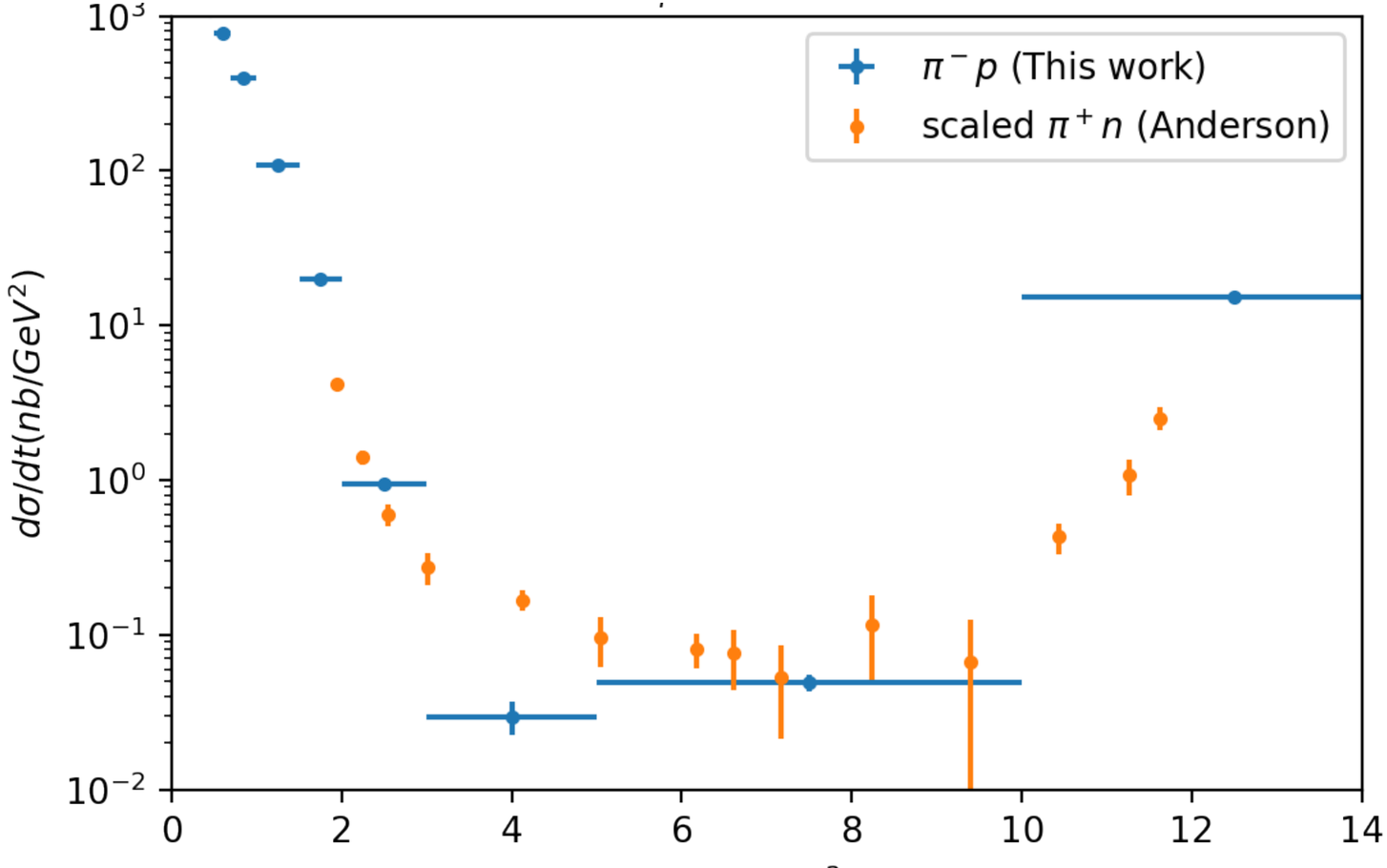
$\gamma n \rightarrow \pi^- p$ cross section on deuterium

- Old cross section
- $E_\gamma = 7.0 - 8.0$ GeV, compared with scaled π^+ data



Improvements on the cross section

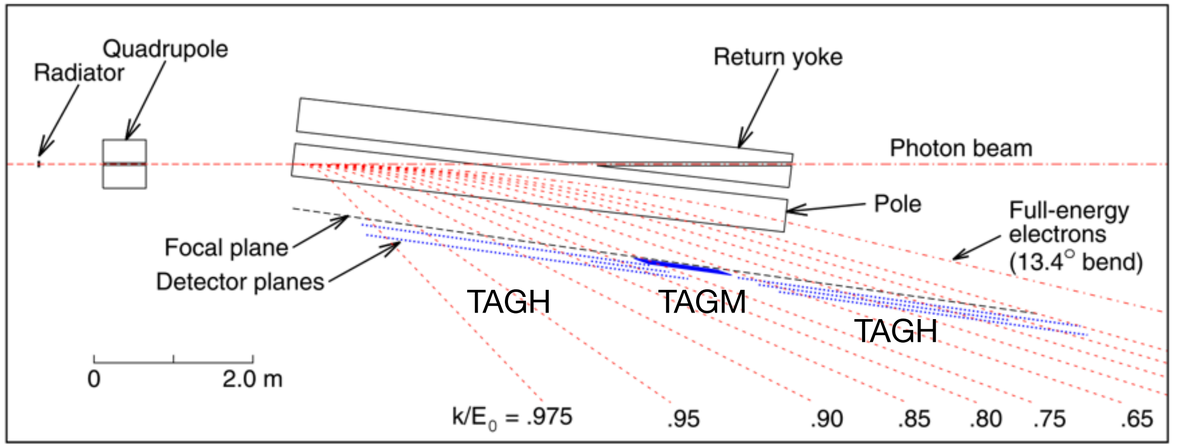
1. Energy bins based on combined tagger counters

- 3 regions divided into 2 bins each
- Detector geometry is taken into account (grouping, tagger width)

5.848-6.837 GeV, 6.837-7.351 GeV

7.351-7.848 GeV, 7.848-8.283 GeV

8.283-9.426 GeV, 9.426-10.617 GeV



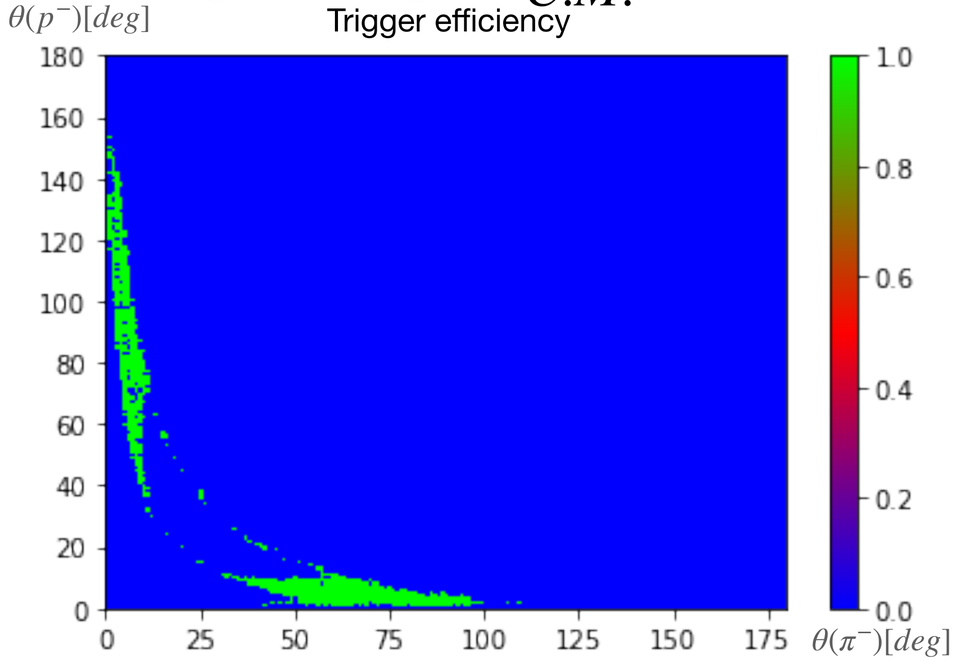
NIM A, 987, 2021, 164807

Improvements on the cross section

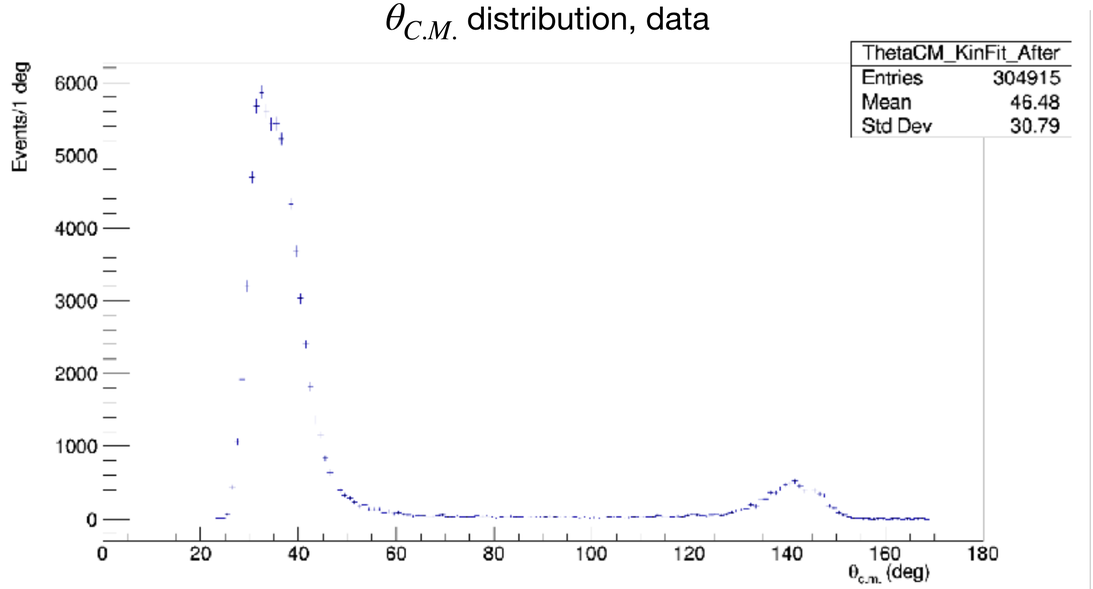
2. Trigger simulation included

- combination of calorimeters and pair spectrometer
- but always require FCAL energy deposition (to control the DAQ rate)
- High t/large $\theta_{C.M.}$ events are greatly suppressed

Trigger efficiency



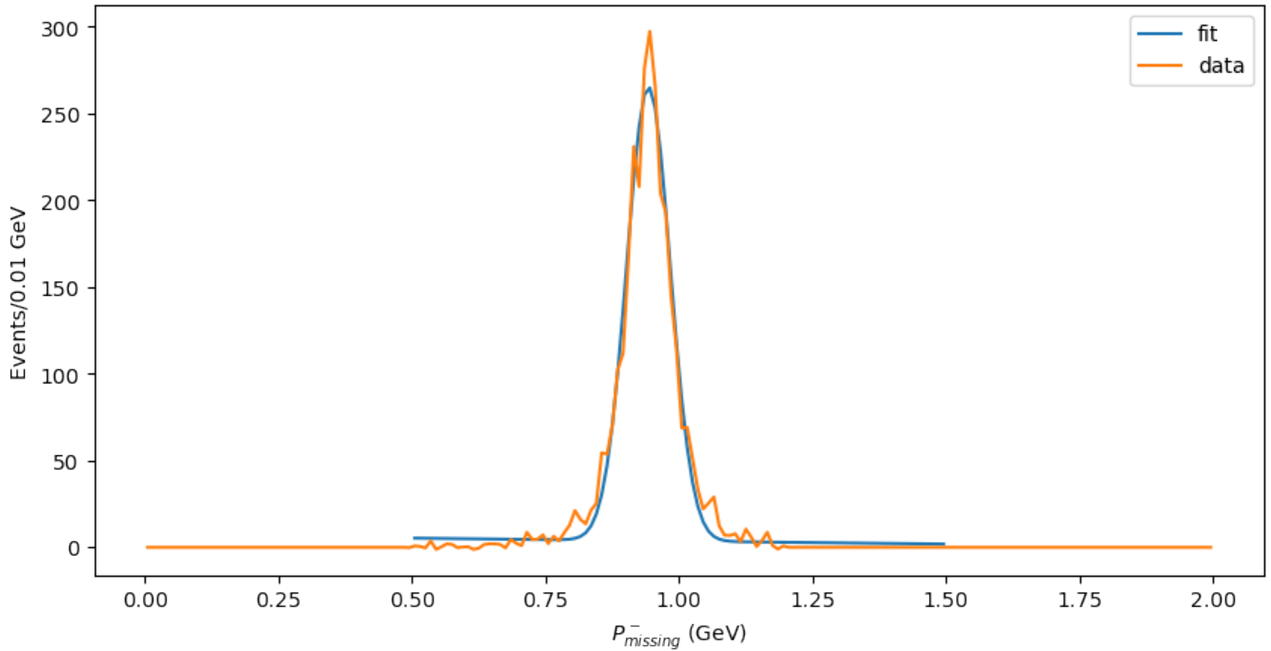
$\theta_{C.M.}$ distribution, data



Improvements on the cross section

3. Yield extraction fitting

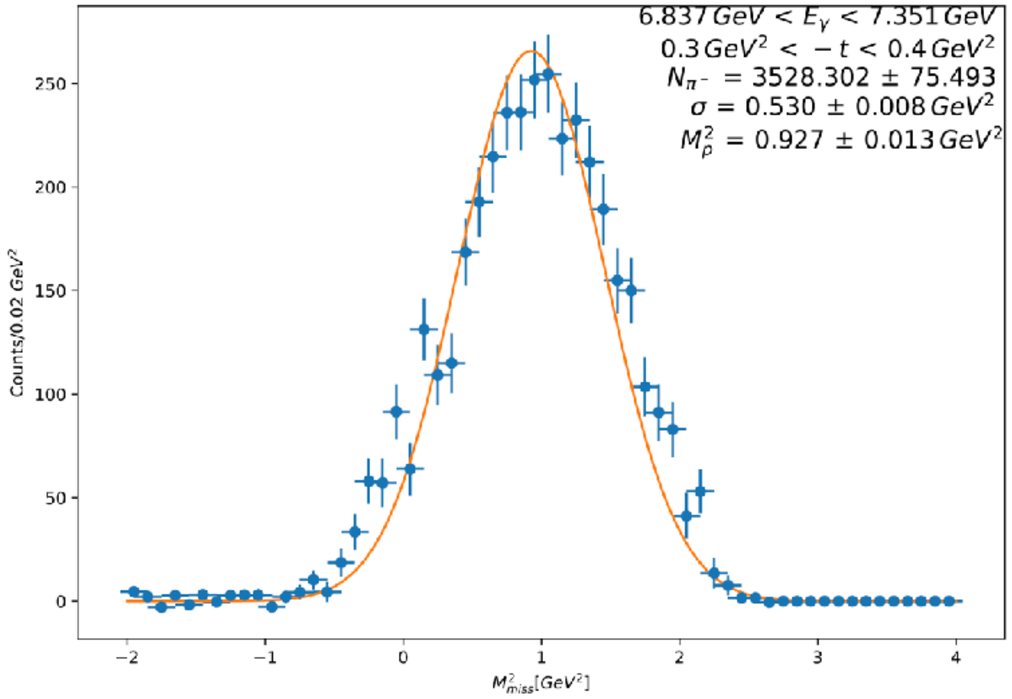
- Previously, $P^{-}_{miss} = E_{miss} - P^{z}_{miss}$ is used due to better resolution
- A light-front coordinate that is not widely used and studied
- Double Gaussian fit is needed, more prone to overfitting



Improvements on the cross section

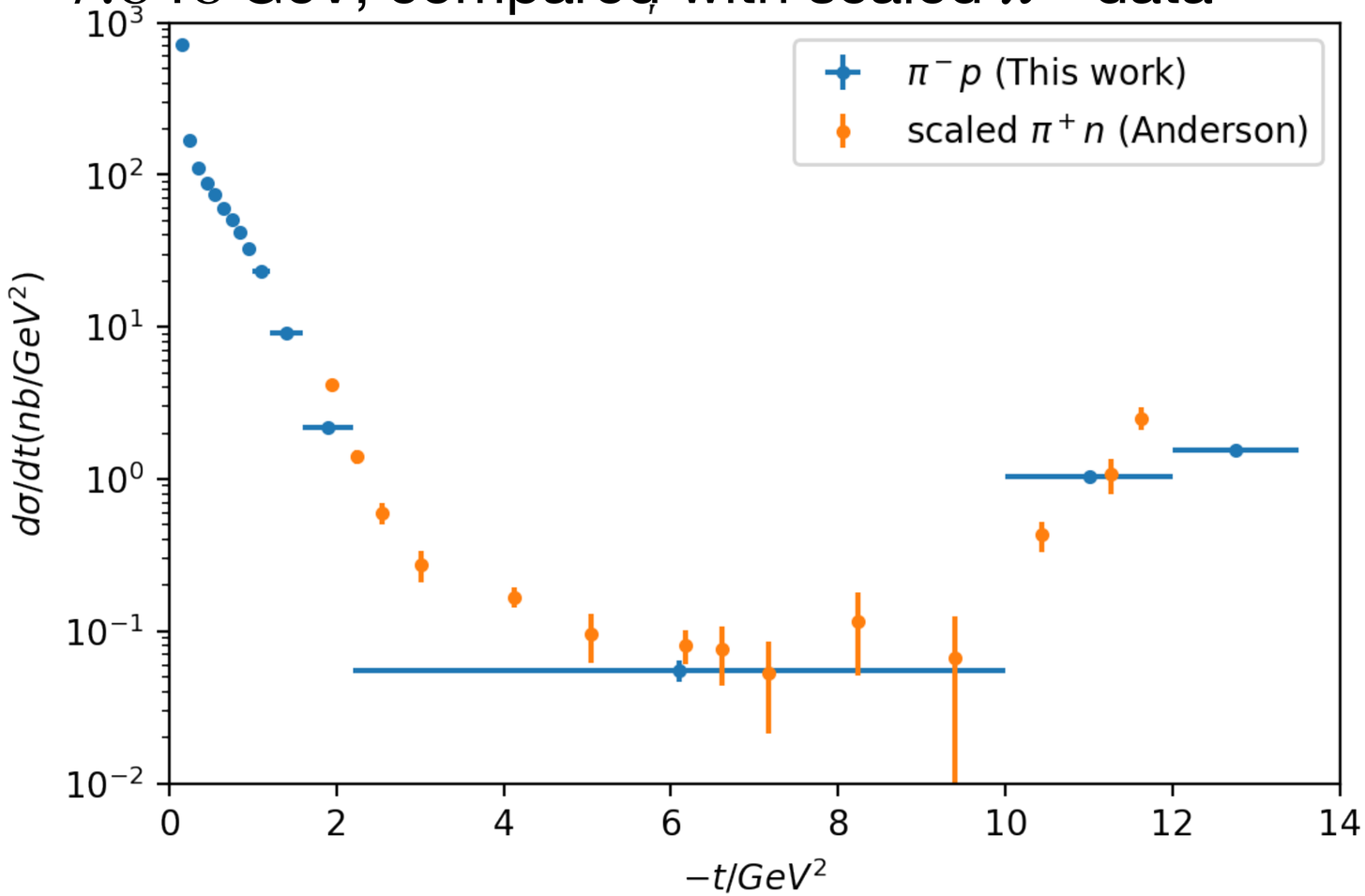
3. Yield extraction fitting

- Missing mass squared M^2_{miss} is used instead
- Poor resolution but the signal is mostly clean
- Single Gaussian fit suffices



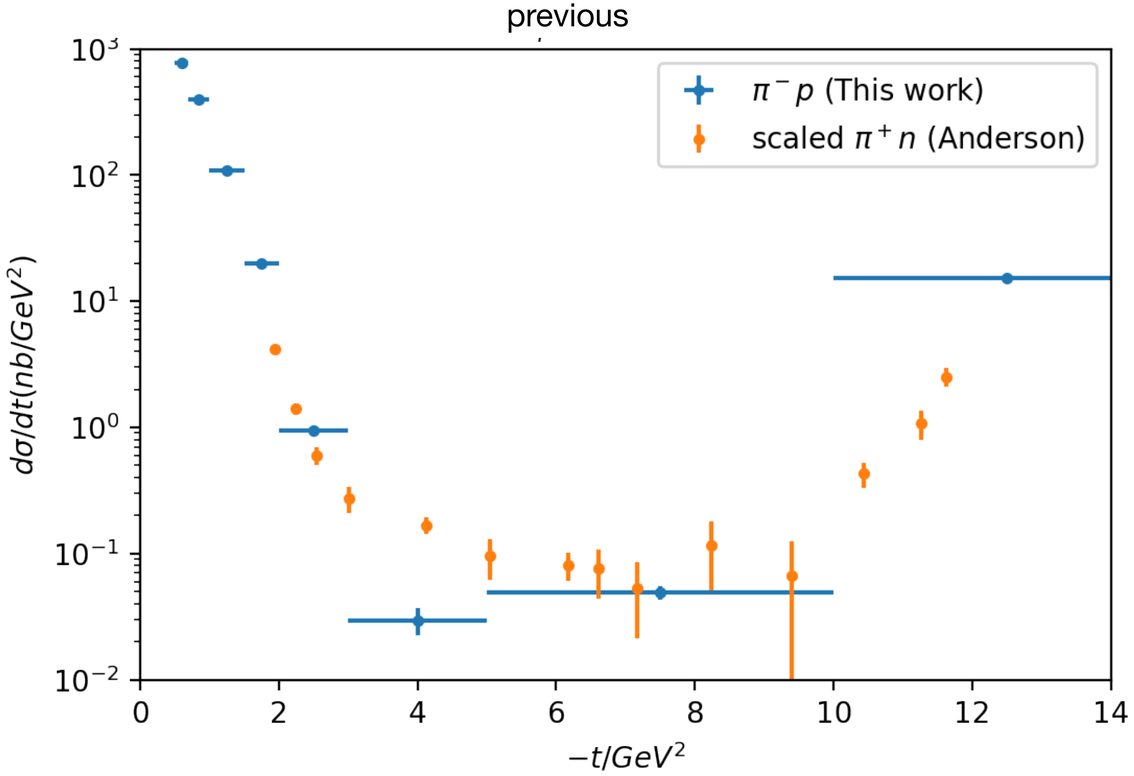
$\gamma n \rightarrow \pi^- p$ cross section on deuterium

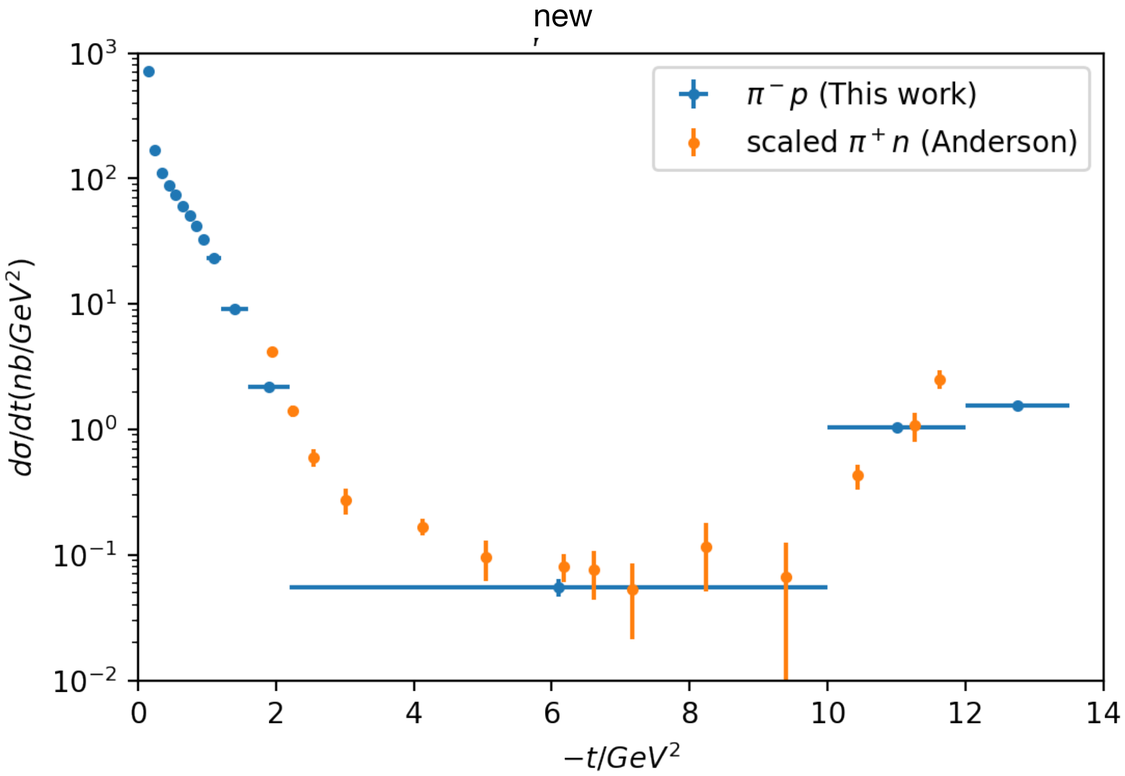
- Updated cross section
- $E_\gamma = 7.351 - 7.848$ GeV, compared with scaled π^+ data



$\gamma n \rightarrow \pi^- p$ cross section on deuterium

- Comparison





$\gamma n \rightarrow \pi^- p$ cross section on deuterium

- Next steps
- Bin centering
- Switch to ROOT fitting for better robustness
- Get an estimate of systematic errors
- Work on corrections: FSI, bin migration
- Check the low u,t behaviors of the generator