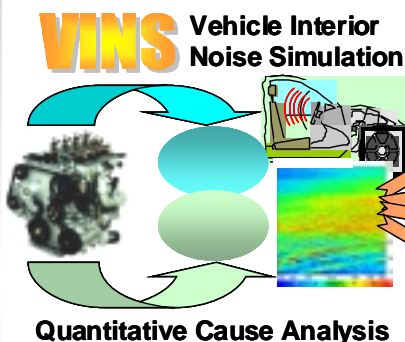


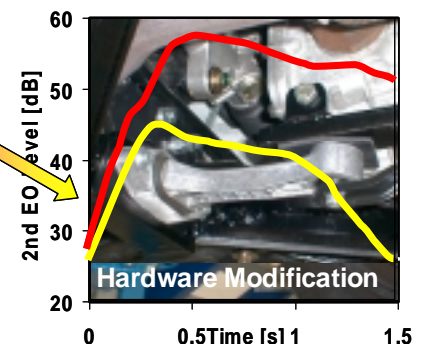
## Vehicle NVH Development Troubleshooting with VINS

Vehicle interior noise is an important factor in conveying overall vehicle quality to the driver and potential customer. Due to shorter development cycles and target conflicts with other vehicle features, NVH concerns often arise in a late state of the vehicle development process. In this situation FEV applies a fast and well proven procedure to eliminate the annoying noise shares. The main tool used in this procedure is FEV-VINS: Vehicle Interior Noise Simulation.

The troubleshooting work starts with the **noise concern determination** together with the client. This is based on 30 years experience in subjective and objective evaluation of NVH concerns. The annoying noise shares are characterised regarding driving condition, frequency content and impulsiveness. An objective parameter fitting to the actual noise concern is used to make the project advancement measurable.



Component	Potential
Engine mounts	++
Exhaust system	0
Intake system	+
⋮	⋮
⋮	⋮



Subsequently, the vehicle interior noise is analyzed in detail with FEV's unique tool VINS: The interior noise is broken down to the contributing powertrain related noise sources and corresponding transfer paths. Airborne noise sources (such as engine noise, intake and exhaust system noise) as well as structure borne noise sources (such as powertrain mounts and drivetrain) are considered.

Based on VINS, it is possible to calculate the effect of realistic noise source and noise path modifications, e.g. reduced orifice noise or change of sound pack. The considered variants can be rated on one hand with the previously defined objective parameter. On the other hand VINS has the advantage to deliver for each variant an audible interior noise, which can be subjectively evaluated.

These virtual modifications are related to individual vehicle components, leading to target-oriented hardware modifica-

## NVH Troubleshooting with VINS

- **Noise Concern Determination**
  - 30 Years experience in NVH evaluation
  - Close cooperation with client
- **VINS: Vehicle Interior Noise Simulation**
  - Association of each noise share with its sources and paths in 2 months instead of 12
  - Virtual vehicle sound
  - Quantitative rating of hardware optimisation potential
- **Demonstrator Vehicle**
  - Target-oriented hardware modifications
  - Cleaned vehicle interior noise

tions. Thus VINS delivers a reliable **decision base** for the selection of the appropriate **hardware modification** regarding costs, timing and improvement potential, without the need for numerous costly and time in-vehicle tests.

As a proof-of-concept, a **demonstrator vehicle** featuring the cleaned target sound can be built by combining the selected hardware modifications.

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