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**EURO-LABS**

EUROpean Laboratories for Accelerator Based Science

HORIZON-INFRA-2021-SERV-01-07 Project EURO-LABS

 Milestone report

Work on Service Improvements Started

milestone: MS19

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Abstract:

*The present document reports on the service improvements planned for the RI Facilities participating to the Work Package 3 of EURO-LABS. Details of the proposed activities, budget and schedule are presented.*

EURO-LABS Consortium, 2023

For more information on EURO-LABS, its partners and contributors please see <https://web.infn.it/EURO-LABS/>

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Executive summary

*The key goal of the EURO-LABS project is to provide Transnational Access (TA) to major Research Infrastructures (RI) in Europe. WP3 groups thirteen facilities focused on High-Energy Accelerator Research. The document details the proposed work to improve the existing facilities to the profit of the users. The expected budget, resources and schedule for the planned activities is presented.*

# Introduction

EURO-LABS is a network of 33 research and academic institutions (25 beneficiaries and 8 associated partners) from 18 European and non-EU countries, involving 47 Research Infrastructures within the Nuclear physics, Accelerators and Detectors pillars. In this large network, EURO-LABS will ensure diversity and actively support researchers from different nationalities, gender, age, and variety of professional expertise.

EURO-LABS aims at fostering the sharing of knowledge and technologies across scientific fields to enhance synergies and collaborations between the RIs of the Nuclear and High Energy communities. Within EURO-LABS the Work-Package 3 (WP3) will provide Transnational Access (TA) to Research Infrastructures for Accelerator R&D.

WP3 will provide TA to a broad spectrum of installations, to test concepts for future accelerators, based on improving the present facilities, and for R&D studies for future colliders like CERN/FCC or the Muon Collider. These facilities will provide beam lines for testing advanced accelerator materials, superconducting or normal Radio-Frequency cavities, magnets and acceleration schemes. These tests use different particles and energies (low-energy protons, low-energy electrons, ultra-soft electron bunches and high-intensity high-energy electrons and could also have connections to industrial applications.

# Hiradmat - cern

*Paragraph 1 : Short description of the facility, justification of the proposed improvement*

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| --- |
| Photos or graphs of the facility relevant to the service improvements |
|  |

Figure - Graphs or photos to show or justify the proposed improvements

*Paragraph 2 : Details on the planned activities*

*Paragraph 3 : Budget planning*

*Paragraph 4 : Schedule*

# FREIA – UU

*Paragraph 1 : Short description of the facility, justification of the proposed improvement*

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Figure - Graphs or photos to show or justify the proposed improvements

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# INFN-LASA – IT

*Paragraph 1 : Short description of the facility, justification of the proposed improvement*

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Figure - Graphs or photos to show or justify the proposed improvements

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*Paragraph 3 : Budget planning*

*Paragraph 4 : Schedule*

# INFN-THOR – IT

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Figure - Graphs or photos to show or justify the proposed improvements

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# CEa/lrfu-Synergium – fR

*Paragraph 1 : Short description of the facility, justification of the proposed improvement*

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|  |

Figure - Graphs or photos to show or justify the proposed improvements

*Paragraph 2 : Details on the planned activities*

*Paragraph 3 : Budget planning*

*Paragraph 4 : Schedule*

# KIT-ALFA(KARA – FLUTE) – GE

*Paragraph 1 : Short description of the facility, justification of the proposed improvement*

ALFA (**AcceLerator Facilities)** is the name of the accelerator facilities as part of KIT's cross-institutional ATP (Accelerator Technology Platform). The main ALFA accelerator facilities are the linear accelerator-based FLUTE (compact Far-infrared Linear accelerator and Test Experiment) and the electron storage ring KARA (KArlsruhe Research Accelerator). ALFA provide a multitude of operation modes as well as diagnostic devices with high data throughput. These diagnostic sensor networks are capable to take synchronized data from different detector system which enables new beam diagnostic methods and detailed beam dynamic analysis. For the analysis, the knowledge of all machine settings at the same time of the data is essential.

Due to the flexibility of KARA and FLUTE the parameter space is too large for a parameter scan for each measurement. Hence, it is essential to implement a meta database, e.g., based on B2SHARE (EUDAT) to collect all parameter settings and link them to the data set. This would make it possible to combine data from different measurements in the data analysis. With this tool, users could make use of other measurements carried out in the past. The careful preparation and planning of experiments is essential to make use of the expensive beam time at accelerator test facilities. An integrated simulation and measurement framework will help to prepare experiments much more in detail and will allow for more automated measurements and data analysis. With the availability of a meta data base measurement could be simulated and tested in advance to identify the optimum setting for the planned experiment at the accelerator test facilities KARA and FLUTE.

According to MS 19 KIT will develop an integrated simulation and measurement framework for facilities with large amounts of data and complex dependencies, such as accelerator facilities, so that users and operators can prepare, plan, perform and evaluate experiments more efficiently. The aim is to implement an integrated simulation and measurement framework within two years at ALFA, based on B2SHARE - EUDAT services, to be able to test it at the KIT facilities KARA and FLUTE. If successful, other research institutions or even companies, including those outside of accelerator research, could take over the development of this integrated simulation and measurement framework and adapt it for their applications.

*Paragraph 2 : Details on the planned activities*

1. Identify relevant meta-data:
Collection of meta-data for each measurement type possibilities to add custom meta-data individually were identified
2. Implement data structure:
Implementation of the data structure for meta-data, simulation- and measurement data is implemented in (e.g. in eudat/b2share)
3. Data-flow documentation:
Documentation of the desired data flow for automated transfer from measurement to permanent storage including meta-data
4. Evaluation of existing tools:
Evaluation of existing simulation and measurement tools as well as existing frameworks for integrations
5. Simulation framework:
Implementation of a framework that allows the integration of simulation codes into the control system including an example integration
6. Measurement Framework:
Implementation of a framework that allows the integration of measurement devices into the control system including an example integration
7. Simulation and Measurement Framework Documentation:
Documentation of the frameworks for simulation and measurements
8. Unified Access Framework:
Implementation and documentation of a framework for unified access across measurement files and simulation results including an example integration
9. Documentation of Access Framework:
Documentation of the framework for unified access to measurement and simulation data

*Paragraph 3 : Budget planning*

The EC contribution amounts to 150,000 €, the additional budget for development and testing will be borne by the Institute.

The head of WP5 agreed to the KIT's request to convert the material budget into a personnel budget in a cost-neutral manner. In contrast to the EURO-LABS proposal, the task is not to be awarded externally via the materials budget approved by the EC, but is to be carried out by a KIT scientist who already has some experience on data management at ALFA.

*Paragraph 4 : Schedule*

The estimated time for the planned KIT activities.

1. Identify relevant meta-data (50d)
2. Implement data structure (40d)
3. Data-flow documentation (35d)
4. Evaluation of existing tools (45d)
5. Simulation framework (85d)
6. Measurement Framework (85d)
7. Simulation and Measurement Framework Documentation (30d)
8. Unified Access Framework (75d)
9. Documentation of Access Framework (15d)

Some of the activities can be carried out in parallel or in a flexible sequence. The proposed service improvements are expected to be developed in the first two years of the project EURO-LABS so that they will be operational from M30 as planned.

# CEA/LIDyl-LPA-UHI100 – FR

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*Paragraph 2 : Details on the planned activities*

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# Annex: Glossary

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| Acronym | Definition |
| TA | Transnational Access |
| VA | Virtual Access |
| RI | Research Infrastructure |
| ALFA | **AcceLerator FAcilities** at KIT |
| ATP | cross-institutional Accelerator Technology Platform at KIT |
| FLUTE | Ferninfrarot Linac und Test-Experiment at KIT |
| KARA | KArlsruhe Research Accelerator and storage ring of the KIT Light Source |
| KIT | Karlsruhe Institute of Technology, Germany |
| EUDAT | EUDAT Collaborative Data Infrastructure |