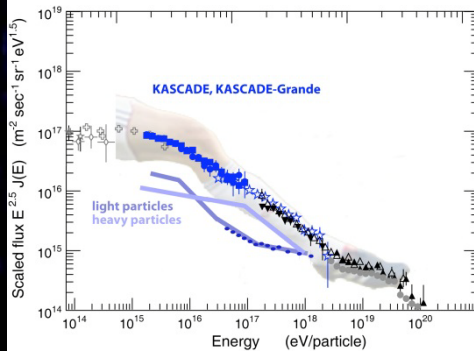
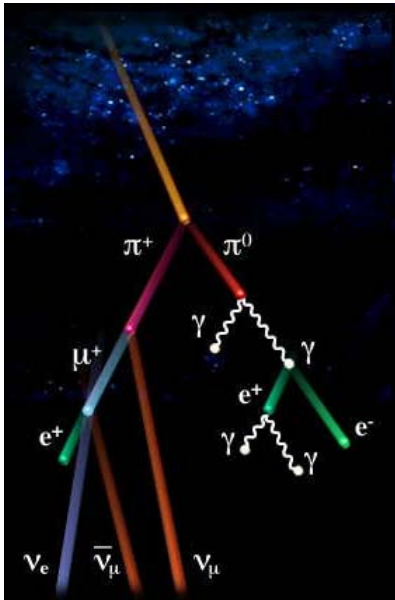


# The KASCADE Cosmic ray Data Center - providing open access to astroparticle physics research data

Dr. Benjamin Fuchs  
Karlsruhe Institute of Technology

- The right tool for the job
  - Why a web portal
- A look under the hood
  - How to get your hands on the data
- On law and order
  - Licenses for KCDC
- On teaching and learning
  - KCDC for teachers and pupils
- The future, an undiscovered country
  - Next steps in KCDC

## KARlsruhe Shower Core and Array DETector



- high energy cosmic ray measurements by detection of air showers
- physics topics under investigation
  - sources, acceleration mechanisms and propagation of cosmic rays
  - knee structure of the energy spectrum
  - search for anisotropy in the incident direction
  - hadronic interactions in the atmosphere

- data provider
  - free, unlimited, open access to KASCADE cosmic ray data
  - selection of fully calibrated quantities
  - reliable data source
  - guaranteed data quality
- information platform
  - experiment description
  - meta information for data analysis
  - physics background
  - tutorials focused on teachers and pupils

- open data publication
  - KIT and Helmholtz signed the “Berlin Declaration on Open Data and Open Access”
  - explicitly requests the use of web technologies
- free unlimited access for everyone
  - requires extensive documentation
  - non-scientific audience in focus
  - provision of examples, data interpretation, experimental description
- modern technologies
  - internet access
  - interactive data selections

## Web pages

- Data selection
- Meta information
- Tutorials
- Downloads

## Job system

- Parallel processing
- Scalability

## Server infrastructure

- CMS System
- User Management

## Web interface

- Administration
- Monitoring

## Databases

- Providing the data
- Providing selections

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**KCDC Homepage**

[KCDC Motivation](#)

[Regulations](#)

[Information](#) ▶

[Announcements](#) ▶

[FAQs](#)

[DATA Shop](#)


[User Page](#)

[Lehrmaterial](#)

[Report a Bug](#)

## Welcome to KCDC

The aim of the project **KCDC** (KASCADE Cosmic Ray Data Centre) is the installation and establishment of a public data centre for high-energy astroparticle physics based on the data of the KASCADE experiment. KASCADE was a very successful large detector array which recorded data during more than 20 years on site of the KIT-Campus North, Karlsruhe, Germany (formerly Forschungszentrum, Karlsruhe) at 49,1°N, 8,4°O; 110m a.s.l. KASCADE collected within its lifetime more than 1.7 billion events of which some 425.000.000 survived all quality cuts. Initially about 160 million events are available here for public usage.



**KASCADE  
Karlsruhe Shower Core  
and Array Detector**

**Institute for Nuclear Physics (IKP)**  
KIT Campus North

**Address:**  
Institute for Nuclear Physics  
Karlsruhe Institute of Technology  
Hermann-v. Helmholtz-Platz 1  
D-76344 Eggenstein-Leopoldshafen

**Postal Address:**  
Institute for Nuclear Physics  
Karlsruhe Institute of Technology  
Postbox 3640  
D-76021 Karlsruhe


**Phone:** +49/721/608-23546  
**Fax:** +49/721/608-23548


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**E-Mail:**  
[ikp-kcdc\[at\]lists.kit.edu](mailto:ikp-kcdc[at]lists.kit.edu)

**Downloads**  
[KCDC Manual \(english\)](#)

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 Karlsruhe Institute of Technology

  
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[\[kcdadmin\]](#) | [HOME](#) | [KIT](#) | [IKP](#) | [IMPRESSUM](#) | [ADMIN](#) | [LOGOUT](#)

- KCDC Homepage
- KCDC Motivation
- Regulations
- Information ▶
- Announcements ▶
- FAQs
- DATA Shop
- User Page
- Lehrmaterial
- Report a Bug


## KCDC Data Shop

Selection	Cuts	Submission														
<ul style="list-style-type: none"> <li style="border: 1px solid gray; padding: 5px; margin-bottom: 5px; background-color: #f0f0f0;">Full Data</li> <li style="border: 1px solid gray; padding: 5px; margin-bottom: 5px; background-color: #f0f0f0;">High Energy</li> <li style="border: 1px solid gray; padding: 5px; margin-bottom: 5px; background-color: #f0f0f0;">Vertical Showers</li> </ul>	<p style="text-align: center; margin-bottom: 5px;"><i>"Full data selection"</i> Quantities selected for retrieval</p> <table style="width: 100%; text-align: center;"> <tr> <td style="border: 1px solid gray; padding: 5px; background-color: #00b050; color: white;">Energy</td> <td style="border: 1px solid gray; padding: 5px; background-color: #00b050; color: white;">Core Position</td> </tr> <tr> <td style="border: 1px solid gray; padding: 5px; background-color: #00b050; color: white;">Zenith angle</td> <td style="border: 1px solid gray; padding: 5px; background-color: #00b050; color: white;">Azimuth angle</td> </tr> <tr> <td style="border: 1px solid gray; padding: 5px; background-color: #00b050; color: white;">Electron Number</td> <td style="border: 1px solid gray; padding: 5px; background-color: #00b050; color: white;">Muon Number</td> </tr> <tr> <td style="border: 1px solid gray; padding: 5px; background-color: #00b050; color: white;">Air Temperature</td> <td style="border: 1px solid gray; padding: 5px; background-color: #00b050; color: white;">Air Pressure</td> </tr> <tr> <td style="border: 1px solid gray; padding: 5px; background-color: #00b050; color: white;">Local Date (UTC)</td> <td style="border: 1px solid gray; padding: 5px; background-color: #00b050; color: white;">Global Time</td> </tr> <tr> <td style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">Micro Time</td> <td style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">Time of Day</td> </tr> <tr> <td style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">Run Number</td> <td style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">Event Number</td> </tr> </table>	Energy	Core Position	Zenith angle	Azimuth angle	Electron Number	Muon Number	Air Temperature	Air Pressure	Local Date (UTC)	Global Time	Micro Time	Time of Day	Run Number	Event Number	<div style="text-align: right; font-size: 0.8em; margin-bottom: 5px;"><span style="color: red; font-weight: bold;">i</span></div> <p><b>Full Data Set</b></p> <p>The Full Data Set holds all events presently available for download. Stored are 158.718.853 events with all quantities available for download and no cuts applied. The size of the download zip file is 5.5 GB. This data set is mutable in quantities selected as well as in applied cuts.</p> <p><a href="#">[ details-&gt; kcdc-manual ]</a></p>
Energy	Core Position															
Zenith angle	Azimuth angle															
Electron Number	Muon Number															
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- KCDC Homepage
- KCDC Motivation
- Regulations
- Information ▶
- Announcements ▶
- FAQs
- DATA Shop
- User Page
- Lehrmaterial
- Report a Bug

## KCDC Data Shop


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## KCDC Data Shop

Selection
Cuts
Submission

**"Full data selection"**  
Define cuts on quantities selected for download

<b>Cuts on Energy</b>	from <input style="width: 50px;" type="text" value="1e16"/> to <input style="width: 50px;" type="text" value="1e17"/> eV	<input type="button" value="add cut"/>
<b>Cuts on Core Position X</b>		<input type="button" value="add cut"/>
<b>Cuts on Core Position Y</b>		<input type="button" value="add cut"/>
<b>Cuts on Zenith angle</b>		<input type="button" value="add cut"/>
<b>Cuts on Azimuth angle</b>		<input type="button" value="add cut"/>
<b>Cuts on Electron Number</b>		<input type="button" value="add cut"/>
<b>Cuts on Muon Number</b>		<input type="button" value="add cut"/>

**Cuts on Energy** **i**


The available data sets are within the Energy range  $10^{14}$  to  $10^{17}$  eV. The values have to be provided in  $\log_{10}(E)$  like  $1.123e14$  in [eV].

[\[ details -> kcdc-manual \]](#)


**Information**


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Helmholtz Open Access Webinars on Research Data  
Webinar 15 - 8 / 12 November 2013




HELMHOLTZ  
GEMEINSCHAFT  
Open Access






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Karlsruhe Institute of Technology



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- KCDC Homepage
- KCDC Motivation
- Regulations
- Information ▶
- Announcements ▶
- FAQs
- DATA Shop
- User Page
- Lehrmaterial
- Report a Bug

## KCDC Data Shop

Selection	Cuts	Submission																																																												
<p style="text-align: center;"><b>"Full data selection"</b> Check your order and submit request</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: left;"> <thead> <tr> <th style="width: 20%;">Parameter</th> <th style="width: 15%;">range:</th> <th style="width: 15%;">min</th> <th style="width: 15%;">max</th> <th style="width: 35%;">Unit / Status</th> </tr> </thead> <tbody> <tr> <td>Energy</td> <td>range:</td> <td>1.00e+16</td> <td>to 1.00e+17</td> <td><math>\epsilon V</math></td> </tr> <tr> <td>Core Position X</td> <td>range:</td> <td>-91.0</td> <td>to 91.0</td> <td>m No cuts applied</td> </tr> <tr> <td>Core Position Y</td> <td>range:</td> <td>-91.0</td> <td>to 91.0</td> <td>m No cuts applied</td> </tr> <tr> <td>Zenith angle</td> <td>range:</td> <td>0.0</td> <td>to 60.0</td> <td><math>^\circ</math> No cuts applied</td> </tr> <tr> <td>Azimuth angle</td> <td>range:</td> <td>0.0</td> <td>to 360.0</td> <td><math>^\circ</math> No cuts applied</td> </tr> <tr> <td>Electron Number</td> <td>range:</td> <td>1.00e+01</td> <td>to 5.00e+08</td> <td>No cuts applied</td> </tr> <tr> <td>Muon Number</td> <td>range:</td> <td>1.00e+01</td> <td>to 5.00e+06</td> <td>No cuts applied</td> </tr> <tr> <td>Micro Time</td> <td>range:</td> <td>0</td> <td>to 999999999</td> <td><math>\mu s</math> No cuts applied</td> </tr> <tr> <td>Time of Day</td> <td>range:</td> <td>0.0</td> <td>to 235959.0</td> <td>s No cuts applied</td> </tr> <tr> <td>Run Number</td> <td>range:</td> <td>282</td> <td>to 4683</td> <td>No cuts applied</td> </tr> <tr> <td>Event Number</td> <td>range:</td> <td>1</td> <td>to 3000000</td> <td>No cuts applied</td> </tr> </tbody> </table> <p style="text-align: center; margin-top: 10px;"><a href="#" style="background-color: #ff9900; color: black; padding: 5px 15px; text-decoration: none;">submit retrieval request</a></p>			Parameter	range:	min	max	Unit / Status	Energy	range:	1.00e+16	to 1.00e+17	$\epsilon V$	Core Position X	range:	-91.0	to 91.0	m No cuts applied	Core Position Y	range:	-91.0	to 91.0	m No cuts applied	Zenith angle	range:	0.0	to 60.0	$^\circ$ No cuts applied	Azimuth angle	range:	0.0	to 360.0	$^\circ$ No cuts applied	Electron Number	range:	1.00e+01	to 5.00e+08	No cuts applied	Muon Number	range:	1.00e+01	to 5.00e+06	No cuts applied	Micro Time	range:	0	to 999999999	$\mu s$ No cuts applied	Time of Day	range:	0.0	to 235959.0	s No cuts applied	Run Number	range:	282	to 4683	No cuts applied	Event Number	range:	1	to 3000000	No cuts applied
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**Request Submit Info** **i**

Overview on the parameters selected and their ranges after the user cuts were applied. To change the cuts or add deselected parameters go back to the 'Cuts' page or to the 'Selection' page respectively.


**Note :** Only 4 cuts per parameter are displayed, even though more cuts are selected and active.


[\[ details-> kcdc-manual \]](#)

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- KCDC Homepage
- KCDC Motivation
- Regulations
- Information
- Announcements
- FAQs
- DATA Shop
- User Page**
- Lehrmaterial
- Report a Bug

## KCDC User Page


MY JOBS | PROFILE | CHANGE PASSWORD | CLOSE ACCOUNT


**Your last requests were:**

Job from	Nov. 4, 2013, 11:20 a.m.	current status:	SUCCESS
<a href="#">Details</a> <a href="#">Delete</a> <a href="#">Resubmit</a> <a href="#">Download</a>			
Job from	Nov. 4, 2013, 12:08 a.m.	current status:	SUCCESS
<a href="#">Details</a> <a href="#">Delete</a> <a href="#">Resubmit</a> <a href="#">Download</a>			
Job from	Nov. 4, 2013, 12:08 a.m.	current status:	SUCCESS
<a href="#">Details</a> <a href="#">Delete</a> <a href="#">Resubmit</a> <a href="#">Download</a>			
Job from	Nov. 4, 2013, 12:01 a.m.	current status:	SUCCESS
<a href="#">Details</a> <a href="#">Delete</a> <a href="#">Resubmit</a> <a href="#">Download</a>			
Job from	Nov. 1, 2013, 10:50 p.m.	current status:	SUCCESS
<a href="#">Details</a> <a href="#">Delete</a> <a href="#">Resubmit</a> <a href="#">Download</a>			
Job from	Nov. 1, 2013, 10:49 p.m.	current status:	SUCCESS
<a href="#">Details</a> <a href="#">Delete</a> <a href="#">Resubmit</a> <a href="#">Download</a>			
Job from	Nov. 1, 2013, 11:34 a.m.	current status:	SUCCESS
<a href="#">Details</a> <a href="#">Delete</a> <a href="#">Resubmit</a> <a href="#">Download</a>			
Job from	Oct. 31, 2013, 4:09 p.m.	current status:	SUCCESS
<a href="#">Details</a> <a href="#">Delete</a> <a href="#">Resubmit</a> <a href="#">Download</a>			
Job from	Oct. 31, 2013, 4:02 p.m.	current status:	SUCCESS



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- KCDC Homepage
- KCDC Motivation
- Regulations
- Information
- Announcements
- FAQs
- DATA Shop
- User Page**
- Lehrmaterial
- Report a Bug

## Preselection Download Page

You have chosen the preselection "Full Data". [Download here](#)

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- open data publication
  - no ready available open data licence
- twofold issue – licence for web portal and data required
  - software licences usually based on EULAs
- KCDC approach
  - licence based on EULA model
  - flexible and adaptable to our needs
  - inclusion of good scientific practice
  - signed during registration & shipped with each data package

- licence details – following the industry
  - no warranty for damage by owner of web portal or data
  - no guarantee for availability or uptime
  - in case of disputes with local law EULA intention is conserved
  - changes possible at any time
  - termination of EULA at our digression
  
- open data components
  - free access to data and web portal
  - good scientific practice for work with data
  - commercial usage of data not prohibited
  - citation of collaboration, KIT, and the web portal mandatory
  - free redistribution of data “as is”

- KCDC EULA still work in progress
  - cooperation with KIT law department
  - adaption to open access and KCDC needs



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Regulations - Legal Aspects of KCDC

**KCDC Licence agreement (EULA)**

PLEASE READ THIS END USER LICENSE AGREEMENT ("EULA" OR "AGREEMENT") CAREFULLY. BY USING THE [kcdc.ikp.kit.edu](http://kcdc.ikp.kit.edu) WEBSITE AND RELATED WEBPAGES (THE "webportal"), OR BY USING ANY RELATED SERVICES YOU AGREE THAT THIS AGREEMENT IS ENFORCEABLE LIKE ANY WRITTEN CONTRACT SIGNED BY YOU. IF YOU DO NOT AGREE TO ALL OF THE TERMS OF THE AGREEMENT, CLICK ON THE BUTTON THAT INDICATES THAT YOU DO NOT AGREE TO ACCEPT THE TERMS OF THIS AGREEMENT (IF APPLICABLE) AND DO NOT CONTINUE THE USE OF THE webportal, THE PROVIDED DATA OR ANY RELATED SERVICES.

The software program, webportal, data and any files that are delivered to you by the Karlsruhe Institute of Technology (KIT) via online transmission or otherwise, as well as any printed materials and any online or electronic documentation (the "Manual"), and any and all copies and derivative works of the webportal and Manual for the KASCADE COSMIC RAY DATA CENTRE (KCDC) and related modules is the intellectual property of KIT, or any of its subsidiaries and affiliates and their licensors (collectively, "KIT"). Any and all uses of the webportal and provided data are governed by the following ("KCDC Terms") terms of this EULA which may be amended from time to time, together with any posted rules or instructions regarding a particular activity, job or other offering. The KASCADE data is distributed solely for use by authorized end users according to the KCDC Terms. Any use, reproduction, modification or distribution of the data not expressly authorized by the terms of this EULA is expressly prohibited. You are obliged to name in an appropriate manner KIT and KCDC as the owner of the data when publishing results, which are obtained utilizing the data.

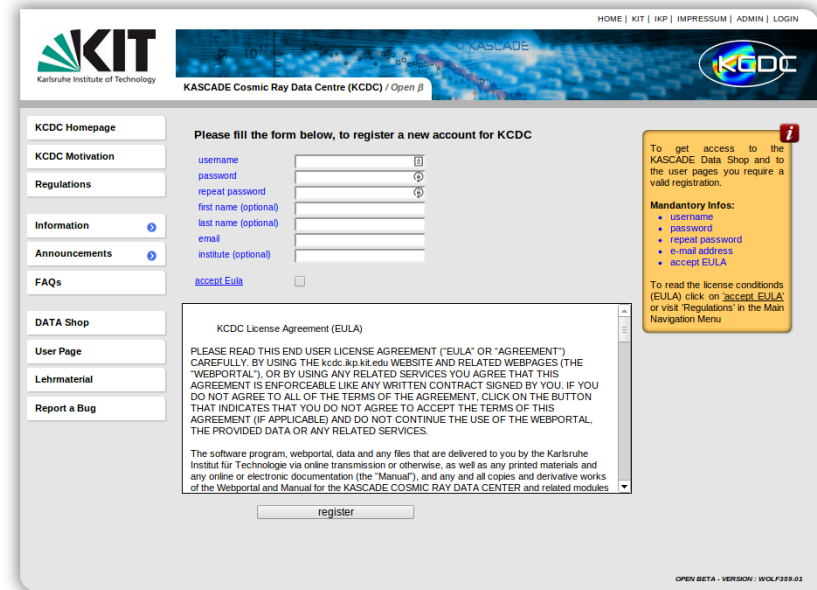
**I. Limited Use License**  
Subject to your agreement and continuing compliance with the KCDC Terms, KIT hereby grants to you a limited, personal, nonexclusive, non-transferable, non-assignable and fully revocable license to

- the Webportal and
- download and use the scientific data of the KCDC in compliance with good scientific practice

provided through the webportal or related online services for your non-commercial scientific purposes only. Commercial purposes are defined as projects for your own or third parties for which you are paid or granted values in lieu of cash for the use of the data. You agree that you will not, under any circumstances

- in whole or in part, copy, photocopy, reproduce, translate, reverse engineer, derive source code from, modify, disassemble, decompile, or create derivative works based on the KCDC material; provided, however, that you may make copies of the KCDC materials and the manuals for personal purposes only
- exploit the webportal or any of its parts, including without limitation the related services, for any commercial purpose or modify any files that are a part of the webportal or the provided data in any way not expressly authorized by KIT; intercept, emulate or redirect the communication protocols used by KIT in any way, for any purpose.
- facilitate, create or maintain any unauthorized connection to the webportal or the related services, including without limitation (a) any connection to any unauthorized server that emulates, or attempts to emulate, the Website; and (b) any connection using programs or tools not expressly approved by KIT.
- you are not allowed to sell, grant a security interest in or transfer reproductions of the webportal to other parties in any way not expressly authorized herein, or rent, lease, or license the webportal or provided data to others

\* you are not allowed to use means to monitor, modify or otherwise alter the provided data in your which are not in accord with "good scientific practice"



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Please fill the form below, to register a new account for KCDC

username

password

repeat password

first name (optional)

last name (optional)

email

institute (optional)

[accept EULA](#)


**Mandatory Info:**


- username
- password
- repeat password
- e-mail address
- accept EULA

To read the license conditions (EULA) click on ["accept EULA"](#) or visit ["Regulations"](#) in the Main Navigation Menu.


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- The goal: Providing the data to a general public
- Education portal (in development)
  - first tutorial is up (only in German at the moment)
  - knowledge database on KASCADE, astrophysics and related topics
  - step by step tutorials of simple data analyses
  - including a modern programming language code example
  - interpretation and discussion of the outcome
- Education portal (in development)
  - cooperation with local teachers and pupils
  - later offering to teachers dedicated lessons for high schools
  - and to pupils the access to the knowledge they need





KASCADE Cosmic Ray Data Centre (KCDC) / Open  $\beta$



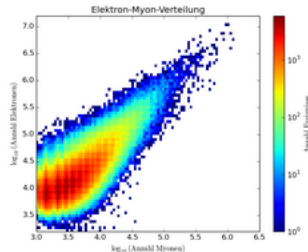
[\[kcdadmin\]](#) | [HOME](#) | [KIT](#) | [IKP](#) | [IMPRESSUM](#) | [ADMIN](#) | [LOGOUT](#)

- KCDC Homepage
- KCDC Motivation
- Regulations
- Information >
- Announcements >
- FAQs
- DATA Shop
- User Page
- Lehrmaterial
- Report a Bug

## Portal für Lehrer und Schüler

Auf dieser Seite sind interessante Aufgaben zusammengestellt rund um den Bereich kosmische Strahlung, die mit Hilfe der Daten des KASCADE Experimentes einige der Vorgänge ausserhalb und innerhalb unserer Erdatmosphäre veranschaulichen sollen. Diese Aufgabensammlung soll in Zusammenarbeit mit interessierten Lehrern und Schülern stetig erweitert werden und so zum Verständnis der kosmischen Strahlung beitragen.

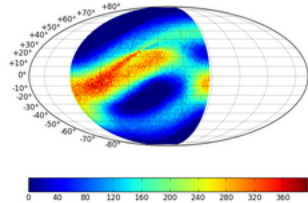
### Wie schwer ist ein kosmisches Teilchen?



Kosmische Strahlung besteht aus positiv geladenen Atomkernen der Elemente Wasserstoff (Ladung: 1 Proton) bis hin zu Eisen (Ladung: 26 Protonen) die sich mit nahezu Lichtgeschwindigkeit durch den Weltraum bewegen und zufällig auf die Erde treffen. Beim Eintritt in die Atmosphäre und Zusammenstoss mit den Luftmolekülen entstehen neue und verschiedenartige Teilchen (hauptsächlich Myonen und Elektronen), die wiederum Stösse auslösen usw. So entstehen Teilchenkaskaden, die mit fortschrittlichen Messgeräten (Detektoren) nachgewiesen werden. Diese Messungen der sogenannten Luftschaer am Erdboden ermöglichen es, Eigenschaften des ursprünglichen kosmischen Teilchens, wie die Masse oder die Energie, zu bestimmen.

[Hier gibt's : Aufgabe - Anleitung - Lösung](#)


### Was sieht KASCADE am Himmel?




Erdgebundene Detektorsysteme sehen in der Regel nur einen eng begrenzten Winkelbereich am Himmel. Das gilt für Teleskope und für Nachweisgeräte der kosmischen Strahlung gleichermaßen. Um den sichtbaren Bereich am Himmel darzustellen, müssen aus der gemessenen Einfallsrichtung der Teilchen und aus der Uhrzeit die Himmelskoordinaten bestimmt werden. Die Verteilung der Einfallsrichtungen können dann in einem 'Skyplot' dargestellt werden. Der hier gezeigte Skyplot ist übrigens die Grundlage für das KCDC-Logo. Ein weiterer Schritt der Analyse wäre nun eine Wichtung der einzelnen Winkelbereiche mit der jeweiligen Beobachtungszeit.

[Hier gibt's : Aufgabe - Anleitung - Lösung](#)

Helmholtz Open Access Webinars on Research Data  
Webinar 15 - 8 / 12 November 2013



Open Access



Announcements

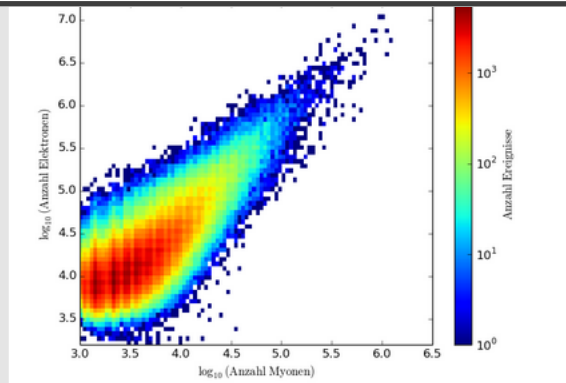
FAQs

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Diese Datei kann unter <https://kcdc.ikp.kit.edu/pdf/NeNmuTutorial.pdf> heruntergeladen werden.

#### Hinweis

Software Voraussetzungen:

- Python 2.7
- matplotlib
- numpy
- dateutil

#### Inhaltsverzeichnis

- Physikalischer Hintergrund
  - Warum ist die Masse von kosmischen Teilchen interessant?
  - Wie kann man die Masse bestimmen?
  - Detektion von Elektronen und Myonen im KASCADE Experiment
  - Ein-dimensionale Histogramme
  - Zwei-dimensionale Histogramme
- Analyse
  - Erstellung des Plots
- Interpretation des Plots

- Introduction
- physics background
- step-by-step analysis tutorial
- source code example
- Discussion
- Interpretation
- PDF download of all instructions

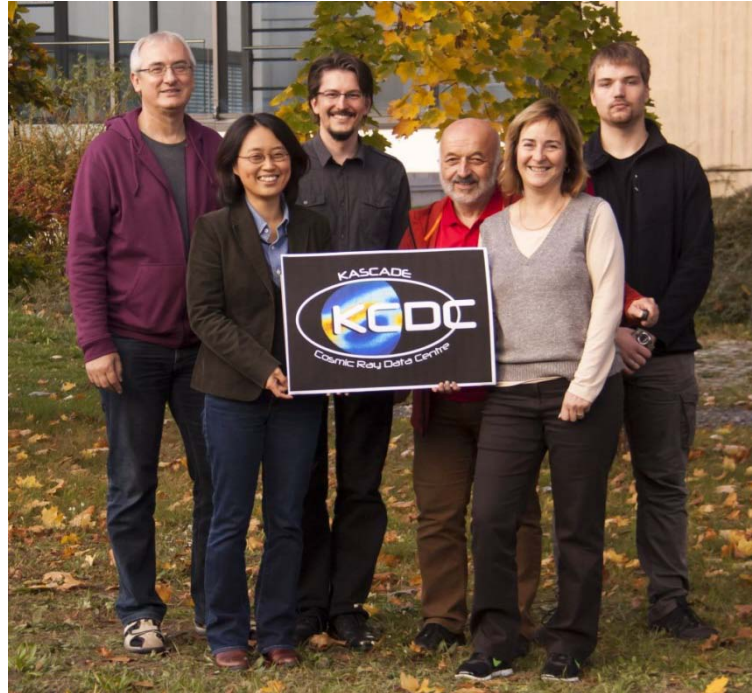
- 4. November 2013

- KCDC open beta release to public
- more than 150 million events of the KASCADE experiment
- **<https://kcdc.ikp.kit.edu>**

- Next steps

- extending the education portal
- building a knowledge data base
- improving data selection process
- adding more data sets of the KASCADE and other experiments

<https://kcdc.ikp.kit.edu>



**Questions?**