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Übungen zu Teilchenphysik I

Wintersemester 2023/24

Exercise 2

To be worked on until November 9, 2023

Analysis of Dimuon Spectrum

In this exercise, we will analyze real data recorded by the CMS experiment in proton-proton collisions with a center-of-mass energy of 7 TeV at the Large Hadron Collider (LHC) located at CERN. The data for this exercise contains measured quantities of identified muons. After on-line selection by the trigger system of the CMS experiment and reconstruction of physics objects, a subset of events with two reconstructed muons was selected from the large amount of stored data. The data set provided for this exercise does not contain all recorded information of proton-proton collision, but only a part of the data with the most essential information about the two muons.

The particular data set from which the data for this exercise was derived can be found on the CERN open data portal under the URL

<http://opendata.cern.ch/record/545/>

More details on the data set are also available from this web page. Note that the chosen data format, `csv` ("comma separated values"), is very simple, but suitable for the kind of analyses we will perform here in order to investigate the properties of dimuon events. A similar data set from earlier collision events recorded in the year 2010 is available under

<https://opendata.cern.ch/record/303>

This earlier data set provides a browser-based display to visually inspect some typical events with two muons. Please have a look at some of these so-called event displays to understand what kind of events we are trying to analyze in the following.

To start with the exercise, please login to the [jupytermachine](#), start the standard **Datenanalyse** container and update your **tp1_forstudents** repository, e.g. by navigating to the directory in the file browser on the left and then selecting **Git -> Pull from Remote** from the menu bar. A new subfolder **Exercise02** should appear with a Jupyter notebook **DimuonAnalysis.ipynb**. Open this notebook and work through the different tasks that are given inside.