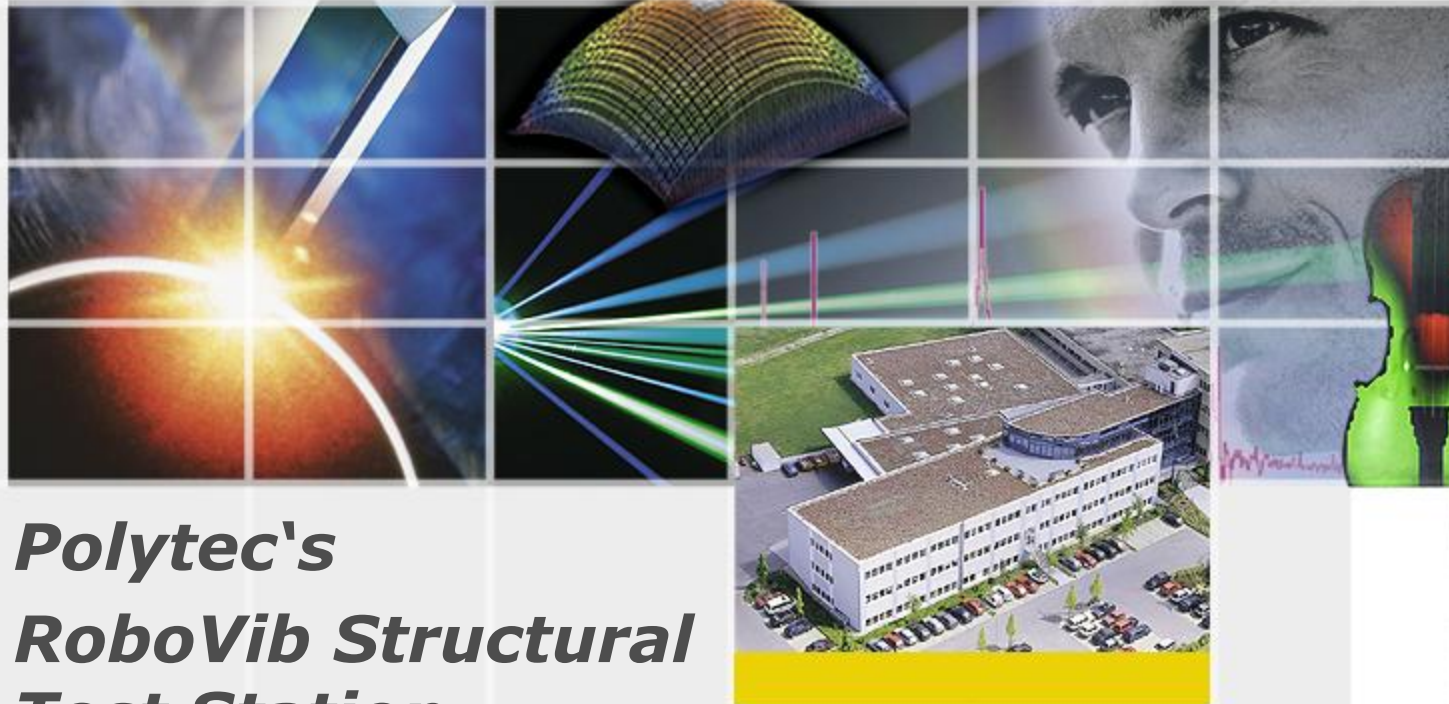


# Measurement of structure-borne noise with laser Doppler vibrometers for NVH optimization



## *Polytec's RoboVib Structural Test Station*

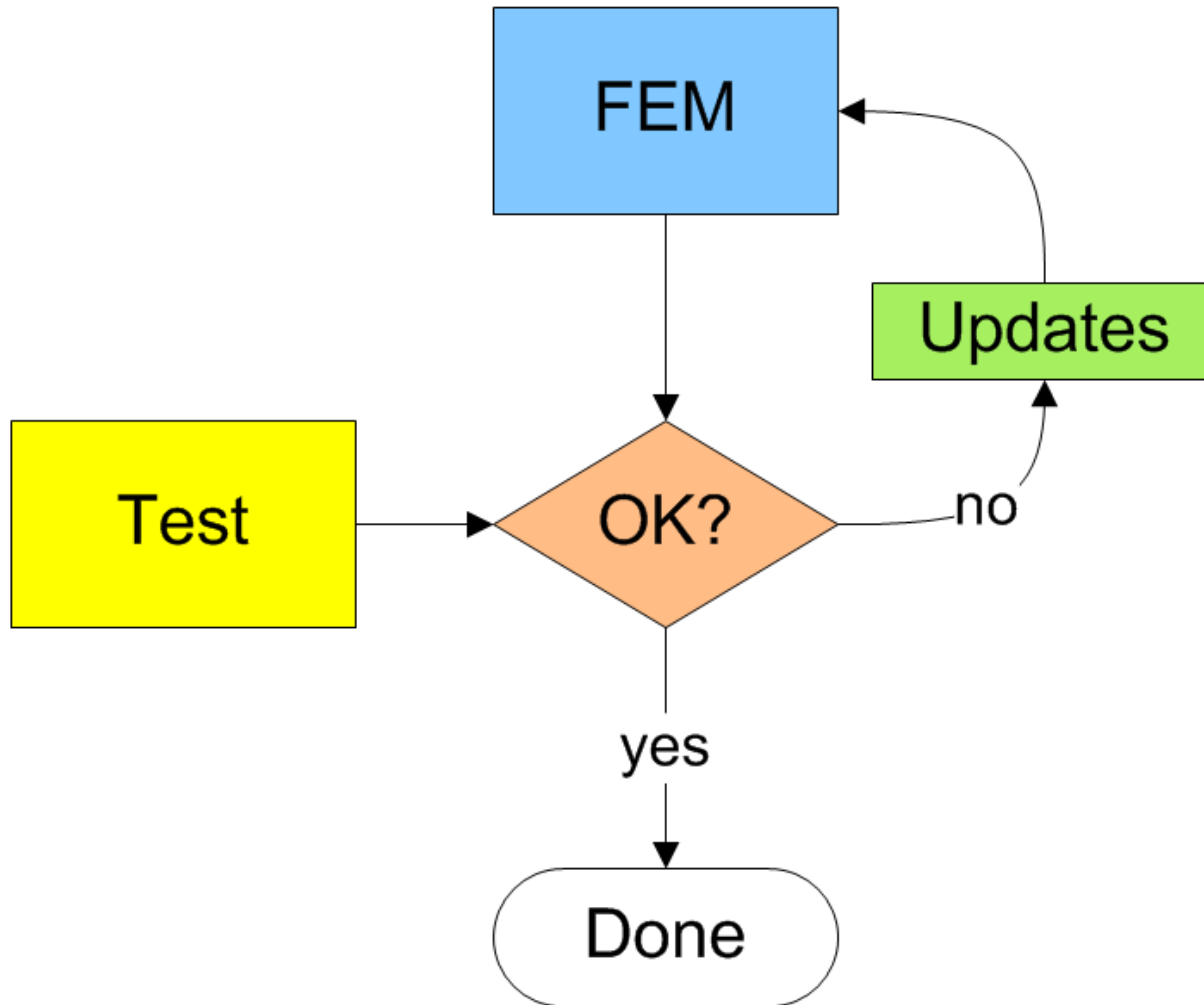
# Outline

- **Purpose of Measurement**
- **Sensor:** Scanning-Laser-Doppler-Vibrometer
- **Sensor Positioning:** Industrial Robot
- **Workflow**
- **Interface** between Vibrometer and Robot
- **Results**

# Purpose of Measurement

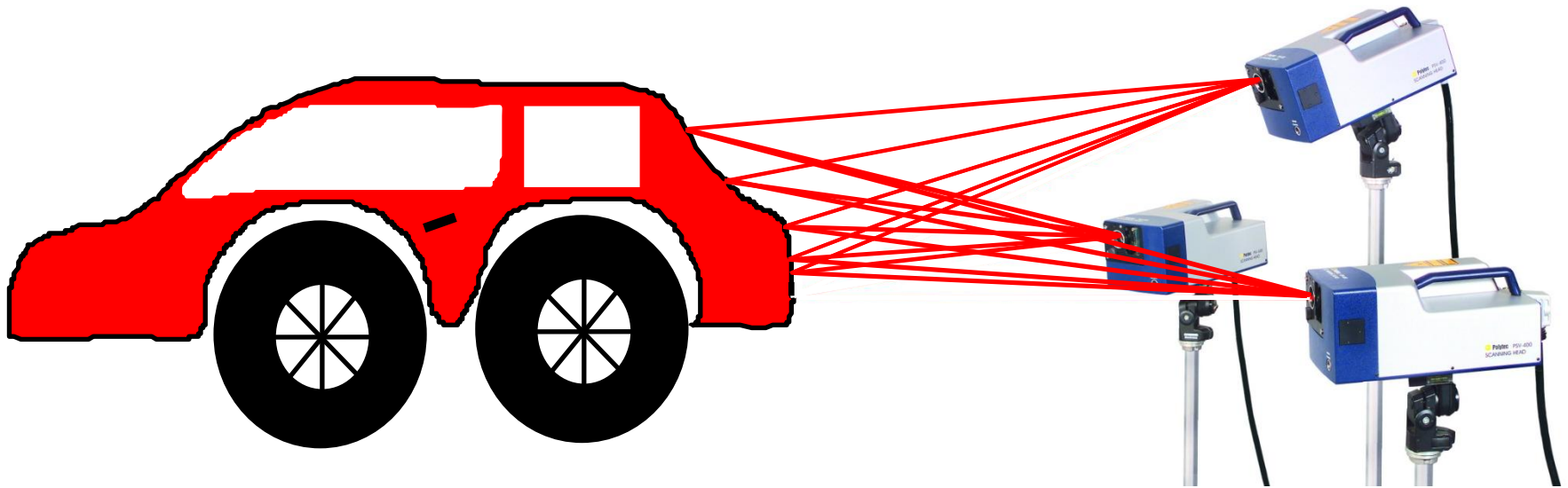
- FE-Model Updating
- Benchmarking
- Troubleshooting

# Purpose of Test: FE-Model Updating



## Sensor: PSV-400-3D

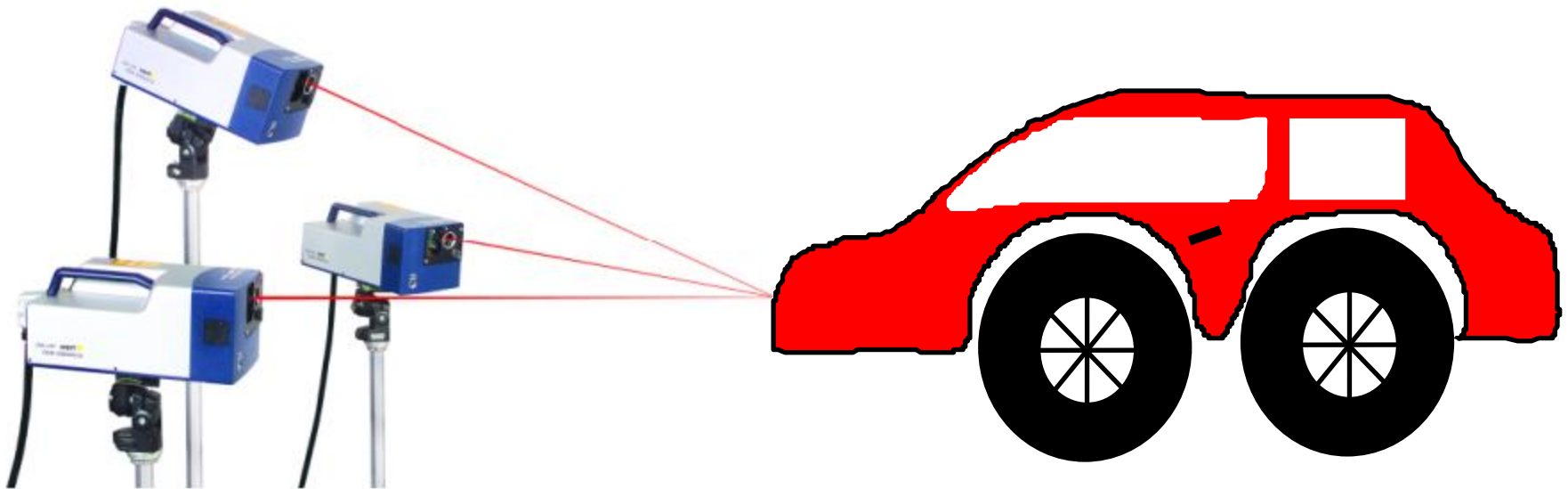
- 3 Vibrometers measure on the same point, each from a different direction



- All points measured one after another, lasers moved by scanning mirrors

# PSV-400-3D Principle

- Vibrometer scan heads repositioned to measure different parts of car



- Measured data is transformed into Cartesian coordinate system of car

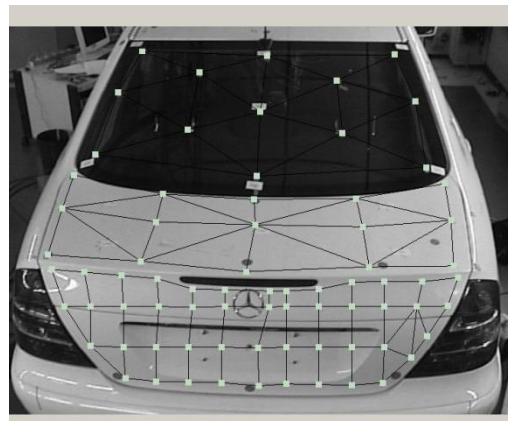
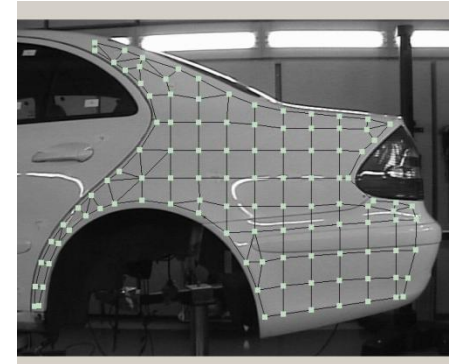
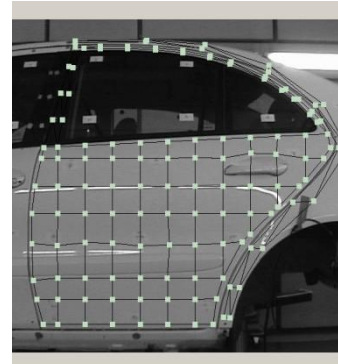
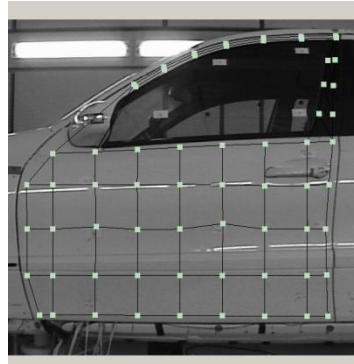
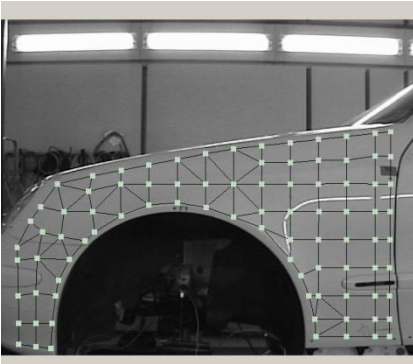
# Conventional Positioning of Scanning Heads

- Different parts measured from different positions
- Scanning heads on 1 or 3 tripods



# Conventional Positioning of Scanning Heads

- Different parts measured from different positions

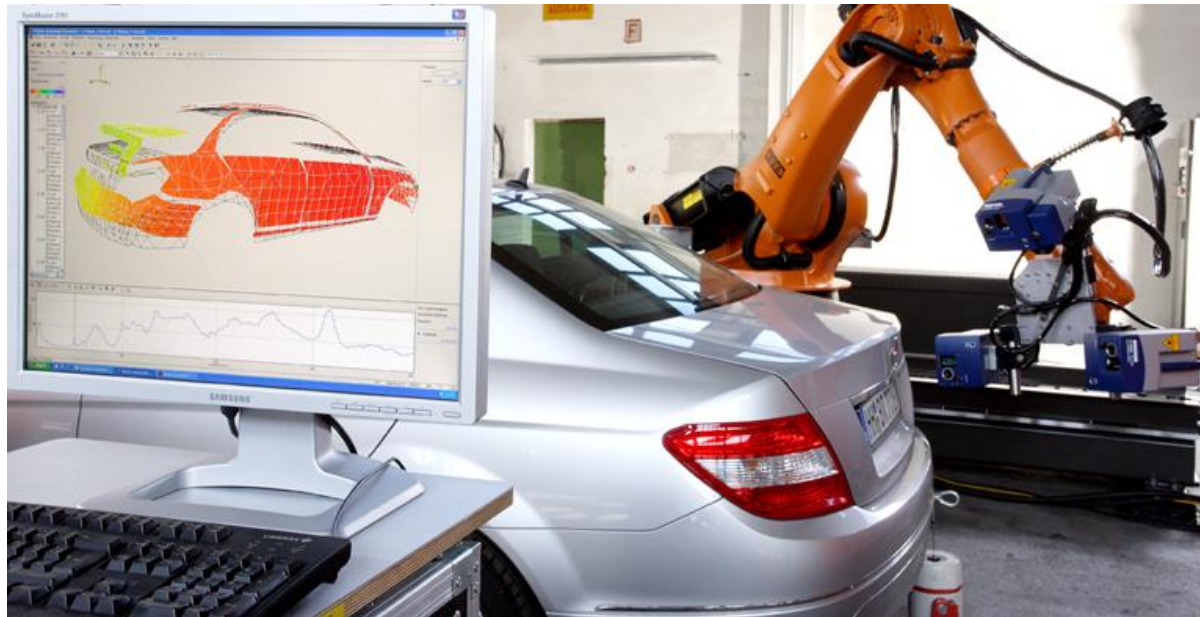


# Conventional Positioning of Scanning Heads

**Repositioning of the scanning  
heads is  
time consuming**

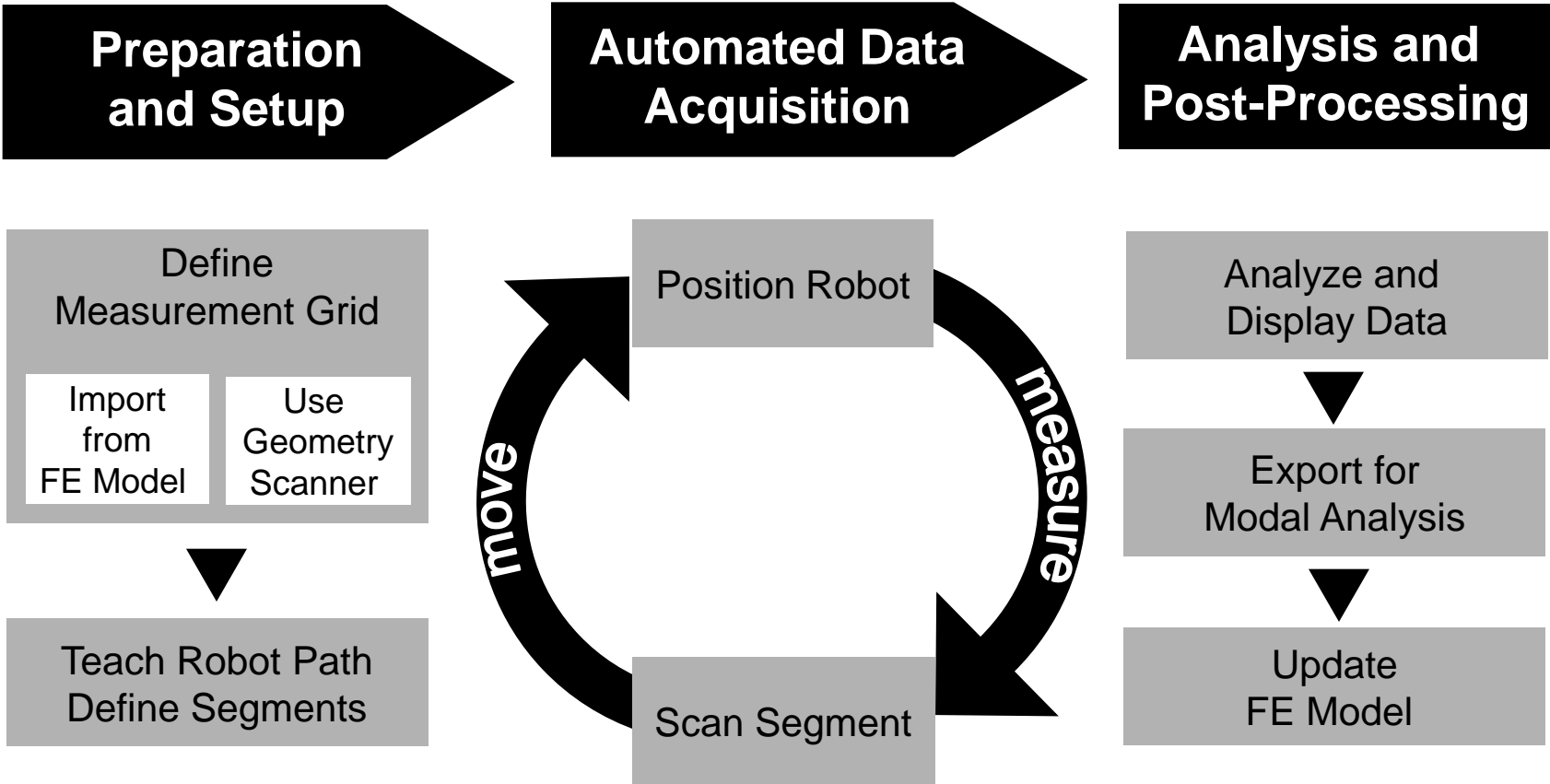
**The solution is...**

# Sensor Positioning by Robot



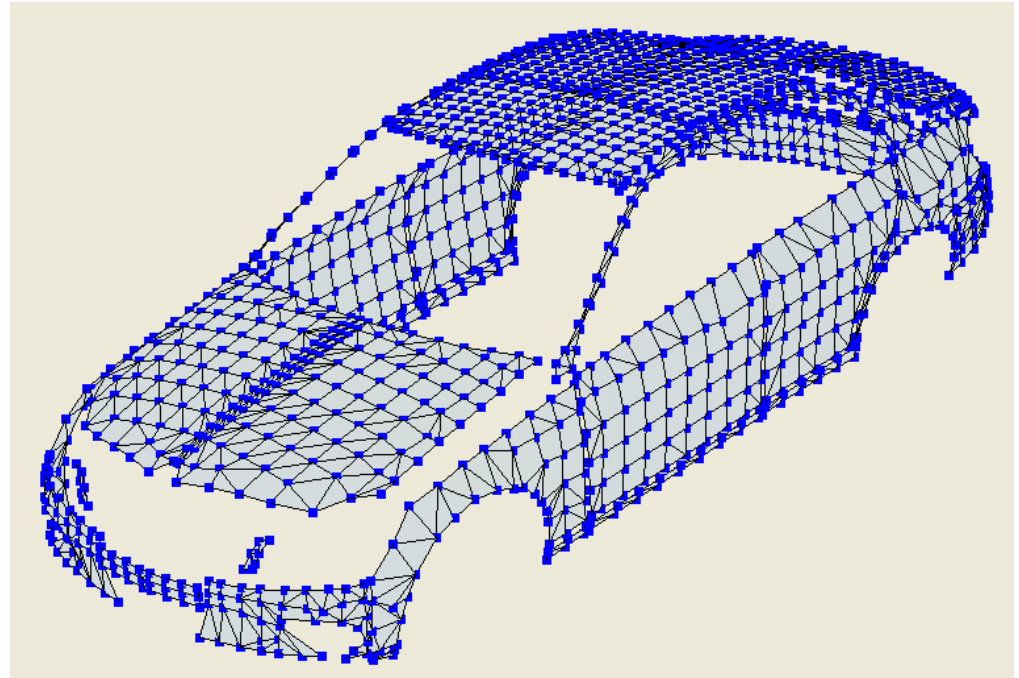
- Fixed Sensor arrangement
- Optimum working distance
- Automated measurement
- Automated 3D-alignment

# Workflow



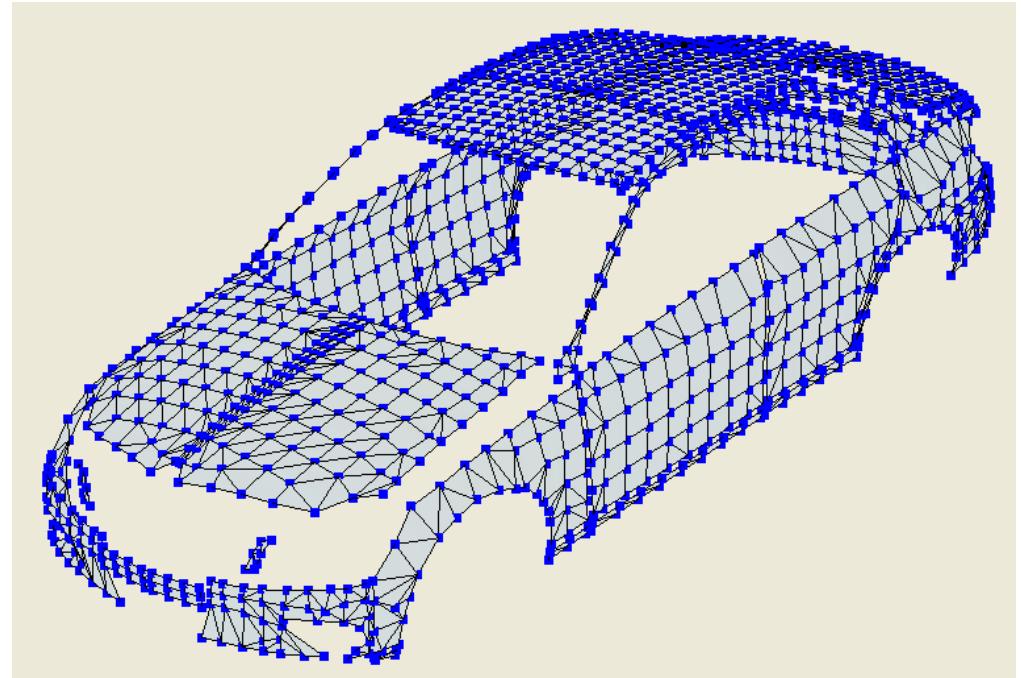
# Import Measurement Points

- Import Format: Universal File
- Can be derived from FEM-Model
- Provided by Customer
- Alternative: Geometry measurement



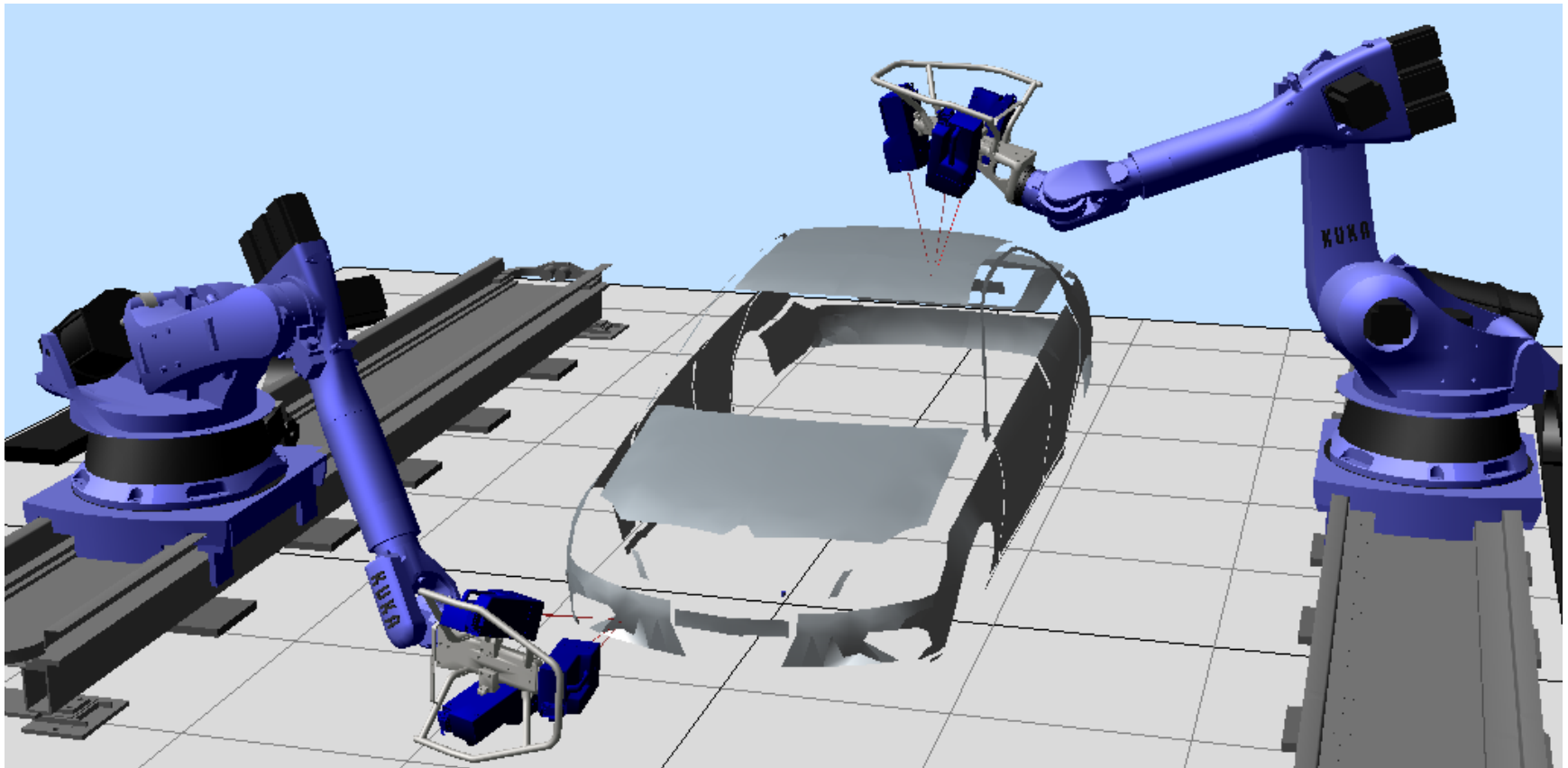
# Match Grid with Real Structure

- Position Lasers with Robot to four points
- Enter corresponding coordinates
- Robot BASE coordinate system calculated

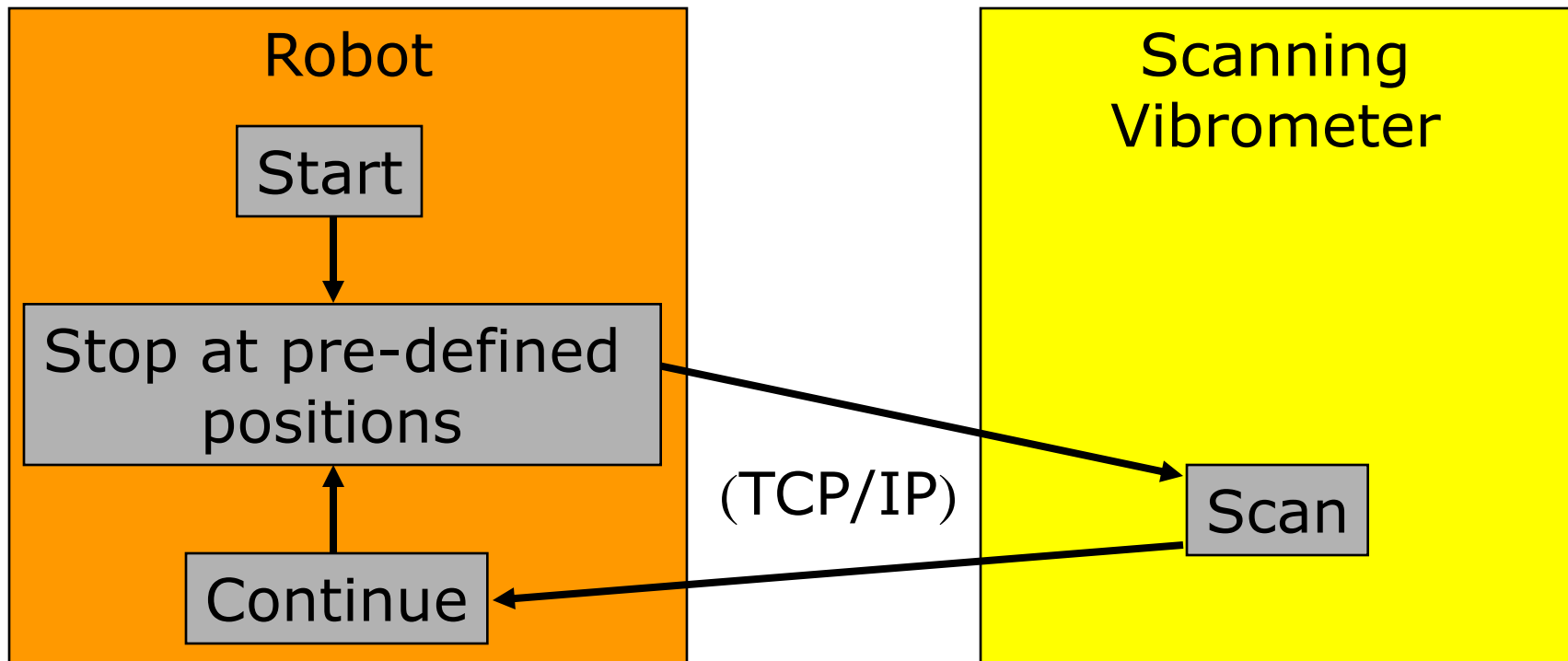


# Generate Robot Program

- ... Using Robot simulation software

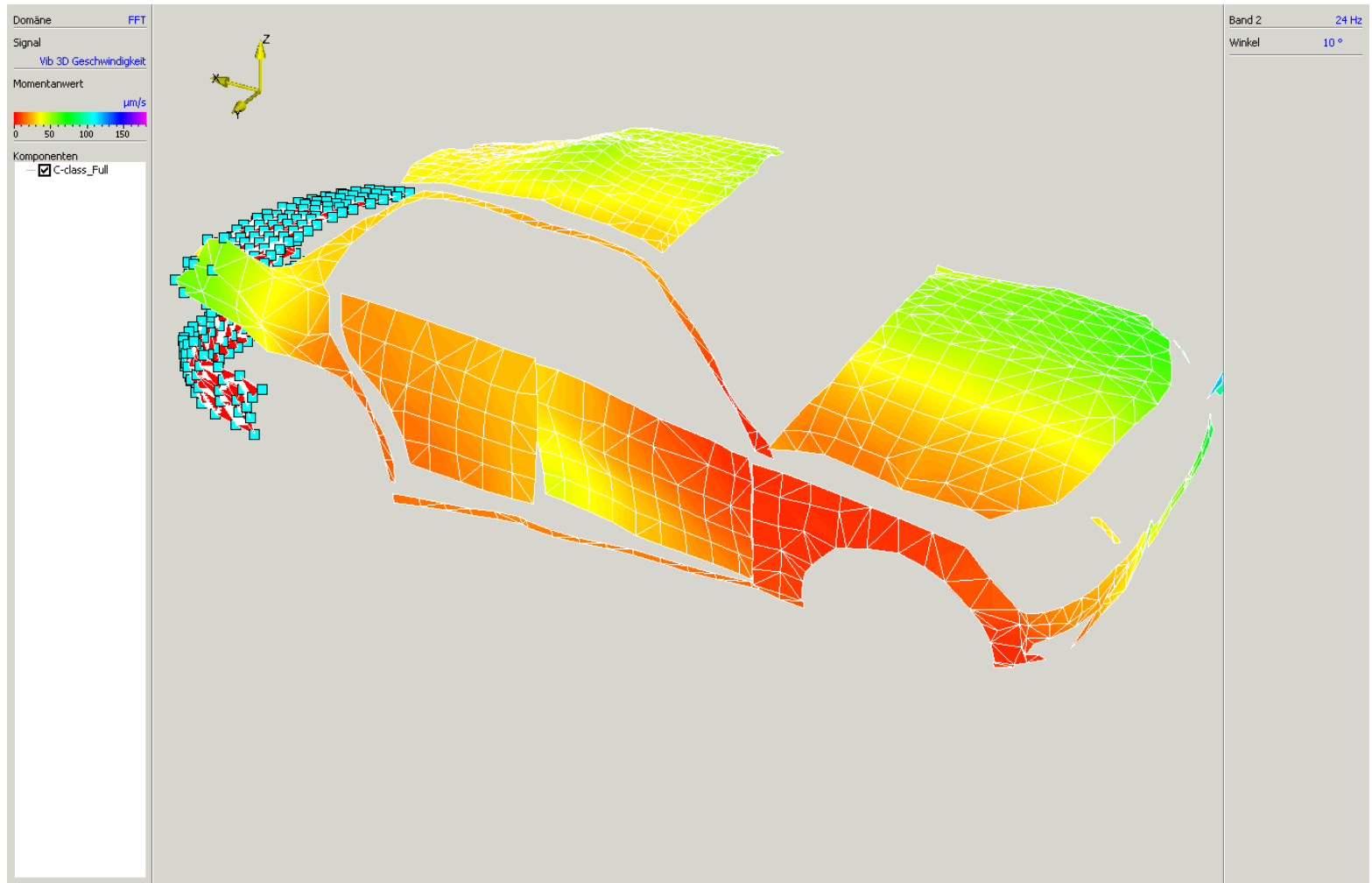


# Automated Data Acquisition



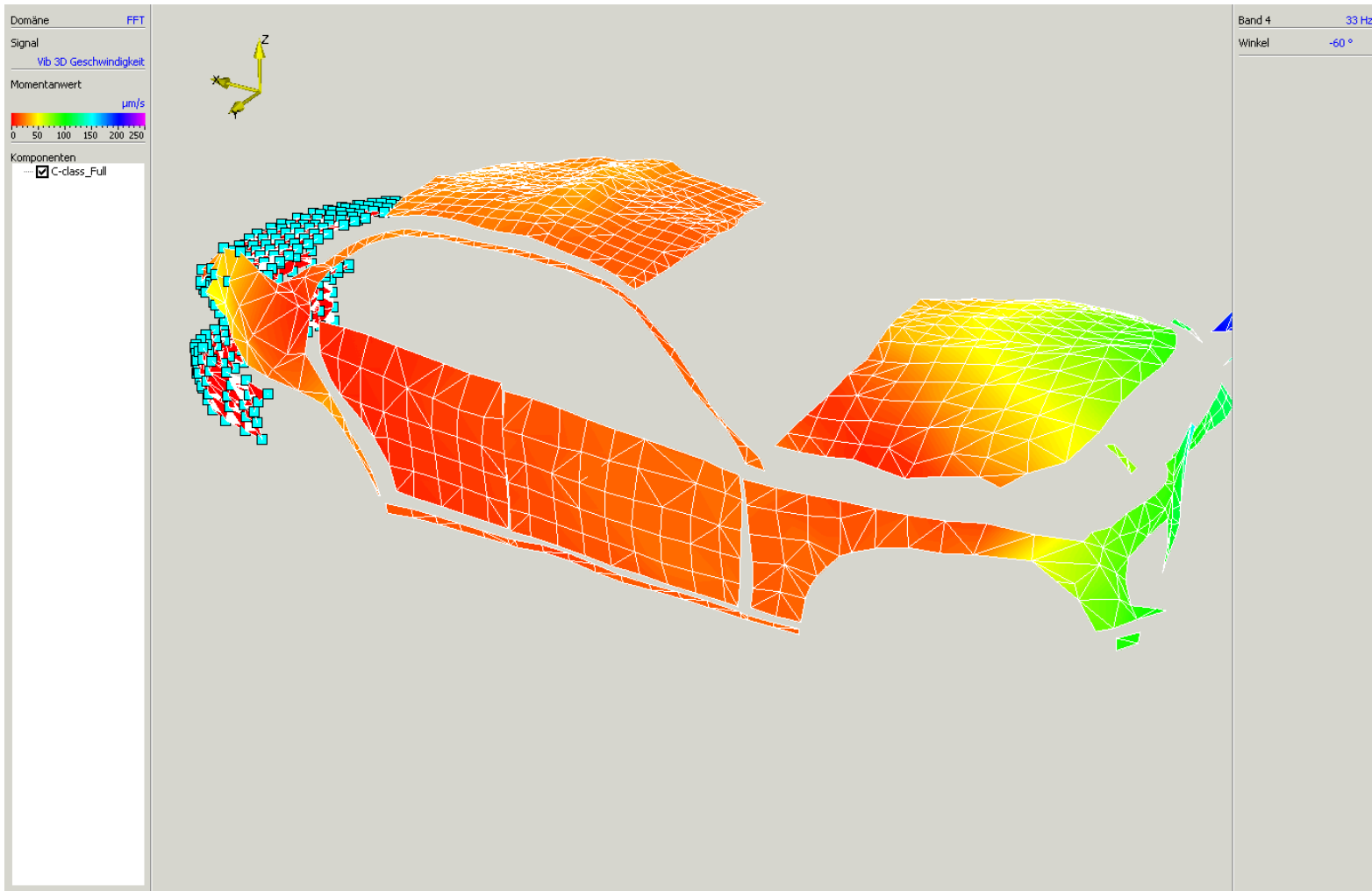
# Results

- Example: deflection shape at 24 Hz



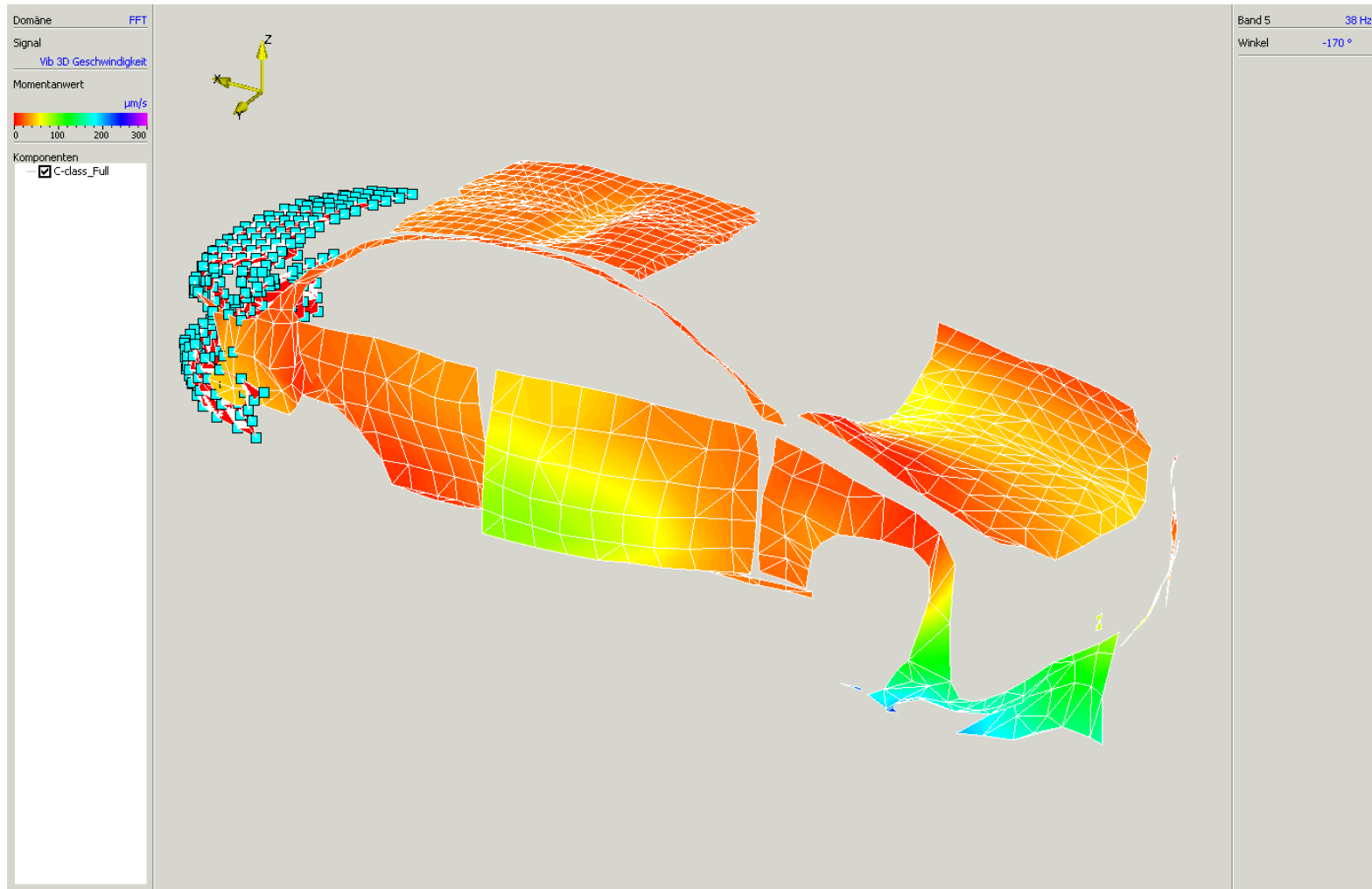
# Results

## ■ Example: deflection shape at 33 Hz

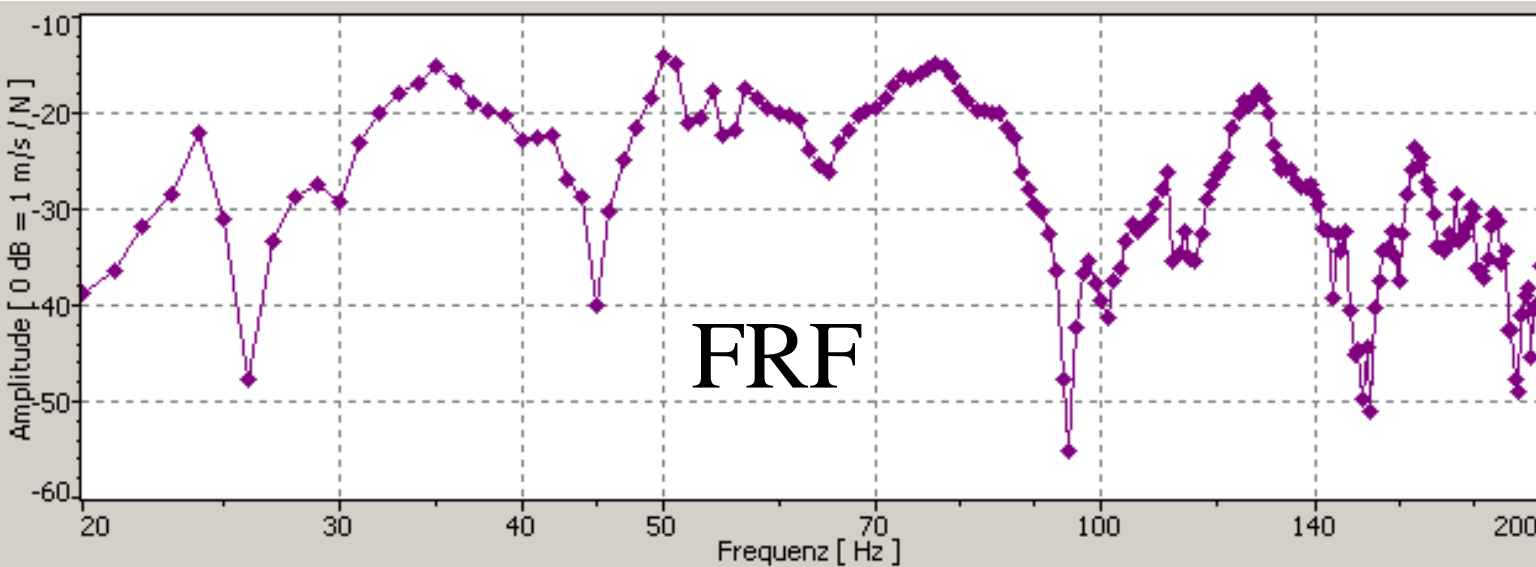


# Results

- Example: deflection shape at 38 Hz

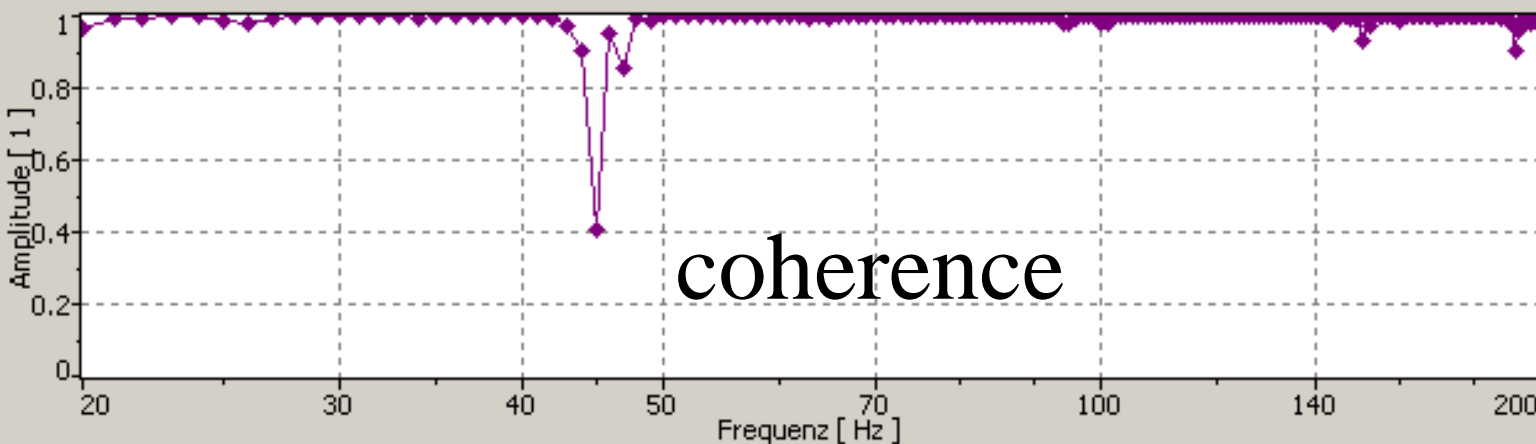


# Results



Vib X & Ref1 H1 Geschwin...

Index [1049](#)



Vib X & Ref1 Kohärenz

Index [1049](#)

# Summary / Conclusions

- **Fully automated & non-contact** vibration measurement
- Robot used for sensor positioning
- Over night measurement
- Optimal results
  - Optimal beam positioning
  - Optimal working distance
- Easy reutilization of created programs
- Saves time on prototypes
- Increases throughput of Lab