*GSI Helmholtzzentrum für Schwerionenforschung*

Research Field Matter

**Status Report 2024**

Volume I

*[Notes: To facilitate the use of the template, you will find short explanations or guiding questions (highlighted in green) under the respective headings. Please delete them completely before submitting this report.]*

Date: Month day, 2024

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1. Introduction

*[Introductory words on the idea of the status report as a basis for the scientific review process (3 lines).]*

[Text]

* 1. Helmholtz Association [responsible author: Helmholtz President]

*[Brief description of Helmholtz Association, its mission and strategy (2 pages).]*

[Text]

* 1. Research Field Matter [responsible author: Vice President]

*[Brief description of the mission and strategy, research portfolio und the corresponding programs as well as its position in the national and international context (3 pages); first sections of the strategy paper]*

[Text]

* 1. GSI Helmholtz Center for Heavy Ion Research [resp. author: Center Director]

***[names needed! Paolo Giubellino? Yvonne Leifels?]***

*[Brief description of the research center, the activities in all research areas in general, the most important research infrastructures and user facilities (5 pages).]*

[Text]

1. Research activities [responsible author: Center Director]

***[names needed! Paolo Giubellino? Yvonne Leifels?]***

*[Notes: Introductory words on the presentation of the research activities of the research center along the programs and topics (1/2 page).]*

Text

|  |
| --- |
| Optional: Picture / Chart |

Fig. 1: Text

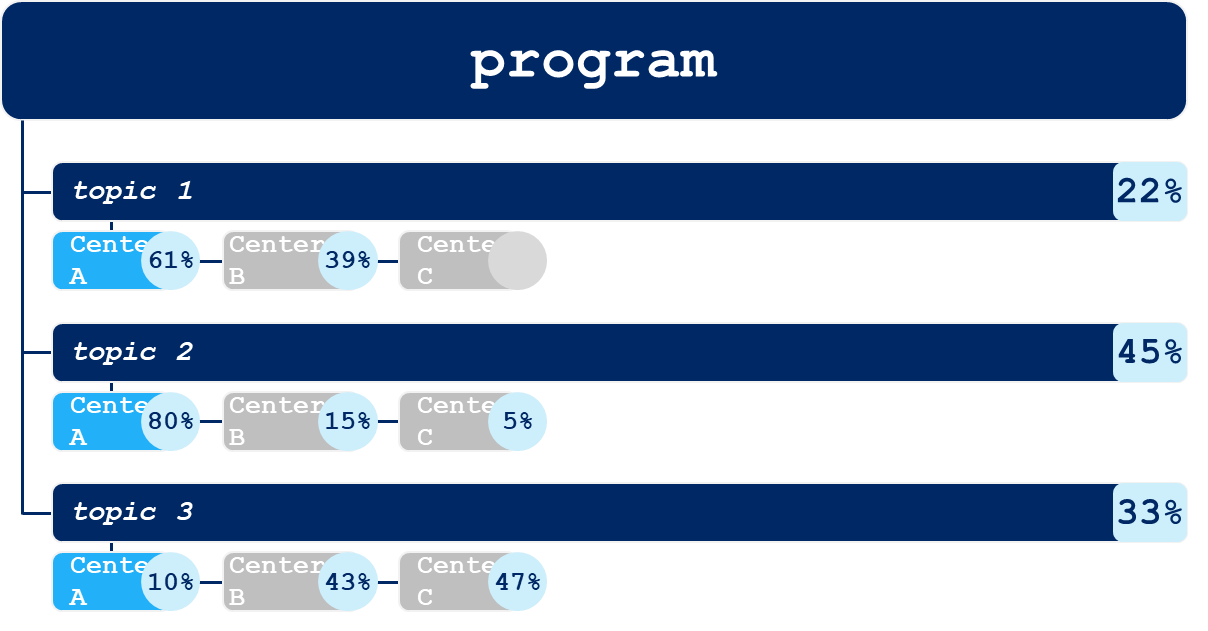
[Text]

* Text
  1. Program 1 Matter and the Universe [Yvonne Leifels]

*[Notes: Brief description of the current program, its strategy and the corresponding contributions of the research center at the level of topics and the entire program (up to 2 pages).]*

*[Key questions: See template for the review report,* [*LINK*](https://syncandshare.desy.de/index.php/s/6tr5rg4eYAwmGCP)*.]*

*Examples*



*Fig. 2: Text*

*[Choose one of the examples to show the structure of the program]*

[Text]

* + 1. Topic 1.1 Cosmic Matter in the Laboratory [Tetyana Galatyuk]

*[In-depth description of the contributions of the center to the topic including past and future challenges (less than 1/3 page per FTE. -> ~28 pages for 85.1 FTE as of ZFB-2022).]*

Scientific performance and impact

*[Key questions:*

* *How do you rate the scientific quality and the innovative potential of the research activities?   
  At what level is the research internationally competitive?*
* *How do you rate the transformative impact of the research on the field and/or potential for significant societal or economic impact?*
* *How do you evaluate the scientific achievements in relation to its size, available infrastructure, and funding?*
* *What are specific strengths and weaknesses?*
* *Can you identify novel contributions to the field? If so, which are they?*
* *Please indicate the most prominent research results (up to three).*
* *Can you identify scientists with exceptional contributions to the field?]*

Contribution to the topic

*[Key questions:*

* *How do you rate the impact of the center’s contributions to the topic? Which are essential, important, or additional contributions?   
  Please comment in view of originality and strategic relevance for this research field, the re- search policy objectives as well as the topic’s key objectives and milestones.*
* *How do the different research groups of the topic interact with each other?]*

Potential contributions to future strategic priorities of the research field (future program period)

*[Key questions:*

* *How do you rate the future scientific prospects and direction of the topics with respect to the strategy of the research field, but also in comparison with national and international roadmaps in the respective research area?]*

[Text]

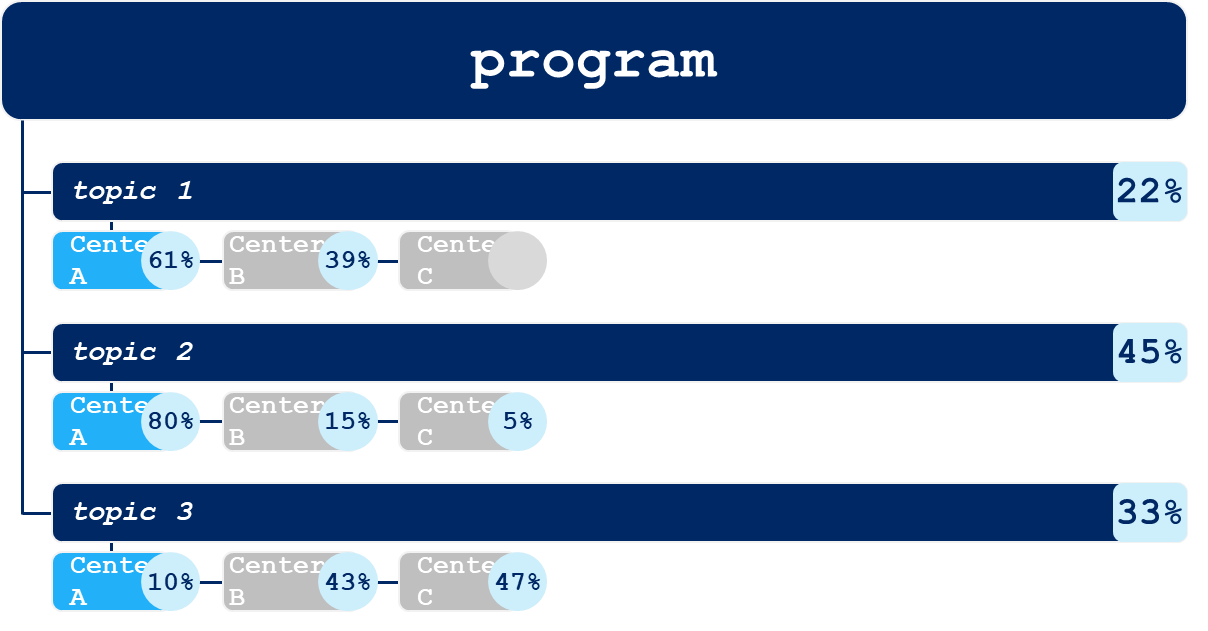
Five selected publications

1. Text
2. Text
3. Text
4. Text
5. Text
   1. Program 2 From Matter to Materials and Life [Thomas Stöhlker]

*[Notes: Brief description of the current program, its strategy and the corresponding contributions of the research center at the level of topics and the entire program (up to 2 pages).]*

*[Key questions: See template for the review report,* [*LINK*](https://syncandshare.desy.de/index.php/s/6tr5rg4eYAwmGCP)*.]*

*Examples*



*Fig. 3: Text*

*[Choose one of the examples to show the structure of the program]*

[Text]

* + 1. Topic 2.1 Matter – Dynamics, Mechanisms and Control [Sonja Bernitt]

***[****In-depth description of the contributions of the center to the topic including past and future challenges (less than 1/3 page per FTE -> ~12 pages for 35.5 FTE as of ThSt-table 04/2024).]*

*[Key questions: See template for the review report,* [*LINK*](https://syncandshare.desy.de/index.php/s/6tr5rg4eYAwmGCP)*.]*

[Text]

Five selected publications

1. Text
2. Text
3. Text
4. Text
5. Text
   * 1. Topic 2.2 Materials – Quantum, Complex and Functional Materials [E. Toimil-Molares]

***[****In-depth description of the contributions of the center to the topic including past and future challenges (less than 1/3 page per FTE -> ~2.5 pages for 7.3 FTE as of ThSt-table 04/2024).]*

*[Key questions: See template for the review report,* [*LINK*](https://syncandshare.desy.de/index.php/s/6tr5rg4eYAwmGCP)*.]*

[Text]

Five selected publications

1. Text
2. Text
3. Text
4. Text
5. Text
   * 1. Topic 2.3 Life Sciences – Building Blocks of Life, Structure and Function [Christian Graeff]

***[****In-depth description of the contributions of the center to the topic including past and future challenges (less than 1/3 page per FTE -> ~6 pages for 18.5 FTE as of ThSt-table 04/2024).]*

*[Key questions: See template for the review report,* [*LINK*](https://syncandshare.desy.de/index.php/s/6tr5rg4eYAwmGCP)*.]*

[Text]

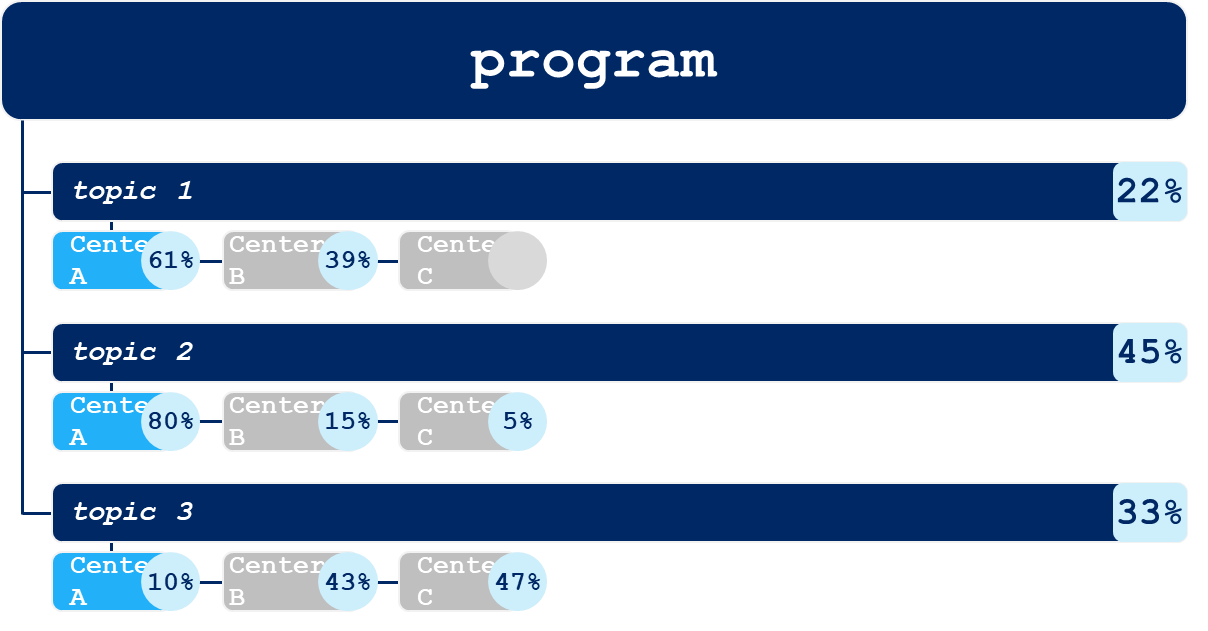
Five selected publications

1. Text
2. Text
3. Text
4. Text
5. Text
   1. Program 3 Matter and Technology [Ralph Aßmann]

***[****Notes: Brief description of the current program, its strategy and the corresponding contributions of the research center at the level of topics and the entire program (up to 2 pages).]*

*[Key questions: See template for the review report,* [*LINK*](https://syncandshare.desy.de/index.php/s/6tr5rg4eYAwmGCP)*.]*

*Examples*



*Fig. 4: Text*

*[Choose one of the examples to show the structure of the program]*

[Text]

* + 1. Topic 3.1 Accelerator Research and Development [Ralph Aßmann]

***[****In-depth description of the contributions of the center to the topic including past and future challenges (less than 1/3 page per FTE. -> not yet disentangled on topic level ! ZFB-2022: 26.6 FTE = ~ 9 pages for whole MT = ~3 pages for ARD).]*

Scientific performance and impact

*[Key questions:*

* *How do you rate the scientific quality and the innovative potential of the research activities?   
  At what level is the research internationally competitive?*
* *How do you rate the transformative impact of the research on the field and/or potential for significant societal or economic impact?*
* *How do you evaluate the scientific achievements in relation to its size, available infrastructure, and funding?*
* *What are specific strengths and weaknesses?*
* *Can you identify novel contributions to the field? If so, which are they?*
* *Please indicate the most prominent research results (up to three).*
* *Can you identify scientists with exceptional contributions to the field?]*

Contribution to the topic

*[Key questions:*

* *How do you rate the impact of the center’s contributions to the topic? Which are essential, important, or additional contributions?   
  Please comment in view of originality and strategic relevance for this research field, the re- search policy objectives as well as the topic’s key objectives and milestones.*
* *How do the different research groups of the topic interact with each other?]*

Potential contributions to future strategic priorities of the research field (future program period)

*[Key questions:*

* *How do you rate the future scientific prospects and direction of the topics with respect to the strategy of the research field, but also in comparison with national and international roadmaps in the respective research area?]*

During the POF-4 period GSI, together with the Helmholtz institutes in Mainz (HIM) and Jena (HIJ), has contributed to all four sub-topics of Accelerator R&D (ARD). Since start of POF-4 in 2019 we covered a range of important R&D topics and have achieved major results. In the following we comment on the highlight results achieved, the research infrastructures used, the novelty of solutions, the potential societal impact and the position and connection to various roadmaps.

**ARD ST1 - Advanced CW SRF Systems**

Propose text to be added by W. Barth, deadline 24 May. I propose to here include comment on cost savings possible with HELIAC technology in the GSI complex. I assume there is no extra HIM report – in case this is true include comment on HIM infrastructure here.

[Text – ¾ page including 1 highlight picture]

**ARD ST2 - New Concepts and Prototypes for Maximizing the Performance of Hadron and Electron Accelerators**

Propose text to be added by P. Spiller (+ input R. Assmann), deadline 24 May. I propose to also add here text on the novel two ion species beam at GSI and possible use for improved cancer therapy – I propose to also add here text on the new macro/micro spill optimization and impact on science output, point to GSI/FAIR ambition towards semi-autonomous accelerator operation. I propose to also add a comment on space charge compensation with electron beam lens – include PRL Oeftiger/Boine-Frankenheim into list of 5 pubs below.

[Text – 1 ¼ page including 1 highlight picture]

**nARD ST3 - Advanced Beam Control, Diagnostics and Dynamics**

Propose text to be added by P. Forck, deadline 24 May.

[Text – ½ page]

**ARD ST4 - Ultra Compact, Novel Accelerators and their Applications**

Propose text to be added by M. Kaluza (I assume there is no extra HIJ report) + V. Bagnoud, deadline 24 May. Comment on laser capabilities. Plans for injection into SIS-18 from ion laser accelerator at GSI.

[Text – ¾ page]

* + 1. Topic 3.2 Detector Technologies and Systems [Christian J. Schmidt]

***[****In-depth description of the contributions of the center to the topic including past and future challenges (less than 1/3 page per FTE. -> not yet disentangled on topic level ! ZFB-2022: 26.6 FTE = ~ 9 pages for whole MT = ~3 pages for DTS).]*

Scientific performance and impact

*[Key questions:*

* *How do you rate the scientific quality and the innovative potential of the research activities?   
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* *Please indicate the most prominent research results (up to three).*
* *Can you identify scientists with exceptional contributions to the field?]*

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*[Key questions:*

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  Please comment in view of originality and strategic relevance for this research field, the re- search policy objectives as well as the topic’s key objectives and milestones.*
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Propose text and proposed publications filled to R. Assmann, deadline 24 May.

[Text]

Five selected publications

1. Text
2. Text
3. Text
4. Text
5. Text
   * 1. Topic 3.3 Data Management and Analysis [M. Al-Turany / Thorsten Kollegger]

***[****In-depth description of the contributions of the center to the topic including past and future challenges (less than 1/3 page per FTE-> not yet disentangled on topic level ! ZFB-2022: 26.6 FTE = ~ 9 pages for whole MT = ~3 pages for DMA).]*

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Propose text and proposed publications filled to R. Assmann, deadline 24 May.

[Text]

Five selected publications

1. Text
2. Text
3. Text
4. Text
5. Text
   1. User facility GSI MU Ion Facilities [Yvonne Leifels (w/ RA)]

*In-depth Description of the LK II facilities including the research environment; i.e. national and international roadmaps and cooperation, strategic partners), costs, and personnel; past and future challenges, previous work and current activities, life cycle analysis, access and service for user, management current investments for the plants (up to 10 pages).]*

Scientific performance and strategic relevance

[Key questions:

* *Does the facility enable users to carry out excellent scientific work?*
* *How do you rate the scientific results produced at this facility? Please indicate the most prominent results (up to three).*
* *How do you rate the facility on a national, European, and international level?*
* *How would you judge the technical design and implementation?*
* *How would you evaluate the interaction with the programs and its topics? Is the infrastructure vital for carrying out the research activities?*
* *To what extent has the facility been exploited for excellent in-house research?*
* *What role does the facility play in national or international roadmaps in the respective research areas?]*

Access and service for users

*[Key questions:*

* *Does the facility attract an outstanding community of scientists?*
* *How do you judge the technical and scientific support provided for external users?*
* *Do the procedures ensure equal access to the facility for scientists from Helmholtz and for external users?*
* *Are the present staff qualifications and management structures appropriate to a user-oriented facility aiming to meet international standards?]*

Appropriateness of resources used and future costs

*[Key questions:*

* *Taking into account the cost, availability and scientific demand, is the facility operated on a sufficient level to meet requirements (running time and average use)?*
* *Do you consider the estimates of the remaining life span of the facility to be realistic?*
* *What is your assessment of the plans concerning a replacement of the infrastructure and its possible costs?]*

[Text]

**Sources**

Propose text to be added by R. Hollinger, deadline 24 May.

[Text – 1 ½ page]

**UNILAC**

Propose text to be added by W. Barth (1 page) and L. Groening (1 page) , deadline 24 May.

[Text – 2 page]

**SIS-18**

Propose text to be added by P. Spiller, deadline 24 May.

[Text – 1 ½ page]

Green-IT Cube

Propose text to be added by T. Kollegger, deadline 24 May.

[Text – 1 page]

Five selected publications

1. Text
2. Text
3. Text
4. Text
5. Text
   1. User facility GSI MML Ion Facilities [E. Toimil-Molares (w/ RA)]

*In-depth Description of the LK II facilities including the research environment; i.e. national and international roadmaps and cooperation, strategic partners), costs, and personnel; past and future challenges, previous work and current activities, life cycle analysis, access and service for user, management current investments for the plants (up to 10 pages).]*

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* *What is your assessment of the plans concerning a replacement of the infrastructure and its possible costs?]*

**ESR**

Propose text to be added by M. Steck, deadline 24 May.

[Text – 1 ½ page]

**CRYRING**

Propose text to be added by F. Herfurth, deadline 24 May.

[Text – 1 page]

**HiTRAP**

Propose text to be added by F. Herfurth, deadline 24 May.

[Text – 1 page]

[Text]

Five selected publications

1. Text
2. Text
3. Text
4. Text
5. Text
   1. FAIR under Construction (User Facility) [Yvonne Leifels]

*In-depth Description of the LK II facilities including the research environment; i.e. national and international roadmaps and cooperation, strategic partners), costs, and personnel; past and future challenges, previous work and current activities, life cycle analysis, access and service for user, management current investments for the plants (up to 10 pages).]*

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Appropriateness of resources used and future costs

*[Key questions:*

* *Taking into account the cost, availability and scientific demand, is the facility operated on a sufficient level to meet requirements (running time and average use)?*
* *Do you consider the estimates of the remaining life span of the facility to be realistic?*
* *What is your assessment of the plans concerning a replacement of the infrastructure and its possible costs?]*

[Text]

**FAIR Research Infrastructure – Overall Status, Building and Utilities**

Propose text to be added by O. Boine-Frankenheim, H. Hagelskamp et al, deadline 24 May.

[Text – 1 ½ page including one highlight picture]

**FAIR Early Science Machine (SFRS)**

Propose text to be added by H. Simon + R. Gebel, deadline 24 May.

[Text – 1 ½ page including one highlight picture]

**FAIR First Science Machine (SIS-100)**

Propose text to be added by P. Spiller, deadline 24 May.

[Text – 1 ½ page including one highlight picture]

**FAIR Commissioning – Technical, Cost, Personnel**

Propose text to be added by S. Reimann (1 page) + U. Weinrich (1 page), deadline 24 May.

[Text – 2 pages including one highlight table]

Five selected publications

1. Text
2. Text
3. Text
4. Text
5. Text
   1. Cross-cutting research activities [Thomas Stöhlker]

[*Brief description of the center's contributions to selected crosscutting activities of the research field (1 – 2 pages).]*

[Text]

1. Strategic topics [Klaus-Dieter Gross]

*[Introductory words on the idea of the strategic topics (up to 1/2 page).]*

*[Key questions: See Template for the review report,* [*LINK*](https://syncandshare.desy.de/index.php/s/6tr5rg4eYAwmGCP)*.]*

[Text]

* 1. Talent management

*[Description of the center's activities w.r.t. measures implemented in favor of talent management and career development; suggestions for improving the respective recruiting and/‌or career development mechanisms for specific target groups (up to 3 pages).]*

[Text]

* 1. Cooperation

*[Description of the center's activities w.r.t. potential for added value and synergies regarding networking and collaboration strategy of the center, both nationally and internationally; potential partners that could further strengthen the center’s capacity for system solutions (up to 3 pages).]*

[Text]

* 1. Innovation

*[Description of the center's activities w.r.t. structures and achievements in the area of knowledge and technology transfer (up to 3 pages).]*

[Text]

* 1. Diversity and equal opportunity

*[Description of the center's activities w.r.t. its goals and measures to promote equal opportunity and diversity (up to 3 pages).]*

[Text]

* 1. Further strategic topics [optional]

*[Brief description of the center's activities on further strategic topics ERGÄNZENDER TEXT (up to 3 pages).]*

[Text]

1. Outlook

*[Introductory words on the 5th program period (1/2 page).]*

*[Key questions: See Template for the review report,* [*LINK*](https://syncandshare.desy.de/index.php/s/6tr5rg4eYAwmGCP)*.]*

[Text]

* 1. Helmholtz Association [responsible author: Helmholtz President]

*[Strategic priorities of Helmholtz for the 5th program period incl. new cross-cutting topics (up to 2 pages).]*

[Text]

* 1. Research Field [responsible author here: Vice President]

*[Strategy paper of the research field, sections on challenges for the next ten years and on future thematic and programmatic plans (max. 10 pages).]*

[Text]

* 1. Center [responsible author: Center Director]

*[priorities of the center’s activities in the research field for the 5th program period (max. 5 pages).]*

[Text]

**Strategic Facility Development and Accelerator R&D at FAIR/GSI During POF-5**

Propose text to be added by R. Assmann, deadline 1 June. What will we aim at for POF-5 in the accelerator area? Enhanced research with regional universities. Technical facility roadmap. ARD roadmap.

[Text – 1 page]

**Digital Technologies – Towards Semi-Autonomous Accelerator Operation**

Proposed common lighthouse goal ARD and DMA with special opportunity for Rhein-Main area. Propose text to be added by R. Assmann + T. Kolleger, deadline 1 June.

[Text – 1 page]

1. Annex
   1. Strategic Guidelines (2021–2027)

*[Research policy objectives 2021 – 2027]*

[Text]

* 1. Recommendations of the Helmholtz-Senate (2021–2027)

*[Senate recommendations and summary of achievements in this regard.]*

[Text]

* 1. Glossary

[Text]

***End of Volume I***