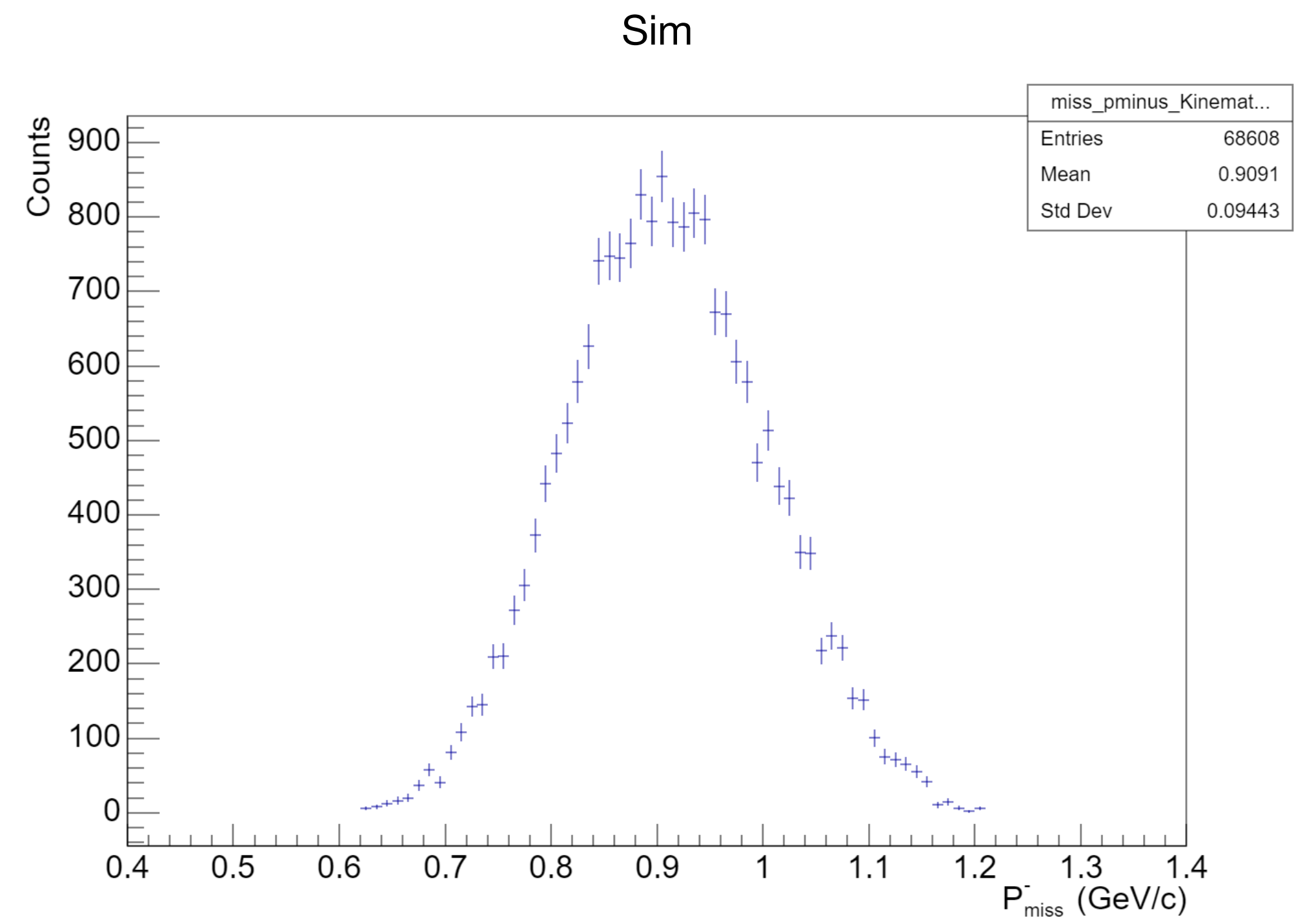
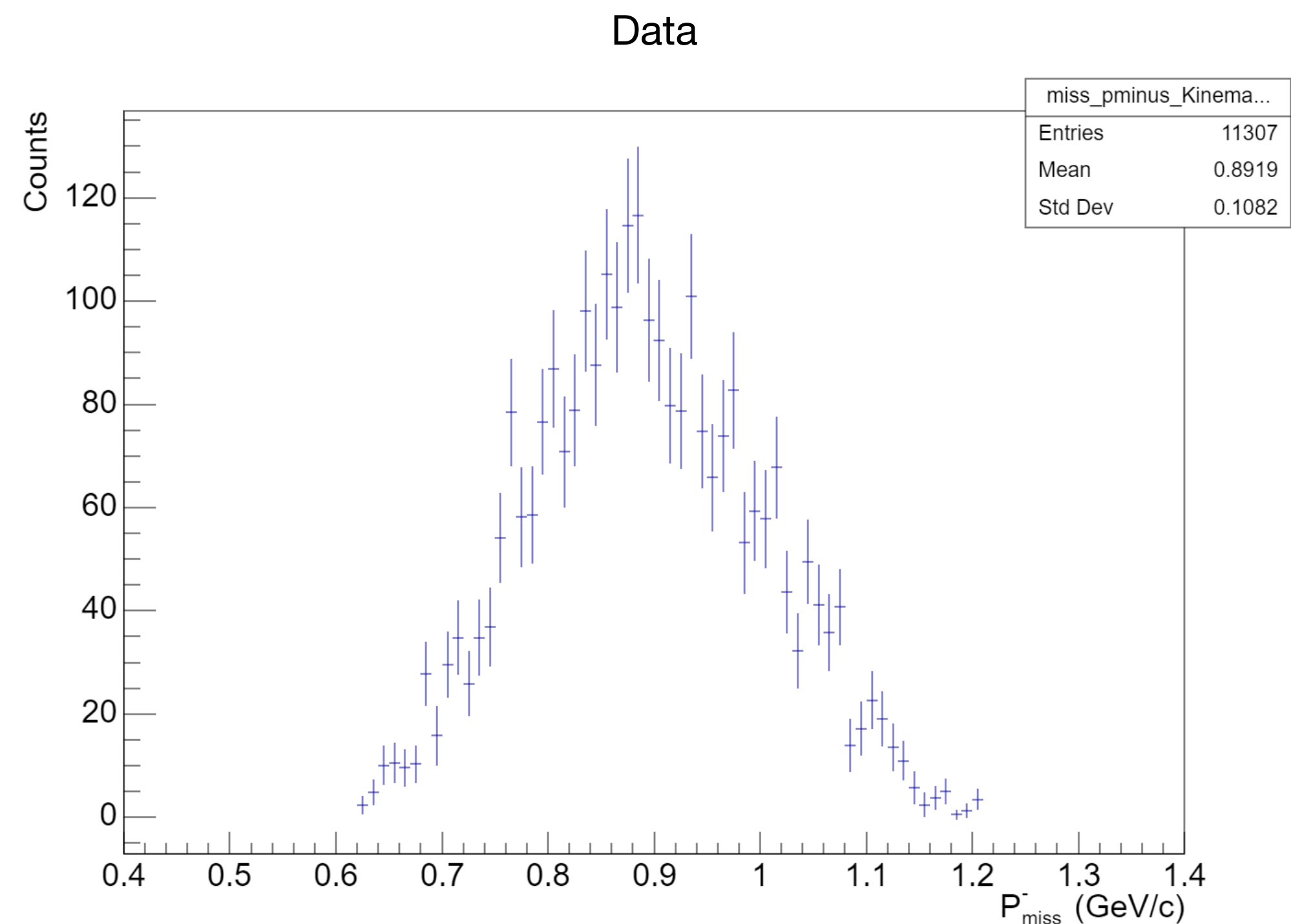
$\gamma n \rightarrow \pi^- p$ channel on carbon target

- Adding cuts on missing momentum
- >500 MeV for vertex constraints only
- >300 MeV for missing mass constraints added
- Restrict the initial neutron to quasi free regions
- Help remove background events with bad energy balance

- Looking at $-t > 500$ MeV, $-u > 500$ MeV for now

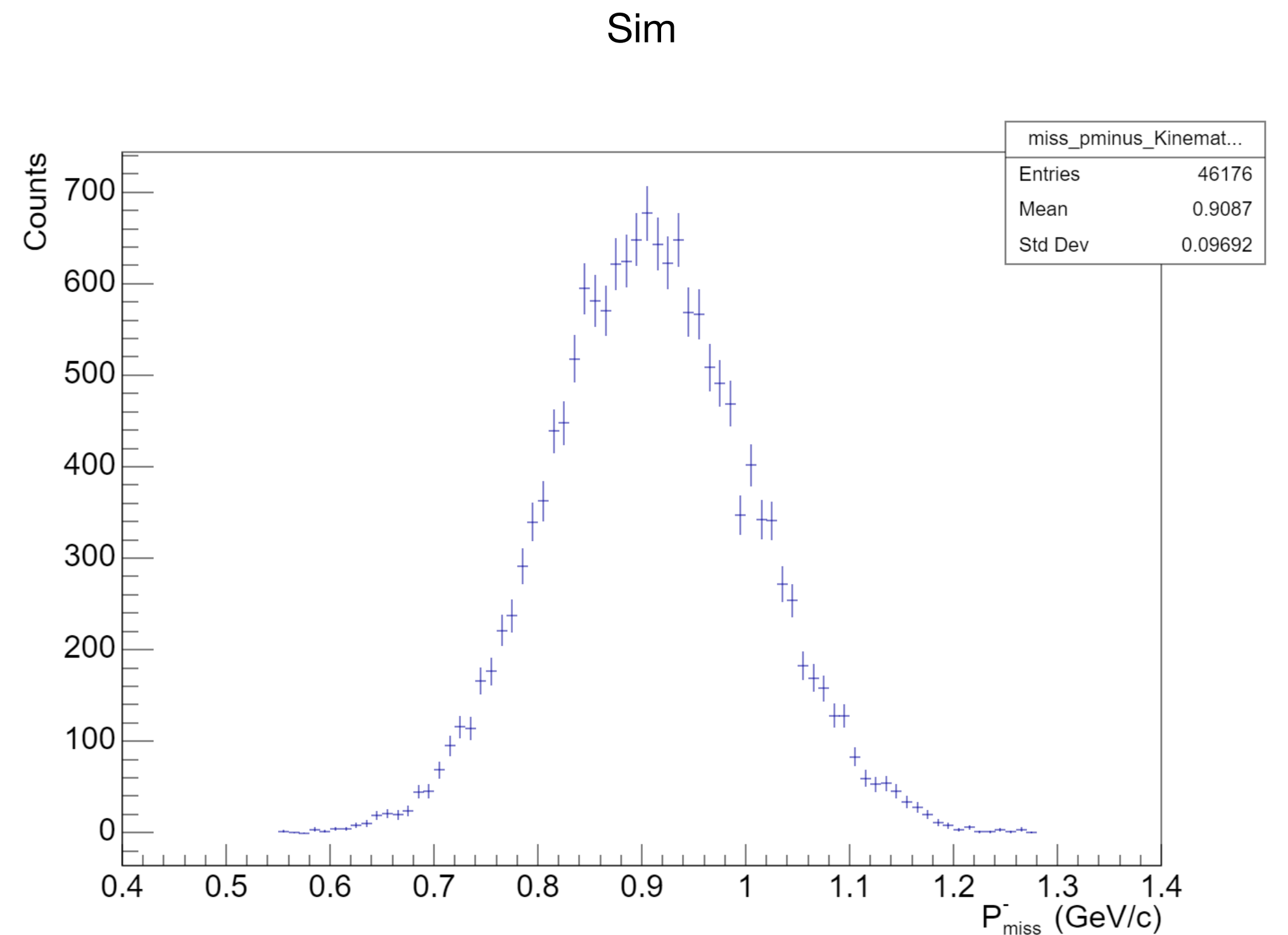
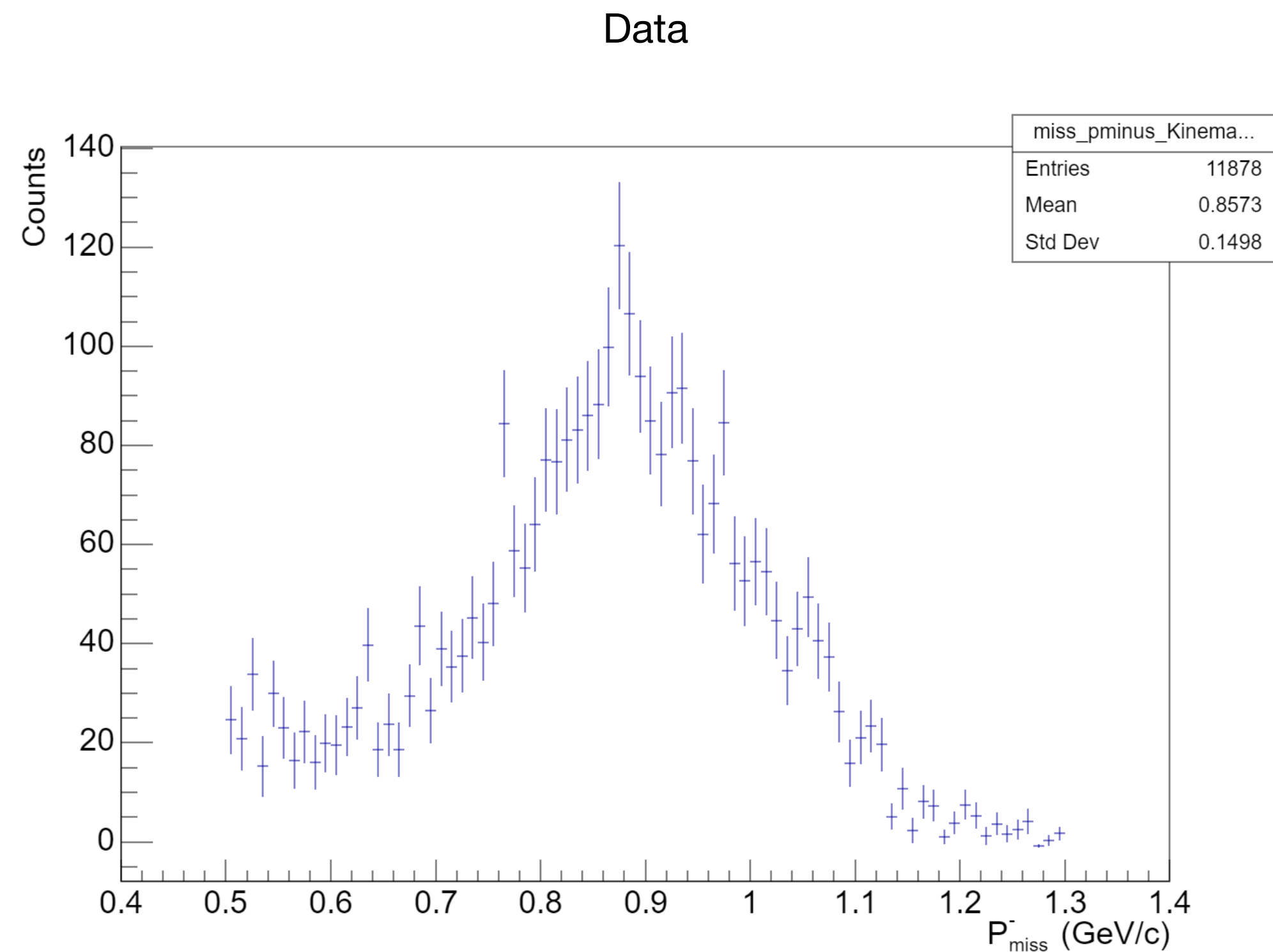
$\gamma n \rightarrow \pi^- p$ channel on carbon target

- Observable: Minus momentum component of the initial neutron
- $P_{miss}^- = E_{miss} - P_{miss}^z$
- Missing mass constraint added



$\gamma n \rightarrow \pi^- p$ channel on carbon target

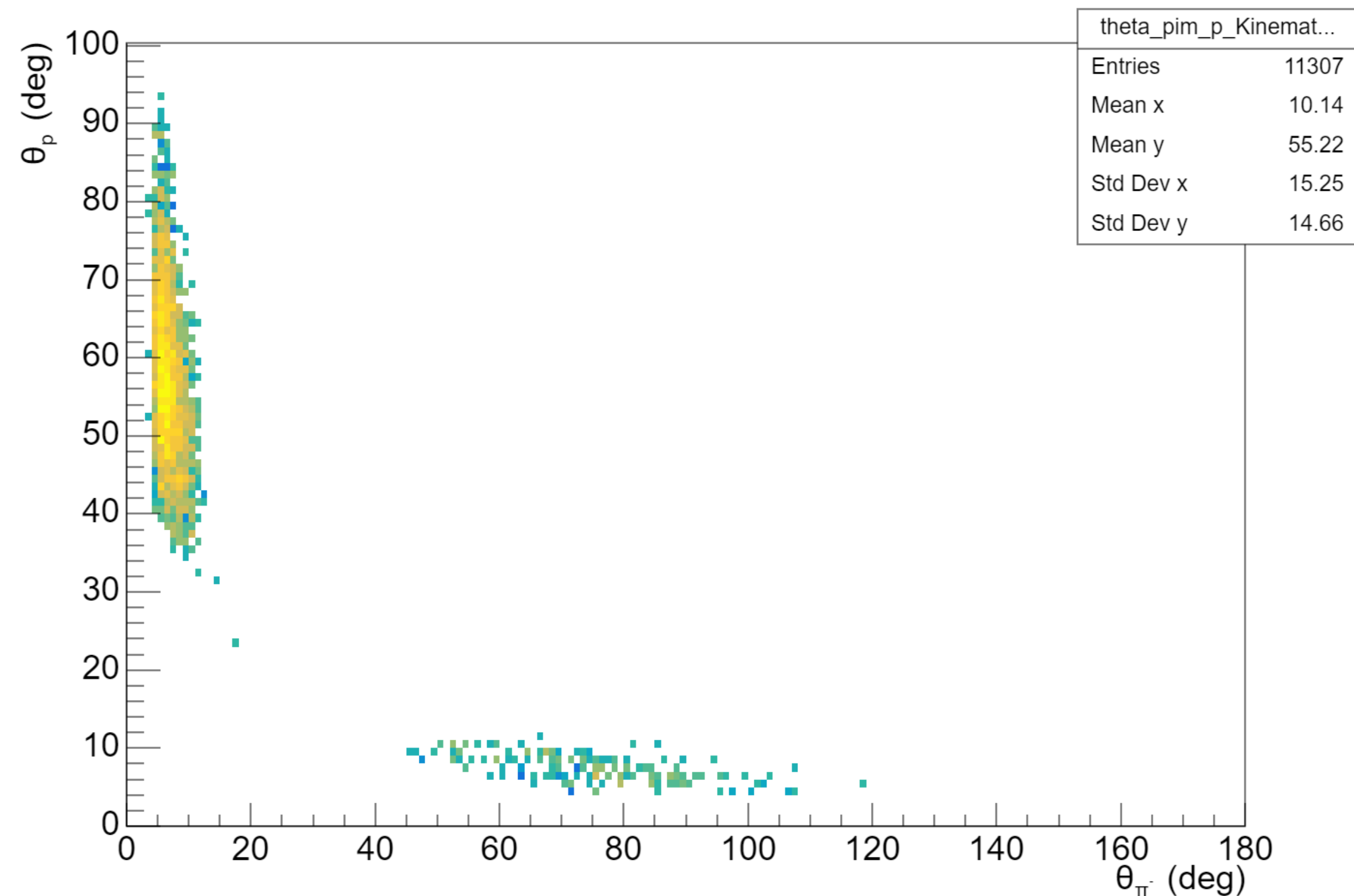
- Observable: Minus momentum component of the initial neutron
- $P_{miss}^- = E_{miss} - P_{miss}^z$
- Vertex constraint only



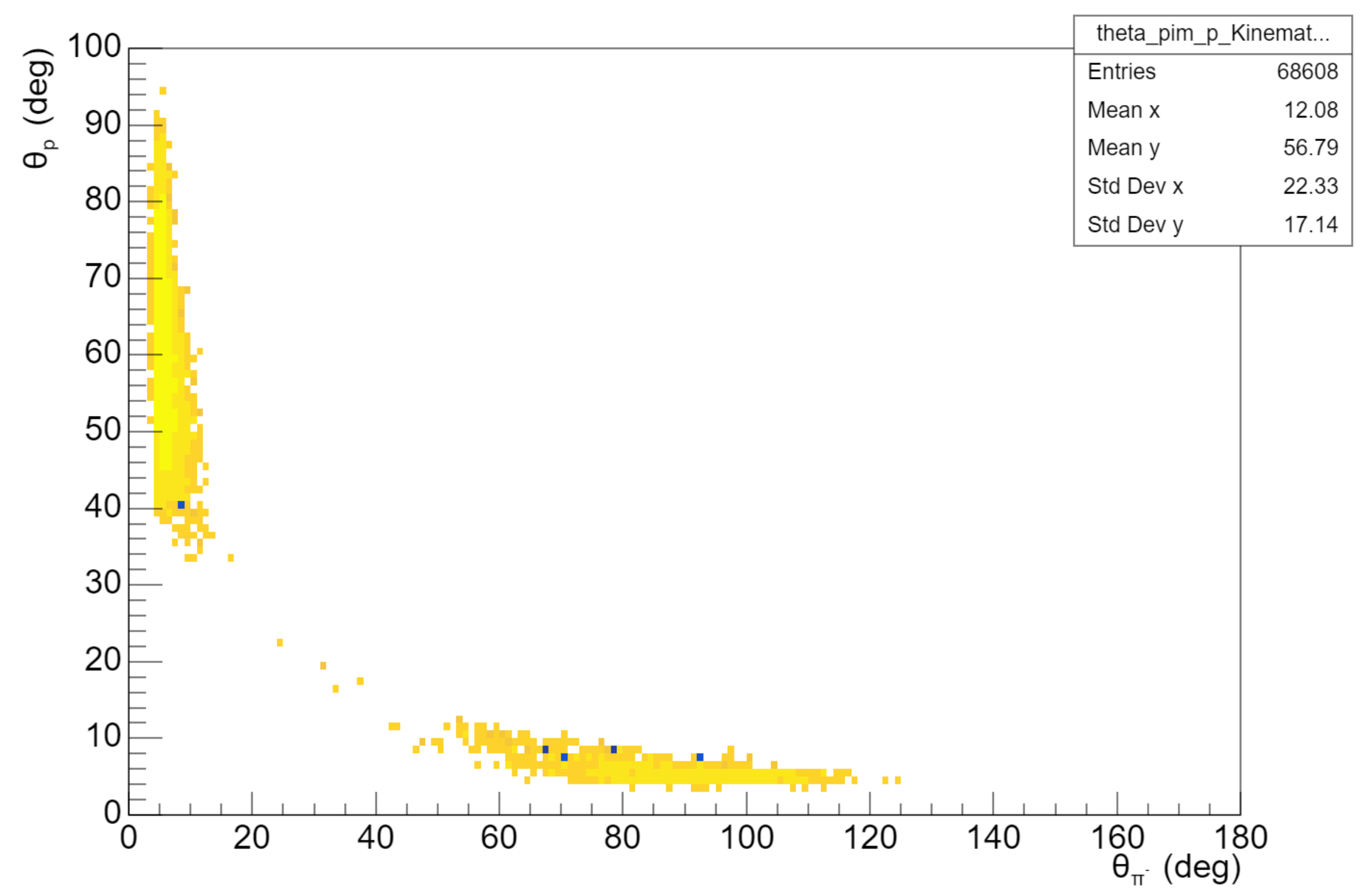
$\gamma n \rightarrow \pi^- p$ channel on carbon target

- Final state kinematics
- Missing mass constraint added

Data



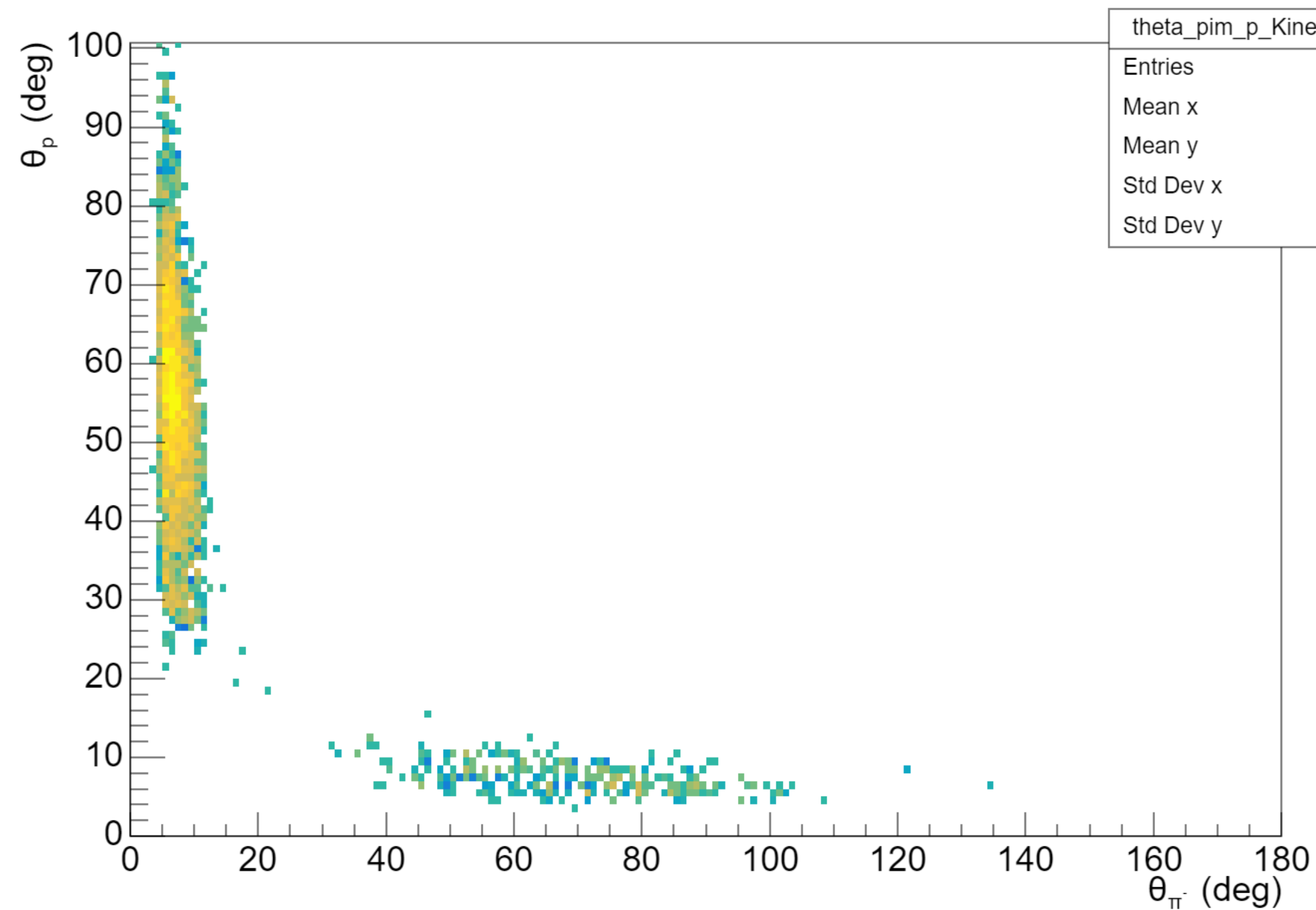
Sim



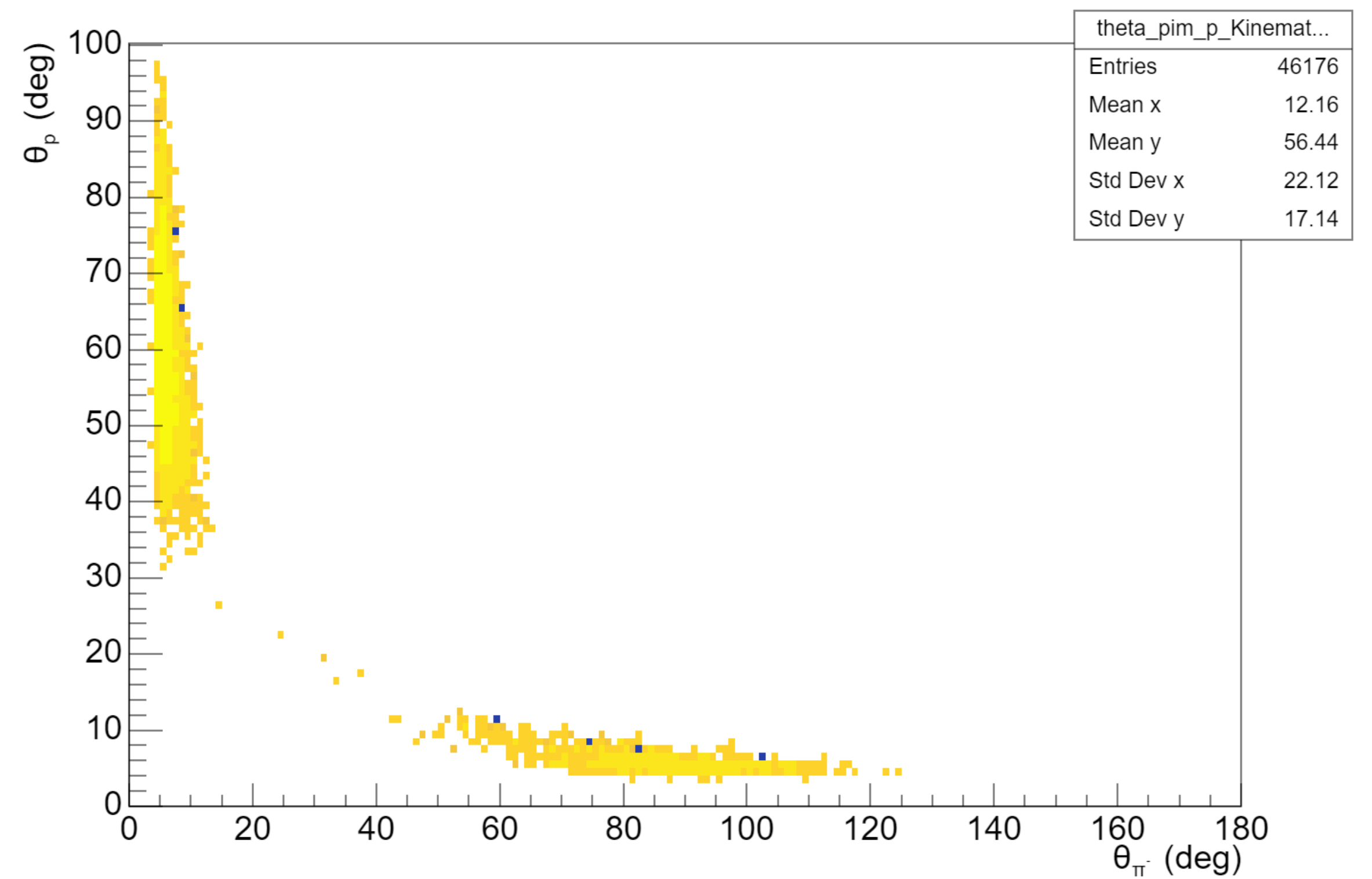
$\gamma n \rightarrow \pi^- p$ channel on carbon target

- Final state kinematics
- Vertex constraint only

Data



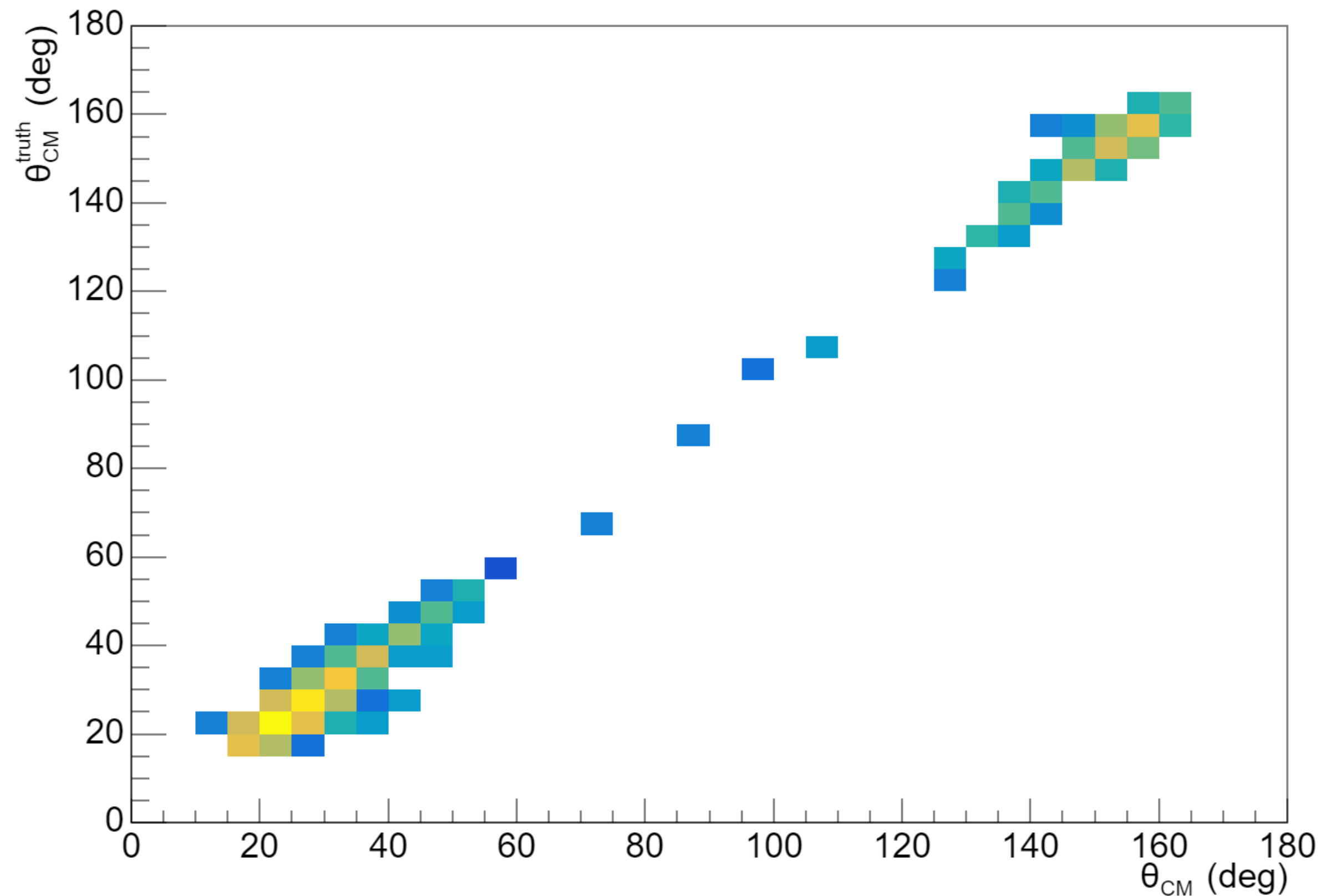
Sim



$\gamma n \rightarrow \pi^- p$ channel on carbon target

- Bin migration effect, due to the limited resolution
- About 10% of all events migrated to another bin

Missing mass constraint added



Vertex constraint only

