Particle Measurement Programme

Exploratory work & Validation Exercise (JRC)
First Validation Exercise comparisons

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JRC, 30 March 2009

Outline

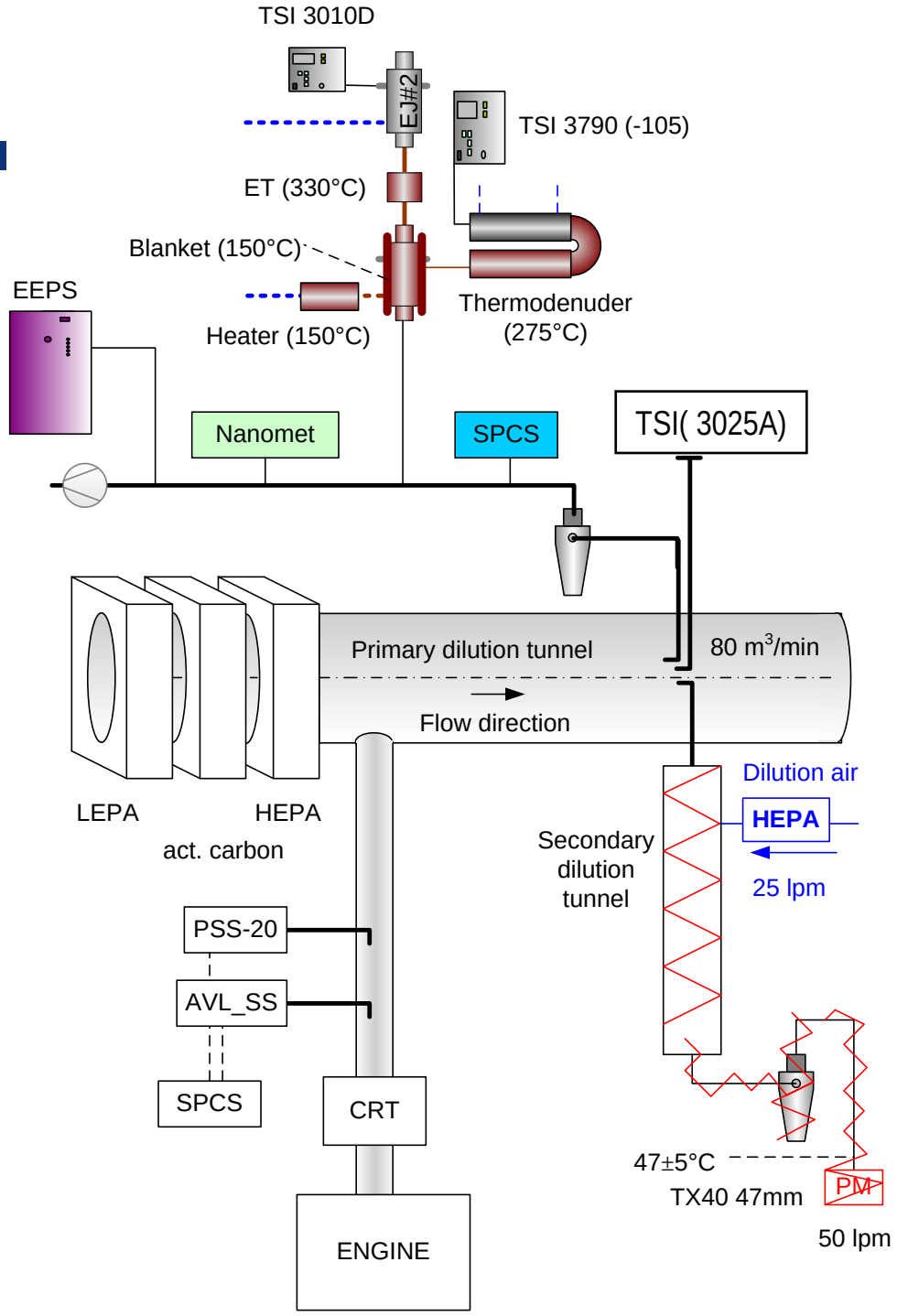
- Status
- Exploratory Work (JRC)
  - Preconditioning
  - Particles <23 nm
- Validation Exercise (JRC)
  - Partial – Full flow systems comparison
  - Number systems comparison
  - After-treatment comparison
- Validation Exercise comparisons

Status

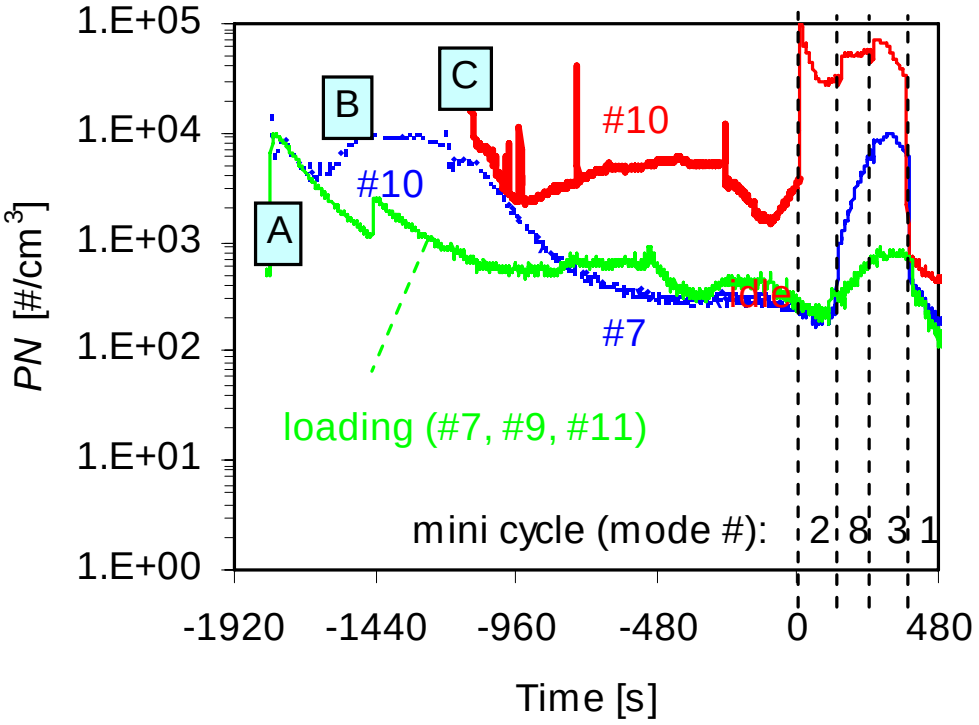
Date	Validation Exercise	Round Robin
Jan – Feb 2008	JRC	
Mar-Apr 2008	AVL-MTC	
May – Jun 2008	JRC	
Jul – Sept 2008		RWTUEV
Oct – Nov 2008		Ricardo
Dec 2008 – Jan 2009	Ricardo	NTSEL
Feb - April 2009	UTAC	JARI
April – June 2009	EMPA	NIER (Korea)
July – Sept 2009	JRC	
Oct – Nov 2009		Volvo
Dec 2009 – Jan 2010		JRC
Feb – Mar 2010		UTAC
Apr – May 2010		TNO
Jun – Aug 2010		VTT
Sep – Oct 2010		Scania
Nov – Dec 2010		Environment Canada
Jan – Feb 2011		Daimler

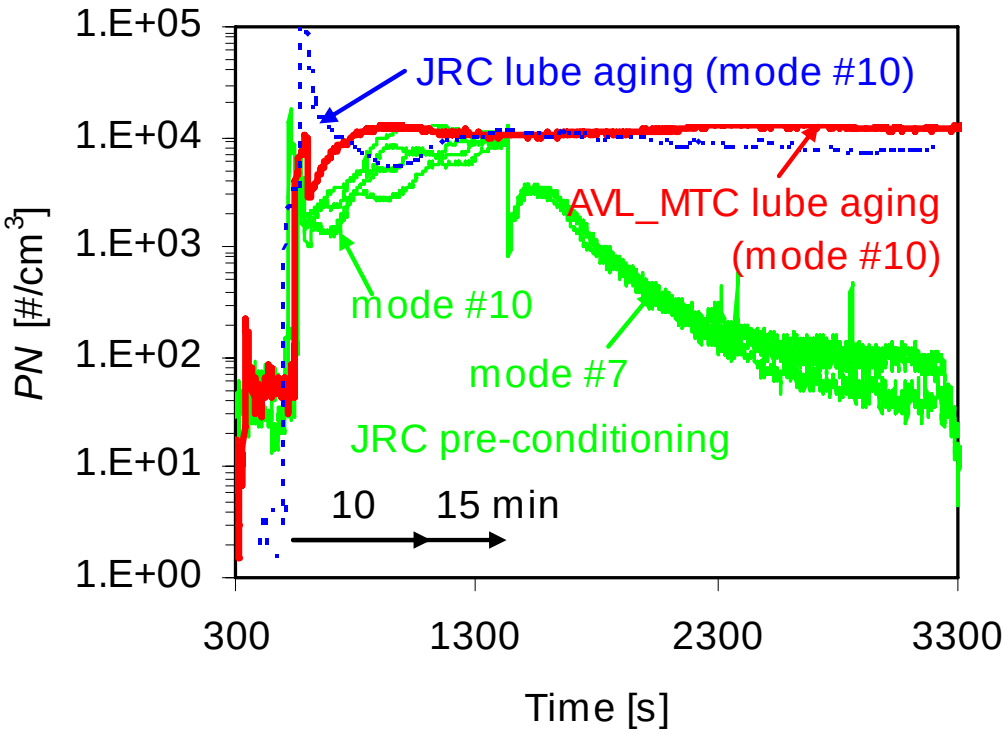
Set up

- One Golden instrument at CVS and one at the partial flow system
- Alternative systems (EJ+ET+EJ+3010D, EJ+TD+3790, Nanomet-C)
- Other systems (EEPS, 3025A)



Preconditioning





Non-volatile particles >23 nm

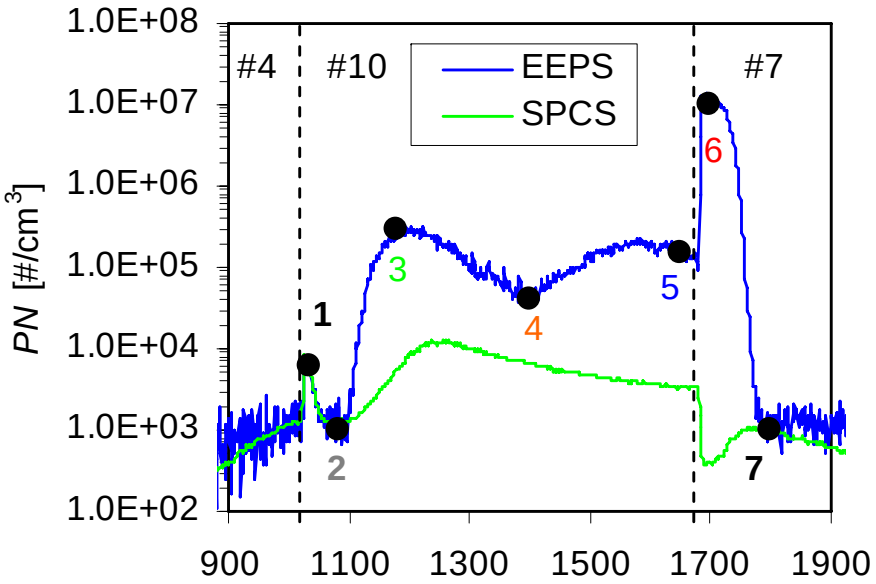
Low temperature modes → Low emissions

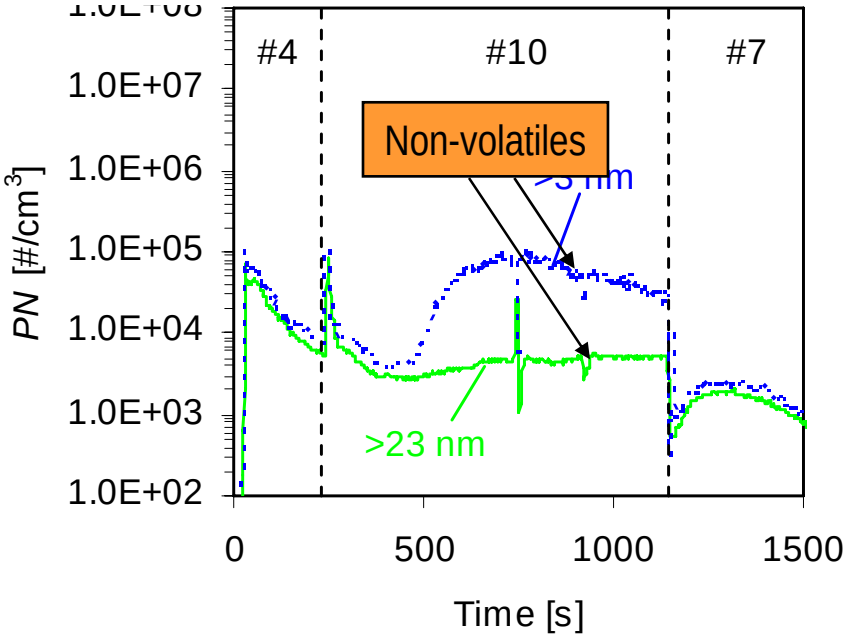
High temperature modes → High emissions

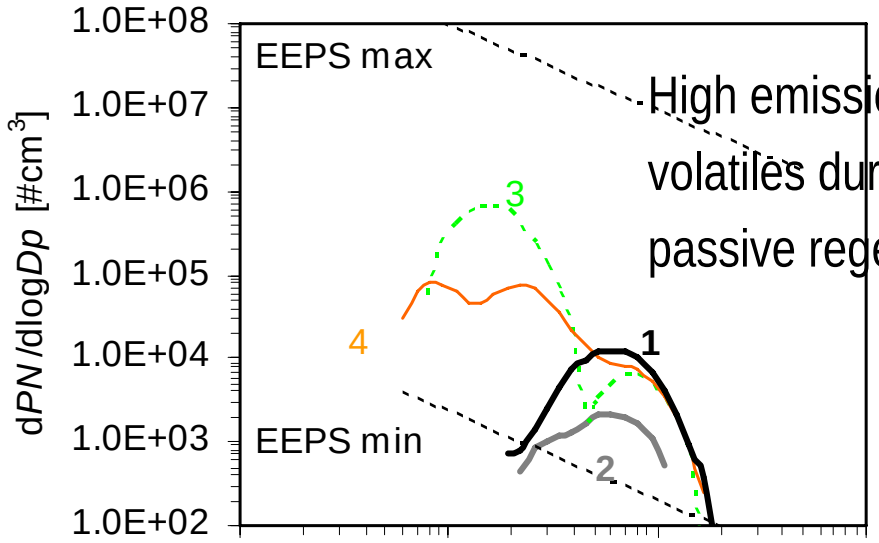
Non-volatiles >23 nm

15 min at mode 10 is the minimum time for Pre-conditioning

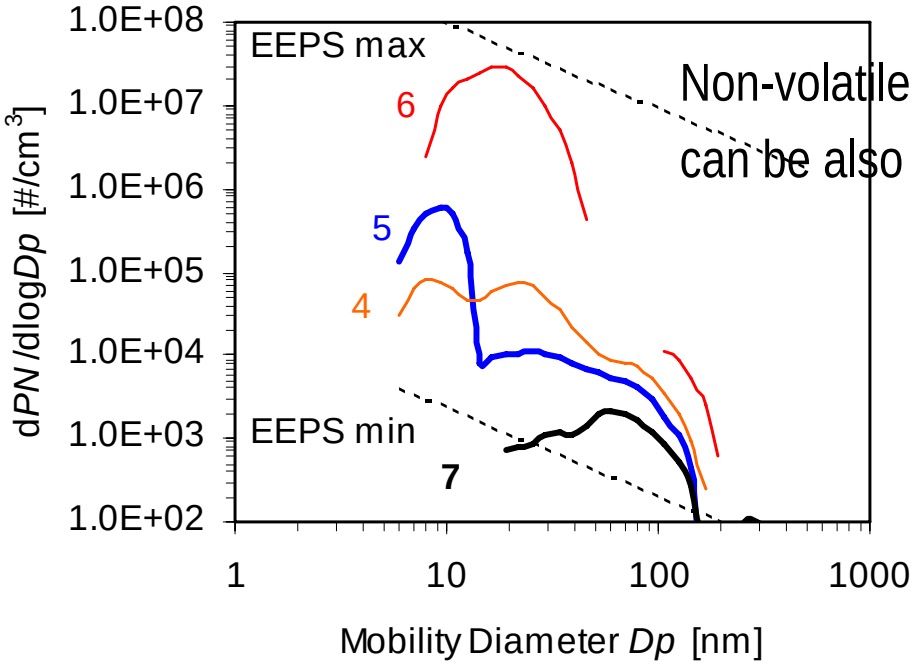
Pre-conditioning emissions





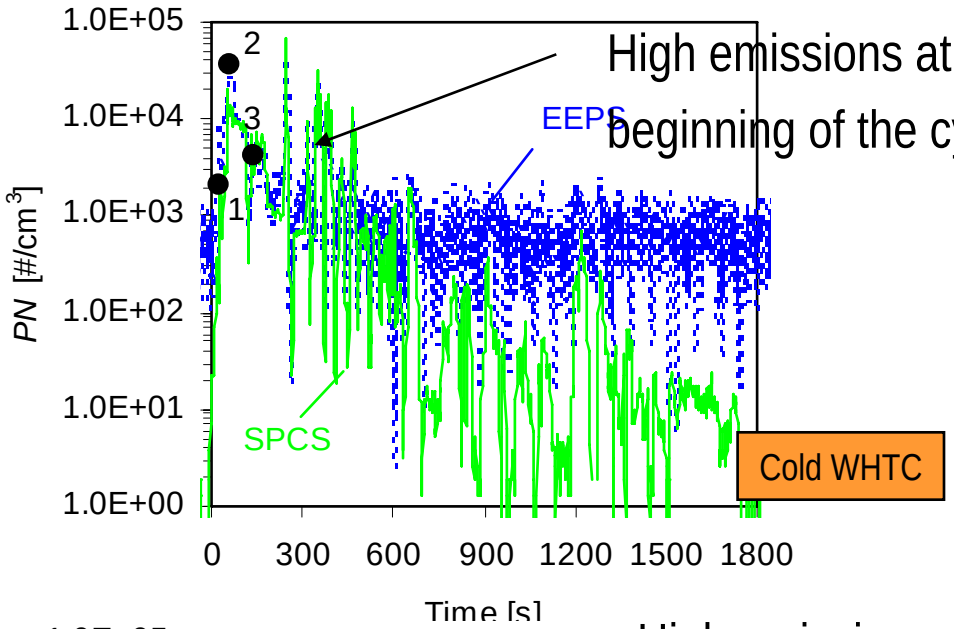


High emissions of volatiles during passive regeneration

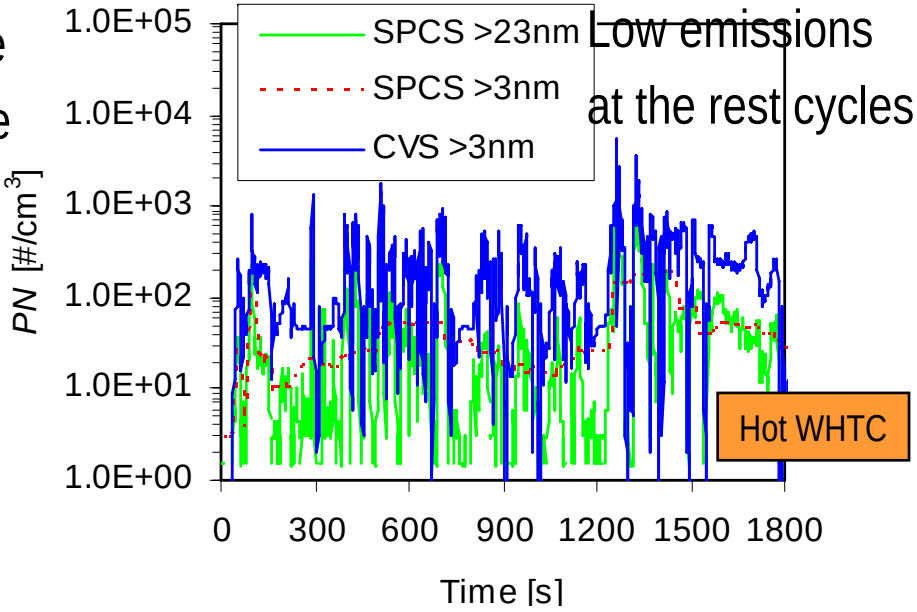


Non-volatile emissions can be also observed

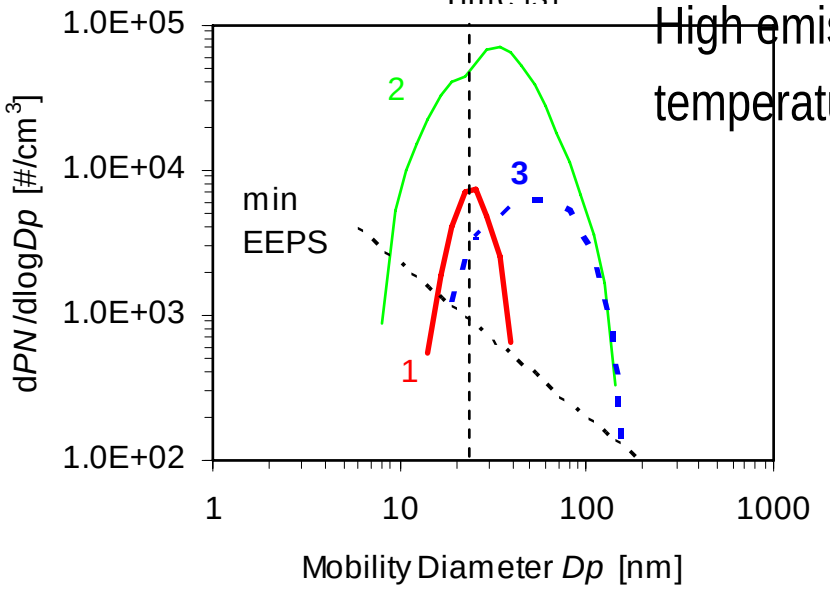
Cycles



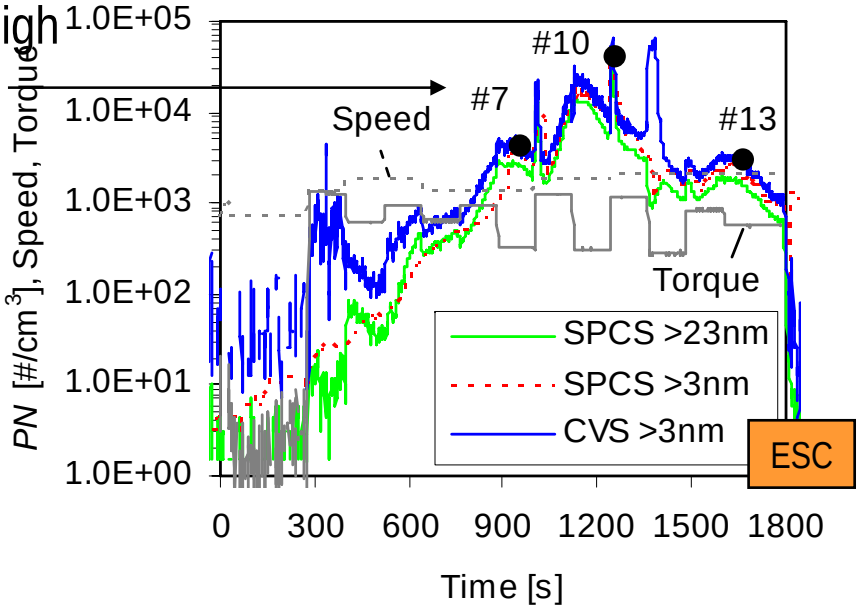
High emissions at the beginning of the cycle



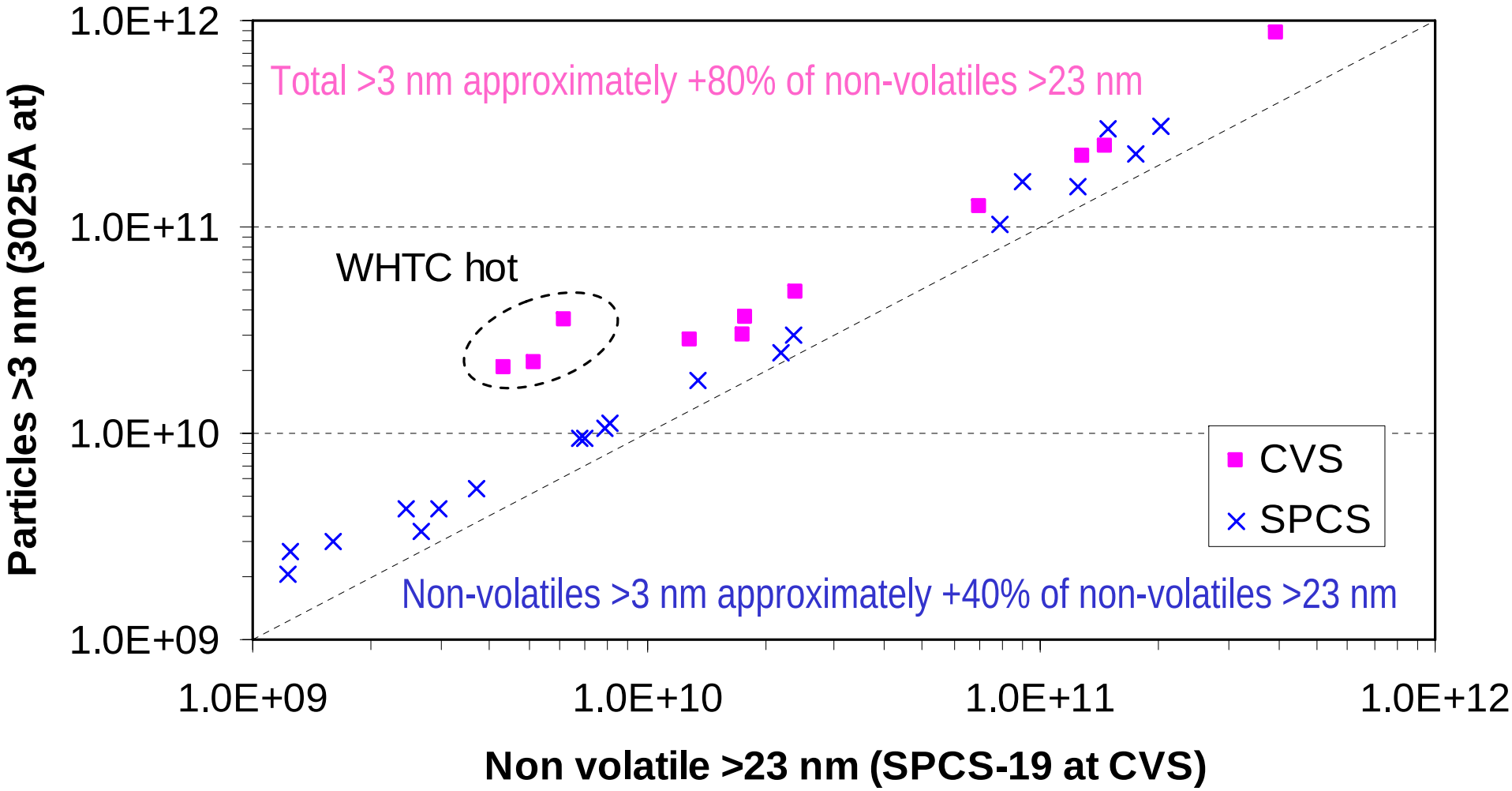
Low emissions at the rest cycles



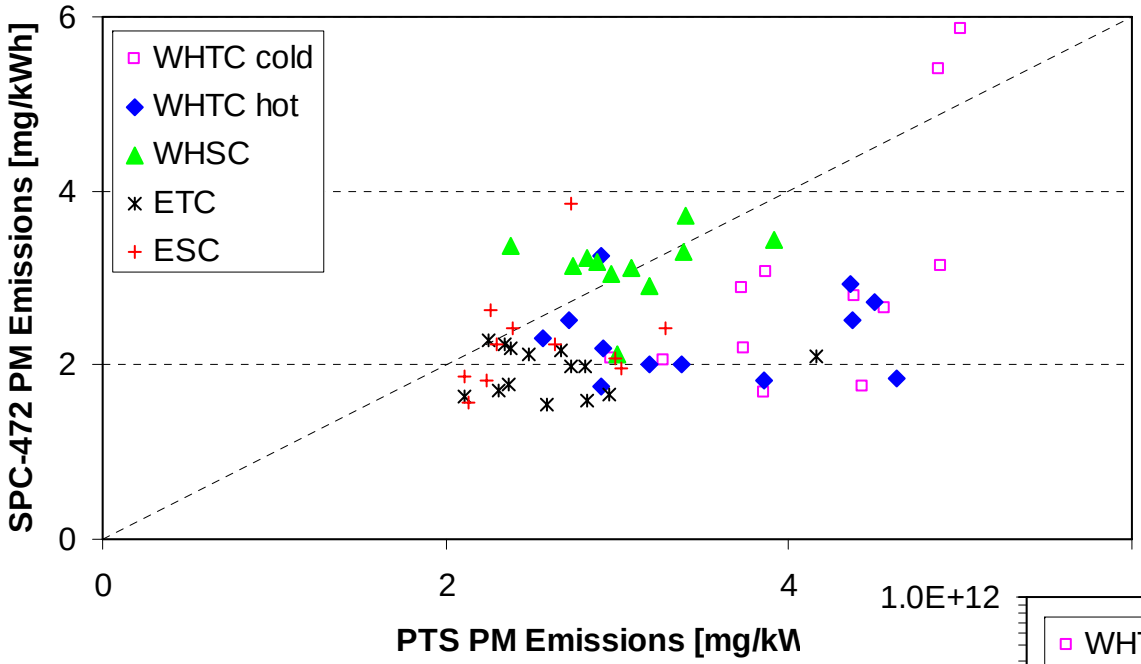
High emissions at high temperature modes



Particles <23 nm

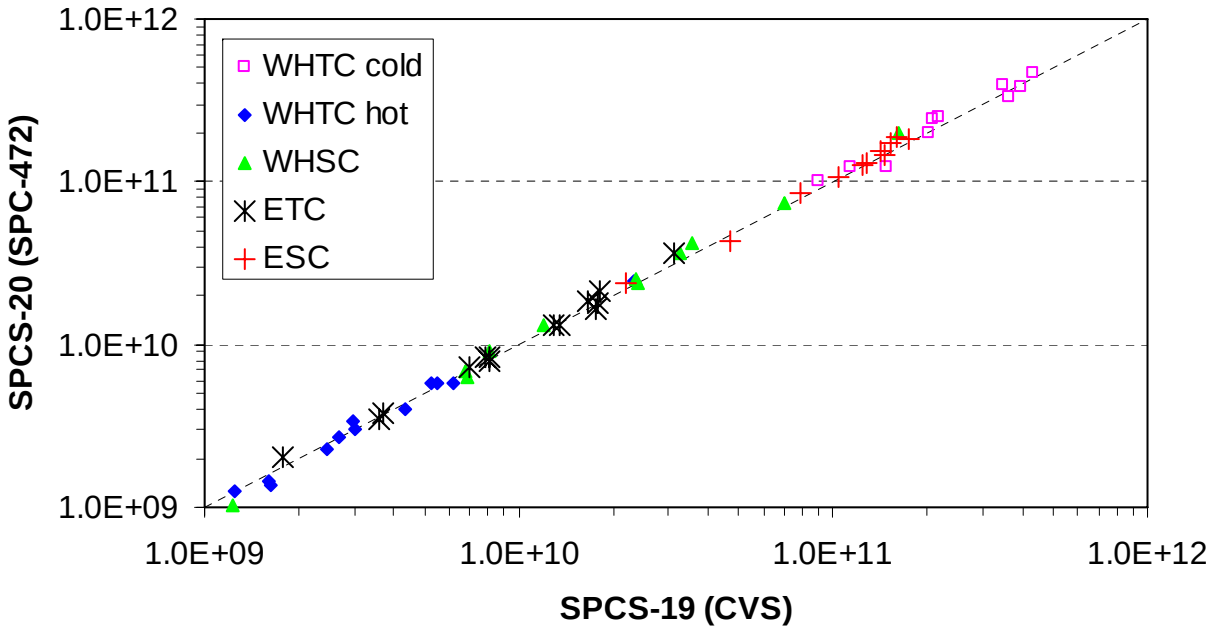


Partial-Full flow systems

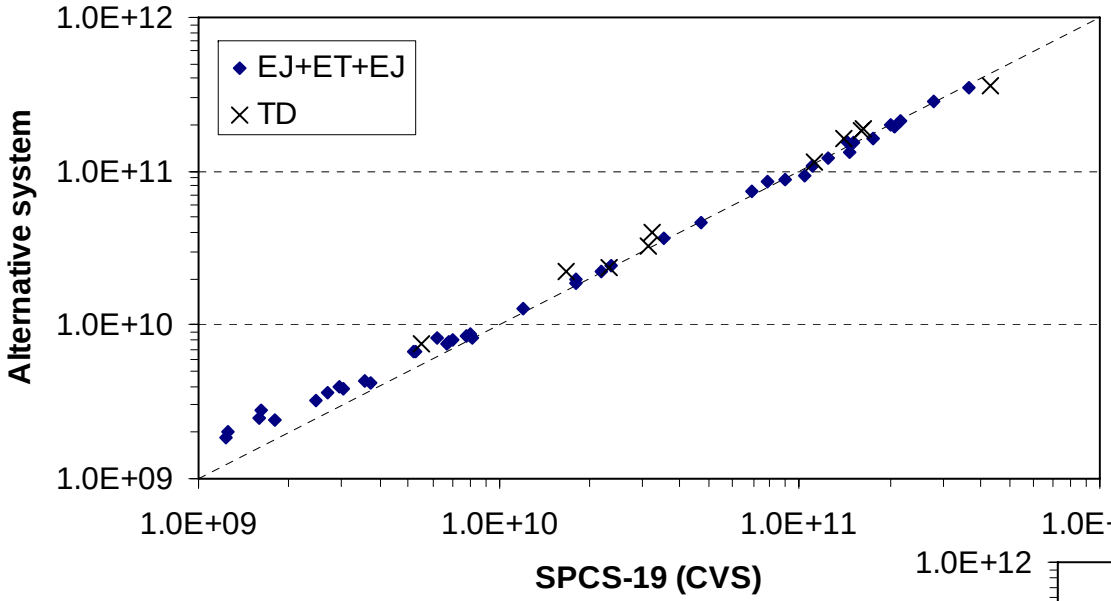


Not good PM correlation between partial and full flow systems (However similar levels)

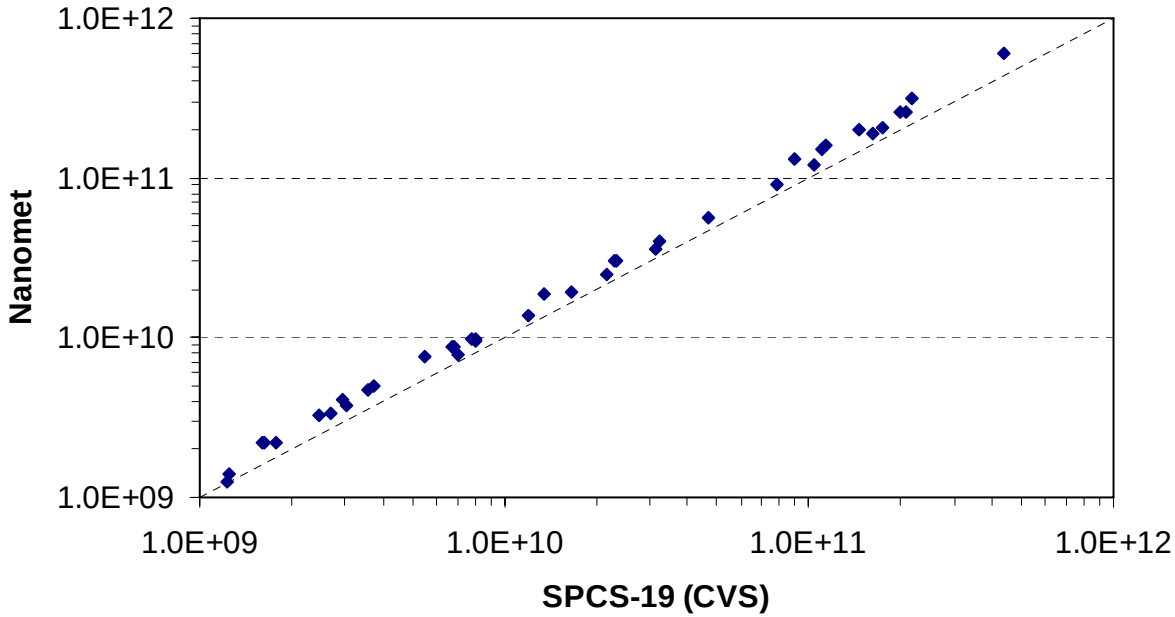
Very good PN correlation between partial and full flow systems



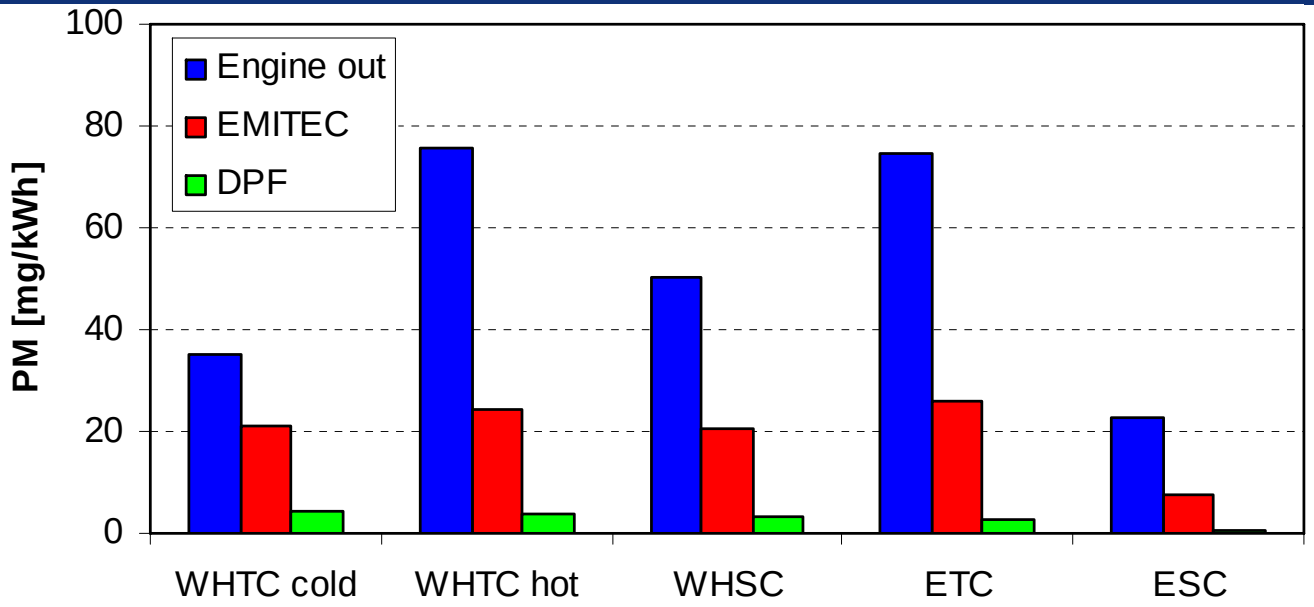
Number systems comparison



Very good agreement between alternative and golden systems measuring from CVS in parallel



Aftertreatment effect

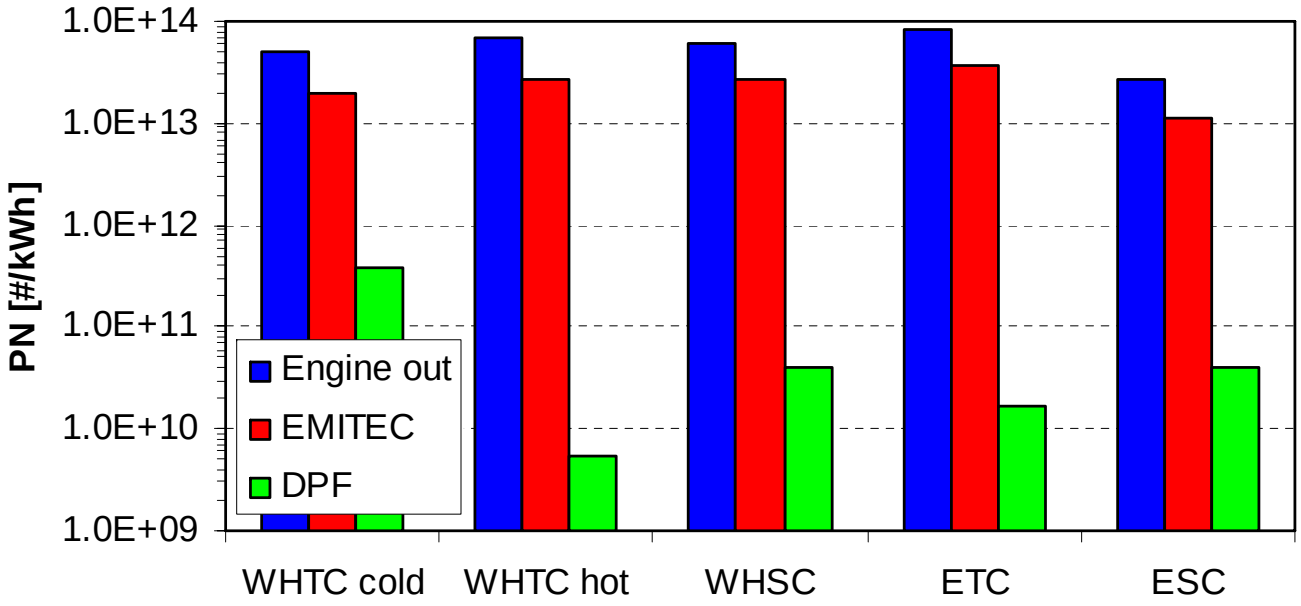


65% reduction with partial flow Deep Bed Filter

99% reduction with wall flow filter

EMITEC=PM Metalit
Partial Flow Deep Bed Filter

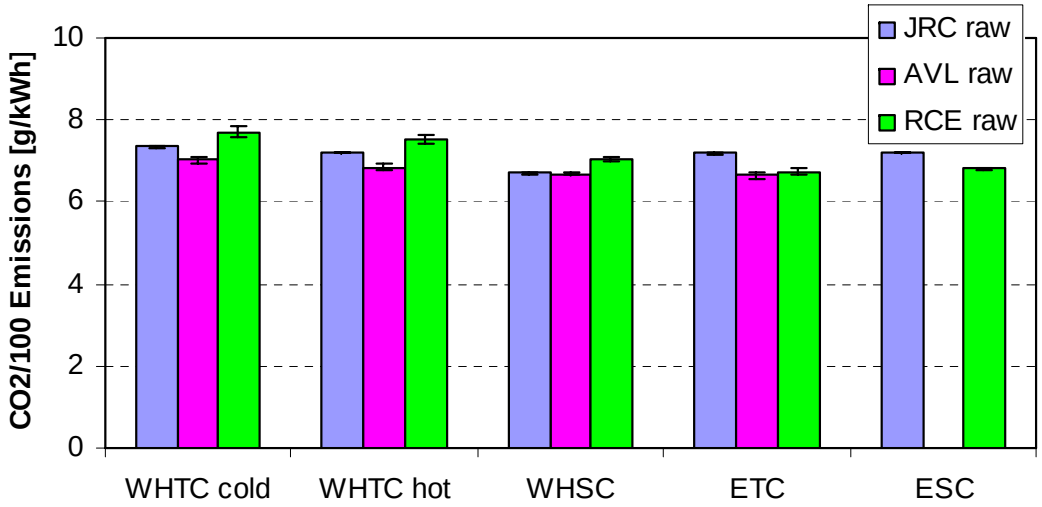
DPF=Pt based oxicat upstream of wall flow filter

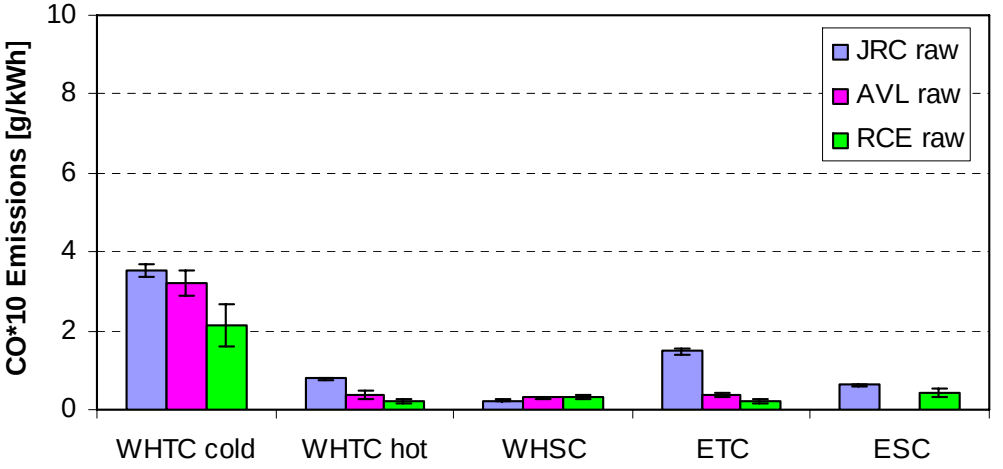


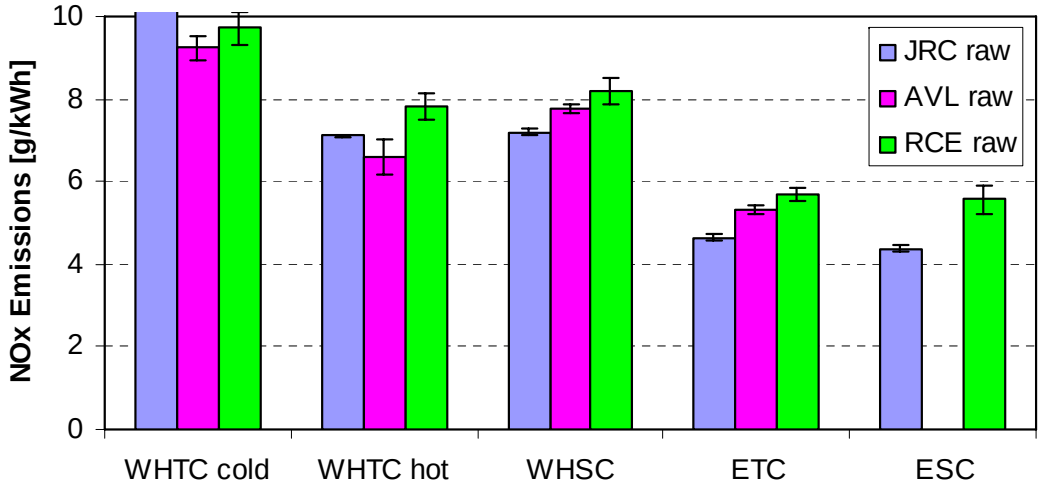
VE Comparisons - setup

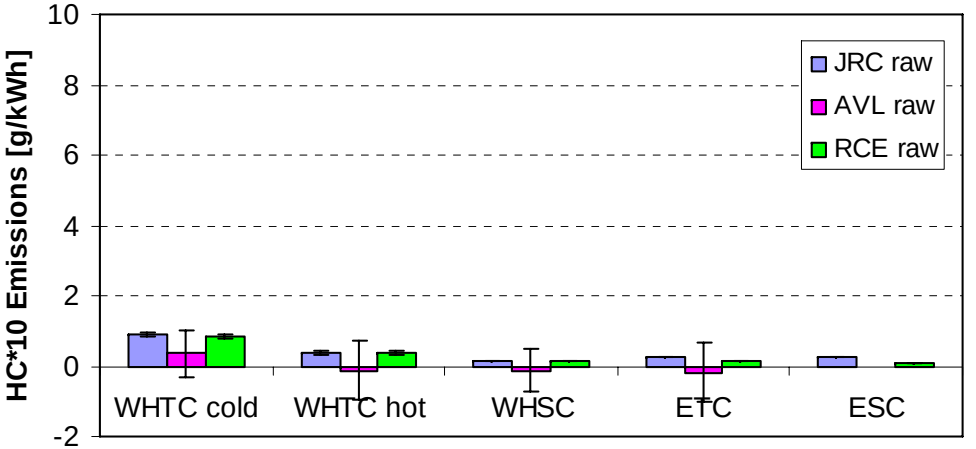
	JRC	AVL_MTC	RCE
CVS dimensions [cm/cm]	470/47	500/50	450/45
CVS flowrate [m^3/min]	80	72	60
Sec. tunnel dimen. [cm]	64/8.6	30/8	100/10
Sec. tunnel flowrates	25/50	25/50	20/40
Partial flow system	Smart Sampler PSS	Smart Sampler	MDLT
PM flow, split ratio	1.08, 0.0626%	1.08, 0.0626%	1.205, 0.0909%

VE Comparisons - gaseous

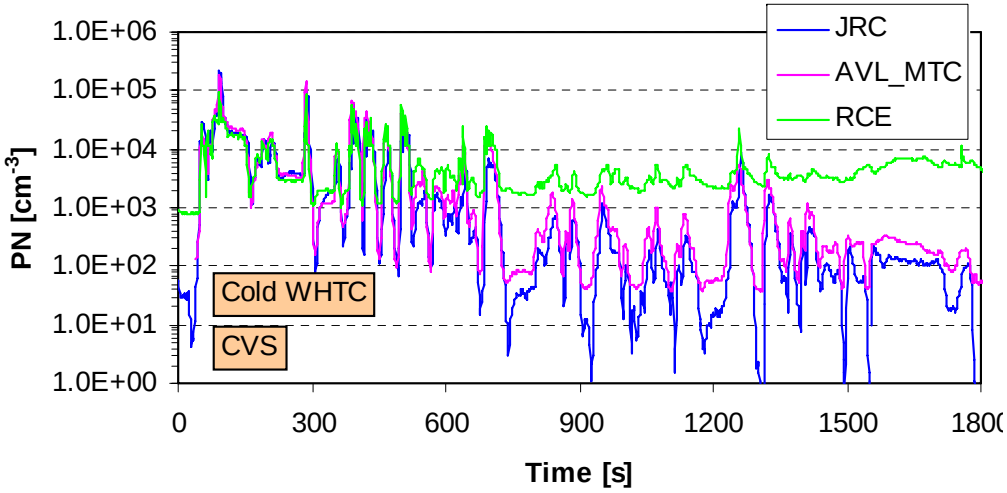


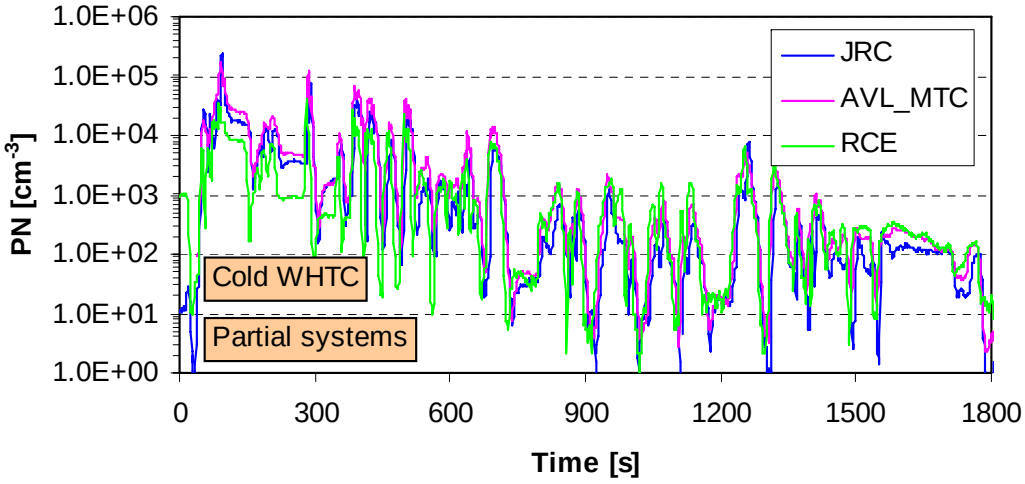


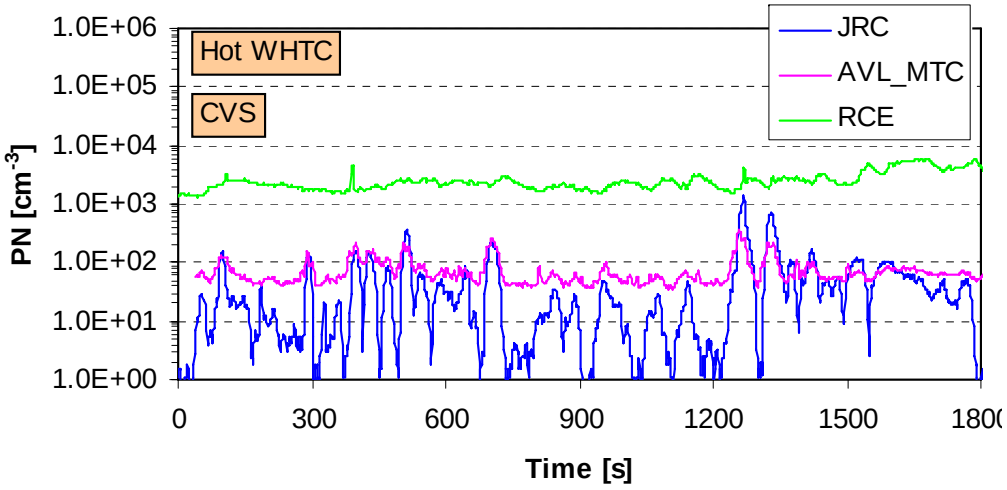


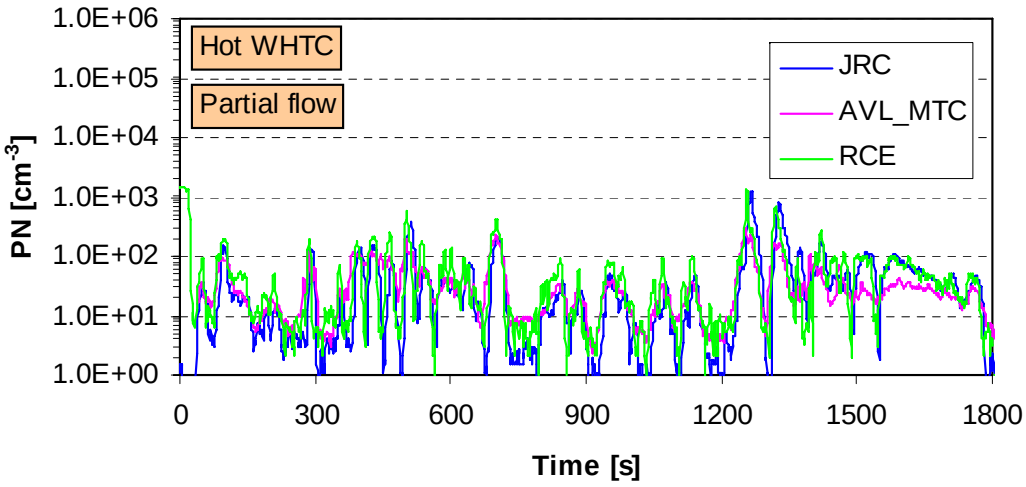


VE Comparisons – Real time PN

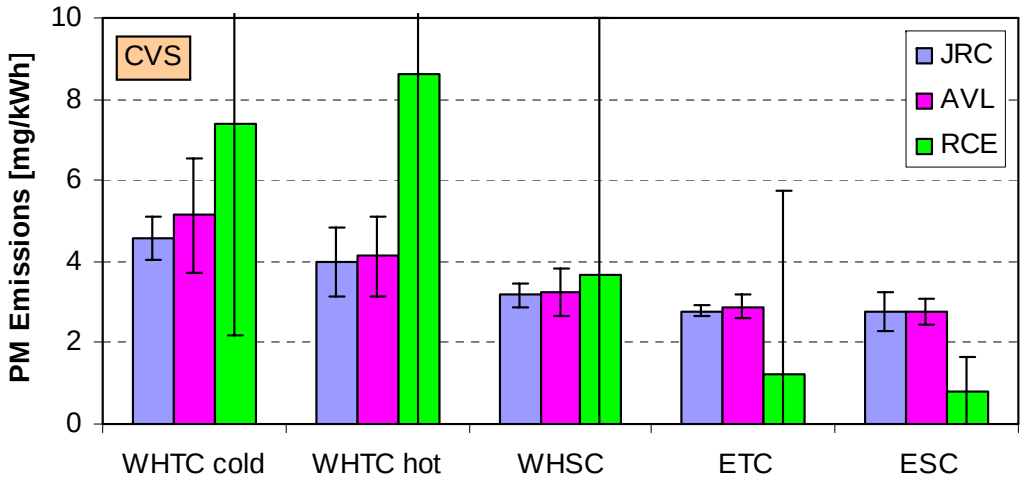


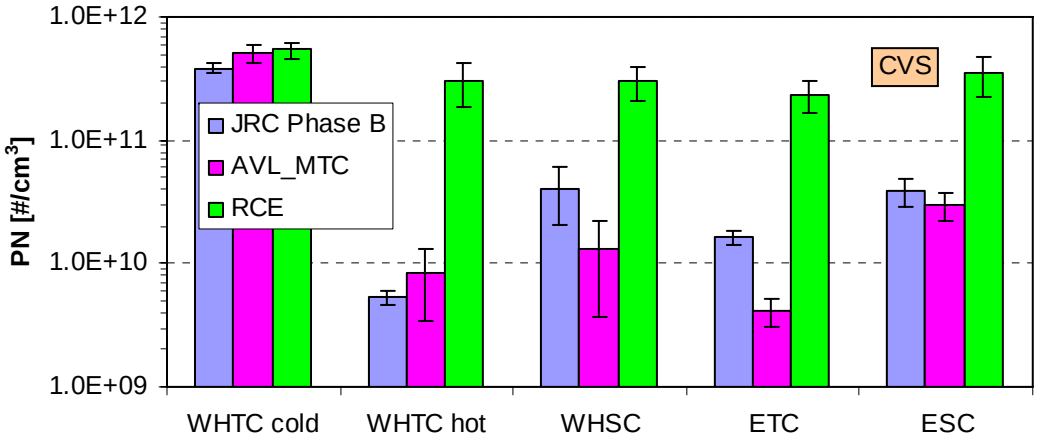


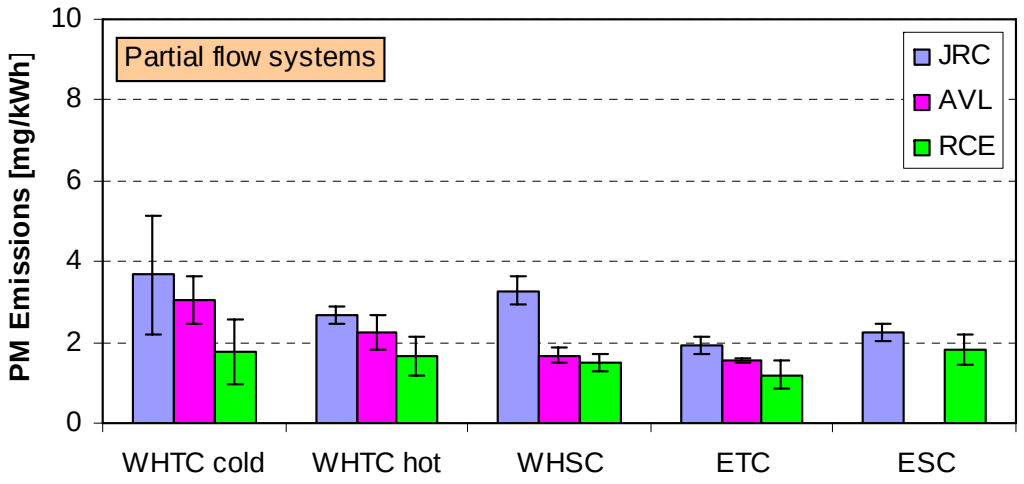


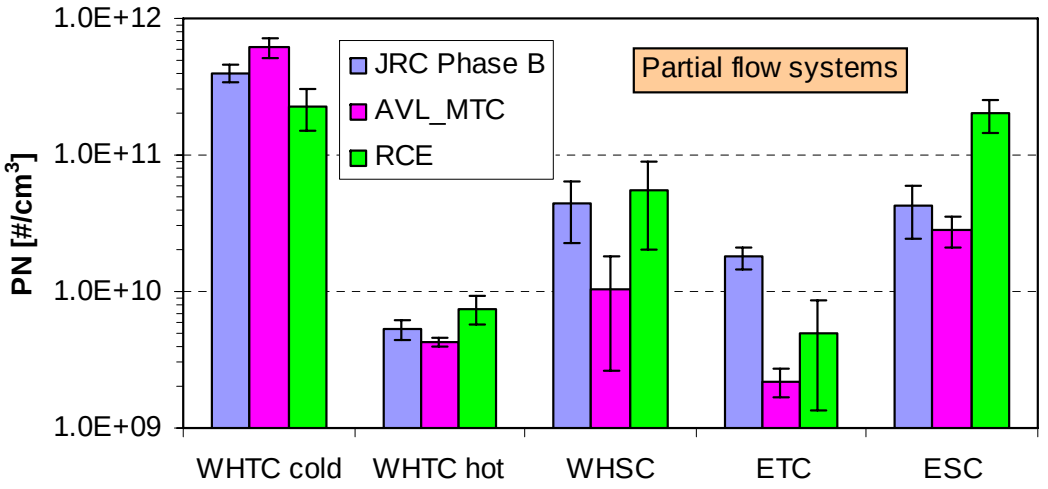


VE Comparisons – PM and PN









Conclusions

- Exploratory Work (JRC)
  - Preconditioning: Regeneration + Loading
  - Not high concentration of particles <23 nm (and proportional)
- Validation Exercise (JRC)
  - Good correlation between partial and full flow systems
  - Good correlation between particle number systems
  - Wall flow filters can reduce efficiently number emissions
- Validation Exercise comparisons
  - Background important
  - Quite good repeatability of PN emissions