

**VIPRATECH**

**Our Way to an  
Online Laboratory Course in  
Chemical Engineering and Unit Operations**

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# TOC

- 1. VS-C**
- 2. VIPRATECH**
- 3. Remote Control of Experiments**
- 4. Experiences**
- 5. Next Steps**

# VS-C – Network for Chemistry Education

Federal Strategic Project in Germany 1999 – 2004

## Aims

- network of knowledge modules (*Learning Unit*) for undergraduate studies in chemistry
- LU: 45..60 min ; can be combined to a teaching path
- using a web-based interactive teaching platform

## Partners

FIZ Chemie GmbH

- project management
- development of the interactive teaching platform

13 Universities (16 groups)

- creating contents (learning units)
- all chemistry disciplines involved

## Usergroups

- undergraduate students in chemistry
- graduate students

## Statistic

- 13841 web pages
- 1327 LUs
- 3171 animations
- ....

# Technical Chemistry

laboratory course

seminars

lectures

VIPRATECH

**Idea:** online laboratory course in chemical engineering and unit operations  
**Aim:** improve - evaluation of data  
improve - experiment manual  
support - carrying out a real experiment

## web-based material - Experiment LUs

### web-based manuals

- hardware description
- experimental objectives
- theoretical backgrounds
- offline experiments
- online experiment
- evaluation of data
- interactive simulation
- self control

### remote control experiments

**Observe and control an experiment by using a standard web-browser**

#### Advantages

- Sharing expensive lab resources
- Bringing lab experiments into the lecture hall
- Enabling more flexible timetabling of labs
- Sharing resources

# Experiment LU



Introduction

Experiment Objectives

Equipment

Procedure / Offline Exp.

Online Experiment

Evaluation / Discussion

Simulation

Self-controlling

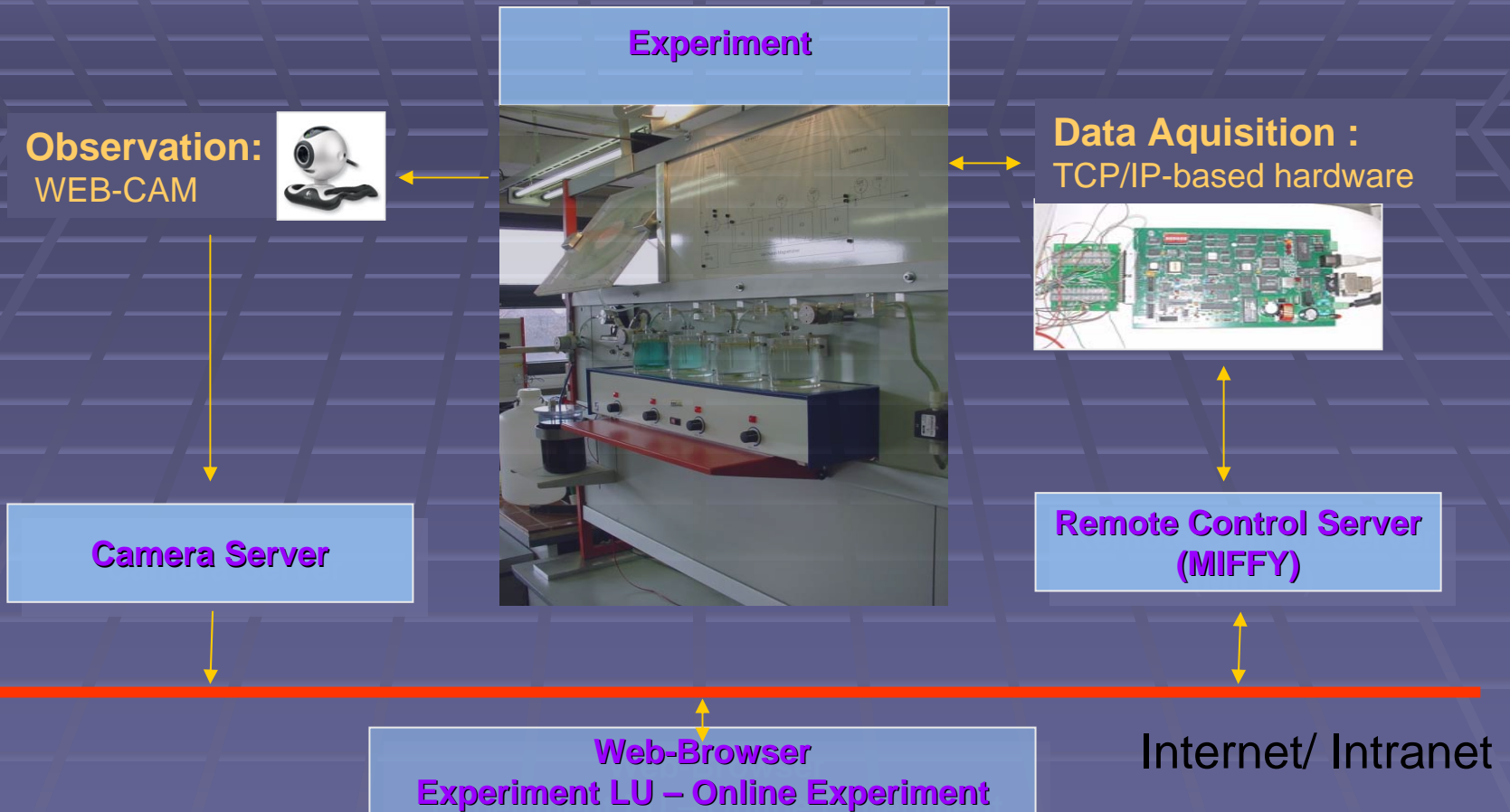
The screenshot shows a web browser window with the address [https://vscms.vernetztes-studium.de/vsengine/vlu/vsc/en/ch/7/vwz/praktikum/vwz\\_engl.vlu/Page/vsc/en/ch/7/vwz/praktikum/apparatur/apparatur.vscml.html](https://vscms.vernetztes-studium.de/vsengine/vlu/vsc/en/ch/7/vwz/praktikum/vwz_engl.vlu/Page/vsc/en/ch/7/vwz/praktikum/apparatur/apparatur.vscml.html). The page content includes a navigation menu on the left with options like 'Übersicht', 'Introduction', 'Ideal Reactors', 'Non-ideal Reactors', 'Residence Time Distribution', 'Task', 'Equipment', 'Experimental Realization', 'Online-Experiment', 'Analysis', and 'Simulation'. The main content area is titled 'Equipment' and contains the following text: 'Residence time apparatus: A continuous volume flow will be generated by a conveyor pump. A salt solution pulse will be added, its dispersal in the system will be observed using conductivity. The 3/2-way valve at the entrance makes it possible to switch between the cascade of continuously stirred tank reactors and the flow reactor. The equipment details are to be taken from the diagram below.' Below the text is a schematic diagram labeled 'Abb. 1' showing a flow system with 'Water', 'Salt Solution', 'Four Point Magnetic Stirrer', 'Camera 1', 'Camera 2', 'Computer', and 'Electronics'. A legend at the bottom of the diagram lists components: 'Flow Reactor', 'Cascade of Continuously Stirred Tank Reactors', 'Conveyor Pump', '3/2-Way Valve for Shifting between Water Tap and Saline Impulse', '3/2-Way Valve for Shifting between Cascade/Flow Reactor (Entrance)', '3/2-Way Valve for Shifting between Cascade/Flow Reactor (Exit)', 'Conductivity Sensors for the Cascade', 'Conductivity Sensors for Cascade and Flow Reactors (Exit)', and 'Volume Flow Sensor'. The browser interface also shows a search bar, navigation buttons, and a taskbar at the bottom with an Internet icon.

Online Experiment :

3 web pages::

user management; scheduling; remote access

# Remote Control - Single Experiment



- access to distant laboratory equipment (experiment) by VSC Experiment LU
- **Java-Client to control the experiment:**
- Java Bean Library to create Java Clients
- realized: simple scheduling, user management



# Online Experiment

## USERDATENBANK

Angemeldet als ralf fuer folgende Versuche :  
 VWZ-DEMO = super assistant  
 RES1 = administrator  
 TEST = administrator  
 VWZ = administrator  
 WT = super assistant

## Usermanagement

LOGOUT

Sortieren nach:  Datensatz einfuegen markierte Daten loeschen markierte Daten aendern

username	firstname	familyname	email	group	
<input type="checkbox"/>	alexander	Alexander	Moros	moros@chemie.uni-leipzig.de	Technical Chemistry
<input type="checkbox"/>	brian	Brian	Rous	brian@caret.cam.ac.uk	Caret
<input type="checkbox"/>	demo	DEMO User VWZ-passiv	-	moros@chemie.uni-leipzig.de	Technical Chemistry
<input type="checkbox"/>	demowwz	DEMO User VWZ	-	moros@chemie.uni-leipzig.de	Technical Chemistry
<input type="checkbox"/>	frank	Frank	Luft	luft@chemie.uni-leipzig.de	Technical Chemistry
<input type="checkbox"/>	hendrik	Hendrik	Dathe	dathe@organik.chemie.uni-leipzig.de	Technical Chemistry
<input type="checkbox"/>	jane	Jane	Moros	jmoros@rz.uni-leipzig.de	Technical Chemistry
<input type="checkbox"/>	madhavi	Madhavi	Thottempudi	madhavi@caret.cam.ac.uk	Caret
<input type="checkbox"/>	marc	Marc	Liebscher	marc.liebscher@epost.de	Technical Chemistry
<input type="checkbox"/>	ralf	Ralf	Moros	moros@organik.chemie.uni-leipzig.de	Technical Chemistry
<input type="checkbox"/>	rico	Rico	Rockmann	moros@chemie.uni-leipzig.de	Technical Chemistry
<input type="checkbox"/>	warwick	Warwick	Bailey	warwick@caret.cam.ac.uk	Caret

Anzahl der Datensätze: 12

Username: ralf Versuch:WT

LOGOUT  
 Monat:

## Scheduling

1-2 3-9 10-16 17-23 24-30 31-31

	Montag 24.3.2003	Dienstag 25.3.2003	Mittwoch 26.3.2003	Donnerstag 27.3.2003	Freitag 28.3.2003	Sonnabend 29.3.2003	Sonntag 30.3.2003
00:00 - 00:30	Frei	Frei	Frei	Frei	Frei	Frei	Frei
00:30 - 01:00	Frei	Frei	Frei	Frei	Frei	Frei	Frei
01:00 - 01:30	Frei	Frei	Frei	Frei	Frei	Frei	Frei
01:30 - 02:00	Frei	Frei	Frei	Frei	Frei	Frei	Frei
02:00 - 02:30	Frei	Frei	Frei	Frei	Frei	Frei	Frei
02:30 - 03:00	Frei	Frei	Frei	Frei	Frei	Frei	Frei
03:00 - 03:30	Frei	Frei	Frei	Frei	Frei	Frei	Frei
03:30 - 04:00	Frei	Frei	Frei	Frei	Frei	Frei	Frei
04:00 - 04:30	Frei	Frei	Frei	Frei	Frei	Frei	Frei
04:30 - 05:00	Frei	Frei	Frei	Frei	Frei	Frei	Frei

## Remote access

# Lab Provider - Leipzig – 6 Online Exp.

## Residence Time Distribution



2001

## E-House Demonstration



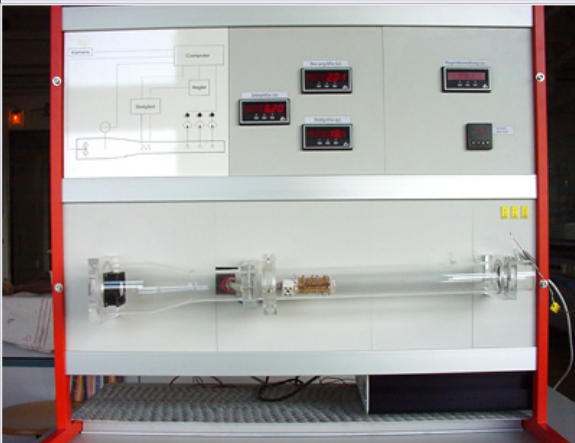
2002

## Heat Transfer



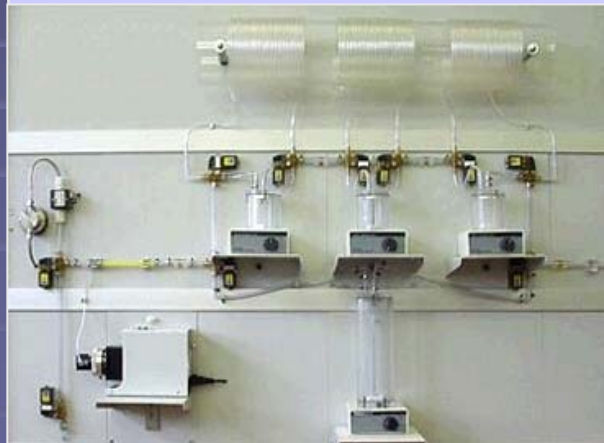
2003

## Temperature Control Experiment



2004

## Saponification of an Ester



2005

## Dehydration



2005



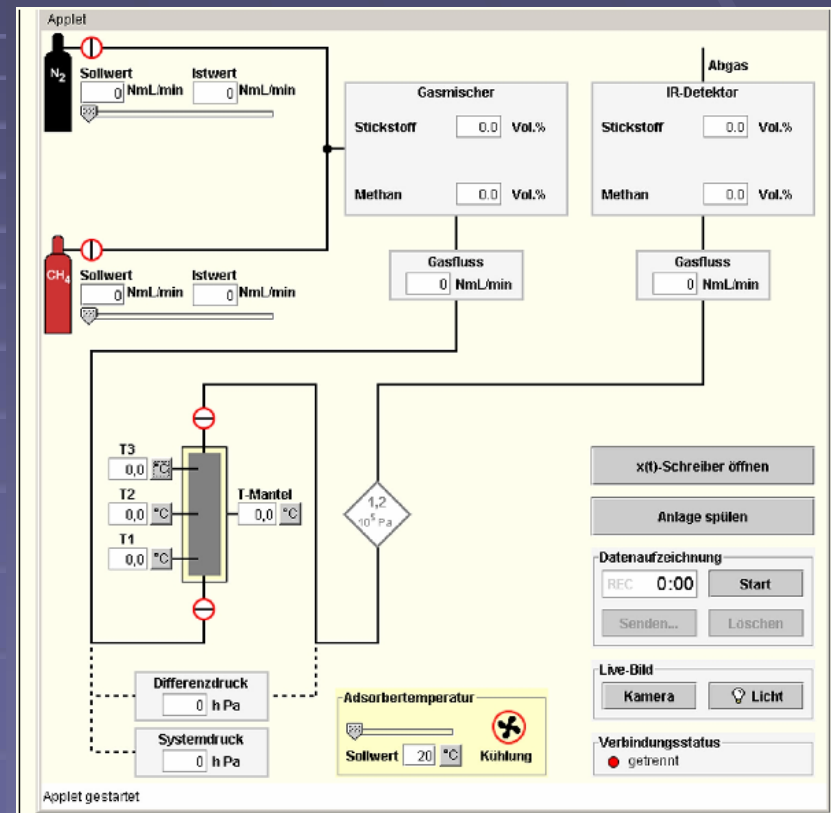
# Lab Provider – Oldenburg – 1 Online Exp.

## Adsorption



2004

- In 2004 the adsorption experiment has been realized
- aim: building ,testing and analyzing a network of remote controled experiments



GUI

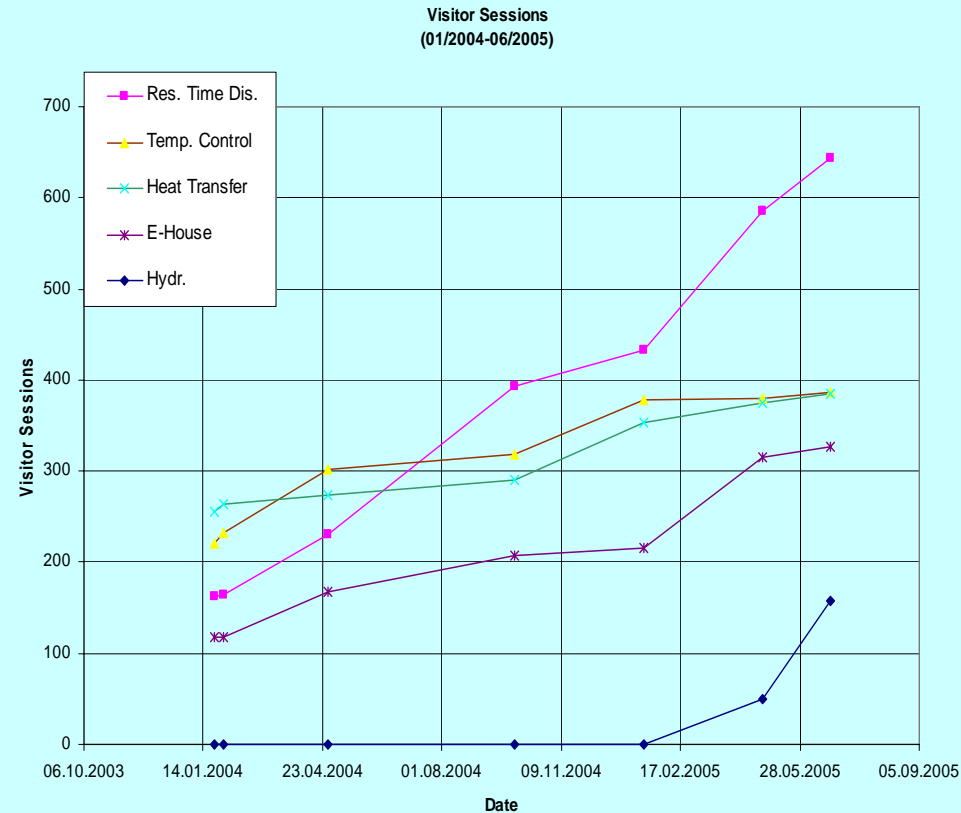
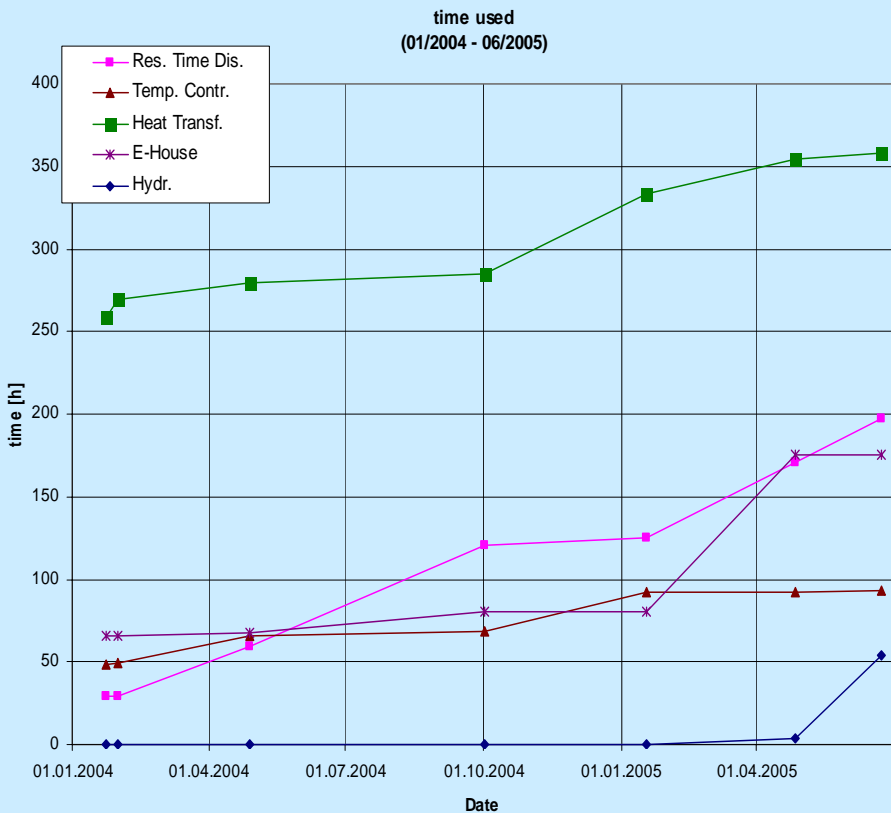
# VIPRATECH: Experiences

- being in use for the last 4 years
- high reliability of servers (MIFY)
- easy to create servers/clients:
- Who using it?
- most used experiment in 2004 (Leipzig):

Server: 1 day; Client: 4-6 weeks

Students from Leipzig / Oldenburg/..

RTD (2004: 96h, 271 sessions)



# VIPRATECH: Experiences

development of a new remotely controlled experiment

What do you need?	Hardware	Software	Staff
Example	Residence Time Distribution Experiment		
Hardware:	(Computer) TCP-IP Data Aquisition Hardware (EDAS: 3 T€) Sensors, Actuators, Cameras, ....		15 T€
Software:	MIFFY-Server tomcat-server Apache-server Servlets for User Management Client: Java Applet	(VSC - OS) (OS) (OS) (VSC -OS)	1 day   5 weeks
Staff:	Software Developer Hardware Developer WEB Developer	Applet (Java Beans) Experiment Experiment LU	

# VIPRATECH: Experiences

- **Problems:** no problems with client/server
  - User management/Scheduling if 2 (or more) Lab providers
  - Data storage , Data delivery (e-mails, ftp, download,..)
  - availability (24 hours/day)

*Necessary to outsource service functions*

- **Next Step:** Lab Provider and Service Provider

Service Provider which provides all service functions -> based on iLab Software

(user management, scheduling, data storage, data delivery, statistics, billing,..)

# Next steps

## More Experiments

- create more experiments ; using for automation of lab units

## iLab support

- further development of our server in order to support iLab software

## Translation

- translation into other languages

## Network

- building a network of remote controled experiments (chemical engineering,..)



# Funding

