

Quark Matter 2022

Performance study of

Ξ_{cc}^{++} via decays into

$\pi^+ + \Xi_c^+ (\rightarrow p + K^- + \pi^+)$

with ALICE 3



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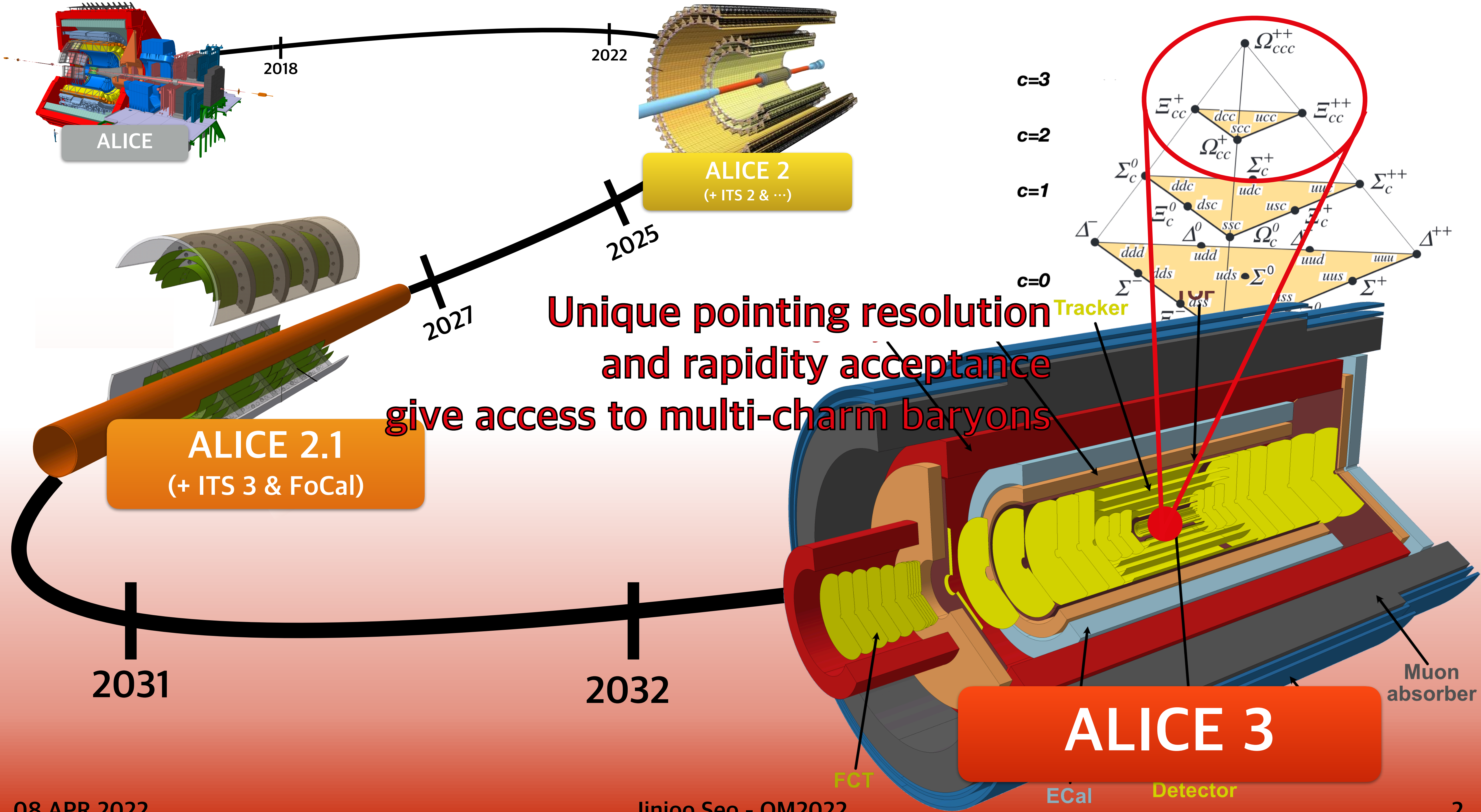
On behalf of the ALICE Collaboration

1) Inha University

2022. 04. 08.



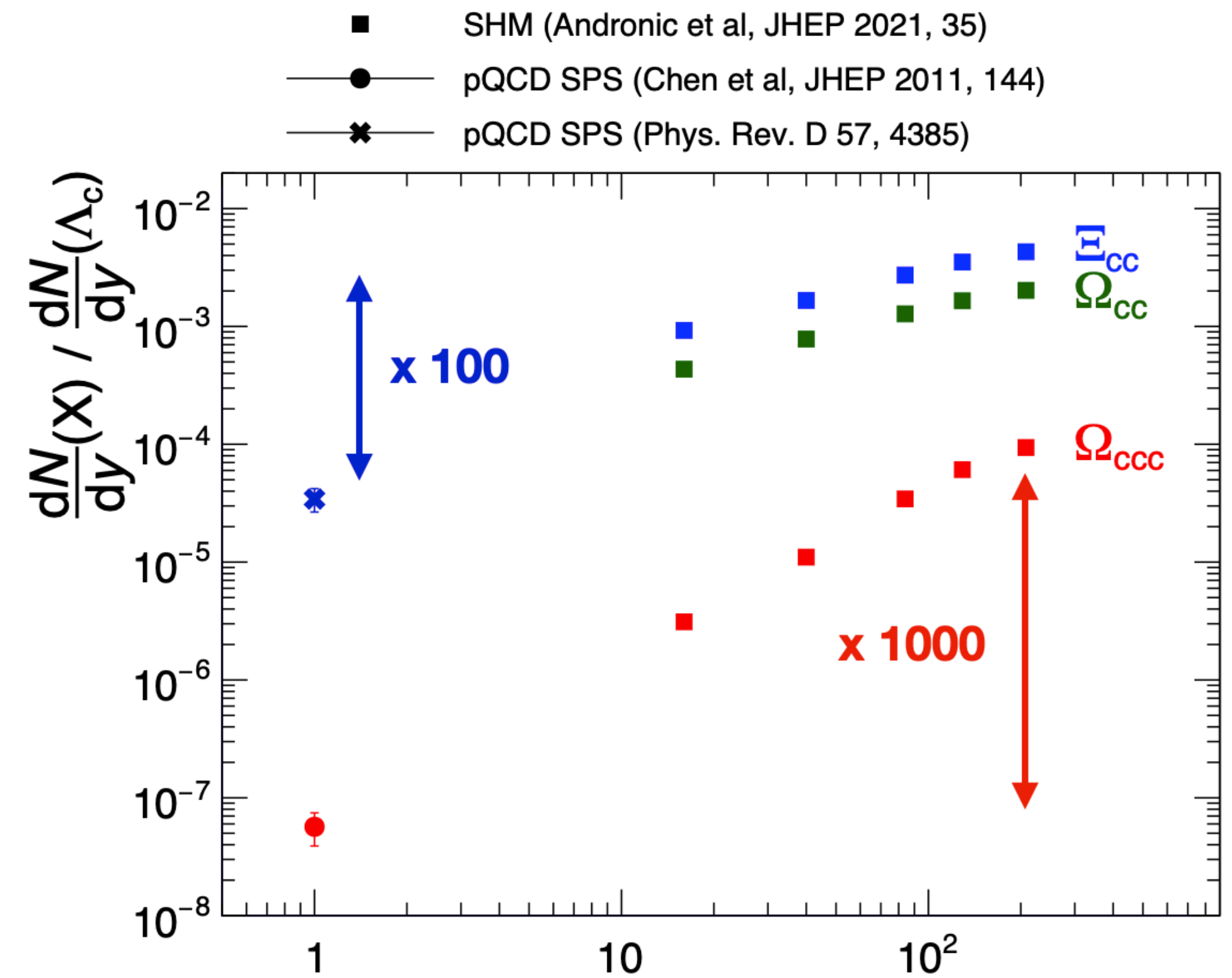
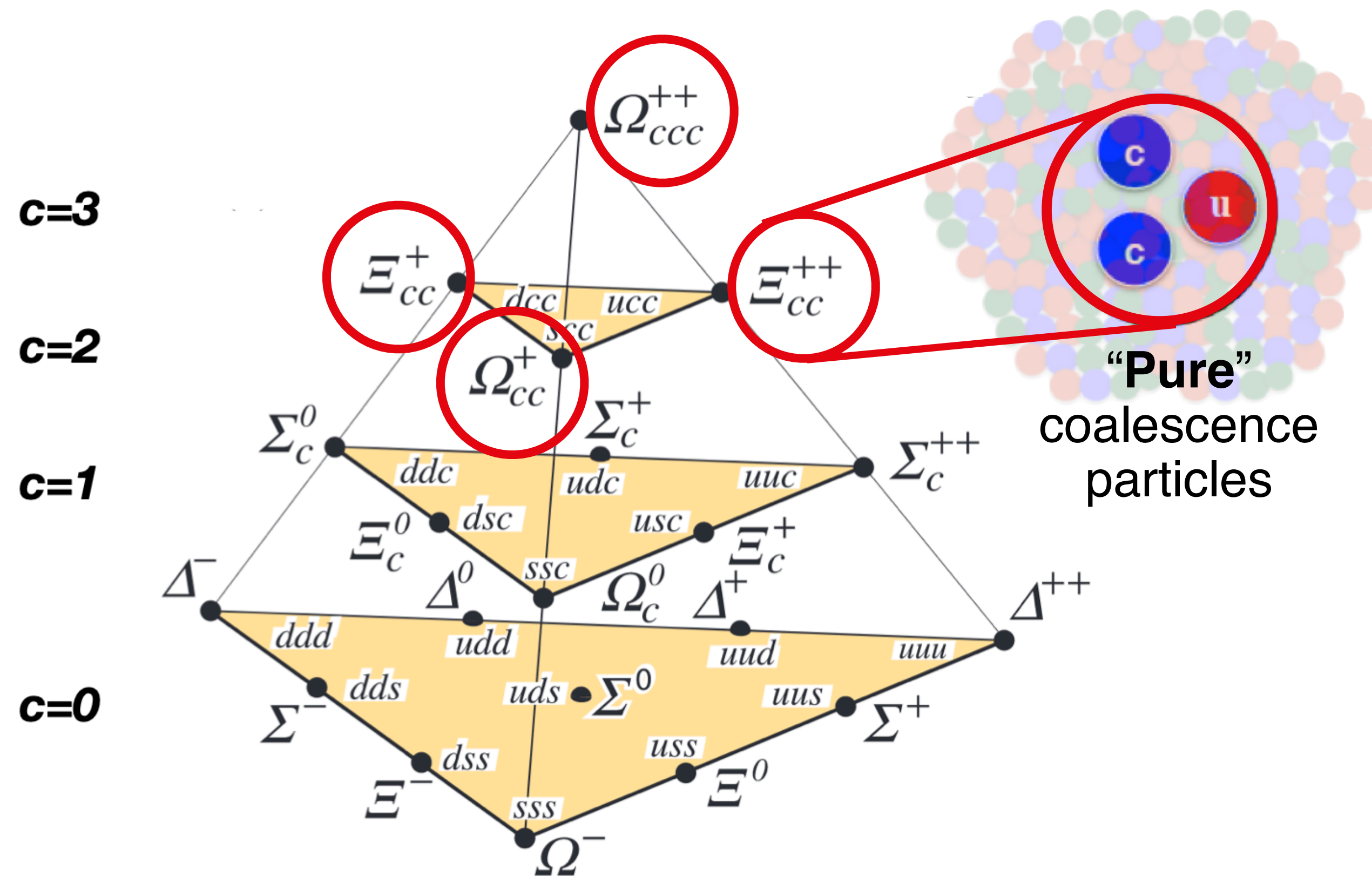
ALICE



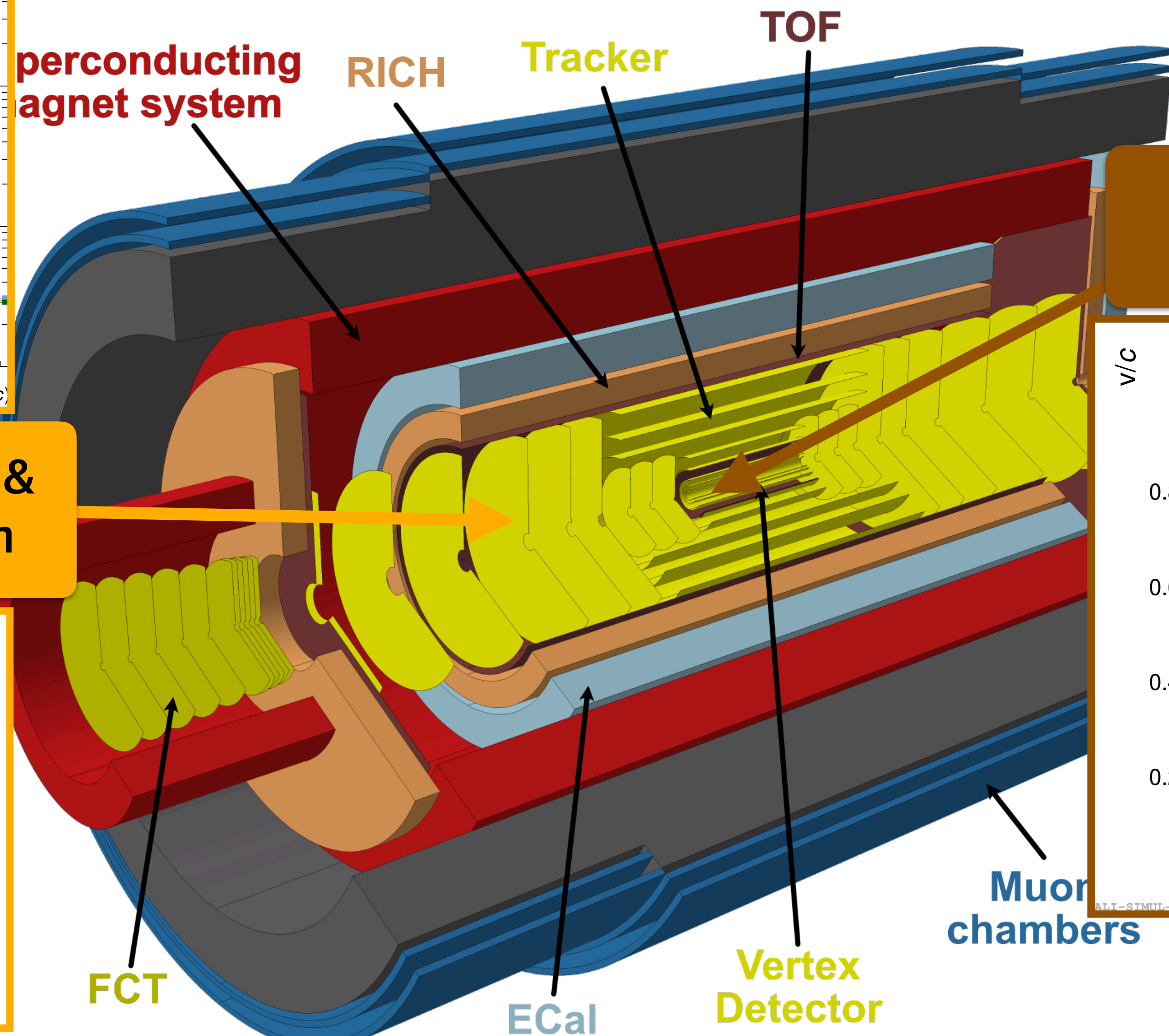
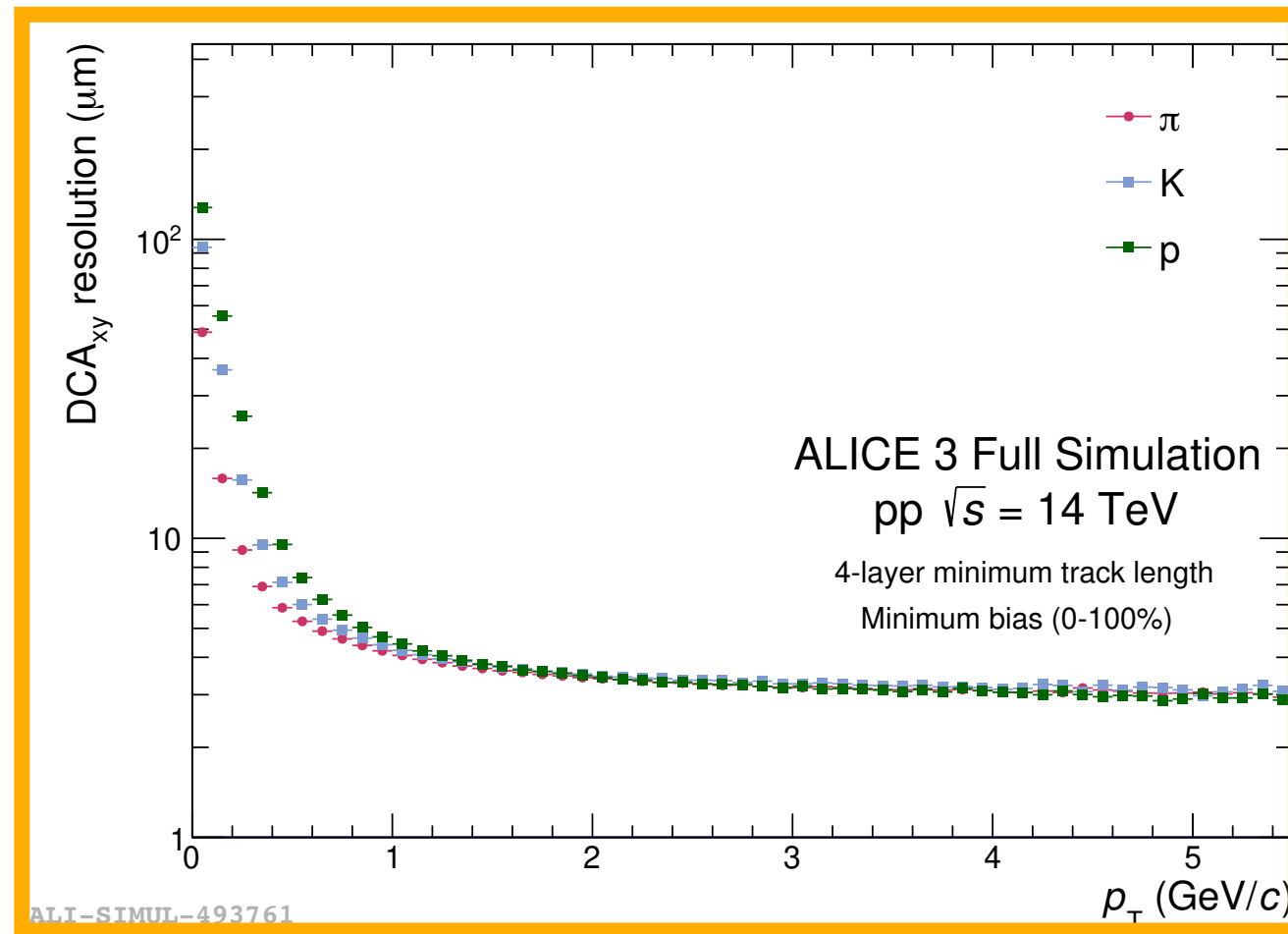
ALICE 3 Physics goal

- **Multi-charm baryons**

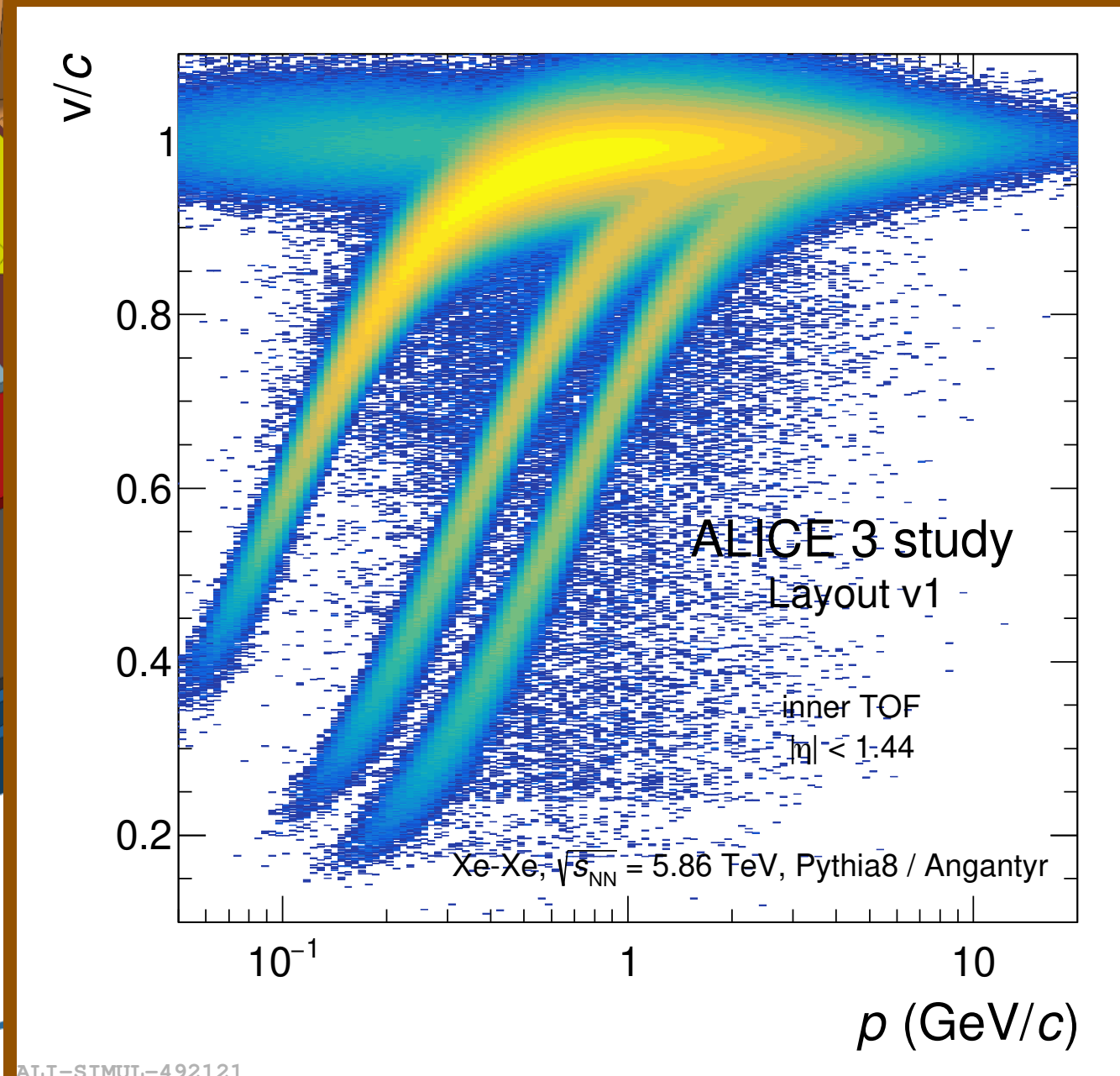
- Multi-charm baryons are produced via purely coalescence process.
 - Sensitive probe of study the hadronisation mechanism due to the large mass of charm quarks ($m_c \sim 1.3 \text{ GeV}/c^2$).
- Multi-charm baryons are expected to show a large enhancement in AA collisions.
 - Investigate microscopic thermalisation in the QCD medium.



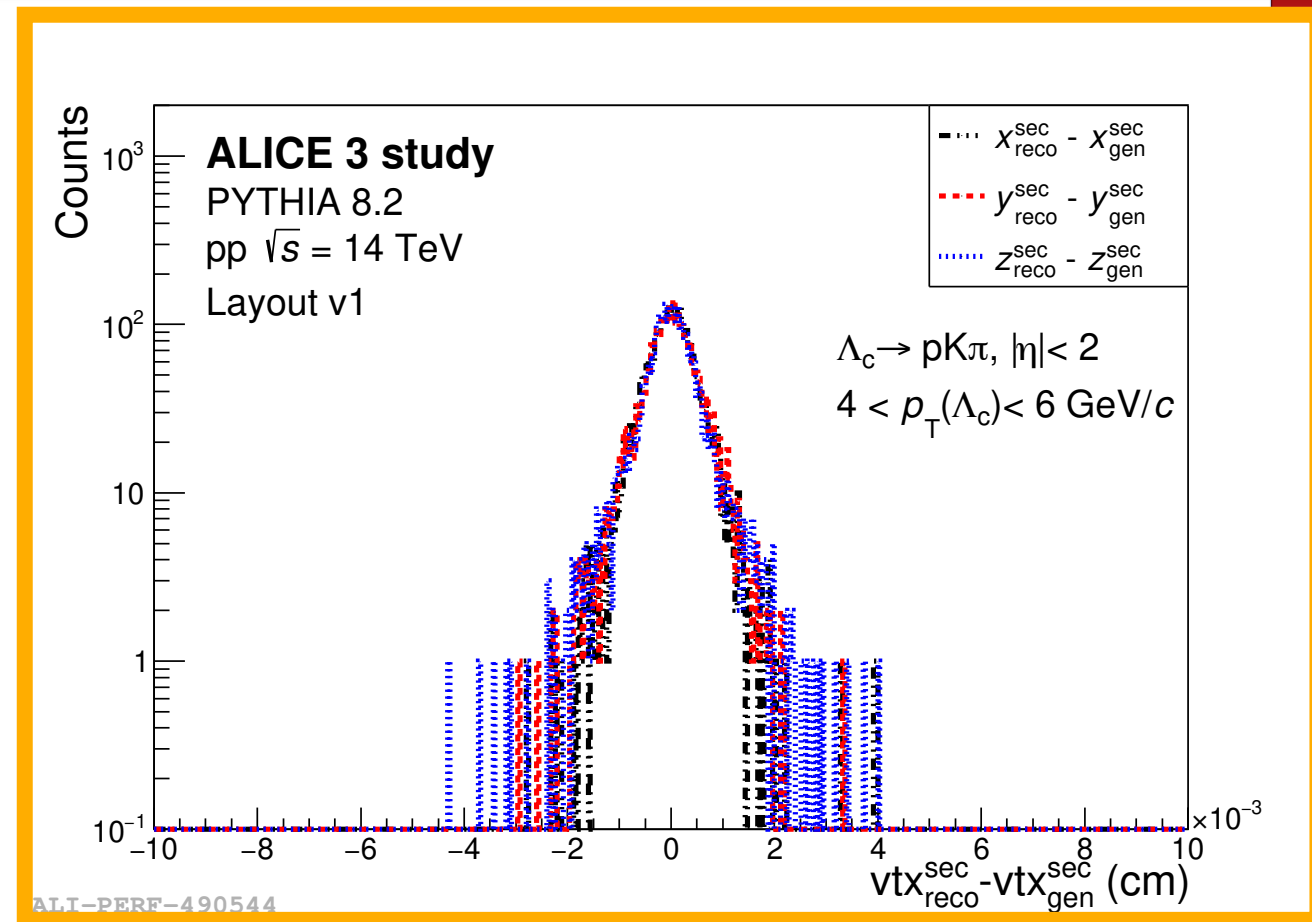
ALICE 3 Detector



Hadron PID from
 $p \sim 0.1$ to 8 GeV/c



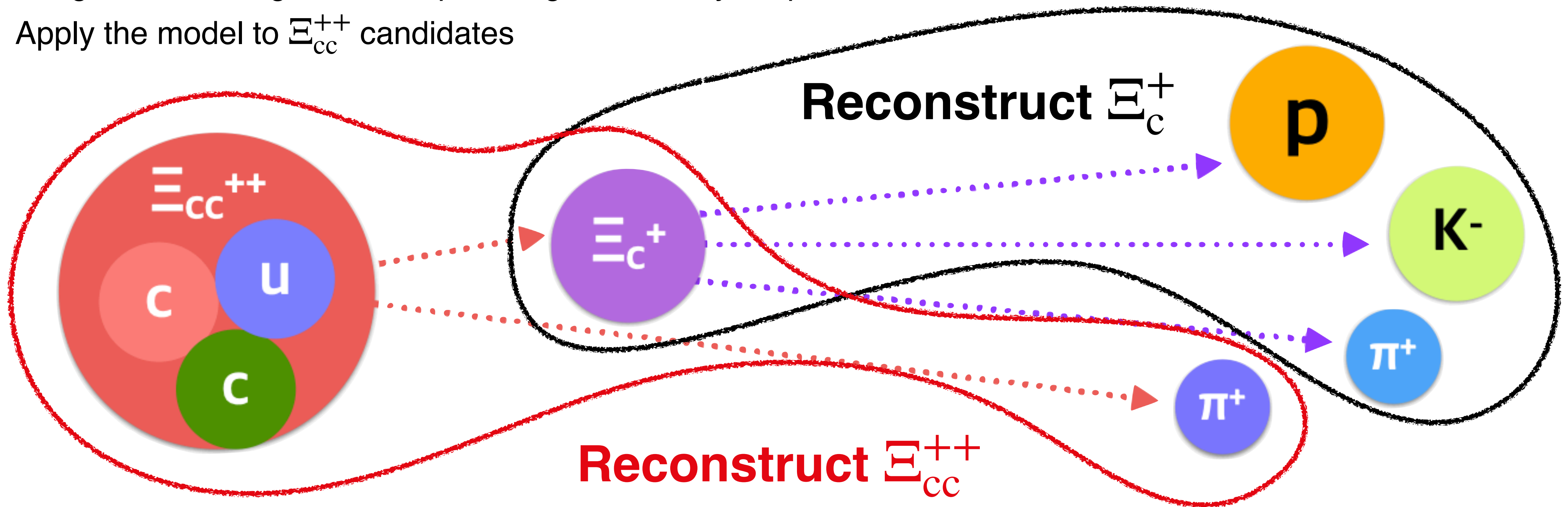
Primary/secondary vertex &
DCA_{xy} resolution : $O(1)$ μm



Ξ_{cc}^{++} Performance study with ML

- **Performance study strategy**

1. Reconstruct the Ξ_c^+ candidates with loose selections
2. Reconstruct the Ξ_{cc}^{++} candidates with loose selections
3. Training model using machine learning (BDT algorithm : XGBoost)
 - ➔ Signal and background sample are generated by DelphesO2
4. Apply the model to Ξ_{cc}^{++} candidates



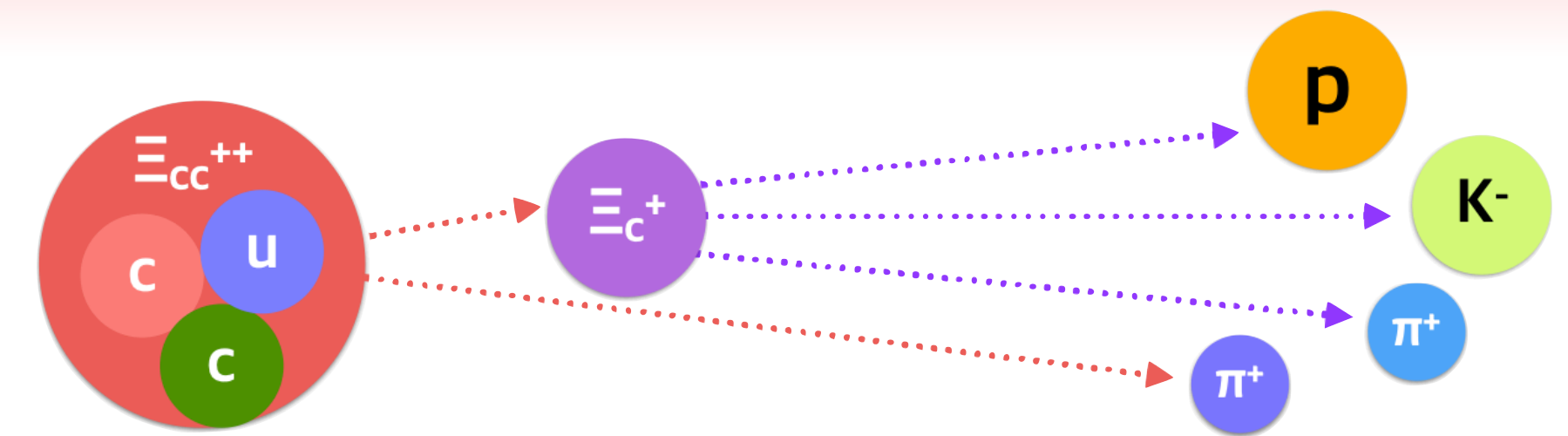
Expected performance

- **Performance study** : Ξ_{cc}^{++} with direct reconstruction

- **Efficiency** : Increases with p_T due to higher momentum π^+ .

- **Significance**

- Signal/event : Theoretical expectation(cross section, 39 nb) + PYTHIA 8 (p_T shape) + efficiency + BR(0.03%).
- Large uncertainty on production cross section and branching ratio.
- Promising significance in pp collisions even with the worst-case scenario.



[arXiv:hep-ph/9710339](https://arxiv.org/abs/hep-ph/9710339)

