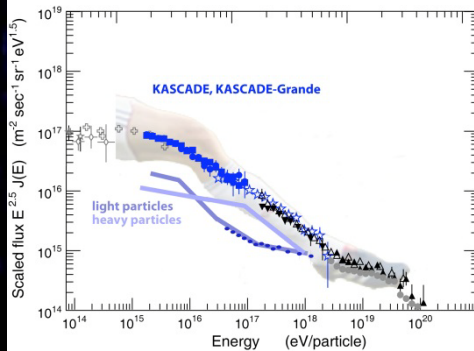
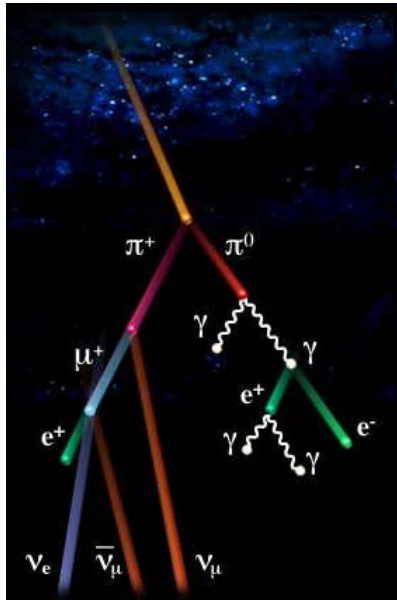


The KASCADE Cosmic ray Data Center - providing open access to astroparticle physics research data

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

Web pages

- Data selection
- Meta information
- Tutorials
- Downloads

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KASCADE Cosmic Ray Data Centre (KCDC) / Open β



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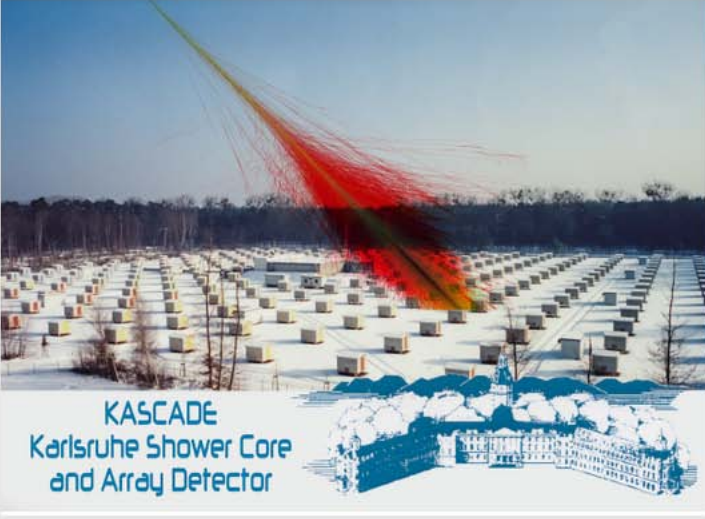
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Lehrmaterial

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

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

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

OPEN BETA - VERSION : WOLF359.01



Karlsruhe Institute of Technology





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KCDC Data Shop

Selection	Cuts	Submission
Full Data	"Full data selection" Quantities selected for retrieval	
High Energy		
Vertical Showers		
	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

Full Data Set i

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.

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

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KCDC Data Shop

Selection	Cuts	Submission
Full Data	"Full data selection" Quantities selected for retrieval	
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Vertical Showers	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

Global Time Info ⓘ

Besides UTC all event times are as well given in Unix Time reference (called GT in KASCADE), a counter for the seconds elapsed since 1.1.1970 0:00:00 UTC. The presently available KASCADE data range from 0846277797s (25.10.1996 21:09:57 UTC) to 1071878399s (19.12.2003 00:00:00 UTC).

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

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KCDC Data Shop

Selection
Cuts
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"Full data selection"
Define cuts on quantities selected for download

Cuts on Energy	add cut
from 1e16 to 1e17 eV	
Cuts on Core Position X	add cut
Cuts on Core Position Y	add cut
Cuts on Zenith angle	add cut
Cuts on Azimuth angle	add cut
Cuts on Electron Number	add cut
Cuts on Muon Number	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].

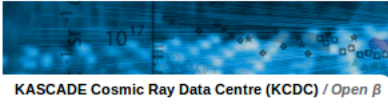
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Selection
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"Full data selection"
Check your order and submit request

Parameter	range:	min	max	unit	cuts
Energy	range:	1.00e+16	1.00e+17	eV	
Core Position X	range:	-91.0	91.0	m	No cuts applied
Core Position Y	range:	-91.0	91.0	m	No cuts applied
Zenith angle	range:	0.0	60.0	°	No cuts applied
Azimuth angle	range:	0.0	360.0	°	No cuts applied
Electron Number	range:	1.00e+01	5.00e+08		No cuts applied
Muon Number	range:	1.00e+01	5.00e+06		No cuts applied
Micro Time	range:	0	99999999	μs	No cuts applied
Time of Day	range:	0.0	235959.0	s	No cuts applied
Run Number	range:	282	4683		No cuts applied
Event Number	range:	1	3000000		No cuts applied

submit retrieval request

Request Submit Info

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.

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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
	Details	Delete	Resubmit Download
Job from	Nov. 4, 2013, 12:08 a.m.	current status:	SUCCESS
	Details	Delete	Resubmit Download
Job from	Nov. 4, 2013, 12:01 a.m.	current status:	SUCCESS
	Details	Delete	Resubmit Download
Job from	Nov. 4, 2013, 12:01 a.m.	current status:	SUCCESS
	Details	Delete	Resubmit Download
Job from	Nov. 1, 2013, 10:50 p.m.	current status:	SUCCESS
	Details	Delete	Resubmit Download
Job from	Nov. 1, 2013, 10:49 p.m.	current status:	SUCCESS
	Details	Delete	Resubmit Download
Job from	Nov. 1, 2013, 11:34 a.m.	current status:	SUCCESS
	Details	Delete	Resubmit Download
Job from	Oct. 31, 2013, 4:09 p.m.	current status:	SUCCESS
	Details	Delete	Resubmit Download
Job from	Oct. 31, 2013, 4:02 p.m.	current status:	SUCCESS



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Preselection Download Page

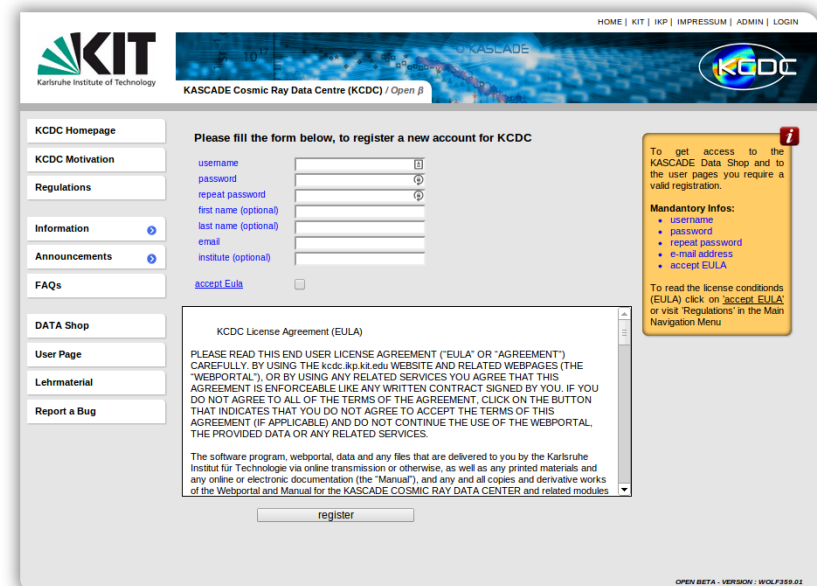
You have chosen the preselection "Full Data". [Download here](#)

OPEN BETA - VERSION : WOLF359.0.1

- 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

- 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



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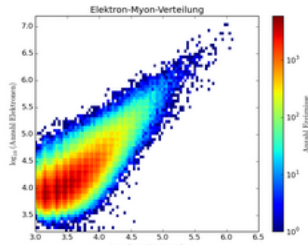
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Report a Bug

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.

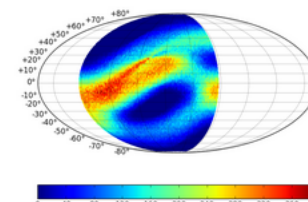
Wie schwer ist ein kosmisches Teilchen?



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 Luftschaue 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?



Erdbundene 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 Einfallrichtung der Teilchen und aus der Uhrzeit die Himmelskoordinaten bestimmt werden. Die Verteilung der Einfallrichtungen 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](#)

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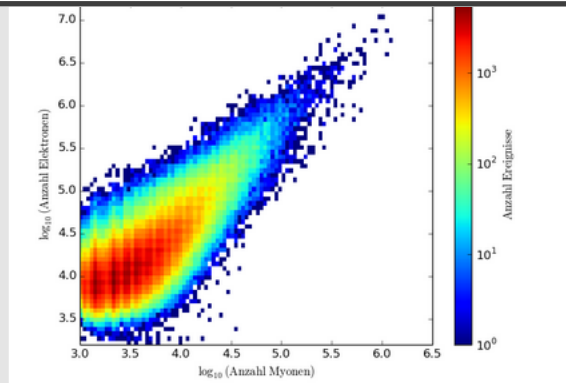
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Report a Bug



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

Hinweis

Software Voraussetzungen:

- Python 2.7
- matplotlib
- numpy
- dateutil

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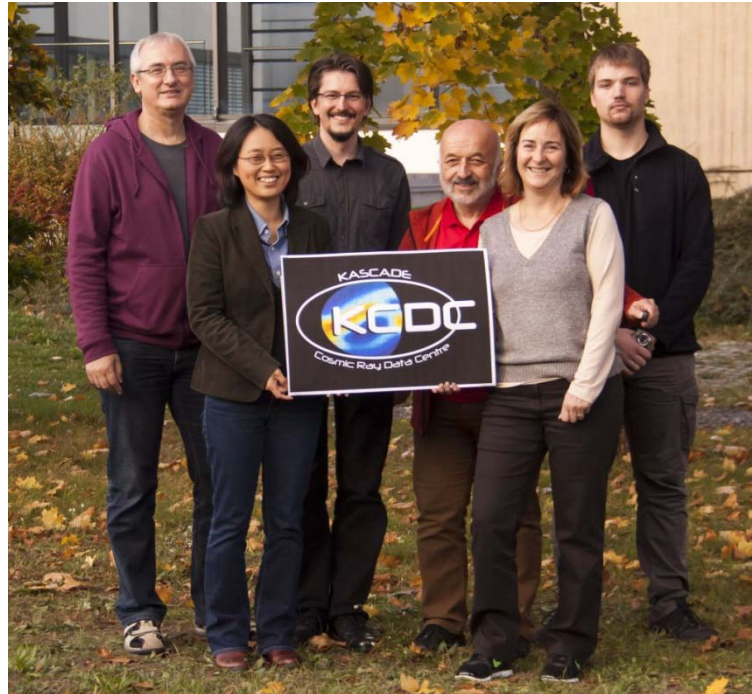
- Physikalischer Hintergrund
 - Warum ist die Masse von kosmischen Teilchen interessant?
 - Wie kann man die Masse bestimmen?
 - Detektion von Elektronen und Myonen im KASCADE Experiment
 - Ein-dimensionale Histogramme
 - Zwei-dimensionale Histogramme
- Analyse
 - Erstellung des Plots
- Interpretation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