D1.4 Policy Feedback Brief for Period 1

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Abstract	
Key Words	Policy Brief, Recommendations
This deliverable uses the template provided by the European Commission and aims to provide brief feedback on the relevance and contribution of the project to the policy areas listed below for research infrastructures in Europe. It includes some short summary of the project, highlighting the status of the key exploitable results (KERs) and the policy implications toward: Implementation of research infrastructures, Funding of research infrastructures, International co-operation of research infrastructures, Employment and skills in research infrastructures, Greening of research infrastructures., Interaction of research infrastructures with industry, ERIC legal framework, Technology development, data and digital services, digitalisation, Level of connection of your RI to EOSC, Contribution to other research areas and to broader EU priorities, Sustainability of research infrastructures.	

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Terminology / Acronyms	
Terminology / Acronym	**Definition**
AI	Artificial Intelligence
AMB	Activity Management Board
CoP	Community of Practice
DoA	Description of Action
DocDB	EGI Document Database
DOI	Digital Object Identifier
EAB	External Advisory Board
EM	Exploitation Manager
GA	General Assembly
GDPR	General Data Protection Regulation
HEP	High Energy Physics
HTC	High-Throughput Computing
HPC	High Performance Computing
JENAA	Joint ECFA, NuPECC and APPEC Computing Initiative
KER	Key Exploitable Result
KPI	Key Performance Indicator
MS	Milestone
PD	Project Director
PM	Project Manager
PMO	Project Management Office
PO	Project Objective
RA	Radio Astronomy
RI	Research Infrastructure
SRIDA	Strategic Research, Innovation and Deployment Agenda
WG	Working Group
WP	Work Package
WPL	Work Package Leader

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1. Introduction: SPECTRUM Project

CALL: HORIZON-INFRA-2023-DEV-01

TOPIC: HORIZON-INFRA-2023-DEV-01-05 - Preparation of common strategies for future development of RI technologies and services within broad RI communities

PROJECT: Computing Strategy for Data-intensive Science Infrastructures in Europe

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SPECTRUM aims to deliver a Strategic Research, Innovation and Deployment Agenda (SRIDA) and a Technical Blueprint for a European Compute and Data Continuum.

The amount of data gathered, shared and processed in frontier research is set to increase steeply in the coming decade, leading to unprecedented data processing, simulation and analysis needs. In particular, High Energy Physics (HEP) and Radio Astronomy (RA) are gearing up for groundbreaking instruments, necessitating infrastructures several times larger than the current capabilities. In this context, the EU-funded SPECTRUM project brings together leading European science organisations and e-Infrastructure providers to formulate a Strategic Research, Innovation, and Deployment Agenda (SRIDA) defining the vision, overall goals, main technical and non-technical priorities, investment areas and a research, innovation and deployment roadmap for data-intensive science and infrastructures described in a Technical Blueprint for a European Compute and Data Continuum. This collaborative effort is set to create an Exabyte-scale research data federation and compute continuum, fostering data-intensive scientific collaborations across Europe.

Project Objectives and Key Results: In order to develop the SPECTRUM SRIDA the project aims to address the following objectives:

- Join Efforts of research infrastructures and e-infrastructures to address common research and innovation needs towards exabyte-scale computing; as a result SPECTRUM will create a Community of Practice (SPECTRUM CoP) of research infrastructures and domain researchers in physics, radio-astronomy and other relevant scientific domains

- Identify Use Cases: relevant use cases, related challenges and opportunities. As a result a Compendium of Use Cases, will be gathered including the gaps and requirements covering technical and policy aspects

- Landscape Analysis: understand the landscape and best practices. As a result a compendium of existing approaches, services, technical solutions and policies for the federation of data and compute infrastructures will be gathered.

- Increase Collaborative Service Delivery by e-Infrastructures at national, European and international level. As a result a set of recommendations will be compiled for a jointly supported corpus of interoperable access policies.

- Strategic Actions: agree on strategic action paths, specific actions and policy recommendations. As a result two major documents will be generated - a Technical Blueprint of a European compute and data continuum and the Strategic Research, Innovation and Deployment Agenda (SRIDA) which includes a strategy and a plan for the implementation of exascale research data federation and compute continuum for data-intensive science.

The SPECTRUM Community of Practice (CoP, KER1) is a connected community of scientists and infrastructure managers who work towards a mutual understanding of future needs, associated challenges and their possible solutions. The goal of the CoP is to serve as a discussion forum across the HEP and RA domains to identify common directions for the design and operations of future systems, agreed processing models and solutions, and to provide feedback on investment to funding agencies and policy makers. It was created early in the project and open for any interested experts to join by adhering to the **Community Charter**. It also joined efforts with the **JENAA (Joint ECFA NuPECC APPEC Activities) Computing** Initiative to conduct a survey to understand the current best practices and future needs in large-scale and data-intensive scientific computing in HEP and RA domains. The survey was directed at researchers, managers of scientific initiatives and infrastructure managers, either on individual or institutional bases and the results have been published in deliverable D3.1 "Community of Practice – Interim report"[1].

The Compendium of Use Cases (KER2) covers the future compute needs in High Energy Physics, Radio Astronomy and other domains encompasses major experiments such as the Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC) , ALICE, ATLAS or Square Kilometer Array (SKA) or Low Frequency Array (LOFAR) examples among many others. The compendium is being published in deliverable D5.1 "Representative use cases: analysis and alignment" and will be also made available via SPECTRUM website (**https://www.spectrumproject.eu**).

Together with the Landscape Analysis (KER3) and the Access Policies compilation (KER4) that is being prepared in D5.2 "Interoperable access policies: analysis and recommendations" and D5.3 "Landscape of RIs: technologies, services, gaps", they represent the top-down approach and they serve as the basis to develop the Technical Blueprint Architecture (KER5) and the Strategic Research Innovation Deployment Agenda (KER6), the roadmap documents that will be delivered at the end of the project (D6.1 and D7.1).

2. Policy Implications and Recommendations for Research Infrastructures

SPECTRUM is relevant for all Research Infrastructures in the scientific domains of the project – with **HL–LHC** and **SKAO** being the major initiatives, but also all others in the domain such as JIVE, **KM3Net**, **Cherenkov Telescope Array**, **Extremely Large Telescope (EST)** or in adjacent domains such as **Einstein Telescope** or the ones from other compute intensive domains such as **EBRAINS**. Altogether they represent major experiments in the domains and cover hundreds of thousands of researchers in the major European research centers and universities. SPECTRUM is contributing concretely to the following policy areas of RI:

- **Technology development, data and digital services, digitalisation.** This is the main policy area SPECTRUM is addressing, as it will describe the compute, data and digital technologies and services that will be needed in the next decade based on the requirements gathered during the project and will provide a vision towards trans-continuum data intensive computing infrastructures. The main project output will be the Technical Blueprint for Compute and Data Continuum (D6.1).

- **Implementation of research infrastructures.** SPECTRUM is crucial for the current and future implementation and operations of research infrastructures. Scientific research will not be able to keep up with the future challenges and needs of science if the compute and data infrastructure is not upgraded accordingly. This will be tackled under the SRIDA document (D7.1).

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[1] **https://zenodo.org/records/15100587**

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- **Access to research infrastructures.** SPECTRUM is producing the deliverable D5.2 focusing on understanding the access policies for the compute infrastructures available for scientific communities working with research infrastructures. The document also provides several recommendations for the interoperability of the access policies.

- **Funding of research infrastructures.** The SRIDA (D7.1) will provide the roadmap for upgrading the digital compute and data technologies. The SRIDA will analyze the areas where investments are needed and will provide recommendations and a time-line to make it happen.

- **International co-operation of research infrastructures.** Having all the interested stakeholders agreeing on a common technical blueprint architecture enabling seamless access by scientific communities will facilitate the international collaborations fostered by research infrastructures. The use cases explained in D5.1 will give examples of the relevance and intensity of international cooperation in the SPECTRUM domains and are ought to inspire further improvements and extension of cooperation.

- **Employment and skills in research infrastructures.** Transversal topics such as upskilling in digital expertise of scientific communities is covered by deliverable D3.1 (Community of Practice – Interim report). Deliverable D4.1 (Community of Practice and sustainability plan – Final report) will also propose some actions to grant the sustainability of the Community of Practice after the end of the project.

- **Greening of research infrastructures.** Greening of RIs is a key topic.[2] The deployment of distributed infrastructures is the most efficient way to serve the compute and data needs of the scientific communities across Europe. Environmental aspects such as the choice of energy efficient technologies and reduction of carbon footprint are being assessed by research communities – such as WLCG or within the radio astronomy domain, and they will be taken into consideration as part of the Technical Blueprint (D6.1).

- **Interaction of research infrastructures with industry.** The necessary infrastructure upgrades represent an outstanding opportunity for European industrial technology suppliers across the whole value chain, but they require an understanding of the needs from the scientific counterparts. SPECTRUM final deliverables will shed light on those, as such, they will also be shared with European relevant industrial players and other research infrastructures.

- **Level of connection of RIs to EOSC.** Most SPECTRUM partners are key players in the EOSC ecosystem, therefore synergies between EOSC capabilities and requirements of scientific communities will be also sought.

- **Contribution to other research areas and to broader EU priorities.** While SPECTRUM is focusing mainly in High Energy Physics and Radio Astronomy domains, the proposed infrastructure will be also valuable to all other scientific domains having similar computational challenges, with a particular focus on data intensive sciences. Several use cases have been also analysed in D5.1 covering health, environment, meteorological sciences, etc.

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[2] https://icri2024.au/wp-content/uploads/2024/12/ICRI2024-Conference-Slides-Wednesday-4th-December-Session-16.pdf

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3. Conclusions

Why SPECTRUM is important, in the context of Europe and European research:

Large scale scientific challenges are pushing the boundaries of what is currently possible with computing technologies. SPECTRUM enables understanding, scaling, and planning the future generation of compute infrastructure needed to support the realization of major experiments that will produce scientific advancements in the next decade.

SPECTRUM work is based on solid grounds, i.e. the involvement of 2 major communities (HEP and RA), with the needs of other communities also under consideration. Hence, the project outputs are not only a mere theoretical exercise, the estimations concern the foreseeable evolution of what is already existing and used by the research communities.

Understanding these gaps is an opportunity to optimize the advanced computing research to address the real needs of user communities and foster the adoption of future advanced computing technologies to maximize the impact of European scientific research.

Main recommendation:

As SPECTRUM project has reached the half of the project duration, and early results have started to emerge from the Community of Practice, e.g. community needs, use cases, landscape and access analysis which are available in the project deliverables due at month 15. Funding bodies such as the European Commission, EuroHPC, national bodies, etc, shall leverage:

1) the analysis done under SPECTRUM because it is based on the experience of two important (and huge) scientific communities and which also covers a number of other communities.

2) the vision for the future opportunities and the recommendations we will deliver through the Tech Blueprint and the SRIDA.

To do that, funding bodies are encouraged to engage with the ongoing project activities to ensure the necessary programmes will be in place to be able to comply with the foreseen opportunities and needs in a timely manner.