

Charmonium production measurement at midrapidity using TRD-triggered data

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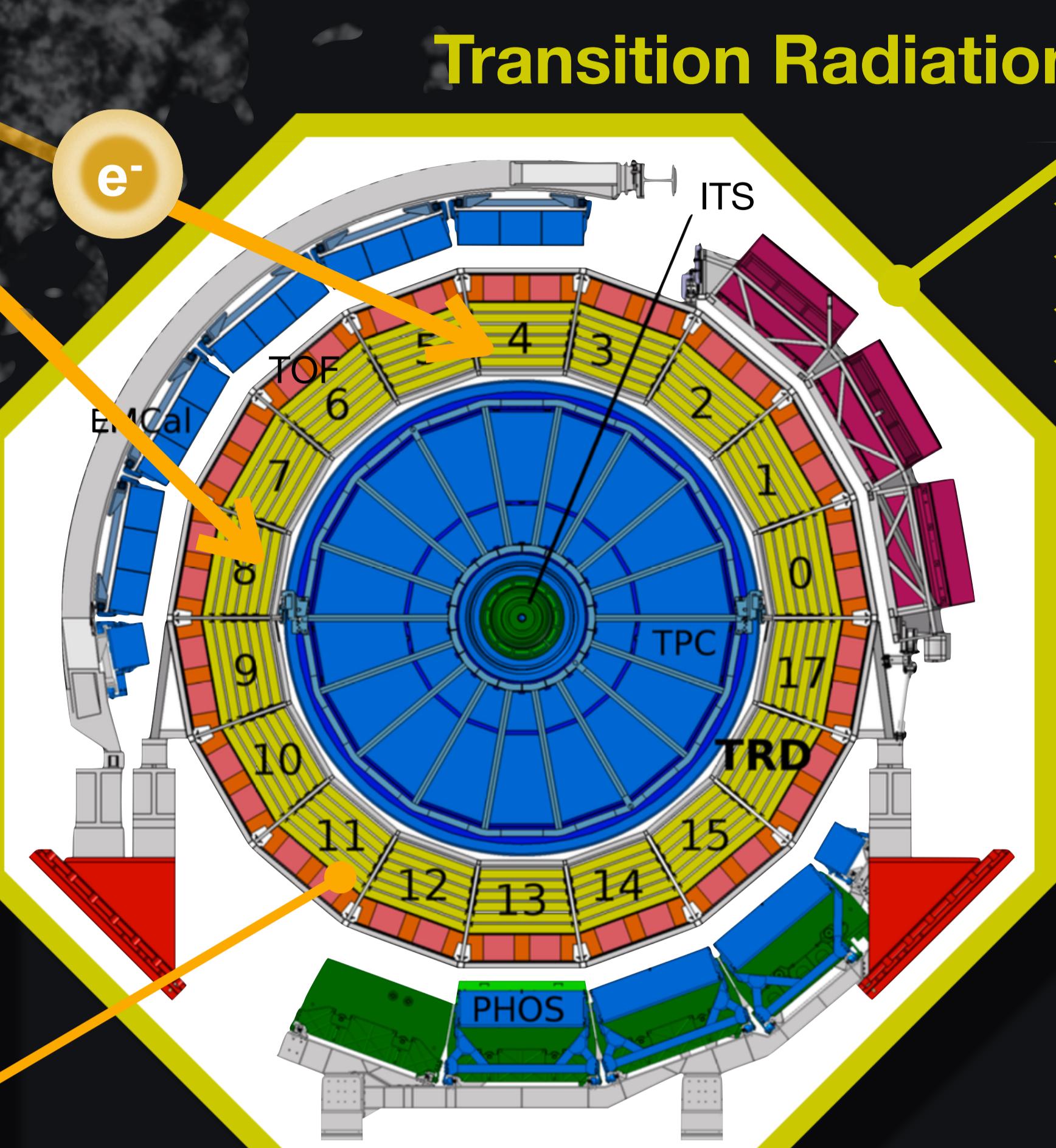
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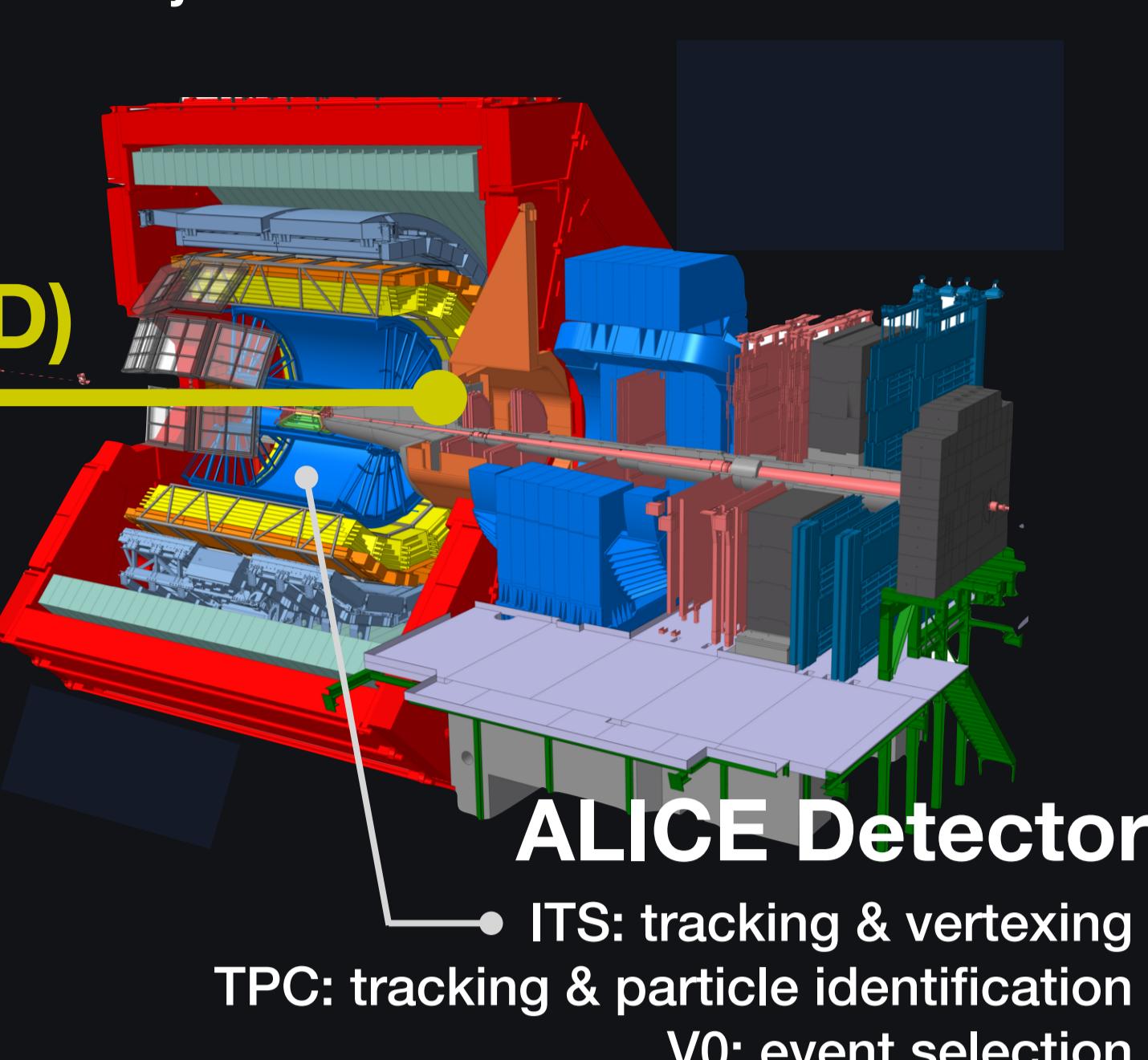
ALICE



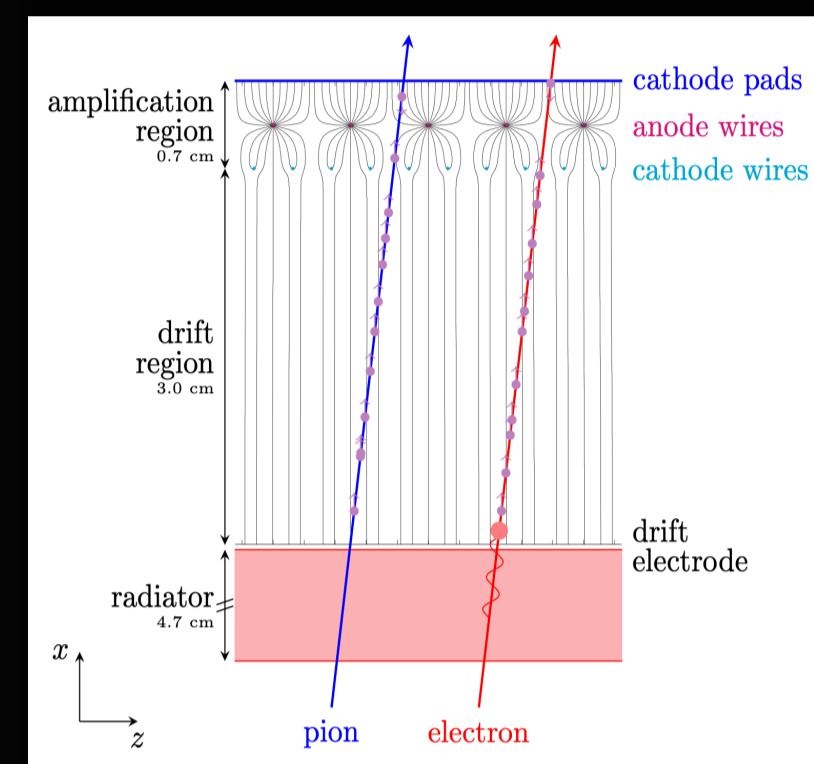
- Charmonium:** bound state of c and anti c quark
- Deconfinement & statistical hadronization in AA collisions
- Charmonium measurements in different systems**
 - pp: reference of AA collisions, suitable for QCD studies
 - p-Pb: nuclear PDFs & final state effects
- Requirements**
 - Excellent electron identification
 - Trigger to enhance events with high-momentum electrons



- 2.9 < r < 3.7 m
- |η| < 0.84
- <X/X₀ > ~25%
- ~27 m³ Xe/CO₂ (85:15)

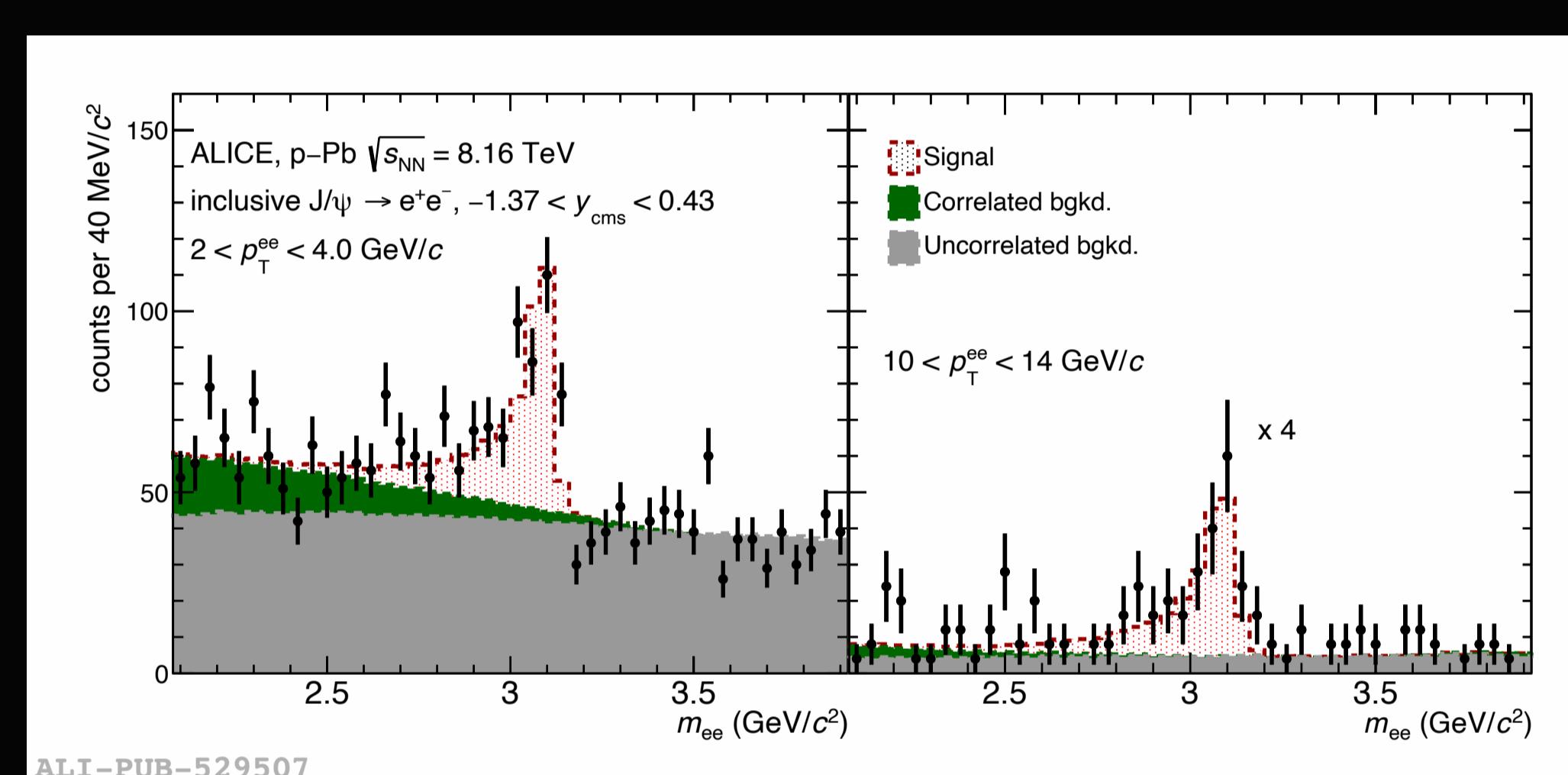


ALICE TRD (Drift Chamber + Transition Radiator)



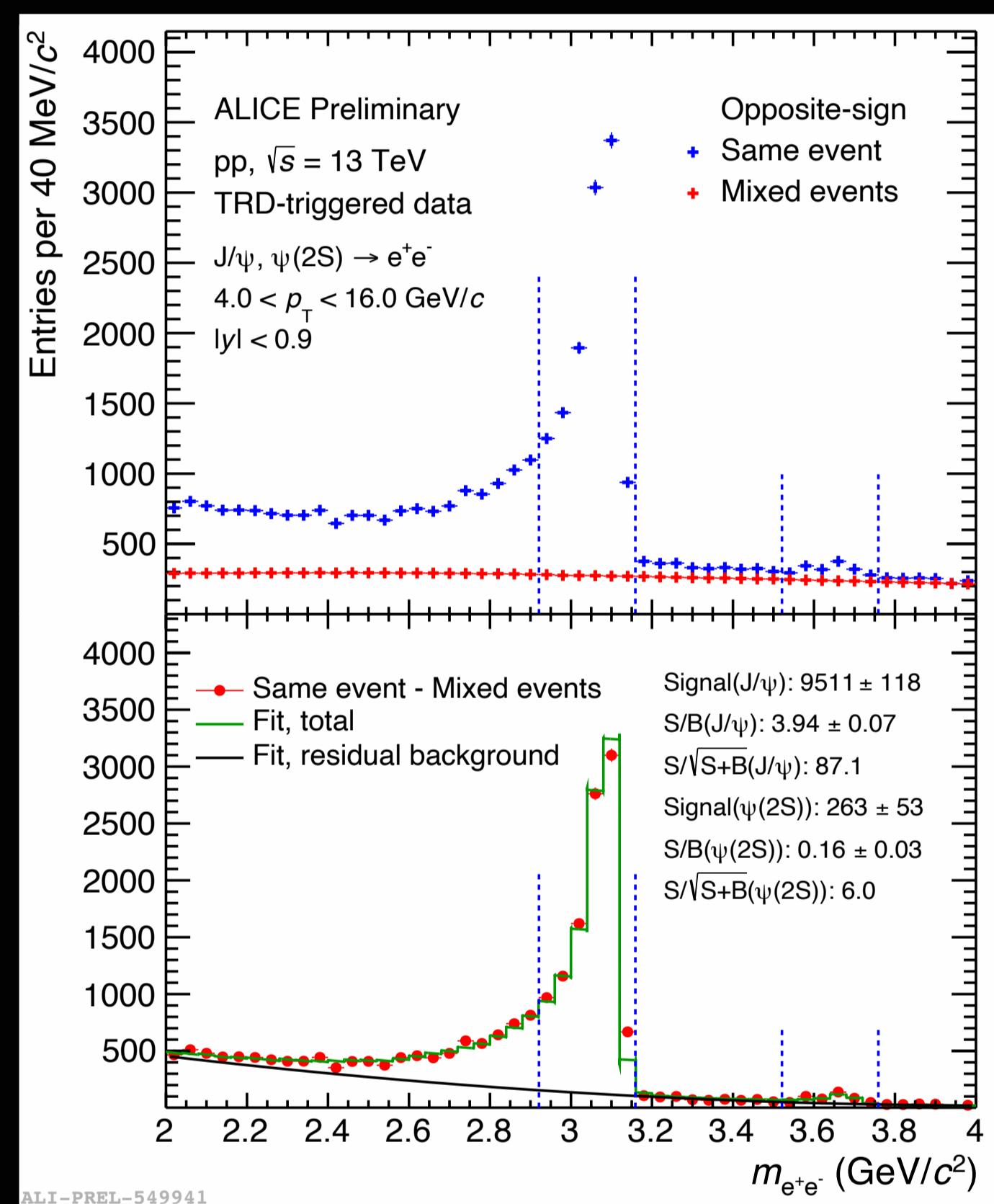
- Transition radiation (TR)
- Produced by relativistic particle ($\beta\gamma > 500$) crossing between materials with different dielectric constants
- ~ 1 TR photon per electron with $p > 0.5$ GeV/c

J/ψ signal extraction in p-Pb

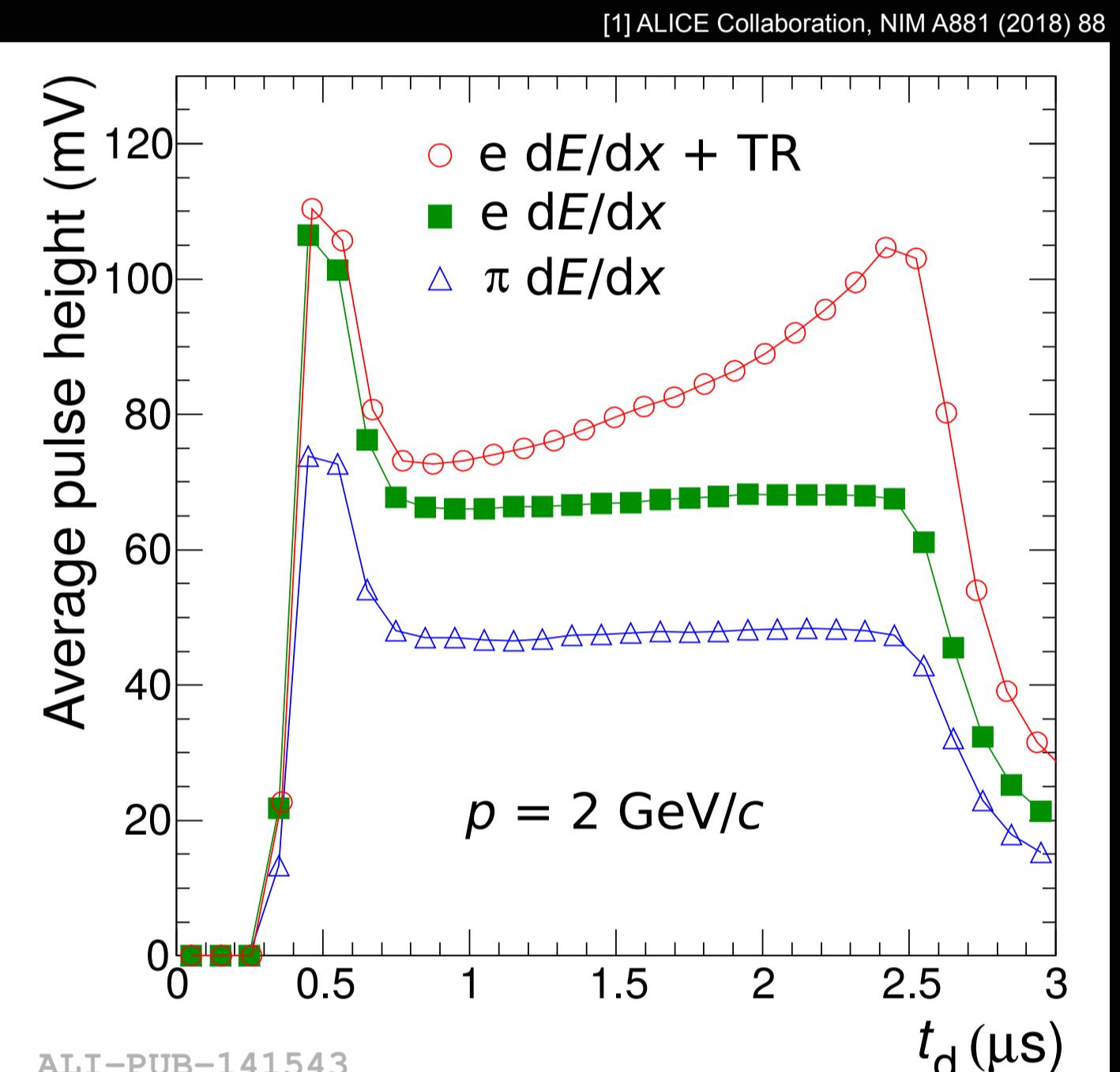


- Background rejection: mixed-event technique
- Residual background: 1st order polynomial fit function
- Significant enhancement of J/ψ signal with TRD trigger

J/ψ and ψ(2S) signal extraction in pp



Electron identification performance of TRD



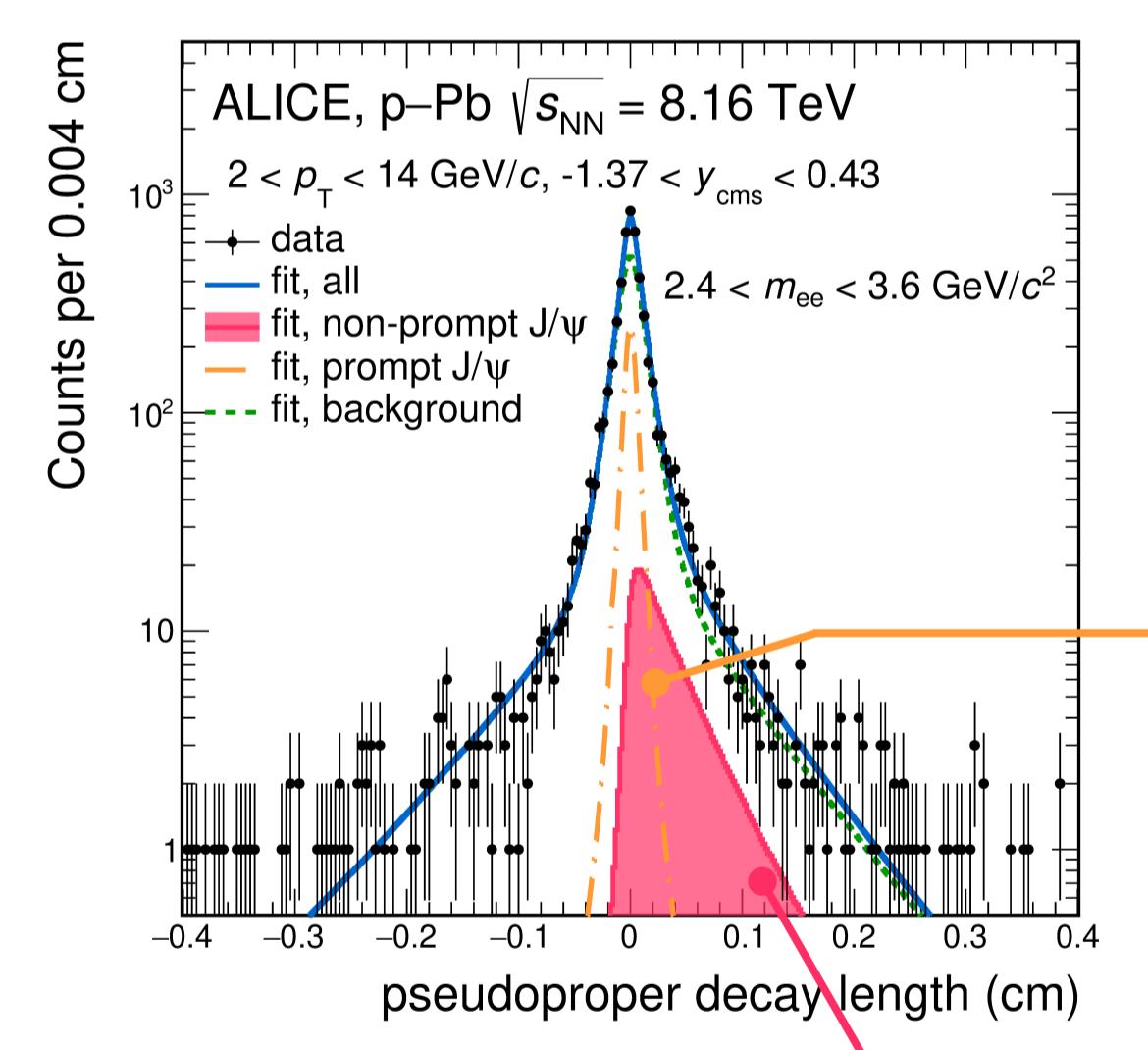
- Recording of the temporal evolution
- Separate TR photon and the charged particle
- TR photon absorption at the entrance of the chamber
- Characteristic peak at large drift time
- Pion rejection factor (inverse of efficiency)
- ~ 400 at 1 GeV/c in p-Pb

Prompt/Non-prompt J/ψ separation in p-Pb

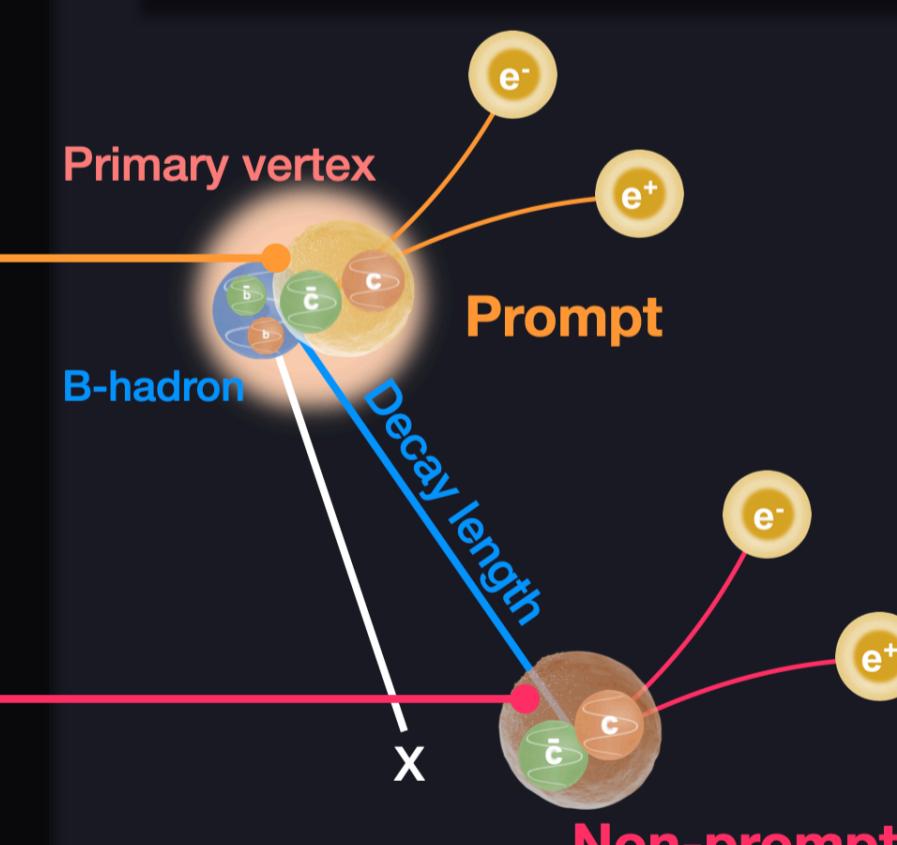
- Based on displaced secondary-decay vertex
- Pseudoproper decay length

$$x = \frac{c \cdot L_{xy} \cdot m}{p_T}$$

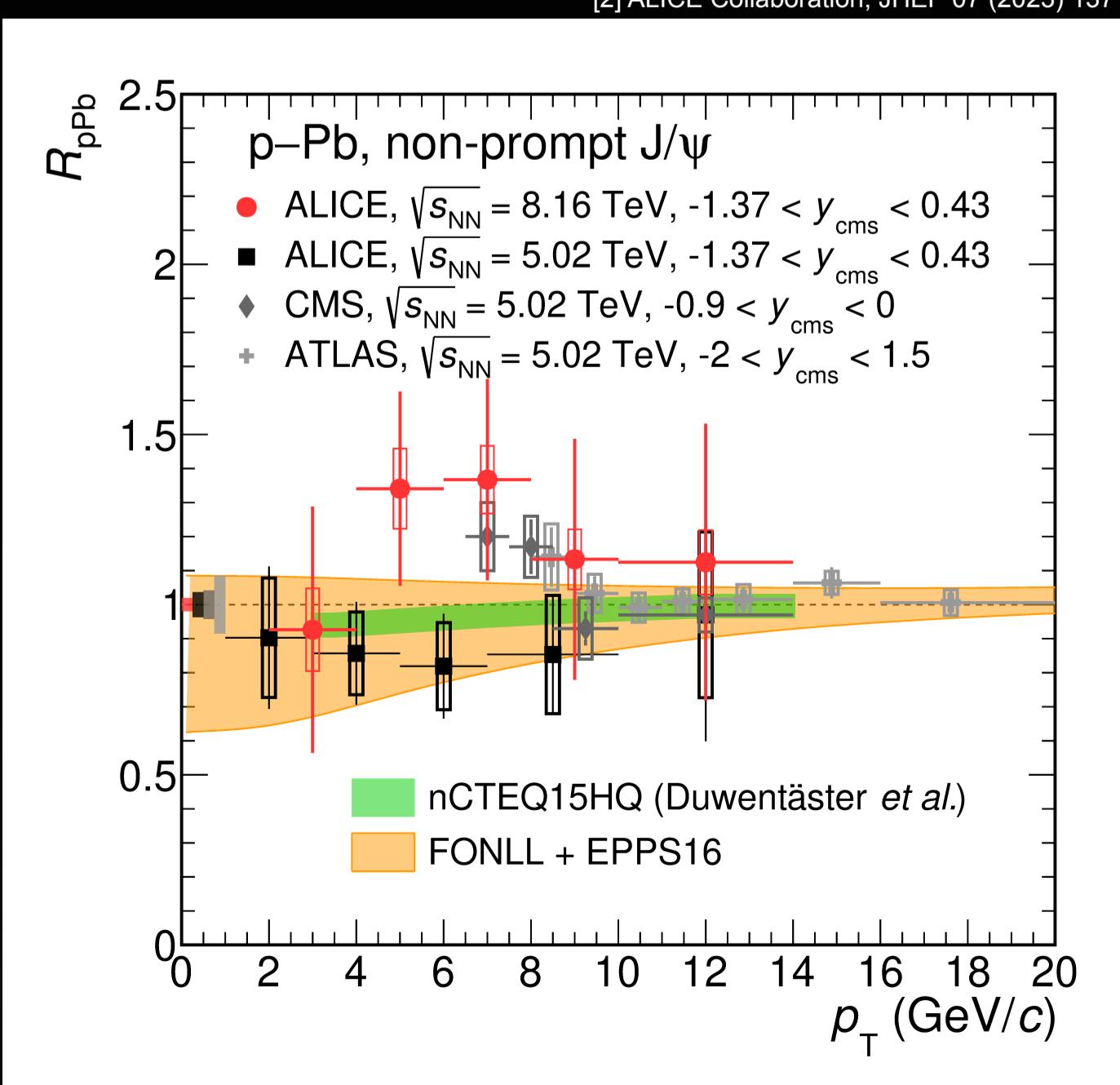
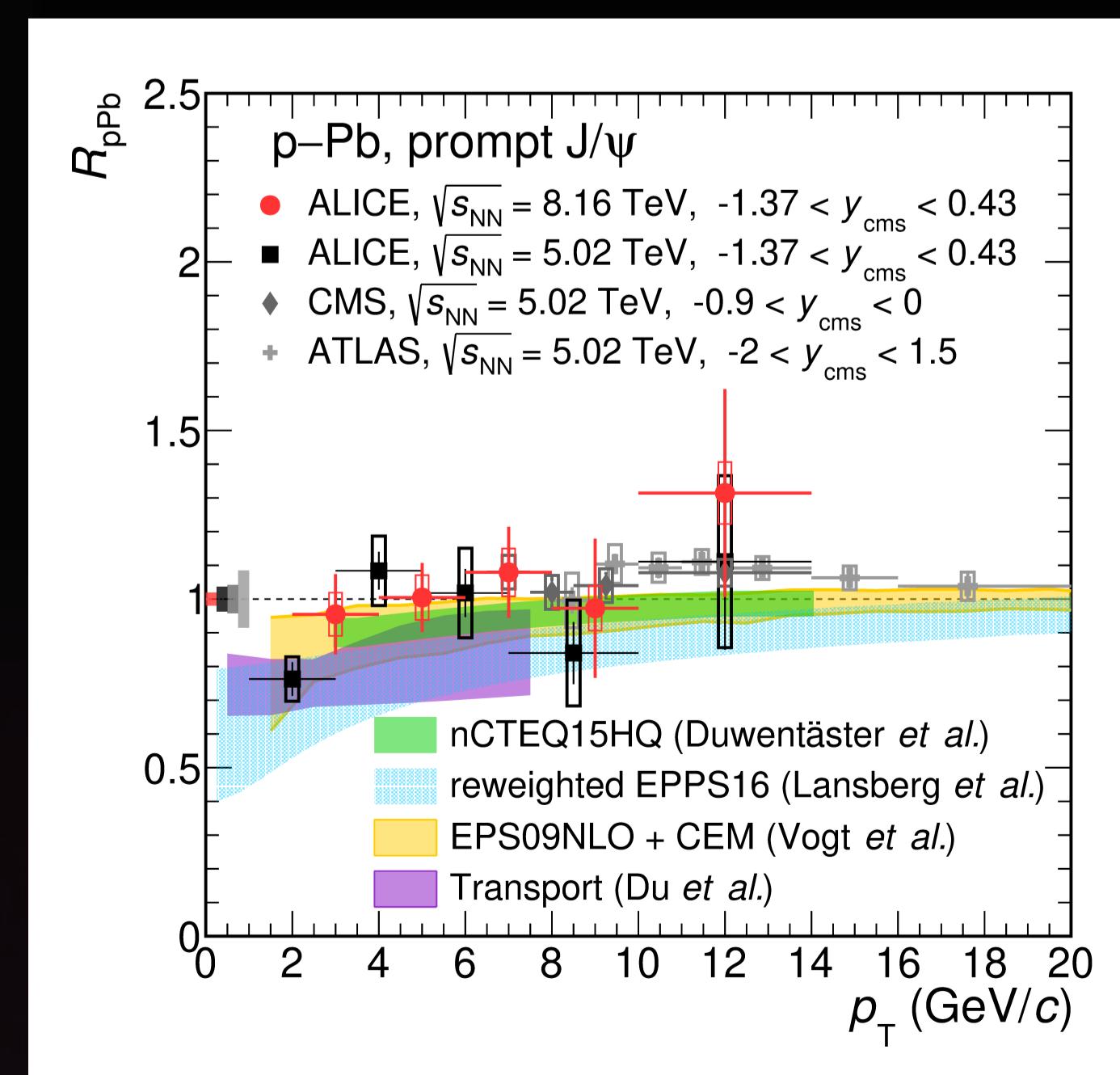
L_{xy} : projection of the flight distance onto its transverse momentum vector



- Background rejection: mixed-event technique
- Residual background: 2nd order polynomial fit function
- Clear J/ψ and ψ(2S) signal

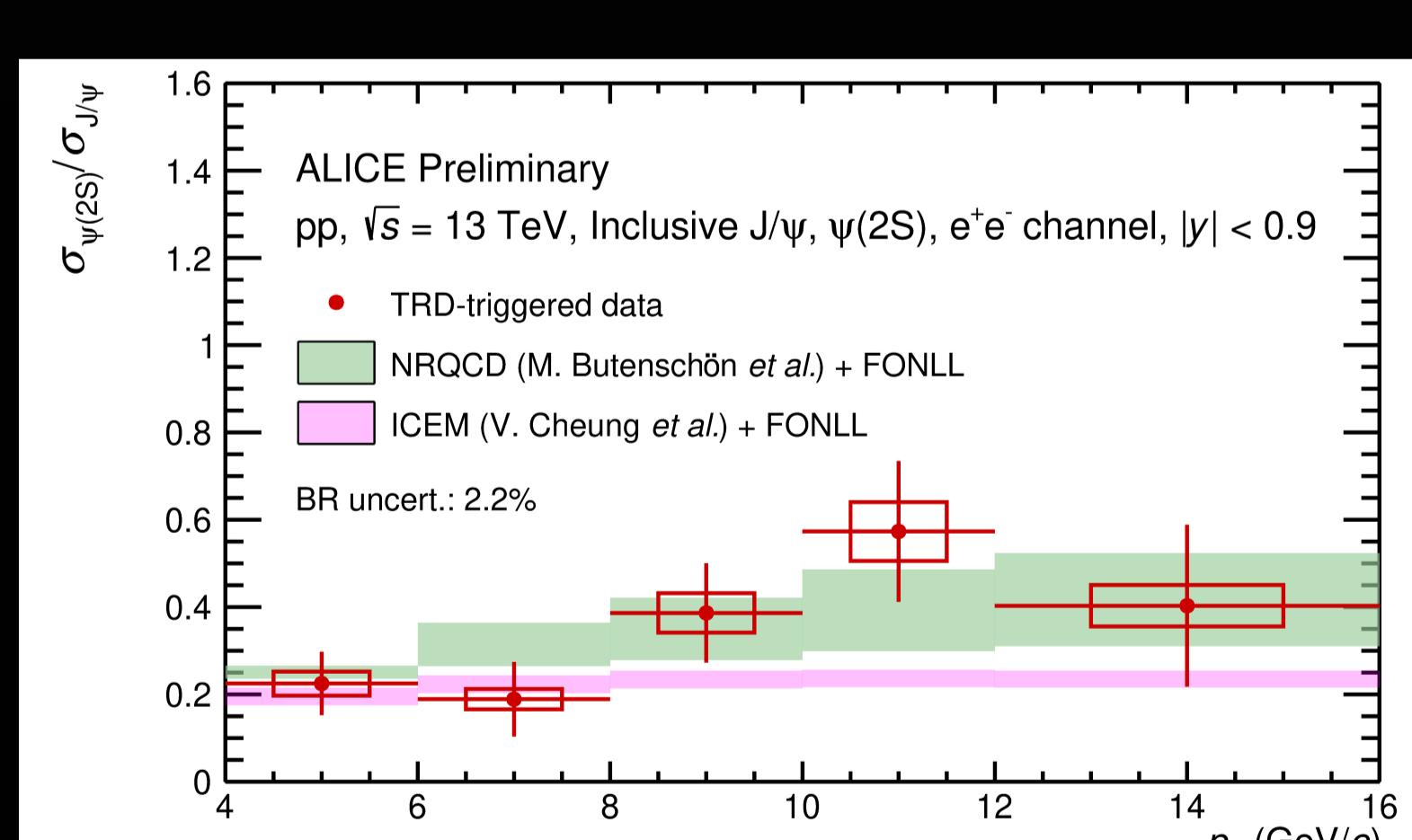
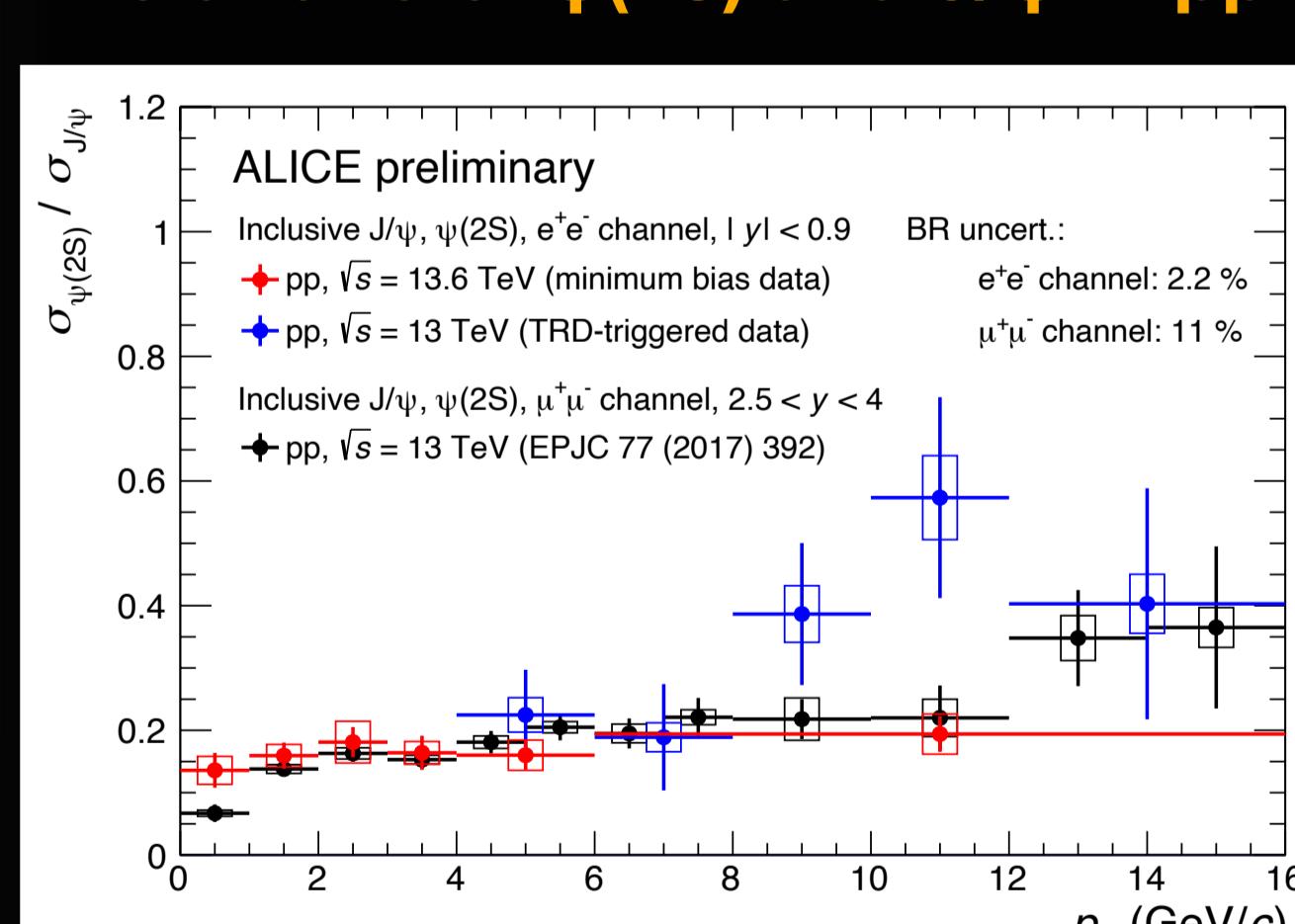


Nuclear modification factor



- Compatible R_{pPb} of prompt and non-prompt J/ψ within uncertainties ($p_T > 2$ GeV/c)
- Prompt J/ψ : EPS09NLO + CEM and nCTEQ15HQ are close to data
- Suppression at low p_T mostly due to nPDFs effect
- Non-prompt J/ψ : Described with EPPS16 parameterizations
- Smaller shadowing than prompt J/ψ

Yield ratio of ψ(2S) and J/ψ in pp



- Increasing trend with p_T
- Results at mid and forward rapidity: agreement within uncertainties
- Results at 13 TeV and 13.6 TeV: agreement within uncertainties
- Described within uncertainties by NRQCD including color-singlet and color-octet contributions
- p_T integrated yield ratio of ψ(2S) and J/ψ in pp at 13 TeV at midrapidity
- $0.242 \pm 0.047(\text{stat.}) \pm 0.026(\text{syst.})$ ($4 < p_T < 16$ GeV/c)

Summary

- Significantly enhanced charmonia signal thanks to TRD trigger
- pp: providing important constraints to QCD for particle production
- p-Pb: suppression of prompt J/ψ at low p_T due to nuclear PDFs effects



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