

## Step by Step description of the experiment

- A flow cell will be heated by heating coils (see Fig. 1), remotely controlled via an Eurotherm EPC3004 controller. Temperatures of up to 600 °C will be reached. H<sub>2</sub>, He and CO<sub>2</sub> as gases will be used.

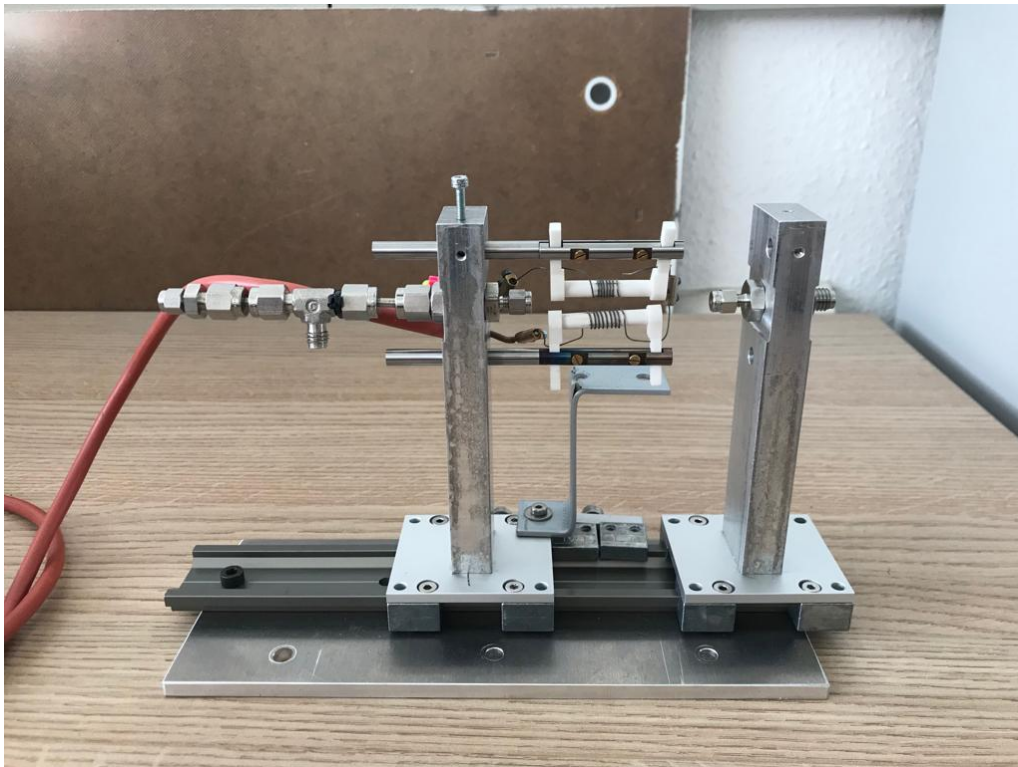


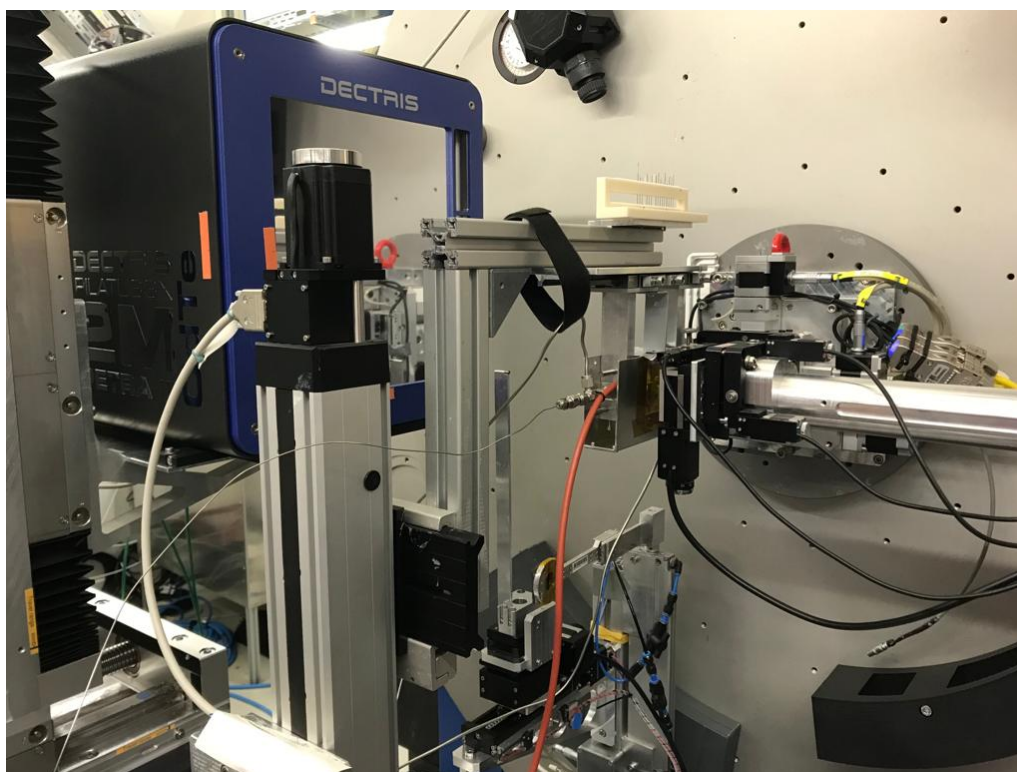
Figure 1: New gas flow cell



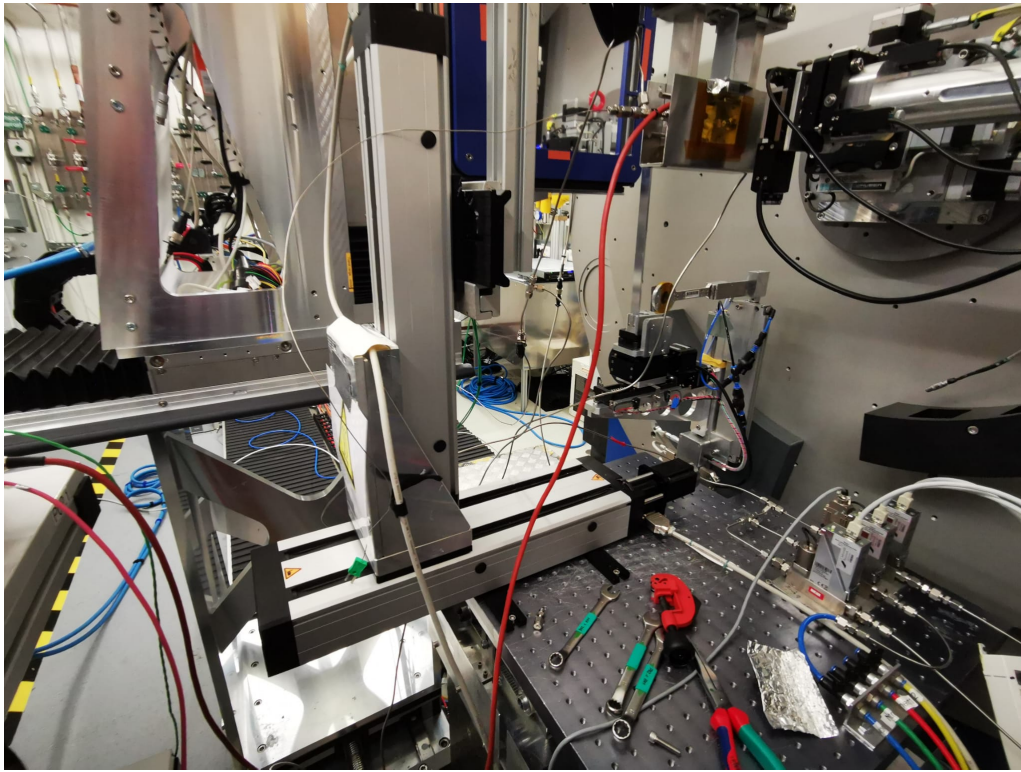
Figure 2: Eurotherme controller

To guarantee gas tightness the following safety concept exists.

- For all gas connections, gas-tight Swagelok and Hy-Lok fittings are used, as well as metal pipes. The dosing system of the gas mixture consists of three Bronkhorst 200-CV-002-RGD-33-V mass flow controller (will probably be replaced by newer models of the same company), which are monitored and controlled via a FLOW BUS system on a PC. A maximum gas flow of 20 mL/min will be used under a pressure of 1 atm. A temperature resistant quartz capillary as a sample container will be used. Capillaries will come prepared with the catalyst held by quartz wool plugs. This capillary is connected with gas-tight Swagelok fittings and graphene ferrules. The whole setup will be screwed on the sample stage.
- The same setup was just used at a beamtime at DESY and can be seen in Figure 3. The flow cell was installed upside down on a X/Y stage, allowing sample exchange to run smooth. A closer look of the X/Y stage can be seen in Figure 4.



*Figure 3: Comparable experimental setup at DESY*



*Figure 4: Close up on the X/Y stage*

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- Prior to the experiment, the flow cell will be purged with helium for approximately 10 minutes. This will be controlled with a gas sensor, gas flow meter and mass spectrometer. When the flow cell is gas tight, dosing with hydrogen can be started and another leak test with H<sub>2</sub> sensor is done. After this, the flow cell will be covered with a heatshield, for stabilizing the temperatures around the sample, while preventing anyone from touching the wire. The exhaust gas will end in an exhaust pipe in safe distance to the heating coils.