German Collaborative Research

Overview and Impact

Cremlin Connecting Russian and European Measures for Large-scale Research Infrastructures

Frank Lehner, DESY

CREMLIN WP2 Funding Workshop
Grenoble, 15/16 June 2017

HELMHOLTZ ASSOCIATION

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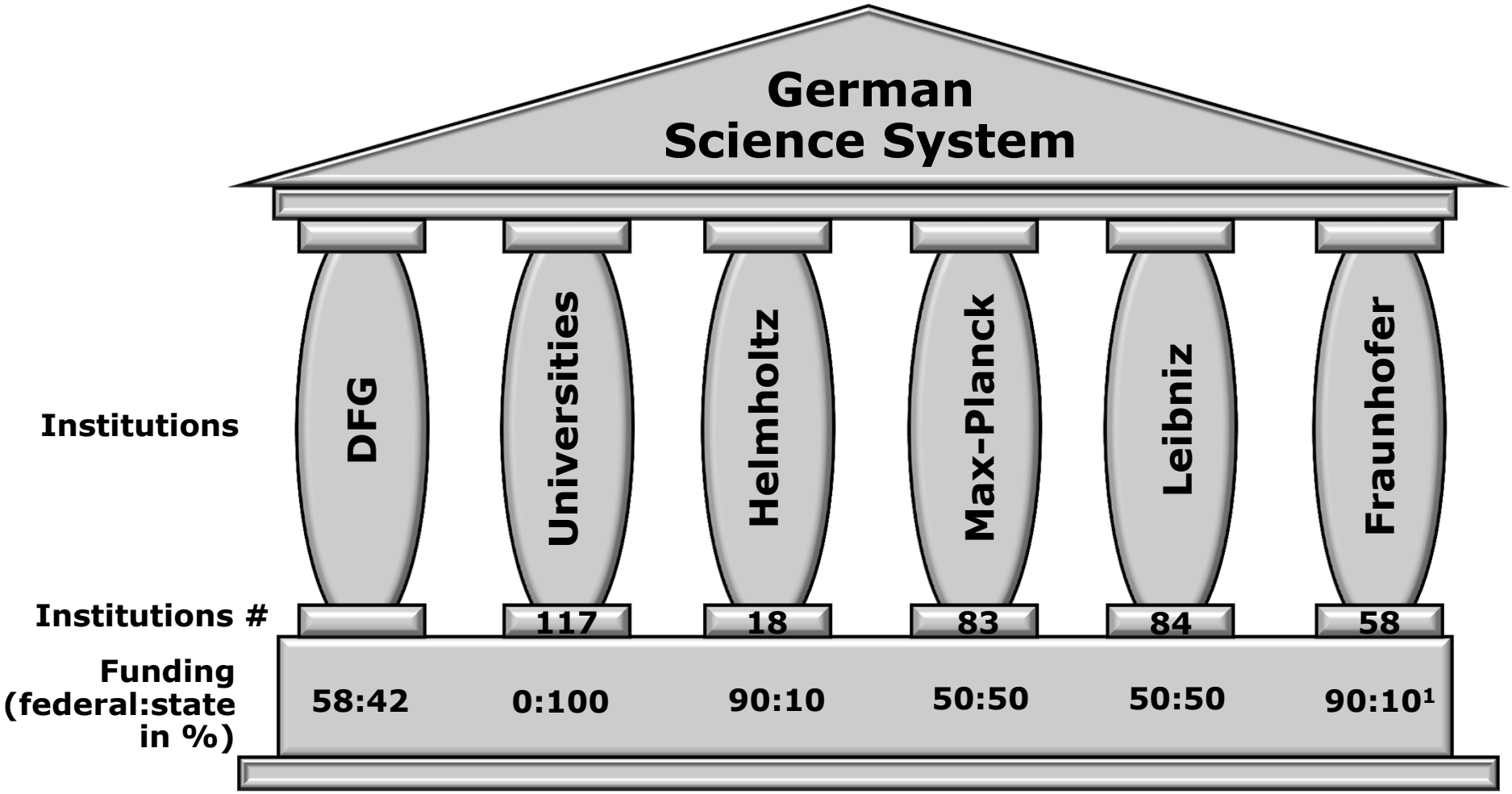
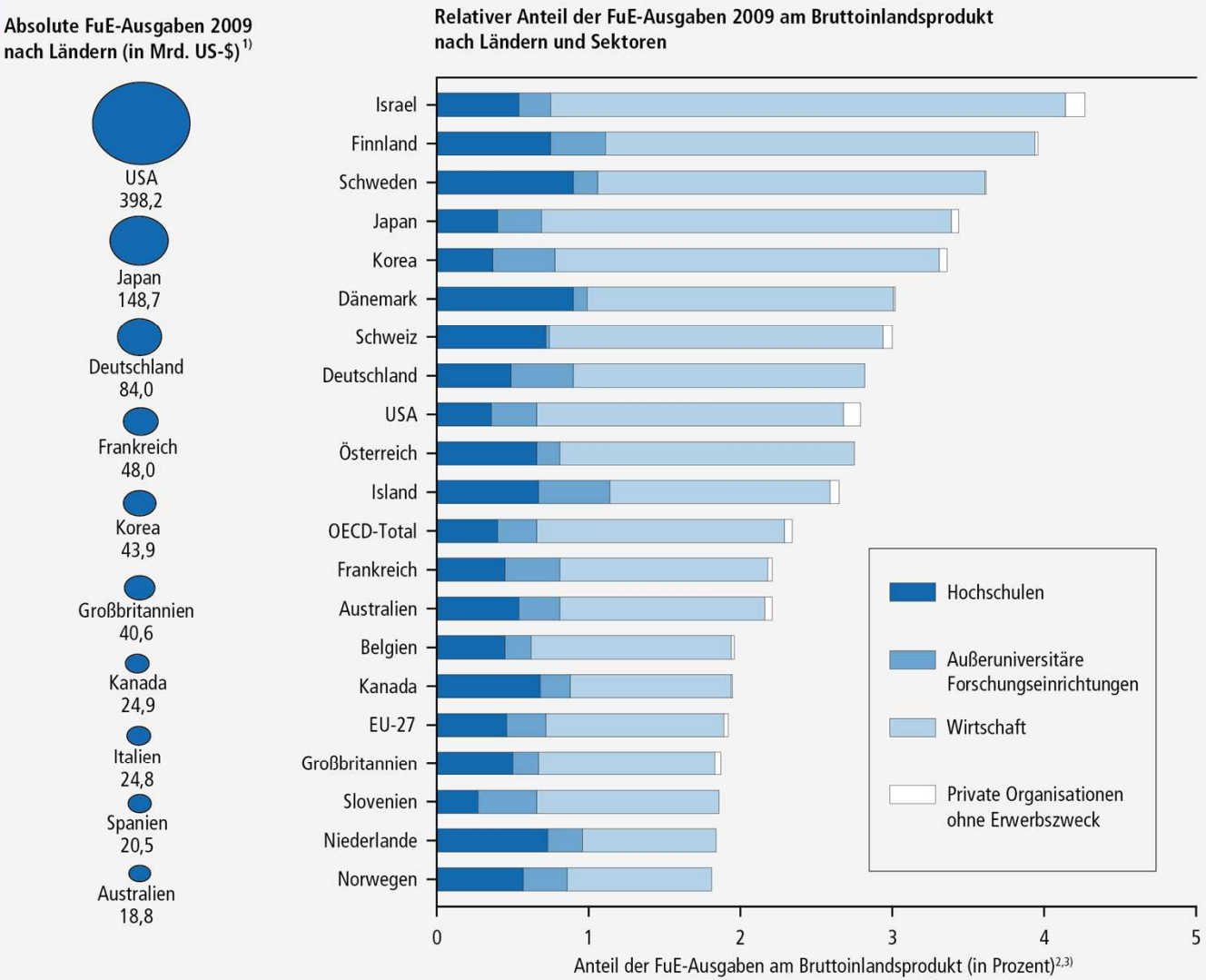
German Science System



(1) Basic public funding only 30 %

Abbildung 2-1:
FuE-Ausgaben von Deutschland im internationalen Vergleich

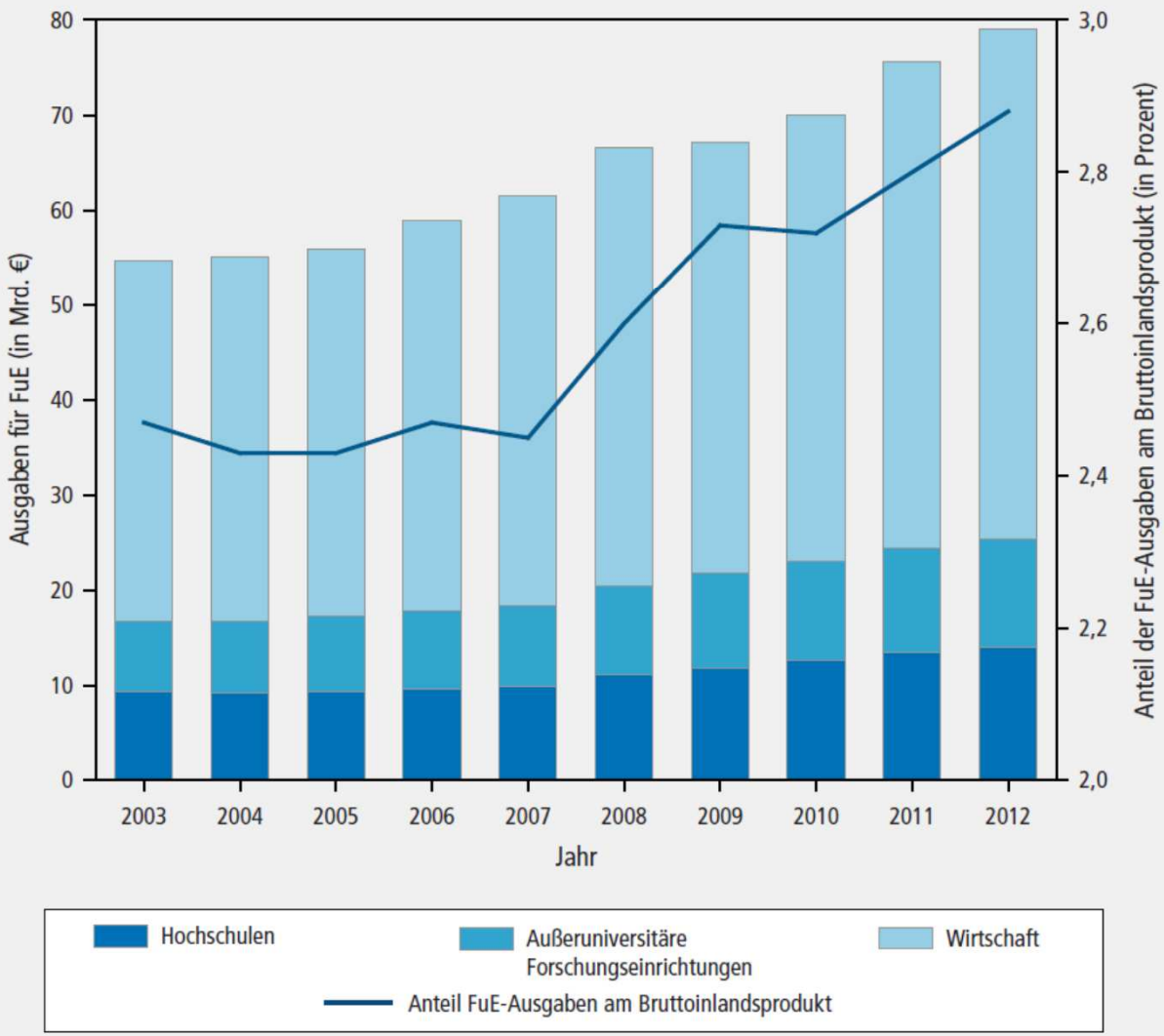


[1] Nominale Ausgaben, umgerechnet in US-$-Kaufkraftparitäten.
[2] Werte sind teilweise vorläufig oder von der OECD geschätzt.
[3] Nur Länder, die 2009 einen Anteil von mindestens 1,8 Prozent der FuE-Ausgaben am Bruttoinlandsprodukt aufweisen.

Datenbasis und Quelle:
Organisation für wirtschaftliche Zusammenarbeit und Entwicklung (OECD): Main Science and Technology Indicators 2010/2.
Berechnungen der DFG.

Lisbon-Goal: 3%

Abbildung 2-2:
Entwicklung der FuE-Ausgaben von Deutschland nach Einrichtungsarten 2003 bis 2012

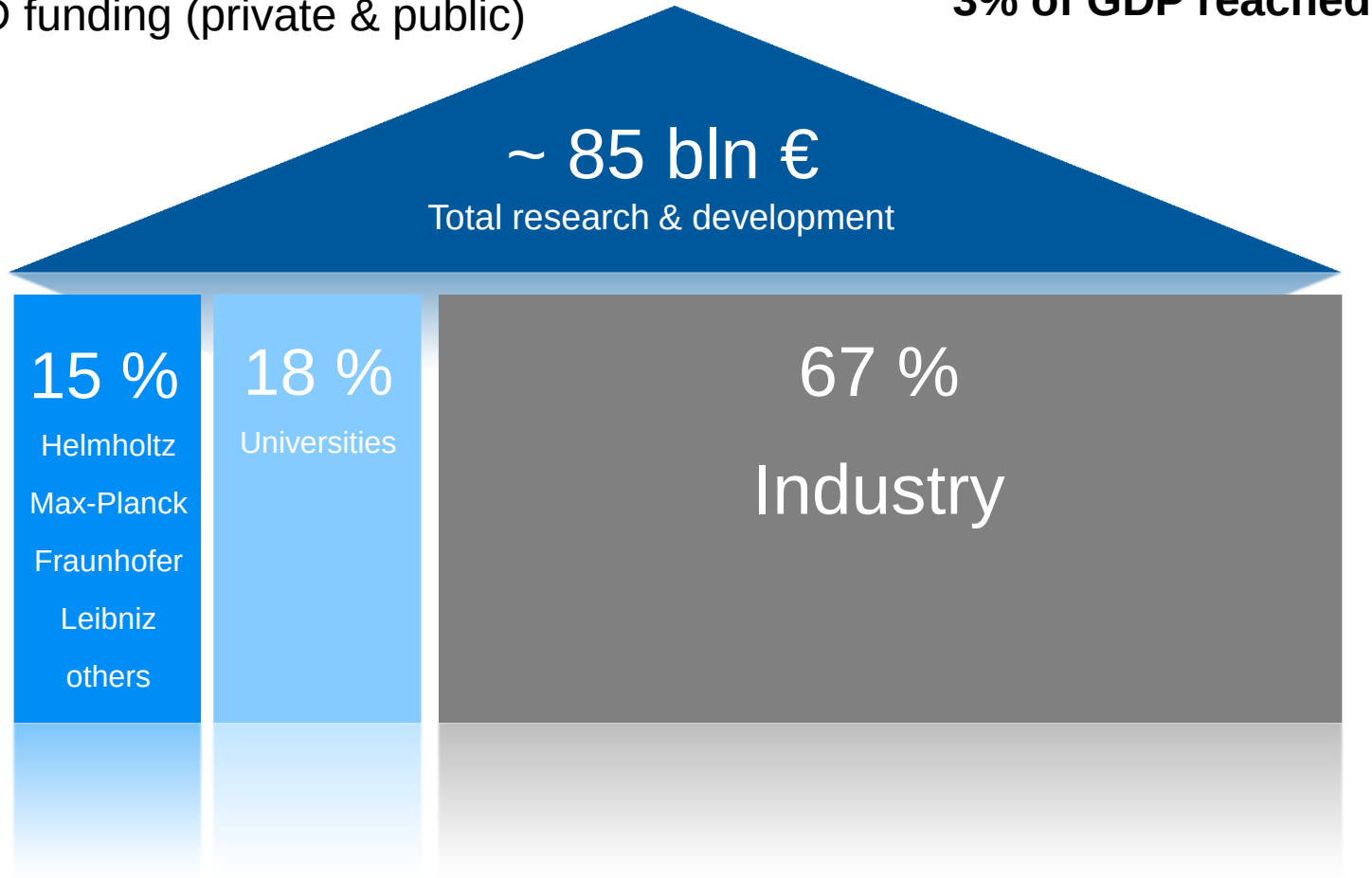


Datenbasis und Quelle:
Bundesministerium für Bildung und Forschung (BMBF): Bundesbericht Forschung und Innovation 2015, Tabelle 1.1.1.
Berechnungen der DFG.

German Research System

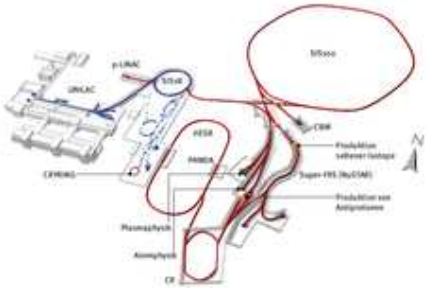
Lisbon-Goal:
3% of GDP reached

Total R&D funding (private & public)



Research Infrastructures

- Germany's research landscape is rich with strong research actors outside universities (e.g. Helmholtz, Max-Planck, …)
- funding streams are complex due to federal state character of Germany
- Large-scale research infrastructures (RIs) in Germany mostly the domain of Helmholtz Association, i.e. the national labs (such as DESY)
- Federal government (BMBF) has taken over main ownership in constructing and operating RIs
- In addition, BMBF has developed the funding instrument of "collaborative research/Verbundforschung" that had and has profound impact on the excellence and innovativeness of RIs



Collaborative Research / „Verbundforschung“

- Was developed early 1970 to support science at German RIs (particles/hadrons/nuclei, photons, …) through universities
- Main mission:
  - Optimize the utilization of RIs through collaborative research of excellent university (and industry) groups
- Features:
  - project-based funding: 3 years
  - support research at RIs of supraregional, national or international relevance
  - build collaboration of several universities
  - establish strong links between universities and RIs
  - focus on methods, technologies and instrumentation/detectors
  - can take place at each step of the RI life cycle

Collaborative Research / „Verbundforschung“

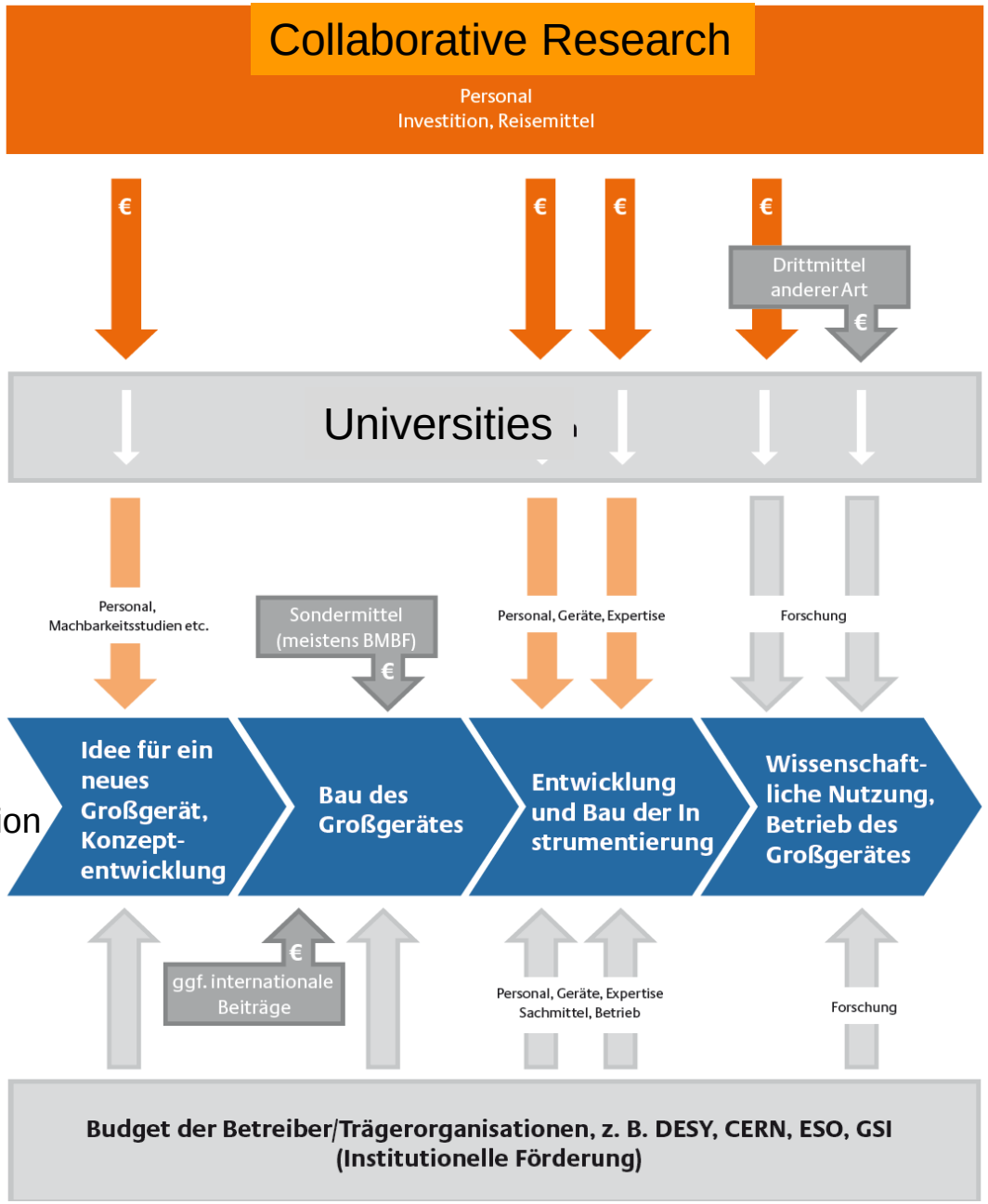
- win-win situation for all participants in (national) science system
  - Universities: profiting from excellent research opportunities at RIs
  - RIs: getting fresh and innovative ideas from universities while instrumentation and methods are permanently further developed/upgraded
- Collaborative research (relevant for physics) divided in
  - Particle physics
  - Hadrons and nuclei
  - Condensed matter
  - Astrophysics/astronomy, astroparticle physics (earth-based obsservatories)
  - (accelerators)
- Total funding volume: ~60M€ / year

Does not support regular access or user/RI operation !!!
For research projects other national funding streams through DFG are also available

Principle

Taken from
„Stark im Verbund -
Naturwissenschaftliche
Grundlagenforschung an Großgeräten“
BMBF Brochure, 2009

RI lifecycle
Idea/design- construction - utilization

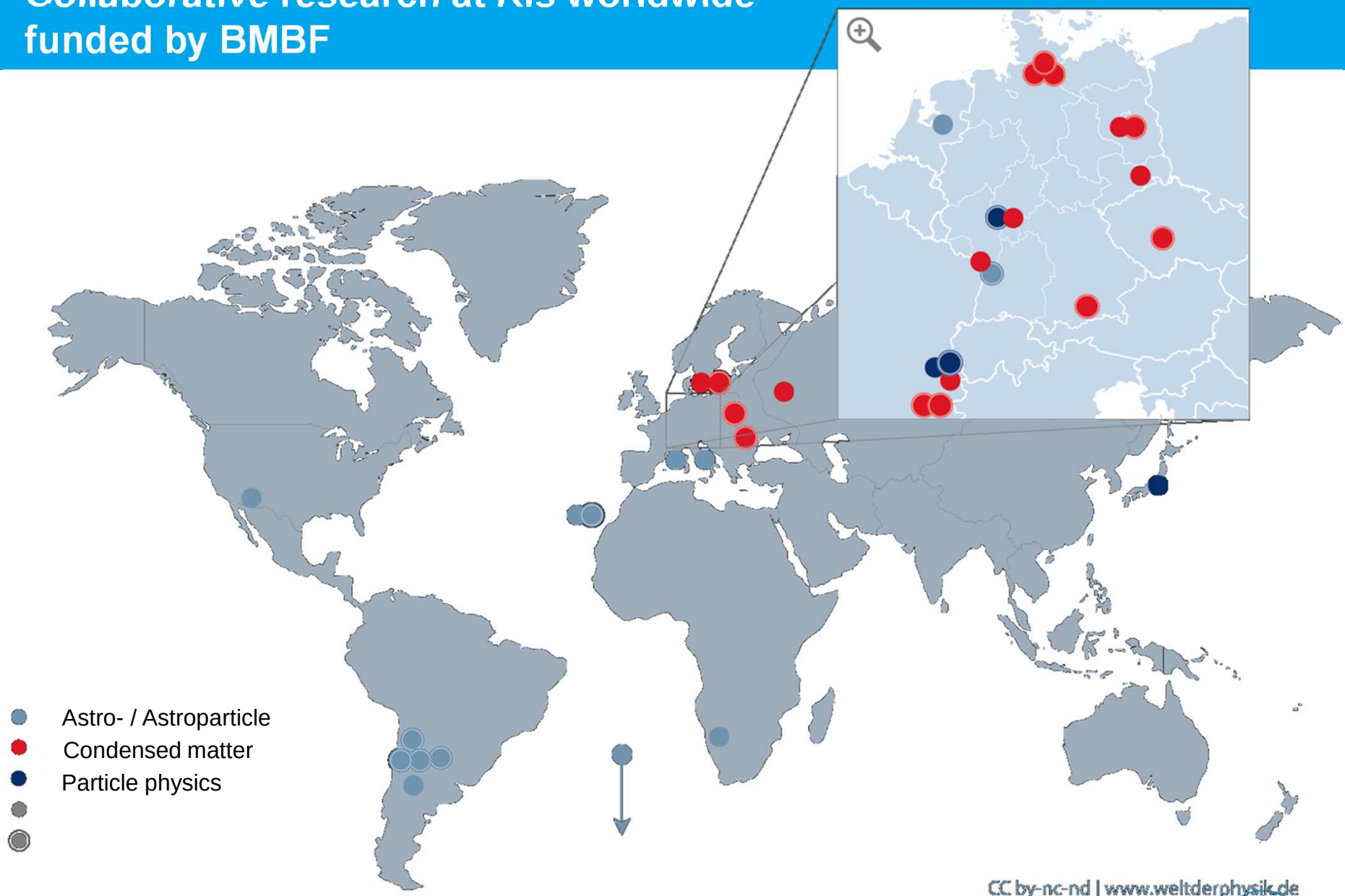


From the idea to the project – process of project funding

- Preparation and research strategic context
  - Discussions BMBF, committees, user communities
- Launching/publishing of calls, every three years
- Evaluation of proposals through review commitees
- Funding decision by BMBF
- Administered through project agency office – „Projektträger“
- Projects
  - Duration: 3 years
  - Typical project funds: ~500k€ over 3 years
  - 3-6 universities involved in proposal

Committees:
KfS – Synchrotron Radiation
KfN – Neutron Science
KET – particle physics
KAT – astro particle
KhuK – hadrons and nuclei
KfB - accelerators
…
Serve as interface between Ministry and user communities

Collaborative research at RIs worldwide funded by BMBF



Recent Evaluation of „Verbundforschung“

- Ex-post analysis of three funding periods from 2006-2014 (3x three years)
- Total 1032 funded projects:
  - 336 in hadrons & nuclei
  - 324 in condensed matter
  - 189 particle physics
  - 183 astro- and astroparticle physics
- Total funding spent: ~580 M€ over 9 years

Fraunhofer MOEZ technopolis |group| Fraunhofer INT

23. September 2016

Evaluation der Verbundforschung im Bereich der „Naturwissenschaftlichen Grundlagenforschung“

Endbericht

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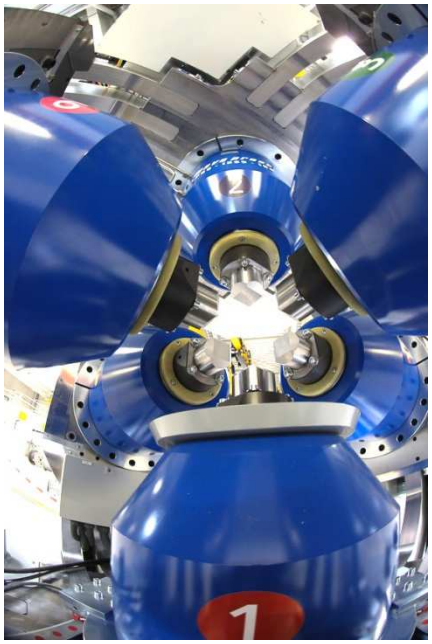
Results of Evaluation of „Verbundforschung“

- “Verbundforschung” has positive effects on science system
  - beneficiaries rate “collaborative research” in terms of effectiveness and efficiency as highly valuable
- innovative instrumentation and / or novel methodologies from universities reach RIs, are realized at RIs and are finally made accessible to international scientific users
- drives long-standing collaboration among universities and between universities and RIs
- helps to better integrate university groups into RI strategies and vice versa
- Promotion of young investigators:
  - About 1800 postdocs and ~3000 PhD students were funded 2006-2014
- Projects and collaborations attract further third party funds: 75% of projects acquired further funds between 100k€-1M€
- 40% of projects had spill over effects to universities – improvements in infrastructure

Examples of collaborative research

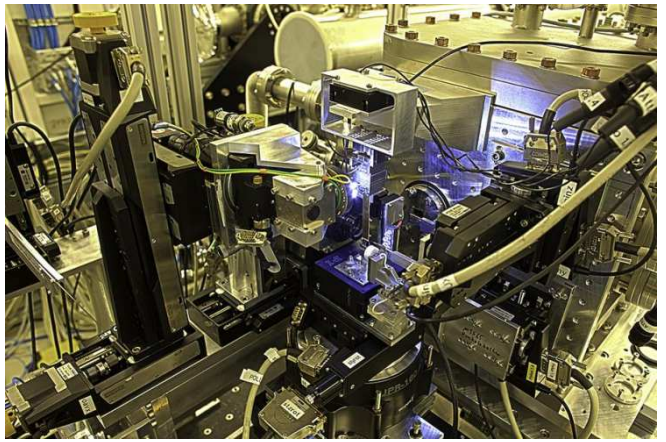
- Large Volume Press at PETRA III, beamline
- exerting forces of up to 500 tons - corresponding to 300,000 times atmospheric pressure or 900 km below Earth's surface
- Compress samples as large as 1 ccm - largest at any synchrotron light source in the world
- additionally, samples can be heated to more than 2000 degrees Celsius
- simulating dynamic processes in the Earth’s interior, but also for synthesising and studying super-hard materials that only form under high pressure.



BMBF grant no. KEI0500009612
Project “Aufbau einer experimentellen Station mit einer großvolumigen Hochdruckapparatur an der Damping-Wiggler-Beamline des Deutschen Elektronen Synchrotron DESY" (principal investigator Tomoo Katsura, University of Bayreuth).

Examples of collaborative research

- The Göttingen Instrument for Nano-Imaging with X-Rays (GINI-X) at PETRA III (at beamline P10)
- Coherent diffractive imaging of micro- and nanostructures
- Set up uses advanced mirror systems and a modular system of additional optical elements for beam definition, filtering and focusing with spot sizes in the range from 500 nm down to 5 nm
- Three classes of experiments:
  - Scanning X-ray transmission microscopy (STXM) and nano-diffraction
  - Ptychographic imaging
  - Holographic imaging (cone beam propagation imaging/tomography)

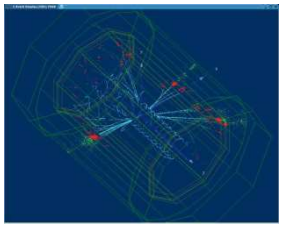


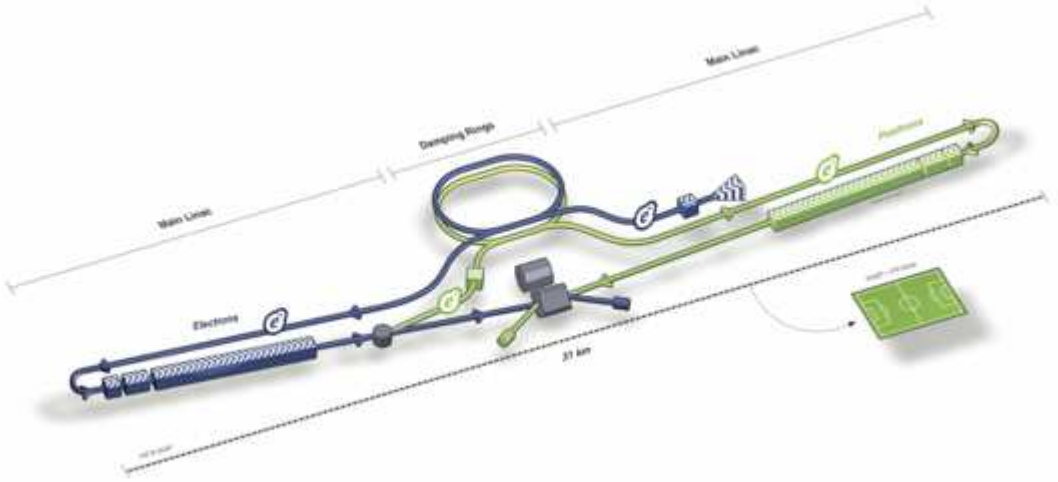
BMBF Verbundforschung “Struktur der Materie”,
Projects 05KS7MGA, 05K10MGA, and 05K13MG

T. Salditt, M. Osterhoff, M. Krenkel, R. N. Wilke, M. Priebe, M. Bartels, S. Kalbfleisch and M. Sprung.
J. Synchrotron Rad. 22, 86 7, (2015)

Examples of collaborative research

- Detector R&D for future linear colliders
- Consortium of U Bonn, Hamburg, Heidelberg, Mainz, Siegen, Wuppertal embedded in international collaborations
  - CALICE
  - LCTPC
- Hadronic calorimeter
  - SiPM readout
  - ...
- Time-Projection Chamber



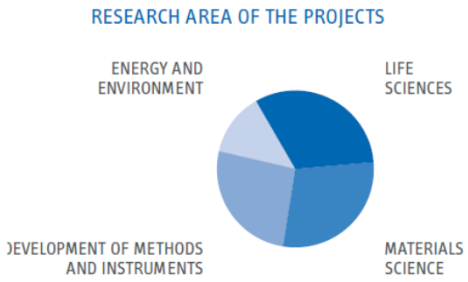


BMBF grants;
05H15PXRDA, 05H15UMRDA, 05H15PDRDA,
05H15VHRDA, 05H15GURDA, 05H15PSRDA

Extension of Collaborative Research to bilateral cooperation

Röntgen Ångström Cluster

- Röntgen-Angström-Cluster RAC
- German-Swedish Collaboration Platform since 2009
- Materials science and structural biology at neutron and x-ray sources
- 3 calls, ~53 GER-SWE research projects, 37 M€



IRI Ioffe Röntgen Institute

- Ioffe-Röntgen-Institute
- German-Russian Collaboration since 2011
- Materials & nano science at x-rays and neutron sources
- 1 call, 11 projects, ~10+10 M€
- Next call in preparation

DESY

Summary

- German science system is characterized by universities and an exceptionally large research sector outside universities (e.g. Helmholtz)
- need to exploit synergies and cooperation among research actors, i.e. between universities and RIs
- collaborative research links the expertise of the universities with the unique opportunities at RIs, creating innovative and new instrumentation, techniques and methodologies
- these instruments will then be put into open access – letting international users benefit
- Evaluation has shown the added value of „Verbundforschung“ as national funding instrument to maximize utilization of RIs at optimized performance
- A best practice model also for the Russian Megascience initiative?