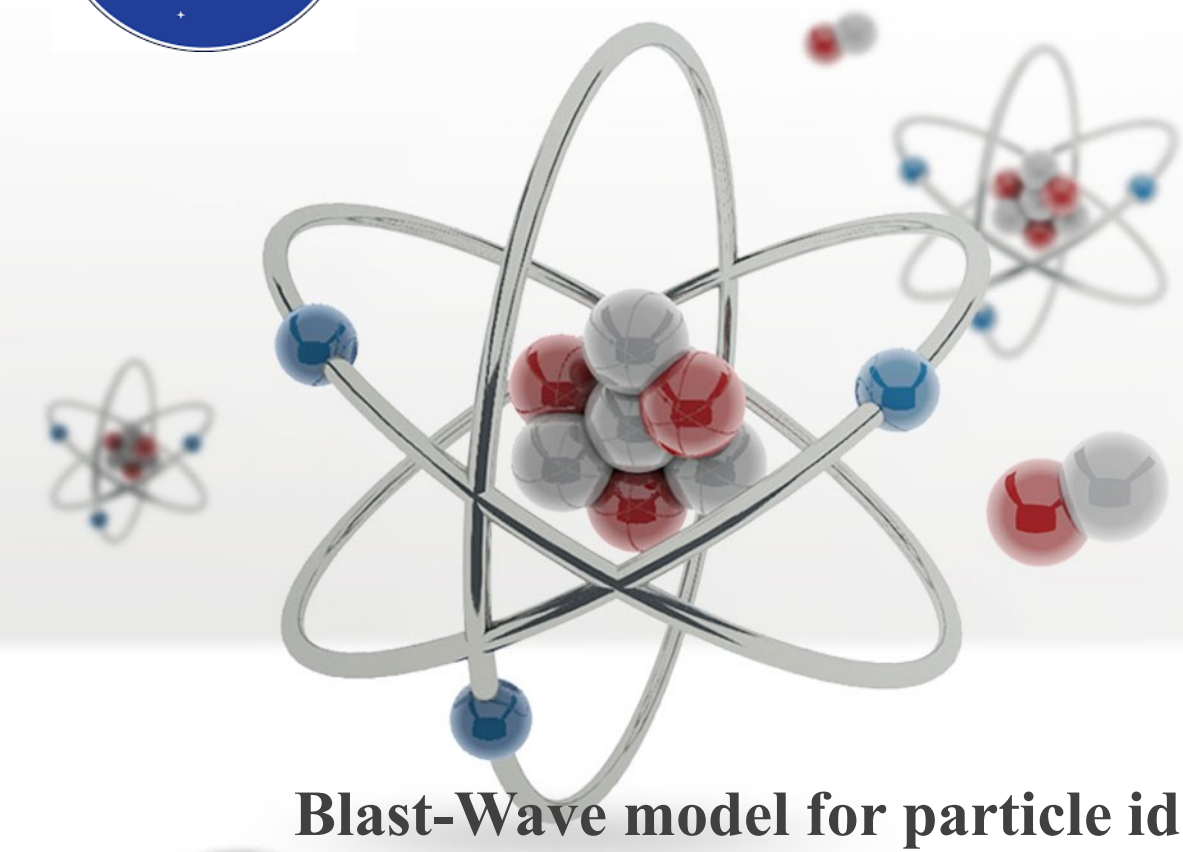

Blast-Wave model for particle identification and elliptic flow in heavy ion collisions at high energies

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UDREA Carina-Iuliana
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Dr. DOBRIN Alexandru

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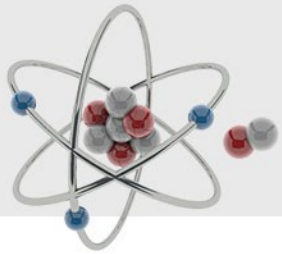
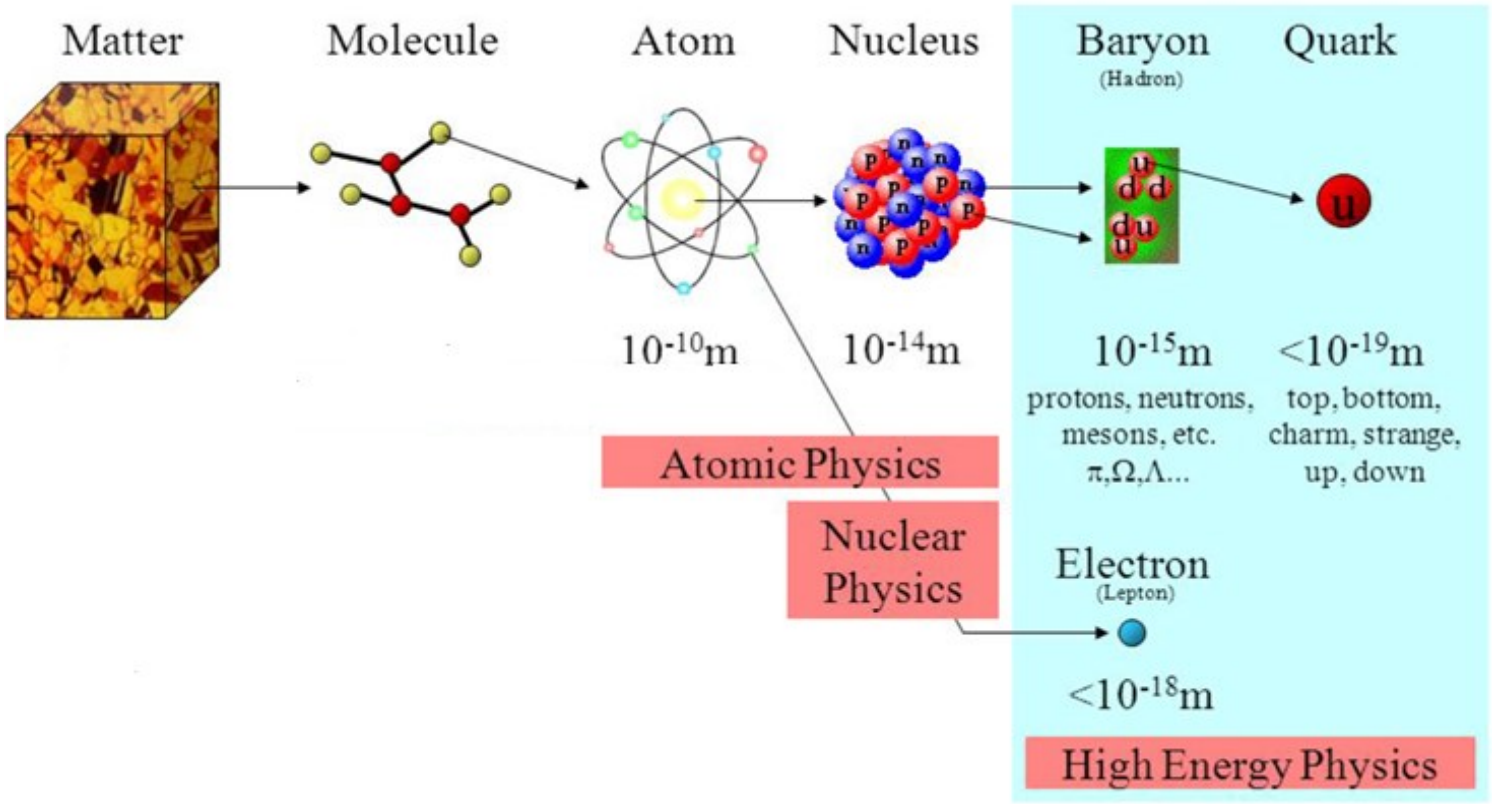
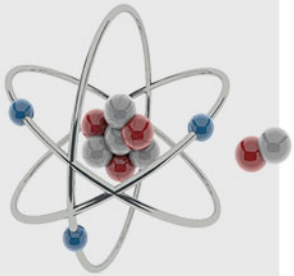


Structure of matter and strong interaction

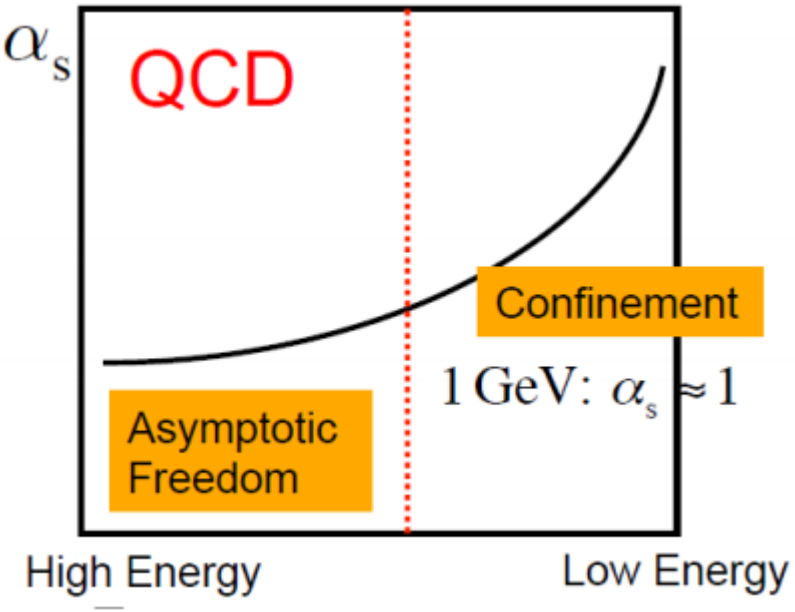


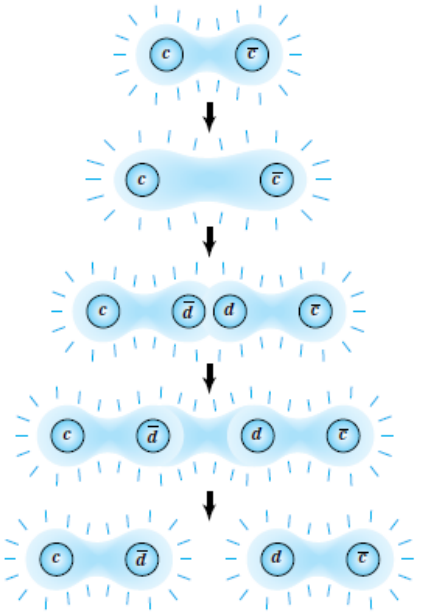


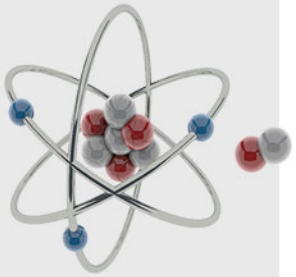
QCD (quantum cromodynamics) - the theory of strong interaction

Strong interaction has 2 unusual properties:

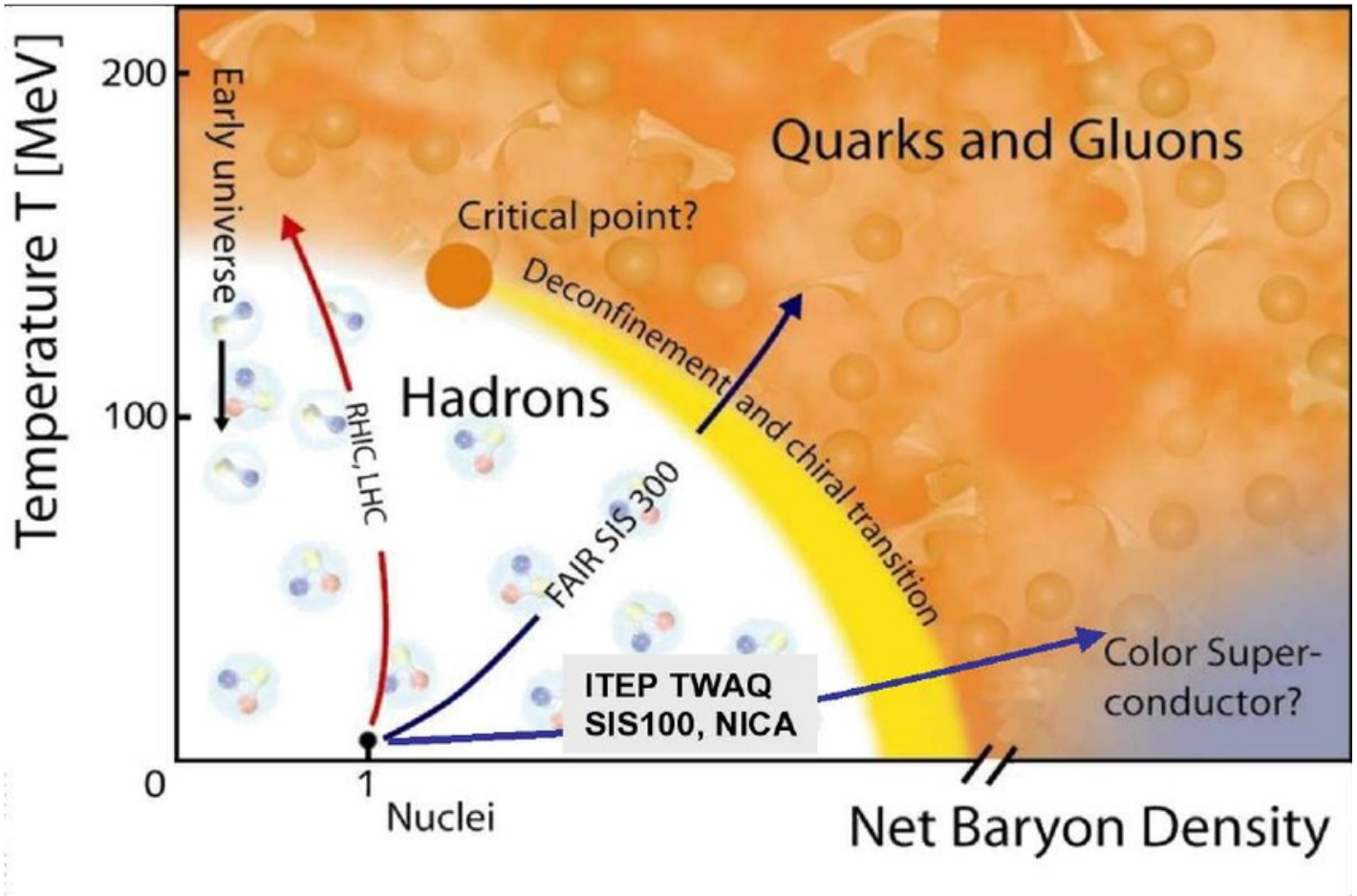
- **Asymptotic freedom**: the more the quarks approach one another, the stronger the nuclear force decreases, asymptotically approaching the zero value
- **Confinement**: quarks exist only confined in hadrons





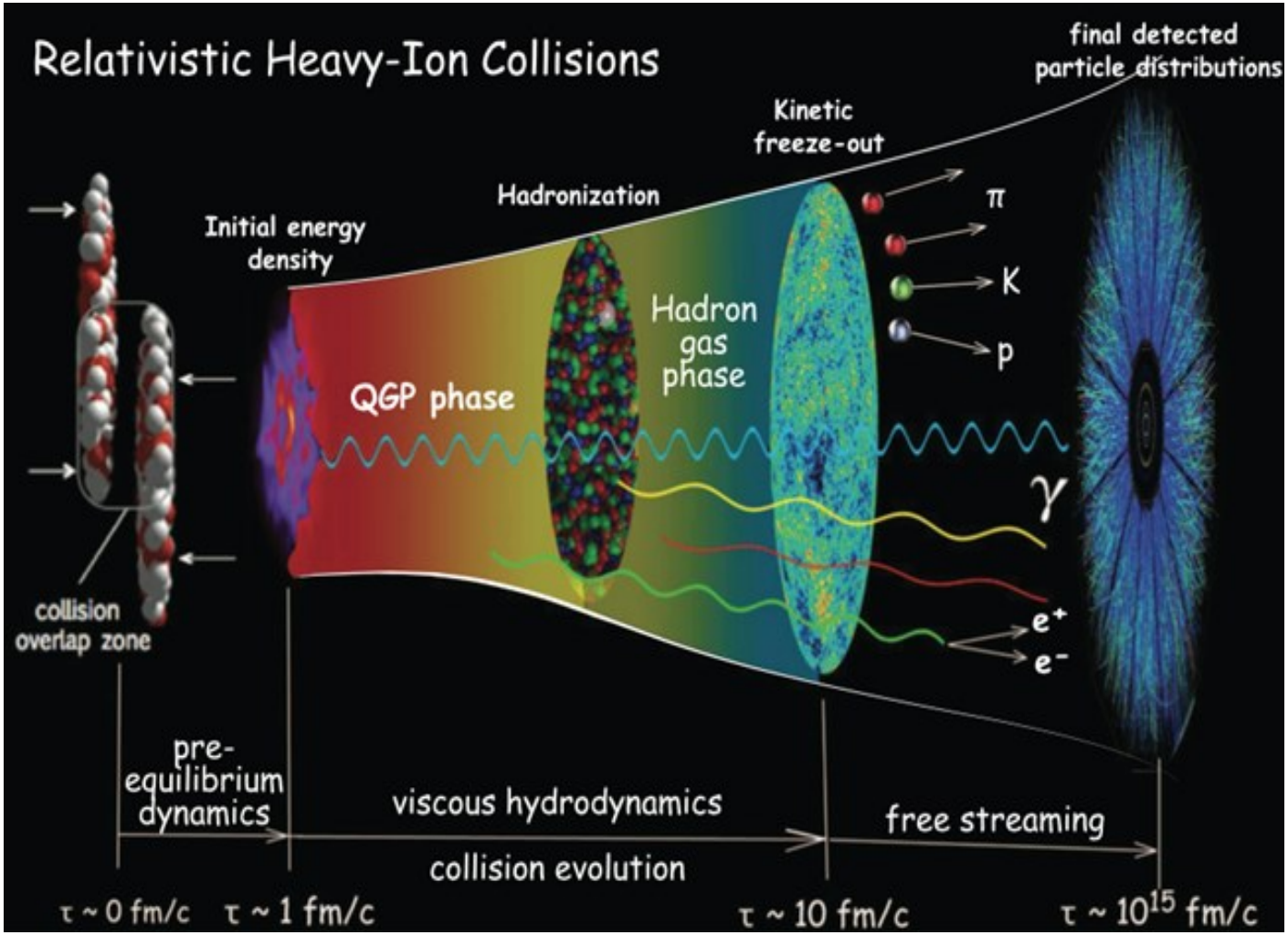


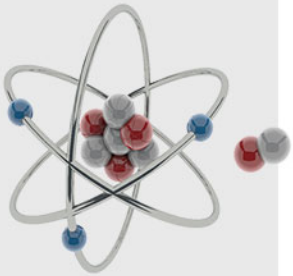
Quark gluon plasma



QCD predicts a new state of matter -> a deconfined system of quarks and gluons -> quark gluon plasma

Evolution in time of a relativistic collision





Elliptic flow

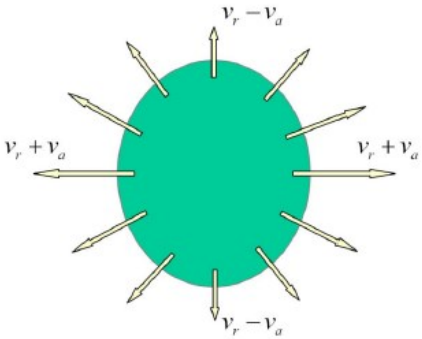
In a non-central collision, the overlapping region is not symmetrical in the transverse plane having an elliptical shape.

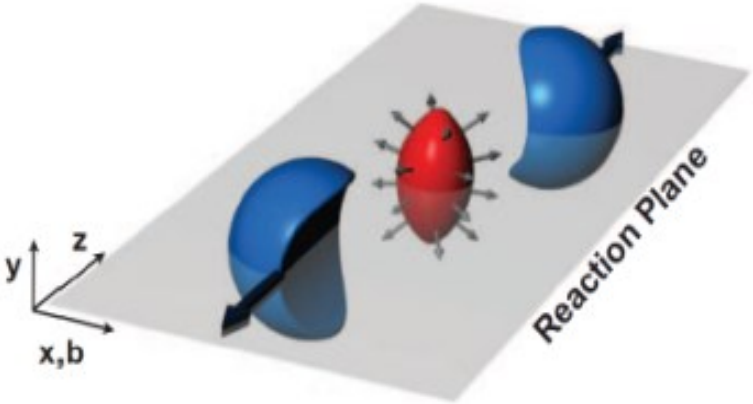
The pressure gradients "push" the particles on the x-axis (flow)

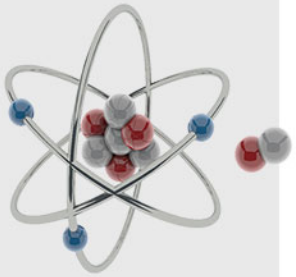
Multiple collisions ⟶ asymmetry in momentum space ⟶ anisotropic flow

Elliptic flow

- has the highest contribution,
- can constrain the freeze-out conditions of the medium,
- can constrain the mechanisms of particle production.







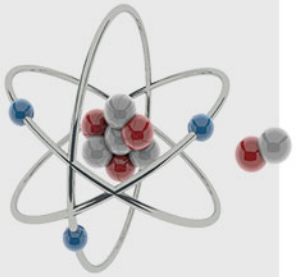
Blast-Wave model

Blast-Wave parameterization is similar to the freeze-out configuration obtained from hydrodynamic calculations.

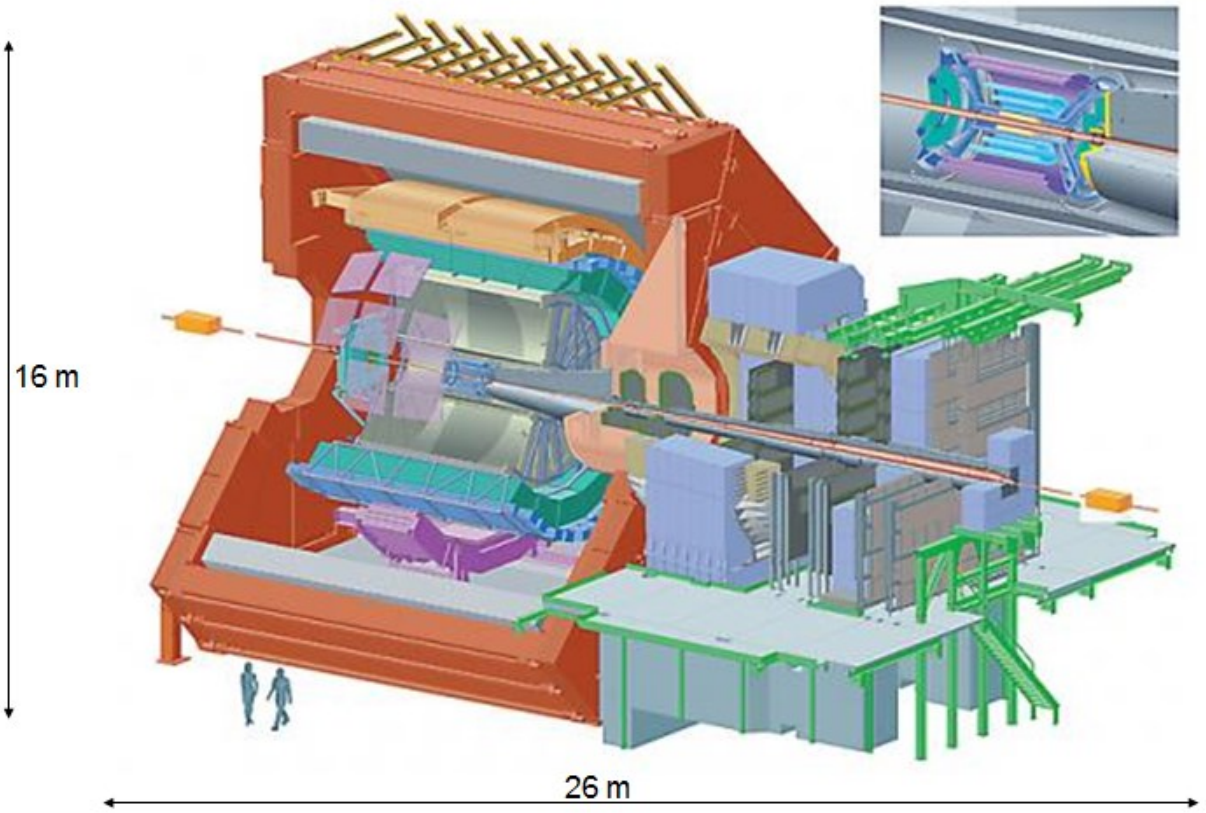
The main purpose is to quantify the parameters of the freeze-out configuration.

Lisa Retiere model has 8 parameters:

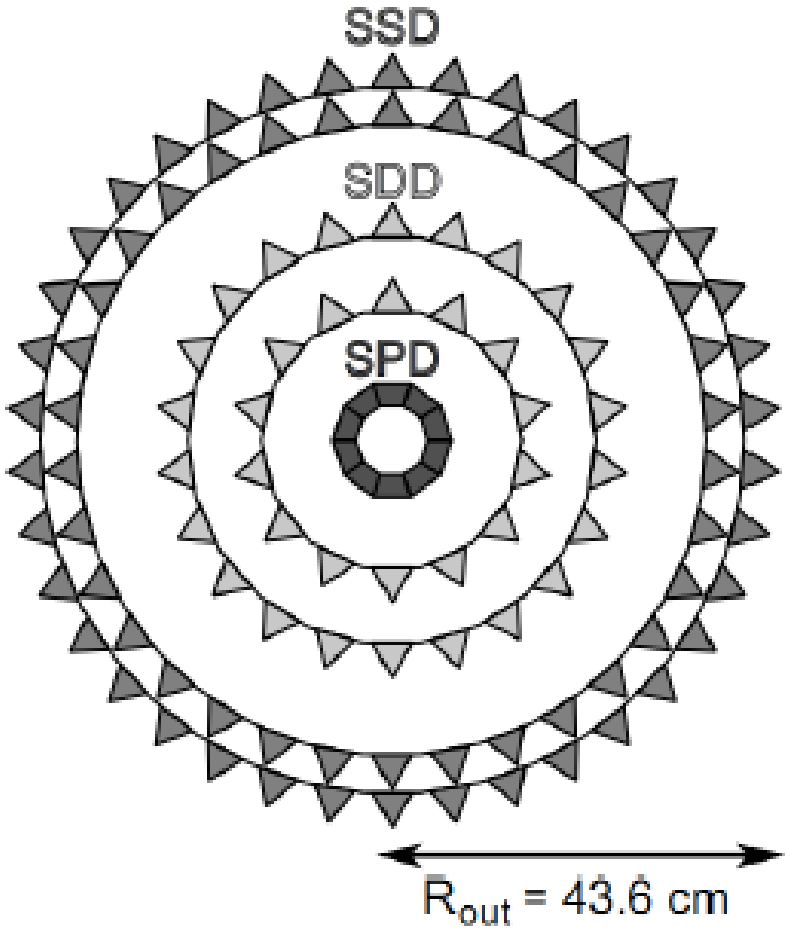
1. T (freeze-out temperature),
2. ρ_0 (radial flow),
3. ρ_2 (ellipticity),
4. Rx, Ry (source radii),
5. a_s (surface of source emission),
6. τ_0 (the Gaussian distribution peak of longitudinal proper time),
7. $\Delta\tau$ (the width of the Gaussian distribution).



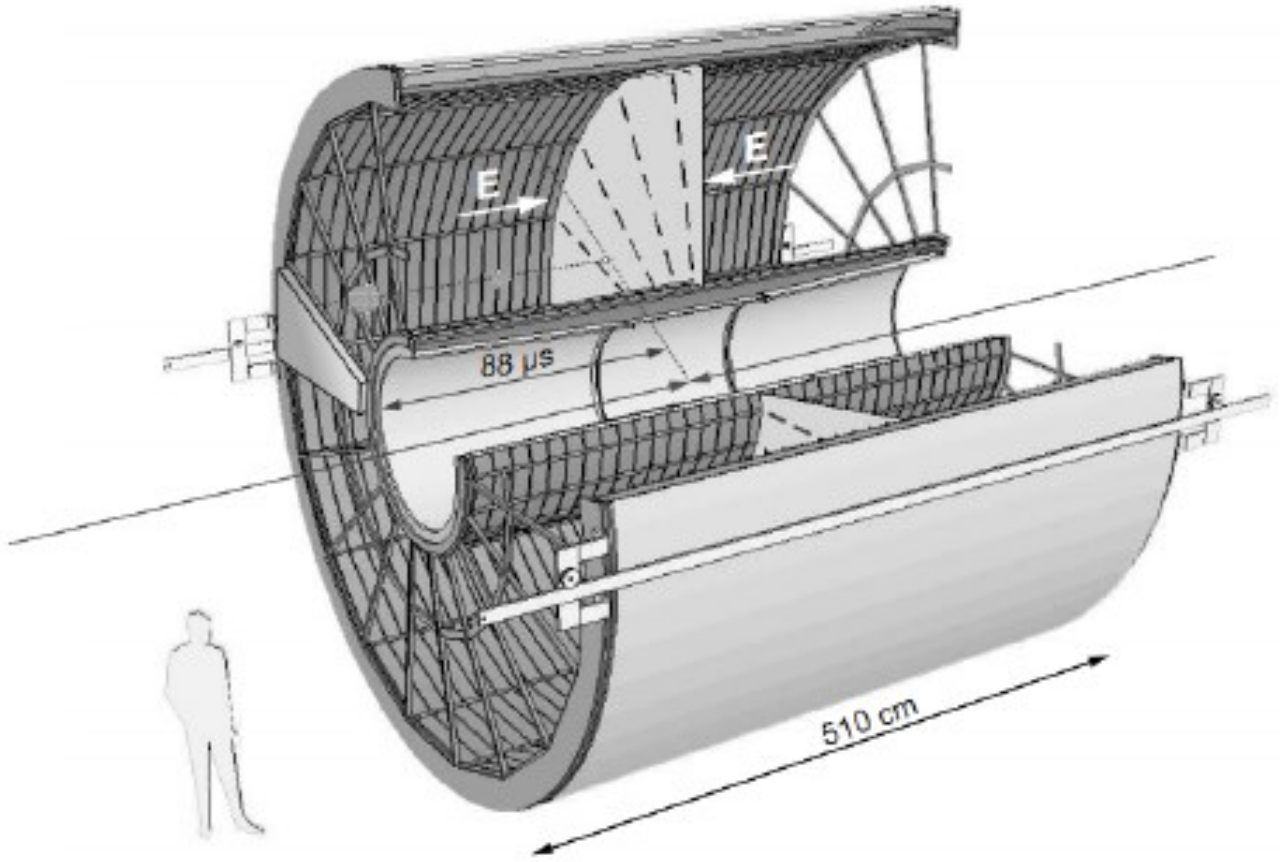
ALICE detector



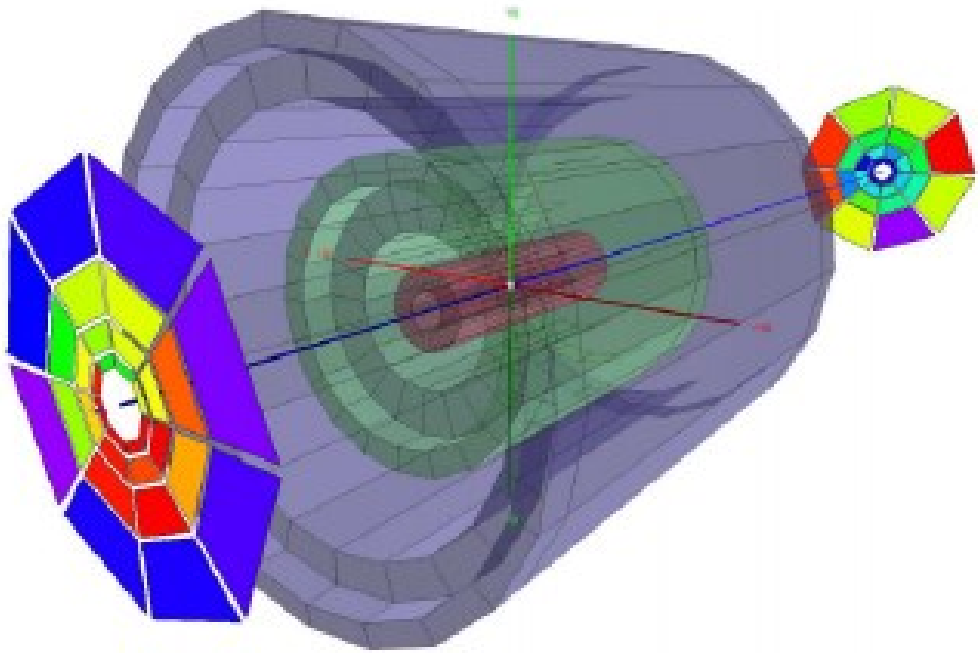
Inner Tracking System detector



Time Projection Chamber detector

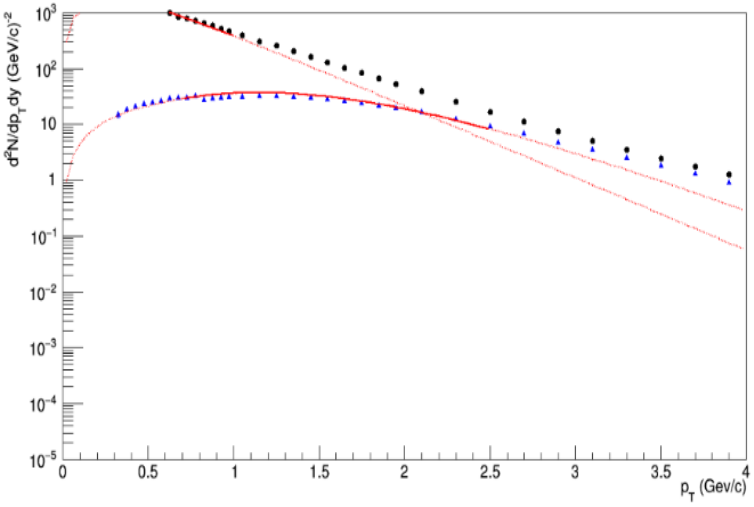


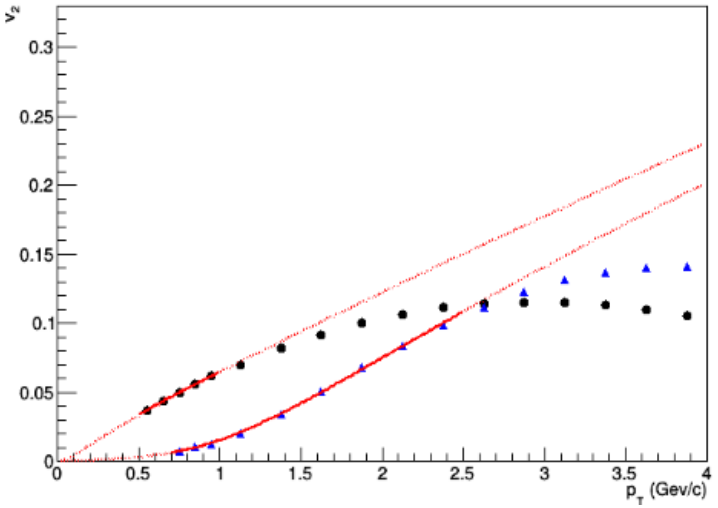
V0 detector

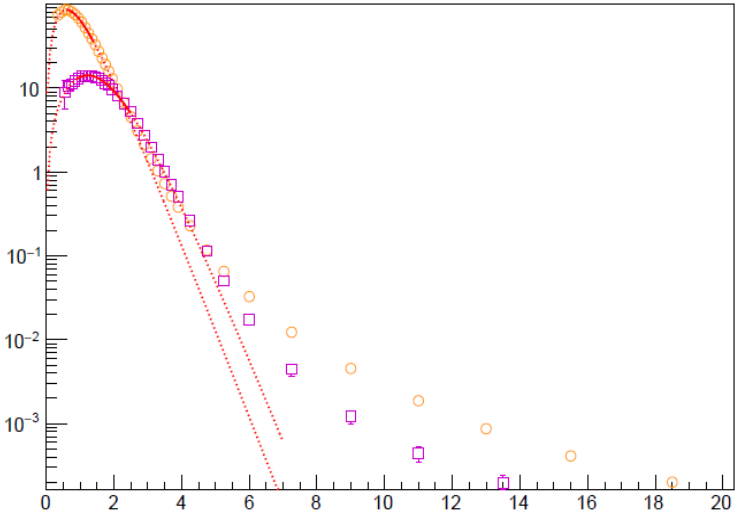


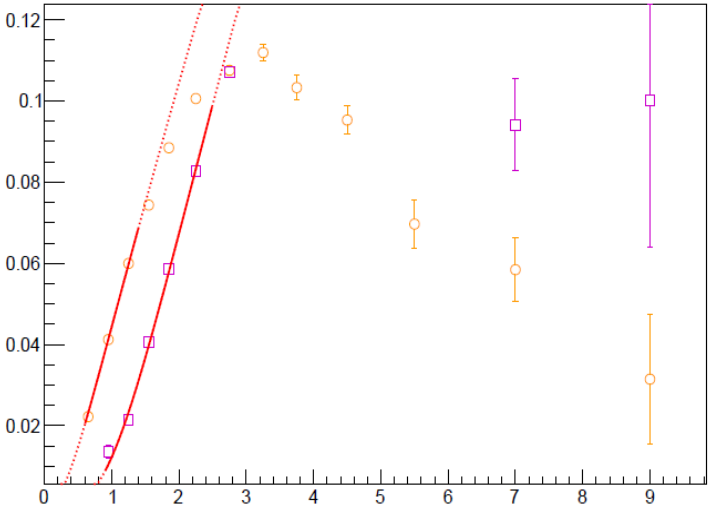
Results

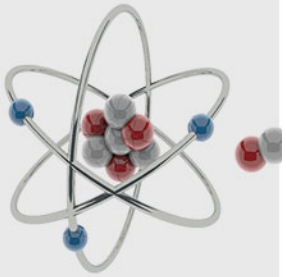
Spectra (left) and elliptic velocities (right) for pion-proton (upper side) and kaon-lambda (lower side)



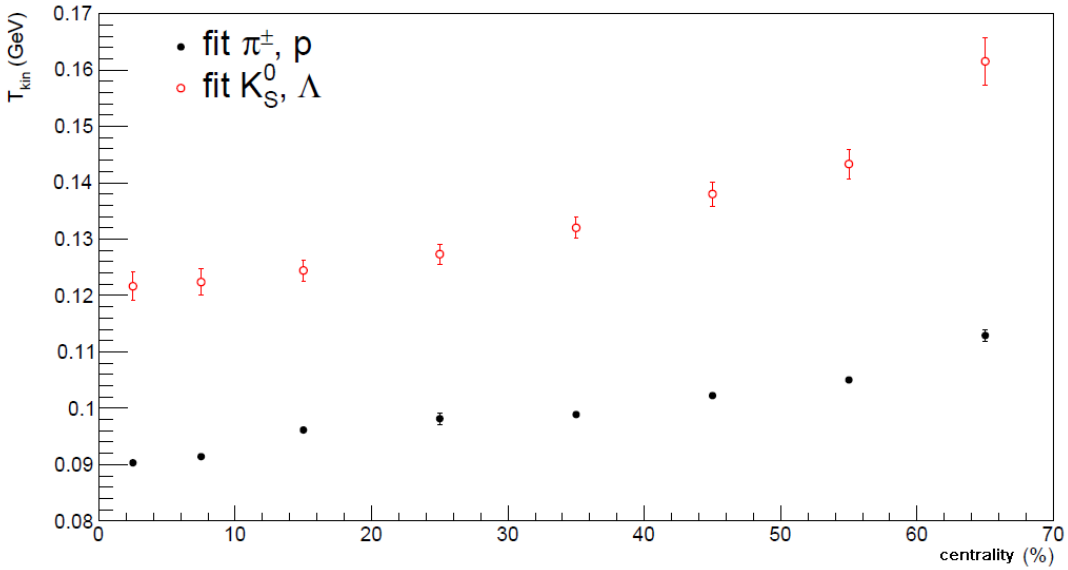


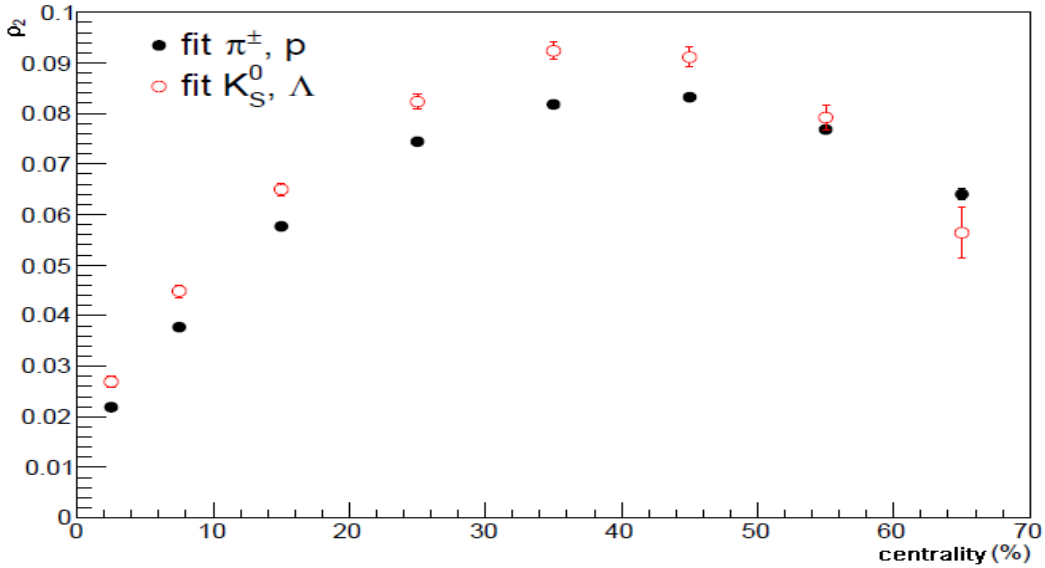


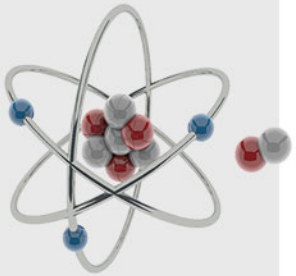




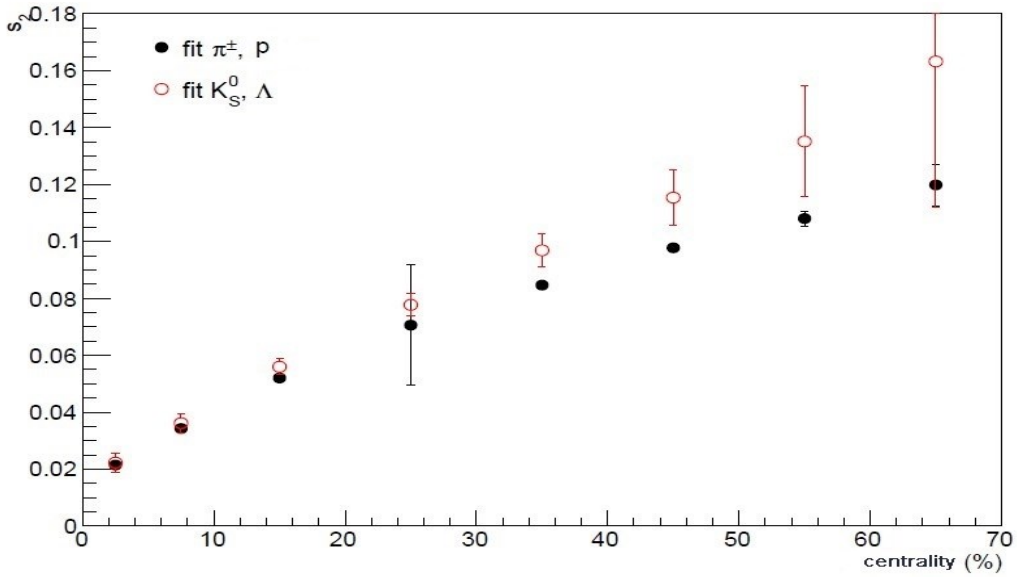
Results

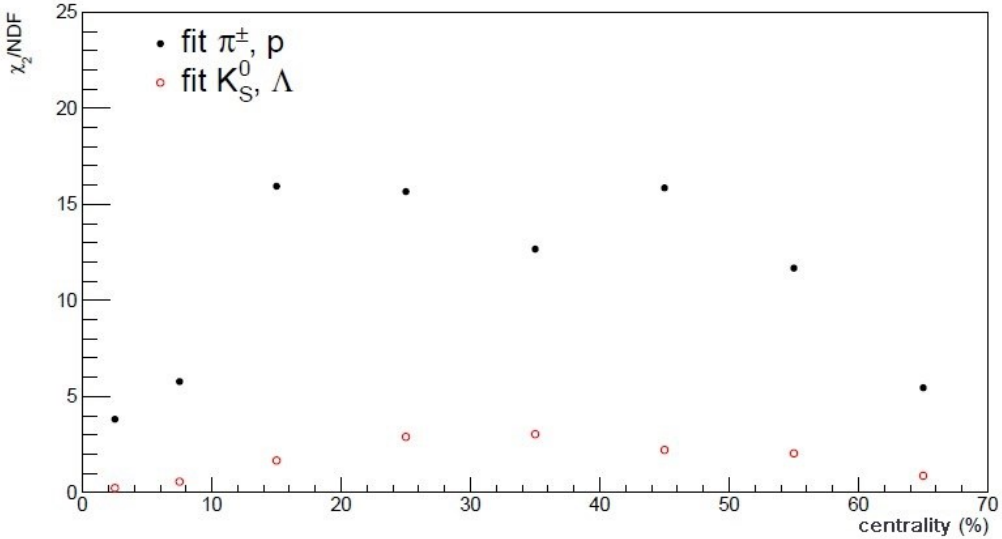

fit π±, p
fit K0S, Λ
Tkin (GeV)
centrality (%)

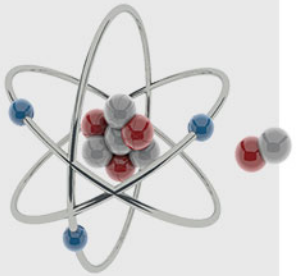

fit π±, p
fit K0S, Λ
ρ2
centrality (%)



Results

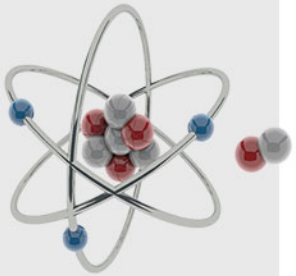

s_2
fit $\pi^{\pm}$, p
fit K^0_S, Λ
centrality (%)


χ_2/NDF
fit $\pi^{\pm}$, p
fit K^0_S, Λ
centrality (%)



Conclusions

1. Fits of spectra and elliptic velocities depending on the centrality has been presented,
2. Analyzing the freeze out temperature, ellipticity and azimuthal variation of source density we noticed differences caused by the strange quark in the second class of particles,
3. χ^2/NDF test is presented as a function of centrality in order to show the deviation in used intervals.



Thank you for your attention!