VPR round robin evaluation

PMP Meeting Ispra, dec 6th 2011

Automotive Test Systems, Product Engineering
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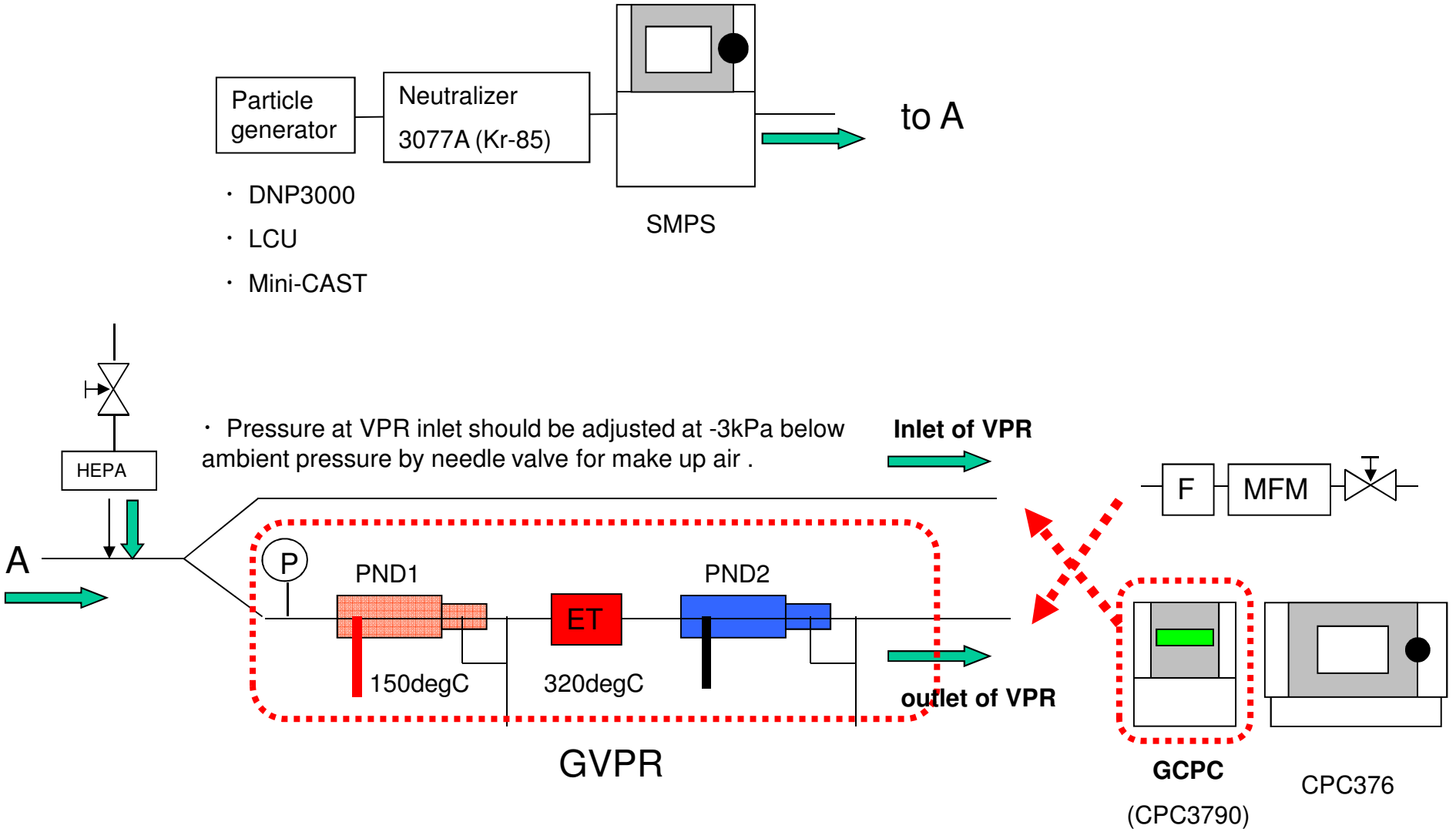
Date: 06.12.11

Purpose of VPR round robin

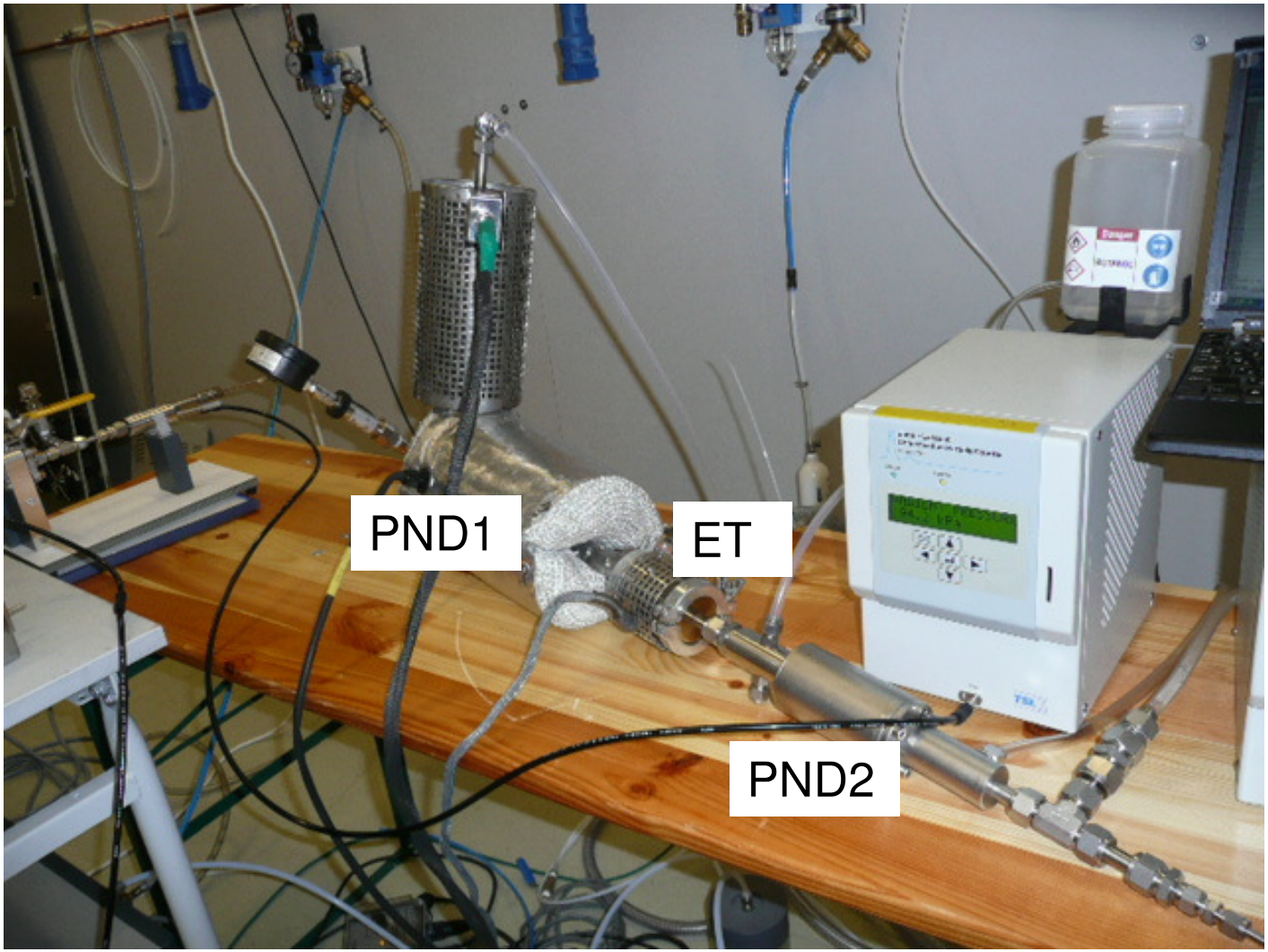
Improve PCRF calibration procedure

- The differences for aerosol morphology and material
  - •DNP3000(Palas): spark method using graphite electrodes
  - •LCU (HORIBA) : Nebulizer method: sodium chloride particle
  - •Mini CAST (Jing) : Diffusion Flame Soot: carbon particle
- Possibility to avoid the use of neutralizer
  - •Kr85:370MBq
- Effect of CPC cutoff size
  - •CPC3790 (GCPC) : 50% cut point @23nm
  - •CPC3776:50% cut point @2nm
- Stability for each generator

Evaluation procedure for PCRF calibration

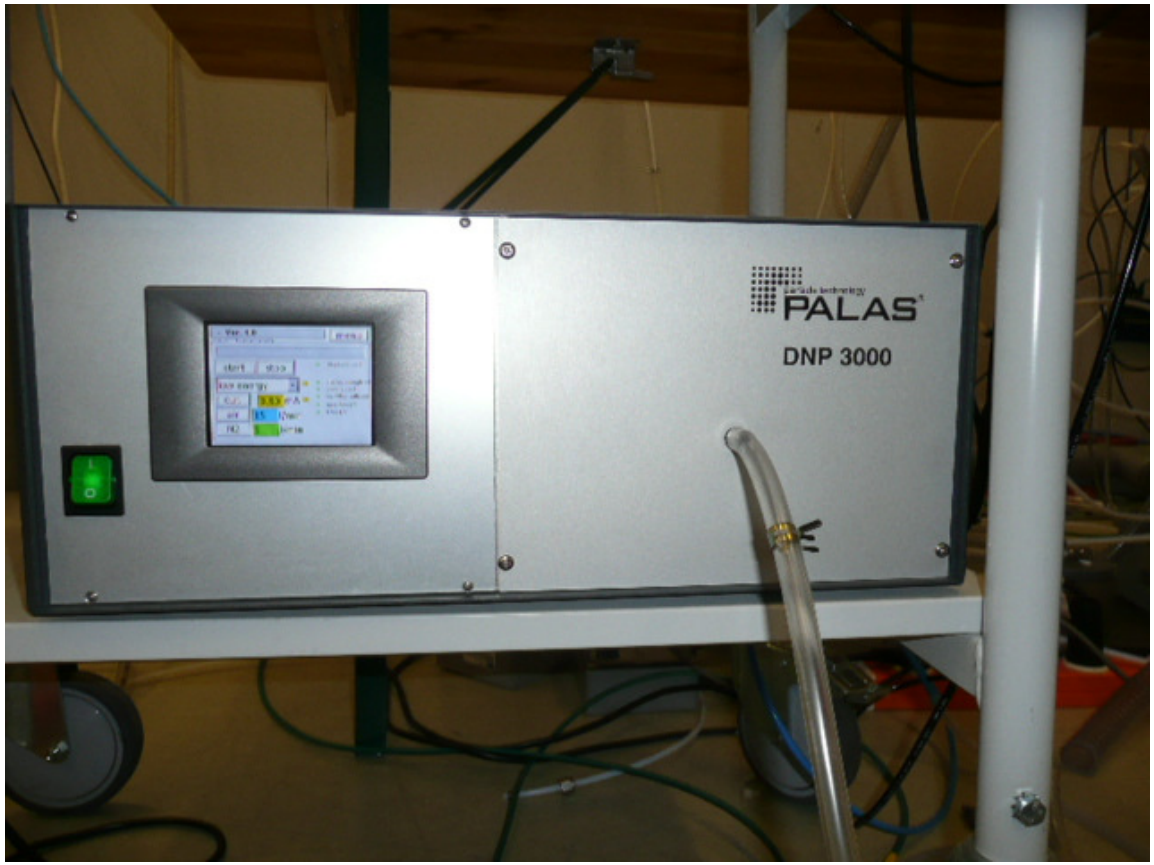


Measurement Setup



Golden Aerosol Generator

- DNP3000
  - Carbon spark



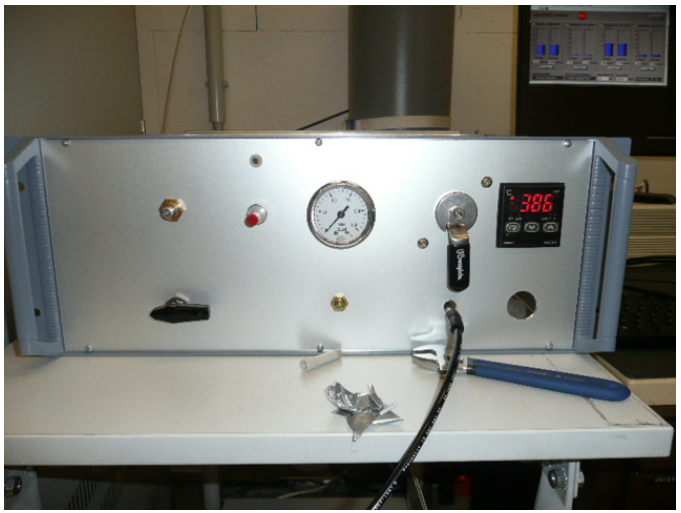
Aerosol Generator – HSG

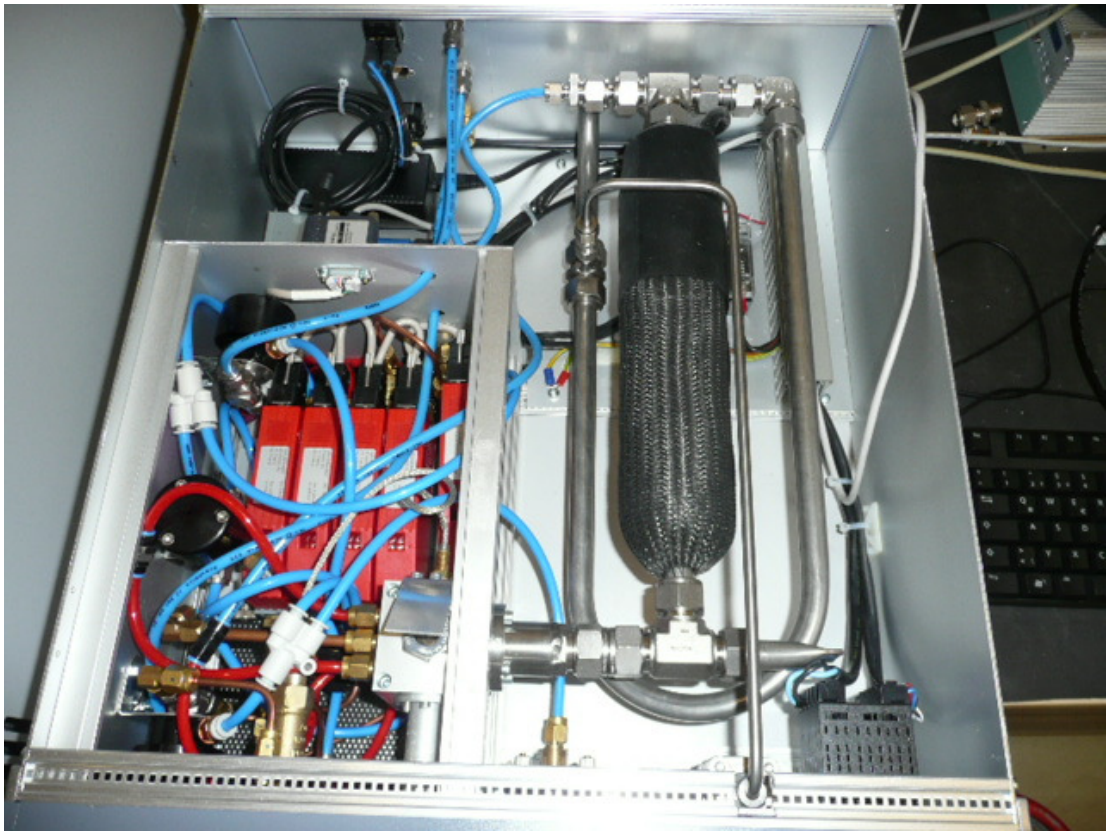
- Horiba Soot generator (HSG-6203)

  (based on Mini CAST)

  - Diffusion Flame Soot
  - With ET(350degC)

    and PND(RT)





Aerosol Generator - LCU

LCU

- Nebulizer method :sodium chloride

Golden CPC

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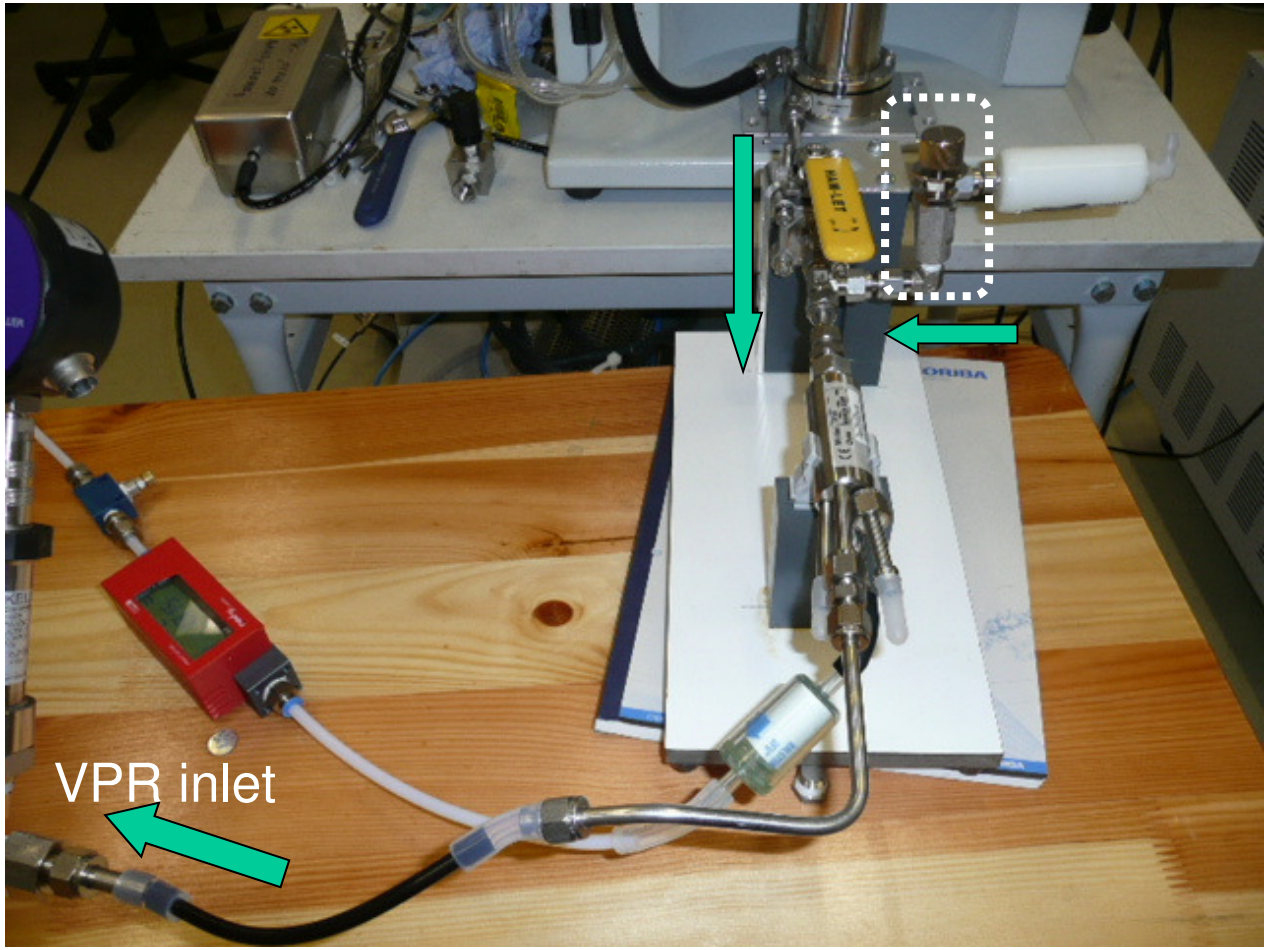
Ultrafine CPC3776

Inlet of VPR

- Adjust the inlet pressure of VPR -3kPa with make up air



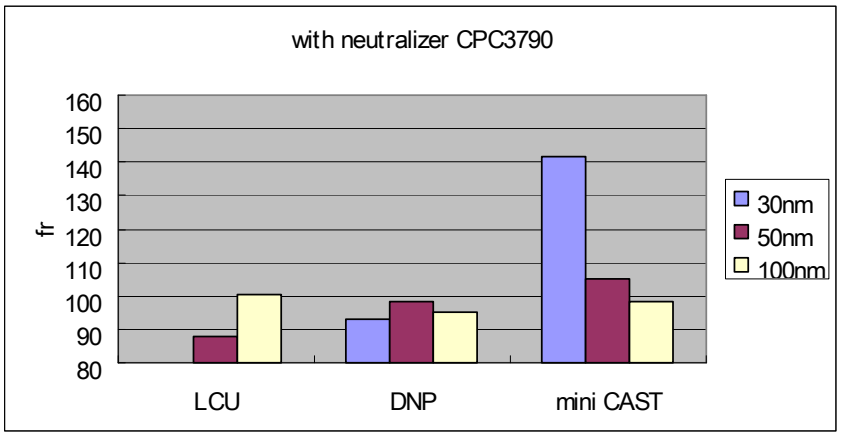
Dilution Factor Check (gaseous)

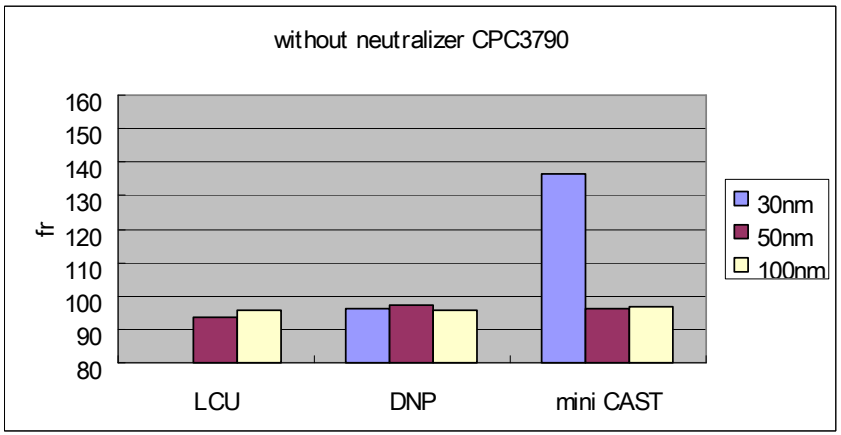
$$DF = \frac{\text{Bottle Concentration}}{\text{Diluted Concentration}} = \frac{9506\text{ppm}}{104.1\text{ppm}} = \mathbf{91.3}$$

Diluted Concentration

NO ~10000ppm

PCRF result (CPC3790)





	LCU	DNP	mini CAST
30nm	#DIV/0!	93.0	141.8
50nm	88.1	98.1	105.0
100nm	100.5	94.9	98.5

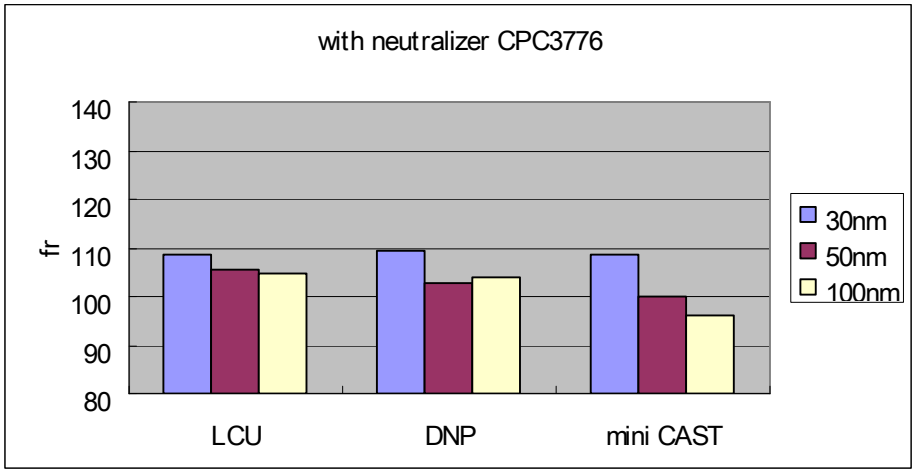
	LCU	DNP	mini CAST
30nm	28.3	96.1	136.6
50nm	93.6	97.1	96.2
100nm	95.8	95.9	96.9

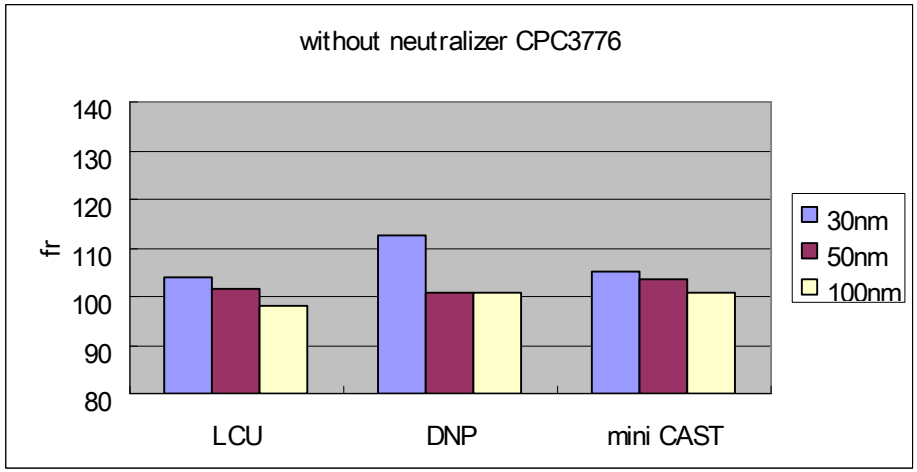
PCRF result: CPC3790

- LCU: Cannot measure PCRF at 30nm and 50nm using D50=23nm CPC.
- Mini CAST: Unexpected high PCRF at 30nm
- DNP3000: PCRF for each electro mobility diameter are similar with DF value.
- No difference with and without neutralizer was observed.

PCRF result (CPC3776)

- PCRF for all kinds of generator are almost same (within measurement uncertainty of +/-10%) using D50=2nm CPC
- No difference with and without neutralizer was observed.



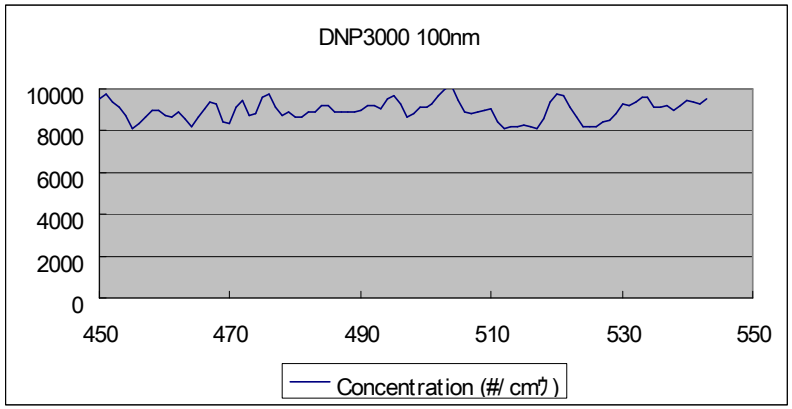


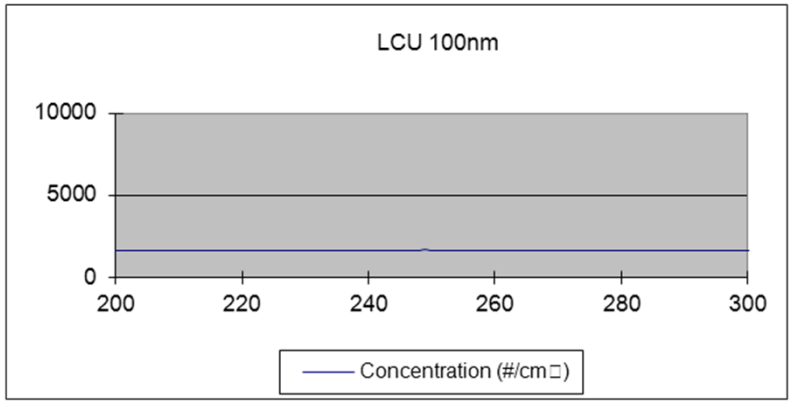
	LCU	DNP	mini CAST
30nm	108.4	109.6	108.8
50nm	105.3	102.6	100.0
100nm	104.6	103.9	96.1

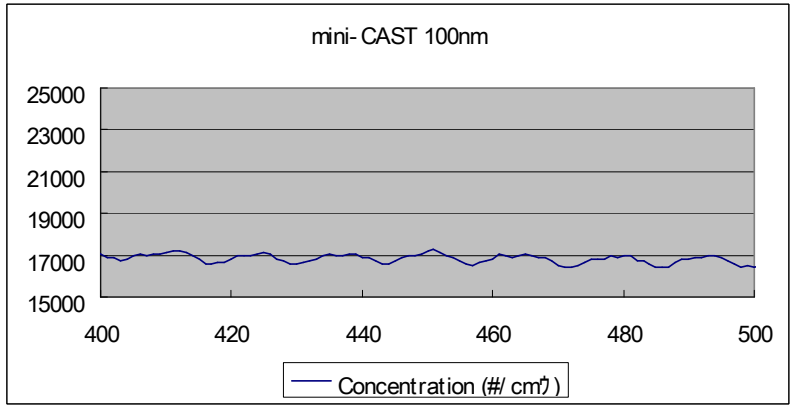
	LCU	DNP	mini CAST
30nm	103.7	112.7	105.2
50nm	101.7	100.7	103.4
100nm	98.0	101.0	101.0

Stability for each generator(100nm)

LCU (atomizer method) is most stable compared with other generator

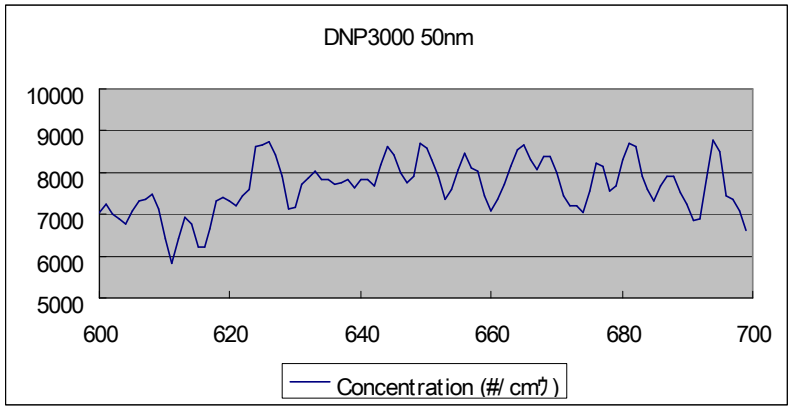


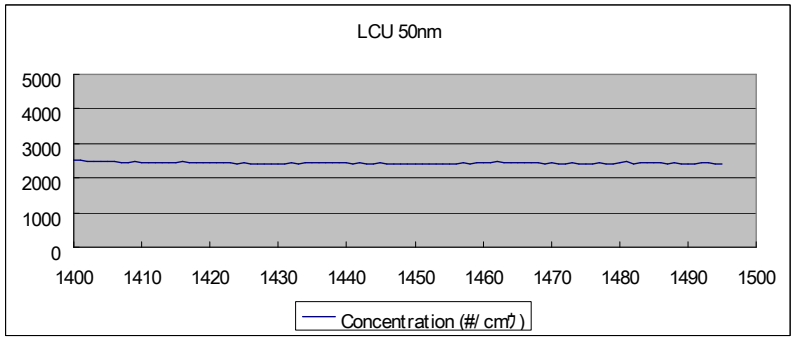


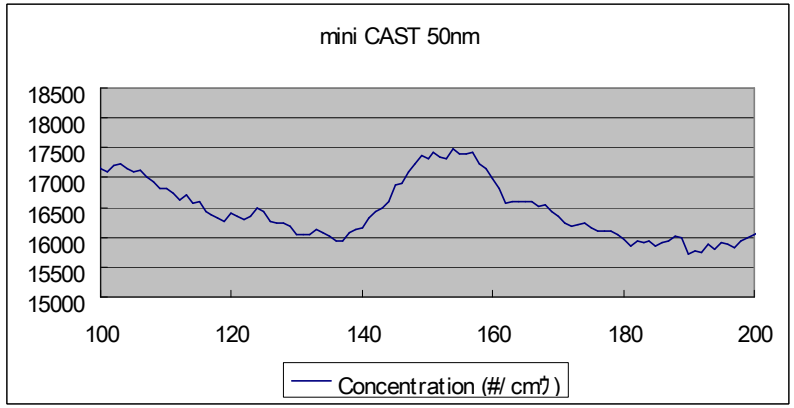


Stability for each generator(50nm)

LCU (atomizer method) is most stable compared with other generator

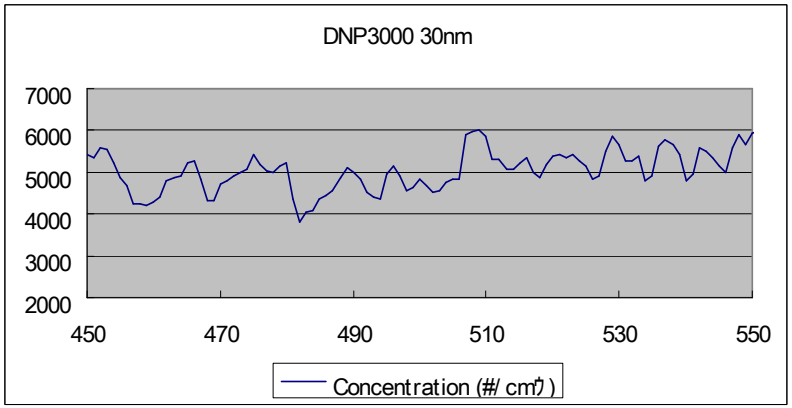


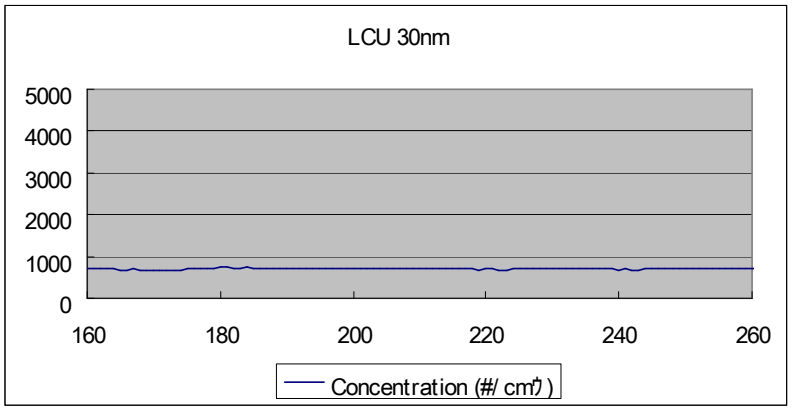


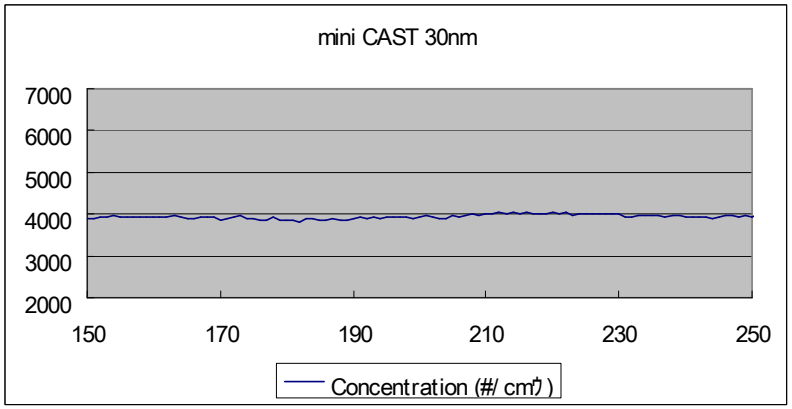


Stability for each generator(30nm)

LCU (atomizer method) is most stable compared with other generator







Summary

- CPC with D50=2nm is preferred over one with D50=23nm.
- All three principles of particle generators showed same results. (Caution: Do post treatment correct)
- Stability of Nebulizer method is superior to others.
- Polydispers PCRF (no DMA) failed in this study (results not shown).

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Automotive Test Systems

Thank you

ありがとうございました

ขอบคุณครับ

谢谢

اشكُرْ

Gracias

Grazie

Σας ευχαριστούμε

धन्यवाद

நன்றி

Tacka dig

Danke

Merci

Obrigado

감사합니다

Большое спасибо

Omoshiro Okashiku