

# Estimation of the mean particle size by sampling in parallel with two Pegasor Particle Sensors

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## Introduction

- The Pegasor Particle Sensor (PPS) signal has a size-dependent response to particle size ( $\propto d^{1-1.29}$ ).
- Errors in the reported particle mass & number are expected when the size distribution differs from the calibration's reference ( $D_g=50\text{nm}$ ,  $\sigma_g=1.7$ ).

### Scope of this study:

- Estimation of the mean particle size by sampling in parallel with 2 PPSs at different ion trap voltage and correction of the original mass & number calibration formulas.
- Validation of the method with diesel exhaust particles during transient testing.

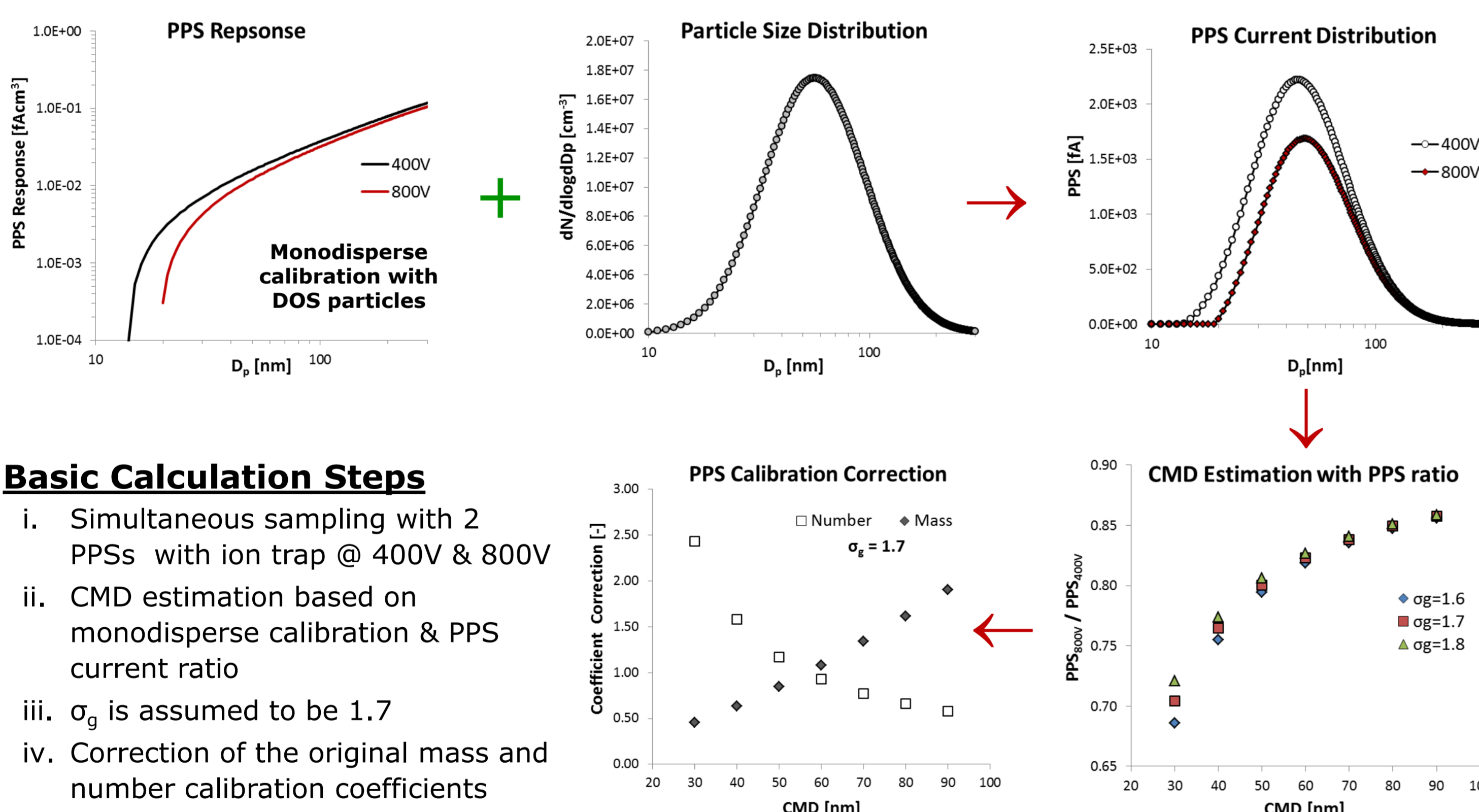
## Theoretical Background



### Pegasor Particle Sensor

- Measurement of "escaping current"
- Particles are not collected
- Hot & undiluted sampling directly from the tailpipe
- High resolution and sensitivity (10 Hz, 0.3s response time)

### CMD Estimation Methodology

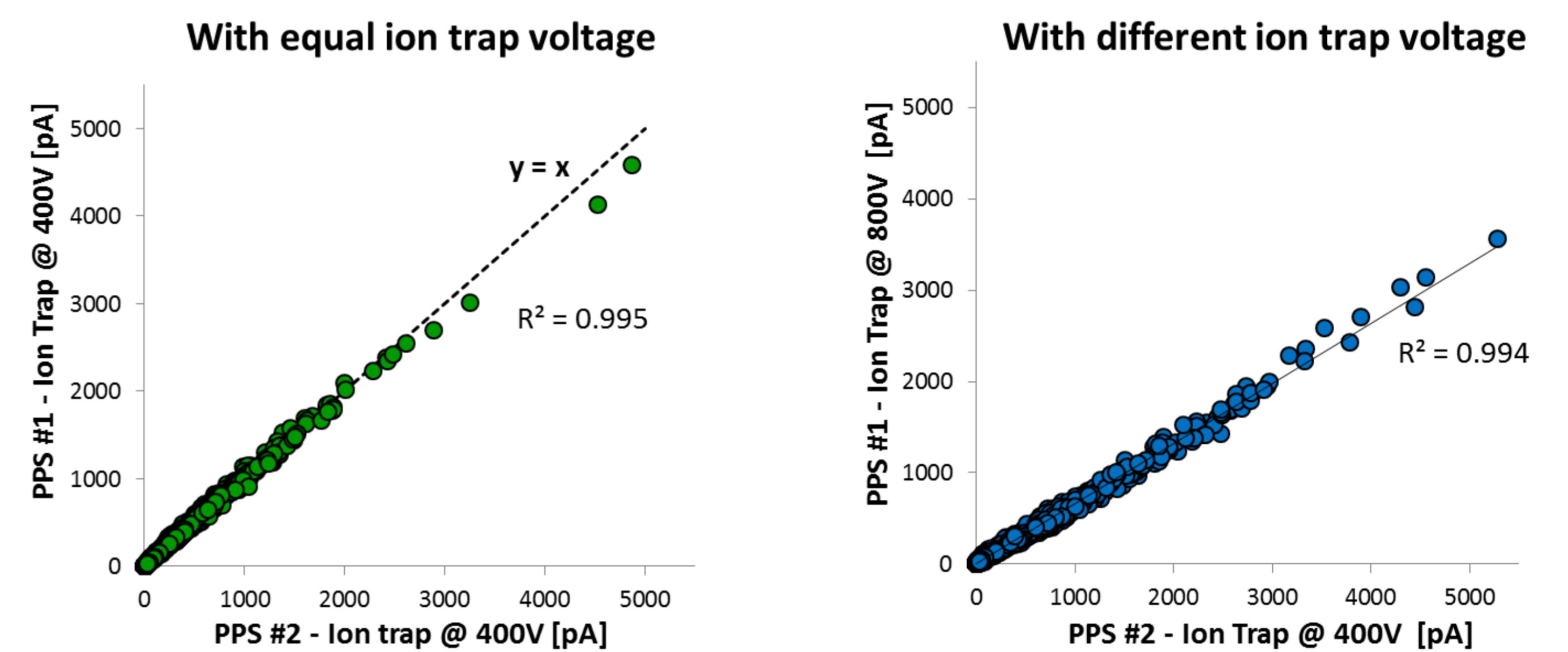


### Basic Calculation Steps

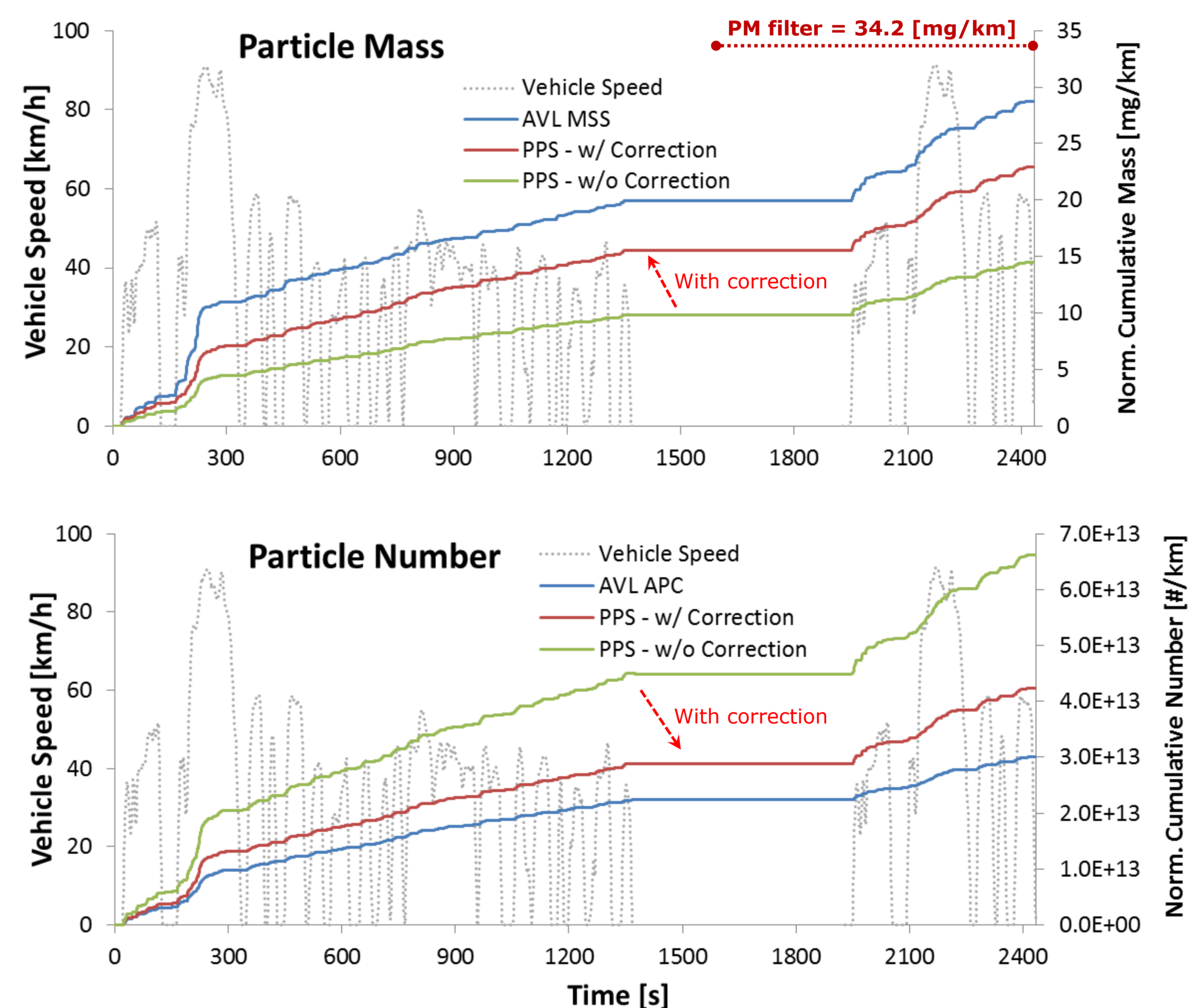
- Simultaneous sampling with 2 PPSs with ion trap @ 400V & 800V
- CMD estimation based on monodisperse calibration & PPS current ratio
- $\sigma_g$  is assumed to be 1.7
- Correction of the original mass and number calibration coefficients

## PPS Linearity

### Correlation of the 2 PPS signals during the FTP

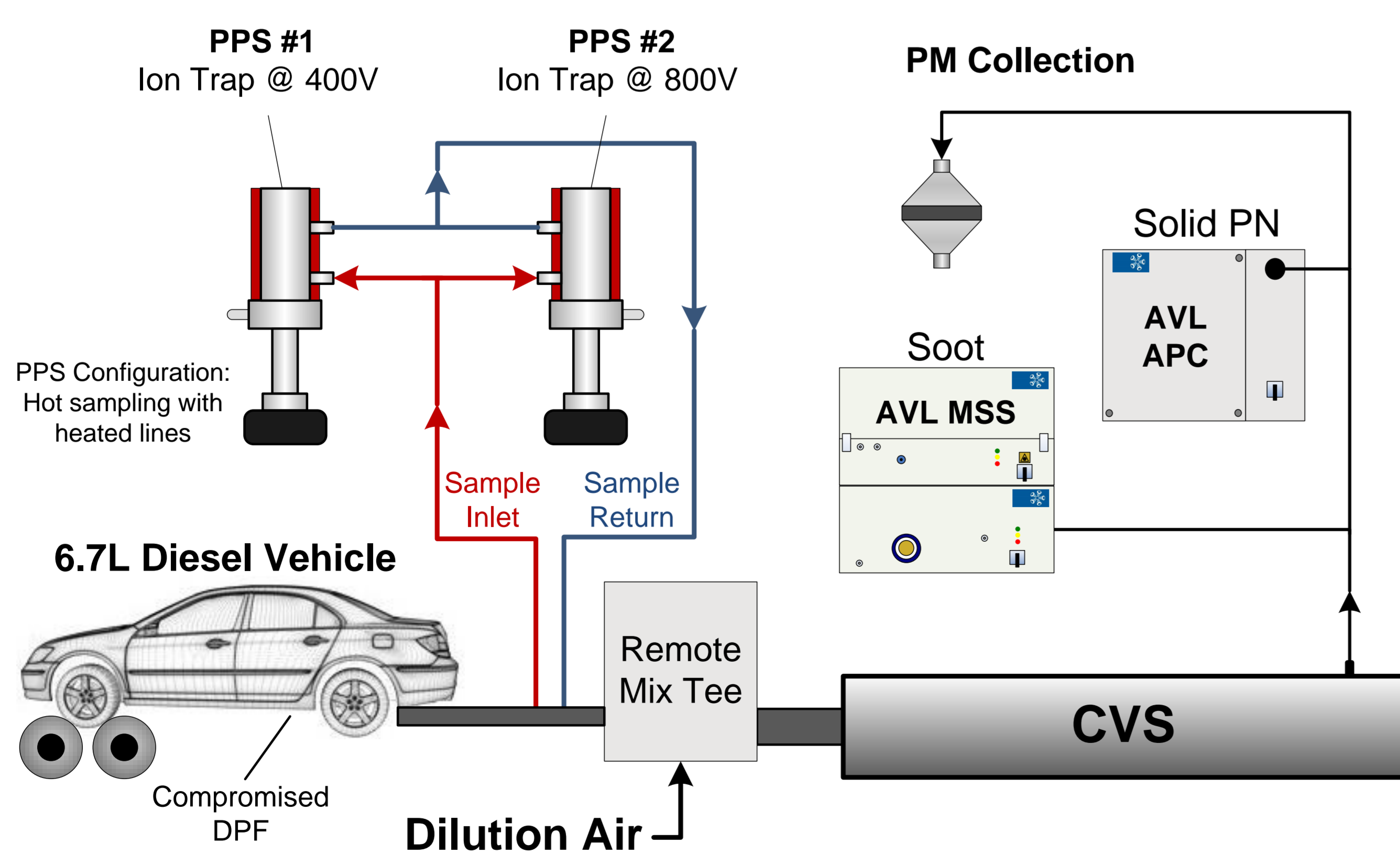


## Results



➤ Mean particle size during FTP estimated @ 80nm

## Experimental



The vehicle was run over the FTP driving cycle

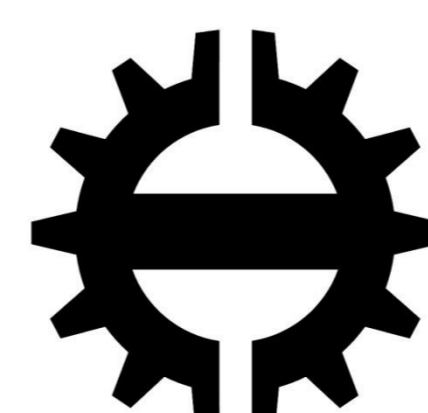
## Outlook & Conclusions

- The mean particle size can be estimated by sampling in parallel with 2 PPSs
- The method is based on the different PPS response for different ion trap voltage according to monodisperse calibration
- Size estimation offers correction of the original mass & number calibration formulas
- The method was applied on diesel vehicle exhaust particle measurements over the FTP driving cycle:
  - Linearity between the 2 sensors was >99%
  - PPS : MSS (soot particle mass) ratio increased from 50% to 80%
  - PPS : APC (solid particle number) ratio decreased from 220% to 140%

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