Technische Universität Berlin

Test Gas Generators

Dr.-Ing. York Neubauer | Institute of Energy Engineering | Berlin 04.04.2014

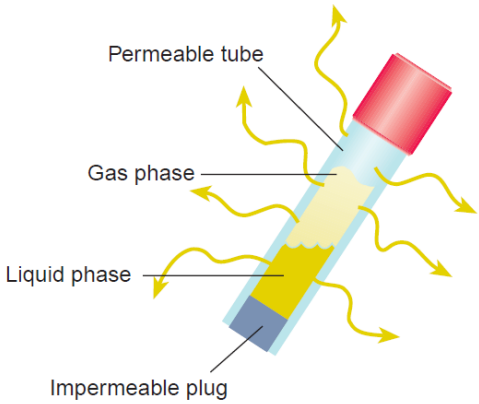
EVUR

test gas generators

A Mobile Mass Spectrometer for Comprehensive On-Line Analysis of Trace and Bulk Components of Complex Gas Mixtures: Parallel Application of the Laser-Based Ionization Methods VUV Single-Photon Ionization, Resonant Multiphoton Ionization, and Laser-Induced Electron Impact Ionization

F. Mühlberger,†,‡ R. Zimmermann,*,†,‡,§ and A. Kettrup†,⊥

Anal. Chem. **2001,** 73, 3590-3604



The Compact Calibration Gas Unit. Quantification and calibration is an important issue for laser-based analytical techniques,because highly nonlinear processes are involved. Moreover, different analytes often have largely different responses.

Similarly to preceding work,[13,16] we use a standard gas containing relevant analytes in parts-per-billion volume quantities for external calibration and quantification. The standard gas is generated after the “defined leak” principle using the permeation tube approach.[48,49]

J. Namieśnik, “Generation of standard gaseous mixtures,” Journal of Chromatography A, vol. 300, pp. 79–108, 1984

CHREV. 171

GENERATION OF STANDARD GASEOUS MIXTURES

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(Received April 7th, 1983)

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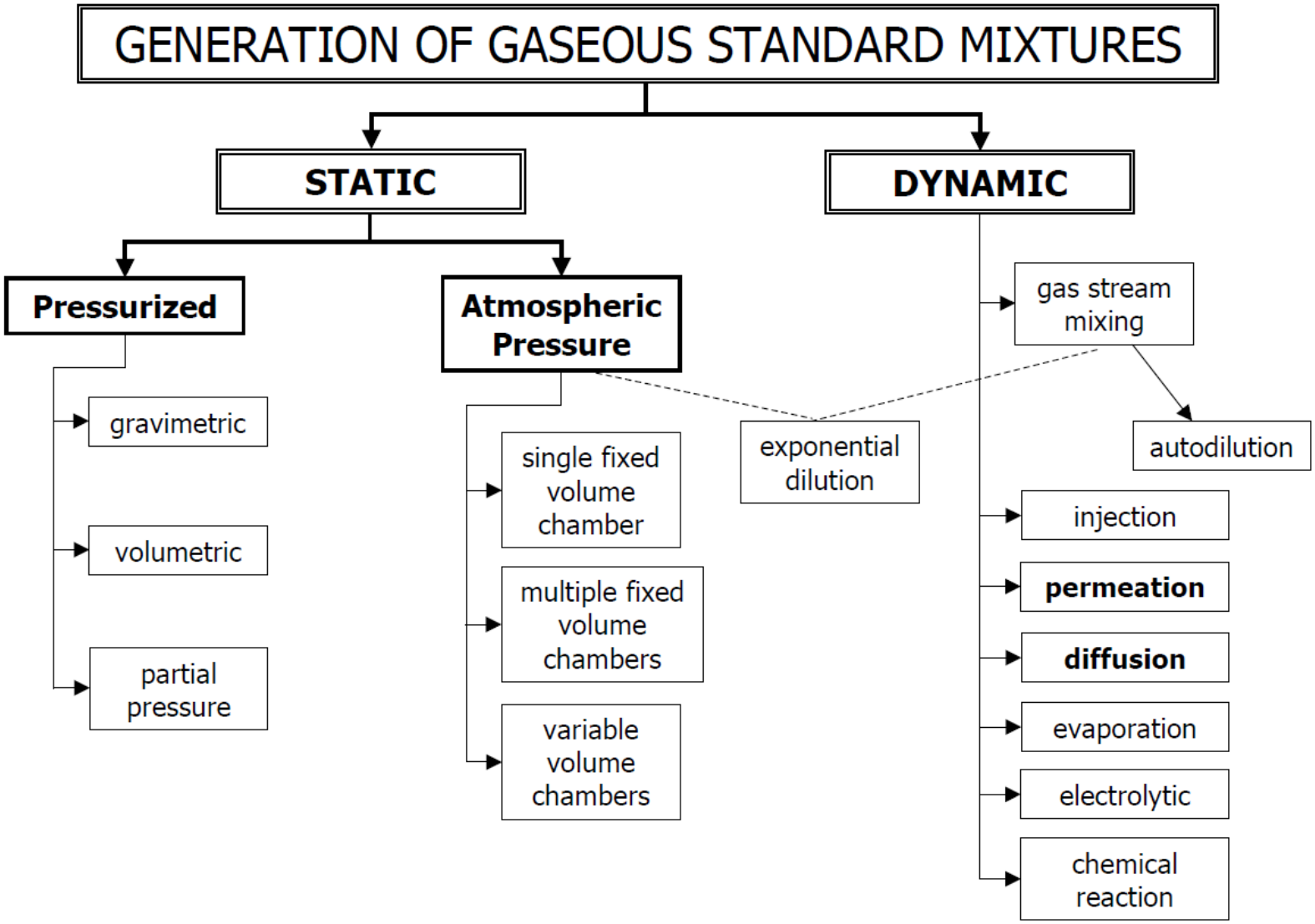
The preparation of proper reference materials used in process of analysis of gaseous samples is a particularly difficult task.


GENERATION OF GASEOUS STANDARD MIXTURES
STATIC
DYNAMIC
Pressurized
Atmospheric Pressure
gravimetric
volumetric
partial pressure
single fixed volume chamber
multiple fixed volume chambers
variable volume chambers
exponential dilution
gas stream mixing
autodilution
injection
permeation
diffusion
evaporation
electrolytic
chemical reaction

Gas Analysis Webinars

test gas generators

March 21st 2014

- *Y. Neubauer, TU Berlin, Germany*
  Brief introduction and scope of this webinar

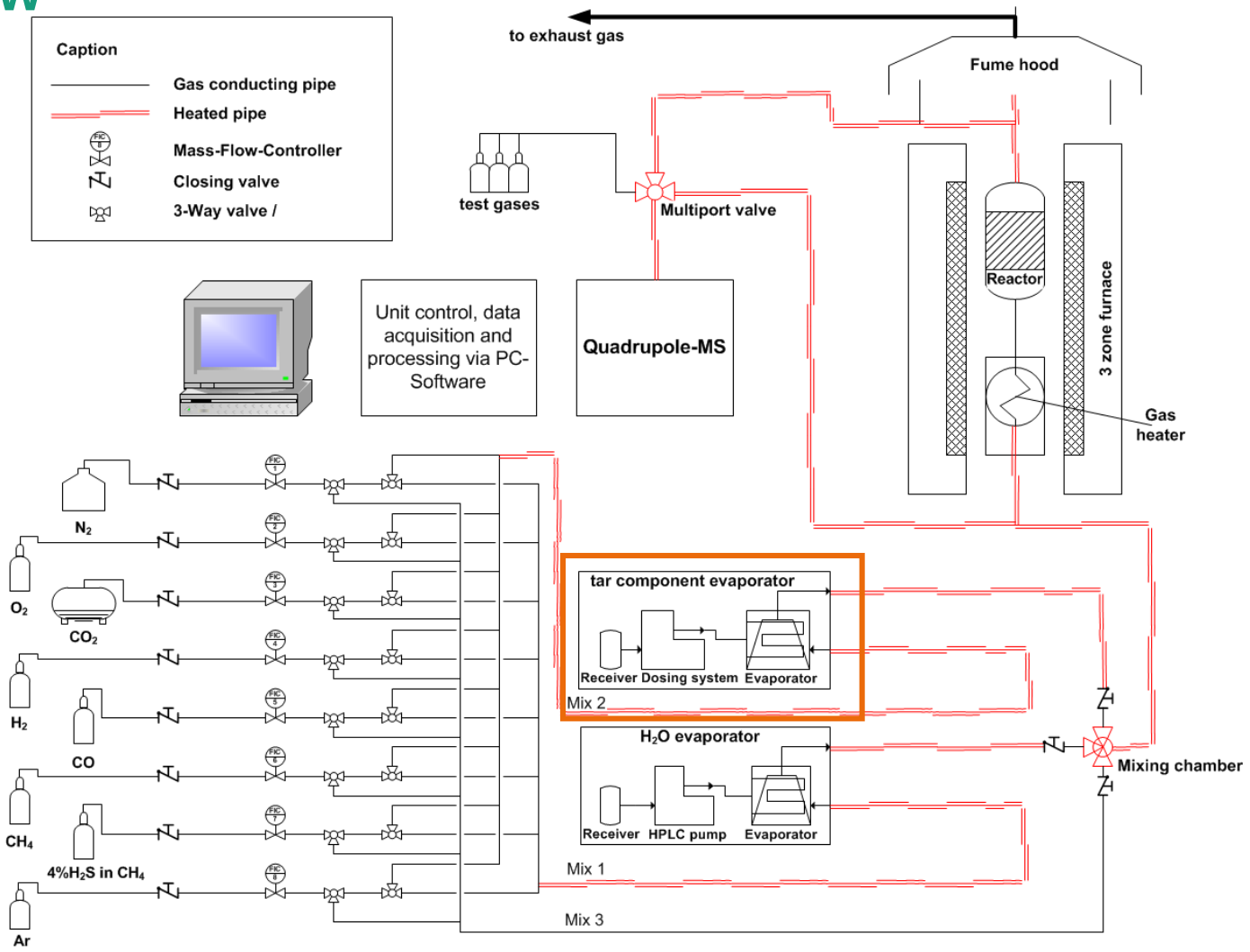
- F. Defoort, cea, Grenoble, France
  Two types of test gas generator systems based on entrainment of saturated gas and on syringe into vacuum vessel

- M. Reinikainen, vtt, Espoo, Finland
  Tar generation by ethene pyrolysis

- C. Hamel, C. Unger, Fraunhofer UMSICHT, Oberhausen, Germany
  Model gas made by Fraunhofer UMSICHT –
  Test gas for catalyst examinations including steam and tar compounds

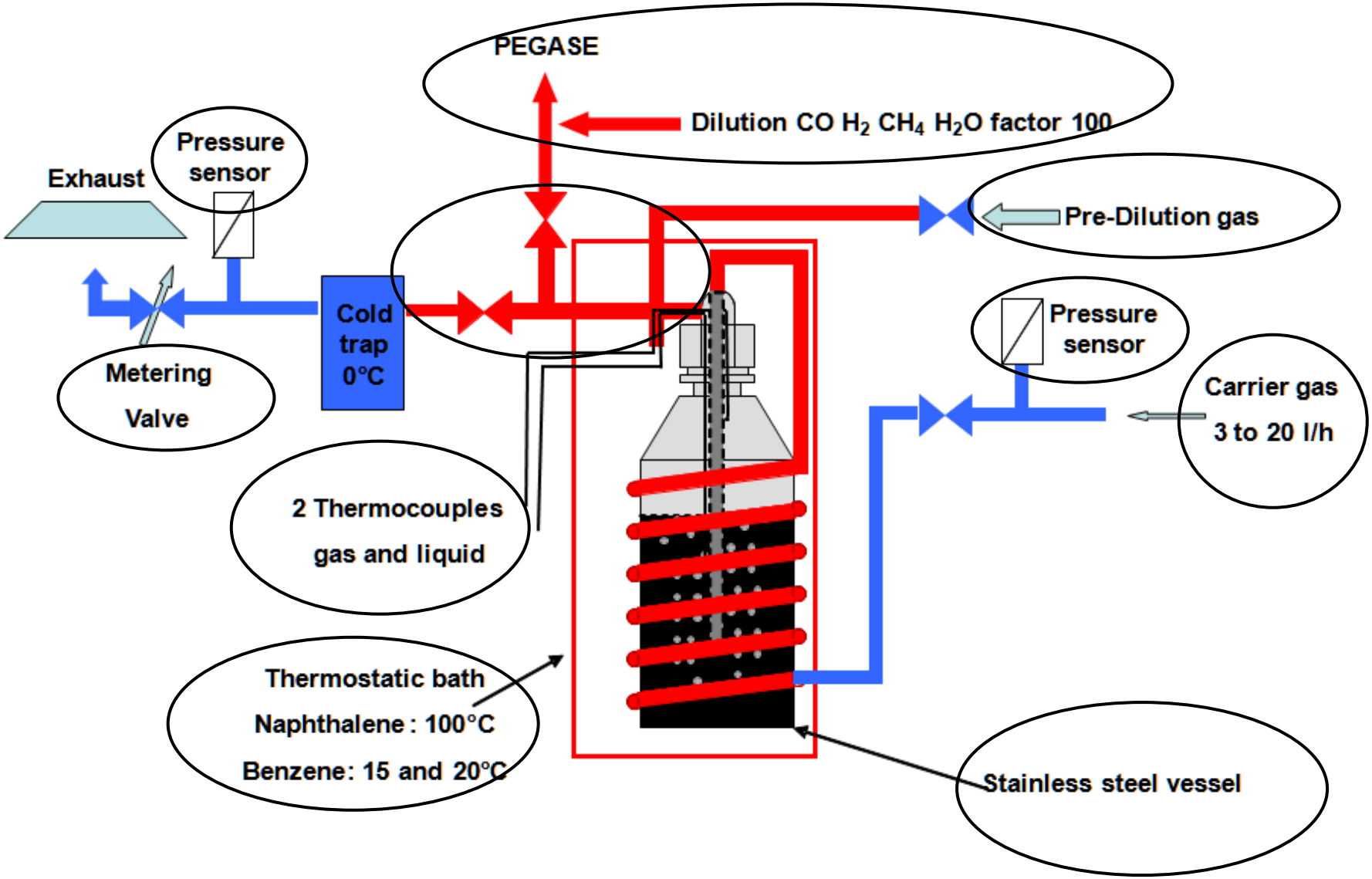
Test system

Overview



Fraunhofer UMSICHT

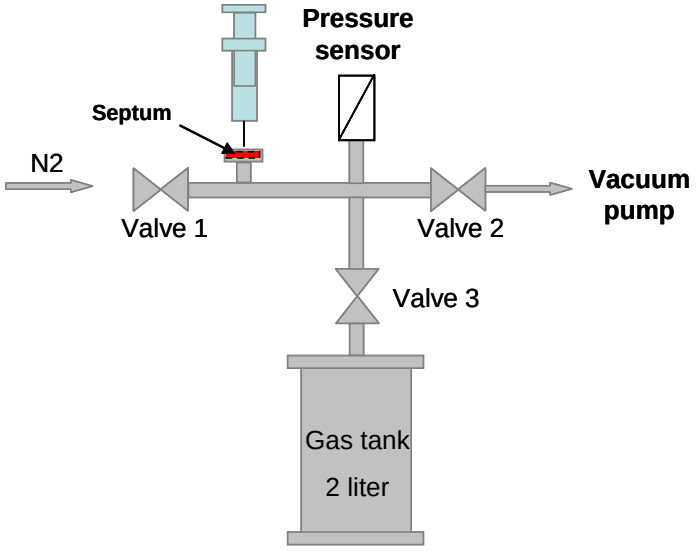
2-System based on entrainment of saturated gas

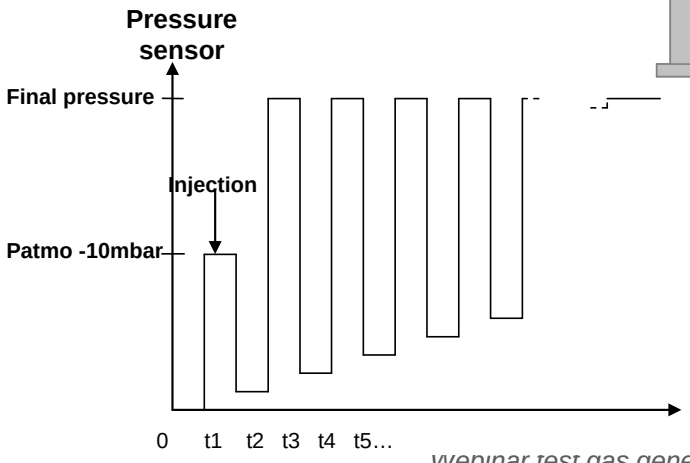


3- System based on syringe into vacuum vessel

- **Need a gas generator**
  - For pure component (gas not polluted by solvent)
  - With about 6 liters of calibrated gas

Filling the Gas Tank





1_ t=0 : V2, V3 open, vacuum is done

2_ t1 : close V2, V3 and open V1 until pressure is slightly below atmospheric pressure.

3_ injection of the liquid by the syringe

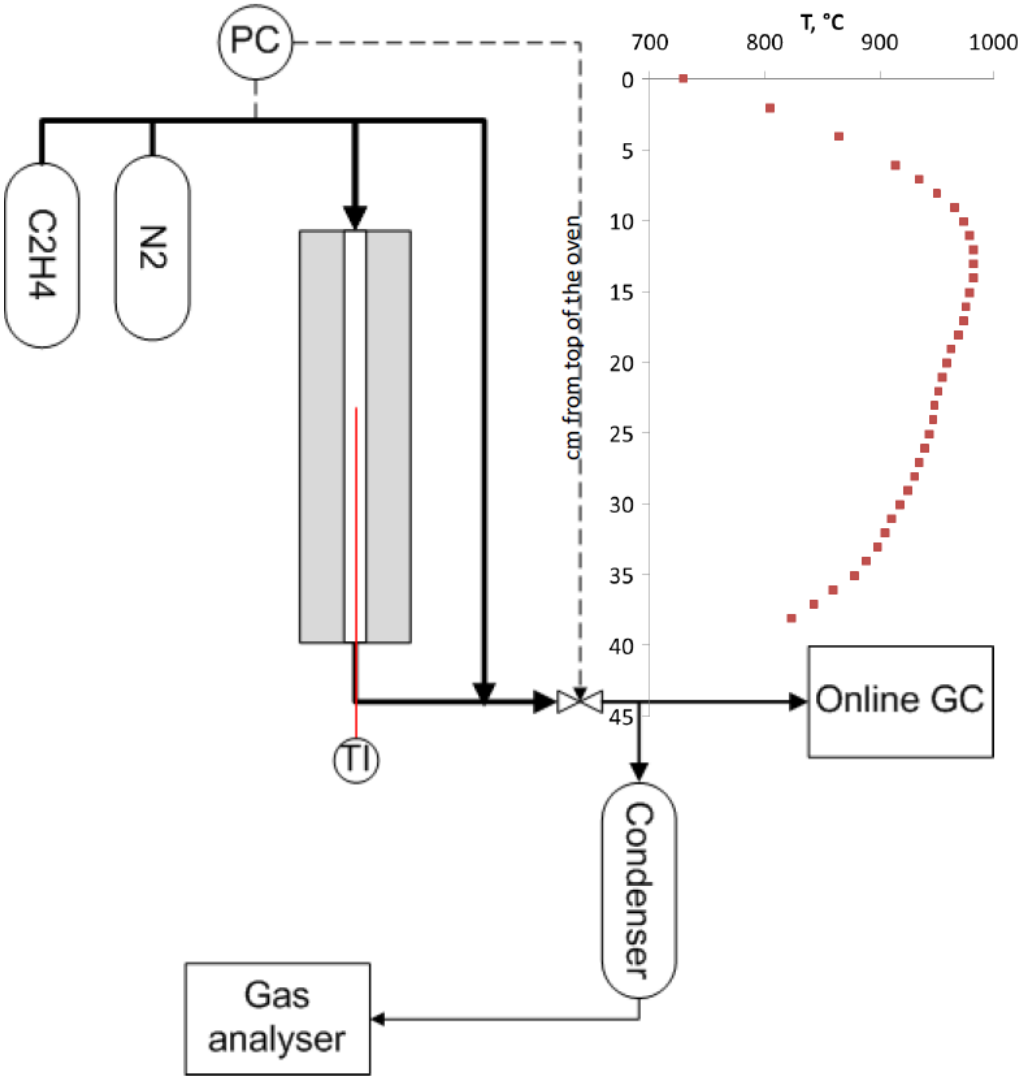
4_ t2 : open V3 and then close

5_ t3 : open V1 for N2 injection to the final pressure and then close V1

6_ t4 : open V3 and then close

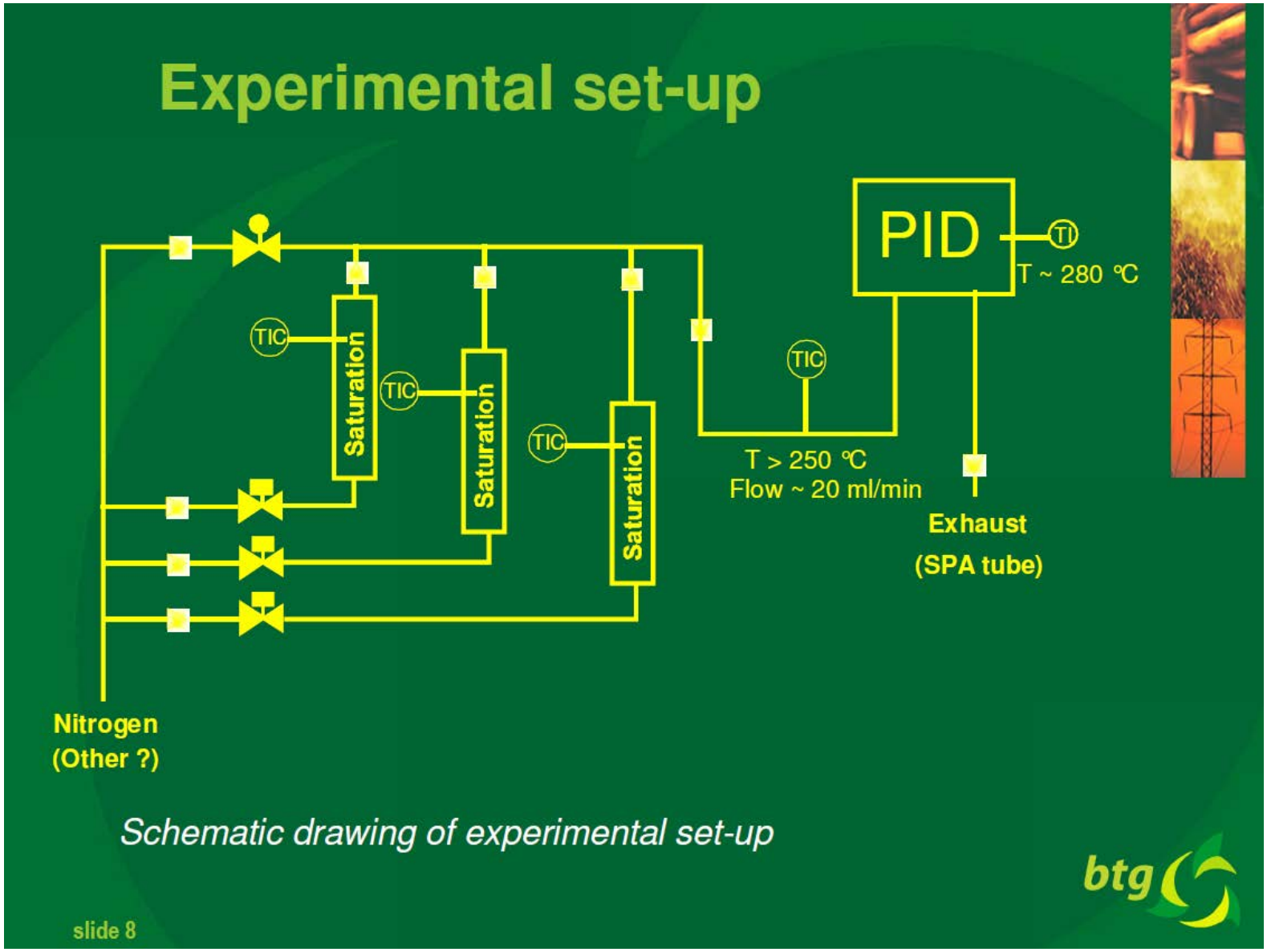
And repeat steps 5 and 6… until you reach the final pressure

Laboratory set-up and conditions



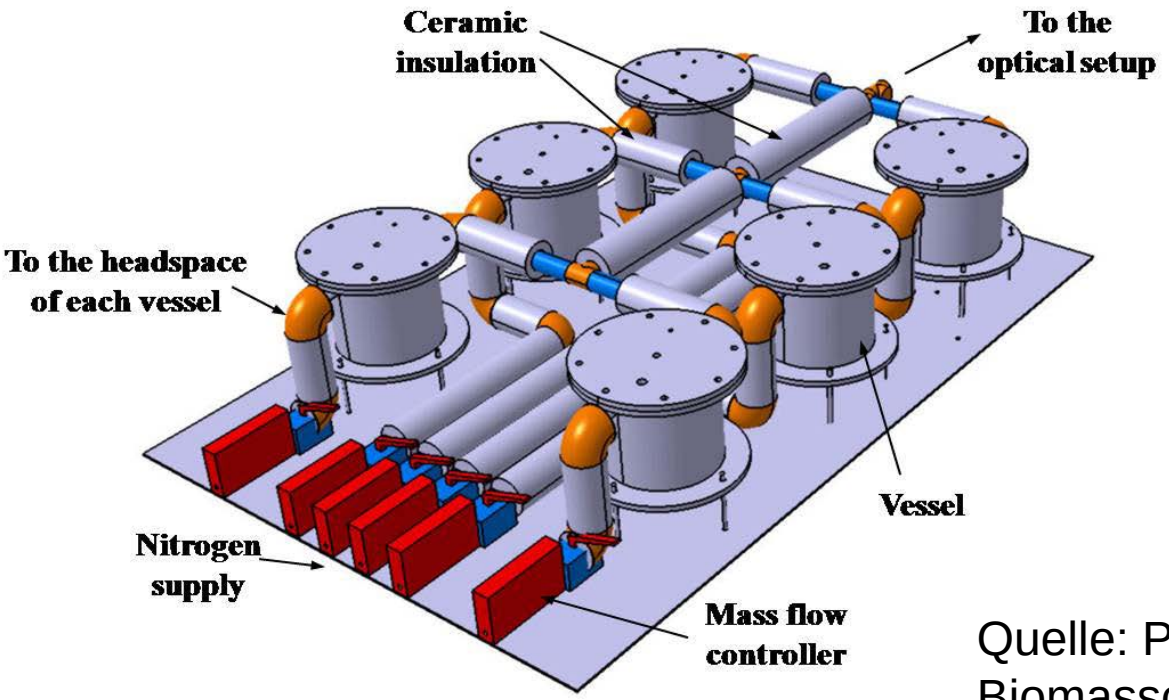
- Feed: 5 vol-% ethene in N2
- Conditions tested
  - Pressure: 1-6 bar(a)
  - Temperature: 800 – 975 °C
  - Residence time: 0.09-3.34 s (calculated for the whole reactor length)

Approaches for PAH ‘evaporators‘ in other working groups



Knoef et al. Tar Analysis Workshop 2012, Berlin

München (Mitsakis)

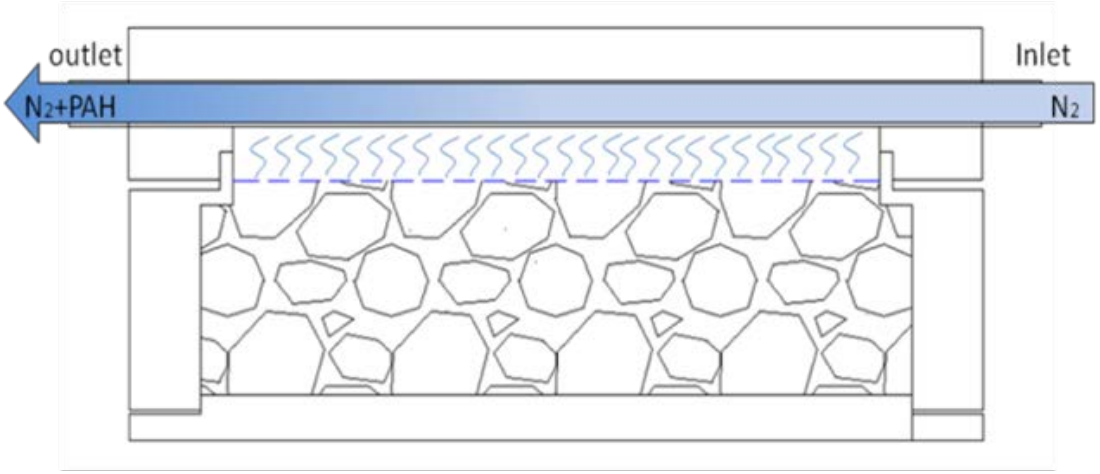


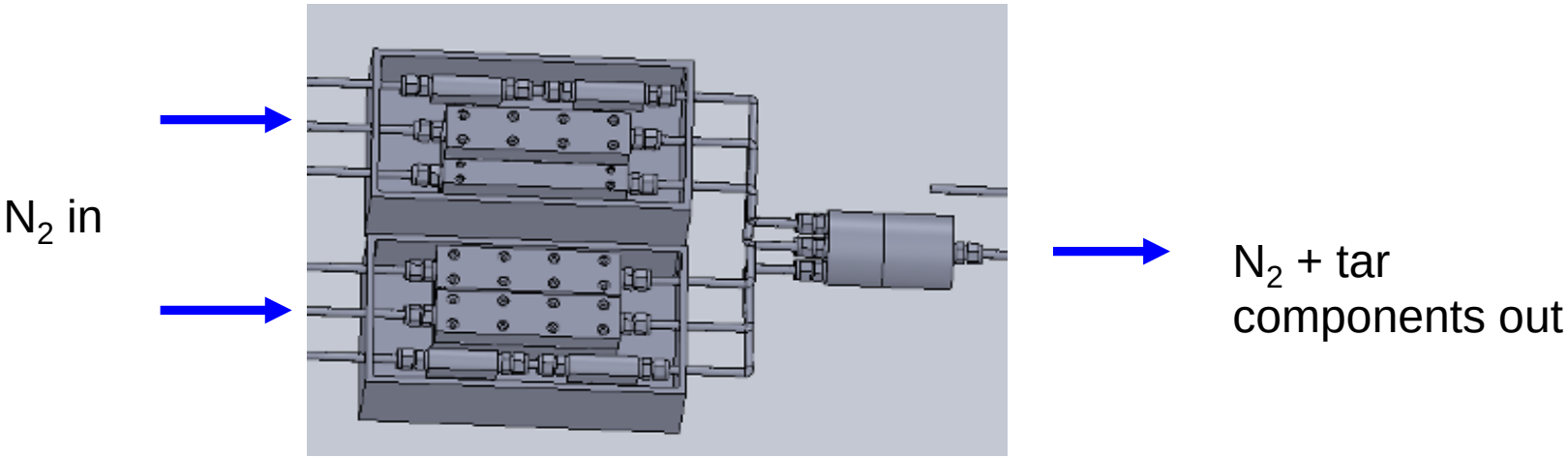
Quelle: Paper 17th Biomassconference 2009, HH

„Tar Mixing Station“

Berechnungsmodell zur Konzentrationsermittlung. Verifiziert mittels Tar Protokoll (PhD Thesis).

Sun et al. TU Berlin

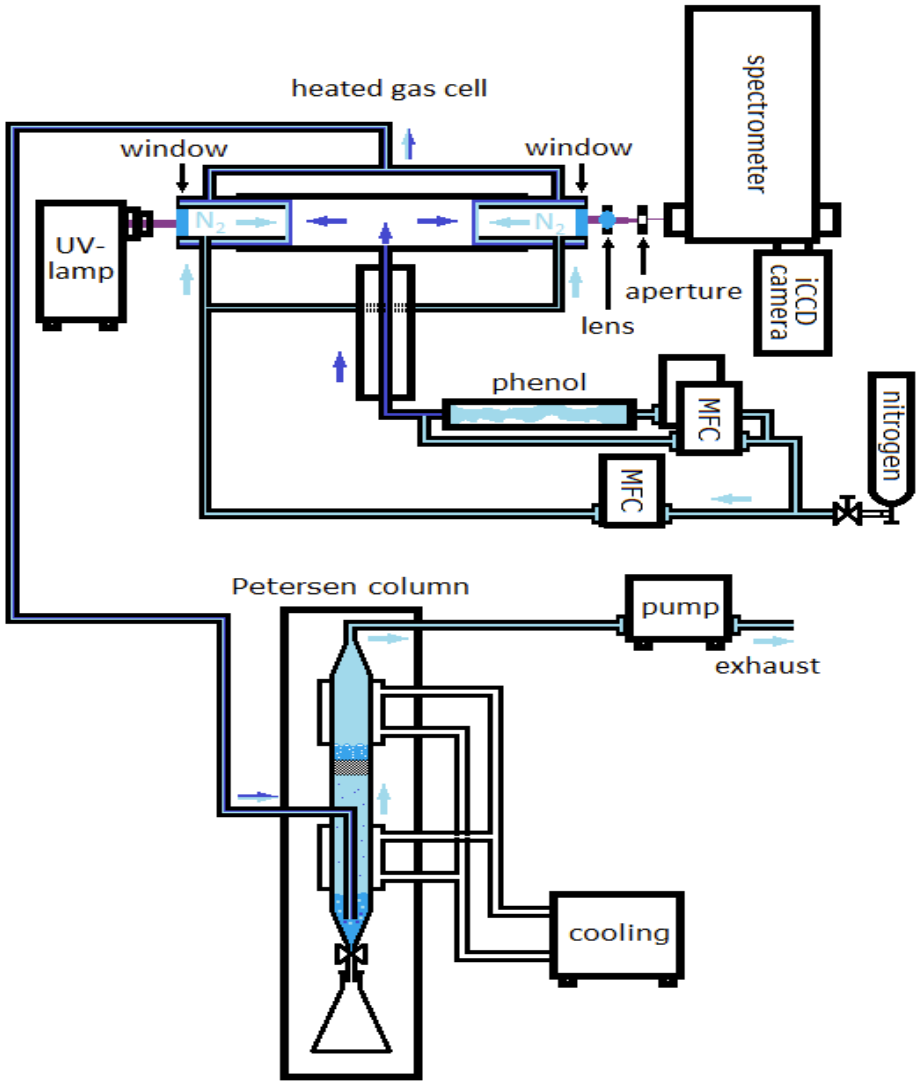




Dänemark (Sárossy)

Konzentrationsermittlung mittels Tar Protokoll (Petersen Column)

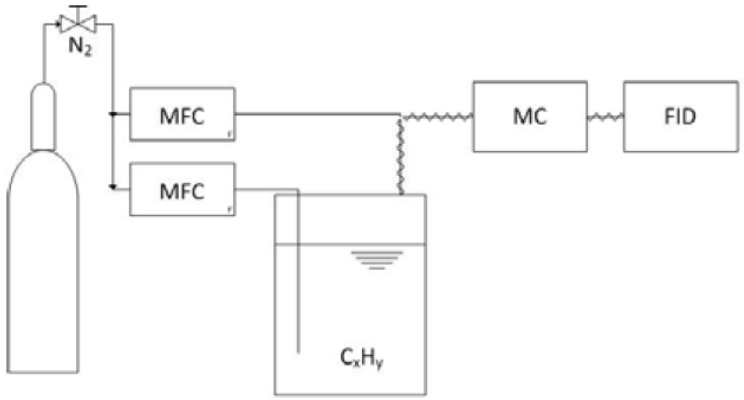
Quelle: Poster Biomassekonferenz 2013



Nürnberg (Roveda)

„Tar Bubbler“
Konzentrationsermittlung mittels FID als Propanäquivalent

Quelle:Paper Patuzzi, Roveda in Fuel 2013



Entwicklung, Validierung und Anwendung eines Verfahrens zur Erzeugung langzeitstabiler VOC-Gasgemische. M. Richter PhD-Thesis 2010