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Optimizing the Color Sorting Store

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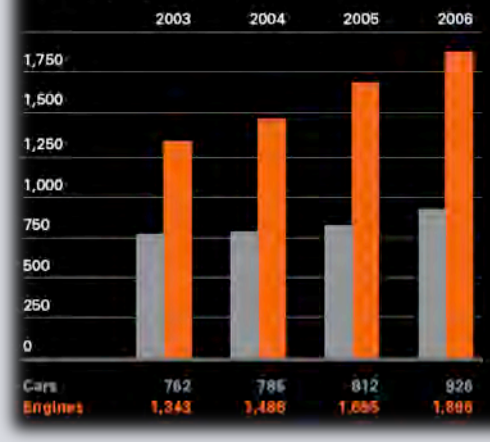
Company Profile

- Founded 1899 in Köln-Ehrenfeld as A. Horch & Cie.
- Since 1910 Audiwerke GmbH
- 962,000 cars per year (2006)
- 52,297 employees (2006)

Production

Car and engine production (thousand units)



Cars	2006	2005
Audi A2	–	10,026
Audi A3	69,813	70,395
Audi A3 Sportback	159,581	150,091
Audi TT Coupé	21,461	8,368
Audi TT Roadster	2,214	3,939
Audi A4 saloon	165,139	157,310
Audi A4 Avant	142,027	155,620
Audi A4 Cabriolet	27,735	22,076
Audi RS 4 saloon	4,384	544
Audi RS 4 Avant	2,666	12
Audi RS 4 Cabriolet	589	13
Audi A5 Coupé	487	10
Audi A6 saloon	150,901	131,344
Audi A6 Avant	70,430	73,334
Audi A6 allroad quattro	11,838	4,295
Audi Q7	72,188	1,194
Audi A8	22,488	21,509
Audi R8	164	6
Total, Audi brand	**924,085**	**810,086**
Lamborghini Gallardo	1,651	972
Lamborghini Murciélago	444	464
Total, Lamborghini brand	**2,095**	**1,436**
Total, Group	**926,180**	**811,522**

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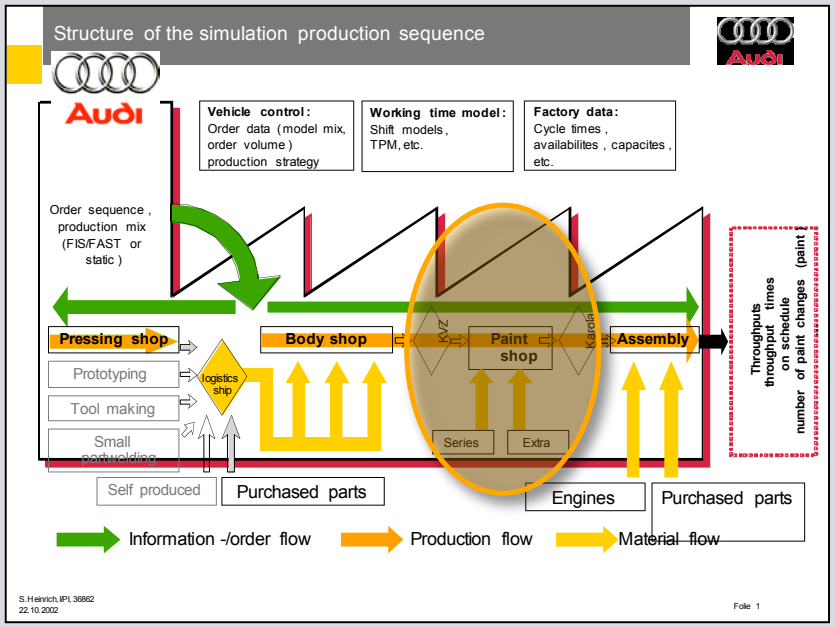
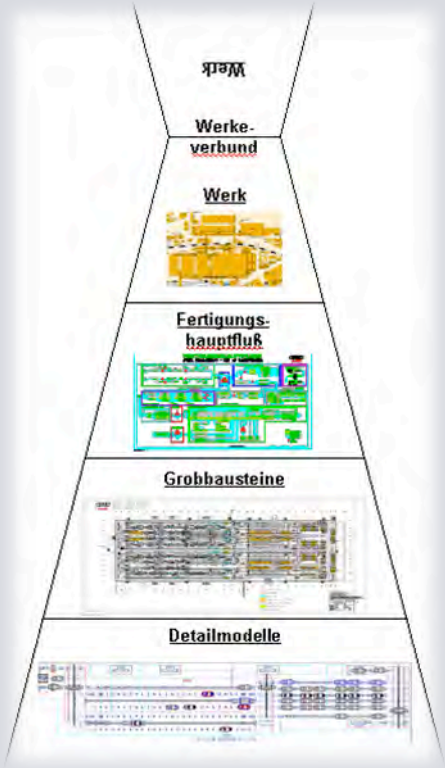
Production Run Simulation Project

Simulation model spans several maintenance groups at the Ingolstadt factory

SiFa (Simulation Fertigungsablauf, i.e. simulation production sequence)





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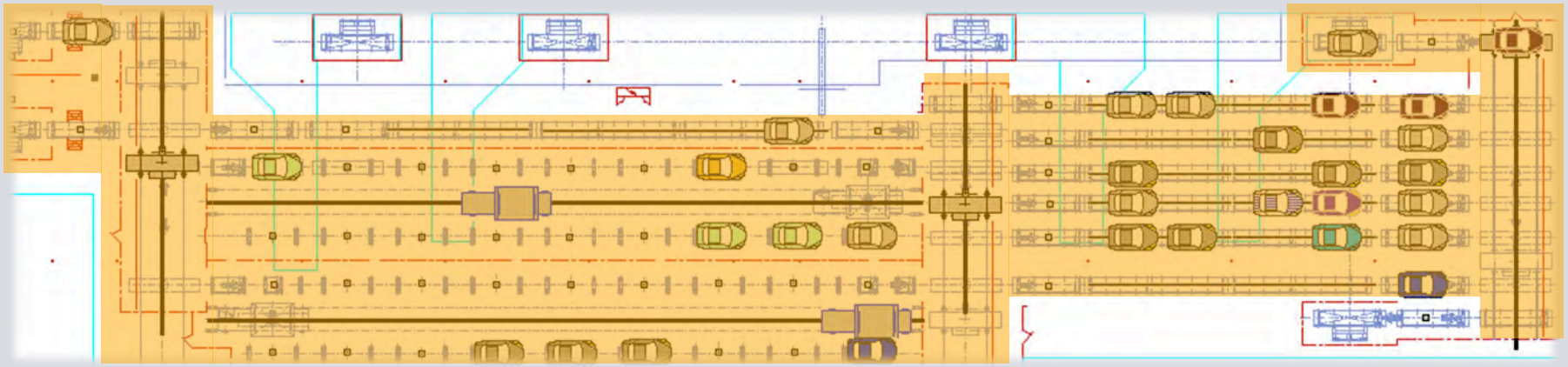
Color Sorting Store

- 320 parking spaces
  - 4 levels
  - 80 parking spaces per-level
- Cars are dispatched from the Body-in-White sequence
- Base coat (pre-treatment, painting small parts, underbody coating)
- Filler, top coat, finish, repair



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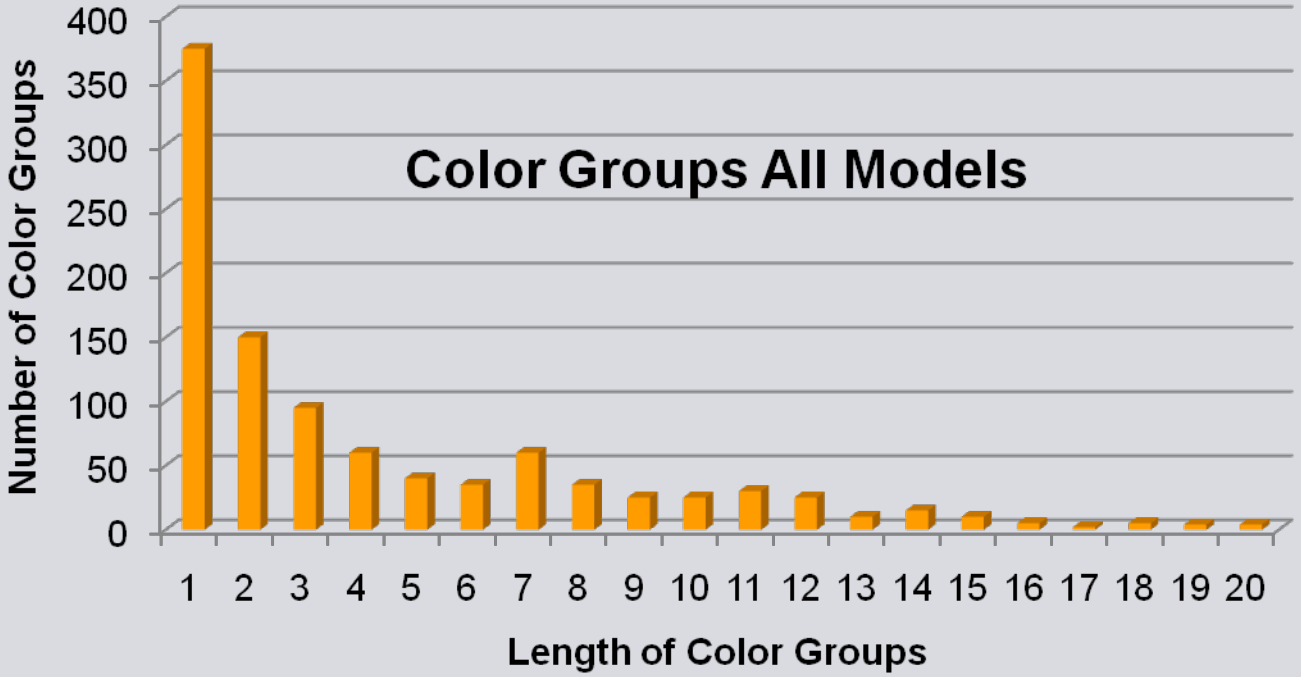
Simulating the Color Sorting Store

Analyzing sorting processes of the color sorting store (FSS)

Why do more than 50% of the color groups contain ≤ 2 cars?



Number	FIS
Number of cars	5876
Mean color block length	**5,86**
Max. color block length	68
Number of color blocks	1003
Number of color blocks ≤ 2 cars.	525

Controlling the Simulation Model with the Original FSS Control!

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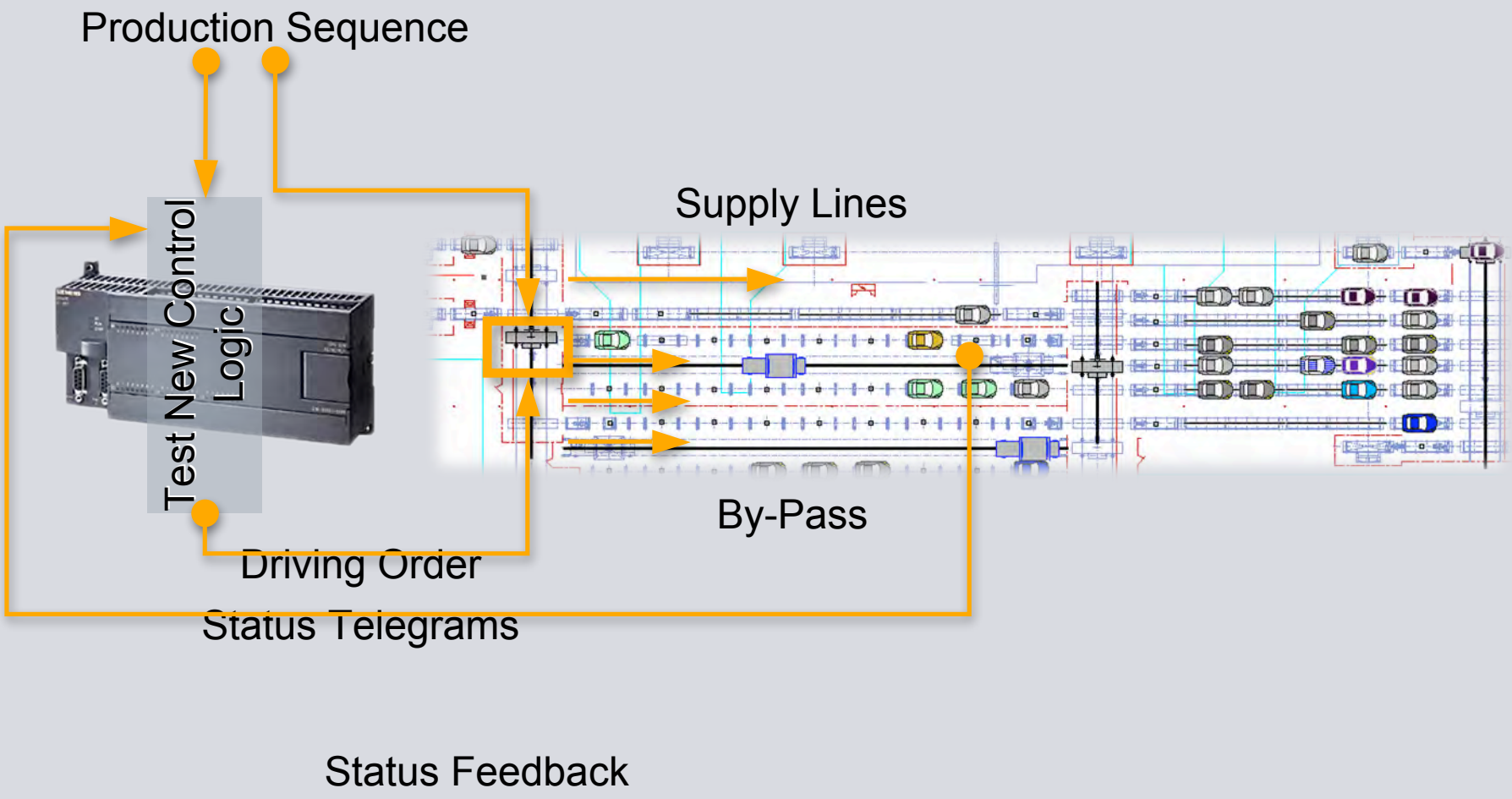
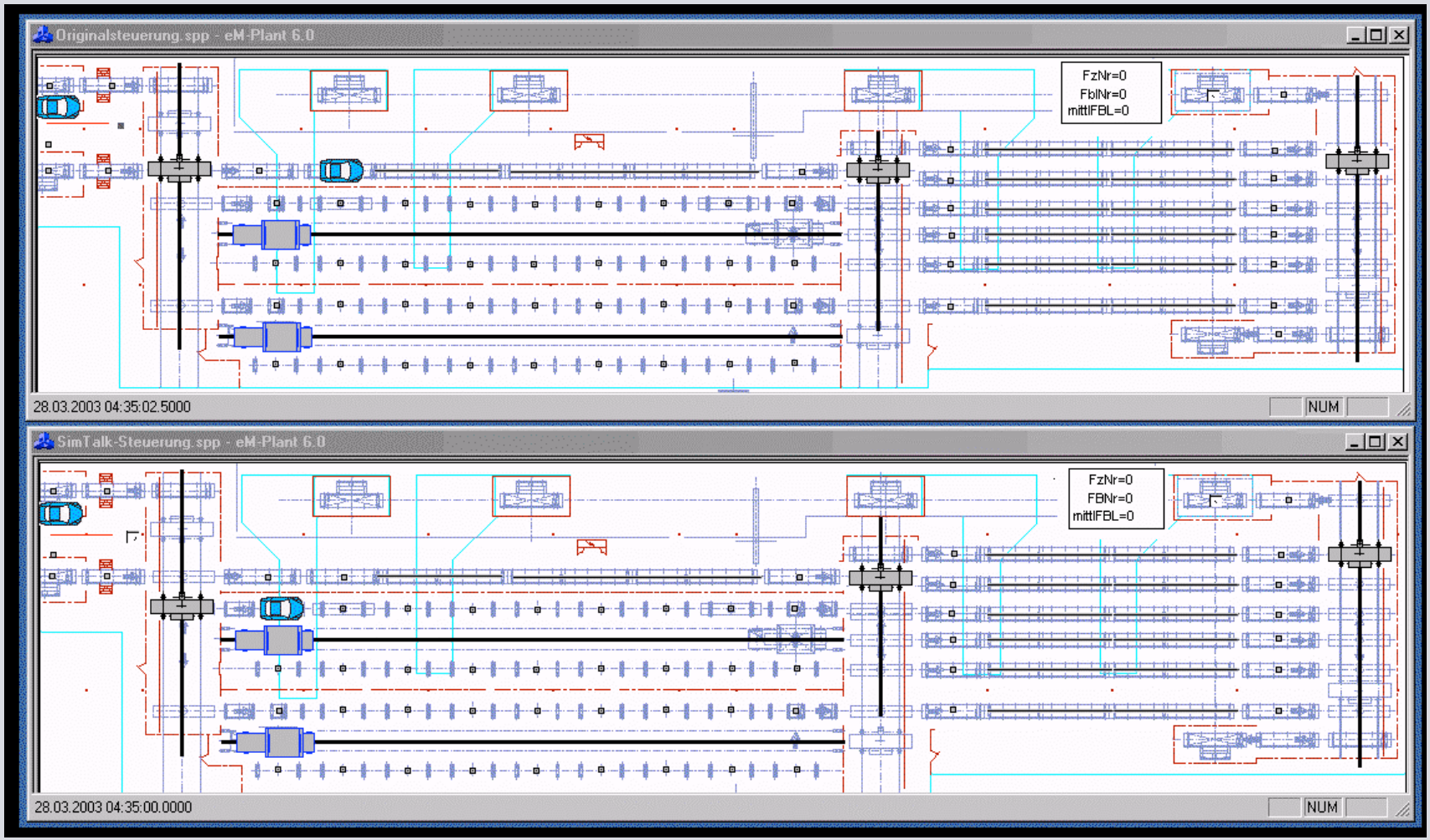


Video



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New Control Logic

Move via by-pass to supply lines when

- …order can be attached to existing color
- …supply line is available and has 5 bodies in random store

- …car body is the same as draw-off color (collect on by-pass until full)
- …otherwise, collect car bodies in random store

Benefits of Optimizing Control Logic based on Simulation

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Develop and modify control logic offline

Reproducibility, time lapse functionality and visualization

Programming controls well in advance of the start of production

Safeguarding strategies, algorithms and functions of new and optimized controls

Risk-free approach to optimal solutions through virtual experiments (testing extreme situations)

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Audi and the VDA

VDA | Verband der Automobilindustrie

580 Members to-date…

- Audi AG, BMW Group, Daimler AG, GME, Volkswagen AG, ZF Friedrichshafen, and more…

Typical application areas…

- Body-in-White, Paint Shop, Assembly and Logistics

"For accomplishing the ever-increasing complexity of planning and production tasks, process simulation is an important tool within the digital factory. VDA decided to create its application object library with Plant Simulation, as it is by far the most flexible and universal simulation software presently on the market." – Stefan Heinrich speaker for VDA Workgroup

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Results

Reduce number of color changes by 40-50%

Reduce single-car color groups by 80%

Increase the average color group from 6-to-10 cars

Profits of 150,000€ per year or 7€ per color change