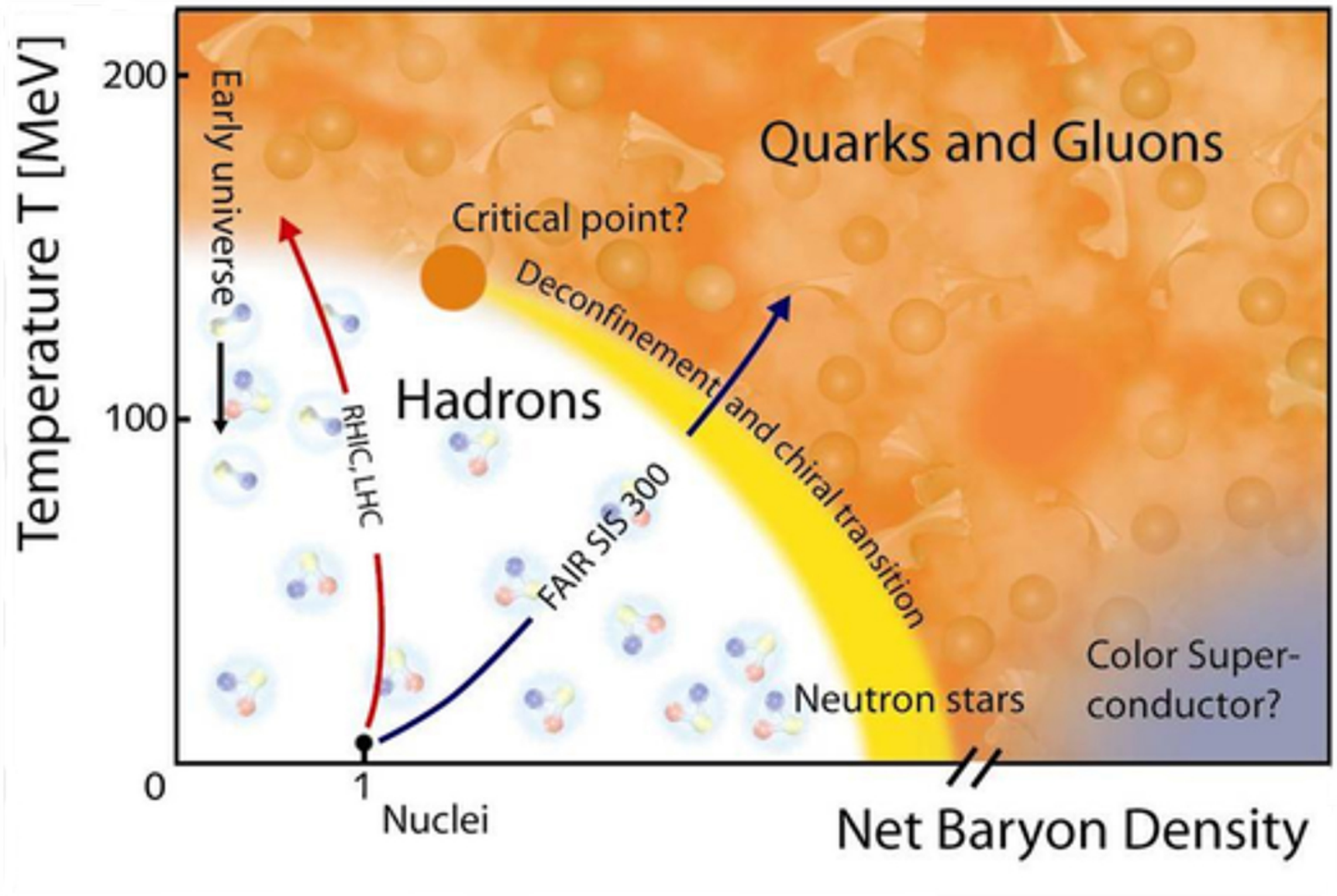
J/ψ production in peripheral PbPb collisions with the LHCb detector

Samuel Belin : samuel.belin@cern.ch

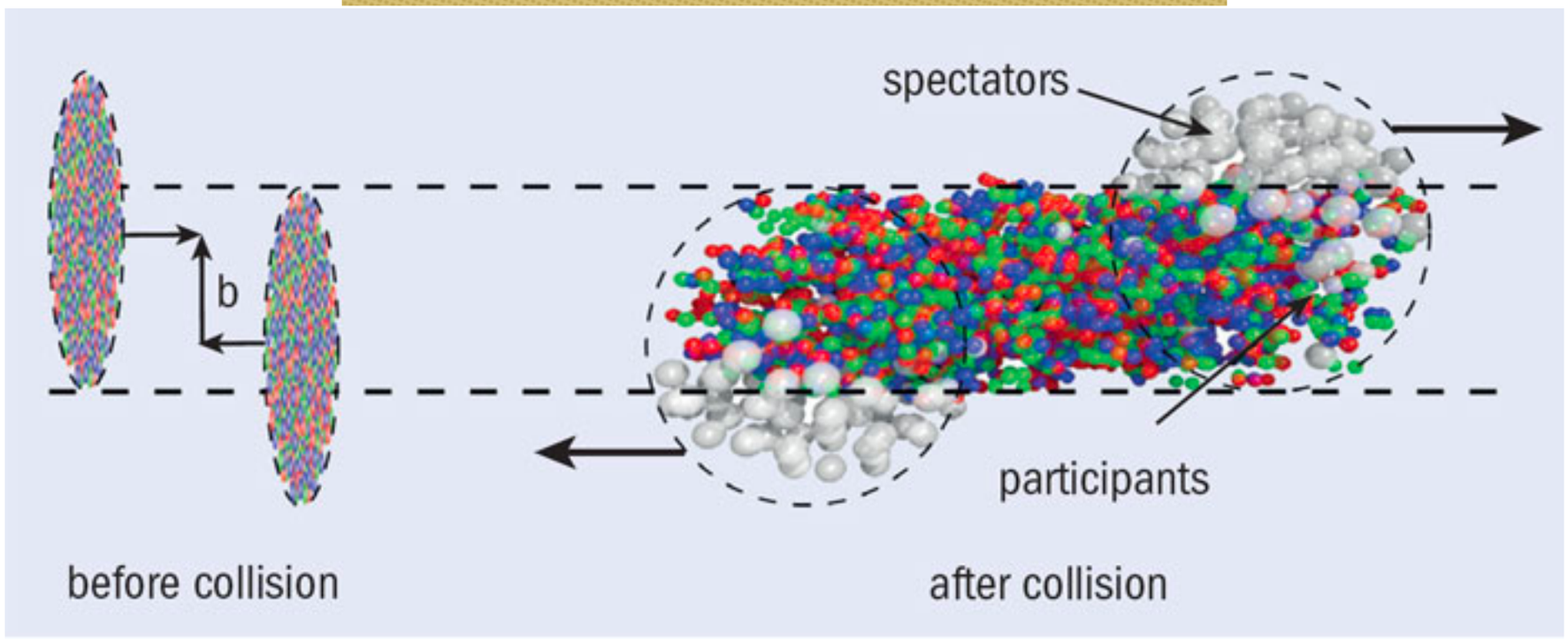
Grant funded by the ExploringMatter ERC Consolidator grant number 647 390.

Heavy Ion Physics



Introduction on analysis

Pb-Pb collisions at the LHC



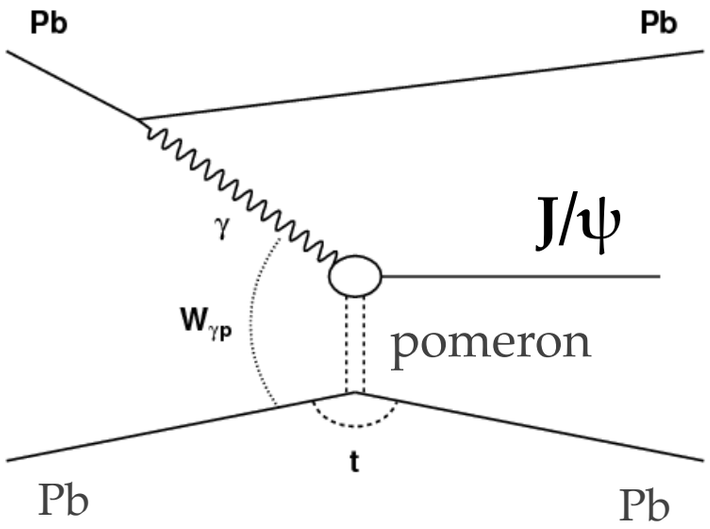
QGP

- small b: more central events, large b : peripheral events
- J/ψ ($c\bar{c}$) particles are produced in these collisions

Hadronic versus Photoproduction

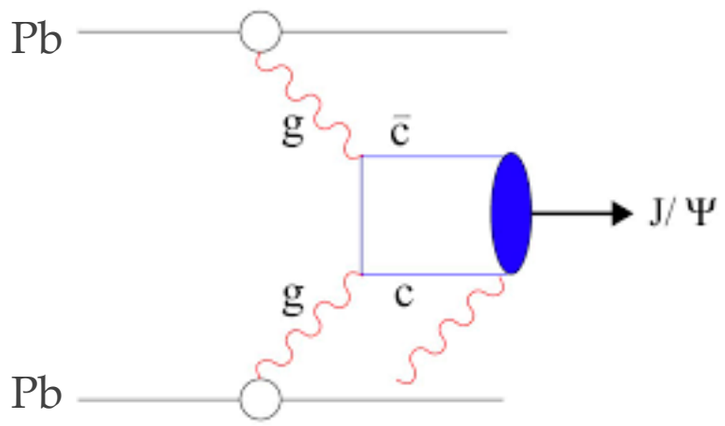
Two different ways of producing a J/ψ

Photo production



$$\gamma(pomeron) \rightarrow J/\psi$$

Hadronic Production



$$gg \rightarrow J/\psi$$

Expected to have a very low transverse momentum

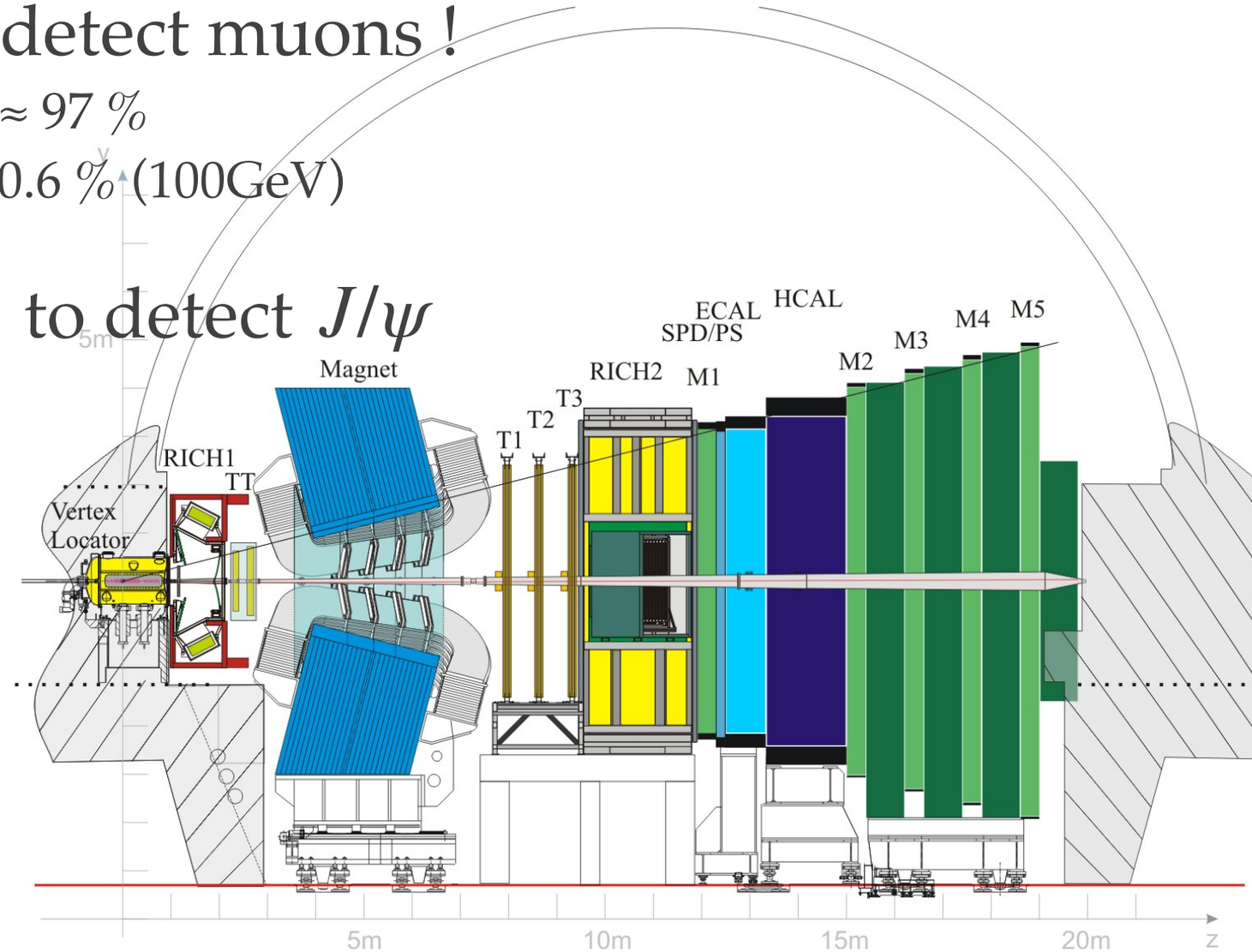
Goal of this analysis: isolate the photo-production process

LHCb detector at LHC, CERN

- PbPb sqrt(s) = 5 TeV sample from December 2018 (L ~ 200 μb^{-1})

- Excellent performances to detect muons !
  - Muon identification efficiency ≈ 97 %
  - $\Delta p/p$ = 0.4 % (5 GeV/c) up to 0.6 % (100GeV)

- Use of the decay $J/\psi \rightarrow \mu\mu$ to detect J/ψ

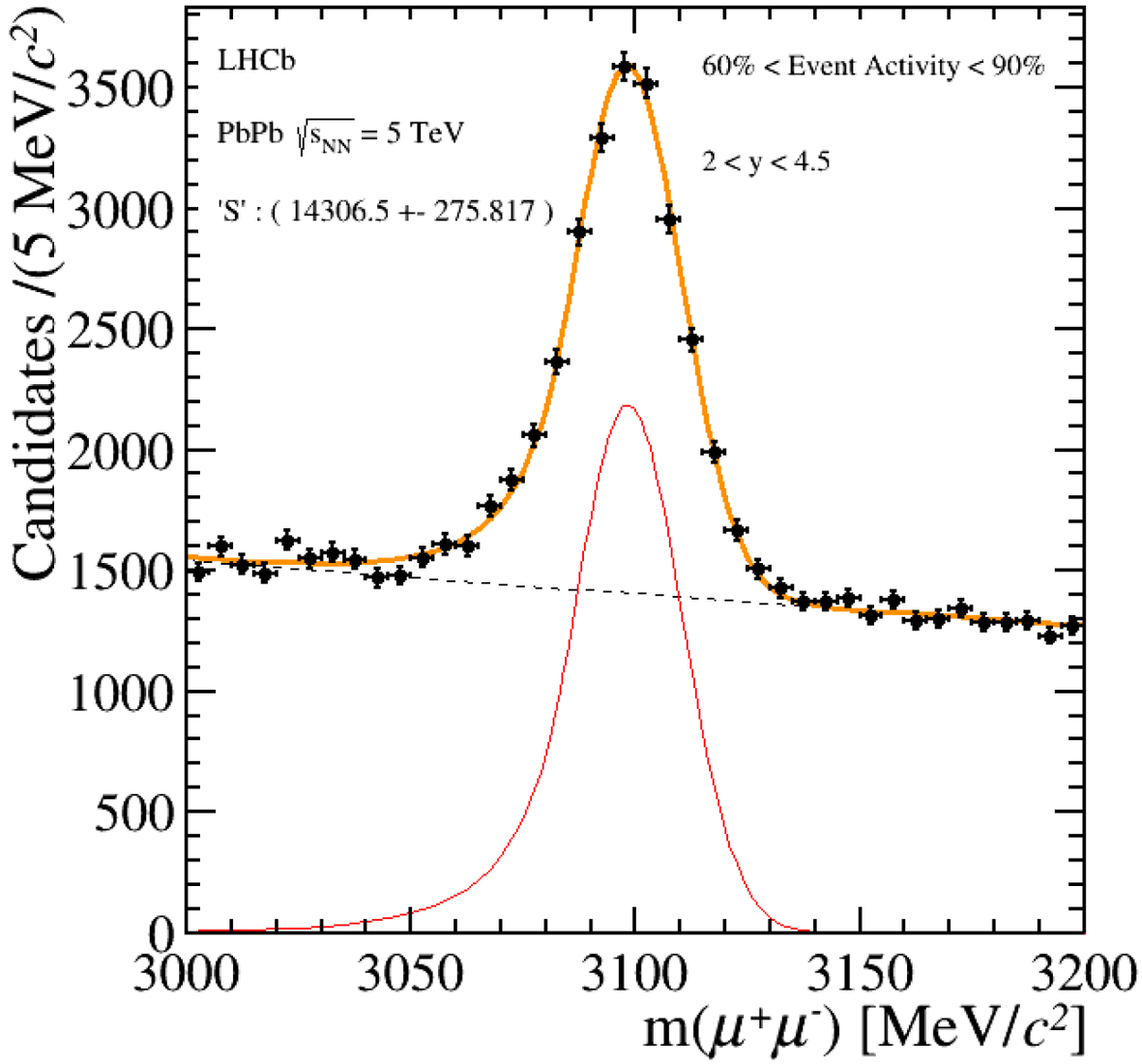


10.1142/S0217751X15300227

Signal Extraction (1)

- J/ψ's are detected through: $J/\psi \rightarrow \mu\mu$
- 2-muons mass spectrum around the J/ψ mass (~3096 MeV/c²)
  - Contains all J/ψ's (Photo and Hadro)

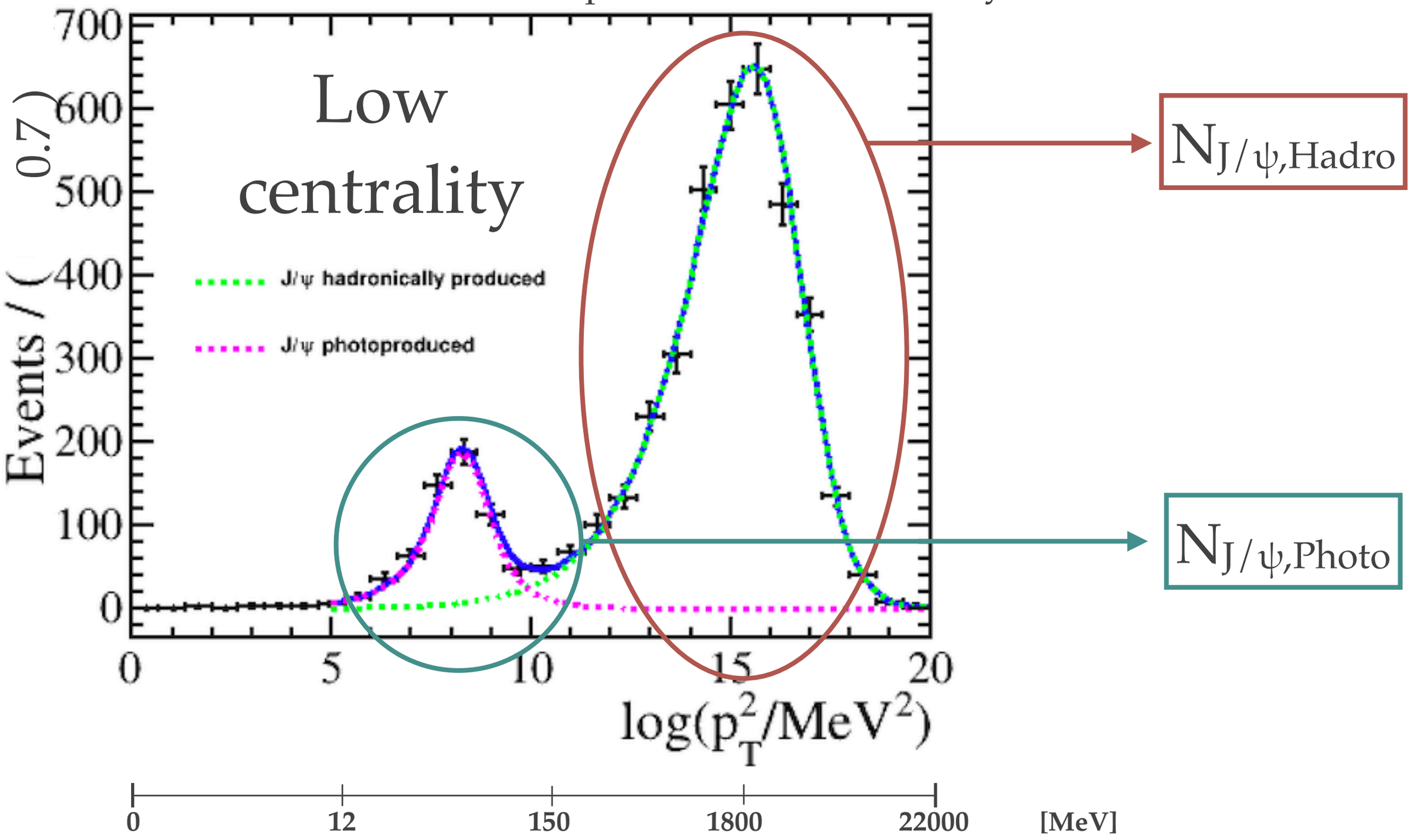
➡ must find a way to separate them



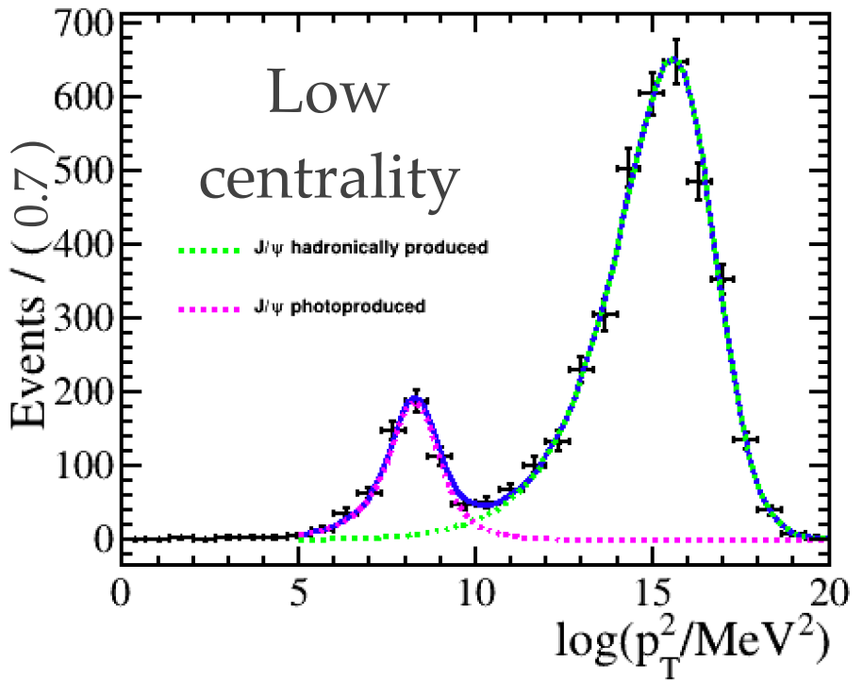
We use the transverse momentum spectrum to differentiate them

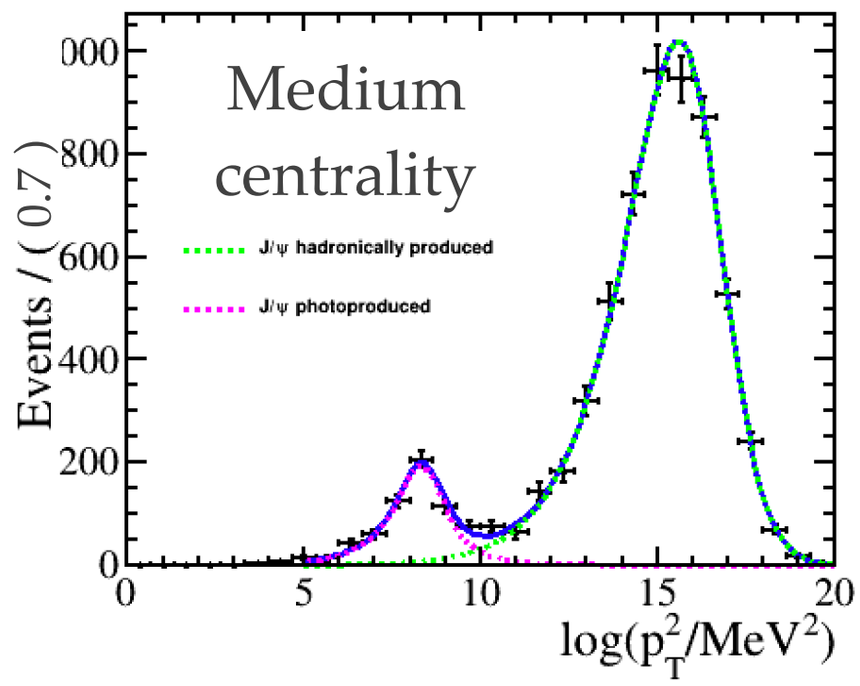
Signal Extraction (2)

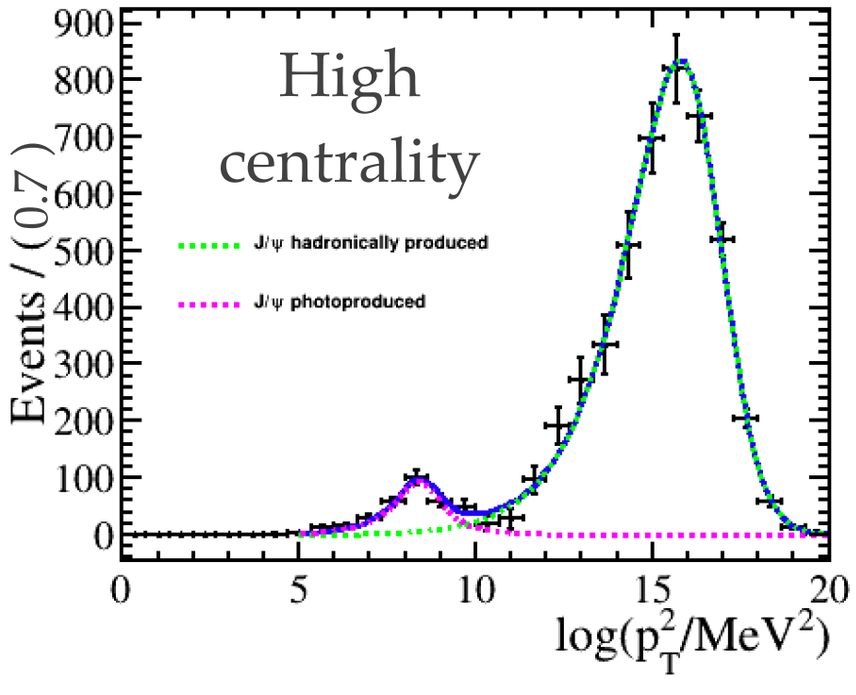
Momentum spectrum in low centrality collisions



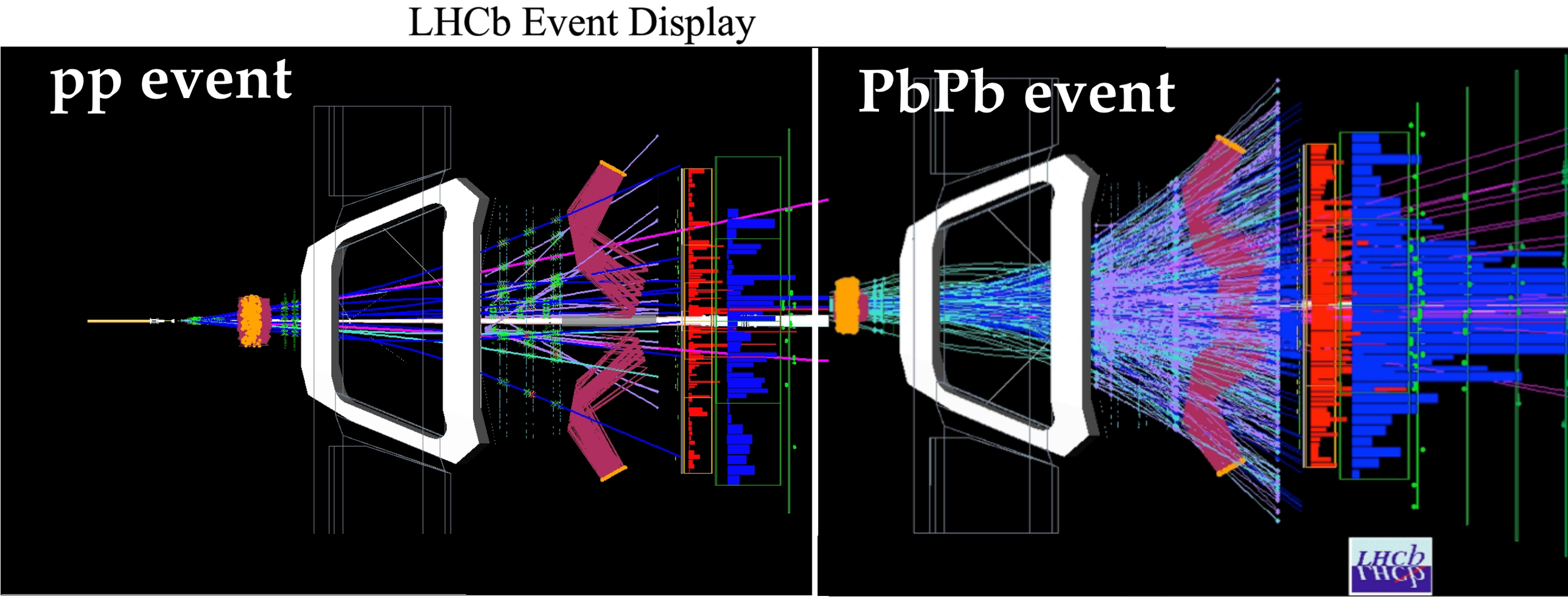
Signal Extraction (3)







Efficiency and centrality

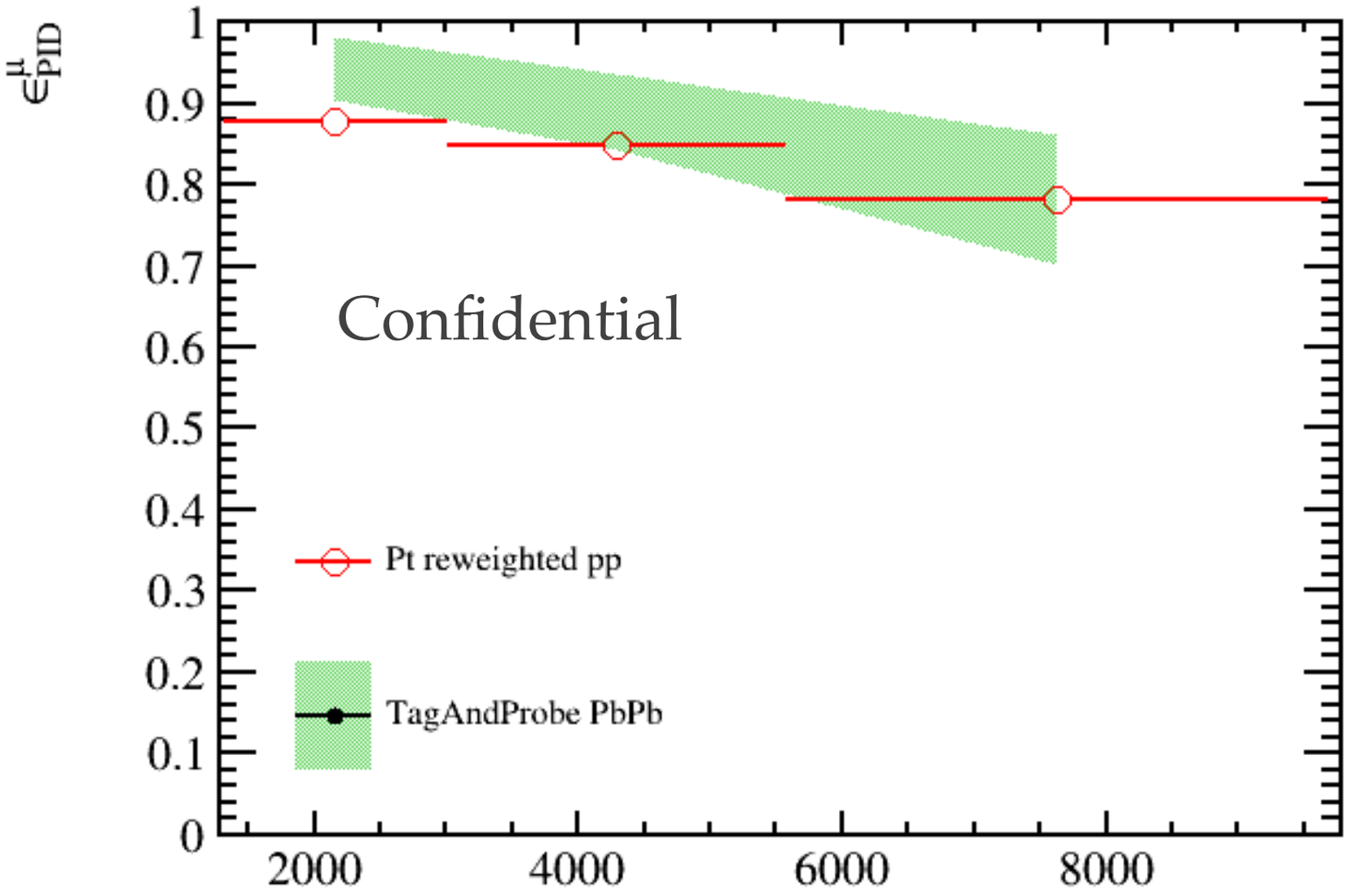


Efficiency and centrality

- Detector thought for proton-proton physics
- Saturates when a high number of particles are going through the detector
- Central part of the analysis : How to estimate the performance of LHCb in high multiplicity collisions ?
  - Development of new data-driven techniques specifically for heavy ion collisions.

Example: PID efficiency

Particle Identification efficiency of a muon



Similar studies to compute the other efficiencies (reconstruction, selection efficiencies…)

Conclusion

- One of the first analysis in PbPb collisions at LHCb
- Great resolution allows good isolation of the photo-production process
- To do:
  - Finish the internal documentation to go paper