



*Zukunft
Gewissheit geben.*

NPTI Petrol

A VERT working group

VERT NPTI Petrol Concept Status



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AeroSolfd

- **AeroSolfd is an EU-funded project that will deliver affordable, adaptable, and environmentally friendly retrofit solutions to reduce tailpipe and brake emissions and pollution in (semi-) closed environments. This will allow a quick transition towards cleaner mobility and a healthier environment.**
- **<https://aerosolfd-project.eu/>**



AeroSolfd Project Work on Gasoline NPTI

- Gasoline GPF retrofit project will start in Q2/23 with 4 vehicles on chassis dyno
- Retrofit GPF Fleet car monitoring
- VERT plans to test 1000 gasoline field vehicles in 2024 with new proposed test protocol

- ***But: How to test Gasoline cars in an efficient way for 1000 vehicles?***

Preferred „static“ test:
meaning Gasoline PTI is done with vehicle not moving



NPTI Gasoline Background

- Periodic Technical Inspection PTI of vehicle emissions is an important measure to control ambient air quality.
- PTI procedures and protocols did not follow the technical progress of emission control technologies, like DPF, GPF and NOx reduction systems like SCR
- In the EU, the PTI regulation only defines a framework for the emission inspection, each memberstate is responsible for its own PTI procedure as well as equipment approvals.
- The need is seen internationally to introduce a NPTI for NOx and PN for all vehicles.
- From the accepted PN PTI it is learned, that new protocols and instruments are needed, but also that for the approach of „One test protocol fits all“ applications of Diesel and Gasoline vehicles for all emission standards, there probably is no easy solution.
- Tailpipe test is a must, OBD check does not suffice

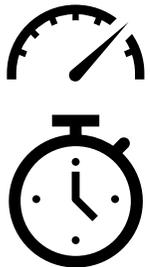


VERT established the NPTI Petrol working group in 2023 with international experts to assist in finding solutions

Status on Gasoline NPTI: Findings from the VERT NPTI Gasoline Expert Studies



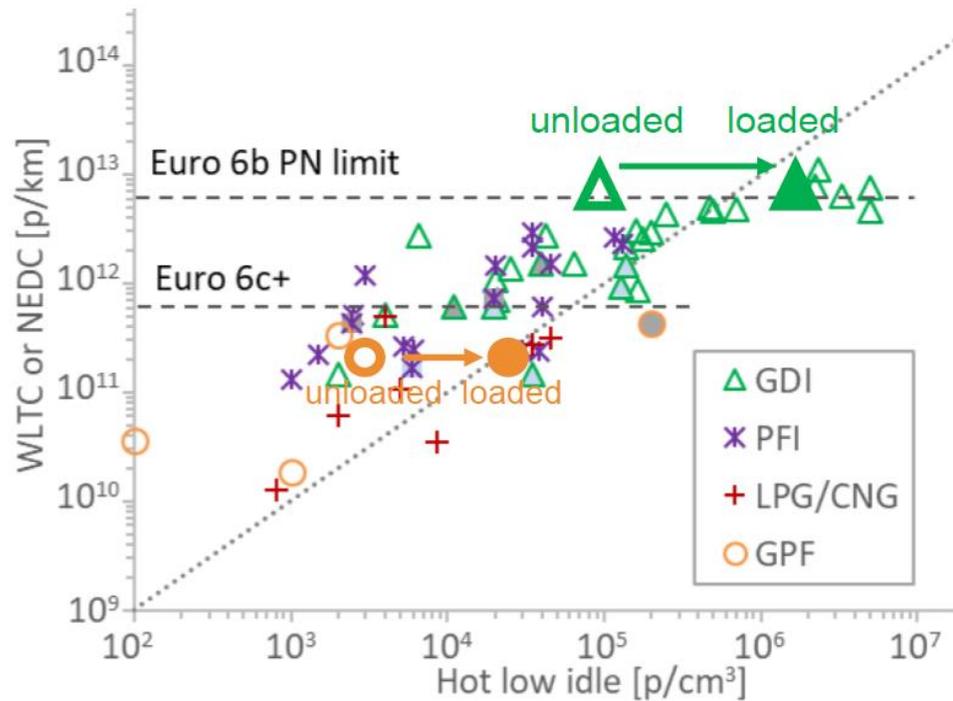
- First focus: PN must be measured with Gasoline vehicles
- PTI test with hot engine, it can be assumed cars arriving at PTI station are with hot engine



- The low idle Diesel test is not adequate, produces low particle number concentrations before and after GPF for Euro 6d-Temp vehicles
- Loaded idling test (e.g. AC-Max) looks still promising for static test (vehicle not moving)
- Low or high engine speed loaded idle test undecided yet
- Static test protocols agreed on 10 minutes duration
- Street test (max. 15 minutes) and chassis dyno test protocol still researched, test protocols seen to be needed for special cases
- Correlations tests of PTI protocol with type approval testing is important for legislators to set pass/fail limits
- NOx-emission control -> implicit covered by traditional gasoline PTI, high idle CO, λ ,

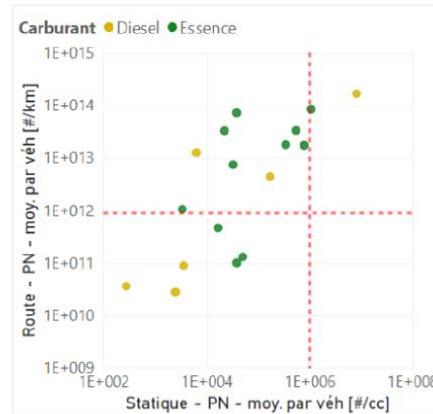
Correlation Testing for PN: WLTP and RDE vs. Idle

Testing relevant for legislators to define solid pass/fail limits -> **Correlation promising**

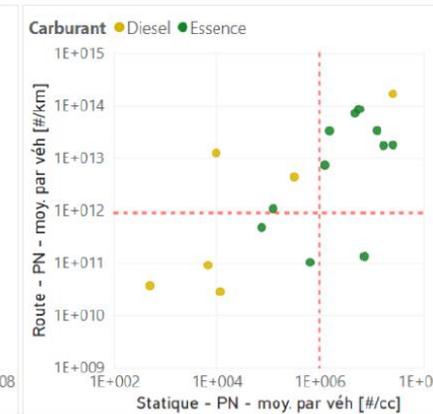


Source: Dr.Melas: PN-PTI testing of gasoline vehicles – Update on the experimental activities of JRC, 24.01.2023, VERT NPTI Gasoline Workshop

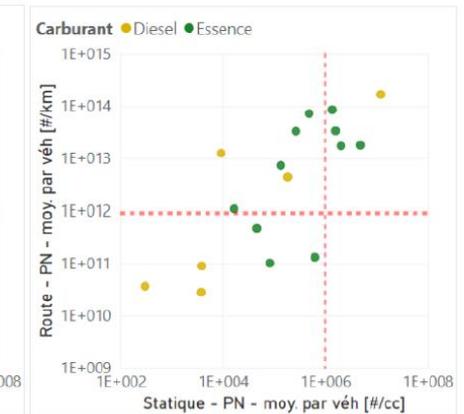
Au ralenti



acceleration libre



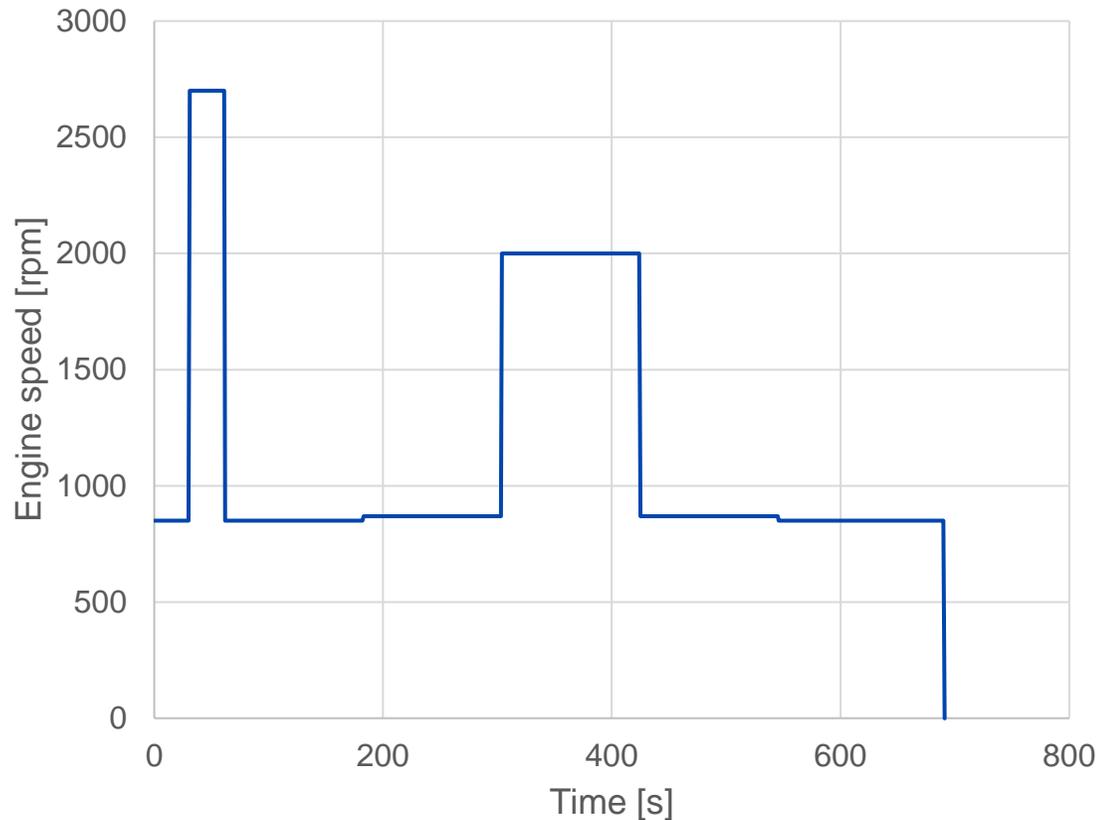
protocole complet



Source: Philippe Degeilh, Aranud Frobert, Sol Selene Rodriguez Rodriguez, Joseph Kermani, 2022, Project SESAME – Raport Final.63pages., <https://bibrairie.ademe.fr/>

New Gasoline Testing Protocol suggested

More integrated approach



Testing protocol assembled from literature¹ combined with (German Euro6) Gasoline PTI will be followed

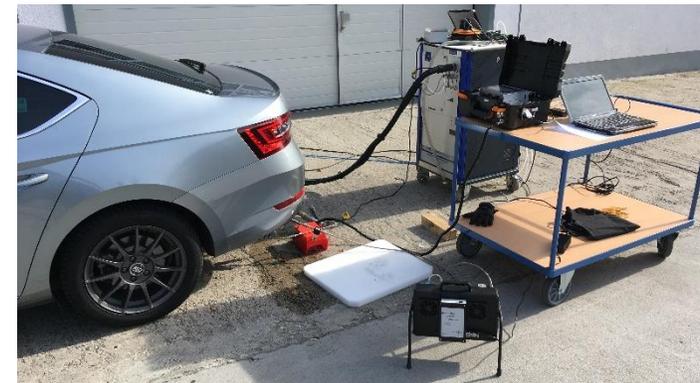
- Switch on engine before „0“ seconds (perform OBD connection and readiness checks)
- ~30 s of unloaded idling (check engine temp. > 60°C)
- 30 s of unloaded idling 2500..3000 rpm (check CO high idle, λ high idle, λ from CO, CO₂, O₂ and HC measurement)
- 120 s of onloaded low idling
- 120 s of loaded low idling (auxiliaries on)
- 120 s acceleration to 2000 rpm & loaded (check SPN₂₃ particle concentration)
- 120 s of loaded low idling (auxiliaries on)
- 120 s of onloaded low idling

1. E.Fernandez et al., Vehicles 4 (2022) 917.

Special Cases and areas to work on

- **Special Case: PHEV HEV Hybrid Vehicles where the engine does not run in idle: e.g.: Toyota Prius**
- **Detect EURO 6d GPF failures**
- **How to deal with possible vehicles without A/C or other accessories where engine loading can not be achieved**
- **Work on better definitions of engine loading in test protocol**
- **Research gasoline NOx emissions in the test protocols and test cycle correlation**
- **Improve suggested test protocol by removing double or steps not required**
- **Investigate possible conditions for „fast pass“ static test, and look at street test protocol for special cases, or difficult cases in addition**

- **Instruments: confirm PTI PN counters and NOx (NO) measuring instruments for gasoline application (water content...)**



Summary and Outlook

- **Three studies with promising correlation results for gasoline PN support the possibility for a static NPTI gasoline test**
- **A new more integrated testing protocol for gasoline CO, λ , PN, (NOx) is suggested**
- **Additional work is required to prove out the protocol in cooperation with JRC and others in 2023**
- **In 2024 VERT will perform the Pilot Study with 1000 vehicles**
- **With regard to EU EURO 6 legislation: we suggest an update for the PN limit to apply to all gasoline vehicles in TA to enable full PTI also to PFI gasoline vehicles**



- **VERT will work to contribute to a NPTI Gasoline protocol**

Thank You for Your attention!

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