KSETA Doktoranden Workshop 2014

Monday, July 21, 2014 - Wednesday, July 23, 2014

Waldhotel Zollernblick

Book of Abstracts

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Minimisation with Python

Authors: Alexander Schulz[1]; Colin Baus[1]; Dmytro Rogozin[2]

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Corresponding Author: dmytro.rogozin@kit.edu

The KSETA Doctoral Workshop allows interested KSETA fellows to learn more about methods and tools that might support their research. Doctoral students of all KSETA research fields, from theoretical or experimental particle and astroparticle physics to software or cryogenic engineering, are invited to spend three interesting and inspiring days together and to benefit from the other participants' experience. One key aspect of the workshop are the tutorials given by all participating doctoral students. In groups, the participants prepare their tutorial "from doctoral fellows for doctoral fellows" on a topic that could be useful to others concentrating on other fields of research. This tutorial may cover introductions to useful tools, basic technologies for non-engineers, basics in physics for non-physicists, or applicable methods for research.
Every tutorial lasts one hour and the presenter is free to use any didactic method like PowerPoint, whiteboard, or interactive methods such as exercises on programs installed on the students' laptops. The workshop program is complemented by invited talks and discussions.
In this tutorial basic statistical concepts and techniques for fitting and minimisation will be presented.
Connected topics like maximum-likelihood and uncertainty estimation will be explained using hands-on examples from (astro-)particle physics. Complementing exercises will be provided using the widely recommended programming language Python.
In fact, Python offers many packages and functions, making it a powerful tool for statistical analysis.

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Introduction to Mathematica: symbolic computing and simple simulation visualization

Authors: Ariel Bridgeman[1]; David Schmidt[1]

[1] *Karlsruhe Institute of Technology*

Corresponding Author: david.schmidt@kit.edu

Mathematica is a powerful programming tool with a visually appealing graphical user interface. While possessing many of the capabilities of a more traditional programming language, it features symbolic computing, which renders mathematical expressions in a format that is easier to read and manipulate. Given these ergonomic features, Mathematica is, among other things, useful for quick numerical simulations and can provide complimentary interactive animations. In this tutorial, we will walk through Mathematica's symbolic prowess and its application to quick simulation and graphical visualization. Prior to and during the tutorial, we will supply students with materials geared towards exploration of Mathematica's functionality.

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Cosmic Ray Science on the International Space Station

Authors: Stefan Zeissler[1]; Stefanie Falk[2]

[1] *KIT*

[2] *IKP*

Corresponding Author: stefanie.falk@kit.edu

This tutorial shall give a brief comparison between AMS-02 and JEM-EUSO regarding their physics objectives, flux and exposure calculations, as well as general measurement techniques for cosmic rays.

Bus Transfer / **4**

Campus North: leaving at 8:00

Summary:

please be on time at Campus North!
We are leaving at 8:00

Please let us know, where you will board (CN @8:00 or CS @8:30)
https://terminplaner.dfn.de/foodle.php?id=pgs1455pf2rfpwri

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Campus South: leaving at 8:30

Please be on time at Campus South!
We are leaving at 8:30

Please let us know, where you will board (CN @8:00 or CS @8:30)
https://terminplaner.dfn.de/foodle.php?id=pgs1455pf2rfpwri

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Discussion and Feedback

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Giving feedback

Authors: Anne Zilles[1]; Olga Kambeitz[None]; Simon Niemes[2]

[1] *EKP*

[2] *simon.niemes@kit.edu*

The tutorial 'Giving feedback' will focus on an open discussion accompanied by a moderator. Based on the experience of the participants, we want to encourage a discussion about giving feedback after rehearsals of talks. Using methods of adult education, the goal of the tutorial is to deduce a code of conduct for this situation which can be used in our everyday (research) life. After a short introduction of general group discussion rules, a brief video will demonstrate a typical feedback situation. Using the video as a reference, the group will develop feedback rules using the 'Metaplan technique'. Those rules will help to raise awareness of how to give constructive feedback in a helpful and polite manner, an important skill for cooperative work.

Summary:

If you are interested in pictures of the single "clusters" please contact Anne Zilles [-at- kit.edu]

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Genetic algorithms

Authors: Dmitriy Kostunin[1]; Felix riehn[1]; Roman Hiller[1]

[1] *IKP*

Corresponding Author: felix.riehn@kit.edu

Optimization problems are very common in high energy particle (astro-) physics. In this tutorial we want to BROADen the typical optimization toolkit known to physicists by introducing so-called genetic algorithms (GA). These algorithms are very powerful when it comes to optimizing abstract or high dimensional problems.

In this course we want to discuss the main concepts and give an overview of the most common problems GAs are applied to. A large part of the course will be dedicated to experimenting with existing implementions so that the participants can form their own opinion.

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Version Control with Git

Authors: David Kunz[1]; Eileen Kuehn[2]; Robin Roth[3]; Sarah Mueller[4]

[1] *TTP, KIT*

[2] *SCC, KIT*

[3] *KIT, ITP*

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Git is a distributed version control system everybody should know about. It is the way to share code. It is the way to contribute to open source projects. But it is also the way to manage personal projects like the PhD thesis. It makes you capable of tracking changes (including errors), automatic backups, branching and merging, and so on.

The workshop will give an introduction to Git, and show how it makes your workflow more productive day-to-day. After a general presentation, there will be a hands-on group session. This will not only cover the basics but also more advanced topics like merging different branches including conflicting changes.

Bus Transfer / **32**

Bus travel back to Karlsruhe

Summary:

We will have stops at CN and CS

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What is a particle

Authors: Ivan Shvetsov[1]; Manuel Kambeitz[2]; Michael Ziegler[3]

[1] *IEKP*

[2] *EKP, KIT*

[3] *EKP*

The tutorial “What is a particle?” gives an introduction to particle physics from an experimentalist point of view. It is targeted at people working outside particle physics. The first part is an overview over the Standard Model of particle physics. The most important particles and interactions are explained. Then the history of the most important discoveries leading to our current knowledge are summarized, especially the recent confirmation of the Higgs mechanism. The last part of the tutorial covers the present experiments performed on the field of particle physics with the focus on experiments with a contribution from KIT.

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Introduction to Boosted Decision Trees - A multivariate approach to classification problems

Author: Simon Fink[1]

Co-authors: Christian Boeser [2]; Steffen Roecker [2]

[1] *KIT*

[2] *IEKP*

Corresponding Author: simon.fink@kit.edu

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In times of ever growing amounts of data and meta-data it is simply not possible to analyse this vast mass by hand effectively. Multivariate techniques offer an elegant way to cope with this issue and are already a common tool in complex fields like particle physics.
One is often required to sort a dataset into two groups, a so called classification. Depending on the problem these groups could be either yes or no, male or female, signal or background. Multivariate methods take advantage of internal correlations between given input variables and this classification variable to predict the likely outcome.
The focus of this session will be on Boosted Decision Trees, a powerful but nevertheless still easily understandable method for classification problems. As an introduction we will show problems and how exactly multivariate methods are able to solve them. Furthermore a demonstrative example how to approach a classification problem and how to solve it effectively using Boosted Decision Trees will be provided.

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Gnuplot Workshop

Authors: Benedikt Zimmermann[1]; Thomas Schuh[2]

[1] *KIT*

[2] *KIT - Karlsruhe Institute of Technology (DE)*

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or applicable methods for research. Every tutorial lasts one hour and the presenter is free to use any didactic method like PowerPoint, whiteboard, or interactive methods such as exercises on programs installed on the students' laptops.
The workshop program is complemented by invited talks and discussions.

The workshop "Gnuplot" will give a short introduction into the plotting program Gnuplot. The workshop deals with three topics. First we will show how to plot, manipulate and adjust functions and graphs in general, by using Gnuplot. Secondly we will present output terminals in general and show how to produce and include made to measure plots into Latex files in a comfortable way. Furthermore we deal with more complicated problems using control structures in Gnuplot.
Every part consists of a short presentation with illustrated examples on the one hand. On the other hand there will be time for exercises complementing the presentation.
One important objective, we want to meet in this tutorial, is to introduce Gnuplot as a plotting program for every day use. Our other main objective is to show the applicability of Gnuplot for producing neat diagrams for presentations and publications.

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Kassiopeia particle tracking framework

Authors: Moritz Erhard[1]; Nikolaus Trost[2]; Stefan Groh[3]

[1] *EKP*

[2] *KIT*

[3] *IEKP*

The Kassiopeia particle tracking framework is an object-oriented software package utilizing modern C++ techniques, written originally to meet the needs of the Katrin collaboration. Kassiopeia's target physics problem consists of simulating particle trajectories governed by arbitrarily complex differential equations of motion, continuous physics processes that may in part be modeled as terms perturbing that equation of motion, stochastic processes that occur in flight such as bulk scattering and decay, and potentially stochastic surface processes occuring at interfaces, including transmission and reflection effects.
This entire set of computations takes place against the backdrop of a fully-featured geometry package which serves a variety of roles, including initialization of electromagnetic field simulations, gas flow simulations, and the support of state-dependent algorithm-swapping and behavioral changes.
In this tutorial a short introduction to the software is given and afterwards the students can run the simulation by themselves and track particles through the katrin mainspectrometer, investigating the properties of the MAC-E-Filter technique.
Additionally a short overview of the visualization library VTK and the tool paraview is given and how they can be used to create fancy 3d pictures of the used geometry and the particle tracks just created before.

Soft Skills / **38**

Personal Competence Profiling

Authors: Carolin Heidt[1]; Philipp Frings[2]

[1] *ITTK/ITEP*

[2] *Institute for Theoretical Particle Physics (TTP)*

During the PhD, not only expertise in the own field of study, but also personal competences should be improved to allow a successful professional development. However, time for personal reflection and help to choose from many qualification possibilities is often not given. Therefore, this tutorial focuses on a self-assessment, where each participant fills in a competence questionnaire provided by the PEW (Personal Entwicklung). With this self-reflection, the participants have the chance to rate their abilities in the fields of professional, methodological, social and personal competences. In group discussions, the main skills and strengths that have already been developed, as well as the possibilities for further development are identified and summarized in a personal competence profile. Briefly, possible qualification programs are presented.