



2023 EIROforum Workshop on Configuration Management - CERN

Thomas Birtwistle (EN dept.), Giulia Romagnoli (BE dept.), Stephane Bally (CMS experiment)

25 April 2023

Outline

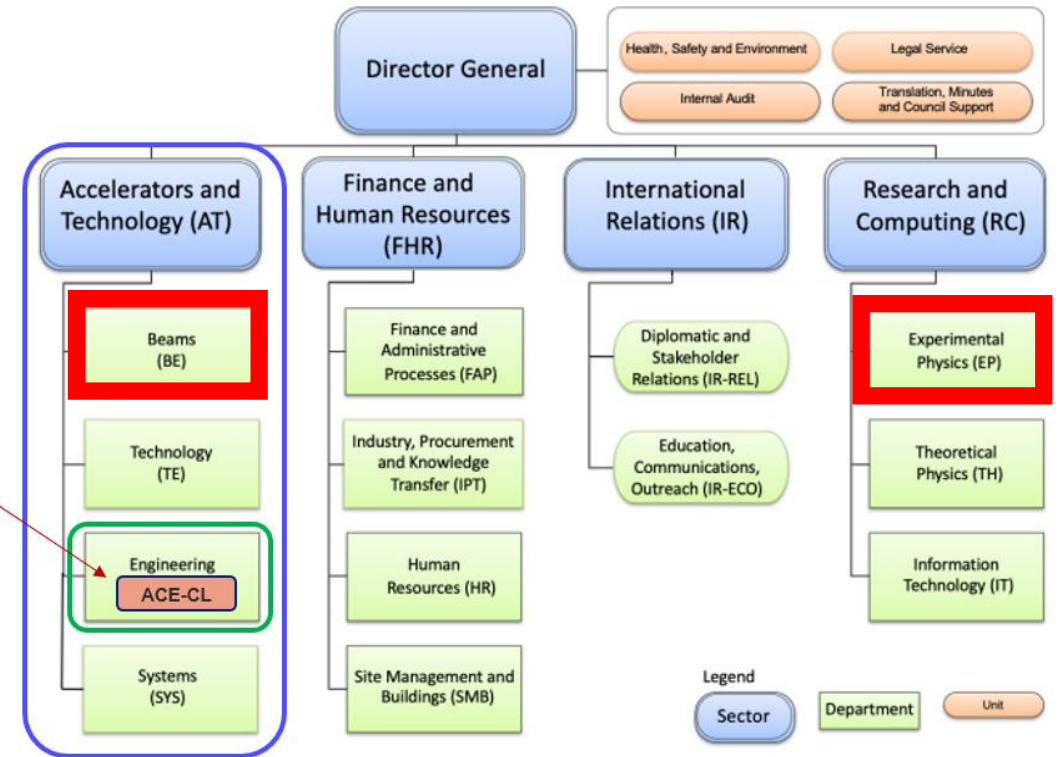
- **CERN Configuration Management Organisational Structure**
- **Configuration Management Mission**
- **Accelerators Perspective on Configuration Management**
 - Naming, Layout Database, Hardware Baselines, Change Management, Panoramas, Overall Process
- **Accelerators' Sector Experimental Areas Configuration Management (Giulia Romagnoli)**
- **CMS Experiment Configuration Management (Stephane Bally)**

CERN Configuration Management Organisational Structure

- **Accelerators**

- Centralise configuration management processes.
- Located in the **Engineering Department – Accelerator Coordination and Engineering Group – Configuration and Layout Section.**
- Ensure the configuration management of all primary beam lines (~50km of beam line)

Configuration & Layout Management team



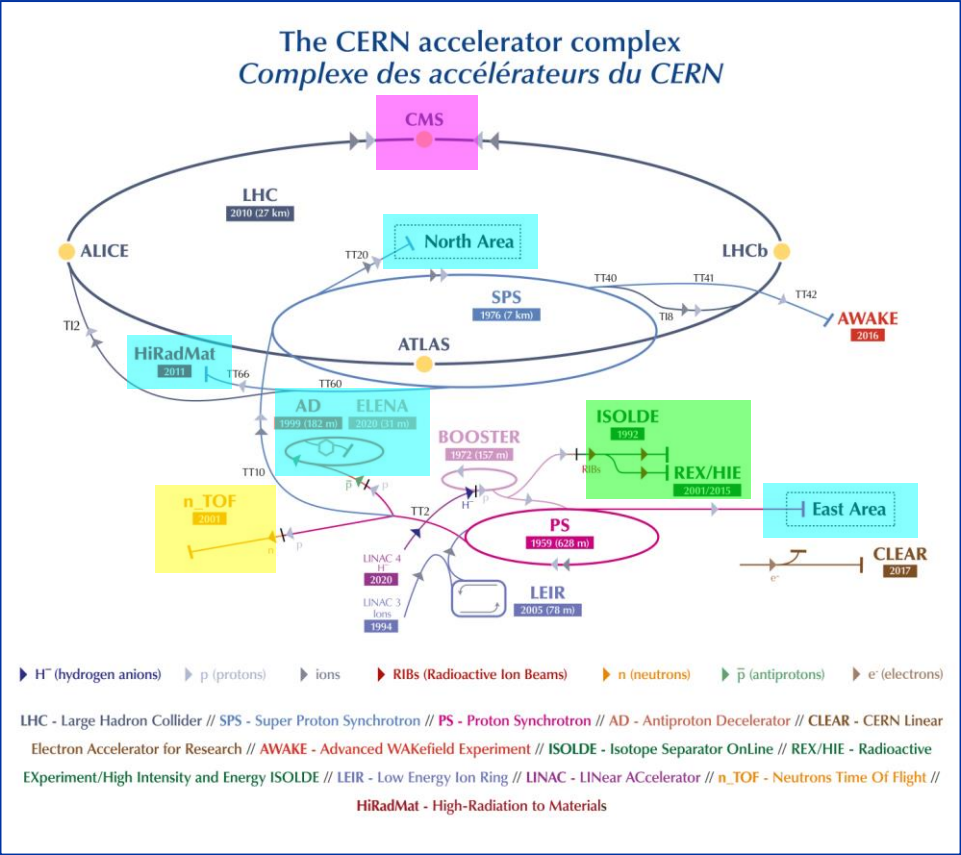
- **Accelerators' Sector Experimental Areas**

- East Area, North Area, AD etc. = **BE-EA group.** Activities to be presented by **Giulia Romagnoli**

- **LHC Experiments (example today from CMS)**

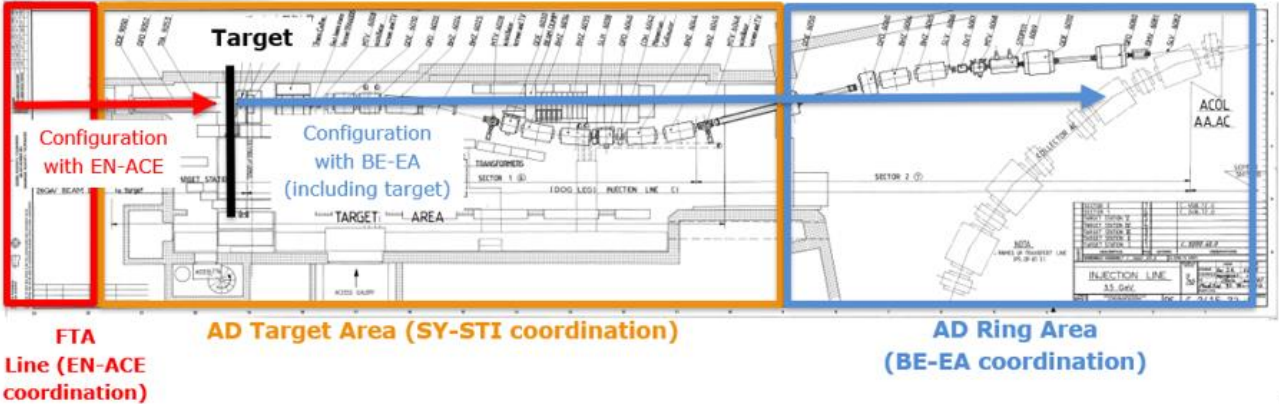
- LHC experiments - CMS = **EP-CMX group.** Activities to be presented by **Stephane Bally**

CERN Configuration Management Organisational Structure



Several actors for configuration management

- Primary beam lines: EN-ACE-CL
- Experimental areas (North Area, East Area...): BE-EA
- nTOF: SY-STI
- ISOLDE: BE-OP
- LHC experiments - CMS



AD target area example - Configuration management responsibilities sharing

Slide courtesy of A.L. Perrot (EN-ACE)

Configuration Management Mission

Provide a clear and coherent representation of the CERN accelerators, experiments and facilities at a given point in time.

Using various engineering tools, databases, and processes.

Working with various stakeholders across the organisation.

Accelerators Perspective on CM

Hardware Baselines / Product Breakdown Structures

- ▶ Linac 3 Hardware Baseline
- ▶ Linac4 Hardware Baseline
- ▶ LEIR Hardware Baseline
- ▶ PS Booster Hardware Baseline
- ▶ ISOLDE Hardware Baseline
- ▶ HIE-ISOLDE Hardware Baseline
- ▶ PS Ring Hardware Baseline
 - ▶ PS Ring LS2 Work Package Analysis
 - ▶ Layout
 - ▶ Integration
 - ▶ Magnets
 - ▶ Injection/Ejection Systems
 - ▶ Vacuum System
 - ▶ DC Powering
 - ▶ Radiofrequency System
 - ▶ Beam Instrumentation
 - ▶ Beam Intercepting Devices
 - ▶ Supports
 - ▶ Transfer Lines
 - ▶ Infrastructure

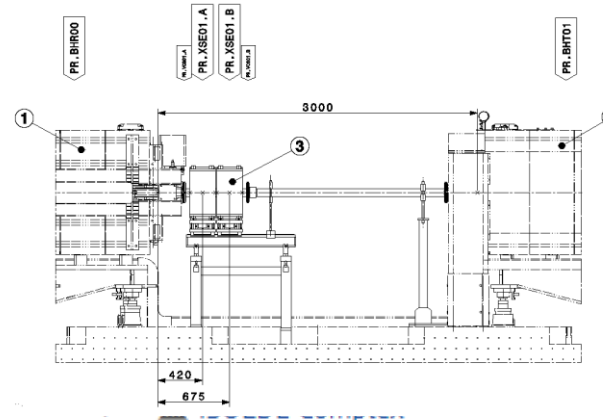


Configuration Items

- ▶ PXMQNAAIAP (v.0) PXMQNAAIAP - Quadrupole magnet, type 401
- ▶ PXMQNABIAP (v.0) PXMQNABIAP - Quadrupole magnet, type 402
- ▶ PXMQNBAFAP (v.0) PXMQNBAFAP - Quadrupole magnet, type 406
- ▶ PXMQNBCAWP (v.0) PXMQNBCAWP - Quadrupole magnet, type 407
- ▶ PXMQNBDAAP (v.0) PXMQNBDAAP - Quadrupole magnet, type 408
- ▶ PXMQNCAAWP (v.0) PXMQNCAAWP - Quadrupole magnet, type 409
- ▶ PXMQNCHAWP (v.0) PXMQNCHAWP - Quadrupole magnet, type 414

Documentation

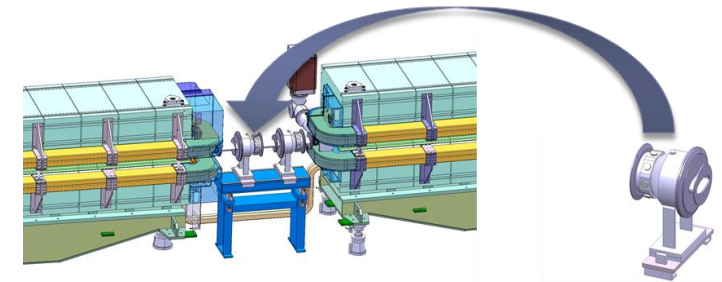
Layout – sequence of functional positions



- ▶ LEIR Complex
- ▶ PS Ring (PR)
 - ▶ SECTOR 1
 - ▶ SECTION 01
 - ▶ PR.SD01
 - ▶ PR.XSE01.A
 - ▶ PR.VCS01.A
 - ▶ PR.XSE01.B
 - ▶ PR.VCS01.B
 - ▶ PR.UA01
 - ▶ SECTION 02



Change Management



Naming

QUALITY ASSURANCE DEFINITION

Conventions for Layout Components of the PS Ring and F16, F61, FTN, FTA, ZT8, ZT9, ZT10, ZT11 Transfer Lines

Panoramas



Accelerators Perspective on CM Naming Portal

[Link to Naming Database](#)

Stores the names/codes of all accelerator equipment.

Coherence ensured by the naming service (EN-ACE-CL), in conjunction with equipment groups.

Equipment codes defined according to naming conventions that are agreed and defined through Quality Assurance Plans / with Quality Assurance teams

The screenshot displays the 'Accelerators Naming Portal' interface. At the top, there is a search bar with the text 'Search...'. Below the search bar is a navigation menu with a list of categories and sub-categories, each preceded by a right-pointing triangle icon. The 'HC' category is expanded, showing sub-categories from 'A' to 'Z'. The main content area is divided into three sections: 'Documentation', 'Support / Entity codes creation', and 'Group Coding Officers'. The 'Documentation' section is further divided into three sub-sections: 'LHC', 'SPS', and 'PS-Complex', each containing a list of links to various naming conventions and plans.

Accelerators Naming Portal

Search...

Search also in description

- ▶ CR CERN Naming Schema
- ▶ FC FCC Naming Schema
- ▼ HC LHC Naming Schema
 - ▶ A Acceleration
 - ▶ B Beam Instrumentation
 - ▶ C Controls and Communication
 - ▶ D Electrical Distribution and Quench Protection
 - ▶ E AC Electrical Distribution
 - ▶ F Fluids
 - ▶ G Survey and Geodesy
 - ▶ H Mechanics, Supports and Handling
 - I Injection
 - ▶ J Infrastructure
 - ▶ K Civil Engineering
 - ▶ L Layout and Assemblies
 - ▶ M Magnet System
 - ▶ N Particle Sources
 - ▶ P Personnel Safety
 - ▶ Q Cryogenics and Machine Cryostats
 - ▶ R Power Converters
 - ▶ S General Safety
 - ▶ T Targets, Dumps and Collimators
 - ▶ U Ventilation and Air Conditioning
 - ▶ V Vacuum
 - ▶ X Experiments and Facilities
 - ▶ Y Access System
 - ▶ Z Electrostatic Systems: Separators and Septa
- ▶ OB Oscar Barbalat Naming Schema
- ▶ PX PS Naming Schema
- ▶ SP SPS Naming Schema

Documentation

LHC

- LHC Quality Assurance Plan
- Equipment Naming Convention
 - LHC Part and Assets Identification
 - General rules for naming of equipment and signals
 - Detailed rules for naming of equipment and signals
 - Detailed Cryogenics Facilities and Equipment Naming Conventions
 - Detailed Vacuum Interlocks and Controls Equipment Naming Conventions
 - Detailed Vacuum Pumping Equipment Naming Conventions
 - Power Converters and EI. Circuits Detailed Naming Conventions
 - Practical Guidelines for Equipment Codes in the CO group
 - Naming of Hardware Equipment in the Controls Topology (draft version)

SPS

- Equipment Naming Convention
 - Naming of Electrical Circuits and Power Converters for: LHC Injection Lines, CNGS

PS-Complex

- Equipment Naming Convention
 - Conventions for naming of Layout components in the PS ring and related transfer lines
 - ELENA - Naming Conventions for the Layout of ELENA
 - ISOLDE - Detailed Naming Conventions
 - Linac4 - Naming conventions for the Layout of Linac4

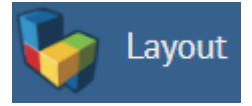
Support / Entity codes creation

[Service Element Accelerators Naming service](#)

Group Coding Officers

[Up-to-date list of Group Coding Officers](#)

Accelerators Perspective on CM Layout Database

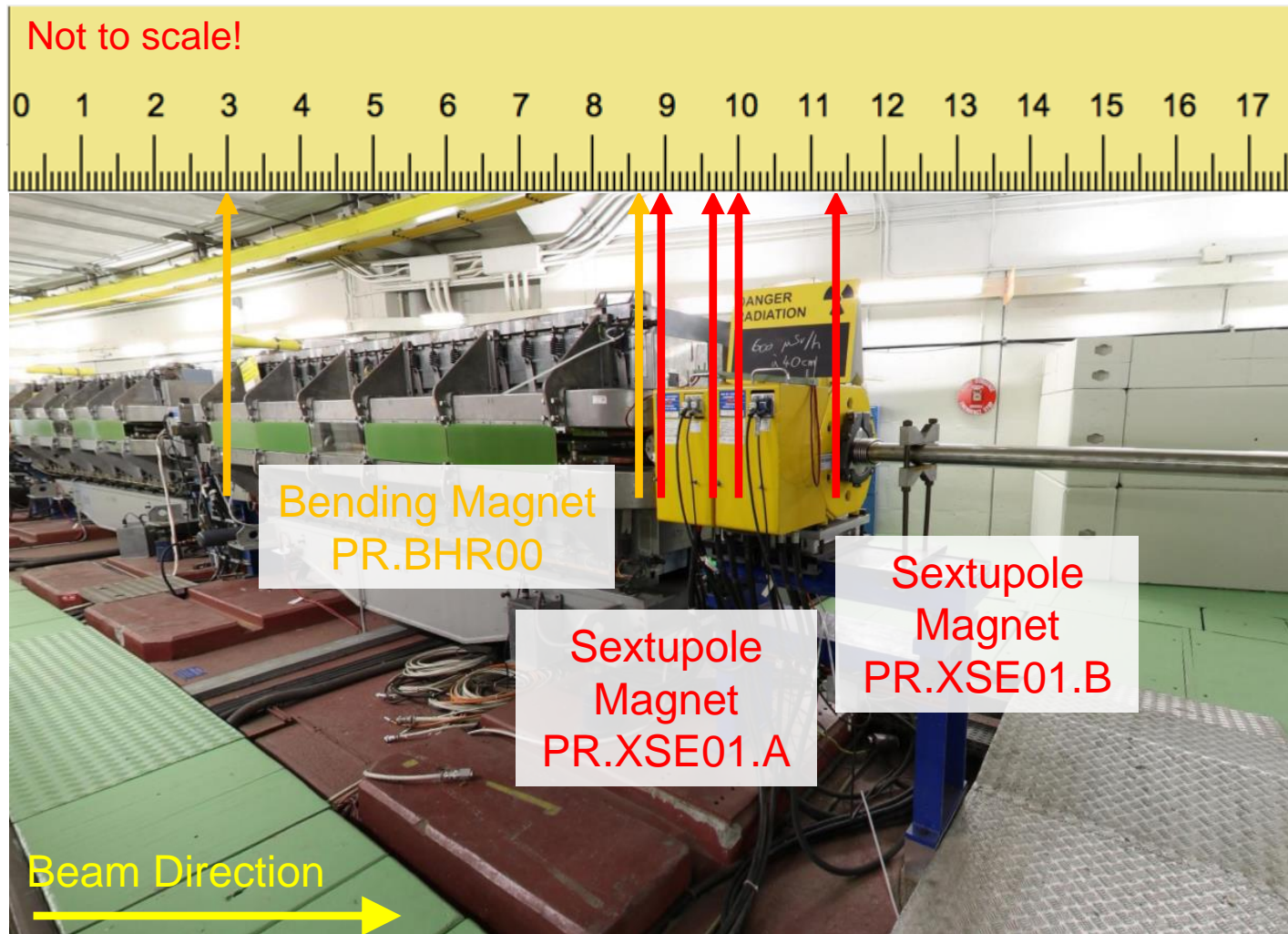


Development by BE-CSS

Stores the sequence of the accelerators and transfer lines components

The screenshot displays the 'Layout Database' interface. On the left, a sidebar contains navigation options: Search, Navigators, Editors, Tools, User Reports, and MAD Sequences. The main area is titled 'Navigators' and shows a 'MACHINE hierarchy' tree. The tree is expanded to show the 'PS Ring (PR)' and 'SPS Ring' components. The 'PS Ring (PR)' tree includes sectors 1 through 10, and the 'SPS Ring' tree includes sextants 1 through 6. The 'LHC Ring' tree is also visible, showing sectors 12, 23, 34, 45, 56, 67, 78, and 81. A blue arrow points from the 'MACHINE hierarchy' dropdown to the 'PS Ring (PR)' tree. Another blue arrow points from the 'PS Ring (PR)' tree to the 'SPS Ring' tree. A third blue arrow points from the 'SPS Ring' tree to the 'LHC Ring' tree. At the bottom, a timeline shows various accelerator phases: LS1, YETS 2015-2016, EYETS 2016-2017, TS1 2017, TS2 2017, YETS 2017-2018, TS1 2018, TS2 2018, LS2, YETS 2021-2022, TODAY (highlighted with a green dot), YETS 2022-2023, LS3 1.5, LS3 1.6, LS3 1.7, and LS4. A blue arrow points from the 'LHC Ring' tree to the 'TODAY' marker on the timeline. The text 'Time versioning' is written in blue above the timeline, and 'Slide courtesy of A.L. Perrot (EN-ACE)' is written in blue below the timeline.

Accelerators Perspective on CM Layout Database



Layout – sequence of functional positions



Mechanical, optical and electrical domains

- ▶ BI Transfer Line
- ▶ PS Booster Rings (BR)
- ▶ BT Transfer Line
- ▶ BTP Transfer Line
- ▶ BTM Transfer Line
- ▶ BTY Transfer Line to Isolde
- ▶ ISOLDE Complex
- ▶ LEIR Complex
- ▶ PS Ring (PR)
 - ▼ SECTOR 1
 - ▼ SECTION 01
 - ▶ PR.SD01
 - ▶ PR.XSE01.A
 - ▶ PR.VCS01.A
 - ▶ PR.XSE01.B
 - ▶ PR.VCS01.B
 - ▶ PR.UA01
 - ▶ SECTION 02
 - ▼ SECTION 00
 - ▶ PR.SD00
 - ▶ PR.UA00
 - ▶ PR.BLMIB00
 - ▶ PR.BHR00
 - ▶ PR.VCB00

Stores a lot of additional data, information and links!

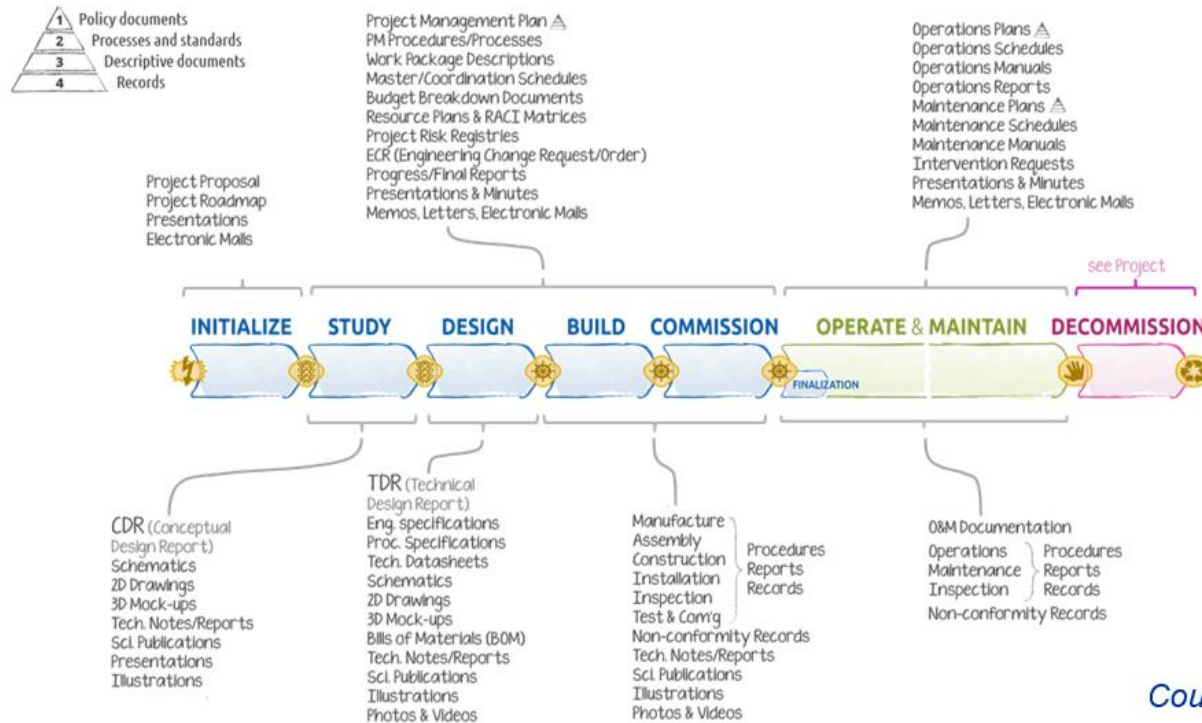
Accelerators Perspective on CM

Layout Database

The screenshot displays a software interface for managing accelerator components. On the left, a 'MACHINE hierarchy' tree shows various sections, with 'PR.XSE01.B' highlighted in a red box. The main area shows a detailed view of 'PR.XSE01.B' (ID 2369747), a 'Sextupole Magnet, type 608'. The magnet's dimensions are width 0.24m, height 0.51m, and depth 0.75m. It is located at PR.SD01 and is associated with the 'PS (PS-RING, PS Ring)' machine. A diagram on the right shows the magnet's position in a 3D space, with a vertical axis labeled 'FLOOR' and 'SKY' ranging from S3 to T. A yellow arrow indicates the beam path through the magnet. Below the main view, there are tabs for 'Positioning', 'Documents', 'Circuits and connections', and 'SmarTeam / DMU'. A 'Distances' panel shows various distance measurements. At the bottom, a timeline shows the evolution of the machine from LS1 to LS4, with 'YETS 2015-2016' through 'YETS 2024-2025' and 'LS3 1.5' through 'LS4' marked.

Accelerators Perspective on CM Hardware Baselines / Configuration Items

- Hierarchy of classes, sub-classes and configuration items
- Stores approved documentation over the full life-cycle

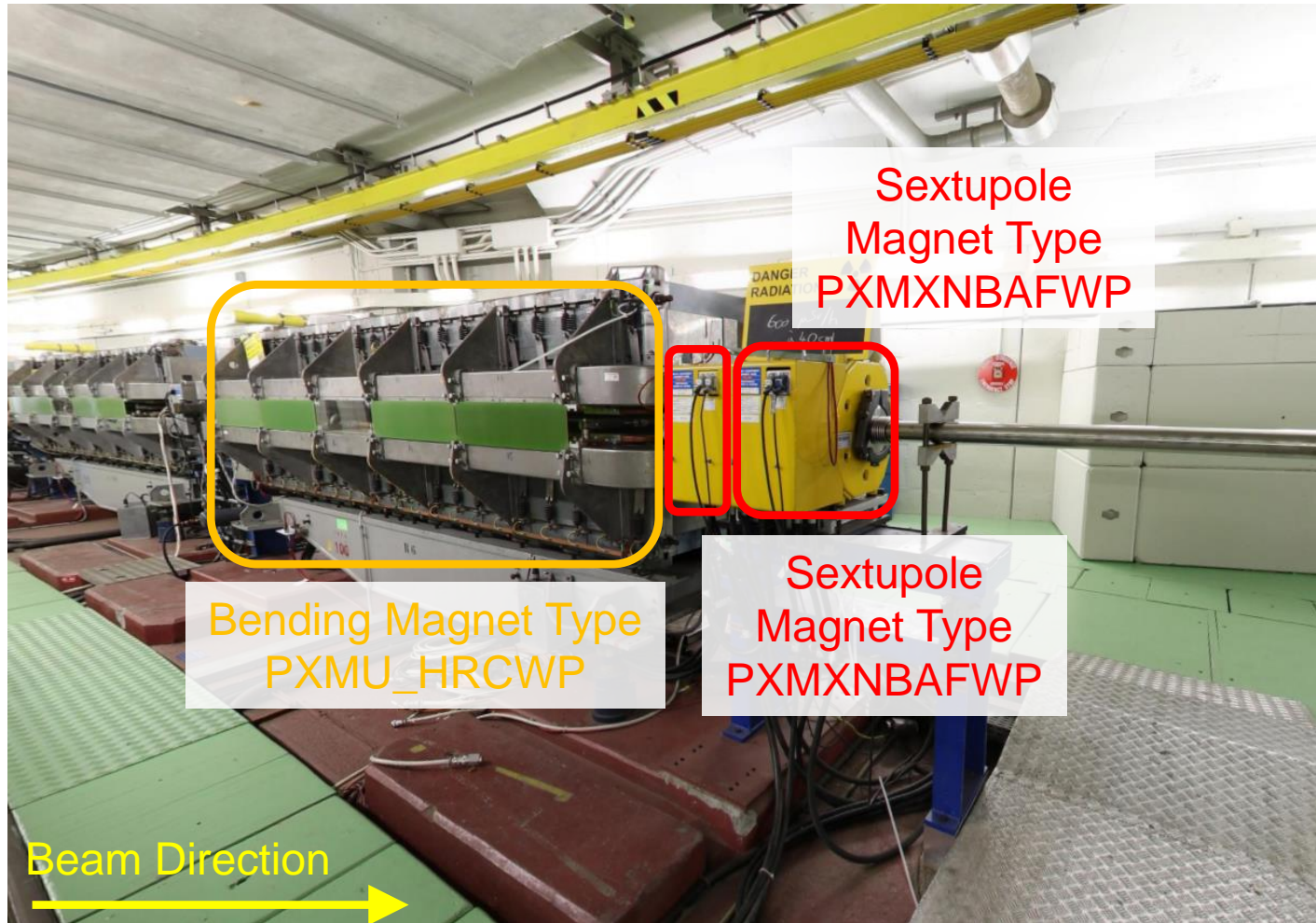


Courtesy S. Chemli & P. Bonnal
(ATS quality service)

- ▷ Linac 3 Hardware Baseline
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Accelerators Perspective on CM

Hardware Baselines / Configuration Items



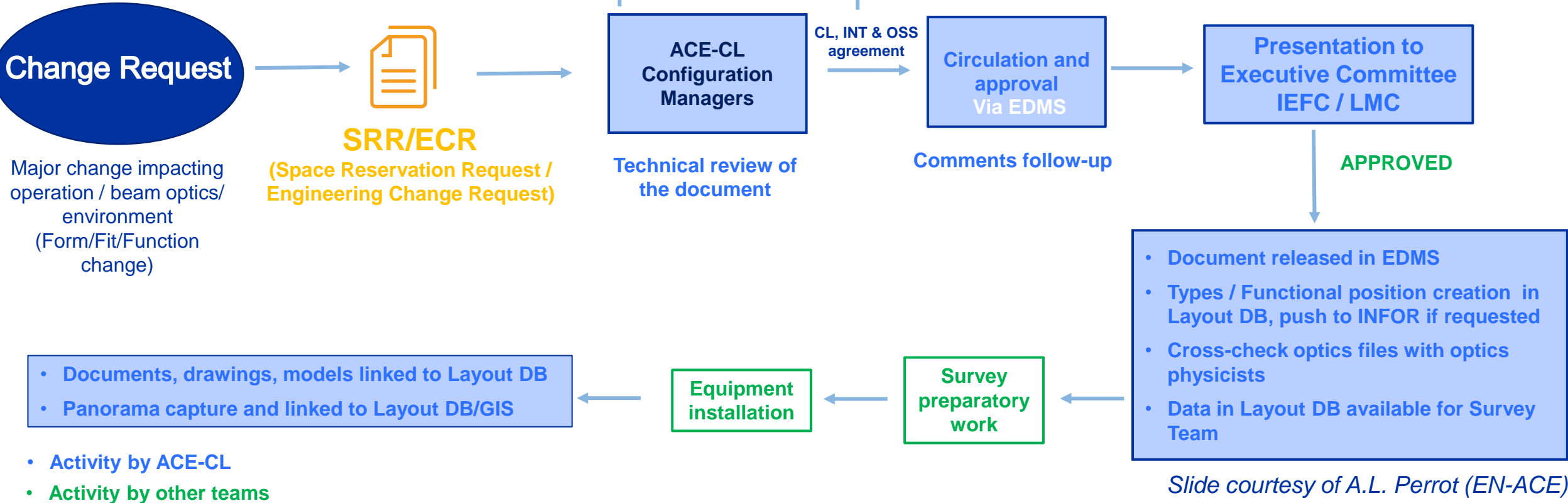
Hardware Baselines / Product Breakdown Structures



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 - ▷ Beam Intercepting Devices
 - ▷ Supports
 - ▷ Transfer Lines
 - ▷ Infrastructure

Handling Changes in the Accelerators Process

Separate Asset Replacement Request Process (ARR) also available for critical asset replacements (like-for-like)



Slide courtesy of A.L. Perrot (EN-ACE)

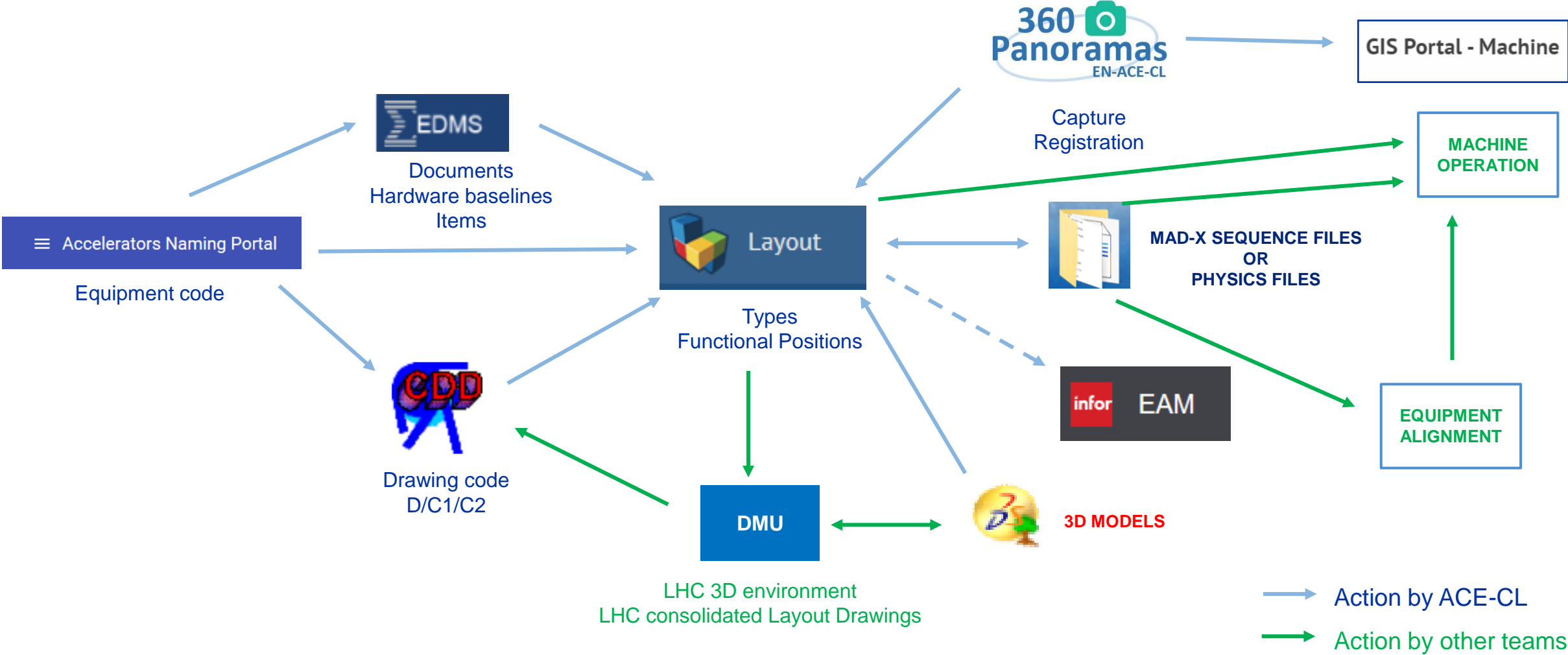
Panoramas

Panoramas (CERN internal)
Outreach version

- 360-degree visualisation of the CERN accelerators and facilities.
- Started in 2013 by EN-ACE-CL.
- Initially covered only primary beam lines. Now extended to many surface buildings, service tunnels, and experiments.
- Used by many groups across CERN for preparing interventions, checking layouts etc. (minimize radiation exposure, save time etc.)



Configuration Management Process



Slide courtesy of A.L. Perrot (EN-ACE)

Some Associated Reading

T. Birtwistle et al., “360 Degree Panoramic Photographs During the Long Shutdown 2 of the CERN Machines and Facilities”, IPAC 2021, Campinas, Brazil, WEPAB315 - <https://accelconf.web.cern.ch/ipac2021/papers/wepab315.pdf>

S. Bartolomé Jiménez et al., “CERN Accelerators Topology Configuration: Facing the Next LHC Long Shutdown”, IPAC 2017, Copenhagen, Denmark, THPAB145 - <https://accelconf.web.cern.ch/ipac2017/papers/thpab145.pdf>

M. Barberan Marin et al., “Integration, Configuration and Coordination: from Project to Reality, at CERN”, IPAC 2016, Busan, S. Korea, TUPMW003 - <https://accelconf.web.cern.ch/ipac2016/papers/tupmw003.pdf>

Conclusion

Coherence is key!



Thank-you for your attention

Acknowledgements

Special thanks to:

S. Petit - ATS Quality Service

P. Le Roux - BE-CSS

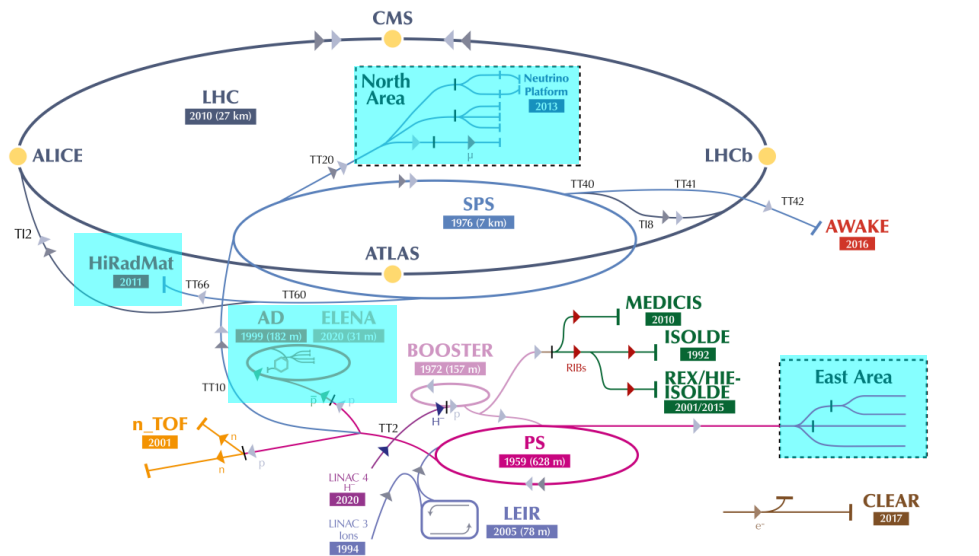
C. Scoero, A. Ortiz - EN-IM

A. L. Perrot, S. Bartolomé Jiménez, B. Feral, S. Chemli - EN-ACE

Configuration Management for Experimental Areas

Experimental areas started adopting the CM strategy in 2019 following the strategy in place and already implemented by EN-ACE for the accelerators:

The CERN accelerator complex
Complexe des accélérateurs du CERN



▶ H^- (hydrogen anions) ▶ p (protons) ▶ ions ▶ RIBs (Radioactive Ion Beams) ▶ n (neutrons) ▶ \bar{p} (antiprotons) ▶ e^- (electrons) ▶ μ (muons)

LHC - Large Hadron Collider // SPS - Super Proton Synchrotron // PS - Proton Synchrotron // AD - Antiproton Decelerator // CLEAR - CERN Linear Electron Accelerator for Research // AWAKE - Advanced WAKEfield Experiment // ISOLDE - Isotope Separator OnLine // REX/HIE-ISOLDE - Radioactive Experiment/High Intensity and Energy ISOLDE // MEDICIS // LEIR - Low Energy Ion Ring // LINAC - LINear ACcelerator // n_TOF - Neutrons Time Of Flight // HiRadMat - High-Radiation to Materials // Neutrino Platform

- **NEW** CM for East Area: completely renewed with East Area Renovation Project (2019-2021)
- AD and ELENA with Transfer lines CM started by EN-ACE and taken over by BE-EA in 2019
- HiRadMat CM started by EN-ACE and taken over by BE-EA in 2019
- **NEW** CM for North Area: Configuration Management implementation in the framework of the NACONS project.

EXPERIMENTAL AREAS CHALLENGE →
 Beamlines subject to **frequent modifications** following requirements of the Users and Experiments
 BE-EA Group is responsible for CM, coordination and for **beamline equipment!!**

Configuration Management Definition

The Configuration Management is a strategy applied to the Experimental Areas with the final goal of:

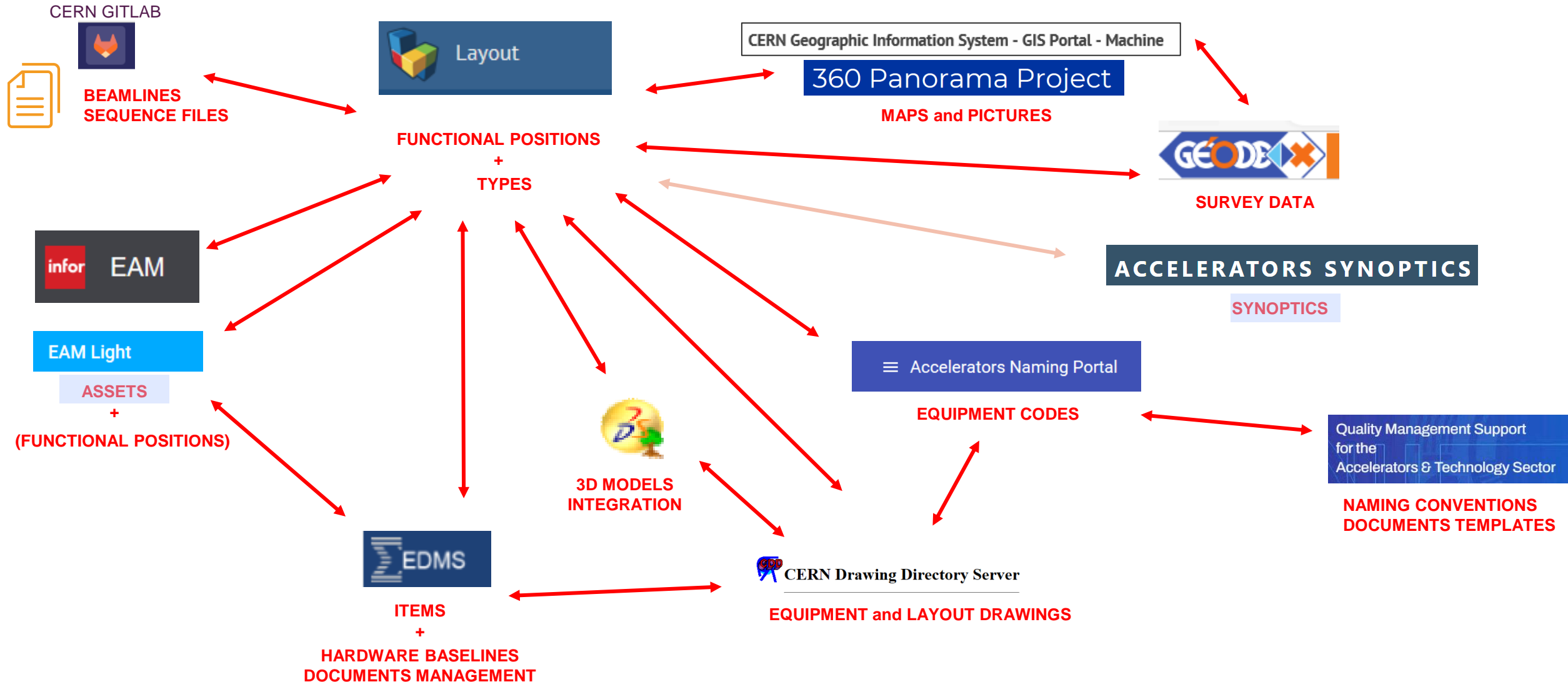
Provide a clear and coherent picture of the status of a **BEAMLINE** at a given point in time.

The main elements used by the BE-EA group to develop the CM strategy are:

- **Hardware Baseline:** Product Breakdown Structures in EDMS (DOCUMENTS Quality Control)
- **Layout Database:** Sequence of functional positions = space management
(Integration and Installation Drawings + Survey Data)
- **Naming:** verify and registering all equipment codes on Naming Portal (ATS Sector Quality)
- **Infor and EAM Light:** ASSET Management

Automatic generation of the sequence file to import in MADX for beam optics

BE-EA Configuration Management Tools



Beamline Configuration - Studies



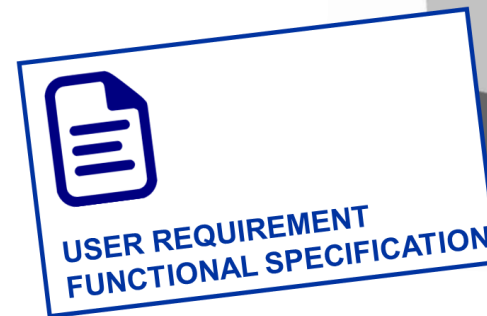
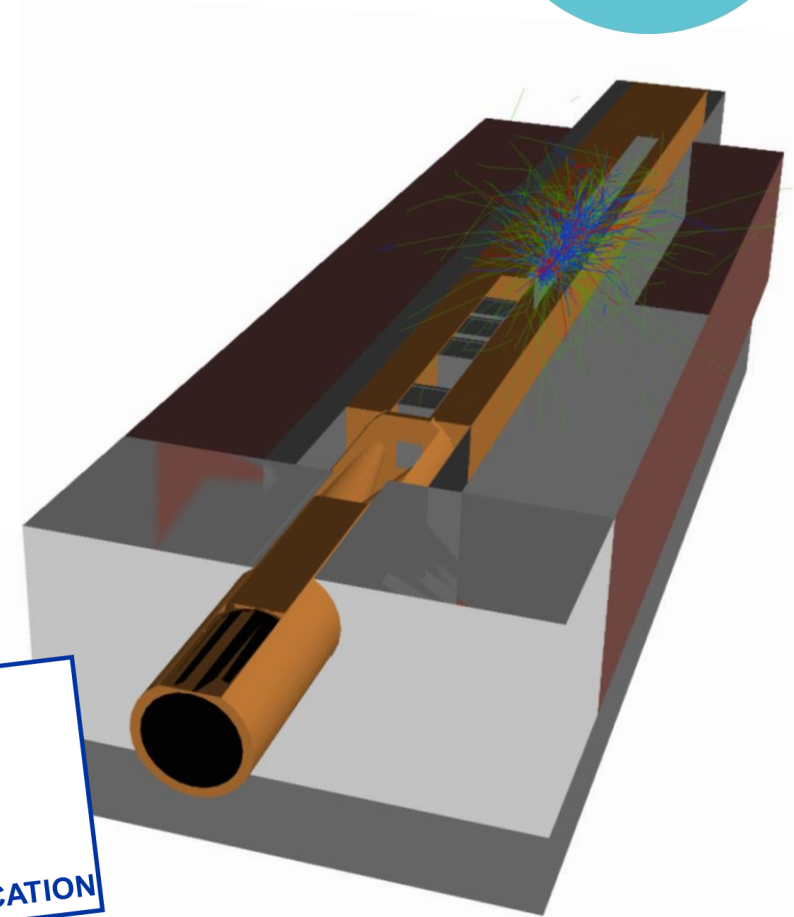
The Experimental Areas are hosting a large variety of experiments/users asking different setting and special configuration of beamlines. To cope with these request, beamline physicists are running simulations and calculating beam trajectories and optics.

The NEED could be of a different nature:

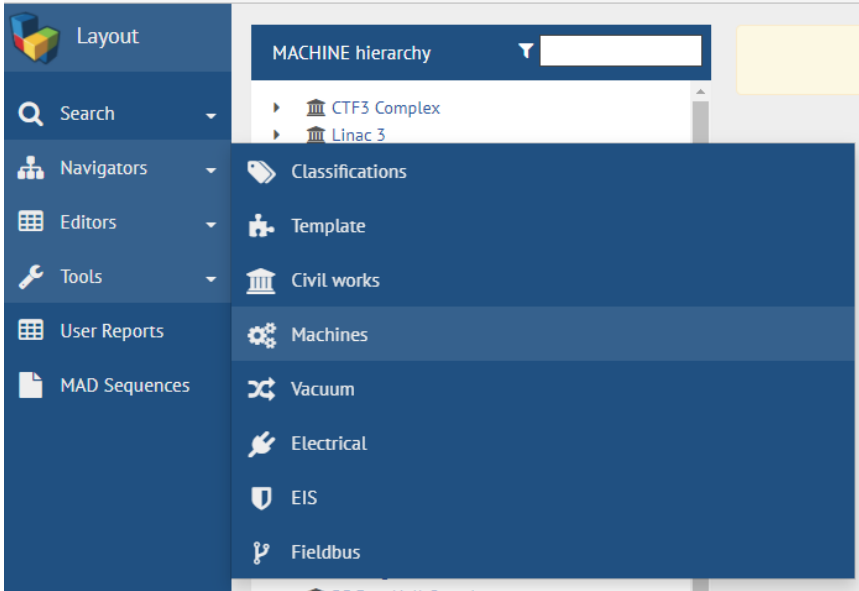
- New component
- Functional change (different configuration)
- Layout change
- Beam-matter interactions

The physicists may also help in designing and modifying existing beamlines for future experiments.

Physics simulations → BDSIM (Geant4) / FLUKA model



Functional Positions – Beamline Structure



Beamlines functional position structure is stored time dependently on Layout Database (LD) tool. LD is the reference tool that centralize all information and data with links to the other database.

- SPS North Area - H2 Line
 - SPS North Area - H4 Line
 - SPS North Area - H6 Line
 - SPS North Area - H8 Line
 - SPS North Area - P42 (P4, P4:6, P42)
 - SPS North Area - P62 (P6, P4:6, P42)
 - SPS North Area - K12 Line
 - SPS North Area - M2 Line
 - SPS North Area - T2 Target Station
 - SPS North Area - T4 Target Station
 - SPS North Area - T6 Target Station
 - SPS North Area - T10 Target Station (T10NA)
 - SPS North Area - P4 Transfer Line
 - TBACA.X0400000
 - TBID.241150
 - TCMAA.X0400001
 - XVW.X0430001
 - MTN.X0400003
 - MTN.X0400007
 - XVA.X0430010
 - XVA.X0430011
 - XVW.X0430017
 - XTAX.X0430018
 - XTAX.X0430020
 - XCIO.X0430021
 - XVW.X0430020
 - MSN.X0430022
 - MSN.X0430029
 - QSL.X0430033
 - QNL.X0430040
 - XTCX.X0430042
 - BLMH.X0430043
 - MCXCA.X0430048
 - QNL.X0430050
 - QNL.X0430054
 - QNL.X0430064
 - MBW.X0430069
 - BLMH.X0430073

Accelerators Naming Portal

EQUIPMENT CODES

Quality Management Support
for the
Accelerators & Technology Sector

**NAMING CONVENTIONS
DOCUMENTS TEMPLATES**

2232190 v.0.5 | SPSX-L-ES-0001 v.0.5 ● Under Approval

Functional Positioning Scheme for the SPS North Area

All positions and equipment codes follow a specify convention agreed with the different equipment groups and stakeholders

Hardware Baseline - ITEMS

SPS NA HARDWARE BASELINE

- ▶ SPSX - Beam Instrumentation
- ▶ SPSX - Beam Intercepting Devices
- ▶ SPSX- Integration
- ▶ SPSX - Layout
- ▶ SPSX - Magnets
- ▶ SPSX - Supports
- ▶ SPSX - Controls
- ▶ SPSX - Beam Parameters
- ▶ SPSX - Infrastructure
- ▶ SPSX - General Services
- ▶ SPSX - Power
- ▶ SPSX - Vacuum system
- ▶ SPSX - Safety and Access
- ▶ SPSX - Experiments
- ▶ SPSX - Mechanical Supports
- ▶ SPSX - Electrical Systems

SPSX - Magnets

- ▶ ECR and ARR Magnets
- ▶ PXMBHHEHWC (v.0) PXMBHHEHWC - Bending magnet, type M200, straight poles
- ▶ PXMBHHJHWC (v.0) PXMBHHJHWC - Bending magnet, type M200, tapered poles
- ▶ PXMBHGGHWC (v.0) PXMBHGGHWC - Bending magnet, type M100, straight poles
- ▶ PXMBXFACWP (v.0) PXMBXFACWP - Bending magnet, H or V, type VB3, 1m gap 108mm
- ▶ PXMBXGDCWP (v.0) PXMBXGDCWP - Bending Magnet, H or V, type MCW
- ▶ PXMBXHACWP (v.0) PXMBXHACWP - Bending Magnet, H or V, type VB1, 2.5m gap 108mm
- ▶ PXMBXHCCWP (v.0) PXMBXHCCWP - Bending Magnet, H or V, type HB1, 2.5m gap 80mm
- ▶ PXMBXHDCWP (v.0) PXMBXHDCWP - Bending Magnet, H or V, type HB2, 2.5m gap 80mm
- ▶ PXMCXCAHWC (v.0) PXMCXCAHWC - Corrector magnet, H or V, type MDX
- ▶ PXMCXCDHWC (v.0) PXMCXCDHWC - Corrector magnet, H or V, type MNPA30
- ▶ PXMQNEETWC (v.0) PXMQNEETWC - Quadrupole magnet, type Q100, 1m
- ▶ PXMQNEGTWP (v.0) PXMQNEGTWP - Quadrupole magnet, type QFS, 0.8m
- ▶ PXMQNFBTWC (v.0) PXMQNFBTWC - Quadrupole magnet, type Q200, 2m
- ▶ SPLSE__FWP (v.0) SPLSE__FWP - Sextupole lens, extraction
- ▶ SPLSX__FWP (v.0) SPLSX__FWP - Sextupole lens, north area
- ▶ SPMBNH_HWP (v.0) SPMBNH_HWP - Bending magnet, secondary beams, horizontal, north area
- ▶ SPMBNV_HWP (v.0) SPMBNV_HWP - Bending magnet, secondary beams, vertical, north area
- ▶ SPMBW__HWP (v.0) SPMBW__HWP - Bending Magnet, main, type B2, 1000A

The hardware baseline is a breakdown structure on EDMS of the components of the beamline collecting all ITEMS there present and all important documents.
All ITEMS are linked to the functional positions in Layout database defining the nature of the positions, the dimensions, the responsible, ...

The screenshot shows the 'Classifications' interface in EDMS. On the left is a 'CLASS hierarchy' tree with 'SPMTN__' selected. The main area displays details for 'SPMTN__ (ID:47534150) Bending magnet, Target N'. A red circle highlights the ID and name. Another red circle highlights the 'Code MTN' and 'EDMS Item SPMTN_HWP' fields. A third red circle highlights the 'Documents' tab in the main navigation. Below is a table of classifications:

ID	Class Name	Main Class	Description	Direct Parent	Actions
2582457	DIPOLES	★	Dipoles	Y	
482530	MAD RBEND	☆	MAGNET	Y	
588322	APERTURE MODEL		Top Assemblies, Magn...	N	
2273638	APERTURES		Slots which should ha...	N	
5920319	CONNECTABLES		Connectable Elements	N	
482517	MAD		MAD Classes used for ...	N	
102071	MAD TOP ASSEMBLIES		Slot types used for MAD	N	
2582453	MAGNET DOMAIN		Magnet domain	N	
102061	MAGNETS		Magnets	N	
2588884	MISCELLANEOUS		Miscellaneous Lists	N	
5920372	NEW LAYOUT		New Layout Classes	N	
2582441	OPTIC DOMAIN		Optic domain (MAD se...	N	
47769961	POTENTIAL EIS ELEM...		Classe filtering the po...	N	

On the right, the 'Domain Properties' panel shows fields for 'Anchor', 'Text', 'Value', and 'Description' with values like 'MACHINE PLANE ICP AXIS' and 'ONICPAXISPLANE'. A 'Save' button is visible at the bottom of this panel.

TYPES - ITEMS



Items are the “virtual objects”, results of the design studies collecting all technical information, specifications, drawings, 3D assembly models,...

TYPE = ITEMS – What?

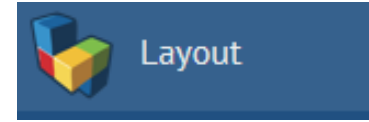


Shape and Color / Family Name

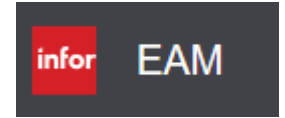
FUNCTIONAL POSITION – Where?



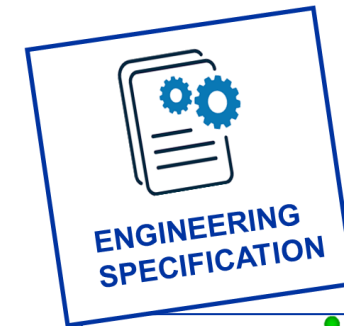
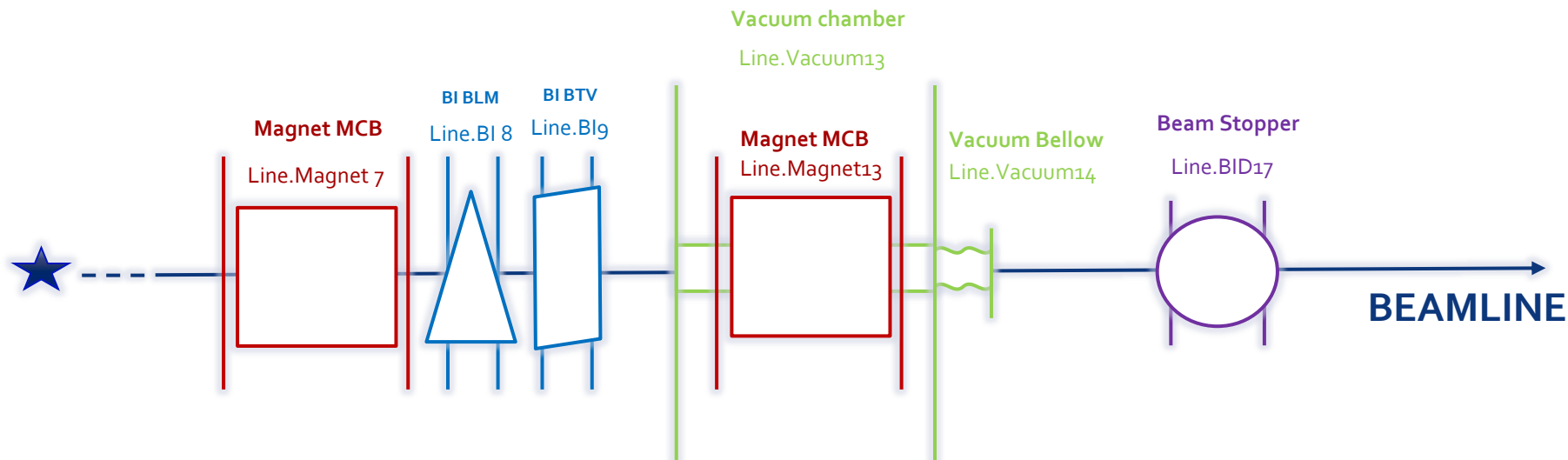
Place / Where it is located?



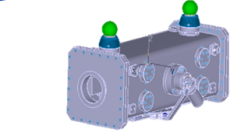
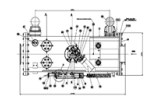
TYPES




PART



ENGINEERING SPECIFICATION

3D Model (.stp) 2D Drawings



ITEM

Accelerators Naming Portal

ASSETS

PRODUCTION - TESTING



ASSETS are the physical instances of a specific ITEM
All ASSETS are linked to the functional positions in Layout Database

ASSET – Who?



Filling / First Name + Family Name

TYPE = ITEMS – What?



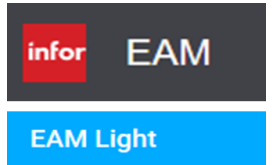
Shape and Color / Family Name

FUNCTIONAL POSITION – Where?



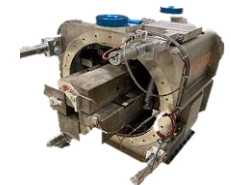
Place / Where it is located?

The assets management tool used is Infor EAM used also for work orders, preventive maintenance, ...

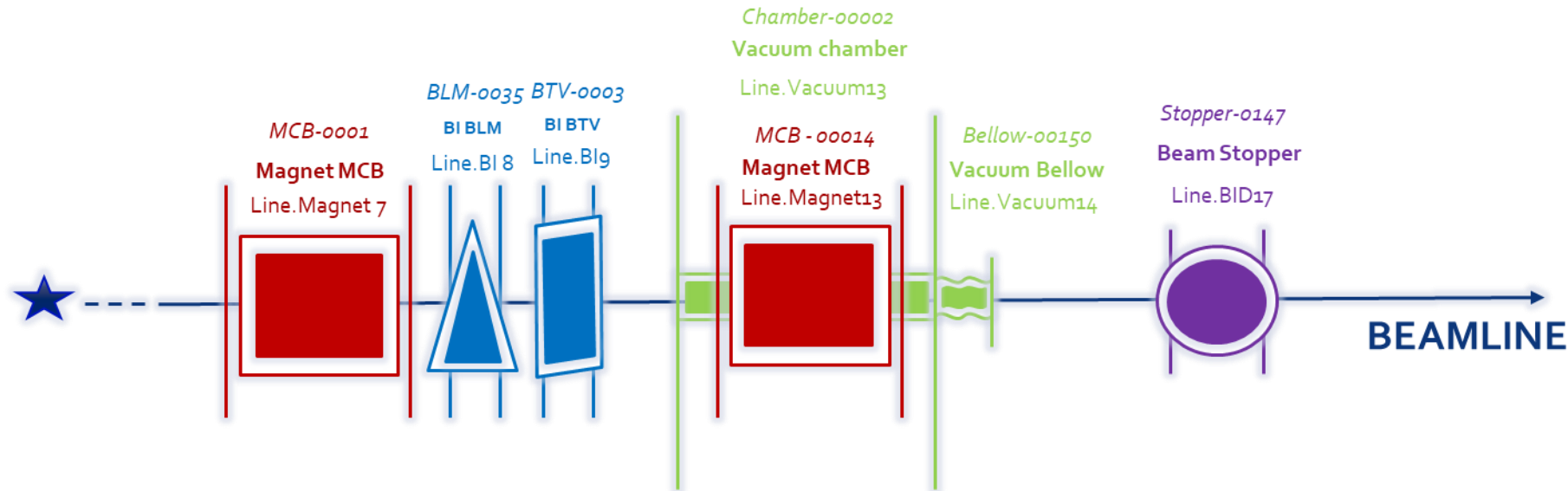


ASSET

Make or buy?
Technical Specification

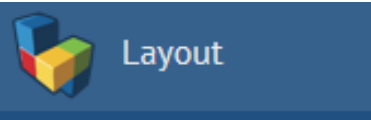


MTF
Equipment Management Folder
Manufacturing workflow



Installation

INSTALLATION



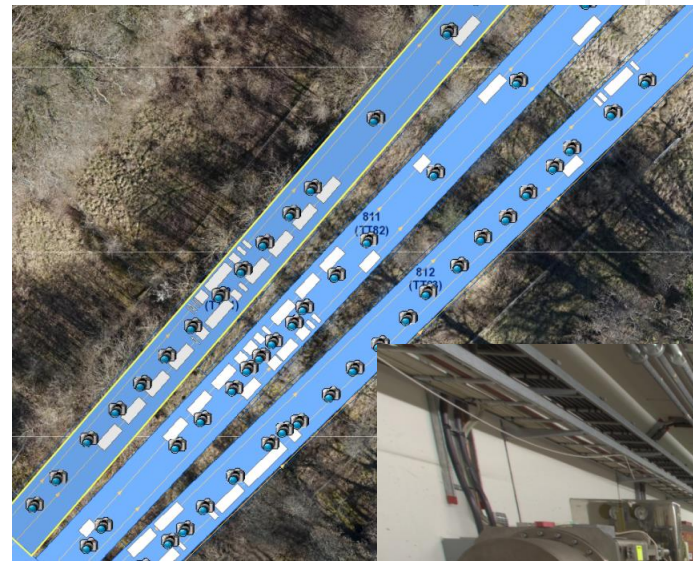
CERN Geographic Information System - GIS Portal - Machine

360 Panorama Project

Panorama contact person: T. Birtwistle, EN-ACE-CL

MAPS and PICTURES

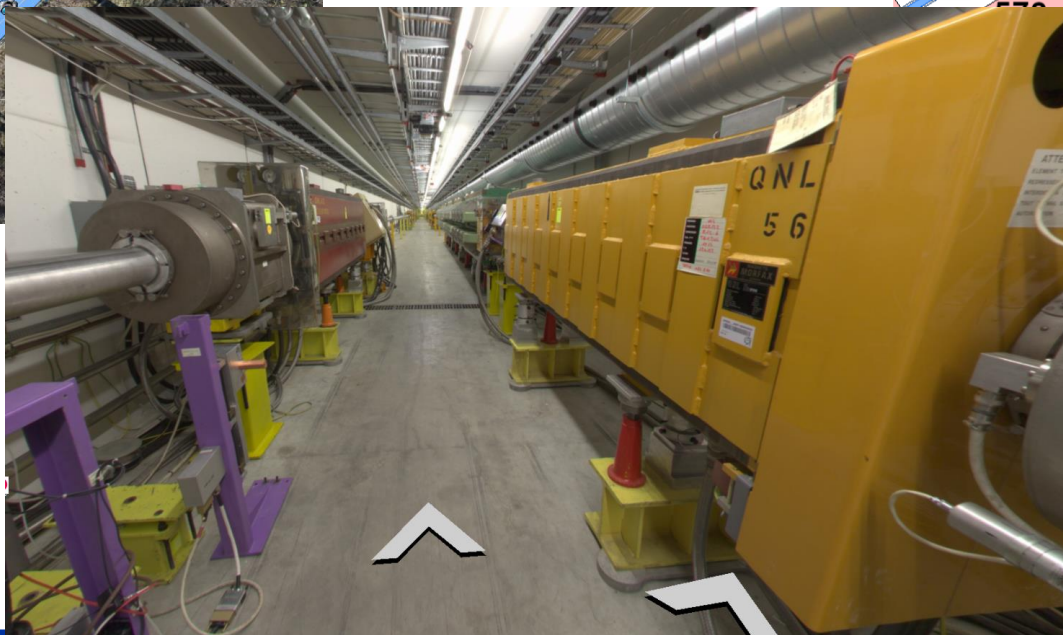
- PS East Hall Complex
 - F61 Transfer Line
 - F61.MQNCL007
 - F61.HMQAD007
 - F61.BLM008
 - F61.BTV012
 - F61.MCXCE013
 - F61.MQNEL014
 - F61.HLMAC014
 - F61.MCXCE015
 - F61.HMCAD015
 - F61.TBS016
 - F61.TBS017
 - F61.TBS018
 - F61.TBS019
 - F61.TBS020
 - F61.MQNEF021
 - F61.HMQAN021
 - F61.BCTF022
 - F61.HBCTF022
 - F61.BCGAA023
 - F61.XSFC023



F61 F61 TRANSFER LINE ID 2036829 F61 Transfer Line 08-10-2007 ENDLESS

Type	MACHINE	Expert Name	F61 LINE
Location	F61	Machines	F61 (F61 LINE, F61 TRANSFER LINE)
Owner Group	BE-EA	Sequences	Element isn't related to any sequence.
Responsible	Giulia Romagnoli		
Links	F61 LINE in GIS		

FLOOR: SKY, T, 8, 7, 6, 5, 4, 3, 2, 1, E, R, S, S2, S3, U



All positions DCUMs are exported to the survey database to allow the alignment and positioning of the elements



SURVEY DATA

Beamline Sequence File

From Layout Database is possible to automatically extract (and save in Gitlab) the beamline sequence file containing:

- Functional positions and expert names
- DCUM (cumulative distances) and optical lengths of elements
- Strength/angles variables and values

The sequence file is used as input into MADx software that is used for optics studies.

BDSIM / Fluka software is used for beam-matter interactions, radiation protection studies, and to provide background fluxes for experiments



MAD Sequences

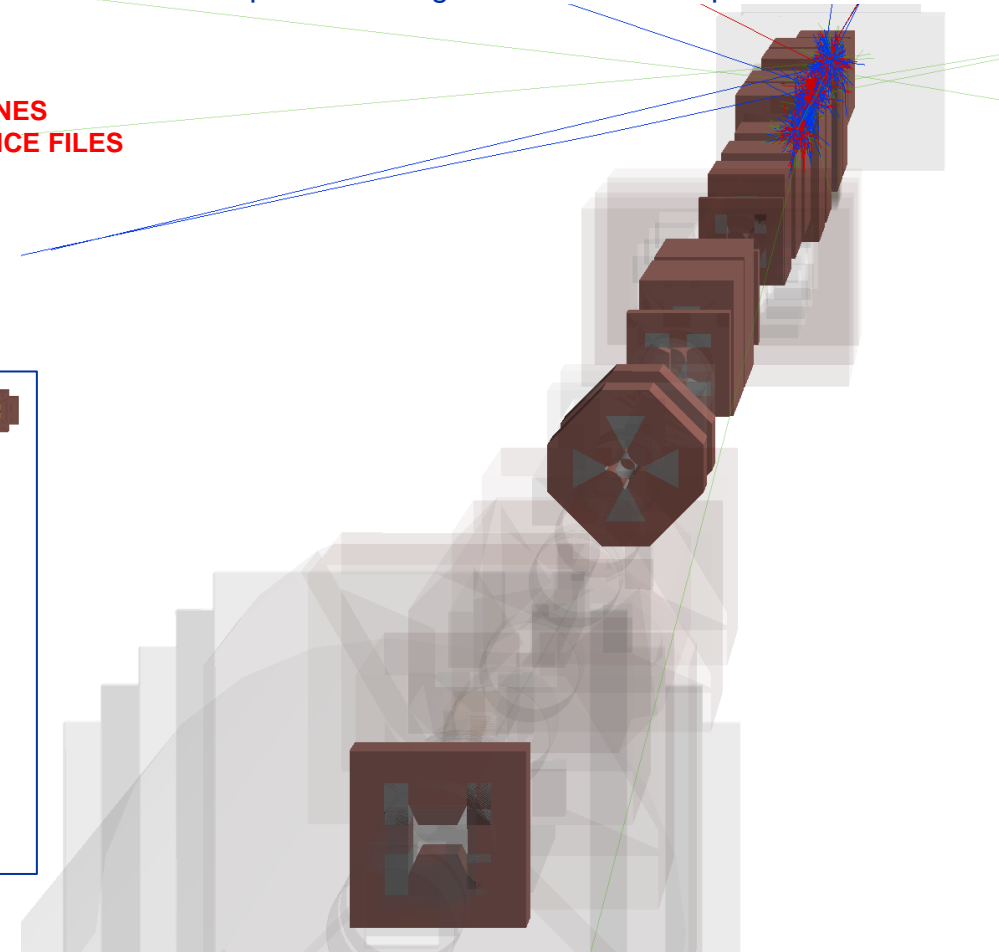
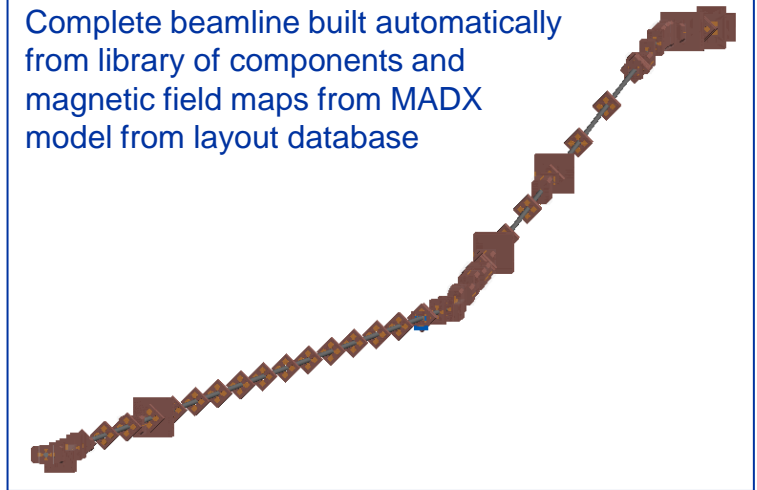
Generate file for: STANDARD Machine: T09 Version: YETS 2022-2023

Fetch latest file Download Refresh MAD sequence GitLab file history

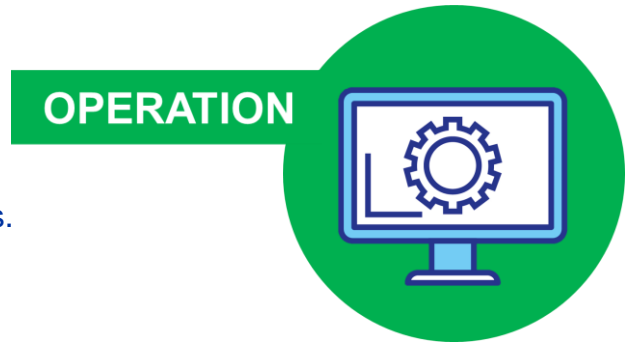
```
/*.....*/
*
* T09 version (draft) YETS 2022-2023 in MAD X SEQUENCE format
* Generated the 22-FEB-2023 19:17:12 from Layout
*
/*.....*/

/*.....*/
/*          TYPES DEFINITION          */
/*.....*/

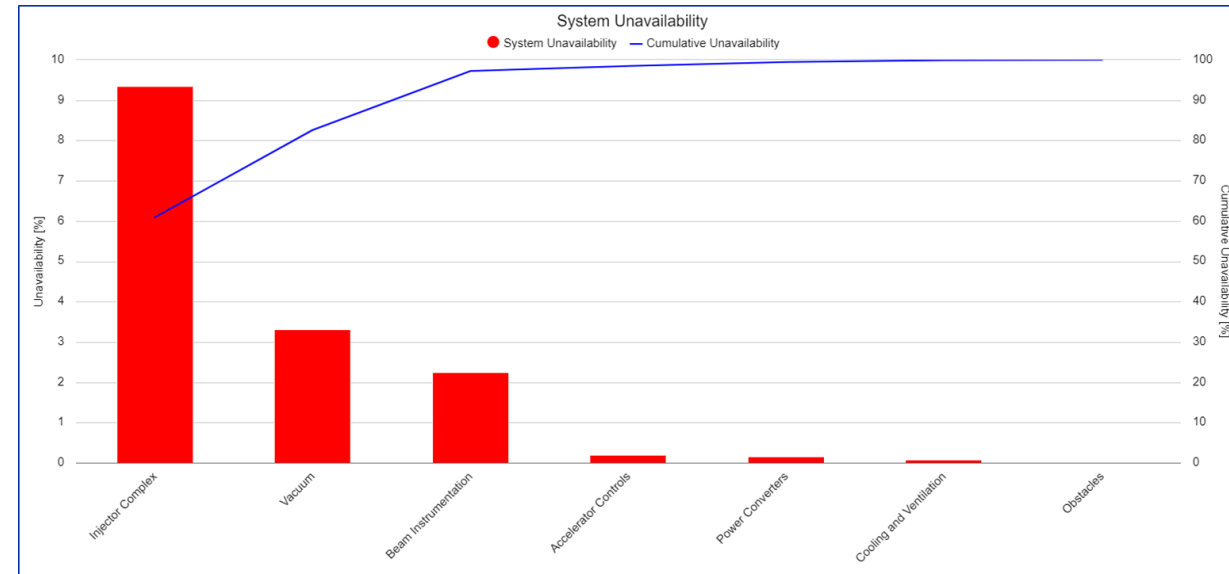
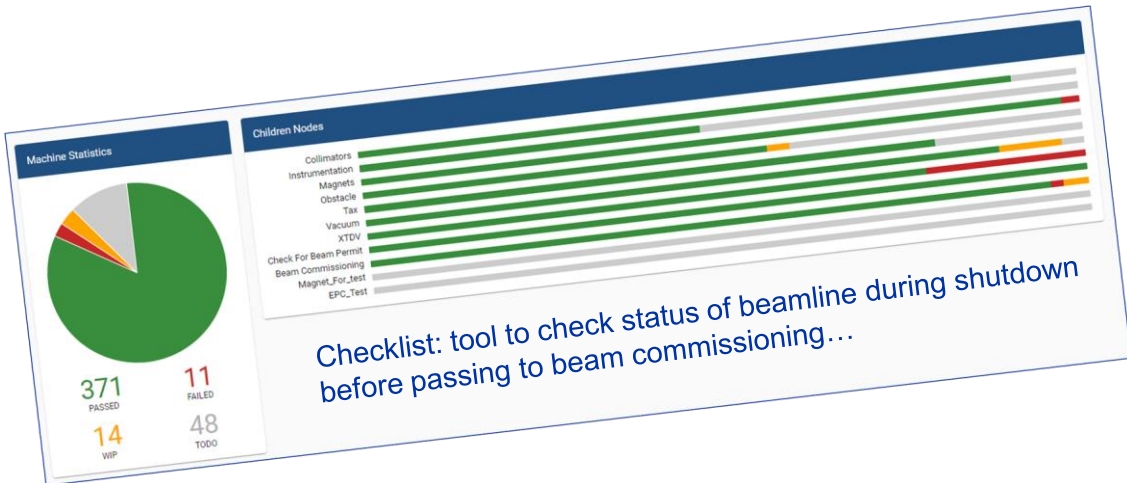
1.T09_BXBPFS01      := 0.152;
1.T09_BXSCI        := 0.2;
1.T09_MBXGFHWIP    := 1;
1.T09_MBXHFHWIP    := 2;
1.T09_MCXCFHWIP    := 0.4;
1.T09_MQNDCTWP     := 0.82;
1.T09_MQNEGTWP     := 0.8;
1.T09_MQNELBWP     := 1.2;
1.T09_MQNEVTWP     := 1;
1.T09_MQNFKTWP     := 2;
1.T09_OMK          := 0;
1.T09_TMTV         := 0.2;
1.T09_XCET_001     := 0.34;
1.T09_XCET_002     := 0.34;
1.T09_XCHV_001     := 1;
1.T09_XCON_P01     := 0.2;
1.T09_XCON_P02     := 0.2;
1.T09_XTCX_001     := 0.4;
```



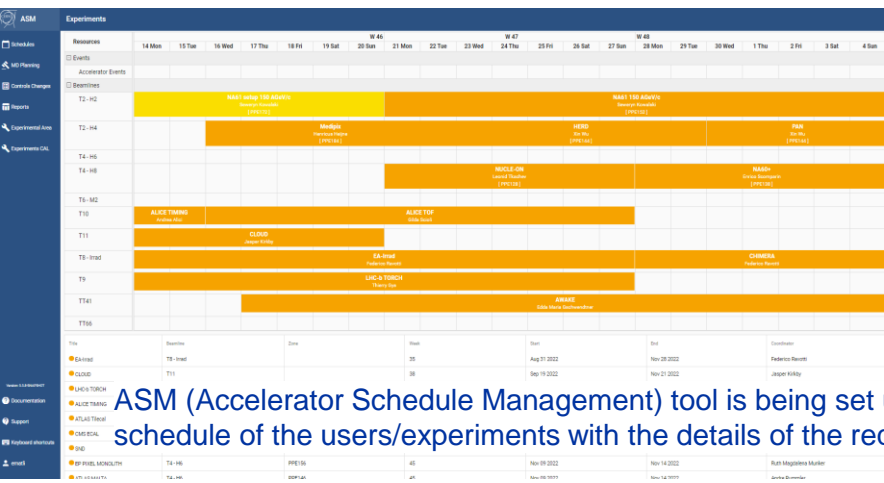
Beamline Operation



AFT (Accelerator Faults Tracking), Checklist and ASM are used to monitor the status of the beamline during operation and shutdowns.



AFT used to declare faults and monitor availability and performance of the machine. The faults are linked to the functional positions in Layout and to the ASSETS



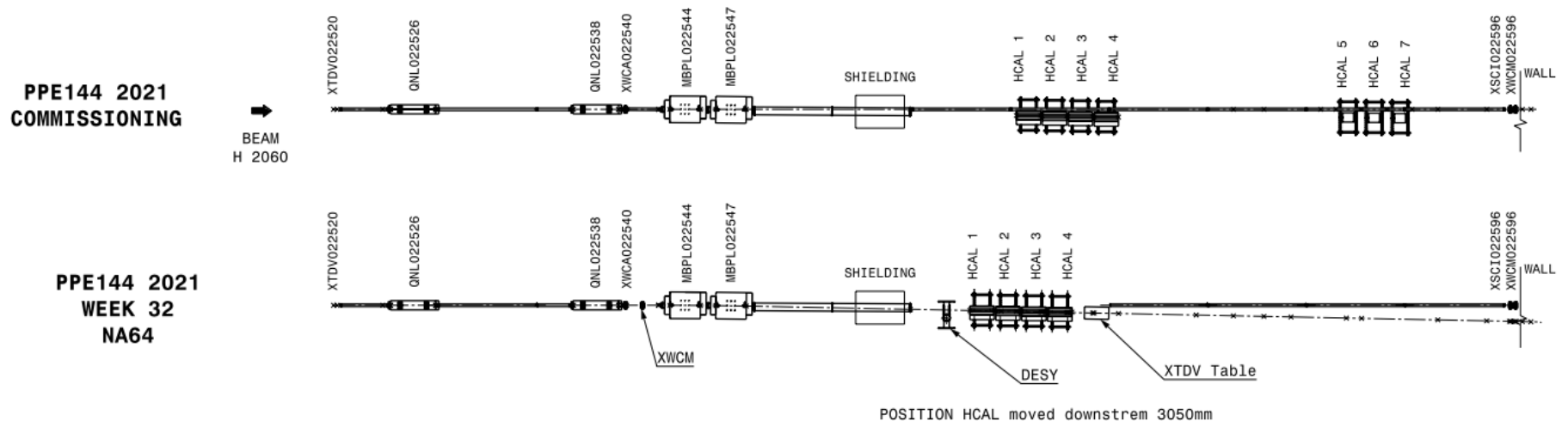
Synoptic – Beamline Configuration

NEED

- Schematic representation different configuration of beamlines
- Long term configurations, weekly changes....

POSSIBLE APPLICATIONS

- User/experiments requests with hystorical trace of configuration
- Vacuum layout with “live” pump and valve status
- CESAR status of beamlines elements
- Coordination meetings: layout drawings or 3D models
- Documents: schematic missing often reducing clarity of the document

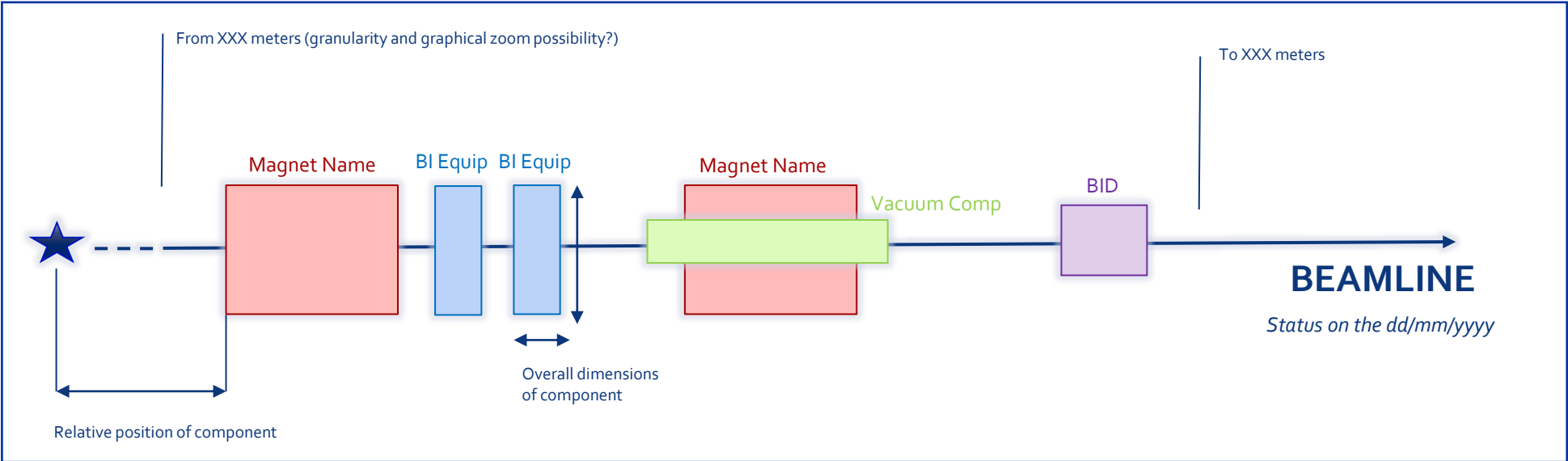


Beamline Synoptic (Under Development)



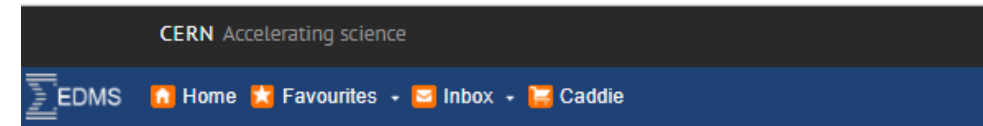
Future development: since experimental beamlines areas are continuously evolving, to facilitate beamlines coordination and changes of physical configurations, a data-driven time-dependent schematics is under study to provide a intuitive overview of the beamline automatically linked to Layout Database structure.

Configuration XX at time XX:



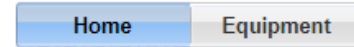
*Work in progress of BE-CSS, BE-EA group
In collaboration with EN-ACE*

Document Quality Management



At CERN documents are stored and organized inside:

EDMS CERN's Engineering Data Management Service



→ The important documents are circulated and approved through official EDMS process by **DOCUMENTS MANAGERS** in the framework of the configuration management strategy

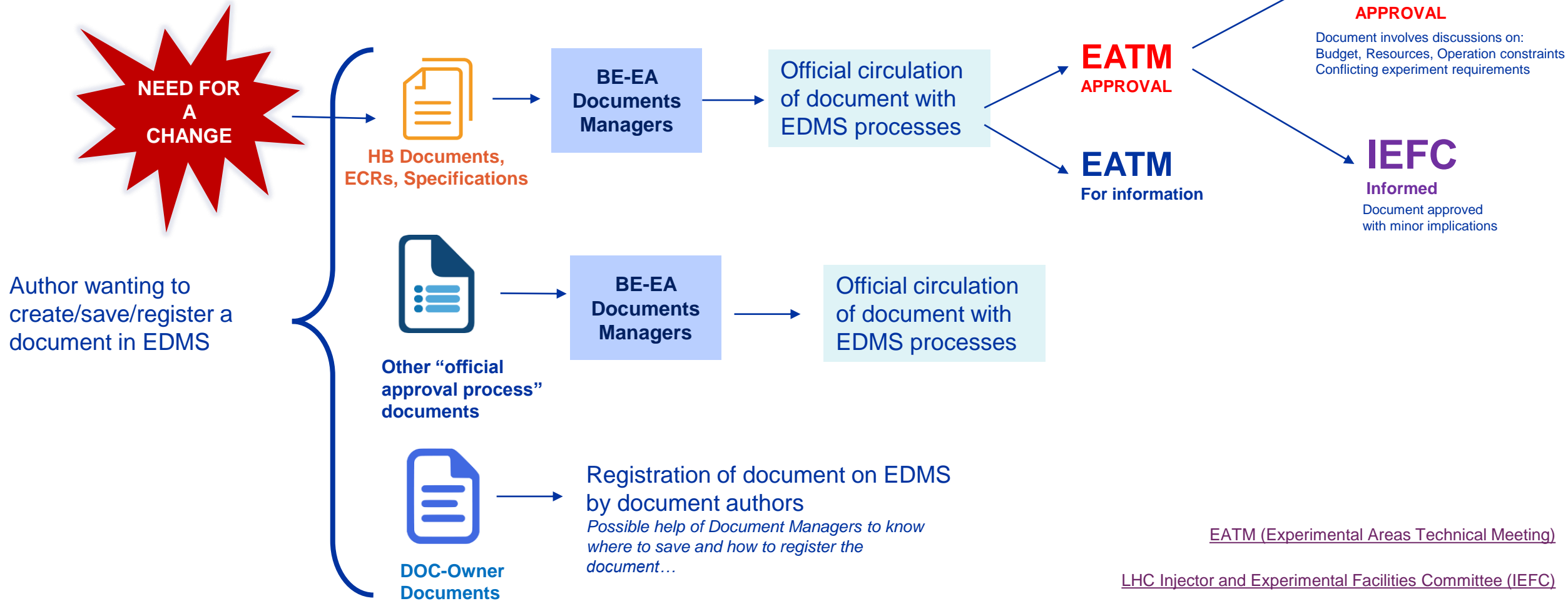


Procedures and quality processes are listed inside the [Quality website](#) at CERN

TEMPLATES are available inside the Quality CERN website: [Templates \(cern.ch\)](#)

Document Quality Management

Document managers of BE-EA are helping authors to correctly treat/circulate/store their documents



Document Approval Process Management

JIRA project considering each EDMS document as a JIRA ISSUE to be treated by the Document Managers



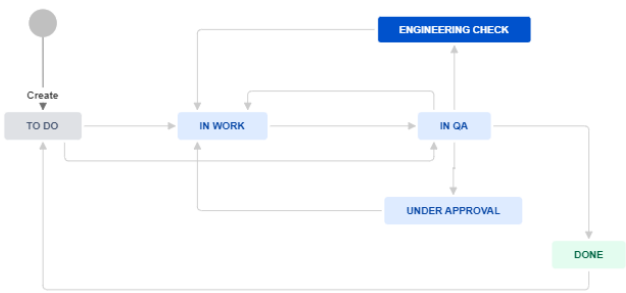
Experimental Areas Doc...

- Summary
- Issues
- Reports

PROJECT SHORTCUTS

- All Documents Table
- EATM Meetings
- Quality.web.cern.ch
- Doc EDMS TEXT Circulation
- EA Documents Kanban Board

Document WORKFLOW



Summary
Description
Reporter
EA Projects
Attachment
Due Date
Priority
EDMS number
EDMS Creation Date
Document Type
Assignee
EDMS Status
EDMS Last Update
EDMS Deadline
Comment on Status
EATM Status
IEFC Status

Experimental Areas Documents / EADOC-13

COVID-19 RISK ASSESSMENT - East Area Celebration Event

Edit Add comment Assign More New Version

Status: **DONE** (View Workflow)
Resolution: Unresolved

DOCUMENT DETAILS

EA Projects: East Area
EDMS number: 2706440 - <https://edms.cern.ch/document/2706440>
Document Type: Safety Report
EDMS Status: RELEASED
Comment on Status: to be approved before the 11th-03
EATM Status: not needed
IEFC Status: not needed

APPROVAL PROCESS DETAILS

Description

Attachments

Activity

All Comments Work Log History Activity

There are no comments yet on this issue.

Add comment

PEOPLE:
Reporter: author of document
Assignee: document manager managing the document (QA, circulation in EDMS, ...)

People

Assignee: Giulia Romagnoli
Reporter: Giulia Romagnoli

Votes: 0
Watchers: 1 Stop watching this issue

Dates

Created: 25/Feb/22 5:52 PM
Updated: 5 days ago
EDMS Creation Date: 22/Feb/22
EDMS Last Update: 07/Mar/22
EDMS Deadline: 10/Mar/22

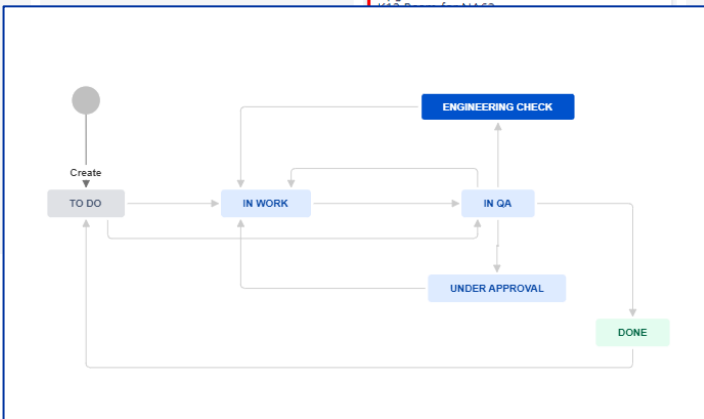
DATES

Document Approval Process Management

All documents treated by the document managers are stored inside a JIRA project, where a Kanban board is used to have an overview of the documents circulating and to monitor the documents status

The screenshot shows a JIRA Kanban board titled 'EA Documents' with a 'Kanban board' view. The board has columns for 'TO DO', 'IN WORK', 'IN QA', 'ENGINEERING CHECK', 'UNDER APPROVAL', 'DONE', and 'Release...'. There are 14 issues in the 'TO DO' column. Each issue card contains details such as ID, title, URL, and assignee. For example, EADOC-16 is 'Variable Rigidity Ion Transport in East Area T8 Line for Electronics Irradiation' assigned to Ruben Garcia Alia. The board also shows cards in 'IN WORK', 'IN QA', 'ENGINEERING CHECK', 'UNDER APPROVAL', and 'DONE' columns.

DOCUMENTS WORKFLOW



See DEMO tomorrow morning at 9.00!!

JIRA PROJECT for EA Document Circulation
Experimental Areas Documents - CERN Central Jira

Conclusion

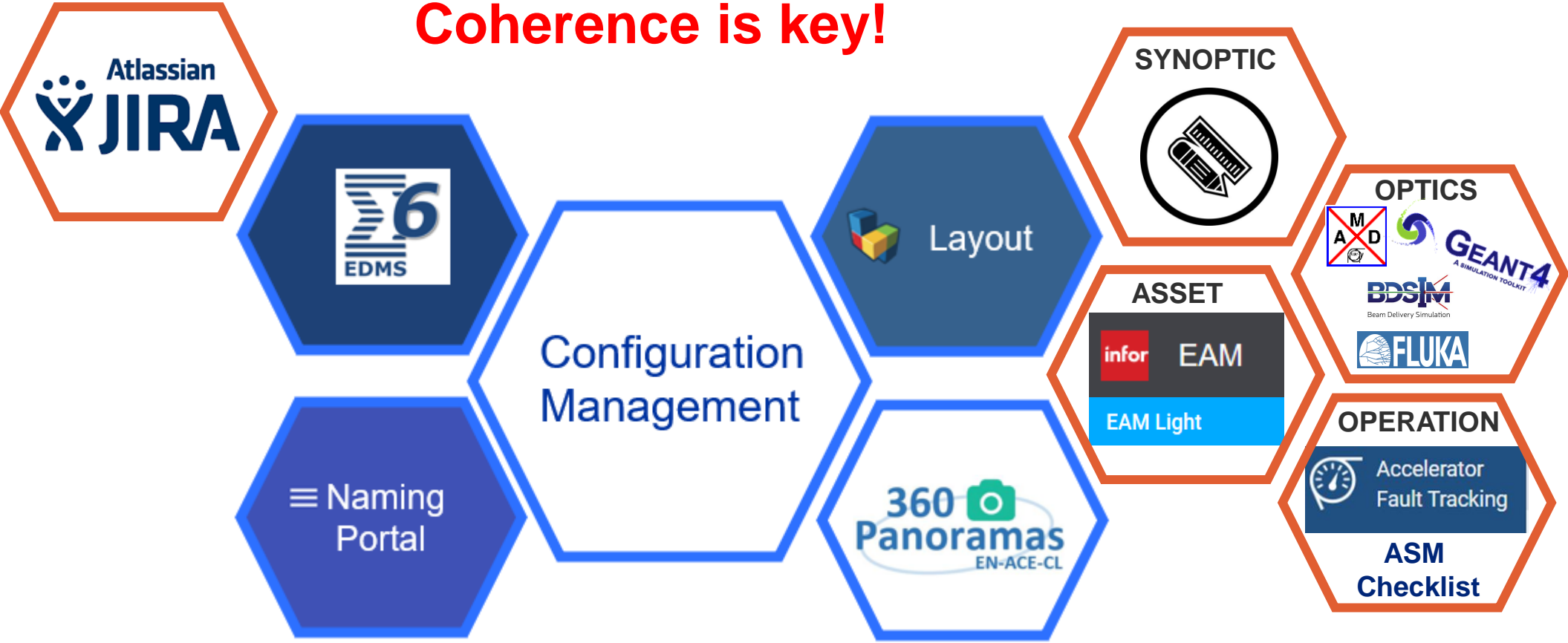
Coherence is key!



Thank-you for your attention

Conclusion

Coherence is key!



Thank-you for your attention

Acknowledgements

Special thanks to:

S. Petit - ATS Quality Service

P. Le Roux - BE-CSS

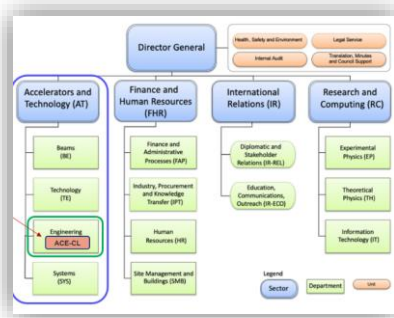
C. Scoero, A. Ortiz - EN-IM

T. Birtwistle, A. L. Perrot, S. Bartolomé Jiménez, B. Feral, S. Chemli - EN-ACE

C. Vendeuvre - BE-GM

D. Banerjee, N. Mandal, J. Buesa, S. Schuh - BE-EA

CMS Experiment Configuration Management Organizational Structure

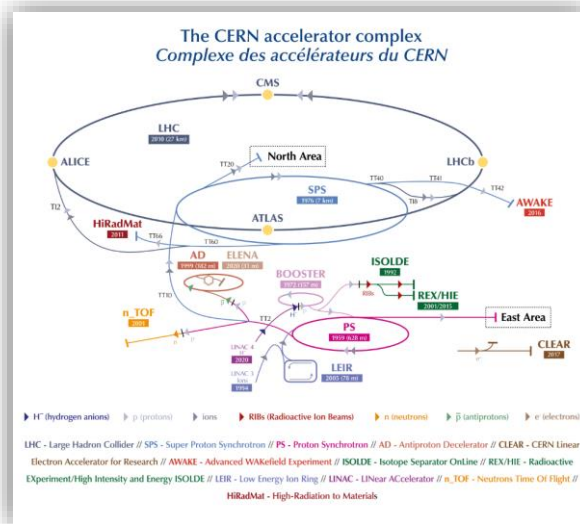


Experimental Physics (EP) Department

- 800 Members of personnel
- 12000 Users from their Home Institutes
- 4 LHC Experiments (ALICE, ATLAS, CMS, LHCb)
- 3 Support Groups

- Detector Technology
- Electronics Systems for Experiments
- Software Development for Experiments

EP Groups structure		Users Groups	
EP-DI	Office of the Department Head	EP-GAD	Antiproton Users
EP-AGS	Administration and General Services	EP-GAI	ALICE Users
LHC Experiments		EP-GAT	ATLAS Users
EP-ALB , EP-ALD , EP-AIP	ALICE	EP-UC3	CTF3 Users
EP-ABE , EP-ABD , EP-ABR , EP-ABT	ATLAS	EP-UCM	CMS Users
EP-CMB , EP-CMG , EP-CMO , EP-CMT , EP-CMX	CMS	EP-UFT	Fixed Target Users
EP-LBC , EP-LBD , EP-LBO	LHCb	EP-USC	General Collaboration Users
Non-LHC Experiments		EP-UNC	Other LHC Users
EP-NV	Neutrino Group	EP-USI	ISOLDE Users
EP-SME	Small & Medium Experiments	EP-ULB	LHCb Users
Support groups		EP-ULD	Linear Collider Detector Users
EP-DT	Detector Technology	EP-UNT	n_TOF Users
EP-ESI	Electronics Systems for Experiments	EP-UNP	Neutrino Platform Users
EP-SET	Software Development for Experiments	EP-UOP	Other Physics Users
		EP-URD	R&D Users



CMS Experiment Groups

- DAQ & Trigger
- Physics, Software & Computing
- Organization
- TOTEM
- Experiment Systems

- Safety, Coordination and Infrastructure
- Engineering & Integration
- Detector Applications

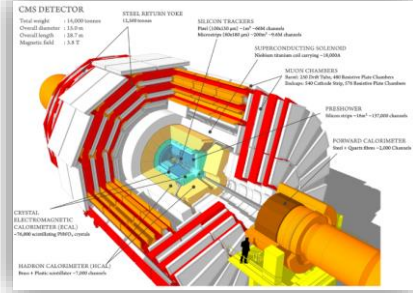


EP-CMO	CMS Organization
	EP-CMO-PO Project Office
EP-CMT	CMS TOTEM
EP-CMX	CMS Experiment Systems
	EP-CMX-DA CMS - Detector Applications
	EP-CMX-EI CMS - Engineering and Integration
	EP-CMX-SCI CMS - Safety, Coordination and Infrastructure



CMS Experiment Configuration Management Project Management

Detector Systems



Future Configurations

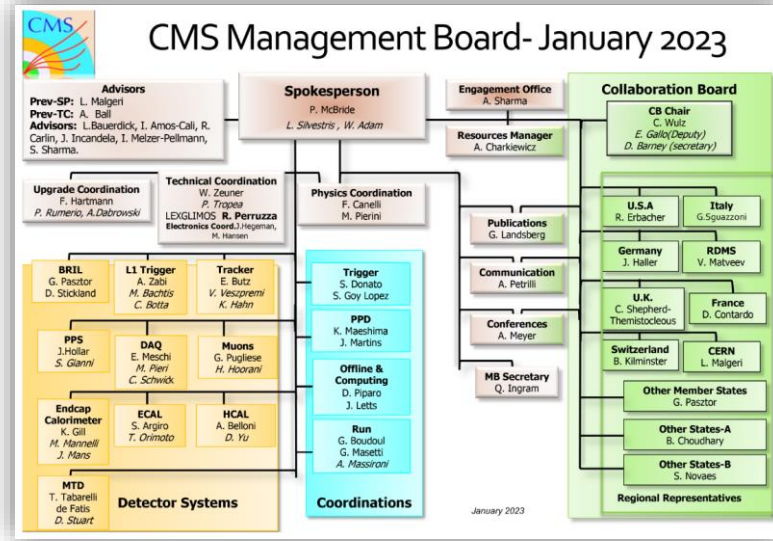
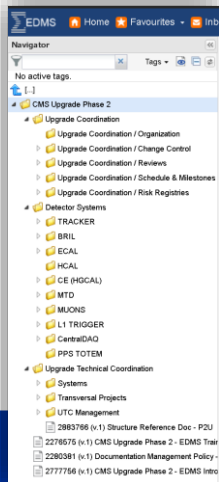
- Study & Design
- Build & Commission

Present Configuration

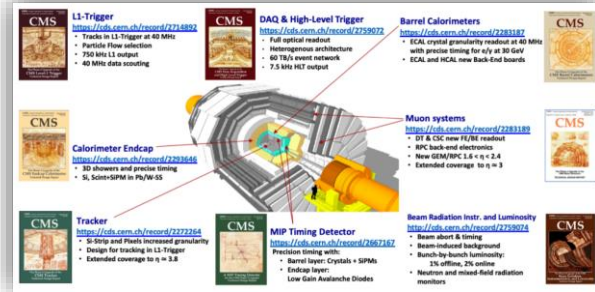
- Operate
- Maintain

Past Configuration

- Recycle / Dispose



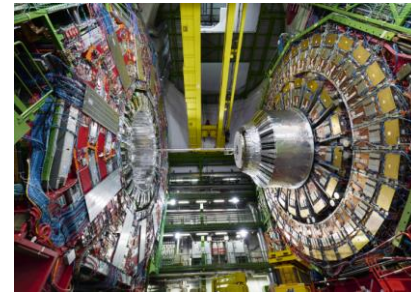
Upgrade Coordination



Future Configurations

- Study & Design
- Build & Commission

Technical Coordination



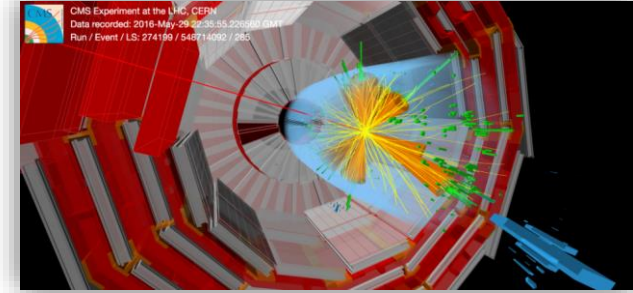
Future Configurations

- Study & Design
- Build & Commission

Present Configuration

- Maintain

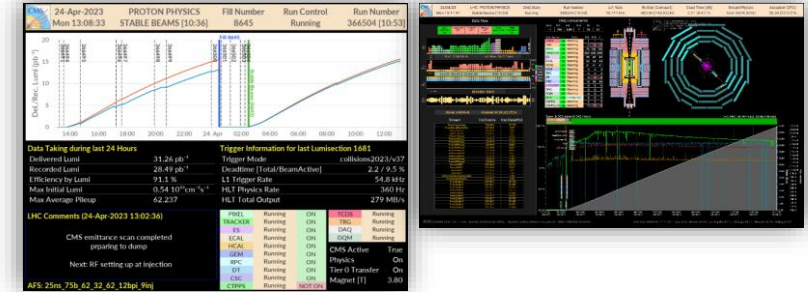
Offline & Computing Coordination



Past, Present & Future Configurations

- Simulation (Digital Twin)

Run Coordination



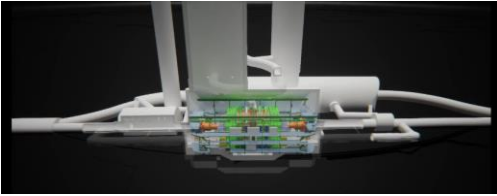
Present Configuration

- Operate (DAQ System)

CMS Experiment Configuration Management Product Management

Product Representations
(Digital Twins)

Surface Sites & Underground Tunnel / Caverns



Virtual (Past/Present/Future)
Product

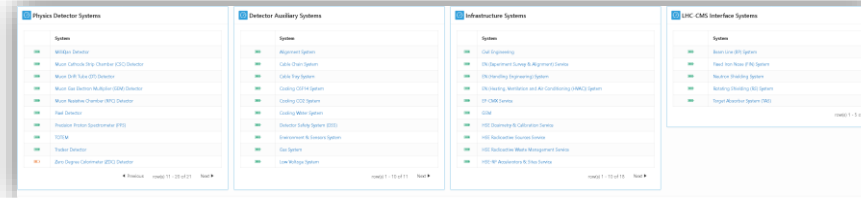
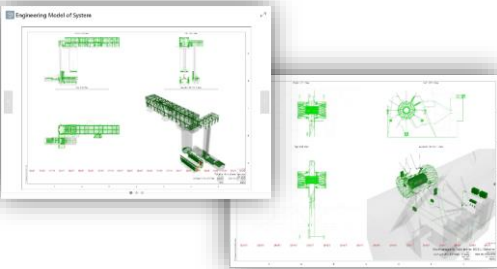
Physical (Present)
Product

Facility Level
Products
Geographic Naming



Physics Detectors, Detector Auxiliary Systems, Infrastructure & Machine-Experiment Interfaces

System Level
Products
Functional Naming

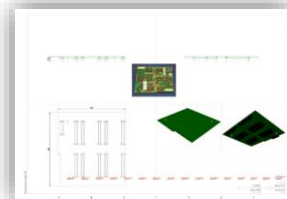


Equipment Level
Products

Catalogue of
Product Items

Inventory of
Product Assets

Cables, Electronics, Equipment & Tools



Product	Part Number	Unit	Material	Unit Price	Description	Supplier
...

Functional Naming

Serialized Naming

CMS Experiment Configuration Management

Asset Management

Asset
Data & History

Item
Specifications

Functional Position
Data

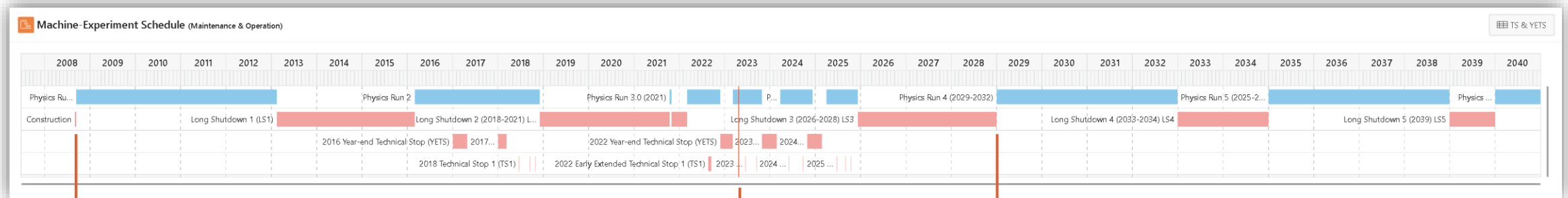
The screenshot displays the CMS Equipment Management Database (EMDb) Application interface. The main content area is divided into several sections:

- Product ASSET Information:** Asset Identifier: 16385, Inventory Barcode: 3320300000001, Serial Number: Dee1, Function Name: Dee, Operating Status: Manufactured, Radiological Risk: Unknown, Waste Policy: Radioactive (ZDR).
- Product ITEM Information:** Item Name: Right Ecal Dee, Dimensions: 1.8 m ; 83.2 cm ; 3.4 m, Mass: 5 t. Includes a digital mockup image of the detector and a note: "Material composition shall be displayed".
- Current System Owner:** System: ECAL Endcap (EE) Sub-detector, Symbol: EE, Code: 332. Includes a digital mockup image of the detector.
- Current Geographic Location:** Installed in: +2 Far EE Dee, 01-JUL-2008. Location: +2 Far EE Dee, Dimensions: 1.9 m ; 90 cm ; 3.8 m, Coordinates: -1 m ; 0 ; +3.7 m. Includes a digital mockup image of the detector and a note: "Since: 177 months and 24 days".
- ASSET Bill Of Material:** (Empty section)
- Event(s) History:** Table with columns: Collaborator, Date & Time, Action, Intervention (WP), Comments, From (Master Equipment/Location), To (Master Equipment/Location), Equipment.

CMS Experiment Configuration Management Product Lifecycle Management

CMS Experiment Program/Project Schedule

➤ Product Operation (Physics Run) & Maintenance (Technical Stop) Lifecycle Timeline

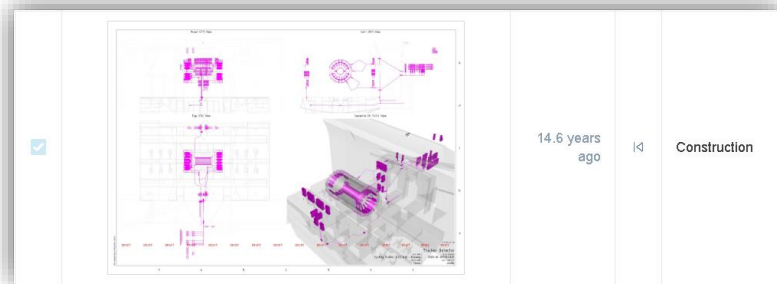


Present Validity

➤ System of Systems

System (Tracker Detector) Validity & Versioning

Past configuration

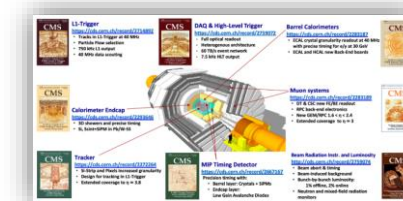
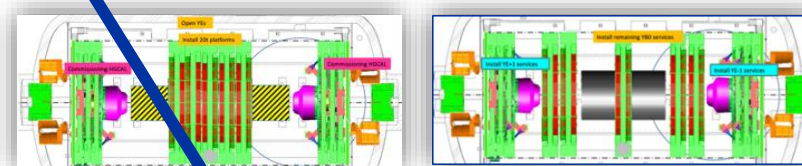
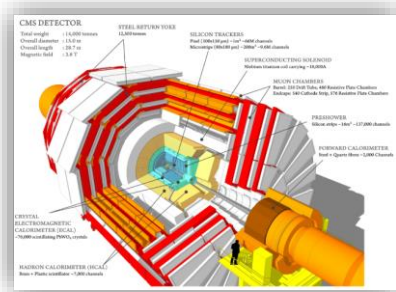


Future configuration

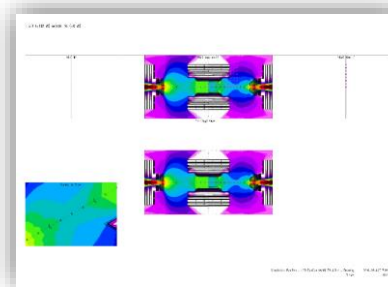
(System) Digital Twin	(End/Start) When	Activity
	5.7 years from now	Long Shutdown 3 (2026-2028) LS3

CMS Experiment Configuration Management Long Shutdown 3 (2025-2028) Maintenance Project

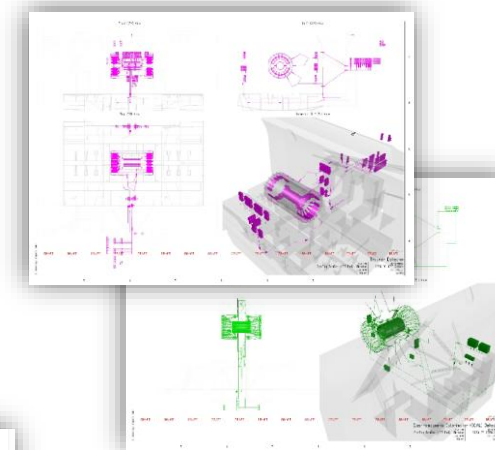
Initial LS3 Configuration → Intermediate LS3 Configurations → Final LS3 Configuration



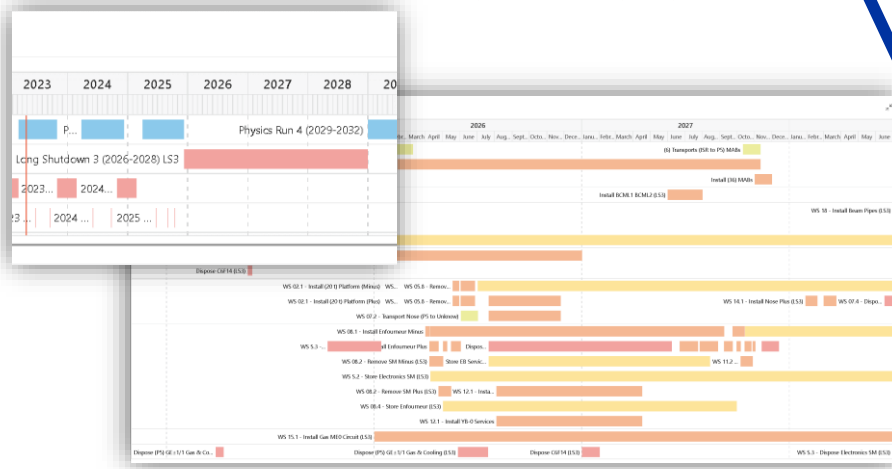
Facility/Activity Safety Map



Systems' Configurations



LS3 Maintenance Schedule
by Systems, by Activity Types



Maintenance Activity Procedure



Bill of Materials

RP	Quantity	Product	L	Description	[kg] Mass	[m ³] Volume
	18	Water	2 [l]	per SM	36	0.036
	18	Super Module EB	-		54 000	19.440
	36				54 036	19.476

CMS Experiment Configuration Management Information Systems Architecture



Conclusion

Coherence is key!



Thank-you for your attention

Acknowledgements

Special thanks to:

CMS - Safety, Coordination and Infrastructure Section members - EP-CMX-SCI

CMS - Engineering and Integration Office members - EP-CMX-EI



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