

Summary of ECCE inclusive activities

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EIC Detector 1 inclusive working group meeting

May 9, 2022

Overview

- Credits
- Generator
- Kinematic reconstruction
- Electron identification/pion rejection
- Physics studies
- Uncertainties
- Ideas for path forward + open questions

Credits

- Inclusive WG conveners: Claire & Tyler
- EW/BSM WG conveners: Xiaochao Zheng & Sonny Mantry
 - Major contributions from:
 - Shima Shimizu
 - Eimear Conroy
 - Jackson Pybus
 - Dien Nguyen
 - Erez Cohen
 - Cameron Cotton
 - Friederike Bock
 - Nicolas Schmidt
 - Valuable input from:
 - Charlotte Van Hulse
 - Ralf Seidl
 - Peter Steinberg
 - Carlos Munoz-Camacho
 - Rosi Reed

Generator

- DJANGO for DIS events (due to close collaboration with EW/BSM WG)
- Pythia6 for photoproduction background events
- These choices were largely driven by the available expertise/personpower, not necessarily which was the “best” for our purposes

Kinematic reconstruction

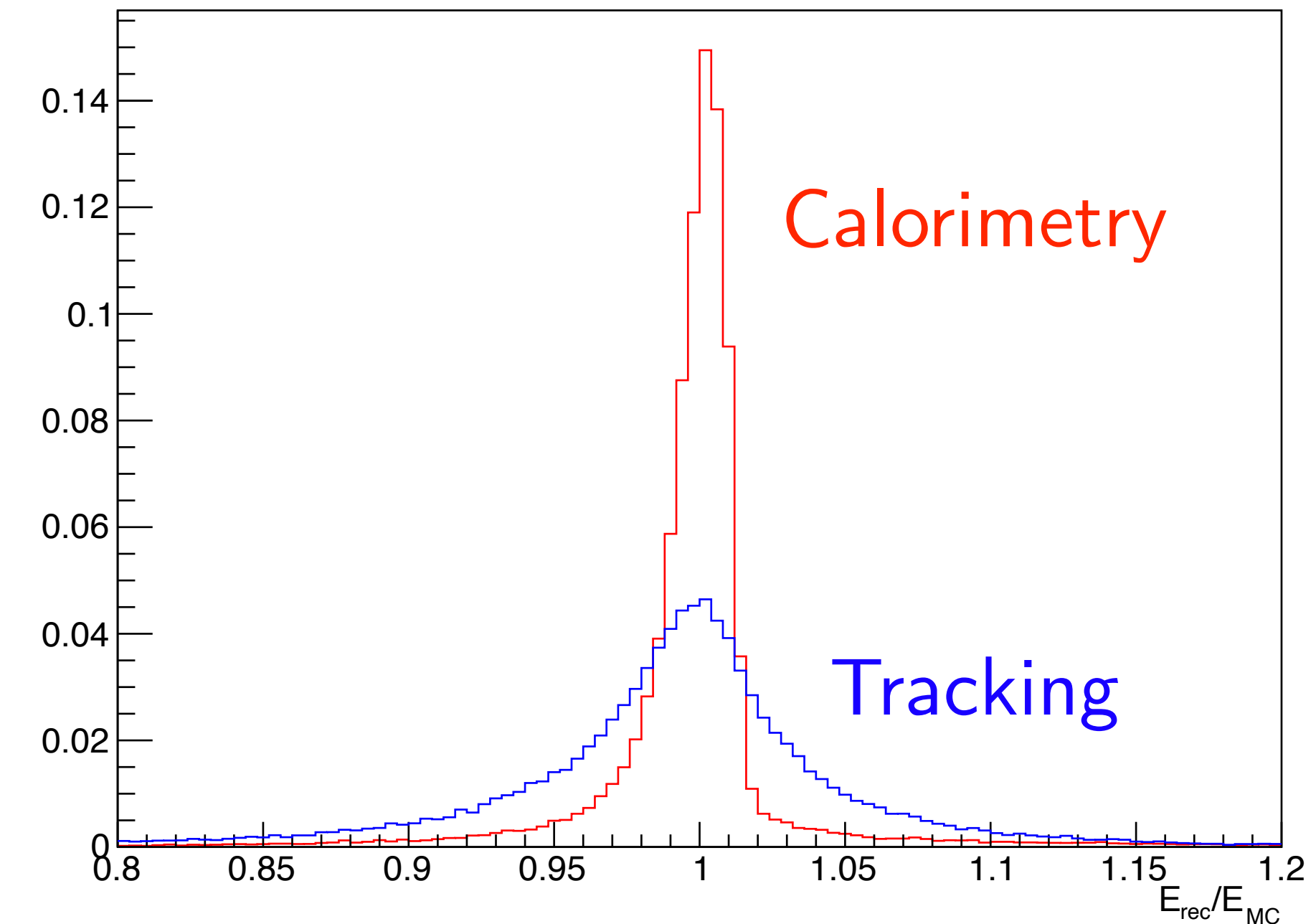
- Studied 3 reconstruction methods: lepton, JB, DA

Successes:

- Major resolution improvement in backward endcap region by including calorimeter energy in lepton reconstruction

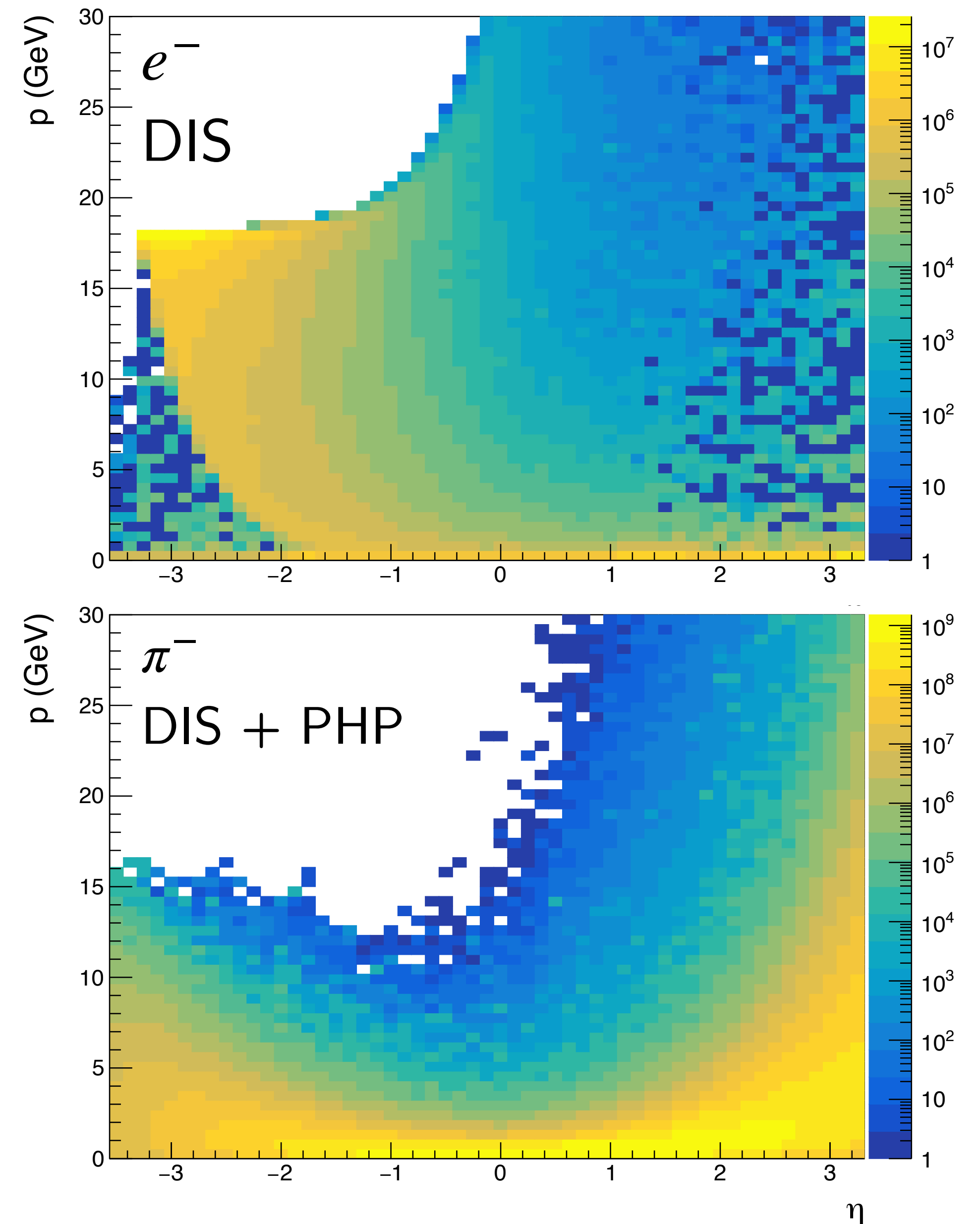
Possible improvements:

- Use charged particle tracks when available for hadronic reconstruction (clusters for neutrals only)
- Include $e\Sigma$ reconstruction method (not done due to limited time)
- Particle flow, kinematic fitting, machine learning...



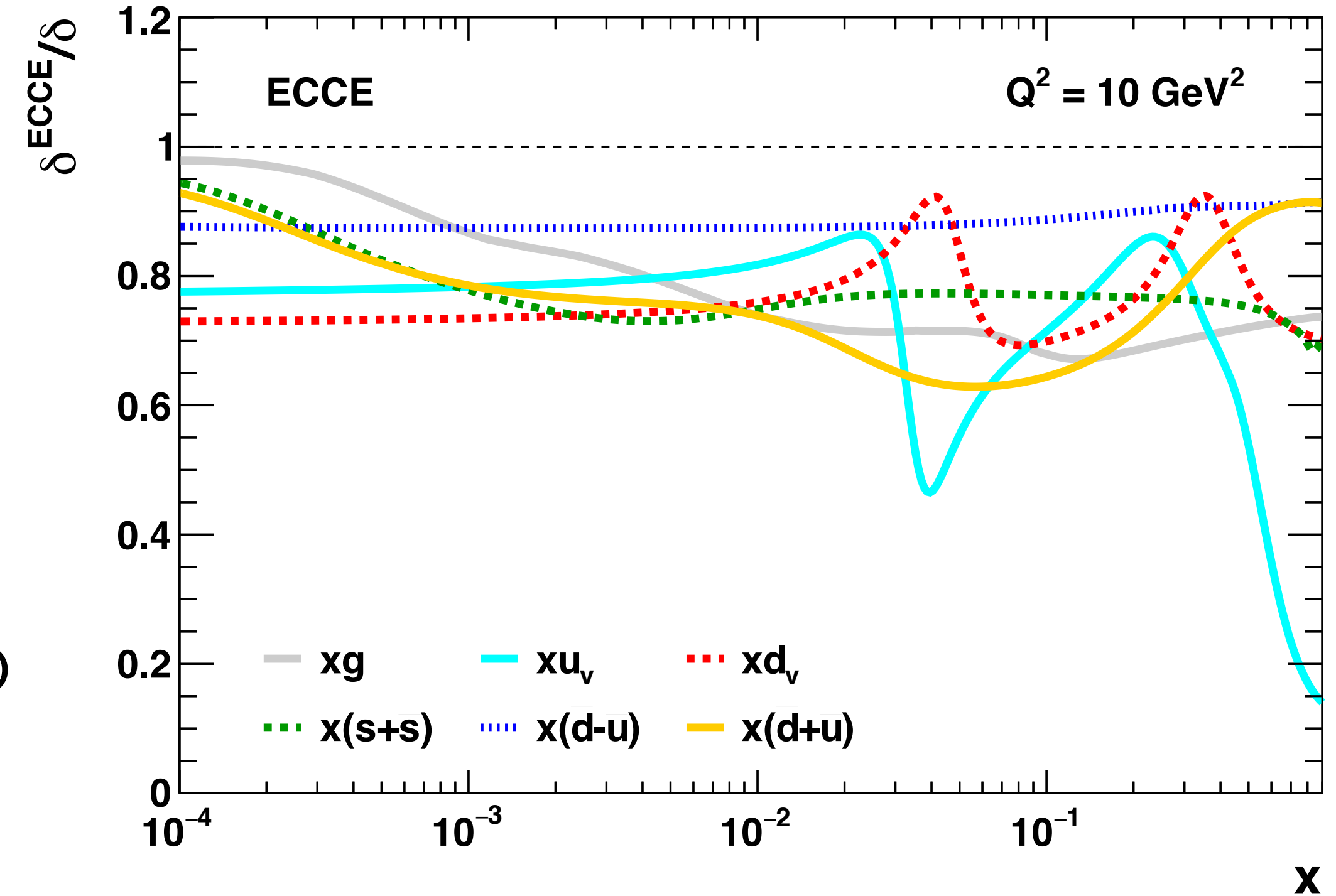
Electron identification/pion rejection

- Studied pion contamination with simulated π/e ratios and rejection factor maps from detector WGs
- Have yet to implement full ePID including simulated signals from all detector subsystems
- Background estimation included DIS and $Q^2 < 2$ GeV photoproduction
 - Other processes?



Physics studies

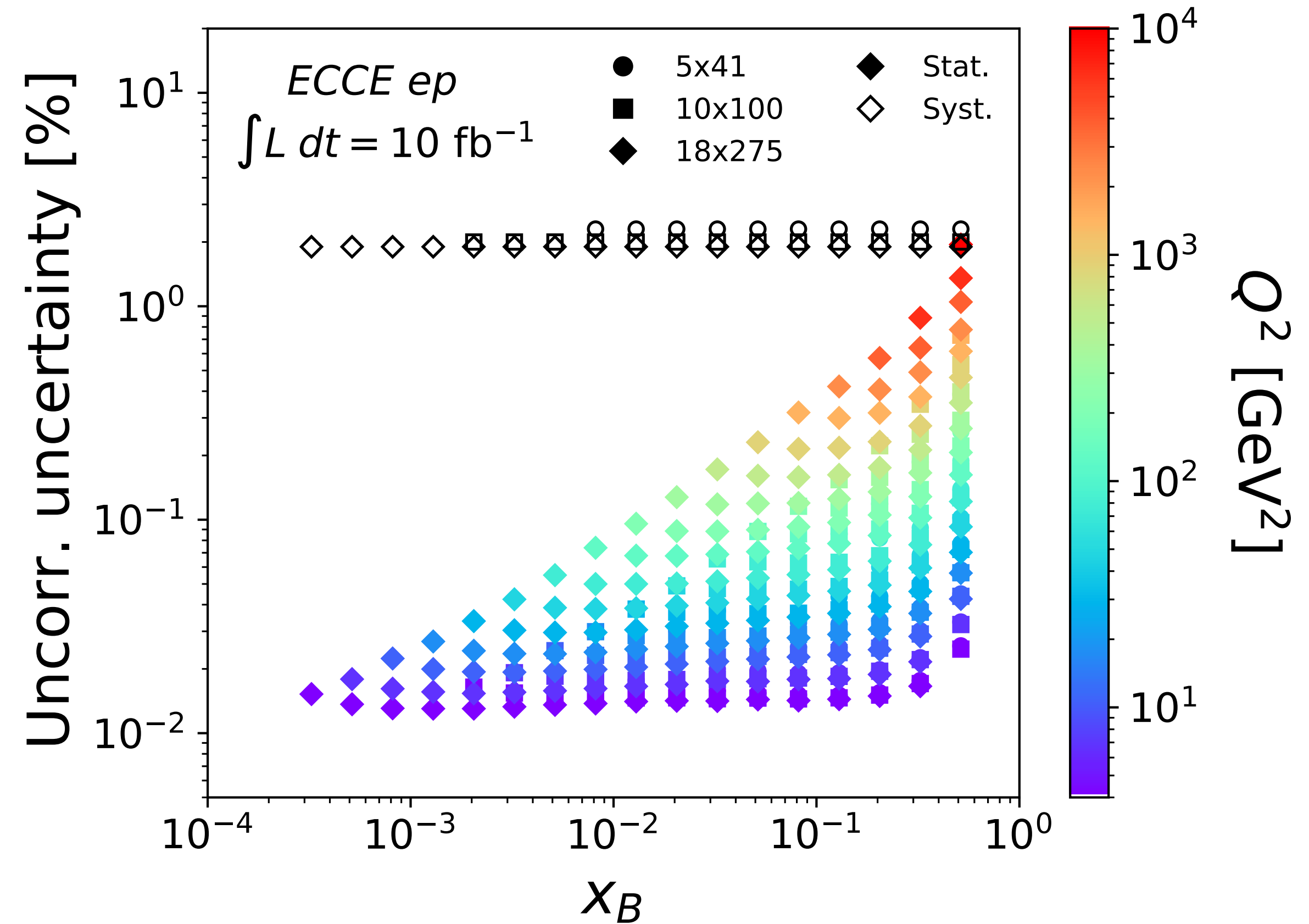
- Completed:
 - Unfolded NC reduced cross sections (ep, eD, eHe3)
 - Unfolded CC reduced cross sections (ep, eD, eHe3)
 - Unfolded proton double-spin asymmetry A_1^p
 - Impact plots for unpolarized PDFs
 - Simple estimation of eA statistical precision by scaling eD



- Yet to complete:
 - Extraction of F_2 and F_L from reduced cross sections (not finished due to time constraints)
 - Impact plots for polarized PDFs
 - Dedicated simulation for eA?
 - Proton twist-3 structure function g_T^p

Uncertainties

- Inflation of statistical uncertainty due to unfolding (RooUnfold)
- Attempted some simplistic estimate of systematics due to resolution
- Systematics mostly relied on guidance from Yellow Report



Ideas for path forward + open questions

In support of “global charge”:

- Identify key detector performance metrics and implement framework for quickly evaluating with evolving detector design
 - Resolution (more or less done?)
 - Full ePID (needs to be implemented)

Broader scope:

- Improved systematics
- Expanding physics studies

Open questions

- Generator?
- Simulation framework?
- *Meeting time?*