SYSTEM ENGINEERING

EuPraxia@SPARC_Lab PROJECT

2nd Cost&Schedule Review LNF 22/11/2024



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The main phases of systems engineering are generally divided into several key stages, each with specific objectives. Here is an overview of the main phases:

1.Requirements Definition: In this phase, stakeholder requirements are gathered and analyzed to understand the needs and expectations of the system. This includes defining the system's functionalities, performance, and constraints.

2. System Design: Based on the requirements, a system architecture is developed that describes how the different components will interact with each other. This phase includes modeling and simulation to verify that the design meets the requirements.

3.Implementation: In this phase, the system components are developed and integrated. This can include writing code, building hardware, and integrating software and hardware.

4. Verification and Validation: Once implemented, the system is tested to ensure it works as expected and meets all requirements. This can include unit testing, integration testing, and system testing.

5. Deployment: After the system has been verified and validated, it is deployed to the end users. This phase includes installation, configuration, and user training.

6. Maintenance and Support: After deployment, the system requires maintenance to fix any issues, update functionalities, and ensure it continues to meet user needs.

These phases are iterative and can overlap, with continuous feedback between the different phases to improve the system.





The project is being implemented through SE phasing approach, the TDR Phase is the phase dedicated to the full design of the machine. In order to develop the TDR phase, a group of technologists is responsible for coordinating the management of activities related to the project. Within this framework, the project strategy put in place covers the following points:

- Functional Layout and naming convention;
- PBS database
- Budget management



EuPRAXIA @ SPARC_LAB – Configuration Machine



The <u>schematic layout</u> was developed using Visio Professional from Microsoft Office 365 as the project software. The purpose of the schematic layout is to provide an immediate overview of the machine elements to help plan and implement the machine components, which will later be listed in a specific database





EuPRAXIA @ SPARC_LAB - Configuration Machine



Undulators







Aqua & Aria Users Beamlines





EuPRAXIA @ SPARC_LAB - Configuration Machine







EuPRAXIA @ SPARC_LAB – Naming Convention



In systems engineering, the hierarchical and tree-like organization of objects is crucial for efficient and traceable configuration management. This approach helps in systematically organizing and managing the various components and their relationships within a system.

Using a specific nomenclature ensures consistency and clarity, making it easier to track changes, manage configurations, and maintain the integrity of the system throughout its lifecycle. This structured method allows to quickly identify and address issues, ensuring that all parts of the system are correctly configured and functioning as intended.



The identifier component machine is defined as the union of two codes

Component Code:

It identifies the system as such. Identical components may have the same code.



Functional Code:

Additional fields that determine the uniqueness of the component by identifying the zone or area of the machine where it is installed and where the component acquires its functionality.





An Excell File has been produced that acts as database for all the components of the machine.

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This database will provide in one shot the whole configuration of the machine.



This database will identify each component of the machine together with most relevant information: - Name

- Position
- Connection
- Cost
- Status
- Utilities Requirements
- Drawings.





The ExGN EAM is an Industry-leading asset management software to extend asset lifecycles and improve productivity.

HxGN EAM core modules

- 1. Asset management Record, maintain, structure and standardize asset information;
- 2. Asset performance management (APM) : Utilize a framework that enables to make use of physical assets to realize specific goals;
- 3. Work management Manage, plan and monitor work, as well as the necessary resources to complete that work;
- 4. Materials management Determine the correct stocking levels to provide an acceptable service level of parts and supplies to meet anticipated demand for maintenance;
- 5. Procurement management Manage every aspect of the purchasing cycle from requisition creation, approvals, supplier selection, purchase order placement and goods receipt through invoice matching.;
- 6. Project management Automate the administration of the complete project process from initial budget and timescale planning to completion of the final work. Facilitate comparison of actual status and progress of work, resource usage and costs against a project plan.

Advanced add-on modules

- OpenCAD Access and mark-up drawings within HxGN EAM. Calculate floor space using predefined industry standards. Save time by building your asset registry and creating assets in HxGN EAM directly from drawings;
- OpenCAD BIM Create and manage project data with an intelligent, 3D-model-based, process building information modeling (BIM) tool. BIM gives architecture, engineering and construction professionals data access and tools that can help them more efficiently plan, design, construct and manage buildings and infrastructure.



EuPRAXIA @ SPARC_LAB – Hexagon Database



In Hexagon, it is possible to manage a significant number of assets for which so-called user fields are defined. Each user field is linked to a class, which in our project is

represented by systems:

User Fileds

- UUID Code
- PBS Code
- WBS Code
- Moduls
- Costs
- Longitudinal coordinate
- Status
- •Type of connectors
- Facility requirements (water flow, electrical power)
- Suppliers

SY	STE	M	

A - Acceleration

- B Beam Instrumentation
- I Circuits
- M Magnets
- **R** RF Power Source
- T Target
- U Undulators
- V Vacuum
- W Laser & Optical System
- X Experimental Users

R50BJECTS

🋃 HxGN EAM

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Materiale 🖛 Oggetto 🖛 Acquisti 🖛 Attività operative 🖛

Vista elenco

Tutti i record 💌 Modifica

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XBAND 3 IN HEL-LA-002	TEST01	HEL-A-ACC-XBD-007			#
VERTICAL CORRECTOR 3 IN HEL-LA-002	TEST01	HEL-M-COR-VER-004_E TYPE			#
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SCREEN 10 IN AQUA LINE	TEST01	AQUA-B-SCN-YAG-010			#
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QUADRUPOLE 3 LEL B - TYPE 3T	TEST01	LEL-M-QUA-BTP-003			#
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INFN -

Amministrazione -





- Moreover is possible to link other document such as:
 - 1. Specifications
 - 2. Approved construction drawings
 - 3. Commercial documents (orders, specifications, etc.)
 - 4. Quality documents (calibration certificates, certificates of conformity, etc.)

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Roadmap- EuPRAXIA @ SPARC_LAB Hexagon Database



	End of 2024	Year 2025	Year 2026	Year 2027
Asset Database Creation	 Requirements analysis, Data collection and normalization Testing Database implementation, Popand verification 	oulation		
Integration with Hexagon Open CAD		•Integration	planning, Collaboration with Hexagor	
Preparation for Service Managers' Access			 Role definition, User interface of Functionality testing, Feedbace 	development ck collection
Implementation of the Asset Lifecycle Management Module			•Module dev •Trainin	velopment, Database integration ng, Launch and monitoring
			I Fa	ira Cioeta - 2 ^{na} Cost&Schedule Review

