

ErUM-Data, DIG-UM and ErUM-Data-Hub

KHuK Annual Meeting

12.12.2025

Thomas Kuhr
LMU München



Bundesministerium
für Forschung, Technologie
und Raumfahrt



KAT

Astroteilchenphysik

KAT. Komitee für
Astro. Teilchen. Physik

KET

Elementarteilchenphysik

KET
Komitee für
Elementarteilchenphysik

KfB

Beschleunigerphysik

KOMITEE FÜR
BESCHLEUNIGER-
PHYSIK **KfB**

KFN

Forschung mit Neutronen

Komitee
Forschung mit
Neutronen

KFS

Forschung mit
Synchrotronstrahlung

Komitee
Forschung mit
Synchrotronstrahlung

KFSI

Forschung mit nuklearen
Sonden und Ionenstrahlen

Komitee
Forschung mit nuklearen
Sonden und
Ionenstrahlen

KHuK

Hadronen-
und Kernphysik

KHuK

RDS

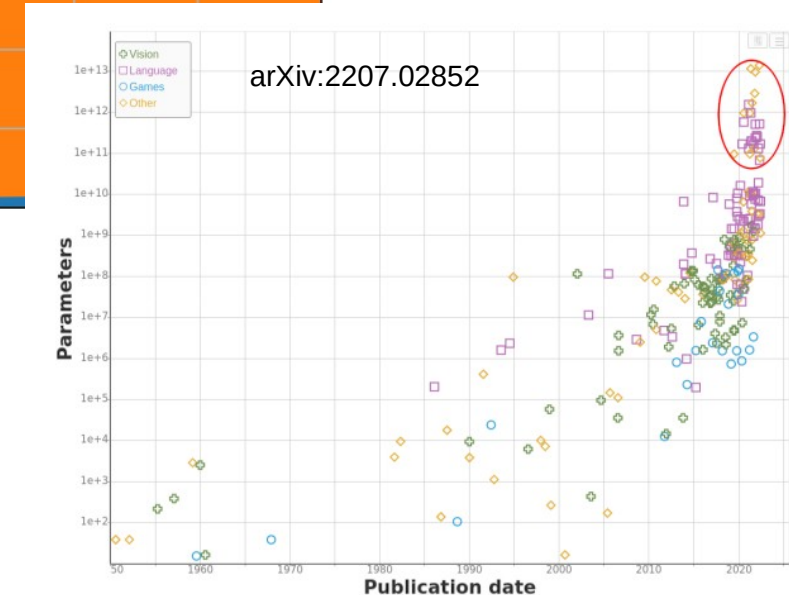
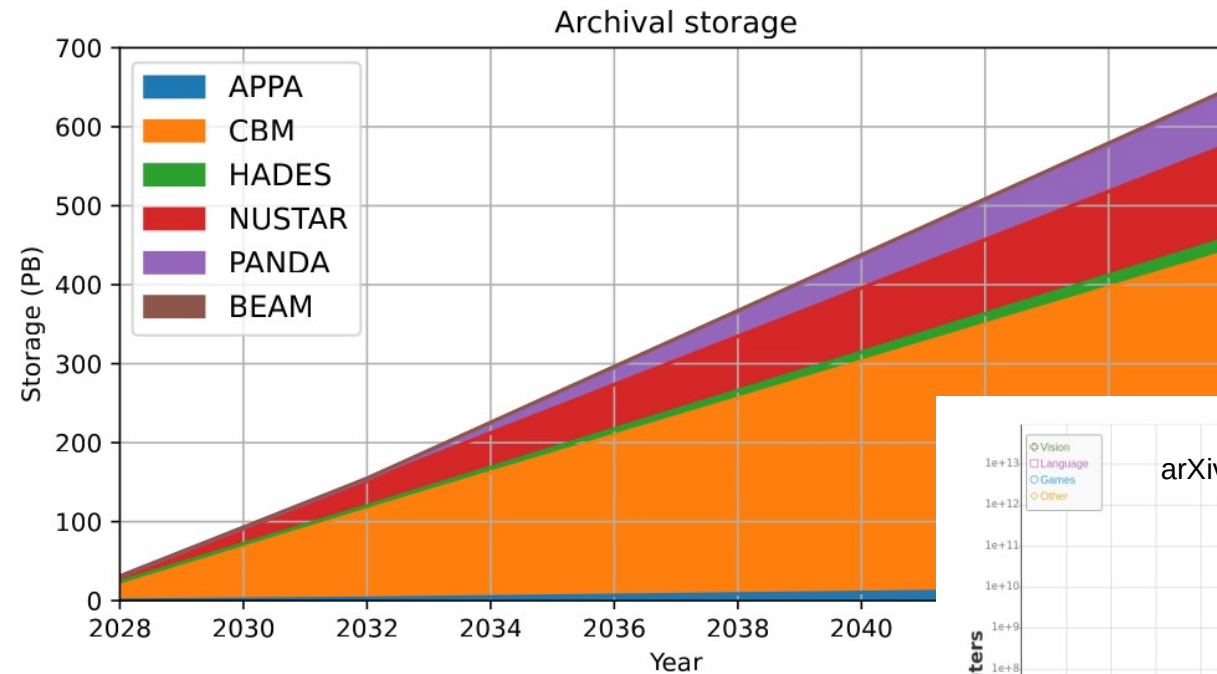
Rat Deutscher
Sternwarten

R D S

→ Research at large scale facilities (accelerators and telescopes)

Common Challenges and Opportunities

- Huge and increasing data sets due to improved instrument resolution
- Scientific advancements due to modern technologies

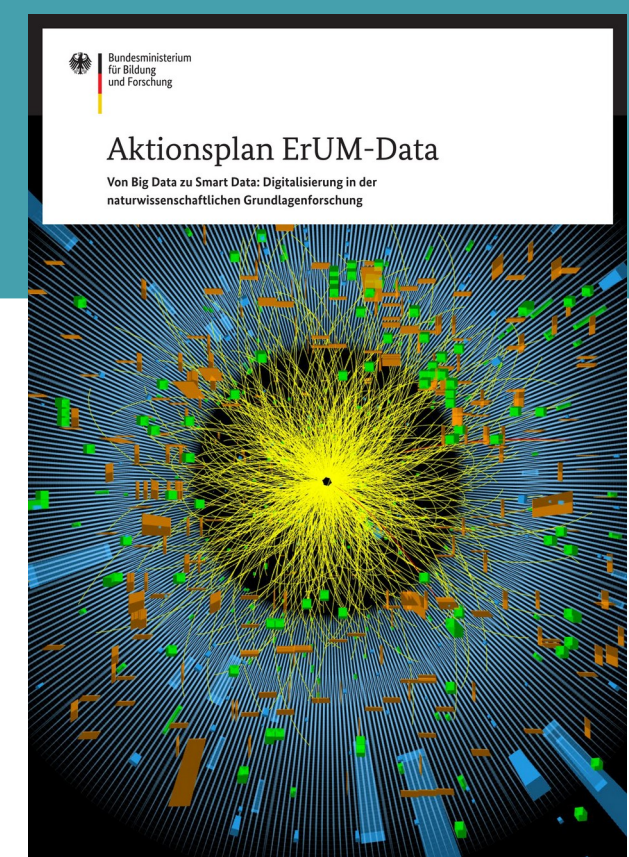


ErUM-Data

From Big Data to Smart Data: Digitization in fundamental, scientific research

Ziele	Themenfelder		
	Forschungsdaten- management	Föderierte Digital- infrastrukturen	Software und Algorithmen
	Wissenschaft vernetzen		
	Digitale Kompetenzen ausbauen		
Transfer und Kommunikation stärken			

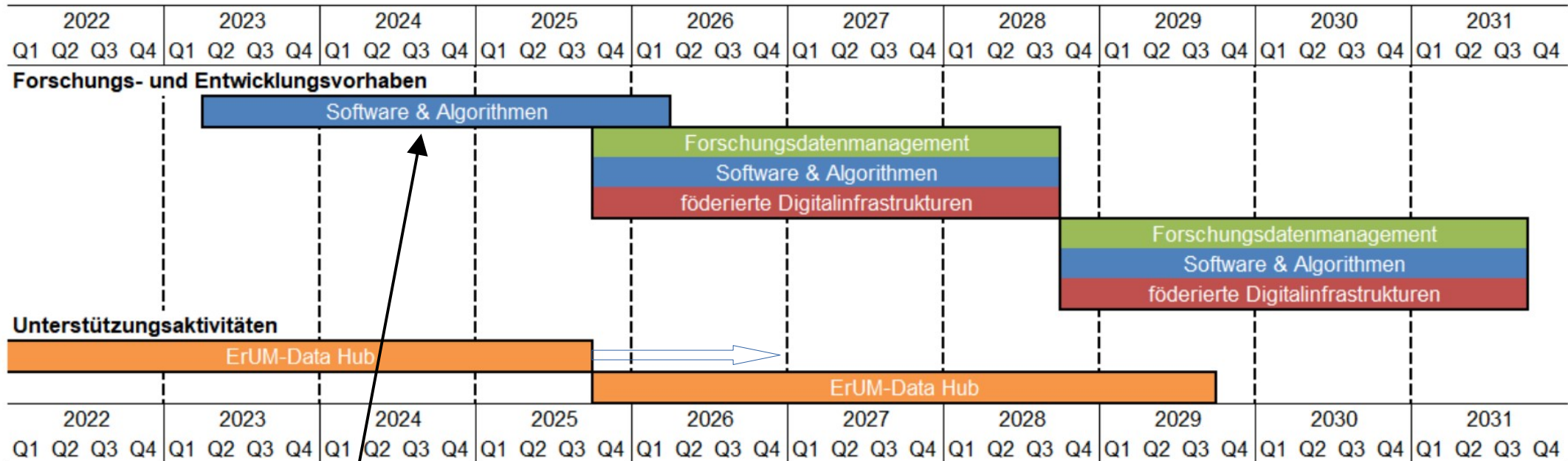
○ Maßnahmen in ErUM-Data



Ausgestaltung und Förderprozess

Das BMBF sieht für den Aktionsplan ErUM-Data eine Laufzeit von 2020 bis 2030 vor. Die Dauer der einzelnen Maßnahmen richtet sich bedarfsgerecht an den förderrechtlichen Möglichkeiten aus. Unter Vorbehalt verfügbarer Haushaltsmittel sind für die Fördermaßnahmen insgesamt bis zu 120 Millionen Euro vorgesehen.

ErUM-Data Schedule



- Two projects with KHuK participation (KISS, EvalSpec-ML) in first funding round + FIDIUM

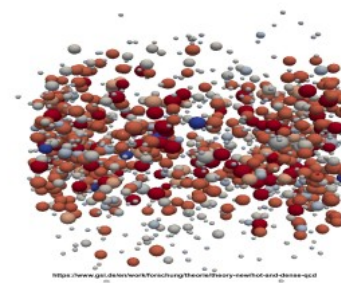
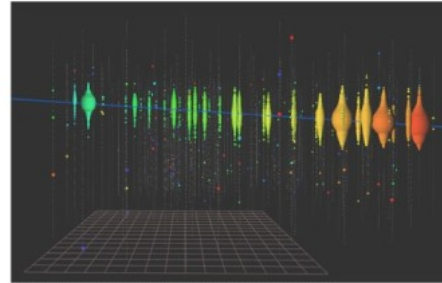
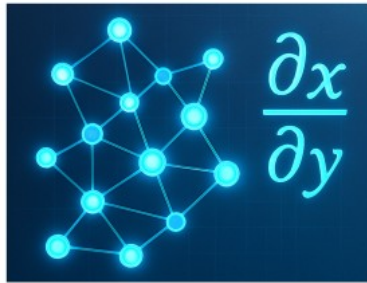
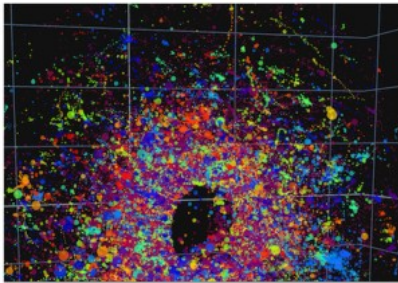
New ErUM-Data Projects

- 23 new projects started in November
- ➔ **Total funding of over 47M€**
- With partners from KHuK community:
BRAID (S&A)
DEMOS (RDM)
FUSE (FI)
- ➔ Further information at
<https://wiki.erumdatahub.de/bin/view/DIG-UM/ErUM-Data%20Projects/>

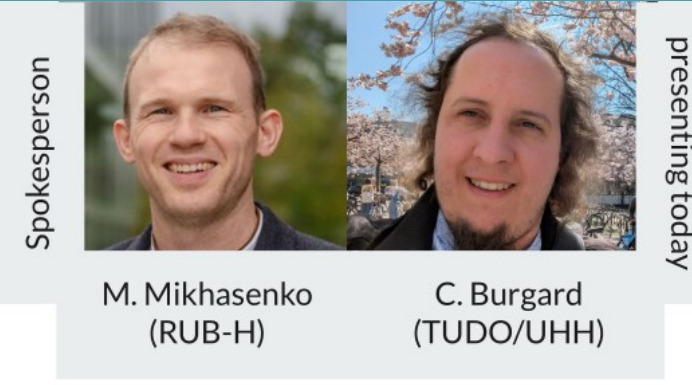


Bridging Domains: AI-Driven Agnostic Reconstruction Frameworks for Irregular High-Dimensional Data (BRAID)

- Jan Kieseler (speaker), **KET**, KIT
- Nicolas Gauger, **Computer Science**, RPTU
- Christian Glaser, **KAT**, TU-Do
- Anastasios Belias, **KHuK**, GSI



- AI has demonstrated transformative power across a wide range of applications.
- BRAID aims at a paradigm change and to **unify reconstruction in particle, astro- and nuclear physics**.
- Goal: a flexible, detector-agnostic framework for irregular, high-dimensional data from experiments such as **HL-LHC, FAIR, and IceCube-(Gen2)**.
- Embed **physics constraints** and ensure **robustness** across varying detector conditions and data regimes.
- Integrate advanced, **gradient-driven dimensionality-reduction methods** to maximise efficiency and resource sustainability.
- Develop **open-source software** and cross-domain **public datasets** to support transparent, reproducible research.
- Demonstrate generalisability through applications beyond HEP, including **medical imaging and monitoring**.

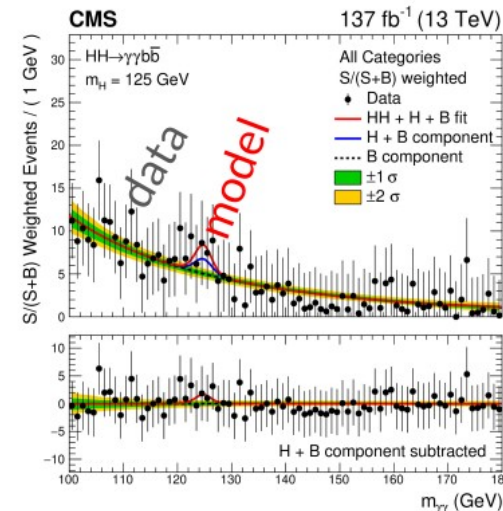


DEMOS - DEMocratizing MOdels infrastructure for FAIR research models

- Vision
 - Make scientific models FAIR — Findable, Accessible, Interoperable, Reusable
 - Boost scientific discovery by democratizing access to complex research models
 - Break silos across ErUM disciplines by enabling sharing, combining, reinterpreting and remixing by establishing a joint research pipeline and statistical software stack
- Core Idea
 - Access to full statistical model boosts reuse-value of published studies
 - Unified DEMOS model standard for probabilistic & computational models
 - Development of common software stack for serializing, using & reusing public models
 - Cross-disciplinary model-sharing platform & registry
- Impact
 - Cross-domain ecosystem for model preservation, execution, combination
 - Reproducible science across ErUM
 - Foundation for next-generation open science & education

Showcase Models (Selections)

- Exotic Hadron Models (P_c , T_{cc} , $\chi c1(3872)$, COMPASS) — RUB-H + MPP
- $B \rightarrow K^{(*)} \ell \ell$ & BELLE II/HF models — LMU + MPP
- BESIII $Z_c(3900)$ amplitude model — JGU
- NN potentials from chiral EFT — RUB-N
- Neutrino oscillation likelihoods — TUM + MPP
- Astroparticle propagation models (CRPropa etc.) — RUB-A
- Laser/WDM structure-factor models & scattering — HZDR
- 2012 Higgs discovery models (HS3 reserialization) — UHH



• Pillar 1 — Standardization

- DEMOS Modeling Language
 - Lead: UHH
 - Domain-specific contributions: HZDR (LP), RUB-A (AP), RUB-N (NP), RUB-H (HP), TUM (NuP)
- Engines in C++, Python, Julia
 - C++: UHH + JGU
 - Python: LMU + SC + TUM
 - Julia: HZDR + RUB-H + MPP
- Complex amplitudes, matrices, static typing compatibility
 - UHH + RUB-H + JGU

• Pillar 2 — Infrastructure

- Portal & Model Gallery (metadata, visualization) — RUB-H
- Model Registry + CI/CD backend — HZDR
- Interoperability with HEPData, Zenodo, repositories — UHH
- LLM-powered search (RAG) — RUB-H
- Binder/interactive execution — RUB-H + TUM

• Pillar 3 — Community & Sustainability

- Documentation, workshops, tutorials — RUB-H + JGU + TUM
- Showcasing models across all ErUM domains — Each institute delivers own domain's models
- Steering committee, governance, release cycles — UHH



Work Packages in FUSE

Detailed Overview of Individual Task Areas

”Federated Storage with a multi-site common directory structure”

- Development and deployment of a central site acting as a hub to plug in external storage infrastructure (based on dCache)
- Integration of storage for “permanent” data (hook up storage at universities, access and namespace managed by hub site)
- Integration of “opportunistic” storage (transparent caches at HPC sites, tape resources at sites without middleware support)
- Monitoring and self-healing capabilities for such a federated system

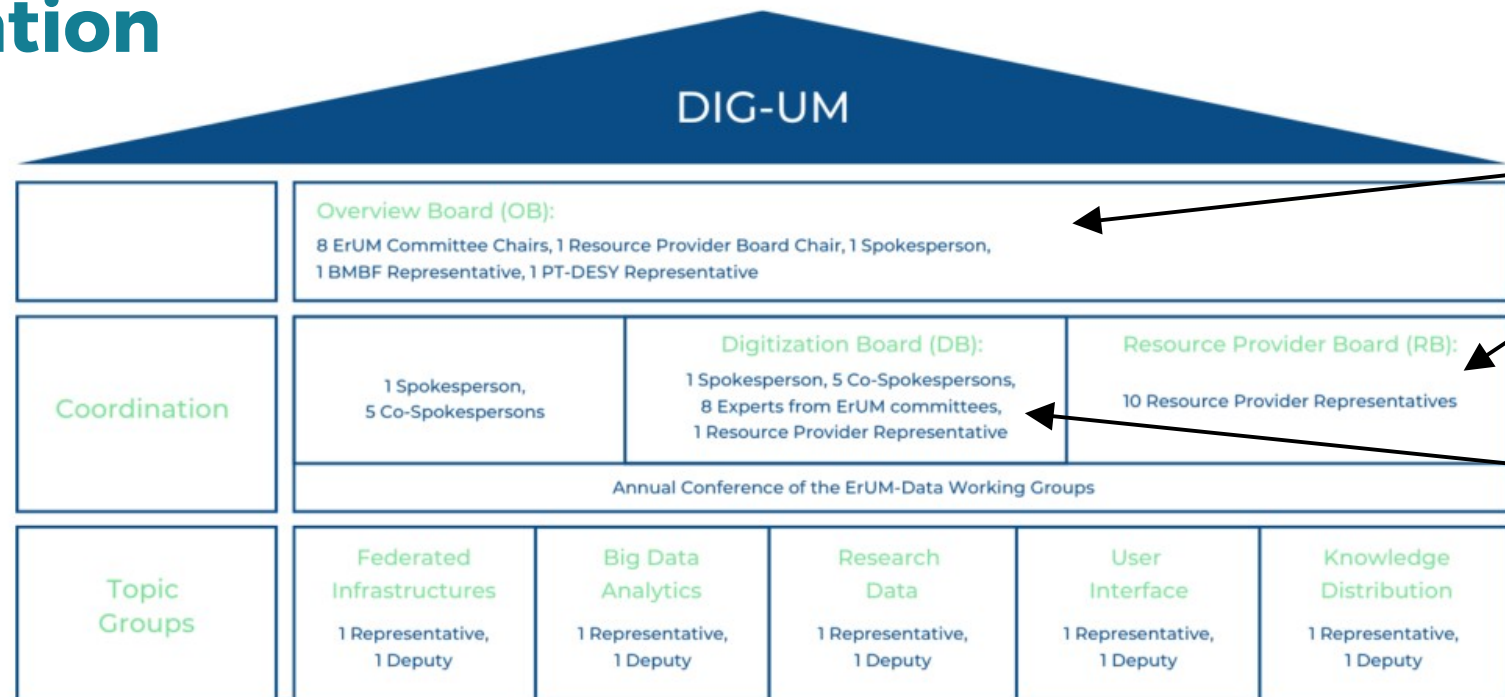
“Caching Services and Cloud Storage Integration”

- Further Development of existing and independent caching solutions with focus on further developments on monitoring
- Bridging the gap between Cloud Compute data access standards and existing scientific storage infrastructure allowing cloud-like access to data stored on classical HPC or Grid-SE storage infrastructure
- Adding Sync&Share capabilities to analysis facilities (requested by the not funded FAIRUM consortia) → discuss future of this task area, maybe limit support/capabilities to selected clusters, e.g. NAF at DESY and LMU user cluster

- Digital Transformation in the Research on Universe and Matter
- Self organization of the ErUM communities

→ **Organization
of and
for you!**

- <https://erumdatahub.de/dig-um/>



Michael Block
Anton Andronic

Thorsten Kolleger
Dmytro Kresan (GSI)

Tobias Stockmanns
Sören Lange

DIG-UM Topic Groups

- Federated Infrastructures
- Big Data Analytics
- Research Data Management
- User Interfaces
- Knowledge Distribution

→ **Wiki and Mailing Lists:**
<https://wiki.erumdatahub.de/bin/view/DIG-UM/Topic%20Groups/>



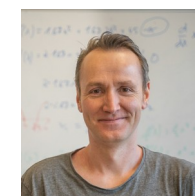
Kilian Schwarz (KET)
Matthias Hoeft (RdS)



Jan Steinheimer (KHuK)
Christian Stieghorst (KFN)



Hans-Goerg Steinrück (KFS)
Michael Schulz (KFN)



Pierre Schnizer (KfB)
Tim Ruhe (KAT)



Judith Reindl (KFSI)
Dirk Lützenkirchen-
Hecht (KFS)

DIG-UM Annual Meeting on December 4th

- <https://indico.desy.de/event/47414/>

- ➔ **DIG-UM PhD Award for Dr. Áron Kripkó**
„Studying the hadron structure with PANDA and CLAS using machine learning techniques“

- ➔ Sponsored by AiNT GmbH



DEAR COLLEAGUES OF THE ERUM-DATA COMMUNITY*, WE CORDIALLY INVITE YOU TO PARTICIPATE IN THE

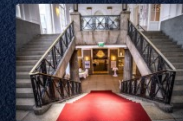
DIG-UM Annual Meeting

- December 4th 2025 -

AGENDA

- discussing the progress of digital transformation in the ErUM community
- contributions from all DIG-UM topic groups, the DIG-UM boards and the ErUM-Data-Hub

 Erholungsgesellschaft
Aachen & online



 13:30 - 19:00



 including
Dinner

Award Announcement

to three outstanding scientists
from the ErUM-Community



REGISTER

indico.desy.de/event/47414/



There is no registration fee.

Gefördert durch:



***ARE YOU PART OF THE ERUM-DATA COMMUNITY?**
There is no official process for becoming part of the **ErUM Data Community**. If you are working in Germany in astroparticle, elementary, accelerator, hadron or nuclear physics, in research with neutrons, synchrotron radiation, nuclear probes and ion beams, at the German Observatory Council or in related fields (computer science, big data, AI, ...) you are automatically part of **ERUM** and invited to the meeting.

ErUM Data Hub

Funded by BMFTR

- Promote networking
- Intensify exchange
- Enhance digital competences
- Strengthen communication

→ <https://erumdatahub.de>

→ <https://wiki.erumdatahub.de>
(infos, material, people, jobs, events, ...)



Events

ERUM-DATA-HUB
EVENT PROGRAMME 2025

6 FEB

TRANSFER WORKSHOP

ERUM & INDUSTRY IN DIALOGUE

AACHEN

7 FEB

6 MAY

DEEP LEARNING “BASIC CONCEPTS”

9 MAY

SCHOOL

AACHEN

24 JUN

PYOPP WORKSHOP

PUBLISH YOUR OWN PYTHON PACKAGE

27 JUN

AACHEN

28 JUL

SUSTAINABILITY & ETHICS IN ERUM-DATA

EXPERT WORKSHOP

AACHEN

1 AUG

15 SEP

DEEP LEARNING

TRAIN-THE-TRAINER WORKSHOP

POTSDAM

19 SEP

FURTHER EVENTS:

CONCEPTUAL ADVANCES IN DEEP LEARNING WORKSHOP (HEIDELBERG)

HAVE AN INSIDE LOOK:



Registration & Contact:

erumdatahub.de

info@erumdatahub.de

MORE TO BE ANNOUNCED SOON!



SHAPING THE DIGITAL FUTURE
OF ERUM-RESEARCH:

SUSTAINABILITY & ETHICS

INSPIRATION • META THINKING • DISCUSSION • ACTION

28.07.-
01.08.25
AACHEN

Confirmed Speaker:

Johannes Hartl, Dr. Martin Möller (Öko Institut e.V.), Wolfgang Gründinger,
Prof. Achim Stahl (RWTH Aachen University), Christopher Schrader, Eoin Woods

Review

WHAT HAPPENED SO FAR

- In Person Workshop 2023
- Follow Up Paper
- Online Discussion Evenings 2024



Contact & Information:
www.erumdatahub.de
info@erumdatahub.de
<https://indico.desy.de/event/47133/>

Follow us @







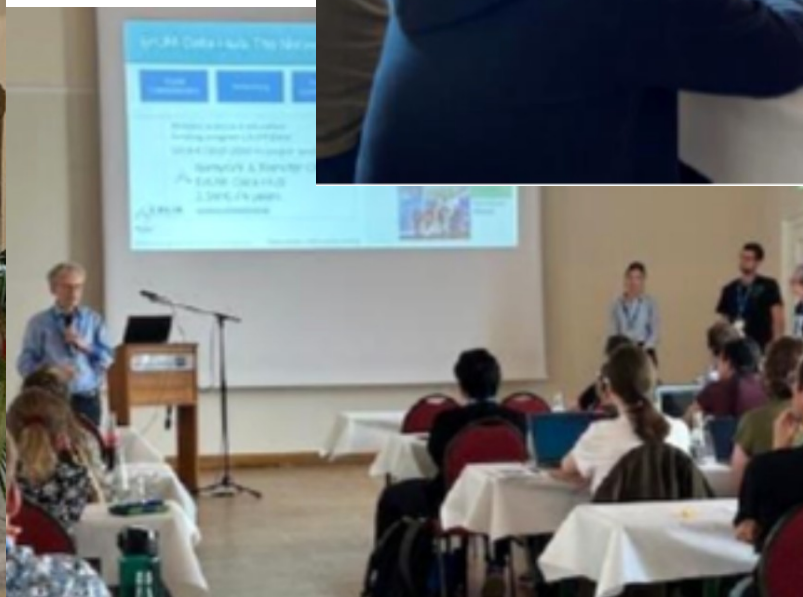
<https://indico.desy.de/category/984/>

Big Data Analytics	7 Veranstaltungen	→
DIG-UM	19 Veranstaltungen	→
KFSI	3 Veranstaltungen	→
Einige Veranstaltungen in der untenstehenden Liste sind ausgeblendet.		

5 Veranstaltungen liegen in der Zukunft. Ausblenden

September 2026		
	01. Sept. - 04. Sept.	Deep Learning School “Advanced Concepts”
Juni 2026		
	18. Juni - 19. Juni	2nd Transfer Workshop: ErUM-Scientists & Industry in Dialogue
April 2026		
	13. Apr. - 17. Apr.	Deep Learning School “Basic Concepts”
Dezember 2025		
	04. Dez.	ErUM-Data Community: DIG-UM Annual Meeting 2025

Impressions from Events



Onboarding Event on 25.11.



- ➔ <https://indico.desy.de/event/50044/>
- Further support measures offer by ErUM-Data Hub:
Website hosting, indico for meetings, event support

What's Next?

- **ErUM-Data Status Meeting on March 18./19. at BMFTR in Berlin**
 - ~100 invited participants (old/new PIs, research infrastructures, NFDI, DIG-UM, industry, PT, BMFTR)
- Discussion about ErUM-Data Hub 2.0 with BMFTR
 - Main Hub with satellites
 - Strengthen connections outside ErUM
- Exploit complementarity with NFDI



Conclusion

- You are welcome to participate in shaping the digital future of ErUM research!



Make ErUM-Data & DIG-UM Shine & Visible!
Share Your Success Stories!
Your Success = Our Impact.

from OB report by
Erik Bründermann