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# Higgs Analysis Walk Through Tutorial Part 1

*Monday 3 July 2023 15:00 (3 hours)*

DESY Terascale Statistics School - July 2023
What: description analysis walkthrough session
Who: Oliver Rieger, Zef Wolffs, Ivo van Vulpen

Course description

The analysis walkthrough is a hands-on session in which we will address, in a 'real life'example, several of the statistics topics that were covered in the lectures. More concretely: we will study the four-muon invariant mass distribution in the Higgs boson decay to four charged muons to explore three different topics:
1. Significance (Poisson distribution, p-values, optimizations)
2. Likelihood fits (parameter estimation, side band fits, background uncertainty)
3. Hypothesis testing (test statistic, toy data-sets, limits)

Goal of the exercises is to guide participants through the various steps without using the standard toolkits, i.e. we'll focus on the concepts and program as much as we can ourselves.

Set-up and computing requirements:
After an introduction lecture all exercises and related background information can be accessed through a dedicated website.
As participant you can use the Root set-up on your laptop (Option 1 below),
or the DESY computing cluster (Option 2 below) for which guest accounts will be provided by the workshop organisers.
Through a GitLab repository all participants have access to all the material: exercises, data-sets, scripts, background information and, not unimportant, the answers to the exercises. Details on the GitLab repository and the website will be provided later.

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**Option 1: Run Root locally on the laptop**

We will run the software locally on the laptop. This requires that you have
Root installed. If that is not the case you can follow the instructions
here: https://root.cern/install/

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**Option 2: Run on DESY cluster from laptop**

We have rented guest accounts on the DESY Cluster, where
tutorials can be run. The only requirement for participants is a
laptop that allows an SSH connection.
- For Linux and MacOS this can be done directly from the terminal
- For Windows machines you need an SSH client (Putty) or chrome extension
secure SSH or setup via VS code and SSH keys & config.

ssh -Y schoolxx@naf-cms.desy.de with xx in range [00,79]
pwd: p9FqFt7f

## Summary

**Presenter:** VAN VULPEN, Ivo (NIKHEF)