

Title:

Practical use of statistical and numerical methods

Course Description and Objectives:

The aim of this course is to equip students with a toolbox of statistical and numerical methods, helping them to effectively achieve their own scientific goals. Good practices of collaborative work will be emphasized, allowing students to operate more productively in environments of modern research teams. The choice of topics also allows for a deeper understanding of the work done by others, helping students to gain confidence in their own scientific pursuits.

Prerequisites:

No experience in topics listed below is required. Students will be asked to bring their own computers, with installed software indicated before the start of classes.

Course Contents:

- * Collaborative tools (git, indico, mattermost, google docs, ...)
- * Basics of Bash Unix shell and related scripting language, computing farms
- * C++ (basics, elements of memory management, classes, including polymorphism and inheritance)
Note: C++ is introduced as example of programming language used in science. All exercises and projects related to further segments of this course can be done in any programming language selected by the student.
- * ROOT analysis framework, including fitting methods
- * Propagation of uncertainties and Monte Carlo techniques
- * Elements of machine learning (artificial neural networks)
- * Introduction to Mathematica (used e.g. to solve symbolic expressions)

Hours:

3h/week, 45h in total

In person, typically 1.5h of lecture followed by 1.5h of supervised hands-on exercises.

Grading Policy:

Students pass this course by completing four minor personal projects (related to Bash, C++, ROOT, Machine Learning) and one major project (related to ROOT and Machine Learning). The later will be done in small groups of students. Each project will be scored in the scale between 2 and 5. To pass the course the arithmetic mean of such scores has to be greater than 3. The final grade will be evaluated as the half-round-up arithmetic mean. Students with a profound knowledge in a given topic can request personal projects to be done extramurally.

Points:

6 ECTS