WebLabs Clusters in Chemical and Biochemical Process Engineering

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Outline

- Objetive and Methodology
- Basic Sciences in Chemical and Biochemical Engineering (USP/RP)
- Catalytic Reactor Engineering (UNICAMP)
- Biochemical Processes Engineering (UFSCar)
- Chemical Processes Engineering (USP-Poli)
- Conclusions
- Prospective Developments

Goal and Methodology

- Development of laboratory experiments for educational and/or scientific purposes in Chemical Engineering
- Cluster at different institution spread statewide
- 1 team (15 faculty and 40 students) in 4 different institutions (USP, USP/RP, UNICAMP and UFScar)
- 100-200 km distance between institutions
- FAPESP finances KyaTera program – applications for high speed internet (3 layers)
- Maximum speed (galo)

Basic Sciences in Chemical and Biochemical Engineering (USP/RP)

- **Main characteristics of USP/RP group**
  - Department of Chemistry
  - 320 km from São Paulo
  - 80 BSc/year, 4 years course
  - MSc and PhD programs
- **Basic Sciences in the cluster**
  - Transport phenomena
    - ➔ Heat transfer
    - ➔ Mass transfer
  - Chemical and biochemical reactions
  - Kinetics

Basic Sciences in Chemical and Biochemical Engineering (USP/RP)

- Heat conduction and convection

Catalytic Reactor Engineering (Unicamp)

- **Main characteristics of Unicamp group**
  - Chemical Engineering
  - 100 km from São Paulo
  - 160 BSc/year, 5 years course
  - MSc and PhD programs
- **Reactor Engineering in the cluster**
  - Transport phenomena
    - ➔ Heat transfer
    - ➔ Mass transfer
  - Chemical reactions
  - Kinetics

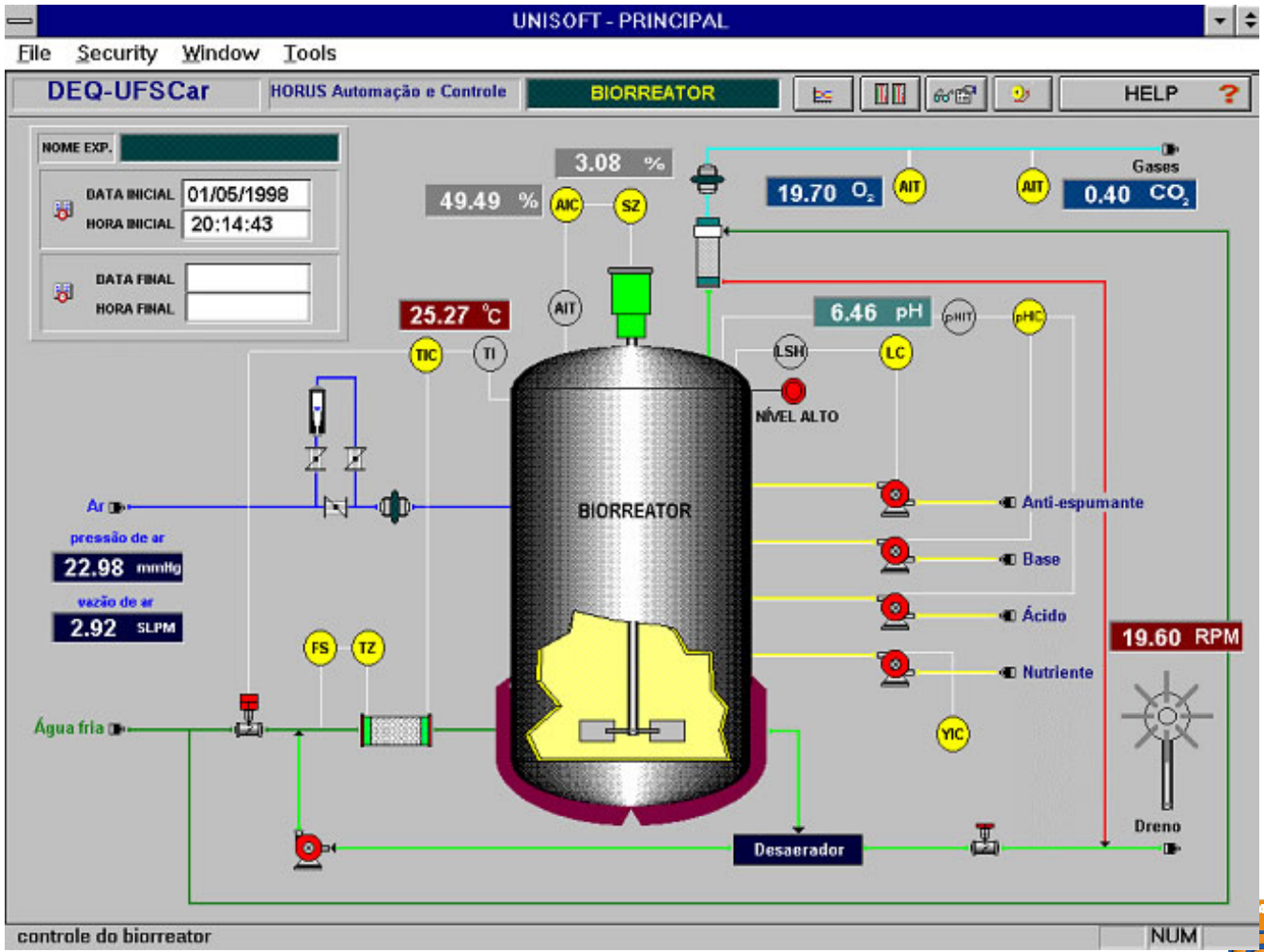
Biochemical Processes Engineering (UFSCar)

- **Main characteristics of UFSCar group**
  - Department of Chemical Engineering
  - 250 km from São Paulo
  - 100 BSc/year, 5 years course
  - MSc and PhD programs
- **Biochemical Processes Engineering in the cluster**
  - Mass transfer and aerobic cultivation of baker´s yeast in stirred tank reactor
  - Enzymatic Hydrolysis of Sucrose
  - State Inference and Control of Enzymatic Hydrolysis of Cheese Whey Proteins
  - Transport phenomena
    - ➔ Heat transfer
    - ➔ Mass transfer

Biochemical Processes Engineering (UFSCar)

- **Mass transfer and aerobic cultivation of baker´s yeast in stirred tank reactor**

- Mass transfer and aerobic cultivation of baker´s yeast in stirred tank reactor



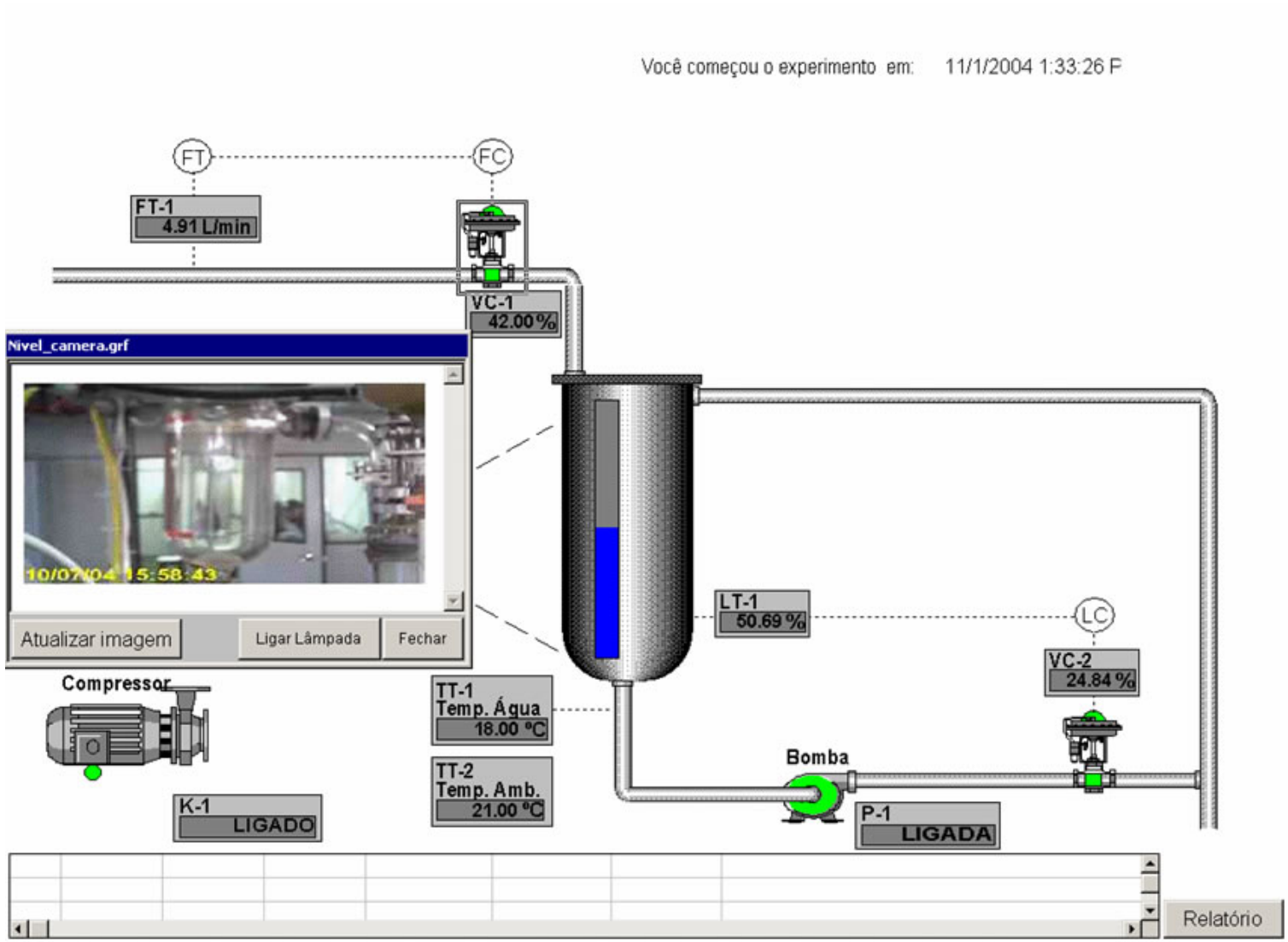
Chemical Processes Engineering (USP-Poli)

- **Main characteristics of USP-Poli group**
  - **Escola Politécnica**
  - **São Paulo**
  - **60 BSc/year, 5 years course**
  - **MSc and PhD programs**
- **Chemical Processes Engineering in the cluster**
  - **Process control**
  - **Heat exchanger network**
  - **Chemical reactors**
  - **Transport phenomena**
    - ➔ **Heat transfer**
    - ➔ **Mass transfer**

Chemical Processes Engineering (USP-Poli)

- Discipline: process control for chemical engineers
- Simplest model: level in a tank
- reproduce the industrial environment
- Same architecture used in the industry: supervisor (iFix GE Fannuc) - PLC (Allen-Bradley), safety interlocks
- Constraints not very friendly usage but realistic

Chemical Processes Engineering (USP-Poli)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4.91 L/min
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Ligar Lâmpada
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LT-1
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VC-2
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Bomba
K-1
LIGADO
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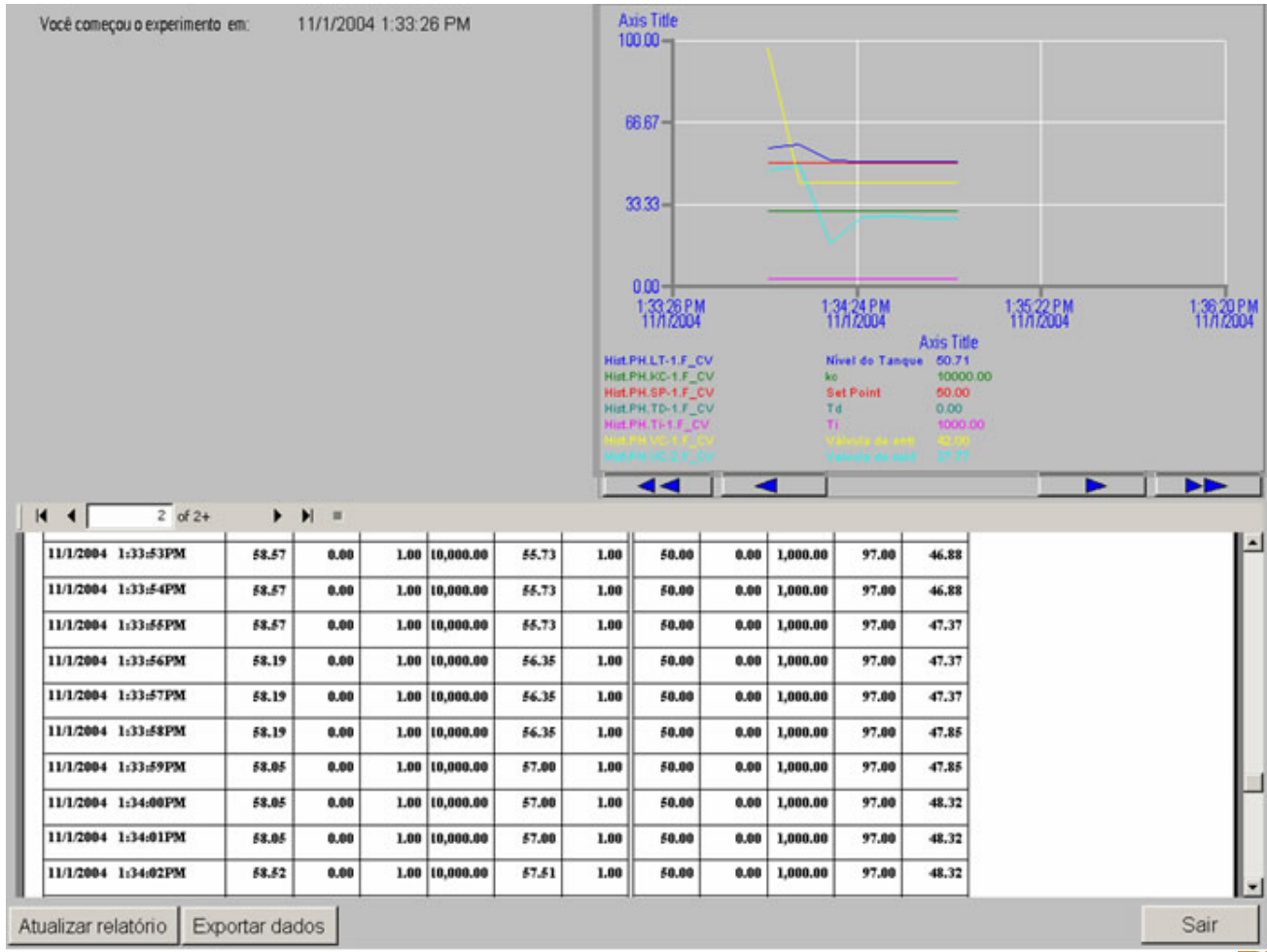
LIGADA
Relatório

Data log for the students



Chemical Processes Engineering (USP-Poli)

- Chemical Reactors

- Heat Exchanger Network

Typical assignment

- Liquid level control in a tank
- 2 students from USP-Poli and 2 from ENSIACET
- They have worked together under the supervision of 3 faculty members.
- Strong and productive interaction.
- Modeling and Simulation.

Typical assignment

- **Objective**
  - To prepare a mathematical model for a tank level control system and compare with experimental data from the WebLab.
- **Work organization**
  - The students should discuss the mathematical model and the mathematical tools to be employed in the solution.
  - The students should discuss how they will prepare and do the WebLab experiments.
  - The students should compare the mathematical model with the experiments.
  - The students should write a report concerning this work (Introduction (problem statements), short literature review, mathematical model, experimental methodology, results and discussion (simulation and experimental), conclusions, references.
- **Essential**
  - All the decisions must be taken by the group of students

Conclusions

- The environment stimulates students to work together
- Weblab can be a powerful tool to promote interaction between students no matter where they could be
- With joint assignments it can also be a tool of “international” experience to the students

Prospective Developments

- International partners to test the interaction Karlsruhe (Germany)
- Develop new methodologies of interaction (joint assigments)

Thanks a lot !

Muito obrigado!

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