

Photon reconstruction via Photon Conversion Method in the ALICE experiment at the LHC

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ALICE experiment

Detector:

Size: $16 \times 16 \times 26 \text{ m}^3$

Weight: 10000 tons

Collaboration:

39 countries

174 institutes

1927 members

- a. ITS SPD Pixel
- b. ITS SDD Drift
- c. ITS SSD Strip
- d. V0 and T0
- e. FMD

EMCal

ZDC

V0

ZDC

ITS

DCal

PHOS

TPC

Tracking (e^\pm, h^\pm)

- PCM (γ, π^0, η)
- $|\eta| < 0.9, 0 < \varphi < 2\pi$
- TPC - gas drift detector
- ITS - silicon detector

Vertex

- Pixel

V0 and ZDC

- Centrality determination
- Trigger

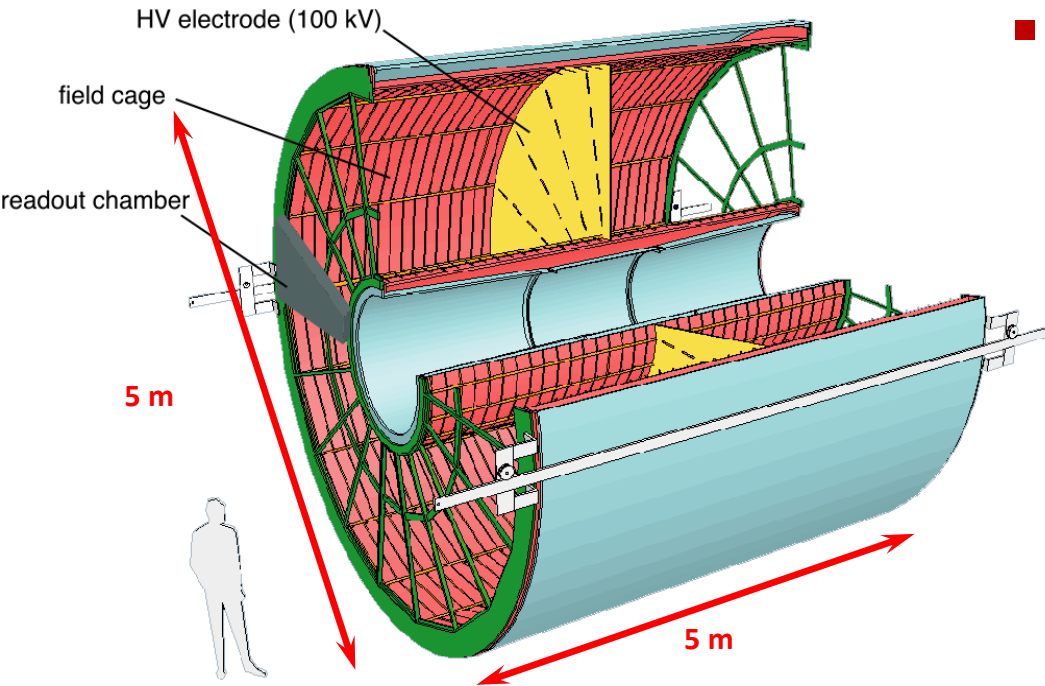
EMCal + DCal (γ, π^0, η)

- Pb-scintillator sampling calorimeter
- Trigger
- Complicated geometry

PHOS (γ, π^0, η)

- PbWO_4 crystal spectrometer
- Trigger
- $|\eta| < 0.12, 250^\circ < \varphi < 320^\circ$

ALICE Time Projection Chamber

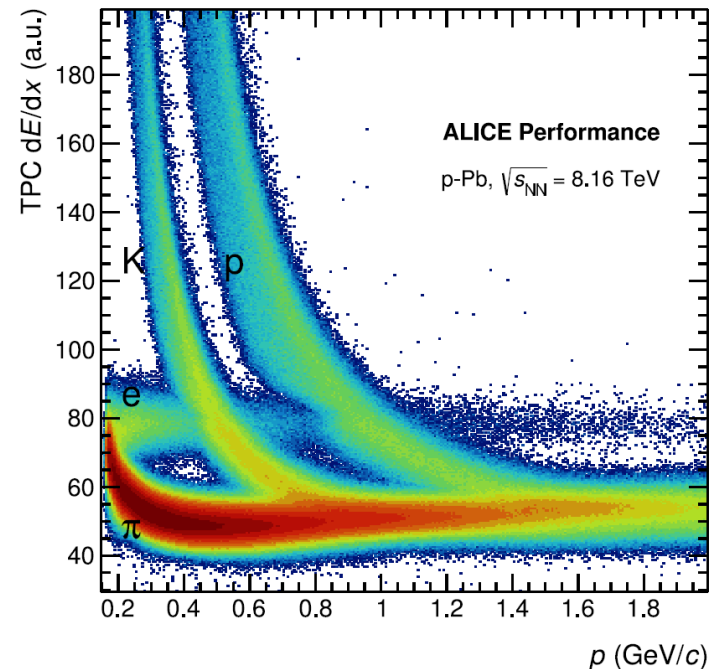


■ Data readout:

- Readout chambers: 72
- Pads (3 types): 557 568
- Samples in time direction: 1000

■ General features:

- Diameter \times Length : 5 m \times 5 m
- Azimuthal angle coverage: 2π
- Pseudo-rapidity interval: $|\eta| < 0.9$
- Maximum drift time: 92 μs
- Gas:
 - Ne-CO₂-N₂ (85.7% - 9.5% - 4.8%)



Method of photon and neutral meson extraction

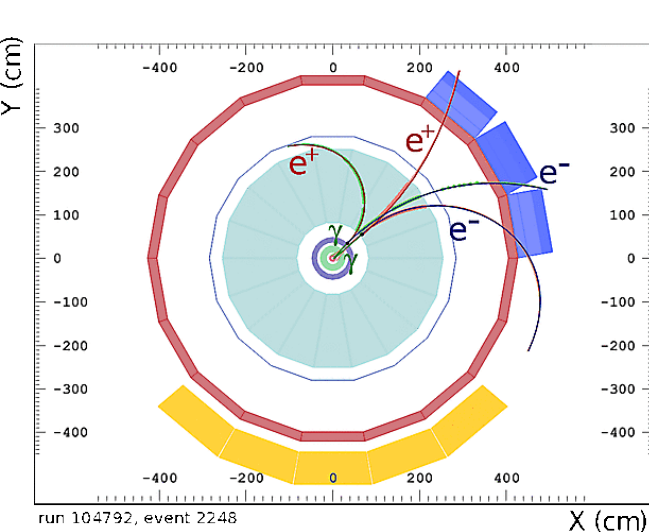
Photons

- External conversion electrons, $\gamma \rightarrow e^+ e^-$ (Photon Conversion Method, PCM)
Small conversion probability ($\sim 8.5\%$)
Compensated by a wide acceptance.
Material budget well known (precision of 4.5%)
Radiation length $X/X_0 = (11.4 \pm 0.5)\%$
- Energy deposit in calorimeter (EMCal, PHOS)

Neutral mesons via invariant mass analysis:

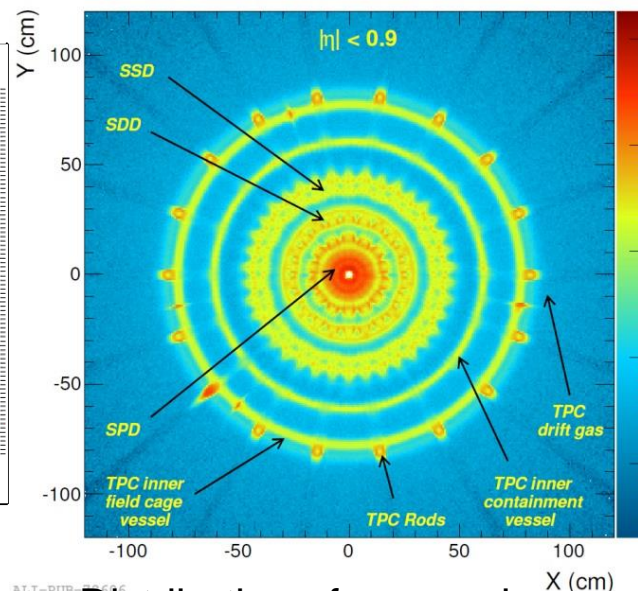
- $h \rightarrow \gamma (\rightarrow e^+ e^-) + \gamma (\rightarrow e^+ e^-)$ (PCM)
- $h \rightarrow \gamma + \gamma$ (PHOS, EMCal)
- Dalitz decays $h \rightarrow \gamma \gamma^* \rightarrow \gamma (\rightarrow e^+ e^-) e^+ e^-$
- Hybrid methods (PHOS + PCM, EMCal + PCM)

$$M_{\gamma\gamma} = \sqrt{2E_1 E_2 (1 - \cos \theta_{12})}$$



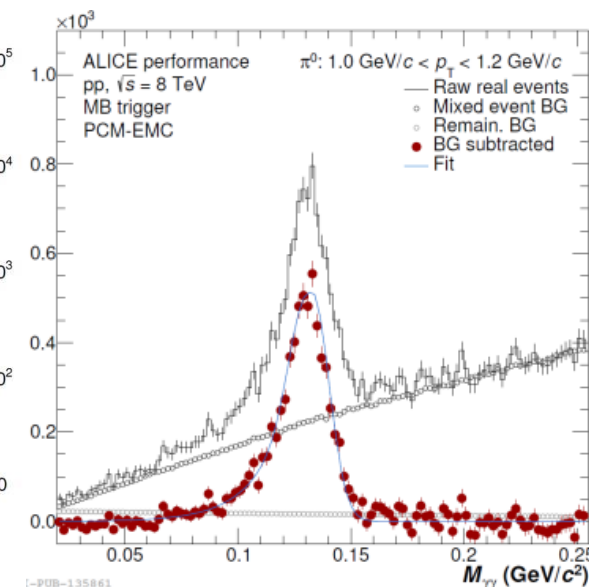
Reconstructed π^0 candidate through conversions

2020-07-06



Distribution of conversions

PPSS 2020 - Adam Matyja



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Goal of the internship

- Basics of Linux system environment
- Reconstruction of photons and mesons
- Ultra peripheral collisions vs pp collisions
- Structure of a data analysis chain in the ALICE experiment
- Data analysis within PCM framework
- Data processing in ROOT/AliROOT
- Short report in Latex
- Final presentation