Agenda Item 3: Progress Report 2022

Helmut Dosch

Vice President Research Field Matter

Research Field Matter

Overview: RF Matter lives a cross-center culture of cooperation

Matter

Matter and the Universe 33%	DESY 54%	GSI 20%	KIT 26%									
Matter and Technologies 31%	DESY 31%	FZJ 2%	GSI 10%	HZB 17%	HZDR 14%	Hereon 1%	KIT 25%					
From Matter to Materials and Life 36%	DESY 29%	FZJ 14%	GSI 14%	HZB 8%	HZDR 24%	Hereon 2%	KIT 9%					

LK II Research Infrastructures

FLASH	DESY	*PETRA III*	DESY	*GSI MML Ion Facilities**	GSI	*BESSY II*	HZB	*HLD*	HZDR
IDAF	DESY	*JCNS*	FZJ	*GSI MU Ion Facilities**	GSI	*ELBE*	HZDR	*GridKa*	KIT
XFEL	DESY	*FAIR*	GSI	*GEMS*	Hereon	*IBC*	HZDR		

**LK II in development*

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Our research aims to make critical contributions to solving grand questions and key challenges of today and tomorrow

MISSION Statement

- Find answers to the **grand open questions** of our universe
- Make critical contributions to
  - the design of **advanced materials** for future energy-, information- and transport technologies
  - our understanding of **biomolecular processes** and to the development of **better drugs**
- Exploit the potential of **large-scale research infrastructures**

Our A^4 strategy supports our mission

Matter A^4 strategy

Matter Roadmap 2023-2030

Upgrade Photon Science Facilities !

Attracting
the best brains

Accessing
new frontiers of research

Advancing
our research infrastructures

Accelerating
innovation and transfer

We have delivered outstanding scientific results

Outstanding achievements within programs
(see reports from MU, MML, MT)

First face-to-face program meetings after Corona

MT annual meeting: 26./27.09.2022 DESY (T. Behnke/A.-S. Müller)

MU annual meeting: 20./21.10.2022 GSI (R. Engel/B. Heinemann)

MML annual meeting: 05.-07.09.2022 HZB (T. Stöhlker/A. Stierle)

We have initiated major new projects bridging disciplines and national borders

Design of new kerosene

- May 2022: Opening of **Care-O-Sene** in Johannesburg

HZB KIT Karlsruher Institut für Technologie **Fraunhofer** & **Industry**

- Cooperation between RFs Matter & Energy
- 40 Mio. € Euro project (incl. 10 Mio. € by industrial partners) to develop novel catalysts for sustainable kerosene
- Building block of the German National Hydrogen Strategy

German Chancellor Olaf Scholz and South African President Cyril Ramaphosa

CARE-O-SENE
Catalyst Research for Sustainable Kerosene

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We have initiated major new projects bridging disciplines and national borders

September 2022: Decision for the **German Center for Astrophysics (DZA)** in Saxony

Important step towards a significant German participation in the Einstein Telescope

Next steps:

- Preparatory phase project from 2023 – 2025 hosted at DESY and TU Dresden
- Foundation of the DZA in 2026

29.9.2022 Günther Hasinger after the announcement of the decision

The DZA in a few years in Görlitz, Saxony

Unterstützt durch:
KAT. Komitee für Astro.Teilchen.Physik
VdR
DESY.
HZDR HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF
CASUS CENTER FOR ADVANCED SYSTEMS UNDERSTANDING
Stadt Görlitz

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We have initiated major new projects bridging disciplines and national borders

June 2022: Opening of the Helmholtz Sesame Beamline **HESEB experimental station** at SESAME (Jordan)

DESY. (coord.) HZB HZDR HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF KIT Karlsruher Institut für Technologie JÜLICH Forschungszentrum SESAME

- Helmholtz funding: 3,5 Mio €
- State-of-the-art X-ray spectroscopy for materials research
- Germany: observer in Council

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The Research Field is preparing the upgrade of its photon science facilities to assure international leadership

Photon Science Roadmap

- PETRA IV: Proposal finished → ready to go
- BESSY III: CDR Phase → construction start 2029/30
- DALI: CDR in final stage

Post Corona user operation

- Increase of *remote* and *mail-in* experiments
- Position paper Photon Science: → more resources
  (in PoF IV no additional Helmholtz funding possible)

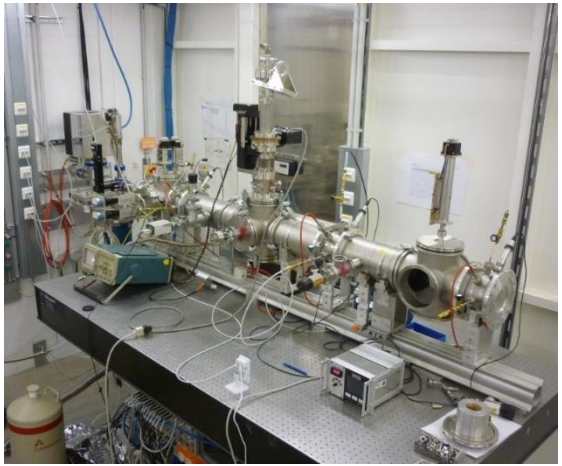
ROCK-IT

- Joint Remote Demonstrator Beamlines at BESSY II and PETRA III

The **ROCK-IT** Demonstrator Project devises the next steps in the autonomous beamline operation of tomorrow

Increasing the degree of automation of complex SR experiments

- Test case: *operando* synchrotron radiation catalysis experiments at BESSY II, PETRA III, and KARA (for testing)
- Highly attractive science and industrial case
- Transfer to
  - other experimental techniques at SR sources
  - other probes like neutron experiments
  - other communities like in the RF Earth and Environment



ROCK-IT has been launched in January 2023 and is taking up speed now

DESY. HZB HZDR HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF KIT Karlsruher Institut für Technologie

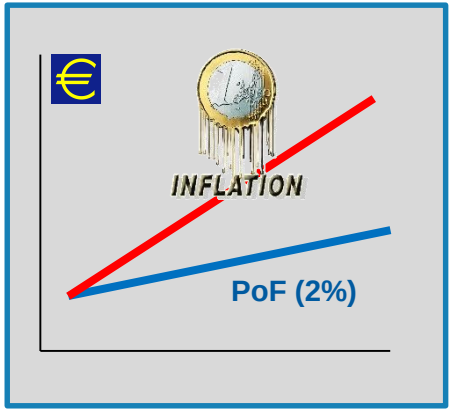
The energy-intensive labs of Matter are challenged by difficult energy and gas supply as well as massive inflation

- **Energy crisis** poses problems for all Matter centers, inter alia for energy-intensive LK II operation:
  - 39 million € LK II reserve → 2023 and 2024
  - national “Härtefallfonds” (500 Mio €) likely to provide relief
- **Massive inflation and steeply rising personnel costs**
  assumption 2023-2025: ≈ 8% (vs. 2% increase in programs)
  - defacto hiring freeze in all centers
  - major concerns about PhD and Postdoc contracts

  → **no solution so far**

  → **need to avoid irreversible damage to next gen scientists**
- **Gas Market: Significant bottlenecks and enormous price explosions**, esp. for He gas

  situation very tense, unclear solution



All labs of the research field are closely following the Senate recommendations

a. Pay attention to new research lines and new topics.

b. Attract young, bright scientists; role model if strong diversity measures are taken.

c. Build in industry contacts within the projects.

d. Achieve greater coordination with the research community beyond Helmholtz in Germany, as a way to promote the objectives of the Helmholtz Association (Health, Energy, etc.)

e. Take forward plans to provide sufficient resources for data handling and computation

Research Field Matter is continuously screening new research lines

a. Pay attention to new research lines and new topics

→ **First preliminary input for program developments in PoF V (see below)**

MML:

– **High Energy Density Matter**	**HIBEF Infrastructure @ XFEL & HIHED proposal (Helmholtz Institute)**
– **LK II user operation**	**PETRA IV, DALI, BESSY III, GSI Ion Facilities**

MU:

– **Gravitational Waves**	**Einstein Telescope (European project)**
– **Dark Matter**	**BabyIAXO, DARWIN**

MT:

– **Laser R&D, Photonics**	**under current discussion: creating more coherence within program structure**
– **DMA**	**more resources, closer cooperation with RF Information, AI**

Contributions to future cross cutting Helmholtz initiatives:

– **“Measures fighting climate change“ and “Quantum technologies” (materials, sensors, computing)**

Research Field Matter offers highly attractive environments for R&D to attract the best minds

b. Attract young, bright scientists; role model, if strong diversity measures are taken

Matter has installed an **HR working group** for

- exchange of best practices and
- devising new joint activities

(see presentation by Katja Frerks)

Successful recruitments, the acquisition of ERC grants and renowned awards prove the success of the A^4 strategy

Elli Pomoni, DESY (MU-FPF)
- “Exact results from Broken Symmetries”
- Appointment with Uni Hamburg
- 2022 **ERC Consolidator Grant**

Tobias Dornheim, HZDR (MT-DMA & MML-Matter)
- Young Investigator Group Leader at Center for Advanced System Understanding
- Methods of machine learning to predict the theoretical description of Warm Dense Matter
- 2023 **ERC Starting Grant** “Predicting the Extreme“ (PREXTREME)

Andreas Bauswein, GSI (MU-CML)
- Theorist in the department Nuclear Structure & Astrophysics
- HEAVYMETAL project (synthesis chemical elements in neutron star mergers)
- 2022 **ERC Synergy Grant**

Frank Schröder, KIT (MU-FPF)
- 2018 assistant professor of physics and astronomy at the University of Delaware, USA
- 2021 Sloan Research Fellowship
- 2019 **ERC Starting Grant** “Digital Radio Detectors for Galactic PeV Particles“

All centers of the Research Field Matter have implemented an efficient technology transfer strategy and structure

c. Build in industry contacts within the projects

- All centers within Matter have implemented an **ILO and/or a CTO** in their management structure
- Matter has installed a **WG Technology Transfer** (team of ILOs, CTOs)
- WG TT has developed a **joint TT position paper**

All FBM centers continue to contribute to the seven TT targets.

New developments

- **Innovationsplattform HI-ACTS**
- **New Helmholtz Transfer Academies**
  operated FB Matter:

InnoSuper	FZJ, GFZ, HZDR, KIT
HAFIS	KIT, FZJ, GSI, HZDR
Future Innovators	DLR, DESY
HZDR Innovators School	HZDR

- **CAROTS Start-Up School** DESY, Hereon
- **Hereon Innovation Lab** Hereon

The **HI-ACTS** project shows how the centers of MATTER can jointly create new avenues of innovation and transfer

c. Build in industry contacts within the projects

Example

HI ACTS | Helmholtz Innovation Platform for Accelerator-based Technologies and Solutions

Transforming our accelerators into „innovator tools“

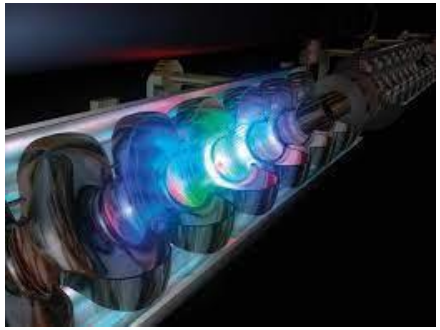
DESY. Coordinator

GSI

Helmholtz-Zentrum hereon

HZB

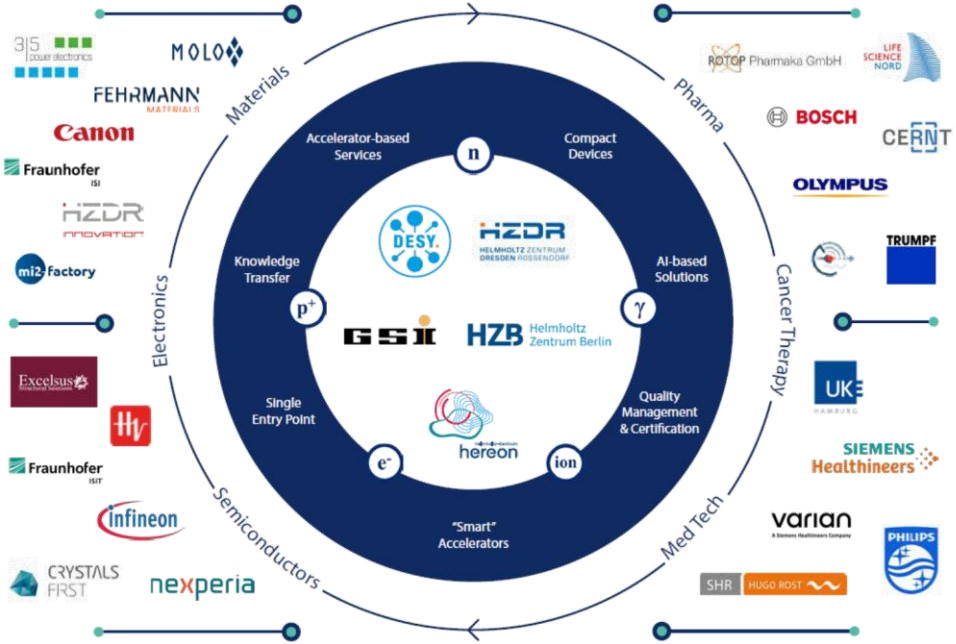
HZDR HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF



Budget:
€ 12.9 Mio (2023-2025, BMBF)

HI-ACTS transforms „expert-accelerators“ to „innovator-tools“ for maximum value in markets

Industrial partners (12 *LoIs*)



- The **One-Stop Agency** for users and technology partner
- Applications in:
  - Medical Radiotherapy & Medical Technology
  - Radiopharmaceuticals & Radiotheragnostics
  - Drug Development
  - Semiconductors
  - Materials Design

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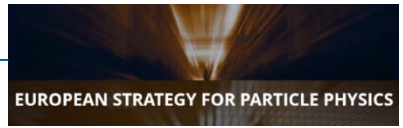
RF Matter is a well established driver for coordination of research across organisations and national borders

d. Achieve greater coordination with the research community beyond Helmholtz in Germany, as a way to promote the objectives of the Helmholtz Association (Health, Energy, etc.)

Last SAB meeting: focus on strategy docs

European strategy for

- **Astroparticle physics (APPEC 2017)**
- **Particle physics (ESPP 2020)**
- **Photon Science (ESAPS 2022)**



LEAPS

Today: role of our research infrastructures

Our user facilities foster team building across disciplines on a national and international level

d. Achieve greater coordination with the research community beyond Helmholtz in Germany, as a way to promote the objectives of the Helmholtz Association (Health, Energy, etc.)

Next step at analytical user facilities:
new access mode (in implementation phase)

„targeted challenge-driven access“

→ adressing large interdisciplinary research groups
→ targets are grand challenges adressed by Helmholtz
work in progress: national/European consortia

- molecular water (CMWS)
- operando catalysis (CatLab)
- biomedical

Our user facilities foster team building across disciplines on a national and international level

d. Achieve greater coordination with the research community beyond Helmholtz in Germany, as a way to promote the objectives of the Helmholtz Association (Health, Energy, etc.)

Further examples of community building

Tailored lab environment and unique facility capabilities

CatLab
CATALYSIS LABORATORY

HZB Helmholtz Zentrum Berlin
FRITZ-HABER-INSTITUT MAX-PLANCK-GESELLSCHAFT
MAX-PLANCK-INSTITUT FÜR CHEMISCHE ENERGIEKONVERSION
BASF We create chemistry
REVCNOSTICS Science & Engineering

Joint platform DESY-Fraunhofer Institutes

- Better utilization of RI
- Strengthen collaboration between applied and basic research
- Current process: gathering needs and questions of participating Fraunhofer Institutes to define concrete projects at SR facility

Fraunhofer
DESY.

U.S. DEPARTMENT OF ENERGY
HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

Helmholtz-DOE-dialog

Management meeting in Washington, DC on 28.09.2022

- Global challenges, geopolitical tensions, strengthening transatlantic relations, promoting international cooperation
- RFs: Energy, Matter, Information
- Agreement on a common method for staff maps & development of a new cooperation framework

We are currently working on several frontiers to land more resources for data handling and computing.

e. Take forward plans to provide sufficient resources for data handling and computation

Current activities include

- Upgrade TIER centers — **Proposal for Strategische Ausbau-Investitionen** in preparation
- MT-DMA in PoF V — **Request for resource increase**
- Incubator Platforms — **HIFIS and HIP with strong Matter guidance** efforts to sustain Helmholtz funding (next slides)

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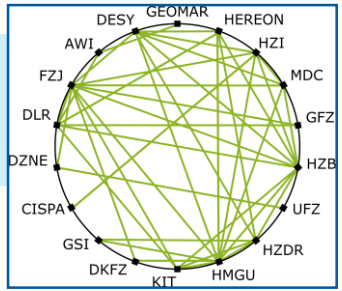


Strong efforts to sustain funding of incubator platforms:

HIFIS | HELMHOLTZ FEDERATED IT SERVICES

HIFIS has become major provider & blueprint for science-oriented digital services

Review Sep 2022 → excellent marks

HMC | HELMHOLTZ METADATA COLLABORATION

Helmholtz Metadata Collaboration promotes qualitative enrichment of research data across all Helmholtz-centers

Review May 2023

HIP

Helmholtz Imaging Platform (by DESY, DKFZ, MDC) provides service in analysis of complex imaging data

Review Apr 2023

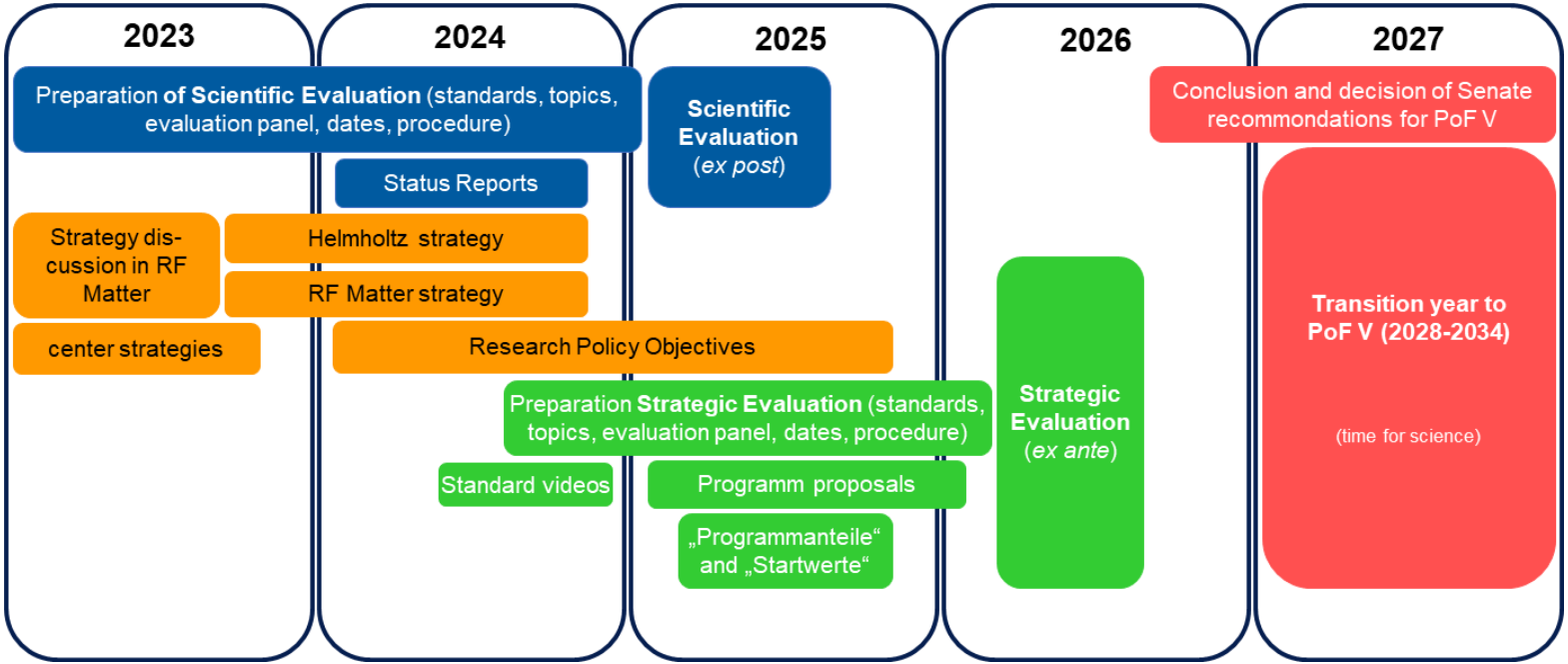
HELMHOLTZ AI | ARTIFICIAL INTELLIGENCE COOPERATION UNIT

Helmholtz.AI MATTER consulting group (by HZDR) provides AI expertise for researchers at all M-centers

Review Oct 2022 → excellent marks

The Matter Management and Steering Board are devising the update of the program for the next funding period.

Preparations for PoF V in full swing



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The Matter Management and Steering Board are devising the update of the program for the next funding period.

Preparations for PoF V include

- **Update of contributions** of all centers to programs
- **Creating more coherence within program structure** of joint R&D initiative as lasers, photonics, quantum (see above)
- **Strengthening of DMA**
  Major data challenges ahead in all programs
  → LK I and LK II need more resources in PoF V
- Integration of **Helmholtz incubator platforms**
  Matter: HMC, HIFIS, HIP, Helmholtz.AI
- Preparation to contribute to **Helmholtz-wide initiatives**
  – Climate change and planetary health
  – Quantum technologies

2023 → 2028

Thank you for your attention!

Last Update of Helmholtz Roadmap in 2022

- 2021 Public presentation of Helmholtz Roadmap
- 2022/23 Update of Helmholtz Roadmap

Research Infrastructures

Research Field Matter – Planned Research Infrastructures

	Titel	Investitionssumme	dv. Dt. Anteil	dv. Helmholtz-Anteil	2023	2024	2025	2026	2027	2028	2029	2030	2031ff	2032	2033	2034	2035ff	jährl BK
Kat. A	**DDL** (**DESY**, HI-Jena, GSI, KIT, HZB)	**31,6**	**31,6**	**31,6**	2,52	9,7	10,085	5,5	3,8									2,95 Mio. €
	ACDC (**HZDR, GSI**)	**< 50,0 Mio. €**	**< 50,0 Mio. €**	**< 50,0 Mio. €**	in Revision													in Revision
	Upgrade TIER-Zentren für HL-LHC (**KIT,** DESY, GSI)	**33**	**33**	**33**					3	11	13	6						13 Mio. €
	Zwischen-∑ A																	
	Titel	**Investitionssumme**	**dv. Dt. Anteil**	**dv. Helmholtz-Anteil**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031ff**					jährl BK
Kat. B Helmholtz Photon Science Roadmap	**PETRA IV** (**DESY**, HZG)	**1,4 Mrd.**	**1,4 Mrd.**			30	165	273	352	304	169	80	41					92 Mio. €
	DALI (**HZDR**)	**200**	**200**			8	8	22	38	30	56	38						20 Mio. €
	BESSY III (**HZB**)	**980**	**980**								70	140	210	240	170	90	60	70-75 Mio €
	Zwischen-∑ B	**2580**	**2580**															
	Titel	**Investitionssumme**	**dv. Dt. Anteil**	**dv. Helmholtz-Anteil**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031ff**					jährl BK/Investdauer
Kat. C	**IC-G2** (**DESY**, KIT)	**292,2**	**40**	**20,8**		2,2	3,3	3,805	2,79	2,555	2,56	2,56	1,03					0,9 Mio. € / bis 2032
	DARWIN (**KIT**)	**175**	**44**	**22**			2,5	2,5	5,125	5,125	3,38	3,38						0,2 Mio. €
	ET (**DESY**, KIT, HZDR)							*x*	*x*	*x*	*x*	*x*	*x*					*<10 Mio. € / bis 2035*
	GCOS (**KIT**)	**390**	**40**	**40**						3,5	3,5	5	28					<1,5 Mio. € / bis 2037
	Zwischen-∑ C (ohne ET in den einzelnen Jahres-scheiben)	**857,2**	**124**	**82,8**	0	2,2	5,8	6,305	7,915	11,18	9,43	10,9	29					

	HIBEF 2.0 (***HZDR, GSI***)	***28***	***28***	***28***		*9*	*10*	*9*										*3,9 Mio. €*