

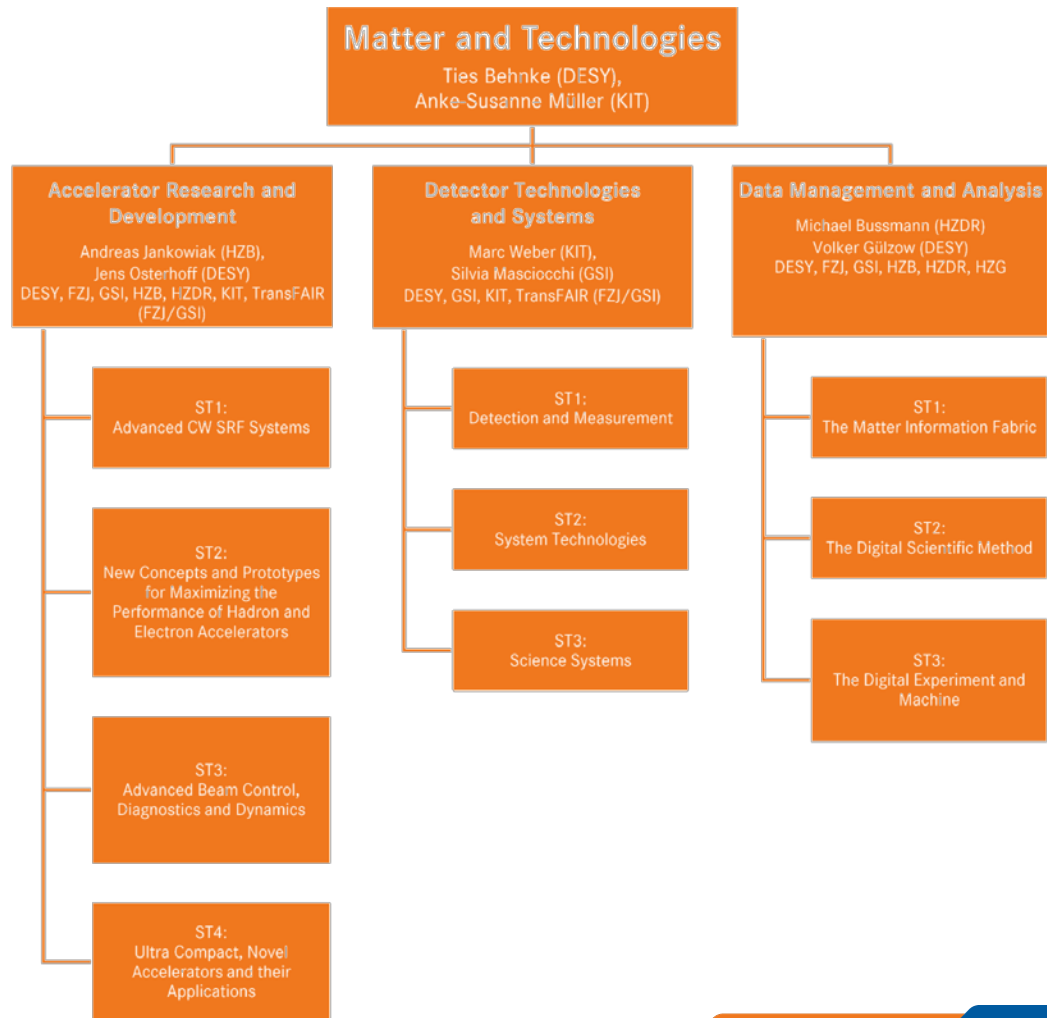
## ARD in PoF IV

(ACCELERATOR RESEARCH AND DEVELOPMENT IN MATTER AND TECHNOLOGIES  
PROGRAM ORIENTED FUNDING PERIOD NO. IV)

A. Jankowiak

7<sup>th</sup> ARD ST3 annual Meeting  
18.10.2019

# Accelerator Research and Development in Matter and Technologies in PoF IV



# ADAPTION OF ARD STRUCTURE PoF III → PoF IV

PoF III

PoF IV

**Subtopic 1**

SCRF Science and Technology

**Advanced cw SRF Systems**

**ST2**

Concepts and Technologies for Hadron Accelerators

**New Concepts and Prototype for Maximizing the Performance of Hadron and Electron Accelerators**

**ST3**

Picosecond and Femtosecond Electron and Photon Beams

**Advanced Concepts for Beam Control, Diagnostics and Dynamics**

**ST4**

Novel Acceleration Concepts

**Ultra Compact, Novel Accelerators and their Application**



# ARD PARTICIPATING CENTERS AND MANAGEMENT TEAM

DESY, FZJ, GSI (is back !!) & (HIJ, HIM), HZB, HZDR, KIT



*TransFAIR of IKP/FZJ to GSI! FZJ will directly contribute to ST4.*

## Management Team in PoF IV

ARD spokespersons: HZB (Jankowiak) / DESY (Osterhoff)

**ST1**

HZB (J. Knobloch)  
HZDR (P. Michel)

**ST2**

GSI (P. Spiller)  
KIT (A. Müller)

**ST3**

DESY (H. Schlarb)  
KIT (E. Bründermann)

**ST4**

DESY (B. Marchetti)  
HZDR (U. Schramm)

# The Program Proposal for the Strategic Evaluation

One document for the whole research area Matter (300 pages)

Three Programs (MU, MML, MT), each with three topics + LK II Facilities

# PROGRAM PROPOSAL IN A NUTSHELL

Strategic guidelines of the federal and state ministries for the strategic positioning of the research field.

Principal investigators of the research field draft comprehensive proposals for new Helmholtz research programs.



- **Matter** report about 300 pages consisting of
  - Overview (Research field)
  - Program Proposals MU, MML, MT
  - LK II facilities (including IDAF in MT)
- Document is written, agreed on and is in its final layout phase



# TOPIC DESCRIPTION ARD

## Executive Summary

Six Helmholtz-Centers and two Helmholtz-Institutes, with their national and international partners, collaborate intensely to **advance the state-of-the-art in accelerator science and technologies**. Our activities substantially contribute to the **future expansion of capabilities of large-scale accelerator-based research facilities within the Helmholtz Association and beyond and, at the same time, serve to develop novel disruptive concepts and methods**. As such these endeavors form the foundation and nucleus for the continued scientific leadership of this research field in deciphering the structure of matter. As ARD is a true cross disciplinary endeavor, linking science and technology, it offers an ideal environment to integrate M.Sc., Ph.D. and Post Doc researchers.

## Strategy

Our strategy is a **consequent evolution of the very successful approach established with PoF III**. The focused research and development program is organized in four subtopics, reflecting the four major research goals: **Advanced CW SRF-Systems (ST1)**; **New Concepts and Prototypes for Maximizing the Performance of Hadron and Electron Accelerators (ST2)**; **Advanced Beam Control, Diagnostics and Dynamics (ST3)**; and **Ultra Compact, Novel Accelerators and their Applications (ST4)**. The research activities take place in an interlinked scientific network guided by an established cross-institutional management structure. They **closely interact not only within ARD, but also with the sister topics DTS and DMA**. Our work is synchronized with the programs of Matter and active links exist to other Helmholtz research fields such as Health. Beyond this lively network, the **intense exploitation of dedicated test facilities and setups within ARD is essential for rapid scientific advances**. **These test facilities also act as catalysts and hubs for our technology transfer activities**.



# MILESTONES ARD-ST1 + ST2

Mst	Year	Milestone + Partners	ST	Centers
ARD.01	2023	Review the usage and impact of Machine Learning on the ARD research program.	common	All
ARD.02	2024	Update evaluation of the user needs for guidance of the research program	common	All
ARD.03	2024	Review of SRF CW materials performance and re-alignment of studies	ST1	DESY, HZB
ARD.04	2025	Demonstration of high-brilliance SRF-based electron sources	ST1	HZDR, HZB, DESY
ARD.05	2025	Demonstration of CW SRF high-current heavy ion beam acceleration	ST1	GSI, HIM
ARD.06	2026	Compilation of recipes for CW SRF accelerating systems design and operation.	ST1	DESY, HZB, HZDR, HIM, GSI
ARD.07	2024	Design review for high field and fast ramped superconducting magnets with an assessment and selection on the most promising concepts.	ST2	GSI, KIT
ARD.08	2024	Assessment on the main intensity limitations of large circular accelerators and options to shift them to higher values.	ST2	GSI
ARD.09	2026	Summary and evaluation of progress in conservation and generation of reliable operation with high beam quality by means of advanced beam controls and cooling concepts.	ST2	GSI, GSI-Jülich, HI-Jena, HZB, KIT

# MILESTONES ARD-ST3 + ST4

Mst	Year	Milestone + Partners	ST	Centers
ARD.10	2024	First stage demonstration of experimental and theoretical methods for tailored longitudinal phase space generation	ST3	All
ARD.11	2025	Establish routine femtosecond precision operation at short-pulse accelerator facilities	ST3	DESY, HZDR, KIT
ARD.12	2027	Demonstration of experimental and theoretical methods for tailored 6D phase space generation	ST3	All
ARD.13	2022	First availability of jointly developed infrastructure ATHENA	ST4	All
ARD.14	2024	Understanding of scaling of proton energies and assessment of applications of societal relevance (e.g. tumor therapy)	ST4	GSI/Hi-Jena, HZDR
ARD.15	2025	Measurement and control of electron beam parameters suitable for FEL pilot user facility	ST4	DESY, KIT, Hi-Jena, HZB
ARD.16	2027	Substantial increase in average power of plasma accelerators for high throughput applications	ST4	DESY, Hi-Jena, HZDR

# OPPORTUNITIES AND RISKS ARD

only excerpt

- ARD's activities are associated with a large portfolio of great opportunities with societal impact in scientific, industrial and medical applications, but are also covering a wide range of risks with varying levels of predictability with respect to a successful fulfilment of the expectations.
- On purpose, the objectives of ARD in PoF IV finely balance high-risk, high-reward projects with evolutionary, and thus, more plannable technology development activities.
- The ARD focus on compact accelerator technology may lead to a paradigm shift in accelerator applications with potentially large impact, e.g., through compact medical applications. These activities are clearly at high-risk but of high-reward, if successful.
- In parallel, we will evolve technology and methods for upgrading existing and planned accelerator facilities, relying on its unique infrastructures and know-how. Most prominently, the realization of efficient CW operation in the near future will have a large impact on the upgrade path of existing large-scale facilities (LSF), the associated risk of failure can be considered low. In contrast, the development and implementation of novel superconductor materials in LSF for cost effective 4.2 K operation of SRF systems is a long-term activity, for which a successful completion is a formidable challenge, and thus, difficult to predict.

# The Strategic Evaluation

One panel (11 members) on 3 ½ days for the whole research area Matter (300 pages)  
Ca. ½ day for Matter and Technologies

# STRATEGIC EVALUATION



**Strategic evaluation** of each research field in total 6, and its programs by international panels of experts.

Members of the Matter panel

- Chair: Ursula Bassler (IN2P3)
- all six chairs of the Ex-Post center reviews
- Freddy Bordry (CERN), Sine Larsen (U CPHG), Michael Peiniger (RI), Christina Scheu (MPG)

- The strategic evaluation for matter: 27.-29. January 2019, Berlin
- The four dimensions of the evaluation:
  - Goals
  - Work plan
  - Competences and Resources
  - Impact & Risks
- The smallest evaluated unit will be the topic

# THE STRATEGIC REVIEW

(MATTER = 27.-29.01.2019)



## Participants in the review:

- The panel (11 members)
- The Senate member responsible for Matter: R.D. Heuer
- A representative of the senate commission
- The president of the Helmholtz association
- Funding agencies
- **Program speakers, topic speakers (3 + 9)**
- Scientific directors of the centers (8)
  
- And additionally for ARD:  
ST speaker J. Knobloch, P. Spiller, H. Schlarb, U. Schramm

09.-10.01.2020: 1<sup>st</sup> rehearsal, DESY, Hamburg  
20.-21.01.2020: 2<sup>nd</sup> (final) rehearsal, Berlin  
(with Mock Reviewers)

16.12.2019: ARD preparatory meeting, Berlin  
(all ST speaker and center representatives)  
18.12.2019: MT preparatory meeting, Kassel

**MANY THANKS FOR YOUR ATTENTION!**

