

# Parts Tracking: A foundation for Lifecycle Management at the European XFEL

2nd Asset and Maintenance Management Workshop - AMMW 2013

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# Agenda



- > Introduction: European XFEL
- > Accelerator Maintenance at DESY in a Nut Shell
- > Parts Tracking: Solution Concept
- > Example: Parts Tracking in Undulator Inspections
- > Summary and Conclusion



Introduction

# EUROPEAN XFEL



- 
- 
- > Up to 17.5 GeV SC Linac, 27000 pulses per second
  - > Three moveable gap undulators for hard and soft X-rays
  - > Initially 6 equipped experiments





- > Construction by European XFEL GmbH (12 participating nations)
- > Locations at DESY, Hamburg, and research site in Schenefeld, SH
- > Budget 1,150 M€ incl. preparation and commissioning



# European XFEL: Aerial View



**Total length: 3,4 km**

**2009-2015: Construction time**

**2015: Start of commissioning**

**2016: Start of user operation**

**Reference: [www.xfel.eu](http://www.xfel.eu)**

# European XFEL: Site DESY-Bahrenfeld



Picture taken on 9 August 2013, Copyright European XFEL  
Reference: [www.xfel.eu](http://www.xfel.eu)



# European XFEL: Site Schenefeld

Picture taken on 9 August 2013, Copyright European XFEL  
Reference: [www.xfel.eu](http://www.xfel.eu)





# European XFEL: Experimental Hall (XHEXP1)



Picture taken on 6 June 2013, Copyright European XFEL  
Reference: [www.xfel.eu](http://www.xfel.eu)



# European XFEL: Cold Linac Tunnel

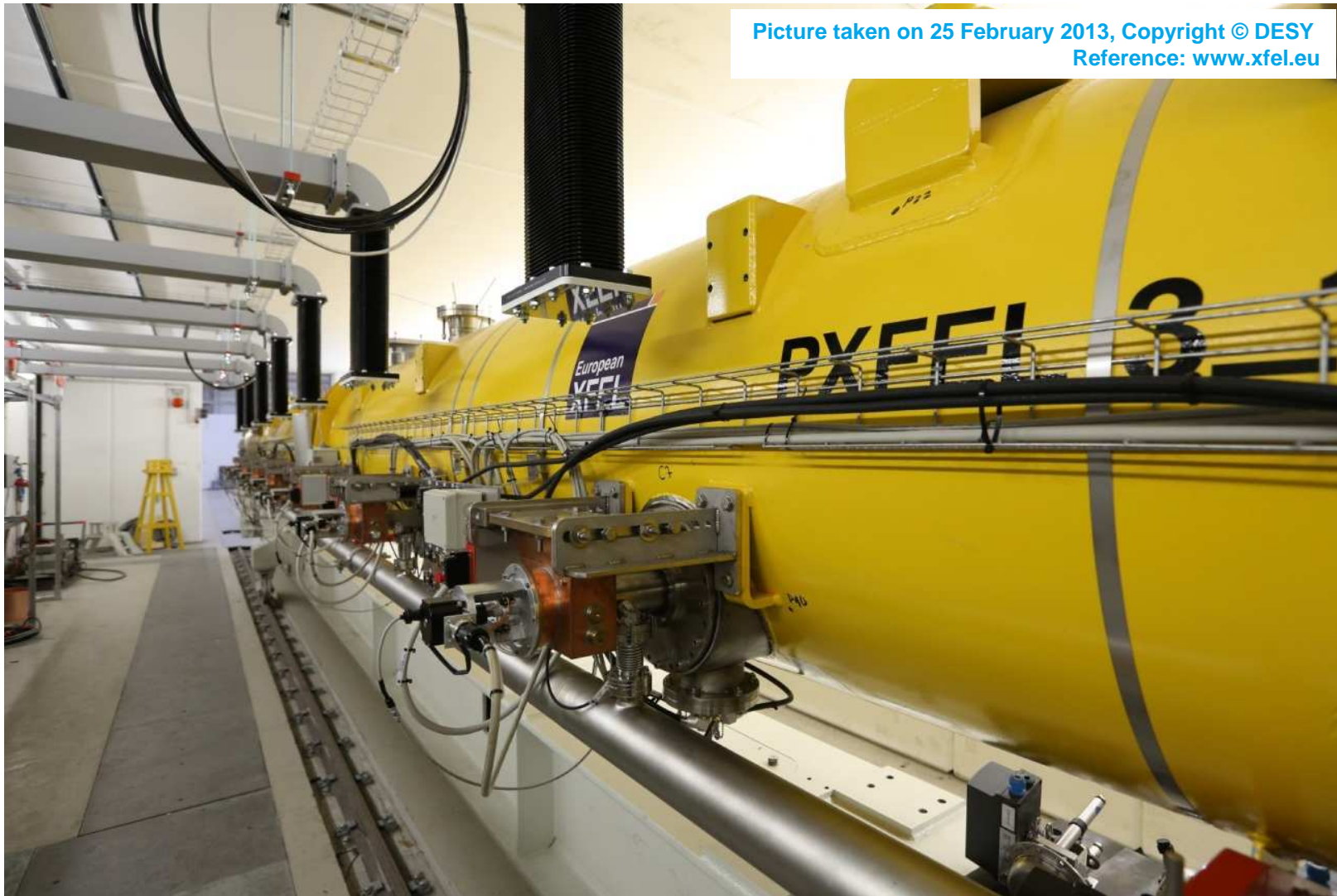


Picture taken on 22 February 2013, Copyright © DESY  
Reference: [www.xfel.eu](http://www.xfel.eu)

# European XFEL: Undulator Lab



# European XFEL: Test Facility Accelerator Modules

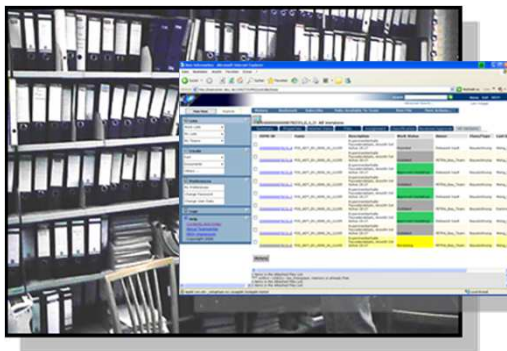


Picture taken on 25 February 2013, Copyright © DESY  
Reference: [www.xfel.eu](http://www.xfel.eu)

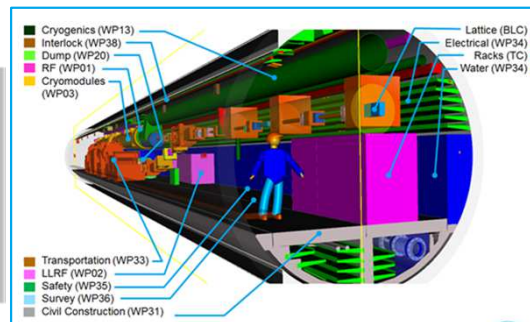


# XFEL WP40: Information & Process Support

- XFEL WP40 “Information & Process Support” provides central services in the areas of Engineering Data Management, 3D CAD collaborative engineering, and the XFEL project management system



Document Management



Design Integration



Parts Tracking

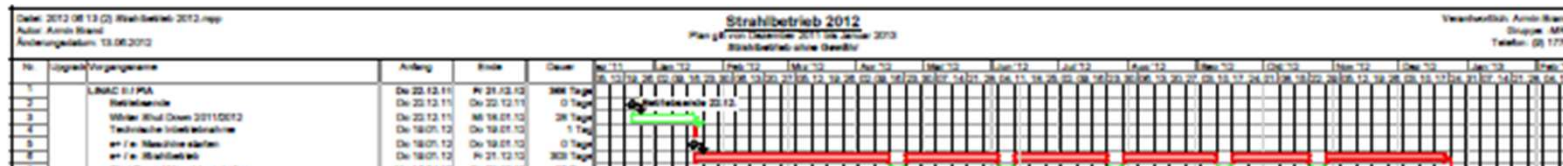
- Key activities of WP40 include e.g. solutions for document management and review and approval processes, design integration and visualization, and parts tracking for quality assurance during fabrication



# ACCELERATOR MAINTENANCE AT DESY IN A NUT SHELL

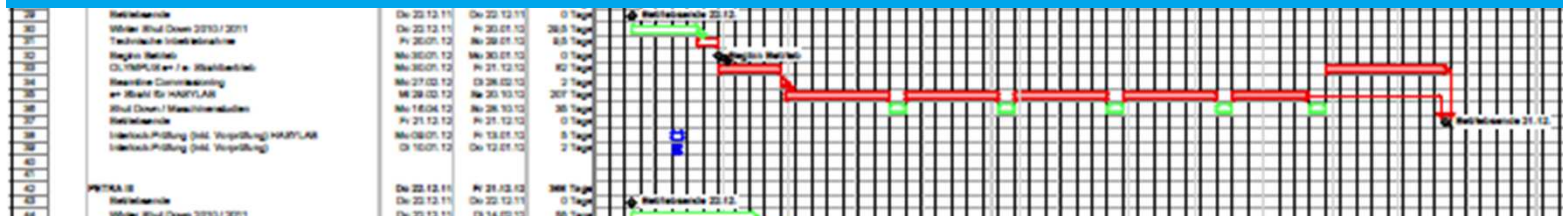


# Approach for Maintenance Management



DESY is expected to operate the linear accelerator of the European XFEL

- Maintenance is expected to be organized similar as for other DESY accelerators
- Availability of beams for the experiments as scheduled is important condition



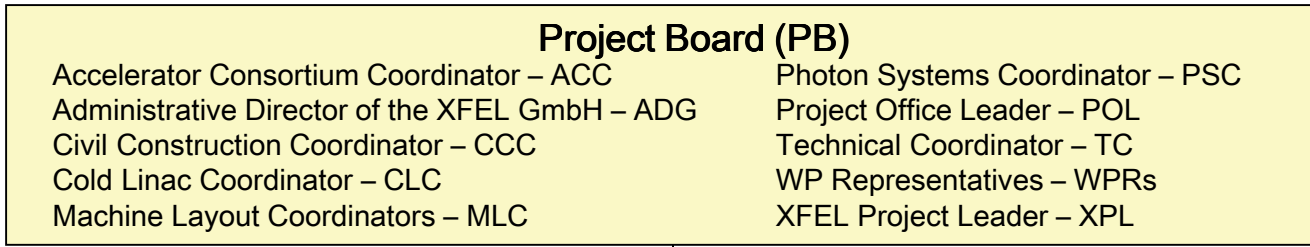
Maintenance at DESY is organized by a decentralized operational concept:

- The responsibility is within the expert groups
- Maintenance is scheduled by fixed time slots
- Benefit for end-users: Reliable schedule for operation and experiments

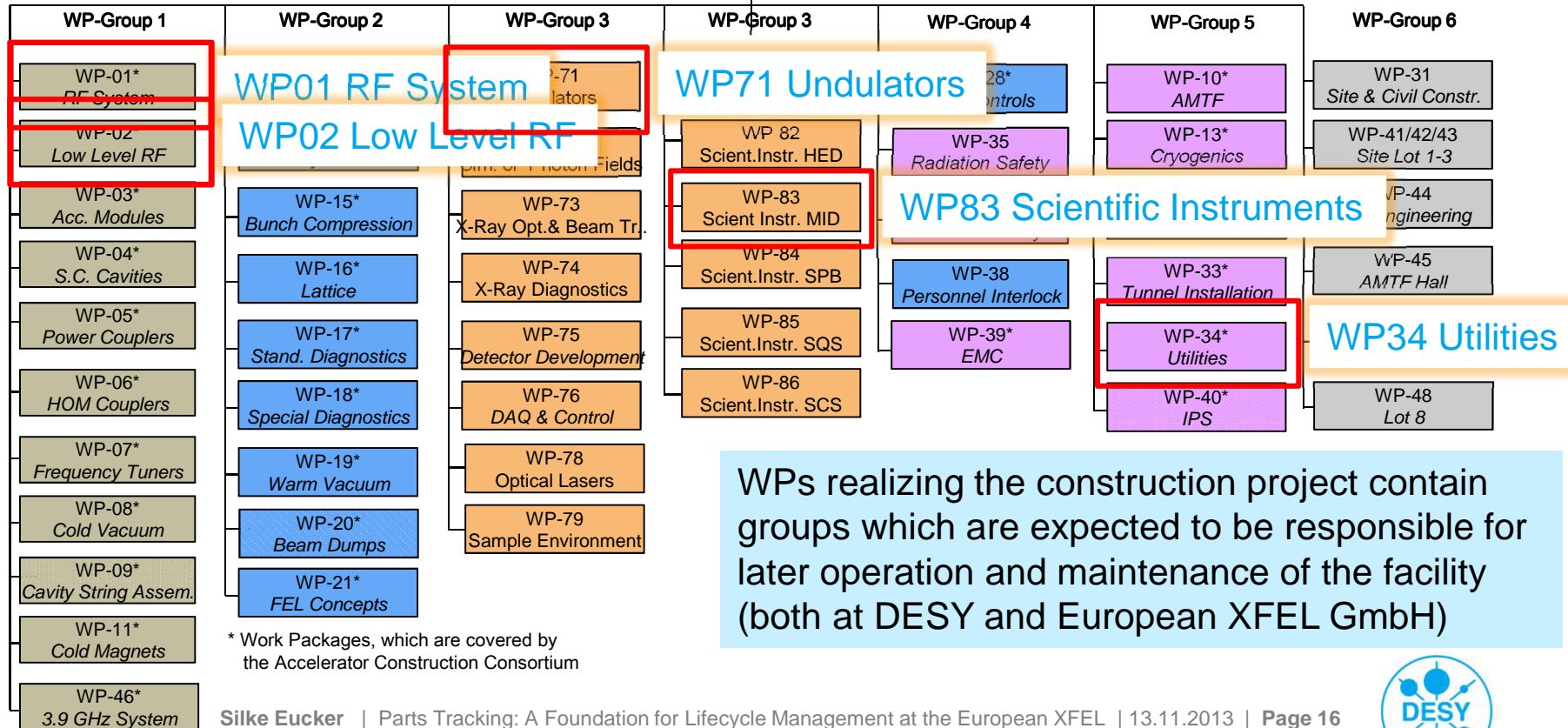
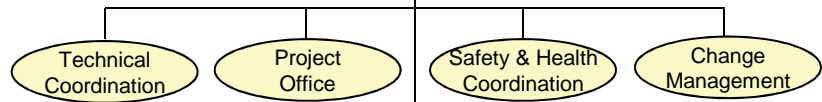
Schedule for beamline operation



# Org Chart “European XFEL Construction Project”



*Staff Functions*





# PARTS TRACKING: SOLUTION CONCEPT



# Parts Tracking Solution: Overview

- The following slides introduce the basic parts tracking solution concept. Parts tracking has been introduced and is used in the XFEL construction project and is expected to provide a good foundation for coming operation and maintenance activities
- Approach: Use documents for describing, initiating and tracking “lifecycle” activities such as e.g. fabrication, maintenance or repair
- In the documentation, separate general descriptions of types of components (concept, part definition) from records and lifecycle history of individual parts (inventory documentation)
- Define basic workflows for capturing and updating documentation, and use them as building blocks for complex processes such as decision making and change control
- Provide an information system with tailored, easy-to-use interfaces for managing the documentation



# Approach: Documentation during Maintenance

- > Maintenance activities are part of the facility lifecycle:

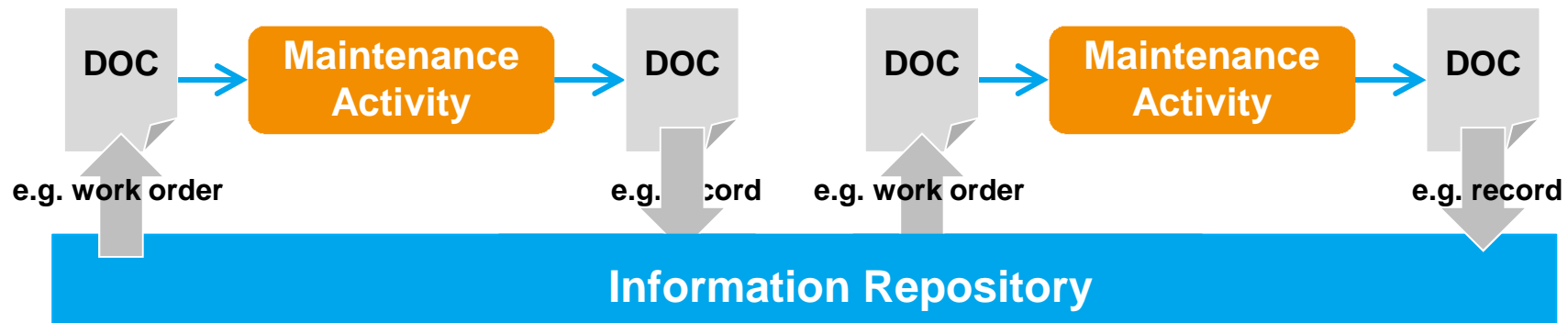


- > All lifecycle activities follow the same general scheme: Initiated by work order, require technical documentation, issue acceptance records, ...



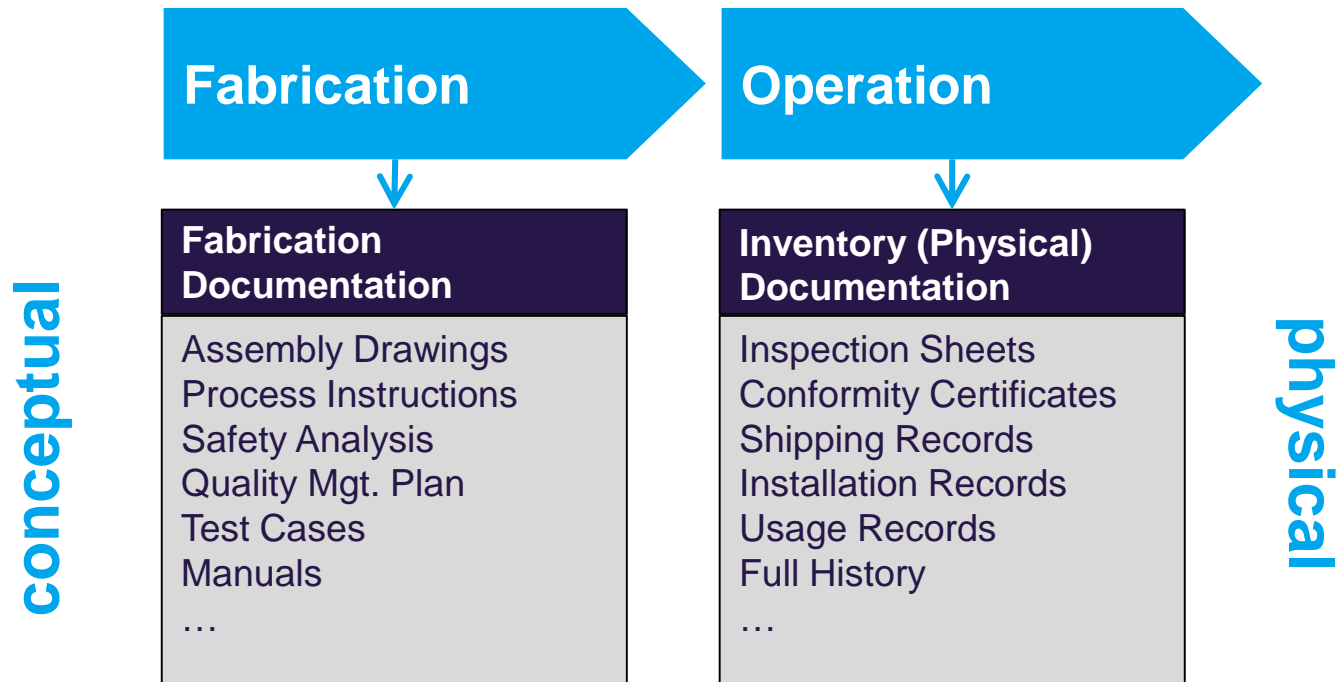
# Approach: Documentation during Maintenance

- > Approach: Documents are used to organize & control (chains of) maintenance (and other) activities



- > A (centralized) information repository can provide complete up-to-date information to any (decentralized) maintenance activity throughout the lifecycle

# Parts Tracking Documentation

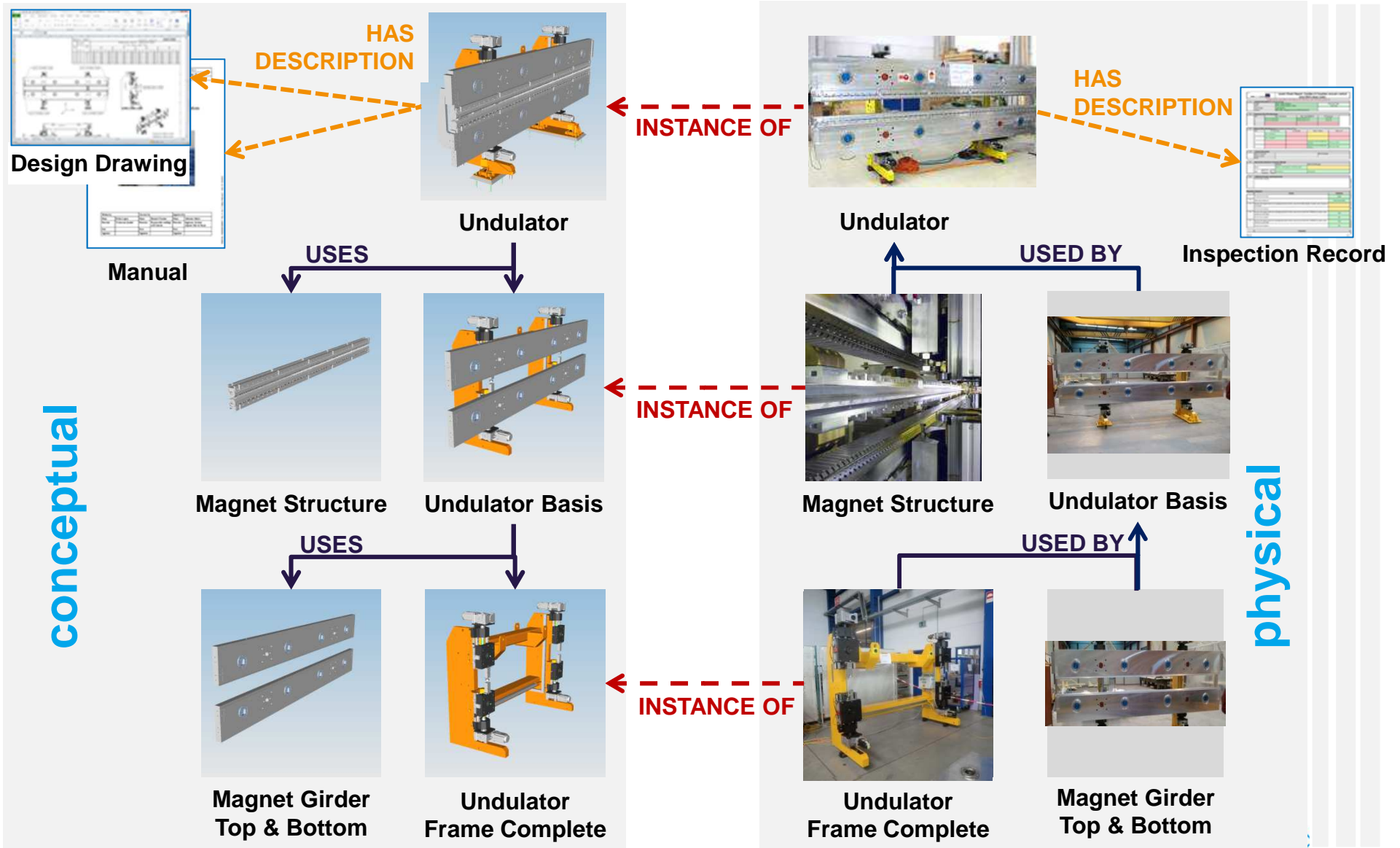


**Fabrication Documentation** for that **type of part**: Define how the part shall be realized.

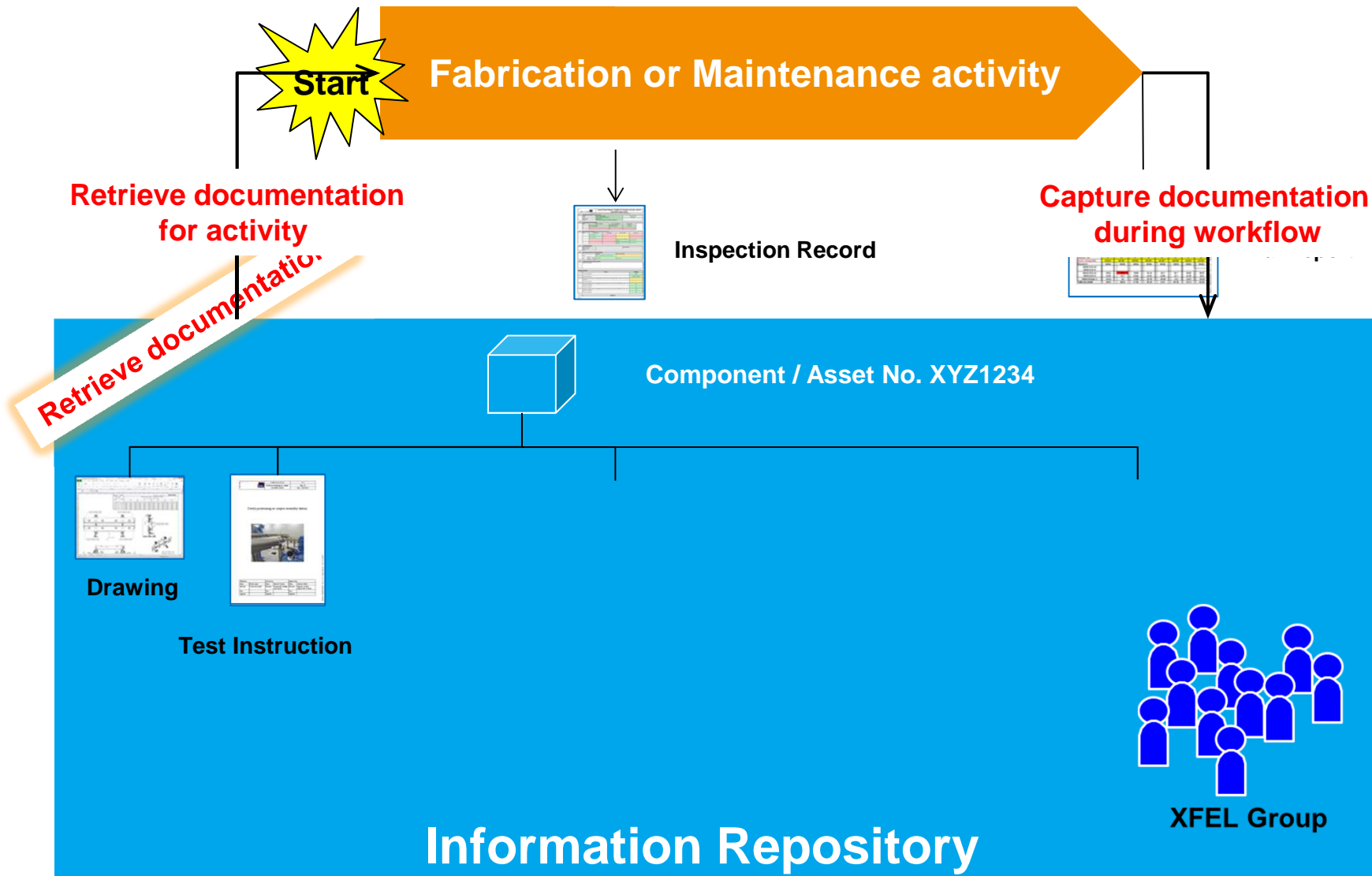
**Inventory Documentation** records the history for that particular **individual physical part**



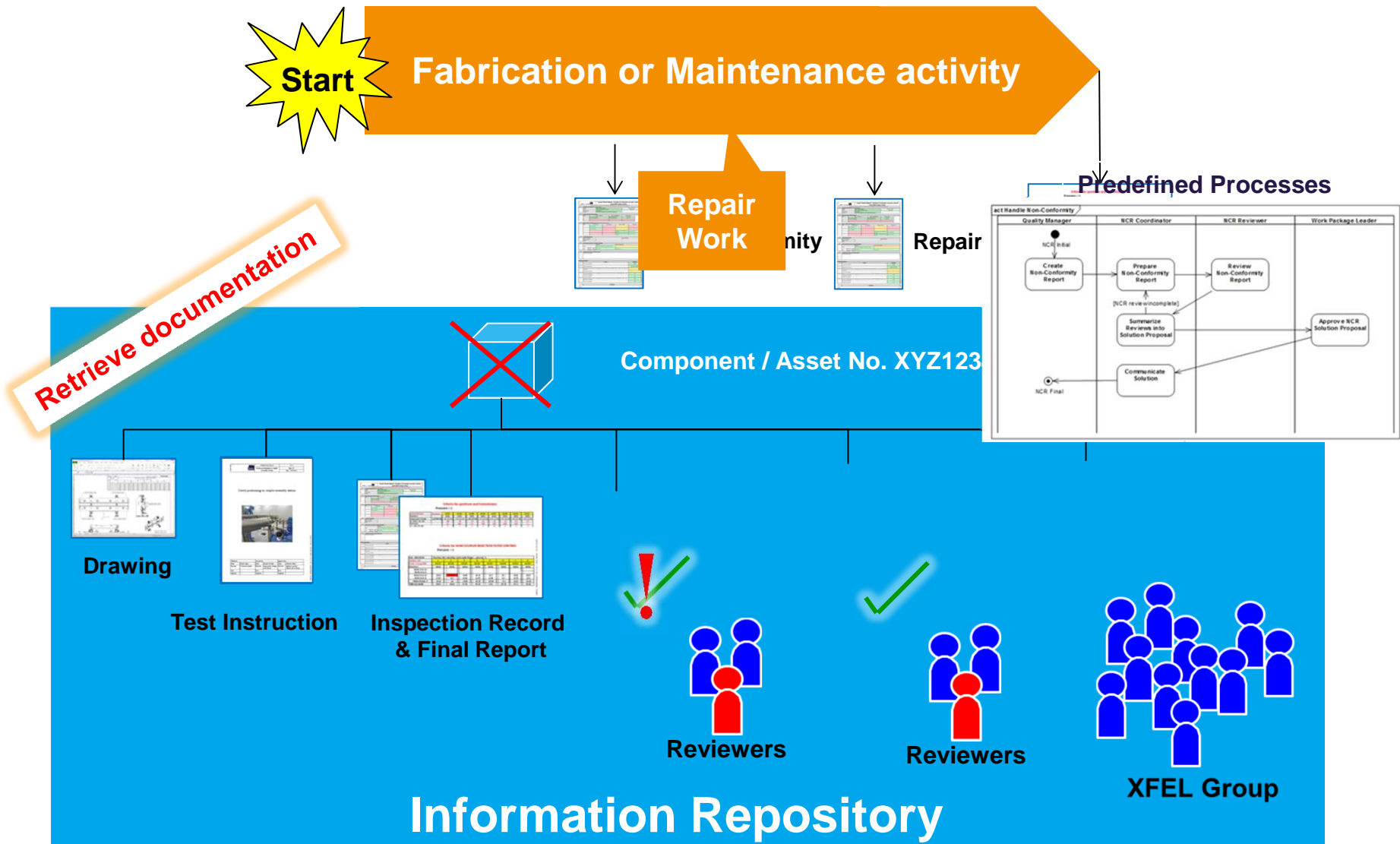
# Different Types of Parts, Documents & Relations



# Basic Process: Capturing Information

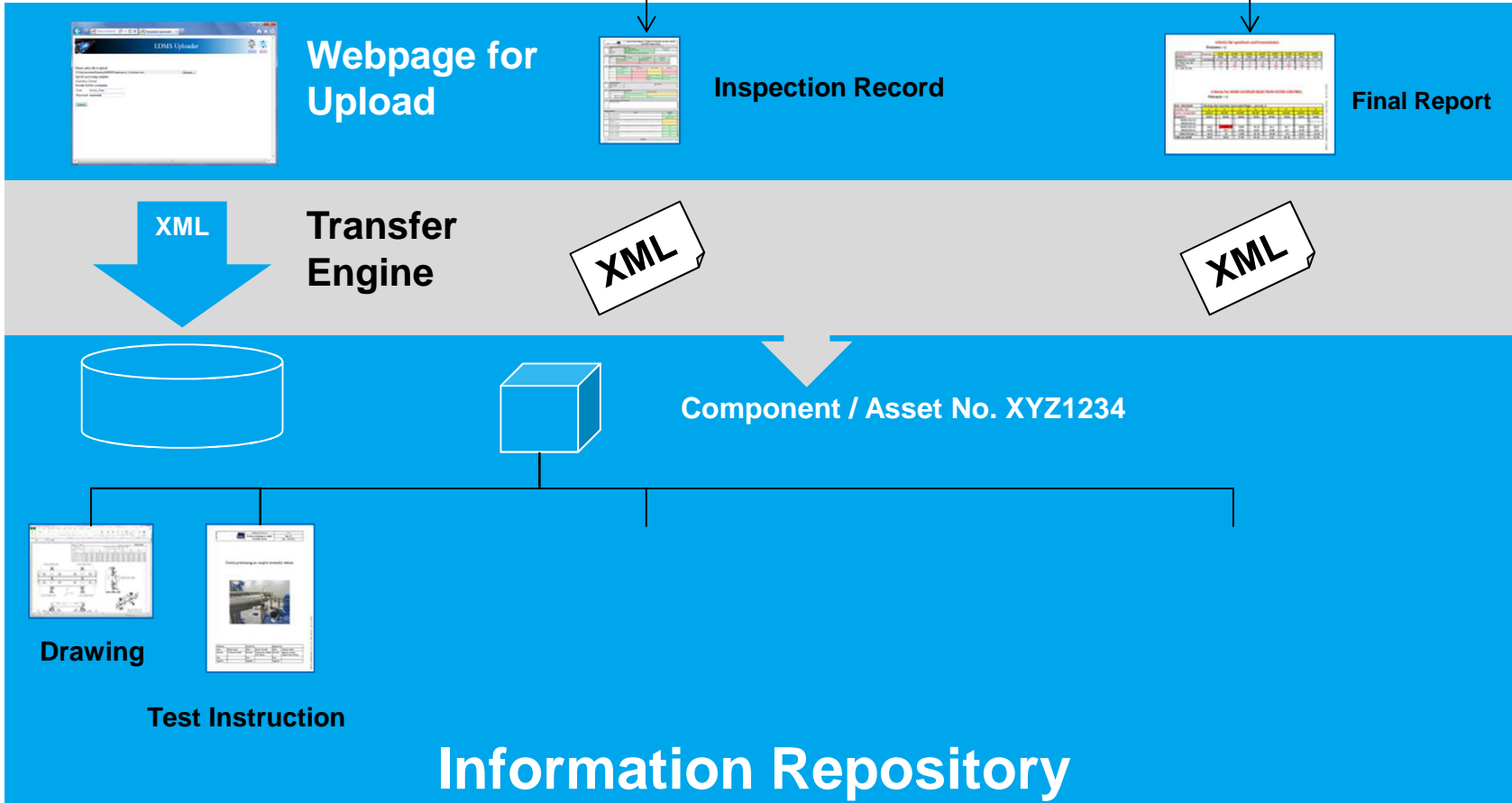


# Advanced Processes: Decision Making and more

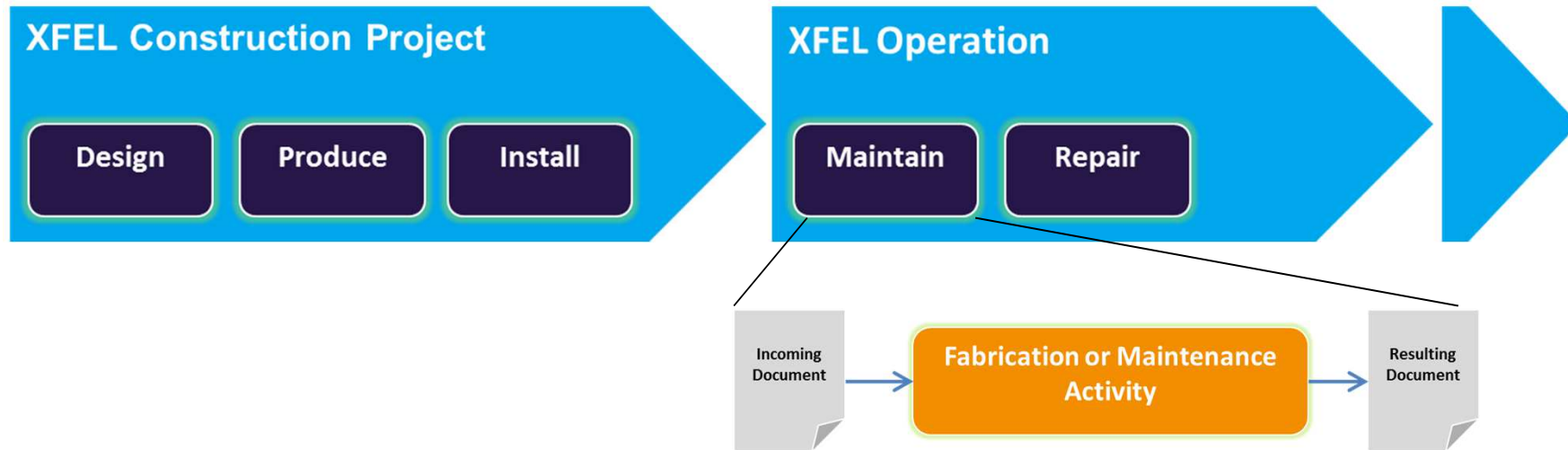




# Easy Upload via Webpage



# Summary



- > The **general approach** is applicable to activities in all lifecycle phases
- > **Documents** describe & trigger activities, capture results & keep history
- > The **solution scales** from simple to complex & defined processes
- > Information repository can provide **complete up-to-date information** to any maintenance activity, and handle **any type of equipment and document**

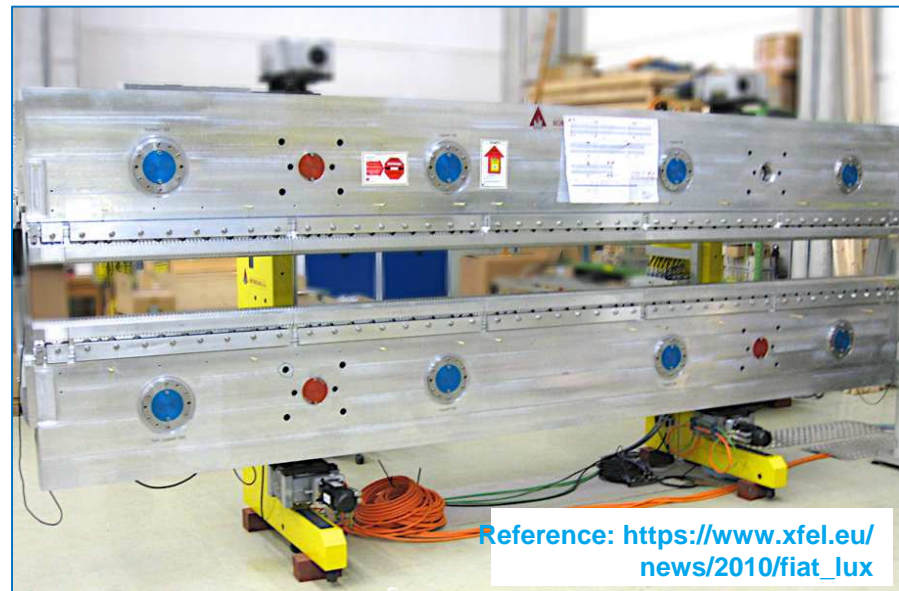
Example

# **PARTS TRACKING IN UNDULATOR INSPECTIONS**



# Example: Undulator Acceptance Test

- The following slides show an example for parts tracking in the course of quality inspections of an undulator. The inspections are performed by XFEL WP71 of the European XFEL GmbH as part of the undulator production. Similar and also more complex activities are performed in numerous other work packages.
- The example describes a scenario for capturing and post-processing undulator inspection results
  - perform activity & providing results
- Optimized for pre-defined activity, easy-to-use for staff
  - here engineer of project team, elsewhere also e.g. sub-contractors
- Repository accumulates lifecycle history



# Performing Inspections

## Scenario:

Get Serial Number

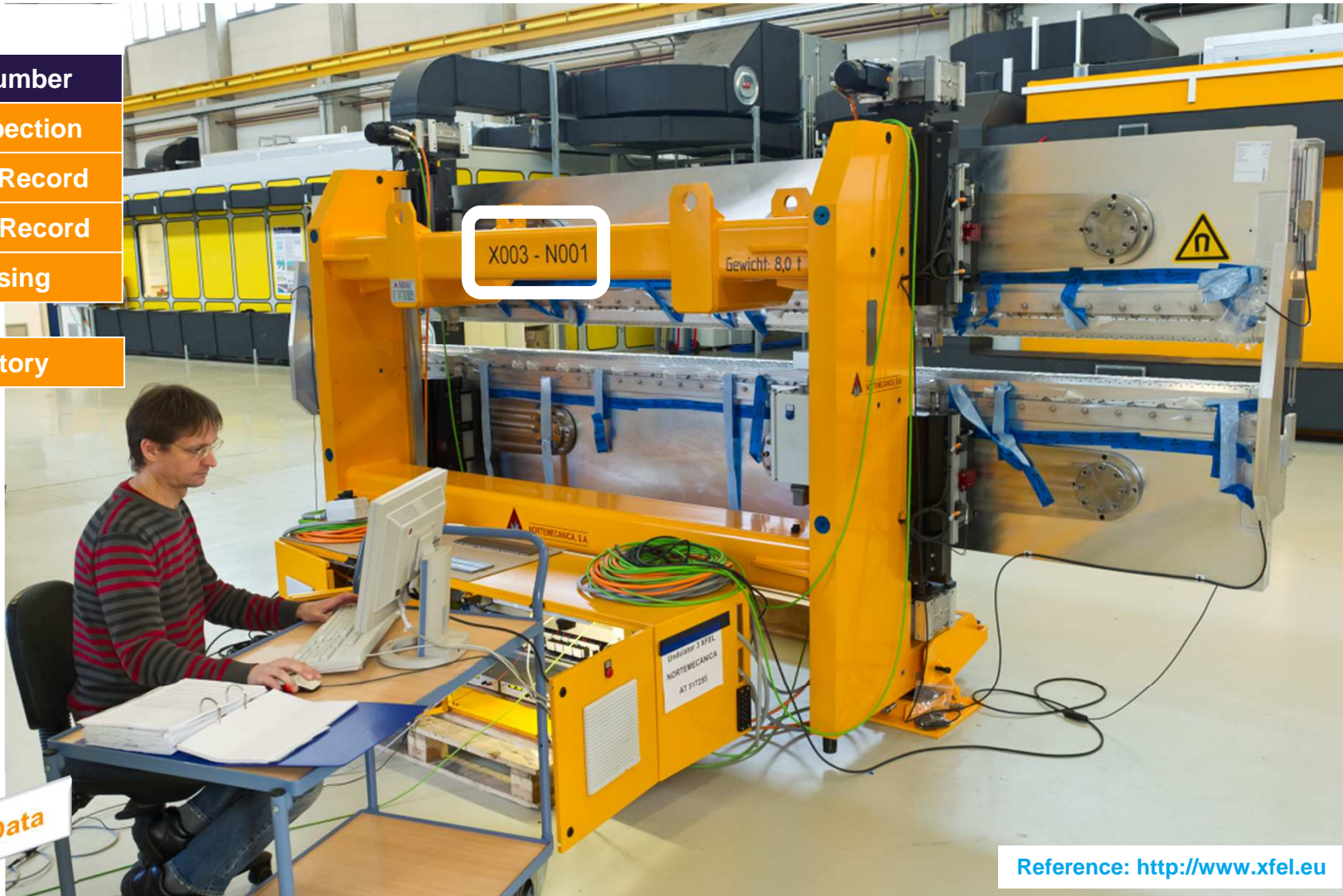
Perform Inspection

Fill-out Test Record

Upload Test Record

Post-Processing

View Repository



Simulated Data

Reference: <http://www.xfel.eu>



# Performing Inspections

Scenario:

Get Serial Number

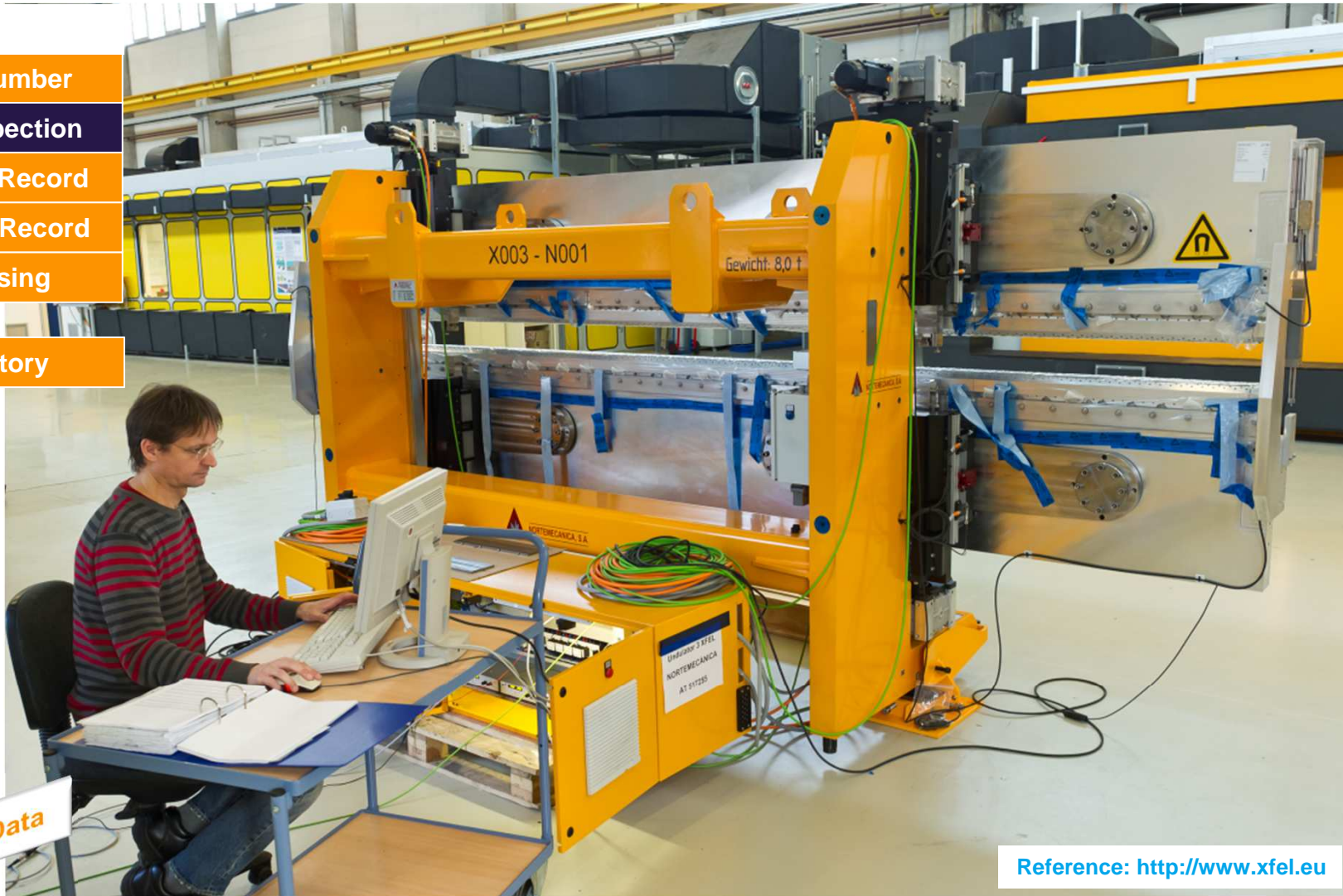
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# Performing Inspections

Scenario:

Get Serial Number

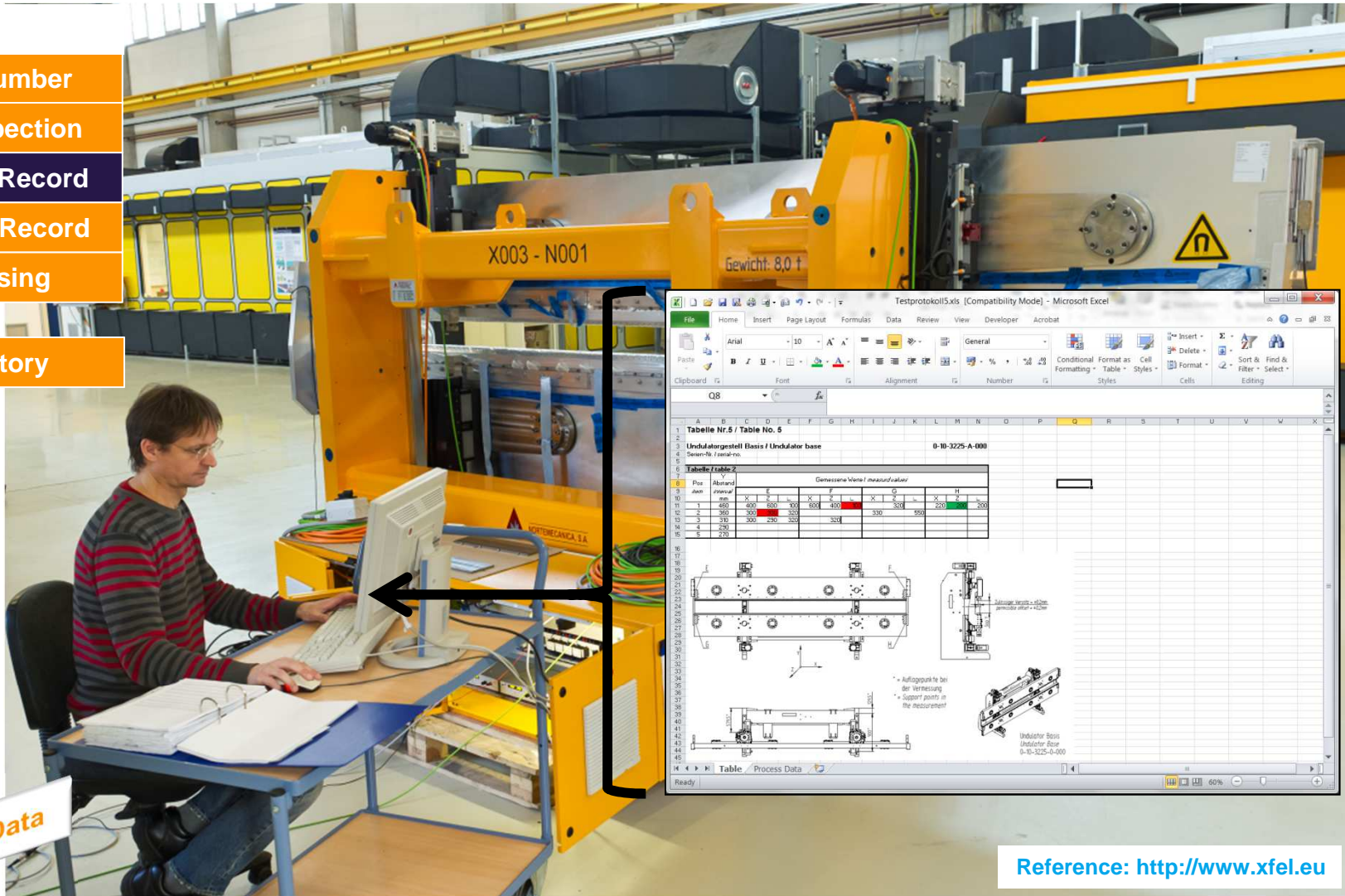
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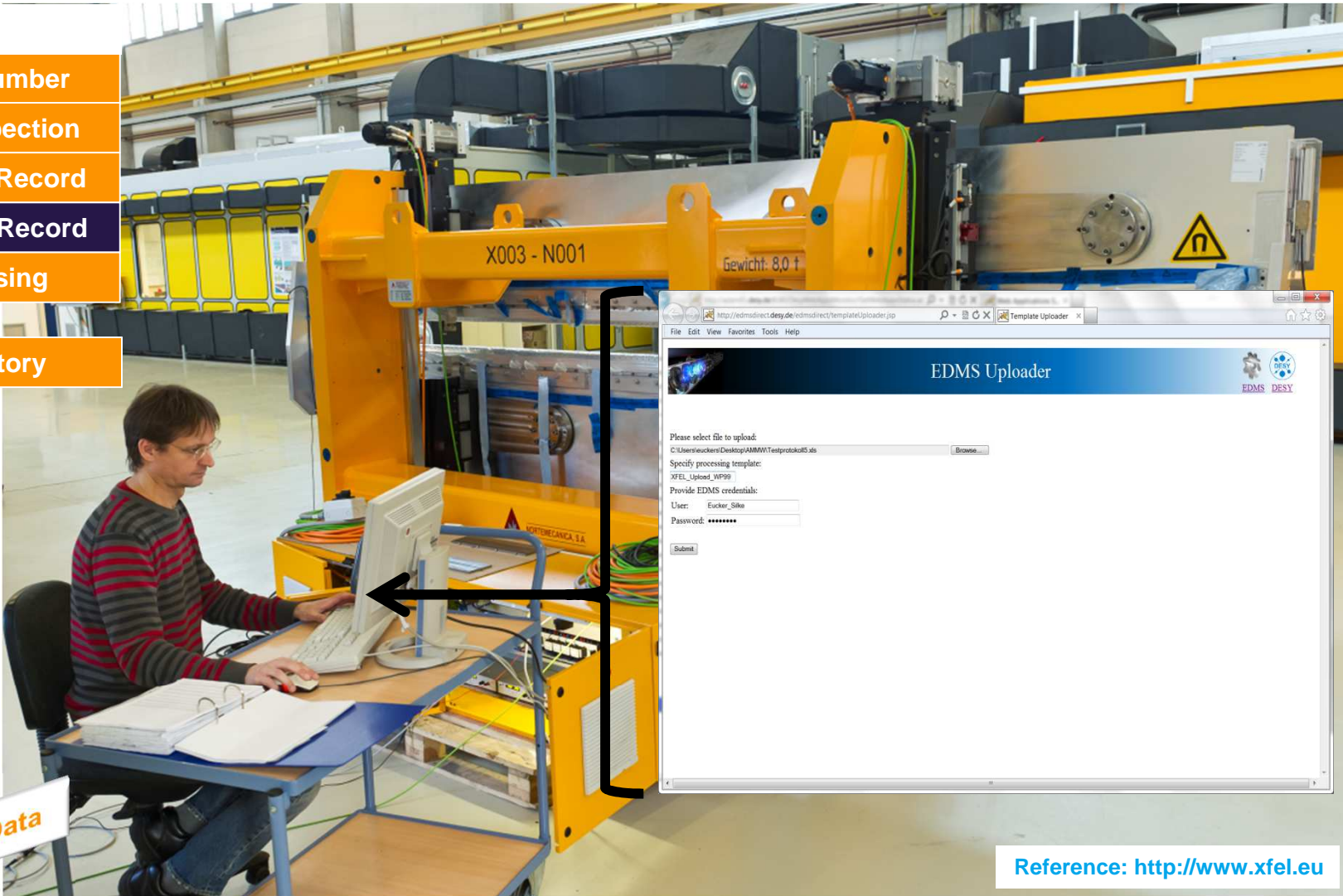
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# Performing Inspections

Scenario:

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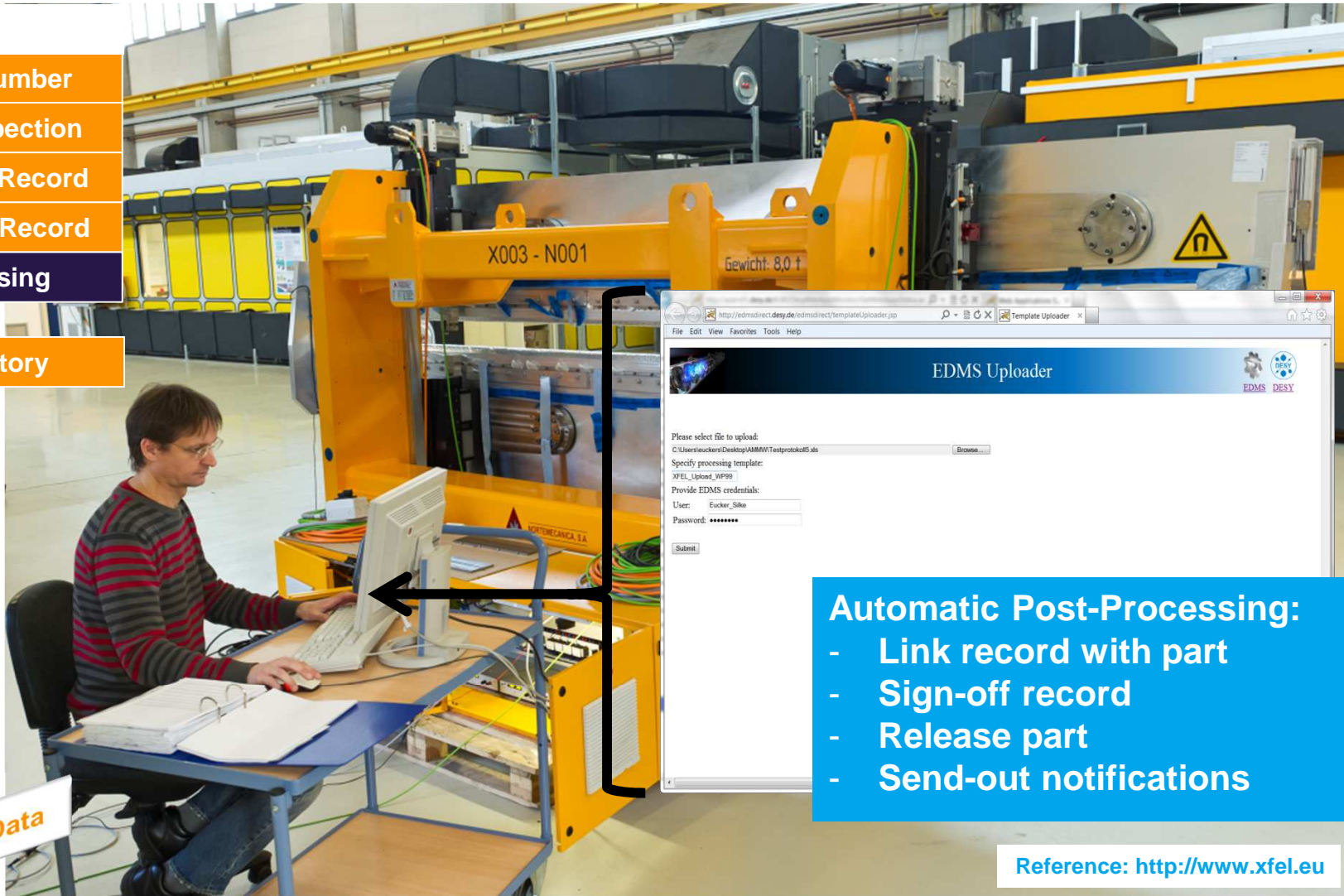
Perform Inspection

Fill-out Test Record

Upload Test Record

Post-Processing

View Repository



# Accessing the Repository: Part Identification

Scenario:

Get Serial Number

Perform Inspection

Fill-out Test Record

Upload Test Record

Post-Processing

View Repository

The screenshot displays the 'Item Information' page for a physical part. The main content area is titled 'Physical Part, D0000000042339,A,1,1, Item Info : Summary'. It features several tabs: Summary, BOM, Properties, Related Items, Next Steps, and All Versions. The 'Properties' tab is active, showing details for 'Undulator Type Z'. The 'Serial Number' is 'X003-N001', which is circled in red. Other properties include 'Life Cycle State: Planning', 'Access Scheme in Use: XFEL\_WP71\_Undulator\_Team', and 'Designated Access Scheme (Project): mro\_admin'. A 'Preview Image(s)' section shows a barcode and a QR code. A callout box on the right provides a larger view of the barcode, with the serial number 'X003-N001' and EDMS-ID 'D0000000042339' circled in red. The left sidebar contains navigation options like 'Part', 'Preferences', 'Logs', and 'In Service'. The bottom status bar indicates '2 items in the Attached Files List' and 'The Physical Part Document was created.'

Simulated Data



# Accessing the Repository: Describing Documents

Scenario:

Get Serial Number

Perform Inspection

Fill-out Test Record

Upload Test Record

Post-Processing

View Repository

The screenshot displays a web-based document management system. The primary view is the 'Item Info: Summary' for a 'Physical Part' with ID D0000000042339, version A.1.1. The interface includes a sidebar with navigation options like 'Work Lists', 'My Lists', and 'My Teams'. A specific section titled 'Has Description: 5 objects' lists several documents: 'Assembly Drawing, A.1.1', 'Final Mechanical Acceptance Test, A.1.1', 'Process Instructions, A.1.1', 'Quality Management Plan, A.1.1', and 'Test Record Undulator Inspection, A.1.1'. An inset window shows a detailed view of a 'Quality Management' document (ID D0000002520721, A.1.1), highlighting a 'Test Record Undulator Inspection' document with associated metadata and a preview of technical drawings. A 'Simulated Data' label is positioned at the bottom left, indicating the nature of the content.



# Conclusion

- > **General-purpose and easy-to-use** solution for tracking and potentially organizing lifecycle activities; in production for XFEL construction
- > Handles **various kinds of components**, such as cavities, cryomodules, undulators, rf system, diagnostic equipment, ...
- > Works **independent of quantities and rates** in different scenarios, such as production of prototypes and individual components, series production of large numbers (at various rates), bulk purchase and delivery, ...
- > Used by **different types of users**, such as engineers (who contribute information), collaboration members (who access information), quality managers, sub-contractors, ..., and **also external systems**, such as ERP systems of sub-contractors
- > **Non-invasive** to the end users' IT equipment, **quickly extended** and adapted for new activities



Conclusion

# SUMMARY AND CONCLUSION



# Summary & Conclusion

- > European XFEL is under construction
  - current activities include production and installation of components, operation & maintenance are still ahead of us
- > Accelerator maintenance expected to be performed by expert groups (decentralized responsibilities)
- > General parts tracking solution established for fabrication, assumed to be good foundation for maintenance activities
  - Documents organize & control (chains of) maintenance (and other) activities
  - Documentation repository can provide complete up-to-date information
  - Non-invasive solution, can quickly be extended to new processes
- > Current focus on capturing information during fabrication, maintenance tools & processes to be developed later



Merci beaucoup!  
Thank you very much!

**Acknowledgement:**

**I like to thank my colleagues for their valuable input and critical review.**

