

# Preface

The Tevatron has been the collider with the highest center of mass energy for a long time. The running at the energy of approximately 2 TeV allowed to create heavy particles, like the top quark whose discovery was one of the main Tevatron results. But the Tevatron experiments CDF and D0 also made outstanding contributions on the flavor physics sector by exploiting the huge samples of bottom and charm hadrons produced in the  $p\bar{p}$  collisions.

Studies of physics processes involving a change of a flavor quantum number have often lead to new insights. Our current knowledge about bottom and charm hadrons was mainly obtained at  $e^+e^-$  colliders and hadron colliders, like the Tevatron and the LHC. The two approaches are complementary in the sense that some measurements can only be done at one type of collider experiment and not or hardly at the other. The different experimental conditions also require different techniques in the detector construction and the data analysis.

This book gives an overview of the flavor physics results of the Tevatron experiments CDF and D0 and the employed experimental techniques. The results published until mid of the year 2012 are covered. A few further results will become available after this date, mainly analyses that are updated to the full Tevatron dataset, and also some new ones. However, no significantly new insights are expected from them. While several flavor physics measurements will be or are already dominated by LHCb, the underlying physics processes are basically the same as at the Tevatron. Hence, also the measurement techniques described here are often reused at the LHC.

Although some discussion of the theoretical background is provided in this book, it focuses on the experimental results and measurement techniques. Knowledge of quantum field theory is not required, but it is assumed that the reader is familiar with the basic concepts of particle physics.

After a brief introduction in [Chap. 1](#), the description of flavor in the standard model is discussed in [Chap. 2](#). The formulas to describe mixing and  $CP$  violation phenomena are derived in [Chap. 3](#). The Tevatron accelerator and the CDF and D0 detectors are presented in [Chap. 4](#). The following [Chaps. 5–9](#) cover measurements

of lifetimes and decay branching fractions, oscillations, indirect  $CP$  violation, direct  $CP$  violation, and rare decays. A conclusion is given in the last Chapter.

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pp-Collisions

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