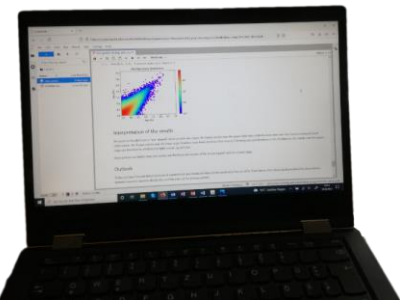


# Online Masterclass built on the KASCADE Cosmic ray Data Centre

## Educational Goals

- Understand the physics of cosmic rays
- Learn about the air shower experiment KASCADE-Grande and the data portal KCDC
- Comprehend the reconstruction of primary particle properties using simulations
- Be aware of the principles of open data
- Discover how scientist analyze large amount of data

## Technical Requirements & Implementation



- Identical workspace for all participants
- Easy and fast installation and setup of the working environment
- Fast processing of large amount of data
- Use well-known data format
- Interactivity
- Minimal programming knowledge required

-> Jupyter Notebooks with Python3 kernel in JupyterHub environment, popular libraries pandas and matplotlib, well-known data format as .txt and .csv



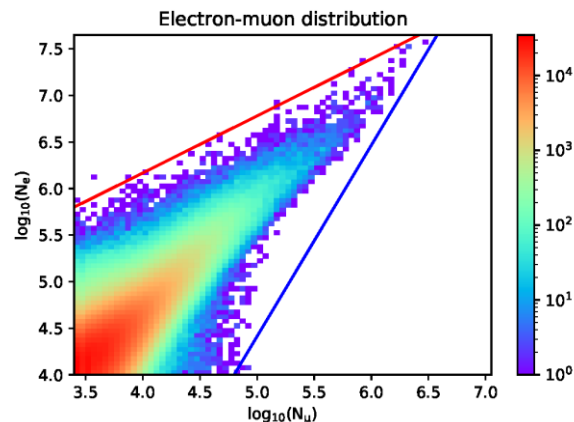
KCDC web portal  
<https://kcdc.iap.kit.edu>

# Online Masterclass built on the KASCADE Cosmic ray Data Centre

## Data analysis tutorials

Two different tutorials for different levels of prior experience were developed. By completing exercises in the tutorials, the students have learned to...

- pre-process and plot large amount of data
- interpret the data and draw conclusions
- compare experimental data and simulations
- derive the primary mass from the muon to electron ratio of an air shower



## First event using the KCDC Masterclass

- Embedded in International Cosmic Day and Woche der Teilchenwelt
- Online event for pupils from an Austrian school
- Introductory talks on Astroparticle physics, air shower reconstruction, basics of programming and the KASCADE-Grande experiment
- Data analysis in breakout sessions, each guided by one tutor
- Final discussion on results

