HORIZON 2020

Call: H2020-GV-2016-2017
Technologies for low emission light duty powertrains

Action:

“Measuring automotive exhaust particles down to 10 nanometres – DownToTen”

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Consortium

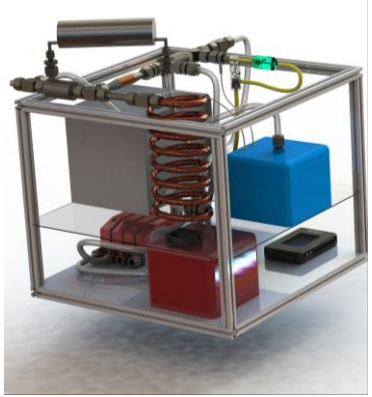
In collaboration with:

The University of California at Riverside,

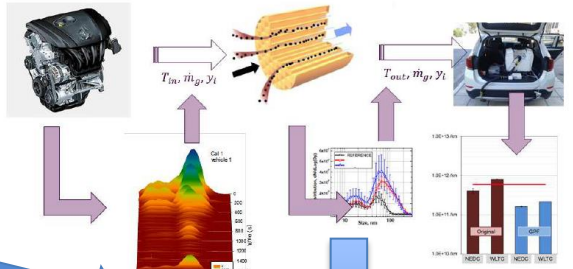
Tokyo Denki University(Japan) and
National Metrology Institute (Japan)

Objectives & Targets

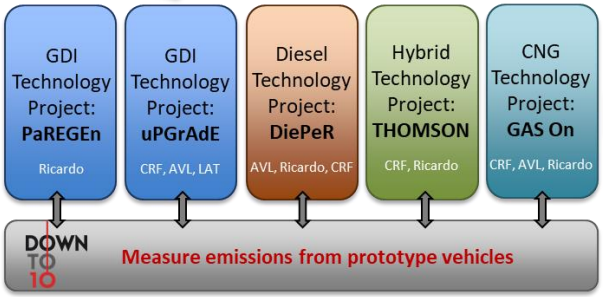
1. Develop instrumentation and sampling set-up to measure exhaust particles as small as 10nm



2. Develop models to understand particle transformation from the tailpipe to sampling and then to the atmosphere



3. Use new setup to measure latest vehicle technologies
(collaboration with parallel H2020 projects)

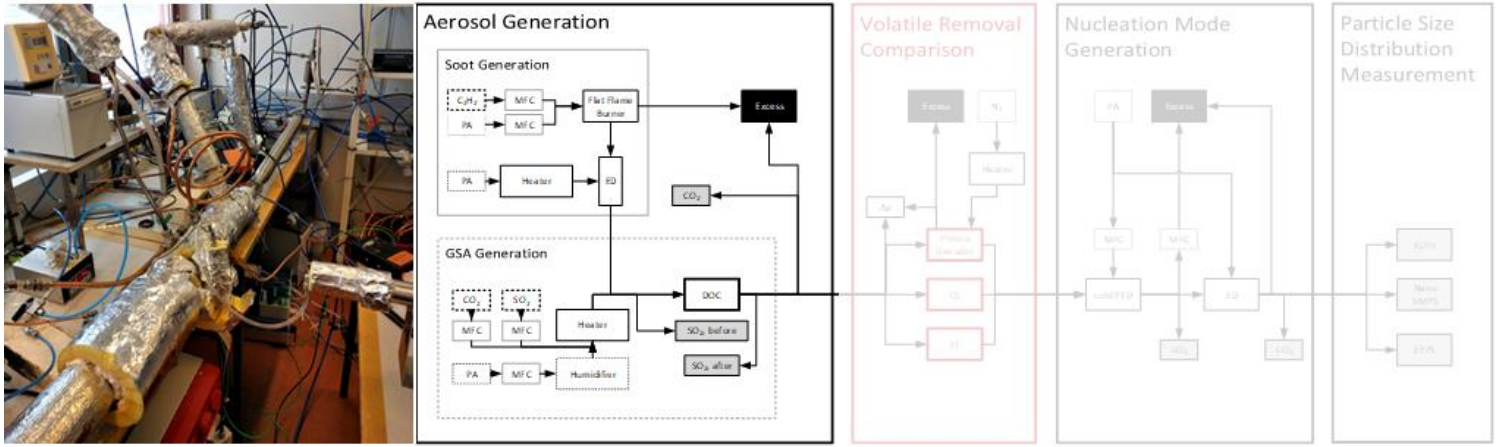


4. Synthesize results to provide policy recommendations (WP5)

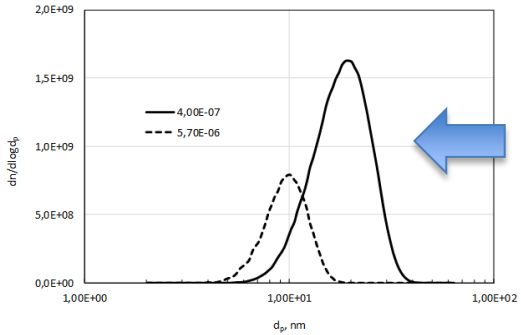
DTT Summary Matrix

WP	Objectives	Products/deliverables	Status
WP2	• Definition of key particle properties, emission and measurement conditions • Instruments and sampling set-ups	• Evaluation of the performance of chosen techniques • Demonstrator of synthetic aerosol bench	Completed
WP3	• PN <23 nm sampling configuration, methodology and chemical characterization • Modelling of particle processes	• Sampling configuration for laboratory testing and PEMS - Demonstrator unit / Test protocol • Simulation model	Completed
WP4	• Testing and further improving the systems proposed in WP2 and WP3 • Development of RDE PN testing procedures	• Test matrix and test protocols for several technologies, fuels and driving patterns • PN PEMS demonstrator / methodology	Close to completion
WP5	• Analysis of DTT measurements to explain technology-specific issues in collaboration with 'vertical' Projects (uPGrAdE, PaREGEn and DiePeR)	• Consolidation of a reproducible and reliable measurement procedure for PN< 23 nm both for laboratory and RDE • Recommendations for emission regulations • Emission factors for models and estimates	On going

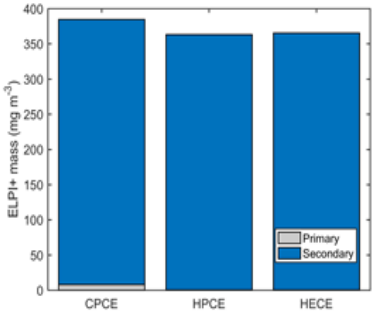
WP2: Evaluation of the performance of chosen techniques/ Demonstrator of synthetic aerosol bench

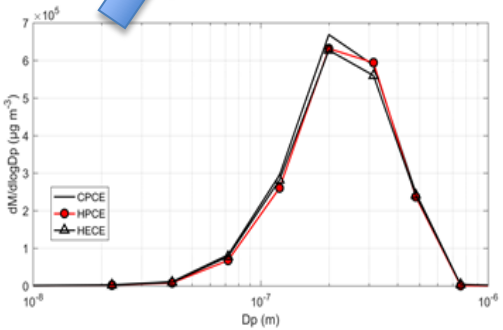


Example of secondary aerosol formation test with different sampling systems: total mass concentrations (left); size distributions (right)

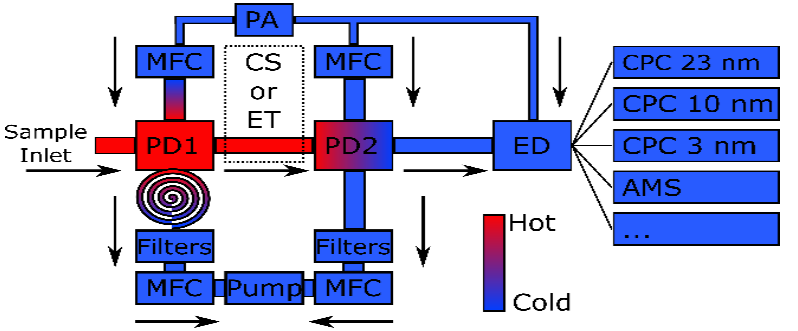


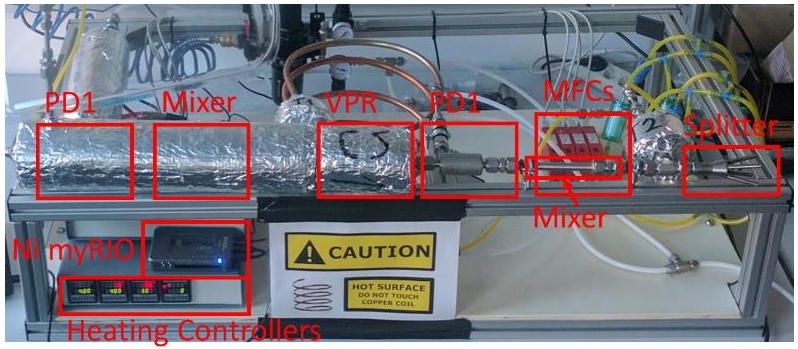
Example of possible solid particle measurement artefact through nucleation process in dilution cooling. Binary sulfuric acid –water system nucleation and growth with two GSA mole fractions





WP3: PN<23 nm sampling configuration for laboratory testing and PEMS (DTT lab based system - 1st prototype)



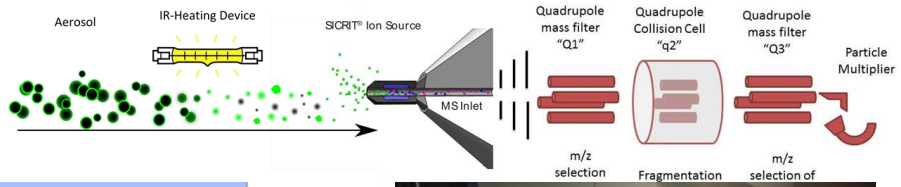


- **Low loss sampling system**
- **Flexibility in sampling**
  - Opt. 1: Current PMP
  - Opt. 2: Enhanced VPR including CS
  - Opt. 3: No VPR (SOA studies)
- **Capacity for PN-PEMS**
  - Counterflow denuder / increased sensitivity
  - Low energy consumption (~100 W)
  - Battery-powered
- **Possibility for different PN modes**
  - Non-volatile primary
  - Delayed primary
  - Secondary

WP3: PN <23 nm chemical characterization

Mass spectrometric techniques

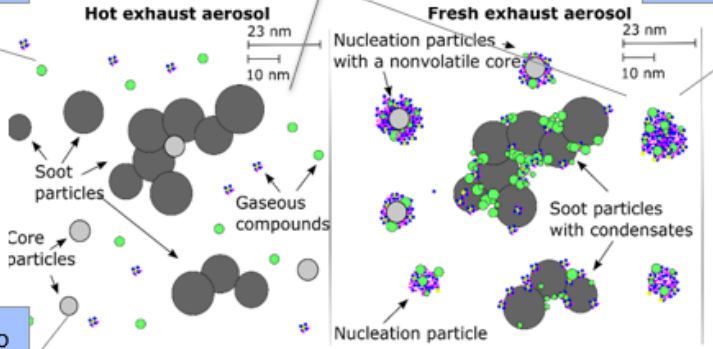
HELIOS –SICRIT- MS



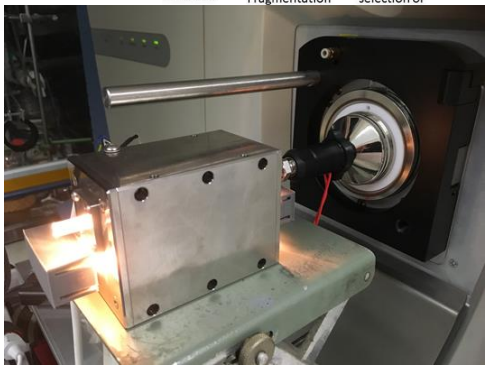
Atmospheric research tools: CI-Api-TOF

SP-AMS for all particle material, but only down to 50 nm

New instrument for semi-volatile particle material

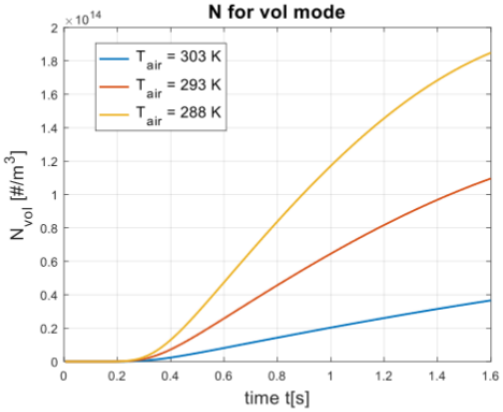


Sub 50 nm particles into SP-AMS: Agglo-inlet

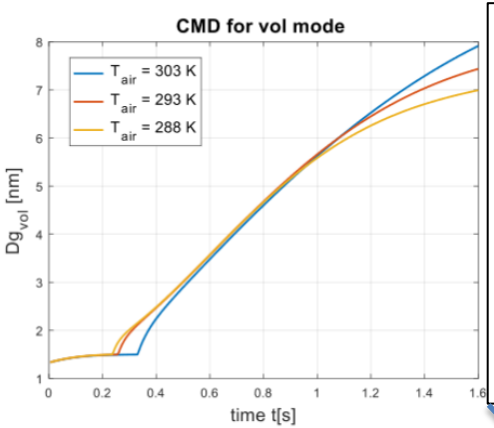


- Direct photo-heating of particles
- Unselective soft ionization
- Robust at high concentrations
- Ongoing work on sensitivity vs substance

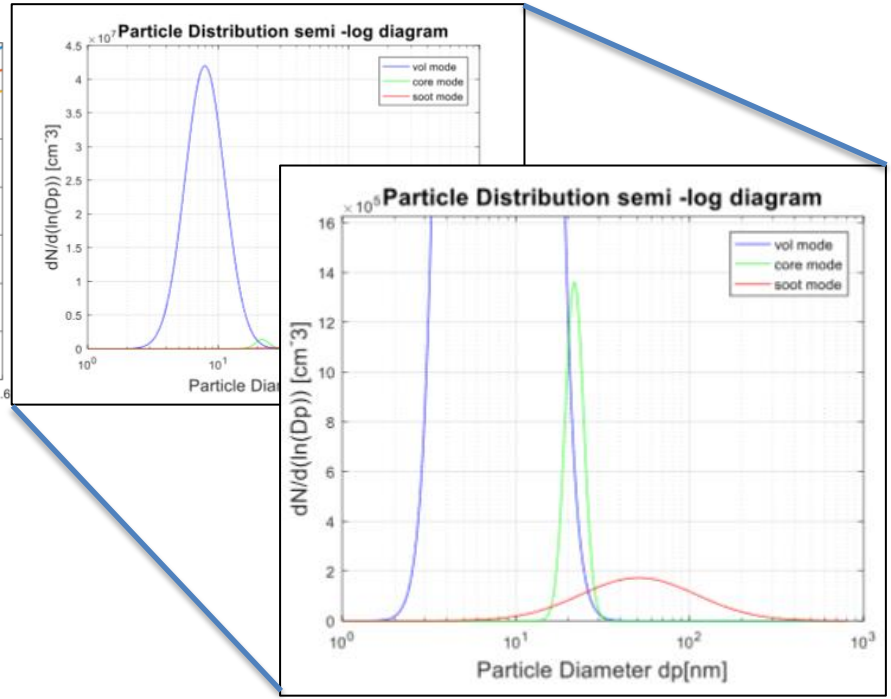
WP3: Modelling of exhaust particle processes from emission to dilution (Diesel exhaust)



Number concentration for volatile mode for different dilution air temperatures

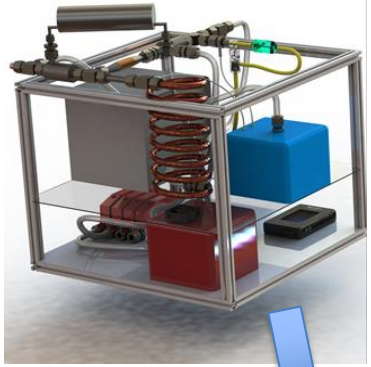


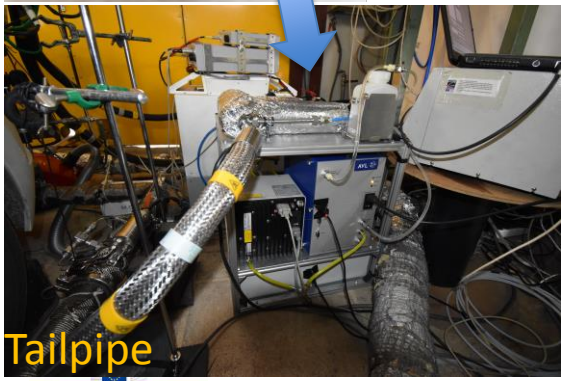
CMD for volatile mode for different dilution air temperature

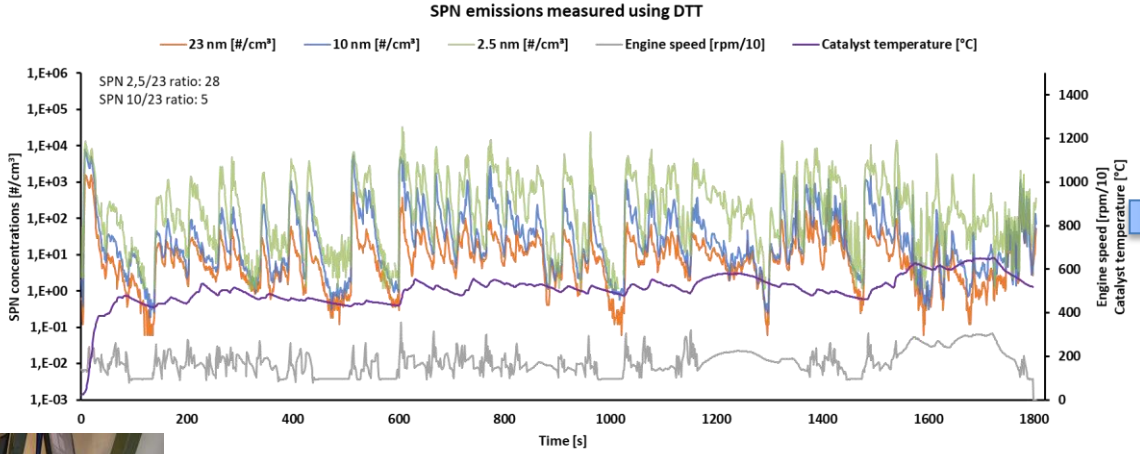


Particle Distribution consisted of distinct modes at the end of ageing chamber

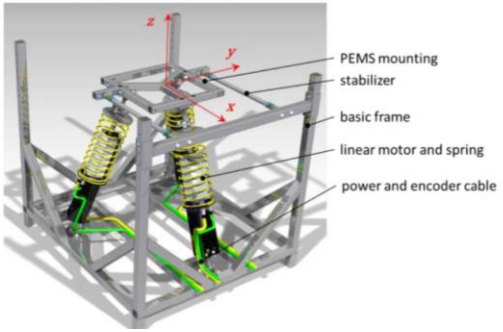
WP4: Development of RDE PN testing procedures

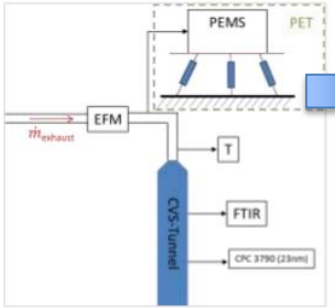






DTT PEMS particle emission measurement performance (WLTC cold)





DTT PN PEMS Robustness evaluation

Timeteble: 3-month extension requested

WP	Workpackage/Task	Year 2												Year 3												Extension		
		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	1	2	3
1	Project Management																											
1.1	Technical project and periodic progress reports																											
1.2	Contractual, administrative and financial project management																											
D	Deliverables												1.5															1.6
2	**Definition of key particle properties,emission and measurement conditions-identification of available instruments and sampling set-ups**																											
2.1	Survey of exhaust particles and their properties																											
2.2	Identification of available instruments and sampling set-ups																											
2.3	Assessement of sampling and instrumentation methods with laboratory aerosols																											
D	Deliverables		2.3																									
3	**Evaluation of sampling conditions and measurement set-ups**																											
3.1	Equipment and sampling set-up																											
3.2	Testing measurement systems with challenging internal combustion engine aerosols																											
3.3	Raw vs. dilute particle sampling modelling																											
D	Deliverables					3.1				3.2 3.3																		
4	**Development of test protocols and performance of testing campaign**																											
4.1	Development of a PN PEMS demonstrator unit																											
4.2	Test protocol and set-ups robustness - Testing measurement systems with challenging internal combustion engine aerosols																											
4.3	Summary of the test results and set-up of a common database																											
4.4	Evaluation and recommendation of RDE relevant methods																											
D	Deliverables									4.1 4.2												4.3		4.4				
5	**Synthesis and evaluation of testing results, incl. metrology**																											
5.1	Proposal of up to date PN emissions measurement procedures for laboratory and real driving conditions																											
5.2	Proposal of potential regulatory limit values and conformity factors for PN emissions																											
5.3	Assessment of the implications of potentially un-regulated particles																											
5.4	Final summary report																											
D	Deliverables																					5.1					5.2	5.3
6	**Dissemination and Exploitation of Results**																											
6.1	Promotional material, incl. project flyers																											
6.2	Stakeholder mapping and Dissemination plan																											
6.3	Website and Interactive Communication Platforms																											
6.4	Newsletter																											
6.5	Scientific & technical paper publications and policy briefs																											
6.6	Stakeholder Events, Science-Policy Dialogue events																											
6.7	DownToTen – Legacy Exploitation Plan																											
D	Deliverables				6.8 6.10									6.9 6.11					6.5					6.12 6.13			6.6 6.7	

original gannt | Delay | Extension | Deliverable | Milestones

Extension because:

- Additional time needed for in-depth analysis
- Limited output of linked technology development projects (uPGrAdE, PaREGEn and DiePeR) in current timeframe