

Accelerator overview and draft section for ESPP input document

German strategy workshop in preparation of the ESPP update

20. January 2024, 14:00, 25'+15'

Erik Bründermann and Florian Hug for the KfB



Supports Accelerator R&D and Technologies







KfB-Vorsitender Dr. ERIK BRÜNDERMANN KIT Helmholtz-Zentren



KfB-Mitglied Dr. MICHAELA ARNOLD TU Darmstadt Universitäten



Stellv, KfB-Vorsitender Prof. Dr. FLORIAN HUG Uni Mainz Universitäten



KfB-Mitglied Dr. PAUL GOSLAWSKI HZB Helmholtz-Zentren

KfB-Mitalied

CARSTEN MAI



KfB-Mitalied Dr. BASTIAN HÄRER KIT Universitäten





KfB-Mitalied Dr. EVA PANOFSKI



DESY Helmholtz-Zentren



KfB-Mitglied Dr. LUCAS SCHAPER DESY Helmholtz-Zentren



KfB-Mitglied Dr. FRANK TECKER CERN Ausländische Institute



KfB-Mitalied Dr. MICHAELA SCHAUMANN DESY Helmholtz-Zentren

TU Dortmund Universitäten



KfB-Mitglied Dr. MARC WENSKAT Uni Hamburg Universitäten

www.beschleunigerphysik.de/de/kfb/

19.-22.01.25 – German strategy workshop in preparation of the ESPP update Accelerator overview and draft section for ESPP input document - KfB



DOI: 10.48550/arXiv.2201.07895, 2022-03-30

Excerpt: ... **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 costperformance of magnet and radio-frequency acceleration systems;
- investigations of the potential of plasma / laser acceleration and energy-recovery linac techniques;
- development of new concepts for muon beams and muon colliders.





DOI: 10.48550/arXiv.2201.07895, 2022-03-30

Presentations on accelerator R&D and accelerator-related technologies

German strategy workshops in preparation of the ESPP

- Future Collider @ CERN Bonn, 22.05.2024
- <u>The Future of Non-Collider Particle Physics</u> Bad Honnef, 22.-24.11.2024
- <u>The future of Collider Physics</u> Hamburg, 27.-29.11.2024



KfB supports Accelerator R&D



The German ARD community has already made worldwide unique contributions.



High-field magnets

 Advancing high-temperature superconductor (HTS) magnets will expand their applications, given the ubiquity of magnets.

RF structures

• In-series-production of superconducting RF modules was demonstrated for the European XFEL.

Plasma / laser acceleration

• Advancing high power lasers will impact the laser industry in various fields and promises compact accelerator facilities.



Energy recovery linacs

- ERLs promise savings by energy recovery using superconducting RF modules.
- Muon beams
 - High-field magnets will also benefit new concepts for muon beams.

Importance of accelerator projects





Around **30% of Nobel Prizes in Physics** are estimated to be connected to research involving particle accelerators and accelerator-based synchrotron light sources.



This is a testament to the incredible impact accelerator projects have had on our understanding of the world around us.



New flagship projects based on accelerators are a significant measure to stay in a world-leading position in science and technology.

Baby boomers retire

• Skilled personnel (technicians, engineers, physicists, ...) retire at an accelerated pace.

Fewer personnel & opportunities BESCHLEUNIGER. PHYSIK

Fewer opportunities for education & research

- Accelerators close for particle physics and for photon science in research and for education.
- COSY at Forschungszentrum Jülich closed,
 - DELTA at TU Dortmund will close soon.





Source: Statistisches Bundesamt 2022-12-02



- Funding for Accelerator R&D "Teilchen" was drastically reduced.
 - Personalmittelsätze (DFG), sum for 3 years: PhD: 0.245 M€, PostDoc: 0.264 M€ (2025).
- To attract highly qualified staff and educators, training grounds must be appealing, as high-level training of young talents is essential.
- Cross-sectional domain knowledge is mandatory.



KOMITEE FÜR

BESCHLEUN

ErUM-Pro Teilchen (Beschleuniger)

Building Europe's skilled workforce



- High demand for our excellent graduates in industry starves human resources for R&D and education.
 - Large-scale projects attract young talent from all over Germany and beyond.
- The accelerator design, building and commissioning phase is a fantastic opportunity for accelerator physicists, engineers, technicians and computer scientists to gain invaluable domain knowledge in the cutting-edge field of accelerator science.



The close contact between research centers, universities and industry during the **building phase** promotes the potential for innovation and the **transfer of knowledge and technologies from science to industry**.



Once the commissioning phase is complete, there will be a wealth of **highly trained experts** ready to operate large-scale infrastructures and to meet the demands of industry and medicine.

Energy and sustainability aspects



Recommendations* for the consideration of sustainability aspects in fundamental/basic scientific research at large-scale facilities. *2nd BMBF PRISMA-Trialog Nachhaltigkeit - 15. May 2024

Upcoming technologies will integrate energy-efficiency and sustainability aspects.

Device performance will also be judged according to the amount and type of **materials** and **energy-efficiency** goals.

This will have an immediate and **positive** effect on all other accelerator facilities.









Accelerators are a focal point, stimulating a vast portfolio of cutting-edge technologies and providing particle and photon beams for a plethora of applications.



Accelerators are triggering high-tech developments in industry.



The **geopolitical landscape is changing rapidly**. Germany and Europe invest heavily in the chip industry and have an ageing population with increasing cancer cases.

Industry and medicine use more accelerators than the science community, with applications in semiconductor production and cancer treatment.

Strengthening the German high-tech industry is crucial to maintaining Germany's and Europe's leadership in science and technology and **ensuring strategic and technological sovereignty** for both Germany and Europe.

The demand for accelerators and its skilled workforce will certainly grow.

CERN, Europe's leading laboratory for particle accelerators, must strengthen in any case R&D efforts in accelerator-related technologies.