Looking for strange particles in the ALICE experiment

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Under the guidance of Peter Hristov - Pleven, The ALICE experiment

Bulgarian HSSIP

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What is ALICE?

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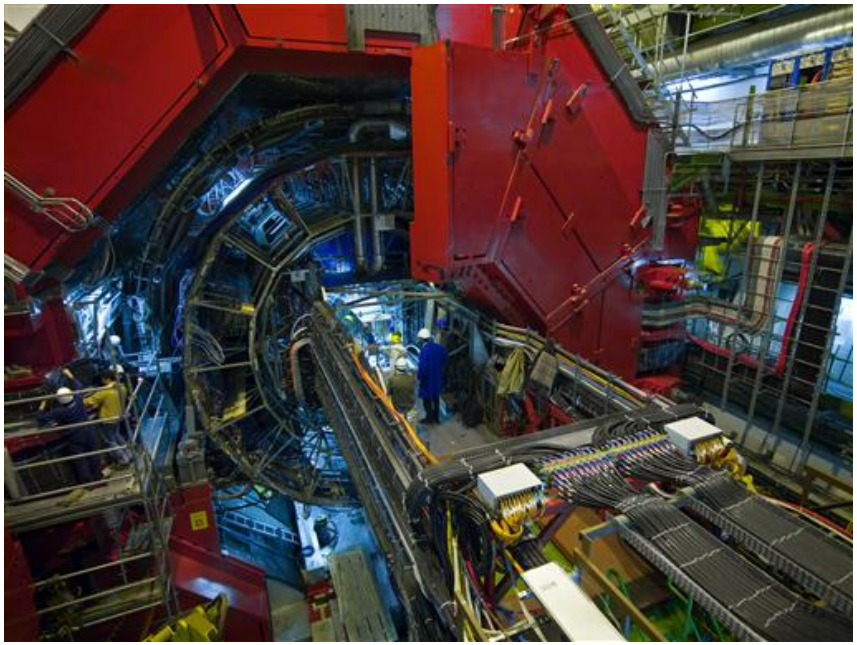

Figure: The ALICE Cavern

Our task

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- Analysis of datasets of events of Monte-Carlo simulations;
  - Datasets contain 15 events;
  - Identification of strange particles by their decay topology.
    - V_s^0
    - *Cascades*

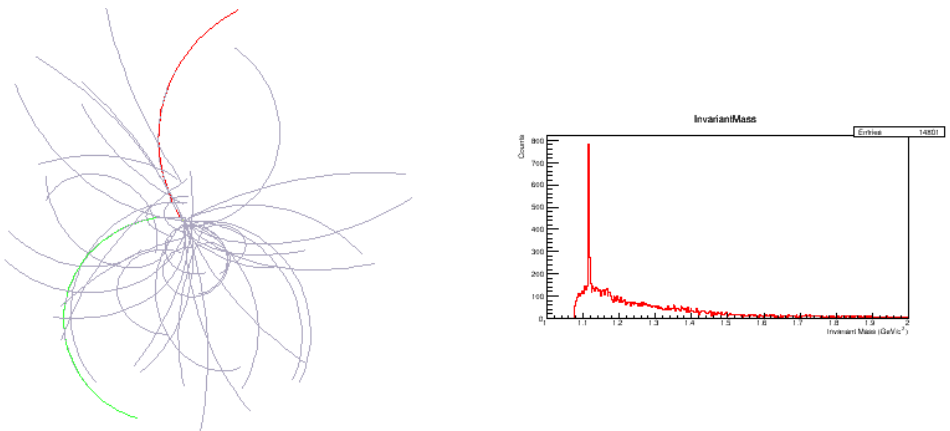

Figure: A proton-proton collision and data from a Pb-Pb collision.

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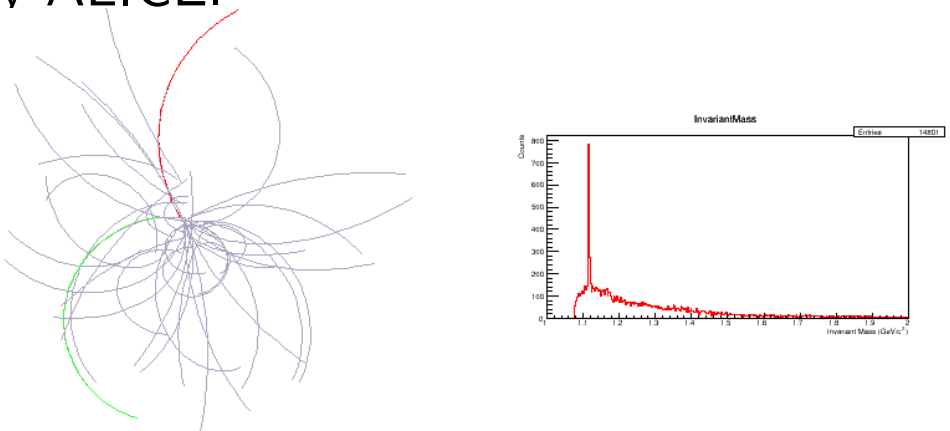
- Statistical analysis of the mass distribution of particles detected by ALICE.



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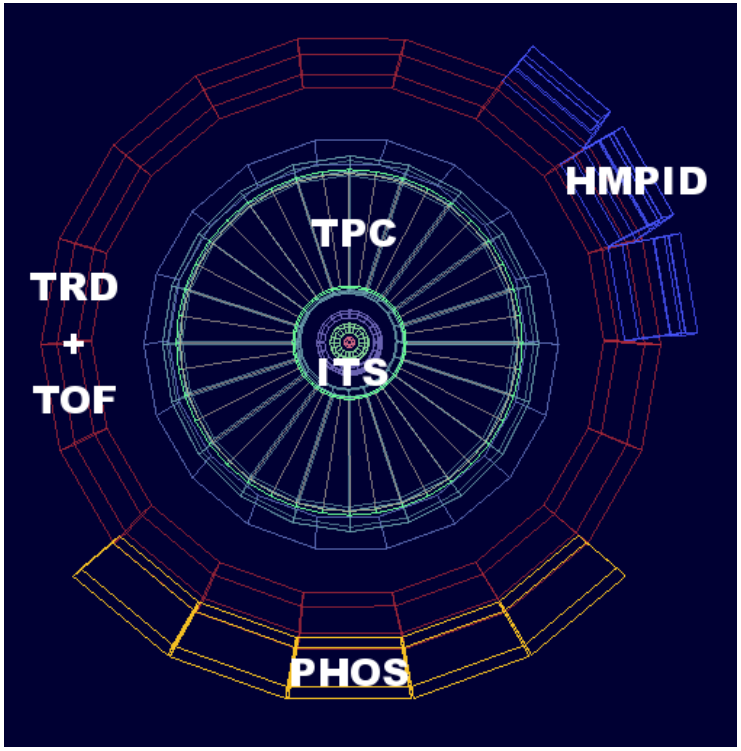

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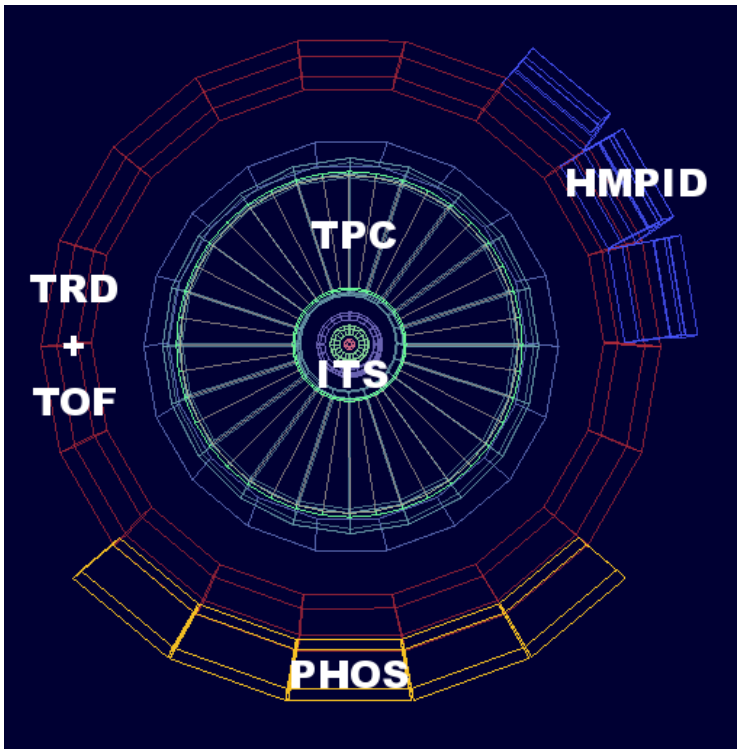
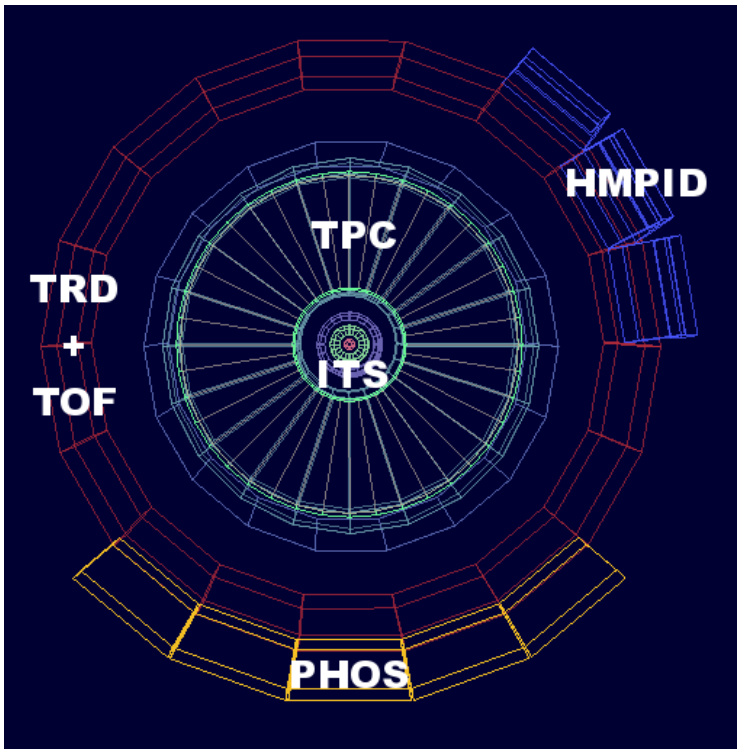


Detection of particles in ALICE

- Inner Tracking System - particle generates electricity;
- Time Projection Chamber - pushed off orbit electrons generates electricity;
- Time of flight - measures the time the particles needs to get from the primary pt the detector.



Decay of particles

- Characteristics of the daughter particles we can obtain through the detectors:

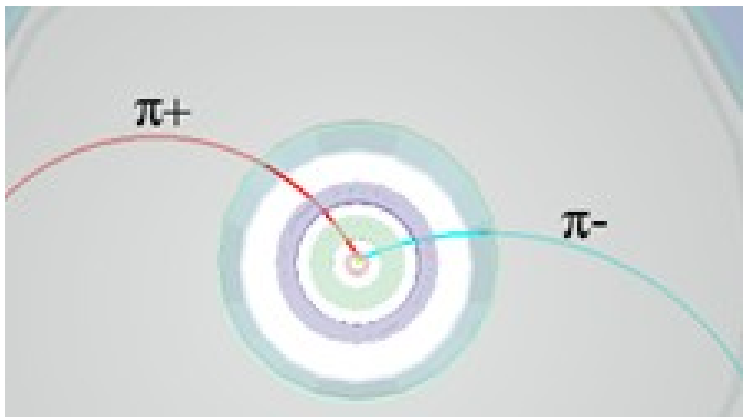


Figure: Decay of a kaon

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- Characteristics of the daughter particles we can obtain through the detectors:
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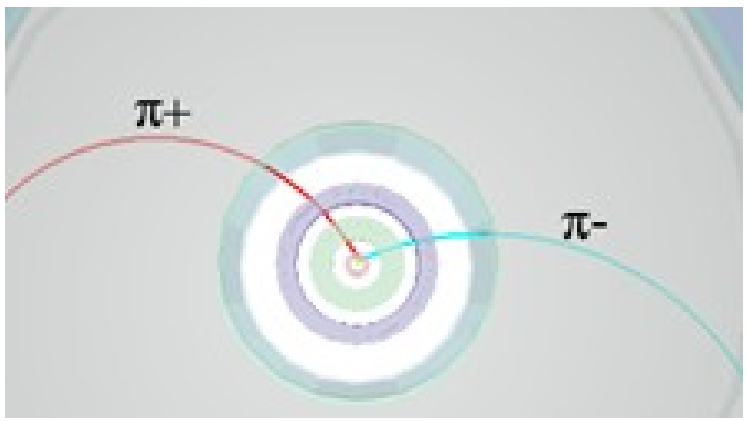

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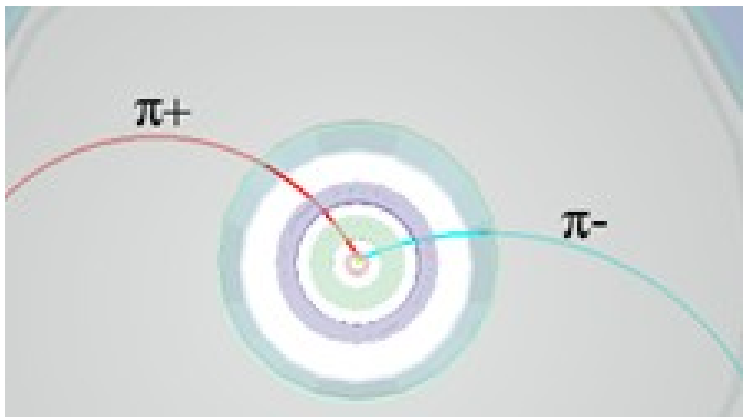

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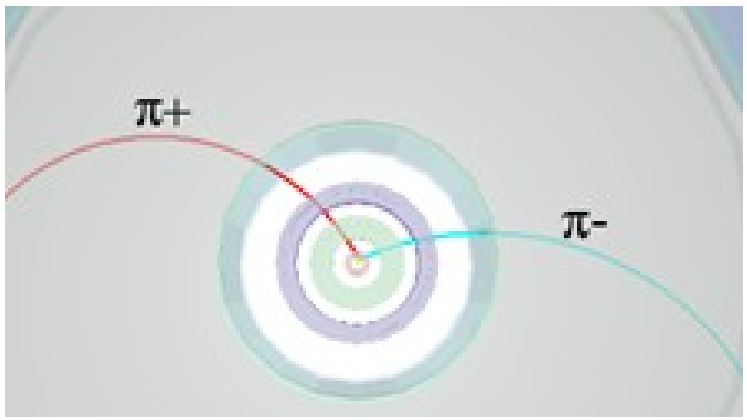
Decay of particles

- Characteristics of the daughter particles we can obtain through the detectors:
  - Charge;
  - Momentum: $p_T = 0.3qBR$; $p = p_T / \cos(\lambda)$;
  - Mass: $m = \frac{p}{v\gamma}$.



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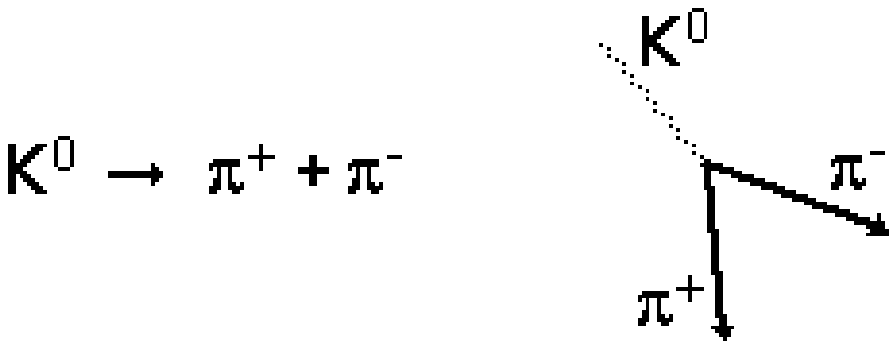
Invariant mass

By using

- Law of conservation of energy;
- Law of conservation of momentum;
- Special theory of relativity: $E^2 = m^2 + p^2$ for $c = 1$.

one could deduce that

$$m = \sqrt{m_1^2 + m_2^2 + 2E_1E_2 - 2\vec{p_1}\vec{p_2}}$$



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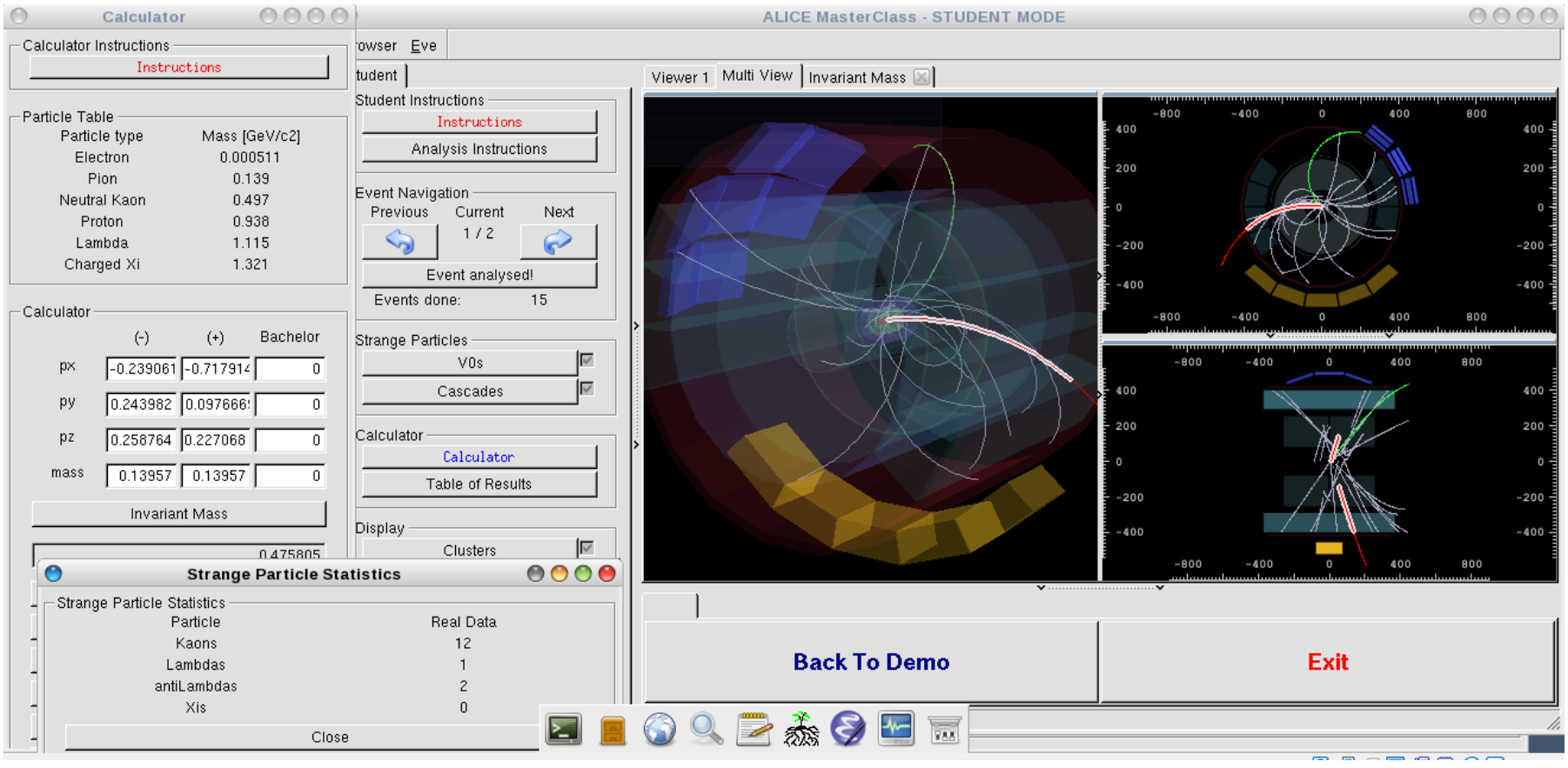
Results


Calculator
Calculator Instructions
Instructions
Particle Table
Particle type
Mass [GeV/c2]
Electron 0.000511
Pion 0.139
Neutral Kaon 0.497
Proton 0.938
Lambda 1.115
Charged Xi 1.321
Calculator
(-) (+) Bachelor
px -0.239061 -0.717914 0
py 0.243982 0.097666 0
pz 0.258764 0.227068 0
mass 0.13957 0.13957 0
Invariant Mass
ALICE MasterClass - STUDENT MODE
Eve
Student Instructions
Instructions
Analysis Instructions
Event Navigation
Previous Current Next
1 / 2
Event analysed!
Events done: 15
Strange Particles
V0s
Cascades
Calculator
Calculator
Table of Results
Display
Clusters
Viewer 1 Multi View Invariant Mass
Strange Particle Statistics
Strange Particle Statistics
Particle Real Data
Kaons 12
Lambdas 1
antiLambdas 2
Xis 0
Close
Back To Demo
Exit

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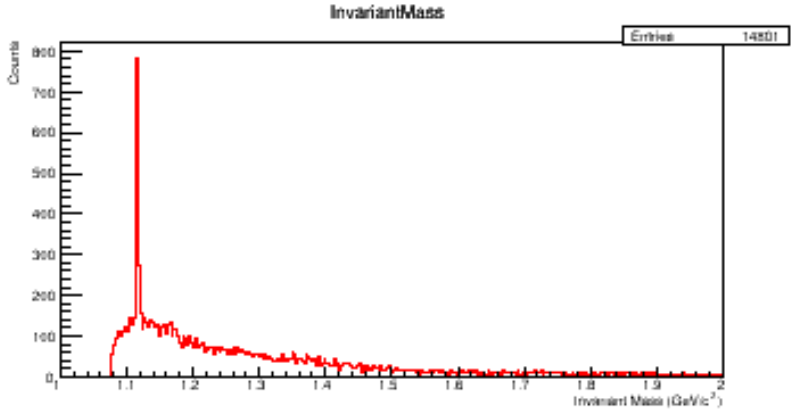
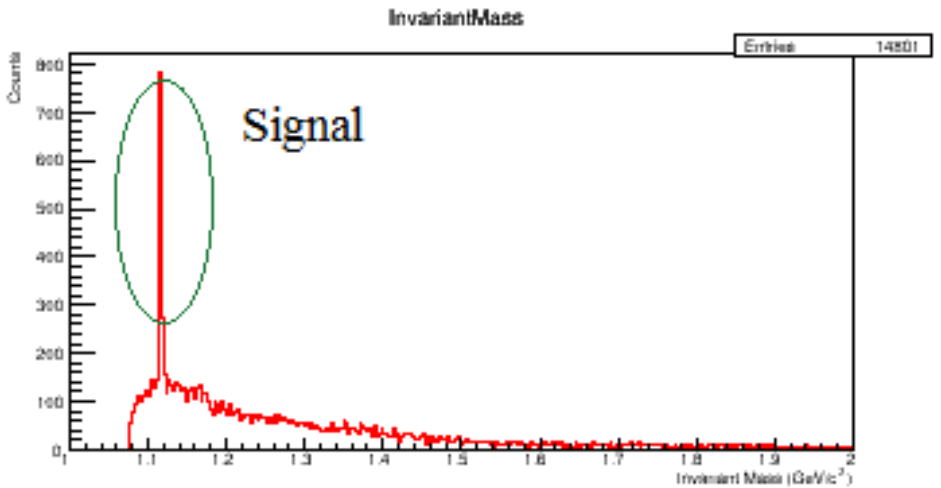


How to "see" a histogram?

Two types of data:

- Signal - What we are searching for!
- Background - What we want to get rid of!



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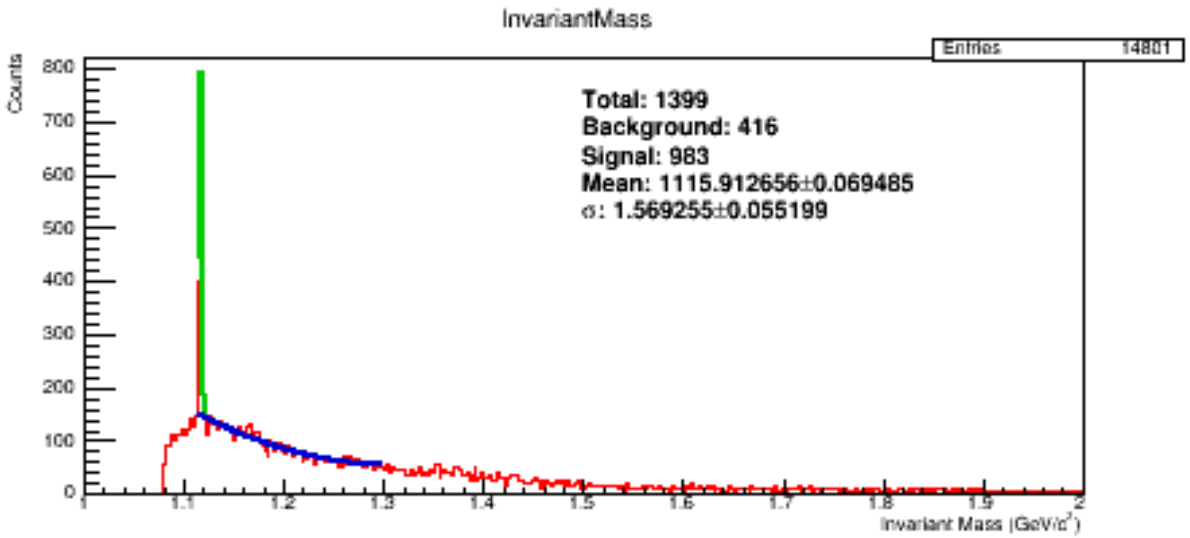
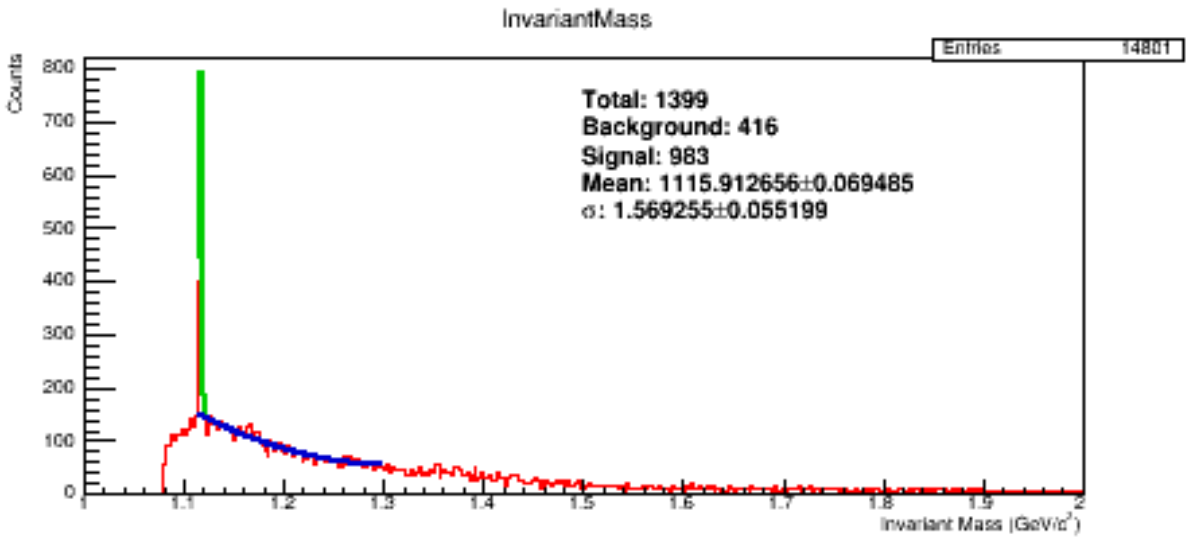


Figure: Lambdas in Pb-Pb collisions data.

Fitting functions

- Background is described by a smooth function;
- **Signal is determined by Gaussian distribution.** The signal is located at the mass of the studied particles and its integral is proportional to their number.



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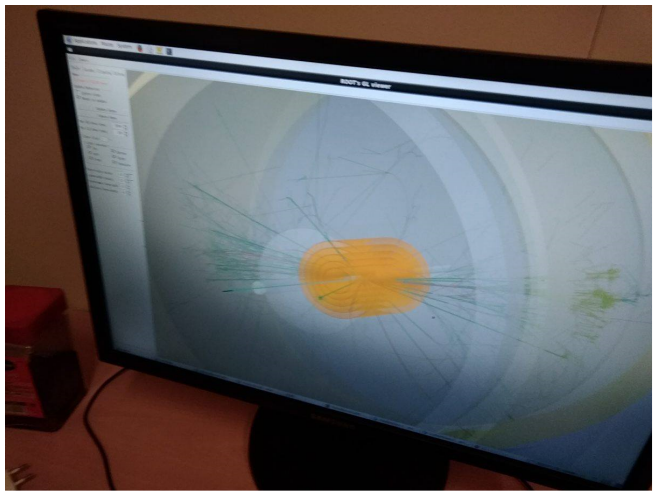
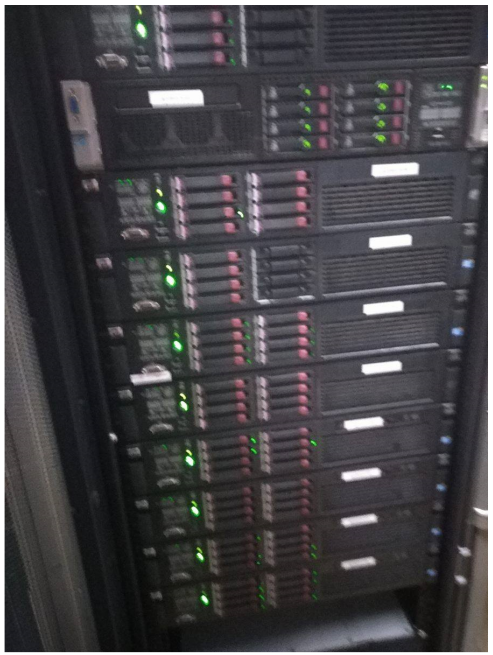
Other projects

- Computer simulations;
- Grid technologies





Our CERN

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