
# Beauty decay electrons in p–Pb collisions using displaced electrons in ALICE

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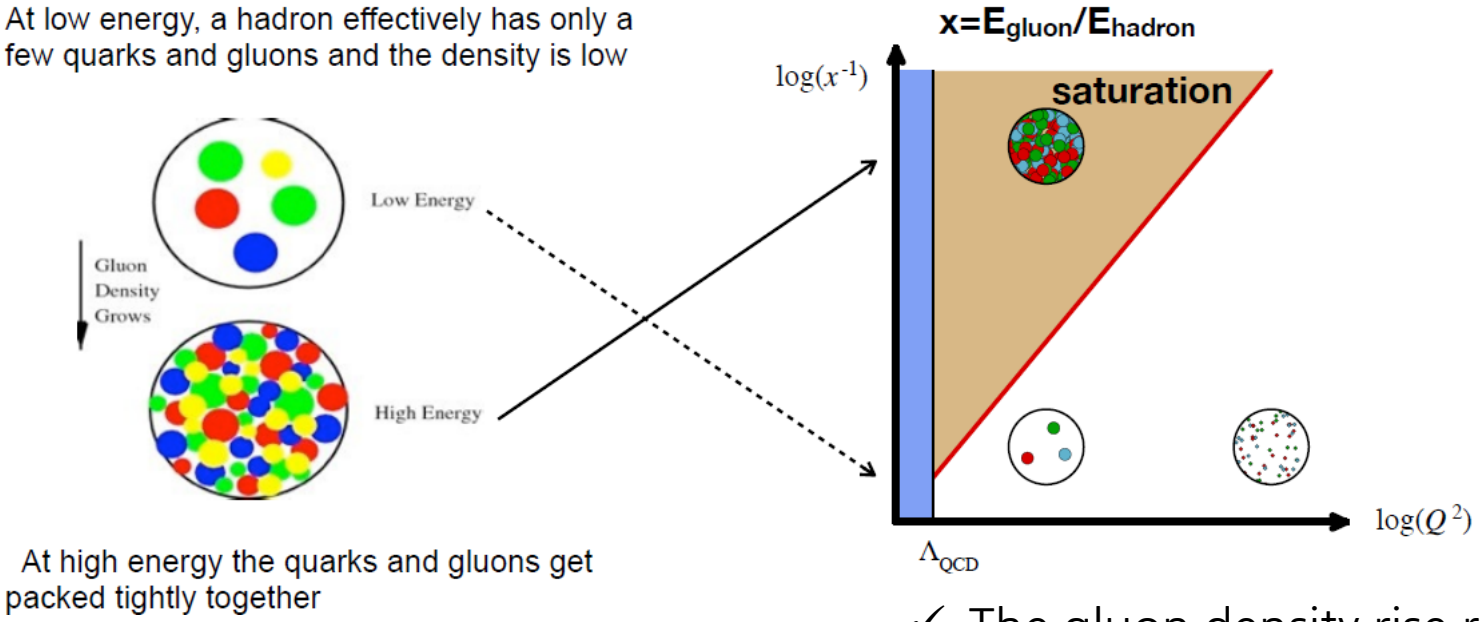
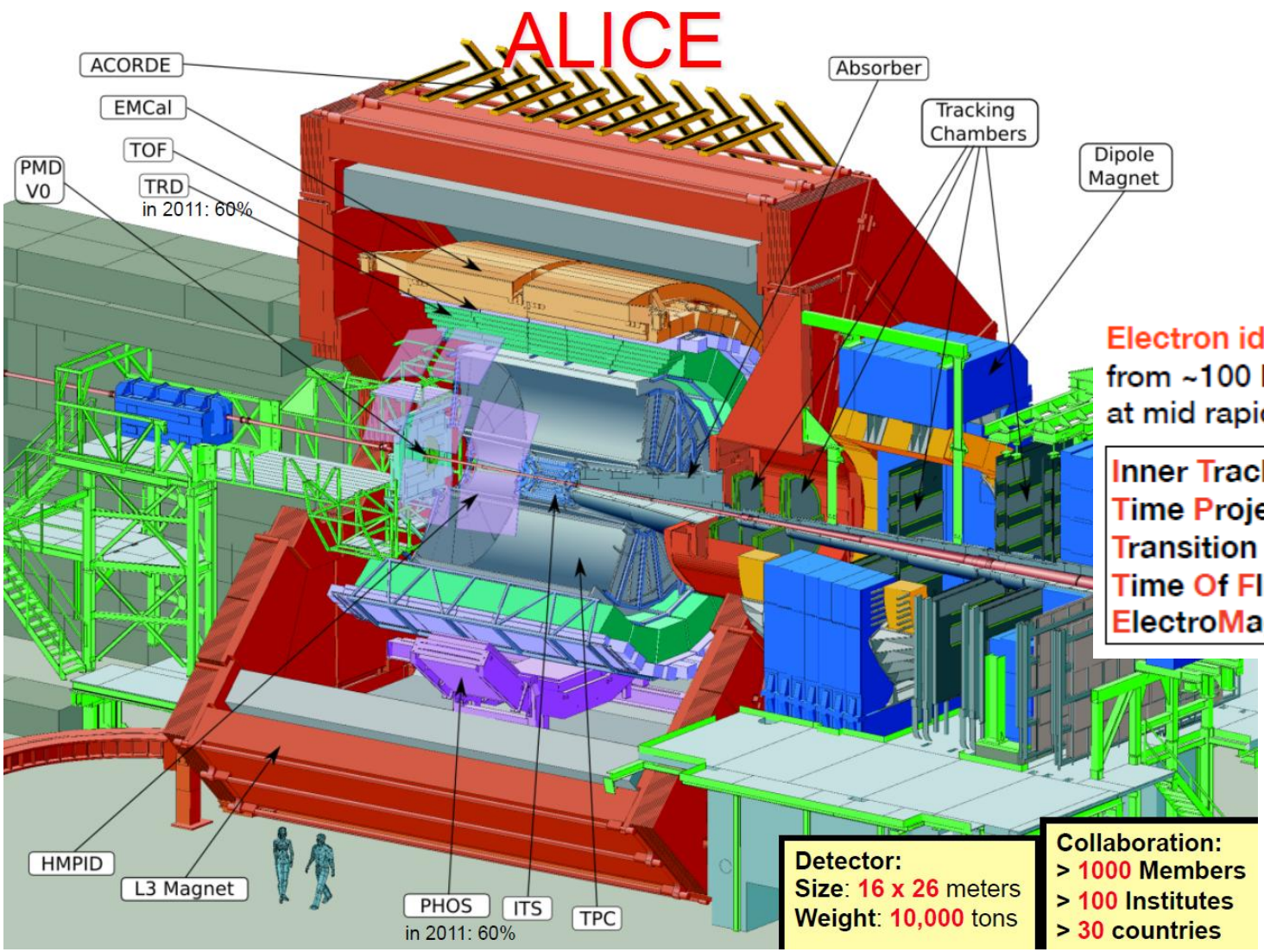
# Motivation




- ✓ The gluon density rise rapidly
  - ➢ The high energy limit of the gluon is the high gluon density limit
  - ➢ The density must saturated for the fixed energy of gluons at high energy

- Study cold nuclear effect
- Study p+A as a benchmark for A+A
  - Benchmark hard processes to disentangle initial from final state effects
  - Characterize nuclear PDF at small $x$

# ALICE detector




**Electron identification capability**
from ~100 MeV/*c* to above 50 GeV/*c*
at mid rapidity (|η|<0.8)

Inner Tracking System
Time Projection Chamber
Transition Radiation Detector
Time Of Flight
ElectroMagnetic Calorimeter

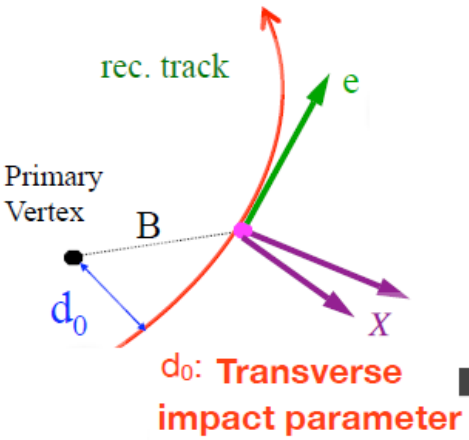
**Detector:**
**Size**: 16 x 26 meters
**Weight**: 10,000 tons

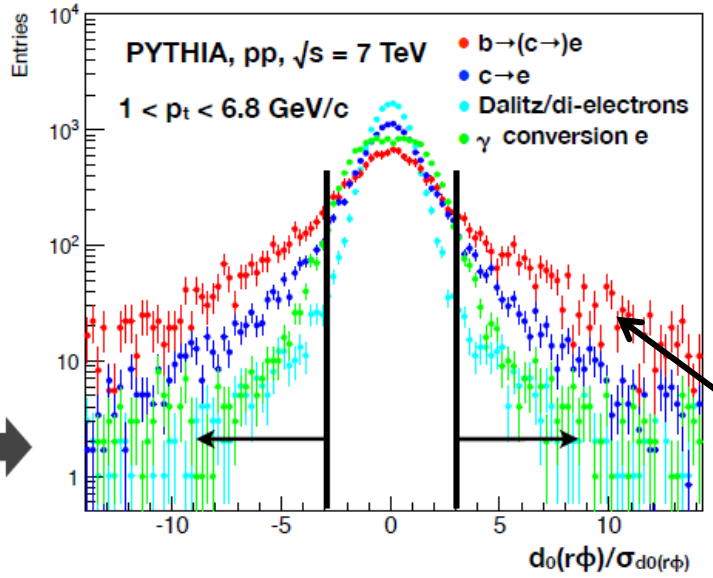
**Collaboration:**
> 1000 Members
> 100 Institutes
> 30 countries

# Analysis method

Minimum impact parameter cut

→ Subtract remaining background electrons




The impact parameter is the core for this analysis

✓ 뎌$c\tau$뎍$_B$~500 $\mu m$

✓ $m_B$~ 5 $GeV/c^2$

It is important to ensure the quality of the impact parameter, especially the run by run stability for p-Pb.

# Data set for p-Pb

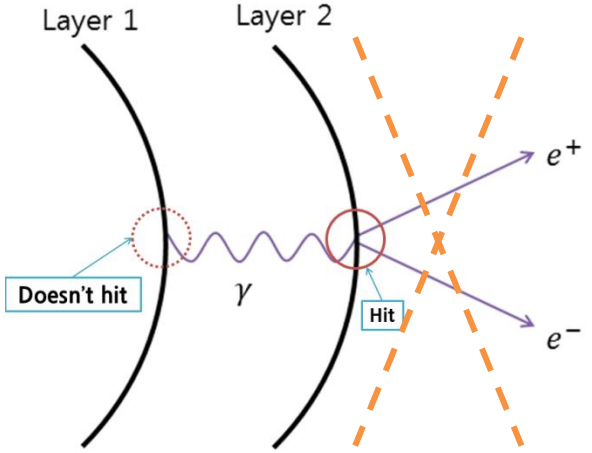
- Experiment
  - LHC13b pass3 (10 runs)
  - LHC13c pass2 (14 runs)

Total 105 million
Minimum bias event

- Monte Carlo
  - LHC13b2_efix_p1 (minimum bias, 24 runs)
  - LHC13b2_efix_p2 (minimum bias, 23 runs)
  - LHC13d3 (HFE signal enhanced sample, 22 runs)

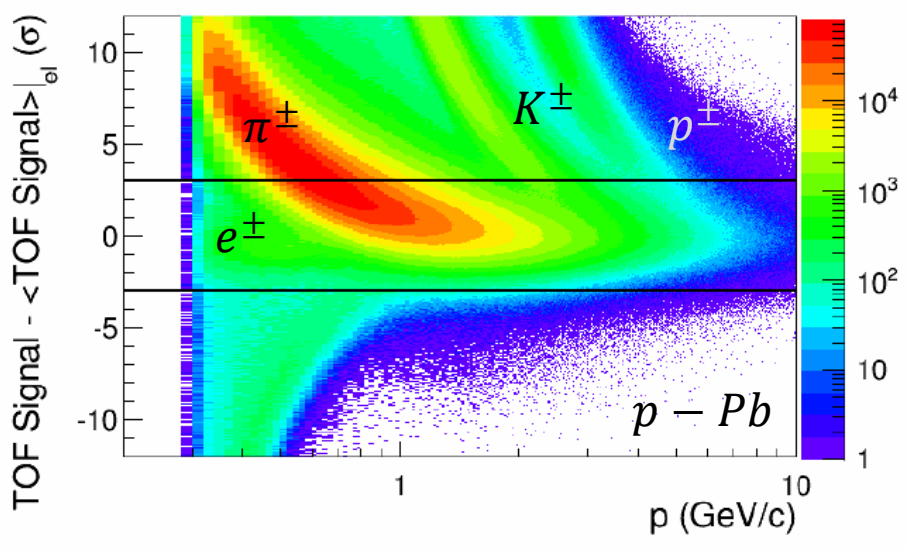
# Track selection criteria

| Observable | Cut value |
|---|---|
| $\eta$ | < 0.6 |
| TPC and ITS refit | Required |
| $\chi^2$ per $TPC$ cluster | < 4 |
| Kink daughter | Rejected |
| Number of ITS clusters | ≥ 4 |
| Requirement of SPD pixels | Both |
| Number of TPC clusters | ≥ 110 |
| Number of TPC $dE/dx$ clusters (PID clusters) | ≥ 80 |
| DCA to the primary vertex in radial direction | < 1 cm |
| DCA to the primary vertex in z-direction | < 2 cm |

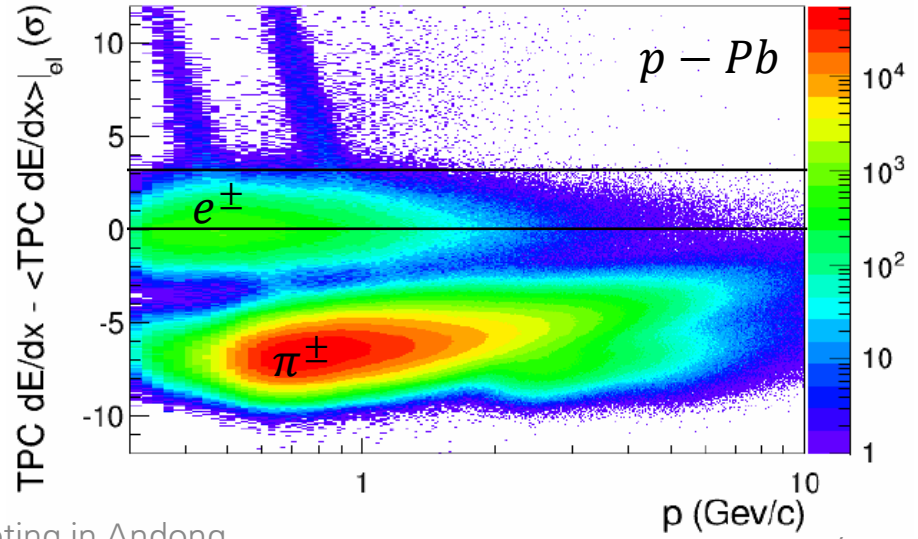


# Particle identification for p−Pb

- TOF(Time of flight)
  - Select tracks with the electron hypothesis within $3\sigma$
  - Reject $K^{\pm}$ for $p < 1.5\ GeV/c$
  - Reject $p^{\pm}$ for $p < 3\ GeV/c$

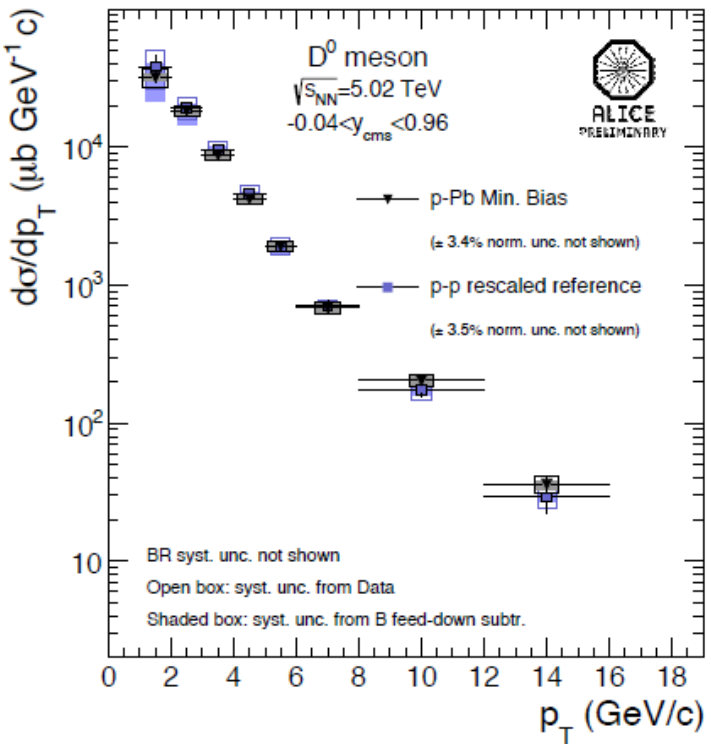


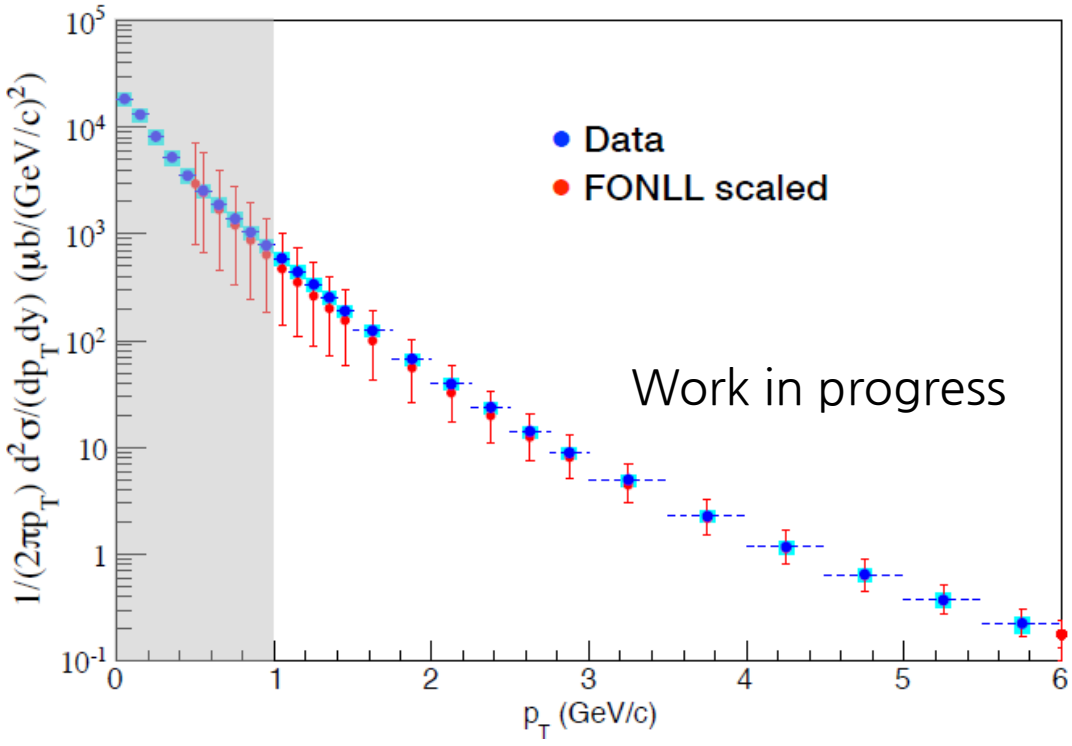

- TPC(Time projection chamber)
  - Select tracks in the upper half of the electron Bethe-Bloch band 뎌$0\sim3\sigma$뎍
  - Reject $\pi^{\pm}$ for $p < 6\ GeV/c$



# Background – Charm decay electrons

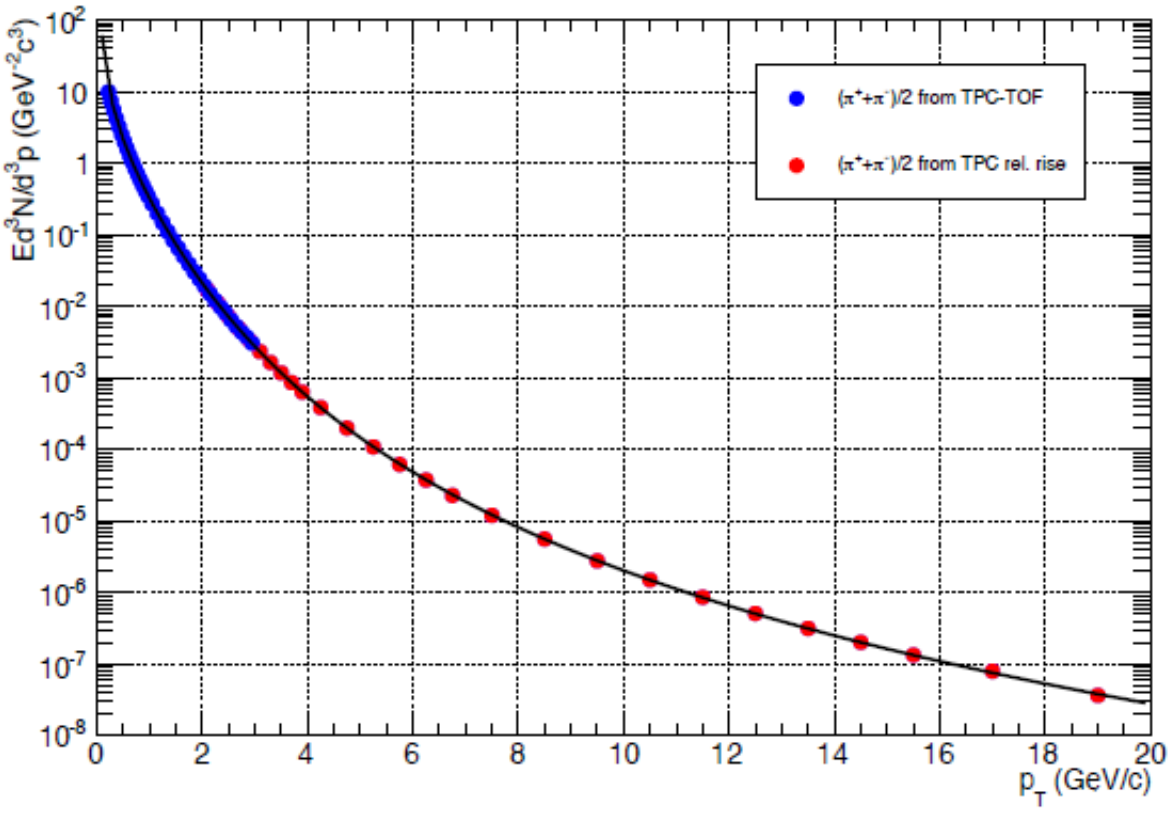
- Measured D- meson $p_T$ spectra for p-Pb in ALICE
- Estimate decayed electron $p_T$ spectra

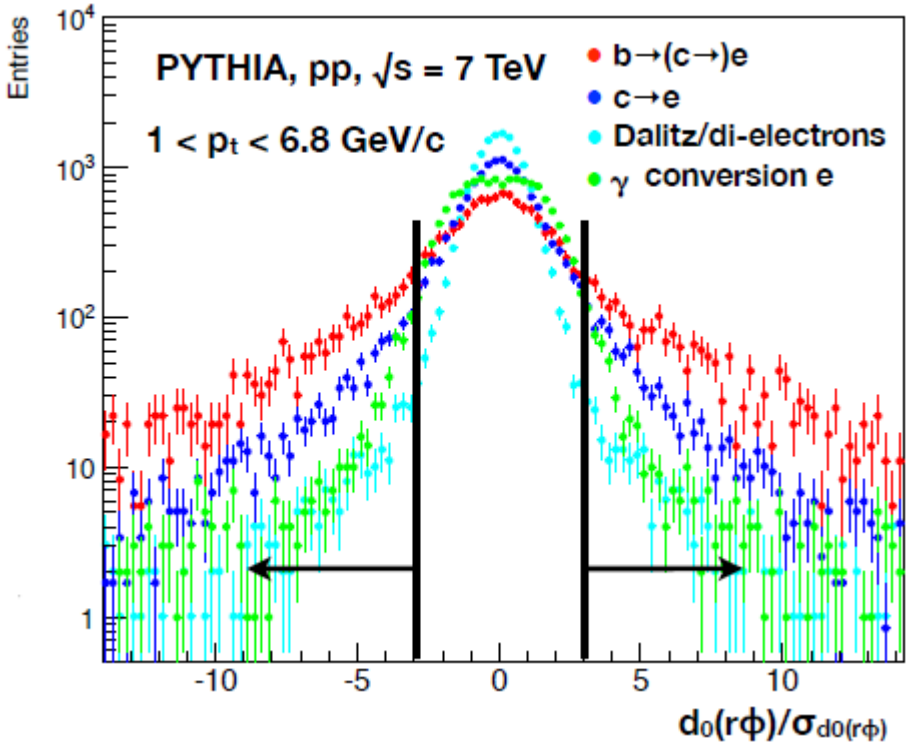


# Background – light meson decay electrons

- Measured $\pi^{\pm}$ $p_T$ spectra for p-Pb in ALICE
- Estimate light meson decay electron backgrounds



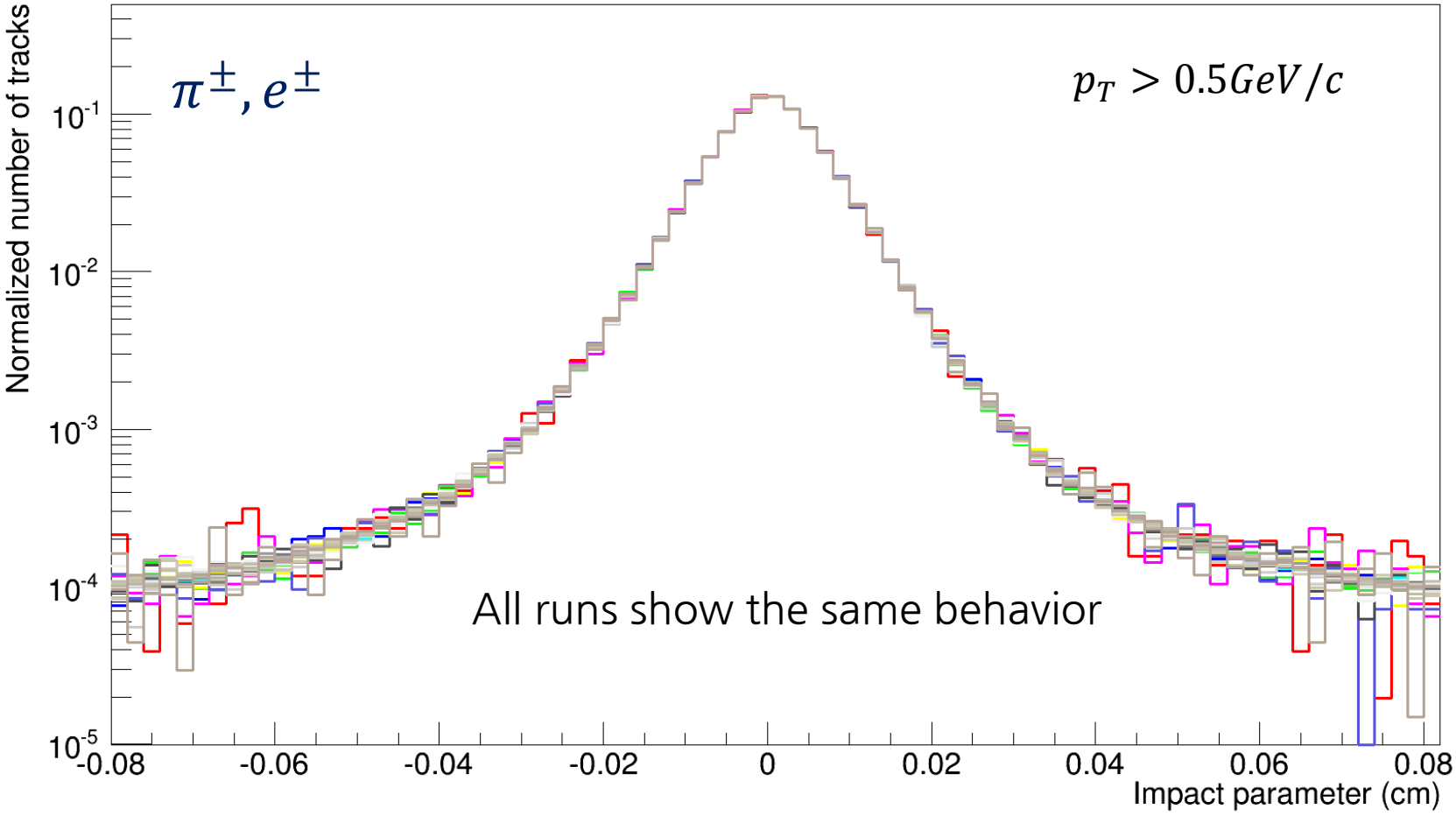



The impact parameter is the core for this analysis

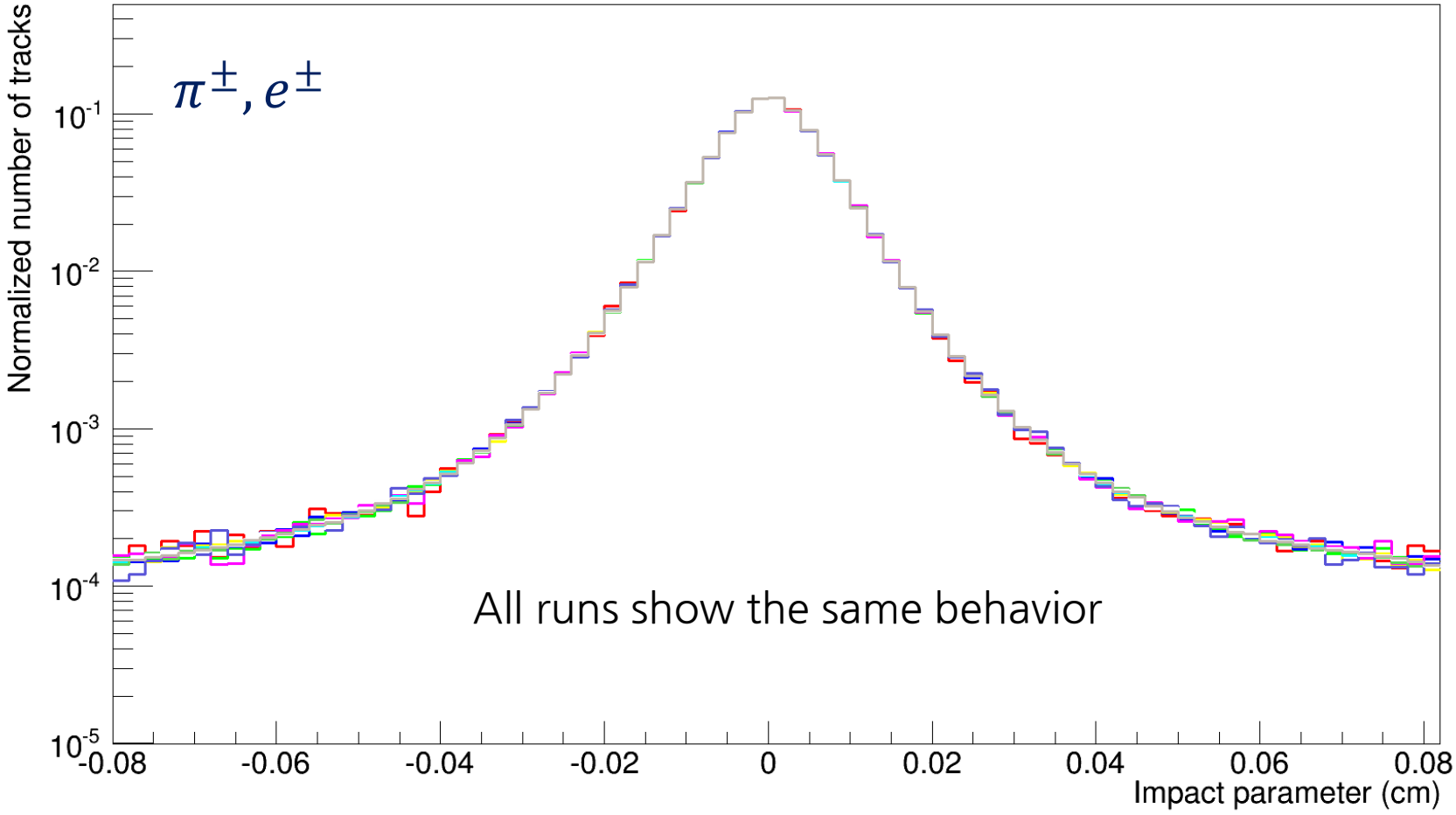
→ It requires **impact parameter QA**

# Impact parameter distribution – MC data (24 runs)

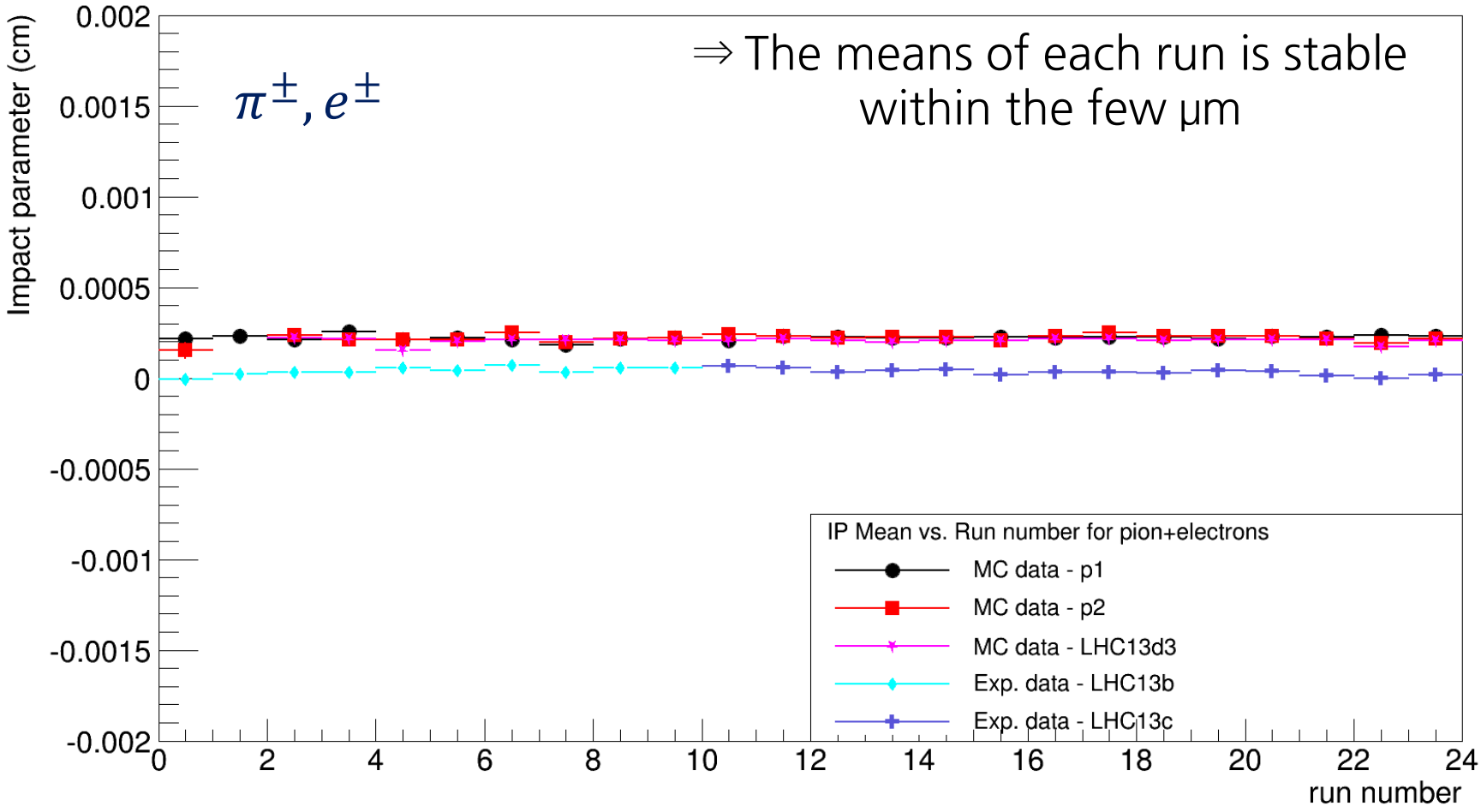
$TOF\ n\sigma_{electron} < 3$



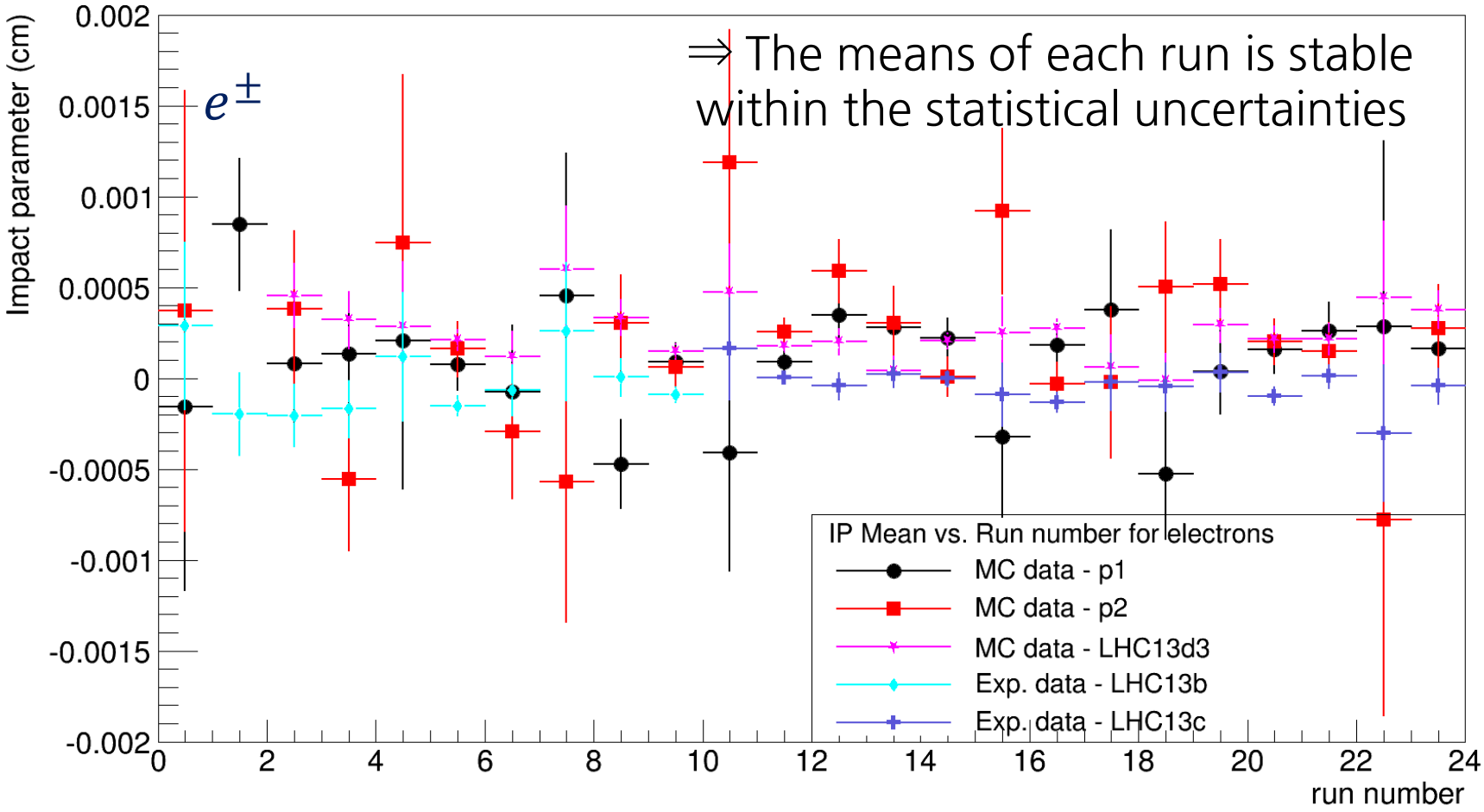
# Impact parameter distribution
## – Experimental data [LHC13b] (10 runs)



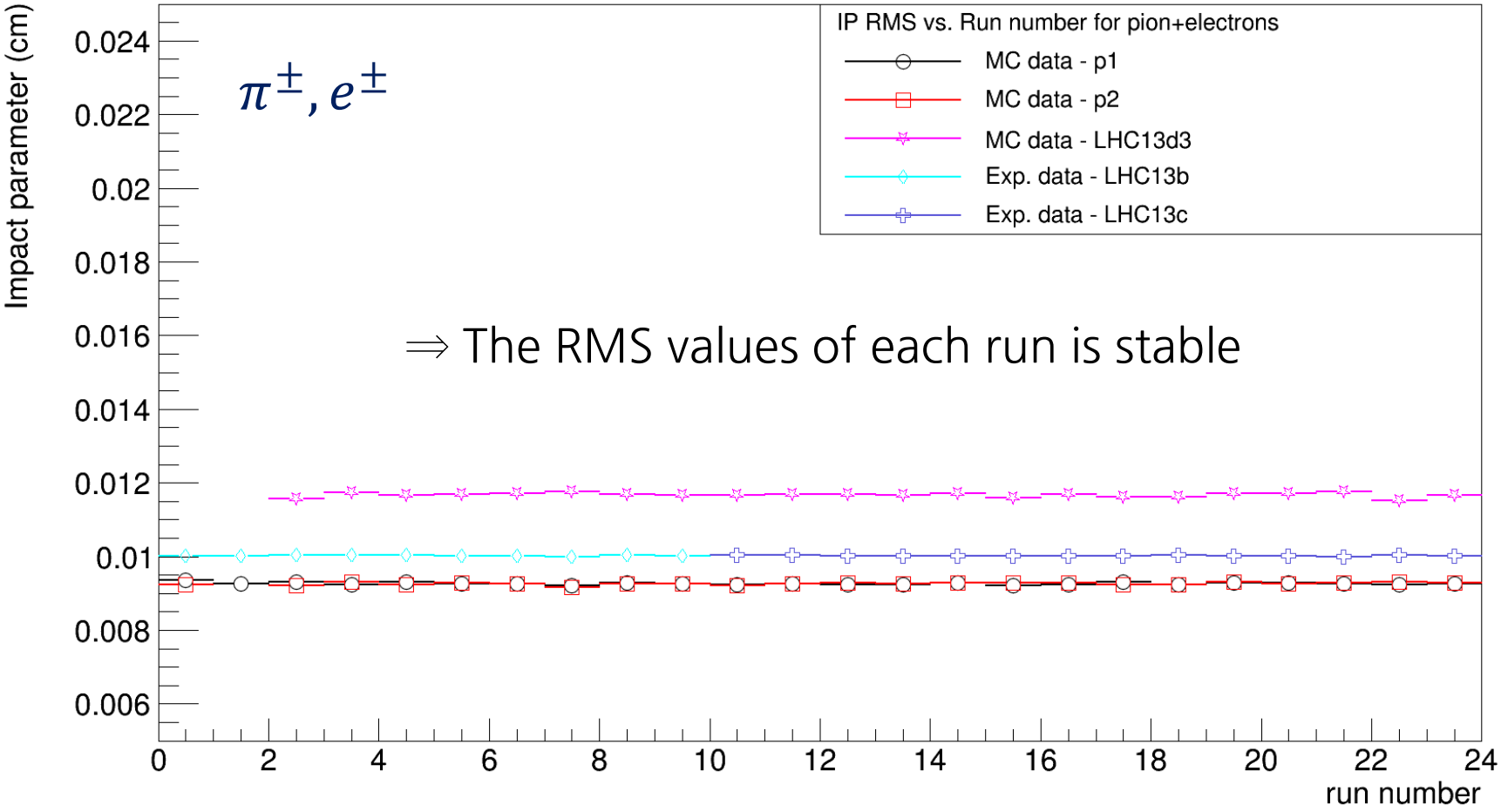
# Impact parameter characteristics
## – Mean vs. Run number



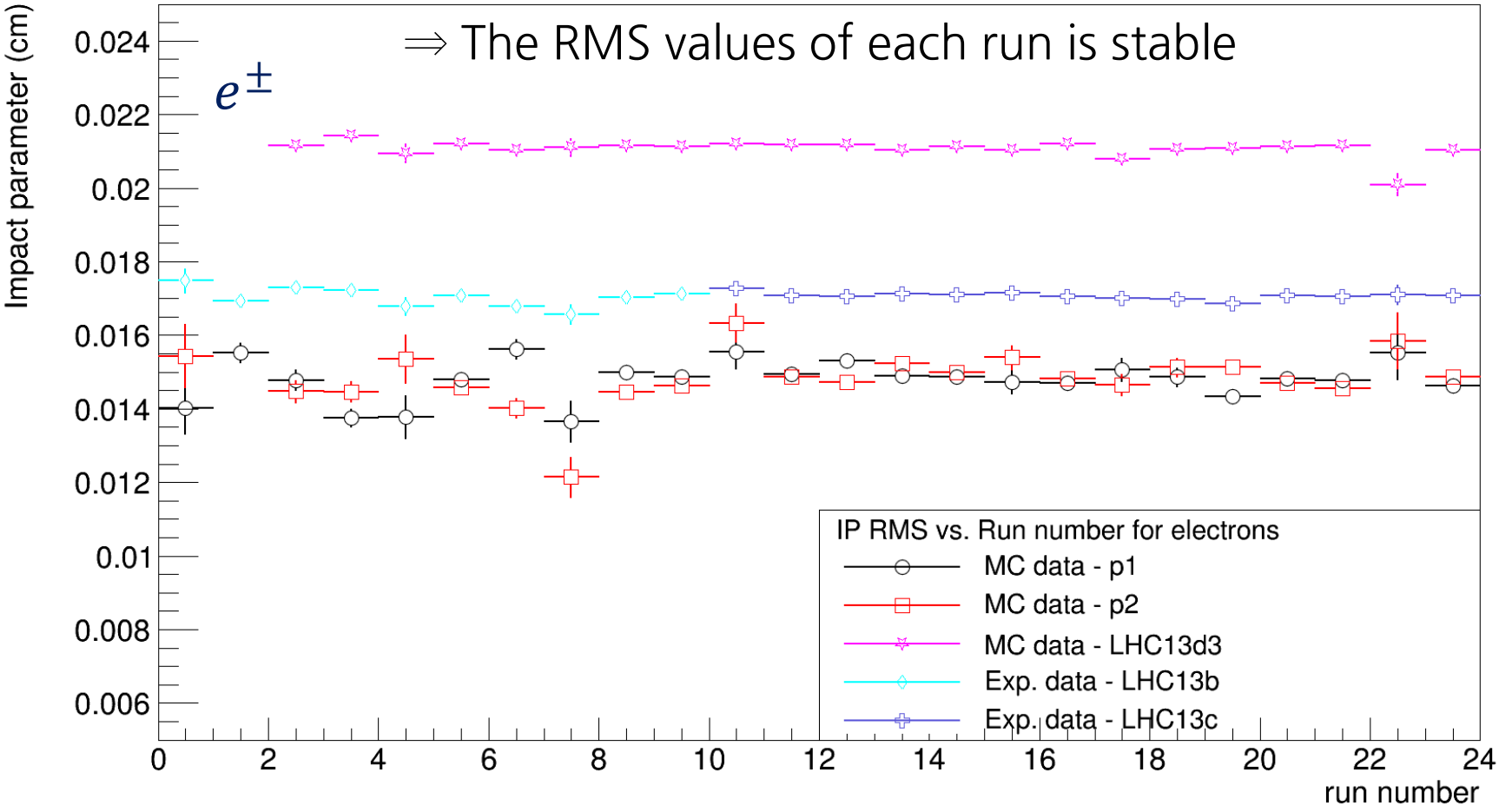
# Impact parameter characteristics
## – Mean vs. Run number



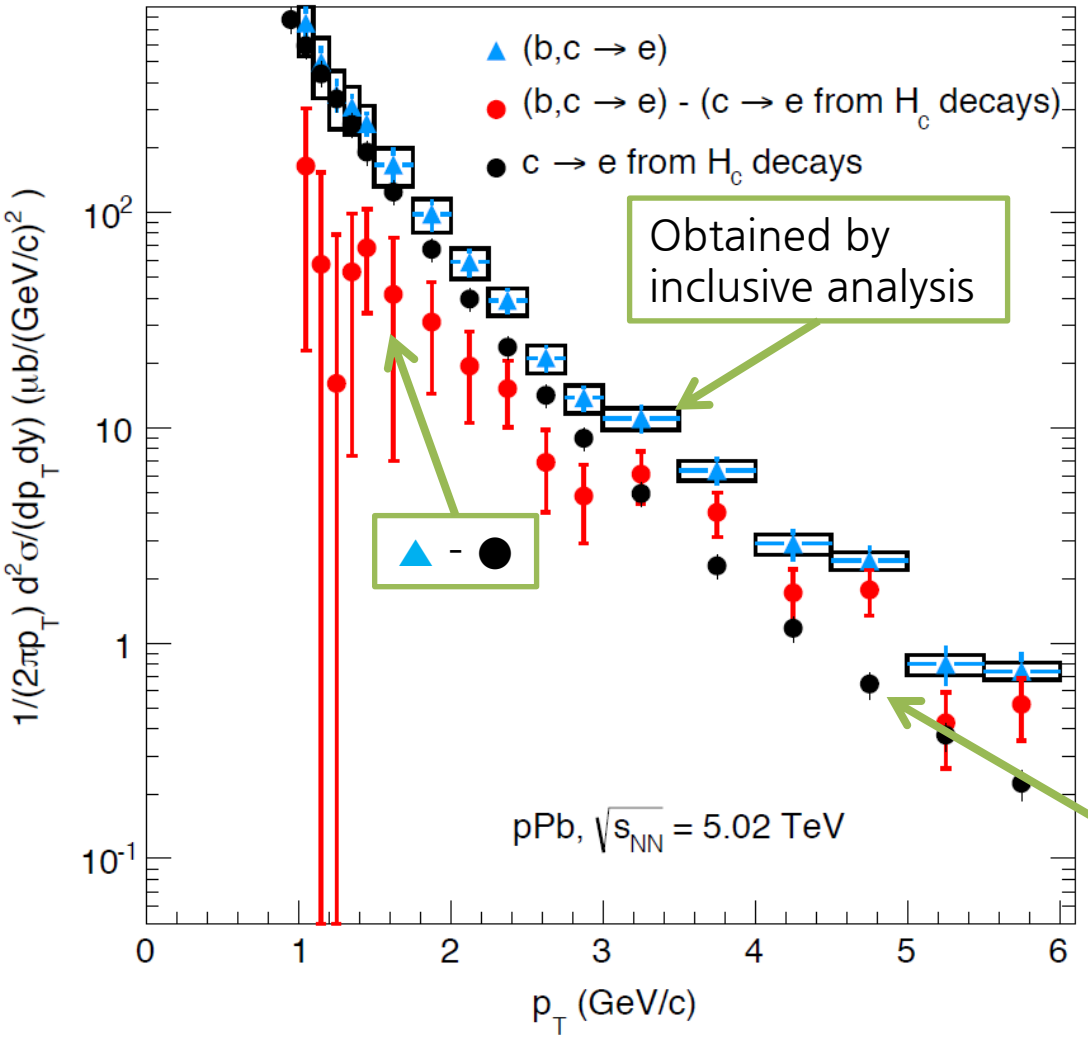
# Impact parameter characteristics
## – RMS vs. Run number



# Impact parameter characteristics
## – RMS vs. Run number



# Future plan




- Large uncertainties at low $p_T$
- To take meaningful result, it is required to use the method described in this talk
- $R_{p-Pb}$ will be available soon, stay tune

Obtained by ALICE D-meson measurement

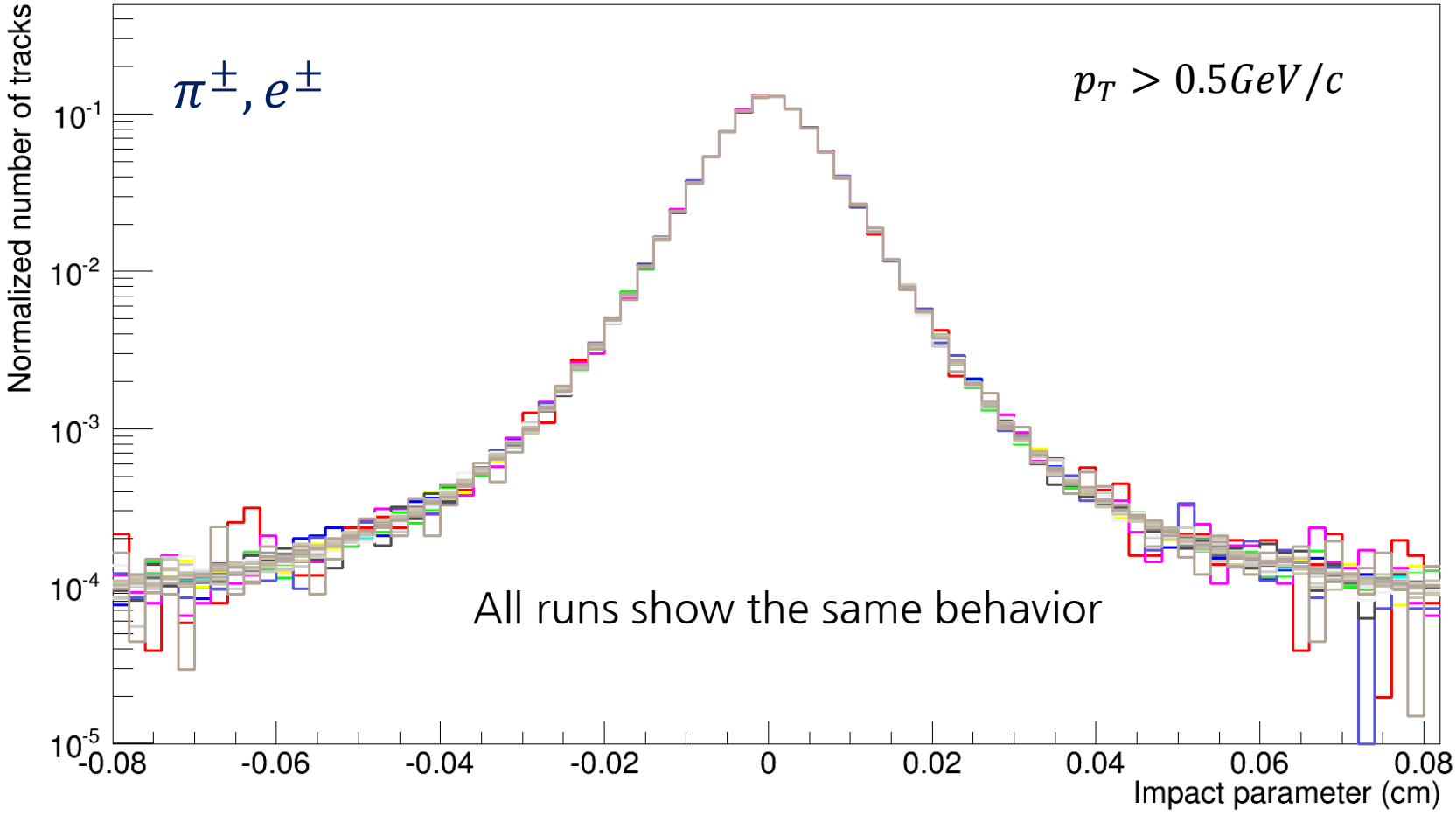
# Summary

- For the impact parameter QA
  - The means and RMS values of each run for both MC and experimental data are stable within the statistical uncertainties
- The beauty decay electron analysis for p-Pb is in progress
- It is aimed to get $R_{p-Pb}$ until Quark Matter 2014

# Back up

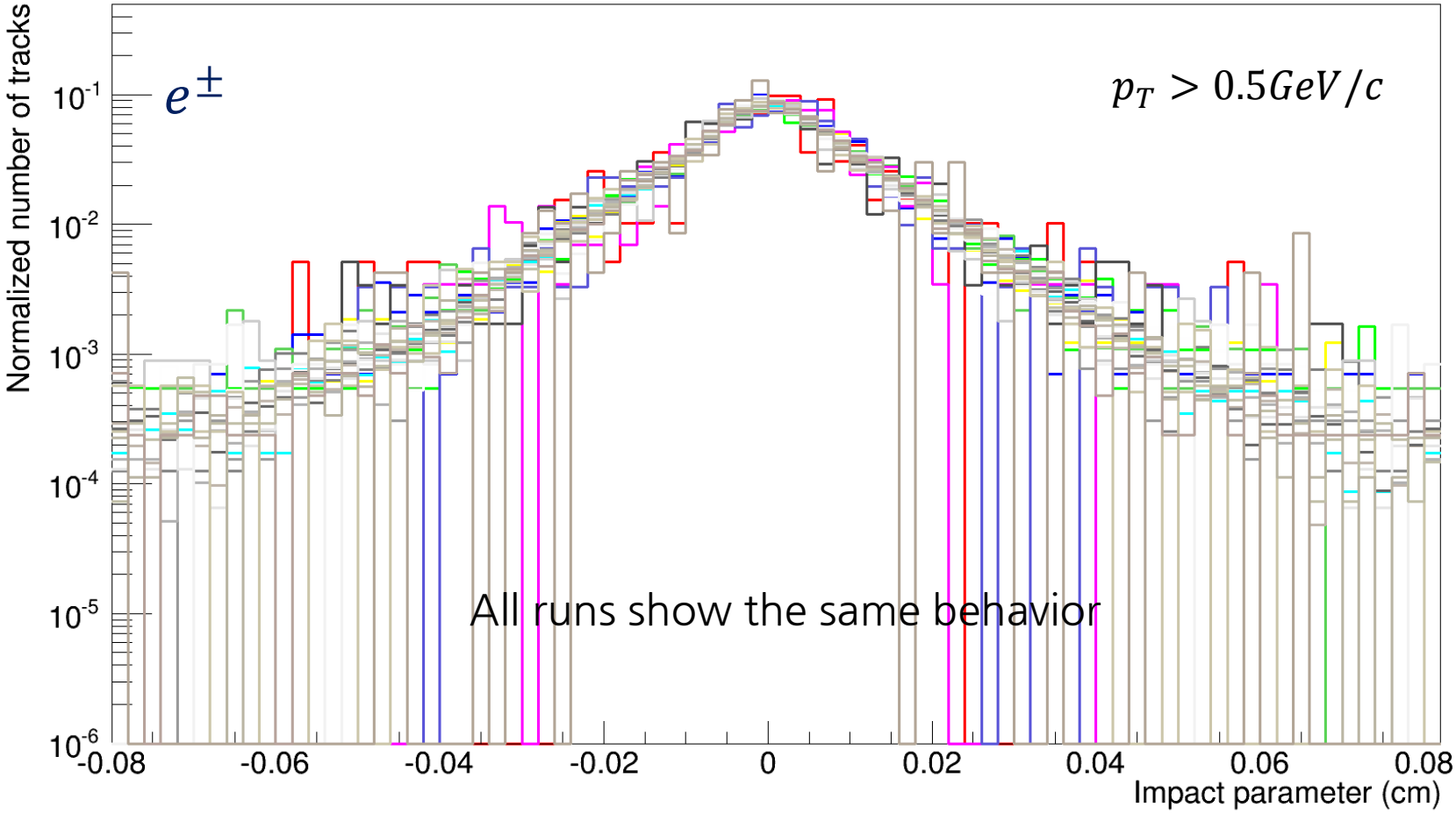
# Impact parameter distribution – MC data [p1] (24 runs)

$TOF\ n\sigma_{electron} < 3$

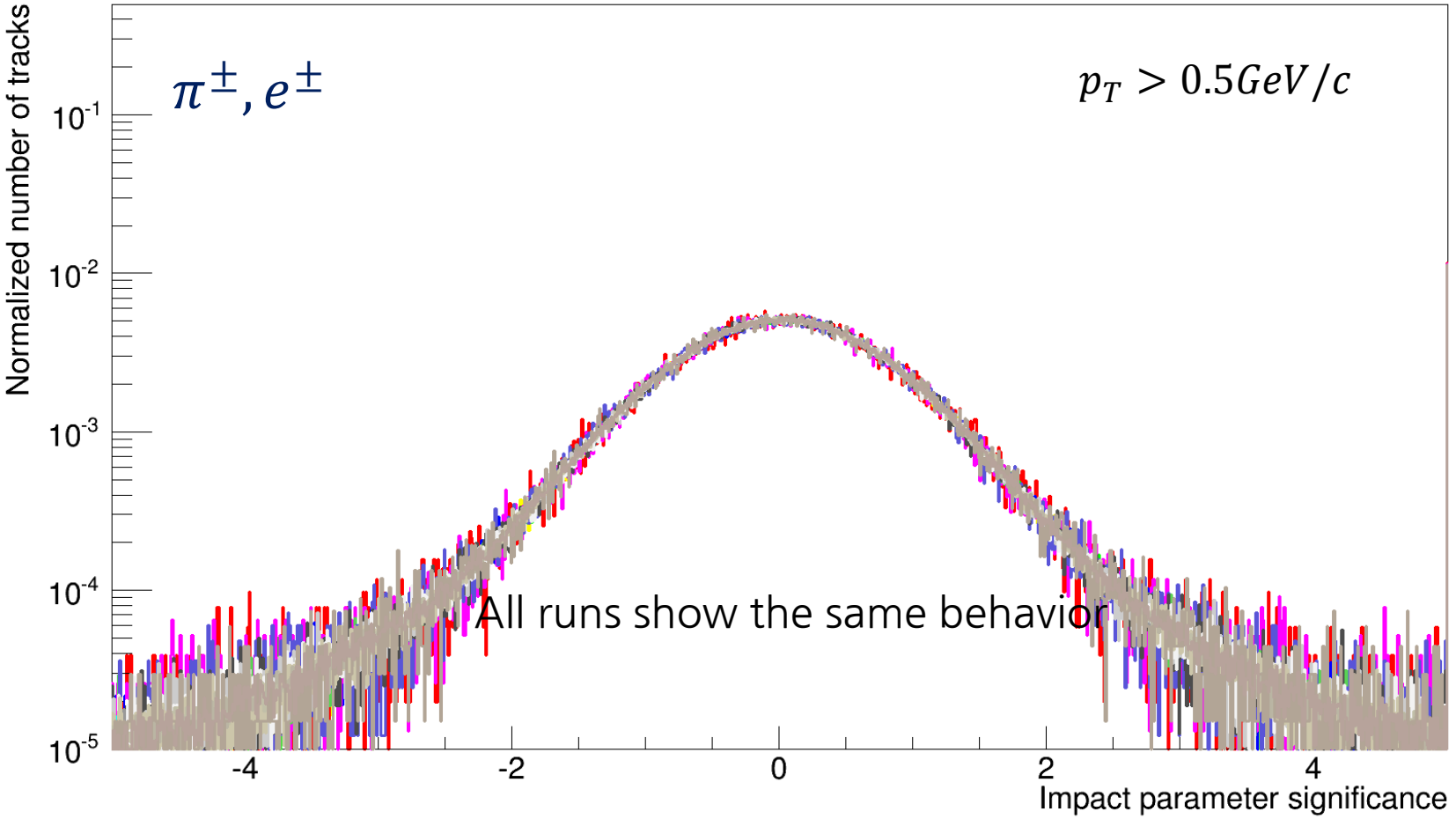


# Impact parameter distribution – MC data [p1] (24 runs)

$TOF\ n\sigma_{electron}^{2} < 3$ & $0.5 < TPC\ n\sigma_{electron}^{2} < 3$



# Impact parameter significance distribution – MC data [p1] (24 runs)



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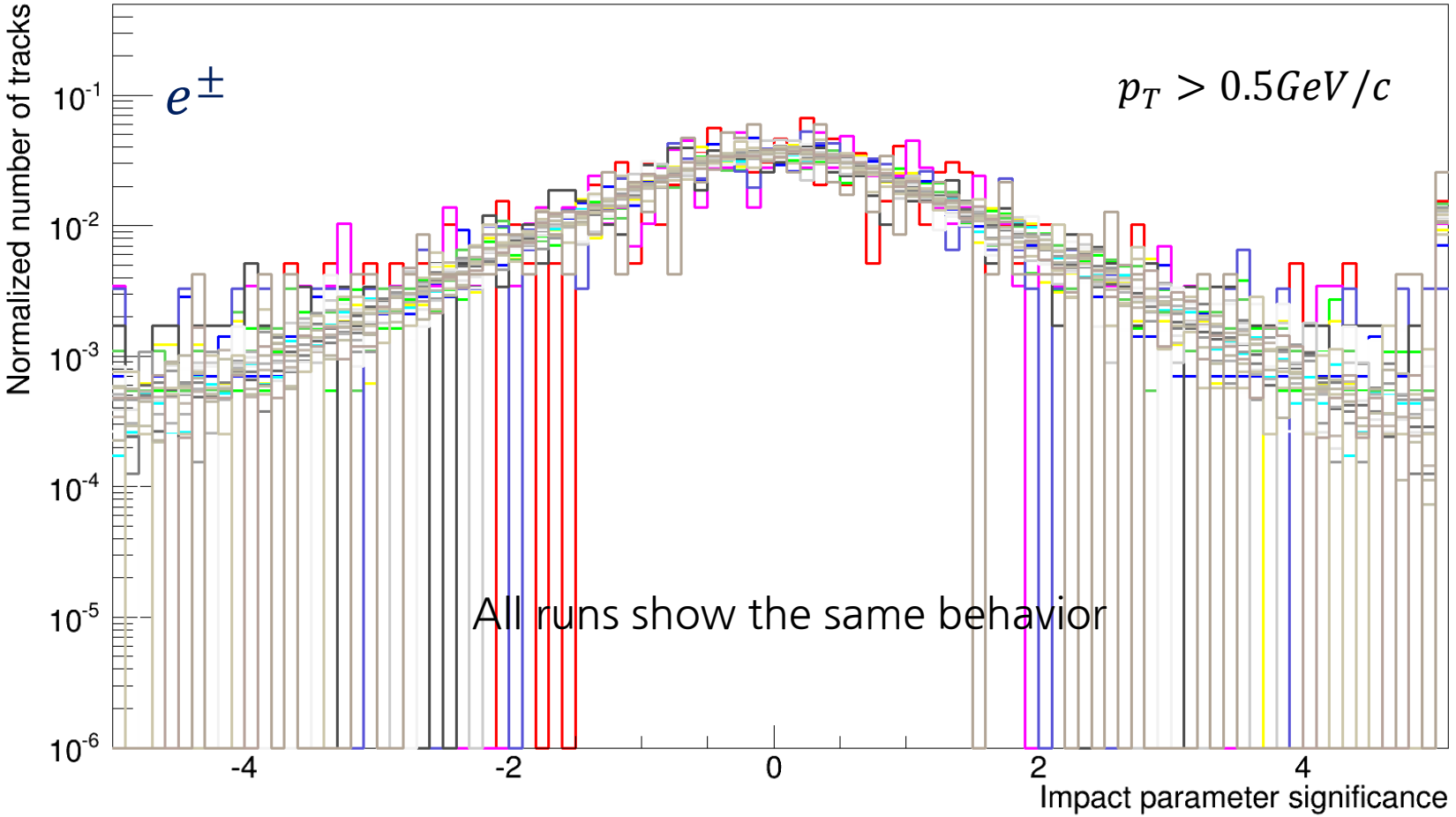
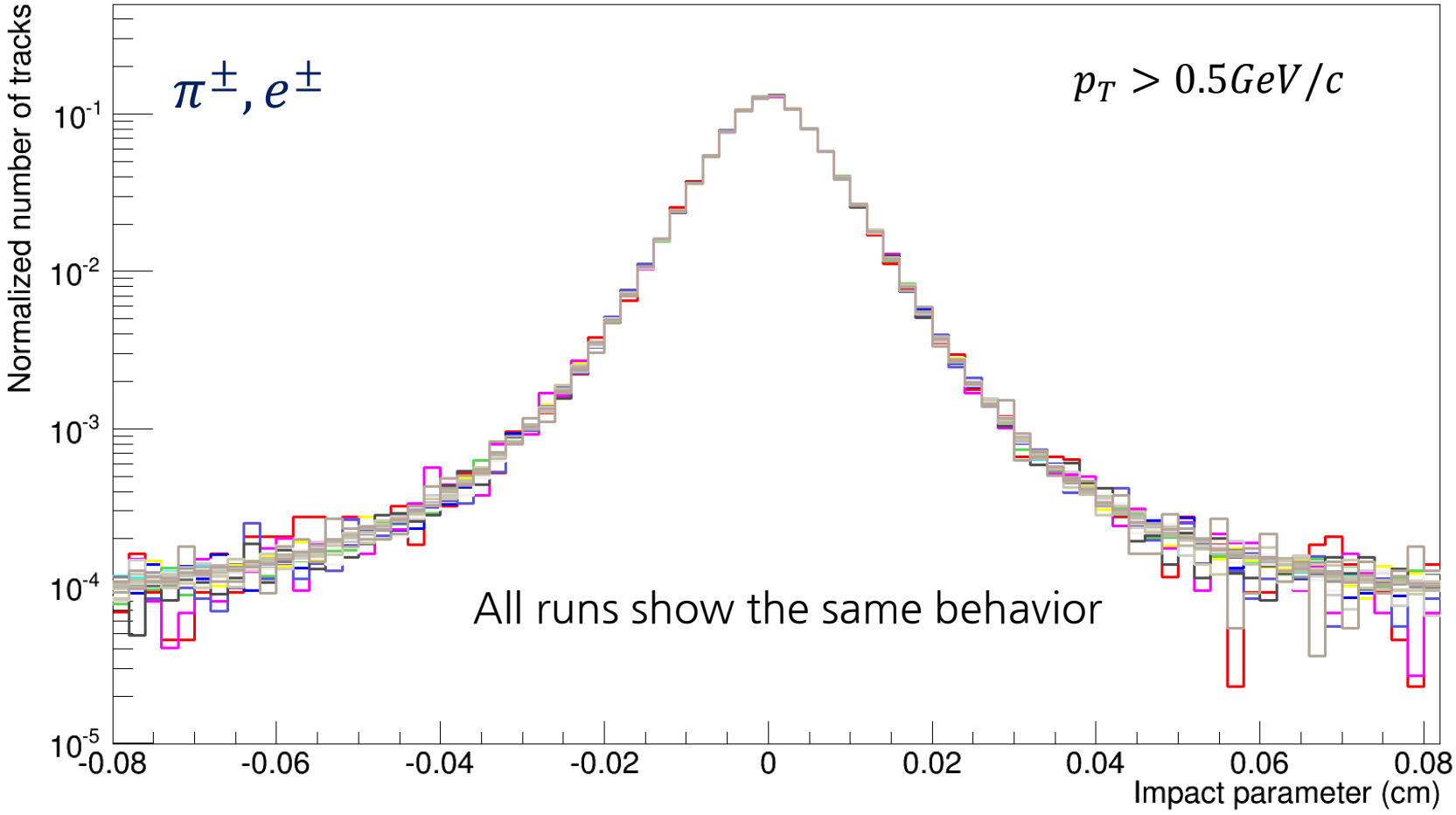
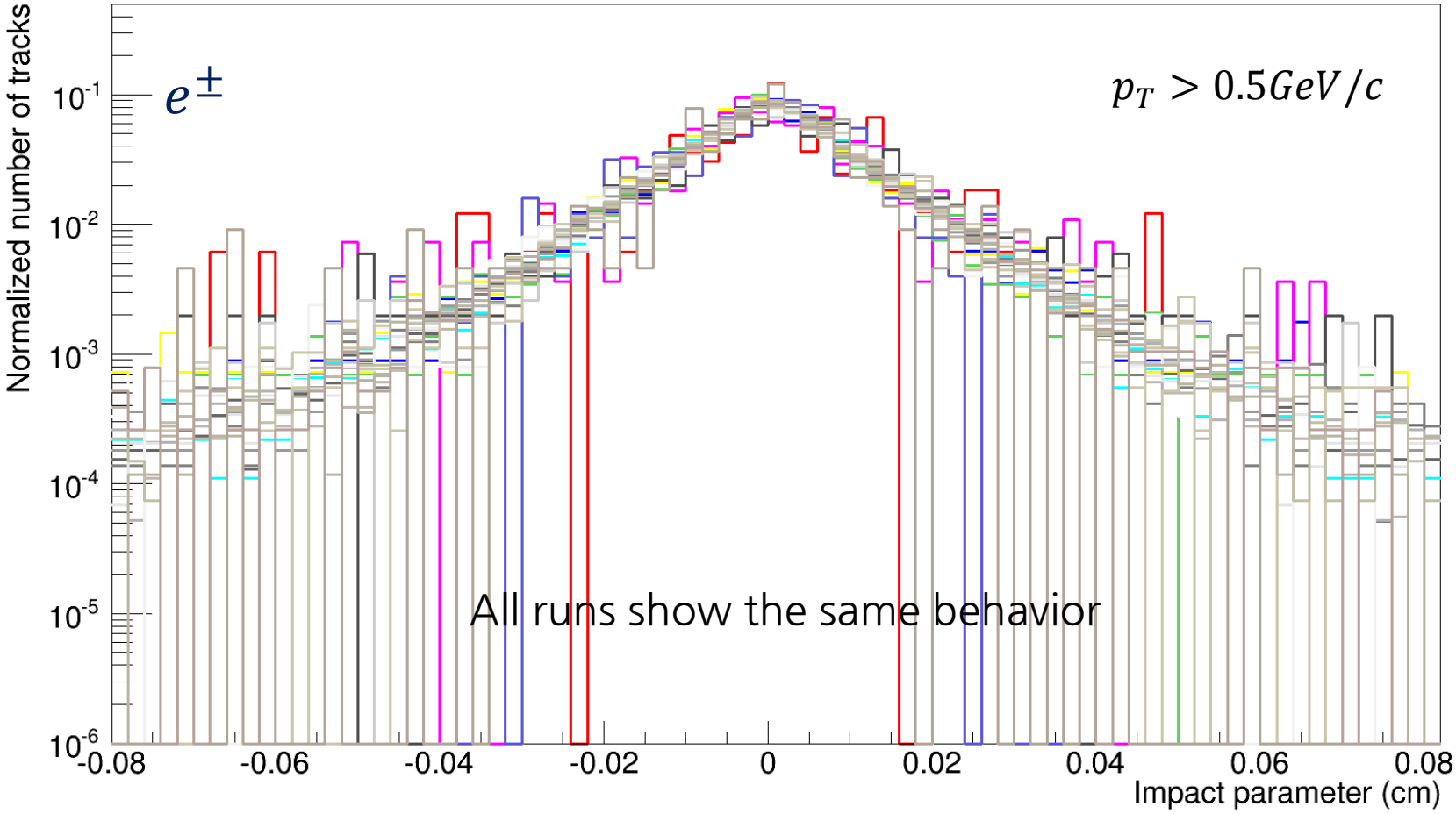


# Impact parameter distribution
## – MC data [p2] (23 runs)



# Impact parameter distribution
## – MC data [p2] (23 runs)



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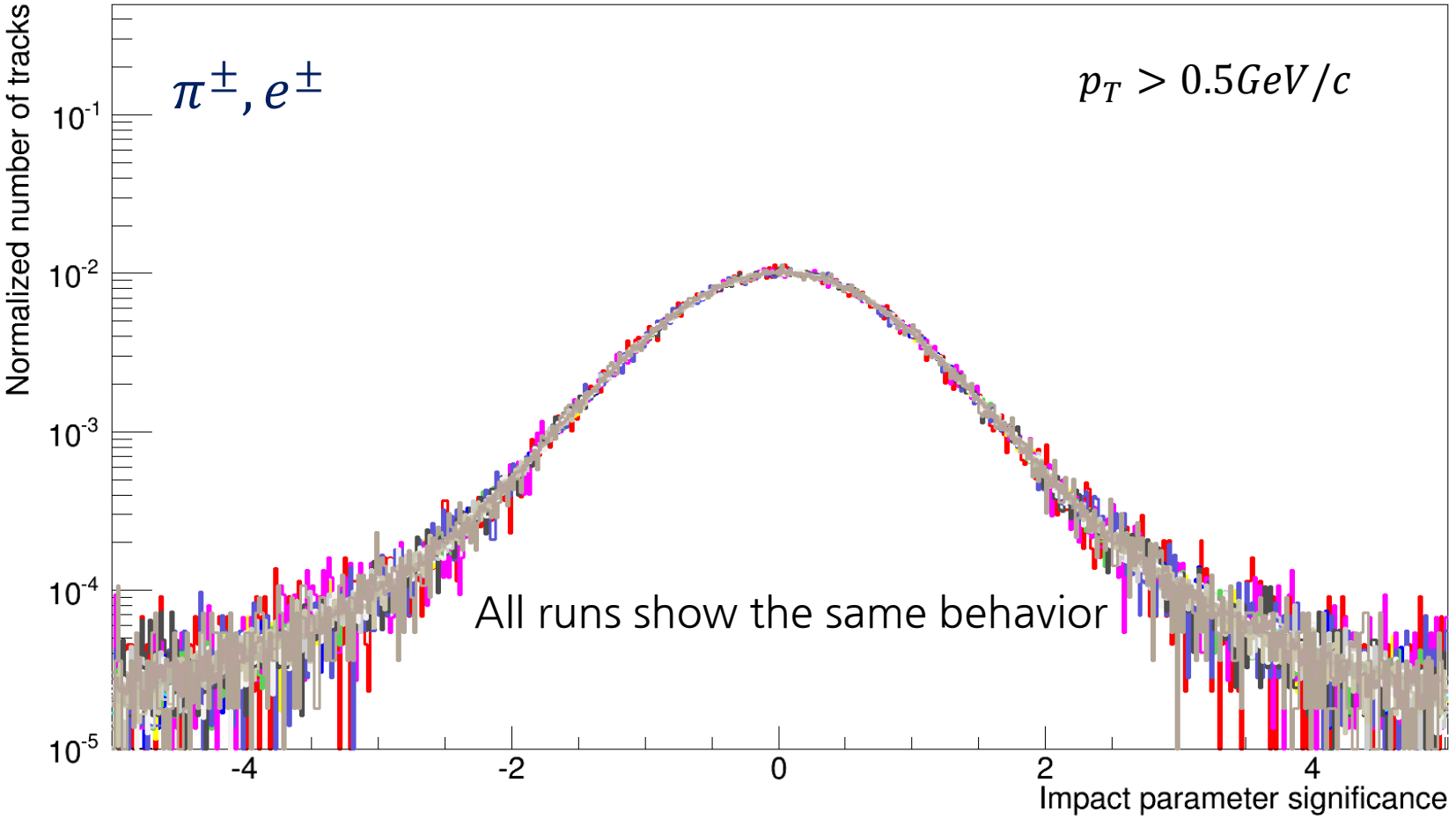

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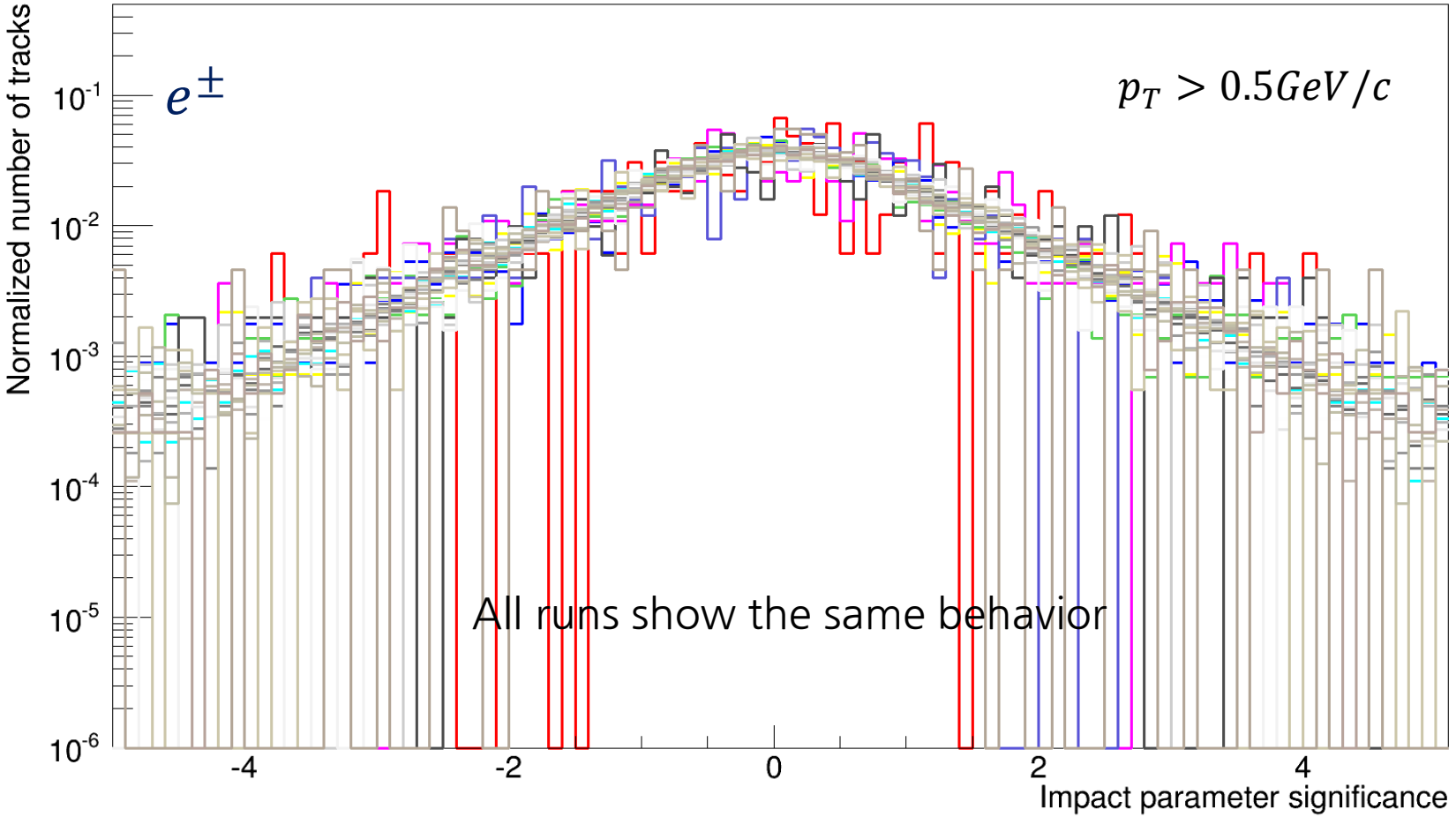
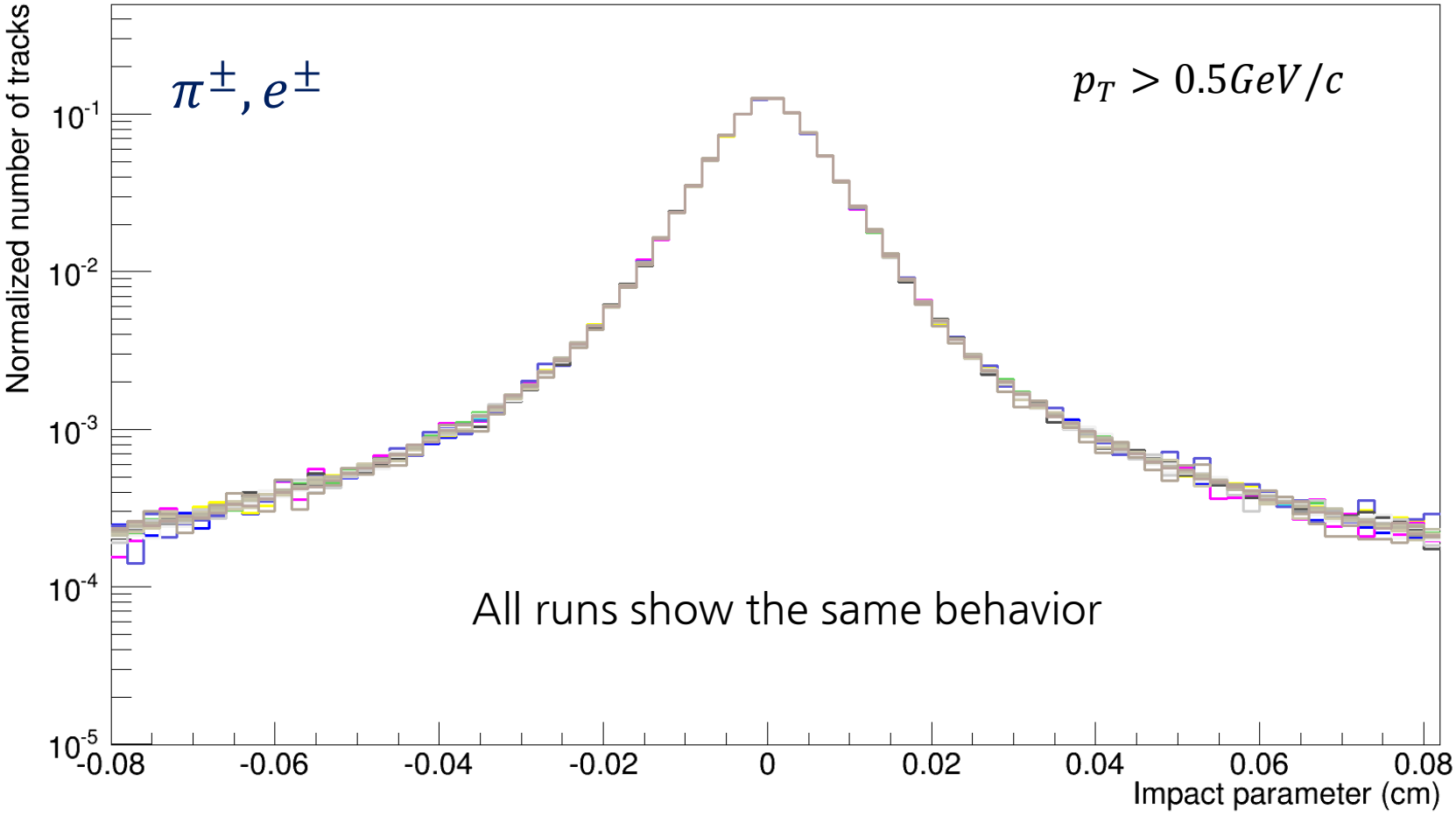
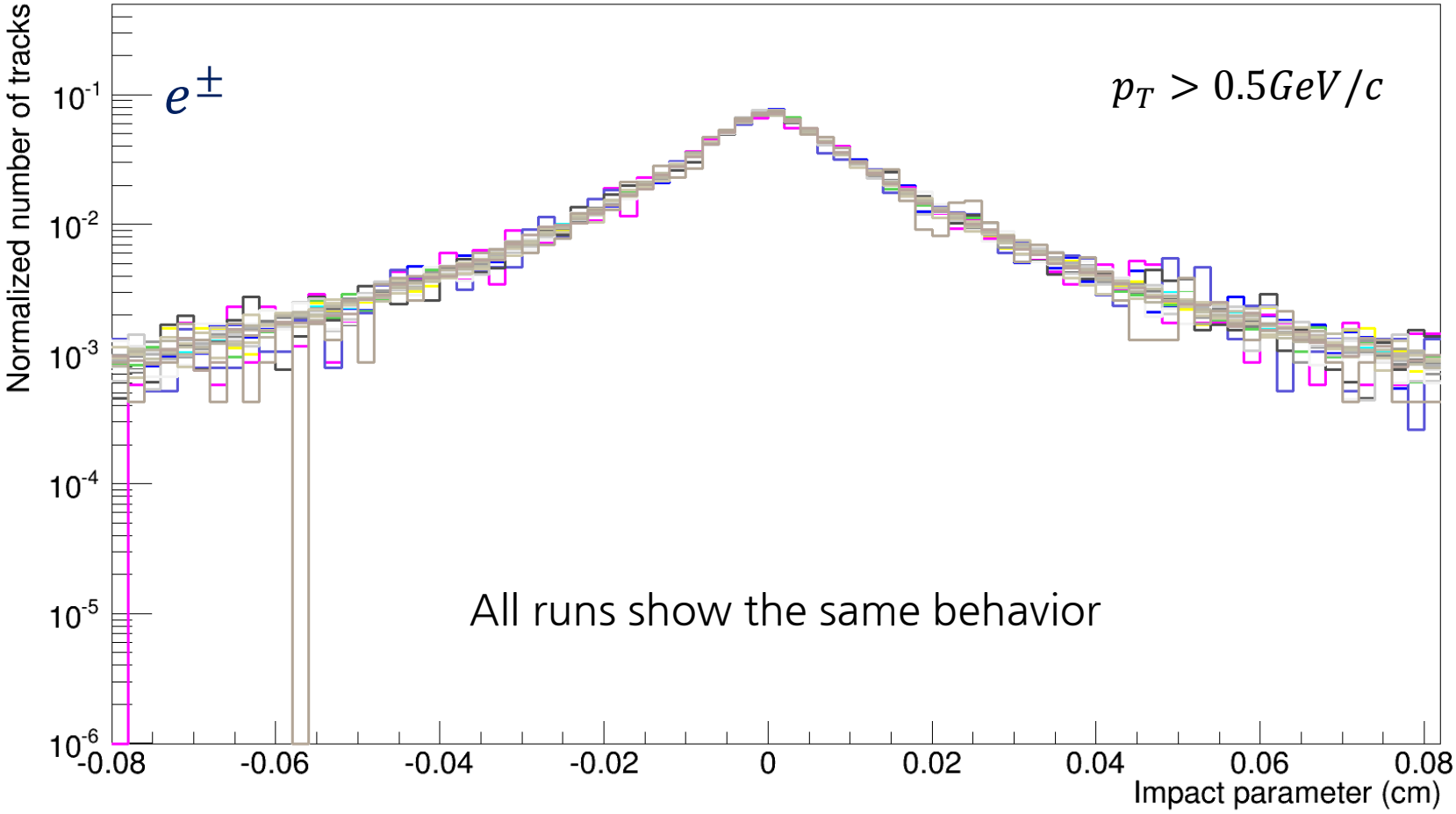


# Impact parameter distribution
## – MC data [LHC13d3] (22 runs)



# Impact parameter distribution
## – MC data [LHC13d3] (22 runs)



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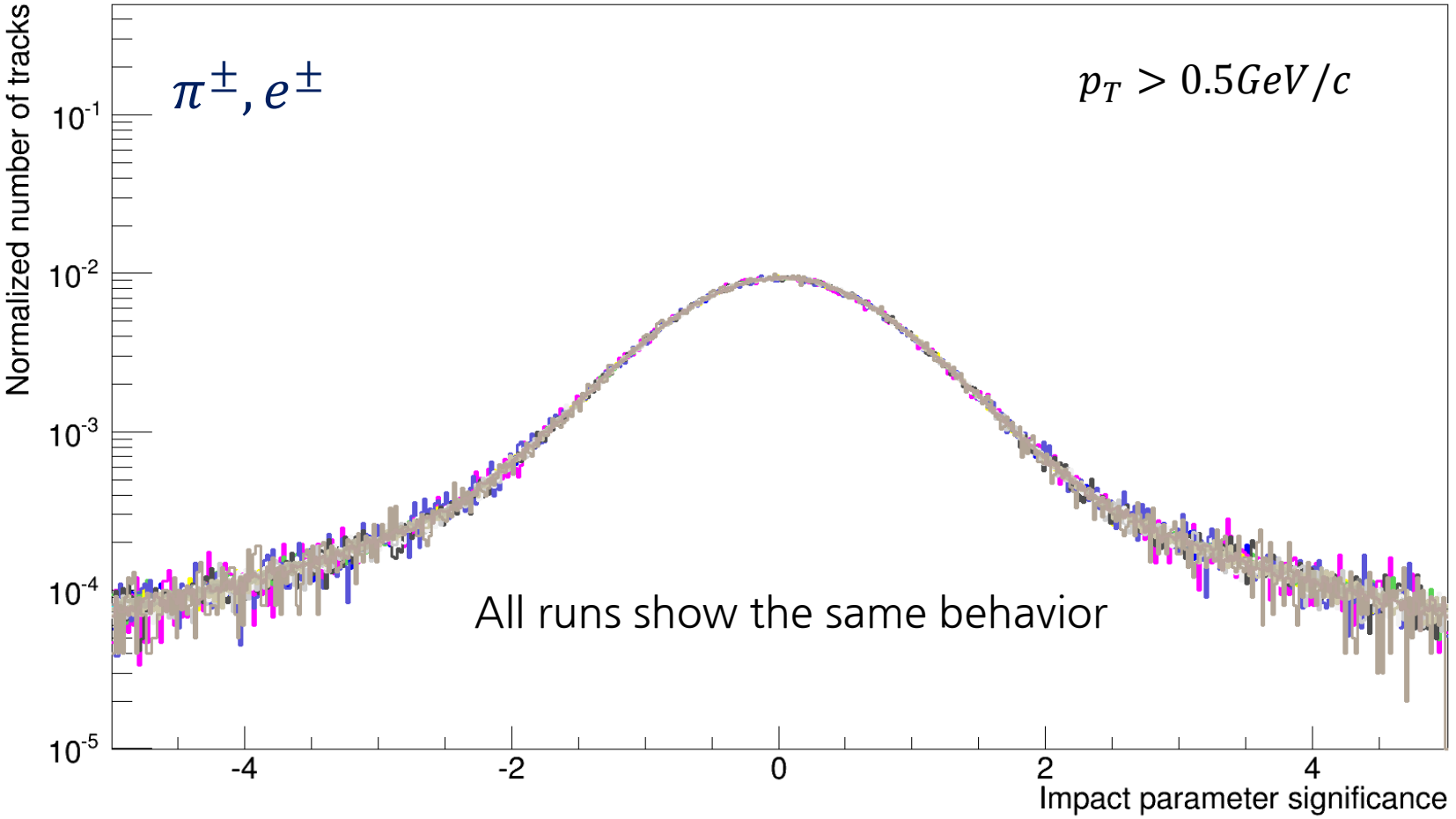

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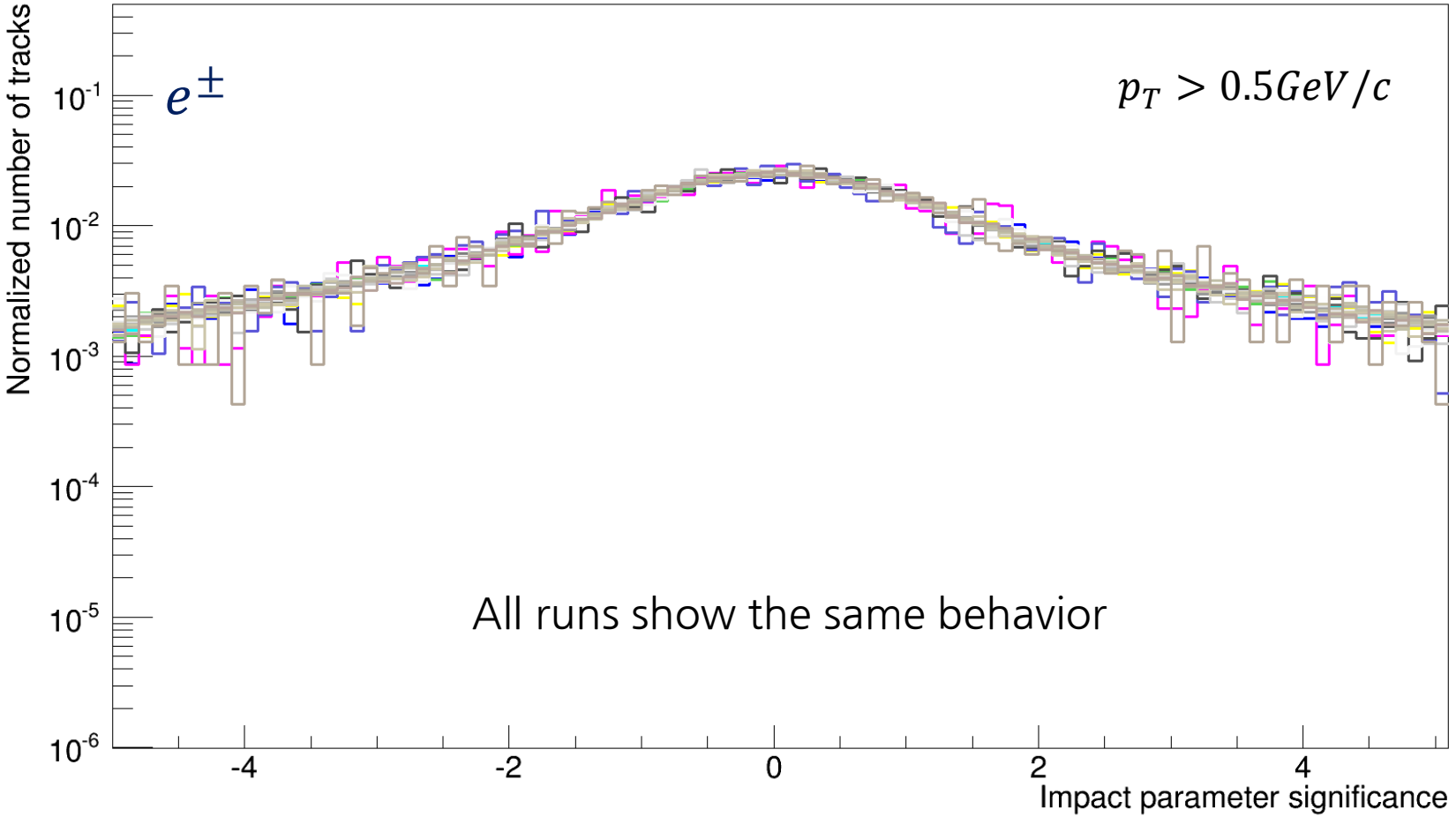
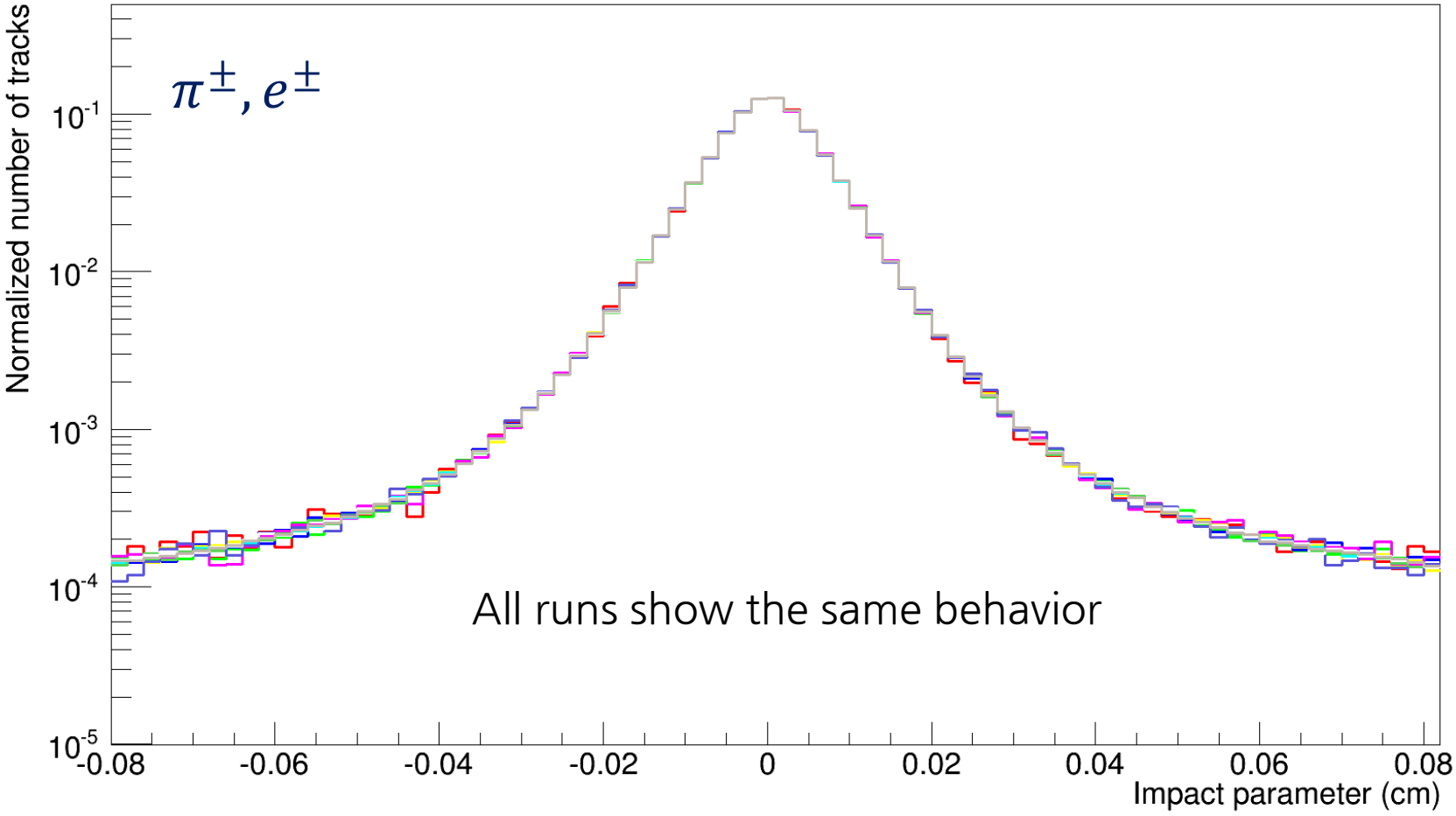


# Impact parameter distribution
## – Experimental data [LHC13b] (10 runs)



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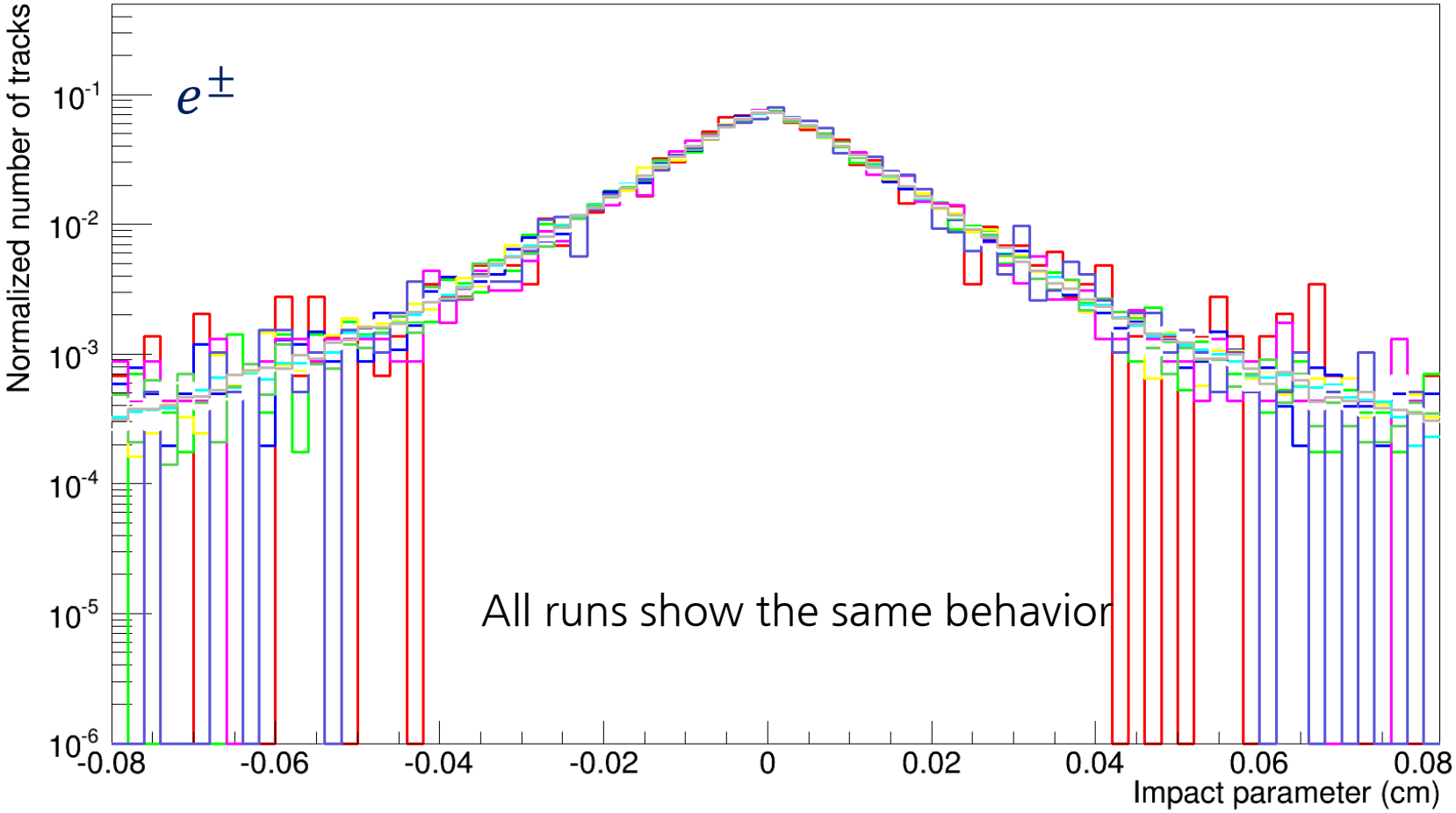

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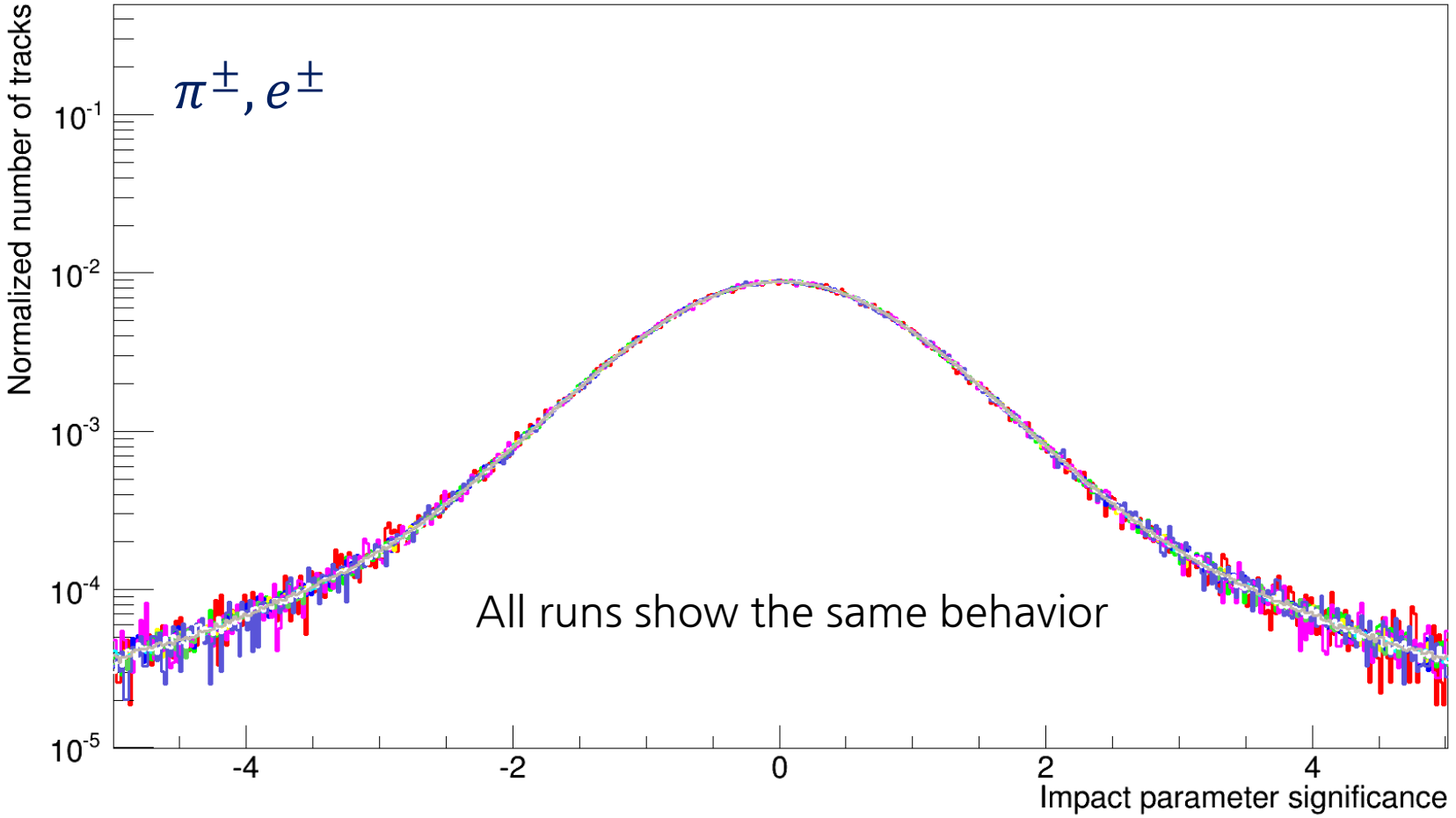

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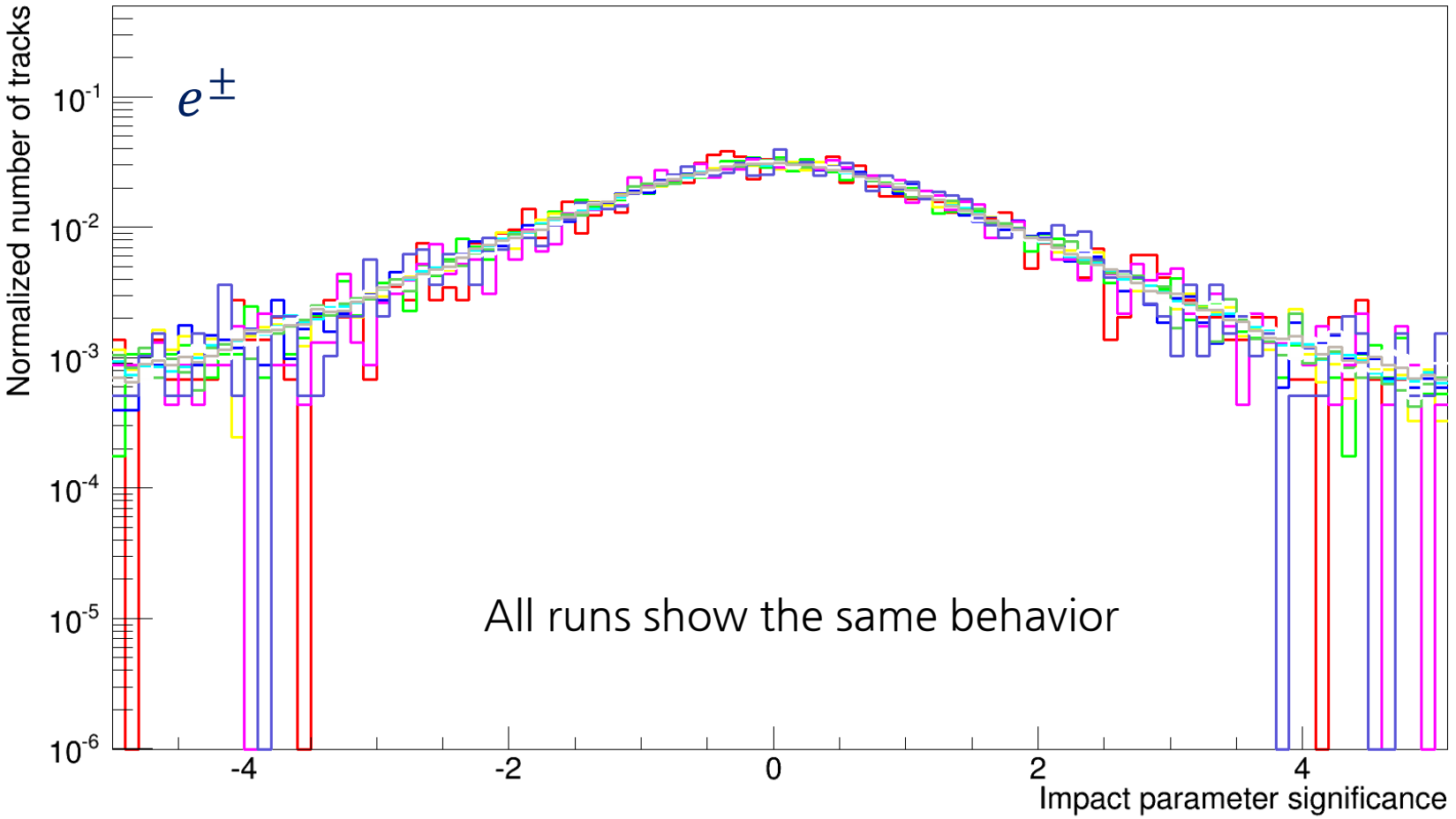
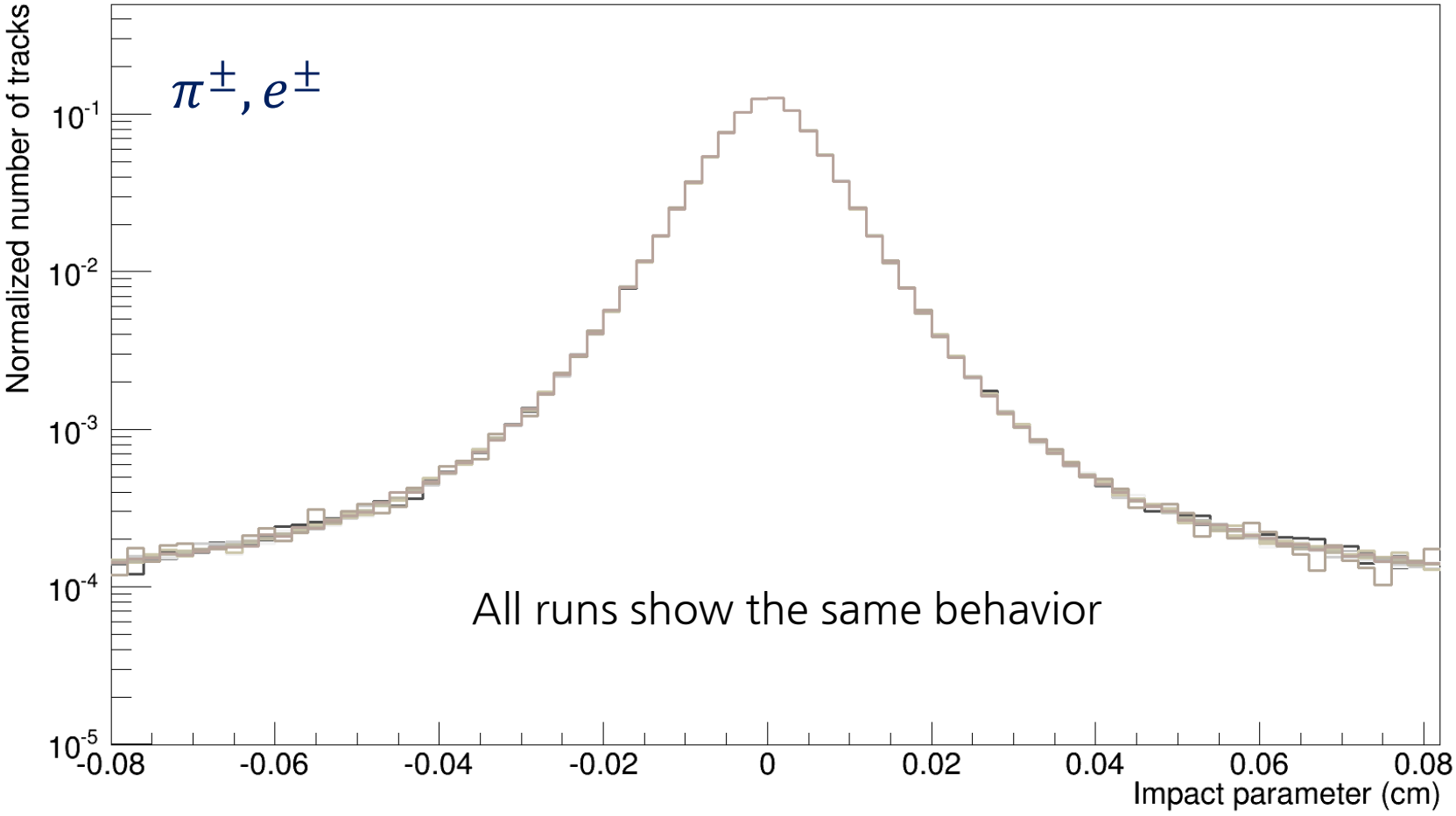
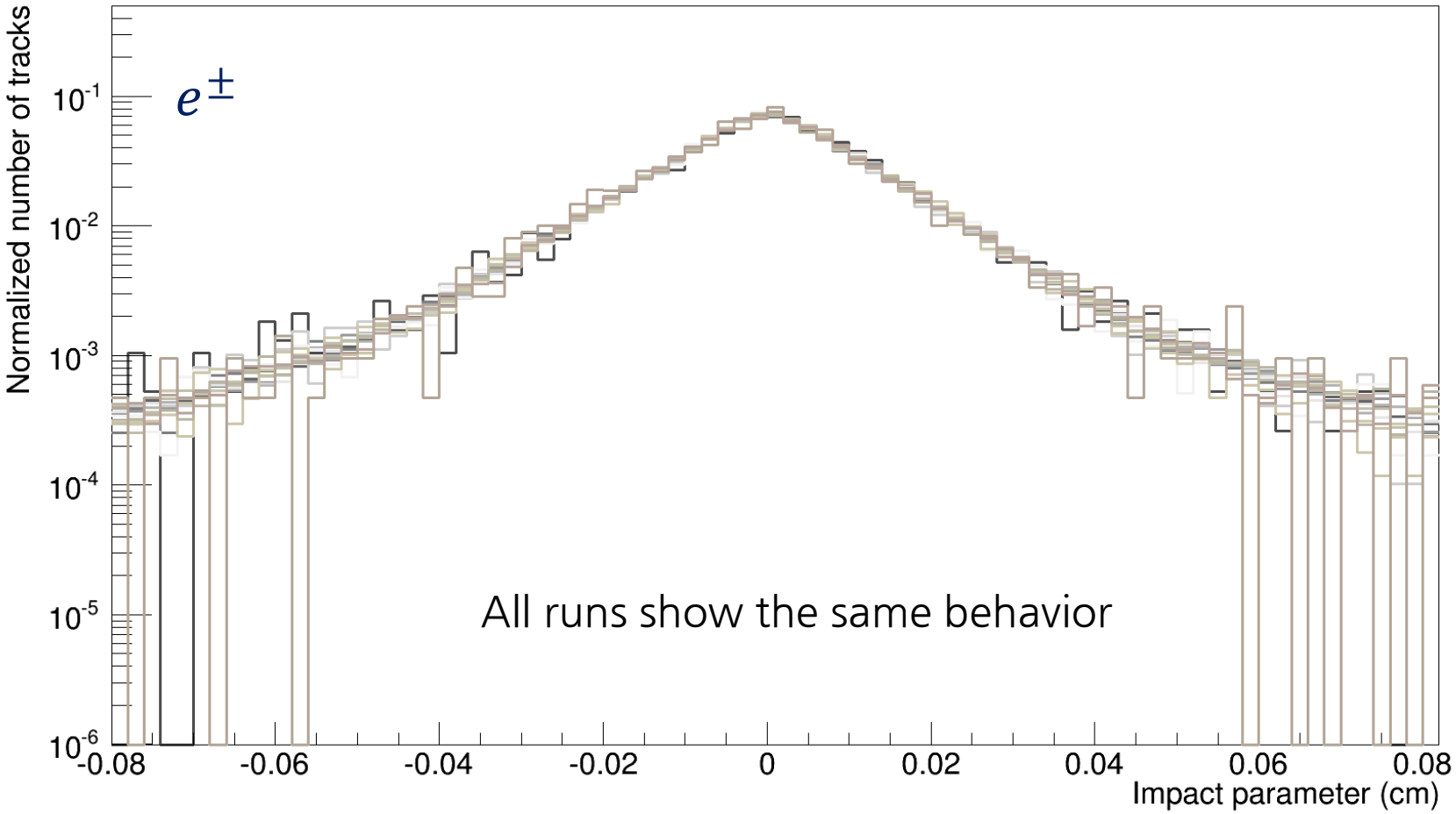


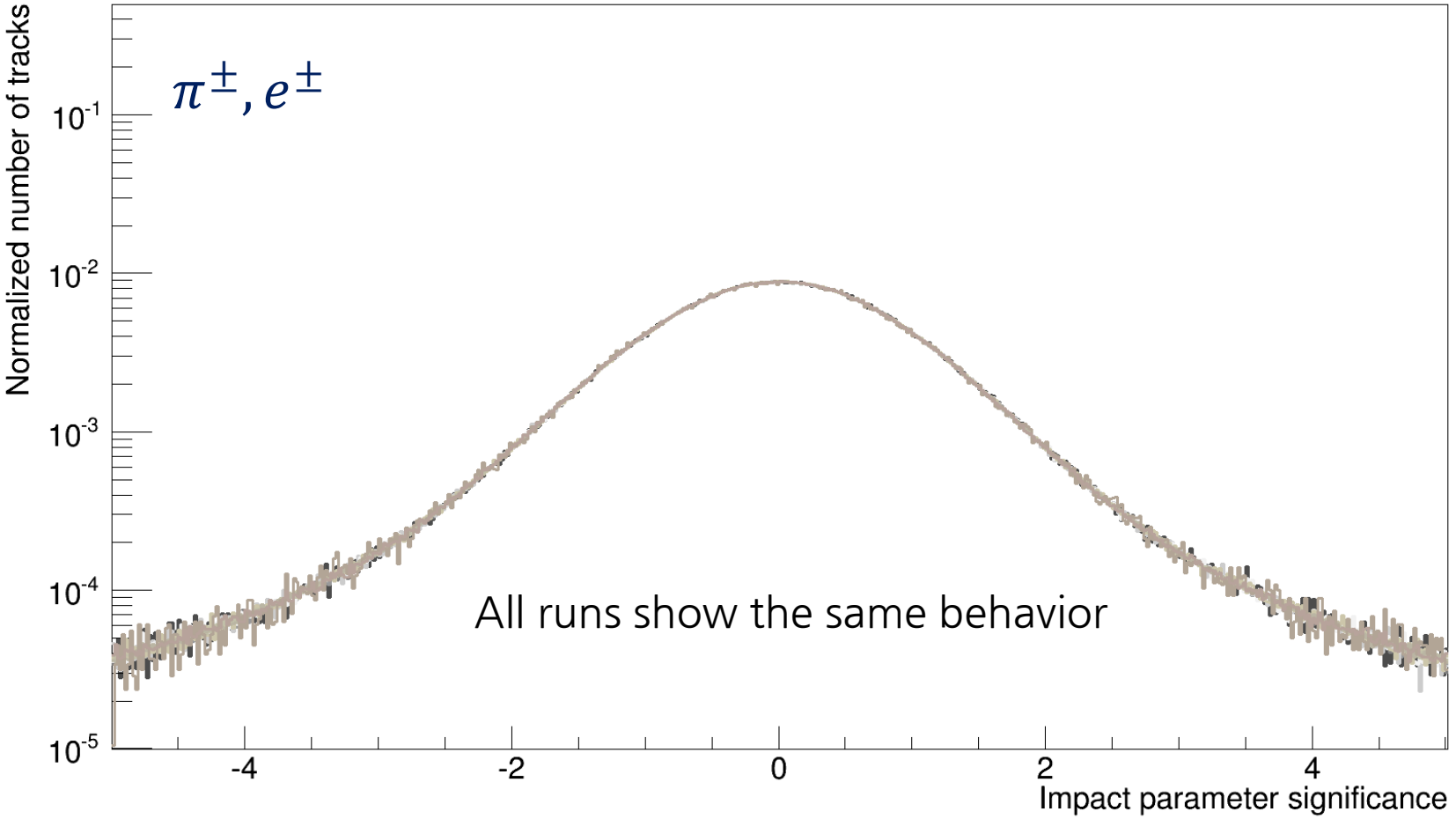
# Impact parameter distribution
## – Experimental data [LHC13c] (14 runs)



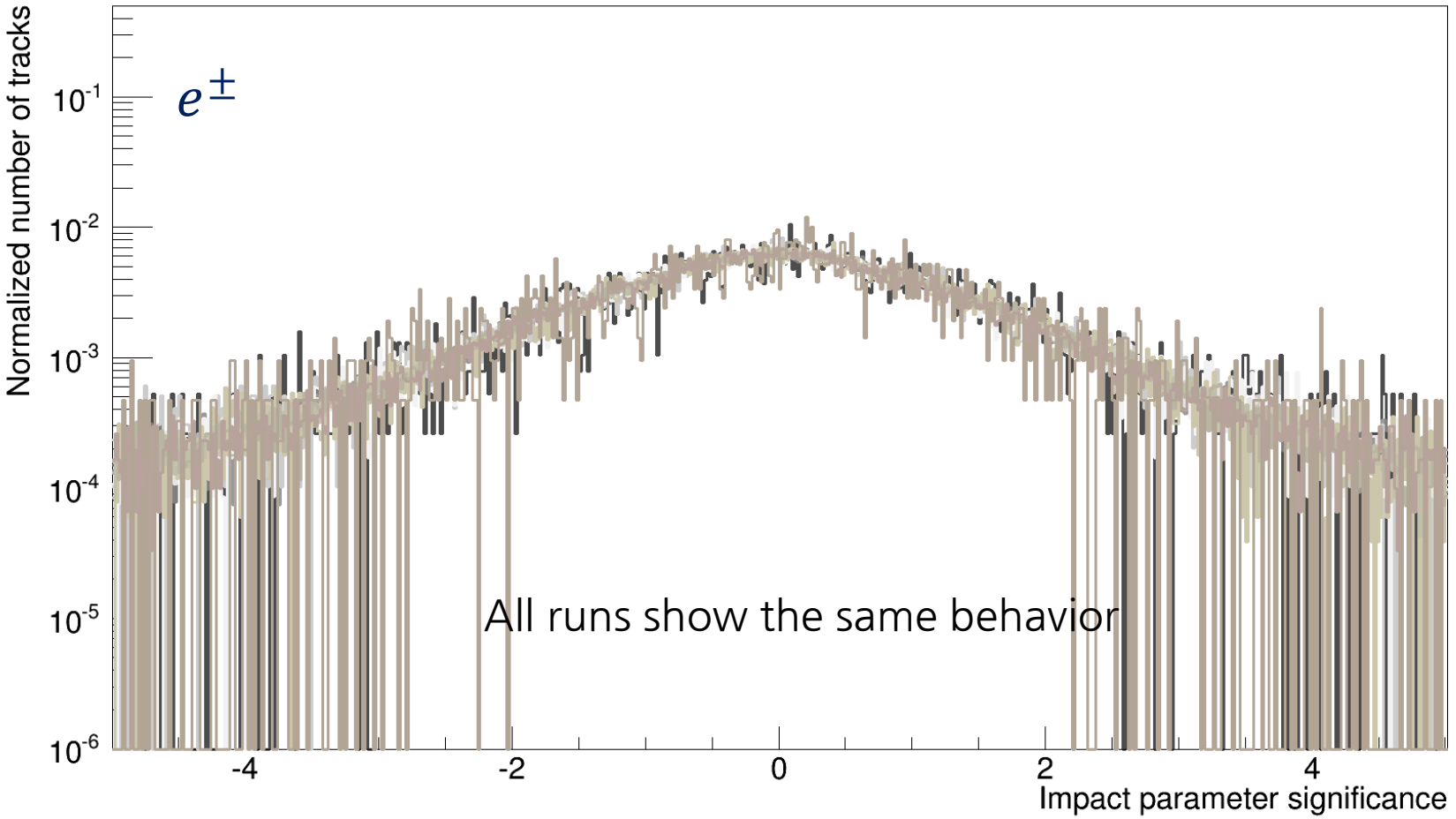
# Impact parameter distribution
## – Experimental data [LHC13c] (14 runs)



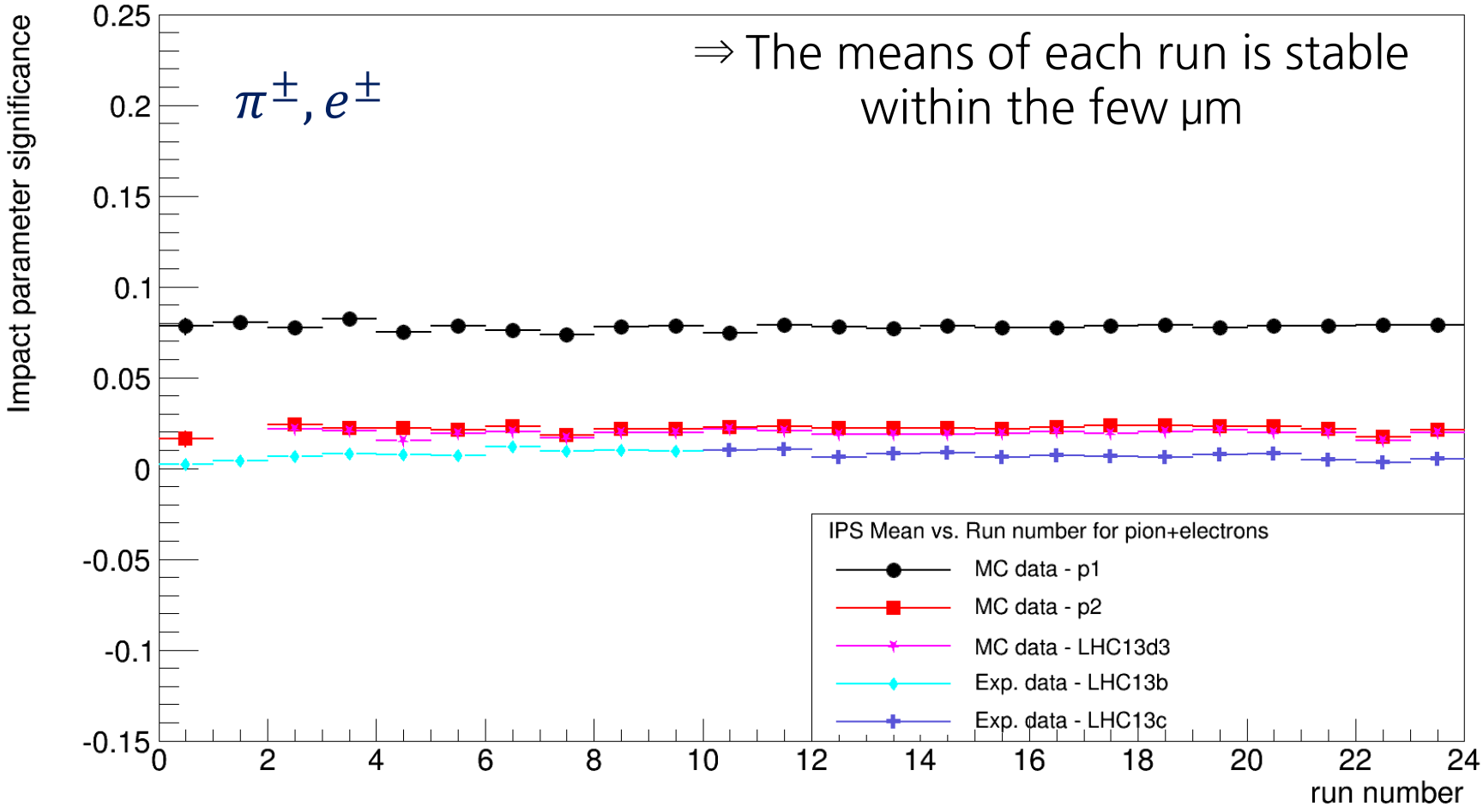
# Impact parameter significance distribution – Experimental data [LHC13c] (14 runs)



# Impact parameter significance distribution – Experimental data [LHC13c] (14 runs)



# Impact parameter significance characteristics − Mean vs. Run number



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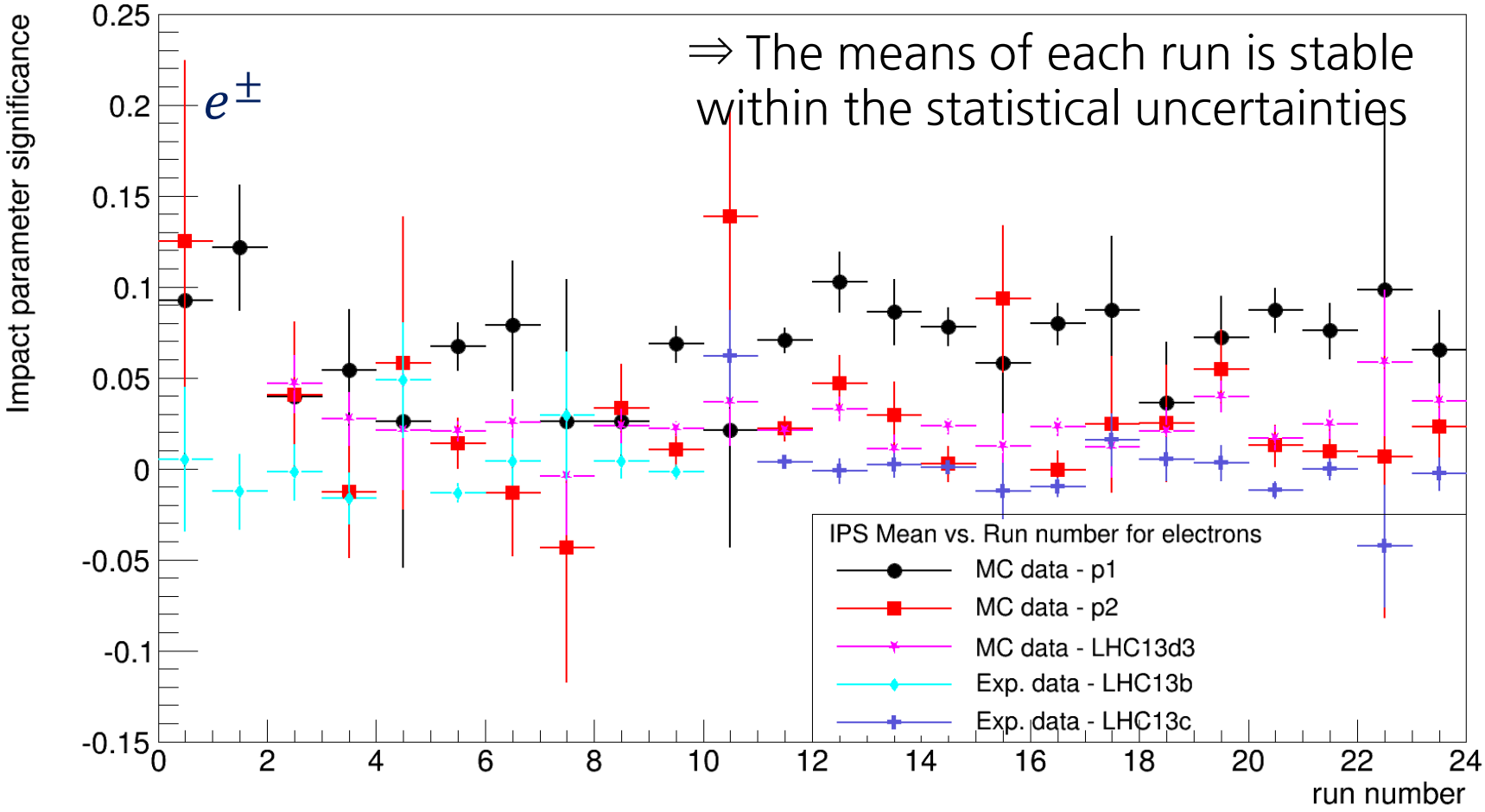
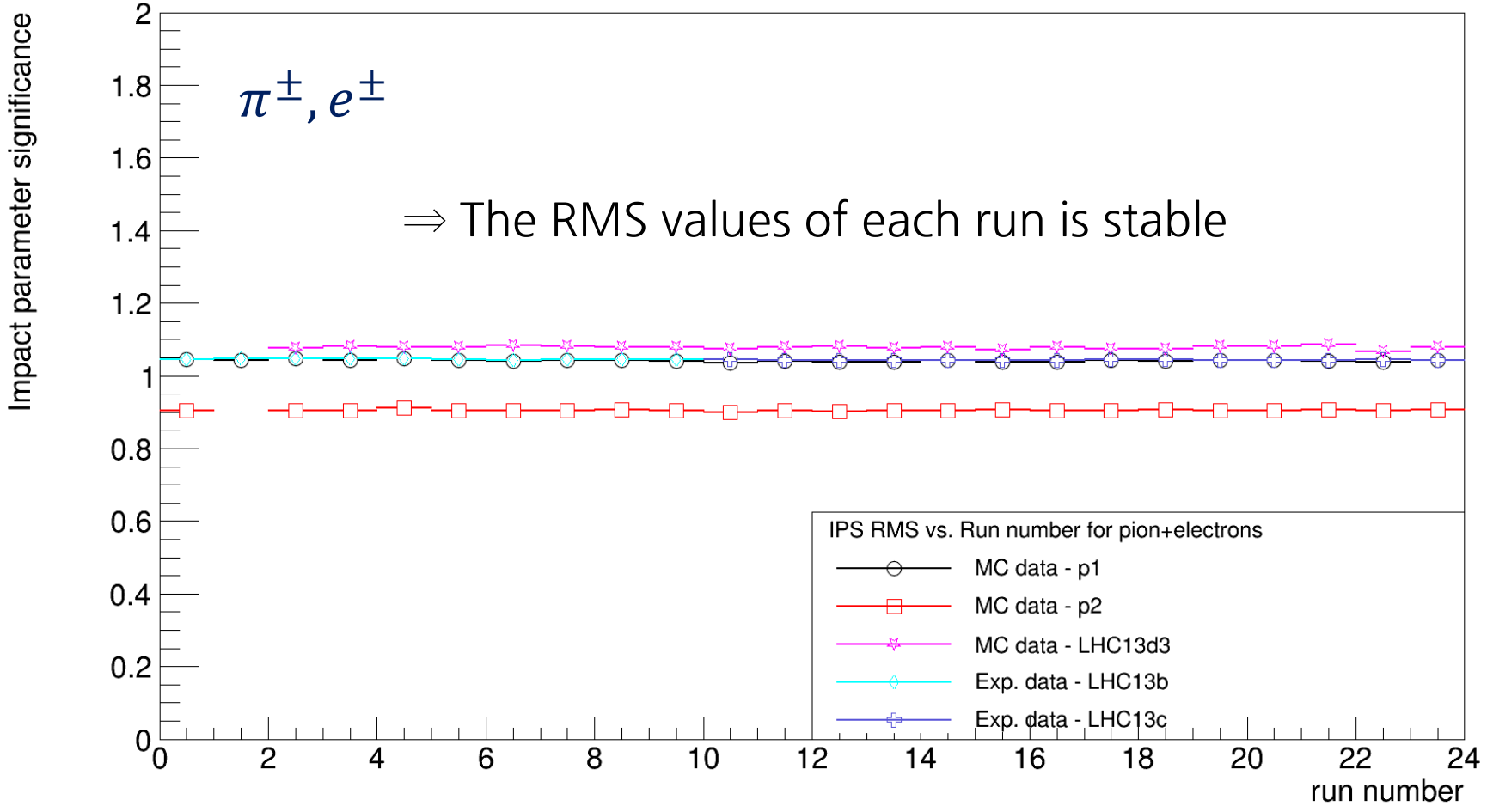
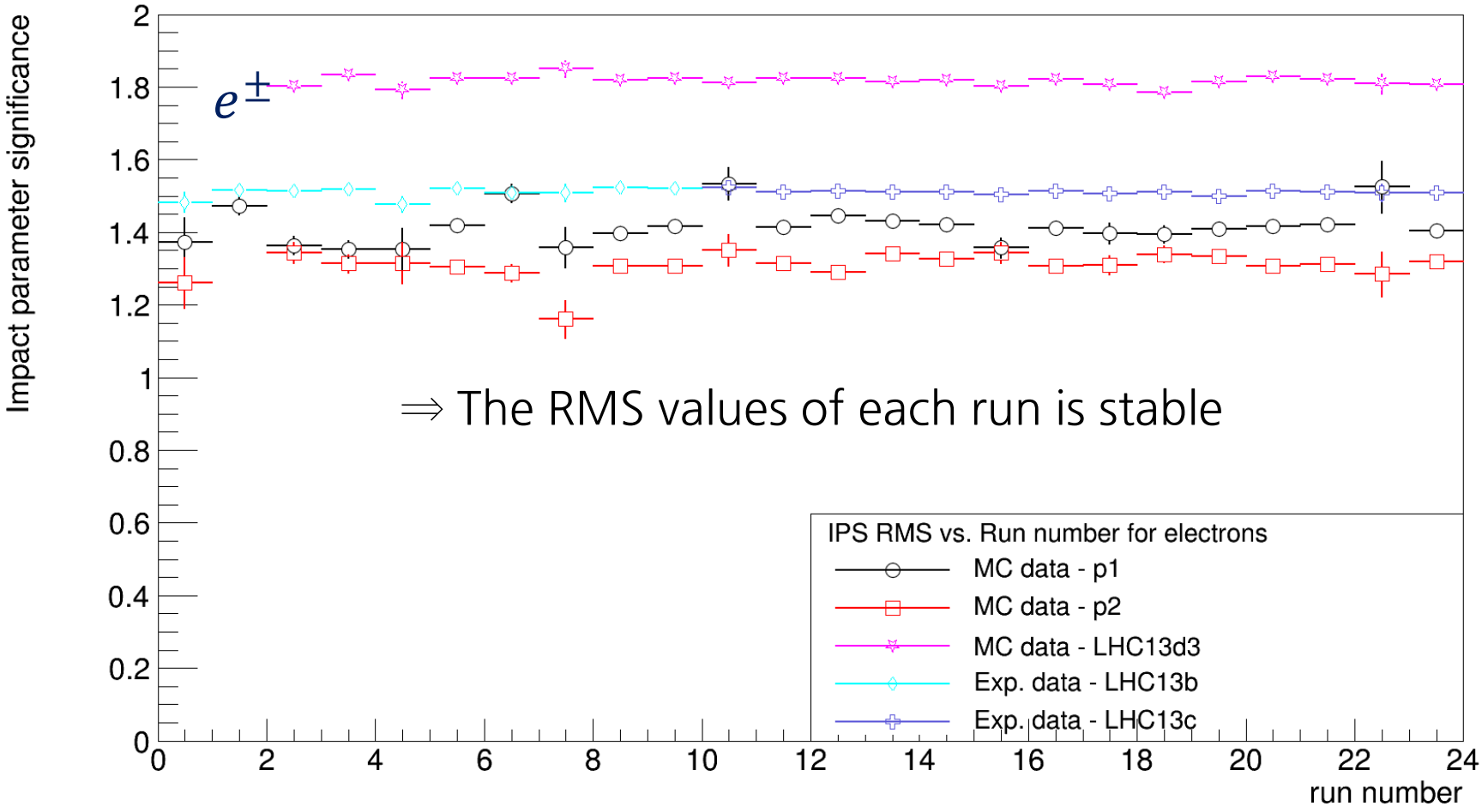


# Impact parameter significance characteristics – RMS vs. Run number

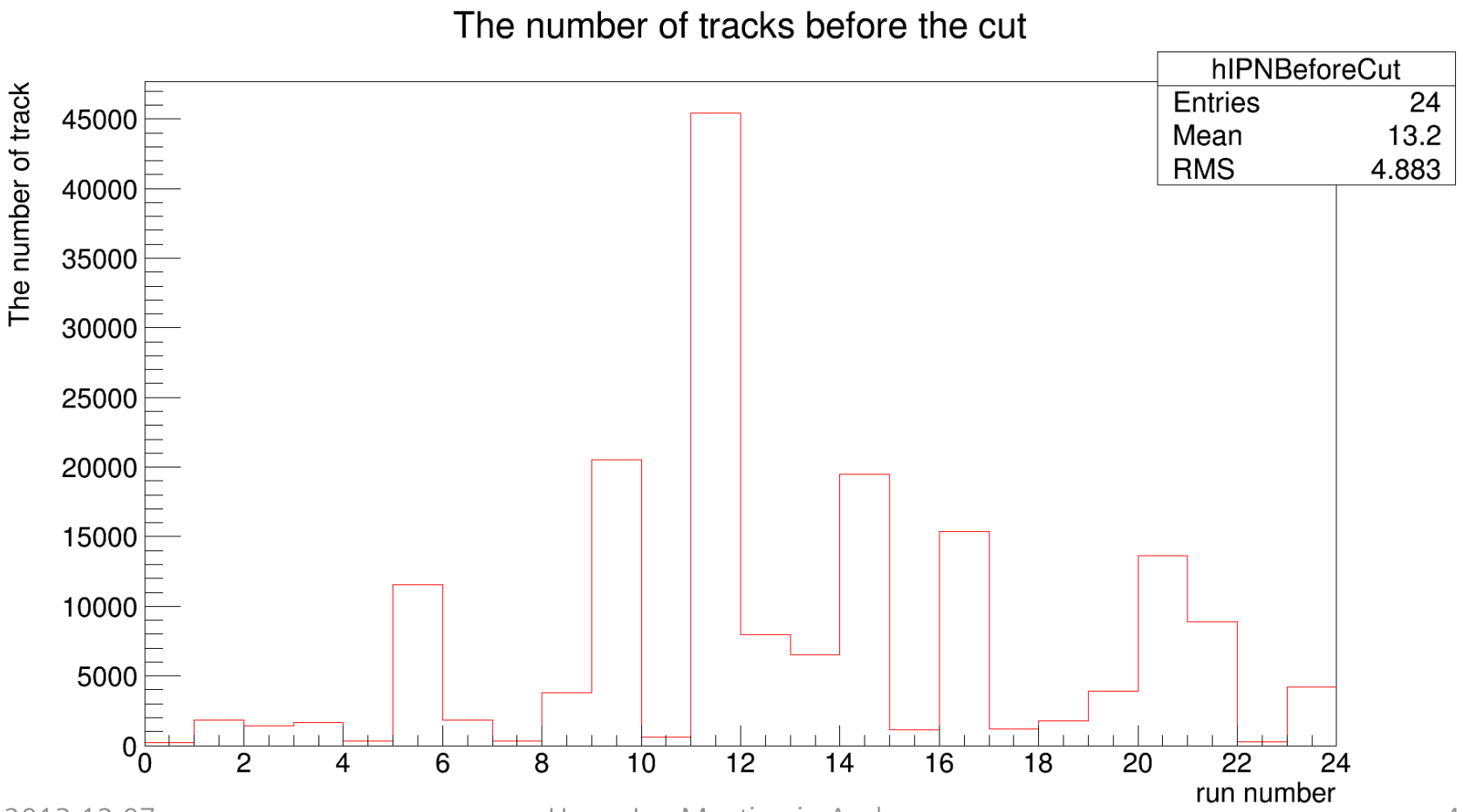


# Impact parameter significance characteristics – RMS vs. Run number



# The total number of tracks for electrons

- MC data - p1 [뎌$p_T$ $Cut$뎍 : $p_T > 0.5Gev/c$]



# The fraction of the outlier for electrons

- MC data - p1 [더$Outlier$덕 : $Impact\ parameter > 800\mu m$]