PI System in a Lab-Based Course: Bio Engineering at MIT

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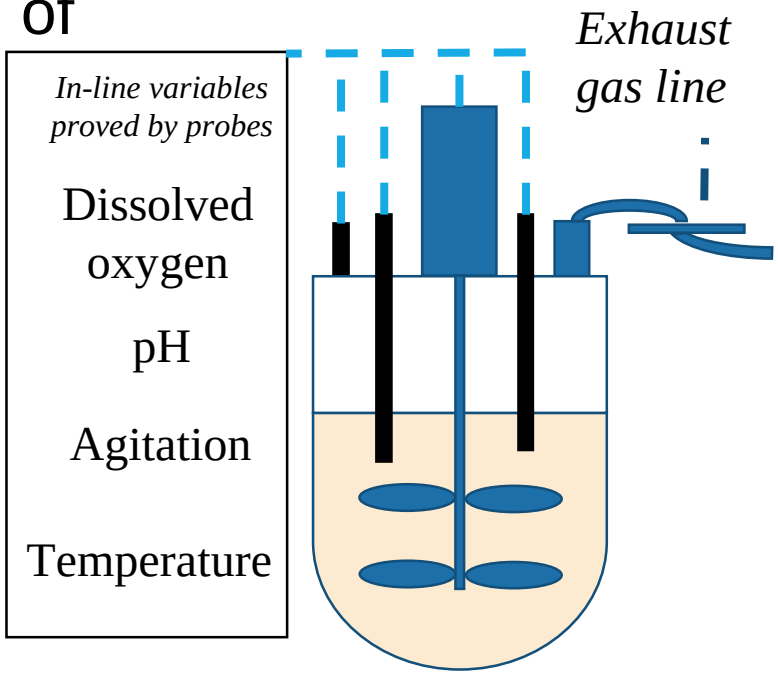
Chemical - Biological Engineering Laboratory

- Revamped, project-based version of Chemical Engineering Unit Operations
- Course objectives include:
  - Hands-on experience with bioprocesses
  - Experimental design
  - Exposure to industry-standard tools



The bioreactor

The Life Sciences Story at OSIsoft

More reasons for PI

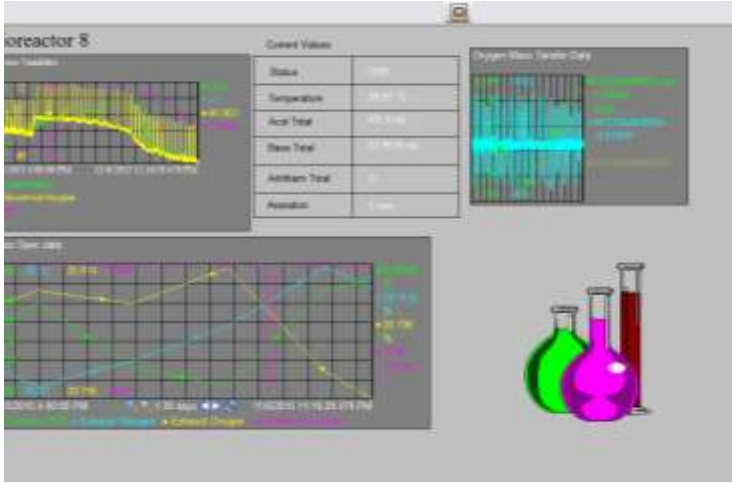
- Real-time monitoring and analysis
- Less data pushing, more time spent on scientific insights and design
- Students pool results
- Retain knowledge from past semesters
- Remote monitoring ability
- Integration with tools such as MATLAB

Classroom rollout

- System setup and education of lab staff
- Start small in pilot semester
- Introduce students to PI Visualization Tools
  - Workbooks with step-by-step instructions, tie-ins to OSIsoft Learning YouTube channel, and student exercises
  - Training databases with simulated Unit Operations data

Classroom rollout

- Assignment 1
  - PI DataLink to analyze simulated process data
- Assignment 2
  - PI ProcessBook to prepare bioreactor displays to be used throughout course



An example student display

Classroom rollout

- Assignment 3
  - Analyze real-time results from experiments
  - Students pool results
    - Explore effects of a wide range of independent variables

Student interaction during a mass transfer experiment

- *Outline:*
- Improve the Students Understanding Bioreactors with PI
- New Lesson to the Syllabus
- Integration of Outside Data Analysis

Working PI into the Syllabus: Future Plans

Improving the Students Understanding of Bioreactors with PI

Use previous PI data from early semesters to educate the students to use PI

Benefits:

- Project relevant teaching
- Increased student motivation
- Improved experimental design

New lesson to the Syllabus

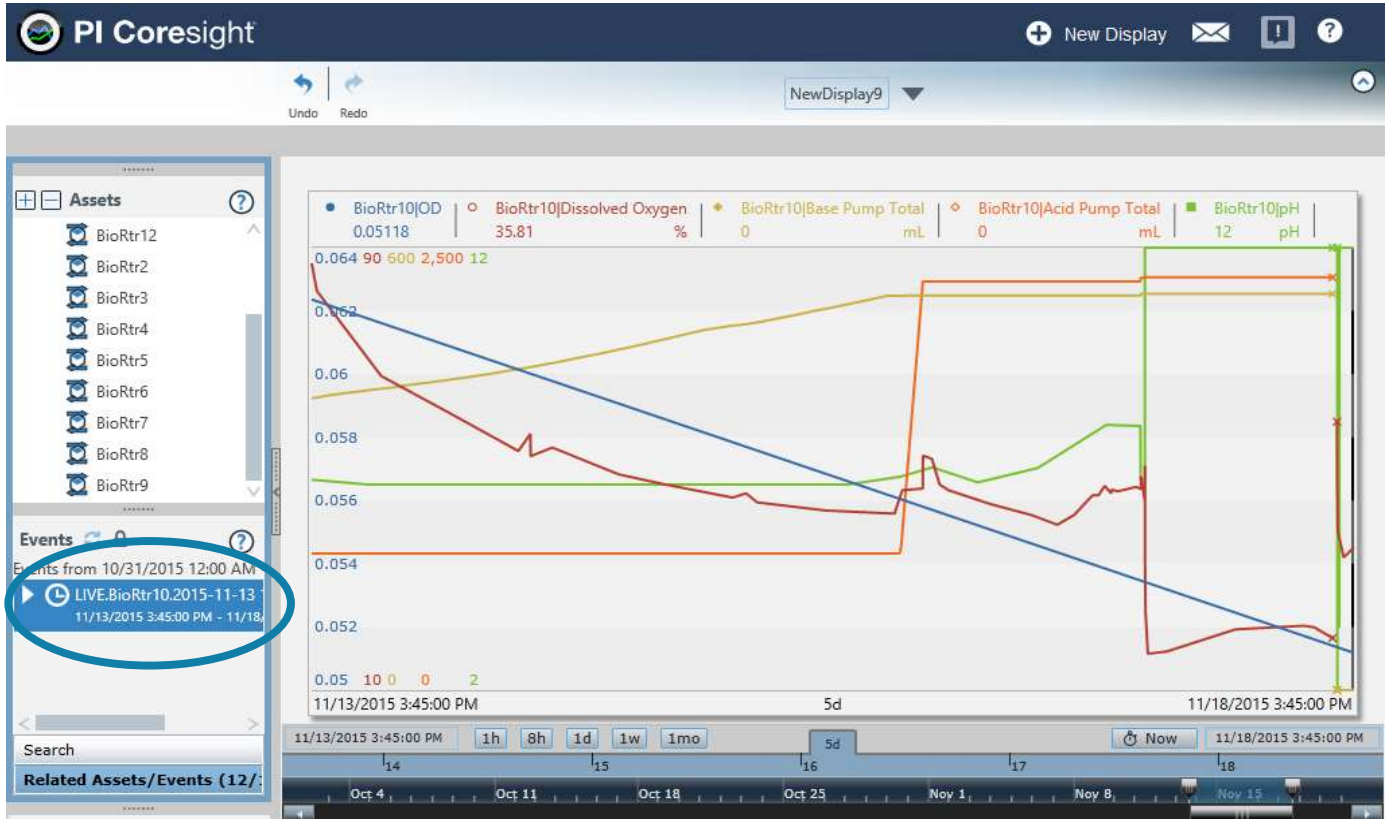
- The new lesson was tested with incoming researchers in the Hamel laboratory in the Spring term (IAP).
- The goal was to not only have the students present data as they became accustomed to PI but to also learn to interpret data.
- In this, we created case studies to get students to begin to think about their reactors and make the connections of what they data is communicating

  - ❖ Event frames were implemented to bookmark experimental runs to make finding experiments easier

Example of the New Teaching Style

Students are given an event and the desired parameters that the reactor should keep throughout the process as well as reactor type.

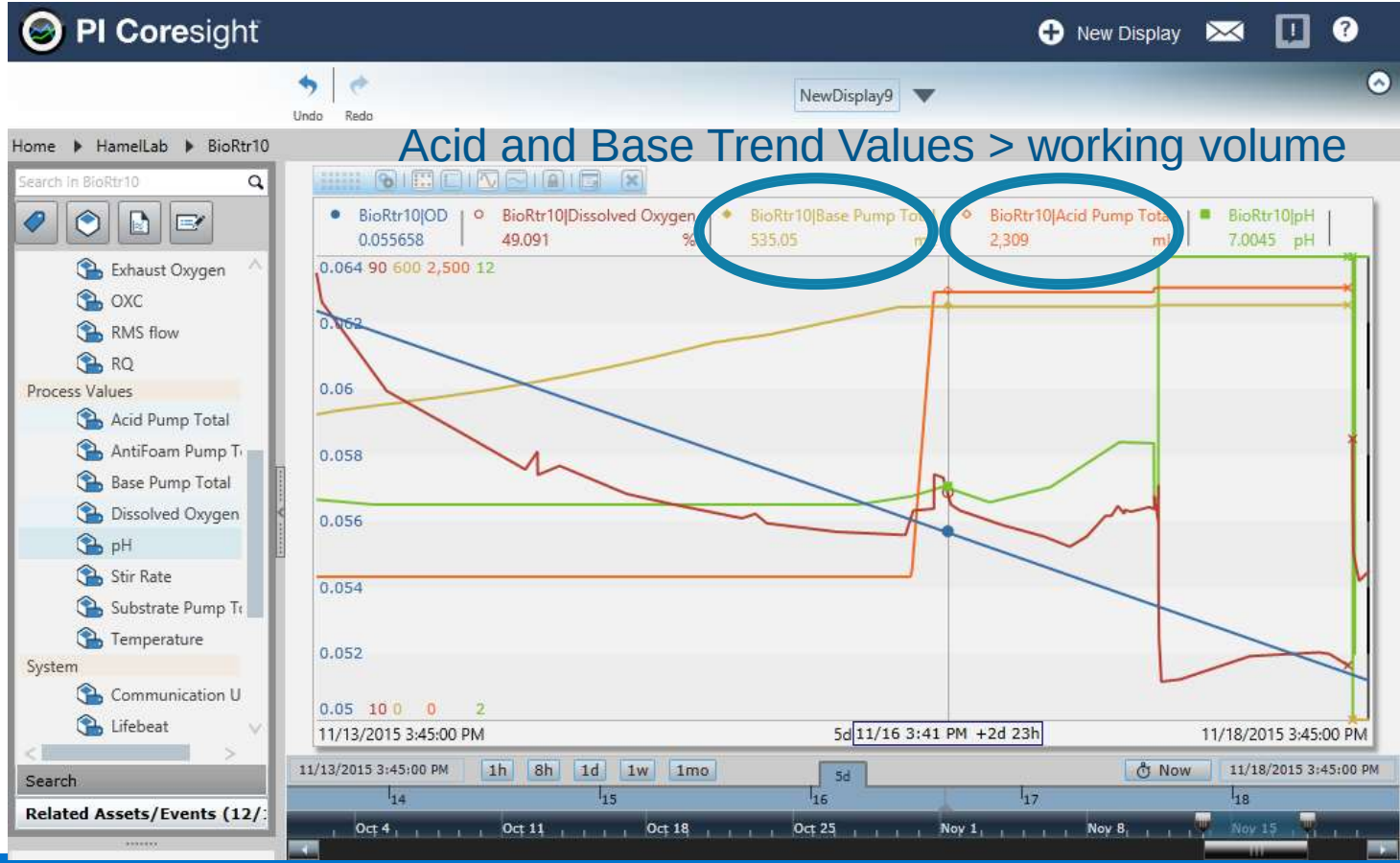
Example parameters:
Reactor type: Batch
Reactor working volume: 1.5L
pH= 7
T=30C
Stir rate: 300rpm
Dissolved Oxygen: not controlled



Students will be encouraged to make their own displays and access odd occurrences in the trends.

The students will notice pH is amiss (pH≠ 7) and will investigate acid and base addition values

Students will see that the acid and base additions are illogical and diagnose the problem.



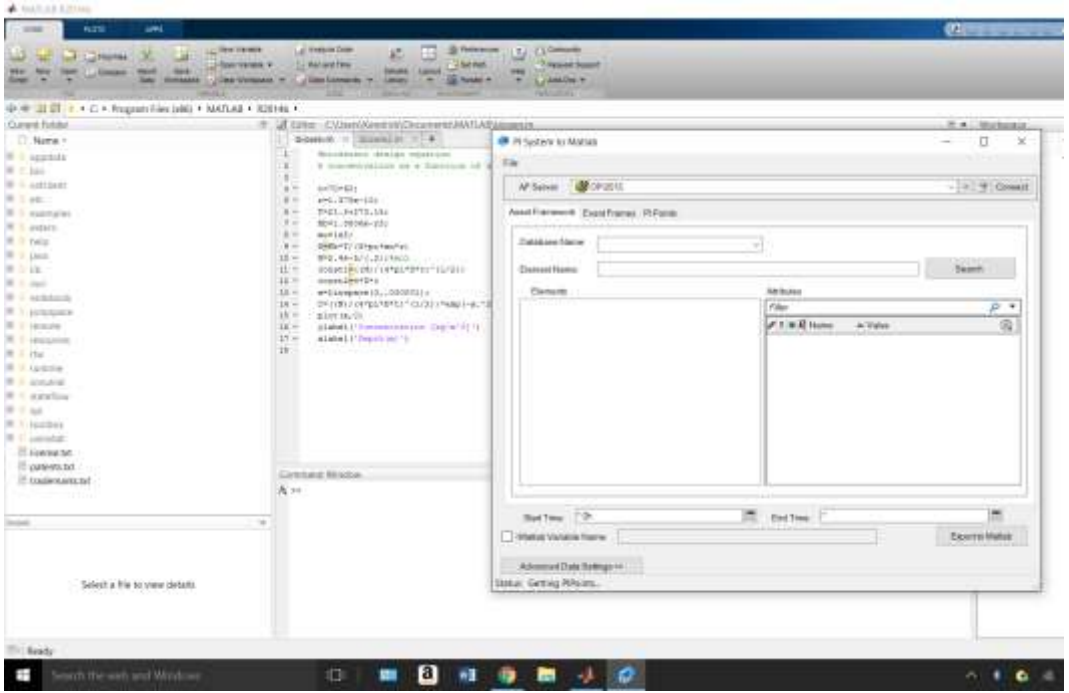
Integrating Outside Data Analysis Tools

We plan to introduce MatLab data manipulation to the current syllabus

- Students are already familiar with Matlab by this point in their studies
- A program, the PI-to-MATLAB Utility, supplied by OSIsoft already exists and is easily accessible
- The additional computing capacity will allow the students complete the carbon mass balance to analysis cellular metabolism

The PI-to-MATLAB Utility

The Pi-To-MatLab shortcut directly opens MatLab and allows you to access the PI server is credentials are acceptable



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谢谢

Danke

Gracias

Merci

Thank You

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Спасибо

Obrigado