Grant Agreement No: 101004761

AIDAinnova

Advancement and Innovation for Detectors at Accelerators

Horizon 2020 Research Infrastructures project AIDAINNOVA

MILESTONE REPORT

DEFINE REQUIREMENTS, GLOBAL ARCHITECTURE AND DESIGN THE EXTENDED DATA MANAGEMENT SYSTEM FOR ENEA-FNG AND CERN-GIF++

MILESTONE: MS13

Document identifier:	AIDAinnova-MS13
Due date of milestone:	End of Month 18 (September 2022)
Report release date:	30/10/2022
Work package:	WP4: Upgrade of Irradiation and Characterisation Facilities
Lead beneficiary:	CERN
Document status:	Final

Abstract:

This milestone report describes the requirements, global architecture, and design of a new data management system for the CERN Gamma Irradiation Facility (GIF^{++}) and the Frascati Neutron Generator in ENEA (ENEA-FNG). These systems will be a generalisation of the IRRAD Data Manager, developed and deployed in the framework of AIDA-2020 EU-Project.

The Advancement and Innovation for Detectors at Accelerators (AIDAinnova) project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement no. 101004761. AIDAinnova began in April 2021 and will run for 4 years.

Delivery Slip

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Executive summary

This milestone report describes the main requirements, the software architecture, and design of a new data management system for the CERN Gamma Irradiation Facility (GIF++) and the Frascati Neutron Generator in ENEA (ENEA-FNG). These systems are a generalisation of the IRRAD Data Manager, developed and deployed in the framework of AIDA-2020 EU-Project.

1. INTRODUCTION

The CERN Gamma Irradiation facility (GIF++) and the Frascati Neutron Generator in ENEA (ENEA-FNG) are two reference facilities for irradiation experiments with photons and neutron respectively. Both facilities are used to perform several tens of experiments on materials, detectors, and electronics components per year. This leads to a load of data related to the users and experimental activities' management that must be properly managed and stored for further analysis and traceability. In AIDA-2020, a data management software for the CERN Proton Irradiation Facility (IRRAD) had been developed called the IRRAD Data Manager (IDM) [1-2]. Using this development as a starting point, we define the requirements, design and architecture for the data management systems that can be developed for ENEA-FNG and GIF++.

2. USER CLASSES

In the following paragraphs, user classes are described. Since the user classes are similar for both facilities, they will be described together.

- **Data management system administrator**: This class is assigned to the facility operators or coordinators for having full access and permissions on the system.
- **Experiment responsible person**: This role is assigned to the person that is responsible for the experiment. Usually, the responsible person is the one that created the experiment request, but it can be also assigned by a different user. The responsible person has restricted views, which are dedicates to the functionalities of their registered experiments.
- **Experiment team member**: Users are usually members of the team requesting an experiment. As the responsible person, they also have restricted views to the experiments that they are concerned.

3. SOFTWARE TECHNOLOGY CHOICES

The data management systems will share same software technologies and architecture as the IRRAD Data Management except in the case these technologies are more CERN-related as, for example, OpenShift which is a platform as a service to deploy web applications at CERN [3].

- **Back end:** The Django framework, which is an open-source Python framework for web development, it will be used [4]. This framework contains modules that can make development faster, more secure and with less redundancy.
- **Front end:** The Semantic UI framework has been chosen for the front end since it allows for a user-friendly and minimalistic interface [5].
- **Database:** The database type will be defined separately in the facilities depending on the institute's service and IT infrastructure. For the GIF++ facility, an instance of MySQL database will be used hosted by the Database on Demand infrastructure (DBOD) [6].
- **Deployment:** The GIF++ data management tool can be hosted in the CERN OpenShift platform, since it is a CERN infrastructure. Regarding ENEA-FNG, a virtual machine on the local IT infrastructure has been set up to be used for the deployment.

4. FUNCTIONAL REQUIREMENTS

Both data management systems share some common requirements for functionalities, but there are also some requirements more specific to each facilities' operation. In the next paragraphs, the common functionalities will be described, and more details will be provided for each facility.

4.1. COMMON FUNCTIONALITIES

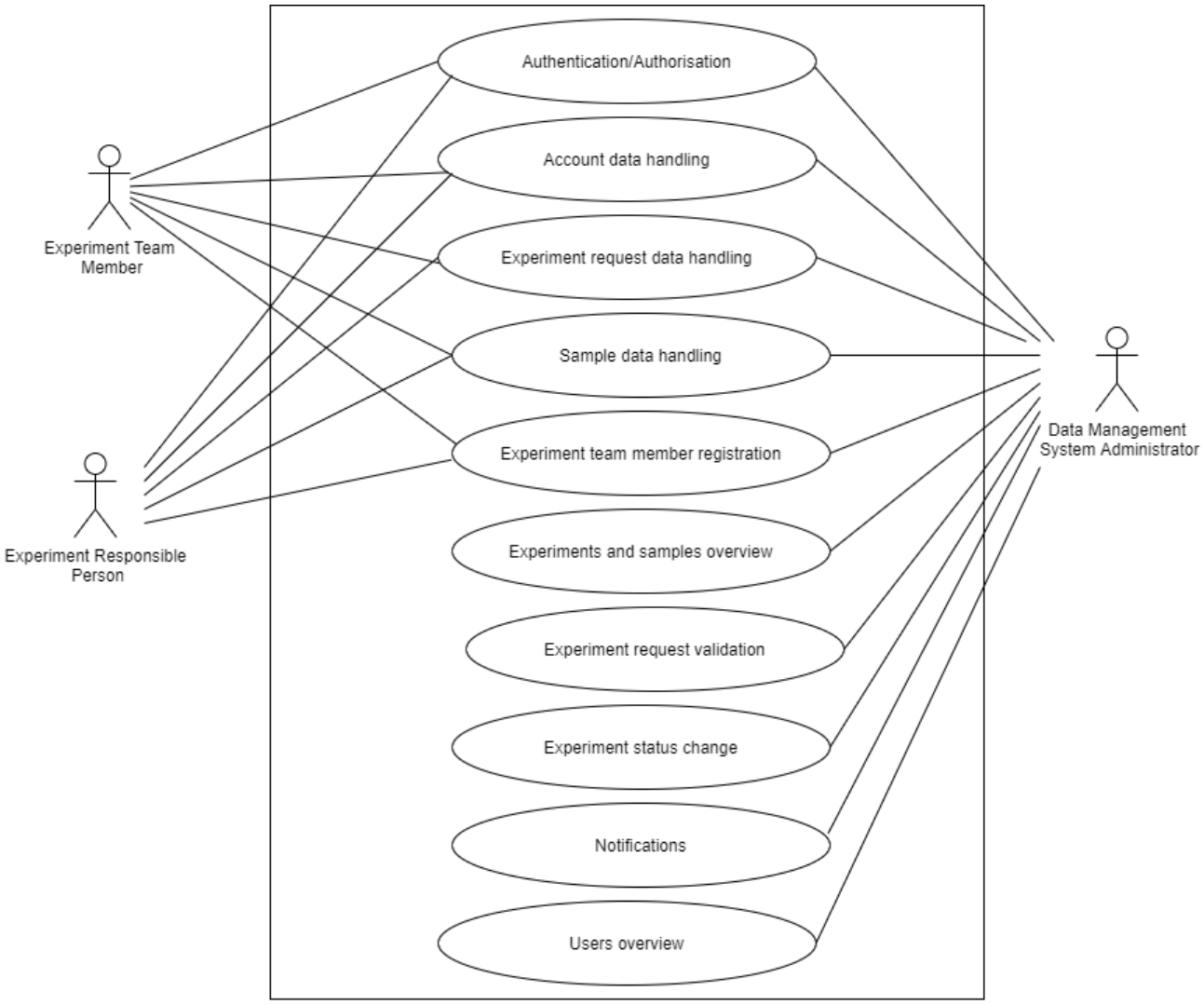

Fig. 1 General use case diagram.

As shown in Fig.1 the common functionalities for the facilities include:

- **Authentication/Authorisation:** All users should first sign into the data management system.
- **Account data handling:** Users should be able to modify their account information.
- **Experiment request data handling:** All users should have the permission to create, edit, clone, or delete an experiment request. The data management system administrator should be able to modify any experiment data. However, the experiment responsible person or a team member can access and modify only the data of their experiments.

- **Sample data handling:** All users should be able to handle sample data such as creating, editing, cloning, or deleting sample data entries. As in the case of the experiments also for the sample entries the administrators can edit any samples data in contrast to the other users that can modify only their data.
- **Team user registration:** Team members or a responsible person can be registered indirectly as part of an experiment by another user.
- **Experiments and samples overview:** Administrators should have a dedicated view where they can see all registered experiments and samples.
- **Experiment request validation:** Only the administrators should have the possibility to validate an experiment request.
- **Experiment status change:** The administrators should be able to change the status of the experiment according to their decision and status of the operation.
- **Notifications:** Notification should be automatically sent to from the administrators to the users for certain actions such as experiment validation.
- **Users overview:** Administrators should be able to see all the registered users.

4.2. ADDITIONAL FUNCTIONALITIES FOR THE GIF++ USE CASE

Some additional functionalities are identified for the GIF++ use case. Those functionalities are more CERN related and cannot be integrated to ENEA-FNG.

- **Authentication and Authorisation through the CERN Single Sign-On (SSO):** All the CERN web applications should be using the CERN Single Sign-On as authentication and Authorisation system.
- **Communication with traceability system (TREC – EAM):** At CERN there is a software tool for traceability of radioactive material TREC and the underline software layer for the traceability of all CERN equipment is EAM [7]. The system should be able to exchange data with this system.
- **Communication with IMPACT:** IMPACT is an access management tool. As a requirement the data management system should exchange data with the IMPACT system.

The data mentioned in this document, used in the CERN and INFN software development projects, are handled according to the data privacy protection regulations adopted by the AIDAinnova project[1]

4.3. ADDITIONAL FUNCTIONALITIES FOR THE ENEA-FNG USE CASE

- **Exporting data:** Data export in PDF format should be possible for compiling site-specific request forms and identification slips for the users' equipment and setups.
- **Personal data linked to personal dosimeter:** A link to the personal dosimetry should exist so that it is possible to exchange data between the data management system and the dosimetry service.
- **Communication to the CAEN Radbase:** Communication to a dedicated database tool [8] linking the residual activation measurements with the samples and the equipment of a given facility user.

5. DATA MODEL REQUIREMENTS

[1] https://aidainnova.web.cern.ch/privacy-policy

The data requirements can variate significantly for the two facilities because of different data requests and procedures of operation. For this reason, they will be described in different sections.

5.1. GIF++ DATA

- **Experiment request data**
  - Title
  - Description
  - CERN Experiment
  - Constraints
  - Irradiation category
  - Availability
  - Status
  - Timestamp of creation
  - Timestamp of last update
  - User that created the experiment request
  - User that updated the experiment request
  - Experiment responsible person
  - Requested dose

- **User data**
  - Name
  - Surname
  - E-mail
  - Institute
  - Department
  - Role

- **Sample data**
  - Name
  - TREC-ID
  - Width
  - Height
  - Length
  - Material
  - Location
  - Experiment associated

5.2. ENEA-FNG DATA

- **Experiment request data**
  - Title
  - Description
  - Irradiation category
  - Availability
  - Status
  - Timestamp of creation
  - Timestamp of last update

- User that created the experiment request
- User that updated the experiment request
- Experiment responsible person
- Total neutron fluence

- **User data**
  - Name
  - Surname
  - E-mail
  - Institute
  - Department
  - Role

- **Sample data**
  - Name
  - FNG ID (through CAEN RFID)
  - Type
  - Description
  - Position
  - Integrated Fluence

6. DESIGN & FIRST PROTYPES

In the following paragraphs, some preliminary design, and some interface prototypes for both facilities' Data Management Systems are shown. Since both facilities have several common functional requirements, it also means that the core design will be similar.

6.1. GIF++

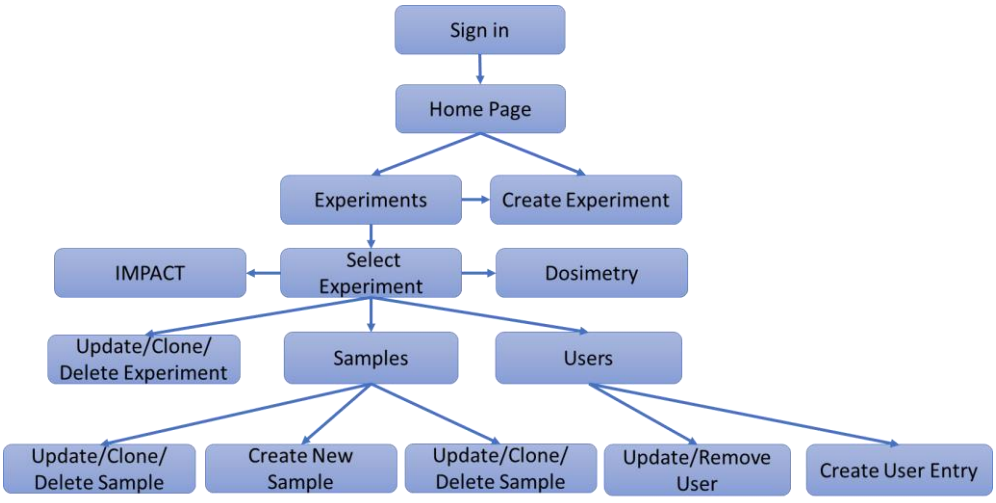

Fig. 2 GIF++ User Interface Design Schema.

Figure 2 shows the user interface design schema for the GIF++ facility. Dedicated pages will correspond to the schema components. For consistency with the IRRAD facility operated by the same team in the EP-DT group at CERN, the user interface style will be similar to the one of IDM but customised to GIF++ when needed. An example of an interface for GIF++ can be seen in Figure 3.

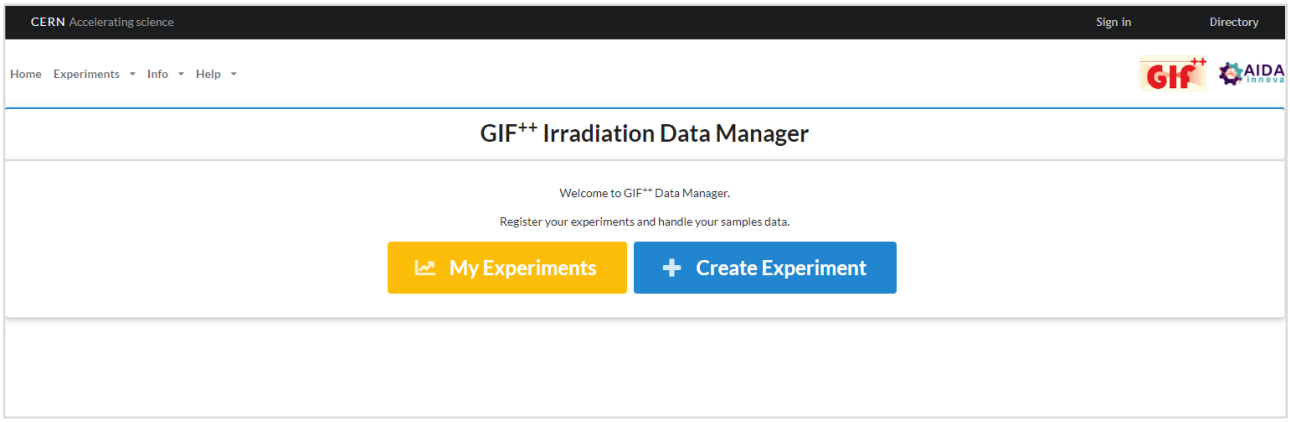

Fig. 3 Prototype page from the GIF++ Data Manager

6.2. ENEA-FNG

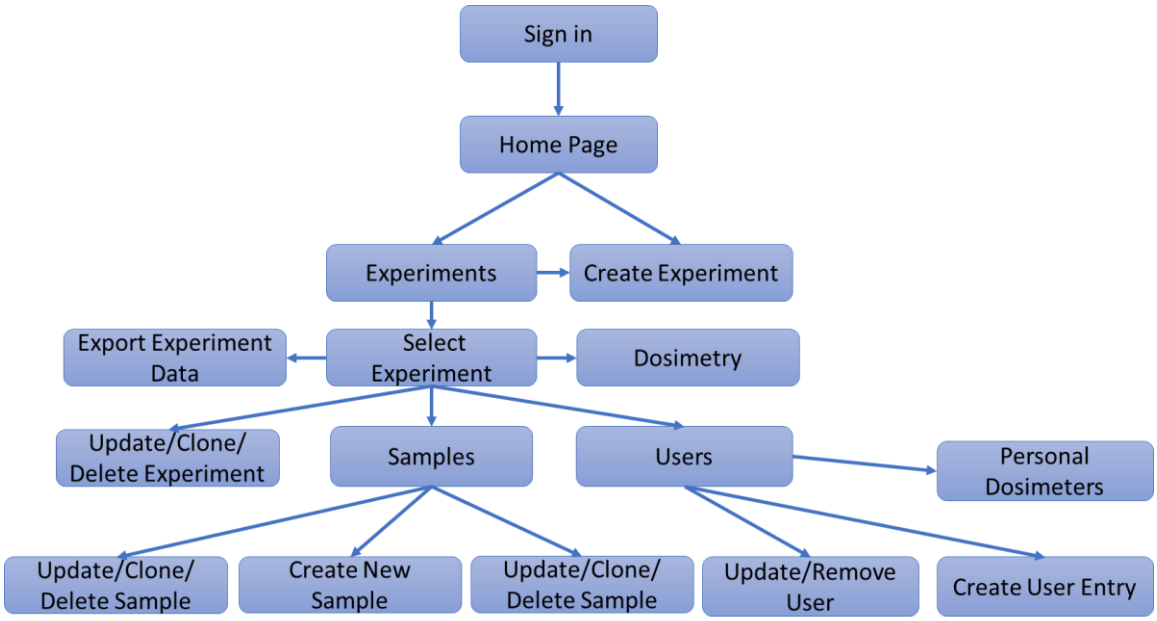

Fig. 4 ENEA-FNG User Interface Design Schema.

Some differences can be seen in the ENEA-FNG requirements (Figure 4) compared to the GIF++ one (Figure 2), such as, for example, the link with the Personal Dosimeters data. A first prototype of GUI interface for ENEA-FNG is illustrated in Fig. 5.

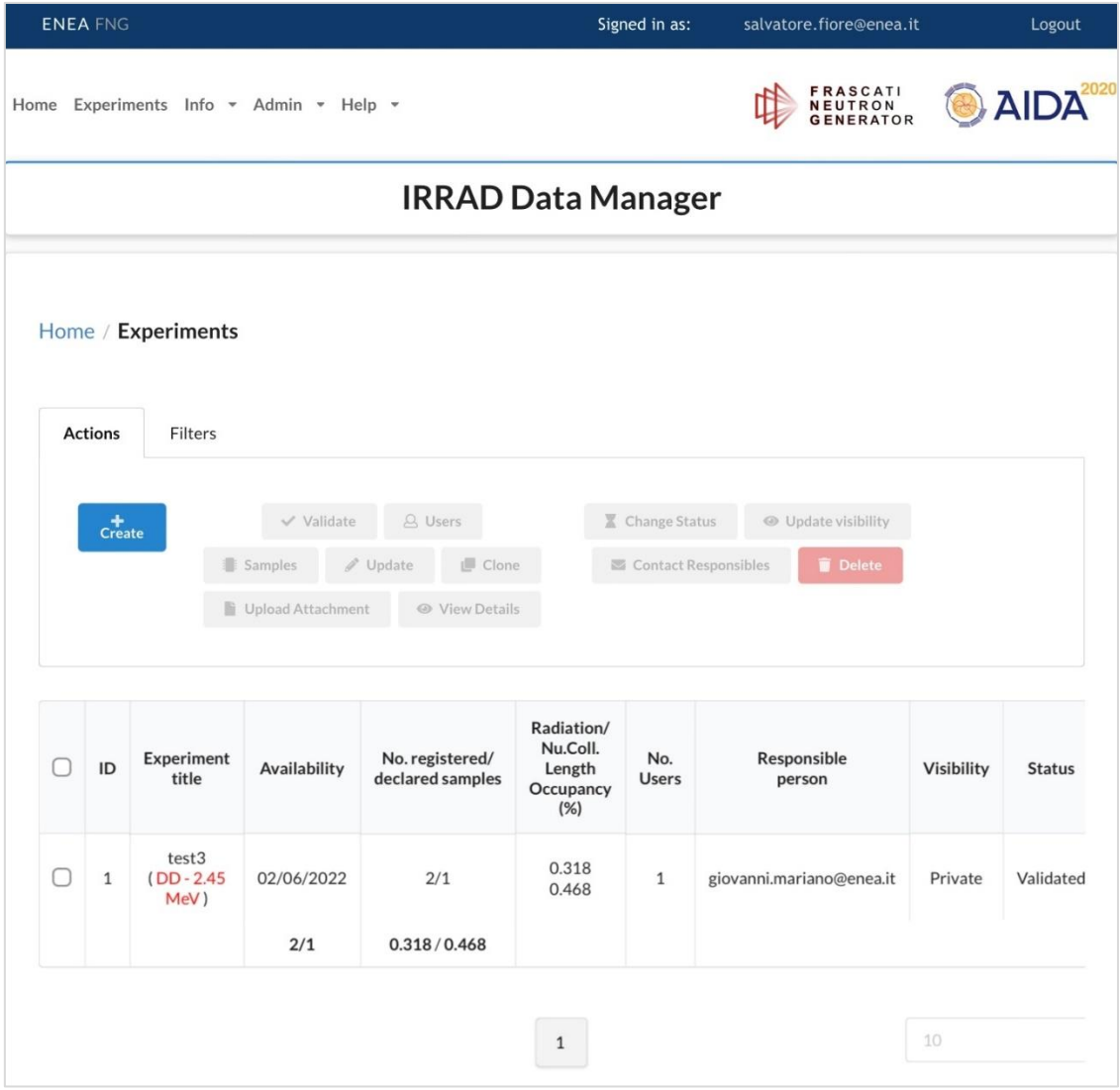

Fig. 5 Prototype from the ENEA-FNG Data Manager

6.3. CONCLUSION

In this milestone report the main requirements, the software architecture, and the first design prototype of a new data management system for the CERN Gamma Irradiation Facility (GIF++) and the Frascati Neutron Generator in ENEA (ENEA-FNG) are described. These systems, generalisation of the IRRAD Data Manager, are currently being developed and deployed and tested at CERN and ENEA following the guidelines and information summarized in this document.

7. REFERENCES

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ANNEX: GLOSSARY

Acronym	Definition
DMS	Data Management System
GIF++	CERN Gamma Irradiation Facility
ENEA-FNG	Frascati Neutron Generator in ENEA
SSO	Single Sign-On