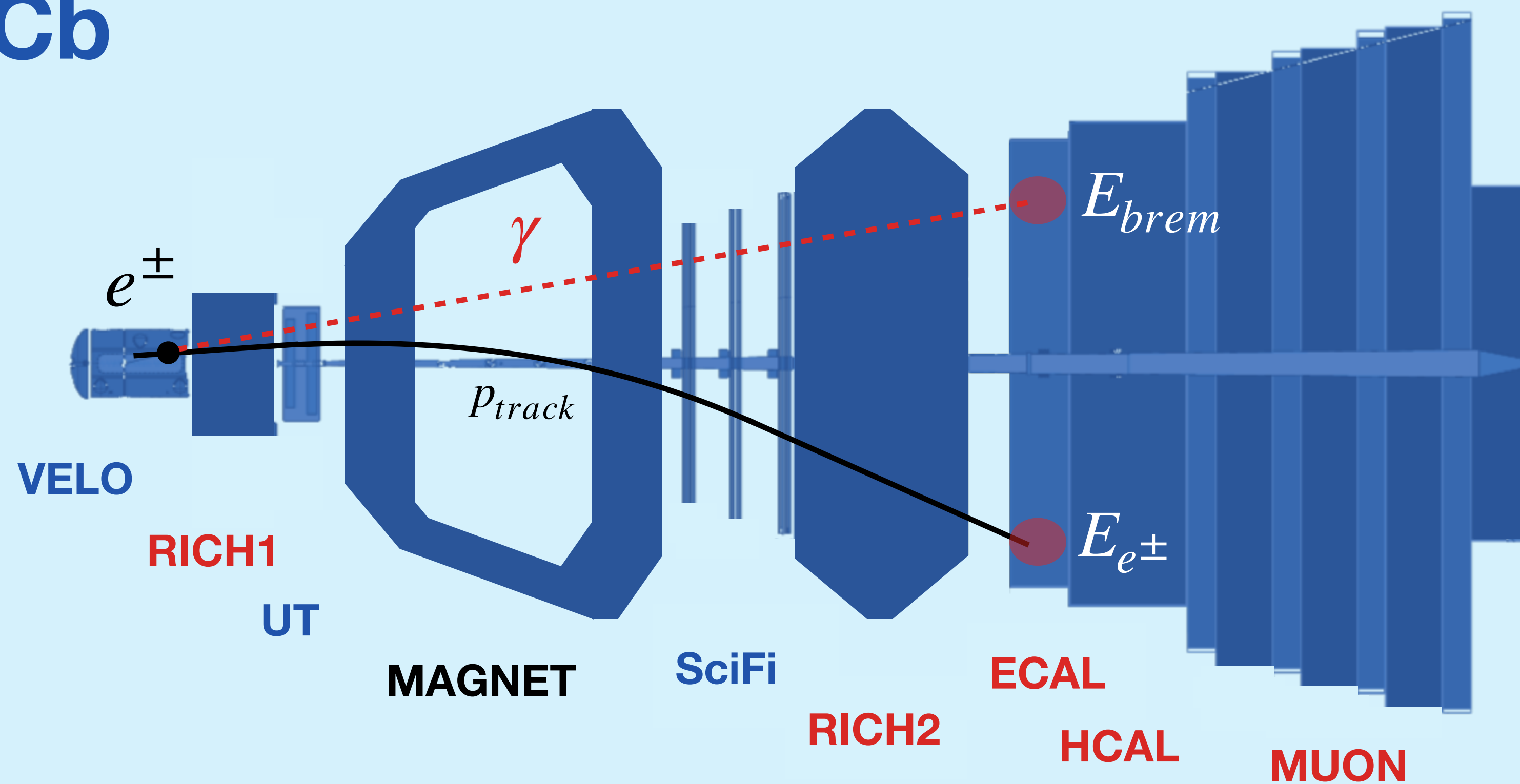


Introduction and motivation

- LHCb detector largely upgraded for Run 3: brand-new tracking detectors, improved RICH and full software trigger → x5 pile-up. Recorded 9.5 fb^{-1} in 2024 (more than Run 1+2!)
- The performance of electron particle identification (PID) is of vital importance for LHCb and is evaluated with 2024 data

Electrons in LHCb

- DLL uses information from PID detectors
- ProbNN adds tracking information
- Both use E_{e^\pm}/p_{track} and E_{brem} when available



- Electrons emit **bremsstrahlung photons** when they traverse detector material → energy loss
- Brem recovery: extrapolate tracks from VELO and UT linearly to energy deposits in ECAL

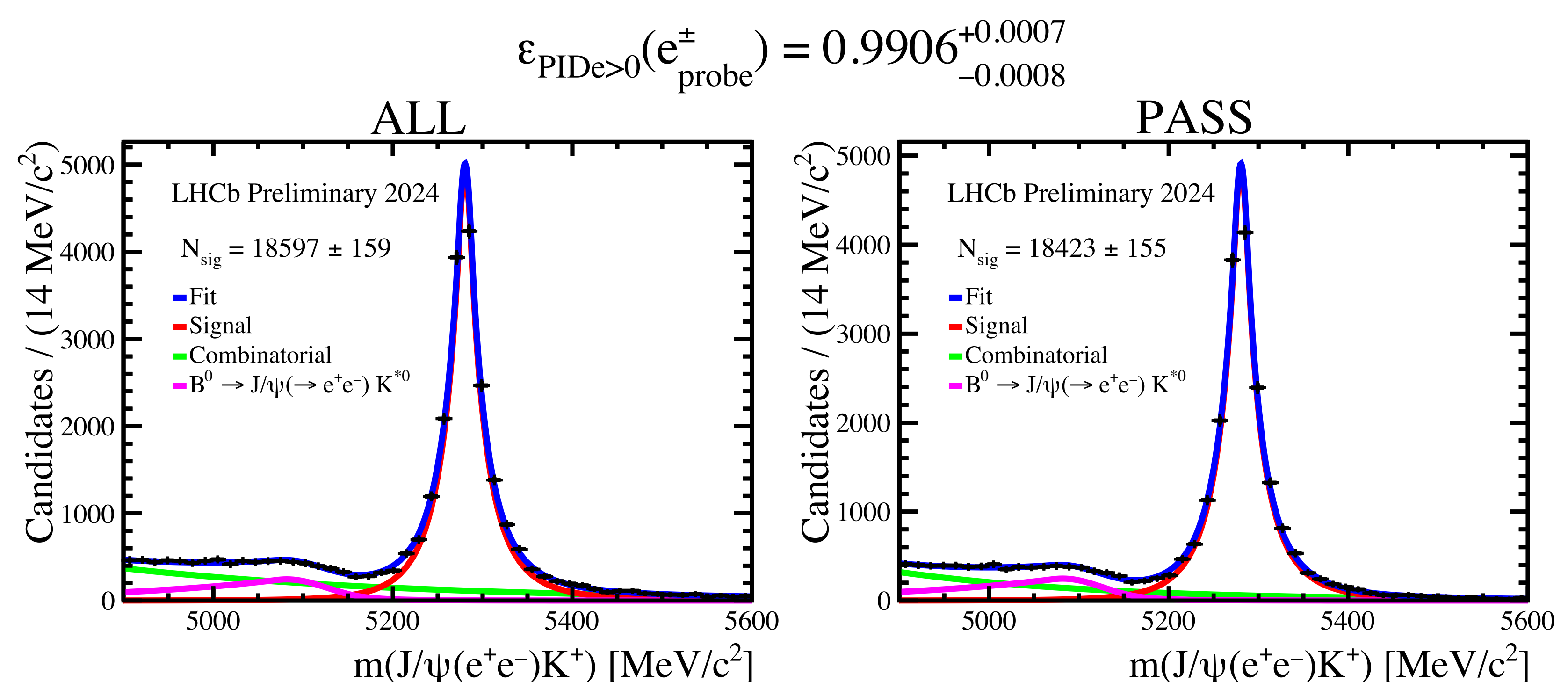
$$p(e^\pm) = p(e^\pm_{track}) + p(\gamma_{brem})$$

Methodology

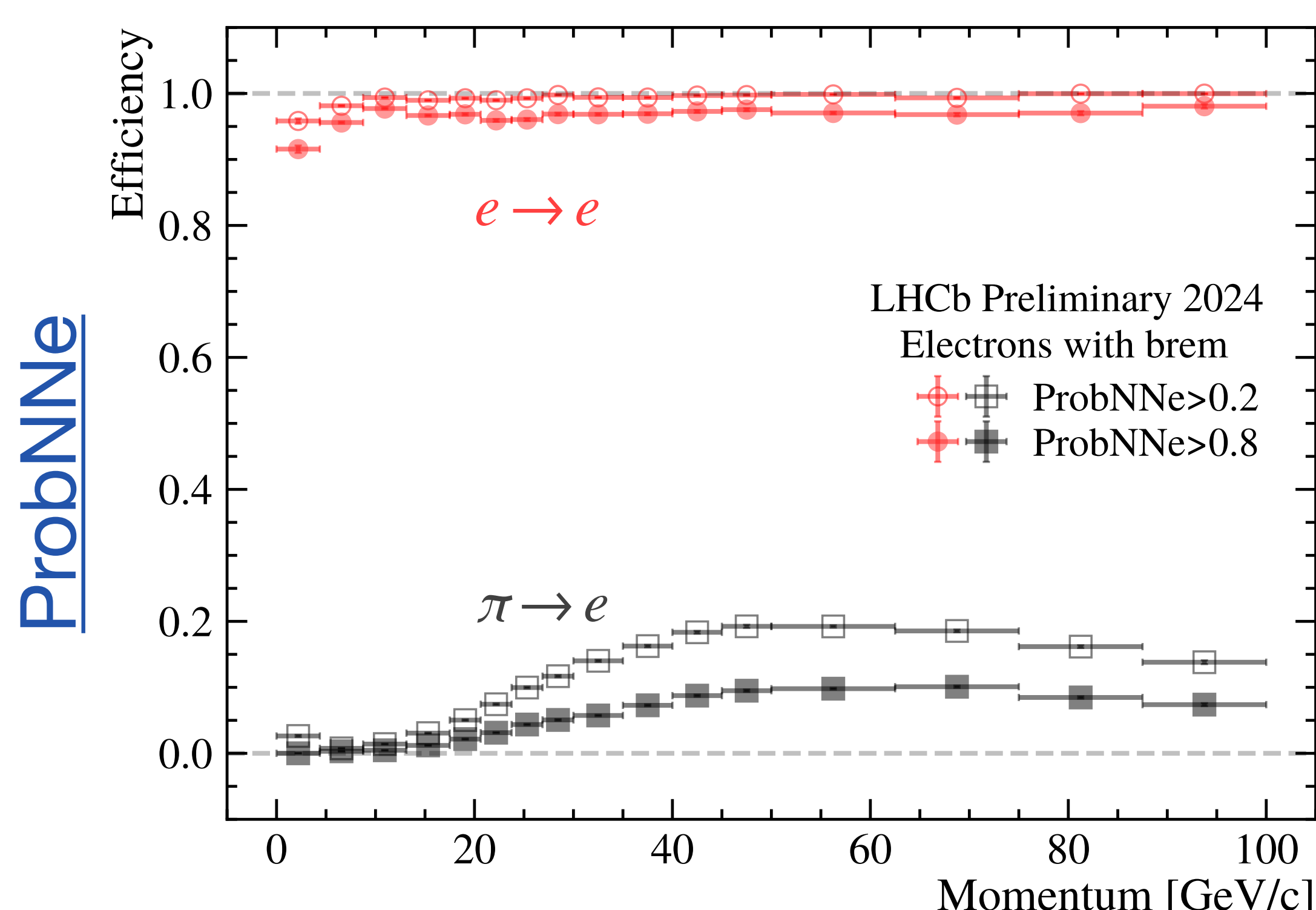
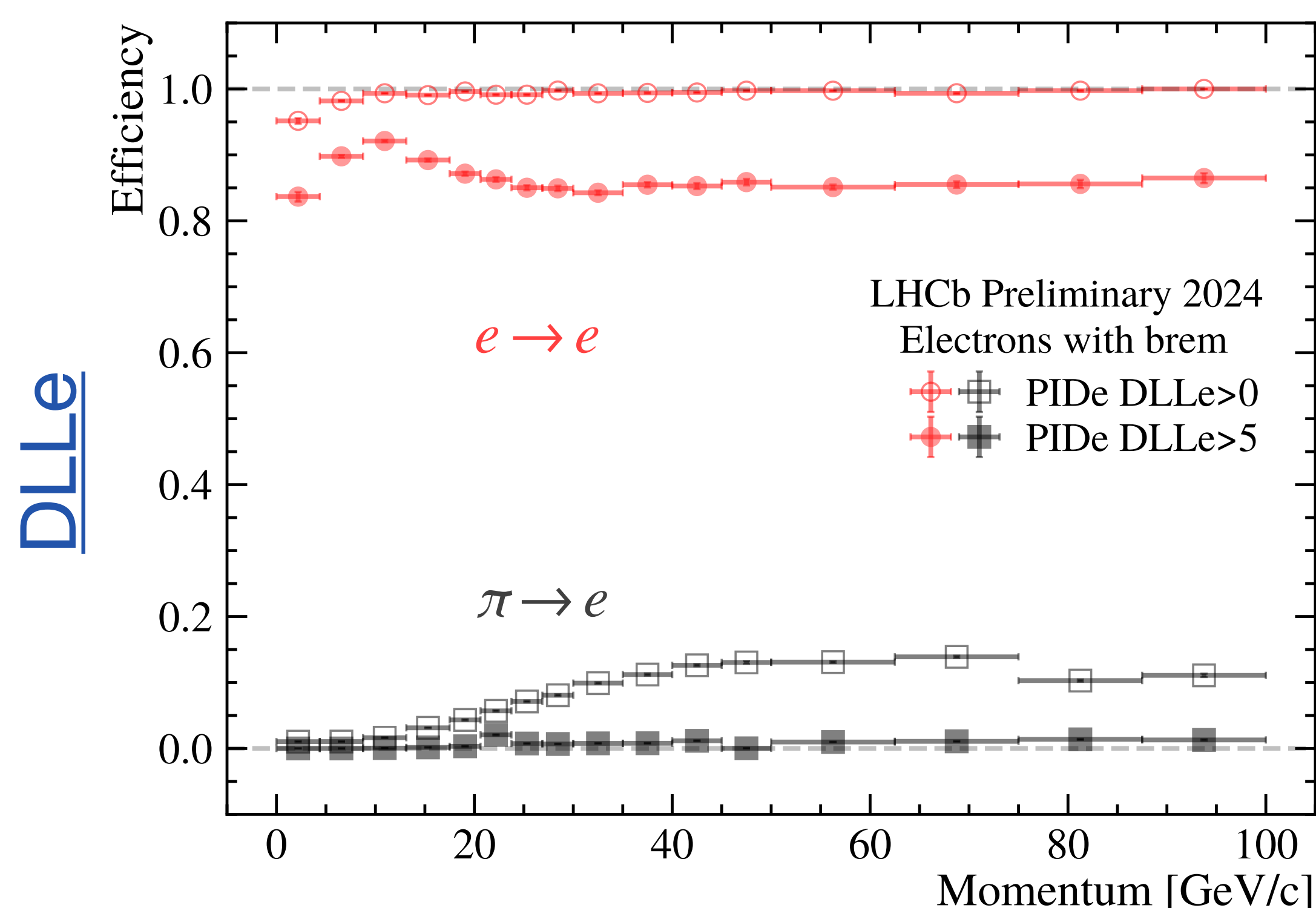
- $B^+ \rightarrow J/\psi(\rightarrow e^+e^-)K^+$, highest yield and purity with electrons in final state
 - HLT2 Calibration line to select the candidates
 - Offline selection: linear cuts + BDT
- Tag & Probe:
 - tag: electron with tight PID requirement
 - probe: electron without PID requirement
 - apply PID offline to measure efficiency

Fitting Model

- Fit & Count: Simultaneous fits to ALL and PASS samples



Results



$\pi \rightarrow e$ misID

- Important to evaluate when the algorithm wrongly identifies pions as electrons
- $D^{*+} \rightarrow D^0(\rightarrow K^-\pi^+)\pi^+$, high yield and purity
- 2D fit on D^0 and $(D^{*+} - D^0)$ mass

Conclusions and Prospects

- The Calorimeter reconstruction was improved in order to cope with the increased pile-up in Run 3. The efficiency for the electron identification shows very good performance, while keeping the level of the $\pi \rightarrow e$ misID under control
- For future work, provide flexible calibration for usage in analyses with any PID requirement

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