Spark discharge as a calibration source for particle detectors in the sub 5 nm size range

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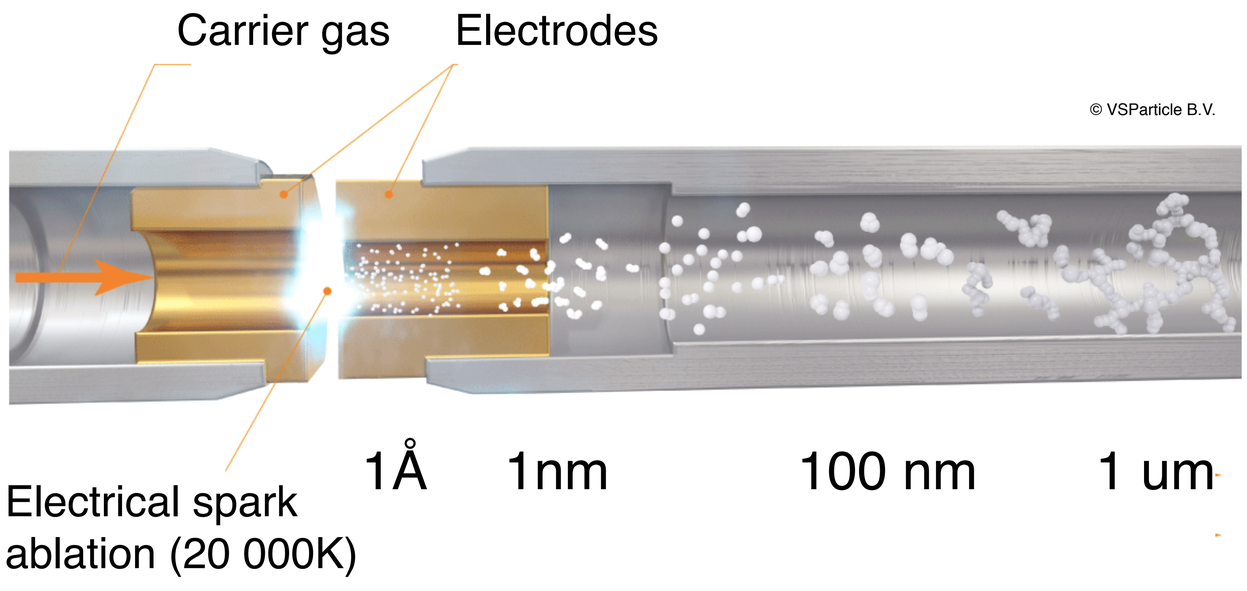
★ Resent studies show significant nanoparticle emissions from combustion engines in the size range of **1-5 nm**

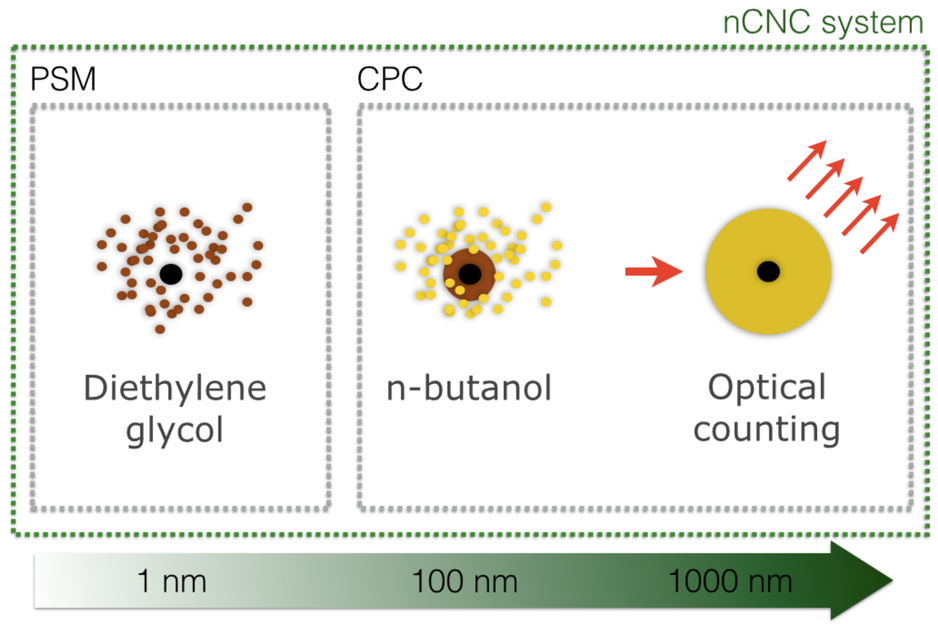
★ Airmodus nCNC can be used to measure those particles

★ In this study we show that a spark discharge aerosol generator can be used to calibrate the nCNC

Spark discharge generator

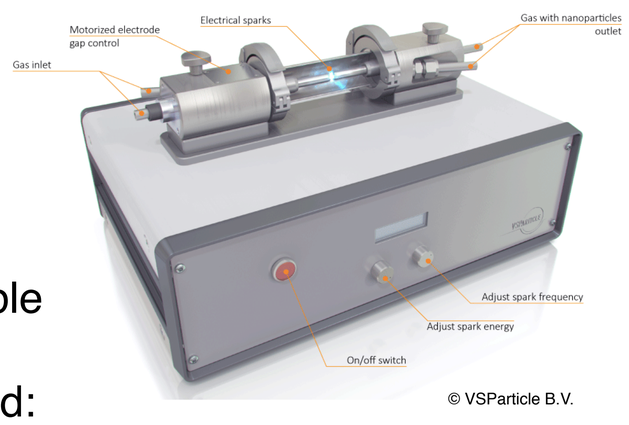


nano Condensation Nucleus Counter



Generating 1 nm particles:

- VSParticle G1 Spark Generator
- Method is based on short repetitive spark discharges between two electrodes
- Electrode materials can be easily changed -> even alloy particles can be produced
- Relatively high yield and stable output
- Particle size can be controlled:
  - Residence time
  - Flow rate
  - Spark energy

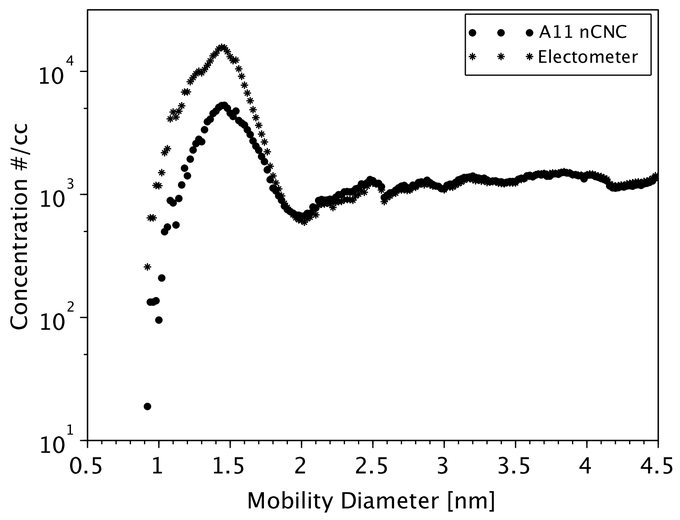


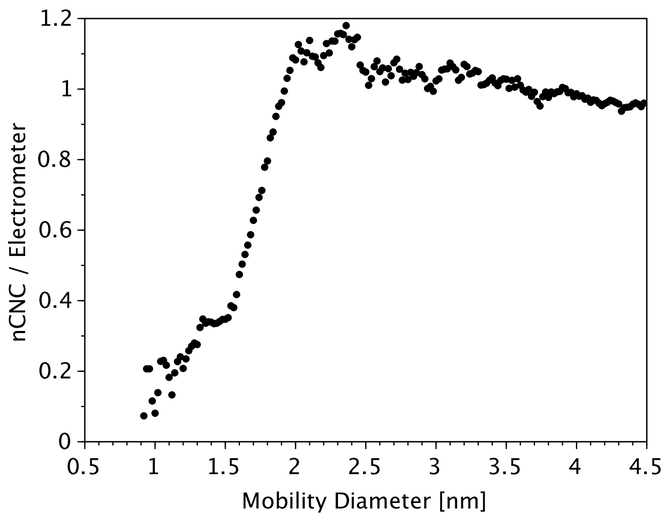
Measuring 1 nm particles:

- Airmodus nano Condensation Nucleus Counter A11 (nCNC)
- Two stages of activation and condensation to detect particles as small as 1 nm in diameter.
- **50% cut-off at 1.3 nm (NiCr)**
- Mixing type activation for size resolved measurements (**1-4nm**)
- Total number concentration between 1-1000 nm

Results:

- Size distribution of negatively charged copper nanoparticles was measured by using a high flow DMA (HalfMini, SEADM)
- Both Airmodus nCNC and an aerosol electrometer by SEADM was used to measure particle number concentration
- VSparticle G1 was capable of producing a distinct mode of particles in the size range of 1.0 to 1.5 nm





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SPARK DISCHARGE REFERENCE HERE

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