



UNITED NATIONS

75th UNECE GRPE session

PMP IWG Progress Report

Joint Research Centre
the European Commission's
in-house science service



JRC Science Hub: ec.europa.eu/jrc

PMP meetings in 2017

2017-01-11: PMP 42nd (GRPE Geneva summary)
2017-03-15/16: PMP 43rd
2017-05-22: PMP 44th (telco)

NEXT MEETING: 7th – 8th November 2017 (Location: JRC Ispra)

EXHAUST PARTICLE EMISSIONS

Main open points

- Round Robin Sub-23nm
- Raw exhaust sampling
- Round Robin PNC (Particle Number Counter)
- Horizon 2020 projects
- WLTP low temperature PN testing

Scope of the sub-23 Round Robin

Development of a sub23nm (cut-off size:~ 10 nm) particle number measurement procedure based on the existing PMP methodology conveniently adapted.

Main purpose: Monitoring particle emissions of new engine/after-treatment technologies.

Assessment of the repeatability/reproducibility of the proposed particle counting methodology by means of a “round robin”.

Investigation of sub23nm protocol

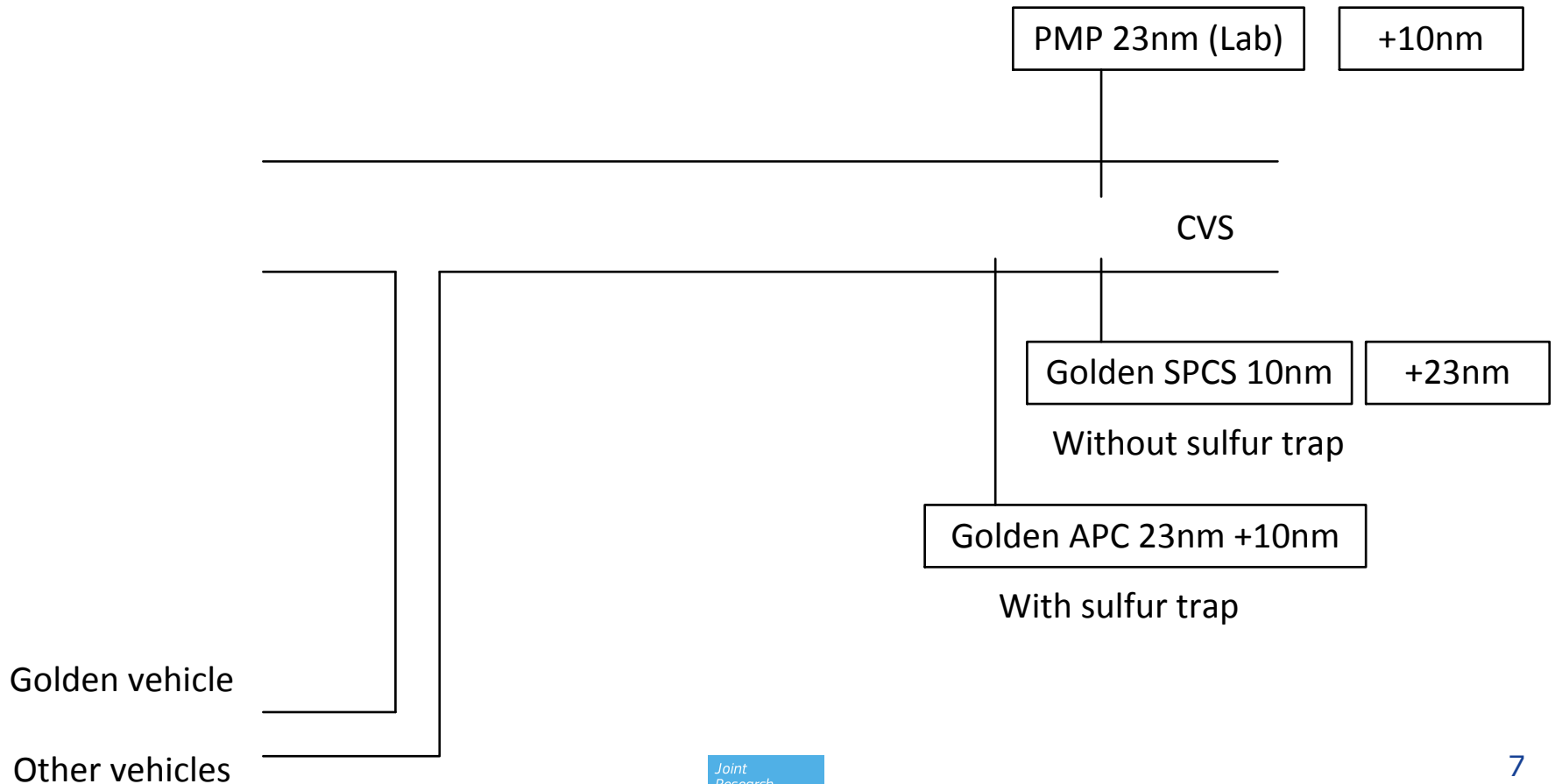
Two systems with CS and 10nm CPC to circulate

Each lab PMP system plus a 10nm CPC (to circulate)

One golden vehicle (to be decided)

Different labs will test different engine technologies

Suggested setup



Investigation of sub23nm protocol

- Instruments to be delivered to JRC in July
- At least 6 labs confirmed participation
- Most labs would prefer GDI+GPF as Golden vehicle
- However Golden car with GPF might have bad reproducibility
- Detailed program to be decided (desired timing and logistics do not match)
- JRC can start as soon as golden instrument and vehicle are available

PN Counting from Raw Exhaust via Fixed Dilution

- Interest in this approach confirmed by some engine manufacturers and some instrument manufacturers
- 01 Series of amendments to Reg. 132 already includes such possibility but the procedure is not defined
- First analysis of potential benefits/issues presented during the last meetings
- Correlation with other methods (CVS and partial flow system) and advantages/disadvantages to be checked – Additional data required

Raw exhaust (tailpipe) sampling

- Preliminary results generated by the JRC show 20% differences
- Input from others is necessary
- Theoretical investigation of uncertainty

Raw exhaust (tailpipe) sampling

- Data presented by the industry during the 43rd meeting confirming good correlation
- Questionnaire on experimental program circulated
- Replies still to be received
- Experimental program details under discussion

PNC Calibration Round Robin

- Confirm that the k factor can be included in the final counting efficiencies
- Investigate the possibility to change the calibration material
- Investigate the possibility to calibrate at 10 nm
- Preliminary results were presented. CAST aerosol showed good reproducibility – Report in preparation
- Sub-group led by PTB (German NMI) was formed to look into more detail the results – New limited RR taking into account lessons learned?

HORIZON 2020

Participants presentations

- DownToTen
- PEMS4nano
- SUREAL-23

Gas engine testing

- Industry to provide facilities
- Experimental program under discussion

Low Temperature testing

- Testing is done since >10 years
- Input is necessary on experimental setup / difficulties encountered or topics to be investigated
 - Are there difficulties with current setups?
 - Are there any other questions. E.g. Quantification of temperature effect: Urban part or whole cycle?

NON-EXHAUST PARTICLE EMISSIONS

Steps for Building a Common Method for Measuring Brake Wear Particles

PROPOSED APPROACH

Three steps were identified as fundamental for the development of the methodology for brake wear particles measurement:

- ✓ Development of a new braking test cycle representative of real-world conditions
- ✓ Selection of the most suitable methodology for sampling brake wear particles
- ✓ Selection of the most suitable methodology for brake wear particles measurement and characterization

STEP 1 – BRAKING CYCLE

Four sub-steps were identified as necessary for the development of the desired braking schedule:

- ✓ Analysis of the WLTP Database for understanding real world driving and braking behavior (**Concluded**)
- ✓ Comparison of WLTP data with existing braking cycles (**Concluded**)
- ✓ Development of a first version of the braking schedule (**Deadline: June 2017**)
- ✓ Testing and Validation of the schedule – possible round robin (**Deadline: January 2018**)

STEP 1 – BRAKING CYCLE

The situation as we speak can be summarized as follows:

- ✓ A WLTP database based profile is being developed by FORD and will become available to the TF and the PMP Group
- ✓ A short version LACT profile is being developed for the purposes of the LOWBRASYS Project and will become available to the TF and the PMP Group
- ✓ TF members are willing to test and validate both schedules at least in terms of temperature profile and wear
- ✓ 6 laboratories will participate in this round robin which is expected to start in September and finish in December 2017¹⁹

Step 2 - Selection of the most suitable sampling method

- ✓ Comparison of existing systems/test rig configurations (Deadline: June 2017 – On-going work by the group)
- ✓ Selection of Functional Parameters (Deadline: June 2017 – On-going work by the group)
- ✓ Selection of Testing Parameters (Deadline: January 2018)
- ✓ Testing and Validation of the Selected Configuration (Deadline: To be defined depending on the progress)

STEP 2 – SAMPLING METHODOLOGY

Selection of the method

v. Dyno vs. Mobile vs. Road-side testing: How did you decide to focus on Dyno testing?

At least 3 different systems have been proposed



- ✓ Each of these sampling system comes with its pros and cons
- ✓ Also, different on-road systems have been used by some researchers

STEP 2 – SAMPLING METHODOLOGY

Selection of the method – Results

✓ **Pin-on-disc systems:**

- Simple and easy to use
- Study of wear mechanism

✓ **On the other hand:**

- Do not take into account the pad shape and the caliper design
- They have important limitations (i.e. speed)

✓ **Full chassis dyno:**

- Better reflect real world conditions
- Takes into account the full range of possible technologies for BW particles emission reduction

✓ **On the other hand:**

- Contribution from other sources

STEP 2 – SAMPLING METHODOLOGY

Selection of the method – Results

✓ **Brake dyno systems:**

- Simpler compared to a full chassis dyno
- Easy to control parameters like speed, cooling air flow rate, etc.

✓ **On the other hand:**

- Such a test procedure would put the emphasis on technologies for BW emission reduction only linked to the brake system

✓ **It appears that a commonly accepted test rig configuration is an objective that can be achieved in a reasonable time frame**

PARTICLES SAMPLING AND CHARACTERIZATION METHODOLOGIES

- ✓ **During the 43^d face-to-face meeting several projects were presented by the stakeholders with different approaches regarding the sampling and measurement procedures.**
- ✓ **Need to better define the objectives of the methodology to be developed within the PMP group**
- ✓ **Need to coordinate the different activities in order to be more effective and efficient**
- ✓ **JRC proposed the formation of a second Task Force which will include mainly measurement experts to speed up the process.**

STEPS 2 & 3 - SAMPLING AND MEASUREMENT METHODS

- ✓ Comparison of existing systems and methods (Deadline: November 2017)
 - ❑ Several systems exist. Task Force will compare these systems and decide which ones are the most appropriate
- ✓ Selection of testing and functional parameters (Deadline: March 2018)
 - ❑ After the system selection the TF will work on the optimization of the testing and functional parameters
- ✓ Testing and Validation of the Selected Configuration and methods (Deadline: To be defined depending on the progress)

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