

# Particle identification quiz

Quiz, 10 questions

10  
points

1.

Detector has the following systems:

- ☒ Tracking system
  - ☒ Muon system
  - ☐ Annihilation chamber
  - ☐ Quark calorimeter
  - ☐ Pion system
  - ☒ Electromagnetic calorimeter
- 

10  
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2.

The goal of the particle identification (PID) is to identify a type of a particle associated with a track using responses from different systems.

- ☒ True
  - ☐ False
- 

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3.

Tracking system is responsible for:

- ☒ Particle tracks recognition
- ☒ Track momentum estimation
- ☐ Track energy measurement

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4.

The RICH detector is based on the Cherenkov radiation effect. This effect describes a particle behaviour in material when it flies with speed higher than speed of light in this material. When the particle flies with such speed it emits light in a cone with emission angle theta. The correct dependency of that angle:

☒  $\cos(\theta) = \frac{\sqrt{p^2 + m^2 c^2}}{np}$

☐  $\cos(\theta) = \frac{\sqrt{E^2 + p^2}}{npE}$

☐  $\cos(\theta) = \frac{\sqrt{E^2 + m^2 c^4}}{pE}$

☐  $\sin(\theta) = \frac{\sqrt{E^2 + m^2 c^4}}{pE}$

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5.

Calorimeter system is designed to measure particles energy. Particles interact with matter of the calorimeter and lose their energy. The calorimeter measures how much energy the particles lose before they stop. What is true for the electromagnetic calorimeters:

- ☐ The electromagnetic calorimeter is responsible for measuring the energy of electrons and protons
  - ☐ The electromagnetic calorimeter is responsible for measuring the energy of protons, kaons and neutrons
  - ☒ The electromagnetic calorimeter is responsible for measuring the energy of electrons and photons
- 

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points

6.

Hadronic shower is produced in a hadronic calorimeter by the following particles:

- ☒ Kaons
- ☐ Electrons
- ☐ Photons
- ☒ Proton



Pions

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7.

The muon system is responsible for the muons identification and their energy estimation. It is the last and the heaviest system of a detector because:

- ☒ Muons weakly interact with matter and almost no responses in the calorimeters
  - ☐ Muons have too high energy to be stopped by the calorimeter system
- 

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8.

Which detector systems are used for particle identification:

- ☐ Muon Chambers
  - ☐ Electromagnetic calorimeter
  - ☐ Ring Imaging Cherenkov detector
  - ☐ Hadron calorimeter
  - ☐ Tracking system
- 

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points

9.

Particle identification is the following problem in machine learning:

- ☐ Regression
  - ☐ Dimensionality reduction
  - ☒ Classification
  - ☐ Clustering
-

10

points

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Quality of the particle identification depends on particle parameters such as its momentum, transverse momentum or energy. However, it is preferable to have no such dependences. In other words, we would like to have flat or uniform dependency of the particle identification quality on the different particle parameters. Which approaches can help:

- ☐ Solving particle identification as regression problem instead of classification one
- ☐ Deep neural network with dropout and batch normalization
- ☒ Special loss function modification for AdaBoost classifier
- ☒ Adversary neural network combining with classifier neural network to prevent non-flatness of the classifier

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