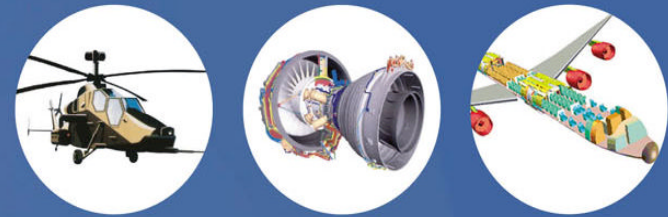


# VIVACE Forum 2, Den Haag October 24-26, 2006



# VIVACE

**Ideal Workflow and Process Planning Concept  
for the Product Development Phase**

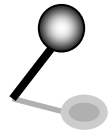
**Dr. Hans-Uwe Baron – MTU Aero Engines GmbH**



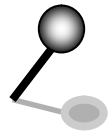
# Structure



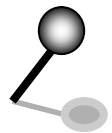
**Introduction**



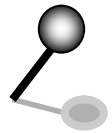
**Concept for Process Planning and Evaluation**



**Software Supported Implementation of the Method**



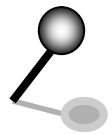
**Further Steps**



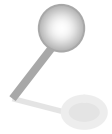
**Summary**



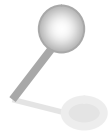
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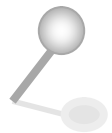
## Introduction



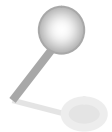
## Concept for Process Planning and Evaluation



## Software Supported Implementation of the Method



## Further Steps



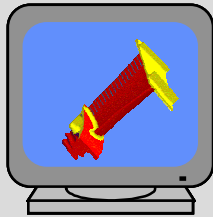
## Summary



# Introduction Scenario

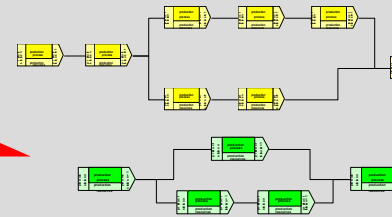
## Product Development

product design



*integrated planning, assessment and selection*

## Process Planning

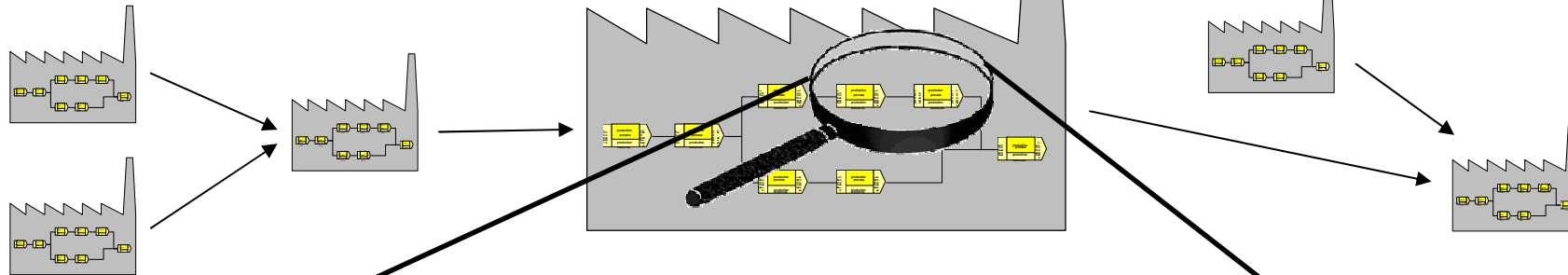


*alternative process chains*

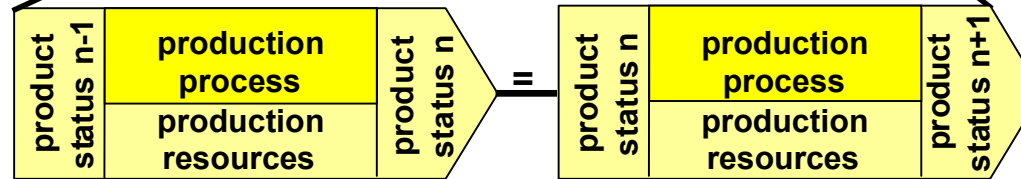
supplier

company

customer



production process n



production process n+1

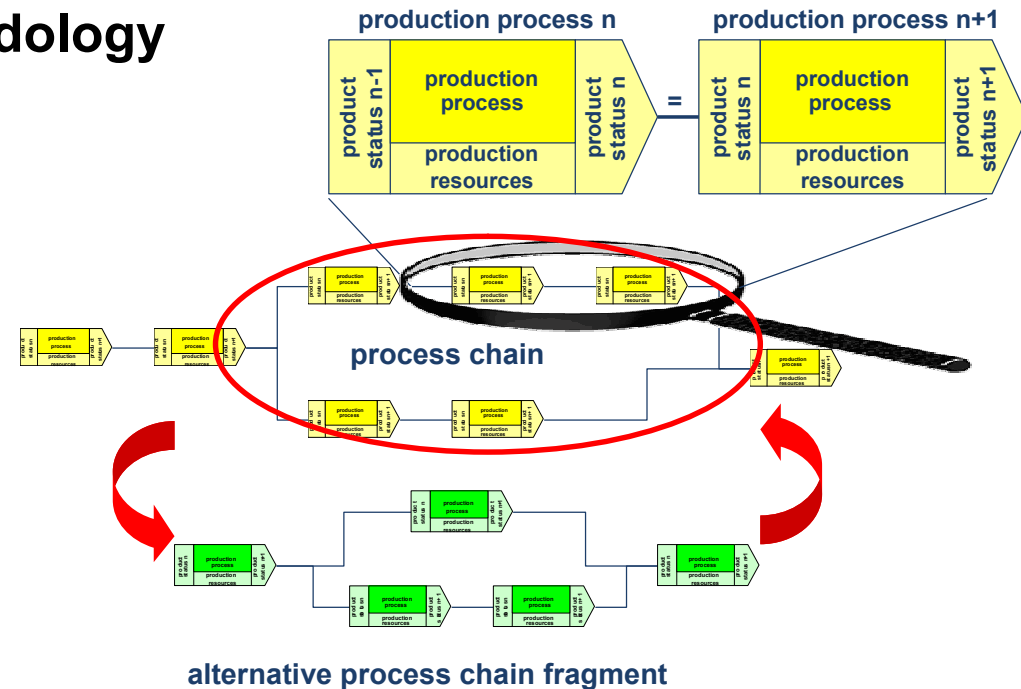


# Introduction General Objectives

## Overall Concept of the Methodology

methodical generation of optimal process chains by a continuous integrated planning processes

- ➔ storage and usage of **production know-how** within the decision processes
- ➔ **standardisation, transparency** and systematisation regarding process chain configuration
- ➔ explicit consideration of process interdependencies and **new technologies**
- ➔ building set oriented instead of similarity based process chain configuration
- ➔ enabling of a systematic and **maturing cost assessment**

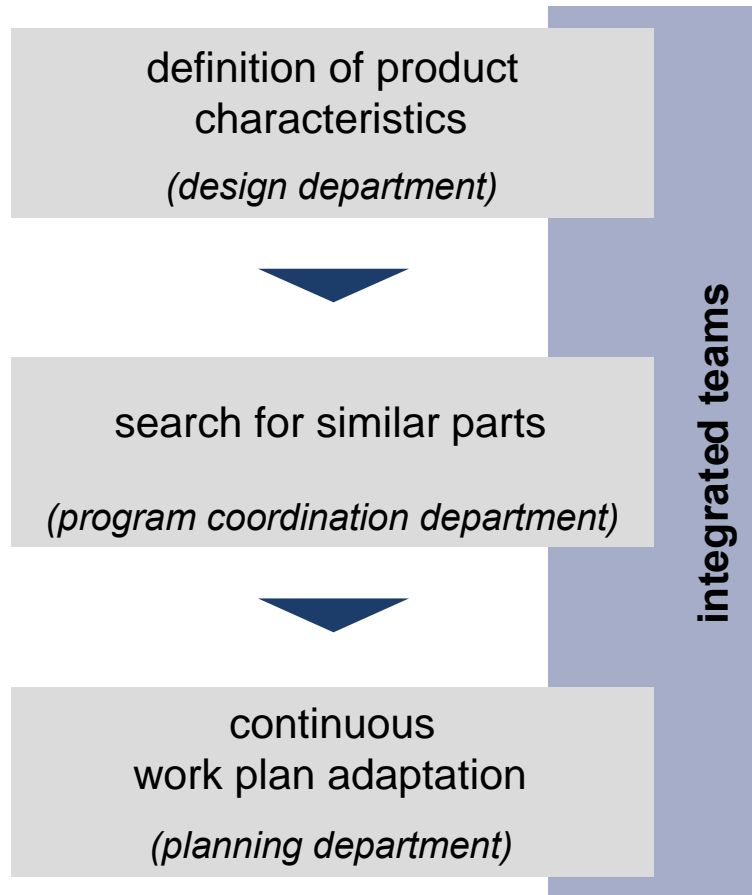




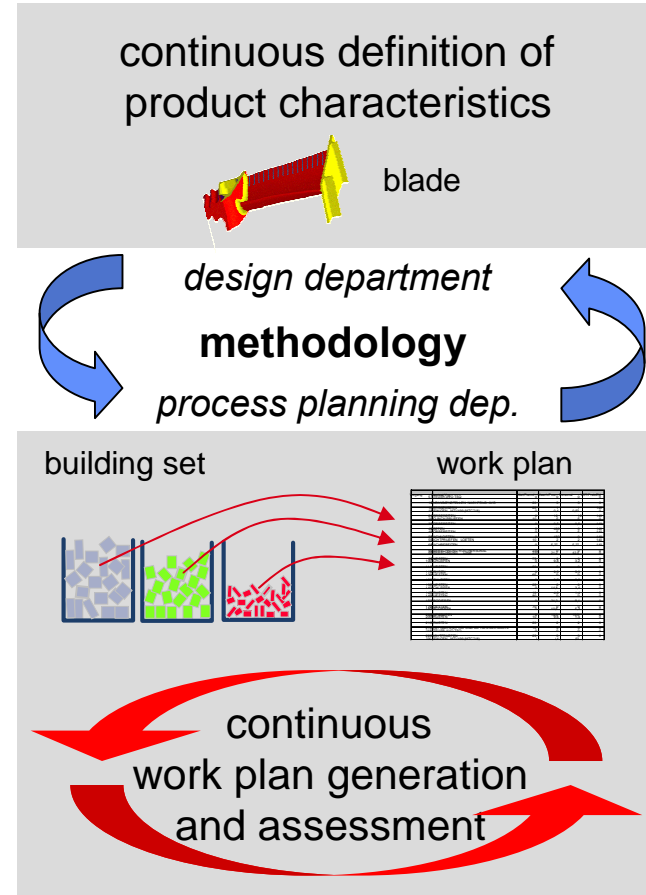
# Introduction

## Differences: Past - Future

### Proceeding in the Past

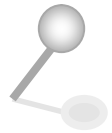


### Future Proceeding

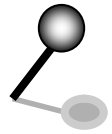




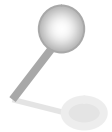
# Structure



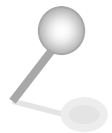
Introduction



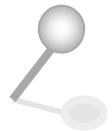
**Concept for Process Planning and  
Evaluation**



Software Supported Implementation of  
the Method



Further Steps

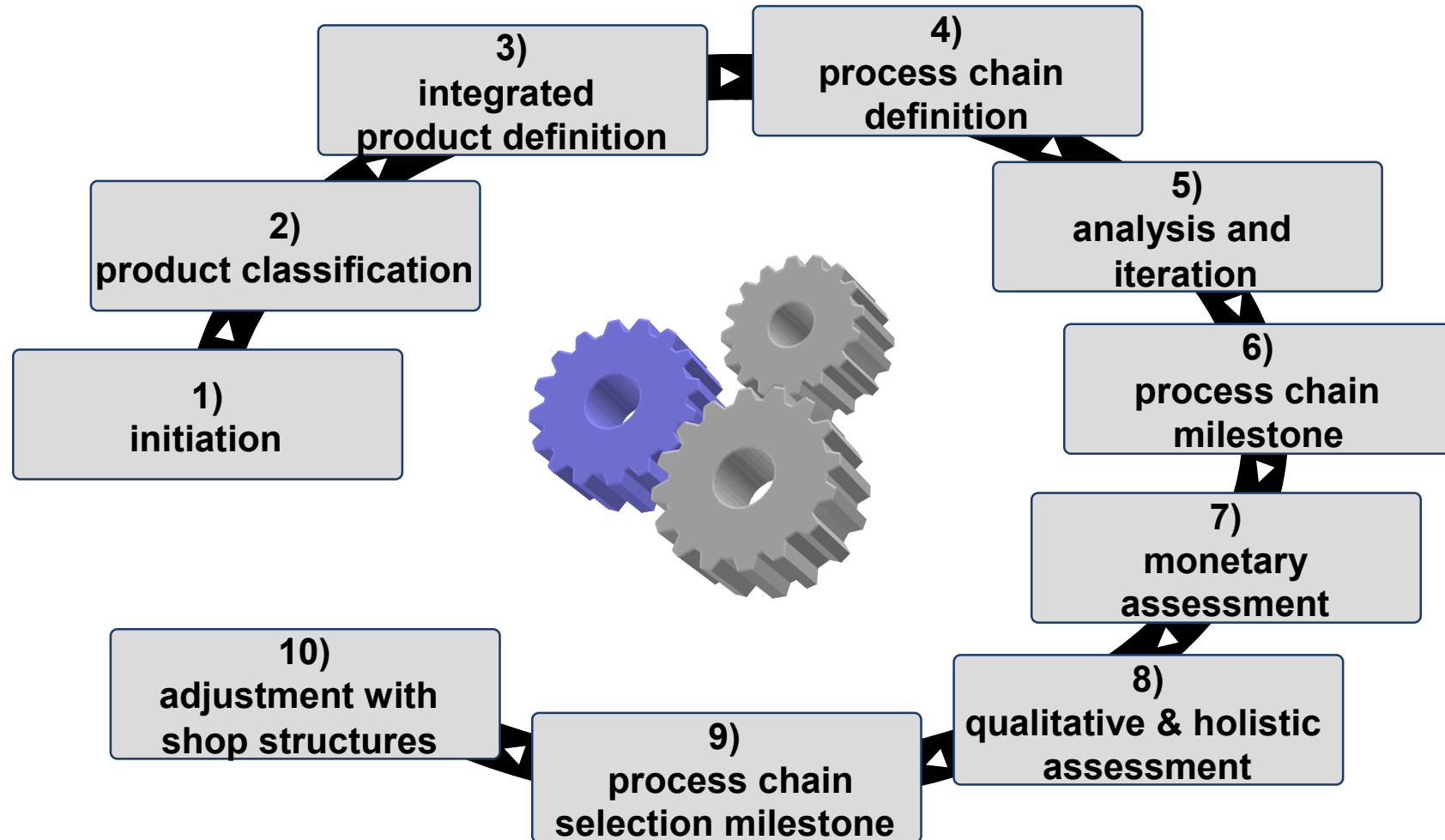


Summary



# Process Planning and Evaluation

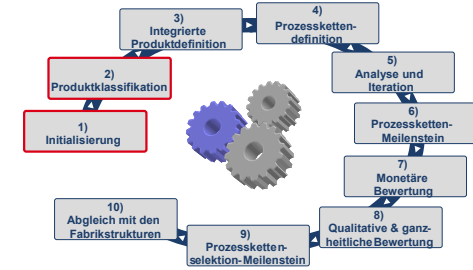
## 10 Steps of the Methodology





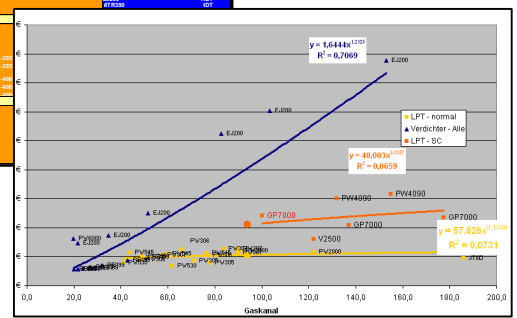
# Process Planning and Evaluation Initialisation (1) & Product Classification (2)

- incoming of a product request
- assignment of the product to a product class
- analysis of the grade of deviation of cost graphs (regression analysis)



## classification table

Beispiel-Zuordnungstabelle	Planungsmethode	Übergangsbereich der Planungsmethode	Planungsmethode
MDT - Leitschaufen	Planungsmethode: Planung auf Basis V-Plan	Übergangsbereich der Planungsmethode	Planungsmethode: MEZAF-ER
MDT - Leitschaufen	Planungsmethode: Planung auf Basis V-Plan	Übergangsbereich der Planungsmethode	Planungsmethode: MEZAF-ER
MDT - Leitschaufen	Planungsmethode: Planung auf Basis V-Plan	Übergangsbereich der Planungsmethode	Planungsmethode: MEZAF-ER
MDT - Leitschaufen	Planungsmethode: Planung auf Basis V-Plan	Übergangsbereich der Planungsmethode	Planungsmethode: MEZAF-ER



costs regression analysis

The assigned product class and the grade of deviation of the cost graphs signalises

... low potential regarding production alternatives:

➡ The methodology for the base for surely considering all options

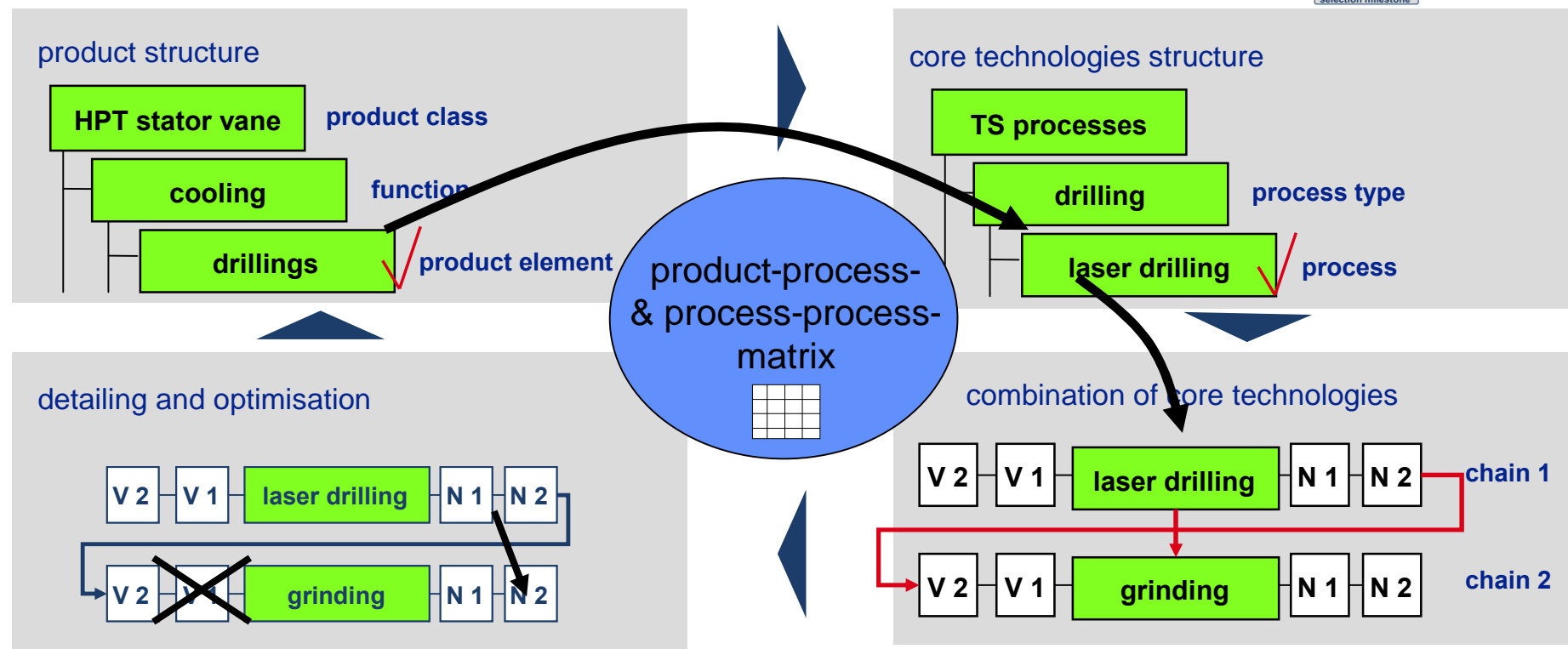
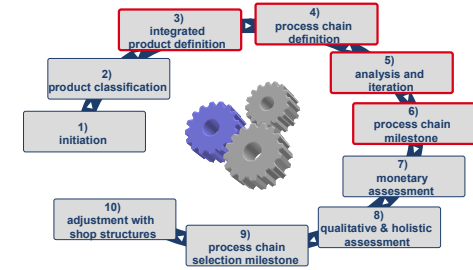
... high potential regarding production alternatives:

➡ step by step building set oriented elaboration of the work plan



# Process Planning and Evaluation Product & Process Chain Definition (3-6)

## Generation of all Possible Process Chain Alternatives



V x – predecessor process; N y –successor process



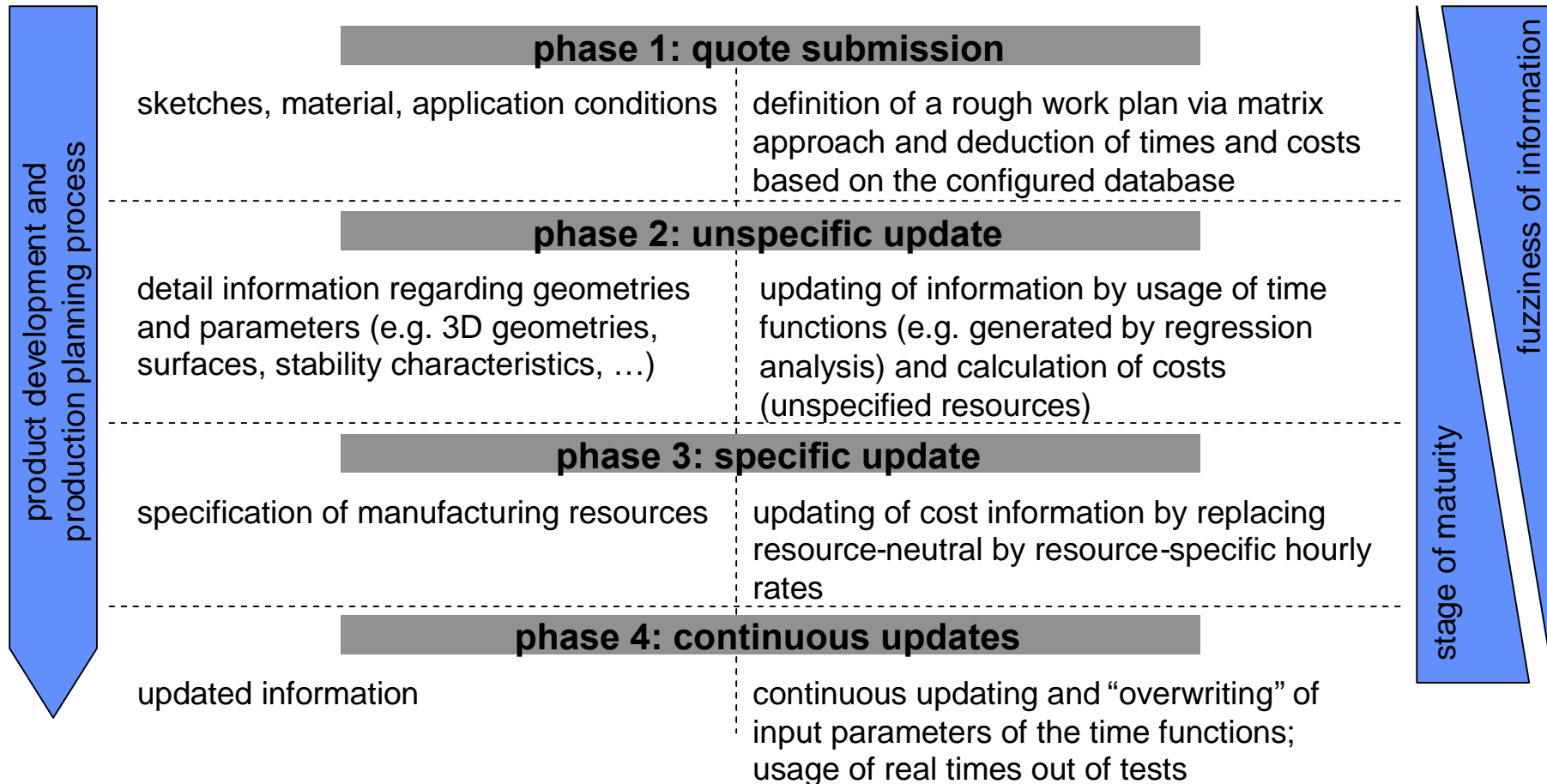


# Process Planning and Evaluation

## Maturing Process Chain Assessment

### Available Information

### Deduction of Time and Cost Information

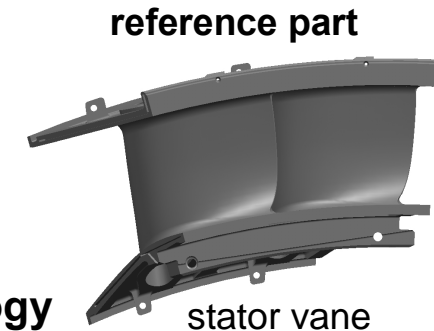




# Process Planning and Evaluation Use Case

## Objectives

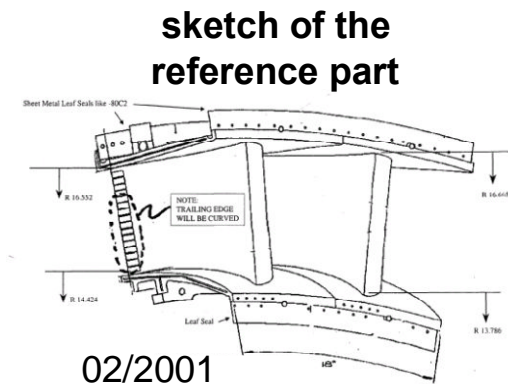
- iterative **generation of a work plan** by using the methodology  
→ analysis of the possibility to **rebuild an existing work plan**
- cost calculation by the use of the data base behind the matrices  
→ analysis of **cost deviation between existing and the methodology based calculation**
- analysis of the potentials of the methodology regarding the integration of **new technologies** or the “testing” of **alternative process chains**



## Initial Situation

➔ basic information regarding the part:

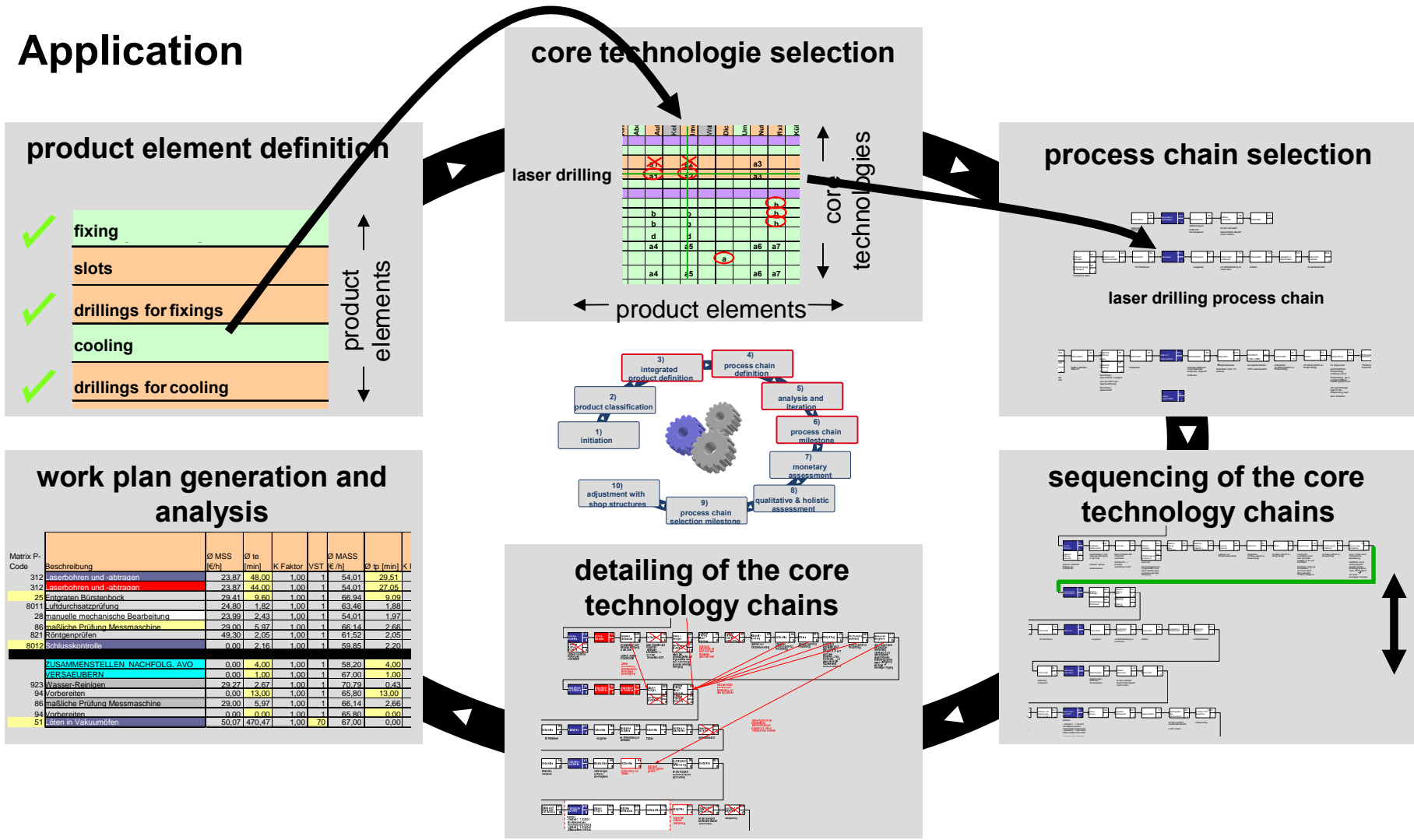
- main features of the geometry, drilling, coating and mechanical machining are known
- material is specified





# Process Planning and Evaluation Use Case – Matrix Application

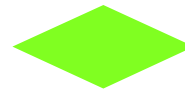
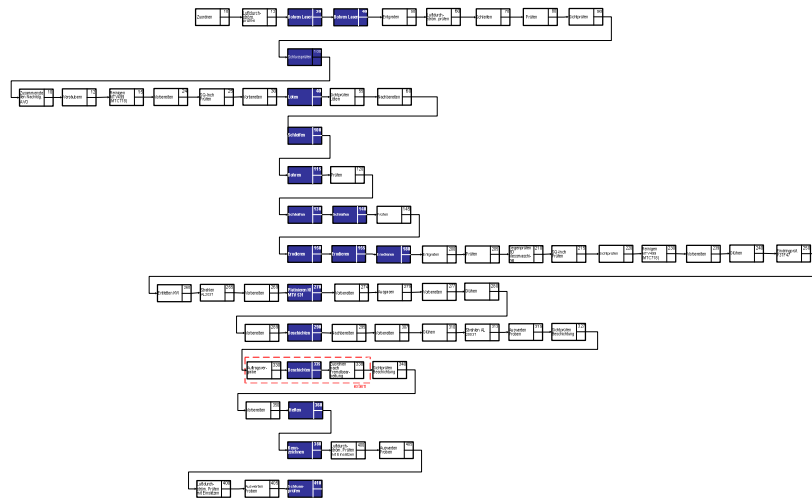
## Application



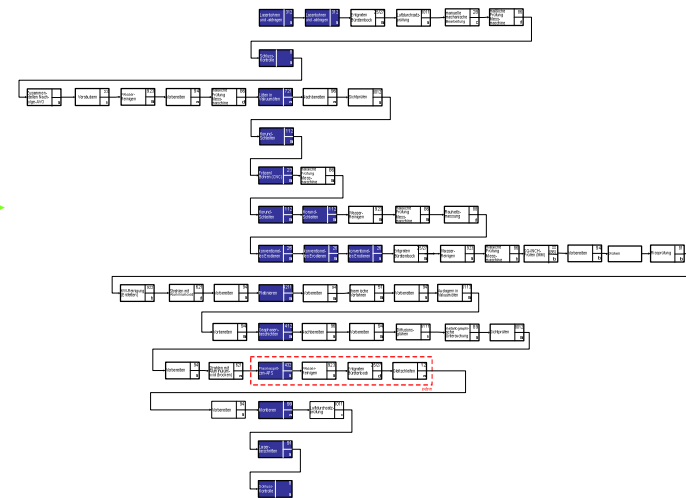


# Process Planning and Evaluation Use Case - Results

## Existing Work Plan



## Methodically Generated Work Plan



**broad congruence between the existing work plan and the work plan generated by the use of the methodology**

- 17 of 17 core technologies
- 39 of 44 predecessor and successor processes (additional: 2; missing: 7)
- few obvious differing process positions (2)



# Process Planning and Evaluation Use Case - Results

	META FER costs [€]	VoKa costs [€]	difference META FER - VoKa
single part (ET)	xx,-	uu,vv	8,8%
segment (SEG)	yy,-	aa,bb	-5,5%
total (2ET, SEG)	zz,-	rr,ss	-3,7%

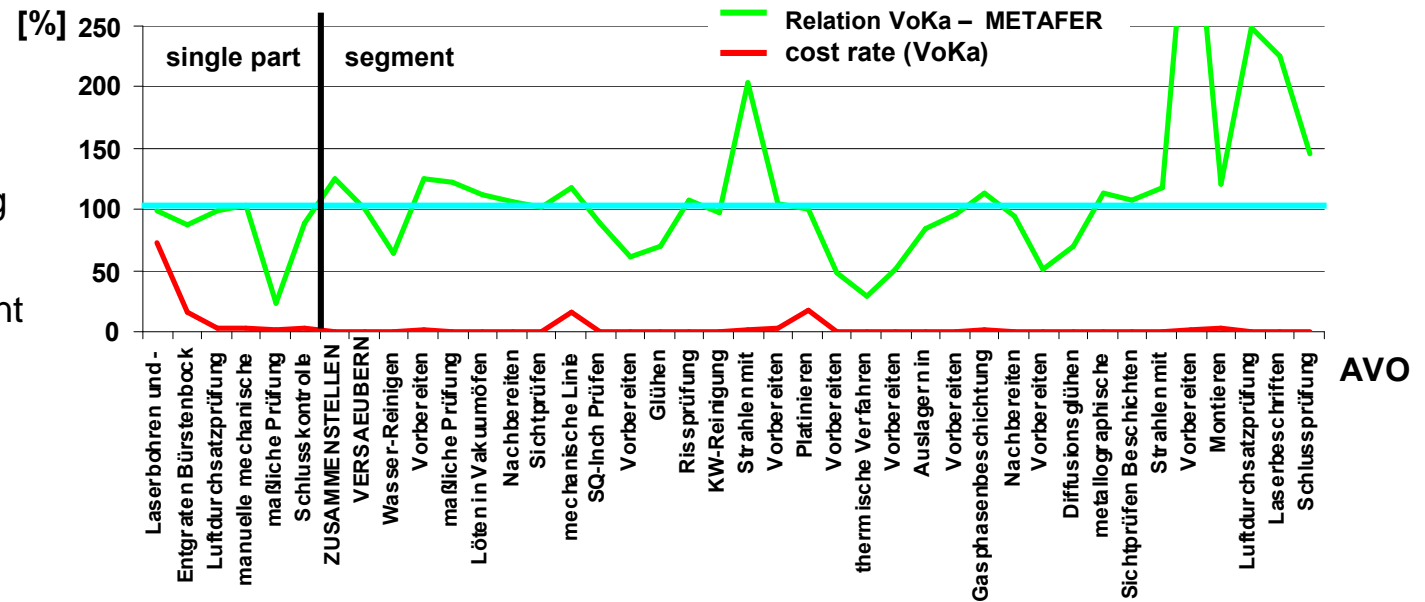
➔ slight deviation of the overall result after one iteration loop

**comparison of the manufacturing costs:  
methodology based vs. current precalculation (VoKa)**

**deviation analysis**

➔ high correlation regarding cost driving core technologies

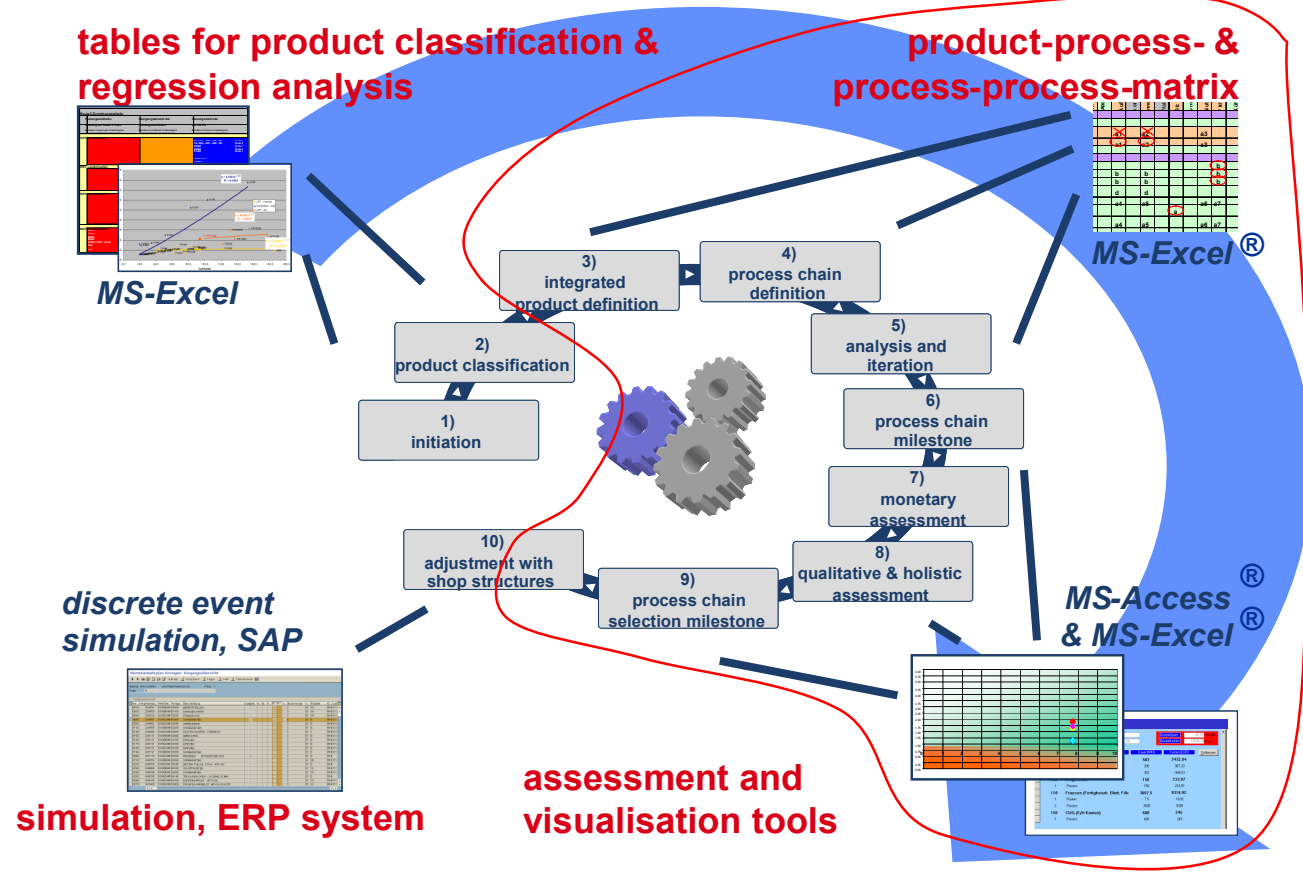
➔ no highly cost-relevant "runaways"





# Process Planning and Evaluation Conclusion

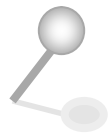
- proof of the operability
- illustration of integration possibilities
- illustration of potentials and benefits
- identification of required further steps



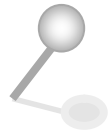
requirements for ensuring a long-term operability of the methodology ▶ identification of an adequate software tool



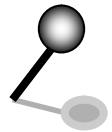
# Structure



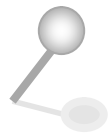
Introduction



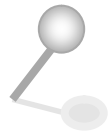
Concept for Process Planning and  
Evaluation



**Software Supported Implementation of  
the Method**



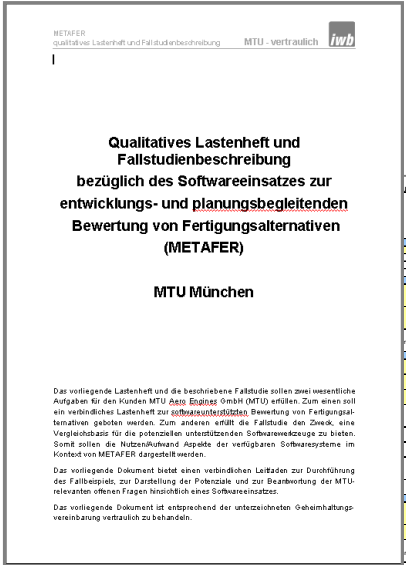
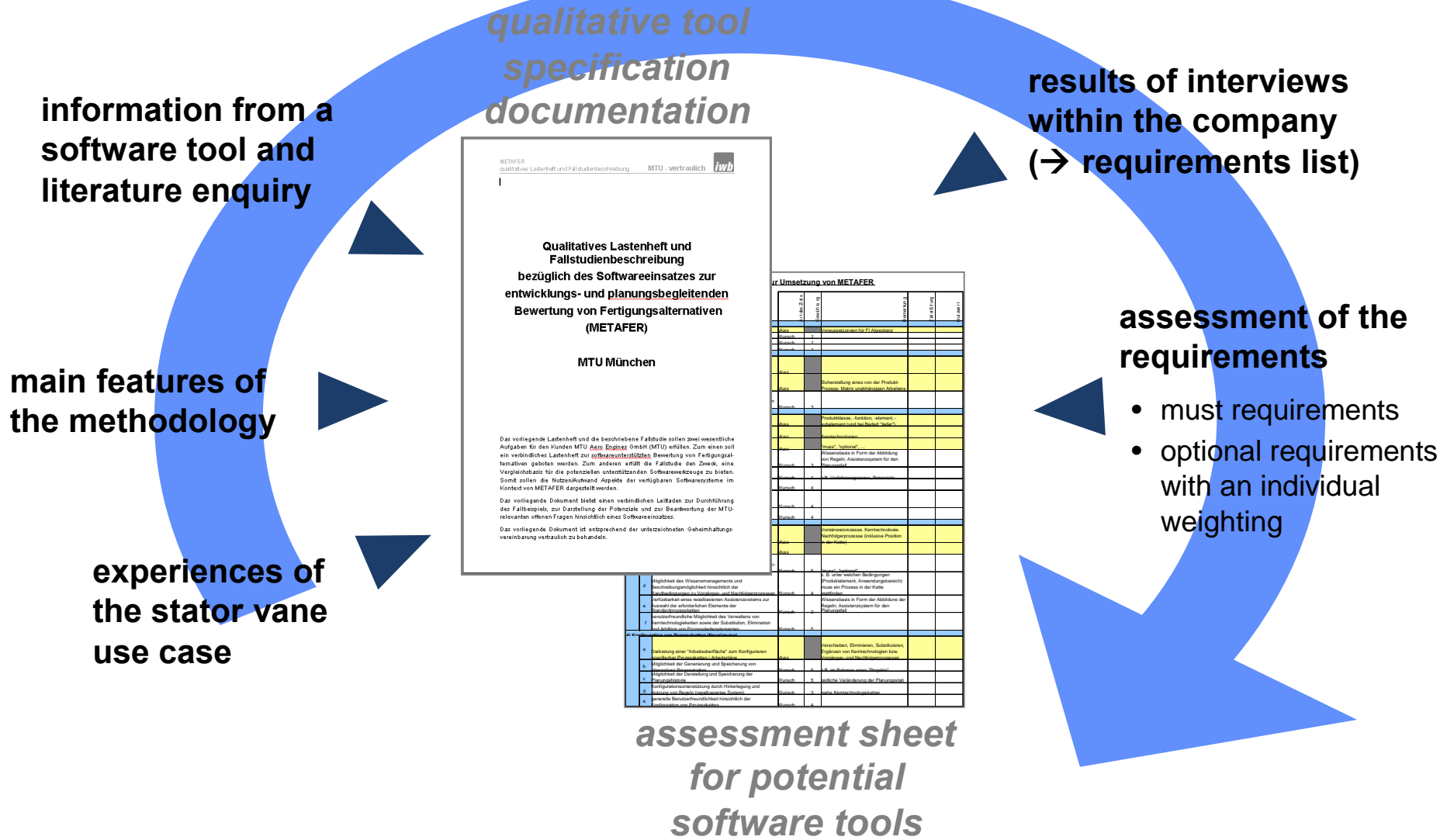
Further Steps



Summary



# Implementation of the Method Software Tool Specification



**Ihr Umsetzung von METAFER**

Kriterium	Erreichung	Erreichung	Erreichung	Erreichung	Erreichung
1. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
2. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
3. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
4. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
5. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
6. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
7. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
8. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
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10. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
11. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
12. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
13. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
14. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
15. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
16. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
17. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
18. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
19. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
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21. Einmaligkeit der Datenstruktur	Erreicht	Erreicht	Erreicht	Erreicht	Erreicht
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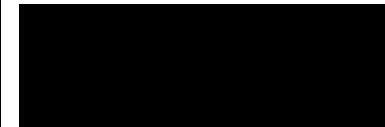
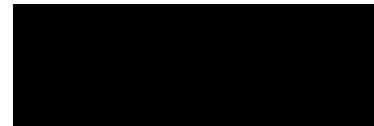


# Implementation of the Method Enquiry and Assessment Proceeding

1. enquiry and pre-selection of software tool providers:



Innovative  
Organisationsysteme  
GmbH **HSi**



*current spectrum of software tool providers*

2. preparation and transmission of the qualitative software specification  
and a simplified use case description

3. presentation of the use cases



4. assessment of the fulfilment of requirements based on the  
assessment sheet and selection of the most adequate software tool



# Implementation of the Method Qualitative Assessment Results

## assessment criteria and results:

		HSi			SAP
0) IT preconditions (0 to 10 (optimal))		8	assessment results of excluded solutions are not shown in this presentation		10
1) generation and recirculation of process chains		++			++
2) products and processes		+			+
3) core technology chains		+			+
4) configuration of process chains (planning process)		++			++
5) types of determination of process data (e.g. times)		+			0
6) comparison and visualisation of alternatives		+			++
7) calculation of manufacturing costs		++			++
8) assessment by investment appraisal		0			++
9) qualitative assessment		0			0
10) maturing assessment		+			+
11) qualitative IT criteria		-		++	

## evaluation regarding qualitative/subjective criteria:

a) transparency		+		++
b) personal impression		++		++

## legend:

- must requirement fulfilled
- not completely clarified, if must requirement fulfilled
- must requirement not fulfilled

## qualitative criteria ...

- ++ very good fulfilled
- + good fulfilled
- 0 neither good nor badly fulfilled
- badly fulfilled
- very badly fulfilled

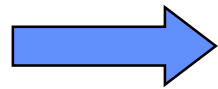


# Implementation of the Method Overview

Rank	Software System	Brief Description (subjective)
1	SAP iPPE / PDCE	- iPPE: <u>PLM tool</u> ; tool with a sort of product process backbone - PDCE (Product Design Cost Estimate): <u>integrated cost estimation tool</u> - both tools can be combined with an time management tool (DMC)
2	HSi	<u>process planning tool</u> ; tool which complements SAP/PP in the field of detail planning on base of hierarchical structures and parameters
3		<u>knowledge-based process planning tool</u> (origin: products with a lot of variants); object oriented „rule engine“
4		tool focuses cost transparency and maturing <u>cost assessment</u> along development and planning phases
5		<u>process planning tool</u> ; configuration of products, processes and resources on base of a central data base
6		<u>process planning and time management tool</u> ; process planning on base of parameters and by the use of a time management data base
7		<u>process planning and time management tool</u> ; process planning on base of parameters and by the use of a time management data base



# Implementation of the Method Conclusion



## Recommendation of the Software Systems SAP iPPE/PDCE or HSi

### Essential Criteria for the Implementation of SAP iPPE/PDCE or HSi

#### SAP

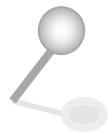
- **high level of congruence** regarding the required **functionalities**  
(missing aspects: knowledge-based functionalities)
- **no licences needed**; licences are already covered by the MTU Aero Engines standard SAP environment
- **familiar gui**
- **minimal interface problems**
- **optimal system support**
- **positive overall impression** within the presentations

#### HSi

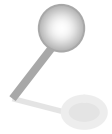
- **high level of congruence** regarding the **required functionalities**
- **good user-friendliness** (SAP similarity)
- especially **process planners** regarded the tool as helpful (data base for the management of detail times)
- **positive overall impression** within the presentations



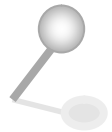
# Structure



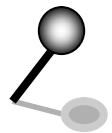
Introduction



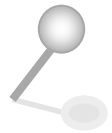
Concept for Process Planning and Evaluation



Software Supported Implementation of the Method



**Further Steps**

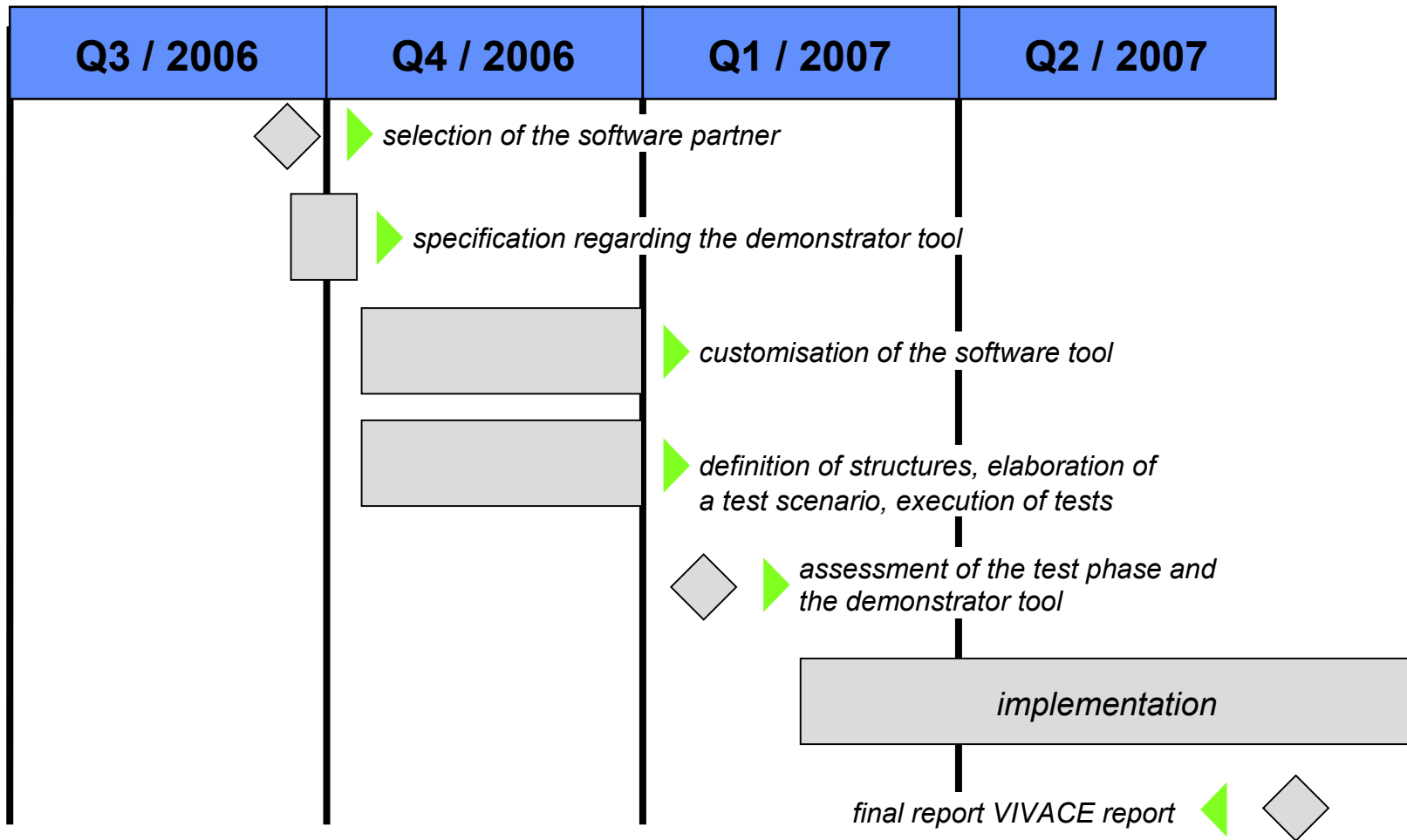


Summary



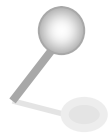
# Further Steps Time Table

## Test / Demonstrator Tool Phase / Implementation Phase

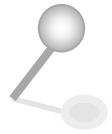




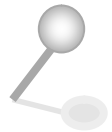
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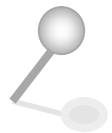
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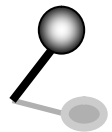
Concept for Process Planning and Evaluation



Software Supported Implementation of the Method



Further Steps



**Summary**



# Summary Expected Benefits

## general

- ➔ The methodology delivers **process chains** and their **times** in very **early phases**. Insofar it represents the basis for an early calculation of **lead times** within a company. Therefore it can deliver information for the **planning of supply chains**.
- ➔ The implementation of the METAFER methodology with a software tool offers an access towards a computer aided **product-process-configuration, time management** and **the management of process planning knowledge!**

## process planning

- ➔ **reduction of manufacturing costs**  
(estimation: up to 5 %)
- ➔ **reduction of time to market** by an accelerated planning process
- ➔ optimisation of the following aspects:
  - **standardisation**
  - **secureness** regarding process decisions
  - consideration of **process interdependencies**

## generation of quotations

- ➔ **reduction of the reaction time and lead time** regarding quotations **up to 50%**  
(→ „quotations within 5 days“)
- ➔ qualified estimations instead of a planning oriented generation of quotations will lead to **savings** up to some **hundred thousand €/a**



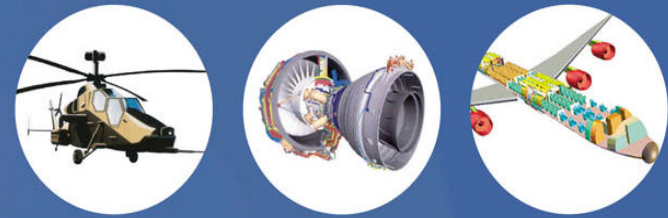
# Summary and Further Steps

## General Aspects and Benefits

### *general benefits and relevance for other companies and industries*

- ➔ The methodological concept can be **adapted to every production company** in the field of serial production.  
(general description of defining structures and relation matrices)
- ➔ The introduced **building kit** enables every company to force a **standardised process planning** proceeding.
- ➔ The explicit configuration of process chains supports the integration of **innovative technologies**.
- ➔ The fast configuration of “internal” process chains and their assessment enables the formation of robust and reliable **supply chains within very early phases**.
- ➔ The methodology is **based on a company independent guideline** / procedure description. Insofar it can easily be adopted.
- ➔ The methodology is **designed software neutral** for enabling an individual implementation. It includes an guideline regarding the software selection process to support the implementation.

**Dr. Hans-Uwe Baron**  
**MTU Aero Engines GmbH**



# VIVACE

**Ideal Workflow and Process Planning Concept  
for the Product Development Phase**