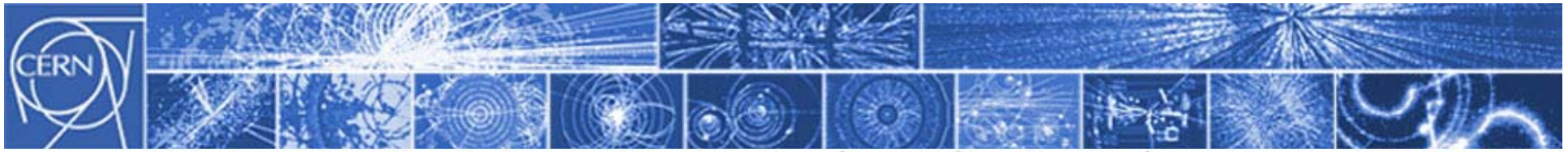


CERN
European Organization for Nuclear Research
Organisation Européenne pour la Recherche Nucléaire

Integrated Project Support Study Group Findings

Study Group Members

Jurgen De Jonghe	IT-AIS
Christophe Delamare	TS-CSE
James Purvis	IT-AIS (Chair)
Tim Smith	IT-UDS
Eric Van Uytvinck	TS-CSE

Additional Contributions from

Jean-Yves Le Meur	IT-UDS
Per-Olof Friman	TS-CSE
Timo Tapio Hakulinen	TS-CSE
Nils Høimyr	IT-CS

Thanks for supporting information from

Alessandro Bertarelli	TS-MME
Johan Burger	DESY
Ramon Folch	TS-MME
Lars Hagge	DESY
Don Mitchell	FNAL

James Purvis

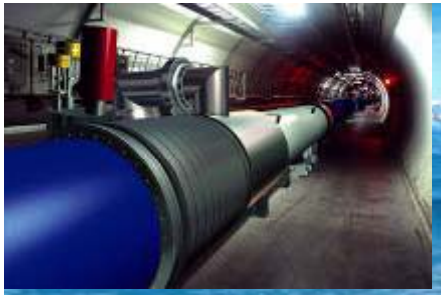
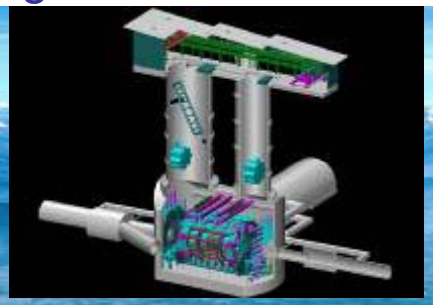
HR

Recruitment, Programmes & Monitoring

Full report:
https://edms.cern.ch/document/1247665684/1
http://cdsweb.cern.ch/record/971016/

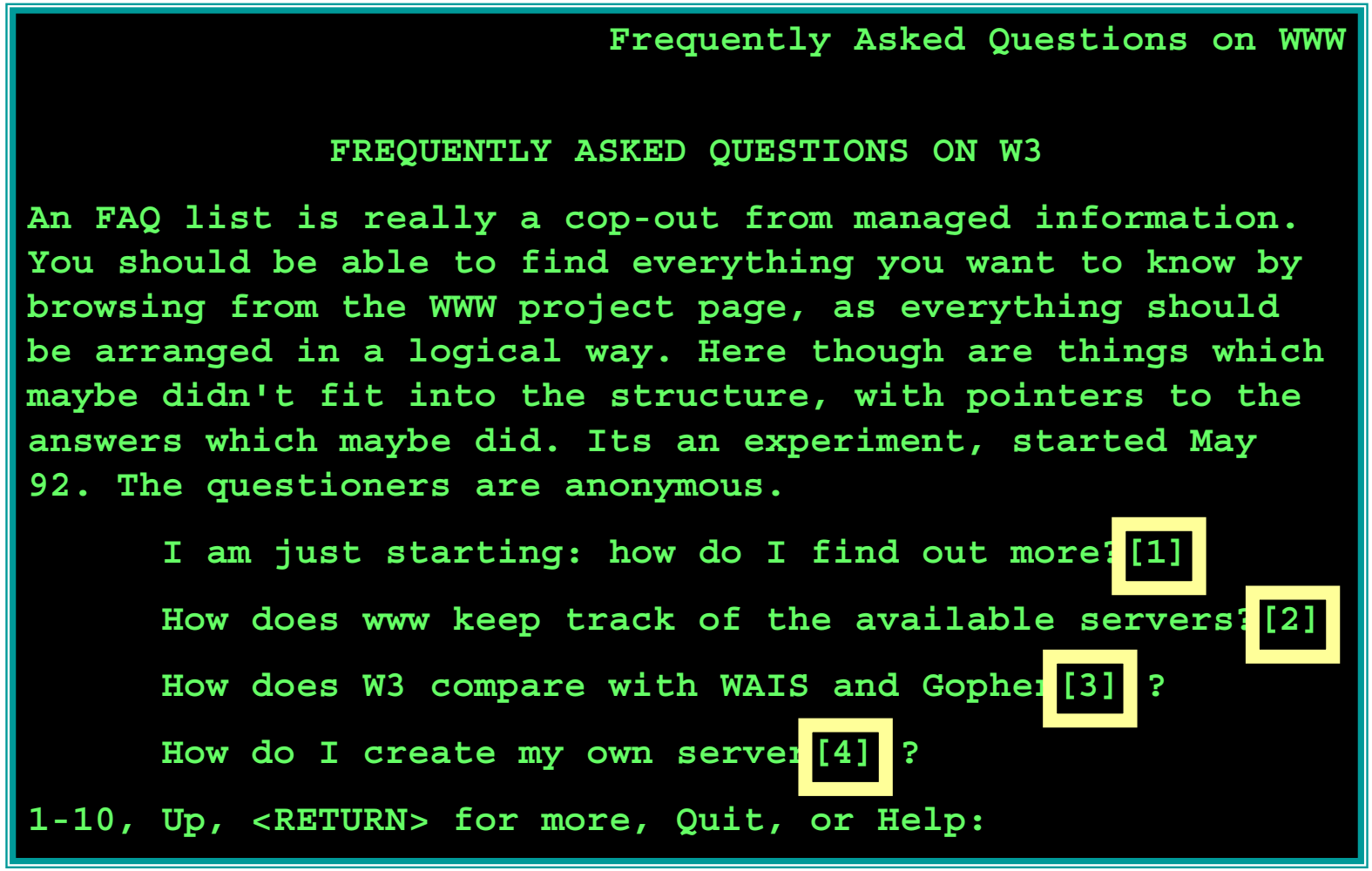
The Challenge

Build the worlds largest scientific instrument…

- **LHC Project : 3bn CHF project, 11,000 workunits, 200 Companies,**
- **Experiments : 146 institutes, 33 countries**
- **Contract Management, Workflow, e-business, safety, admin, customs procedures...**
- **Increased Expectations with Reduced Resources**

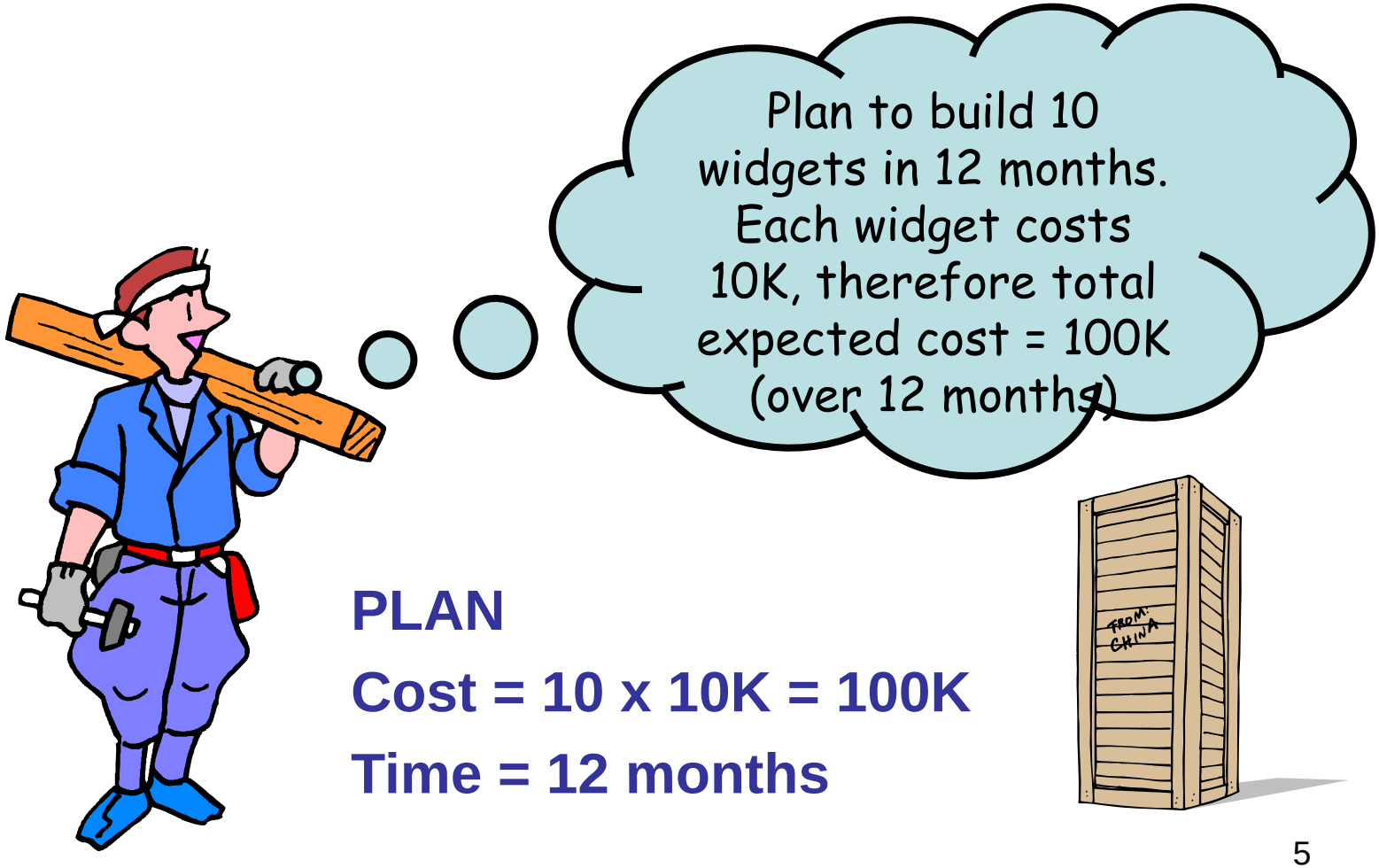
The Tools


Frequently Asked Questions on WWW
FREQUENTLY ASKED QUESTIONS ON W3
An FAQ list is really a cop-out from managed information. You should be able to find everything you want to know by browsing from the WWW project page, as everything should be arranged in a logical way. Here though are things which maybe didn't fit into the structure, with pointers to the answers which maybe did. Its an experiment, started May 92. The questioners are anonymous.
I am just starting: how do I find out more? [1]
How does www keep track of the available servers? [2]
How does W3 compare with WAIS and Gopher [3] ?
How do I create my own server [4] ?
1-10, Up, <RETURN> for more, Quit, or Help:

The Tools

- CAD (Euclid/CATIA)
- Earned Value Management (EVM)
  - Project schedule & costing of the accelerator
- Project Progress Tracking (PPT)
  - Project management of the experiments
- Engineering Data Management System (EDMS)
- Indico
  - Event, Agenda, Conference Management
- CERN Document Storages (CDS)
  - Long term archiving

EVM in 60 seconds

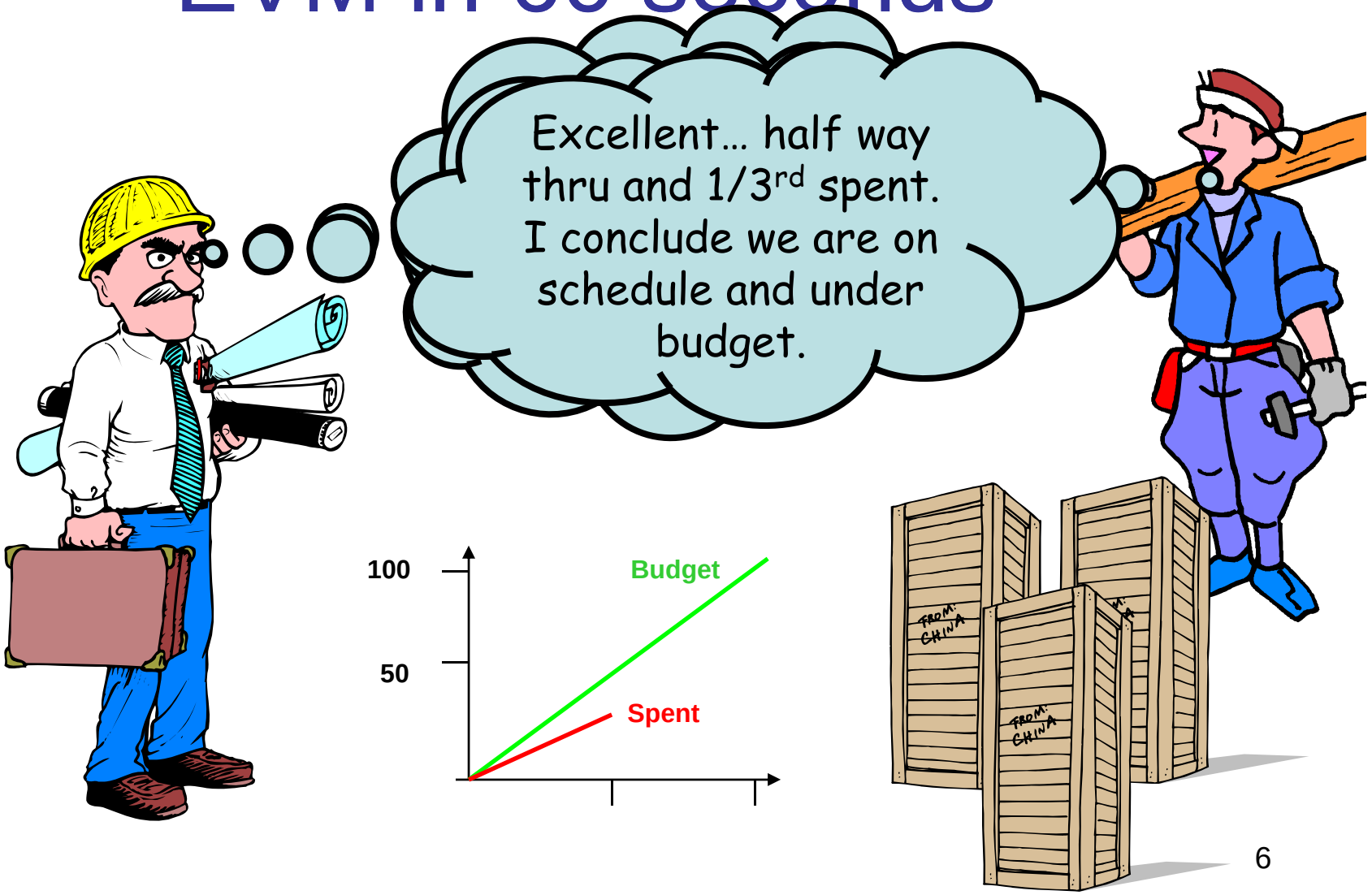


PLAN

Cost = 10 x 10K = 100K

Time = 12 months

EVM in 60 seconds



EVM in 60 seconds

An EVM expert

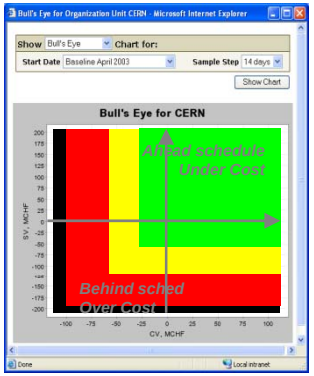
Remember: Joe planned to build 10 widgets in 1 year for 100K

In Reality: Joe has built 3 widgets in 6 months at a cost of 36K

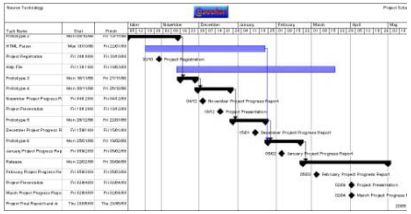
Question: How long will it take him to build 10 widgets and at what cost?

Answer : 120K in 20 months

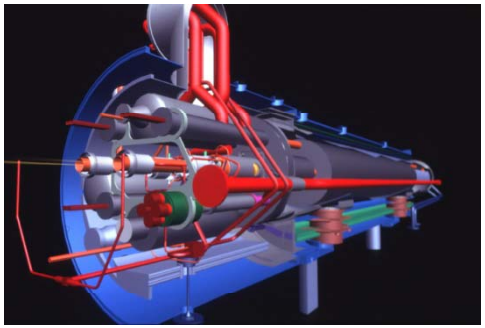
The future?



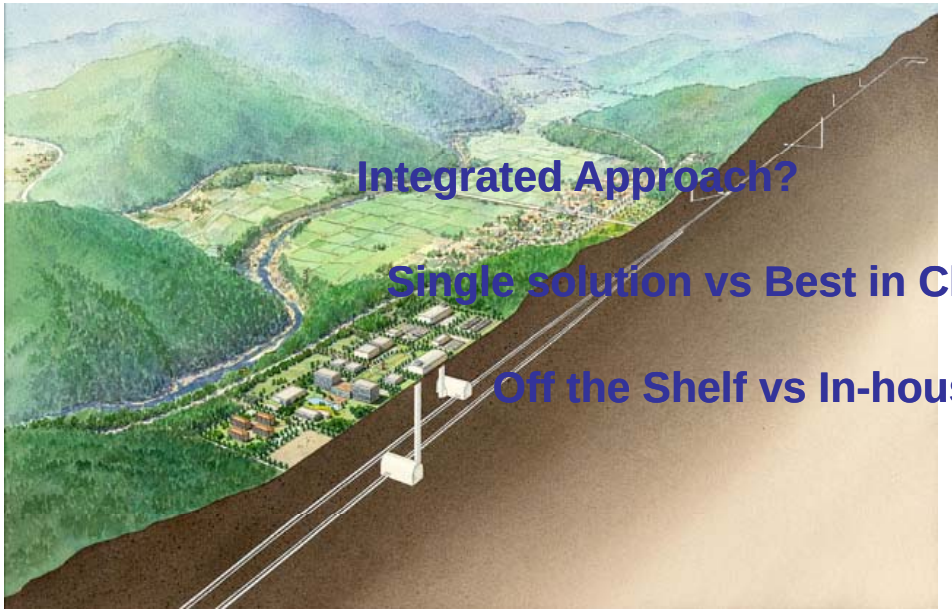
Earned Value Management



Project tracking



CAD management



Integrated Approach?

Single solution vs Best in Class?

Off the Shelf vs In-house?

Engineering Document Management

Global Collaboration

Integrated Project Support Study Group Mandate

***From the Director General**. Reviewing the offering on the eve of LHC commissioning one can identify three major challenges:*

1. How to integrate the tools to provide a uniform and **integrated full-product lifecycle solution**

2. How to evolve the functionality in certain areas to **address weaknesses** identified with our experience in constructing the LHC and integrate emerging industry best practices

3. How to coherently package the offering not just for future projects in CERN, but moreover in the context of providing a **centre of excellence for worldwide collaboration in future HEP projects**.

Study Group Members

Jurgen De Jonghe
Leader of Project Management Tools Section
Implementor of EVM & PPT

Christophe Delamare
Leader of EDMS Section

Tim Smith
Leader of UDS

Eric Van Uytvinck
Leader of CAD

James Purvis
IT-AIS

Review Calendar

Meeting between DG, JP Delahaye, J. Ferguson, W. Von Rüden :	3-Apr-2006
Meeting between W. Von Rüden & J. Purvis :	4-Apr-2006
Study group participants selected :	7-Apr-2006
Initial meeting of Study Group (scope/mandate):	10-Apr-2006
Mandate of study group sent to DG :	13-Apr-2006
PPT/EVM Analysis Meeting of Study Group :	12-Apr-2006
UGS teamcenter presentations/visit :	20-Apr-2006
	16-May-2006
	23-May-2006
Dassault presentation/visit :	10-May-2006
	17-May-2006
EDMS Analysis Meeting of Study Group :	21-Apr-2006
Revised mandate given to study group :	24-Apr-2006
CDS/Indico Analysis Meeting of Study Group :	25-Apr-2006
CAD Analysis Meeting of Study Group :	26-Apr-2006
PLM/multicad analysis meeting with UGS Teamcenter :	27-Apr-2006
Discussion with I. Neilson for Grid VOM solutions :	2-May-2006
Discussion with A. Pace for Certificates :	8-May-2006
Discussion with E.V.Bij for CAE :	9-May-2006
Visit to DESY :	18/19 May 2006
Status report to Wolfgang Von Reuden :	22-May-2006
Visit to UGS to test CATIA-TeamCenter integration :	23-May-2006
Methodology Discussion with R. Folch & A. Bertarelli of TS-MME:	24-May-2006
Conference Call with Dassault :	29-May-2006
Final Costing Scenario Analysis :	29 May 2006
PLM Summit	26-28 June 2006
DG Decision	4th July 2006

DG request

Management involved

Cross-functional team

Cross-departments

Discussions with Suppliers

Input & Advice from Domain Experts

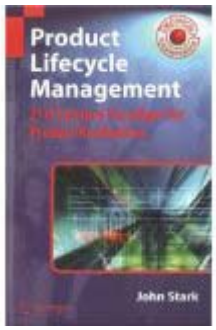
Cross-laboratory International Collaboration

Learn from Experience

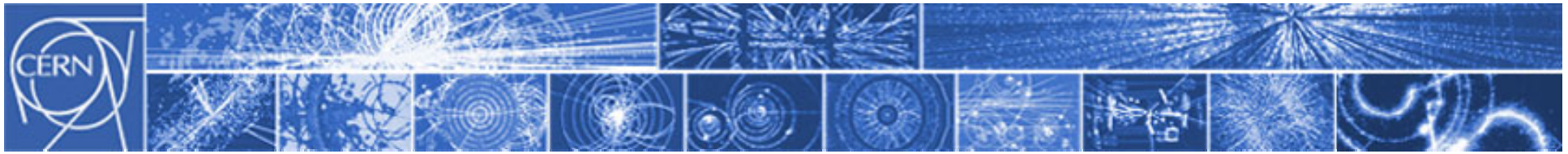
Examine Industry Best Practices

PLM Summit (June 06)

- Dr. Marc Halpern, Gartner
  - Worked with CERN in past
- Dr. John Stark, PLM Guru
  - Did his PhD at CERN!



- Discussions with : GM, Lockheed Martin, Honeywell, UGS, Oracle, SAP, Red Bull, Meyn Food, VW, A380
- Emerging combinations : CATA v5 CAD winner, TeamCenter is PLM/PDM leader
- CATIA & UGS not uncommon (e.g BMW)



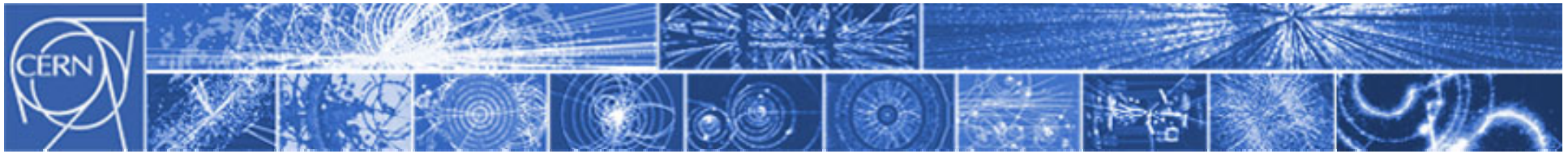
SWOT

Strengths
- Leading edge toolset
- Knowledge & Experience
- Choice of CATIA
- CERN's Web experience

Weaknesses
- No integration
- PDM is 2D-centric (not 3D)
- Missing item notion in design stage
- Some design errors detected too late
- CERN EDMS vs TeamCenter gap
- Early adoption of web

Opportunities
- Move to CATIA
  - Culture change?
  - Change to 3D/item?
  - Introduce new PLM?
- Become centre of excellence
- Future international support
- Integrated toolset?
- CLIC/ILC & DG's interest

Threats
- Do as before
- Lose future projects to Labs with more modern tools
- For future CERN, errors detected too late, too high cost?
- Investment (lack of)



PLM Challenges today

- Management of CERN CAD designs today is **document-centric** as opposed to being **item-centric**
- Current CAD data management system **lacks support for fully interoperable multi-CAD configuration management**
- At best managing CAD drawings, but **unable to manage interdependencies** and versioning between various components
- Item concept **misses link to original design** data

Goal

Introduce full product lifecycle management, CAD interoperability and configuration management

Issue Overview

Coherency: Can I guarantee the design of dependent components won't evolve?

Maintenance : Can I trace defects to the original design?

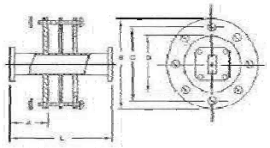
Idea | Plan | Design | Build | Install | Operate

Casual 3D "gaseous phase"

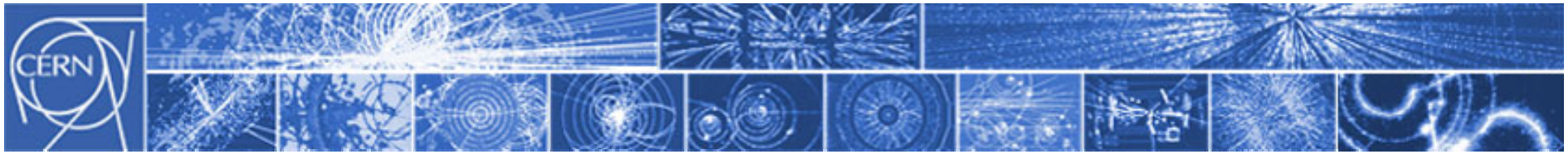
Assembly : Can I guarantee all the parts of an assembly will fit together?

2D

workflow



Traceability : Can I trace the prototype to the design?



Observations

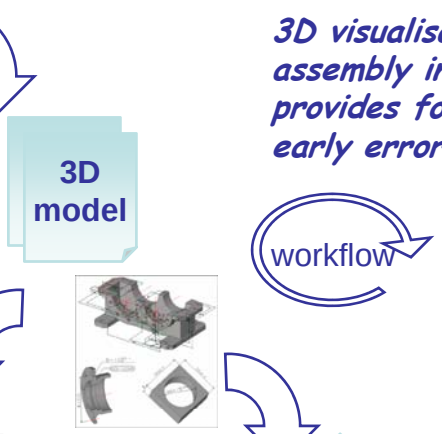
- Fermilab & CERN
  - Deliverable at design stage are 2D plans
  - Approval workflow based on 2D view
  - Problems missed, found at later & more expensive build phase

Future

Defects traced to earliest possible stage

Casual 3D "gaseous phase"

3D visualisation of assembly in workflow provides for rapid & early error detection

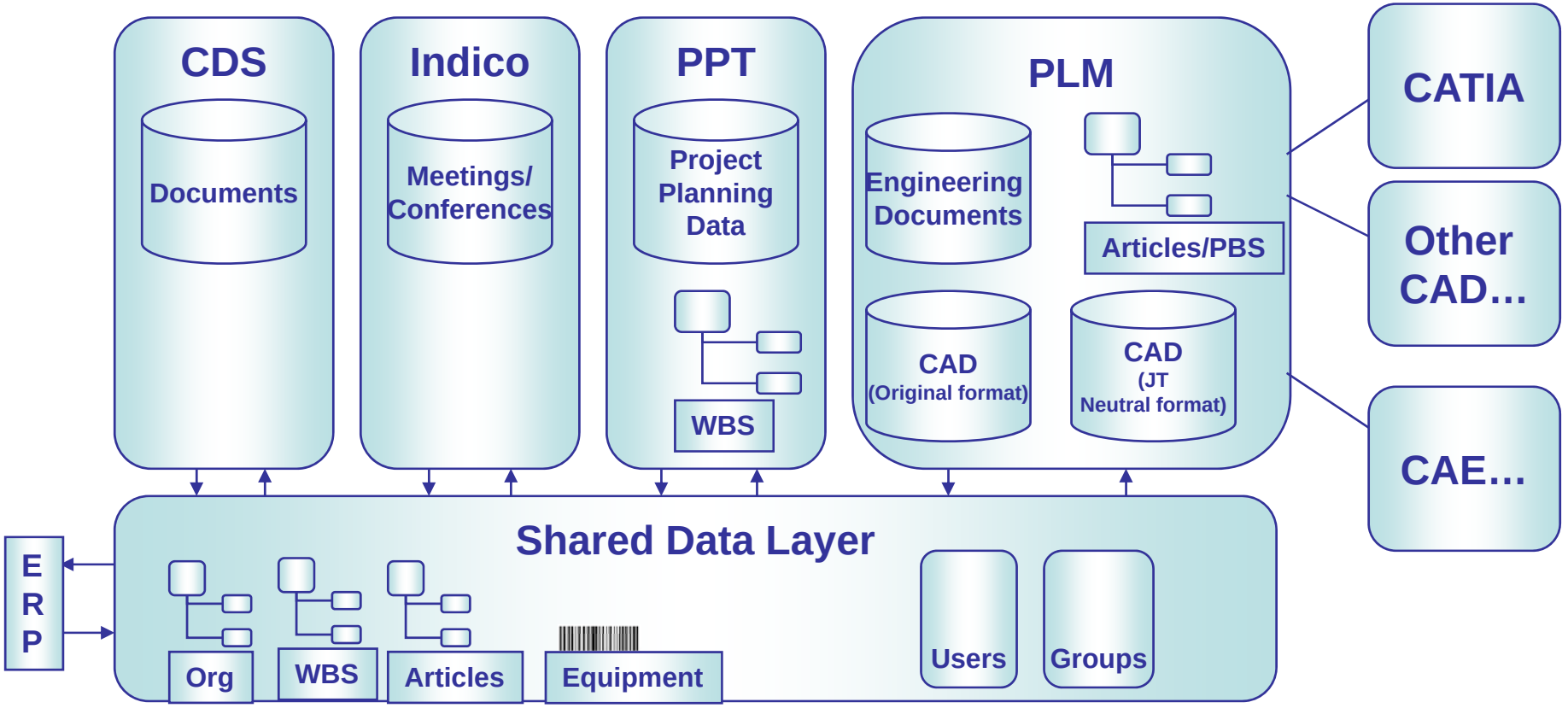


All Items/ Assembly declared even in prototype phase

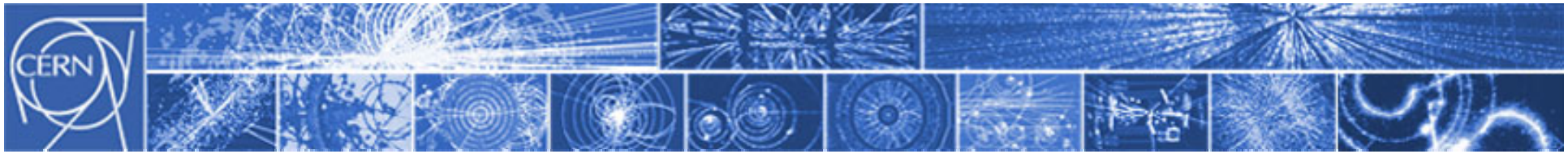
2D plans (where necessary)

Invalidates assemblies if dependent components altered

Integrated Solution Architecture



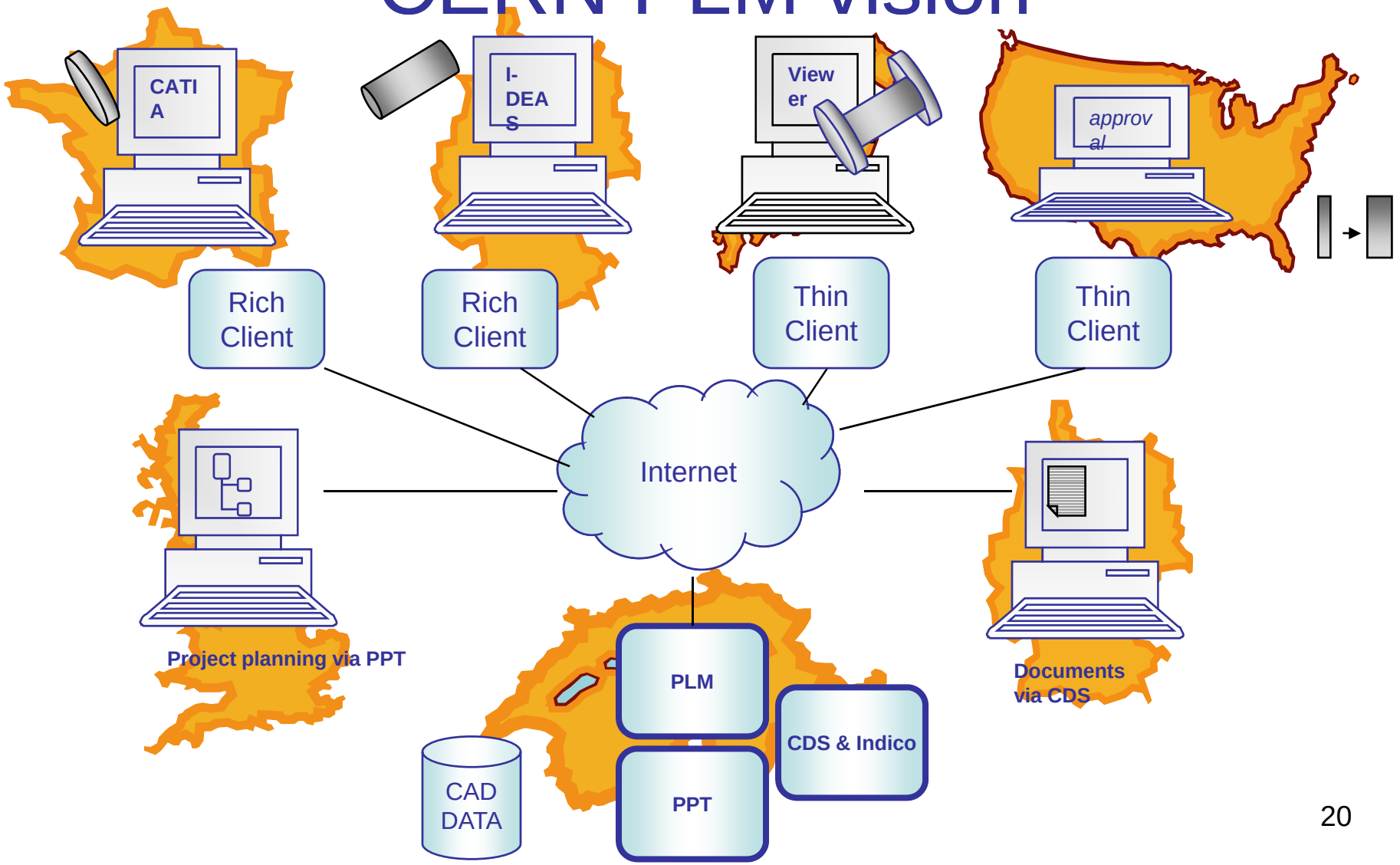
Requirement to “future-proof” existing investments…

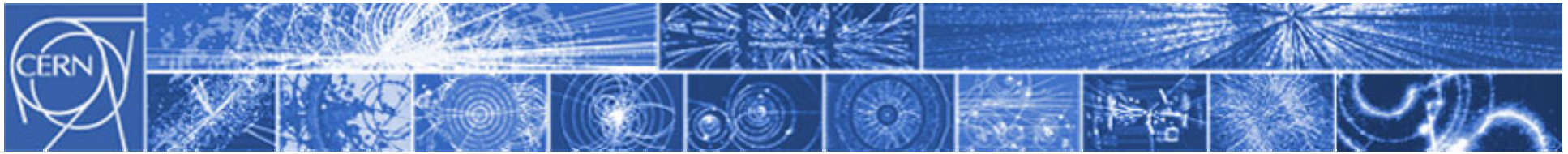


ILC observations

- Design already quite advanced
  - Major players DESY & Fermi using IDEAS
  - DESY ILC Teamcenter operational
- CERN
  - 1 year before operational
  - (DESY 1 yr + half year * 2.5 UGS consulting, Fermi 2 years still not oper and they have x-UGS recruits!)

CERN PLM vision

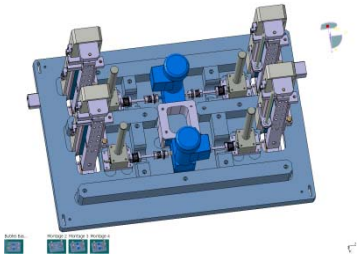
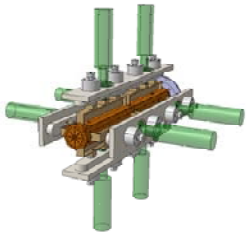
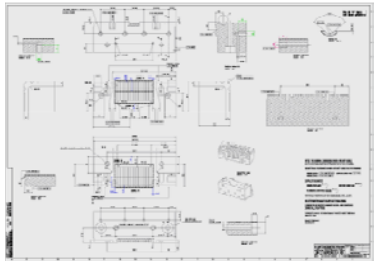
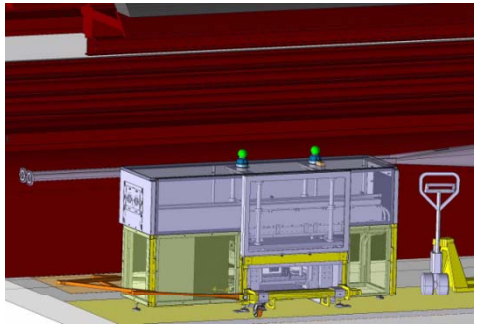
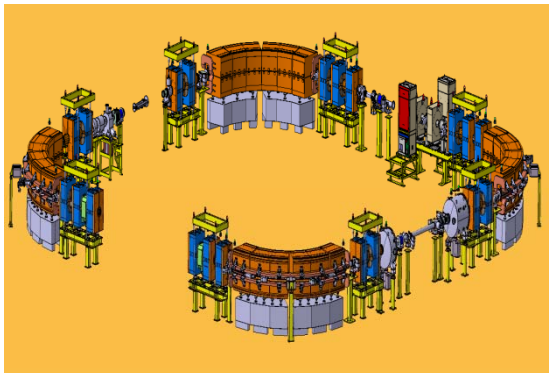
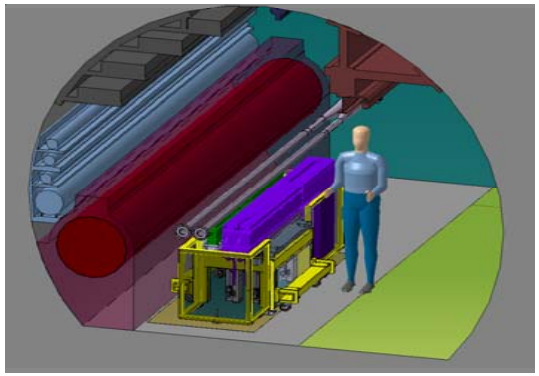
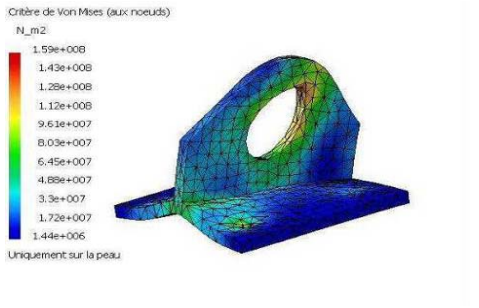




2008 UPDATE

Migration to CATIA

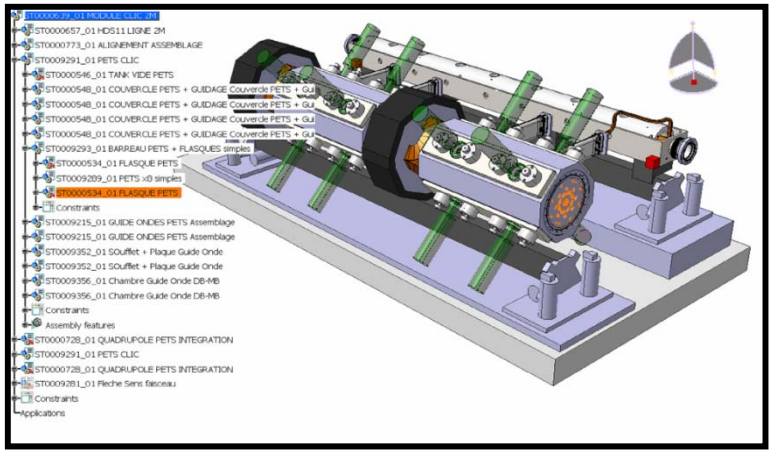
- CATIA is a modern parametric 3D CAD system widely used in industry.
- It is a all-in-one multidisciplinary CAD tool with dedicated modules for many specific trades; (Mechanical design, cabling, FEA, machining, ergonomics, etc)

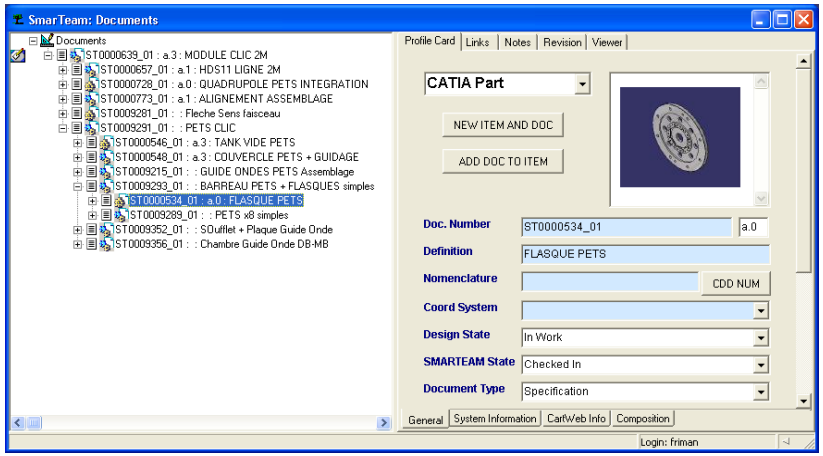
CATIA and Smarteam

- CATIA is, like all modern 3D-CAD systems, generating a large amount of files with many references between them.
- Today therefore all 3D-CAD systems are used together with a data management tool to help keeping track of these links.
- The tool used for CATIA data management is Smarteam, which also is a product from Dassault systems ensuring a tight integration between the two tools.

CATIA

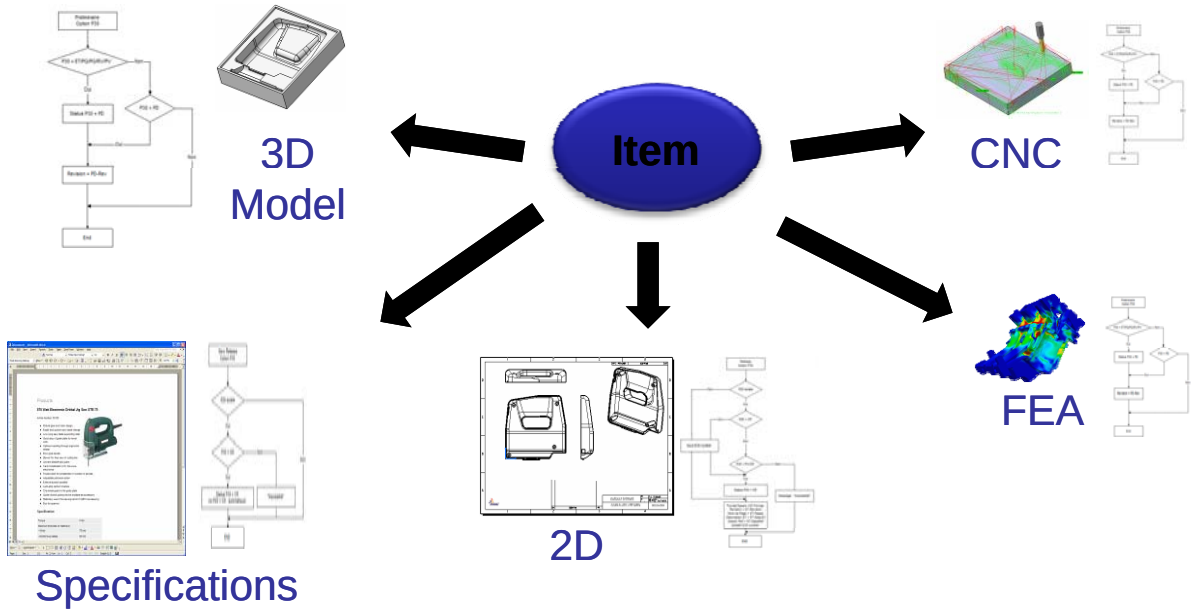


Smarteam



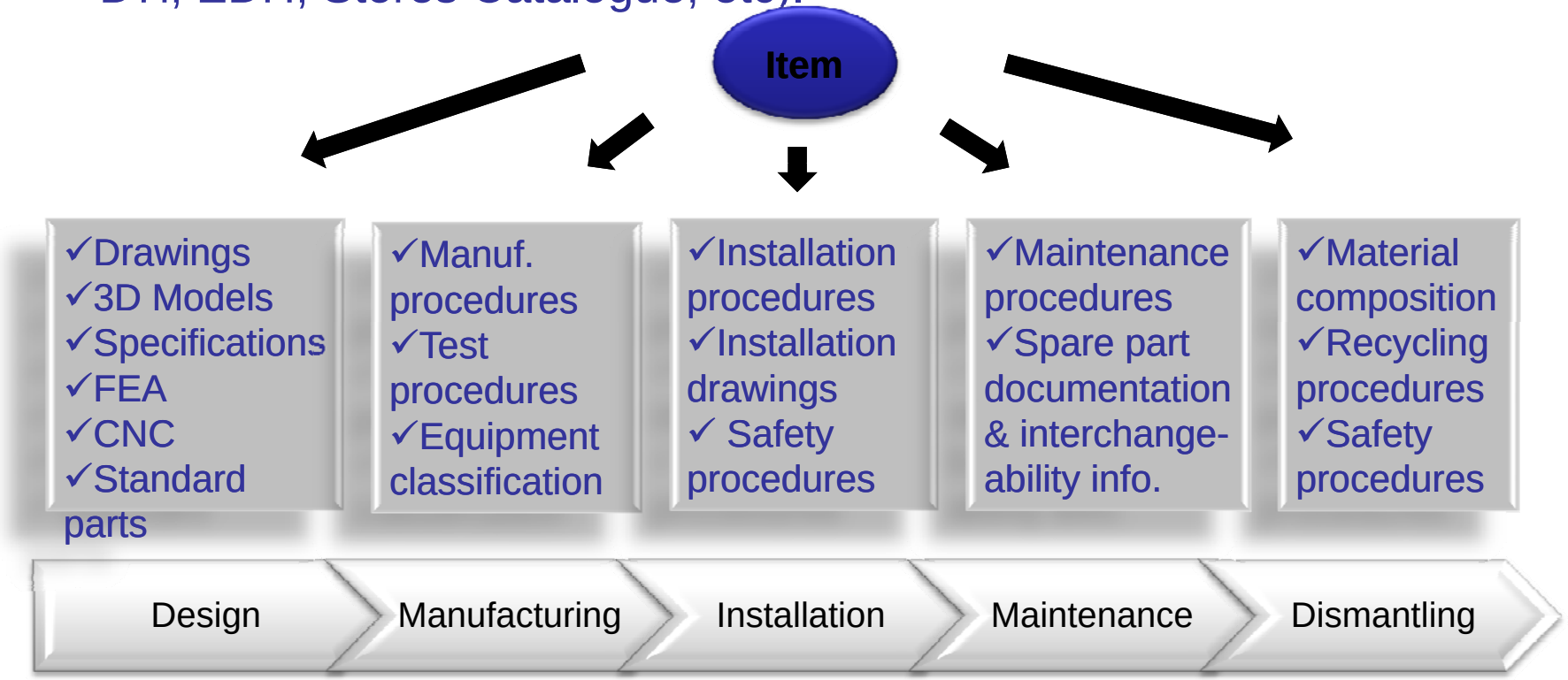
An item-centric approach

- CATIA/Smarteam provides a simplified data management approach where all information about a part or assembly is linked to an Item.
- This Item-centric approach makes it easier to find information, it allows grouping of information that belongs together and it can improve the workflow of approving designs.

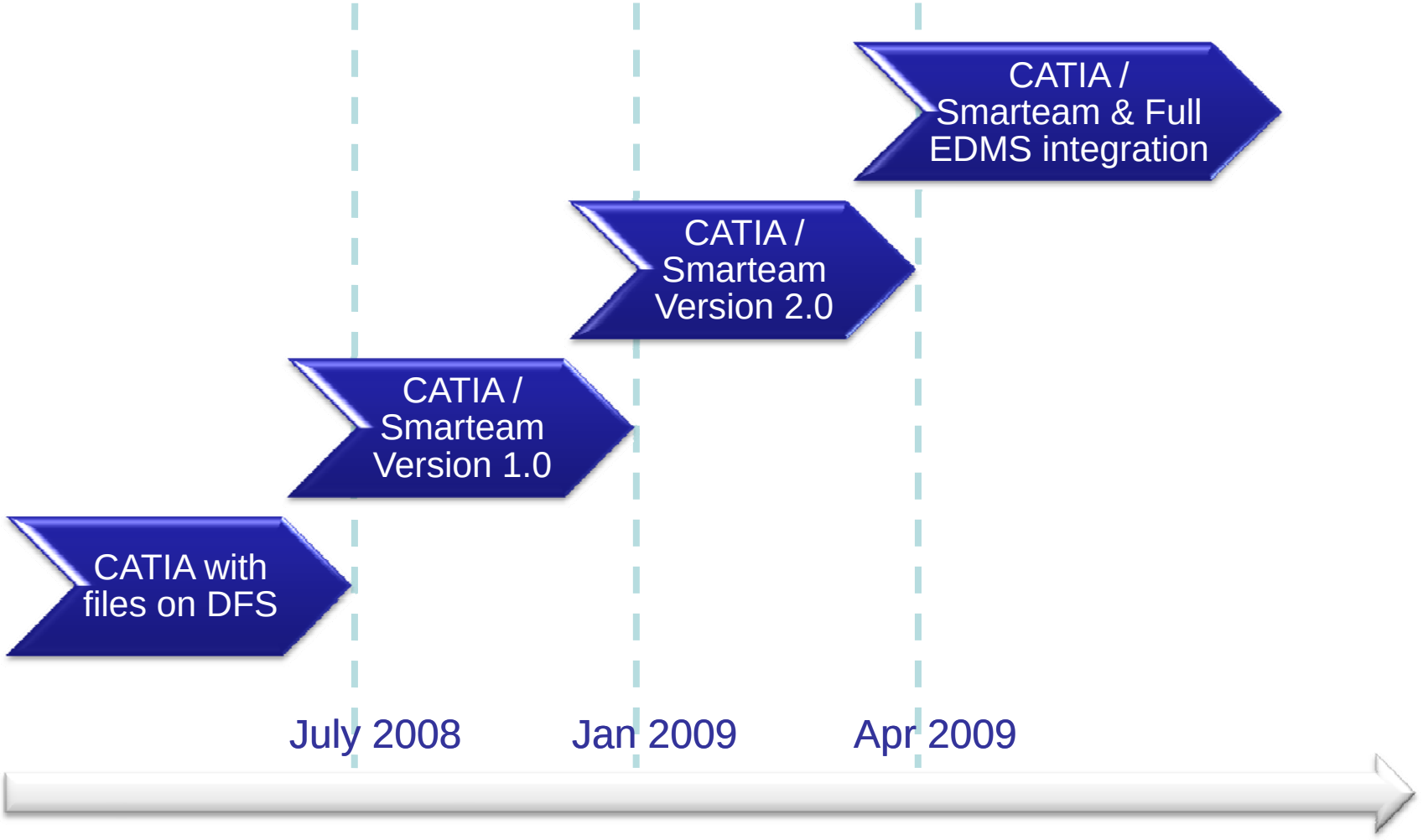


An item-centric approach

- The Item will become the carrier of information and point of navigation throughout all the different project phases and different information systems used at CERN (CATIA/Smarteam, EDMS, MTF, D7i, EDH, Stores Catalogue, etc).



CATIA/Smarteam timeline



CATIA/Smarteam timeline

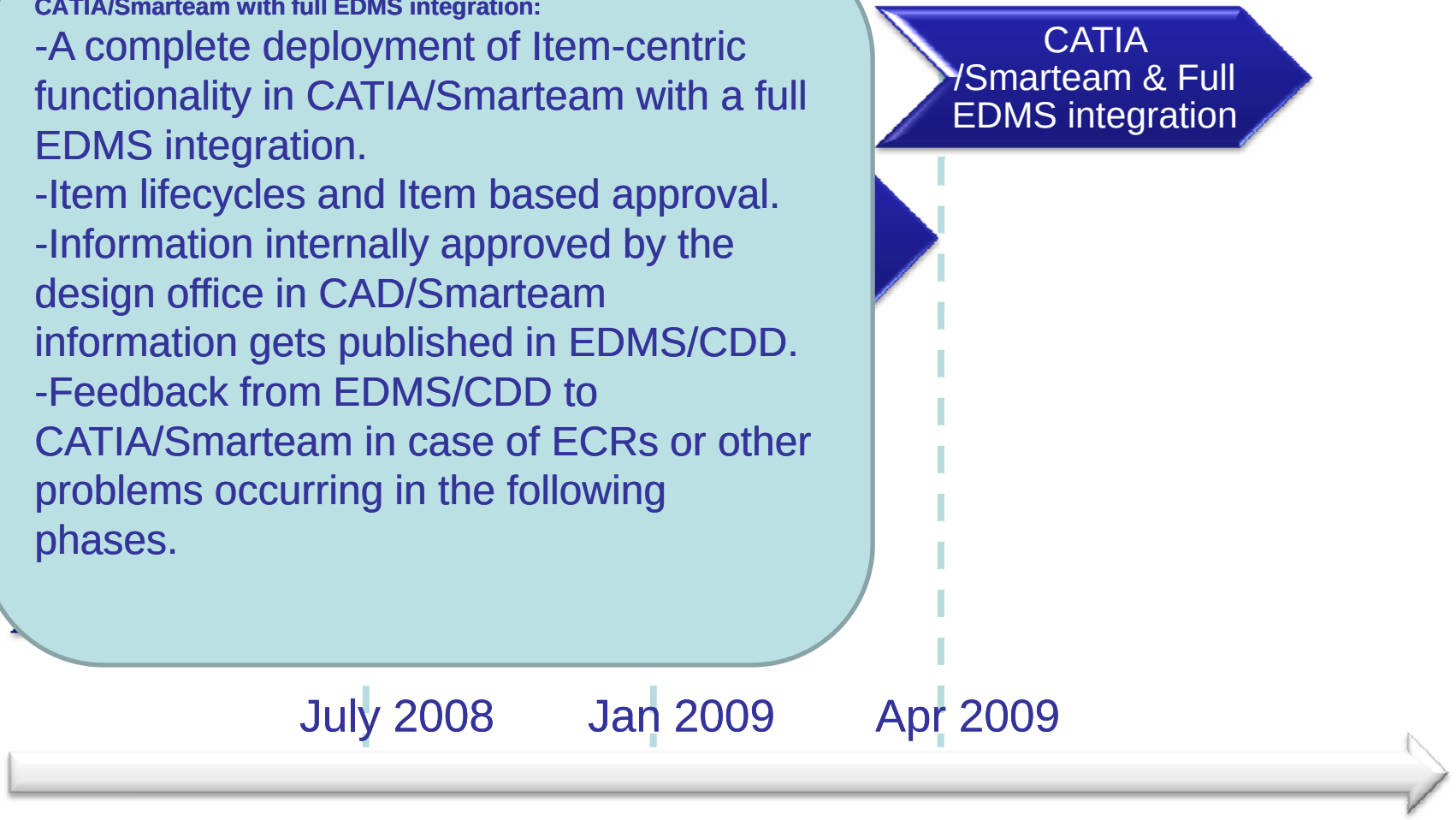
CATIA/Smarteam with full EDMS integration:

-A complete deployment of Item-centric functionality in CATIA/Smarteam with a full EDMS integration.

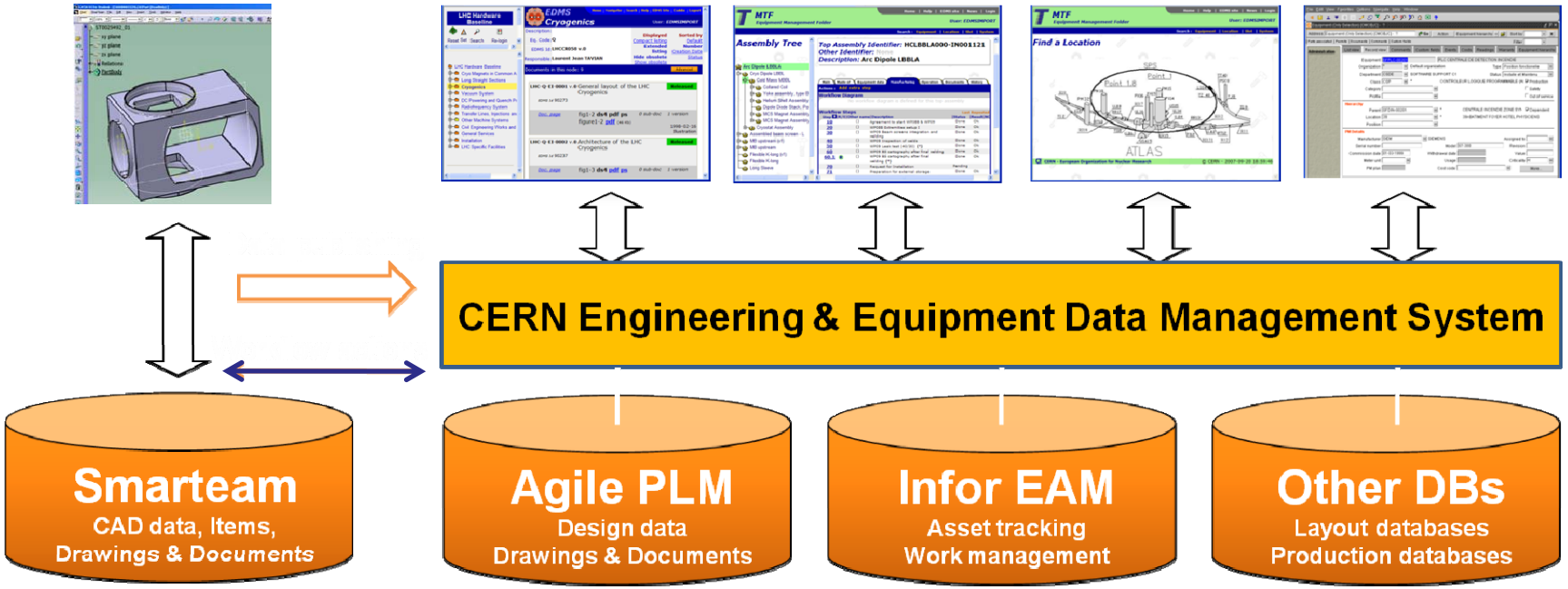
-Item lifecycles and Item based approval.

-Information internally approved by the design office in CAD/Smarteam information gets published in EDMS/CDD.

-Feedback from EDMS/CDD to CATIA/Smarteam in case of ECRs or other problems occurring in the following phases.



CATIA/Smarteam & the CERN EDMS



* Agile PLM was formerly called Axalant
* Infor EAM was formally called Datastream7i

Conclusion

Quality

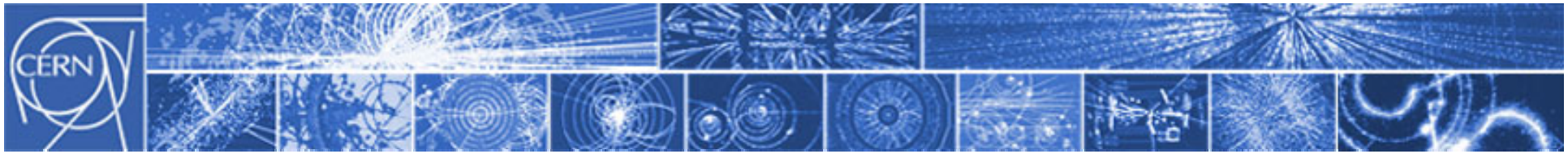
Pick Any two?

Manage all Three!

Cost

Time

Poor project management can increase costs more rapidly than any other factor.
- Barry Boehm



Closing Thoughts

"If you don't know where you are going, any road will get you there."

Lewis Carroll, Alice in Wonderland