



Electrical Safety Project

WP5 Electrical Distribution Network

G. Podoleanu, K. Papastergiou, K. Zielinski, C. Schmitt
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Content

- WP 5 Team, mandate, objectives, roadmap
- WP 5.1 Equipment Responsibility: Strategy, objectives, deliverables, roadmap
- WP 5.2 Drawings & schematics: Objectives, deliverables, roadmap
- WP 5.3 Identification in field: Objective and roadmap
- WP 5 Resources
- WP 5 ESP Pilot
- Next steps

WP5 Team

WP5 Electrical Distribution Network

WPL: G. Podoleanu
EN-EL

WP5.1: Equipment
Responsibility
(WPL: K. Papastergiou SY-ABT)

Cornelia Schmitt
(joined team 1st of September)

WP5.2: Drawings & Schematics
(WPL: K. Zielinski EN-EL)

WP5.3: Identification in field
(WPL: C. Mugnier – ESP CT*)

WP5 Contributors	Dept. Group
G. Langlois	BE-OP
P. Lelong	EN-ACE
A. Andersen, S. Deleval	EN-CV
K. Papastergiou	SY
M. Pezzetti, T. Barbe	TE-CRG
G. D'Angelo	TE-MPE
O. Crettiez	TE-MSD
G. Pigny, R. Ferreira	TE-VSC
J. Fernandez	On behalf of ATS DSOs
C. Mugnier, A. L. Perrot,	ESP Project Office

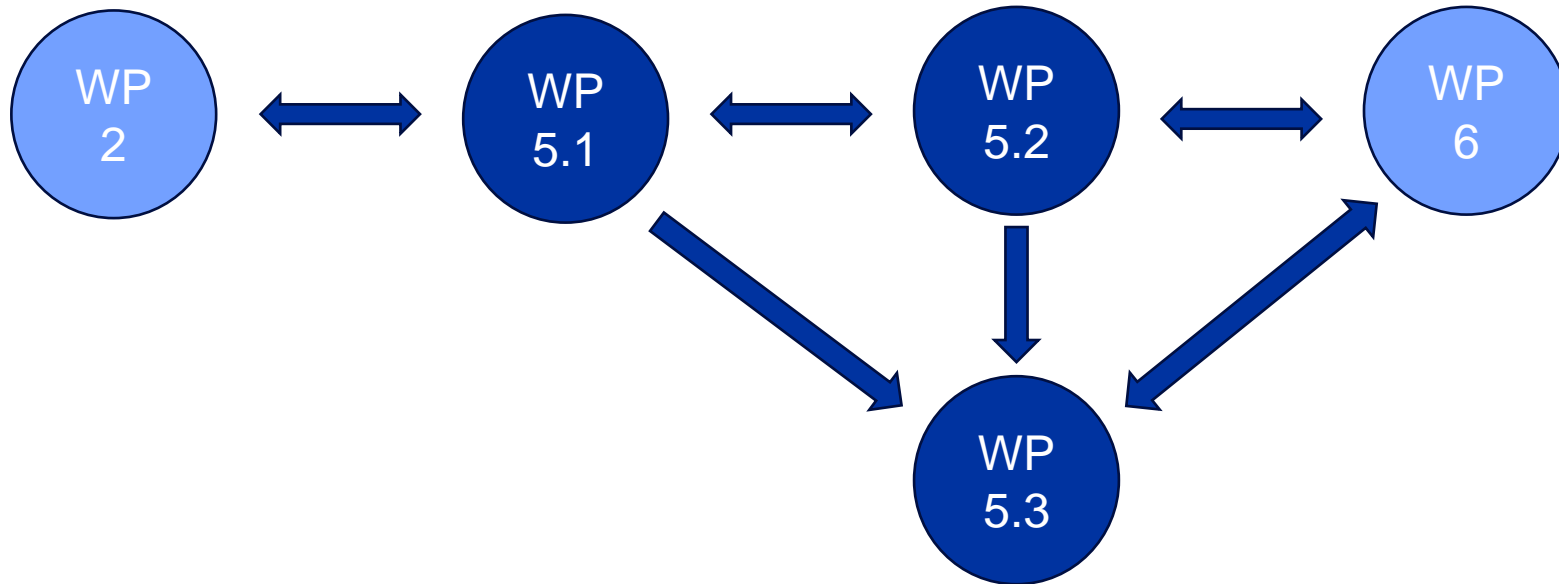
WP5: Electrical Distribution Network

Mandate

- Identify the specific areas of responsibility **along the electrical distribution network** between the Groups, ensuring **identification in field**.
- Develop and implement a **system to continuously maintain updated the electrical dependencies** within CERN's electrical distribution network.

WP5 Objectives

- WP 5.1: Develop a methodology to define limits of responsibilities between Groups and as input to WP5.2
- WP 5.2: Define and develop the features for the future ESP digital tools
- WP 5.3: Identification in field following inputs from WP 5.1 and WP 5.2



Interdependencies
with other
ESP WPs

WP5 Work organization in 2024

Meetings

- WP5 team : weekly meetings
- With all contributors: 4 meetings
- With individual group: 10 meetings

Collaboration





- with WP2 and WP4: on roles definitions
- with WP6: on creating the electrical dependencies in the future Electrical Safety Portal

The image displays three overlapping screenshots from a project management or file sharing system. The top-left screenshot shows a calendar for 'ESP-WP5.1-Equipment Responsibility' with 22 events, listing meetings from December 2023 to September 2024. The middle-left screenshot shows a calendar for 'November 2024' with events from January to November 2024. The right screenshot shows a file directory structure with folders for 'WP4 - intervention management', 'WP5 - Electrical Distribution Network', and 'WP6 - Electrical Data Management'. Under 'WP5 - Meetings', several document files are listed, including minutes of meetings with various groups like EN-CV, TE-CRG, and TE-VSC. At the bottom right, there are links for 'Indico: [link](#)' and 'EDMS: [link](#)'.

WP5 Roadmap

PRELIMINARY PLANNING	RUN		YETS		RUN		YETS		RUN		LS3			
	2023				2024				2025				2026	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
WP 5.1: Define the electrical limits and responsibilities between groups														
Electrical dependencies identification														
Supply scenarios identification														
Supply scenarios SLDs drawing (WP 5.2)														
Operation agreement template approval														
Required fields/attributes of the FPs updated in the databases														
FPs list preparation														
FPs list validation														
FPs lists integration in the operation agreements														
Operation agreements approved between groups														
WP 5.2: Interactive SLD tool, FP wizard tool														
Definition of required functions for the interactive SLD tool and FP wizard tool														
Study: define requirements for WP6 to link the SLD tool and the databases														
Study: define requirements for WP6 to link the FP wizard tool and the databases														
Preparation and development of the interactive SLD tool														
Preparation and development of the FP wizard tool														
Setting up the interactive SLD tool for the production phase														
Setting up the FP wizard tool for the production phase														
SLDs production and database updates														
WP 5.3: Identification / Tag in field each component of the distribution network														
Development of a colour based code														
Identification and labeling on site of FPs listed in the annexes of the operation agreements														

Baseline planning as presented at the 2023 ESP meeting

-  Done
-  Extended deadline
-  Short deadline
-  Start date shifted

WP5.1 Equipment responsibility - Content

- **Strategy**
- **Objectives 2024**
- **Deliverables 2024**
- **Objectives and Roadmap 2025**

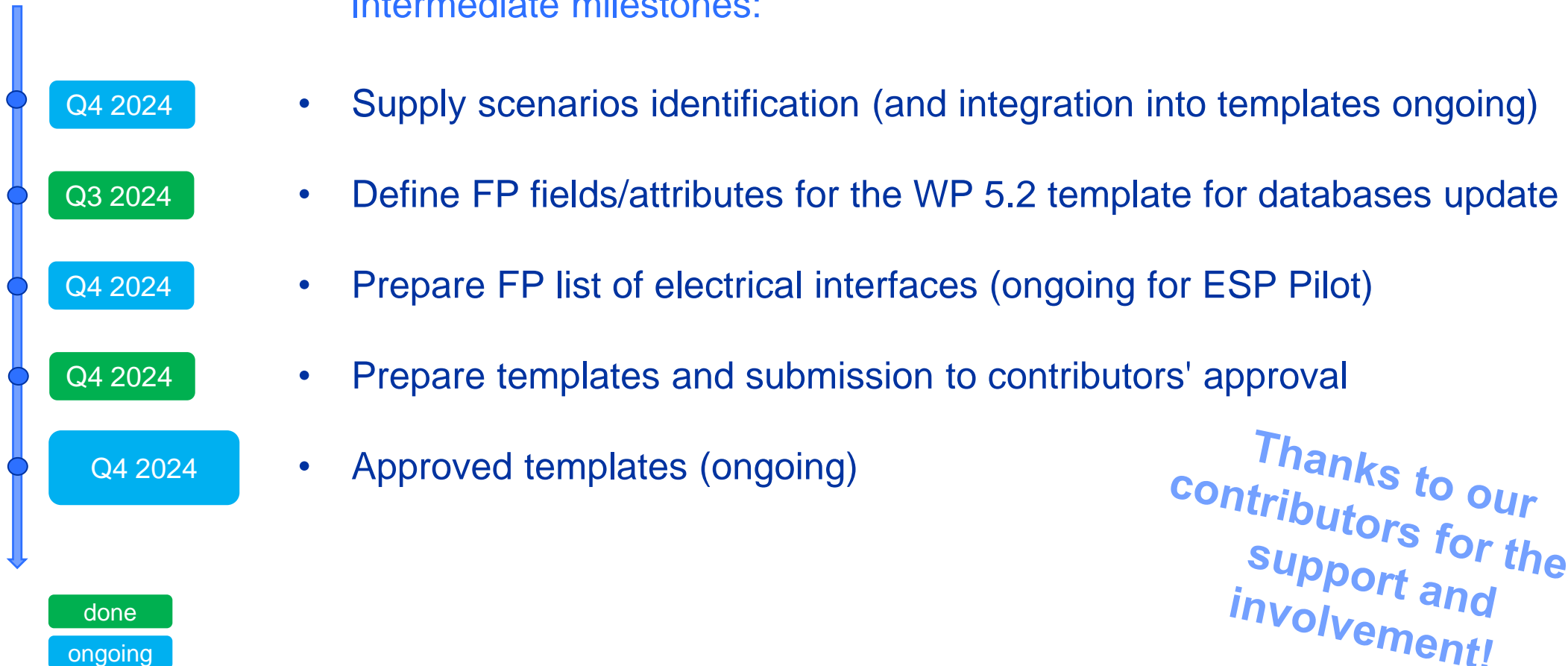
WP5.1 Equipment responsibility - Strategy

1. Define and clarify responsibilities: Establish clear roles and obligations
2. Standardize Agreements: Establish dedicated documents for standard and non-standard powering scenarios
3. Create & Validate Templates: Finalize the template documents followed by the review process

WP5.1 Equipment responsibility – Objectives 2024

The main objectives for 2024: preparation and approval of the *Operation agreement template*.

Intermediate milestones:



Thanks to our contributors for their support and involvement!

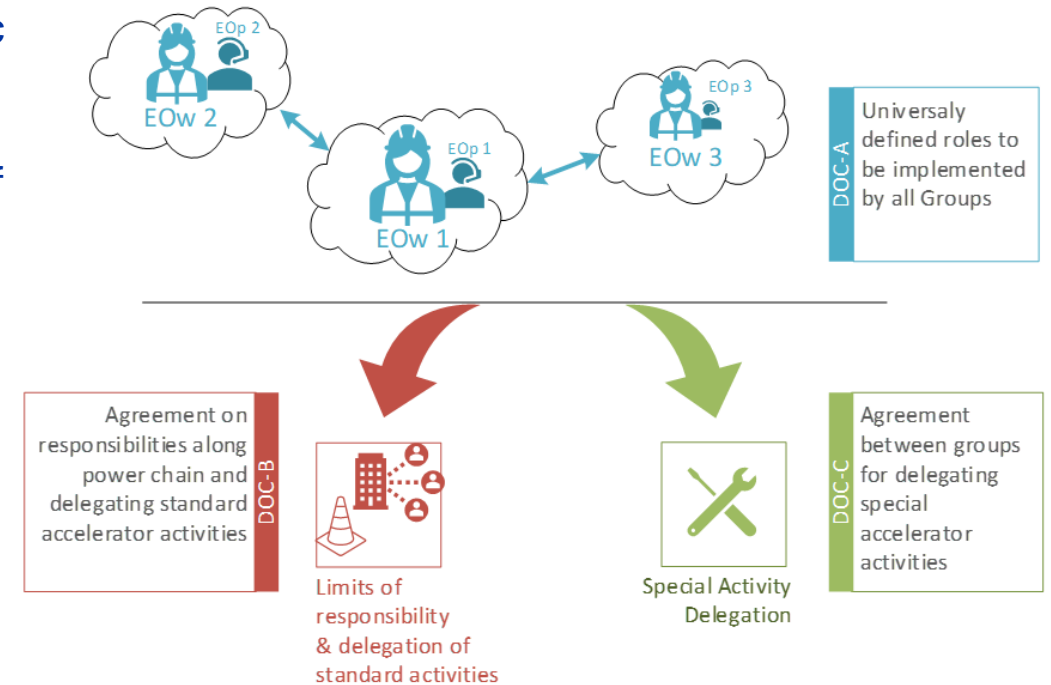
WP5.1 Equipment responsibility – Deliverables 2024

Preparation of new templates:

- The *Operation Agreement template* by EN-EL served as example, leading to the creation of tailored documents to meet Groups specific needs.
- Three documents prepared to formalize roles, limits of responsibilities, and activities delegation:
 - Equipment Owner* and Equipment Operator* Responsibilities with respect to Electrical Safety *EDMS 3128618* (Doc.A)
 - Limits of Responsibility, Operation & Maintenance for the Magnet Powering Chain *EDMS 3158173* (Doc.B)
 - Limits of Responsibility, Operation & Maintenance (Special Case) *EDMS 3129002* (Doc.C)

Current Status: Templates are under review by the contributors, with final versions expected by end of 2024.

*roles names still under discussion with the contributors for approval in WP2 and WP4



WP5.1 Equipment responsibility – Objectives 2025

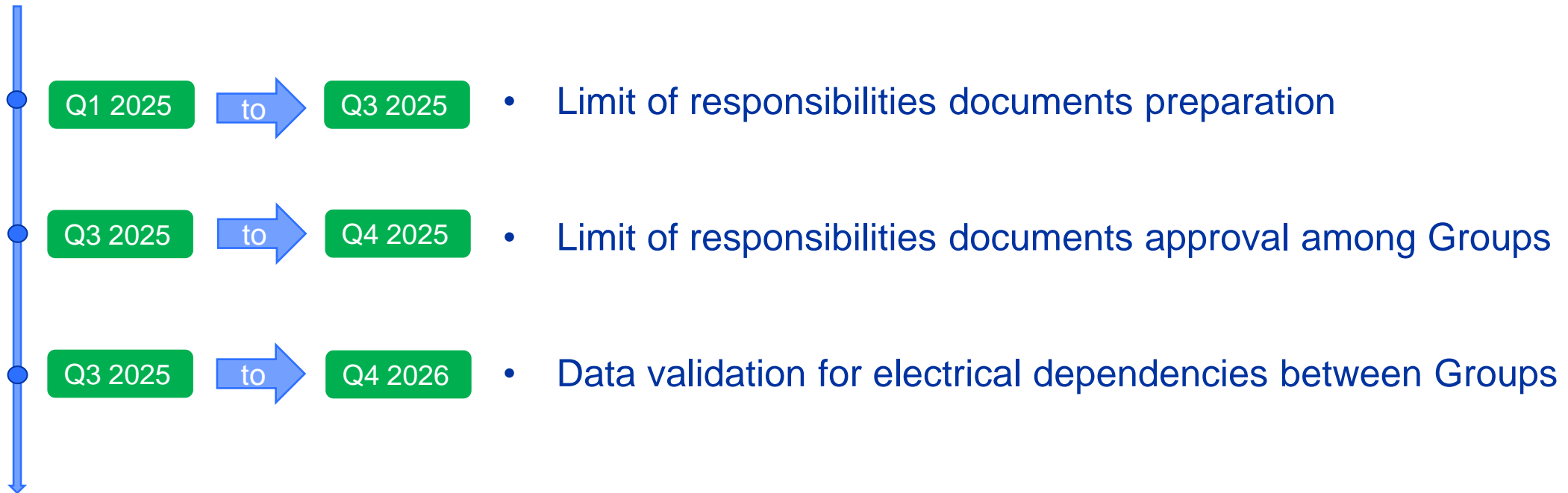
The main objectives for 2025: Limits of responsibilities documents preparation and approval

- **The approach is to prepare one document for each equipment/installation type**
 - Warm and Cold Magnets, Kickers & Septa, Radio Frequency Equipment, Intercepting Devices, Beam Instrumentation, Cryogenics, Cooling and Ventilation, Vacuum
- Template for Magnet Powering Chain prepared in 2024
 - To be validated by EN-EL, TE-MS, SY-EPC, TE-MPE
 - Model to be used for all other documents

With support of our contributors, the documents will be prepared as follows:

- By George for EN-EL's clients
- By Kostas for all other powering chains
- Cornelia as support for both

WP5.1 Equipment responsibility – Roadmap 2025



We count on the support and involvement of our contributors to reach these milestones!

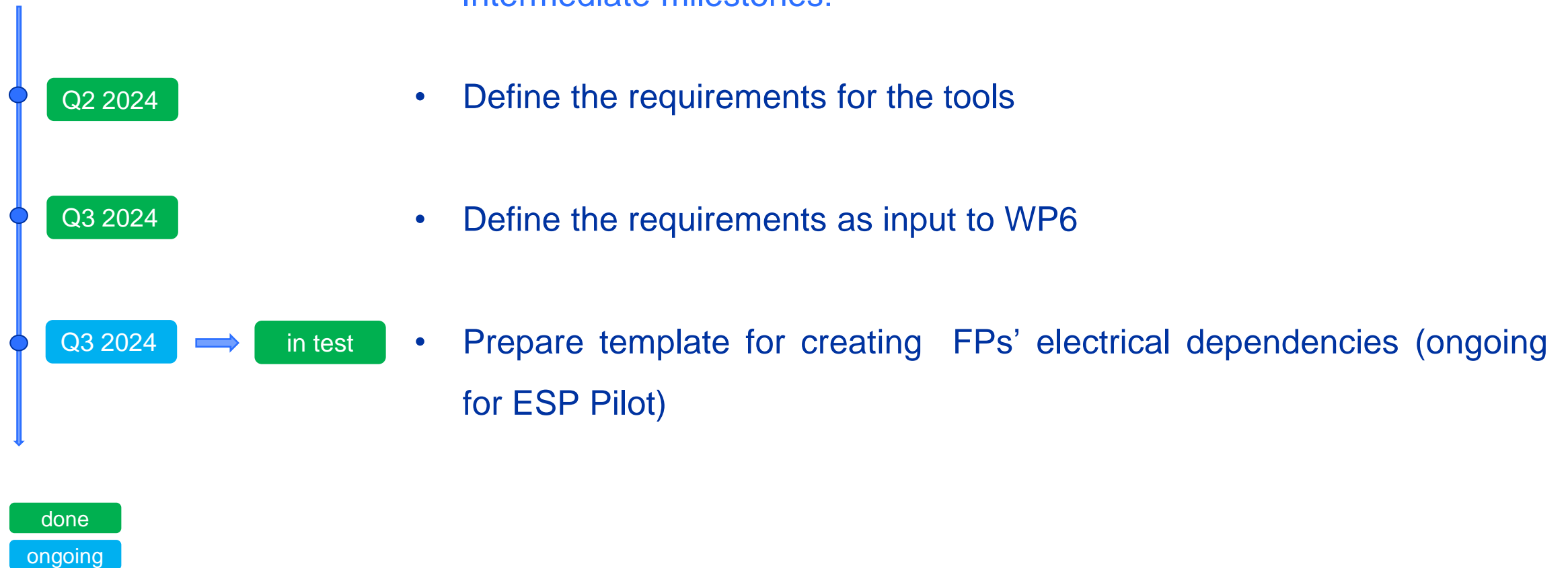
WP5.2 Drawings & Schematics - Content

- **Objectives 2024**
- **Deliverables 2024**
 - Electrical Safety Portal - Concept
 - EAM Batch Upload template and Equipment Dependencies
- **Roadmap 2025**

WP5.2 Drawings & Schematics – Objectives 2024

Two main objectives for 2024: Development of two digital tools for ESP

Intermediate milestones:



WP5.2 Drawings & Schematics – Deliverables 2024



ELECTRICAL SAFETY PORTAL

Concept

A MockUp (structural model) of the web portal for **Electrical Safety Project** purposes has been defined, this includes:

- Structure of the portal
- Functionalities of the **Equipment Explorer** (formerly named Functional Position Wizard Tool)
- Functionalities of the **Single Line Diagrams Viewer** (formerly named Interactive SLD Tool)
- Other functionalities that would be useful in the context of ESP
- Broad possibilities of **customization** based on the user preferences and role

The **Equipment Dependencies** in terms of Electrical Relations has been streamlined in order to make it accessible for all CERN users and represent the dependencies in an interactive graph.

All these features were discussed extensively with the WP6 Leader Łukasz Pater for seamless implementation. Very constructive discussions held during the year.



Electrical Safety Portal - Concept

ELECTRICAL SAFETY PORTAL | FP Explorer | Single Line Diagrams | Knowledge Base | WP4 Sub-Page

KNOWLEDGE BASE

Quick Search

DOCUMENTS

Buttons are an EDMS link

Fixed position, click scrolls to the section, highlight content, section when scrolling

AGREEMENTS

- Operation Agreement (FN EL and SY EPC)
- Operation Agreement (FN EL and TE HSC)
- Operation Agreement (FN EL and FN CV)
- Responsibility Agreement (SY EPC and TE HSC)

PROCEDURES

- Lock-out procedure (FN EL)
- Another procedure

TOOLS

- EAM Upload Utility (Web-based batch upload software)
- FP Upload template (Template batch uploading)
- Another tool (ECP Tool)

LINKS

DATABASES

- Infor EAM (Official CMS of CERN)
- Layout Database (Accelerator Computer database)
- SY-EPC Database (Power Converters database)
- EAM Light (Lighter version of Infor EAM)

STANDARDS

- CERN Naming Portal (Functional Positions naming table)

EXTERNAL

- Electrical Engineering Hub (FN EL unofficial website)
- Electropedia (IEC Electrotechnical vocabulary)
- CERN HSE (CERN HSE Website)

ELECTRICAL SAFETY PORTAL | FP Explorer | SINGLE LINE DIAGRAMS | Knowledge Base | WP4 Sub-Page

Top navigation remains fixed as users scroll

Smart Search

Recognizes EDMS numbers, PLM drawings references and Functional Positions

Electrical Safety Portal description, functionalities, purpose, etc.

Voluntary search bars will confuse the user and if the Smart Search will be available

Search Functional Positions

Search Documents, Templates

Search WP4 content

FUNCTIONAL POSITIONS EXPLORER

SINGLE LINE DIAGRAMS

KNOWLEDGE BASE

WP4 BUTTON

LINKS

The idea is to link to the Knowledge Base. To be discussed, because it's redundant

DOCUMENTS

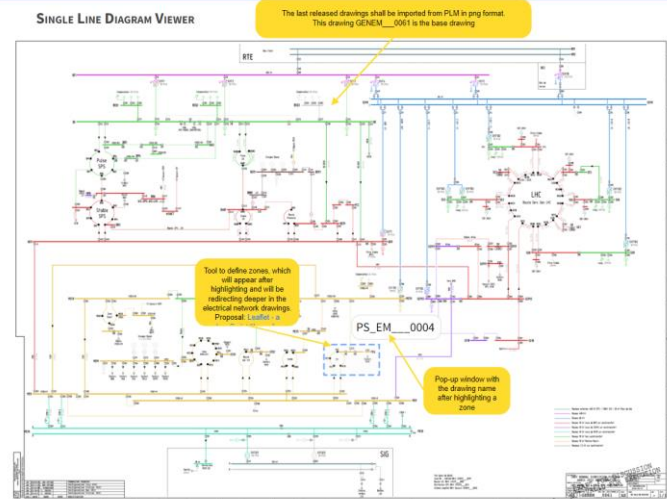
- Operation Agreements
- Responsibility Agreements
-

TOOLS

- FP Upload Tool
- Another Tool
-

EXTERNAL WEBSITES

- EAM Light
- Layout Database
- Electrical Engineering Hub
-



ELECTRICAL SAFETY PORTAL | FP Explorer | Single Line Diagrams | Knowledge Base | WP4 Sub-Page

FUNCTIONAL POSITIONS EXPLORER

Open FP in EAM Light

Location with link to GIS

Site and zone, in e.g. LHC zone 1

Double click on the Functional Position. Bubble opens it in the Functional Position Explorer

Export to CSV

Possibility to define which columns to be viewed by default

After highlighting the field the cable type's descriptions shall pop up

Customizable how many records per page. Or dynamic table length self-adjustable to number of records

After highlighting the field the connector type's descriptions shall pop up

Visible columns to be possible to be defined by the user

Customizable how many records per page. Or dynamic table length self-adjustable to number of records

GIS LOCATION

WP5.2 Drawings & Schematics – Deliverables 2024

EAM Batch Upload template

An Excel template has been developed to create a batch upload utility of attributes required by the documents produced by WP5.1 to EAM. The template can batch upload the Equipment Dependencies to EAM in order to create the Electrical Equipment Dependency Graph from Bottom-to-Top orientation. Ready to be tested during the ESP Pilot.

ESP Electrical Safety Project

Electrical Safety Project equipment attributes

Functional Position <small>click for ID</small>	Equipment owner <small>click for ID</small>	Equipment operator <small>click for ID</small>	Deputy Equipment operator <small>click for ID</small>
EBD11E7	ENEL	123456 Doe John	234567 Doe Jane
EBD1071E7	ENEL	123456 Doe John	234567 Doe Jane
UAC-00001	ENICV	123456 Doe John	234567 Doe Jane

attributes

ESP Electrical Safety Project

Electrical Safety Project delegations - one line per delegation

Functional Position <small>click for ID</small>	To <small>click for ID</small>	Delegated action <small>click for ID</small>	Description <small>click for ID</small>	Conditions <small>click for ID</small>
EBD11E7	ENICV	Operation	Only during RUN	Personnel must hold a BC electrical certification
EBD1071E7	ENICV	Corrective		
UAC-00001	ENEL	Operation	EYETS	
UAC-00001	TE/CRG	Troubleshooting		

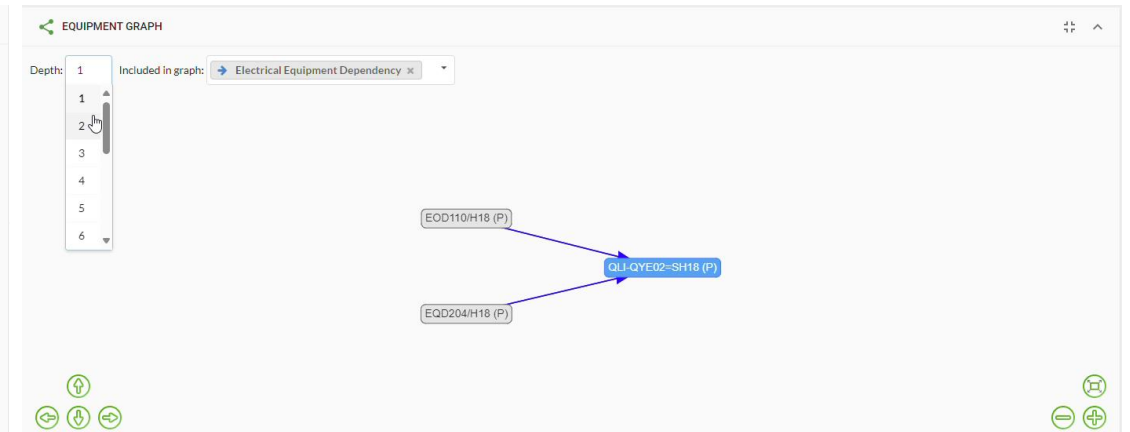
delegations

ESP Electrical Safety Project

Equipment Dependencies Creator - one line per relation

Main Equipment Functional Position <small>click for ID</small>	Source Functional Position <small>click for ID</small>	Equipment Dependencies		
		Type <small>click for ID</small>	Attribute <small>click for ID</small>	Description <small>click for ID</small>
EMD103*11	EMD1*11	POWERED_BY	Normal	
EMT103*11	EMD103*11	POWERED_BY	Normal	
EBD101*11	EMT103*11	POWERED_BY	Normal	
EBD1*11	EBD101*11	POWERED_BY	Normal	
EBD102*11	EBD1*11	POWERED_BY	Normal	
ERD202*11	EBD102*11	POWERED_BY	Backup	

electrical dependencies



WP5.2 Drawings & Schematics – Deliverables 2024

Electrical Equipment Dependencies

... a set of basic rules has been defined how to represent data in the Equipment Dependency Graph

Requirements for the Graph visualizing the Equipment Dependencies **POWERED_BY**

- By default, the arrows shall be displayed as solid blue line
- For the dependency with an associated attribute:
 - Normal – solid blue line (#0086B6), with animation of the flow
 - Backup – blue dashed line (#0086B6), with slower or intermittent flow
 - Limited Power Backup – red dashed thinner (than normal) line (#AF312A), with slower or intermittent flow
 - Battery – orange solid line (#F67828), animated "pulsing" effect
- After highlighting the dependency arrow a pop-up window shall appear, which will contain the Equipment Dependencies "Description" filed (filled voluntarily by the user)
- Double click on the dependency arrow, lists in a side or floating panel all the cables between the two equipment, minimum data:

- Cable number,
- Cable type (code + description, in e.g. PJ3SJ – 3x2.5 CU),

Type	Position 1	
PJ3SJ	EOD1/1E7	ALIM. ONI
PJ3SJ	3 X 2.5 CU CL5 0,6/1KV BL/BR/JV	

- Length,

- Side or floating panel that appears when a node is selected, showing its ESP attributes (EOW, EOp, DEOp, etc.) and delegations if exist

Voltage level when highlighting the FP node
The node can have color adequate to voltage level

18 kV Equipment Cladding

RAL 3005 - Wine Red
R: 89 | G: 25 | B: 31
C: 40 | M: 100 | Y: 60 | K: 40
HEX: #59191F

400 V Equipment Cladding

RAL 5012 - Light Blue
R: 0 | G: 137 | B: 182
C: 75 | M: 30 | Y: 0 | K: 10
HEX: #008986

48 V DC Equipment Cladding

RAL 1018 - Zinc Yellow
R: 250 | G: 202 | B: 48
C: 0 | M: 15 | Y: 100 | K: 0
HEX: #FACA30

3.3 kV Equipment Cladding

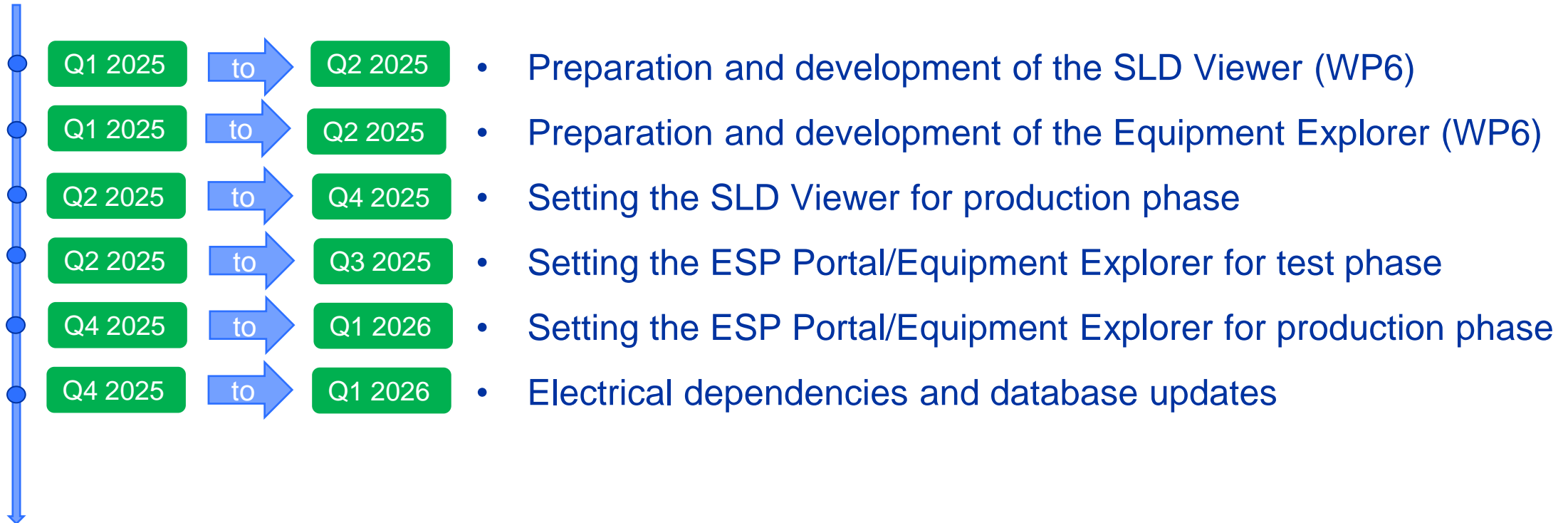
RAL 6016 - Turquoise Green
R: 0 | G: 105 | B: 76
C: 100 | M: 20 | Y: 80 | K: 25
HEX: #00694C

400 V Secured/UPS Equipment Cladding

RAL 2003 - Pastel Orange
R: 246 | G: 120 | B: 40
C: 0 | M: 70 | Y: 90 | K: 0
HEX: #F67828

This will be an iterative process to refine the functionality to all ESP contributors needs 😊

WP5.2 Drawings & Schematics – Roadmap 2025



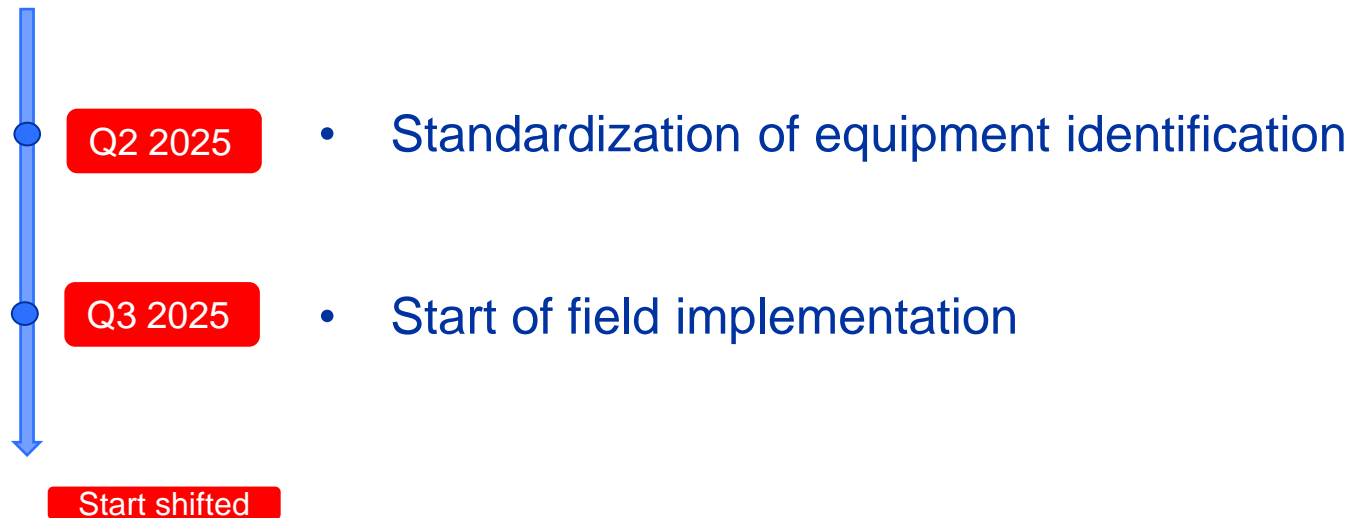
Our contributors will have the means to create the electrical dependencies and their implementation in the database!

WP5.3 Identification in field - Objective and roadmap

Objective: Identification/Tag in field the separation points along the electrical distribution network.
Not started in 2024 due to its dependency on WP5.1 and WP5.2 deliverables.

Identification and labeling on site of FPs subject to the Limits of Responsibilities documents:

- Once the WP5.2 tools become operational and the electrical dependencies are created, WP6 will evaluate the implementation of a direct labels printing feature
- Contributors support is needed for the labelling activity



WP5 Resources

Contributor groups: SY-RF, SY-BI, SY-EPC, SY-ABT, SY-STI, TE-MSc, TE-CRG, TE-VSC, TE-MPE, EN-CV, EN-EL

Group/section	2024		2025		2026
	RUN	YETS	RUN	YETS	LS3 Q1
EN-EL-MO	10 x 0.1	10 x 0.1	10 x 0.1	10 x 0.1	Spare time
EN-EL-EPM+DDO	2 x 0.2	2 x 0.2	2 x 0.2	2 x 0.2	
EN-CV	0.5	0.5	0.5	0.5	
SY-RF	0.2	0.2+ 1 new graduate	0.2+ 1 new graduate	0.2+ 1 new graduate	
SY-BI					
SY-EPC					
SY-ABT					
SY-STI					
TE-MSc	tbc	tbc	tbc	tbc	
TE-CRG	tbc	tbc	tbc	tbc	
TE-VSC	0.1	0.2	0.1	0.2	
TE-MPE	0.1	0.2	0.1	0.2	

EN-EL needs 1.5 FTE to compensate for the involvement of the existing staff

Budget allocated for 1 FTE. Recruitment process started in June 2024. Still very difficult to find a candidate.

Cornelia joined ESP WP5 team in September.

Cornelia started working on preparation of the ESP Pilot.

Following the validation of WP5 documents, the plan is for Cornelia to support WP5 contributor groups in implementing the methodology.

For the next WP5 milestones it is essential to recruit the FTE to work with Cornelia as field support!

WP5 ESP Pilot - Strategy

The areas for the ESP Pilot for WP5:

- East Area: EN-CV, SY-EPC, SY-STI, SY-ABT (PS Extraction), SY-BI, TE-MPE, TE-VSC, TE-MSD
- SH18: TE-CRG
- SM18: SY-RF

Preparation of the ESP Pilot:

- One to one meetings with the contributors to discuss the methodology WP5 is willing to test
- The contributors will send to WP5 the list of FPs to be included
- WP5.1 will prepare two examples of [Limits of Responsibility documents \(Doc B\)](#)
- WP5.2 will build the electrical dependencies in EAM for the included FPs

After the ESP Pilot:

- Apply the return of experience to address identified methodology gaps

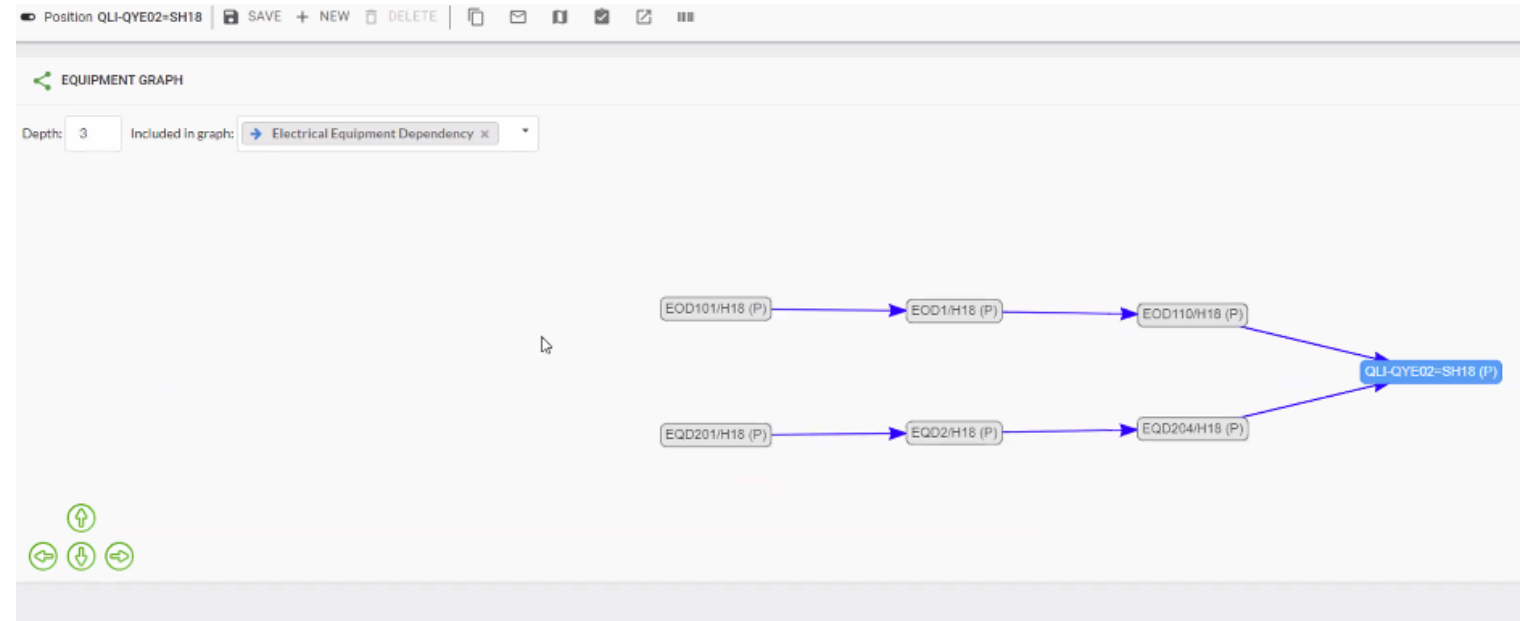
WP5 ESP Pilot - Example

Preparation of the WP5 ESP Pilot for TE-CRG

- ESP Pilot area: SH18
- List of TE-CRG's FPs supplied from EN-EL sent to WP5
- TE-CRG and WP5.1 identified the supply scenarios for the Limits of responsibilities document
 - TE-CRG equipment directly supplied from 0.4 kV
 - TE-CRG equipment directly supplied from 3.3 kV
 - Delegation mechanism for operation of the FPs to be agreed and Doc.B approved
- WP5.2 updated the information in EAM
 - The electrical dependencies were built, and the supply tree is available in EAM

Thanks to Marco
and Thomas for
their involvement!

CRG equipment name	Link EAM	EN/EL
QLI-QYE02=SH18	link	EOD110/H18 EQD204/H18
QLC1H-EM01=SH18	link	EQD213/H18
QLC1H-S-M01	link	EKD209/H18
QLC1H-S-M02	link	EKD208/H18
QLC1H-S-M03	link	EKD207/H18
QLC2H-EM01=SH18	link	EQD406/H18
QLC2H-S-M120	link	EKD211/H18
QLWPU1-EM01=SH18	link	EQD403/H18
QLWPU2-EM01=SH18	link	EQD405/H18
QLG1H-EM11=SH18	link	EQD212/H18
QLG1H-EM12=SH18	link	EQD404/H18
QLG1H-EM13=SH18	link	EQD203/H18



Next steps for WP5 and Contributors

Contributors Groups:

- Finalise your feedback to our documents
- Provide your equipment lists for the ESP Pilot to Cornelia
- Validate electrical dependencies and update databases for large-scale deployment for all your equipment

WP5 team:

- Incorporate lessons learned and ESP Pilot feedback into our agreements and data templates
- Finalise templates for approval
- Develop and test the digital tools (EAM batch upload, SLD Viewer, Equipment Explorer)

Thank you for your attention!