Cost Reduction through Dimensional Management

EDAG Engineering + Design AG

Seppo Perämäki

Reesbergstraße 1
D-36039 Fulda

Tel: +49 (0)661 / 6000 – 644
Mobil: +49 (0)171 / 8816260
seppo.peraemaeki@edag.de

What is quality?

Quality is an indicator to show, how much of the customer requirements have been fulfilled.

”Voice of the customer”

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

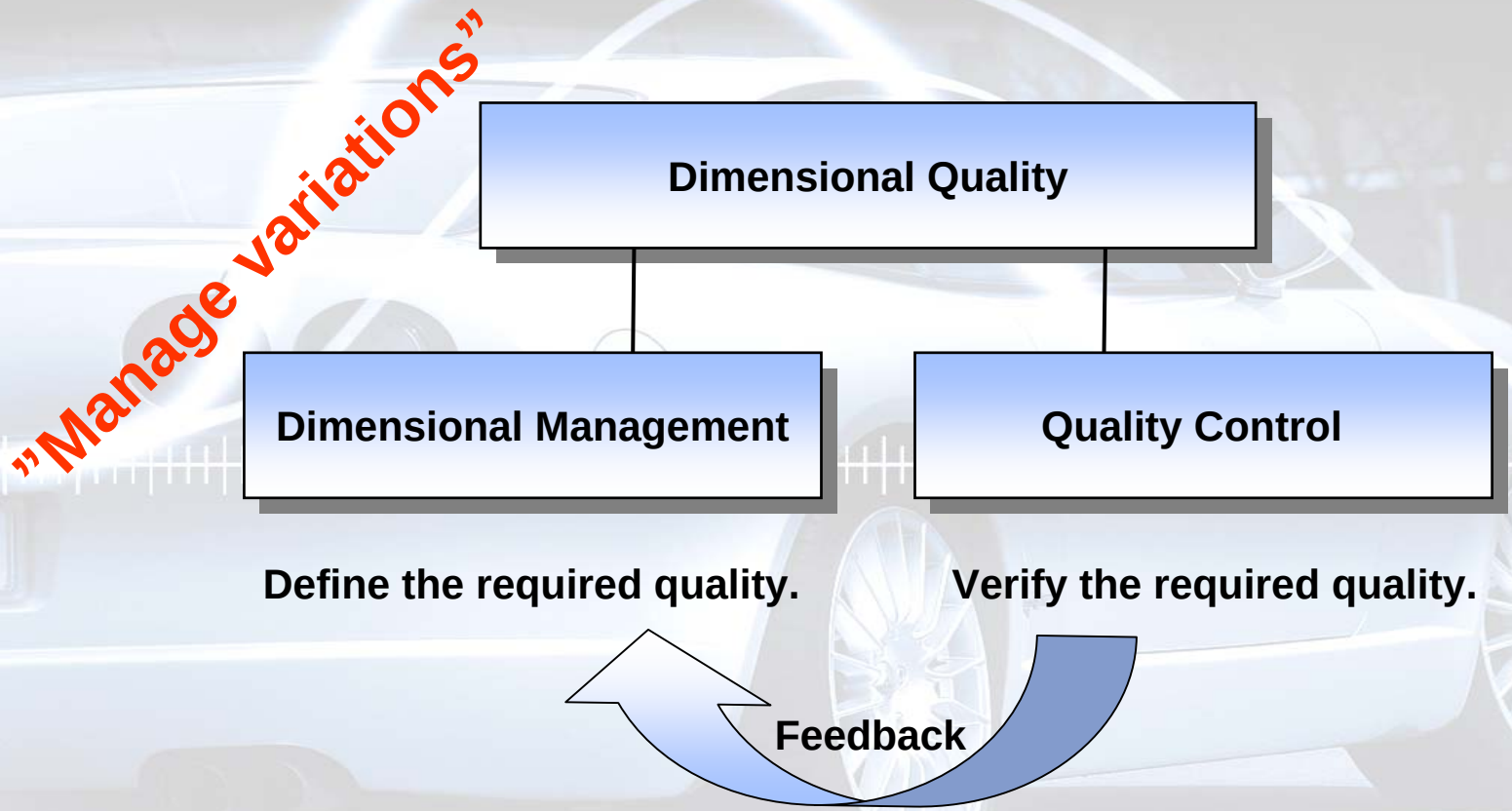
What is dimensional quality?

Dimensional quality is an indicator to show, how much of the measurable, pre-established product quality requirements have been fulfilled.

”Required quality”

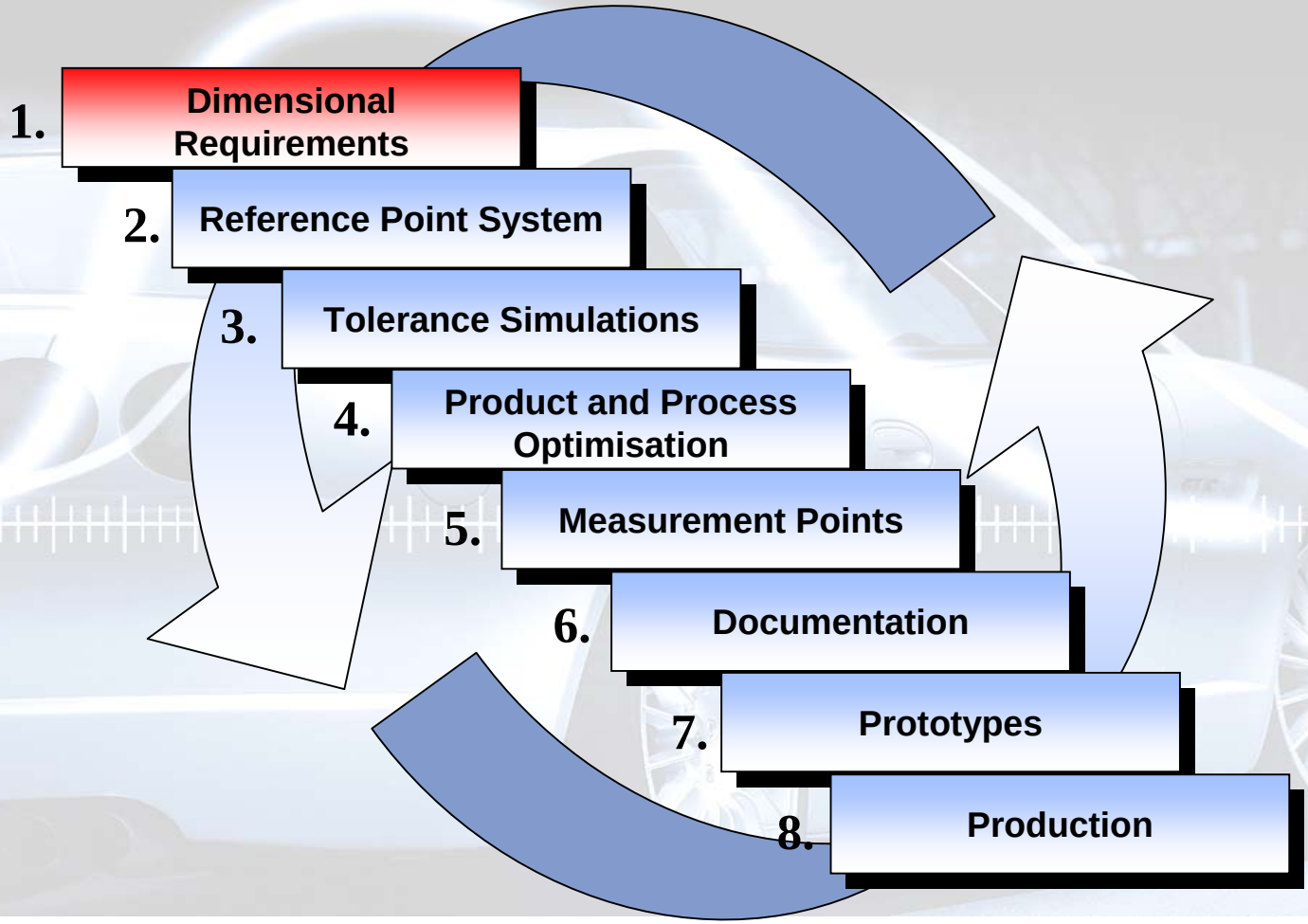
EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Dimensional quality has two parts



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Dimensional Management Process



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Dimensional requirements

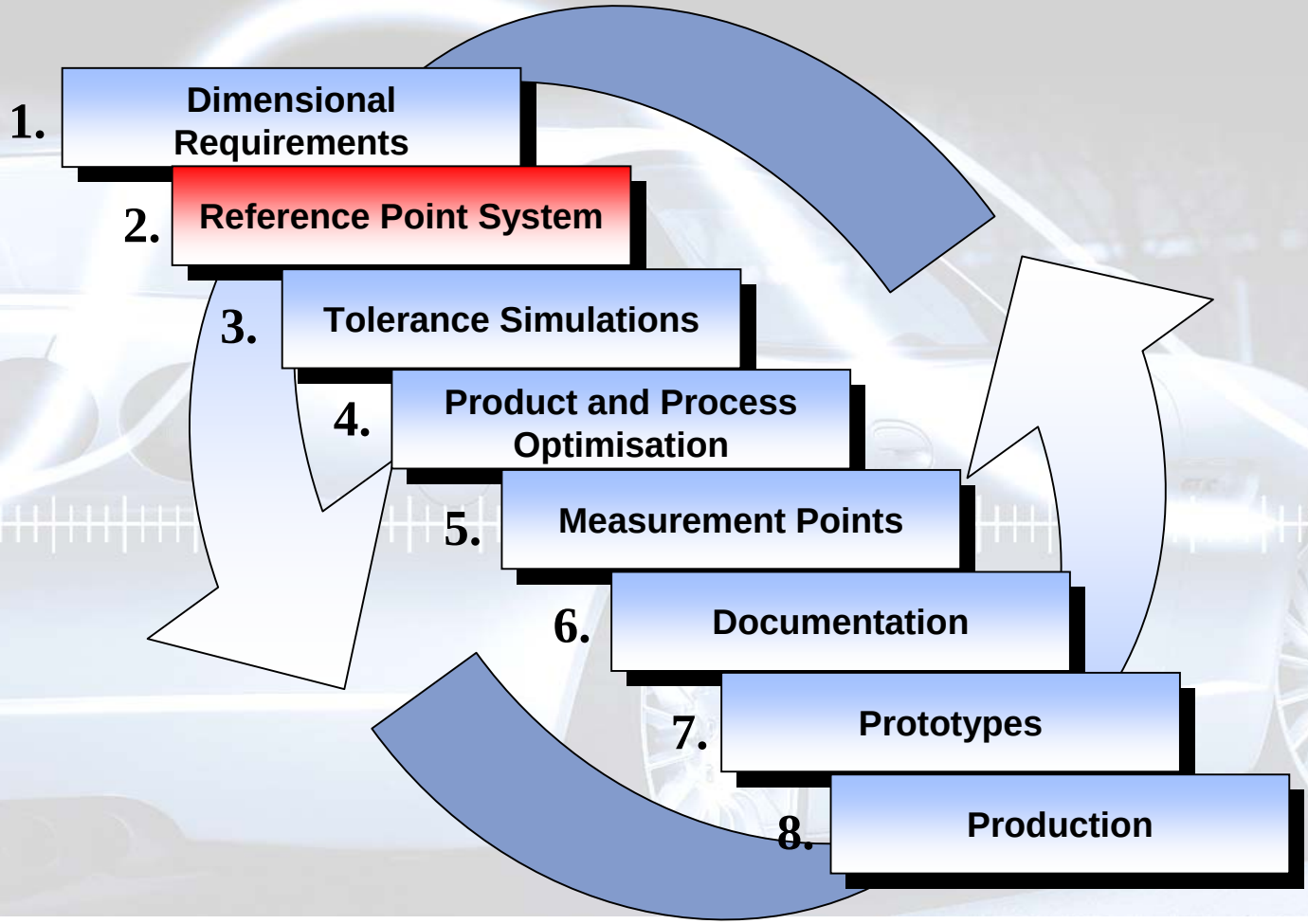
The first step to reduce costs in development phase is to define *realistic* dimensional requirements for the program.

Typical objectives are:

- **Gap and flushness**
- **Functional requirements**
- **Interfaces between different units**

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Dimensional Management Process



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Reference Point System

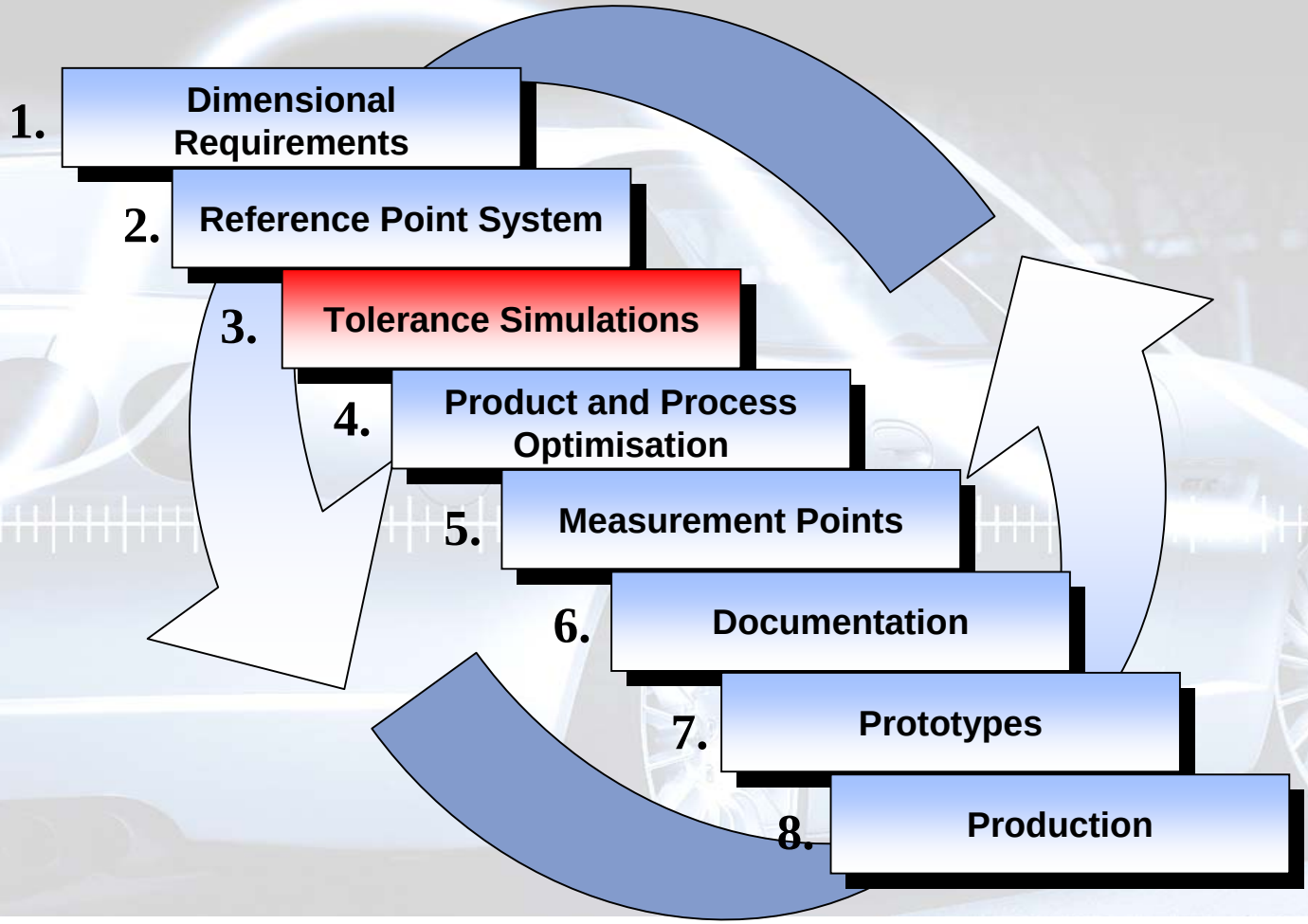
Reference Point System (RPS) is a basis:

- to define the parts and assemblies in coordinate system
- for functions, measurements and tolerances
- for assembly fixtures and production tooling
- for quality control (checking fixtures, measurements)
- for communication between different departments and suppliers

“With a stable Reference Point System you have less variations without additional costs!”

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Dimensional Management Process



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Why do we simulate?

In a development phase the “assemblibility” of all parts must be assured before production release.

In a production phase the possible product- and process changes must be optimised before the expensive hardware changes will been executed.

“Tolerance simulation is a tool to produce neutral, realistic facts for the decision makers in a right time”

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

What is needed for a modern tolerance simulation tool?

- Realistic results
- Consideration of all variations
  - Product (all areas)
  - Production equipment (fixtures, robots..)
  - Process (hamming, gluing…)
- Visualization of variations
- Documentation of variation (values, sensitivity charts, pictures…)
- Integration into the existing systems (CAD, measurement systems…)
- Change Management (quickness, “what if”- optimisation…)
- Usability (easiness, qualification of users…)
- Hardware requirements (mobile)
- …

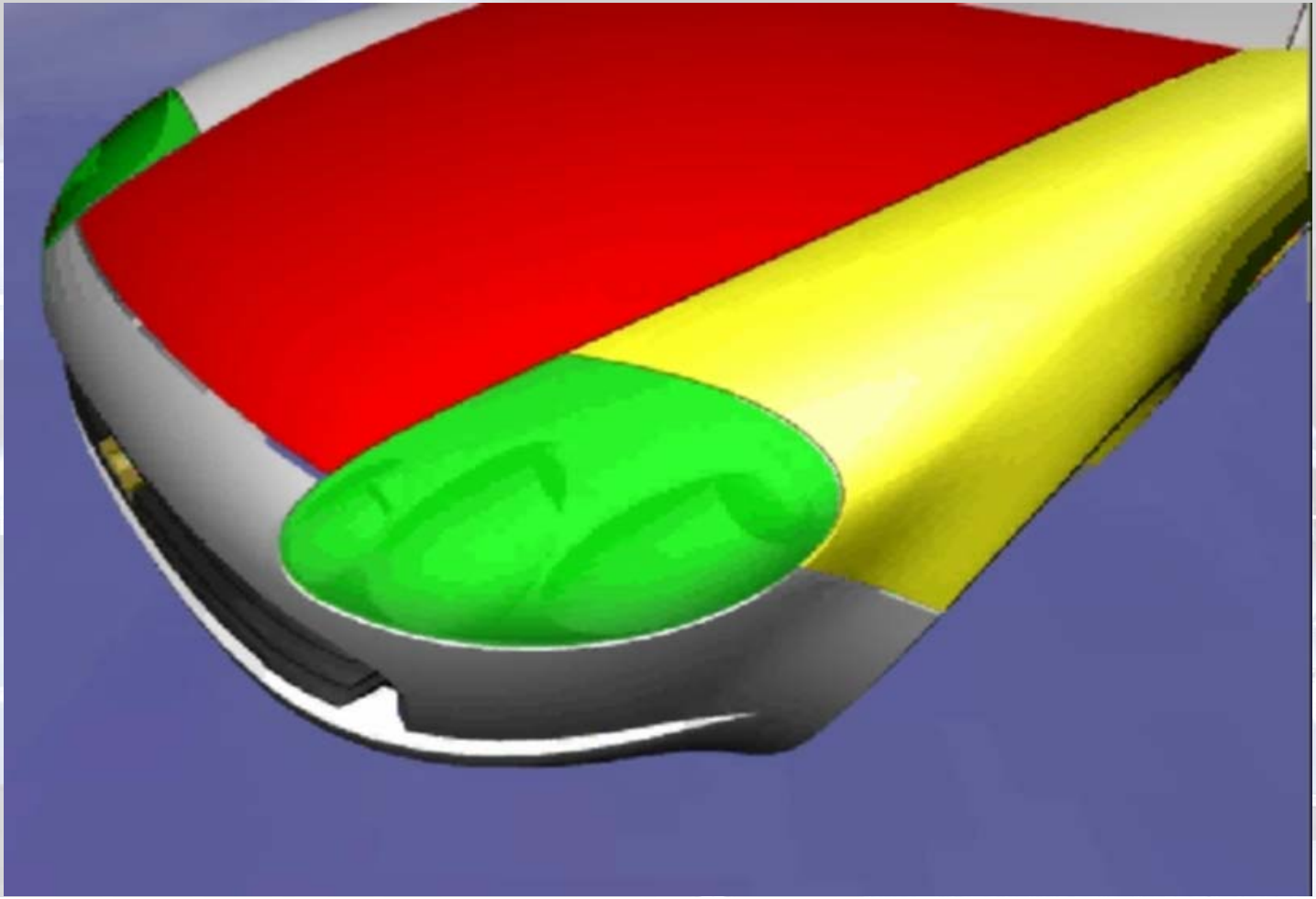
EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

How can I reduce costs through tolerance simulation?

- Less changes in engineering phase
- Problems can be solved before hardware exists
- Less problems because of realistic piece part-, assembly-, tooling- and process tolerances
- Quicker problem solving (decision making)
- Cheaper piece parts (start the simulation with default tolerances, larger piece part tolerances where possible)
- Cheaper fixtures (start the simulation with default tolerances, larger fixture tolerances where possible)
- Less “matching” in tool manufacturing phase
- Less rework in production

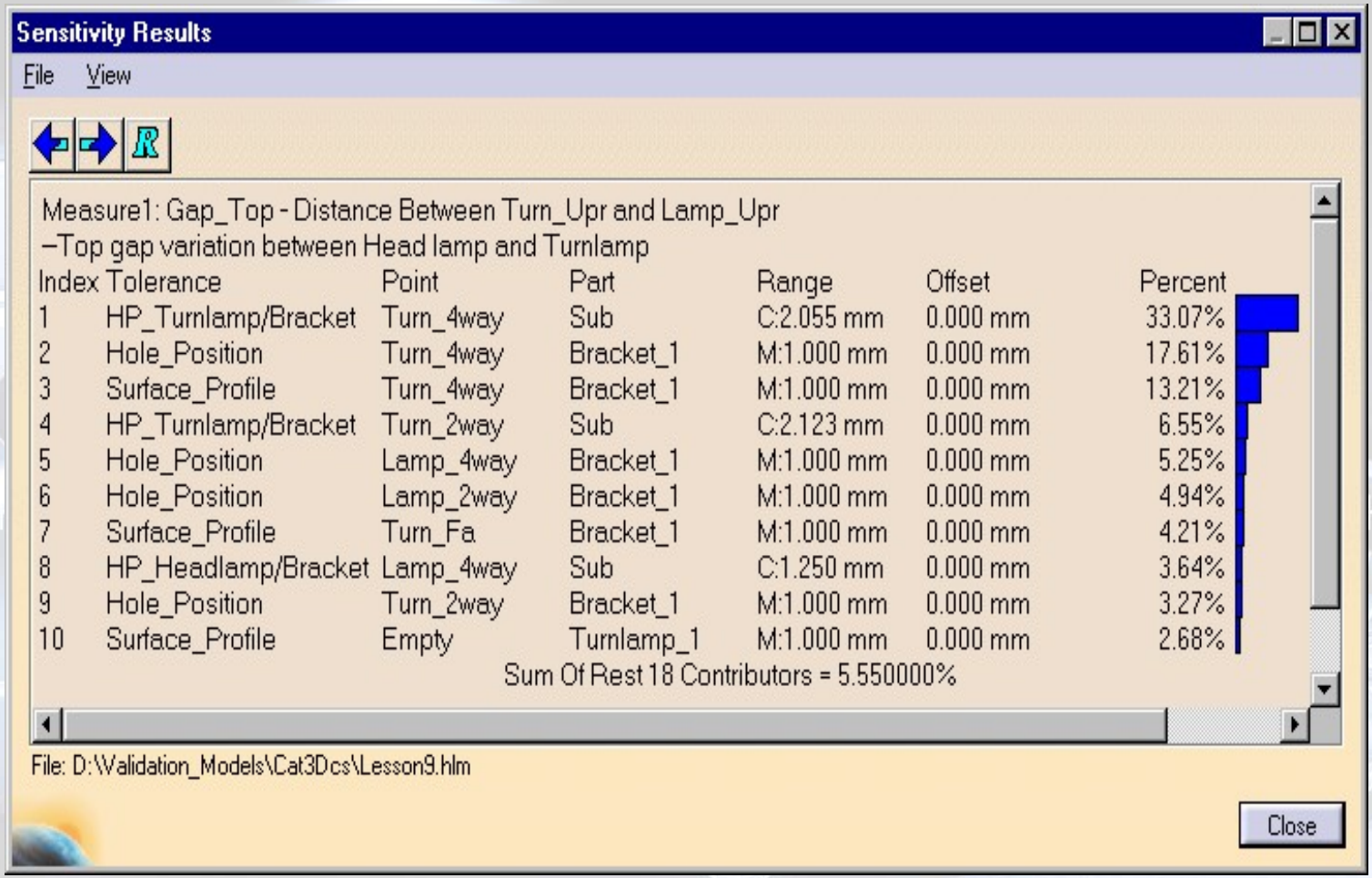
EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Example: Visualization



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

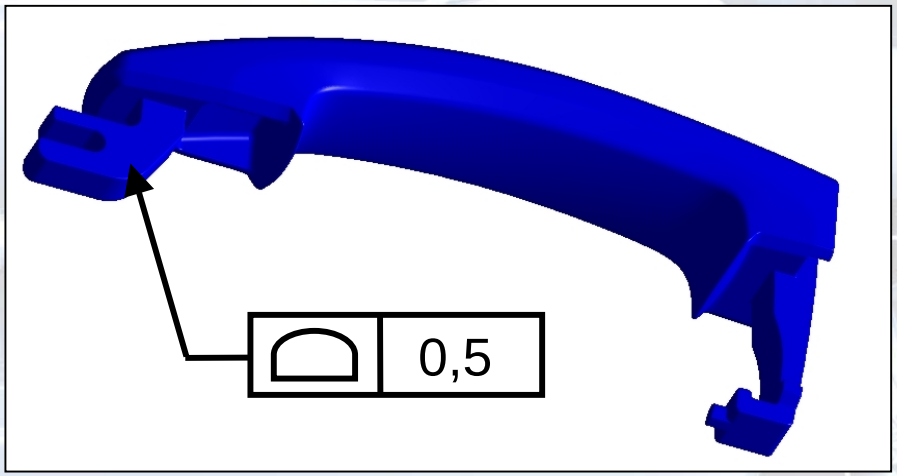
Example: Sensitivity Chart



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

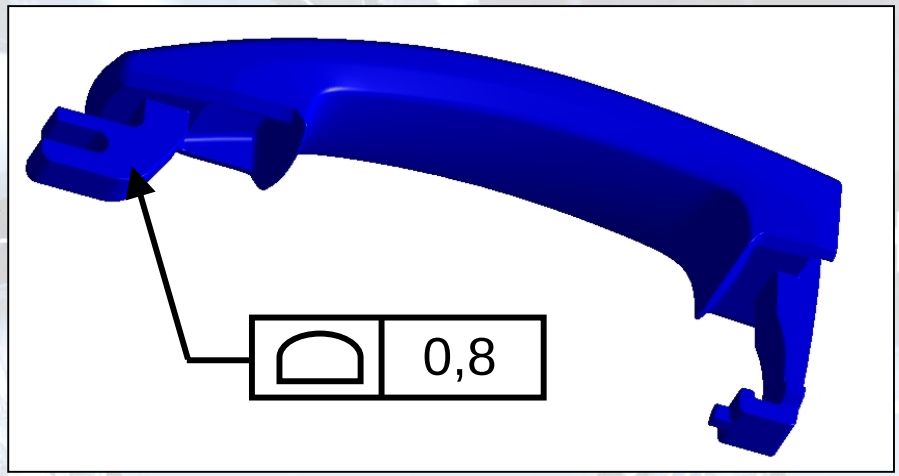
Example: Cost reduction through larger piece part tolerances

„Tolerance, which we always used“



Costs: 4,10 EUR/piece

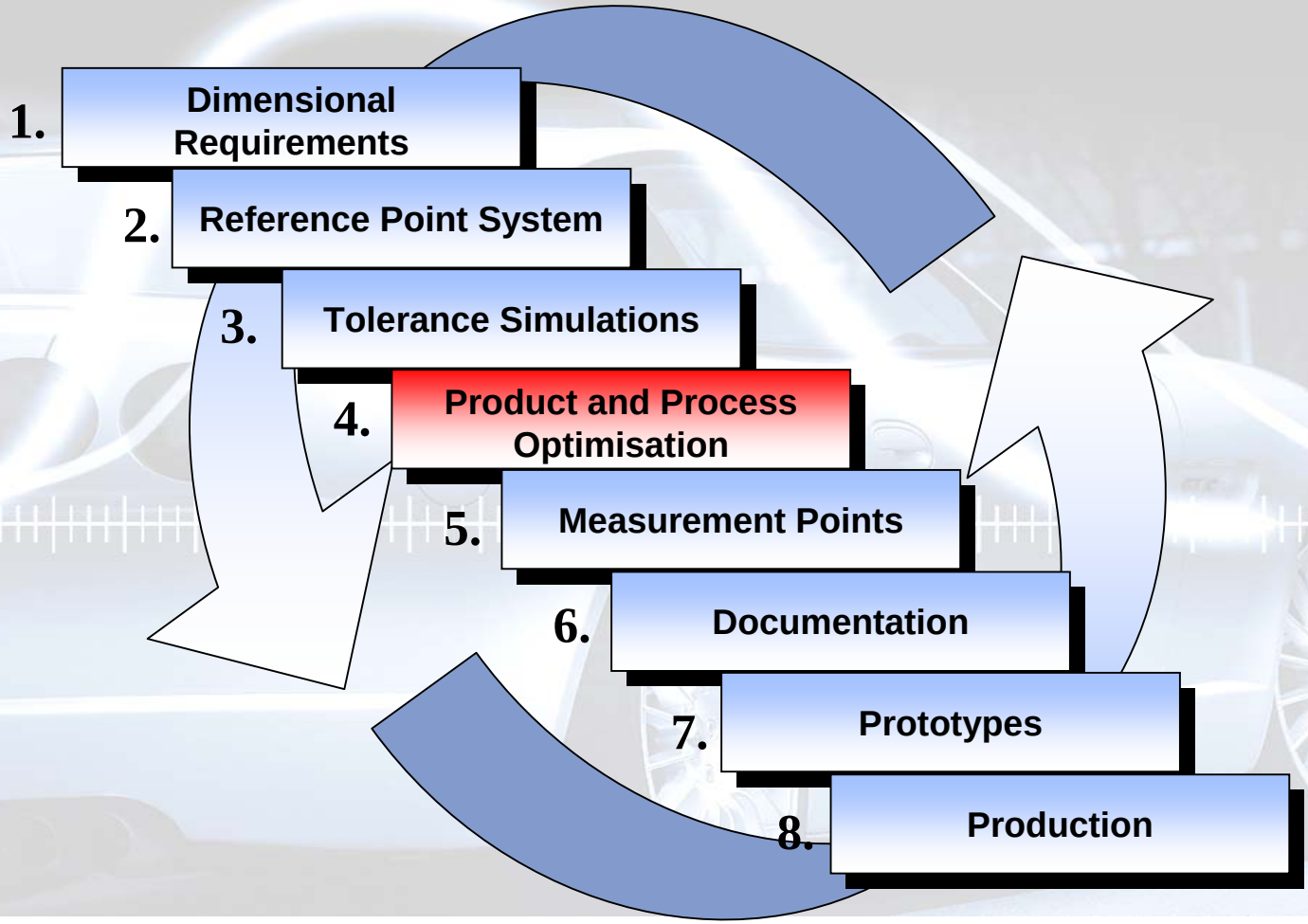
Simulated tolerance



Costs: 2,80 EUR/piece

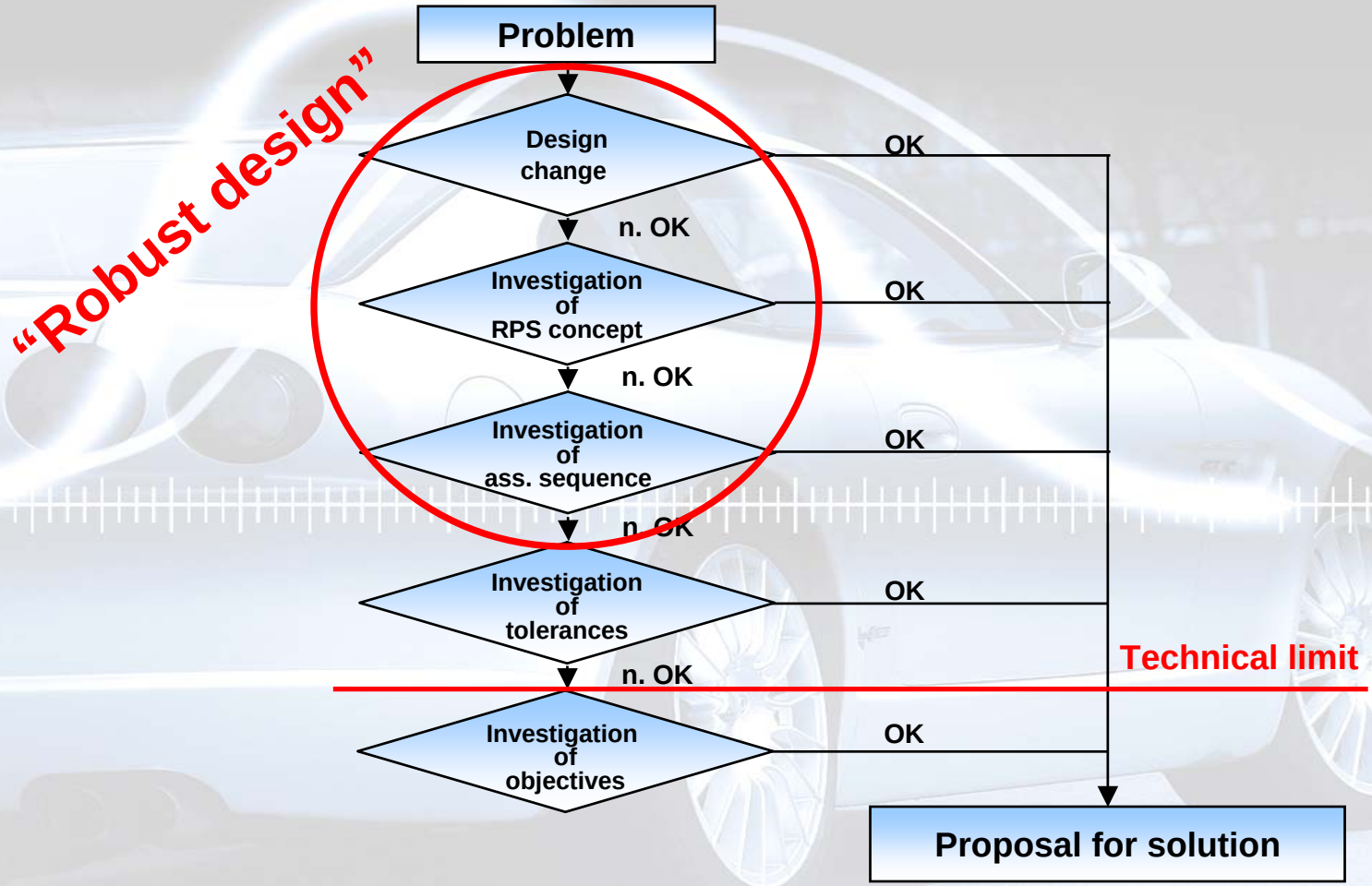
EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Dimensional Management Process



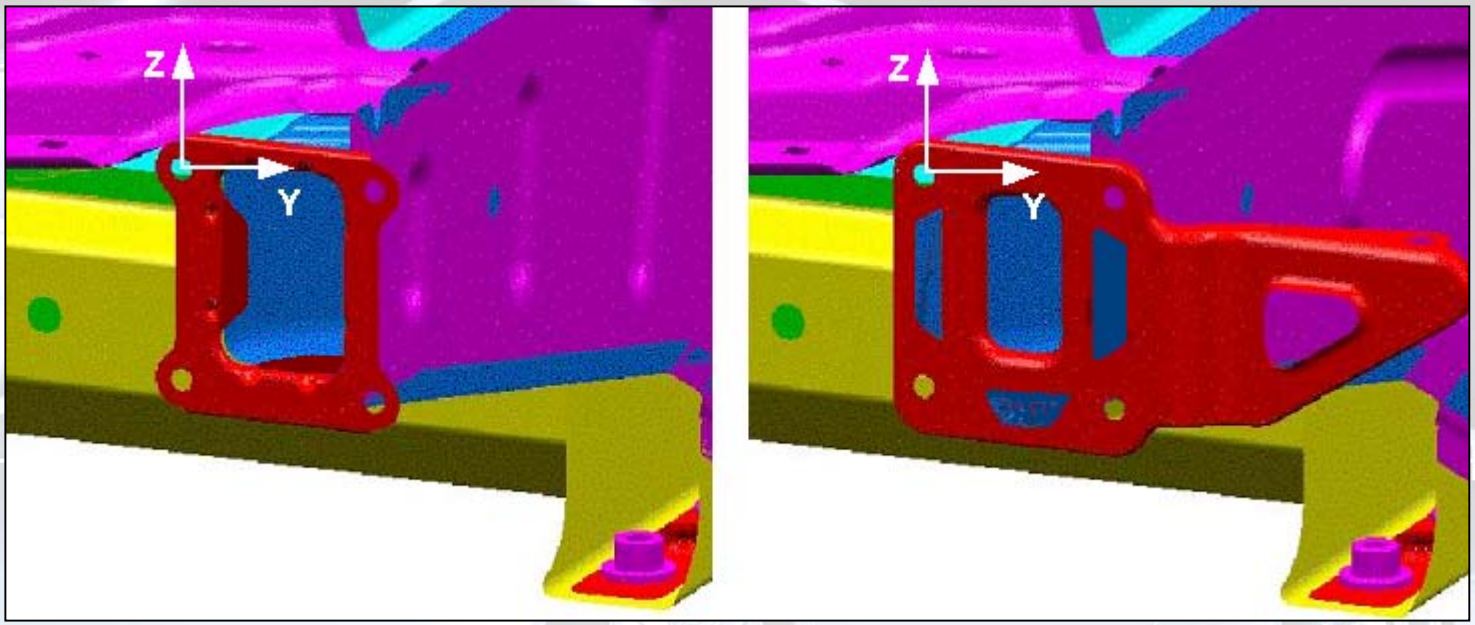
EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Product and Process Optimisation



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Example:
Product Optimisation (Design change)



Objectives:

Y = ± 0,60

Z = ± 0,60

Alternative 1:

Y = ± 1,15

Z = ± 0,91

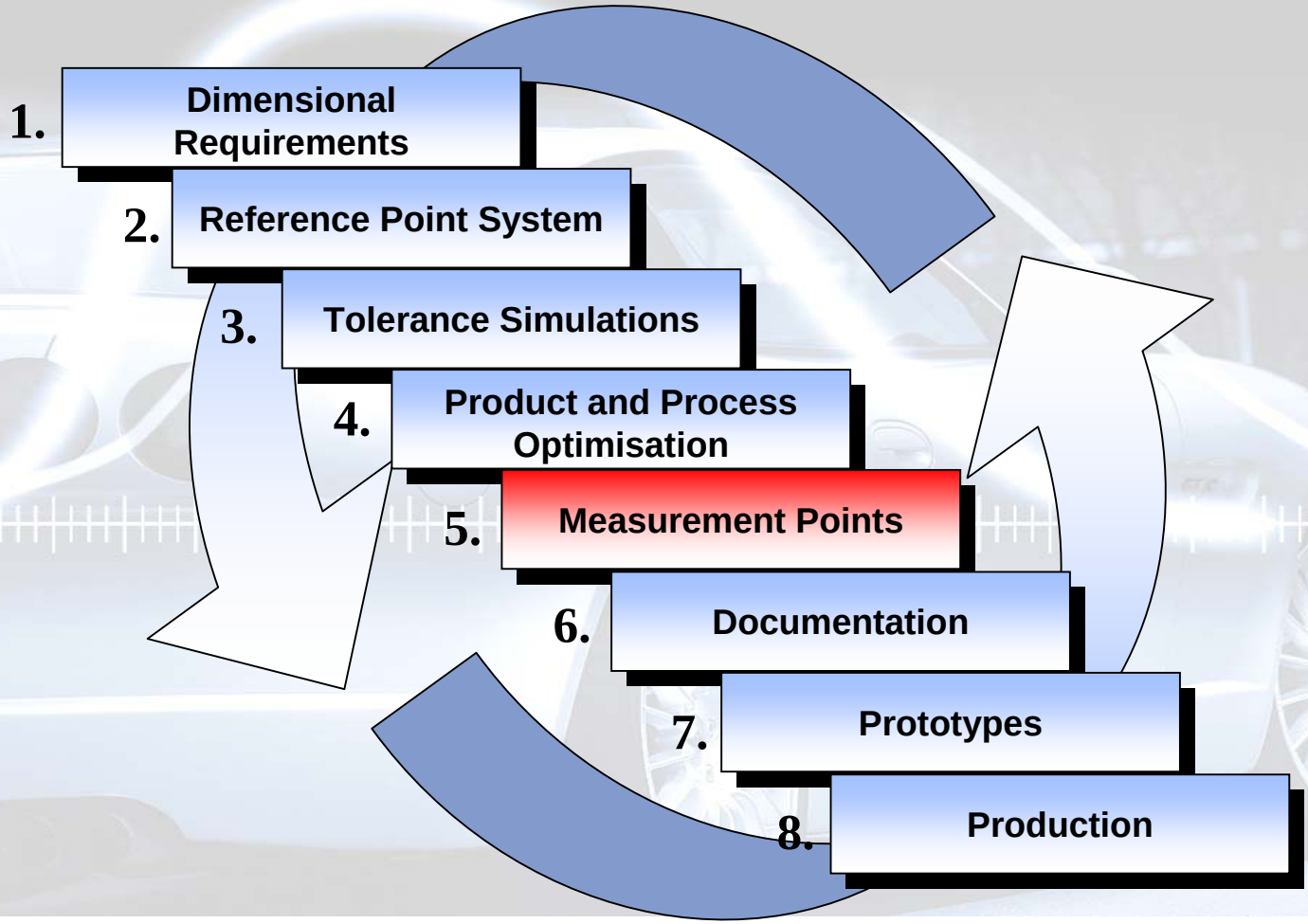
Alternative 2:

Y = ± 0,60 (- 48%)

Z = ± 0,56 (- 38%)

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Dimensional Management Process



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Measurement Points

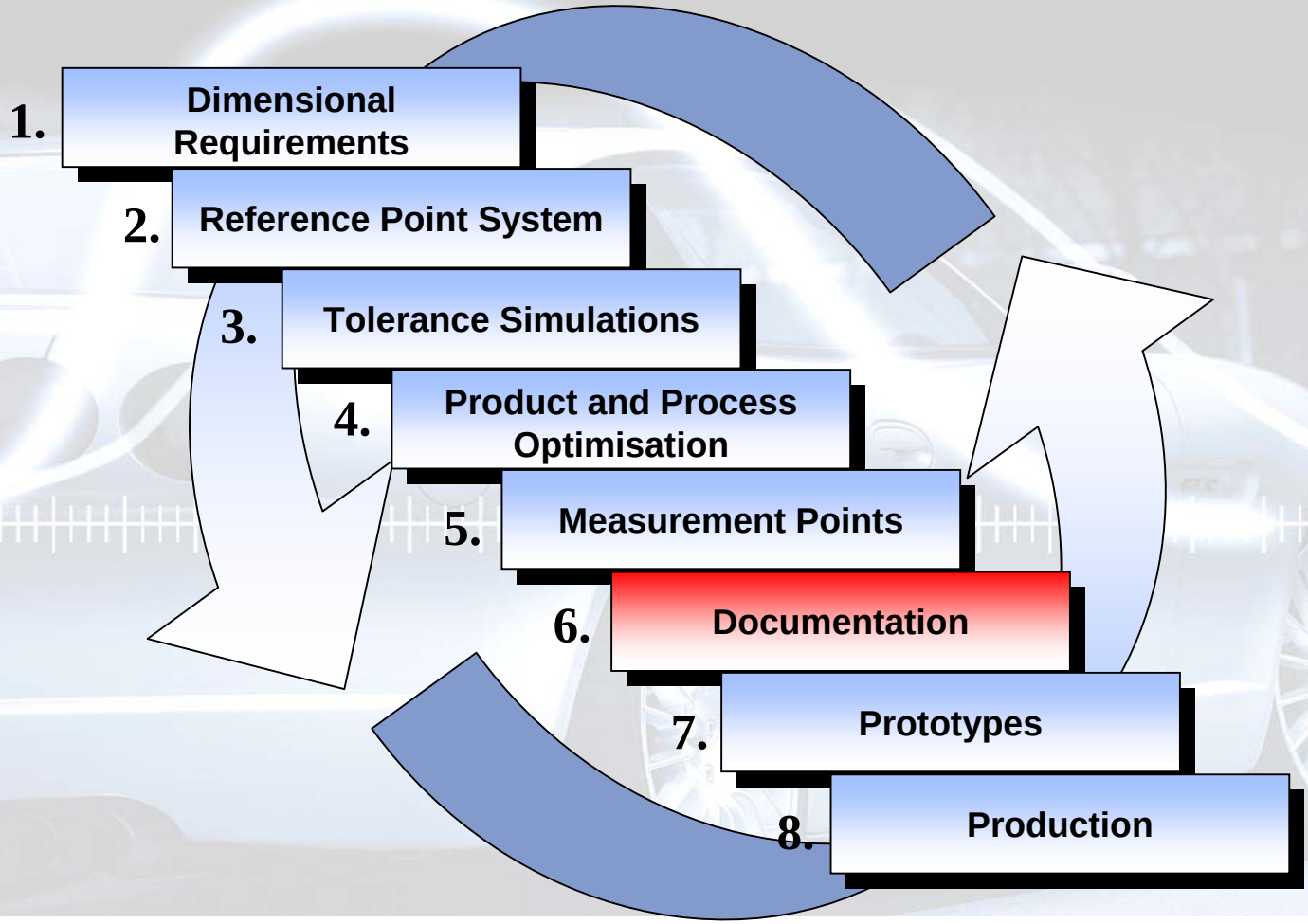
To be able to guarantee the required quality the measurement points must be defined.

The amount and place of measurement points can be optimised based on tolerance simulation results.

“As little as possible – only there where needed”

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Dimensional Management Process



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

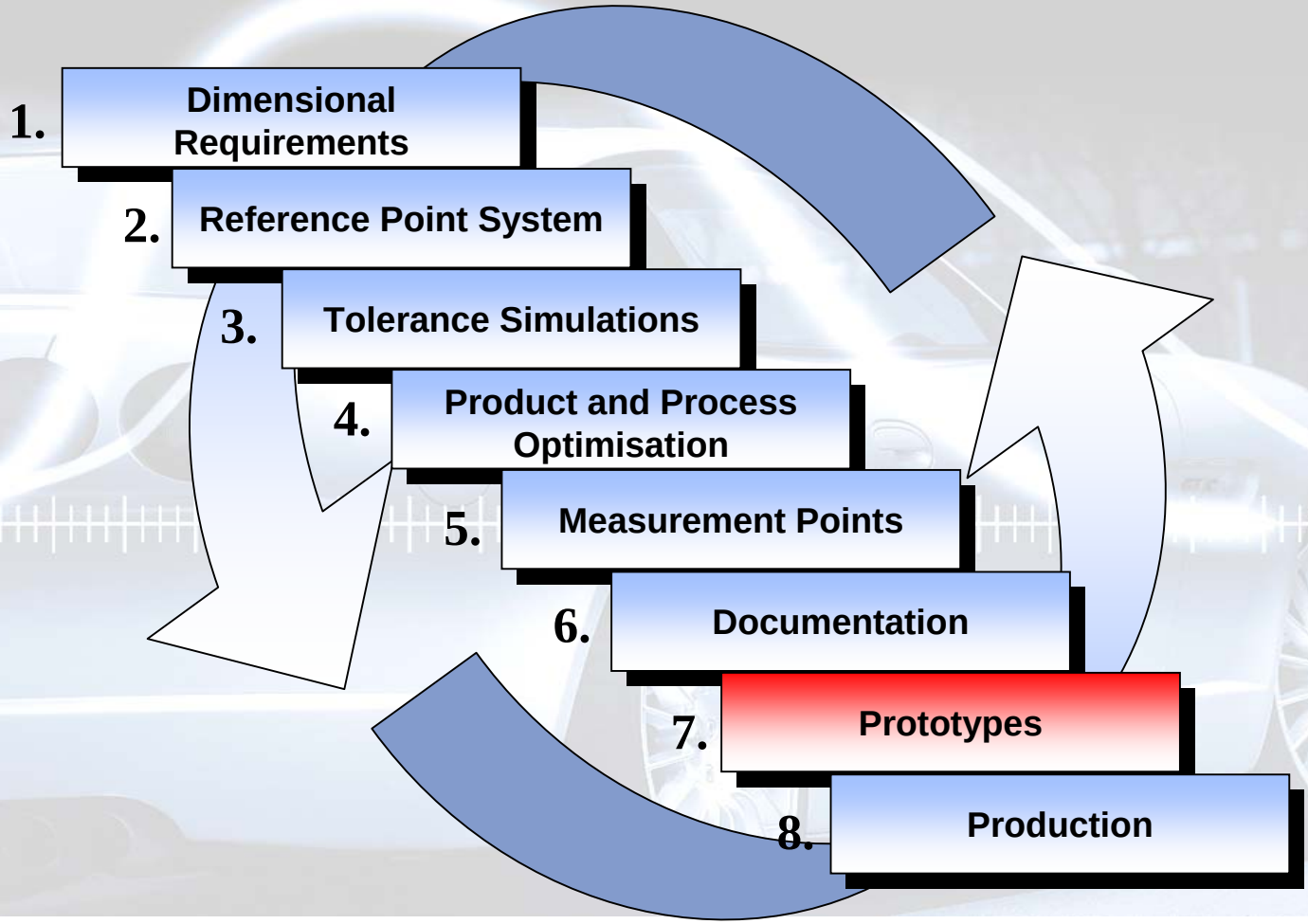
Documentation

The documentation must be carried out so, that all participants (development, suppliers, plant, quality assurance...) do have the possibility to get the quality requirements.

The ideal solution is, when all the quality related information is in a CAD-data (for example FTA).

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Dimensional Management Process



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Prototypes

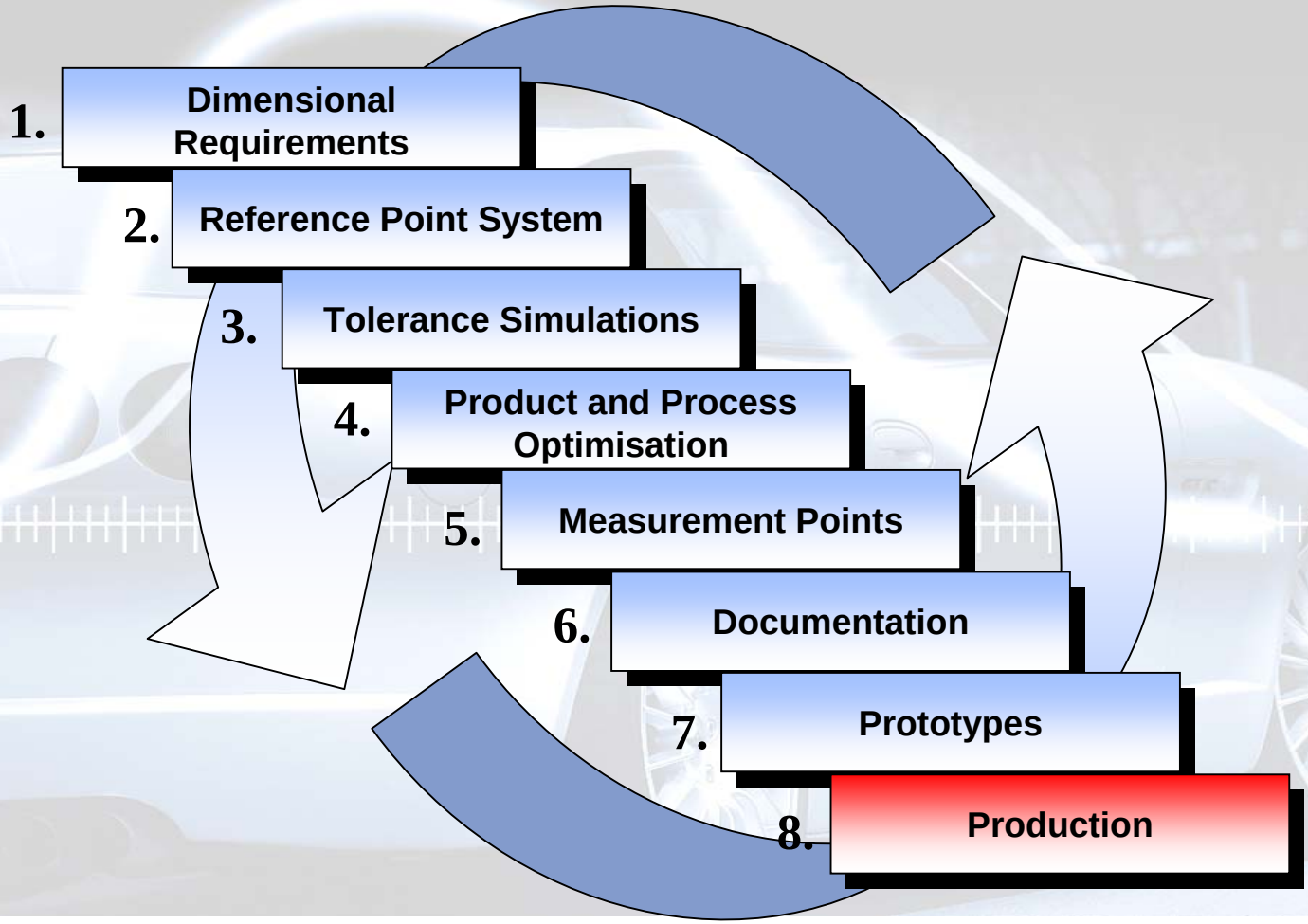
The following quality features will be tested in a prototype phase:

- reference points
- tolerance simulation results
- measurement points
- feasibility of piece parts, assemblies and fixtures

By means of Dimensional Management amount of physical prototypes can be reduced.

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Dimensional Management Process



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Production

In a production phase the possible product- and process changes must be optimised before the expensive hardware changes will been executed.

“Never touch a running system before you have simulated it”

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Investment - Savings

Dimensional Management is one of the most effective methods to reduce so called “Product Life Cycle Costs”.

The savings, generated from different process phases, can easily rise ten times higher than the required investments!

1 : 10

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Example: Investment

Calculation basis:

- Creation of 3D- tolerance simulation model for a total vehicle
- Scope of work:
  - 40 Exterior characteristics
  - 30 Interior characteristics
  - 30 Functional requirements
- Support of the development:
  - 1 year after the creation of tolerance simulation model
  - Update of the 3D- tolerance simulation model
  - Participation in tolerance meetings
  - Creation of proposals for improvements and solutions

Costs **ca. 350.000,- EUR**

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Example: Savings

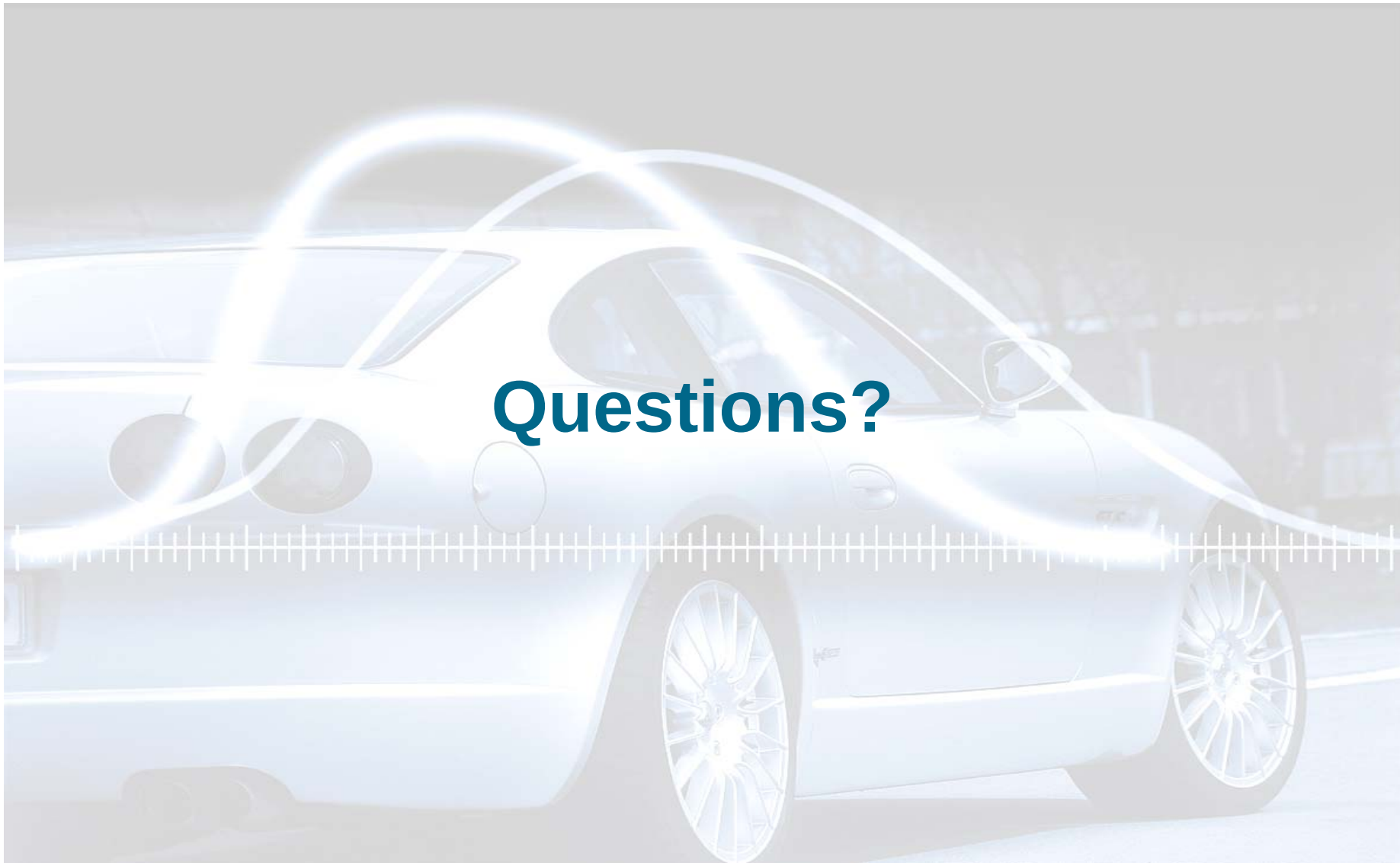
• In product development (less changes)	100.000,- EUR
• In tool manufacturing (less matching)	500.000,- EUR
• In part manufacturing (less scrap)	700.000,- EUR
• In fixture manufacturing (less changes)	300.000,- EUR
• In production (less rework)	2.000.000,- EUR
Savings	**ca. 3.600.000,- EUR**

Calculation basis:

- Production output 200.000 units/year
- Production period 7 years
- Hours/year 1.600 h
- 2 shift work
- Hourly rate, development 70,- EUR
- Hourly rate, production 30,- EUR
- 3 workers less to do rework

SAVINGS 1:10

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de



EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de

Thank you
for your attention.

EDAG Engineering + Design AG
Seppo Perämäki
Tel. +49 (0)661 6000 644
seppo.peraemaeki@edag.de