Popular science summary of the project "Unveiling multidimensional partonic structure of hadrons"

Quantum chromodynamics (QCD) is the theory of the strong interactions with quarks and gluons as elementary particles. Quarks and gluons are permanently bound in hadrons, the strong interacting particles which are directly measured in the detectors of high energy scattering experiments, for example at the Large Hadron Collider (LHC) at CERN. Being inside hadrons, quarks and gluons are almost free; trying to escape from them, they interact very strongly and never become free. However, they indirectly materialize in bunches of hadrons or another directly measured particles like the recently discovered Higgs particle.

In order to describe the scattering processes with quarks and gluons, we need to know how they form the structure of hadrons. The standard methods of quantum chromodynamics, based on the smallness of the quark and gluon interactions, are not directly applicable and we have rely on the most advanced techniques to reveal this structure

The main aim of the project is to provide multidimensional distributions of quarks and gluons inside hadrons as functions of their momenta. On the way to this goal, we need to consider different aspects of these distributions like the collective behaviour of systems of very slow gluons. Another aspect, which is the subject of the project, are correlations between individual quarks and gluons which actively participate in the scattering, producing systems of particles registered at the detectors. To achieve our goal, we will use advanced analytical and numerical techniques of QCD. The final results will be given in terms of the predictions which could be tested experimentally at the present and future colliders.