

**FEMFAT LAB** software

LOAD DATA ANALYSIS

# Testing and Computing Time Optimization with FEMFAT-Lab & Quality Improvement Through Targeted Mixing of Measured Data

2<sup>nd</sup> INDIAN FEMFAT USER  
CONFERENCE / Jan-15 / Pune

E-TH / Markus Baumann

**FEMFAT LAB**

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- Software for the measurement engineer and specialist
- Uniform User Interface for different data formats
- No data conversion for the processing necessary (RPC, Remus, Diadem, ASCII, ...)
- Interface to standard programs (FEMFAT, Microsoft Office Word and Excel, Google Earth, . . .)
- Powerful tools included like:
  - Virtual Iteration
  - Mixing tracks
  - ....
- Project-Philosophy
  - Data processing for a lot of files without any interaction

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Permanent development

- Diploma theses
- Adaption by customer and practical job



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1986

fatigue

First Fortran Version  
“ MESTEC ”

- Statistic calculations
- Rainflow counting
- Damage calculation



1992

time

frequency

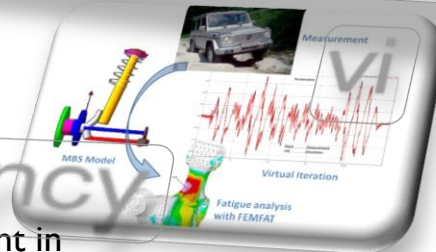
Start of the Development in  
C++ for Windows

- Time domain
- Frequency domain



2015

approx. 120 features  
and functions



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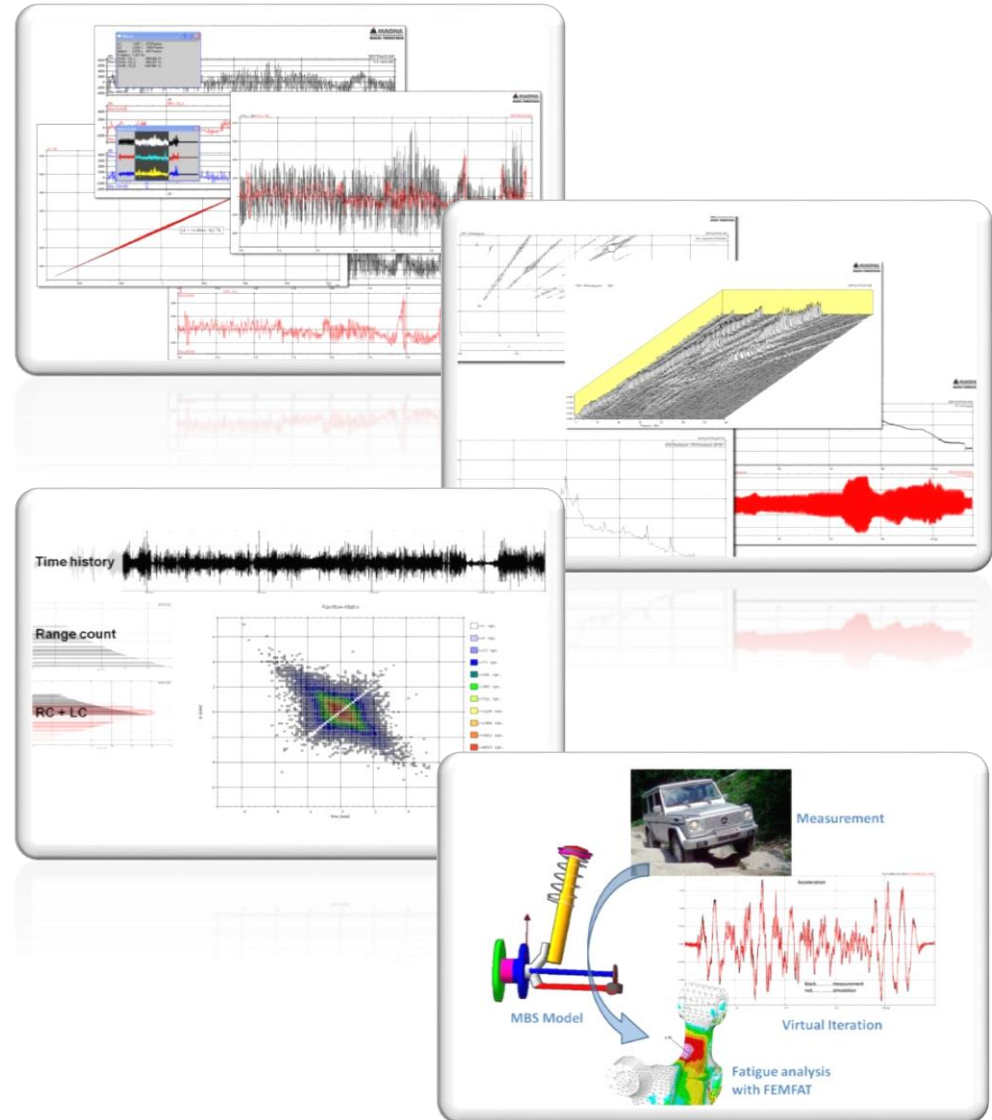
**FEMFAT LAB** time  
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**FEMFAT LAB** frequency  
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**FEMFAT LAB** fatigue  
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**FEMFAT LAB** vi  
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- Visit the FEMFAT-Lab information table in front
  - Mr. Gattringer (MBS – Software and Virtual Iteration Specialist)
  - and myself will give you a lot of information of FEMFAT-Lab



# Testing and Computing Time Optimization with FEMFAT-Lab

Quality Improvement Through Targeted Mixing of Measured Data

- Testing Time Optimization



**Test bench**



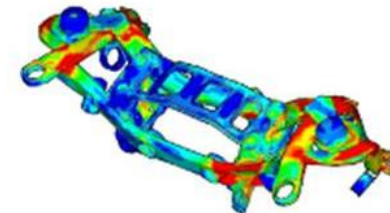
**Proving-ground**



- Computing Time Optimization



**FEMFAT-calculation**



**Multi-body simulation**



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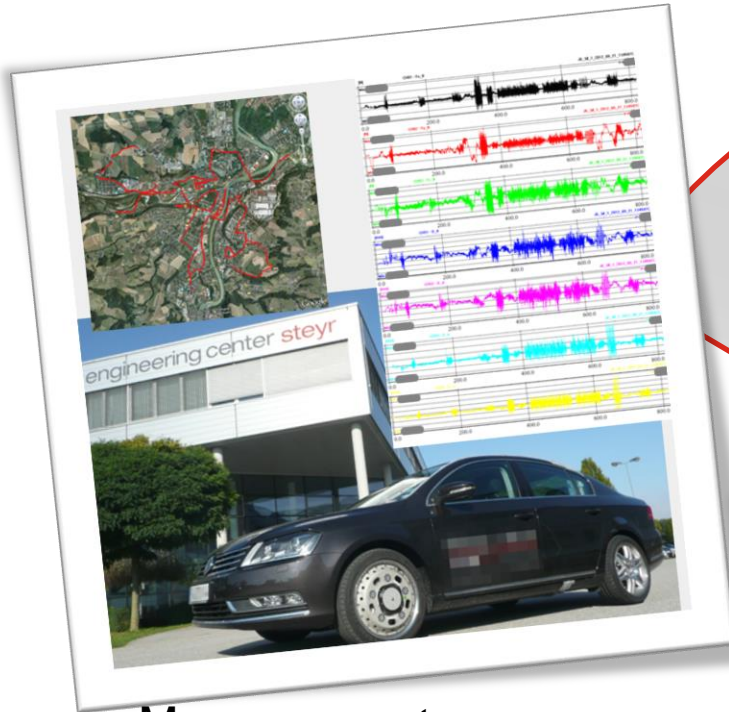


# Reasons and goals for optimization

- Saving time and cost in the testing and computing process
- Constant quality by reaching
  - Same damage
  - Extrema
  - Peak values
    - Maximum and Minimum
  - Amplitude



# Example: Test program generation

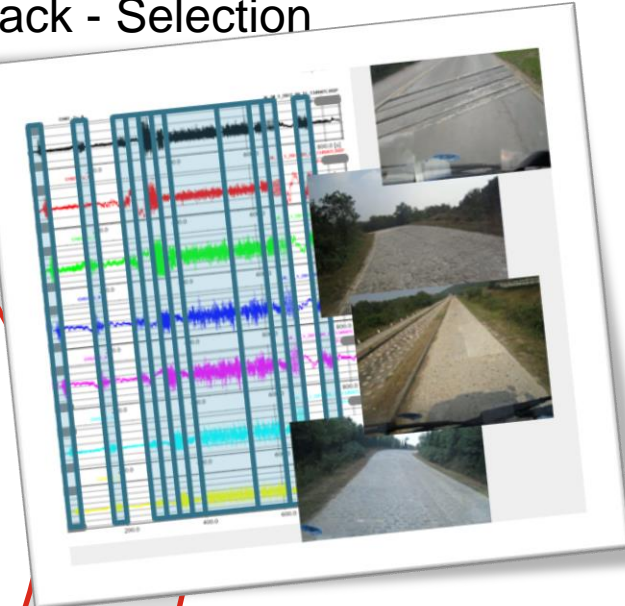


Measurement –  
Target Determination



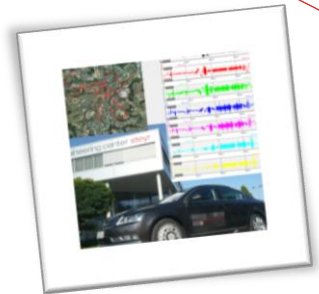
Test Program

Track - Selection



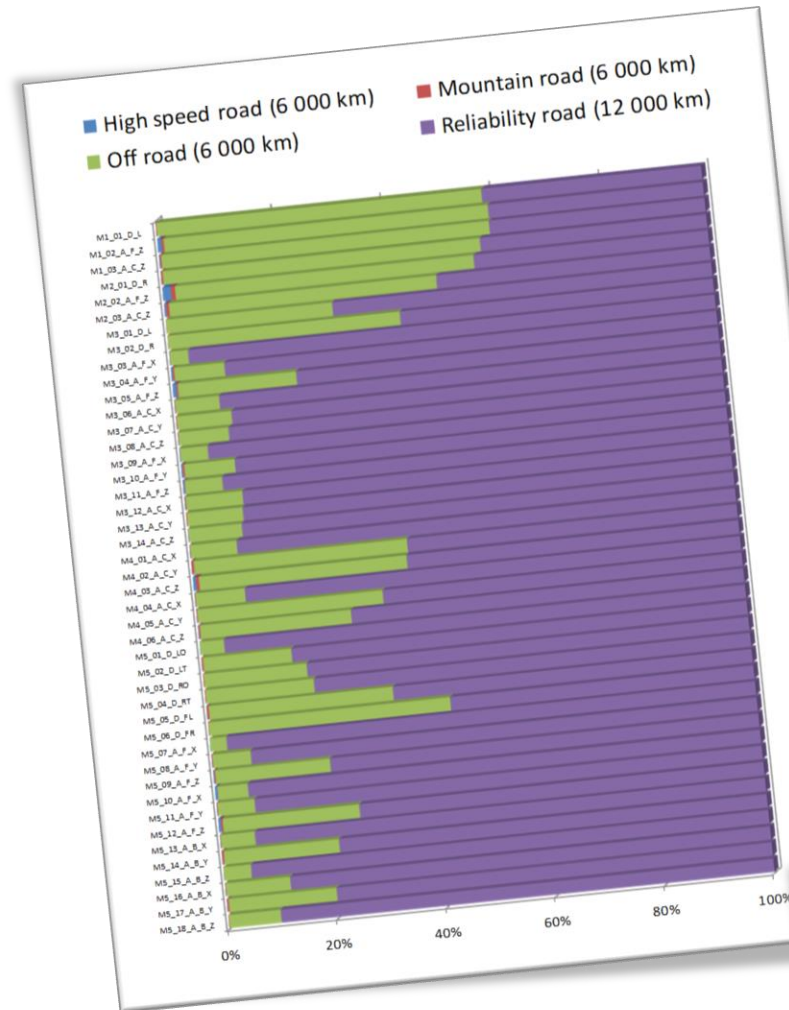
# Measurement – Target Determination

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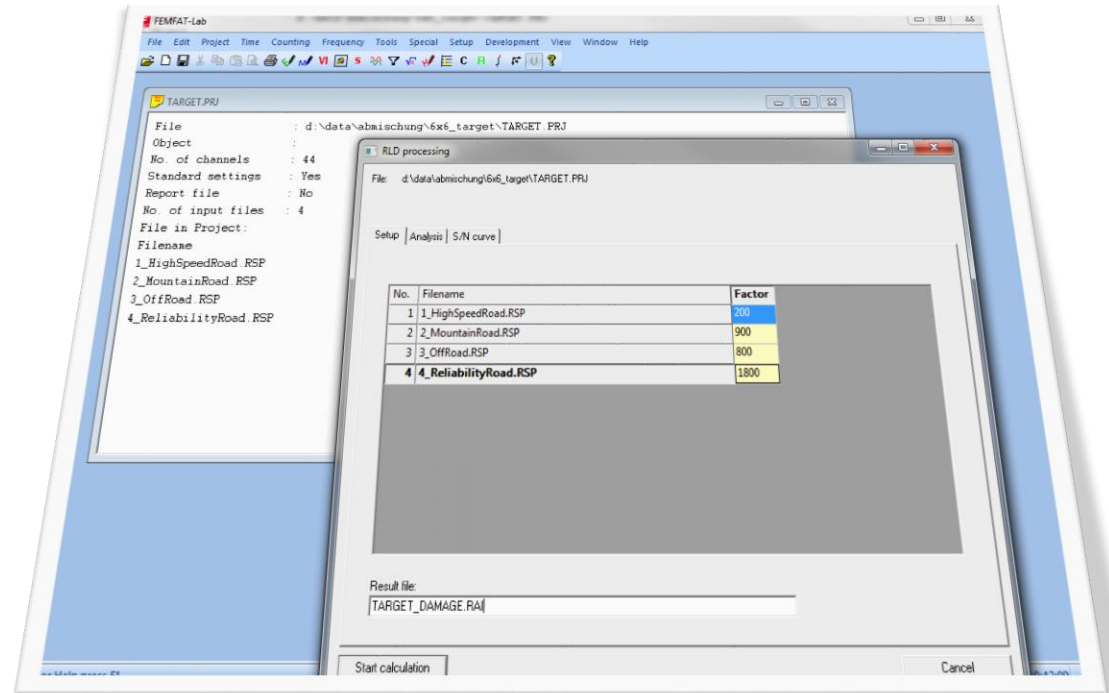


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- Typical distribution of a driving test, according to customer
- Damage distribution of the individual measurement points



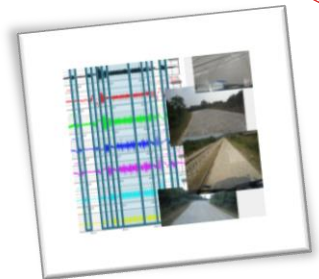
- RLD processing in FEMFAT-Lab
  - Calculate single measurement files with individual repetition factors to one collective
  - Result:  
Target – Damage – File  
(e.g. *TARGET\_DAMAGE.EFA*)





## Track - Selection

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- Data compression in time domain with FEMFAT-Lab
  - Search time domain with the highest damage  
e.g. 25sec. in Offroad measurement file

Damage data compression time domain

Filename: 3\_Offroad.RSP

Sampling: 204.799979

Definition:

Window size [s]: 25

No. of: 52

Data points/window: 5120

Definition of combinations:

☐ Calculate linear combinations

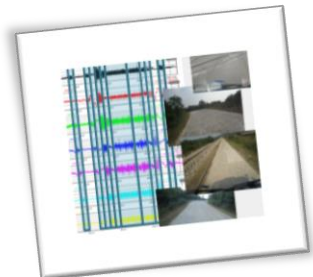
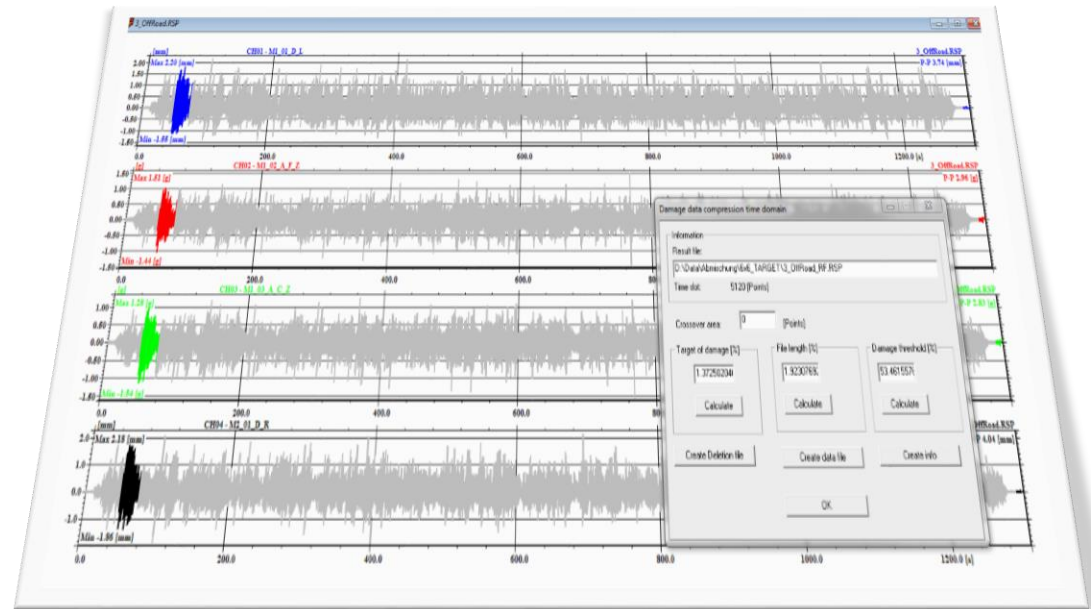
Combinations: 1

No. of channels: 44

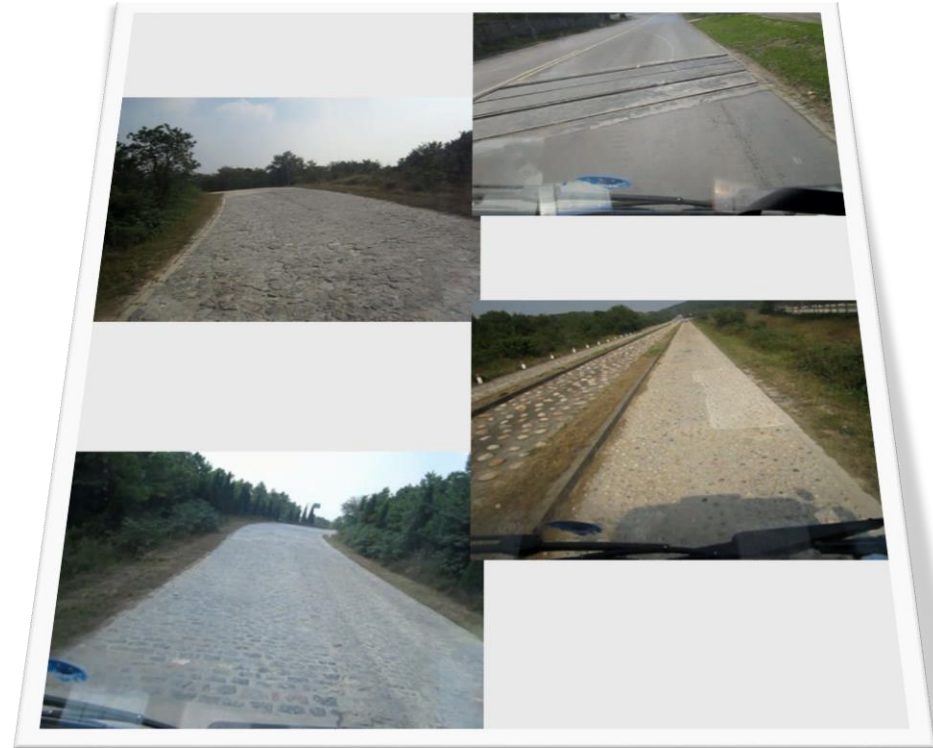
No. of combinations: 44

Channels:

CNo.	Channel descrip	Unit	Dyn. range +/-	Selection
1	M1_01_D_L	mm	15.000458	<input checked="" type="checkbox"/>
2	M1_02_A_F_Z	g	50.001516	<input checked="" type="checkbox"/>
3	M1_03_A_C_Z	g	50.001516	<input checked="" type="checkbox"/>
4	M2_01_D_R	mm	10.000306	<input checked="" type="checkbox"/>
5	M2_02_A_F_Z	g	50.001516	<input checked="" type="checkbox"/>
6	M2_03_A_C_Z	g	50.001516	<input checked="" type="checkbox"/>

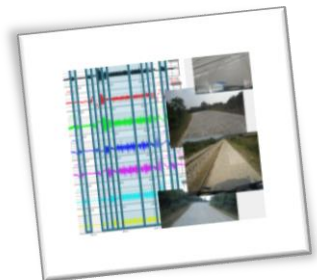


- Measure specific single maneuvers
  - E.g. Washboard, Belgian Block, railroad crossing, potholes, bumps, ....



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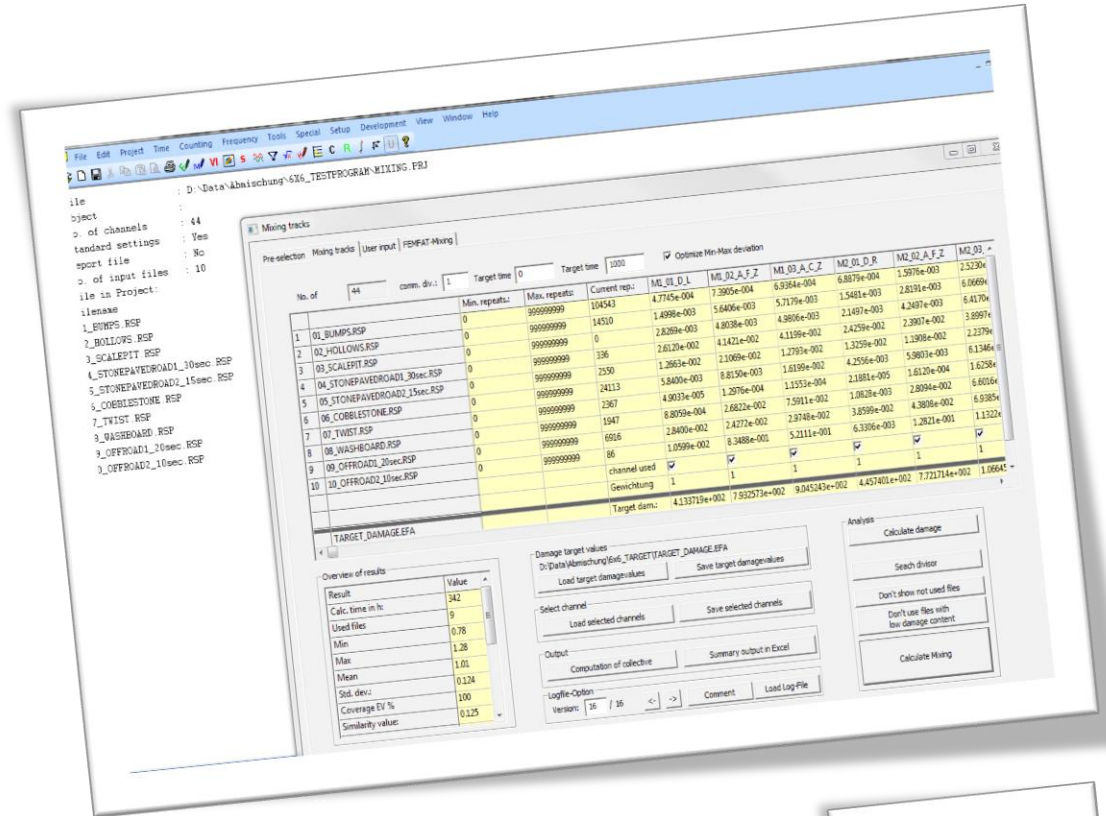
# Test Program

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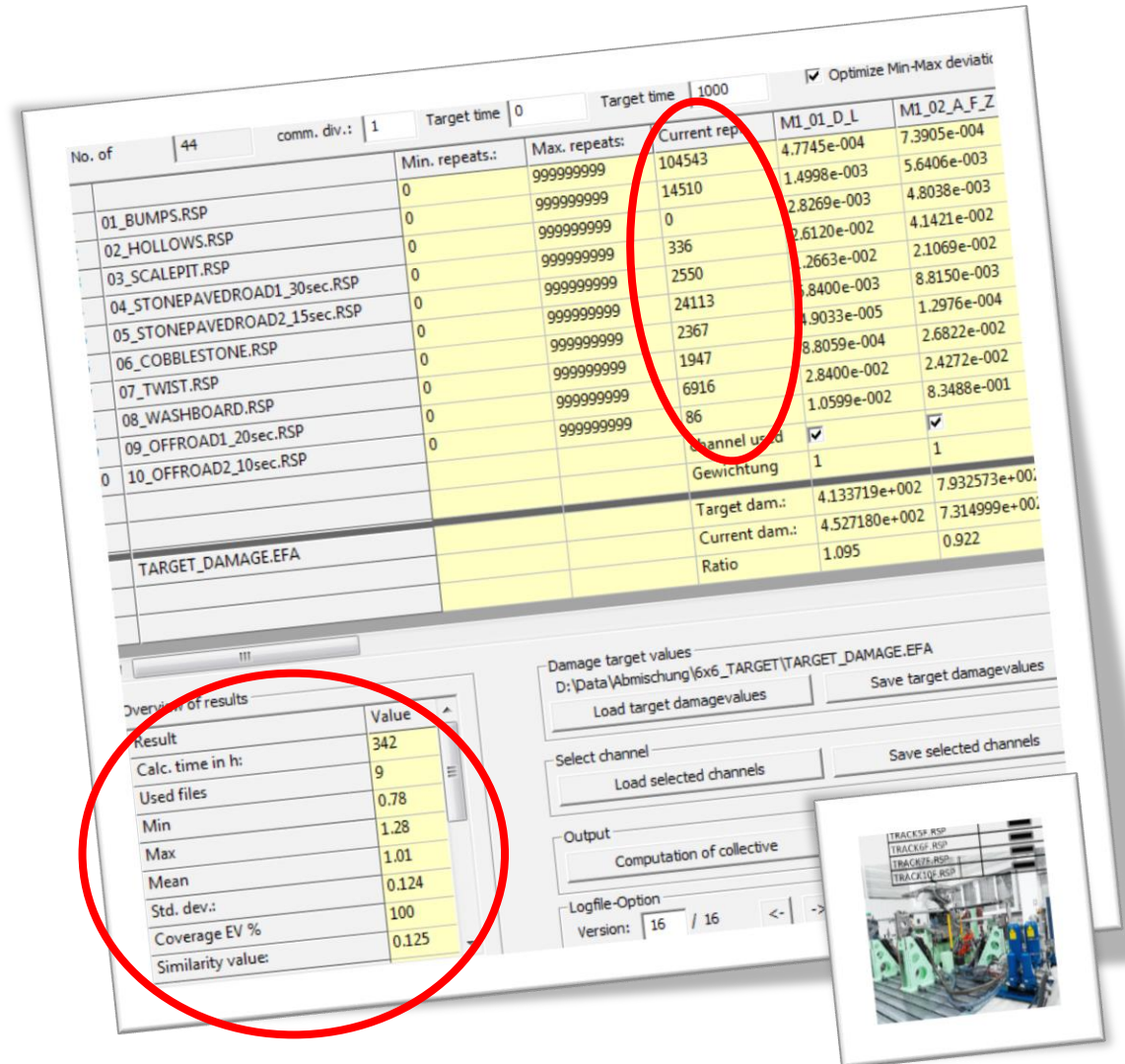


**|** [www.femfat.com](http://www.femfat.com)

- Mixing Track with FEMFAT-Lab
  - Optimized Test time
  - Quality Improvement of testing program



- The first loop is for identifying the mathematical optimum.
- Counting –  
Mixing tracks
- Pre-selection:
  - Select all files
- Mixing tracks:
  - Leave default values
  - Enter target damage
  - Select relevant channels
  - Calculate mixing



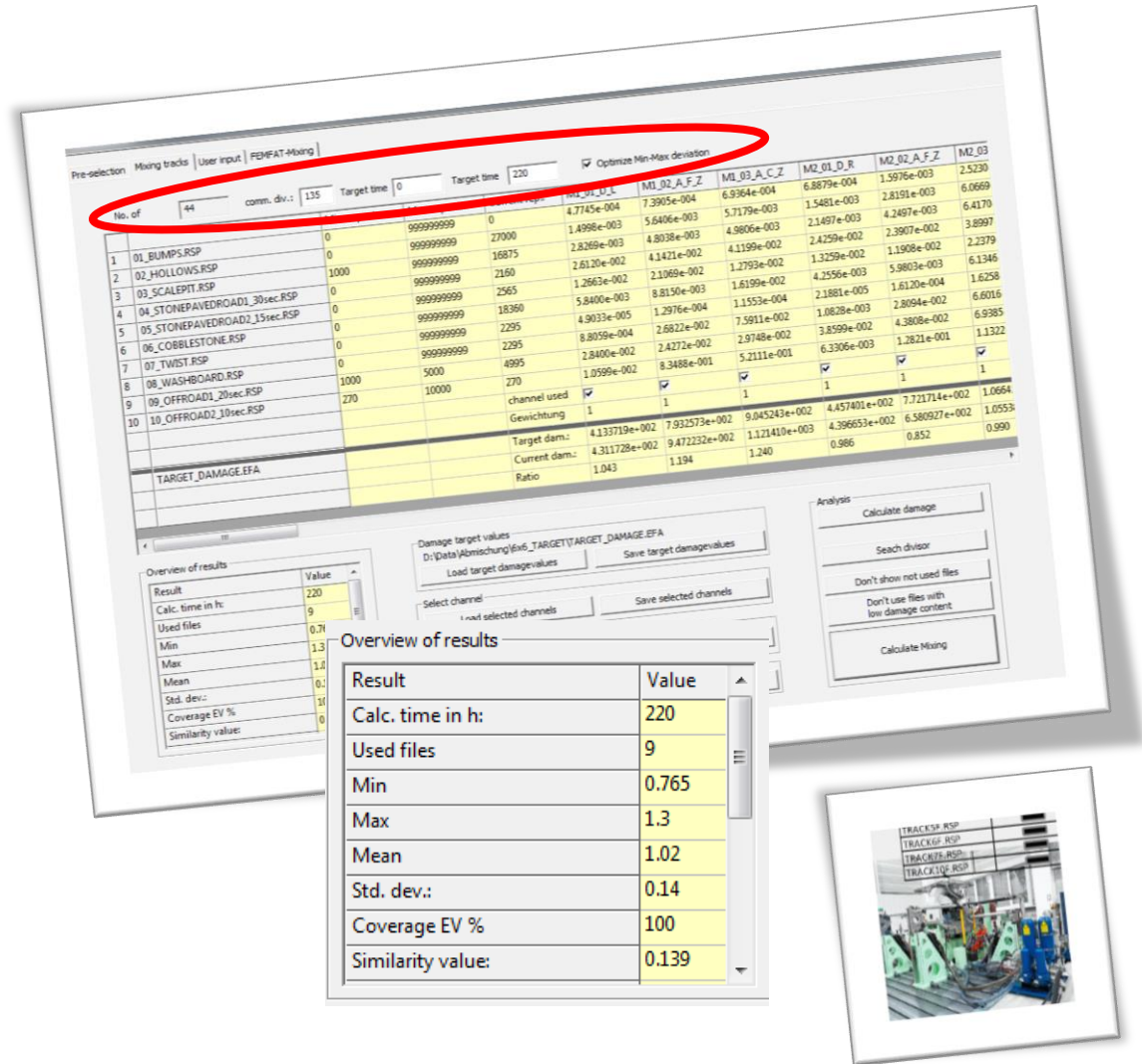


- In the second loop the file selection is done (extreme values, sensible mix, „filler“-files, ...)
- Pre-selection:
  - Select relevant files
- Mixing tracks:
  - Leave default values
  - Load target damage
  - Select relevant channels
  - Calculate Mixing

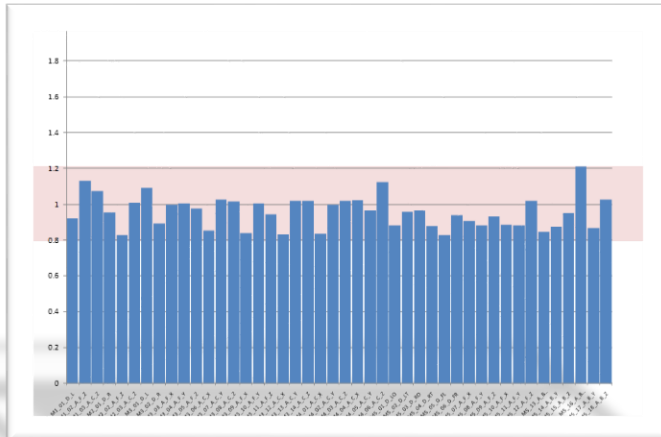




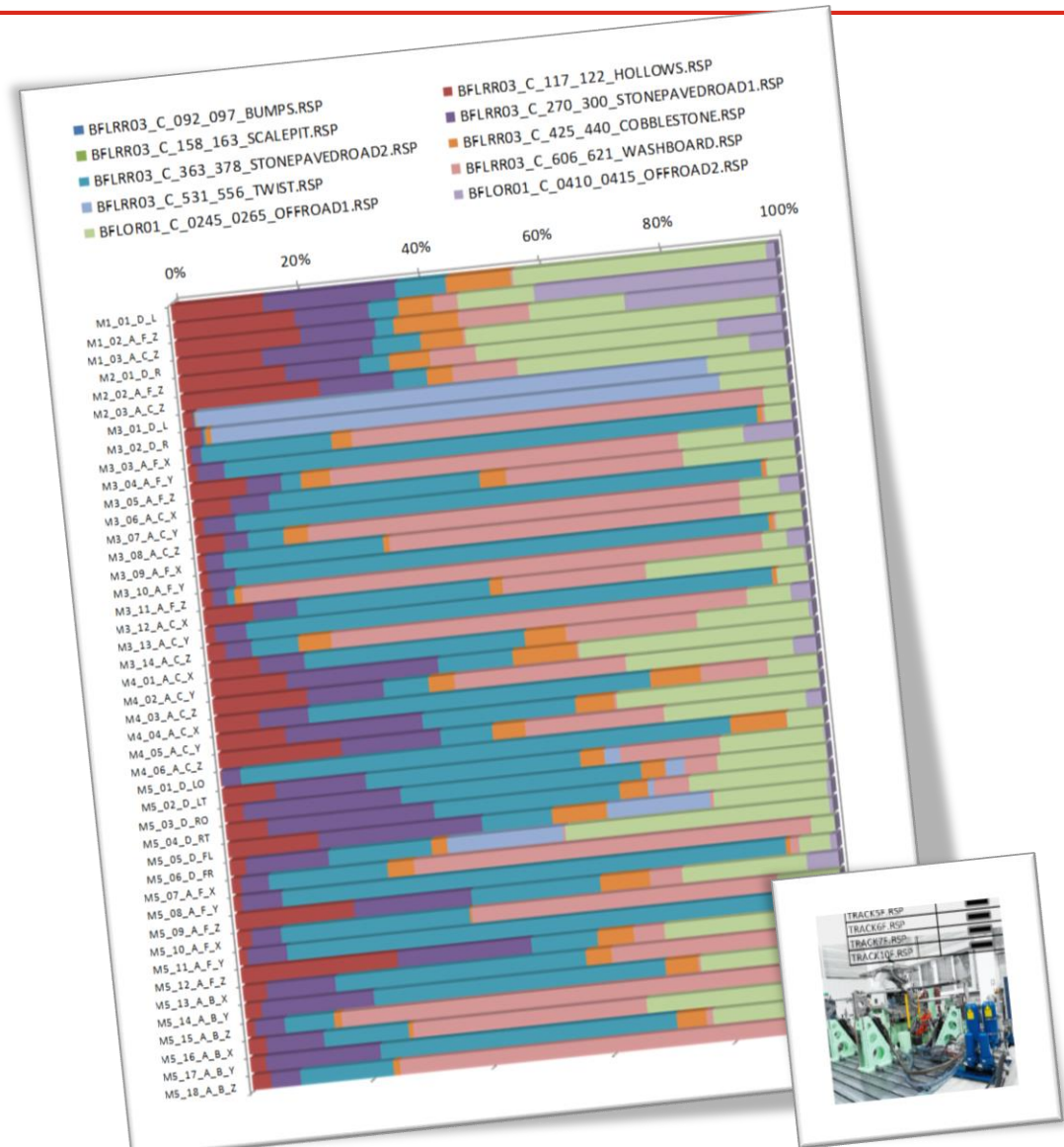
- The last loop is for adjusting the mixing to fit the engineers demands (Target time, min./max. repetitions, common factor)
- Pre-selection:
  - Select relevant files
- Mixing tracks:
  - Load target damage
  - Set limits for the target time
  - Set common factor
  - Set min./max. repetitions
  - Select relevant channels
  - Calculate mixing



- Result / Test Program
  - Distribution of the measuring point damage to the individual sections:
  - Comparison target damage to test damage – Difference factors:



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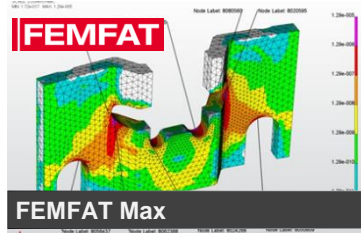
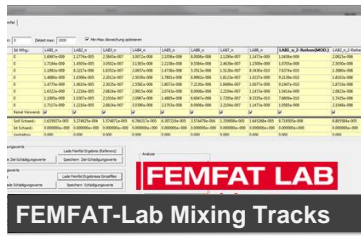
## **New Interface to** **FINITE ELEMENT METHOD FATIGUE**

Mixing Tracks using damage values based on FEMFAT results

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- Same damage like customer road/design cycle in shorter time
- Reduce a lot of measured tracks to a feasible number of tracks
- Correlation of test bench (real or virtual) to proving ground
- Get same damage within shorter time
- Interface between **FEMFAT** (finite element method) and **FEMFAT-Lab**
- Reduction of computation time
- Reduction of testing time
- Reduction of costs

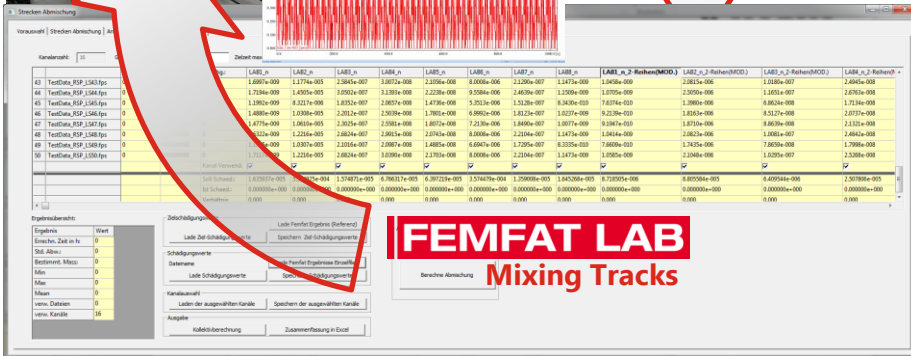
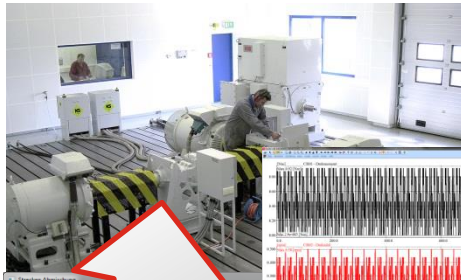
**FEMFAT LAB** software

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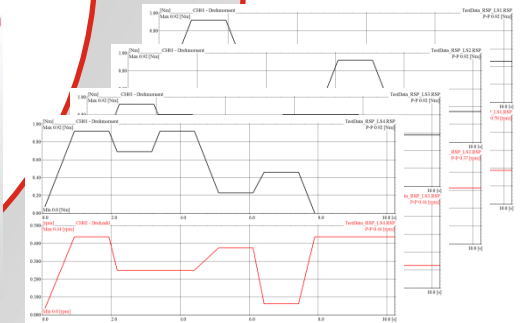
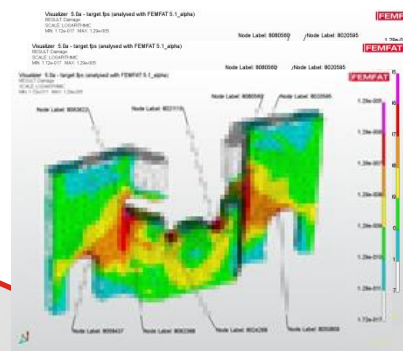
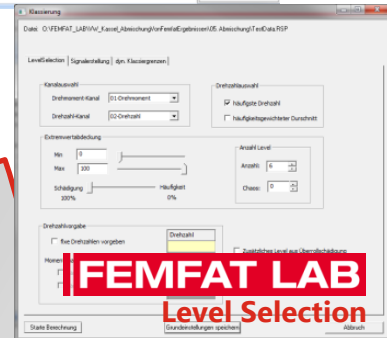
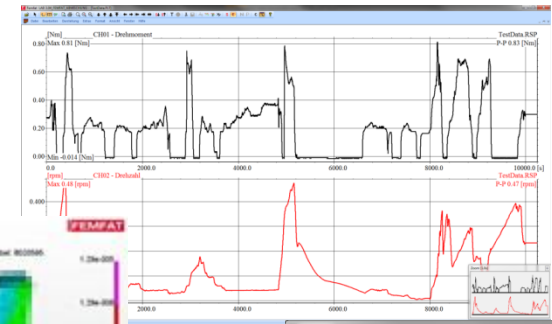
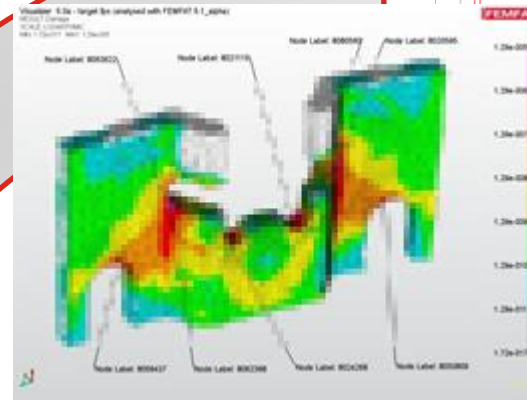
[www.femfat.com](http://www.femfat.com)



1. FEMFAT calculation of target
2. Femfat-Lab Level-Selection
3. FEMFAT create Job- and Queuefile
4. Calculation of repetition factors of Level-Selection files
5. Create testrig inputfile



**FEMFAT LAB**  
Mixing Tracks



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**The future is ours to make.**

**Thank you for your attention.**

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