Technische
Hochschule
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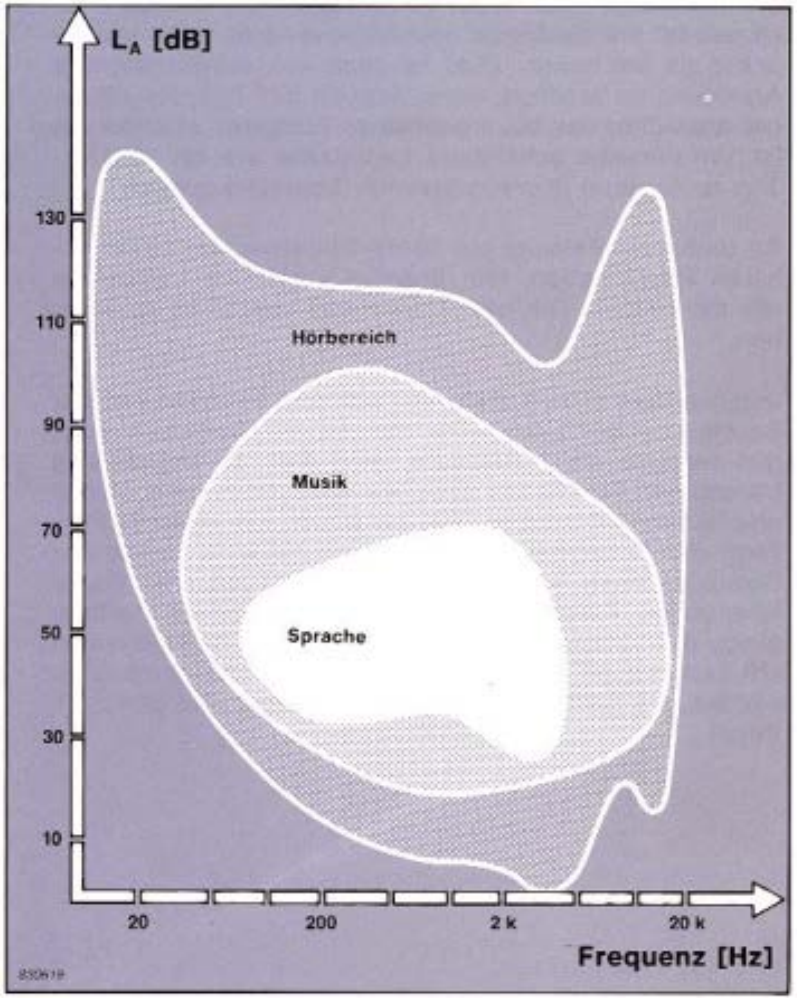
Technical University
of Applied Sciences

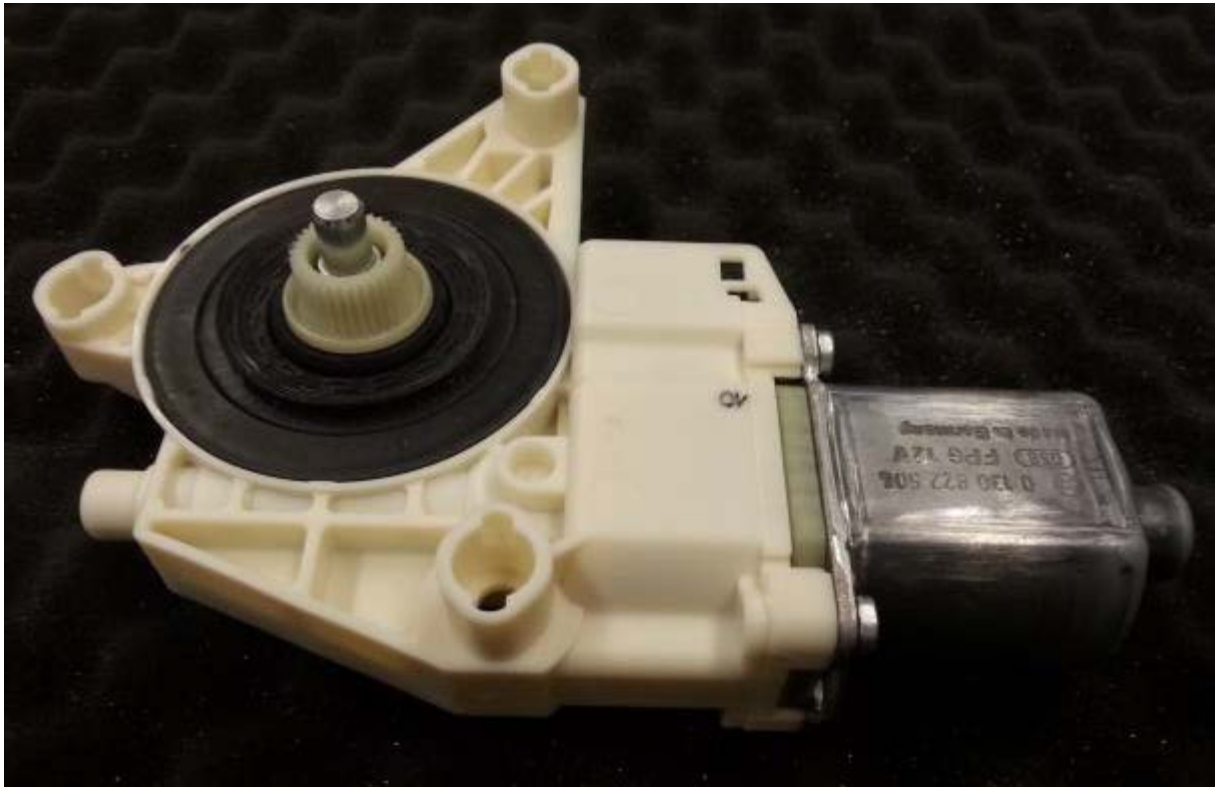
Vibro-Acoustic Characterization of Small Geared Engines

Prof. Dr. Peter Blaschke

Audible Noise

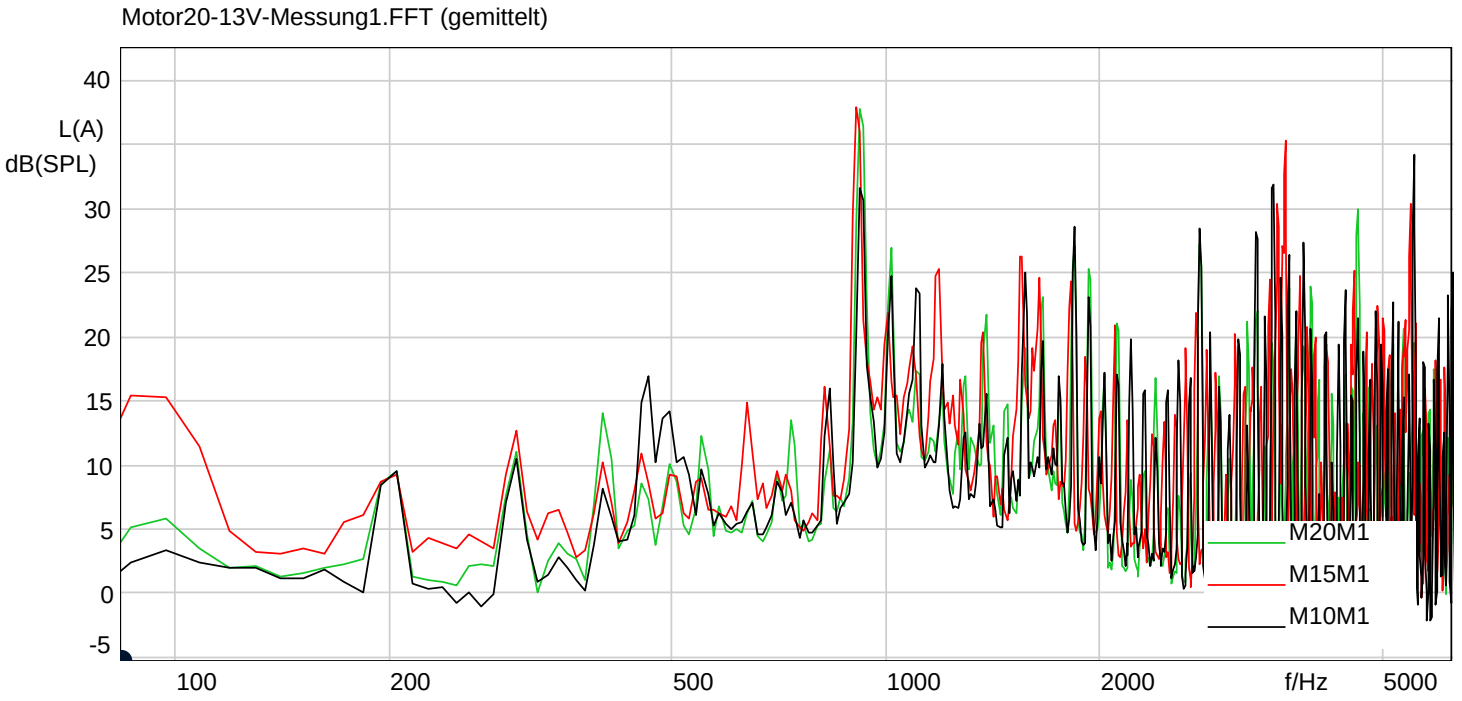


The small geared engine



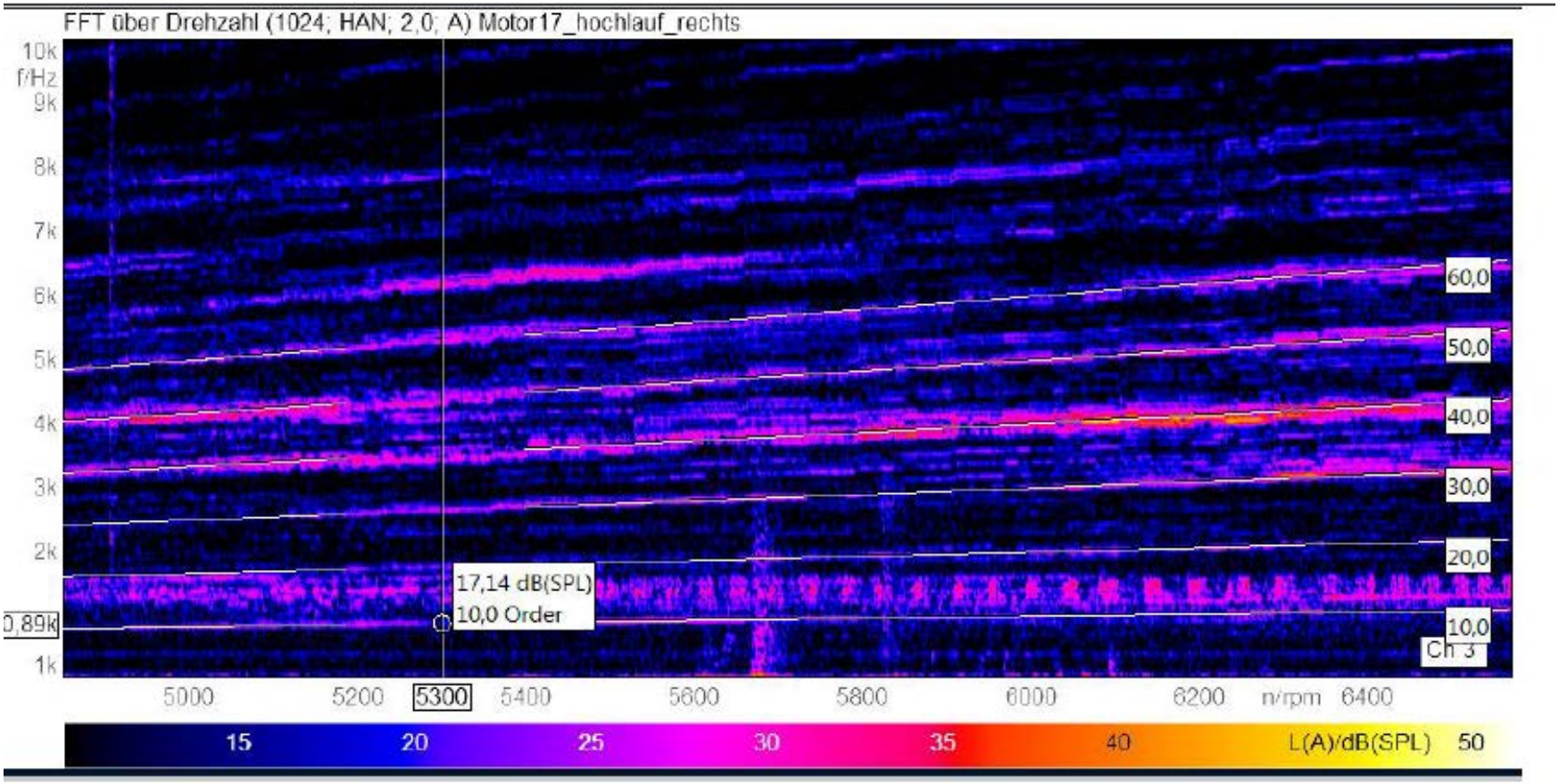
Sound Radiation of the the small geared engine

- Comparison of different engines

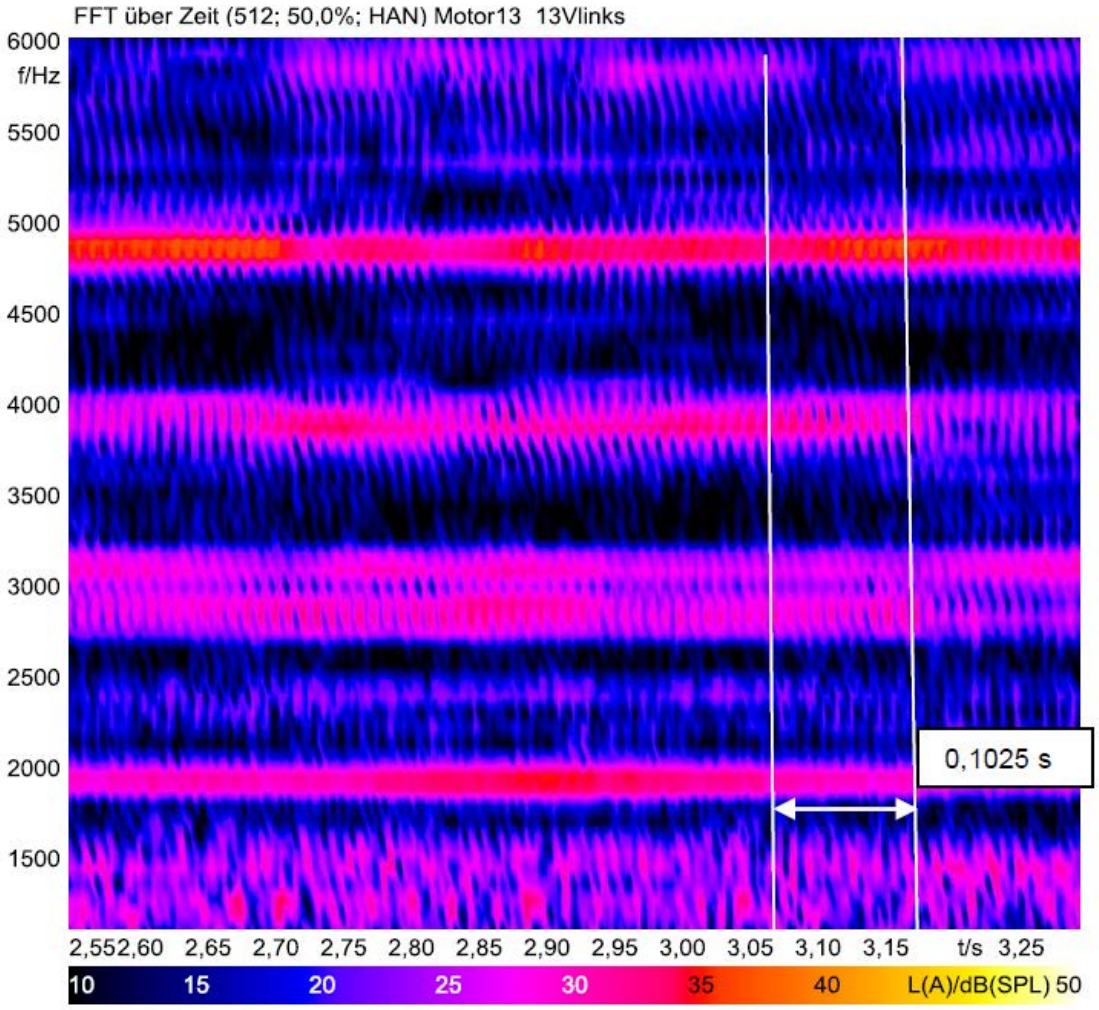


Sound Radiation of the the small geared engine

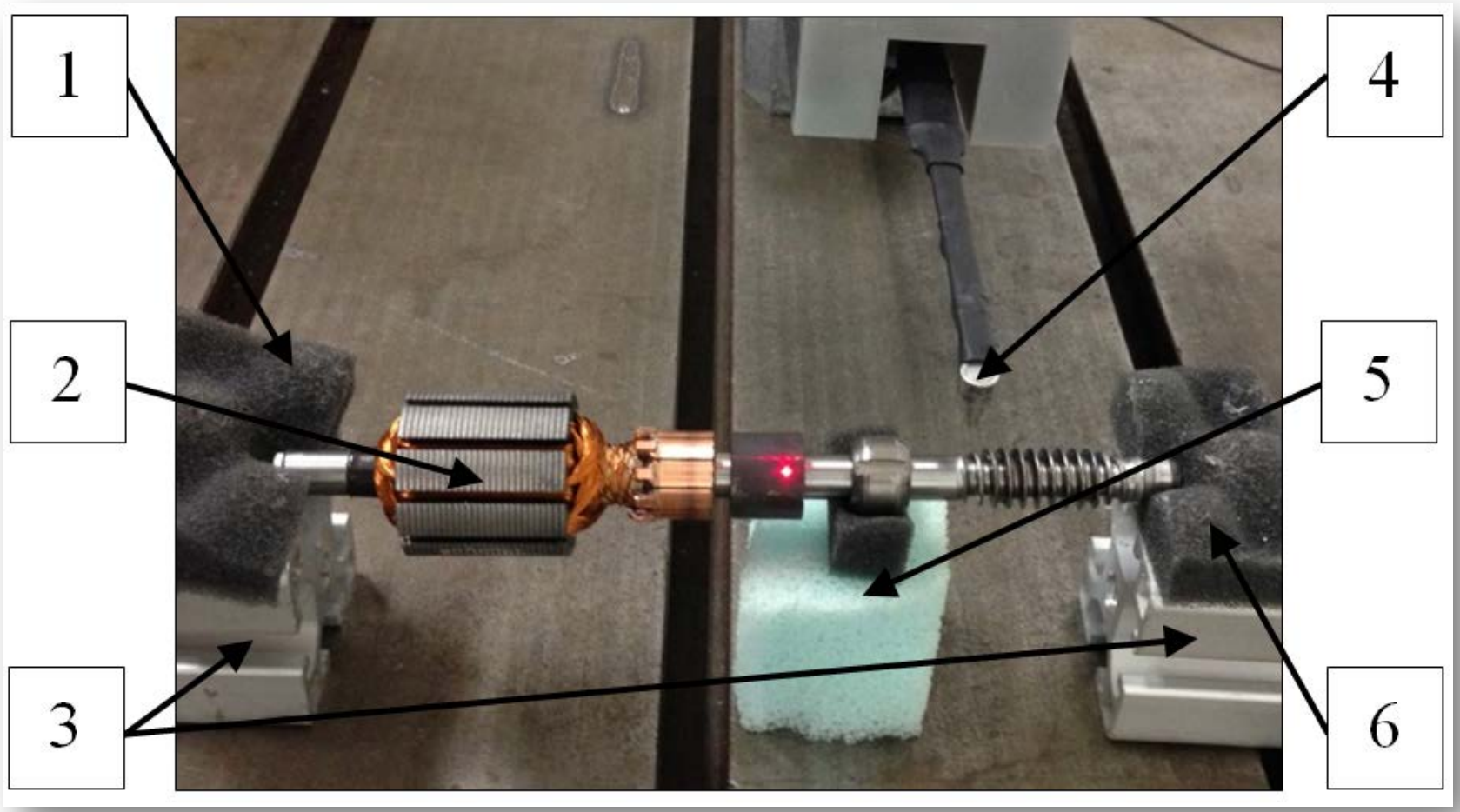
Spectogramm of small geared engines



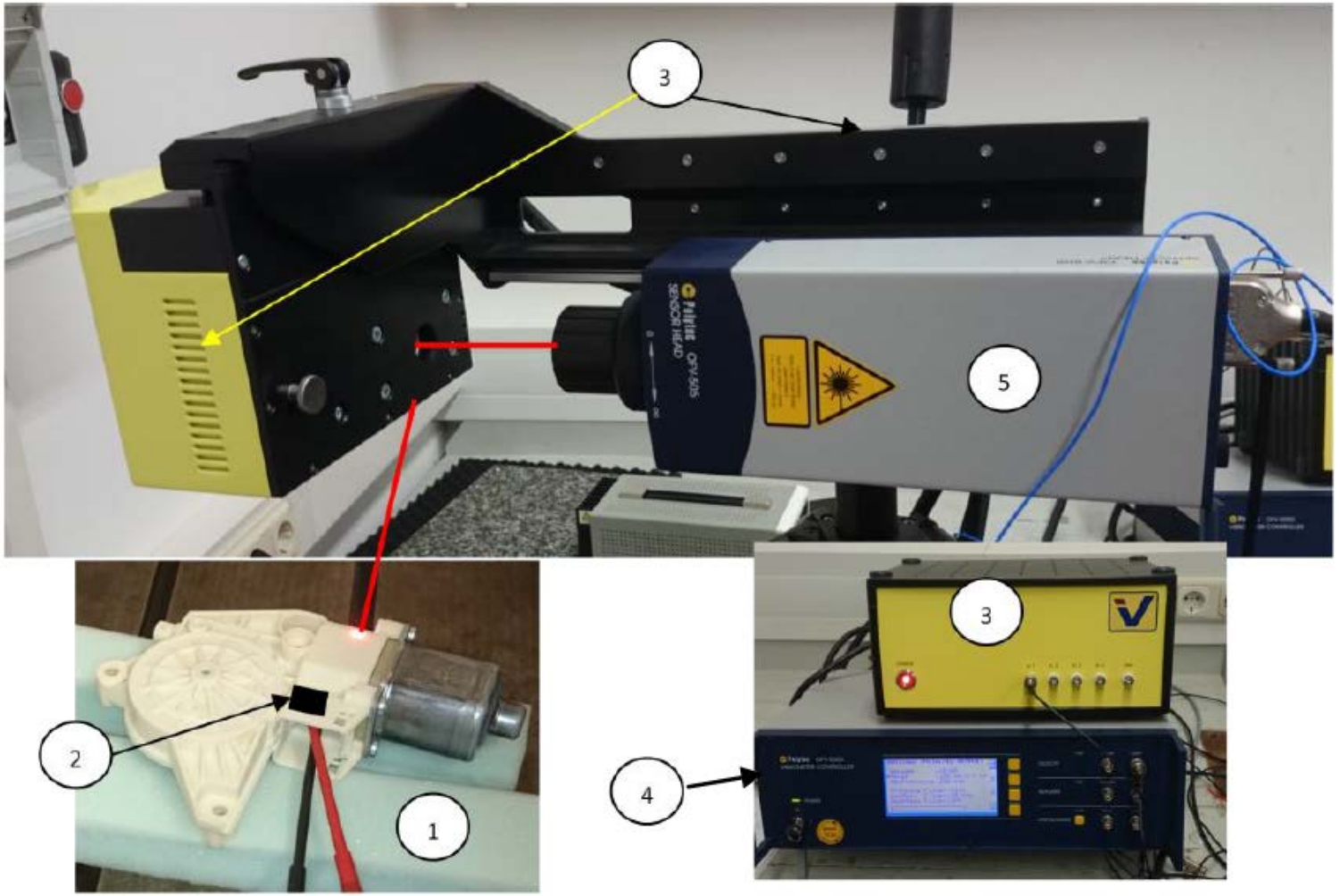
Sound Radiation of the the small geared engine



Sound Radiation of the the small geared engine



Structural analysis of the small geared engine



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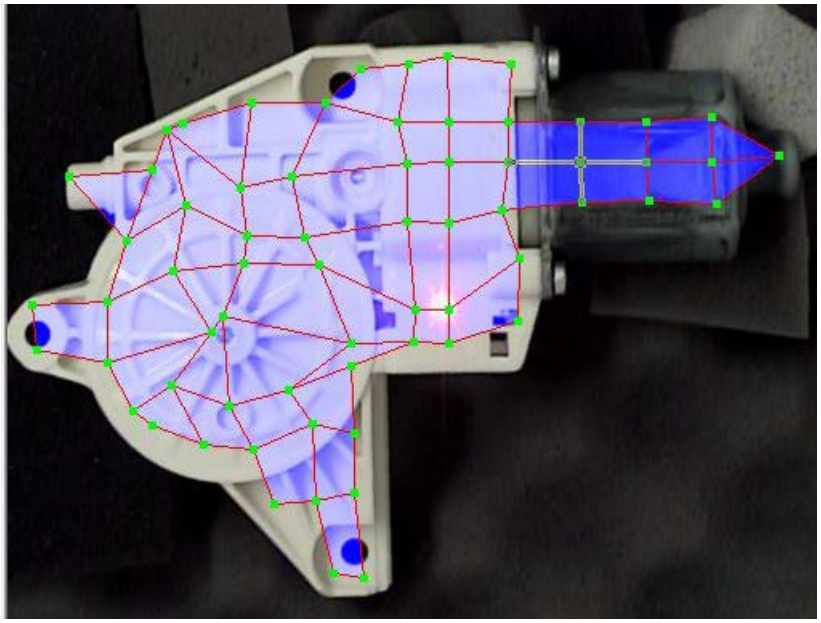
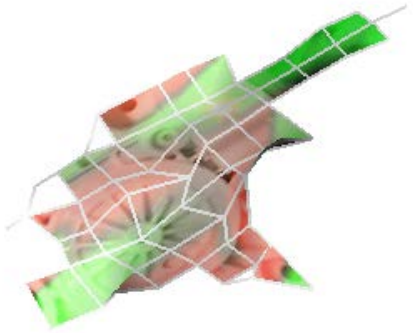


Structural analysis of the small geared engine

ODS (Operational Deflaction Shape) Analysis

465 HZ

1022 HZ



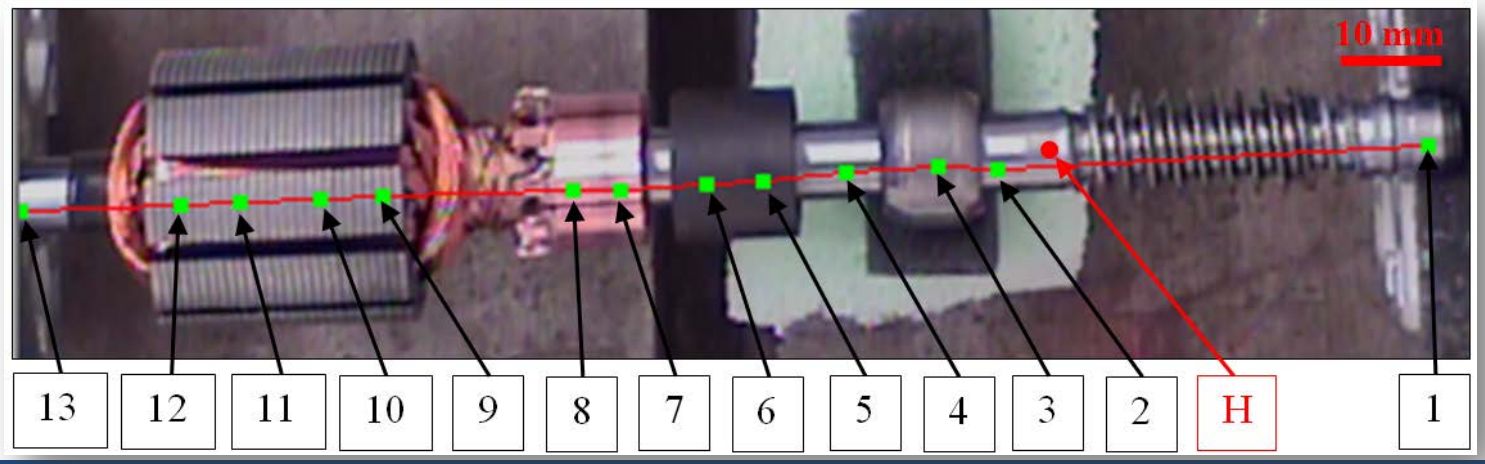
Structural analysis of the small geared engine

ODS (Operational Deflaction Shape) Analysis

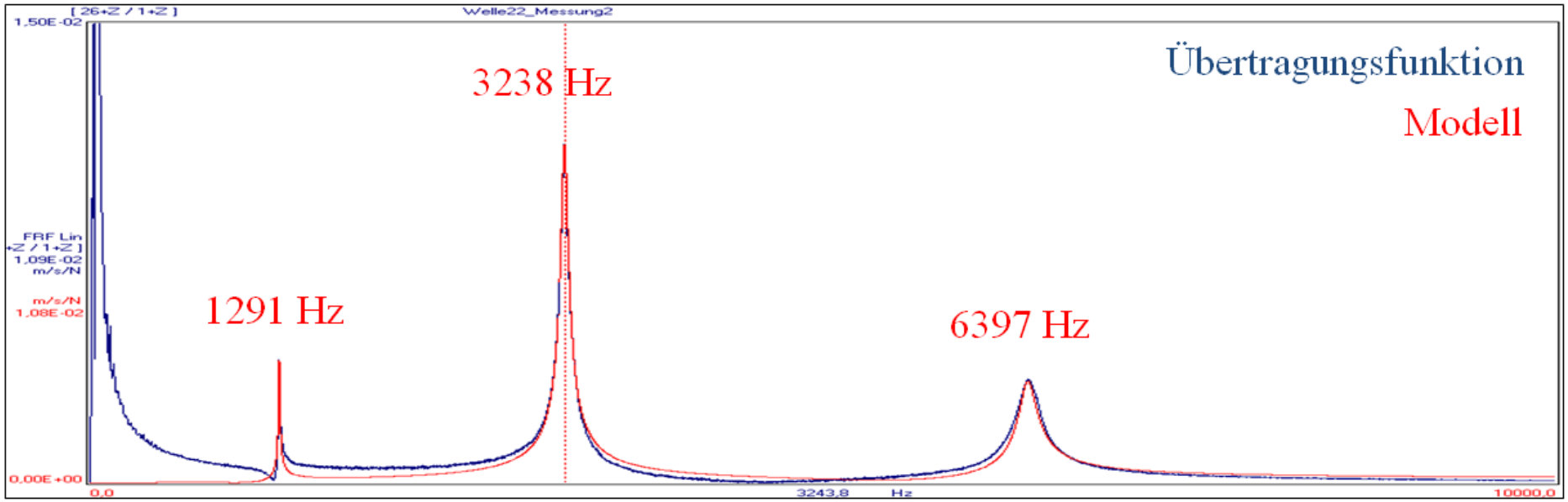
3718 HZ

5579 HZ

Structural analysis of the small geared engine



Structural analysis of the small geared engine



Root Cause of the noise

- **1 Khz is the dominant frequency**
- **The 10th order is**
- **It is excitet by the anker of the shaft and the rectangular slots**
- **The shaft itself has eigenfrequencies in the same area**
- **The body itself has as well eigenfrequencies in the same area**

- **The rectangular slots get excitet by the anker**
- **The impulses of the anker will excite the structure at their eigenfrequencies**
- **Surface areas will radiate the sound**
- **The contact pins will pass the radiation as structure borne noise to the connected structure (seat, door, etc.)**

How to avoid the noise

Reduction of the exitation mechanism –Primary noise reduction

sloped anchor slots
chamfered anchor slots
optimized grease at the gears

Optimization of the airborne sound radiation

design of the shaft at a different eigenfrequency
optimized bearing localisation to tune the eigenfrequency
sensitivity study of the shaft with bearings

Optimization structure borne noise radiation

Sensitivity desing of the connection points out of the area of eigenmodes that match with the exitation frequencies

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