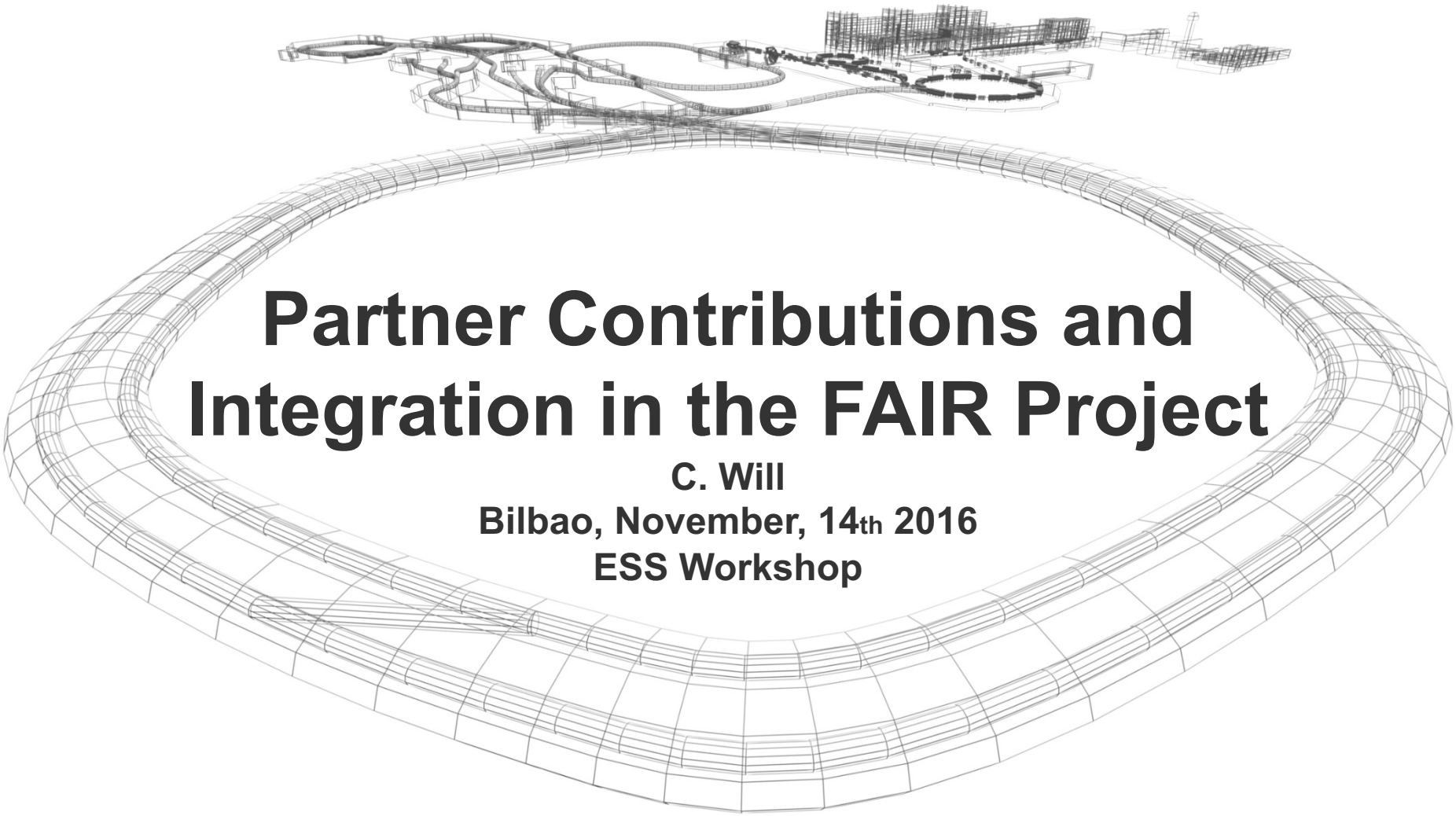
GSI Helmholtzzentrum für Schwerionenforschung GmbH



Partner Contributions and Integration in the FAIR Project

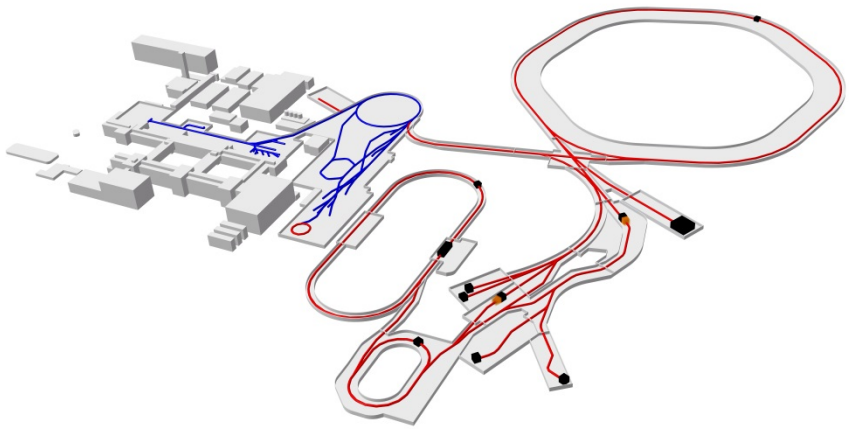
C. Will

Bilbao, November, 14th 2016

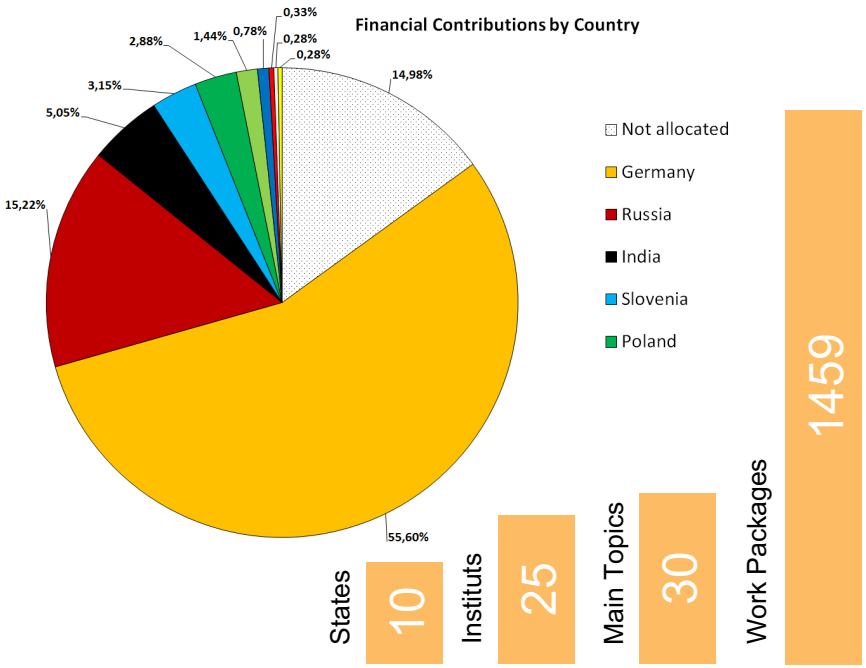
ESS Workshop

The FAIR Project

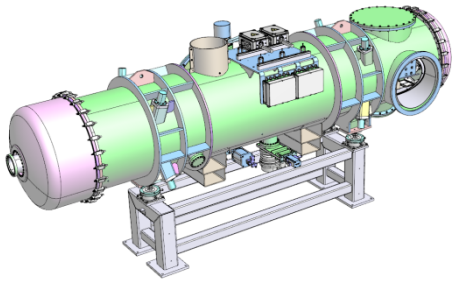
- October 4th, 2010 → the international agreement on the construction of the accelerator facility FAIR (Facility for Antiporoton and Ion Research)
- Investment : ~ € 1 billion (2005)
- Completion: 2025
- When completed, FAIR will comprise 8 ring accelerators of up to 1,100 metres in circumference, two linear accelerators and around 3.5 kilometres of beam pipes.



FAIR Module 0-3

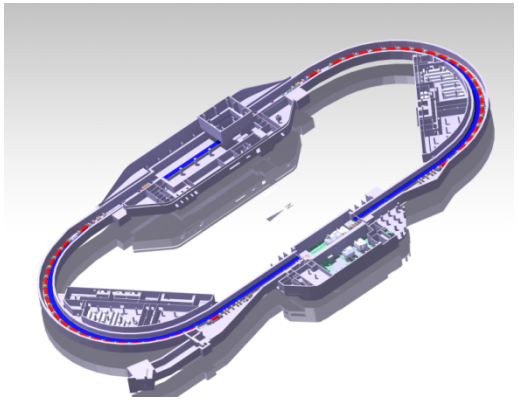


Exampels for contributions to FAIR



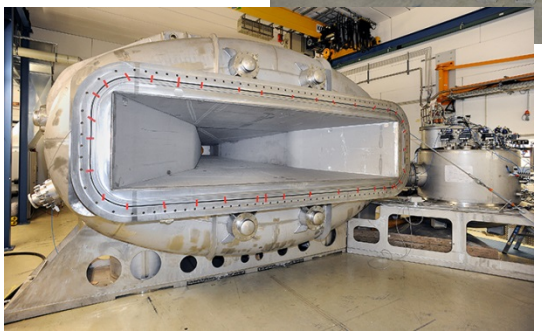
Partner Contributions are:

- Subcomponents
- Components
- Complete machines (CR, HESR)
- Engineering Tasks, Software
- etc.



What does this mean for integration?

- Components and documentation
- Tools, Standards, Knowledge, Workplace
- Interfaces
- Processes
- Establishing the links between information

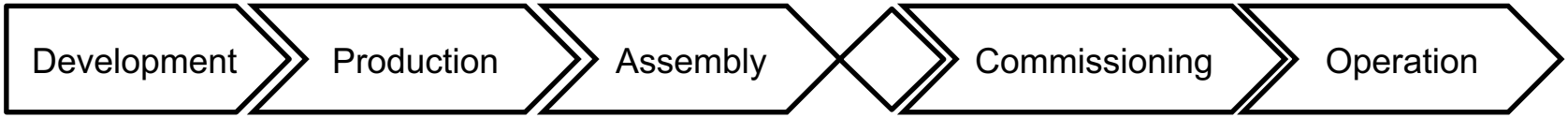


Legal aspects and Target for FAIR

- All partners which produce in the EU or will import into the EU have to follow the legal rules of the EU.

- The following regulations have to be followed:
  - 2006/42/EG Machinery directive
  - 89/391/EWG, 2007/30/EG Regulation to avoid accidents
  - ProdSG- Act on making products available for the market
  - 2014/35/EU Low voltage regulation
  - 2014/68/EU Pressure Vessel regulation

- For certification: Information guide „Manufacturing and operation of equipment designed for research purposes", CE conformity and workplace safety, BGI/GUV-I 5139 E



Permission in reference to Radiation
Legal authorization

Common Definitions

- Leading CAD-system → CATIA V5, SAP
- Leading PDM-System → EDMS (CERN)(For documents) , Archive (For drawings)
- Data Exchange Guideline
- Common Design Guideline
- Common Approval Processes (CDR, FDR, FAT, SAT)
- Interfaces (Component ←→ CC; media supply)
- Reporting (progress, technical)
- Common information about GSI, FAIR → Technical guidelines
- Common legal information about GSI, FAIR
- Change management
- Standard components (vacuum flanges, pumps, alignement units, screws, etc.)
- Reused components
- Common language (Manuals in the most spoken language)
- Control of documents
- Definitions to product-specific technical documents and records
- Templates
- etc.

Technical Guidelines

Technical guidelines:

- Are part of the specifications as common approved information
- Are used for knowledge management
- Combine knowledge of different subject domains with technical solutions
- Are a collection of best practice experiences
- Are generally available

Technical guidelines have to be seen:

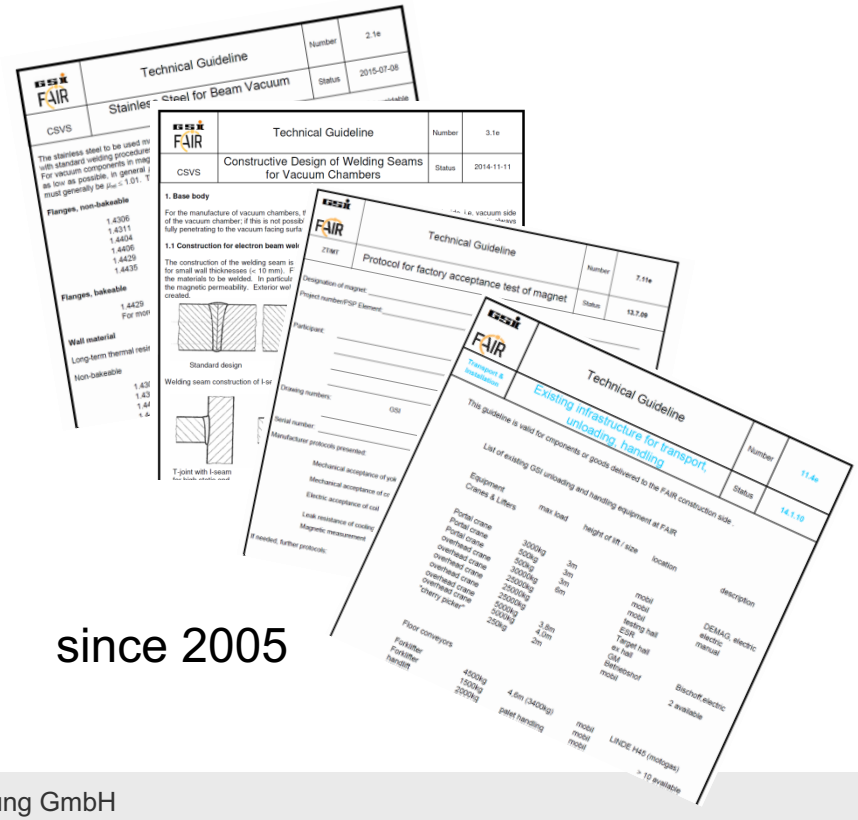
- As a collection of technical data, that are used in GSI
- As an intentionally written guideline and not as specification
- In order to take into consideration the technical know-how
- As information about for instance basic equipment of GSI/FAIR
- As starting point for general standardization at GSI.

Content and Structure:

Classification of the guidelines

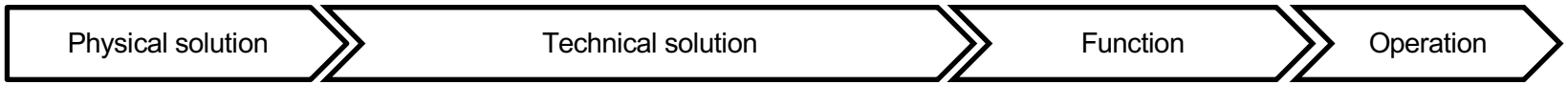
1. Several Information
2. Selection of materials
3. Engineering Design
4. Heating
5. Surfaces
6. Cleaning
7. Acceptance Tests
8. Material Procurement
9. Transport and Packaging
10. Documentation
11. Basic Equipment GSI/FAIR
12. Catalogue of GSI Main Storage
13. Installation Instructions
14. Miscellaneous

+ register with keywords



since 2005

Development and Management Tasks



- prove of planning
- change management
- prove of installation space
- check of practicability of parameter
- check of physical dimensioning
- structuring of data model for product

- check of plausibility of the simulations
- check of necessary prototypes
- confirmation for planning of beam lines
- structure of product model known and plausible?
- definition of connecting and feeding components
- definition of interfaces
- check of requirements by components on the system

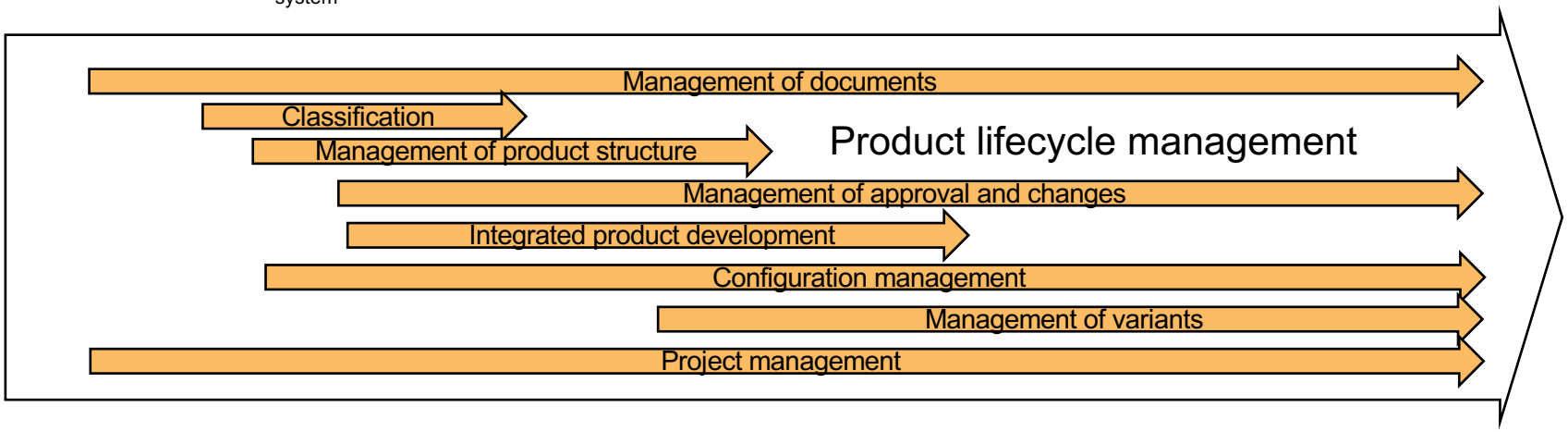
- prove of compatibility of the component to the system
- check of realization of the requirements in the design
- takeover of additional information about the components
- check for mount ability
- planning of quality assurance during production
- prove of interfaces

- as built documentation
- reports of quality assurance
- analyses for completeness
- allocation of identifiers for components
- operation plan
- risk analyses
- certification
- preparation of assembly documentation

- verification of assembly results
- documentation of modifications
- verification of component identification
- proving of interfaces
- manuals

- verification of manuals
- documentation of modifications
- verification of requirements on the system
- documentation of deviations

- documentation of modifications
- recording of operation modi
- check of spare parts
- documentation of operation

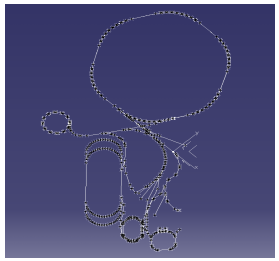


From Physical to Technical Solution

Physical Systems Design

Ion optical layout (IOL) (Nomenclature)

Information about position of function in space



Adress for controls

Nomenclature

T1S1MH01 Dipole

T1S1MH04.GN [HB.D4.01] Power supply

Product structure

Components, which are necessary for realization of function

- Dipole →
- Power supply →
- Water supply →
- Controls →
- Cables →
- etc.

Specification for Dipole
Specification for Power supply
Specification for Water supply
Specification for Controls
Specification for Cables
etc.

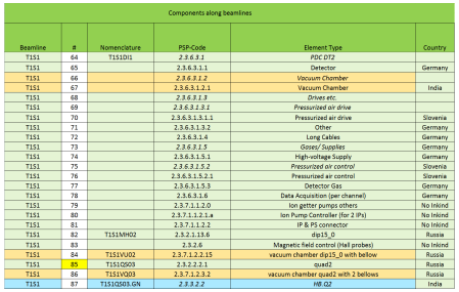
But: Nomenclature ≠ Component ≠ Function

Function = ∑(dipole+ power supply +vacuum chamber + etc.)

Example T1S1MH01 T1S1MH04.GN [HB.D4.01] T1S1VC05

Tasks:

- Development of product structure
- Combination of physical design to mechanical and electrical design
- Creation of interlinks between all development data
- Development of specifications
- Positioning of representation of function at IOL
- Connection of Product structure with PSP → Contracting



Components along beamlines

Beamline	#	Nomenclature	PSP-Code	Element Type	Country
T1S1	64	T1S1DI1	*2.3.6.3.1*	*PDC DT2*	
T1S1	65		2.3.6.3.1.1	Detector	Germany
T1S1	66		*2.3.6.3.1.2*	*Vacuum Chamber*	
T1S1	67		2.3.6.3.1.2.1	Vacuum Chamber	India
T1S1	68		*2.3.6.3.1.3*	*Drives etc.*	
T1S1	69		*2.3.6.3.1.3.1*	*Pressurized air drive*	
T1S1	70		2.3.6.3.1.3.1.1	Pressurized air drive	Slovenia
T1S1	71		2.3.6.3.1.3.2	Other	Germany
T1S1	72		2.3.6.3.1.4	Long Cables	Germany
T1S1	73		*2.3.6.3.1.5*	*Gases/ Supplies*	Germany
T1S1	74		2.3.6.3.1.5.1	High-voltage Supply	Germany
T1S1	75		*2.3.6.3.2.5.2*	*Pressurized air control*	Slovenia
T1S1	76		2.3.6.3.1.5.2.1	Pressurized air control	Slovenia
T1S1	77		2.3.6.3.1.5.3	Detector Gas	Germany
T1S1	78		2.3.6.3.1.6	Data Acquisition (per channel)	Germany
T1S1	79		2.3.7.1.1.2.0	Ion getter pumps others	No Inkind
T1S1	80		2.3.7.1.1.2.1.a	Ion Pump Controller (for 2 IPs)	No Inkind
T1S1	81		2.3.7.1.1.2.2	IP & PS connector	No Inkind
T1S1	82	T1S1MH02	2.3.2.1.13.6	dip15_0	Russia
T1S1	83		2.3.2.6	Magnetic field control (Hall probes)	No Inkind
T1S1	84	T1S1VU02	2.3.7.1.2.2.15	vacuum chamber dip15_0 with bellow	Russia
T1S1	85	T1S1QS03	2.3.1.2.2.1	quad2	Russia
T1S1	86	T1S1VQ03	2.3.7.1.2.3.1	vacuum chamber quad2 with 2 bellows	Russia
T1S1	87	T1S1QS03.GN	*2.3.3.2.2*	*HB.Q2*	India

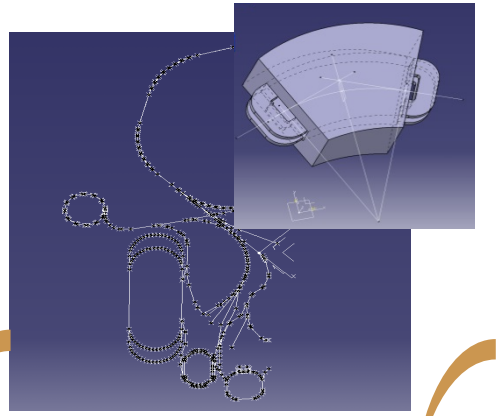
PSP- Project structure plan
IOL- Ion optical Layout

From Physical to Technical Solution

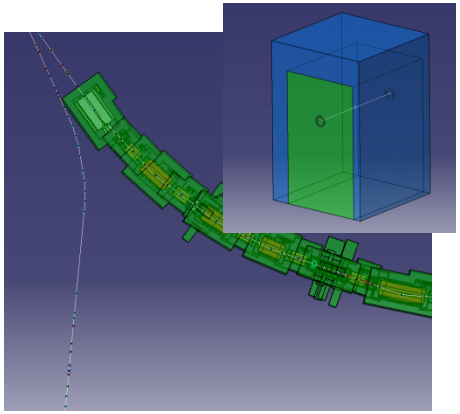
Transfer of the physical solution into technical requirements:

- Choosing the active principle for realization of function
- Positioning of the function in the system (Ion optical Layout)
- Definition of necessary space of the function
- Definition of necessary media
- Adaption of requirements from product life-cycle

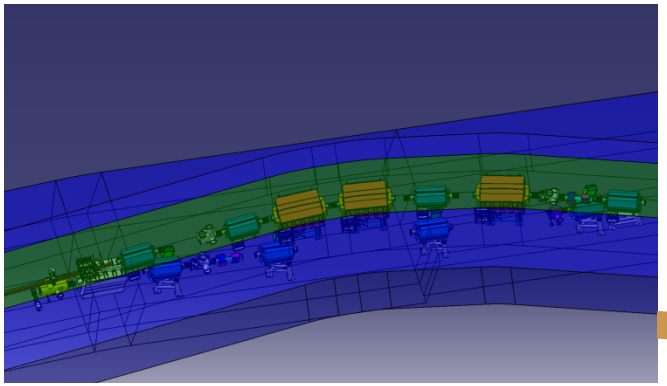
- Maintenance
- Alignment
- Emergency scenario
- etc.



IOL(Step)->CATIA SAP



Installation space for components

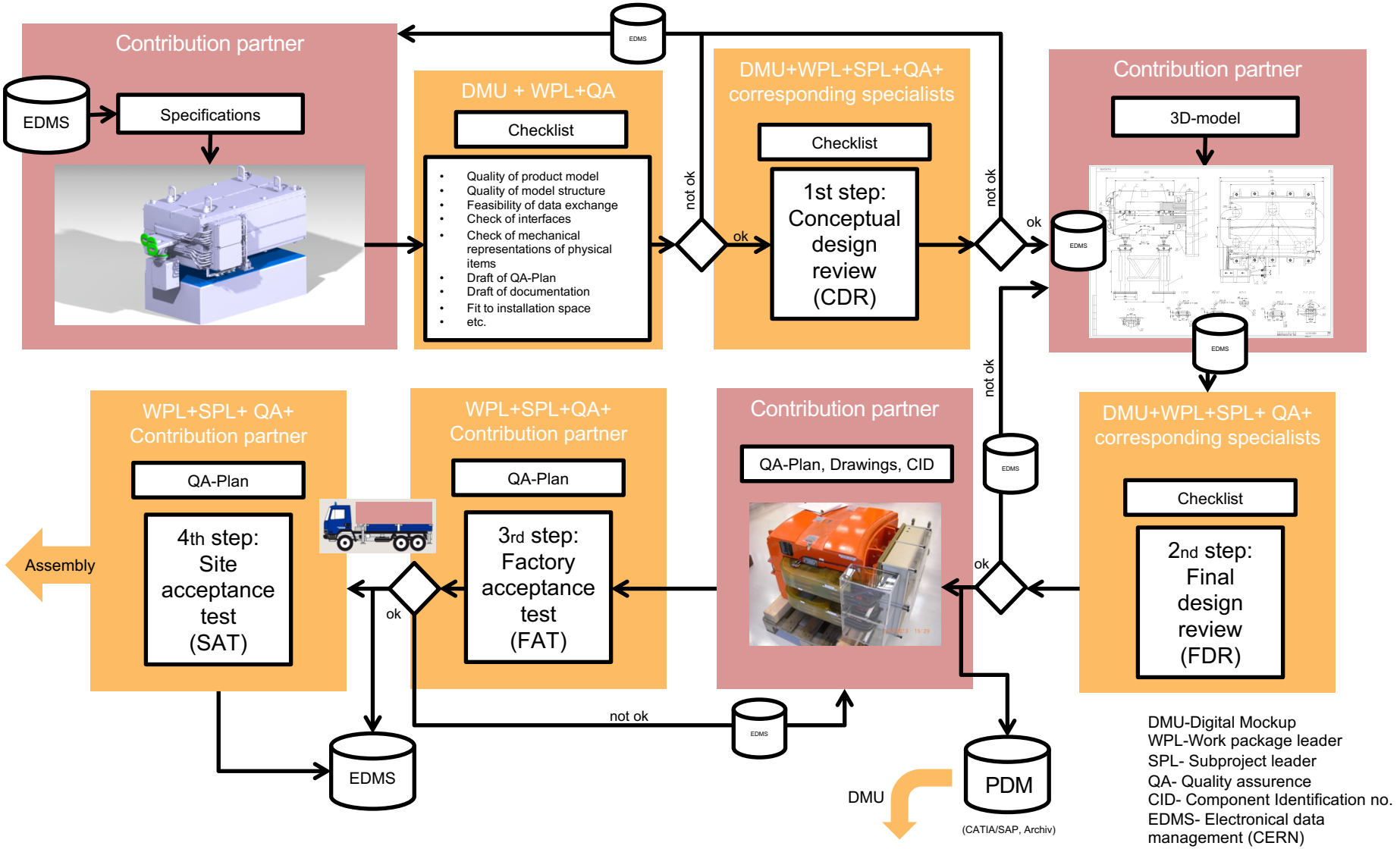


Requirements from Product life-cycle

Civil construction

Specifications

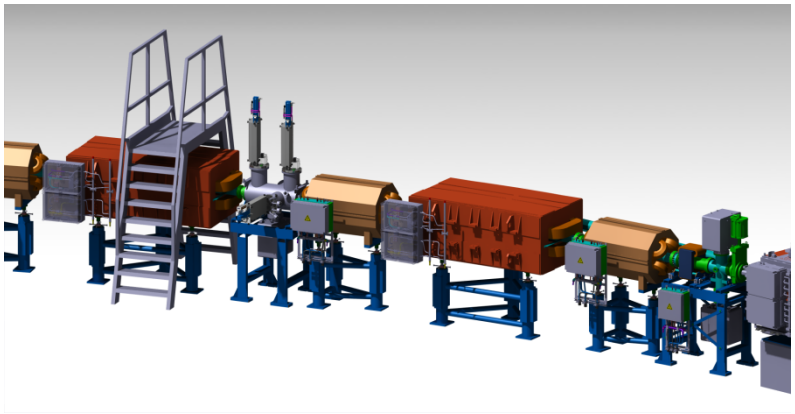
Proving of Technical Solution

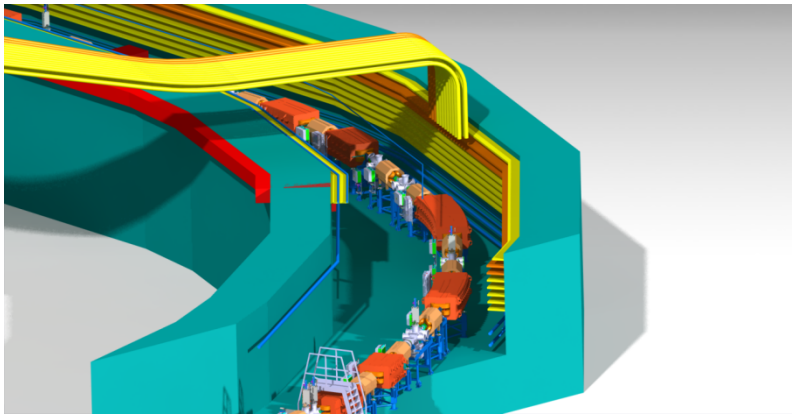


DMU-Digital Mockup
WPL-Work package leader
SPL- Subproject leader
QA- Quality assurence
CID- Component Identification no.
EDMS- Electronical data management (CERN)

Proving of Technical Solution

DMU Combination of 3D-models of different sources to one common overview





Development of Models for Beamlines as basis for:

- Interface drawings
- Drawings for installation
- Digital representations as basis for installation and maintenace
- A basis for simulations for remote manipulation of radioactive components

Combination of:

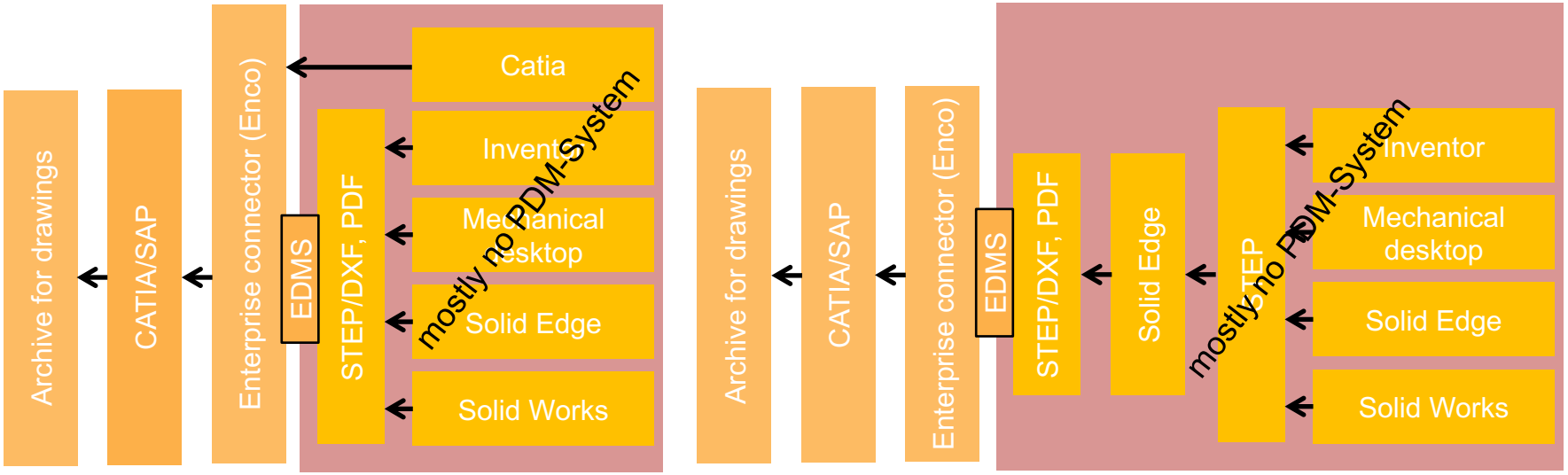
- Models of different sources like civil construction, GSI and contribution partners
- 3D-Scans with CAD-Models as As-built-documentation

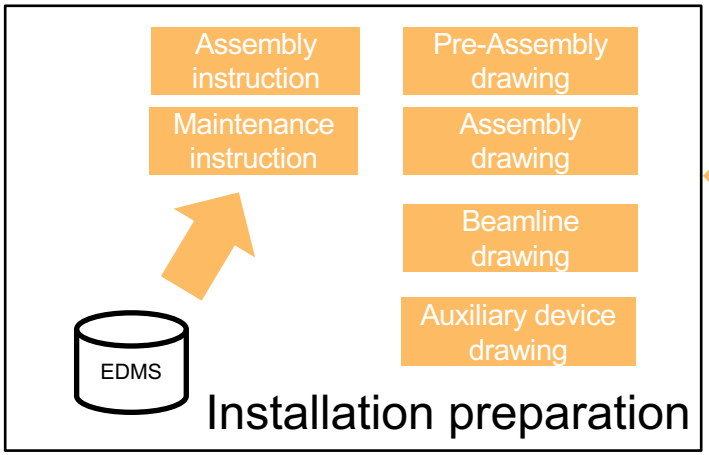
Prove of:

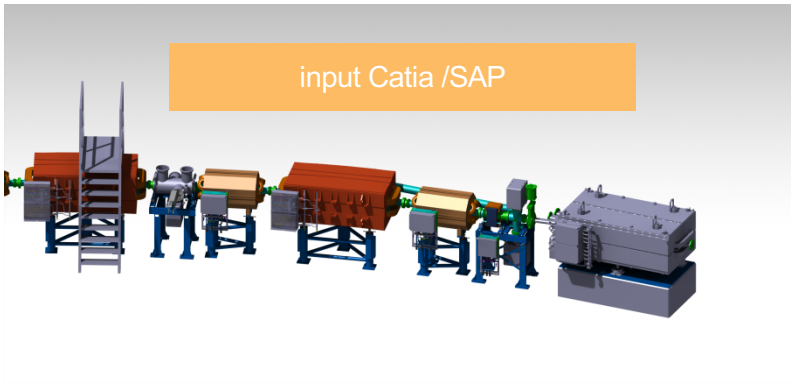
- Completeness of product structure
- Interfaces
- Installation scenarios
- Maintenance scenarios
- Emergency scenarios

CAD Integration

Scenarios for CAD data creation, implementation and use

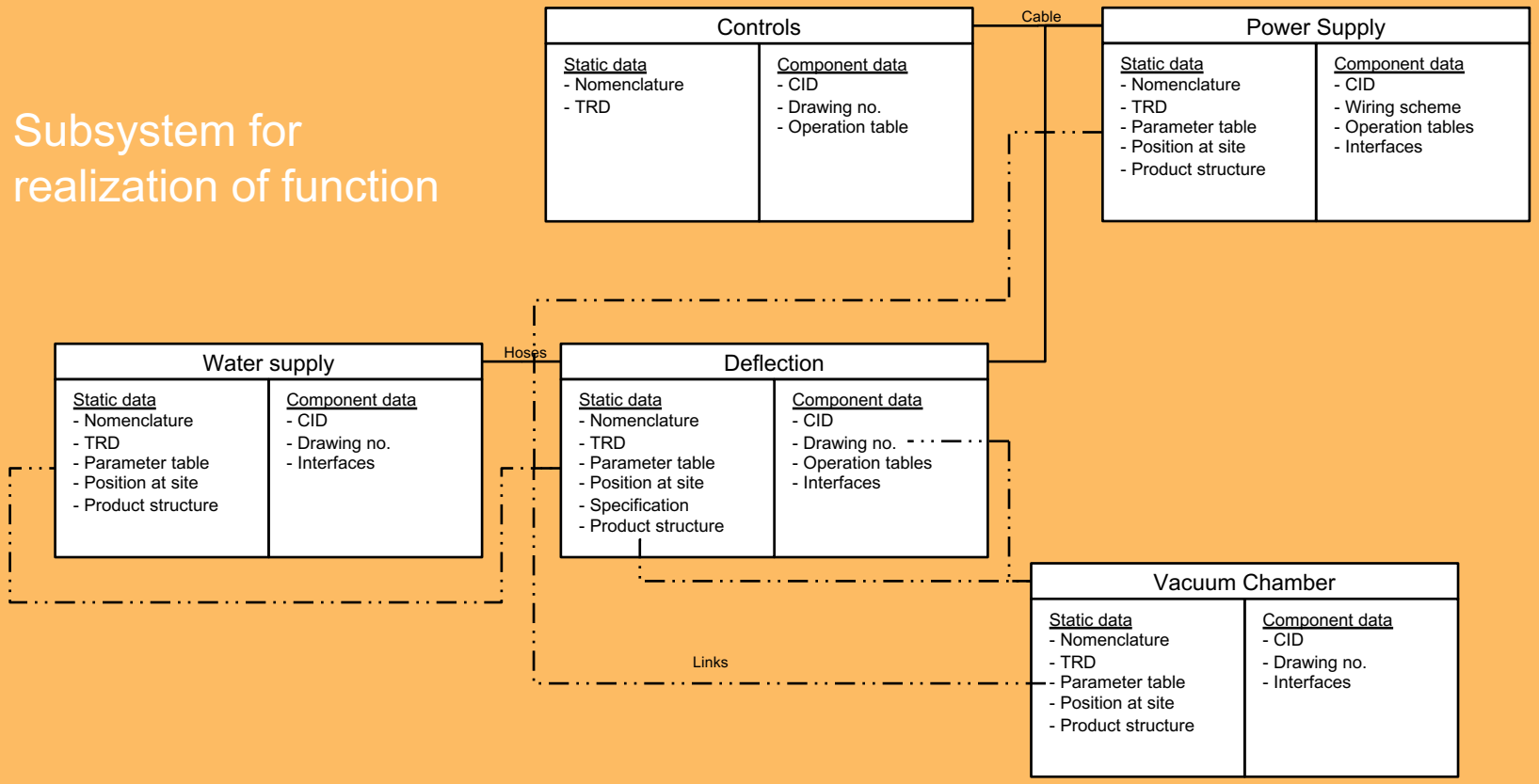






Technical Documentation for the System

Subsystem for realization of function

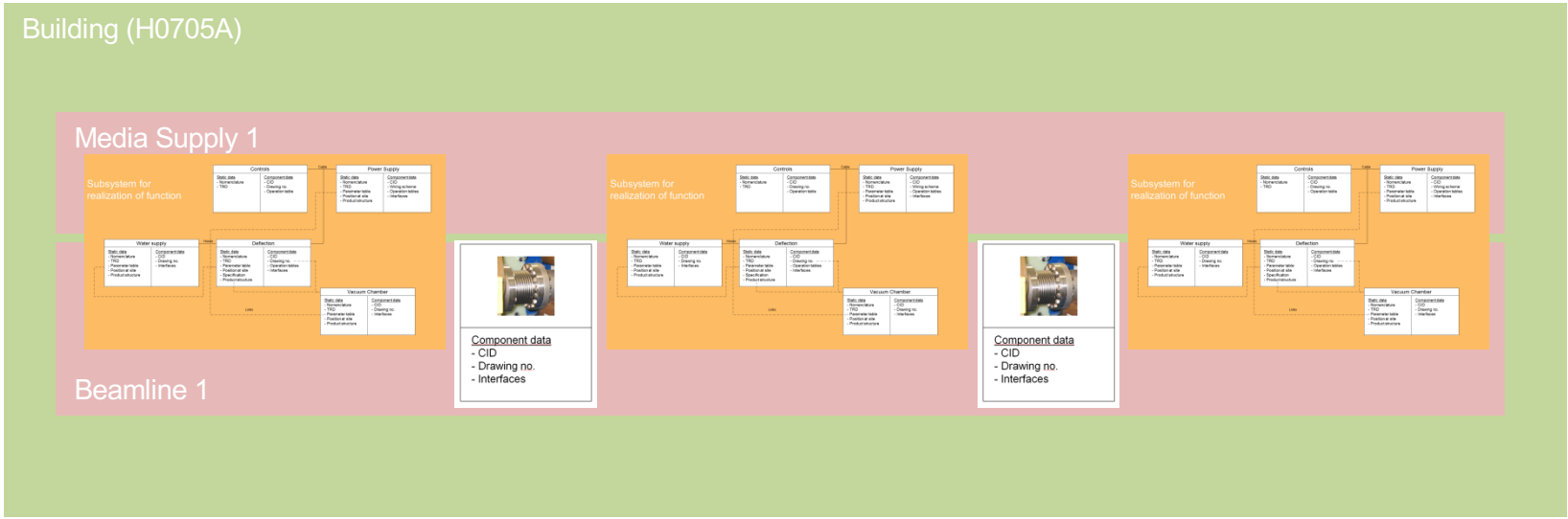


Technical Documentation for the System

Technical reference designation (TRD) will be used for[1]:

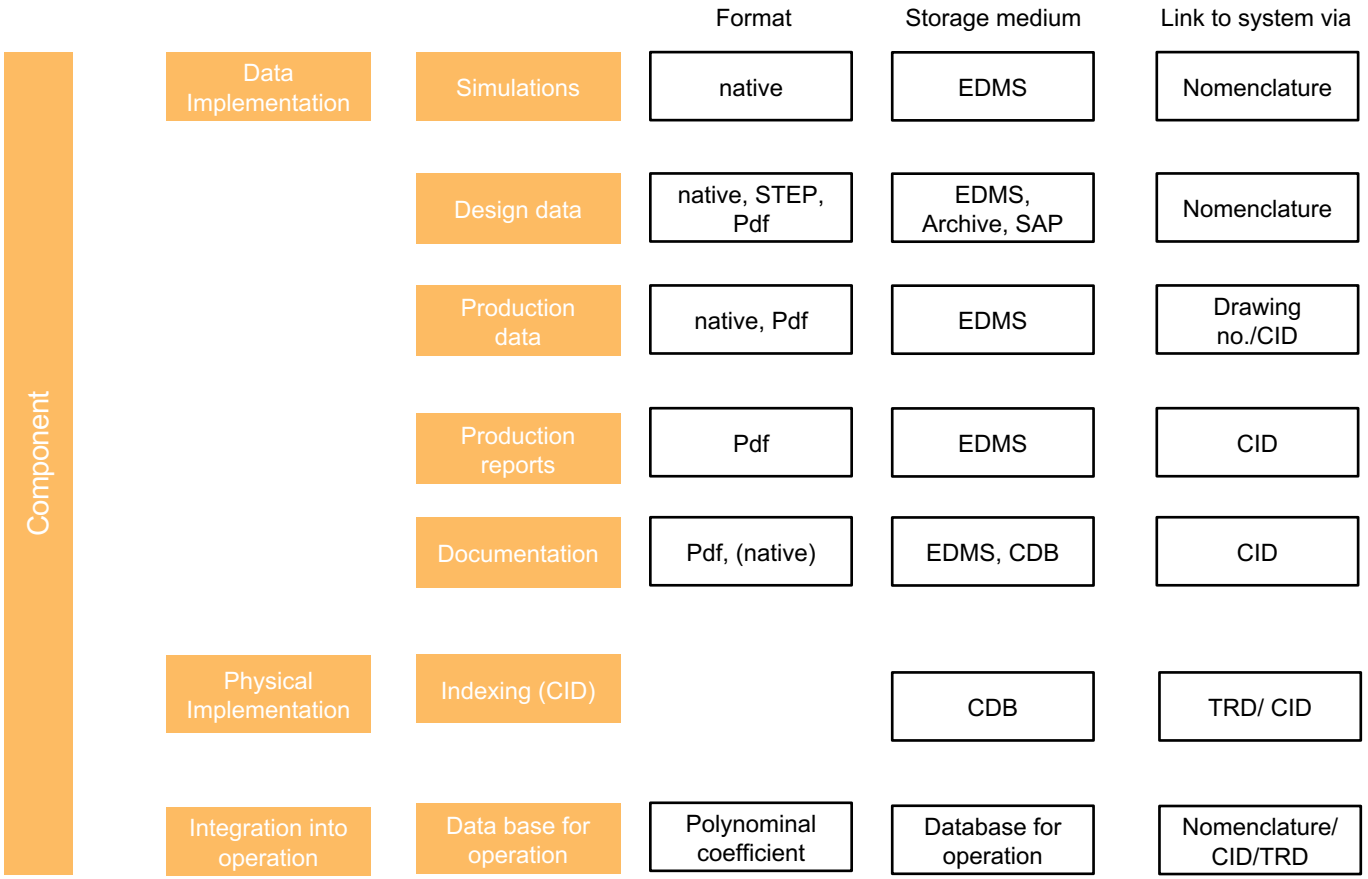
- Identification of objects
- Labeling of technical objects in facilities
- Cross references between facility and documentation
- Designation of documents
- Identification of shown objects in documents

It combines function, position and product structure items.



[1] http://www.kleiner-ma.de/download/ASA_Dok_Kennz.pdf

Integration



CDB- Component data base
TRD- Technical reference designation

Lessons learned

- Early Classification of components
- Classification ≠ Function
- Nomenclature ≠ Function
- PSP ≠ Product structure
- Definition of Product structure in reference for CAD and management processes
- Combination of Nomenclature, Product structure, drawing no. system and CID
- Explanation of change management process to all partners
- Training of designers of partners on site for Data exchange, product structure and methodology
- Check of compatibility for CAD-Data
- Check of content of CAD-Data (tree, quality, structure of modells, revision, reuse, naming of files, etc.)
- etc.

Thank you for your attention!