RAMIRI

Key Factors of Success in the Management of Large Research Infrastructure Projects

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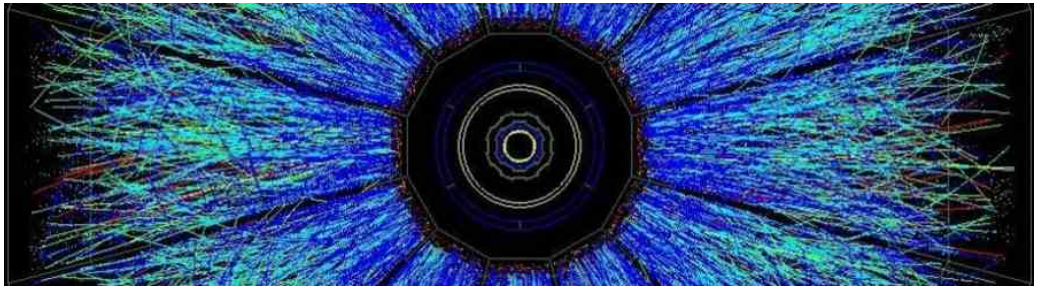

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RAMIRI

The overall situation:

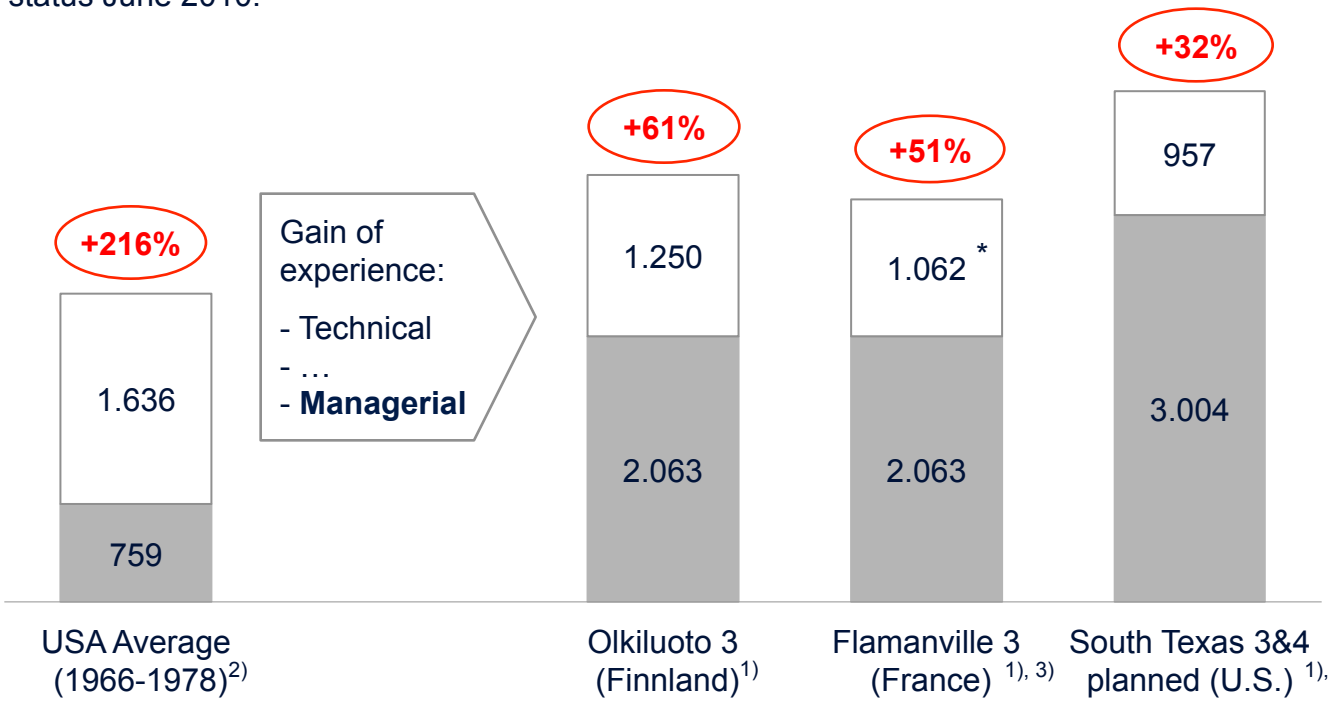
- Excellent, motivated people are working in the construction of large Research Infrastructure (“RI”) projects.

- Cost overruns (up to > 100 %), time delays (up to > 100 %) and changes of scope are reality
  - in research (often)
  - in industry (sometimes, too)

Actually built nuclear power plants are still facing high cost increases.

Example: Cost overruns per KW of selected nuclear build projects

Costs in Euro/KW, status June 2010.



1) Estimates, projects in progress (South Texas construction not yet started)
2) Currency conversion date May 20th, 2010
3) Initial overnight estimate 2005, cost update in 6/2010

Sources: Arthur D. Little, "Nuclear New Build Unveiled", * EDF, Press Release "H1 2010 Results"

Important aspects in the management of large RIs.

Aspects:

- Governance
- Management
- Planning, Reporting & Controlling, Counter measures
- Procurement

Situation (at the beginning):

- Engineers and scientists develop a basic concept of the RI with rough estimations
- Political decisions demand fixed data
- Ongoing project changes according to the project‘s conceptual development are not adequately considered (cost, time)
- Consequence: the project starts and runs under optimistic assumptions/conditions

Key Factor 1:

- Political agreement upon a „memorandum of common understanding“ with fixed shared understanding of the foreseen scope, schedule and cost together with a phase oriented approval process

Key Factor 2:

- Competent supervising boards must have clearly defined authority and responsibilities and powers of self-assertion

  – to be able to control and to supervise the top management
  – to immediately impact the project, whenever this is necessary
  – to quickly resolve conflicts presented by the top management

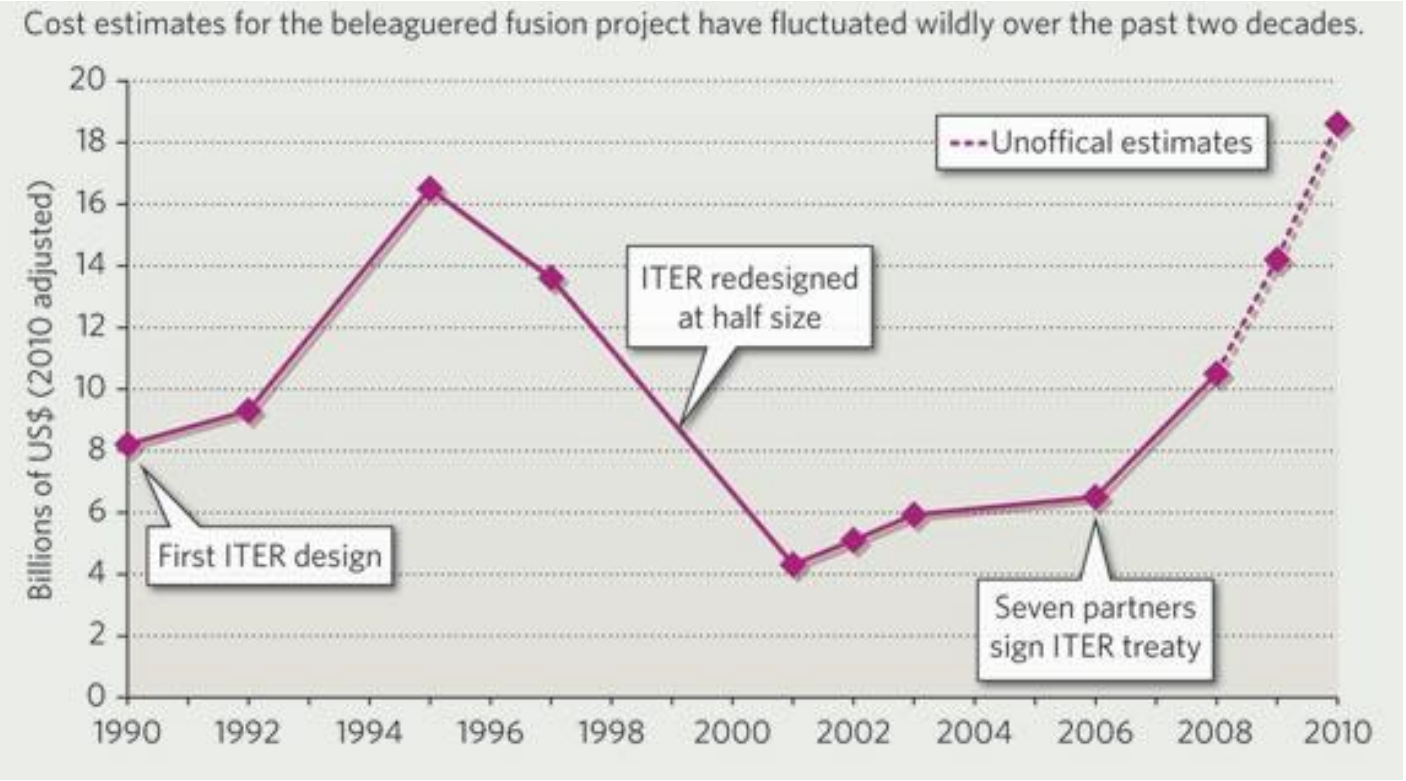
Key Factor 3:

- Selection of the management team on the basis of project management and technical skills with large independence and authorization and with full responsibility.
- The management must be challenged to achieve the project goals within the given cost and time frames
- The supervising boards should implement independent scientific and technical audits and external, professional project control.

The ITER project needs severe changes…

Example: ITER Cost increase

Costs in Billions of US $, 2010 adjusted



Source: Nature 465, page 532-533 (2010), online publication 28 May 2010

Situation (after the start):

- The project starts with limited resources (cash, personal).
- Structures and processes still have to be defined and modified according to the project's growing.

Key Factor 4:

- A clear and structured organization with respect to its growth is necessary (structure and processes).

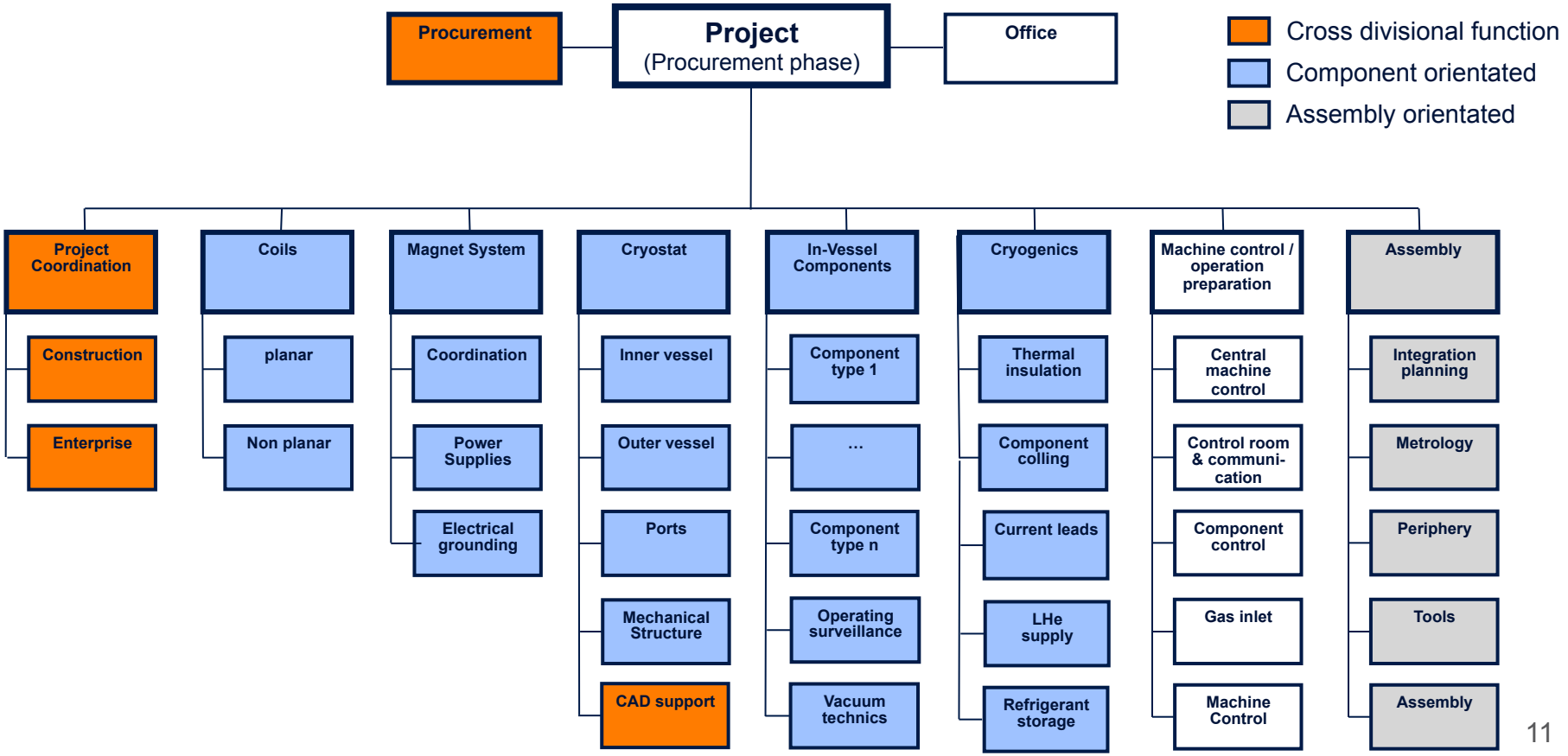
- The management must ensure
  - the implementation of full responsibility at every level
  - direct, transparent reporting lines
  - the full use of management and project tools

- The project must install processes
  - to decide quickly upon technical, cost and time aspects
  - to react quickly on technical, cost and time deviations by elaborating and controlling necessary countermeasures

In early phases component orientation and coordination dominate.

Example: Organizational chart (early phase)

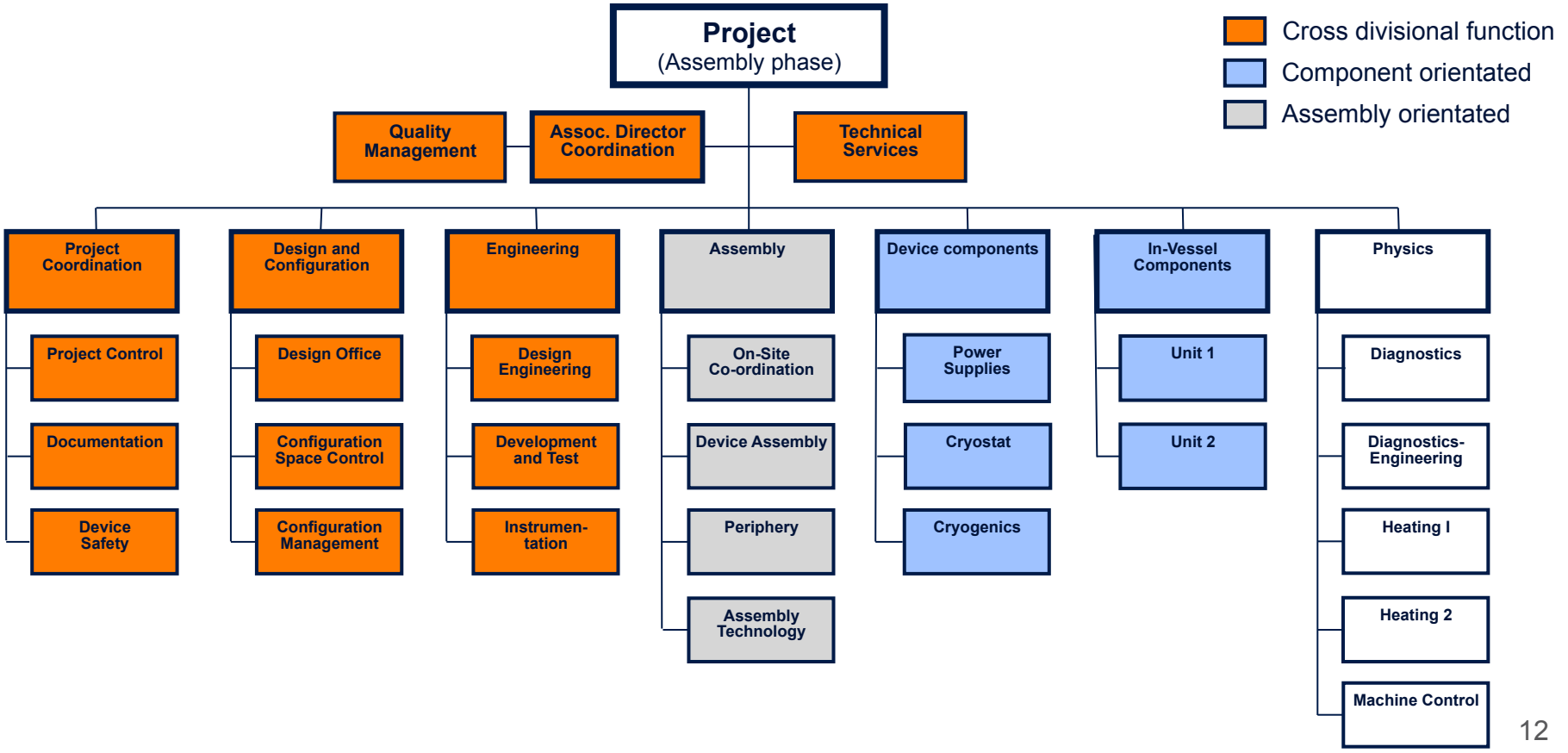
Organization dominated by component design and procurement



More cross divisional functions are necessary during completion.

Example: Organizational chart (later phase)

Organization dominated by machine assembly



Situation (during construction):

- Costs and time aspects are roughly estimated at the project's start.
- Insufficient up dates are conducted in the following phases.
- Sufficient contingencies in costs and time are often not foreseen or not accepted.

Realistic Planning is necessary.

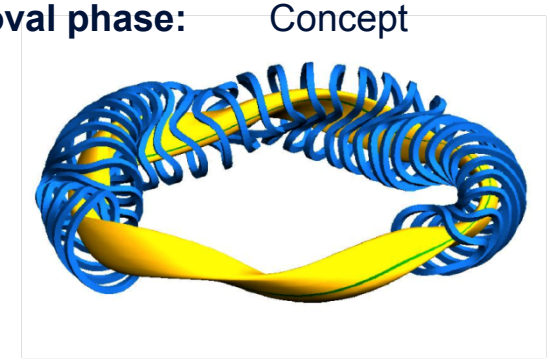
Key Factor 5:

- Costs and time schedules must clearly be defined and realistically planned for all project phases from the very beginning onwards.
- The costs and time schedules must be estimated with appropriate precision according to the different approval phases.
- Phase related contingencies must be provided.

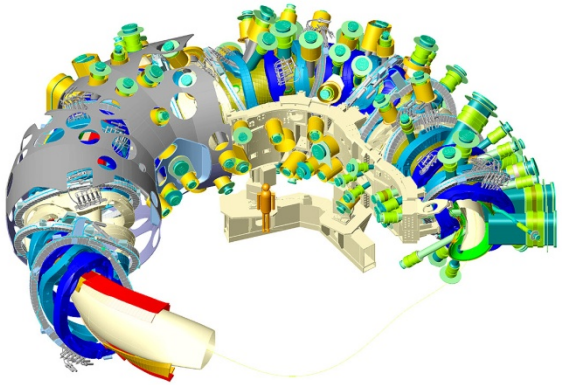
The more completion the more complexity, deeper knowledge and … contingency consumption!

Example: Development of machine design during project development

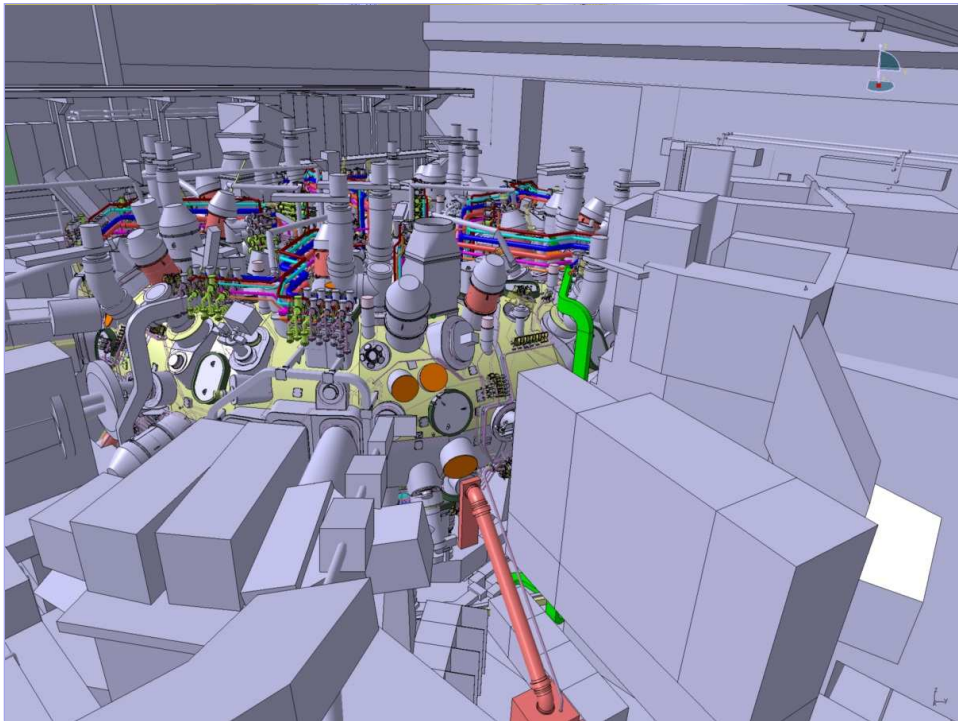
Approval phase: Concept



Procurement phase: Conceptual design



Assembly phase: Detailed design



Effective “online” systems for controlling and steering/counter steering must be consequently applied.

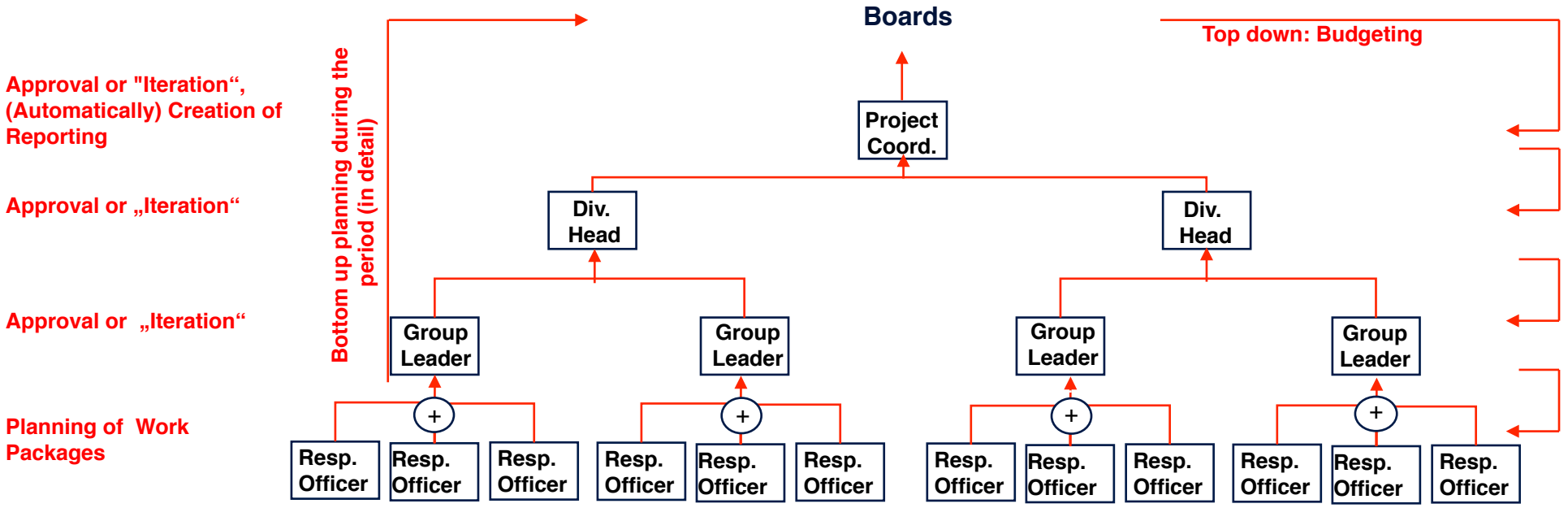
Key Factor 6:

- An always current, bottom-up planning, controlling and reporting system based on work breakdown structures and financial management tools is mandatory.
  - This integrated system must show all the planned and actual, weekly updated data and the resulting deviations

- Efficient project control and risk management systems have to be fully embedded in the project, covering technical, financial and schedule issues, together with the parallel development of mitigating measures in case of deviations.
  This is essential to allow the management
  - to react immediately
  - both internally and externally (for suppliers and in-kind contributors).

Processes: Implementation of a comprehensive bottom up – Planning, Controlling and Reporting Process

Example: Wendelstein 7-X Fusion Reactor IPP/Greifswald: Bottom up Planning Process



Planning- and controlling tools in combination with work breakdown structures (WBS) and different data flows.

Example: Functional Concept of Financial Planning- and Controlling Tools

Actions:

Dataflow:

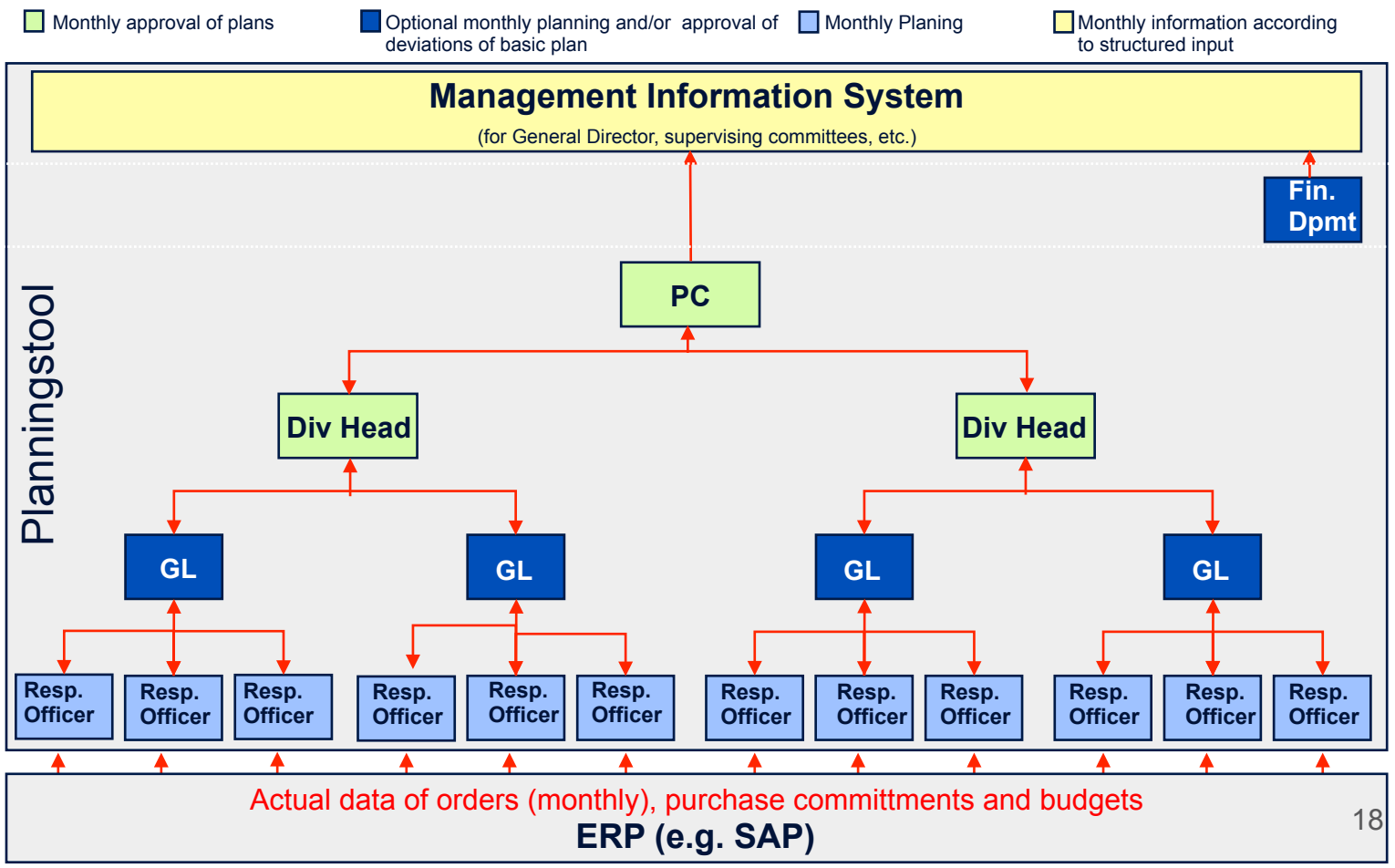
Output: planning of revenues

Output: approval
Input:
actual plan, basic plan, actual, committments, deviations

Output: approval
Input:
actual plan, basic plan, actual, committments, deviations

Output: approval
Input:
actual plan, basic plan, actual, committments, deviations

Output: planned data
Input:
approval information, SAP-data

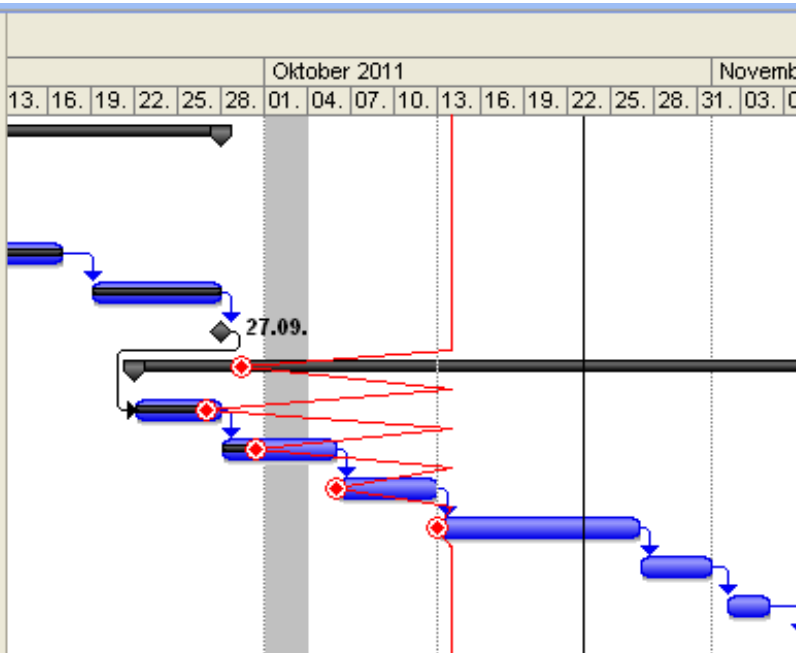


Action oriented work breakdown structures (WBS) are the basis
… also for counter steering.

Example: Comparison: Plan vs. Actual (weekly updated!)

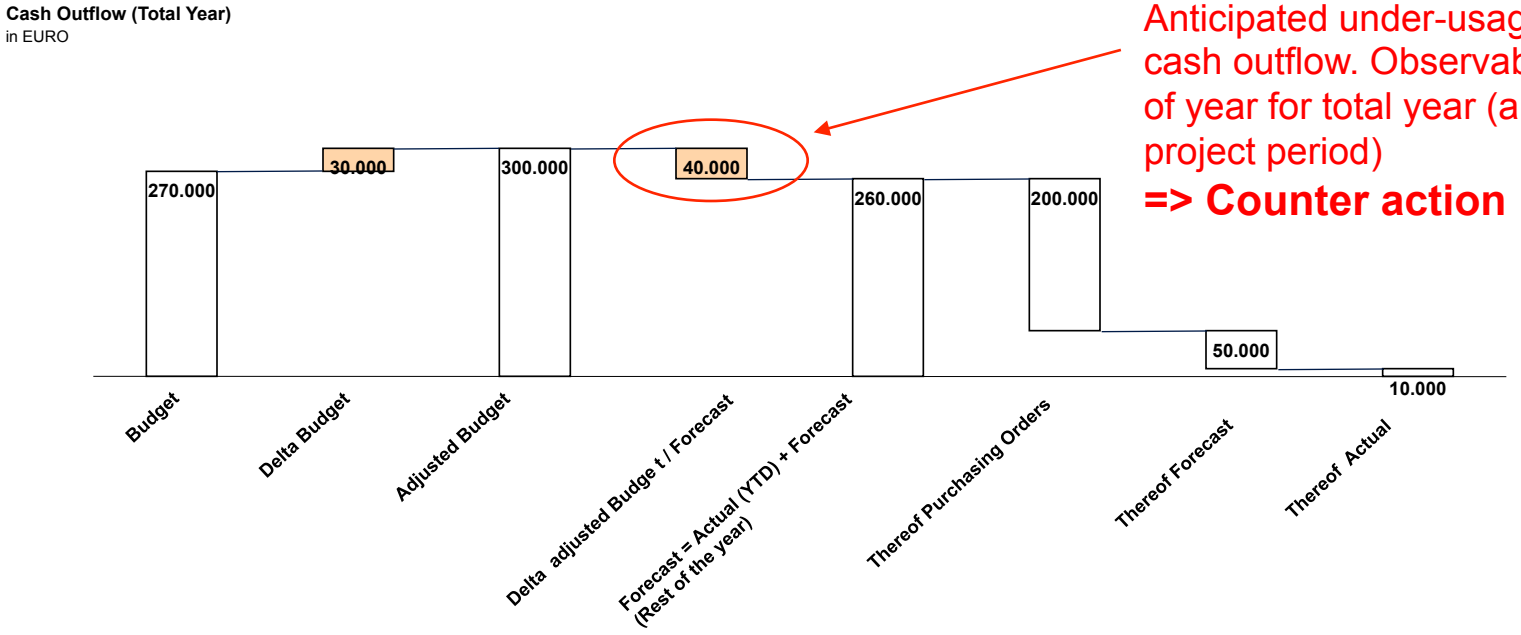
MS-Project file with detailed WBS with linked tasks and completion data.

abge -schlos in %	Vorgangsname
100%	**Endfertigung WT**
100%	Hartlötung (Kupfer-Edelstahl mit entspr. Vorbereitung wie Edelstahlfolie)
100%	Halbrohre, Bälge und He-Einlassrohr Schweißen
100%	Lecktest/Drucktest (TÜV) und Druckabfallmessung
100%	Sensorik, Vakuumrohre, Endlecktest
100%	WT fertig
9%	**Zusammenbau**
75%	Sensorik (TVOs warmes Ende) montieren
50%	Wärmetauscher + HTS Träger löten
0%	HTS-Teil und Kalter Kontakt löten
0%	Sensorik
0%	Vakuumrohr HTS aufschweißen, Zentrier-Bleche anbringen
0%	Lecktest
0%	Abdrehen der Flanschsitze



Continuous calculation of plan deviations, automatically, weekly updated mitigate surprises and allow flexibility.

Example xyz Company: Deviation variance baseline (budget/actual plan)



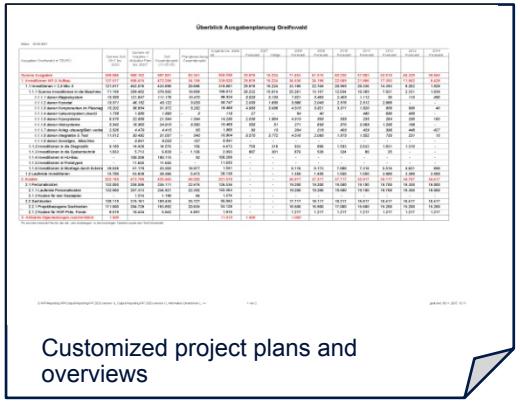
Anticipated under-usage of planned cash outflow. Observable at beginning of year for total year (analog for total project period)

=> Counter action !

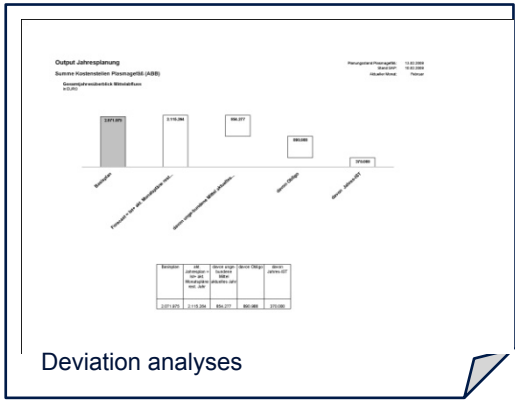
Budget	Delta Budget	Adjusted Budget	Delta Adjust. Budget/ Forecast	Forecast = Actual (YTD) + Forecast (Rest o. year)	Thereof Purchasing Orders	Thereof Forecast	Thereof Actual
270.000	30.000	300.000	40.000	260.000	200.000	50.000	10.000

Quick, easy and comprehensive reporting systems automatically generated: the basis for steering and counter steering.

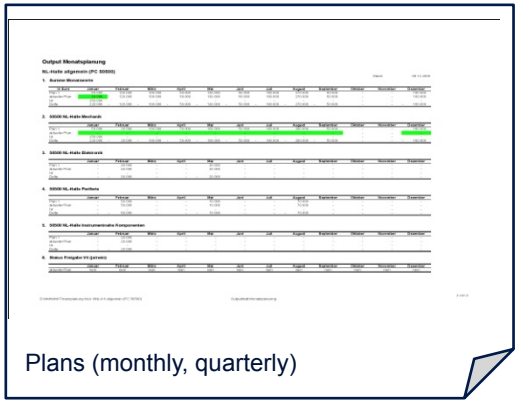
Output-Examples for Management Information System



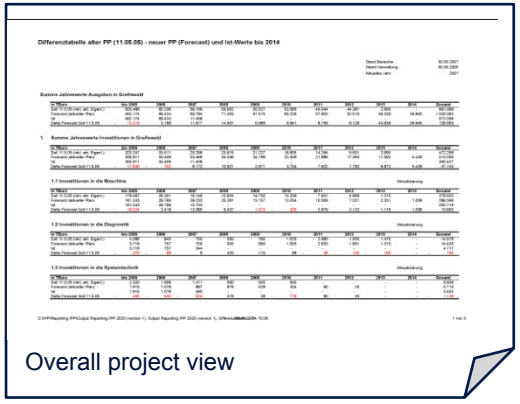
Customized project plans and overviews



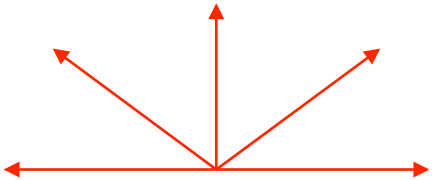
Deviation analyses



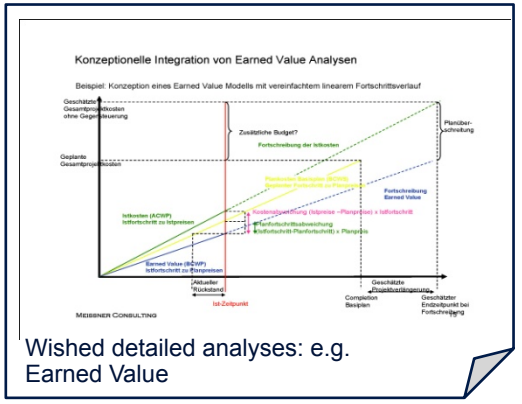
Plans (monthly, quarterly)



Overall project view



Automatical generation on the basis of structured, fixed inputs



Wished detailed analyses: e.g. Earned Value

Situation (7):

- The project needs leading edge products, which can be delivered only by a very limited number of suppliers.
- First of its kind components, technologies and production methods are specified not as detailed as necessary.
- The project is expecting that the supplier is delivering the ordered component or service on the basis of the agreed specifications in time, in cost and in the expected quality. Surprises occur …

Key Factor 7:

- The responsibilities of all suppliers for deliverables must be contractually fixed in a detailed way based on detailed specifications and drawings.

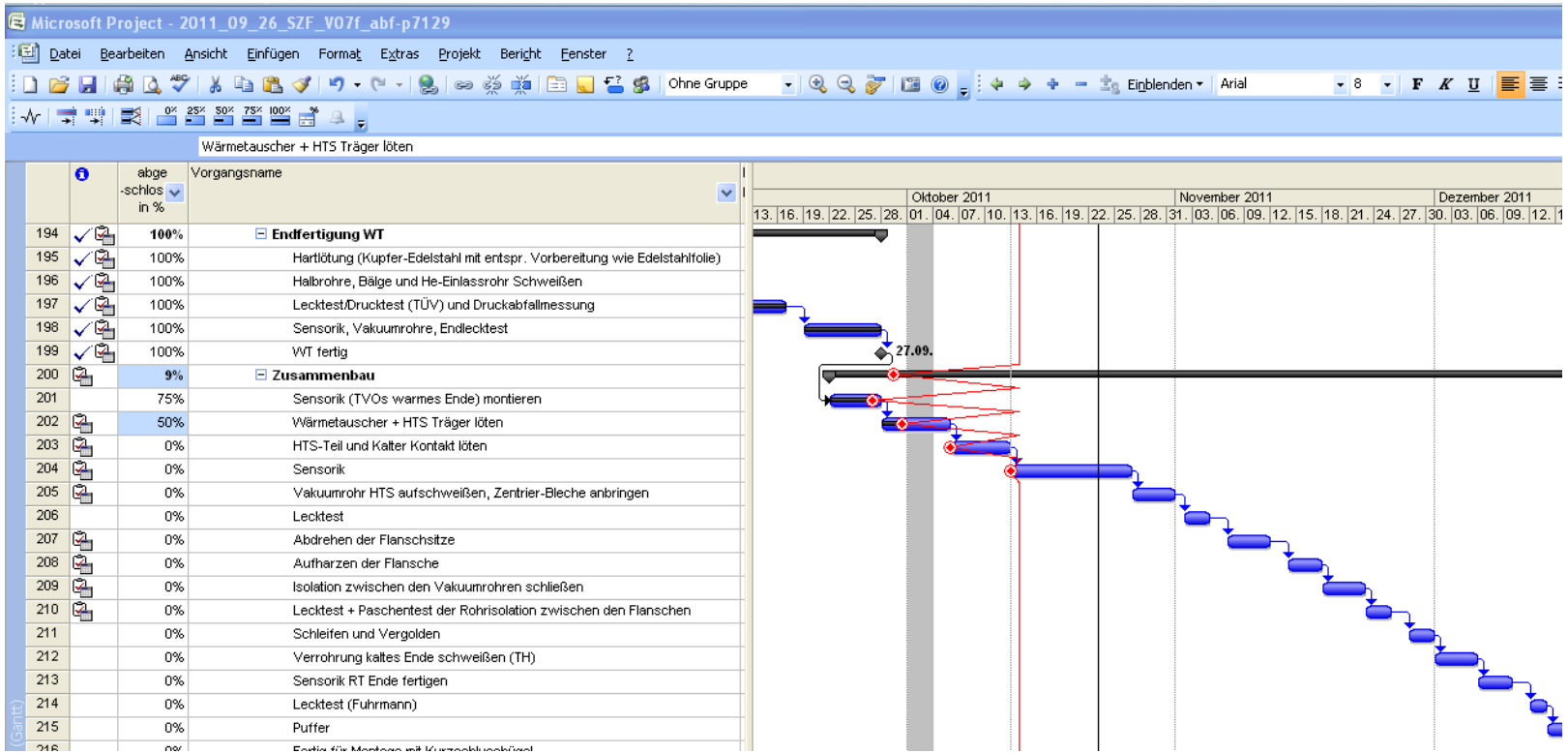
- The project must have full access to all relevant information on a daily basis
  - technical
  - financial (probable exception: in-kind contributions)
  - schedule related

- The same planning and controlling tools should be applied as internally (technical, financial, schedule related, technical).

The suppliers must be controlled and managed by the same tools as internally applied (e.g. weekly updated WBS)

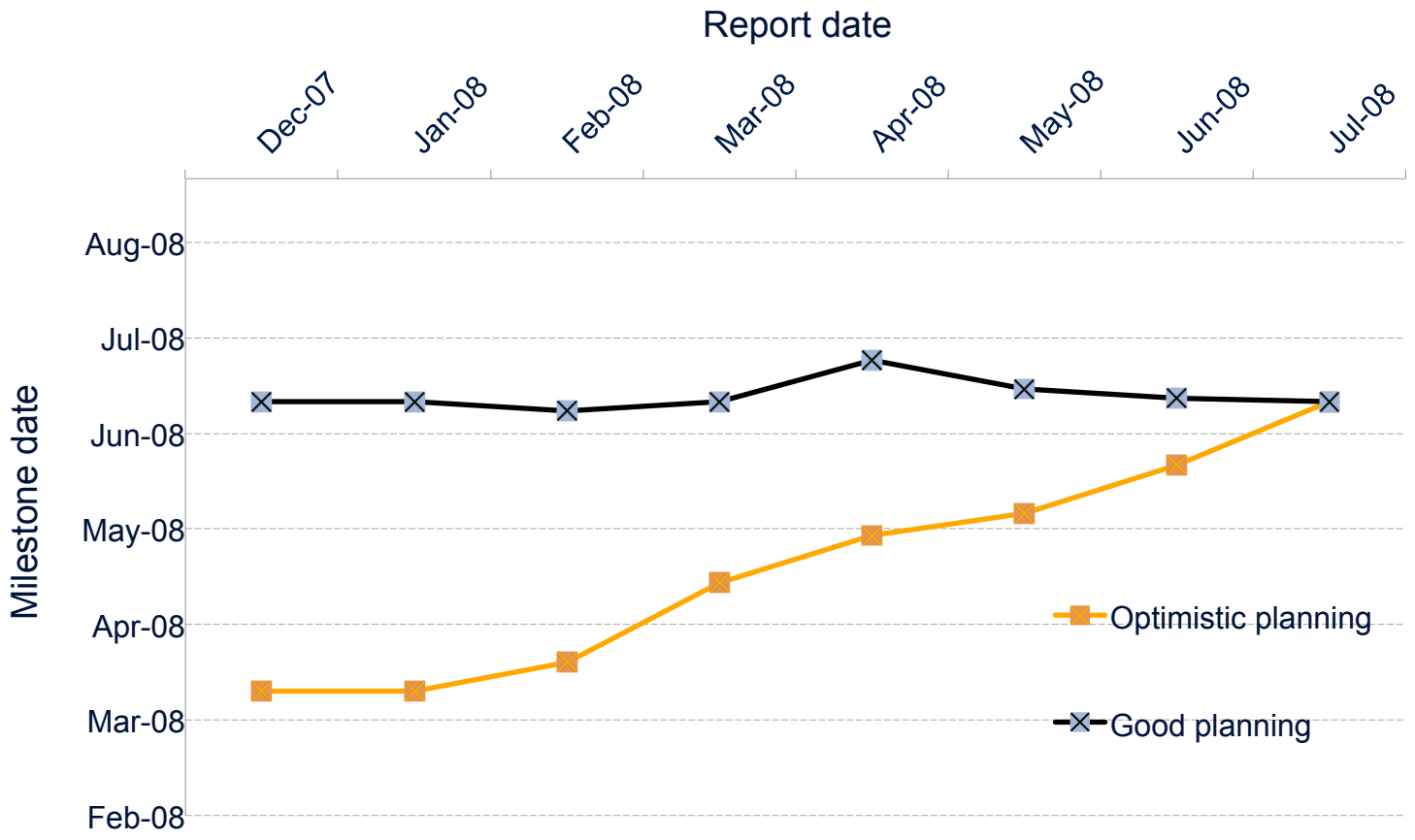
Example: Comparison: Plan vs. Actual (weekly updated!)

MS-Project file with detailed work breakdown structure (WBS) with linked tasks and completion data.



Suppliers must be managed by in process control, operational milestones must be monitored weekly/monthly.

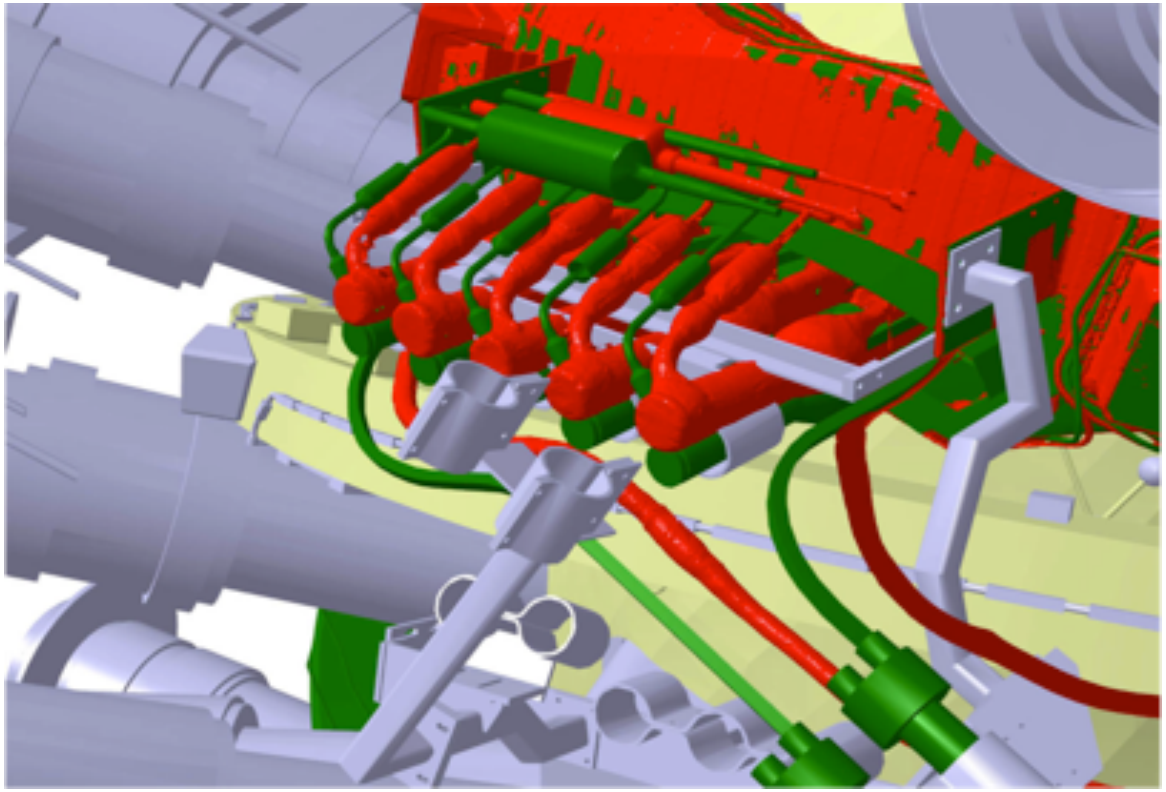
Example: Generic milestone trend analysis (MTA)



Deviations (technical, schedule, cost) occur all the time: Counter steering behavior together with effective tools and processes is mandatory.

e.g.: Design & Engineering:
Difference between “planned” (green) and “as-built” (red) data

Example: Superconducting joints

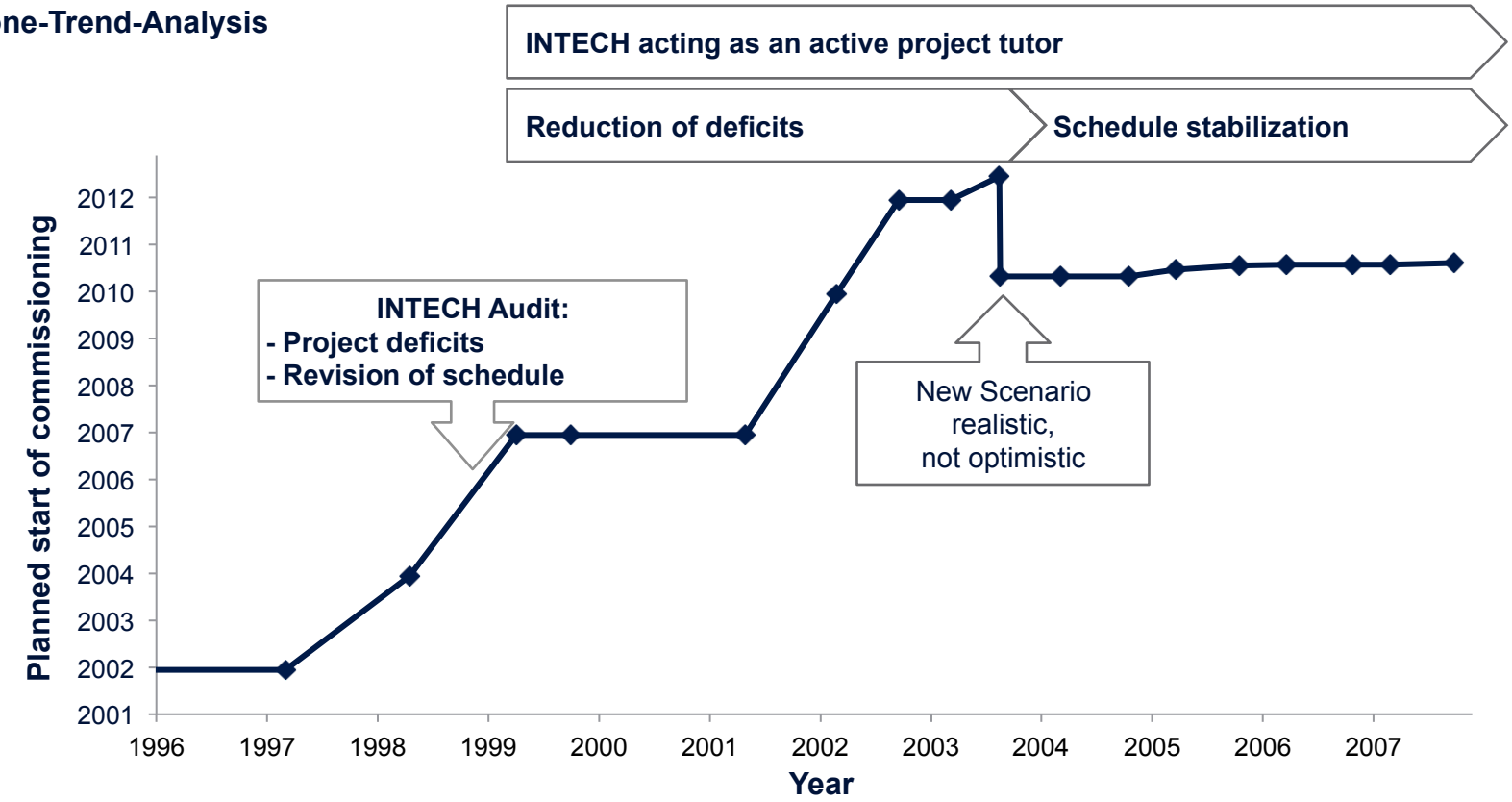


Very important: Even running projects can be stabilized!
Just do it !!

Governance
Management
Controlling
Procurement

Example: Megaproject: Planned start of commissioning

Milestone-Trend-Analysis



Outlook:

- All project members are confronted day by day with many different problems …
- … nevertheless, these project members will create a leading edge Research Infrastructure of which the scientific world can really be proud !

For further information:

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