

# Correlations of Particle Mass and Particle Number with PMP Method

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## Introduction

- Europe adopted particle number (PN) counting method to type approval test to reduce particle emissions from HD-diesel, LD-diesel and LD-gasoline DI cars.
- The United States stated to introduce more powerful PM regulation (1mg/mile) to reduce particle emissions.

**There are two method to reduce particle emissions from vehicles. But how is the correlation?**

## Objective

- Comparing the PM and PN emissions from LD DPF diesel, gasoline DI and gasoline MPI.
- Comparing the PM and PN emissions from HD DPF diesel

For LD, 3DPF-diesel, 6 gasoline DI and 2 MPI were tested.

For HD, 4 DPF-diesel were tested.

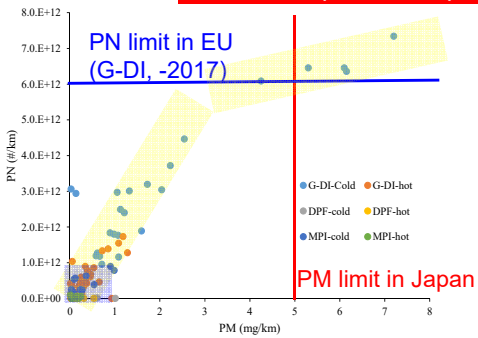
Test mode: JC08 (LD), JE05 (HD)

## Tested Vehicles

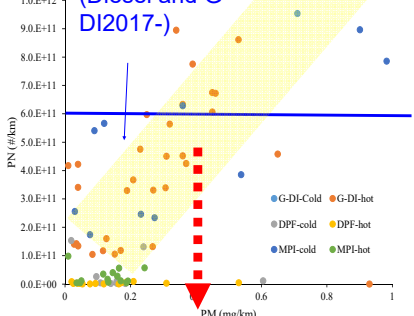


## Results

### LD vehicles (PN > 23nm)



### PN limit in EU (Diesel and G-DI 2017-)



- Japanese PM regulation for diesel and lean burn G-DI (5 mg/km) is almost equivalent to European limit for G-DI until 2017.
- PN regulation for diesel and G-DI after 2017 ( $6 \times 10^{11}/\text{km}$ ) is equivalent to 0.4 mg/km PM regulation.

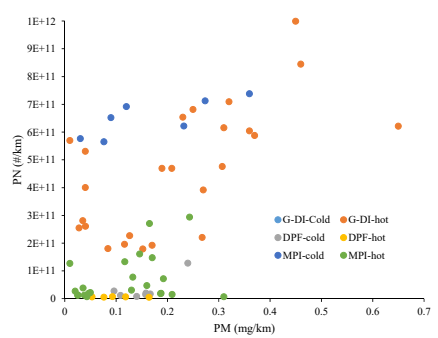
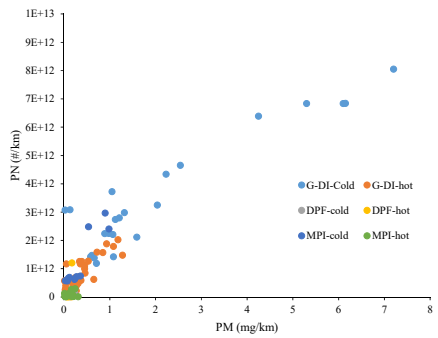
### Current and future PM regulation for LD vehicles

	US	EU	Japan
Method	PM	PN	PM
Limit (mg/km)	0.63 (from 2021)	0.45 (started)	5 (no update)

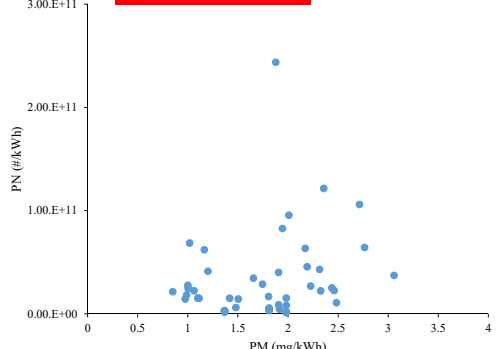
How should we do in the future?

- G-DI and MPI exhibited good c(2 stage linear) correlation.
- There was no correlation in the case of DPF diesel

### LD vehicles (PN > 2.5nm)



### HD-DPF-Diesel



- Particle over 2.5 nm results were similar to those of over 23 nm
- There was no correlation in the case of HD DPF diesel.