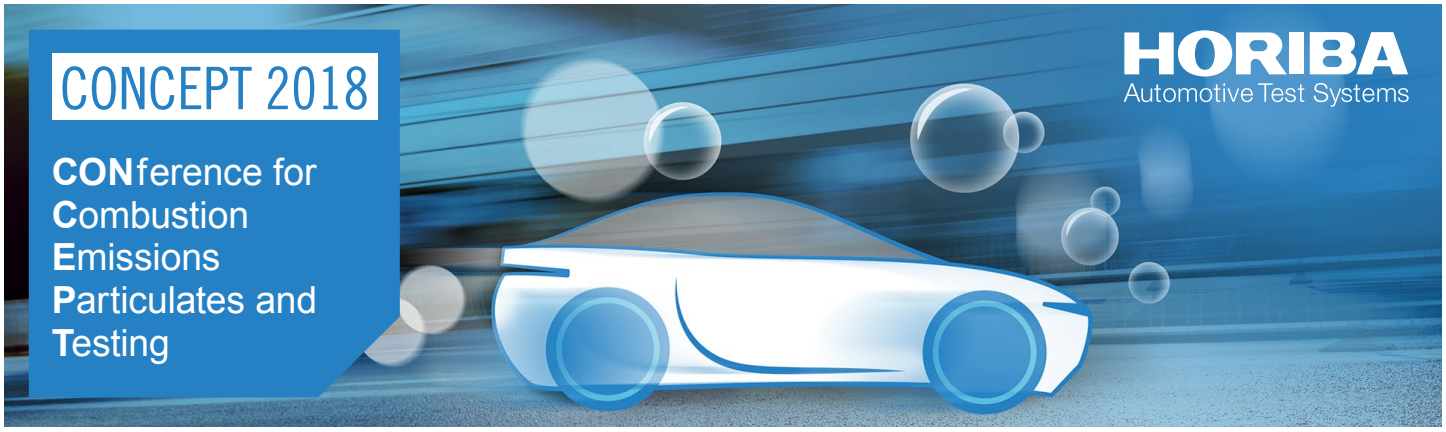

HORIBA CONCEPT EUROPE 2018

CONference for **C**ombustion **E**missions **P**articulates and **T**esting

ABSTRACTS

MARCH 22nd (THURSDAY)

11:30 - 12:30 – Keynote Speech:

Shared Electric Connected and Automated (SECA): The Future of Transportation

Prof. Dr. Matthew Barth
University of California Riverside, Bourns College of Engineering, Center for Environmental Research and Technology (CE-CERT)

We are at a unique time in history where the future of vehicles is undergoing several major changes: We are moving away from personalized vehicle ownership and adopting new shared transportation models; Vehicles with electric drivetrains are becoming more common with advances in motors, controls, and batteries and are now increasingly connected to the rest of the world through ubiquitous communications. Vehicle automation is around the corner, with several vehicle deployments occurring around the world. Given this "SECA" landscape, there is a variety of energy and emission impacts that need to be considered. As a result, new testing methods for alternative propulsion technologies are needed, such as using a new "dyno-in-the-loop" concept. Furthermore, new methods of monitoring and certifying vehicles are emerging, such as Dynamic Energy and Emissions Management (DEEM) strategies that are being explored. This presentation will provide an overview of recent activities in California in these exciting areas.

1. FUTURE EMISSION REQUIREMENTS AND LEGISLATION

13:30 - 14:30 – Keynote Speech:

Health Effects Related to Emissions from Road Transport in Perspective to Other Sources

Dr. Miriam Gerlofs-Nijland
RIVM (National Institute for Public Health and the Environment, Netherlands)

There is substantial evidence that exposure to airborne particular matter (PM) from road traffic is associated with adverse health outcomes. Therefore, many efforts have been taken to diminish traffic emissions, which has resulted in a considerable reduction of engine emissions in the last decades. Although it is often assumed that negative health effects are to be caused by tailpipe emissions other components may also contribute to detrimental effects. With reducing engine emissions, the relative contribution of non-exhaust emissions to particulates is increasing although the implications for health are mainly unknown. This speech will give you a glance of the research that is done in this field and the questions that remain.

14:30 - 15:00

A Definition of Real Driving Emissions

Lars Mönch
Umweltbundesamt (German Federal Environment Agency)

15:30 - 16:00

Non-Exhaust Emissions: How to Deal with Brake Particle Emissions

Dr. Sebastian Gramstat
AUDI AG

Non-exhaust emissions have become very relevant during the last five to ten years. Emission behavior of friction brakes is getting in the focus of research activities all over the world. In a first step, those activities will be introduced and described in terms of their objectives and the actual status. Additionally, joint activities of HORIBA and AUDI AG will be introduced. This includes the presentation of an experimental characterization method and latest measurement results. Finally, some vehicle specific aspects will be addressed. In terms of electrification and refined friction brakes, the impact on brake particle emissions is discussed.

16:00 - 16:30

Recent Developments in European Light Duty Vehicle Emissions Legislation and Their Implications

Les Hill
HORIBA Ltd.

The European Union (EU) has recently introduced a variety of new Directives covering LD, HD and NRMM vehicle categories, impacting all aspects of emissions measurement such as NOx, PM, PN, CO_2 and also evaporative emission test procedures. The new regulations require Real World Testing for both Type Approval and In-Service Conformity as well as new procedures and limits for Type Approval testing in the Laboratory. In addition, the EU Commission has recently set the targets for the LD vehicle manufacturer fleet average CO_2 emissions for 2025 and 2030. The presentation summarizes the current status, reviews the future legislation initiatives already in process and looks forward to potential further developments in the future.

16:30 - 17:00

Virtual Testing and Validation of the Upgradable, Autonomous Car of the Future

Thomas Dietz
Fraunhofer IPA

Autonomous driving and the resulting new business models will have a profound impact on the life-cycle of future cars. The higher degree of vehicle usage through shared mobility, significantly increased life-cycle mileage of the vehicle and complex, rapidly evolving hardware and software will create tremendous pressure to allow for updates and upgrades of core components during the life-cycle of the vehicle. Rapid evolution of technology and complex systems will lead to an explosion of the number of variants in the E/E architecture and software of the car that needs to be managed and evolved over the entire life-cycle. These challenges can only be addressed if functionality of subsystem is highly encapsulated. This vehicle concept borrows from technology and approaches of cyberphysical system and is therefore called a cyberphysical car. The key for realizing the cyberphysical car and unlock its potential with respect to updateability and upgradability is the integration flow for new components and software. The presentation gives an overview of challenges for realizing new business models utilizing autonomous driving.

MARCH 23rd (FRIDAY)

2. TESTING METHODS FOR ALTERNATIVE PROPULSION TECHNOLOGIES

09:00 - 09:30

Analytical Spectroscopy in Automotive Development: Complementary Characterization Tools for Batteries

Dr. Roland Seitz
HORIBA Jobin Yvon GmbH, Scientific

The batteries market is dramatically growing since their first commercial introduction in the early 90's based on demands for electronic devices and automotive. To face large issues such as increase of capacity, safety, life and running time as well as decrease of weight, volume and charge time, all stages have to be understood and controlled to maintain competitiveness and profitability. From any single component to full pack, scientific fields and technologies involved require fast and innovative characterization tools. HORIBA Scientific provides a comprehensive portfolio of characterization platforms for component and cell development, studies and quality control. These platforms allow the characterization of materials and devices on an elemental, molecular and structural level. The complementary characterization tools are presented with results obtained from the analysis of different battery components like cathodes, anodes, binders, separators and electrolytes.

09:30 - 10:00

New Hybrid Test Procedures: X-Ray Instrumented Vehicle Crash and Crash Testing of Charged Batteries

Dr. Malte Kurfiß
Fraunhofer EMI

Innovative concepts for cars aiming for energy efficiency and safety are becoming more and more complex. In order to ensure passive crash safety, new test techniques are needed for a better understanding of the characteristics of innovative materials in dynamic loading scenarios. The Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institute, EMI, is developing new, hybrid test procedures for this purpose. As the battery pack of an electric car is the most critical part, we combined our core competences of measuring signals in high dynamic processes with handling the rough conditions of a thermal runaway reaction in batteries. Fully charged battery cells with capacities up to 60 Ah were tested with impact speeds of up to 5 m/s at forces of several 10 kN. One more crucial aspect to understand and enhance passive crash safety is to observe and measure the non-visible behavior of inner crash relevant structures. The combination of X-ray technology and crash testing makes new information available that could not be observed before. To achieve this goal we are speeding and scaling up X-ray technology with the ultimate goal of a high-speed X-ray video of a car crash.

10:00 - 10:30

Optimized Diesel Hybrid Powertrain and Controls to Minimize Co2 and Nox Emissions

Stefan Rohrer
Continental

Modern passenger car engines need to fulfil demanding targets. For the Diesel engine there is a particular focus on the trade off between fuel consumption and the emissions of nitrous oxides, NOx, in real driving. Best fuel efficiency is achieved when the engine is operated at the optimum position of heat release, HR50. However, this coincides with the highest engine out NOx emissions. To avoid the deterioration of fuel efficiency, engine internal NOx suppression was reduced as much as possible in favour of a highly efficient aftertreatment system. Additionally, moderate 48 Volt electrification was implemented. This provides energy recuperation during vehicle braking as well as torque support for the combustion engine during acceleration. This presentation presents the current status of work in progress of this systemic assessment of the interaction of the three ingredients „engine optimisation", „highly efficient aftertreatment" and „mild hybridisation", to yield a Super Clean yet cost effective Diesel car, fit for the future requirements of CO2 and NOx reduction.

11:00 - 11:30

Bosch Activities on Combustion Generated Nano Particle Emissions and Associated EU Funded Projects

Dr. Andreas Manz
Robert Bosch GmbH

Within the framework of the Horizon 2020 research and innovation program, in particular the green vehicles initiative, the European commission is funding various projects supporting the implementation of future emissions and air quality standards. Reducing the emissions of internal combustion engines includes not only the ambitious CO_2 targets as a key technology driver, but also keeps a clear focus on the further reduction of exhaust emissions such as NOx, HC and PN under real driving conditions. For gasoline engines the emissions of ultrafine particles that are undetected by current measurement procedures are becoming increasingly interesting due to environmental and health concerns. Bosch is involved in two EU-funded consortia that aim to support the in-depth understanding of particle-sources and -characteristics as well as the development of improved measurement systems, engine componentry and combustion systems. Of attention are particle numbers between 10 to 23 nm particle size. Through using advanced measurement techniques, optical engines, modelling and simulation tools (for new control strategies or understanding particle formation) the optimal trade-off between efficiency and emissions will be found.

3. INTEGRATION OF REAL AND VIRTUAL TESTING

11:30 - 12:00

Advanced Vehicle Driving Modes – Future Test and Diagnosis Challenge

Prof. Dr. Bernard Bäker
Dresden Institute of Automobile Engineering, TU Dresden

Based on next step emission legislations especially in urban regions upcoming future vehicles have to cope with a variety of different emerging technology objectives introduced by several new selectable driving modes and features. In this context advanced drive train control systems will still have to manage rightsized combustion engines, hybrid powertrain solutions and pure electric driven propulsion systems and their combinations depending on e.g. the GPS-location, traffic situation and the battery pack condition. An energy efficient control approach for these drive trains can only be realized with a multi-criteria attributed backend city and street map database generated out of a real-time smart vehicle data collection and predictive data fusion and AI algorithms online connected to the vehicle over telematics. High sophisticated backend-based predictive control strategies and intelligent driver speed cycles can be developed, tested and maintained with an automated vehicle-in-the-loop diagnostics approach.

12:00 - 12:30

Big Data and Machine Learning: Challenges and Opportunities to Improve Your Business

Jörg Schönbach
HORIBA Europe GmbH

In order to collect and evaluate data from large vehicle fleets, Big Data or mass data transfer, handling, storage and evaluation is being employed. Machine Learning processes these data sets and generates knowledge from them. Meanwhile, the interpretation of the results remains in human hands. Given the legal framework for RDE data and evaluation, we do not yet have any reliable statements or information on actual fleet consumption and fleet emission values. HORIBA together with project partners works on comprehensive solutions to master future challenges via fleet RDE data and their evaluation.

13:30 - 14:00

Synergetic Utilization of Testing and Simulation in the Audi Chassis Development Process

Dr. Sebastiaan van Putten
AUDI AG

Based on trends towards increasing use of vehicle dynamics and ride comfort simulation, one may assume the final goal in chassis development is complete simulation of all occurring aspects. At AUDI AG however an approach is chosen, in which all basic chassis characteristics are developed within a lean virtual environment. More complex interactions, which would require an extensive modelling and parametrization effort, are subsequently assessed using a limited number of actual prototypes for subsystem and full vehicle testing. By these means, an optimum in efficiency within chassis development is pursued, without reducing the quality and extent of the analysis.

14:00 - 14:30

Integrated Test and Simulation in Handling and Ride Target Cascading

Prof. Dr. Günther Prokop / Felix Kocksch
Dresden Institute of Automobile Engineering, TU Dresden

Today, vehicle development is a very complex task in which target-oriented engineering must be ensured at all levels of the V-model. For this purpose, it will be shown how simulations and tests can be used to derive requirements and to forecast and validate the characteristics of a design. Therefore, in addition to a thorough understanding of the relevant physical chains of effect in the vehicle under development, various reliable road and test bench experiments as well as valid simulation models in varying levels of detail are required. Such a consistent structure consisting of test rigs, models and the necessary maneuver specifications will be presented using the vehicle test center of the TU Dresden and a modular chassis development library in the simulation environment SimulationX as an example. This means that powerful tools are available at every stage of the V-model, ensuring that the reference to the development target is always retained. Finally, an outlook is given on how the presented method can be transferred from handling and ride to aspects of active vehicle safety.

15:00 - 15:30

Integration of Real and Virtual Testing in the Context of Testing ADAS and Automated Vehicle

Dr. Pawel Jaworski
HORIBA MIRA Ltd.

The validation of high-level autonomy features requires large amounts of test data, which conventionally is achieved by accumulating miles on the road and dedicated proving grounds. According to the Rand Corporation, typically 275 million miles would need to be driven without a fatality in fully autonomous operation to have a 95% confidence level in the safety assessment. In this work we present HORIBA MIRA's concept of a digital proving ground that looks at how simulation and virtual testing techniques can be combined with real proving ground tests to reduce the real world test burden and accelerate development and validation of CAV and ADAS. Both engineering and human aspects of CAV and ADAS engineering are considered.