

# FSH3910 - Statistical Methods in Physics

## Content and Learning Outcomes

### Course Contents

In this course, you will get a deeper understanding of statistical treatment of a set of input data. The course provides an overview of the concepts of probability theory and the extraction of knowledge from measurements or observations. You will learn how to robustly extract information from uncertain observations, e.g. the separation of signals from backgrounds, and to quantify the significance of a hypothesis test. The course discusses various approaches to statistical data analysis, ranging from the “Maximum Likelihood” and the “Least Square” methods to Monte Carlo techniques. The course will culminate in a project of statistical nature that is connected to the research of the doctoral student.

### Intended Learning Outcomes

At the end of the course, the students will be able to apply the following concepts to their research:

- \* Meaning of confidence intervals, and how to estimate them statistically from a set of data.
- \* Separation of signal and background.
- \* Monte Carlo techniques and the concept of toy Monte Carlos.
- \* The concepts of fitting, and the related uncertainties including covariance matrices.
- \* Hypothesis testing and limit setting, using likelihood functions with profiling over parameters representing uncertainties.

### Course Disposition

Seminar's on selected topics in statistics, interleaved with discussion sessions and hand-in assignments. In the second half of the course the students will get to work on a project in statistics related to their own research.

## Literature and Preparations

### Specific Prerequisites

PhD student, aimed primarily at students following the PhD program in Physics. It is assumed that the student has basic knowledge of statistics from their undergraduate studies.

English B / English 6

### Recommended Prerequisites

Nothing further

### Equipment

No equipment needed

### Literature

“Statistical Data Analysis” by Glen Cowan.

## **Examination and Completion**

### **Grading Scale**

P, F

### **Examination**

- \* SEM1: Seminars and hand-in assignments. Grade P/F. 2.5 credits.
- \* PRO1: Statistics project and report, related to student's research. Grade P/F. 5.0 credits.

### **Opportunity to Complete the Requirements via Supplementary Examination**

No. Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

### **Examiner**

Jonas Strandberg

### **Ethical Approach**

- \* All members of a group are responsible for the group's work.
- \* In an oral assessment , every student shall be able to present and answer questions about the entire assignment and solution.
- For the projects, the students shall honestly disclose any help received and sources used.

### **Course Web**

<https://www.kth.se/student/kurser/kurs/FSH3910?l=en>

### **Offered By**

SCI/Physics

### **Main Field of Study**

Physics

### **Education Cycle**

Third cycle.

### **Add-on Studies**

No

### **Contact**

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