Programme

- 9.30 Introduction to MetroHyVe project
- 9.45 Overview of the day
- 10.00 Gas sampling devices (overview)
- 10.30 Gas sampling vessels (overview)
- 11.00 Break
- 11.30 Particles sampling (overview)
- 11:45 Health and safety
- 12.05 Lunch
- 13.00 Head over to the hydrogen refuelling station for a visit

METROLOGY for HYDROGEN VEHICLES

Validation of particle sampling using filters

Jordan Tompkins (NPL)

Workshop on hydrogen quality and flow metering for hydrogen fuel cell vehicles
11-12th of September 2019, VSL, The Netherlands

EMPIR EURAMET

This project has received funding from the EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme.

Measurement Need

ISO 14687 includes a specification for particles which must have less than 1 mg kg^{-1} for hydrogen provided to full cell vehicles. In order for laboratories to provide a suitable service for measuring particles, there must be a traceability chain established (which currently does not exist). The current method used for measuring particles in hydrogen is by placing particulate filters in the stream of supplied hydrogen and weighing the filters before and after mass is collected. However, the approach used by industry is not proven to be traceable to National Standards which would be required to guarantee that the measurements are correct. There are commercially available techniques that could be employed to perform online measurement of particulates directly at the station allowing for an immediate result to be provided to the customer, however these techniques need to be developed and validated for hydrogen at high pressures.

EMPIR Project: MetroHyVe

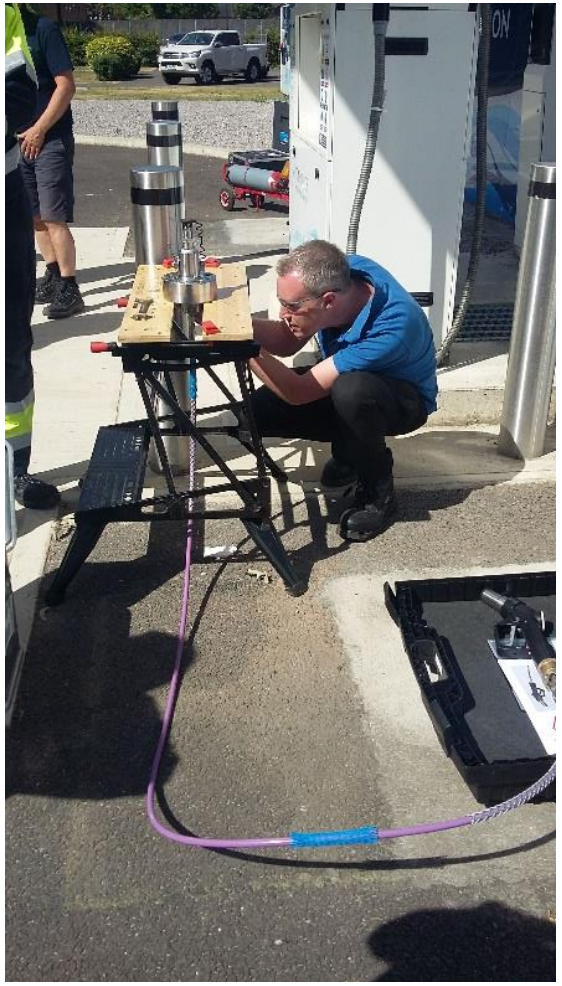
- Validation of particle sampling using filters
  - Examination of current sampling techniques
  - Particle losses in a regulator

'The EMPIR Metrology for Hydrogen Vehicles will be the first large scale project of its kind that will tackle the four measurement challenges that currently prevent the industry from meeting requirements set by International Standards such as flow metering, quality control, quality assurance and sampling.'

Validation of particle sampling using filters

- Research into potential techniques and instrument manufacturers
- Particle Sampling Adapter-H70 (PSA-H70) by Hydac
- Used in HyCoRA and in producing the Japanese Industry Standard in the area
- Difficult measurement to produce an instrument for due to the high pressures involved

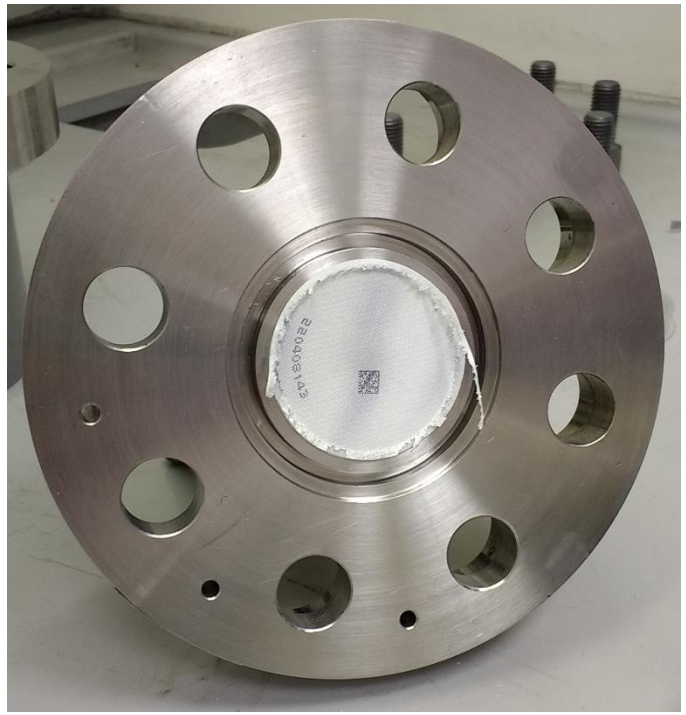
Validation of particle sampling using filters

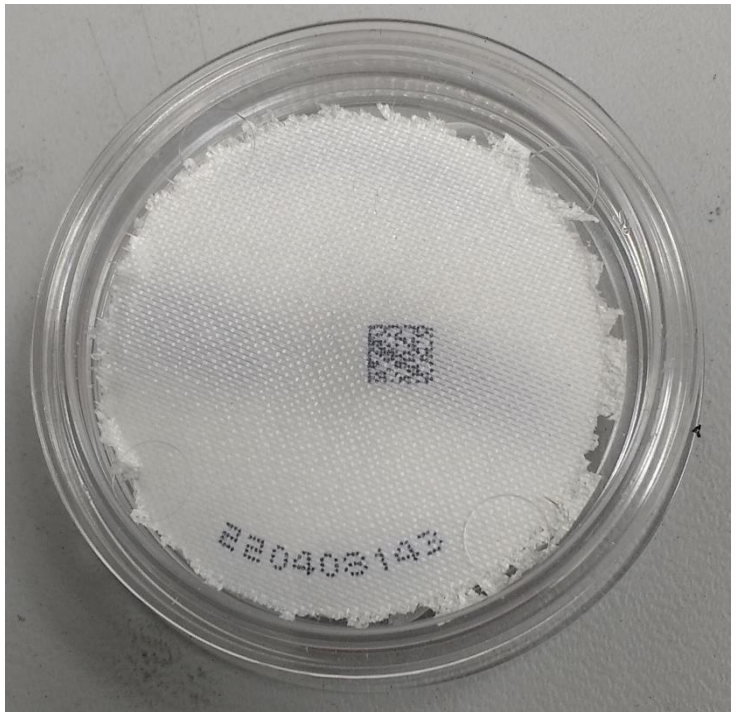


Sampling at the Hydrogen Refuelling Station (HRS) at NPL

Validation of particle sampling using filters

- Hydac suggests solid PTFE
- PTFE coated glass fibre filter
- Smaller pore size in glass fibre
- Tore apart the edge
- Reinforced edge fibre filter

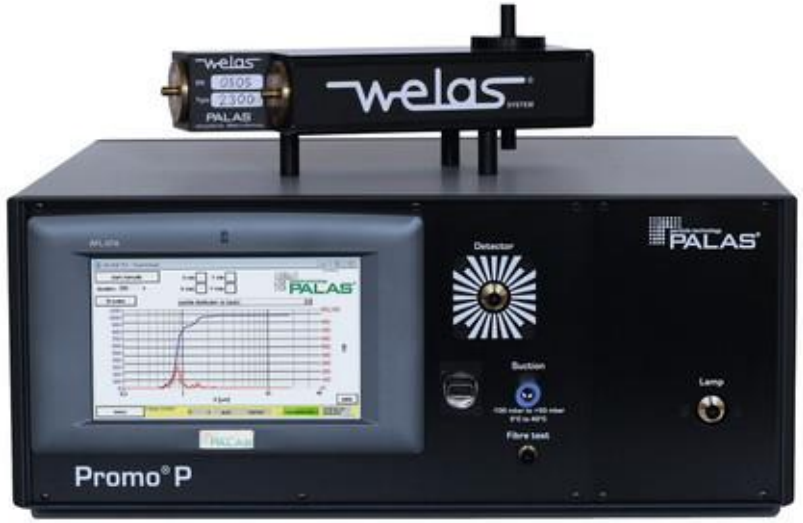




Validation of particle sampling using filters

- Develop a system to determine particle losses in Hydrogen due to pressure regulation.
- Develop a high pressure atomiser
- High pressure OPC head up to 10 Bar
- Switchable system between different pressures
- Loss determination within a standard regulator

PALAS Promo 2000 P - Automatic flow regulation for over pressures from 2 to 10 Bar



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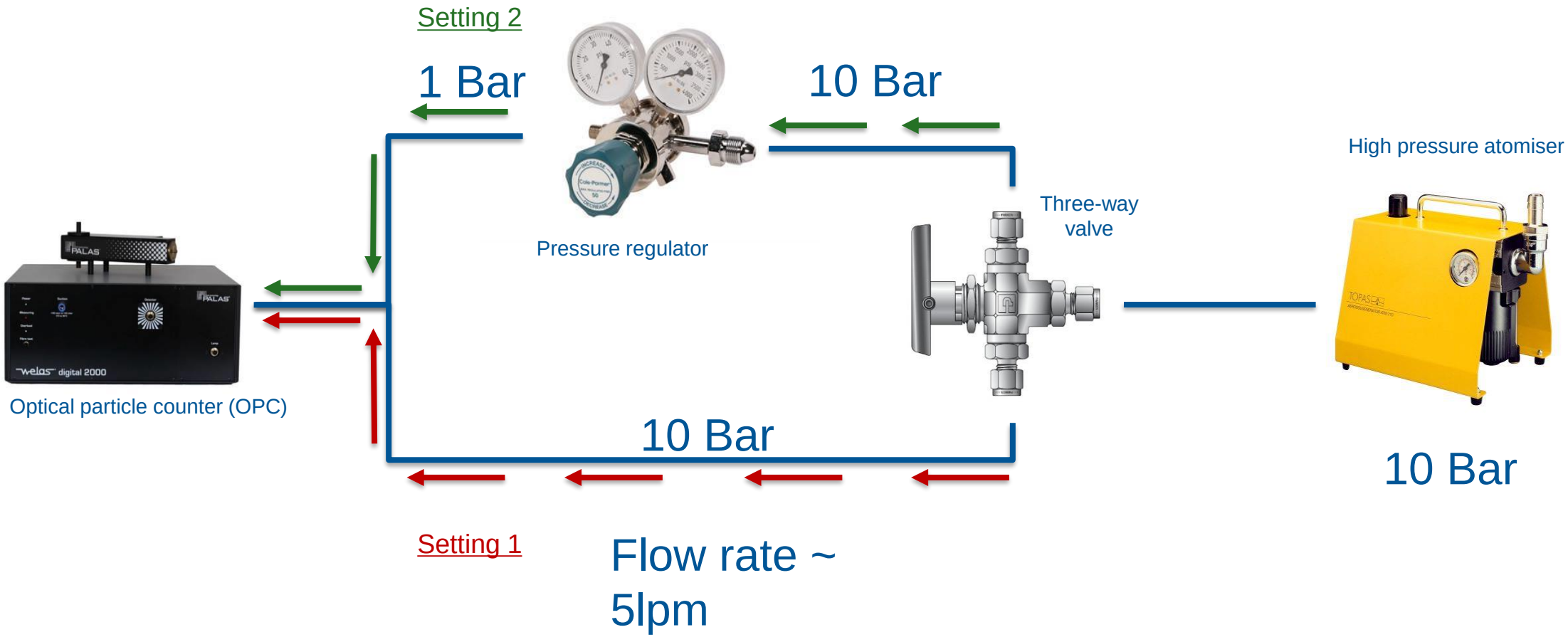

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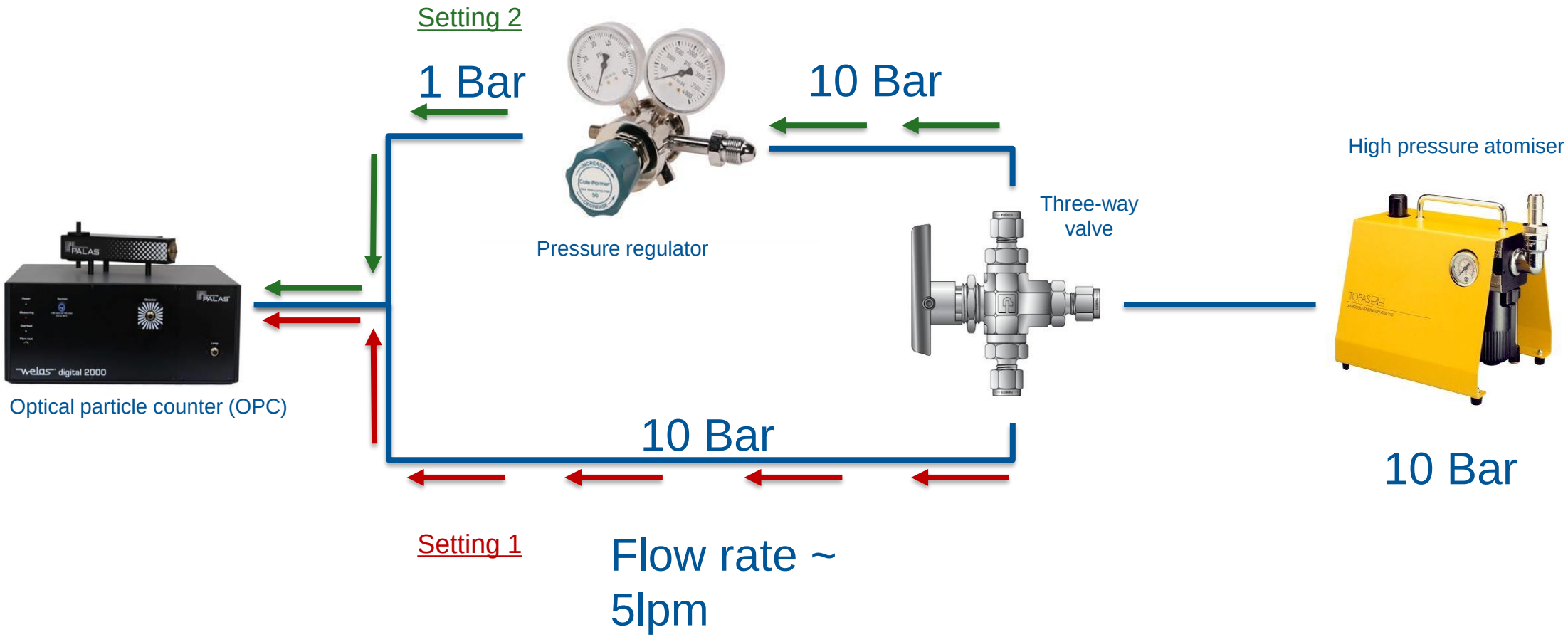

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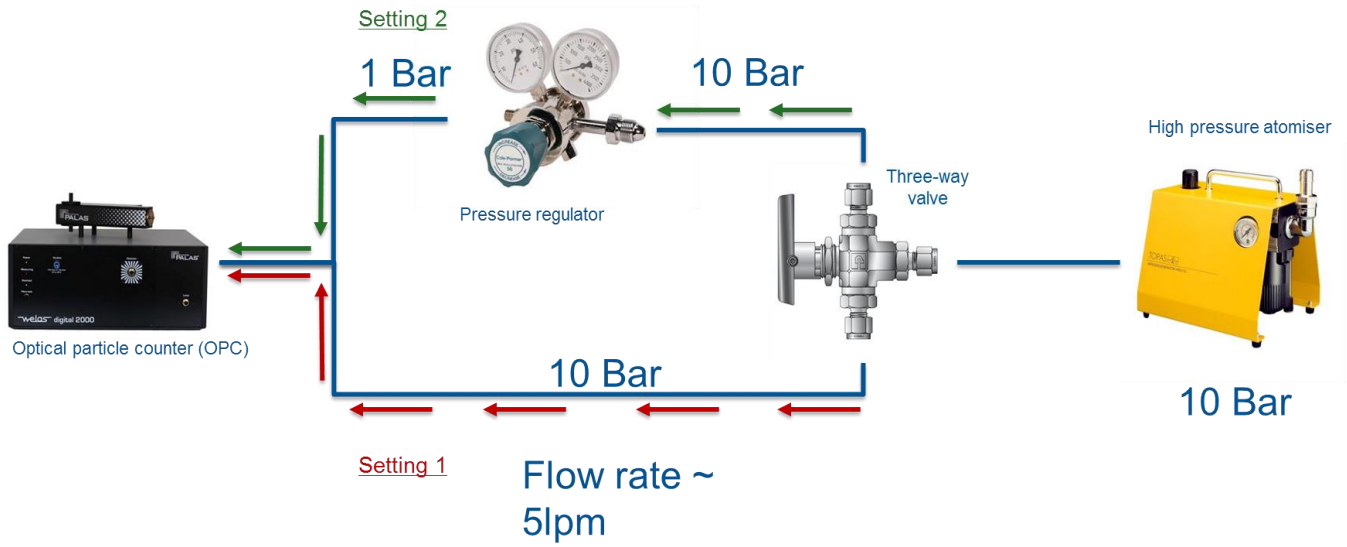
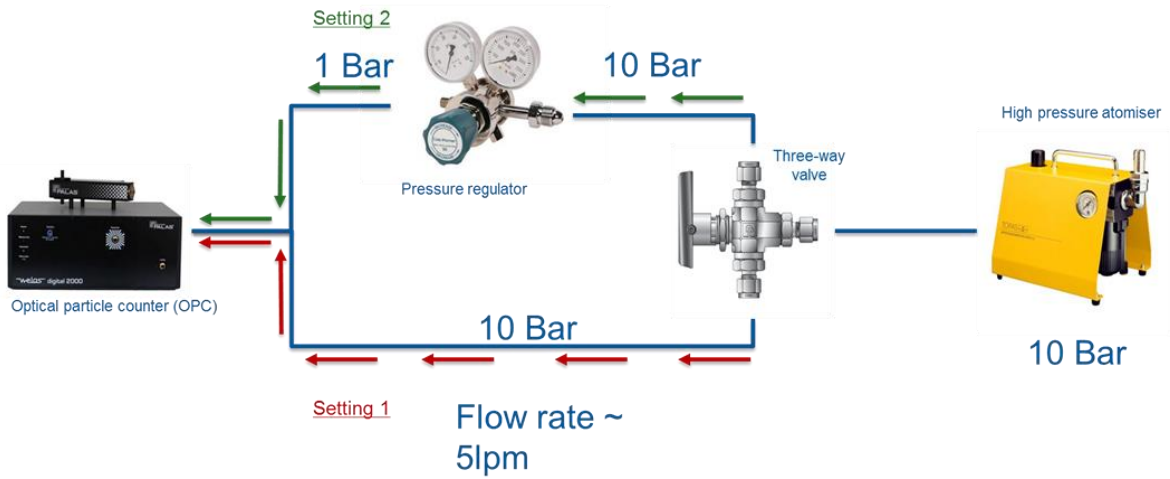


- High pressure atomiser able to aerosolise polystyrene latex (PSL) particles in a flow hydrogen
- Operates at 10 Bar
- OPC able to sample from hydrogen at 10 Bar
- Switching between a free and pressure reduced path
- Difference in particle concentrations between paths gives particle losses in a regulator

Validation of particle sampling using filters



- The results from this laboratory study can then be used to extrapolate the potential particle losses due to pressure regulation at HRS