



# Multi purpose gas handling for automated in-situ gas adsorption measurements

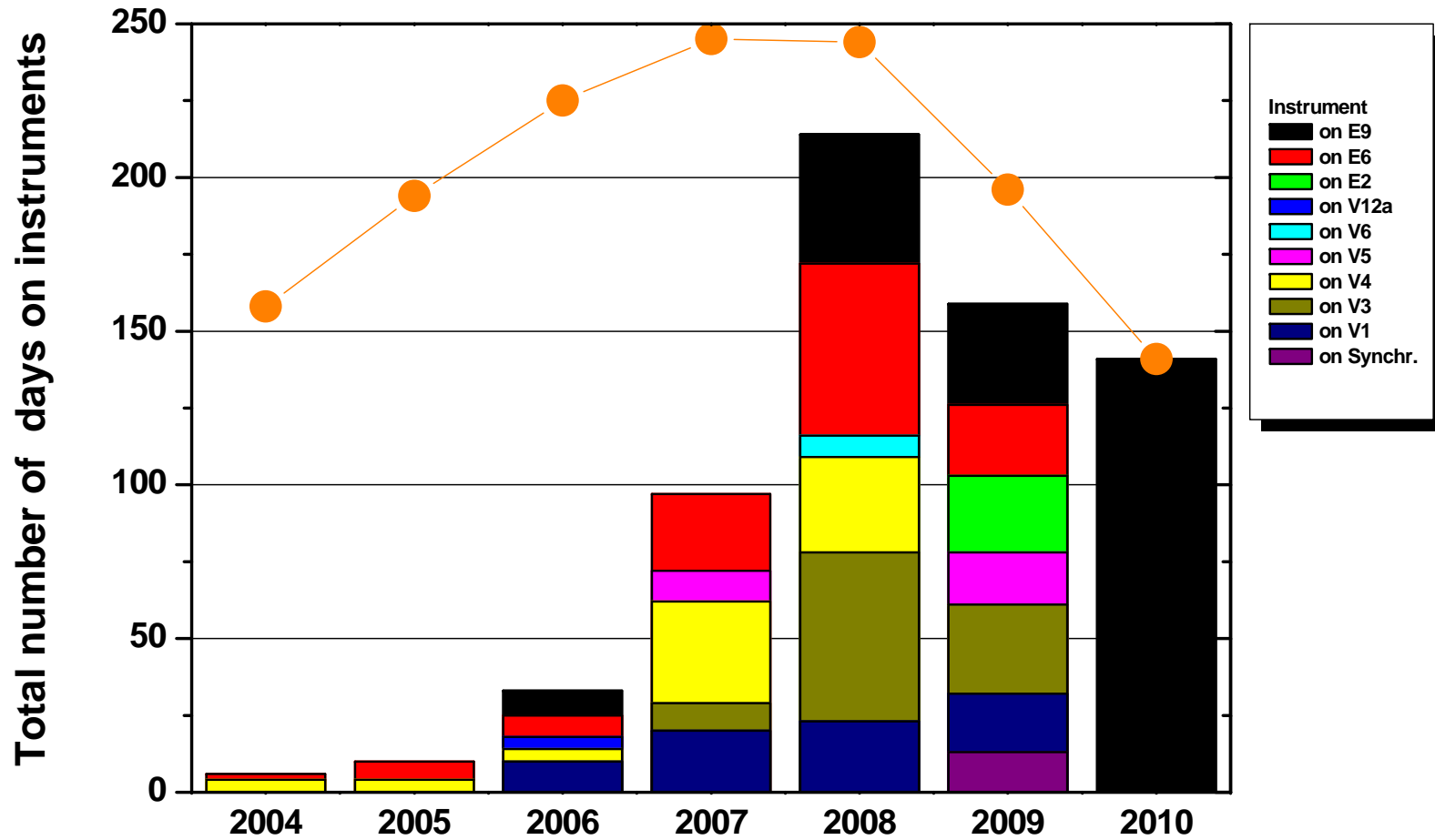
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Helmholtz Zentrum Berlin für Materialien u. Energie

SE-Workshop, München, 1. Oktober 2010

## Gas adsorption equipment at HZB 2005/2006

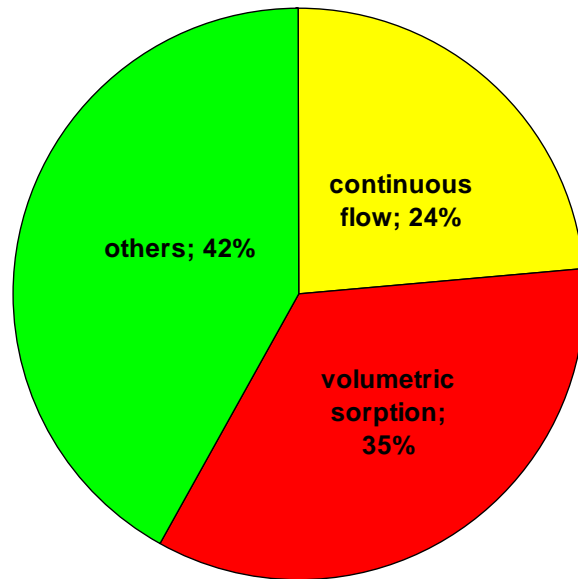


# Statistik of gas adsorption experiments at HZB (2010)

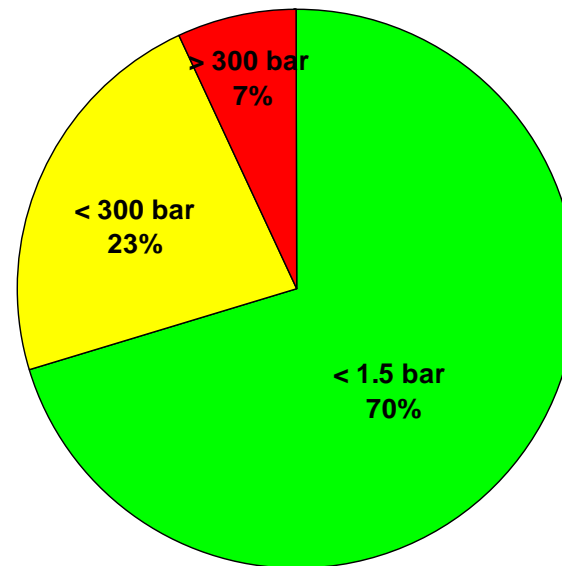


## Statistik of gas adsorption experiments at HZB (2009/2010)

dosing method

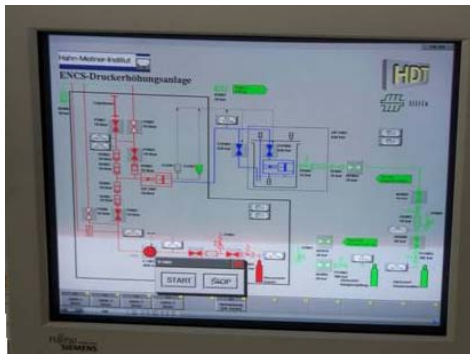
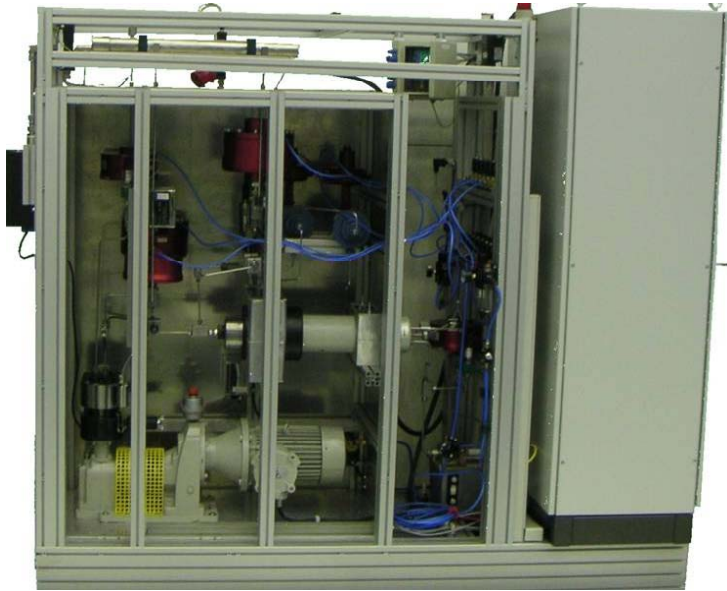


pressure range



**Most experiments below 300bar and from variable type !**

### High pressure systems for inert gas and hydrogen



**10 kbar automated**



**3 kbar semi-automated**



**MOTHES Hochdrucktechnik**

## Continuous Flow System (2008)

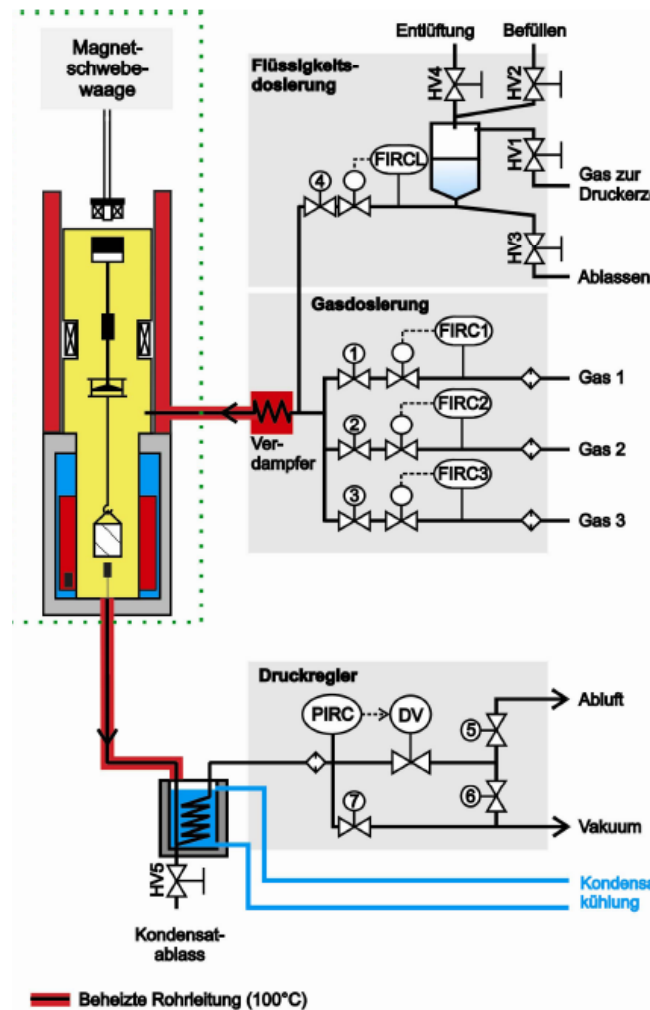


ISOSORP



35 bar automated

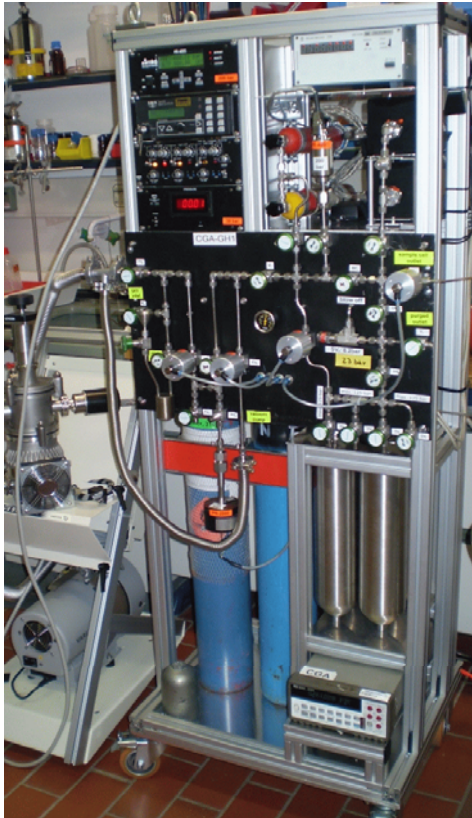
- continuous flow
- evaporator unit
- dynamic mixing
- pressure control



In-situ gravimetric sorption on V1

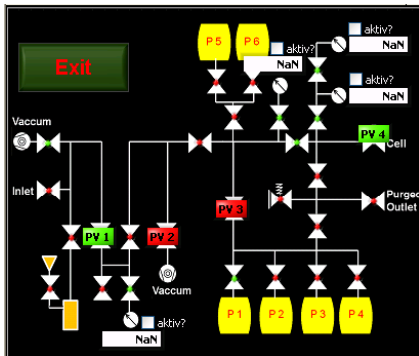
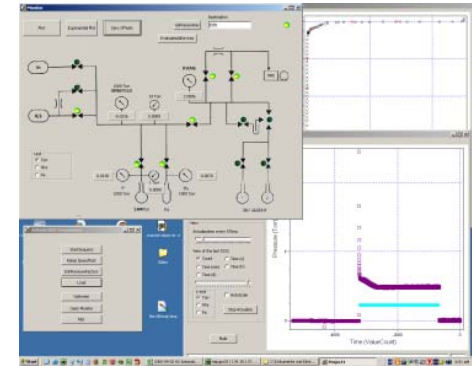


## Medium and Low Pressure Devices



### 70 bar semi-automated

- volumetric method
- gas mixing and storage
- high precision

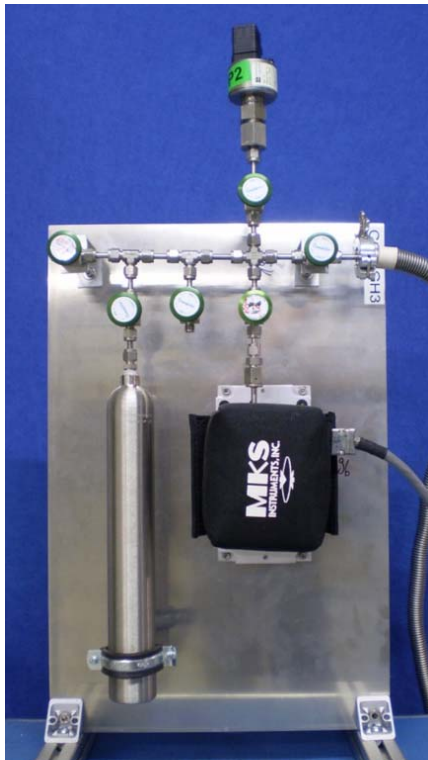


### 1 bar automated

- sorption software
- sample characterization in DEGAS-Laboratory

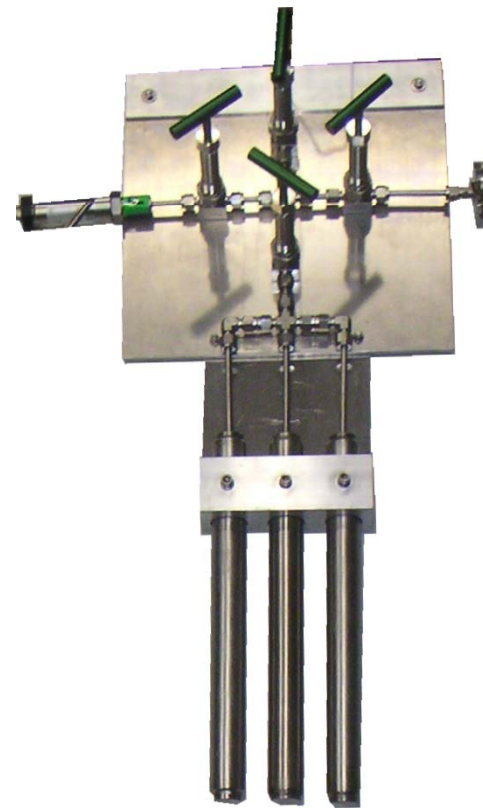


## Medium and Low Pressure Devices II



**70 bar manual**

- 70°C operation for vapours



**300 bar manual**

- volumetric dosing



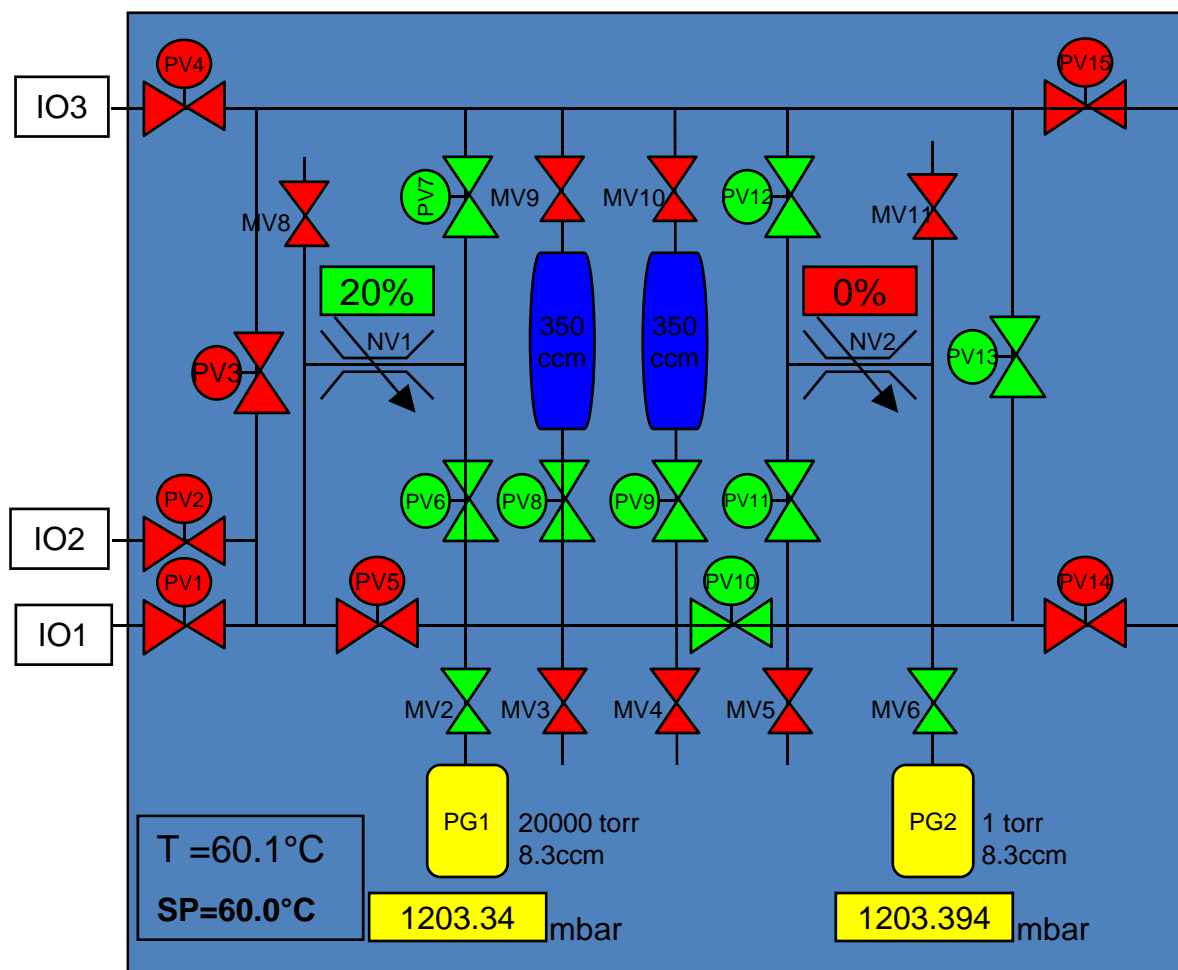
## **Gas handling Systems at HZB Purpose gas handling system:**

- support of volumetric sorption and continuous flow method
- pressures up to 300 bars
- ready for usage with flammable gases and vapours up to 200°C
- gas mixing possibilities
- sample pressure control
- residual gas analysis
- „open“ control software for automated sample loading

**Company or custom made ?**

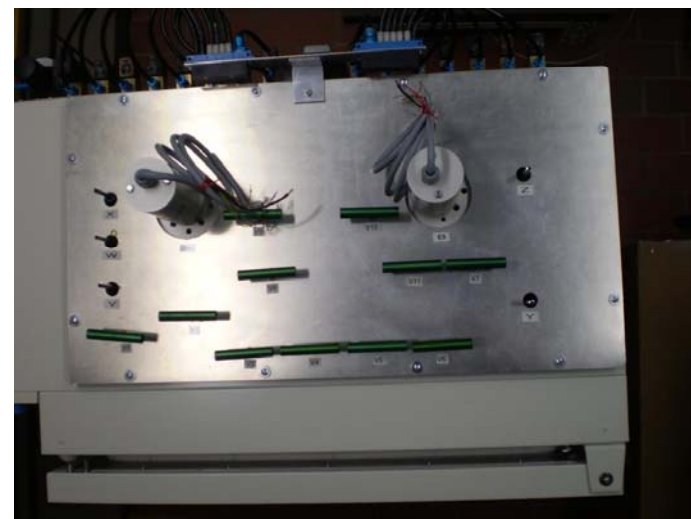
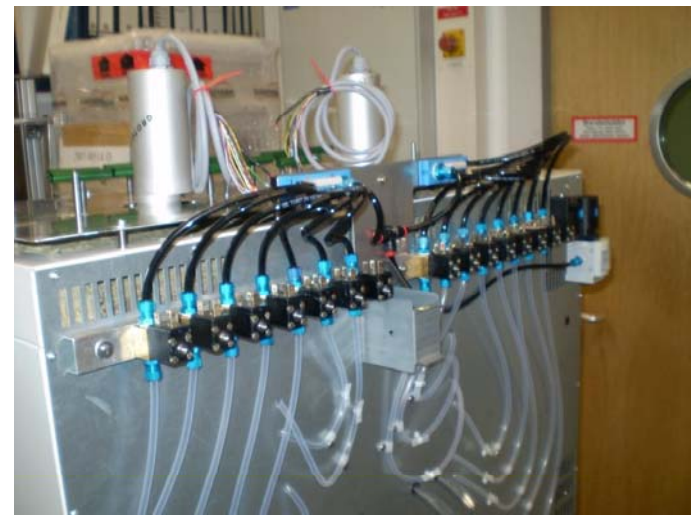
### Multi Purpose Gas Dosing System

Control Panel



- Operating temperature up to 200°C
- Pressure range: 300 bars (high resolution pressure gauges)
- 2 Needle valves for controlled continuous flow option
- Preparation of 2 independent samples
- 8 different volumetric and continuous flow operation modes

## Multi Purpose Gas Dosing System



## Problems:

- temperature dependend calibration of the MKS pressure transducers necessary
- gravimetric induced demixing of gases solved by gas circulator
- felxible dosing software

**Gas circulator option  
(magnetic coupled)**



*(Gardner Denver GK-M 02)*

**System pressure: 150 bar**

**Pressure difference: 75 mbar**

**Gas flow: 2.5 L/min**

**Temperature: ?**

## New flexible Software for automated gas dosing

**Control Unit via Command Manager.vi**

Command manager.v03.vi

**Control Box**

start

Exit

**Value Reading Box**

NV A Temp 0.0 % 21.8 °C -0.36 mbar PG-1

NV B Caress 0.0 % Larstop 0.00 mbar PG-2

**Task Box** current task EndProgram

**History**

[09/30 - 21:53:32] WaitForTimer 400  
[09/30 - 21:53:32] WaitForTimer 300  
[09/30 - 21:53:32] EndMacro <->  
[09/30 - 21:53:32] StartMacro2 ->  
[09/30 - 21:53:35] WaitForTimer 3000  
[09/30 - 21:53:36] WaitForTimer 400  
[09/30 - 21:53:37] WaitForTimer 1500  
[09/30 - 21:53:37] EndMacro <->  
[09/30 - 21:53:37] StartMacro3 ->  
[09/30 - 21:53:37] GetValve 1  
[09/30 - 21:53:38] WaitForTimer 1  
[09/30 - 21:53:39] WaitForTimer 1500  
[09/30 - 21:53:46] WaitForTimer 7000  
[09/30 - 21:53:46] WaitForTimer 2  
[09/30 - 21:53:46] EndMacro <->  
[09/30 - 21:53:46] StartMacro4 ->  
[09/30 - 21:53:46] WaitForTimer 0  
[09/30 - 21:53:47] WaitForTimer 400  
[09/30 - 21:53:47] WaitForTimer 300  
[09/30 - 21:53:47] EndMacro <->  
[09/30 - 21:53:47] StartMacro5 ->  
[09/30 - 21:53:47] GetValve 1  
[09/30 - 21:53:47] WaitForTimer 100  
[09/30 - 21:53:49] WaitForTimer 1500  
[09/30 - 21:54:04] WaitForPressure 1, var3, var1, var8 time is up  
[09/30 - 21:54:04] EndMacro <->  
[09/30 - 21:54:08] WaitForTemp 100, 10, 4500 time is up  
[09/30 - 21:54:08] EndProgram

**config.cfg - Editor**

Datei Bearbeiten Format Ansicht ?

```
GetValve 2
WaitForTimer var2
WaitForTimer 200

macro_evak-v3(0,300)
macro_evak-v3(3000,1500)
macro_evak-v1(1,2,3)
macro_evak-v3(1e-3,300)
macro_fill-v1(100,6000,1200)

WaitForTemp 100,10,4500

EndProgram
```

**error out L1**

status code 0111111111

source VISA Read in Driver Thermo Read SetTemp.vi

**error out L2**

status code 0

source

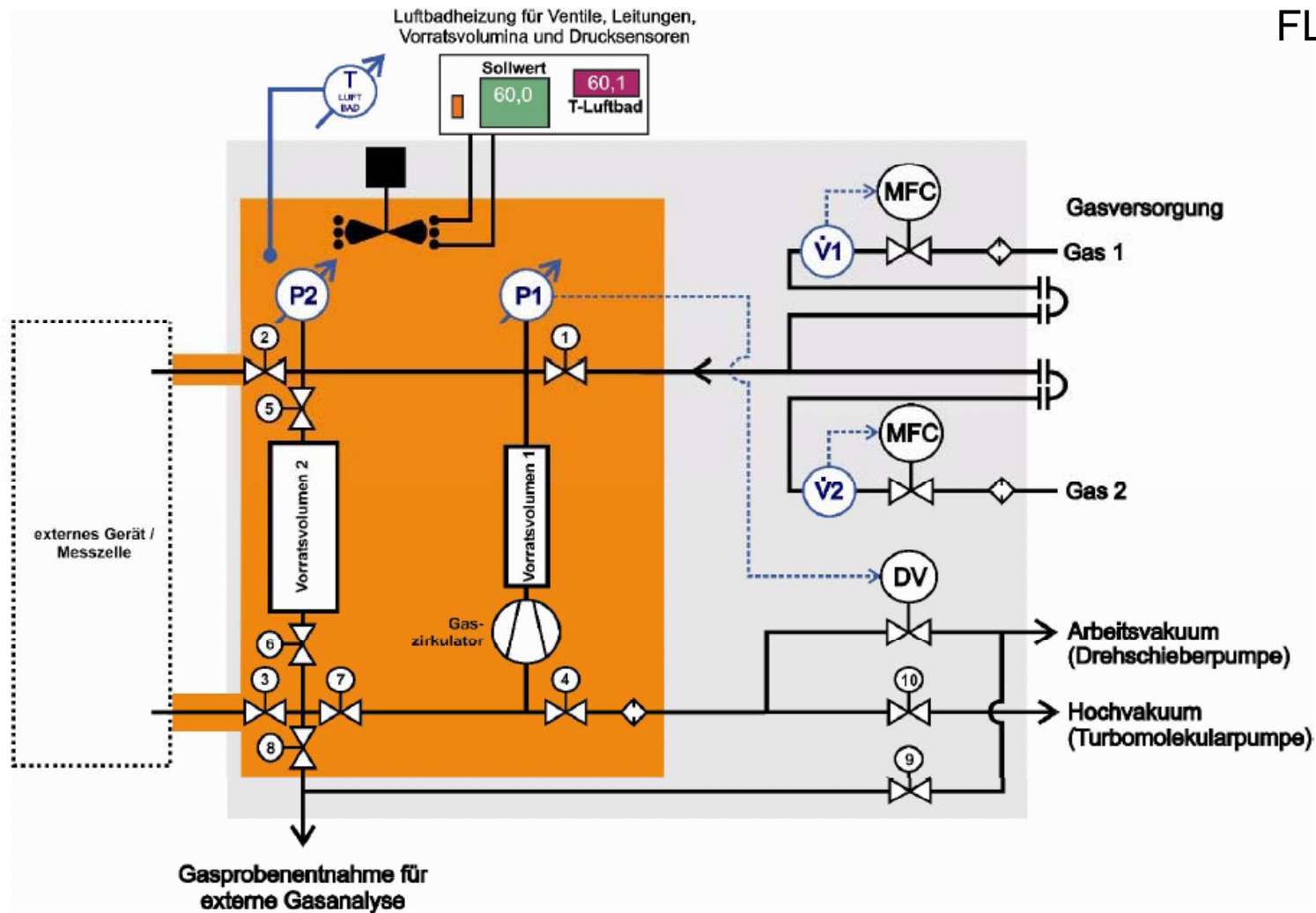
**STOP**



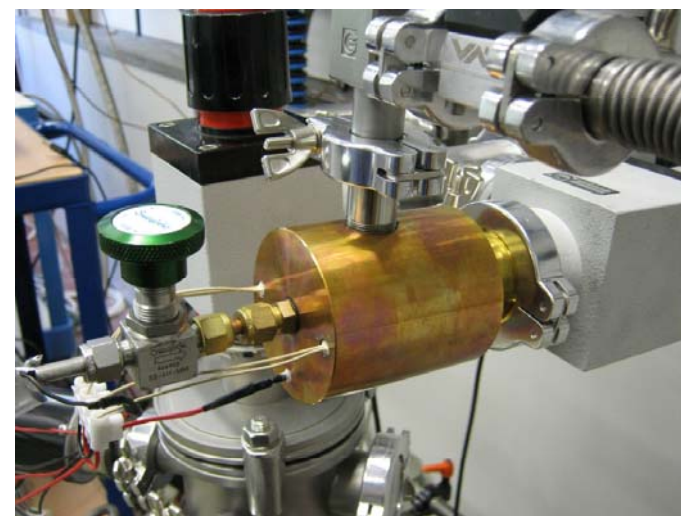
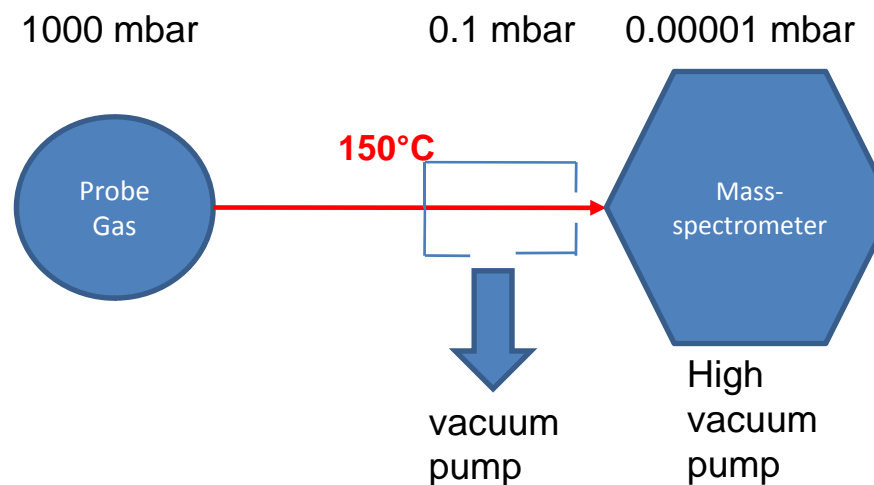
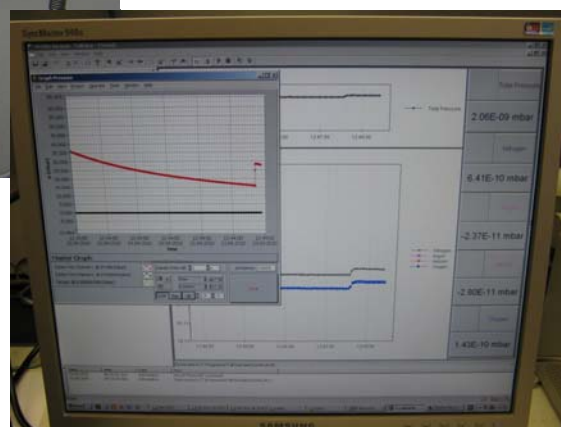
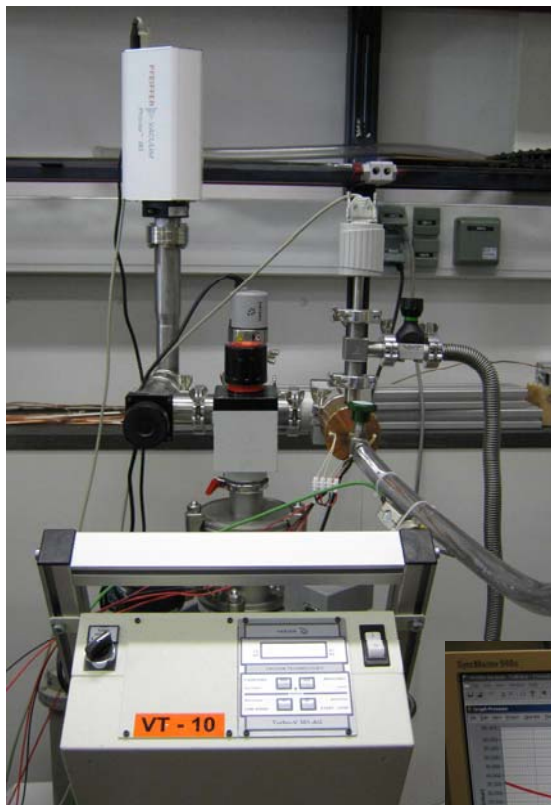
## In the next future at BESSY ?



FLEXIDOSE



## Residual Gas Analysis Station





**THANKS TO**

**Sample Environment Group at HZB**

**Nico Grimm**

**Michael Meissner**

**AND YOU, FOR YOUR ATTENTION**