

# PMP – Particle Measurement Program Informal Working Group

## Task Force 2– Brake Dust Sampling and Measurement

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**Meeting #6 – Thursday 30 November, 2017, 14:00 – 15:00**

### **Minutes of Meeting – Final Version**

**1. Tour de table:** Participants: AUDI-(SG) Sebastian Gramstat; BMW-(RL) Rasmus Leicht; BMW-(KL) Katharina Lammel; BREMBO-(MA) Mattia Alemani; CARB-(SC) Sonya Collier; DEKATI-(VN) Ville Niemela; FORD-(JG) Jarek Grochowicz; FORD-(MMF) Marcel Mathissen; General Motors-(MR) Matt Robere; HORIBA-(DL) Dmytro Lugovyy; JARI-(HH) Hiro Hagino; JRC-(TG) Theodoros Grigoratos; LINK-(CA) Carlos Agudelo; LINK-(RM) Radek Markiewicz; Opel-(RE) Reinhold Enders; TMD-(AP) Andreas Paulus; TSI-(JS) Jurgen Spielvogel; TSI-(SP) Stephan Percot; TU Ilmenau-(DH) David Hesse; TU Ilmenau-(TF) Toni Feisel; TU Ostrava-(MV) Michal Vojtsek

**2. Presentation of TU Ilmenau:** TF presented TU Ilmenau's set-up for sampling and brake dust measurement. After a quick introduction on the use of CFD simulations and the measurement strategy, TF emphasized on the functional details of the brake dyno as well as on the differences of the current setup from the 1<sup>st</sup> generation brake dyno developed in TU Ilmenau. The measurement requirements are summarized to high inlet efficiency, minimized aerosol modification and background, multi-device-measurement and high reproducibility. CFD simulations are available for volume flow and suction direction as well as for studying the residence time both in the chamber and in the duct. Maximum flowrate is about 850 m<sup>3</sup>/h with optimal being approximately the half. Very low residence time of particles both in the chamber and the duct is achieved. Overall, the setup is suitable for PM<sub>2.5</sub> measurements (both mass and number) but not for PM<sub>10</sub>. More details can be found in TU Ilmenau's presentation (attached).

CA asked for a clarification on the brake rotation of the setup. TF confirmed that it is clockwise. CA wanted to know if TU Ilmenau has considered of another geometry for the enclosure or if the actual rotor design was taken into account. The answer is yes but it has not been developed yet. Regarding the influence of the rotor design TF said that it has not been studied so far. CA asked if the losses refer to the duct or the sampling line. TF clarified that losses refer to the duct. Finally, CA asked about the distance of the last disturbance before the probe. TF clarified that it is 500 mm (shorter than 8d) with however CFD studies showing no effect on the flow.

MM asked for a better explanation on the validation procedure of the setup. TF mentioned that they will validate the setup experimentally in the next months (so far everything is based on CFD simulations) and among others they are planning to use particle generators. MM also asked for a clarification whether empirical (slide 16) refers to the application of equations with the answer being positive.

SC asked about the uniformity of the particle flow in the duct and in the chamber and how it is affected. TF said that a compromise is required.

DL asked how the measurement of the flowrate is done. TF clarified that a flowmeter is positioned at the end of the duct and there is the only point for measuring the air flow rate. DL asked why in CFD studies the flow is considered laminar at the inlet. TF clarified that the flow is considered highly turbulent but streamlined.

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TG asked some clarifications on the speed/losses diagram (slide 12). A discussion regarding whether this setup is suitable for urban applications due to high losses followed. TG asked if the incoming air is conditioned. TF answered yes with the use of H13 filters.

Finally, a short discussion regarding RDE applications took place with MR asking how TU Ilmenau is planning to mimic the actual cooling of the vehicle. TF said that thermocouples will be used but still it remains open how cooling will be replicated.

### **3. Other business:**

TG briefly presented a document with short description of existing set-ups and introduced the discussion to follow on losses and uncertainties. Soon the document will be sent to all participants for feedback and to start the discussion.