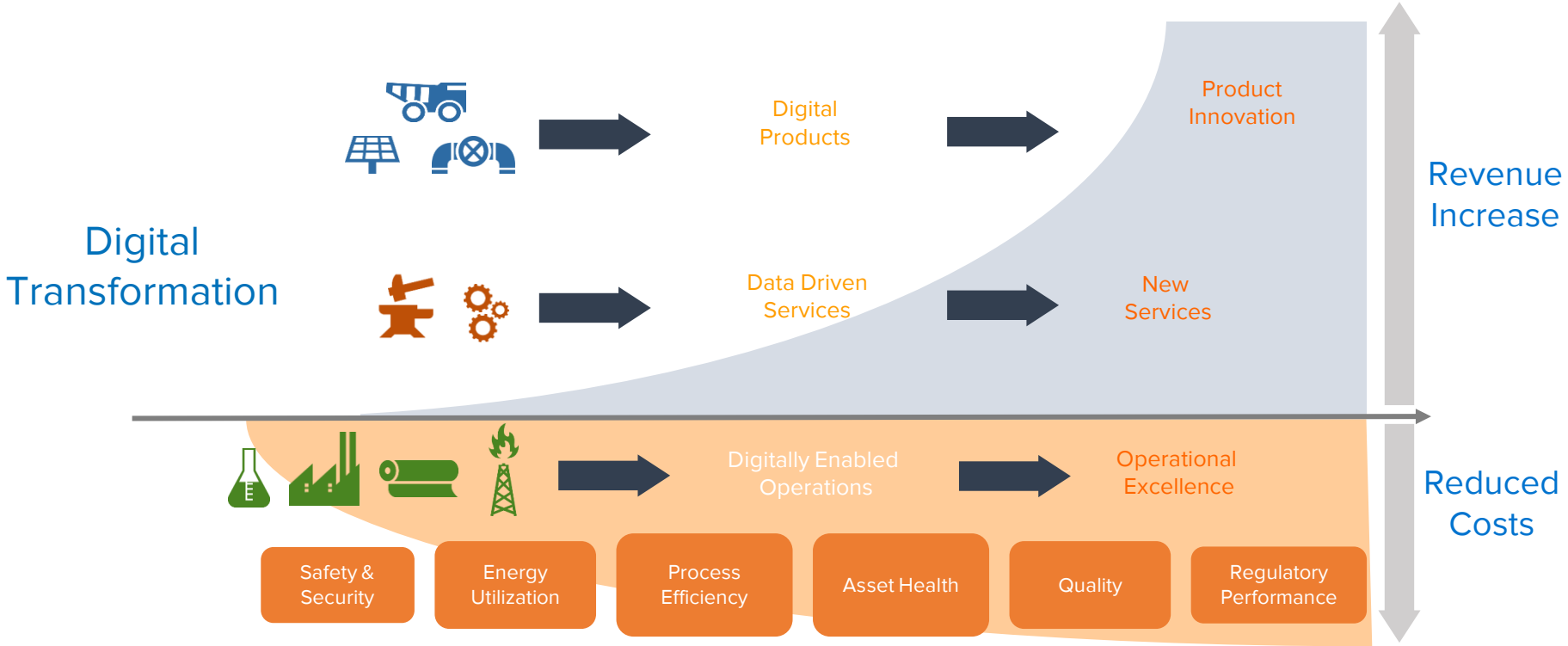
Transforming Student Education with the OSIsoft Academic Hub

Dr. Erica Trump, Program Manager, OSIsoft

Engineering Trends: Data-driven Systems



Business Trends in Our Customers' Industries

- Proliferation of data – in all disciplines
- Digitization of information
- Automation of tasks
- AI becoming more mainstream
- Age and Skill Gaps becoming more pronounced
- Employees demanding experience
- Diversity & Inclusion at the forefront

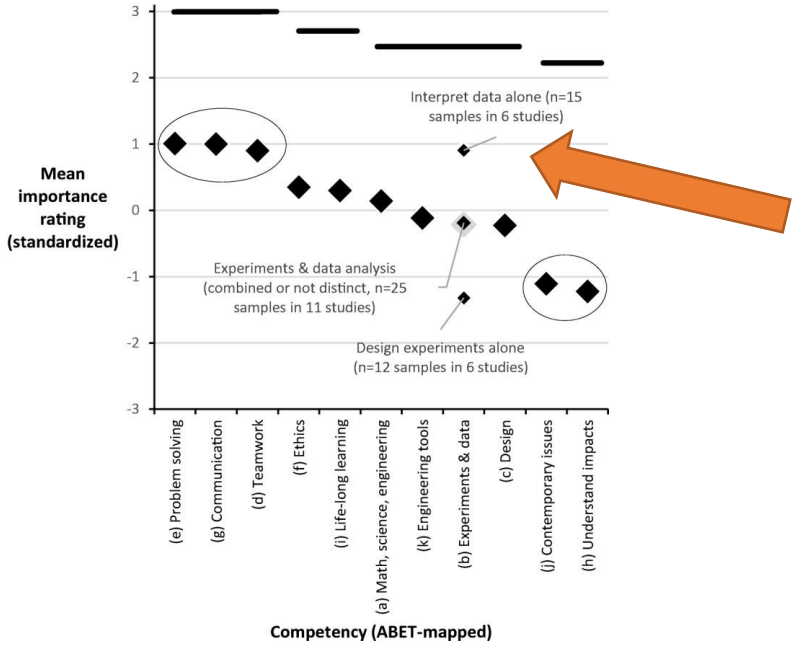
Talent Pipeline and Skill Gap

Key skills needed in today's industry:

- Conceptual Knowledge
- Strong Math Skills
- Comfort with Large Data Sets
- Coding Ability
- Data Engineering Capability
- Communicate Information through Visualization
- Data Integrator

TransCanada

Need for Data-focused Engineering Education



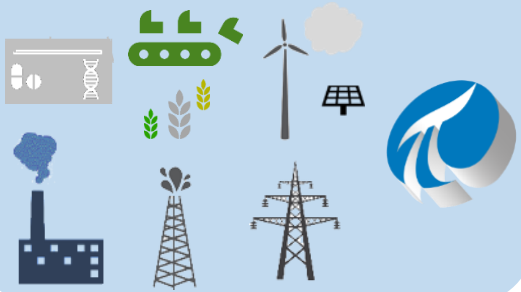
Highest-rated competencies include **Problem Solving**, **Communication**, **Interpretation of Data**, **Teamwork**

Passow & Passow, 2017

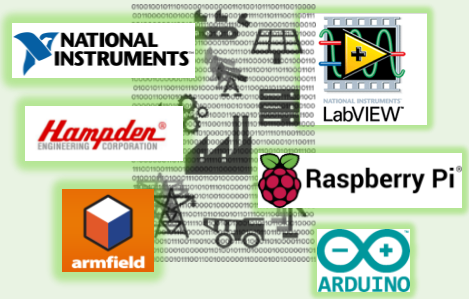
OSIsoft Academic Hub

Empowering the workforce of tomorrow with data-focused skills that industry needs

Industrial Process or Equipment

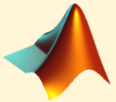


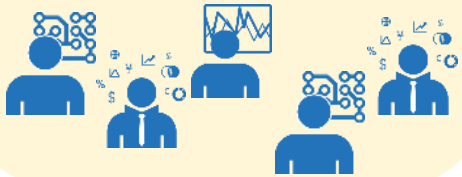
University Lab or Classroom



OSIsoft Academic Hub

Students access data anywhere, from any device

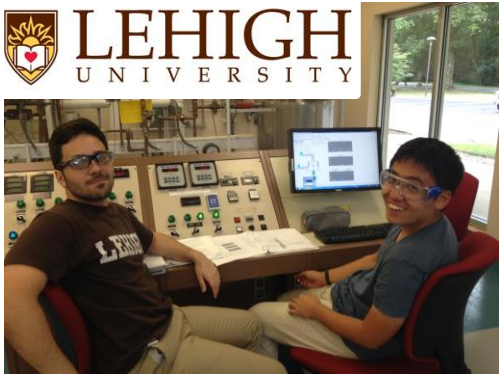




Engineering Lab-based Courses

- ✓ Bridge the gap between theory and **practice**
- ✓ Build skills in **data analysis** and **communication**
- ✓ **Industry-oriented approach** to experimental design
- ✓ Promote teamwork and **informed decision-making**

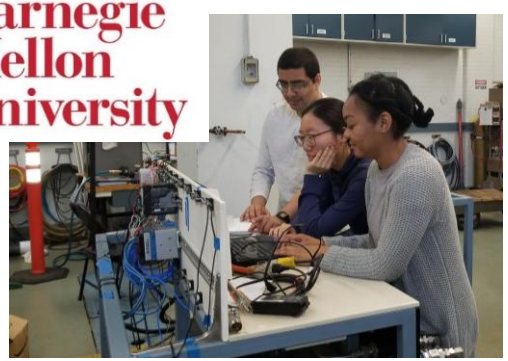
LEHIGH UNIVERSITY



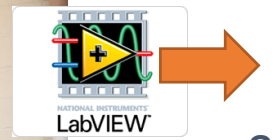
Massachusetts Institute of Technology

ASU Arizona State University

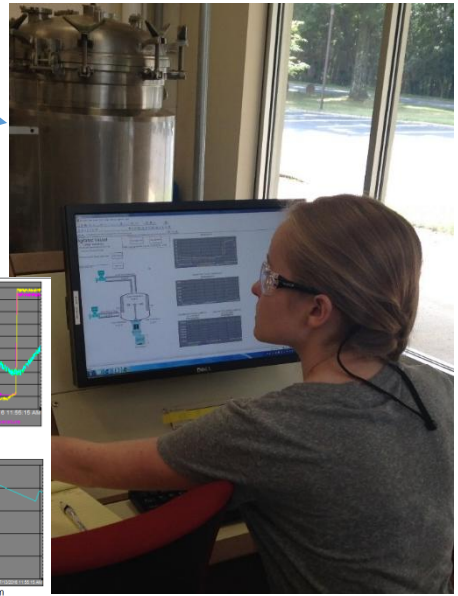
Carnegie Mellon University

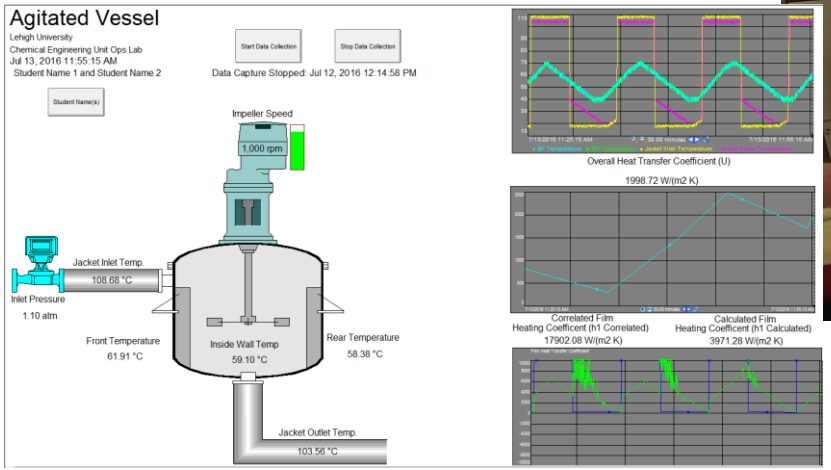


Chemical Engineering Unit Operations



OSIsoft Academic Hub



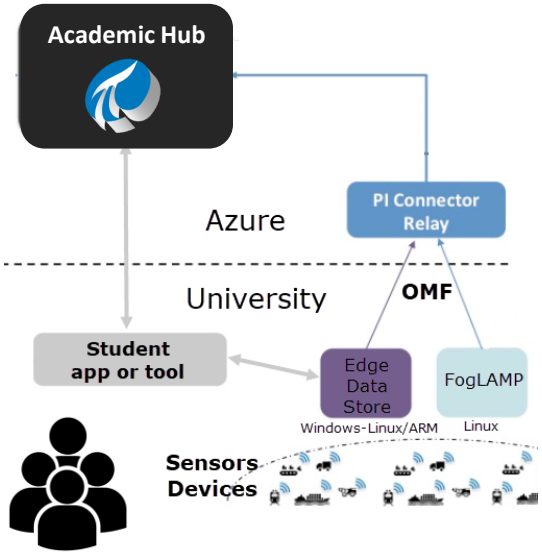


IoT Classroom Projects

- ✓ Students create app to collect data and send to the OSIsoft Academic Hub
- ✓ OSIsoft provides real-time data infrastructure, code examples

ARDUINO

Raspberry Pi®



Industry Example: Glass Furnace Control

Sand to Windshields: CMU-ILS-PPG Project

Objective: Reduce Variations in glass quality using process data and model based control throughout the supply chain

Silicate Sand
Soda-ash
Iron Oxide
++

Sand
Soda-ash
+++

8 flat glass plants

500 tons/day ea. line

mix → melt → form → cool → QC → cut → pack

Siemens/Pilkington Float Process

Flat glass
-Airplanes
-Cars
-Buildings

1000 windshields per day ea. line

Flat glass

Cut → coat → print → form → QC → laminate → pack

OEM discrete parts manufacturing Float Process

Automotive windshields

10 windshield lines

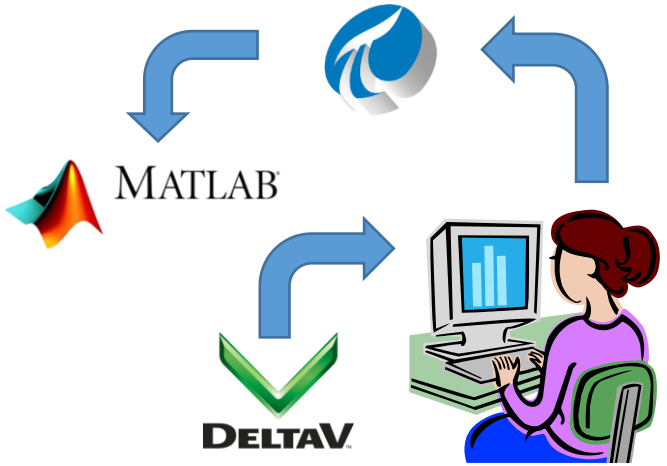
Photos: Hans-Dieter Seufert/Auto Motor und Sport

Accuracy of shape, color, distortion (optical properties) depend on mix, melting conditions in furnace and operation of the tin bath.

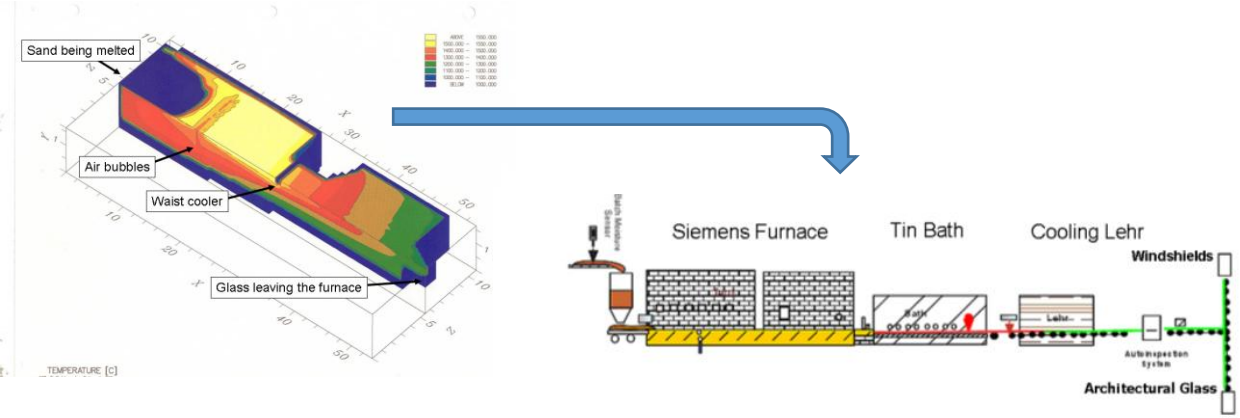
PPG INDUSTRIES

Carnegie Mellon University

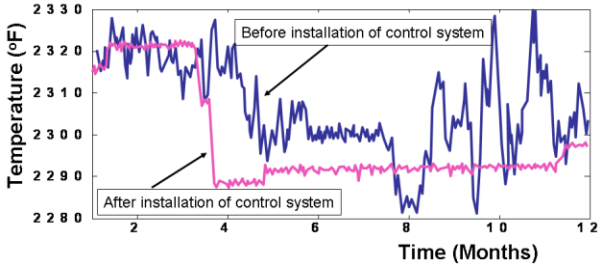
ILS Industrial Learning Systems

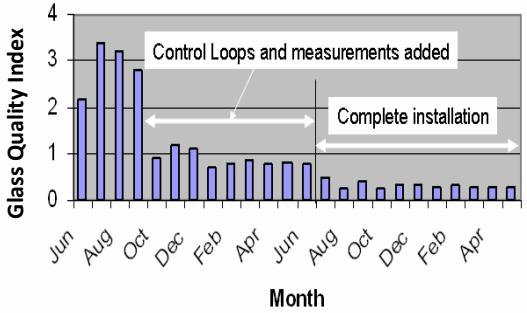


Industry Example: Glass Furnace Control

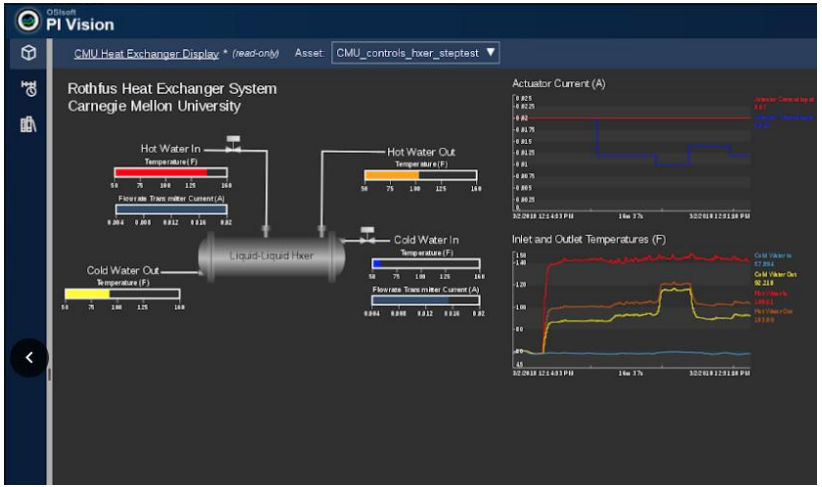


1. Run furnace at steady state
2. Run Bump tests
3. Collect data using PI System
4. Estimate models using ILS open and closed loop identification scheme
5. Tune and simulate MPC models off-line
6. Implement MPC on Furnace

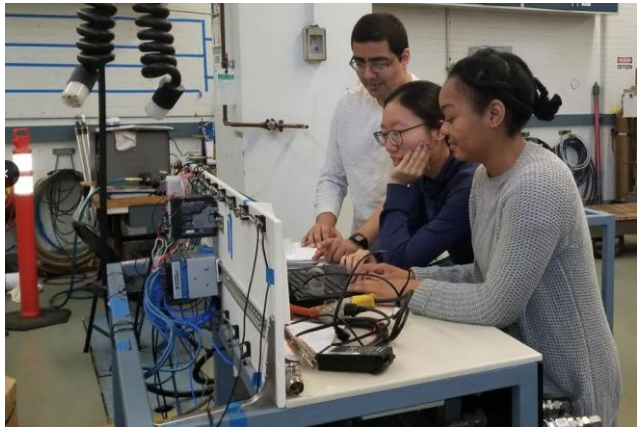




Student Exercise: Heat Exchanger Design & Modeling



Students follow industrial process in parallel with their HX project



Control project carried out by 76 students in teams (~ 4students per team)

- **Session 1:** Collect data, transfer to MATLAB, design and simulate closed loop
- **Session 2:** Run closed loop control test, collect data and analyze

CMU design team at work

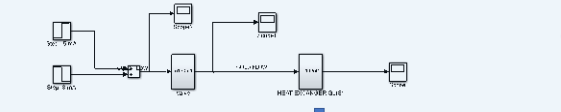
- Praveer Vyas
- Chrystear (Sicong) Liu
- Diane Ngounou

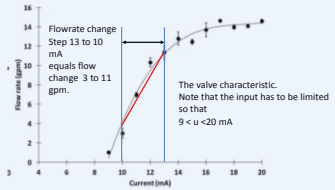
Student Exercise: Heat Exchanger Design & Modeling

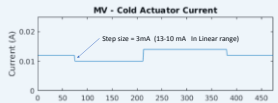
Objectives:

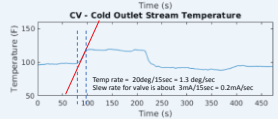
- ✓ Collect and visualize data using PI System
- ✓ Model step-response experiment using Simulink
- ✓ Implement and tune PID controllers on a real system

Simulink model of HX from lab data

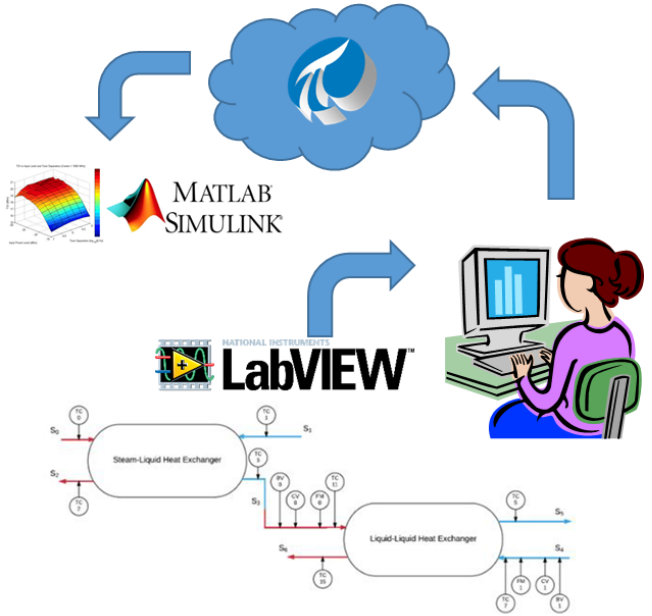








Slew rate	0.2 mA/sec
Valve constraints	9 mA <MV<20 mA
Valve characteristic	$F = 0.0150u^3 - 0/85x^2 + 16x - 85$
Transfer function	$G = \frac{-3}{5s+1}e^{-1.5s}$

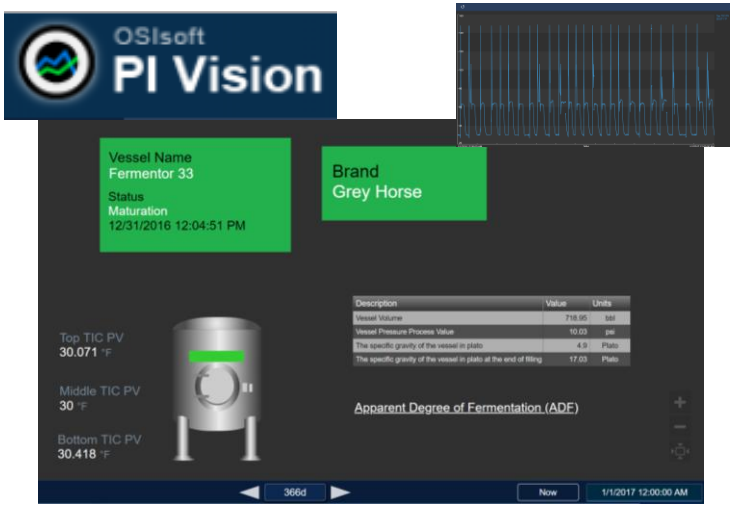


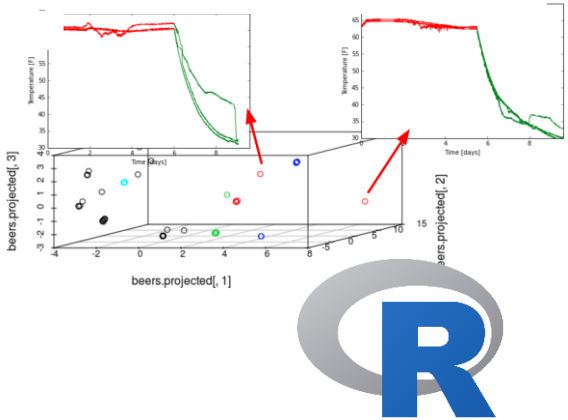
CMU equipment, two coupled heat exchangers

- Steam to generate hot water
- Hot water, cold water

Data Science Modules and Real-world Datasets

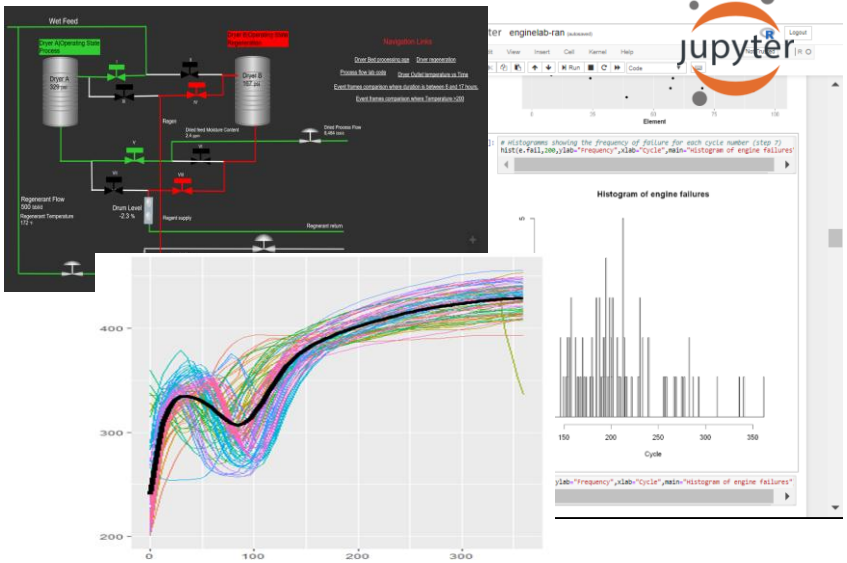
- ✓ PI Vision, Data Science Exercises, Jupyter Notebooks
- ✓ Brewery dataset – fermentation vessels, bright tanks, other processing equipment



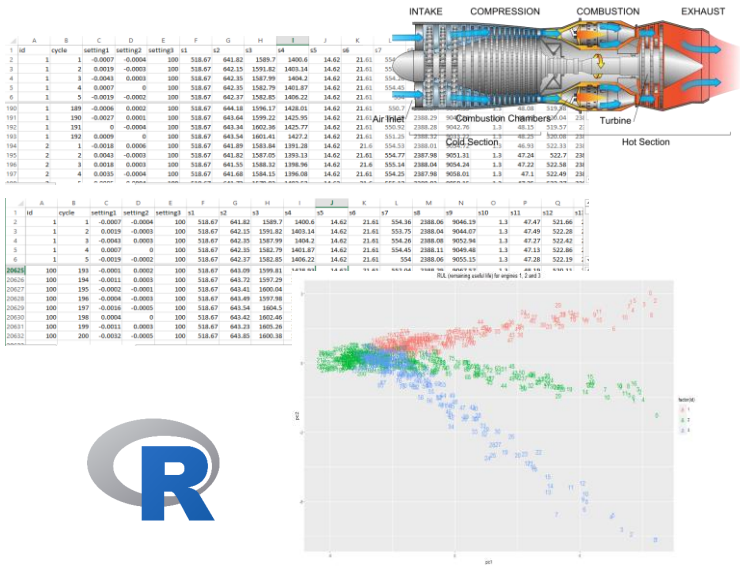


Data Science Modules and Real-world Datasets

Oil & Gas:
Golden run for alkylation process feed dryer



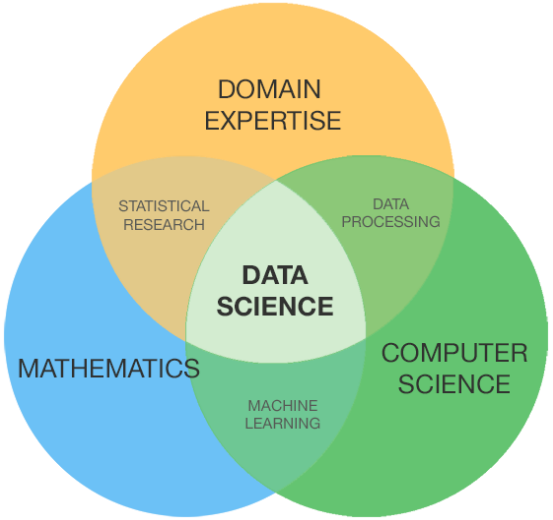
Predictive Maintenance:
Engine failure dataset to calculate remaining useful life



Why Share Real-world Data with Students?

LEHIGH UNIVERSITY

- Improve student education!
  - Modern real-world problems are great motivators for students
  - Help them understand complex and dirty real-world data
- Educate students about your data science problems
  - Industry needs are often different from academic research
  - They will know what you care about, and can jump in when hired
- Increase your brand's visibility to students



Questions

Please wait for the **microphone** before asking your questions

State your **name & company**

Merci

谢谢

Danke

Спасибо

Gracias

Thank You

감사합니다

ありがとう

Grazie

Obrigado

Optional: Click to add a takeaway you wish the audience to leave with.

#OSIsoftUC #PIWorld ©2018 OSIsoft, LLC