



# **An Example for Validation of Tire Parameters with Measurements on Vehicle and Tire Test Stand**

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# Measurement set-up





# Measurement set-up

- 2 RoaDyn Wheel Force Transducer model S625 front and rear
- 1 DCA System with CORREVIT SFIIP 2 axis Sensor
- 1 Fiber optic inertial platform RMS FES 44

## Vehicle

Passenger  
car



# Dynamic Motion Variables

- Transverse acceleration → inertial stabilized gyro
- Lateral acceleration → inertial stabilized gyro
- Yaw rate → inertial stabilized gyro
- Lateral speed → CORREVIT SF sensor



# Measuring variables at the rear wheel:

- Longitudinal Force  $F_x$  → wheel force transducer
- Vertical Force  $F_z$  → wheel force transducer
- Lateral Force  $F_y$  → wheel force transducer
- Camber angle to the surface → DCA System
- Tire slip angle at left rear wheel → CORREVIT SF Sensor



## Main Tasks :

- Measurement of motion variables: camber, slip angle, and wheel forces
- Camber measurement relative to the surface of the road
  - i.e. Camber as function of lateral acceleration
  - Comparison of measured data
- Generation of machine control data for indoor tire test machines
- Use of several measuring wheels for validation purposes



# Measuring track

Dynamic testing is carried out on the handling course of Contidrom proving grounds



# Test track :



Dry Handling course





# Dynamic Camber System

- Two CDS HF500C laser ride height sensors.
- Dynamic camber angle measurement
  - Working range: 375mm ± 250mm
  - Camber angle: ± 25°
  - Camber angle resolution: 0.04°
  - Accuracy: 0.5°
  - Additional mass at the wheel: 3.4kg

•Note

– the laser height sensors measure true height. Therefore, if the measurement surface contains a gap, the true height will be reflected.





# CORREVIT® SFIIP 2 axis optical speed / slip angle sensor

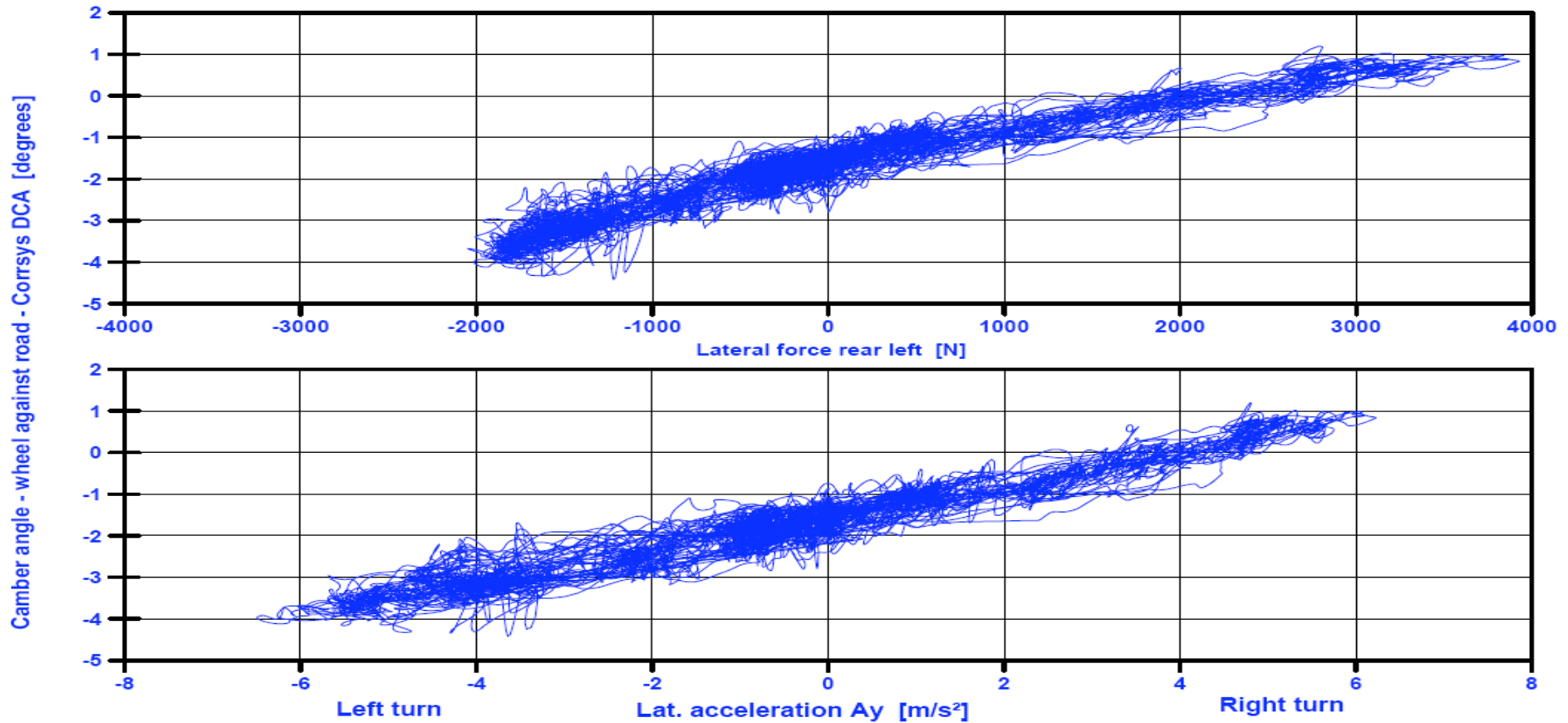
The SFIIP 2 axis non contact optical speed and slip angle sensor measures velocity in two axis as well as tire slip angle

- Velocity range: 0.3-250kmh
- Working range: 180mm +/-50mm
- Slip angle range: +/-40°
- Sensor head weight: 250g





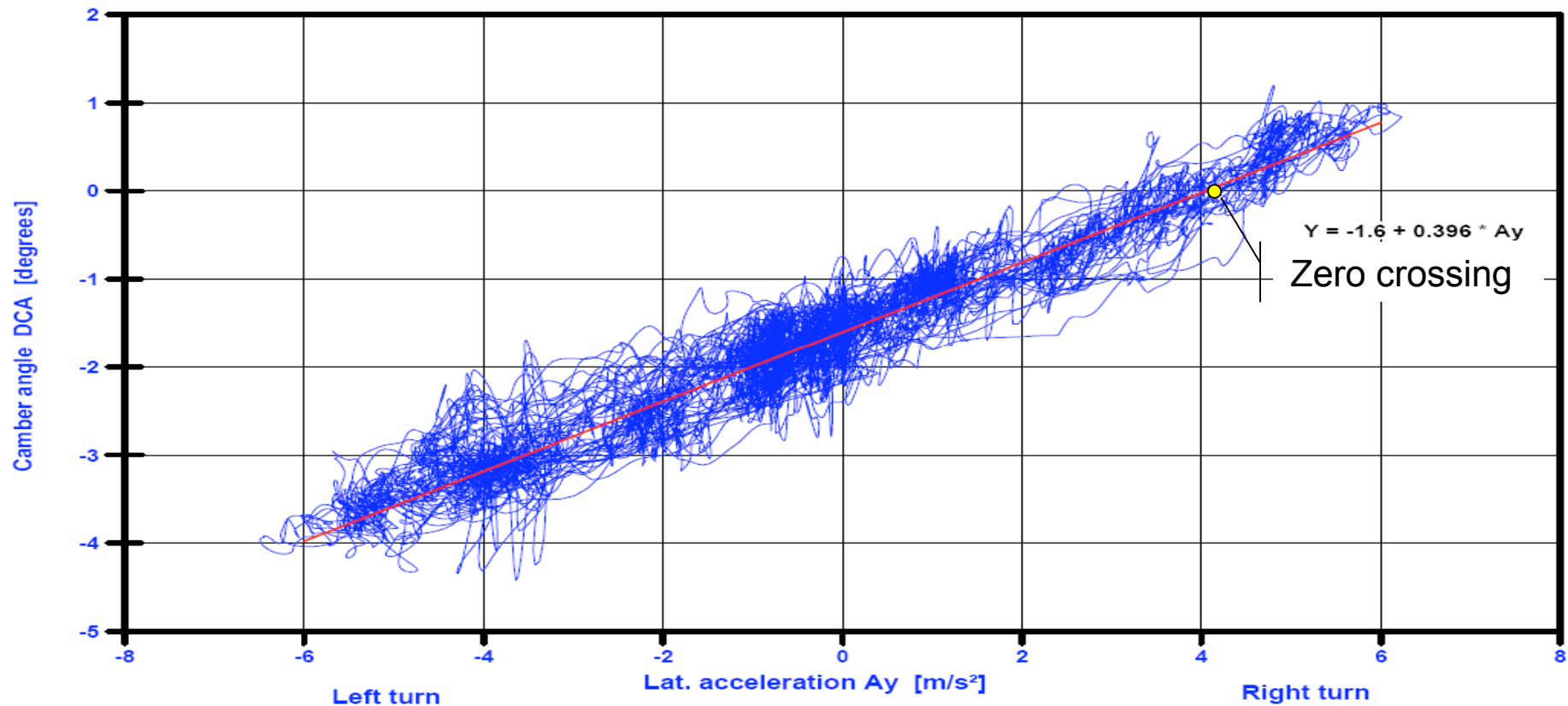
Camber angles as a function of lateral accelerations and of lateral forces



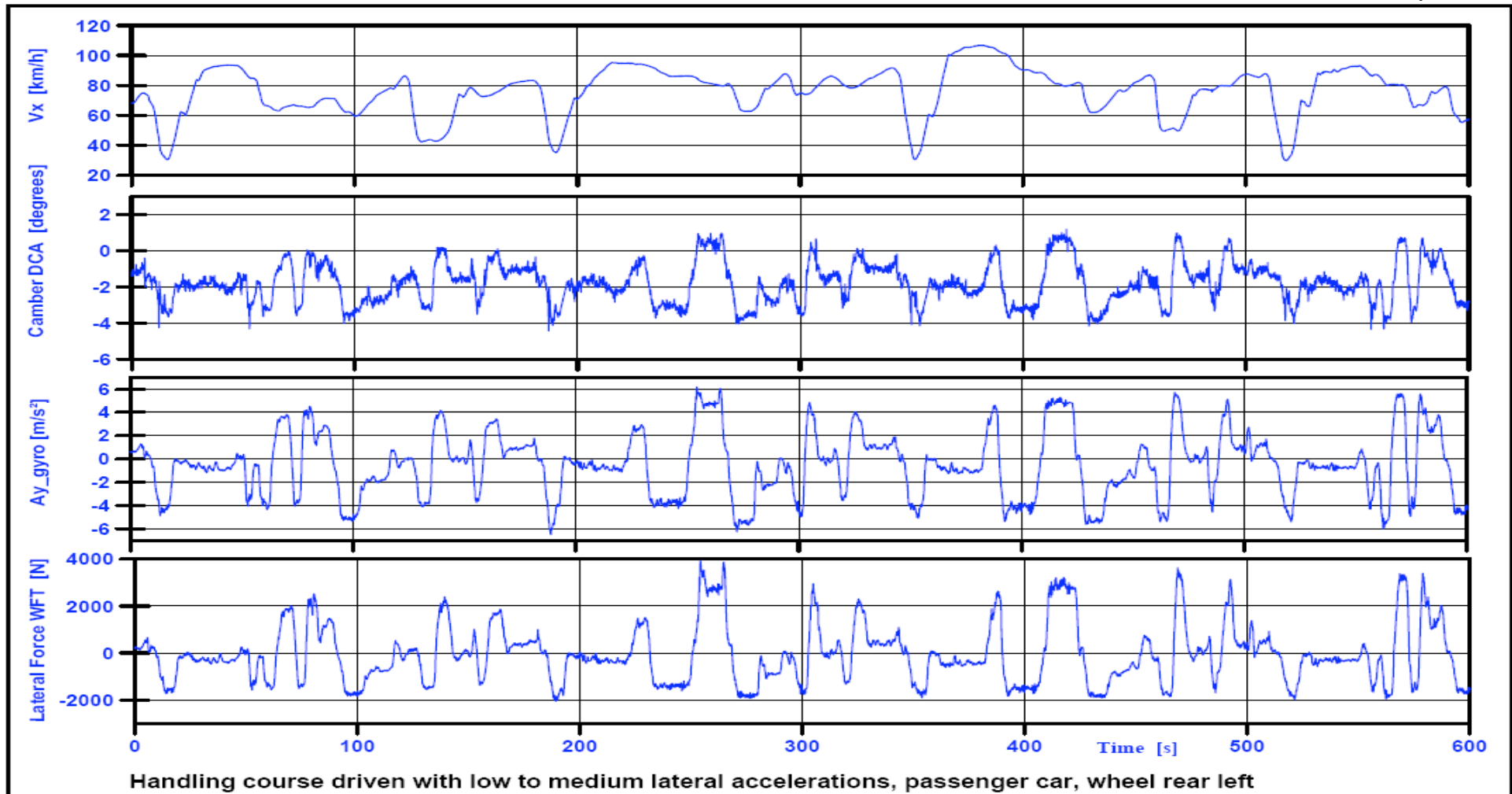
Handling course driven with low to medium lateral accelerations, passenger car, wheel rear left

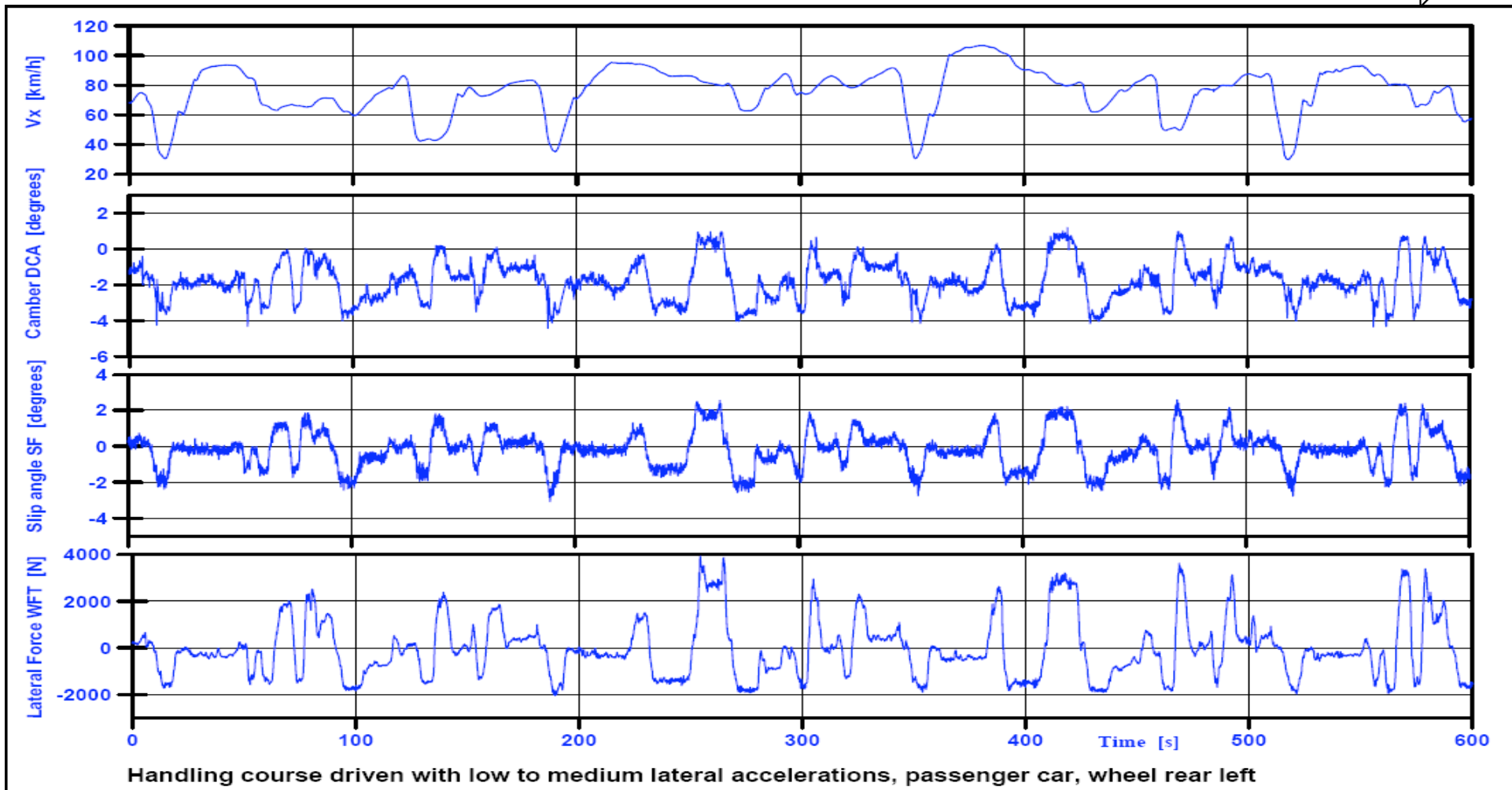


Characteristic function - camber angle vs. lateral acceleration



Handling course driven with low to medium lateral accelerations, passenger car, wheel rear left







## Conclusion :

- Very good correlation between lateral force, lateral acceleration, camber, and slip angle
- Linear relationship clearly visible between measured values. Linear regression curve documents linearity between camber angle and lateral acceleration
- Suitable method to retrieve data for tire test bench control  
Measurements show a very balanced set-up of the vehicles suspension
- The measured zero-crossing of the regression curve is  $4.06\text{m/s}^2$   
The vehicles manufacturer confirms vehicle data with  $4.08\text{m/s}^2$



## Notes

- Dynamic Road tests are necessary
- Measurement of all movements of the wheel is not possible with a test bench
- Delivery of input data for adjusted position of dynamic tests versus the test bench necessary



A special Thank You to Mr. Juergen  
Ehlich of Global Tire Evaluation,  
Continental Tire AG for their  
cooperation



# Dynamic Testing at Dekra Proving Ground in Germany





**Thank you**