

Measuring and reporting PN and PM values from vehicles with different engines, aftertreatment technologies and fuel types

- Calibrating the 3DATX parSYNC for Gasoline Direct Injection (GDI) Vehicles

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Introduction

- The 3DATX parSYNC PN and PM measurement technique combines the signals from 3 different sensors: Scattering, Ionization, and Opacity.
- Particulate properties vary by engine, fuel, and aftertreatment types: The calculation matrix for PN and PM needs to be adjusted accordingly.
- In this poster presentation, a preliminary recalibration of the default parSYNC matrix is presented for use with GDI vehicles specifically:
 - The correlation between each of the three sensors with Dekati Mass Monitor (DMM) PM and Engine Exhaust Particle Sizer (EEPS) PN values was calculated from transient FTP75 data for cold and hot test sections,
 - New PN and PM calculation matrices were formulated from the correlations,
 - The new matrix was then tested on data from a *different* test cycle, and compared with the DMM PM and EEPS PN measured.



Methodology

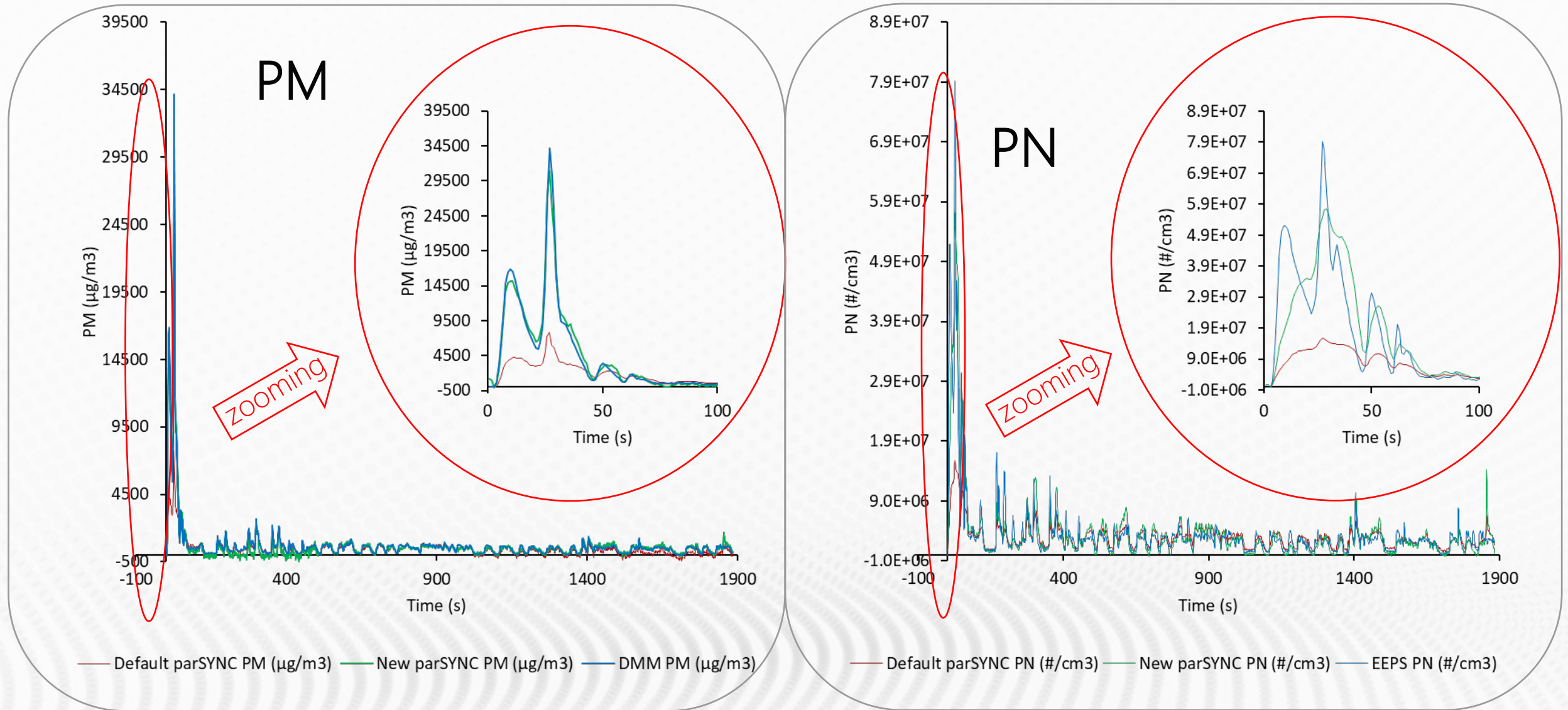
- Experiments were conducted at Ford Motor Company’s Vehicle Emissions Research Laboratory (VERL) using a Gasoline Direct Injection (GDI) vehicle with a three-way catalyst (TWC) but no gasoline particulate filter (GPF).
- Particulate measurement equipment included:
 - TSI Engine Exhaust Particle Sizer – EEPS 3090 – for particle number and size distribution,
 - Dekati Mass Monitor – DMM-230A – for particle mass,
 - AVL Micro Soot Sensor – MSS 483 – for soot mass,
 - 3DATX – parSYNC – for particle number and mass.
- The EEPS and DMM sampled at tailpipe via a Dekati Engine Exhaust Diluter (DEED) for hot dilution of sample. The parSYNC used a heated tube evaporator.

Matrix calibrated using this test →

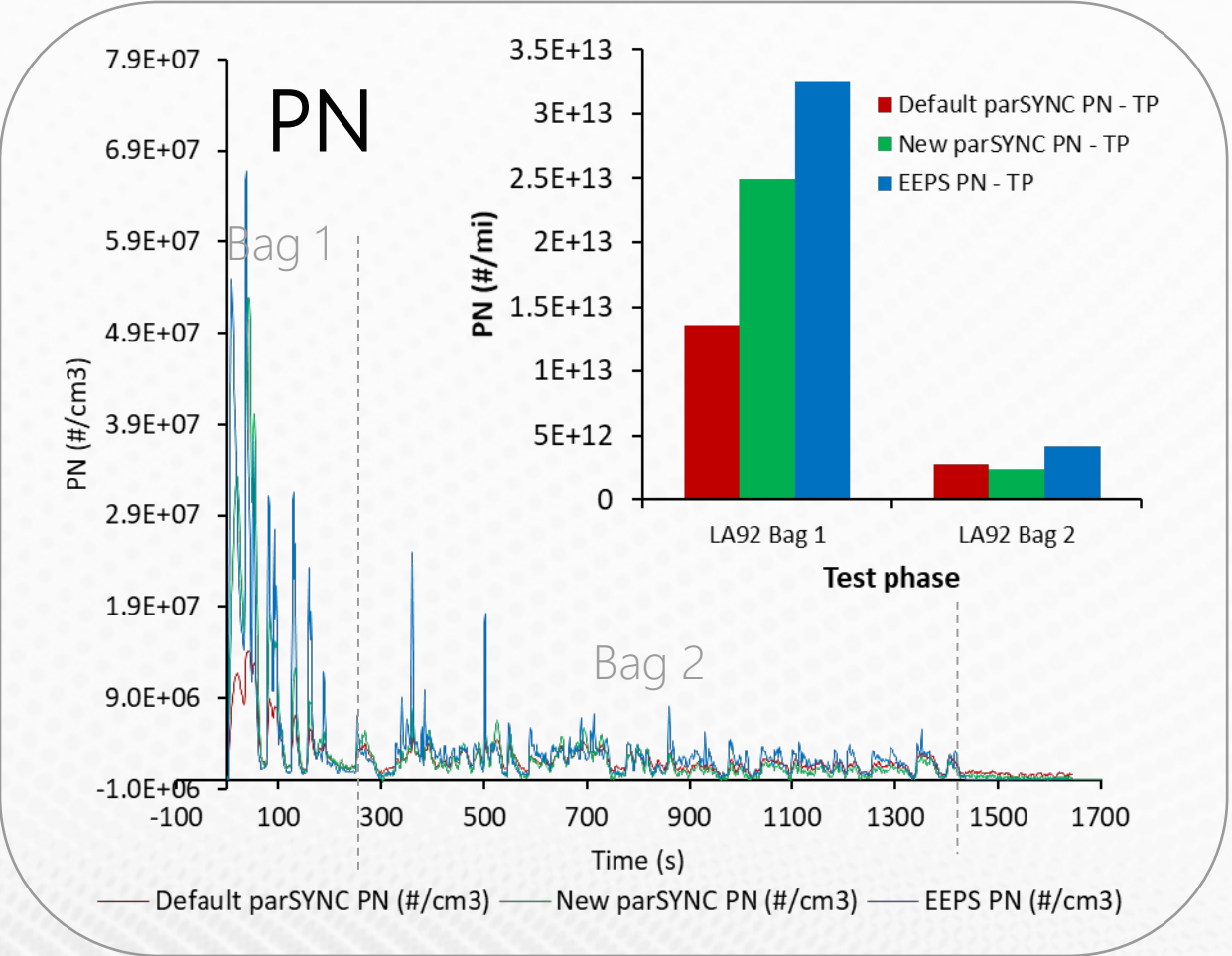
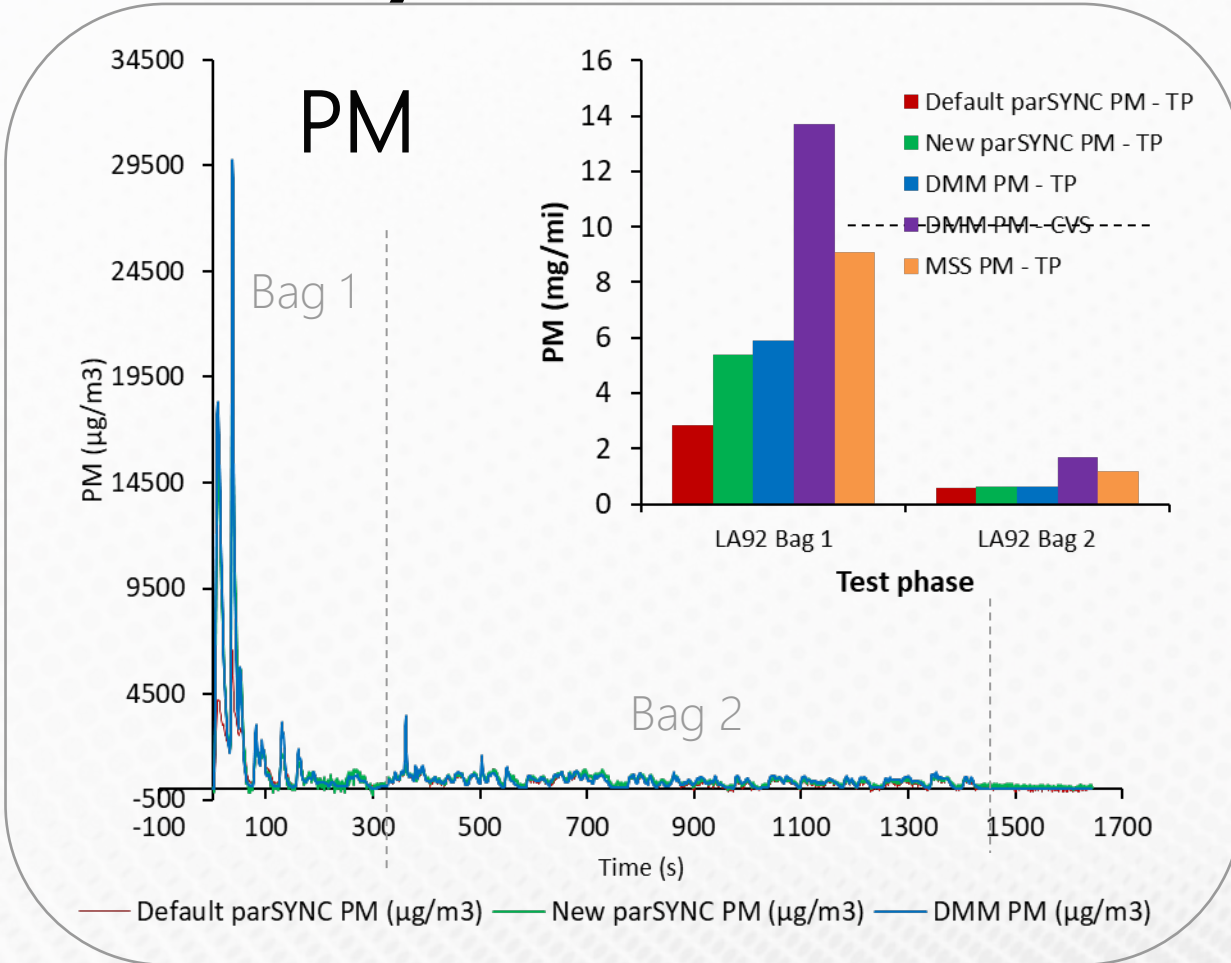
Matrix tested using this test →

Test	Cycle	parSYNC	EEPS 3090	DMM-230A	DMM-230A	MSS 483
1	FTP 75	TP + Heated Tube Evaporator	TP + DEED	TP + DEED	CVS	CVS
2	LA 92	TP + Heated Tube Evaporator	TP + DEED	TP + DEED	CVS	CVS

TP=Tailpipe | CVS=Constant Volume Sampler | DEED = Dekati Engine Exhaust Diluter



Testing the New Matrices on a Different Test Cycle



- Conclusion: The new matrices are an improvement.
- Next steps: Refine calibration with additional vehicle test data