Popular science article

At the CERN Large Hadron Collider (LHC), we try to re-create conditions that are similar to the ones at the beginning of the Universe that we live in. To achieve this, we start by creating small bunches of particles, such as protons or lead ions. These are then accelerated. First linearly and then after they have reached a certain velocity they are put into a system of circular accelerators that takes them on a journey towards higher and higher velocities and therefore energies. These high energies are needed since we aim to de-confine the quarks and gluons in the nucleons that are collided. The state of matter that the ALICE experiments wishes to study is called Quark Gluon Plasma (QGP). This was likely what the Universe consisted of some tiny fraction of a second after its expansion had started.

In this project, we have done two main studies. We started by looking at different fit functions for transverse momentum (p_{T}) spectra. For this part we studied p_{T} spectra for (anti)pions ($\pi\pm$), (anti)kaons ($\mathrm{K}^{\pm}$ and $\mathrm{K}^{0}_{\mathrm{S}}$), (anti)protons ($\mathrm{p}(\bar{\mathrm{p}})$) and the two (anti)lambda particles Λ^0 and $\bar{\Lambda}^0$. We could conclude that the function that could describe the data best was the Lévy function. It is worth noting that this was not the function with the most parameters.

In the second part we studied (anti)pions ($\pi^{\pm}$), (anti)kaons ($\mathrm{K}^{\pm}$) and (anti)protons ($\mathrm{p}(\bar{\mathrm{p}})$) spectra for different multiplicity classes. We did this by looking at the outcomes from many collisions. Some outcomes will have a lot of particles and some will have few. These different outcomes can then be put into different classes. For each particle ((anti)pions, (anti)kaons, and (anti)protons) we had 10 classes. We found that the spectrum for the class with the lowest number of particles was quite different from the other ones and it was therefore eliminated from our next step.

This next step was to make a combined fit for all the classes at once. We did this assuming that there could be a common parameter between the classes. We both used a combined fit and Lévy function fits to help us interpret the spectra dynamics as a function of multiplicity class. Interesting results could be found for both methods.