



# KfB-Bericht / Report

KHuK Jahrestagung / Annual meeting 2024

06. Dezember 2024, 08:50, 15'+5'

Erik Bründermann for the KfB

KOMITEE FÜR  
**BESCHLEUNIGER-  
PHYSIK**

**KfB**

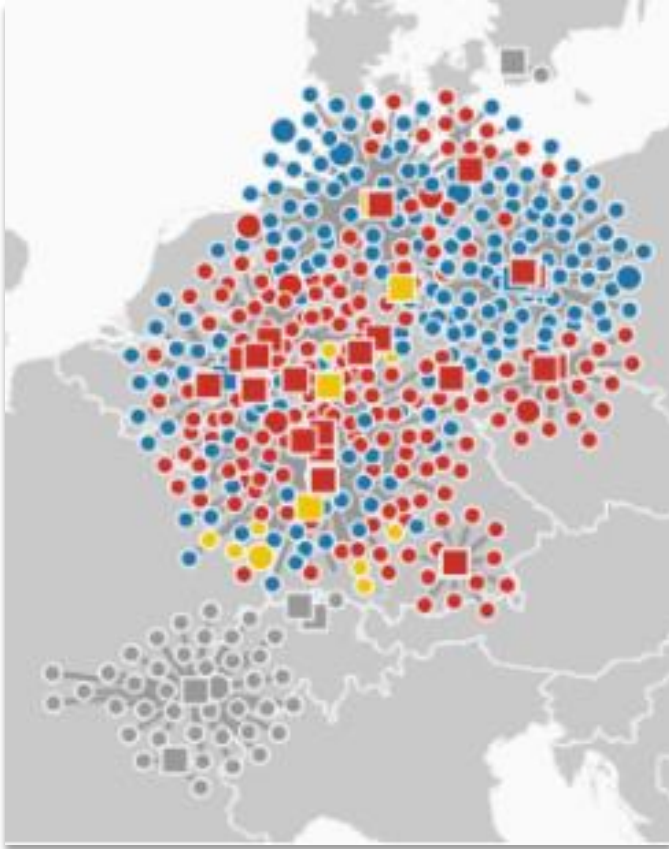


# Forum and 5. KfB












[www.beschleunigerphysik.de/de/kfb/](http://www.beschleunigerphysik.de/de/kfb/)

From **Universities**, **Helmholtz**, **International**, **Labs**

## Accelerator R&D



## Beschleunigerforschung

 <p>KfB-Vorsitender Dr. <b>ERIK BRÜNDERMANN</b> KIT <span>Helmholtz-Zentren</span></p>	<b>H</b>	 <p>Stellv. KfB-Vorsitender Prof. Dr. <b>FLORIAN HUG</b> Uni Mainz <span>Universitäten</span></p>	<b>U</b>
 <p>KfB-Mitglied Dr. <b>MICHAELA ARNOLD</b> TU Darmstadt <span>Universitäten</span></p>	<b>U</b>	 <p>KfB-Mitglied Dr. <b>PAUL GOSLAWSKI</b> HZB <span>Helmholtz-Zentren</span></p>	<b>H</b>
 <p>KfB-Mitglied Dr. <b>BASTIAN HÄRER</b> KIT <span>Universitäten</span></p>	<b>U</b>	 <p>KfB-Mitglied <b>CARSTEN MAI</b> TU Dortmund <span>Universitäten</span></p>	<b>U</b>
 <p>KfB-Mitglied Dr. <b>EVA PANOFSKI</b> DESY <span>Helmholtz-Zentren</span></p>	<b>H</b>	 <p>KfB-Mitglied Dr. <b>MICHAELA SCHAUMANN</b> DESY <span>Helmholtz-Zentren</span></p>	<b>H</b>
 <p>KfB-Mitglied Dr. <b>LUCAS SCHAPER</b> DESY <span>Helmholtz-Zentren</span></p>	<b>H</b>	 <p>KfB-Mitglied Dr. <b>MARC WENSKAT</b> Uni Hamburg <span>Universitäten</span></p>	<b>U</b>
 <p>KfB-Mitglied Dr. <b>FRANK TECKER</b> CERN <span>Ausländische Institute</span></p>	<b>I</b>	<p>CERN, DESY, HZB, KIT, U Hamburg, U Mainz, TU Darmstadt, TU Dortmund</p>	

# Your KfB colleague near you



## 5<sup>th</sup> (3-year-period) KfB from 2023 to 2025

- 5. Jan 2023, official constituting meeting
- Elected by the FORUM (email list > 350 persons)
- The FORUM community: physicists, engineers, computer scientists, mathematicians, and more
- Cross-sectional technologies in Accelerator R&D

## KfB roles, activities, and actions

- **Contact** for politics, industry, media
- **Recommendations** on R&D topics
- Links to DIG-UM/ErUM-Data-Hub, yHEP, KET, KHuK, KFS, ...
- **Sustainable research infrastructures**
- Promoting **networking, early-career researchers** and **young talents**



# KfB members support teaching

- **CERN Accelerator School (CAS)** – 40 years since 1983
  - Head of the CERN Accelerator School: *F. Tecker*
  - CAS Lectures: *M. Arnold*
- **Joint Universities Accelerator School (JUAS)**
  - *e.g. B. Härer, C. Mai, M. Arnold*



JUAS PROVIDES POSTGRADUATE-LEVEL EDUCATION  
IN THE SCIENCE AND TECHNOLOGY  
OF PARTICLE ACCELERATORS

since 1994

40 1983-2023 years  
The CERN Accelerator School  
in collaboration with ALBA

Course on  
**INTRODUCTION TO  
ACCELERATOR PHYSICS**

SANTA SUSANNA, SPAIN  
25 September - 8 October 2023

The two-week residential course represents the core teaching of all CAS courses, offering the ideal opportunity to delve into the fascinating world of particle accelerators. This course is designed for laboratory and university staff and students, as well as manufacturers of accelerator equipment. It provides a comprehensive introduction to the fundamental concepts of beam dynamics and underlying accelerator systems. Through engaging lectures, illuminating tutorials, and insightful discussion sessions, participants will deepen their knowledge of crucial topics in the accelerator universe.

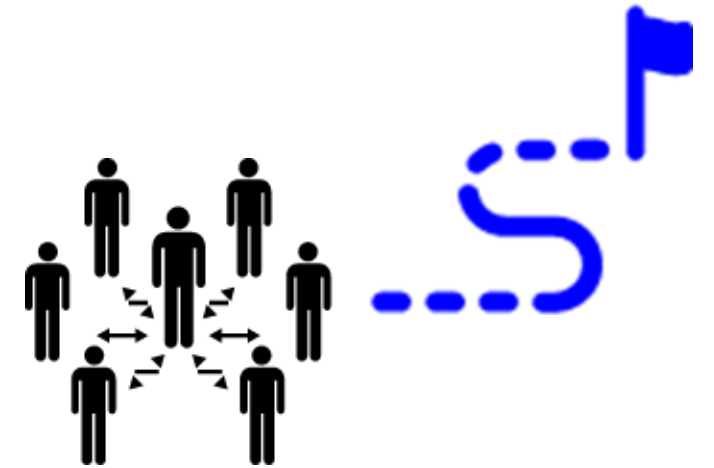
In addition to the comprehensive curriculum, networking is crucial, as attendees forge connections with fellow students and lecturers working in the field. This opportunity to connect and collaborate is a key ingredient of the program, further enhancing its value as an indispensable resource for anyone seeking to expand their understanding of particle accelerators.

Location: Hotel Indalo Park, Santa Susanna

ALBA QR code Contact: CERN Accelerator School CH - 1211 Geneva 23 cern-accelerator-school@cern.ch in CERN

# Networking

- **Frequent unofficial KfB-meetings**, virtual, “coffee sessions”
- **Strategy brochure 2035** – work in progress (led by *B. Härer*)
- **Delegates to:** KET (*M. Wenskat*), KFS (*C. Mai, P. Goslawski*), KHuK (*M. Arnold*), ...
- **Germans at CERN (DAC)**, *F. Tecker*
- **DIG-UM**
  - Digitization Board (*E. Bründermann, F. Hug*)
  - KfB in Overview Board (*E. Bründermann*)
- **DPG Spring Meeting, 17.-22. Mar 2024**
  - KfB presentation in Arbeitskreis Beschleunigerphysik (AKBP)
- **Conferences:** IPAC, IBIC, ...
- **Helmholtz meetings**
  - Matter and Technologies (MT), Accelerator R&D (MT-ARD), ...



# Prisma Strategy Discussions and Calls

## Cross-cutting topic: Accelerator Research

Querschnittsthema:  
Beschleunigerforschung

ErUM-Pro Teilchen

ErUM-Pro Materie

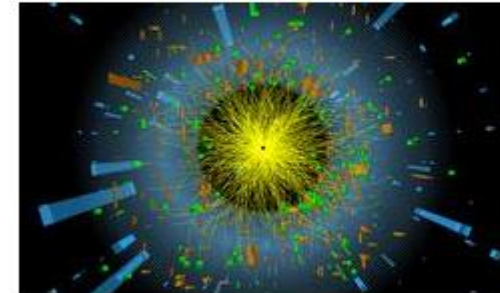
ErUM-Data

ErUM-Transfer

Prisma-Trialog Nachhaltigkeit

## Bekanntmachungen

Hinweise und Unterlagen zu Bekanntmachungen des Bundesministeriums für Bildung und Forschung aus den Gebieten Teilchen, Materie, Universum und Mathematik



**Data** >

Bekanntmachung vom  
30.09.2024



**Materie** >

Bekanntmachung vom  
20.08.2024

Image source: [https://pt.desy.de/bekanntmachungen/index\\_ger.html](https://pt.desy.de/bekanntmachungen/index_ger.html)

## ErUM-Pro Teilchen

- KfB Verbund-Workshop “Teilchen”
  - 19.-20. April 2023

## ErUM-Data

- Visit for more information ErUM-Data-Hub & DIG-UM
  - Visit also for collaborators:  
<https://erumdatahub.de/en/calls/>
  - Deadline proposals: 15. January 2025

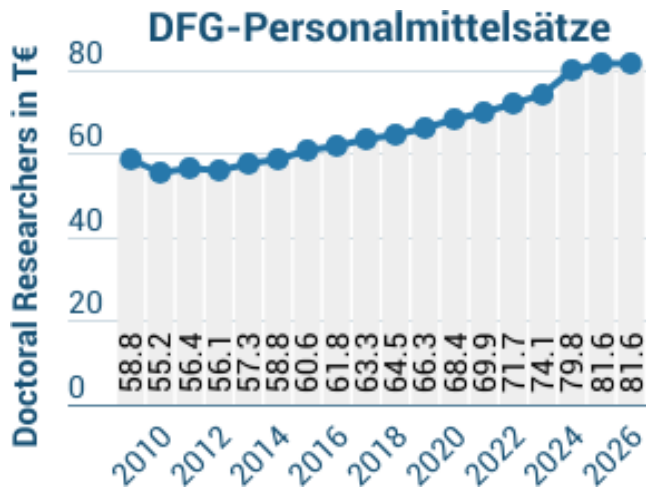
## ErUM-Pro Materie

- KfB call for slides/input from community FORUM
  - 26.03.2024 – Prisma Strategy Discussion ErUM-Pro Materie
- KfB Verbund-Workshop “Materie”
  - 5.-6. September 2024
  - Not open: <https://indico.cern.ch/e/materie2025>
  - Deadline proposals: 1. November 2024



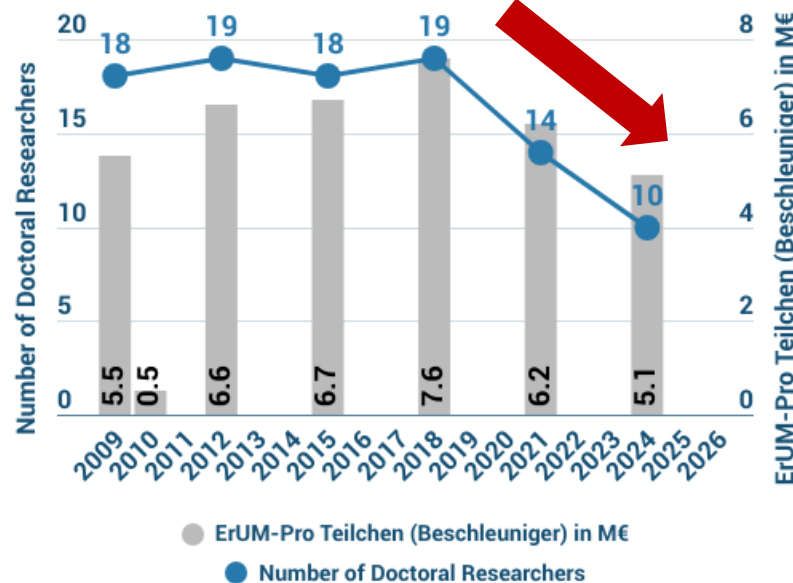
# Excerpt Förderkatalog: Accelerator R&D

ErUM-Pro	Total in M€	Accelerator R&D	ARD/Total	Projects	T€ per project per year
Teilchen – 2021	104.2	6.2	6%	14	200
Teilchen – 2024	99.8	5.1	5%	Numbers without guarantee / ohne Gewähr	



KfB analysis & visualization of the data bank in 01/2023 & 2024. ~ 2 M€/year

Doctoral Researchers vs. Budget Beschleuniger R&D assuming 50% of budget for personnel



- Reduced funding & increasing salaries
- In future, fewer young talents (also to operate accelerators)

<https://www.dfg.de/de/formulare-60-12-246894>



## 2<sup>nd</sup> BMBF PRISMA-Trialog Nachhaltigkeit - 15. May 2024

### Sustainability in Research at Large-Scale Facilities: Resource Efficiency & Securing the Future (*Nachhaltigkeit in der Forschung an Großgeräten: Ressourceneffizienz & Zukunftssicherung*)

#### Working groups

- WG 1: Research planning and organisation
- WG 2: Research funding in ErUM
- WG 3: Data and Computing (supported by yHEP & KfB)
- WG 4: **Technologies in research infrastructures (RIs/FIS)**  
Coordination: *E. Bründermann*, KfB
- WG 5: Data collection, monitoring & accounting
- WG 6: Research for Sustainability



**PT-DESY**

**EMPFEHLUNGEN ZUR BERÜCKSICHTIGUNG VON  
NACHHALTIGKEITSASPEKTEN IN DER  
NATURWISSENSCHAFTLICHEN  
GRUNDLAGENFORSCHUNG AN GROßGERÄTEN**

Recommendations for the consideration of sustainability aspects in fundamental/basic scientific research at large-scale facilities

KfB commented on articles. More at DIG-UM/ErUM-Data-Hub [Workshop](#) and <https://yhep.desy.de/sustainability/>. KfB FORUM & yHEP member, P. Niknejadi, co-authored articles. "[Resource-aware Research on Universe and Matter: Call-to-Action in Digital Transformation](#)", <https://arxiv.org/abs/2311.01169> "[Evaluation of the professional carbon footprint for individual researchers in high energy physics and related fields](#)", <https://arxiv.org/abs/2403.03308>

# Sustainability on several levels

## Challenges

- Responsible use of
  - Energy
  - Materials
- Climate
- Geopolitical issues
- Trend of prices
  - e.g. operating costs
- Intensification of workload
  - Accelerator scientists do not only R&D
  - They do operational tasks – on top
  - They do teaching – on top



## Possible measures

- Energy efficiency & circular economy
  - Components and systems
- Energy production
  - E.g. facility roofs for photovoltaics
- Strategic sovereignty, focus on D and EU
- Thinking in systems and holistically
  - Investments + Operating Costs + Recycle
- Promotion of young talent and training
  - Automation & AI helps, but requires initially more and highly qualified work force
  - Humans essential for world-leading science!

# Accelerator R&D Roadmap

## Excerpt: European Strategy for Particle Physics Accelerator R&D Roadmap

... design and delivery of future particle accelerators in a timely, affordable and **sustainable** way.

... roadmap for **European accelerator R&D** for the **next 5 to 10 years**, covering **five** topical **areas** identified in the Strategy update.

The R&D objectives include:

**improvement of the performance and cost-performance of magnet and radio-frequency acceleration systems;**

**investigations of the potential of laser / plasma acceleration and energy-recovery linac techniques; and**

**development of new concepts for muon beams and muon colliders.**

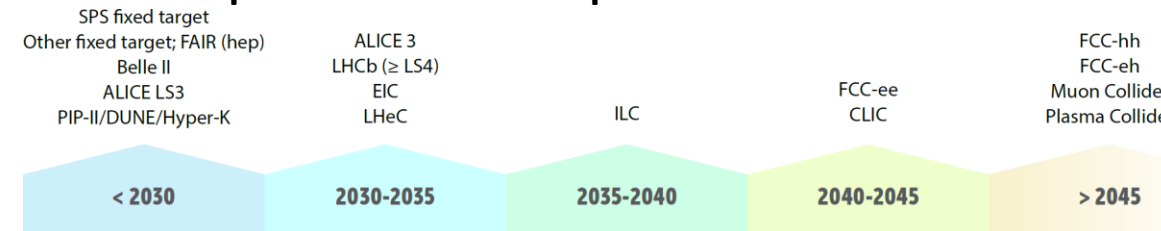


Fig. 1.2: Future accelerator facilities timeline.

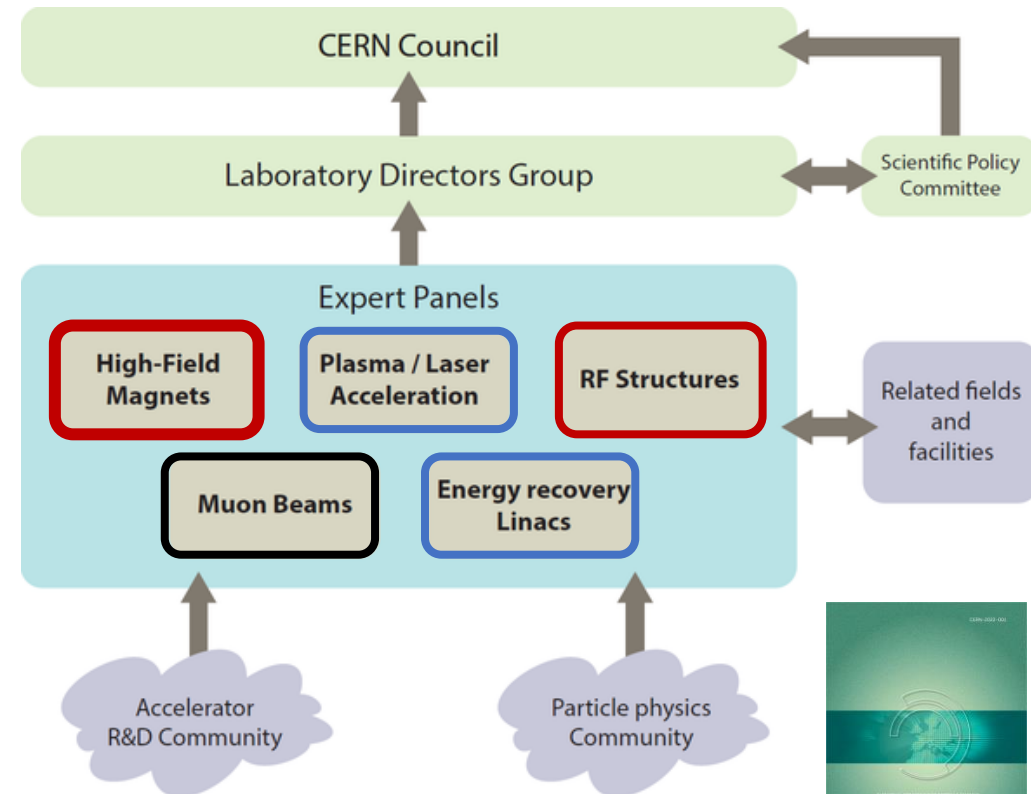


Fig. 1.1: Roadmap panel structure.



Revision:  
30 March 2022

# Updates on accelerator technologies

KfB assisted in

- CERN70 events in 2024
- Workshop in Bonn, May 2024, Future Collider @ CERN  
<https://indico.desy.de/event/44074/timetable/>

## Presentations May 2024 – Speakers from CERN

FCC **sustainability** aspects

- Johannes Gutleber

FCC-ee **key technologies** and technological readiness

- Frank Gerigk

R&D on **high-field magnets** for FCC-hh and **muon cooling**

- Bernhard Auchmann

R&D on **plasma acceleration**

- Marlene Turner

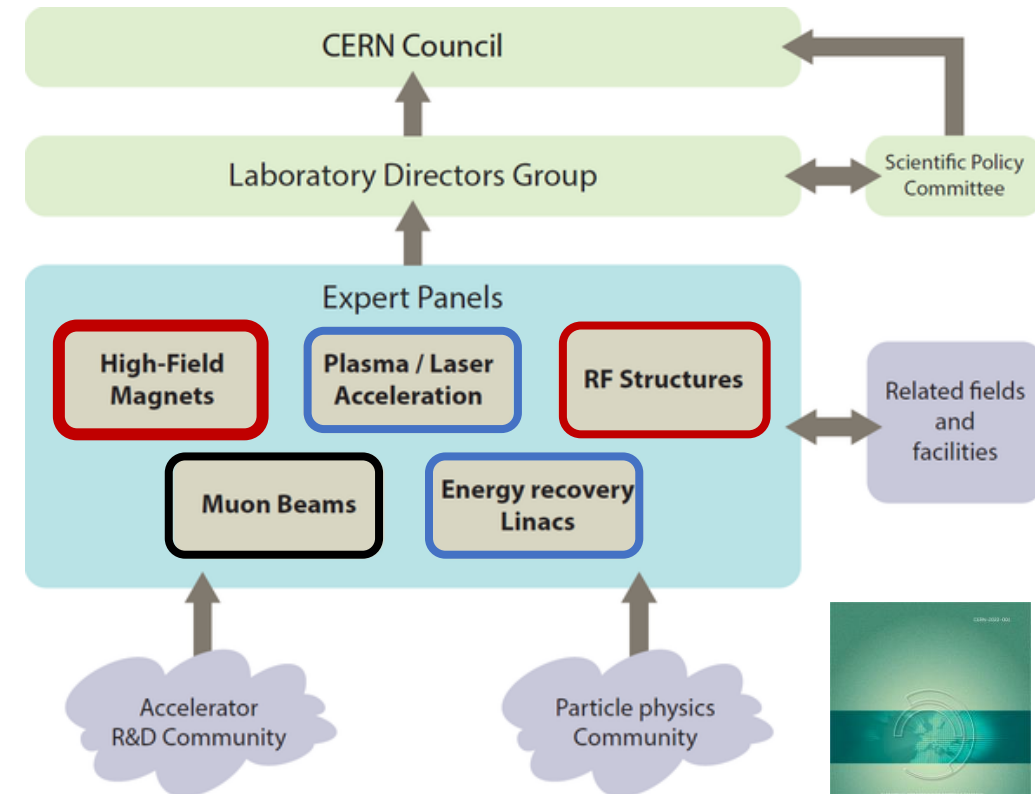


Fig. 1.1: Roadmap panel structure.



Revision:  
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# Accelerator R&D topics

1. **Magnet systems** (permanent, high-temperature superconducting (HTS), hybrid)
2. **Sustainable** and efficient **superconducting RF**
3. **ERL technology**
4. **Plasma-based accelerators**
5. **Ultra-fast & ultra-compact diagnostic** systems, **automation**, **machine learning** for accelerators
6. **Controlled beams** in space, time, and structure (particles, photons) & **polarized** beams
7. **Accelerator-based** sources  
for electrons & synchrotron radiation, **positrons**, protons, **neutrons**, light & **heavy ions**
8. **Additive manufacturing** (3D printing) of accelerator components



# Promotion of young talent and training

## Challenges in Accelerator R&D

- Skilled personnel retire at accelerated pace
- Cross-sectional domain knowledge mandatory
- High level training of young talents necessary, thus attractiveness for highly qualified staff and educators
- High demand of our excellent graduates in industry starves human resources for R&D and education
  - Entry salaries for accelerator researcher and engineers in industry  $\geq$  E14/E15
  - Difficult to sustain large-scale research infrastructures & projects
- Administrative processes slow & short time between written funding announcement and project start
  - Existing time-contracted employees receive letter to go to employment agency 3 months before current project ends, thus potential demotivation of young talents
  - Difficult to quickly find skilled talents, thus task & budget plan vs. cash outflow under pressure

# Wrapping up



## Challenges ahead.

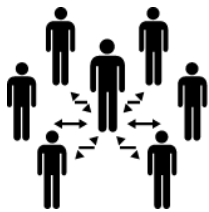
Opportunities are plenty, but funding and prioritization important!



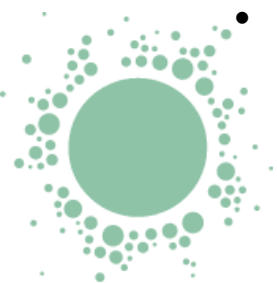
## KfB tries to mitigate present, visible and certain outlook of lacking work force.

- Recognize asymmetry & prioritize cross-sectional activities.

If an accelerator is off, many users suffer – the reverse is lesser the case.



- **Cross-sectional/interdisciplinary R&D** such as **Accelerator R&D** difficult to make visible to the outside to attract young talents – although **excellent job opportunities** in industry and (probably also) in large-scale projects and facilities.



## Plans.

- Amendment of KfB statutes (Satzung), approval needs 2/3 of vote of General Assembly
  - One proposal: change KfBeschleunigerphysik to KfBeschleunigerforschung to adapt to broader community
- Strategy discussions: **strategy brochure.**