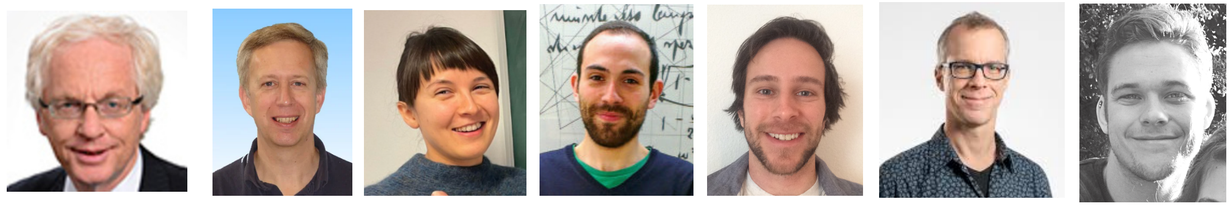
Terascale Alliance Statistics School
DESY Hamburg, 2-5 April 2024

Tuesday ~~INTRODUCTION~~ → Today Closing

PHYSICS AT THE TERA SCALE
Helmholtz Alliance

DESY.

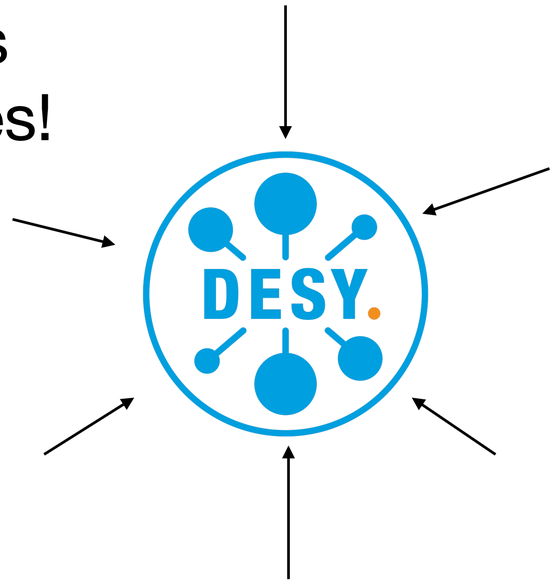
- Thanks to the lecturers/Tutors



For their extremely nice/useful/educational presentations, tutorials and discussions 😍

- Thanks to the local organisers: **OB, Andreas Hinzmann, Dirk Kruecker, Isabell Melzer-Pellmann, Inna Henning, Anna Gerhardt**

you, the 60+ participants coming from various places!



Thank you for your interest/ active/lively participations

Please fill the evaluation of the statistics school at
https://indico.desy.de/event/43398/surveys/577

Have a nice and safe trip back home!

🤦‍♀️🤷‍♂️🤦‍♀️

Terascale Alliance Statistics School
DESY Hamburg, 2-5 April 2024

INTRODUCTION

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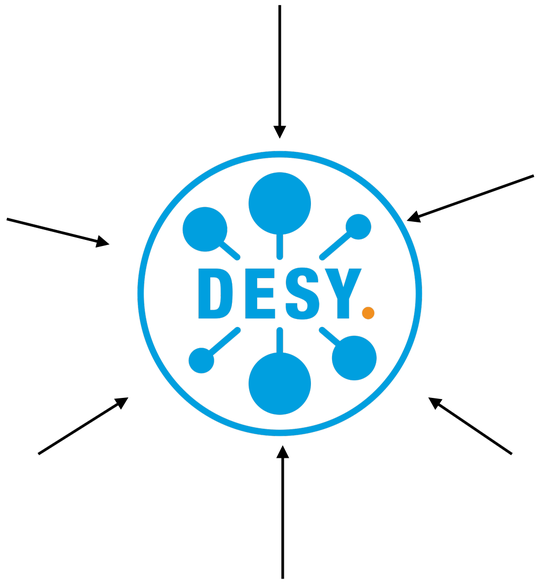


DESY orga team: Olaf Behnke, Andreas Hinzmann, Isabell Melzer-Pellmann, Anna Gerhardt (secretary), Inna Henning (secretary)

For any questions/suggestions/comments write email to: anacen@desy.de,olaf.behnke@desy.de

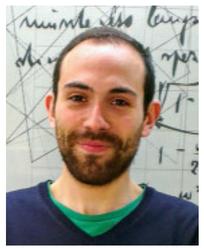
Scientific program

https://indico.desy.de/event/43398/timetable/

Statistical Inference

Glen Cowan | Aliya Nigamova | Nick Wardle | Kyle Cormier






Lectures — Higgs Combine Tutorial

Probability, Hypothesis Testing,
Parameter Estimation, Confidence Intervals, Asymptotics, …

Machine Learning

Tilman Plehn

Likelihood Function for one event

$$L(x_1, x_2, \ldots, x_{N-Feature};\ \theta)$$

Lectures

Introduction to the main ML concepts/tools

The Core

Likelihood Function
$L(x;\theta)$,
x = observed data,
θ = fit parameter(s)

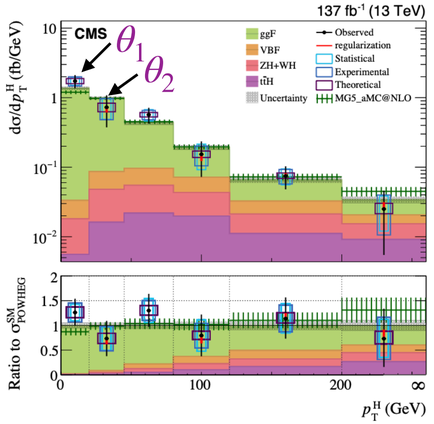
Example: $L \sim e^{\frac{(x-\theta)^2}{2\sigma^2}}$

Unfolding

Vincent A. Croft

Lectures

Measuring distributions — correcting for detector smearing/acceptance/efficiency



CMS-HIG-19-002

H→WW

Uncertainties

Roger Barlow

Lectures

Introduction
Asymmetric Uncertainties
Example: exponential lifetime

$$L(t;\tau) = \tau \cdot e^{-t/\tau}$$

plus School Summary on Friday

Glen Cowan

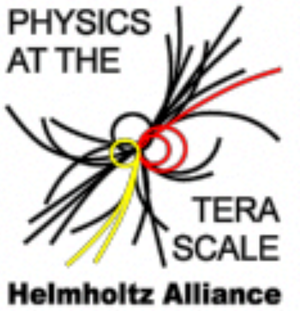
Lectures

Error on Error

Computing information

- WLAN: connect to “Science-Hotspot” (easy registration) or “Eduroam”
- Combine Tutorial: Detailed Information will be given Tuesday afternoon on the spot **https://gitlab.cern.ch/anigamov/combine-tutorial-2023/-/blob/master/README.md**
- We will **not** stream the School in ZOOM

Code of conduct

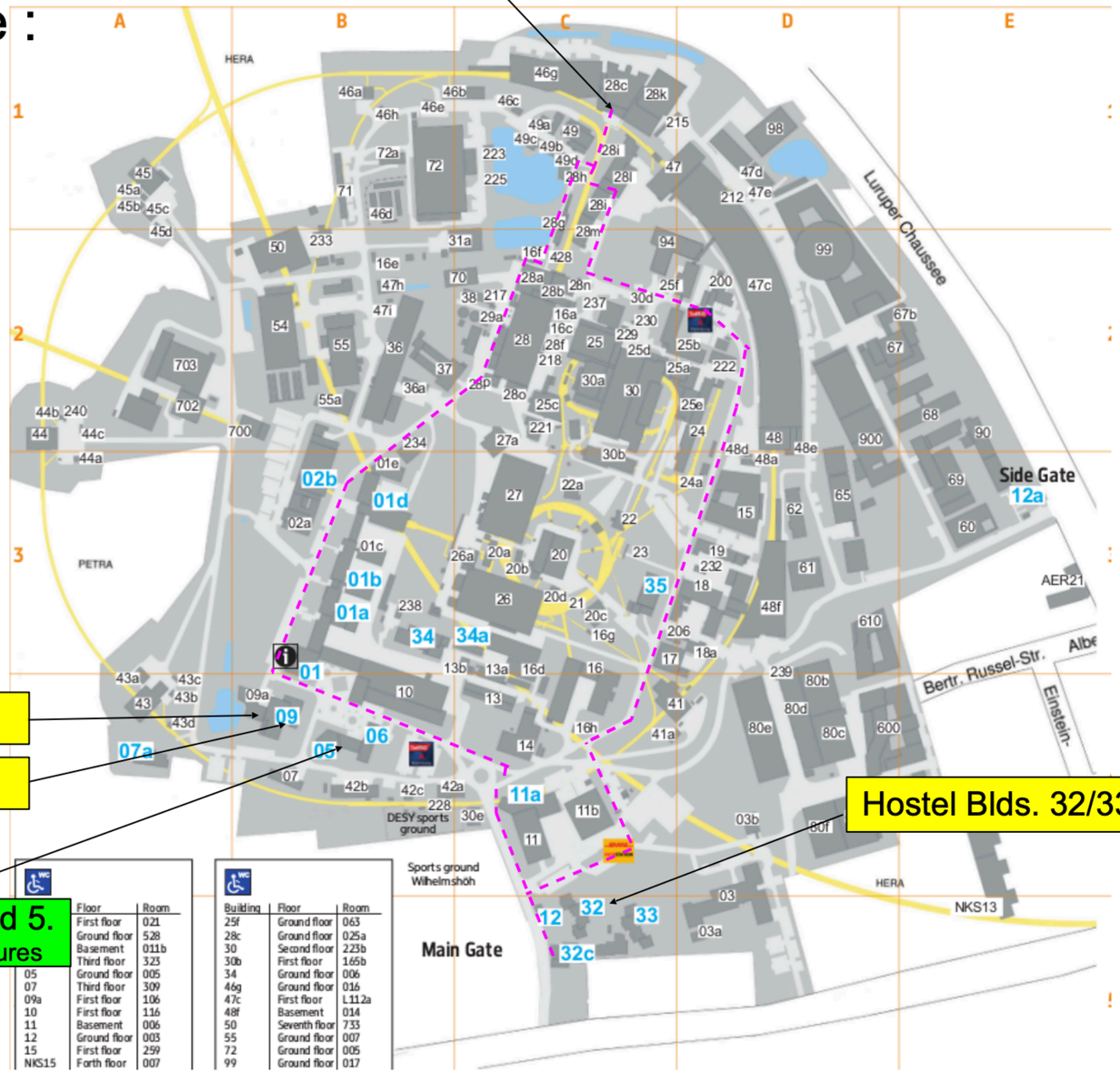


- The Helmholtz Alliance 'Physics at the Terascale' consists of members with varied national origin, ethnic background, race, gender identity, sexual orientation, gender, age, physical ability, and religion.
- As a community, we are committed to being positive and inclusive in all regards. Members of the Terascale Alliance and participants of all Terascale events must maintain a professional environment in an atmosphere of tolerance and mutual respect and abstain from all forms of harassment, abuse, intimidation, bullying, and mistreatment of any kind.
- This includes, but is not limited to, intimidation, sexual or crude jokes or comments, inappropriate anonymous emails, offensive images, and unwelcome physical conduct.
- Keep in mind that behavior and language deemed acceptable to one person may not be to another.
- We commit to helping our community adhere to this code of conduct and speak up when we see possible violations of it.
- In the event that the letter or the spirit of this code has been violated, appropriate action will be taken.

https://indico.desy.de/event/33888/attachments/80565/105358/Code_of_Conduct_Terascale_Slide.pdf

Central school venue → Flash Seminar Room 28c

The DESY Site :



Floor	Room
First floor	021
Ground floor	528
Basement	011b
Third floor	323
Ground floor	005
Third floor	309
First floor	106
First floor	116
Basement	006
Ground floor	003
First floor	259
Forth floor	007

Building	Floor	Room
25f	Ground floor	063
28c	Ground floor	025a
30	Second floor	223b
30b	First floor	165b
34	Ground floor	006
46g	Ground floor	016
47c	First floor	L112a
48f	Basement	014
50	Seventh floor	733
55	Ground floor	007
72	Ground floor	005
99	Ground floor	017

Food

You can buy Lunch and Breakfast in DESY Canteen & Cafeteria

https://desy.myalsterfood.de/

School Dinner takes place Wednesday 7-9 pm in Canteen extension

Dinner places

https://indico.desy.de/event/43398/page/4942-restaurants-in-the-vicinity-of-desy

Please take note: this is just a small selection, based on personal experiences

Terascale Statistics School 2024

Apr 2 – 5, 2024
DESY Hamburg
Europe/Berlin timezone

Enter your search term

Terascale School Support
anacen@desy.de

Restaurants in the vicinity of DESY

Most of the Restaurants below are situated in Ottensen, the nearest downtown quarter ~5km from DESY, reachable by bus, e.g. lines 1 and 2, within ~20-30 minutes.

It maybe worthwhile to buy a daily group ticket for 14,10 Euro, valid for up to 5 persons.

Timetables can be found here. Please take note that the Hamburg City Centre is not the most lively place for going out in the evening, the "action" is mostly in other places like Ottensen, Schanzenviertel, Portuguese quarter or St. Pauli.

- Klempau's Biergarten (Bavarian beergarden, reachable via footwalk from DESY)
- Panda's Kueche (Asian)
- Farina meets Mehl (exquisite Pizza)
- Da MIchele (Best Pizza in Hamburg?)
- Scotty's (Typical Hamburg Kneipenrestaurant)
- L'Orient (modern libanese kitchen)
- Wild Rice (Asian)
- Green Papaya (Asian)
- Otto's Burger (The name says it)
- Il Gambero (italian)
- Burgerlich (in city centre)

Please take note that the above list is just a small selection of recommended restaurants, based on our personal experiences, there is much more to find/discover in Hamburg!

Program of today

Enjoy!

Tuesday, April 2

10:00 AM → 11:00 AM **Registration** — 1h — Seminarraum Flash

11:00 AM → 11:05 AM **Welcome** — 5m — Seminarraum Flash

Speakers: Isabell Melzer-Pellmann (Deutsches Elektronen-Synchrotron DESY), Olaf Behnke (CMS (CMS Fachgruppe TOP))

11:05 AM → 12:30 PM **Statistical Inference Lecture 1** — 1h 25m — Seminarraum Flash

Plan for Lectures 1 and 2:
- Quick review of probability, frequentist vs. Bayesian approaches
- Parameter estimation, maximum likelihood, asymptotic properties of MLEs
- Hypothesis tests – general formalism, p-values
- Confidence intervals from inversion of test, from likelihood function
- General analysis including nuisance parameters, asymptotics

Speaker: Glen Cowan (RHUL)

12:30 PM → 2:00 PM **Lunch Break** — 1h 30m — Canteen (DESY)

2:00 PM → 3:30 PM **Combine Tool Tutorial I** — 1h 30m — Seminarraum Flash

Plan for Tutorial parts I - IV:
In this tutorial we will go through the main features of the Combine software package which provides a command-line interface to many different statistical techniques, available inside RooFit/RooStats, that are used widely inside CMS.
In the first part of the tutorial we'll explain the format of the Combine configuration file (datacard), and then discuss how to set up a simple counting experiment, followed by the shape analysis setup using ROOT histograms as inputs. Then we'll look at how to build simultaneous fits using independent categories, add systematic uncertainties and extract the limits or uncertainty estimates for the parameters of interest. Second part of the tutorial describes how to construct parametric models with RooFit and extract the measurements using Combine.

Speakers: Aliya Nigamova (University of Hamburg), Kyle Cormier (Uni Zurich), Nicholas Wardle

Combine setup

3:30 PM → 4:00 PM **Coffee Break** — 30m — Seminarraum Flash

4:00 PM → 5:30 PM **Combine Tool Tutorial II** — 1h 30m — Seminarraum Flash

Speakers: Aliya Nigamova (University of Hamburg), Kyle Cormier (Uni Zurich), Nicholas Wardle