MAC Pilot Test Phase

MACTP meeting at GRPE

17-1-2012
Geneva

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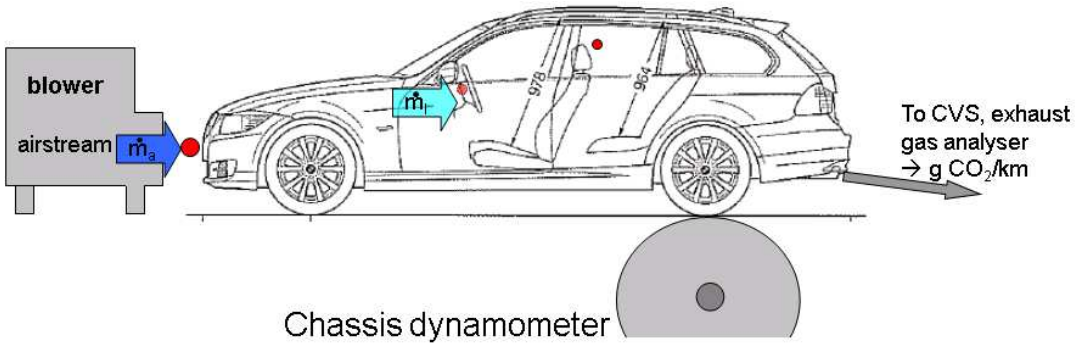

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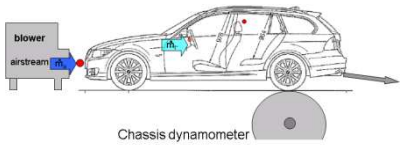
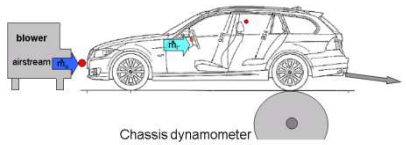


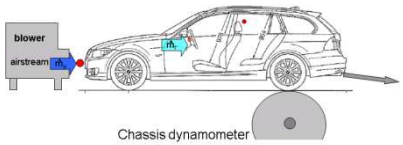
Agenda:

- Introduction
- Targets of the MAC Pilot Test Phase
- Description of the MAC Pilot Test Phase
- Description of the current draft test procedure
- Issues and topics addressed in the Pilot Test Phase
- Actual status

Project setting and background

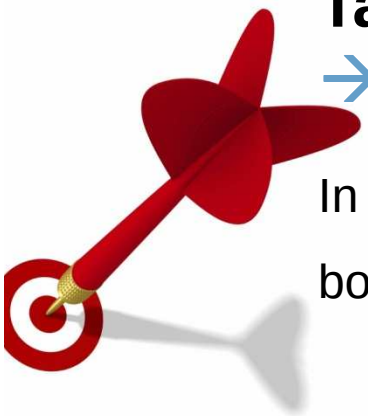


- Type approval test procedure for MAC energy efficiency assessment shall be developed
- In 2010 work was done by TNO-led consortium on this topic
  - Consortium of TUG, LAT, KTI and TNO
  - Result was a proposal for a physical test procedure
  - Conditions and margins for procedure were defined
- In parallel specialists from the industry tested the procedure
- Reported recommendations for development of the TA test procedure
  - Launch a pilot phase to define a suitable classification method
- There are still open issues and comments to be covered in final procedure



Targets of the MAC Pilot Phase

→ Technical annex to the Regulation



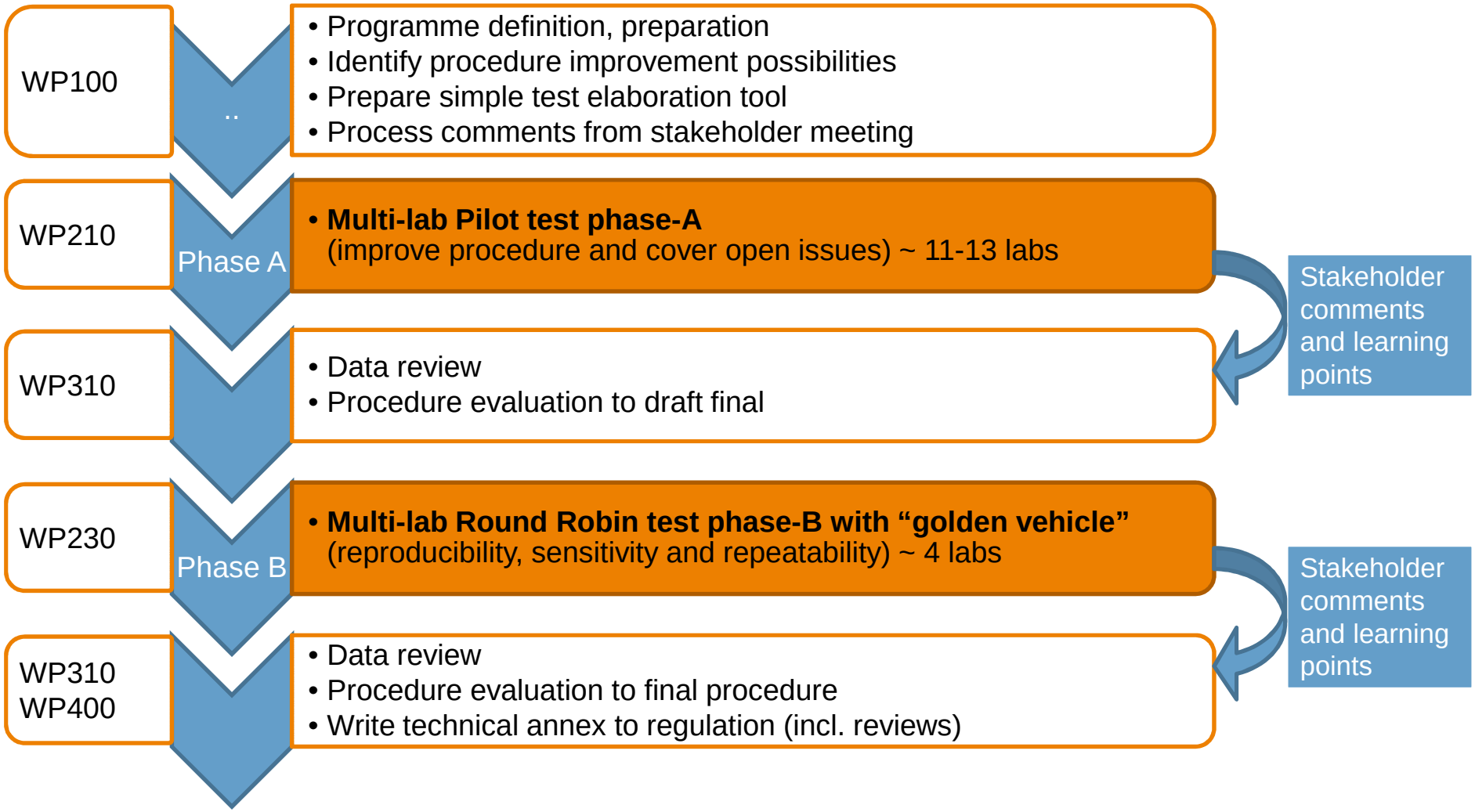
In the first project the analysis of effects of MAC settings and of boundary conditions needed a lot of test resources:

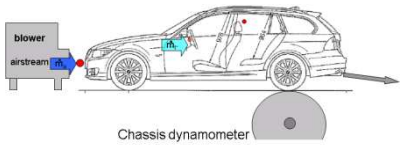
- only one car tested in the “latest version” of the test procedure.
- still some options for settings and data processing open
- no comparable results for different MAC technologies, engines and vehicle sizes as basis for “family definition” etc.

Pilot Test Phase is defined to overcome these issues and to follow-up to the MAC test procedure a technical annex to the Regulation

- During Pilot Phase, labs also gain experience with the procedure

MAC Pilot Test Phase contains two test phases:

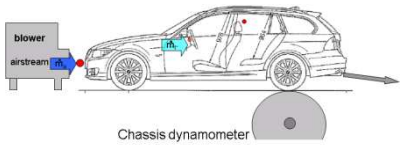




Stakeholders are closely involved

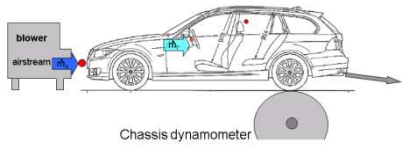
- Participation in Pilot Test Phase A and B
- Provide data and information on
  - performance of test equipment (e.g. controlling of humidity)
  - existing combinations of HVAC systems + vehicle models + glazing quality variations as basis for definition of “families”
  - cooperation in finding solutions for open issues
- Comments to the test procedure
  - Before Pilot Phase A in stakeholder workshop
  - After Pilot Test Phase A and B
  - On text for technical annex to regulation

Time Schedule of the Pilot Test Phase



- Project started 16 August 2011

		2011				2012												2013	
WP	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
100	Definition, preparation	•	•	•	•														
200	Phase A pilot testing				•	•	•	•	•										
	Phase B round-robin												•	•	•				
300	Procedure review					•	•	•	•	•	•	•				•			
400	Annex compilation															•	•	•	•
500	Management	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•



Draft test procedure

Main issues in this presentation

- Test cycle
- Settings of MAC and test cell
- Test evaluation and applied correction factors

Procedure can be found in Circa website:

- http://circa.europa.eu/Members/irc/enterprise/wltp/library

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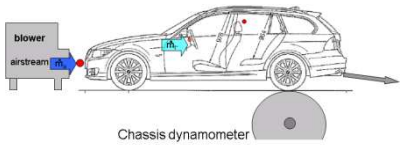
  (access to Circa can be requested with a mail to Satu.Porsti@ec.europa.eu):

Details from first study is also available in the report:

- "Collection and evaluation of data and development of test procedures" in support of legislation on (MAC) efficiency and (GSI)

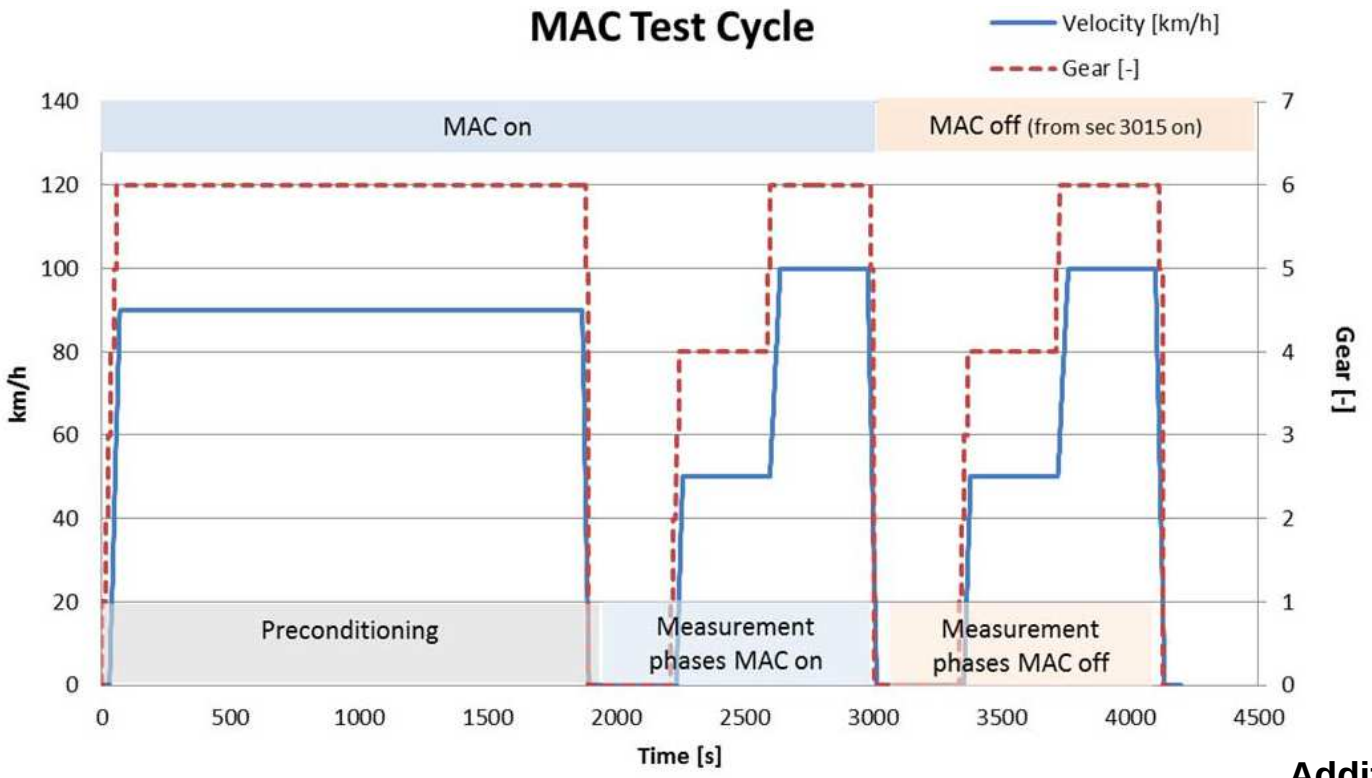


Test cycle on a chassis dynamometer

MAC on, $\dot{m}$ >230 kg/h
Pre conditioning (t_i = 25℃)

MAC on measurement

MAC off measurement

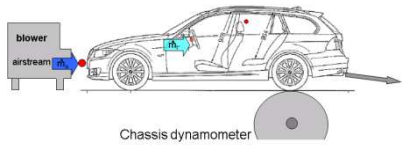


Evaluation periods suggested:

1960 - 2220	MAC on
2320 - 2580	
2710 - 2970	
3090 - 3350	MAC off
3450 - 3710	
3840 - 4100	

In pilot phase:
4 repetitions to test repeatability

Additional MAC FC =
Weighted average [kg/h] MAC on
- Weighted average [kg/h] MAC off

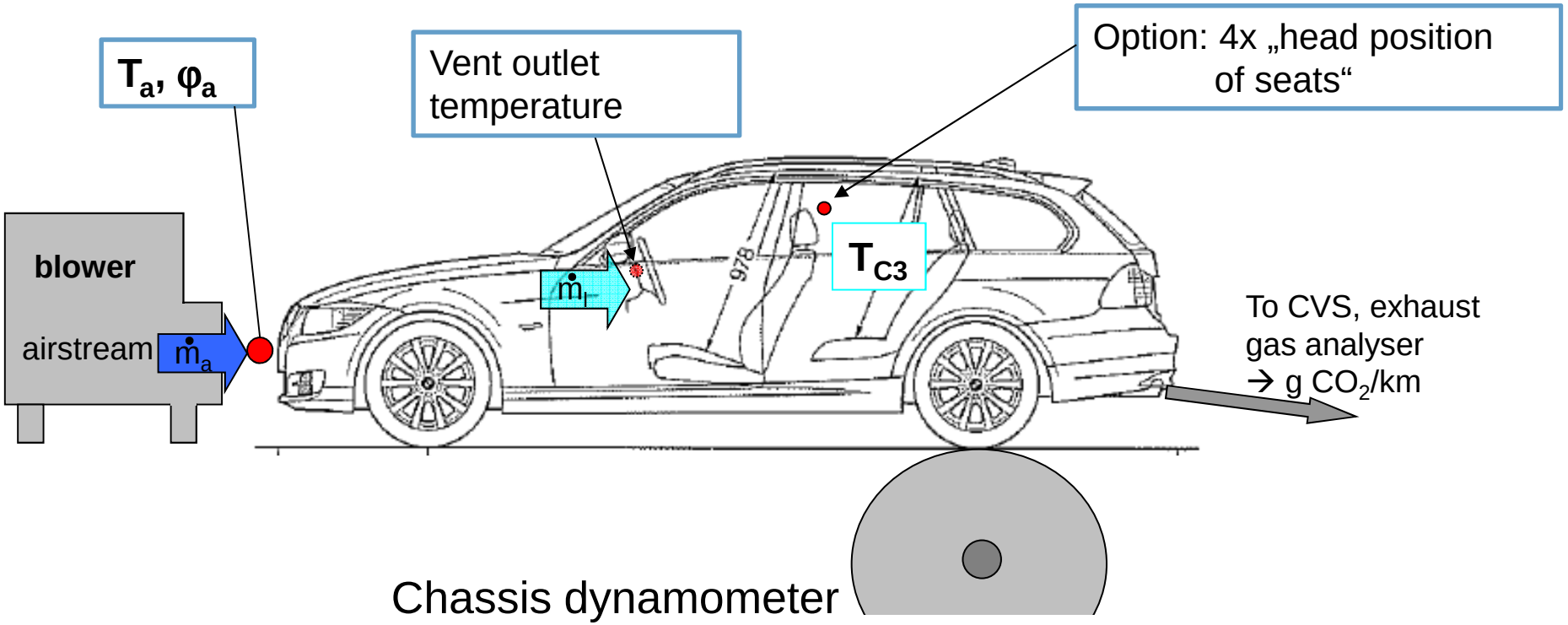


Settings and preconditioning

- Soak >8h at 25°C +/-2°C (with battery connected to charger)
- Driving resistances, fly wheel mass as defined in EC 692/2008 for emission tests
- Set test cell Temperature 25°C +/-2°C
- Set test cell Humidity 45% +/-5%
- Set MAC system to automatic position, adjust at >230 kg/h
- start MAC test, until second 1500 the MAC setting shall be found for <15°C vent outlet
- During test all vehicle openings are closed

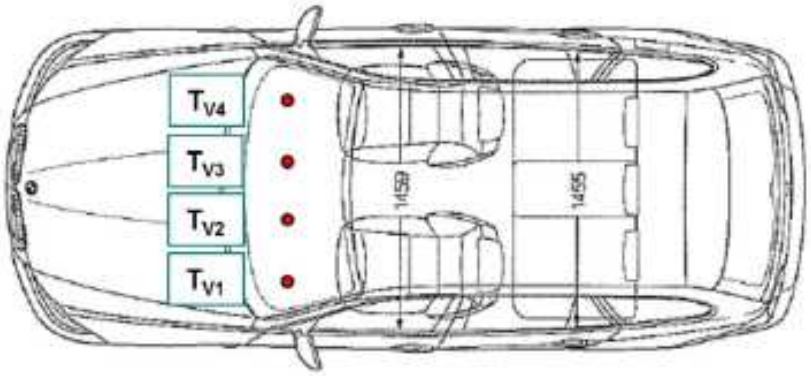
Position of sensors

- ambient temperature 25°C and 45% RH at testbed-blower inlet
- Vehicle temperature measured in the cabin (details see next slide)

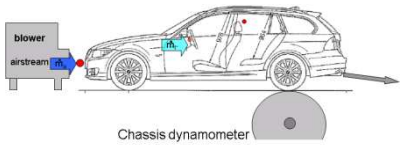


Position of sensors and temperature criteria

- Each vent outlet temperature average shall be <15°C.
- Only the 4 main vents at the dashboard shall be open
- If others cannot be closed, they shall be included in test



Evaluation of the test result

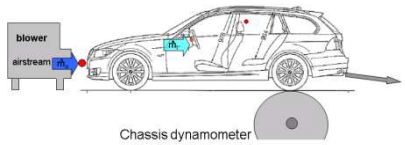


Results of single speeds steps are weighted:

- 15% Idling
- 65% 50 km/h
- 20% 100 km/h

$$FC_{MAC_i} = 3.6 \times C_{COP\,i} \times (FC_{i\,Measured-AC-on} - C_{Pe_i} \times FC_{i\,Measured-AC-off})$$

- Corrections C_{COPi} for variations in cooling demand:
  - test cell temperature and humidity
  - Vent outlet temperature (optional)
- Corrections C_{Pei} for variability of the vehicle speed (dyno braking force)
- Good glazing saves MAC demand: corrections for heat entrance (glazing surface and quality) in separate formula



Evaluation of the test result
with dedicated tool for the MAC Pilot Phase

- A user friendly tool provides:
  - Comparable results for all tests (with and without each step of correction)
  - Standard formats for later analysis of all tests
  - Plausibility check of input data
- Evaluation will be based on instantaneous measured fuel consumption (or CO_2 emission).
- On demand a parallel option for bag values is introduced

- Tool is available on Circa website:

  http://circa.europa.eu/Members/irc/enterprise/wltp/library

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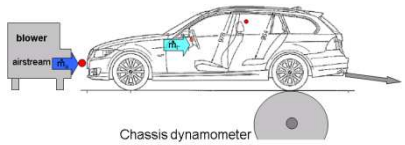
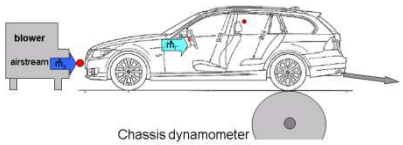
  (access can be requested with a mail to Satu.Porsti@ec.europa.eu):



Important issues and topics are addressed in the Pilot Test Phase

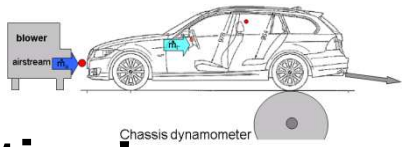
- Sensitivity of the procedure for different:
  - MAC technologies
  - Engine size and fuel types
  - Vehicle sizes and classes
- Sensitivity of the procedure for variations in:
  - Ambient temperature and humidity (test at low and high)
  - GSI versus fixed gear shift strategy
  - Soaking temperatures
  - Drive cycle at minimum and maximum speed (dyno power)
- Blower on/off in MAC off phase of the test
- Solar load simulation during the test in some labs



Current status:
Pilot Test Phase-A is running

- Good input from stakeholders,
  resulting in sharper definitions in the procedure
- Successful stakeholder workshop in Graz:

- First results of Phase-A will be presented to stakeholders 16 april 2012
  (please mail me if you like to participate !)



Thank you very much for your attention!

Questions?

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