Establishing Project Standards

Lars Hagge, DESY

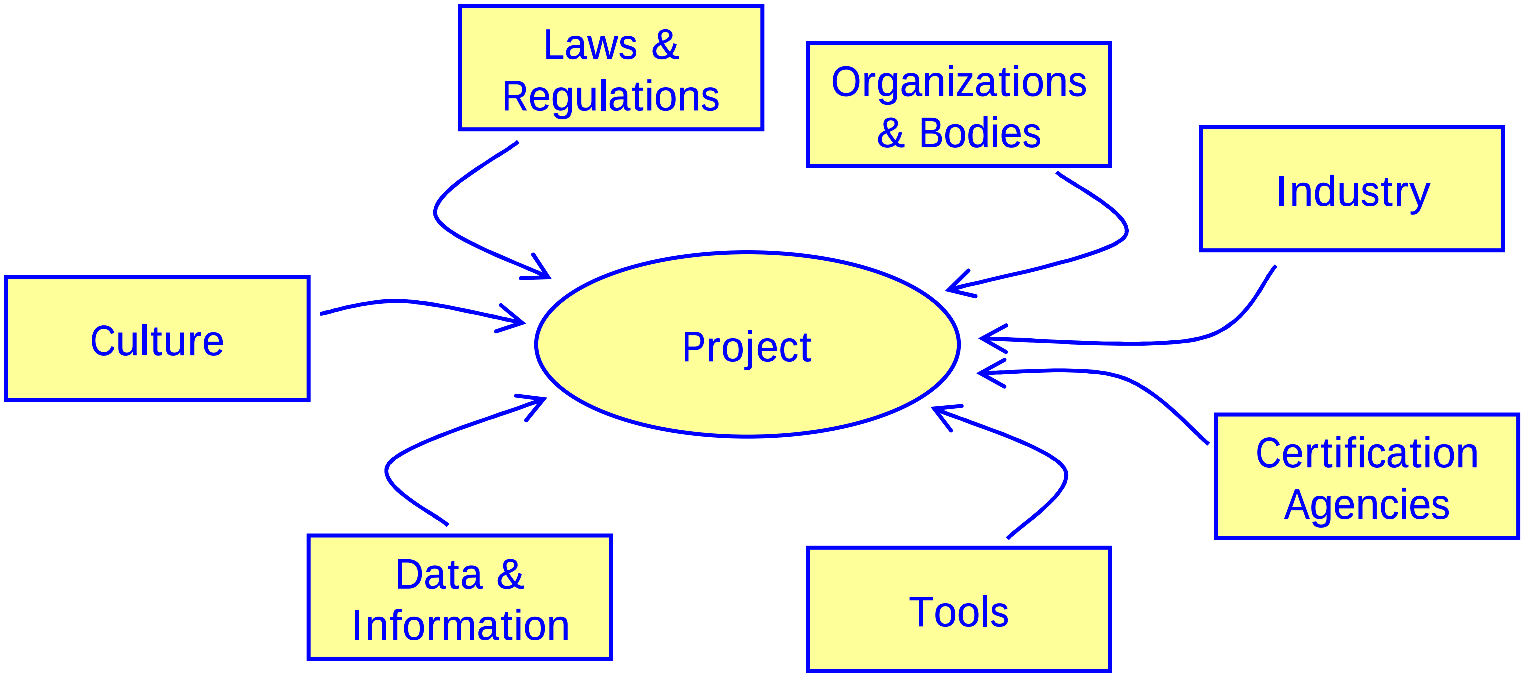
Snowmass ILC Workshop 2005
Global Group 5: Cost and Engineering

Outline

- external and internal engineering standards
- complexity of project information
- tools for collaboration support
- experience from XFEL and TTF/VUV-FEL
- conclusion

External Standards (1)

- external stakeholder groups issue requirements on project procedures, deliverables and quality
  - political interests, regional specialties, economic constraints ...

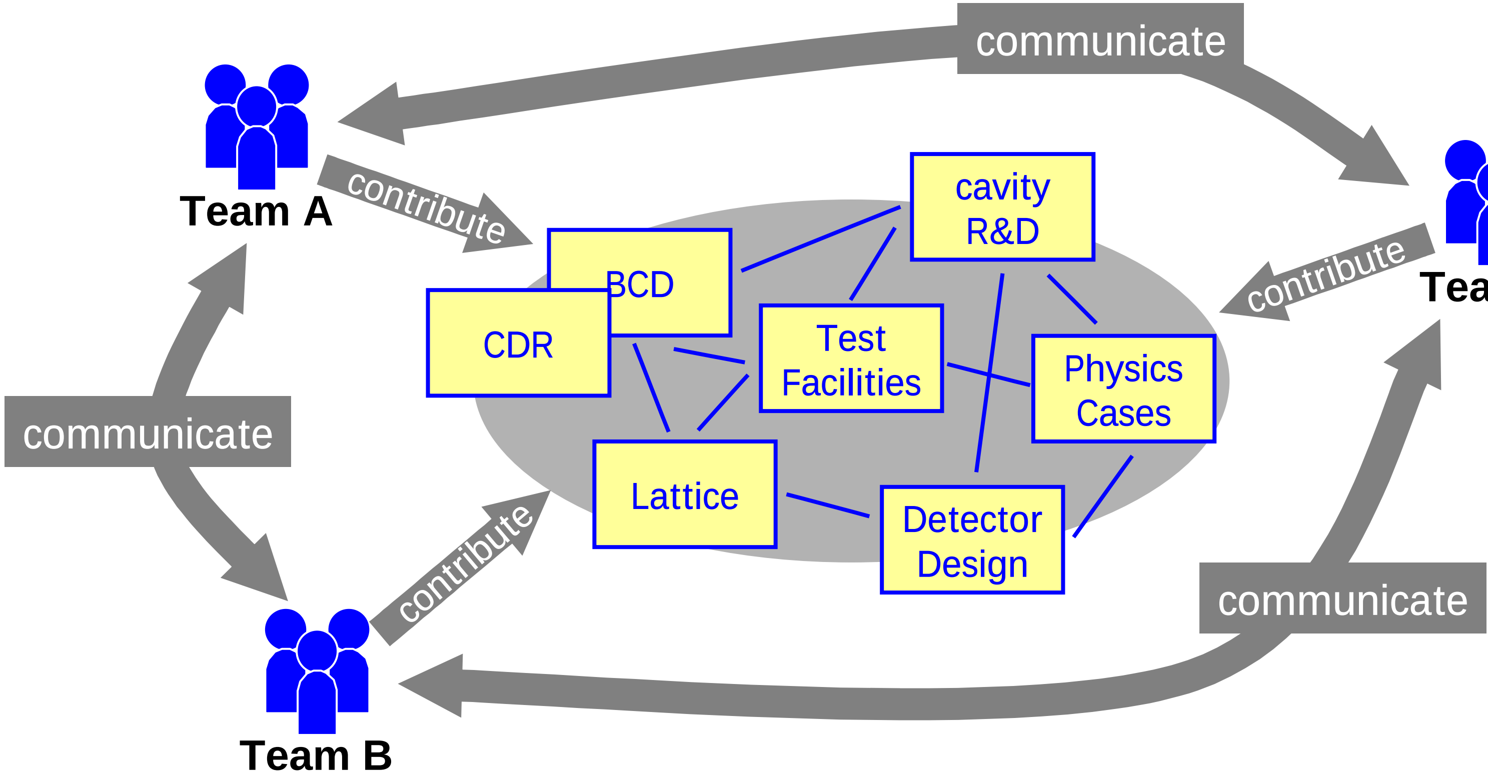


External Standards (2)

- TESLA, XFEL: state contract defines project approval process
  - single approval covers construction and operation
- collaboration to provide technical design documentation for review by public administration
  - respect public/private interests, ensure compliance with regulations
- safety concept for additional review by independent experts
  - covers construction, installation, operation and maintenance
    - technical safety, fire protection & fighting, personal safety, radiation safety ...
  - concepts: prevention, detection, evacuation, access restrictions ...
  - goal: achieve consensus between collaboration and authorities
    - room for decisions, e.g. treat buildings as office or industrial buildings, tunnel as traffic tunnel or mine ...

Inside the Project (1)

- project teams need to collaborate efficiently and prepare for extremely long product lifetime



Inside the Project (2)

- define WHAT has to be done
  - address primarily processes and process outputs
  - references e.g. from organisations, consortiums or institutes as standards (consensus) or capability models (individual assessment)
    - e.g. MIL standards, systems engineering standards and models

technical management: planning, assessment, control

acquisition & supply | system design | product realization

technical support: analysis, verification, validation

- define HOW things have to be done
  - provide e.g. document templates, inspection checklists & tolerances
  - references e.g. from institutes, agencies, national regulations ...

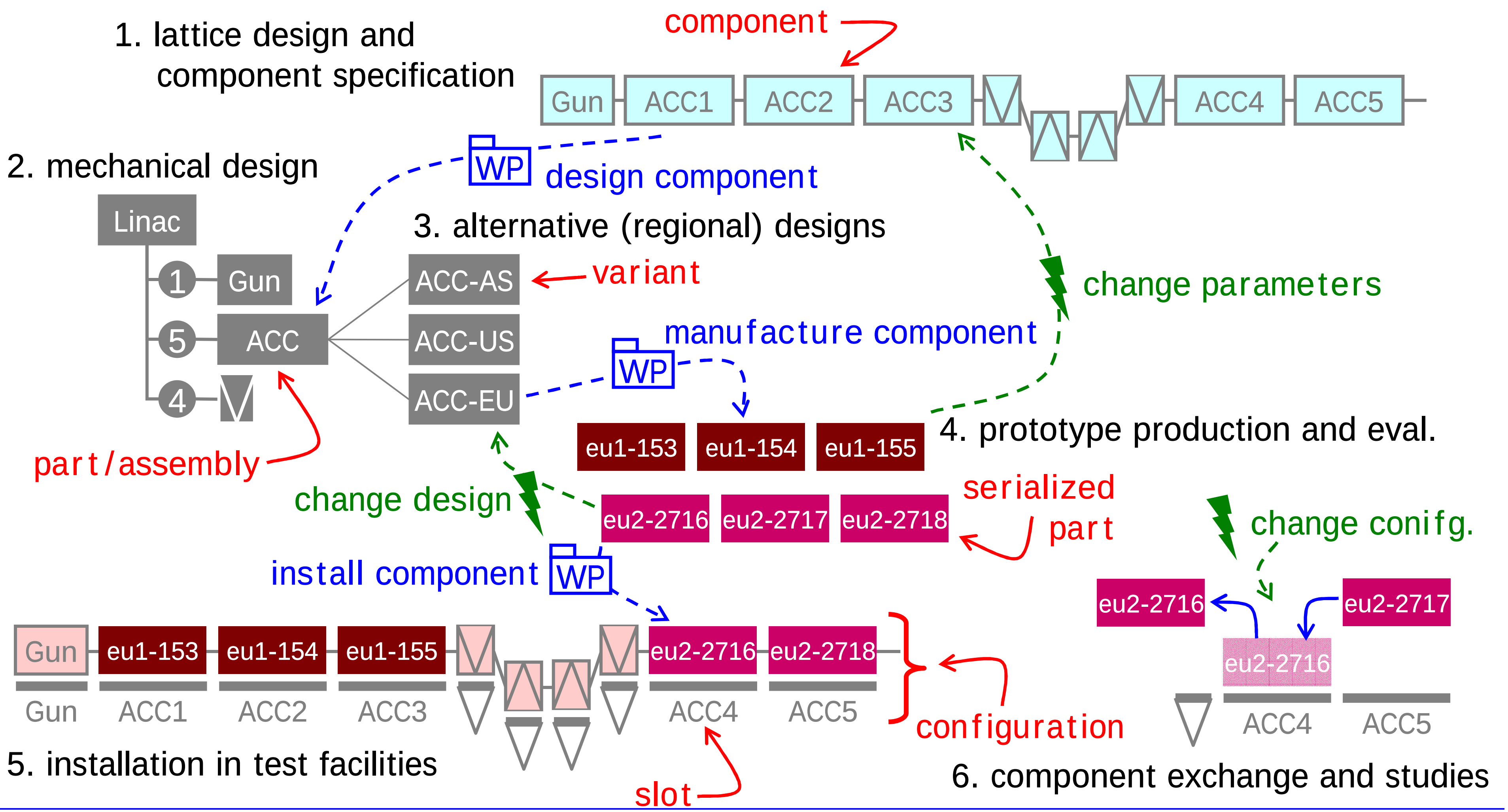
And now?

- personal feeling: internal standards are at the moment more important than external standards
  - external standards can be adopted as the project progresses
  - internal standards need to be available when the work starts
- standards have to be both relevant and helpful
  - identify which procedures and information to standardize
  - provide definitions, examples and tools to ease use of standards
- toy model for understanding what might be needed
  - the big labs are building test facilities – let's assume the test facilities were ILC pilot accelerators, all of them part of a global project under control of the GDE

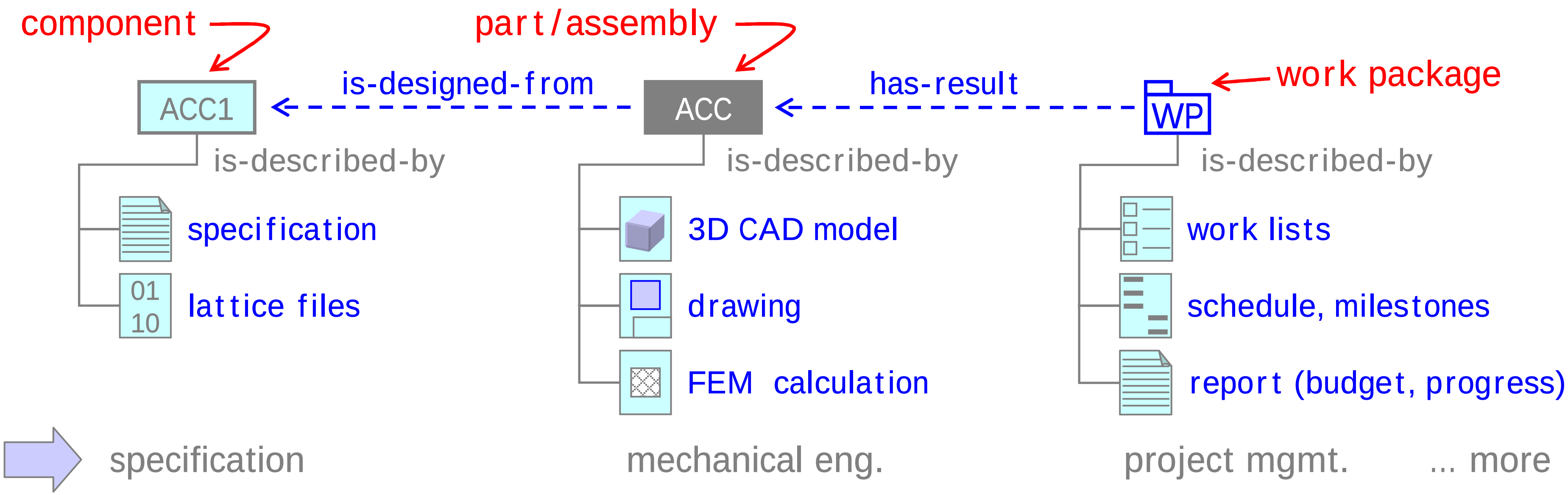
Project Information

- ad-hoc information, e.g. communication, discussion, minutes, notes, presentations
  - to be passed without further explanation along intuitive and easy-to-use communication channels
- structured information, e.g. spec‘s, contracts, CAD models
  - to be reviewed, released and stored in way which guarantees their availability throughout the project lifecycle
  - to be passed with metadata, e.g. instructions on how to use the information, keywords for information retrieval, status information.
- rule of thumb: “the magical fifteen minutes”
  - any information which takes less than fifteen minutes for authoring or for reading and understanding can be considered ad-hoc
  - everything else deserves special attention

Understanding Complexity



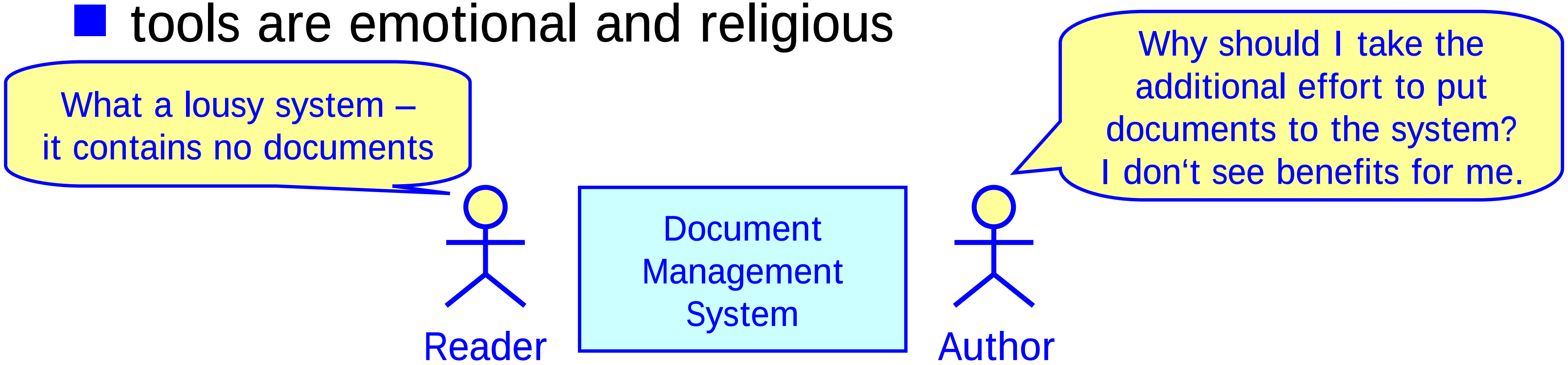
Manging Complexity



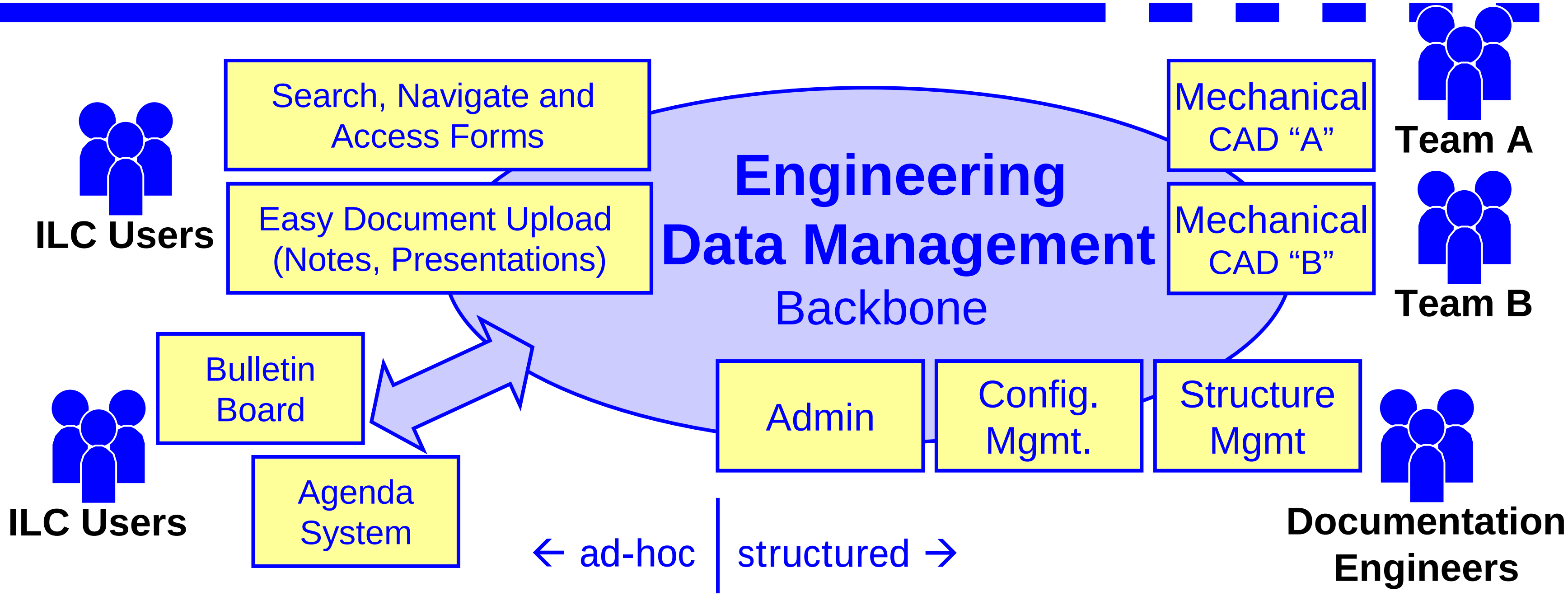
- provide leading structure for each activity
  - product and work breakdown structures, (serialized) system structure ...
  - information is created at node elements in the structures
  - establish information history and traceability between structures
- provide workflows to coordinate activities
  - create element, request for comments, review/publish, change ...

The Role of Tools

- tools should help to manage the complexity
  - understanding the complexity first is the task of the project team
  - tools need be powerful enough for the envisioned application
    - e.g. manage documentation, establish traceability, coordinate workflow
- tools have to be accepted by their users
  - investments into ergonomics and performance
  - but: acceptance should not be a wild card for an infinite wish list
- tools are emotional and religious



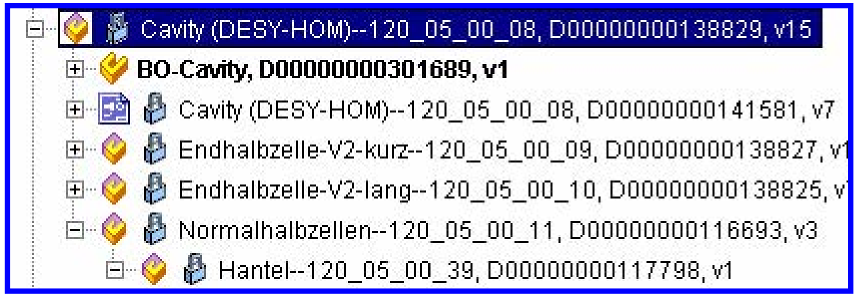
Collaborative Tool Concept



- strategy: powerful backbone with (few!) selected frontend applications
  - consolidated ad-hoc information → summarize for archival
- HEP-wide licenses for EDMS + interfaces by system provider
  - staged model: provider, HEP collaborator, industrial supplier
- Documentation Engineers needed for quality assurance

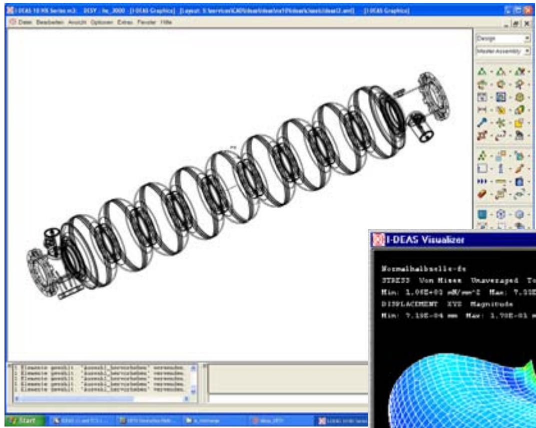
Frequent Abbreviations
EDM: Engineering Data Mgmt
PDM: Product Data Mgmt
PLM: Product Lifecycle Mgmt

3D or not 3D?

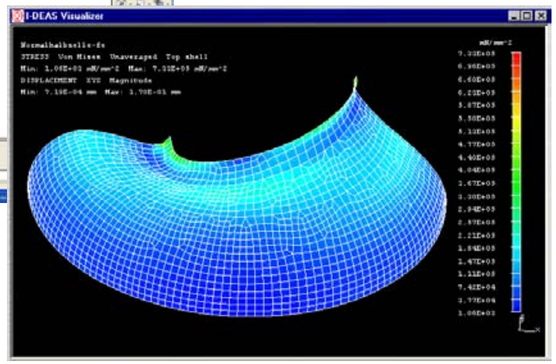


product data structure in CAD data manager

- 3D CAD is leading design tool
  - product structure definition
  - interactive part exploration
  - collision analysis, mechanical and thermal simulation, visualization ...



3D CAD system



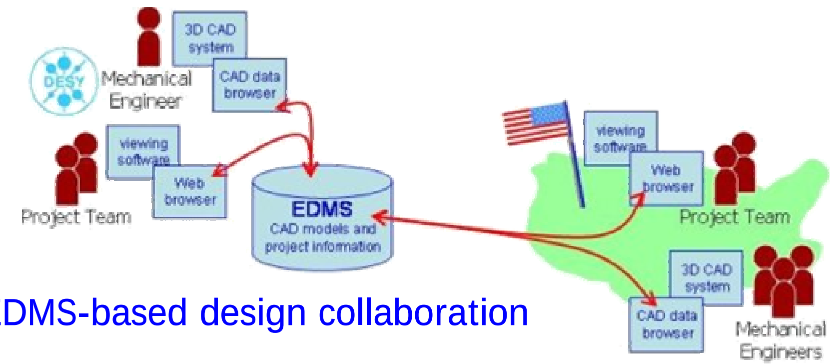
FEM solver

Experience from TTF/VUV-FEL

“GDE” of Cryomodule (1)

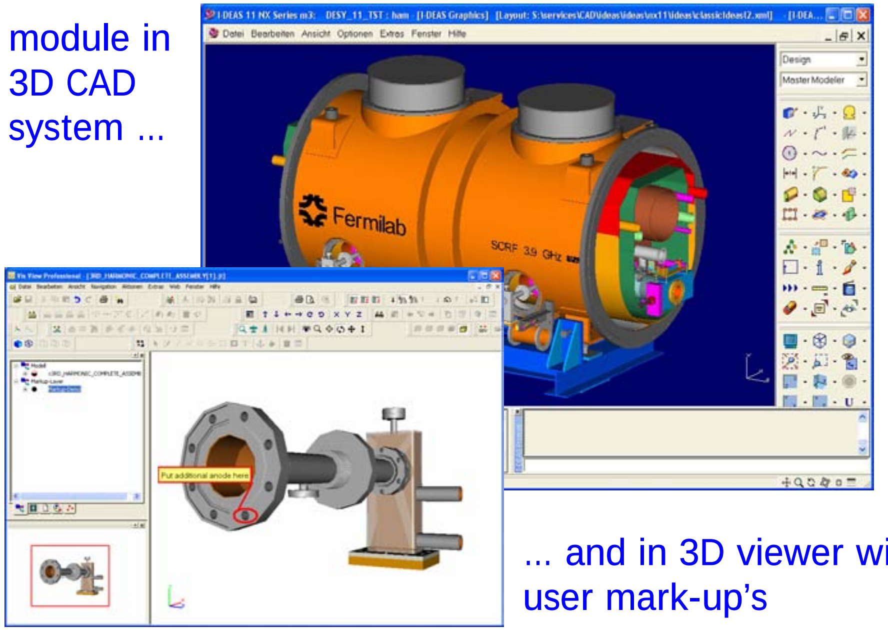
- Fermilab and DESY jointly develop “3.9 GHz 3rd Harmonic Cryomodule” for TTF/VUV-FEL based on TESLA modules
  - mechanical design and production at Fermilab
  - embedding infrastructure design and installation at DESY
  - tight interaction for interface design and CAD model reviews
- Fermilab and DESY connected their 3D-CAD-systems using DESY's EDMS
  - single point of access and a single source of data for project team
- EDMS improves remote collaborative engineering work
  - engineers can access each other's CAD data → interface design
    - viewers: non-CAD-users can inspect & comment on the CAD models
    - design reviews can be performed remotely to a large extent
  - need for travel is reduced and interaction is increased.

Experience from TTF/VUV-FEL
"GDE" of Cryomodule (2)

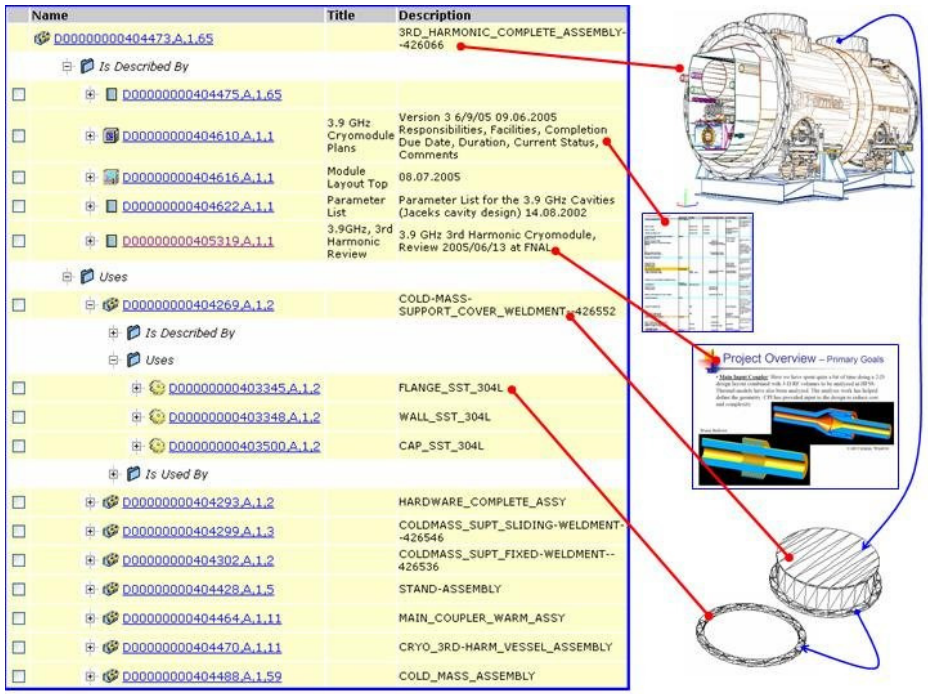


EDMS-based design collaboration

module in 3D CAD system ...



... and in 3D viewer with user mark-up's

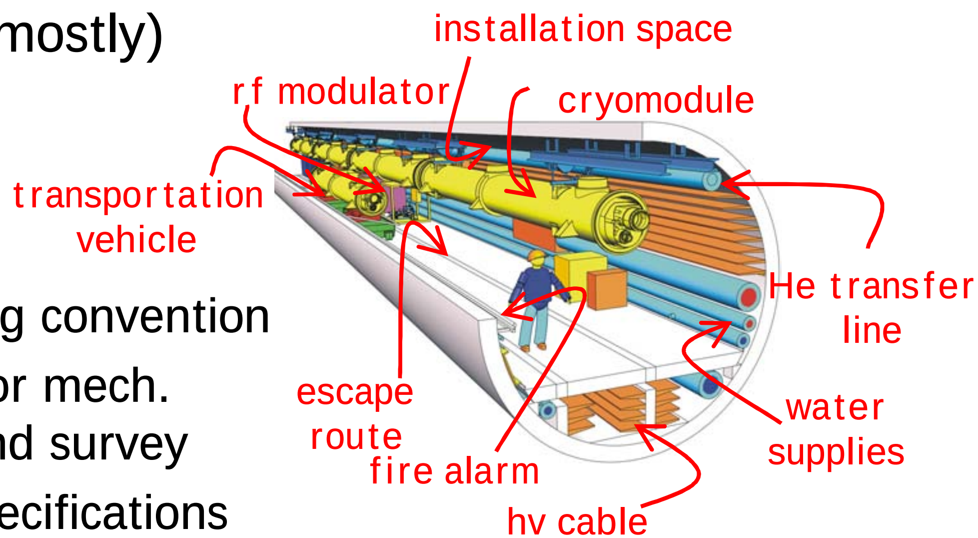


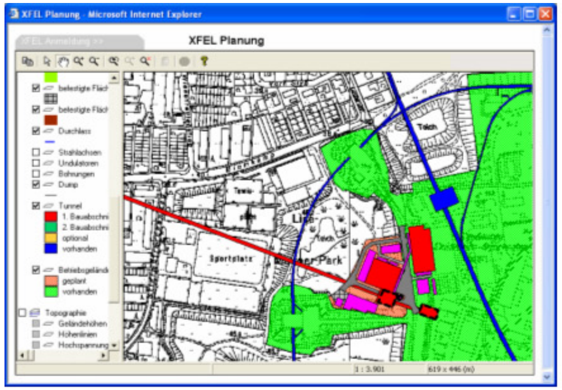
information objects and their relations in the EDMS Web client

Experience from XFEL

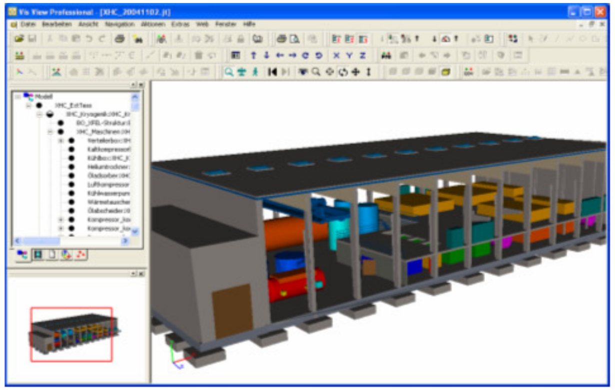
XFEL Site Planning

- component models owned and (mostly) maintained by expert groups
  - common model for coordination
- internal engineering standards
  - part breakdown structure naming convention
  - coordinate system transform's for mech. and civil eng., alignment and land survey
  - classification of requirements specifications





GIS for site planning

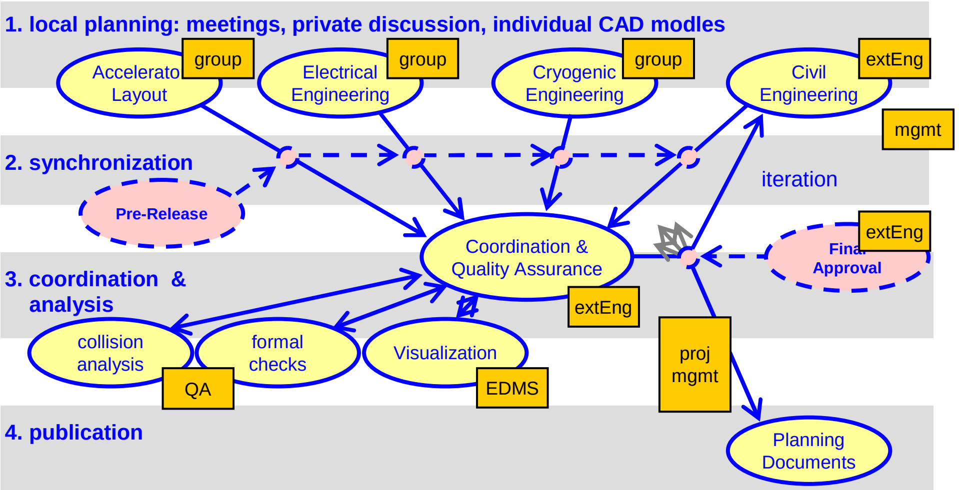


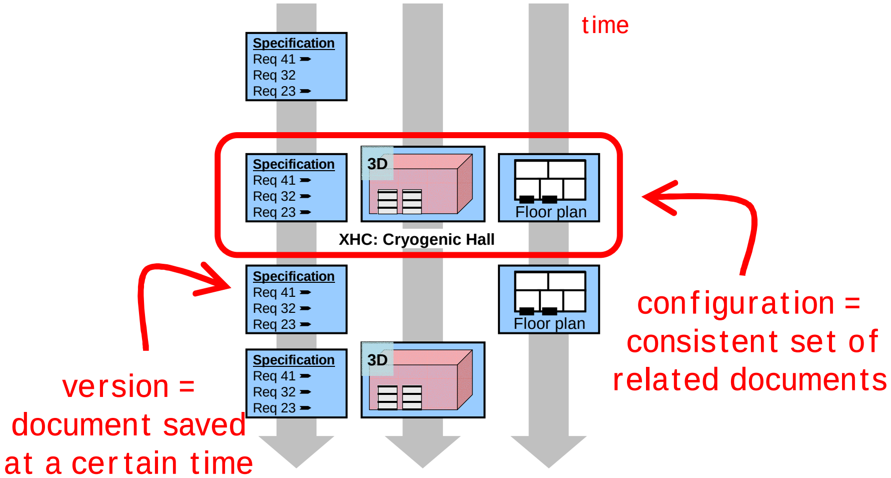
3D CAD & visualization tool

virtual world using CAD data

Experience from XFEL

Coordination of Activities

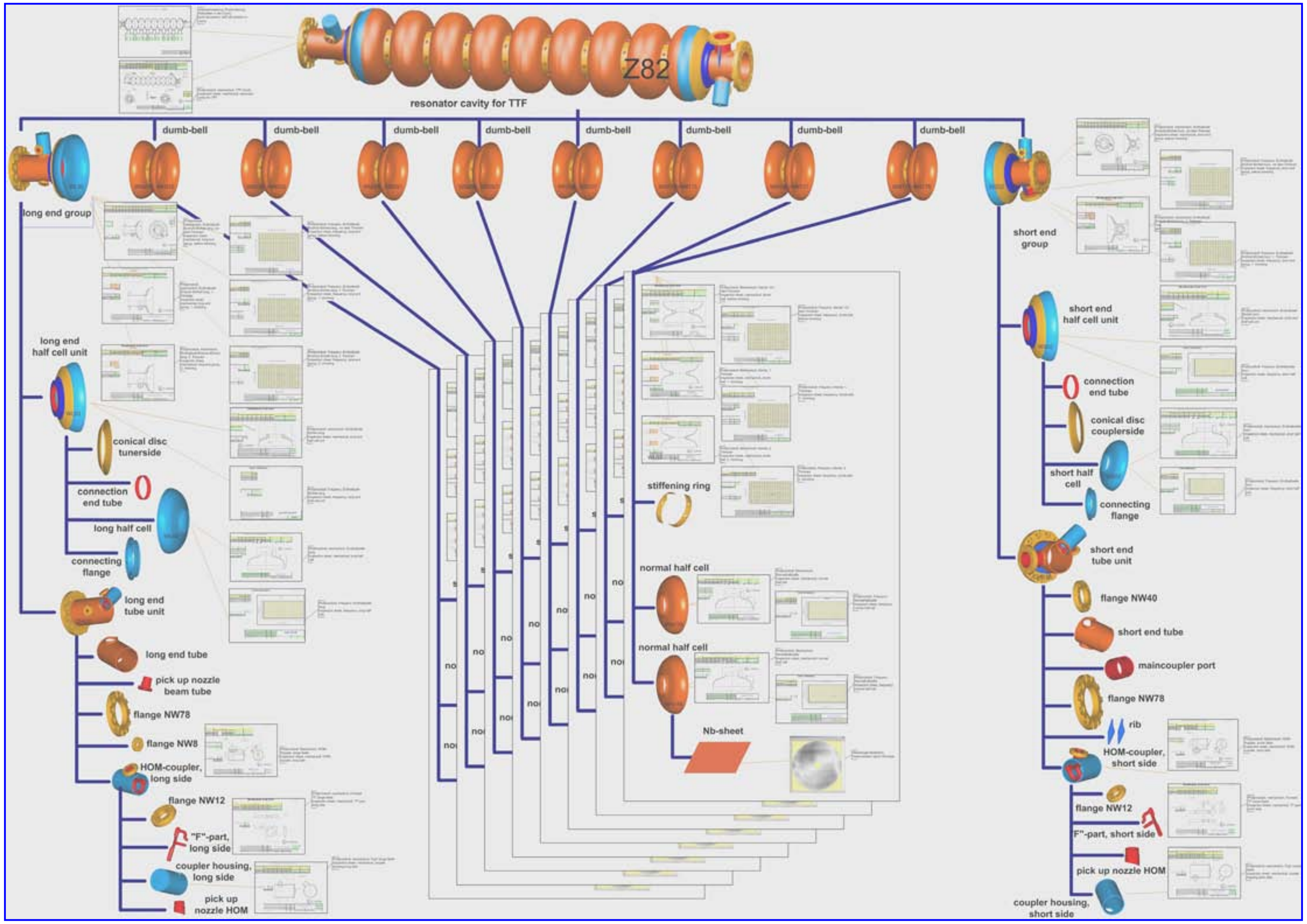




- collaborative, highly iterative planning procedure evolving
  - local independent planning work
  - to be integrated and coordinated at regular time intervals
- configuration management of planning documentation
  - incl. specifications, 3D models, drawings, approval checklists
  - "baseline" marks consistent sets of documents
    - tracks which documents have been delivered when to whom
- procedures coordinated by EDMS using workflows

Experience from TTF/VUV-FEL

Cavity Preparation



Conclusion (1)

- need inside standards now
  - processes, structures and terminology to be ready first
    - standards, templates, examples to be provided
  - quality has to be designed, not checked into product
- need to get going, but not think too small
  - people are tool-driven → provide well thought-out “how-to” material to control “what” is being done
  - document management is not enough
    - powerful backbone product with (few!) adaptable frontends
    - 3D CAD is the most important design tool
    - extend 3D CAD version, config & change mgmt to doc mgmt
  - but: first step – collect the requirements

Conclusion (2)

- significant resources required
  - quality assurance team, change control board ...
  - HEP-wide licenses for tools + interfaces: from system provider?
- envisioned tool implies cultural change
  - will and can all the laboratories share their knowledge, surrender to a single set of rules, and provide extra resources for collaboration?
  - how does industry fit the scenario?
- a glance at industry
  - same challenge, same approch, same tools, more money, more hierarchy, better achievement
- a warning: before, information we needed might not have reached us – in future, any information might reach us ...
  - need to avoid information overflow!