A new dipole-based jet clustering algorithm

Toni SCULAC
Physics Department
Prirodoslovno Matematicki Fakultet
University of Split, Croatia

May 23, 2014

When two protons collide in the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN) a large number of particles is produced. Main task of the experiment is to take the data from the detectors and with it derive a conclusion about what happened in the collision. One can imagine this as an attempt to "rewind" the collision back in time. Theory of interactions between elementary particles is fairly complicated, and even if we have only one particle decaying to two particles it is not always possible to "rewind" it correctly. But the situation at the LHC is much more complicated, detectors measure data for up to around 1000 particles in each collision. In such a mess it is hard to tell which particle comes from which collision, and it is certainly not possible to analyze the data without the help of the computers. This is why computer algorithms are developed for such tasks, and jet clustering algorithms is one important part of the analysis of particle collisions. Jet clustering algorithms take all particles that reach the detectors and cluster most of them, step by step, in jets. By doing this, the problem of analyzing hundreds of particles is reduced to the analysis of couple jets. Our work was the development of the new jet clustering algorithm, called the dipole-k_t algorithm that has some new features. While other algorithms take two particles and cluster them to one particle, our algorithm clusters three particles to two. Furthermore, we use different measure to determine which particles will be clustered in the next step. We hope that in future, the dipole-k_t algorithm will prove to be a useful tool in the LHC analysis.