The Process of Smart Manufacturing

Dean Schneider, PhD, PE
Co-Director, Gulf Coast Regional Manufacturing Center
Clean Energy Smart Manufacturing Innovation Institute
dean.schneider@CESMII.org, 979-458-0251

6th Annual NE/C Louisiana Manufacturing Summit
Tuesday, May 22, 2018
Natchitoches, LA

Accelerating
Your Smart Manufacturing Transformation

Overview

- What is Smart Manufacturing?
- What is the actual process to “DO” Smart Manufacturing?
- The “Nuts and Bolts” of the SM Process and the SM Platform™

What is Smart Manufacturing?

Monetization of Manufacturing Data:

Creation of the "Connected Enterprise"

By

- Leveraging connectivity – IIOT enabled systems
- Moving away from "Run-to-Failure" to "Predictive, Reliability-Centered" operations
- Performing Business/Financial/Energy Optimization at all levels of the enterprise value-chain
- Taking advantage of existing/legacy investment

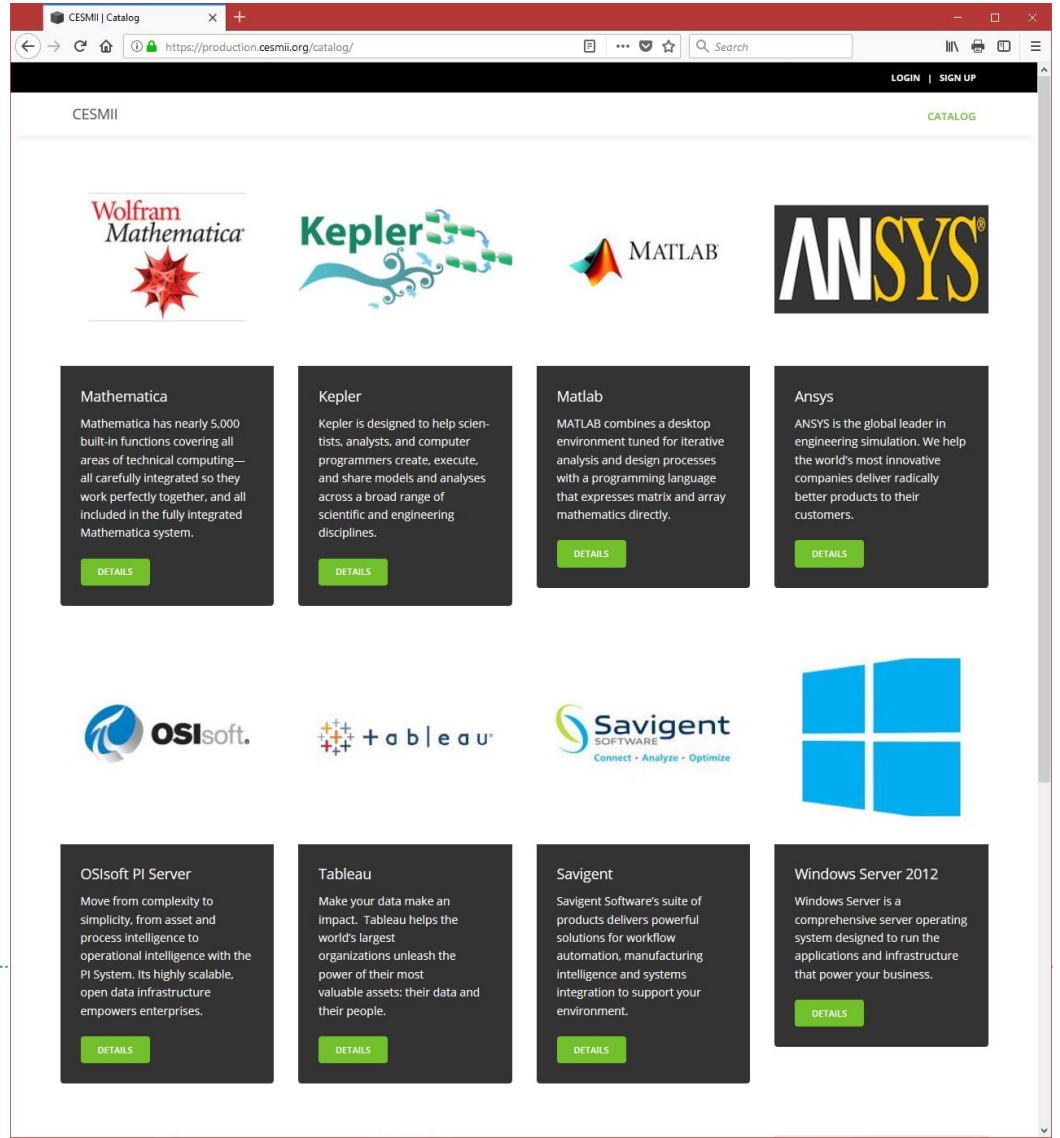
SM enables the **right information** and **right technology** to be available at the **right time** and in the **right form** to the **right people**

The Smart Manufacturing Process

What is Smart Manufacturing?

- The right data at the right place at the right time to make the right decision

- Data Acquisition
- Data Contextualization
- Data Aggregation
- Data Analytics and Models
- Data Presentation



CESMII

Smart Manufacturing Process Explained

Getting Started with Smart Manufacturing

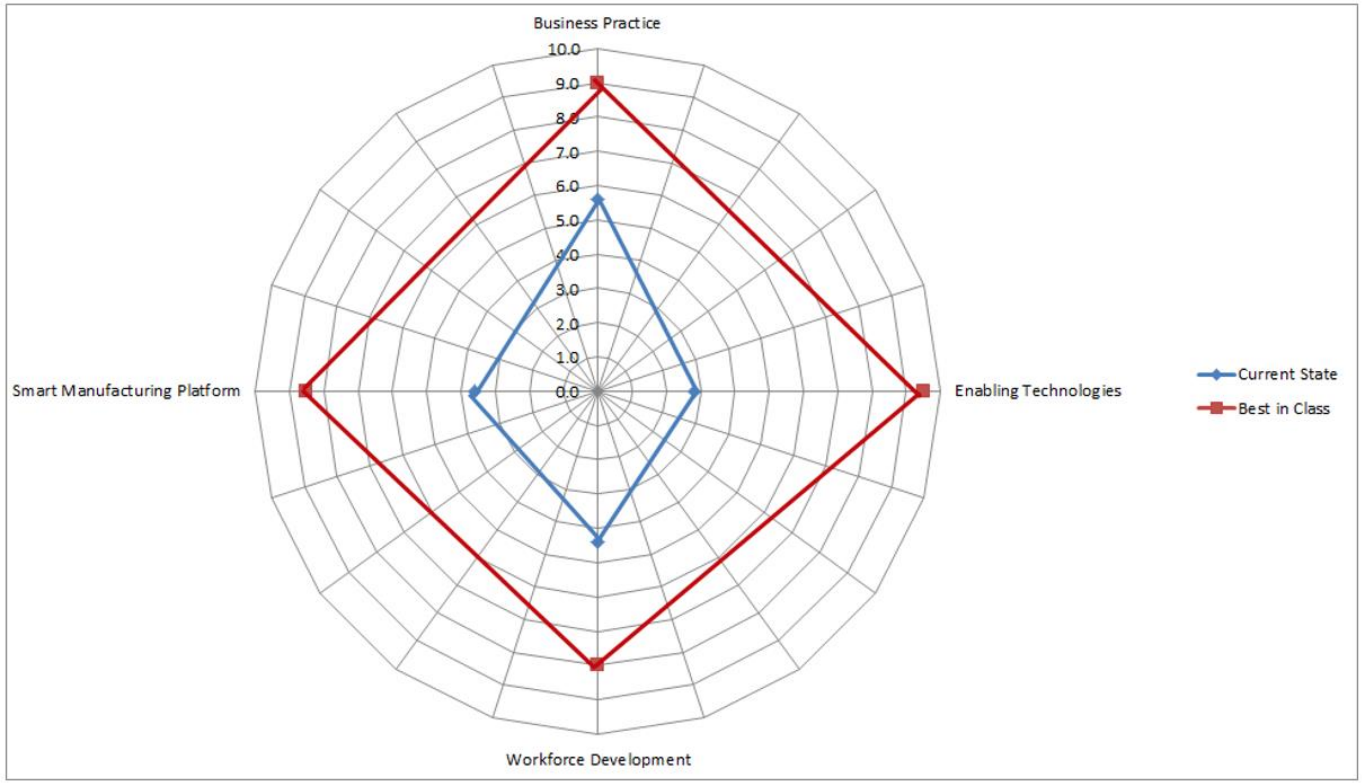
- Smart Manufacturing starts with a problem
  - Economics: How can we do things better to get increased value?
  - Management: How can we better manage our supply chain?
  - Quality: Can we maintain quality while reducing costs?
  - Energy: Can we reduce our energy costs/footprint without reducing production?

- Process
  - Determine readiness of enterprise to adopt SM
  - Identify stakeholders and how they are affected
  - Identify issues with current solutions (if they exist)
  - Determine how the use of data can enable solutions
  - Identify measurable goals/outcomes desired

Assessing Enterprise Readiness for SM

Assess Enterprise along CESMII technology roadmap factors:

- Business Practices
- SM Platform Readiness
- Enabling Technologies
- Workforce Development



CESMII

A Discrete Manufacturing Use Case

Rob is in engineering operations at a medium sized manufacturer responsible for product quality and energy use of the manufacturing process.

Rob needs to shorten the time needed to achieve and verify workpiece batch quality in their manufacturing processes and to optimize energy used during the processes.

Defining the SM Requirements

- A SM Project has to be defined within the context of the problem you are trying to solve:
- Physical resources
  - Is problem centered at one location or multiple?
  - Are links currently available between resources/locations?
- Data
  - What data is currently available?
  - What data is required but not currently available?
  - How will data be used/presented?

Defining the SM Requirements (Continued)

- A SM Project has to be defined within the context of the problem you are trying to solve:
- Tools
  - What SM tools are desired and how will they be used?
  - How will marketplace tools be implemented?
- Results
  - What outcomes are desired/required for success?
  - How will results be communicated to stakeholders?

Discrete Manufacturing Requirements

Subtractive Manufacturing

+

Additive Manufacturing

Hybrid AM System

OT

- Instrumentation
- Real-Time Analytics
- Performance Tools
  - Monitoring
  - Optimization
  - Control
  - Maintenance
  - Scheduling
  - Planning

IT

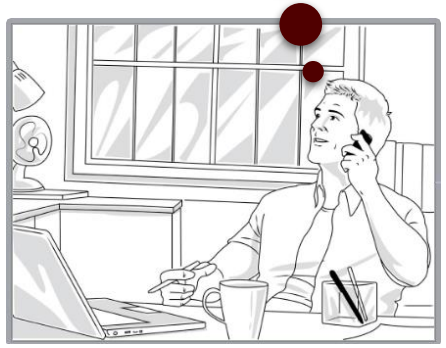
- Computing Hardware
- Communication Protocol
- Interoperable Middleware
- Variety of Software

OT+IT

- Advanced Soft Sensors
- Real/Right-Time Analytics
- SM Platform
  - Seamless Integration
  - Ease of Commissioning
  - Performance Guarantees
  - Energy Efficiency
  - Safety and Reliability
  - Speedy ROI

Seamless Integration of Legacy Investment

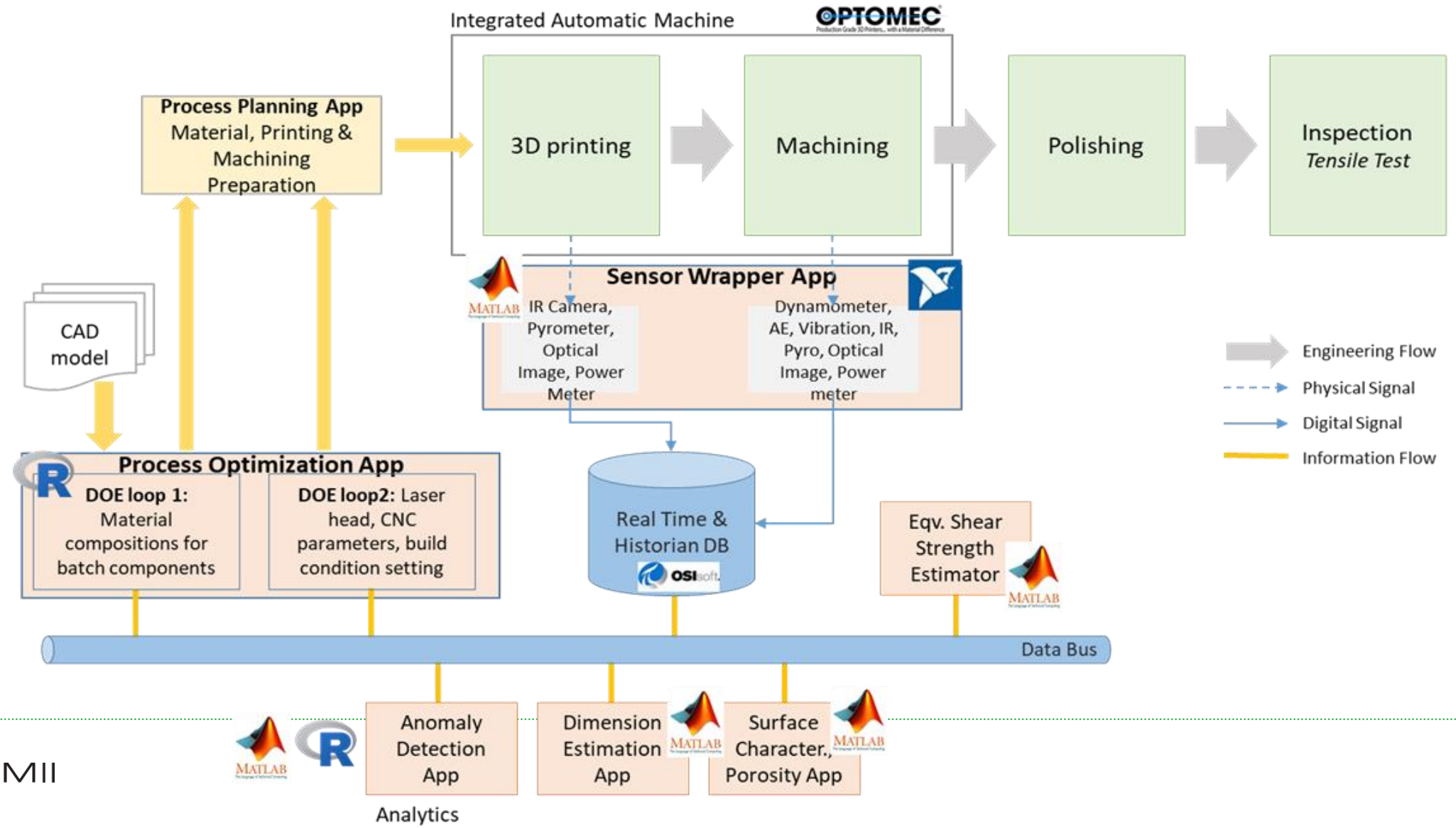
CESMII Team, Can you please help?



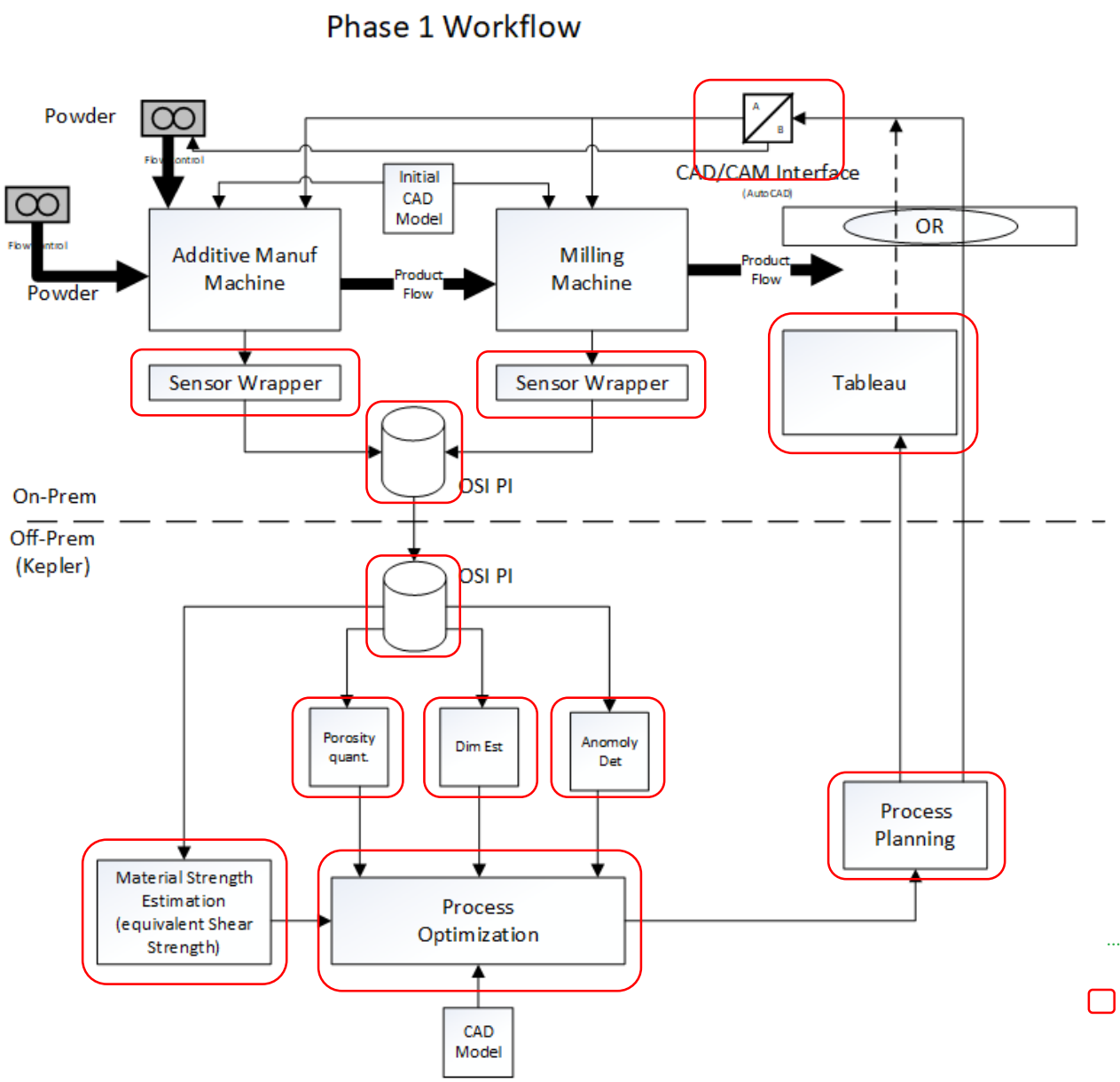
Determine the OT Framework and Data Structure

- Develop OT Framework
  - Processes and personnel
  - Machines and sensors
  - Physical connections
- Determine data structure (workflow)
  - Identify on-premises data workflow
  - Define cloud data workflow
  - Identify Smart Manufacturing products (on-premises and cloud)

Additive Manufacturing SM Application Framework

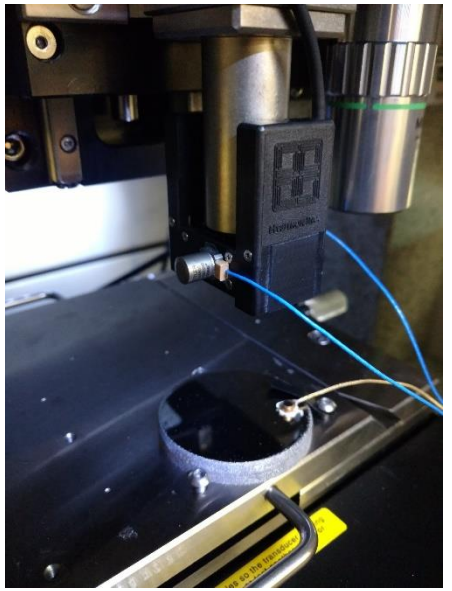


Additive Manufacturing Data Structure

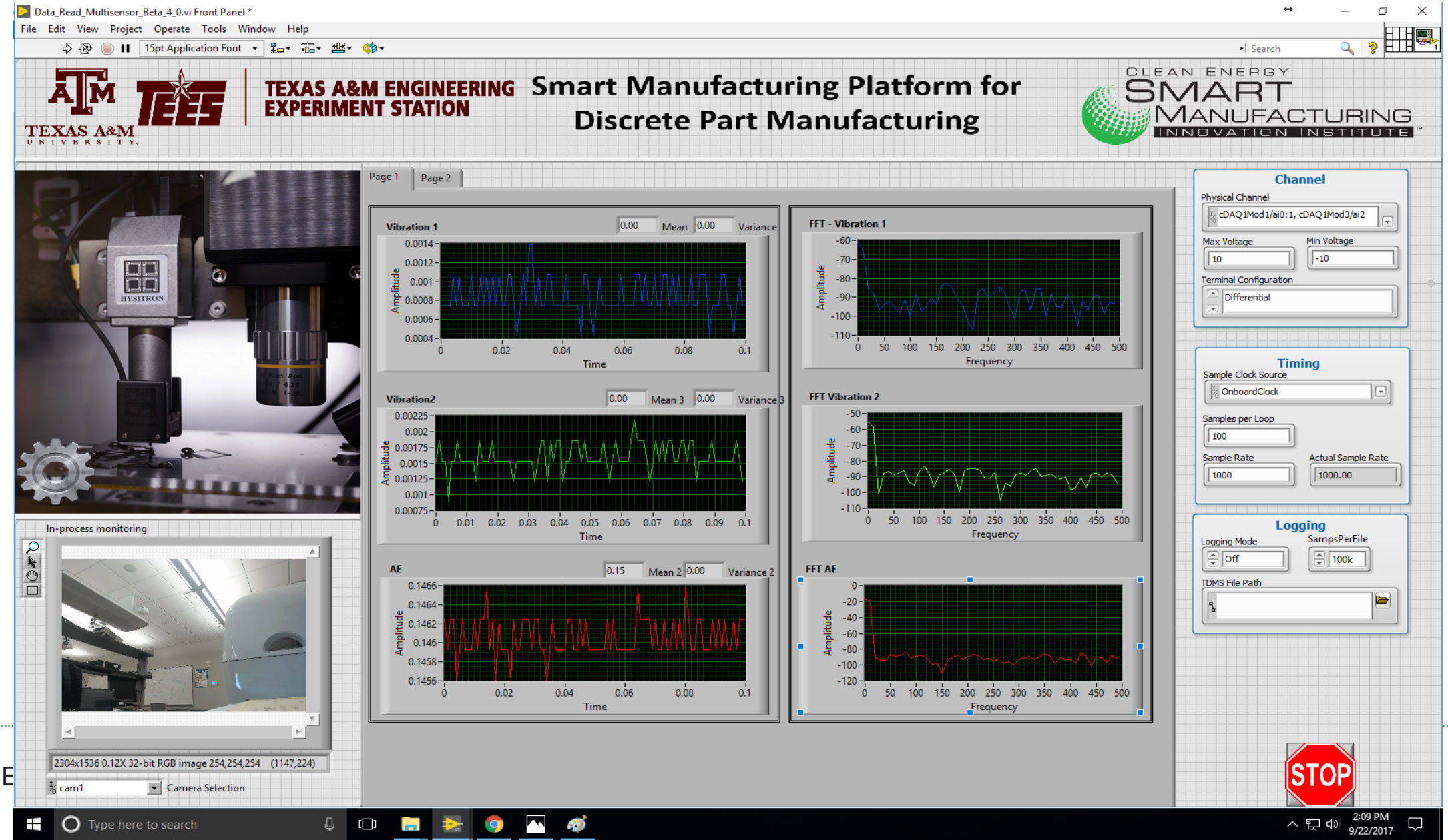


Indicates SM Product

- AM System Data Generation and Sensorization
- LabVIEW Data Acquisition
- Local OSI PI server
  - VM hosted in TAMU cloud



LabVIEW Local Display



Build the IT Infrastructure to support Workflow

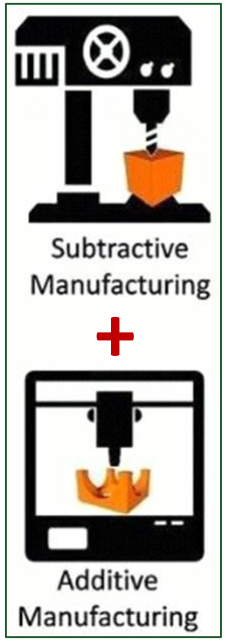
- Local analytics
- Local data storage
- Cloud connection (authentication and security)
- Cloud data storage
- Cloud analytics
- People

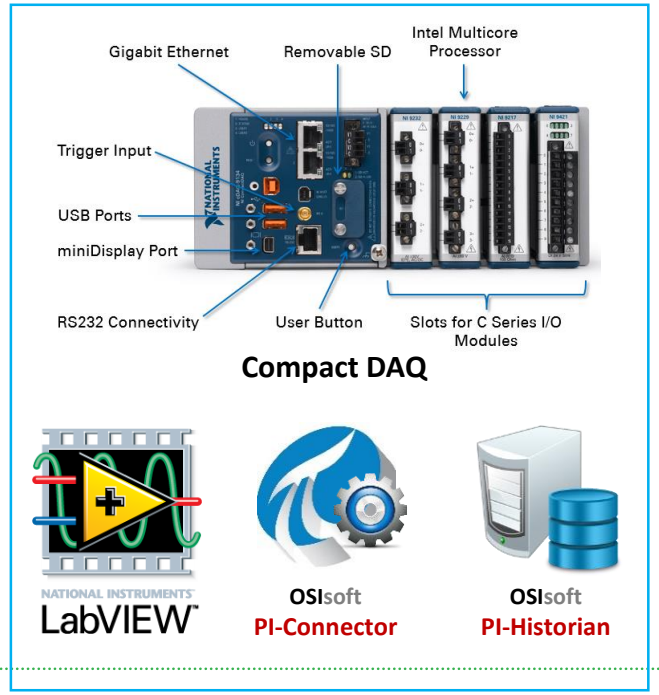
Smart Manufacturing Configuration

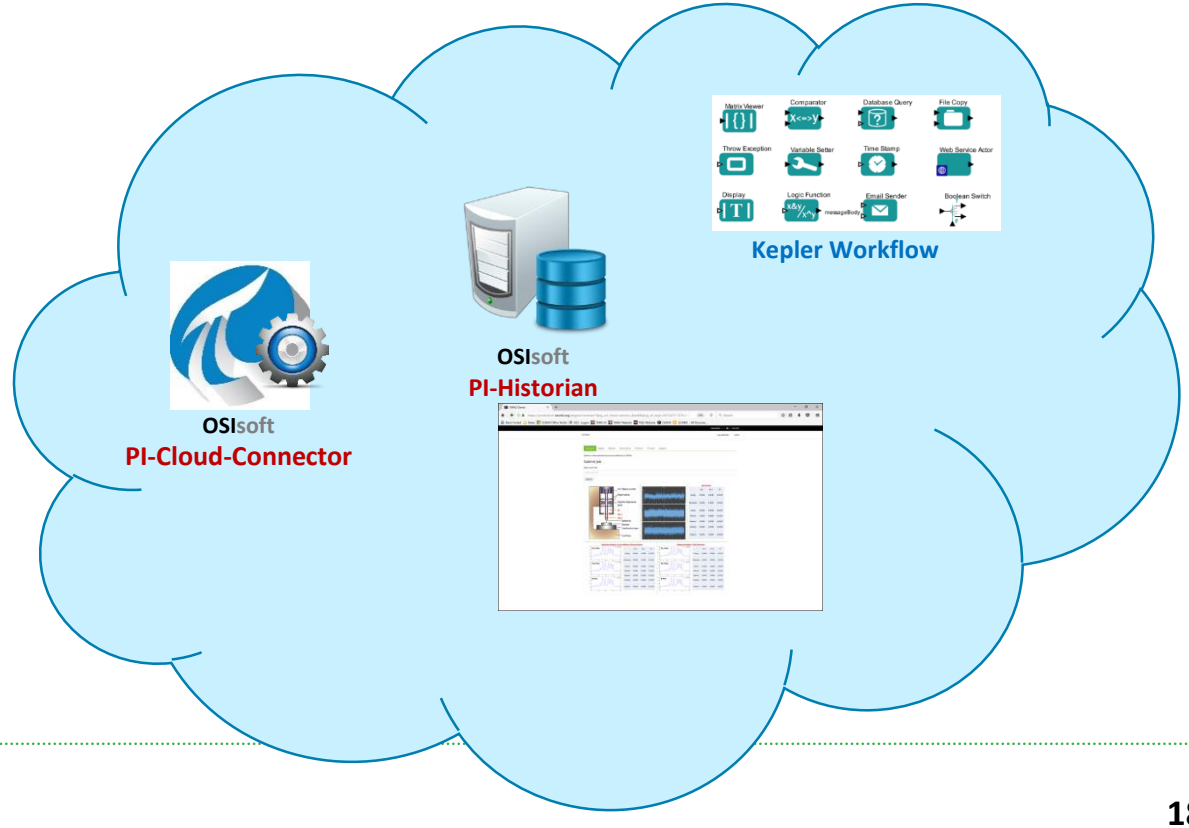
Infrastructure
OT/IT Assets, Integration

Orchestration
Workflow, Composability

Deployment
Marketplace, Tools





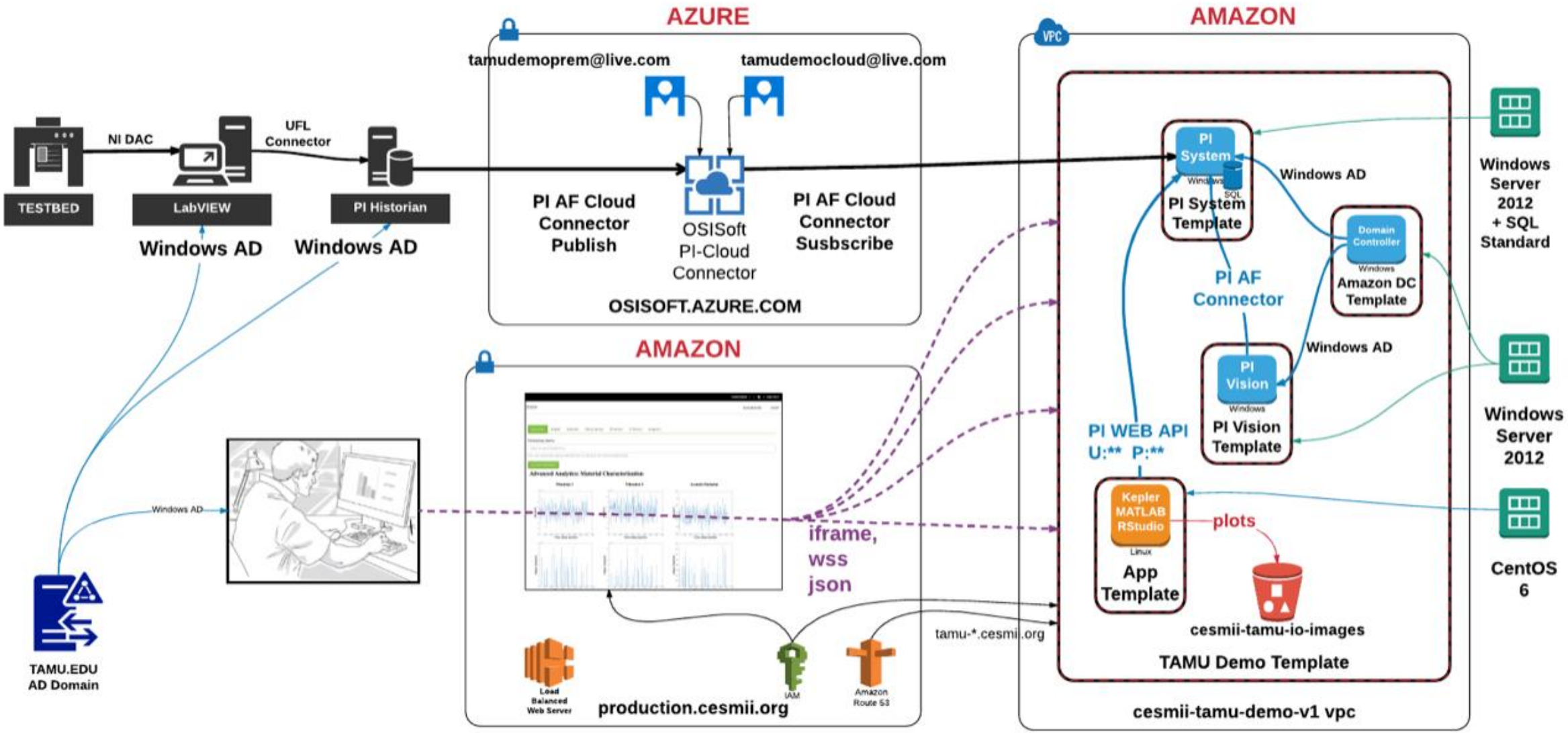


CESMII

Platform OT/IT Infrastructure

Infrastructure

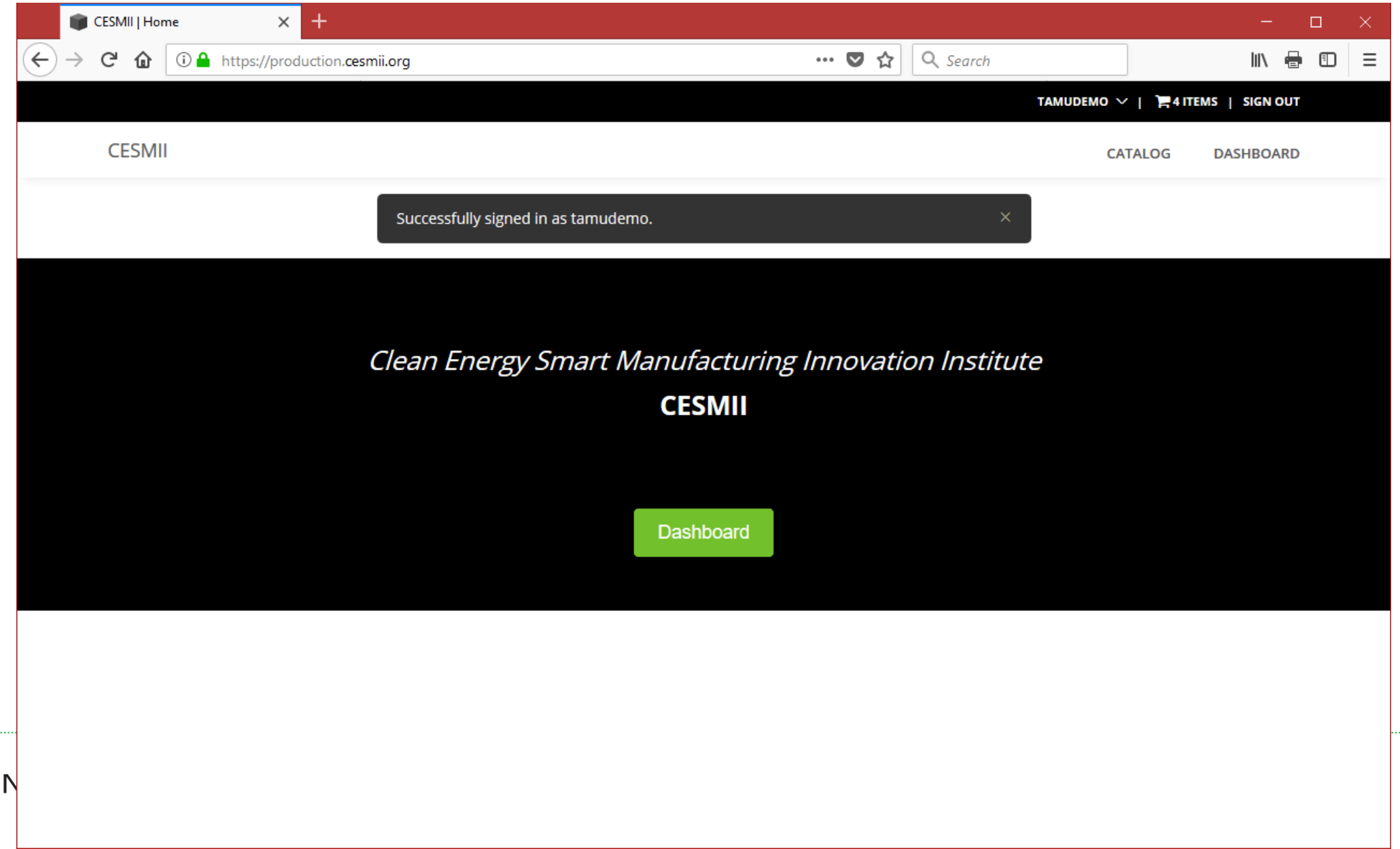
OT/IT Assets, Integration



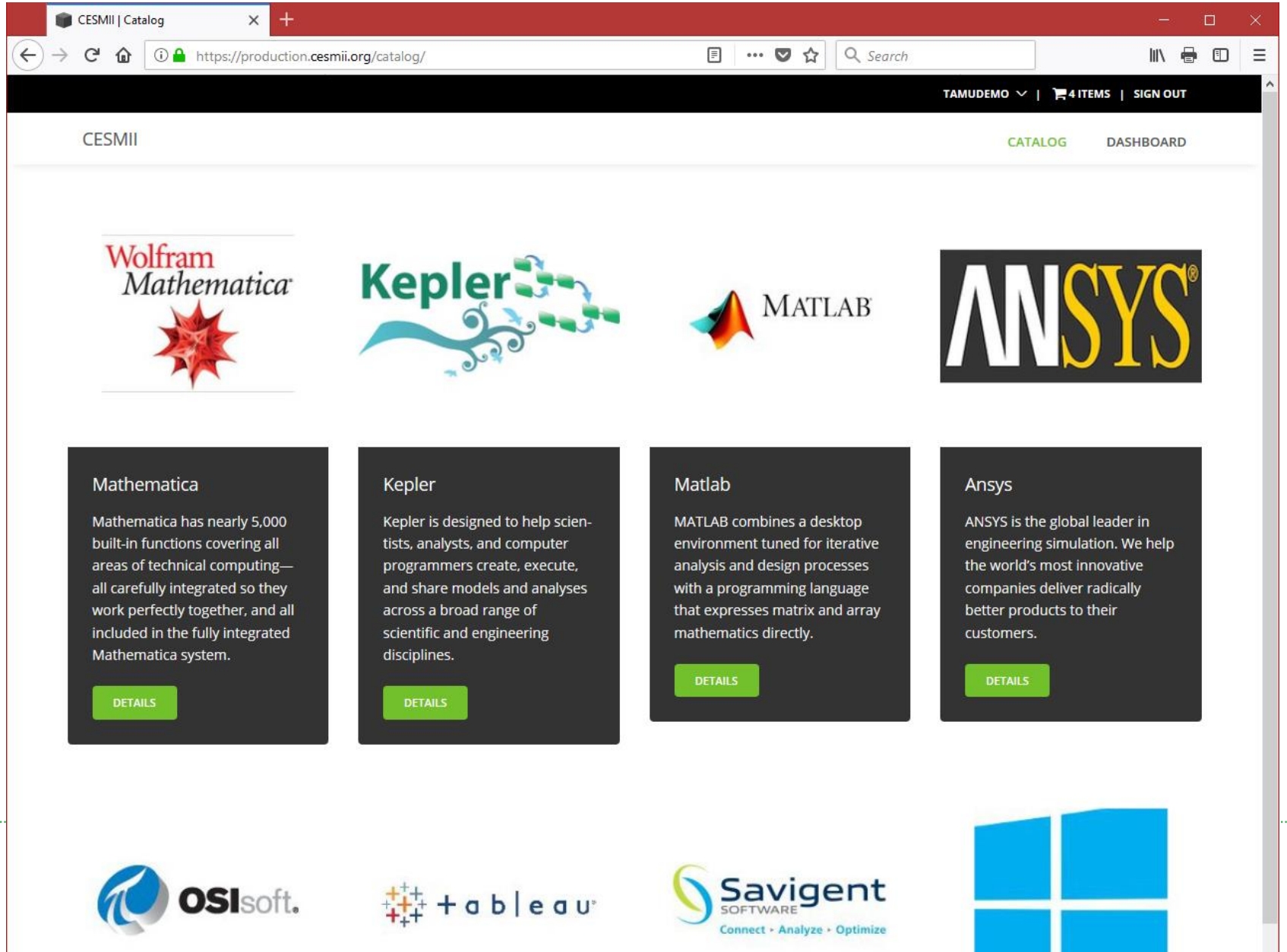
Composing the Workflow

- Marketplace tools and applications
- Process/display outcomes

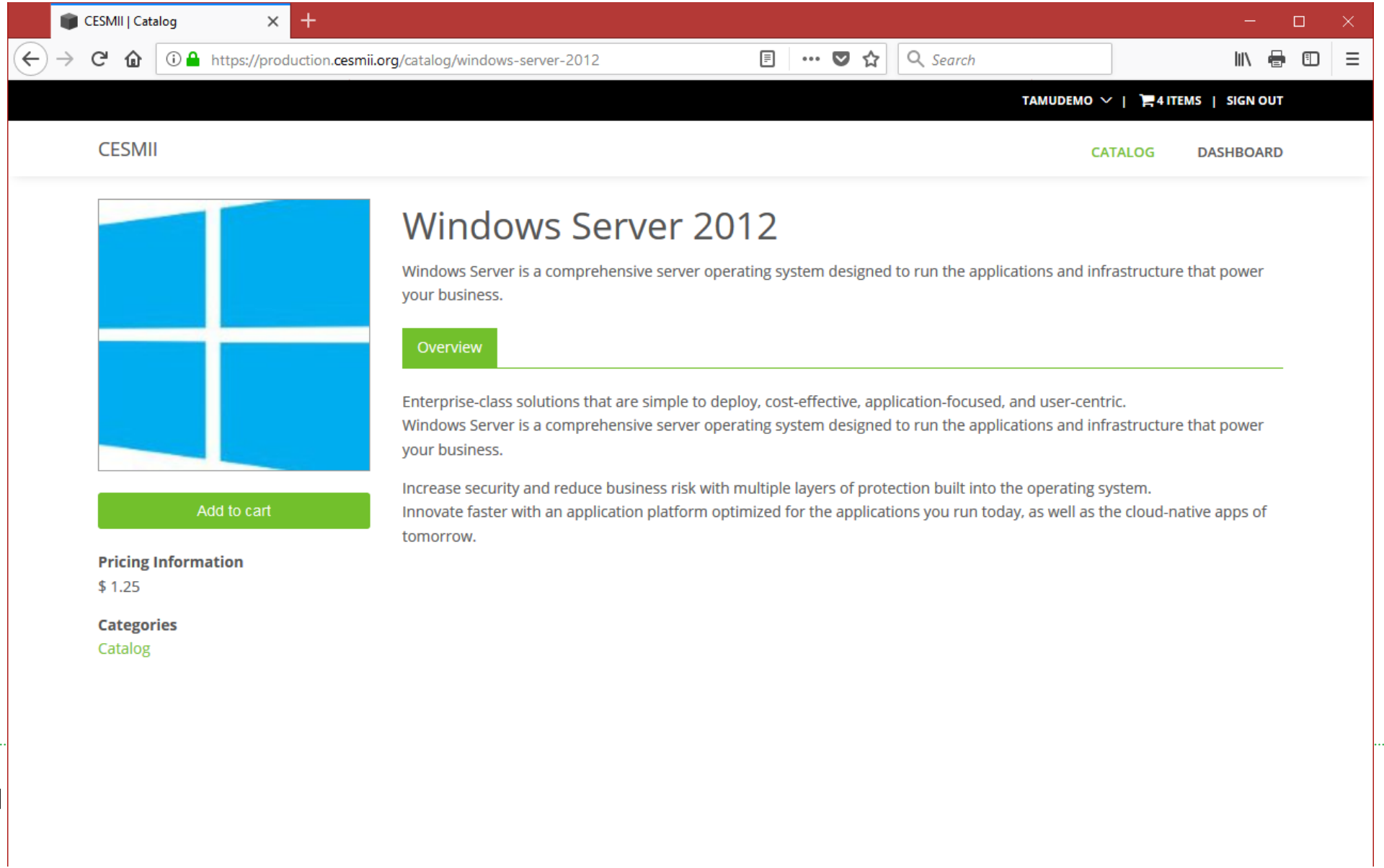
CESMII Production System



CESMII Marketplace Catalog

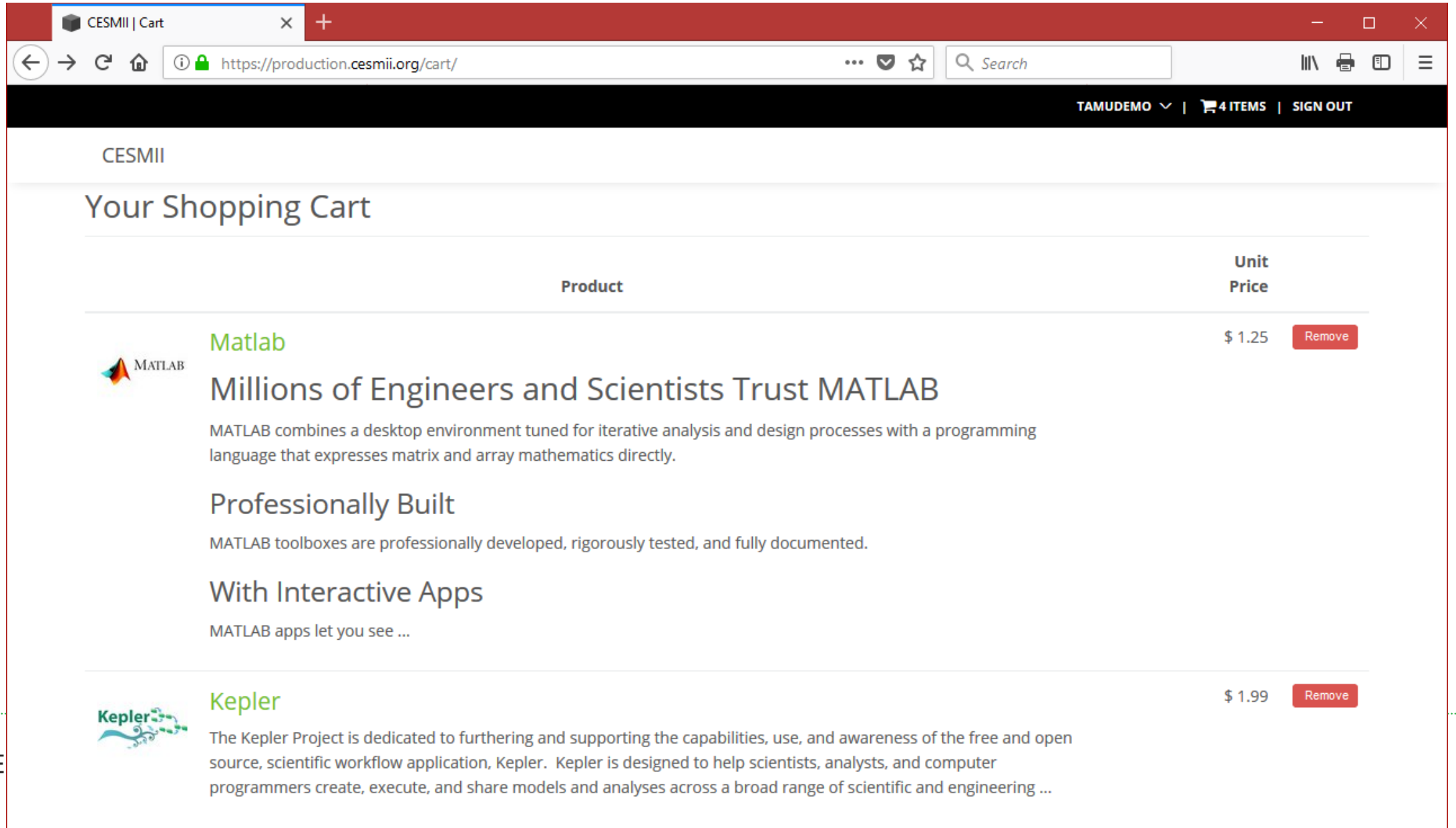


Getting a Product from the Marketplace

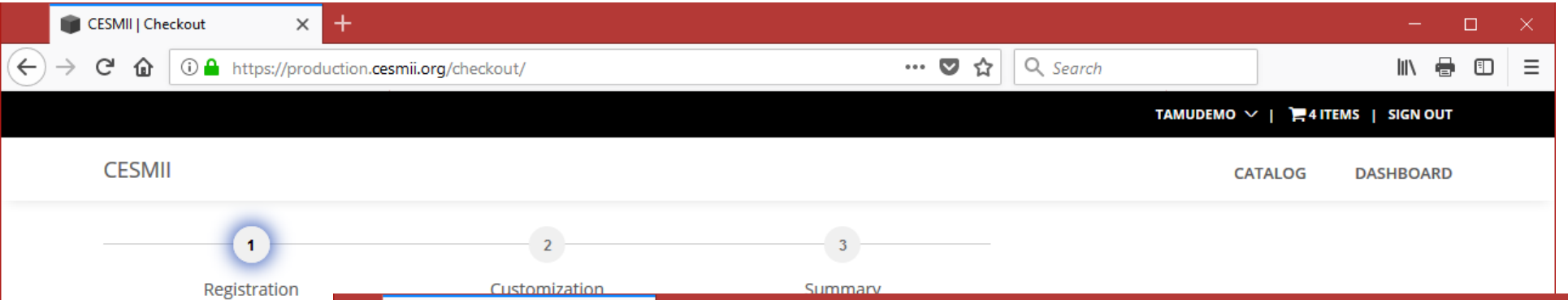


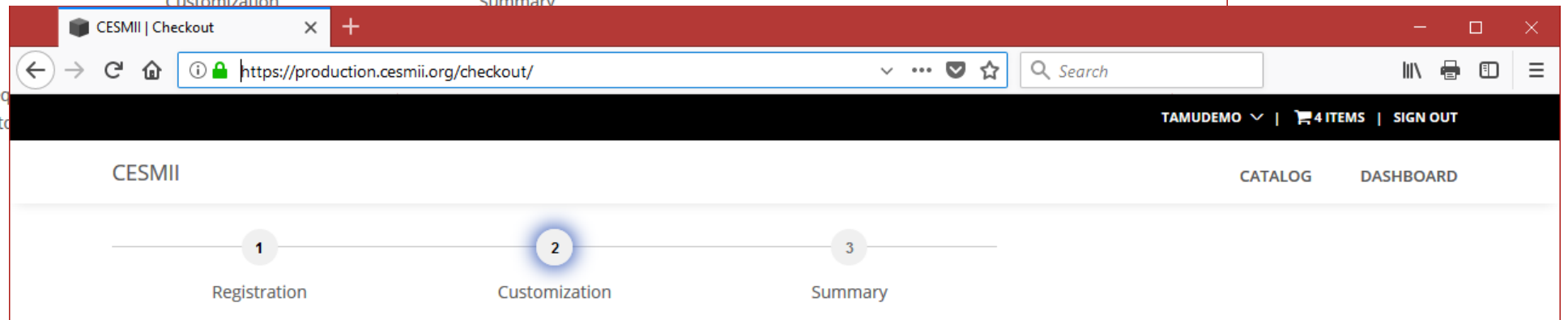
CESMII

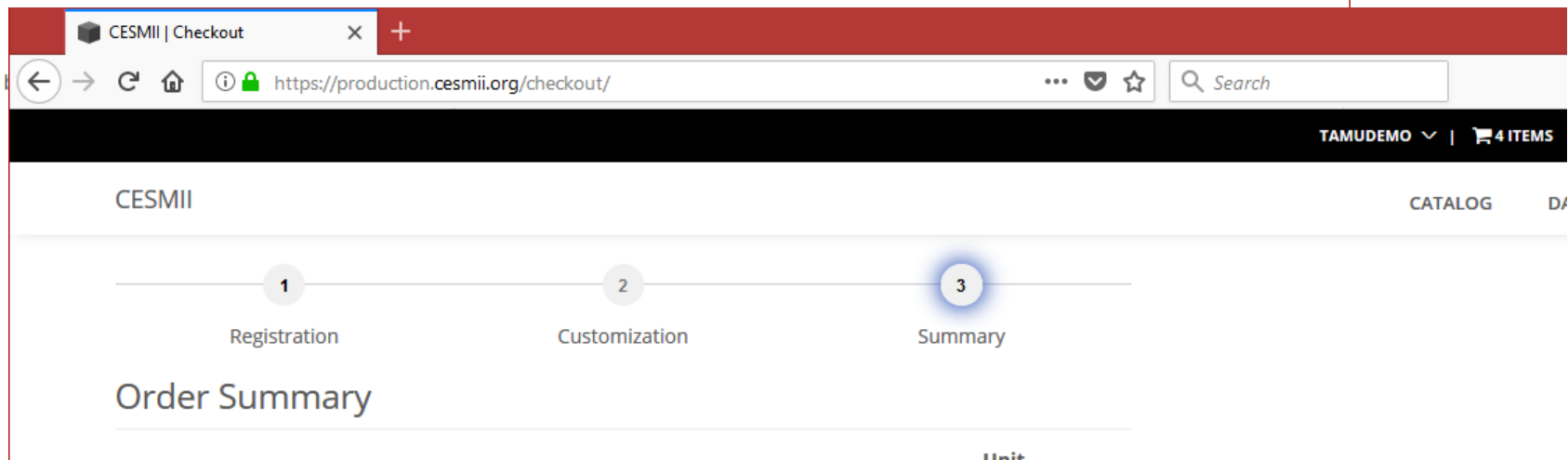
Getting a Product from the Marketplace



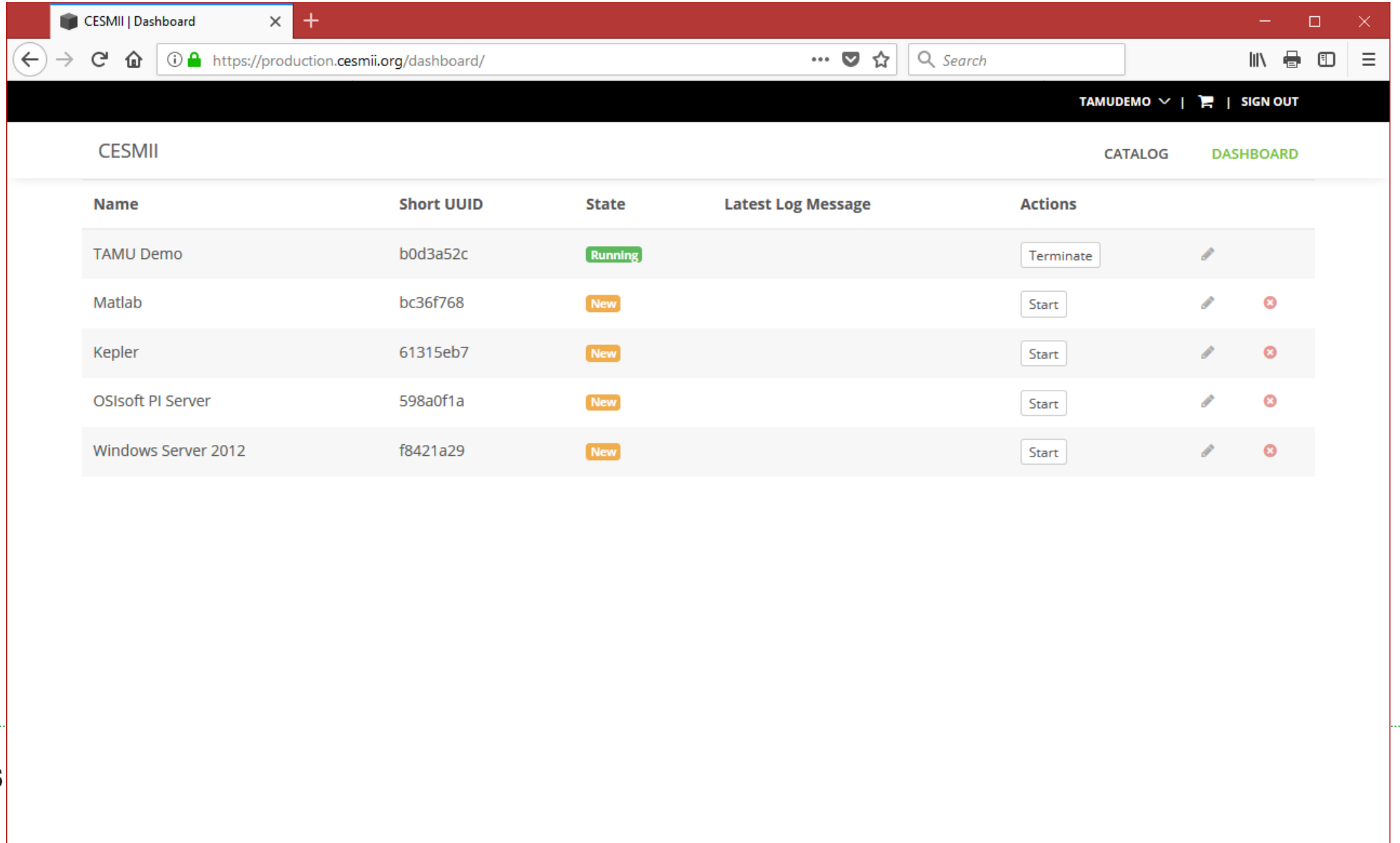
Getting a Product from the Marketplace



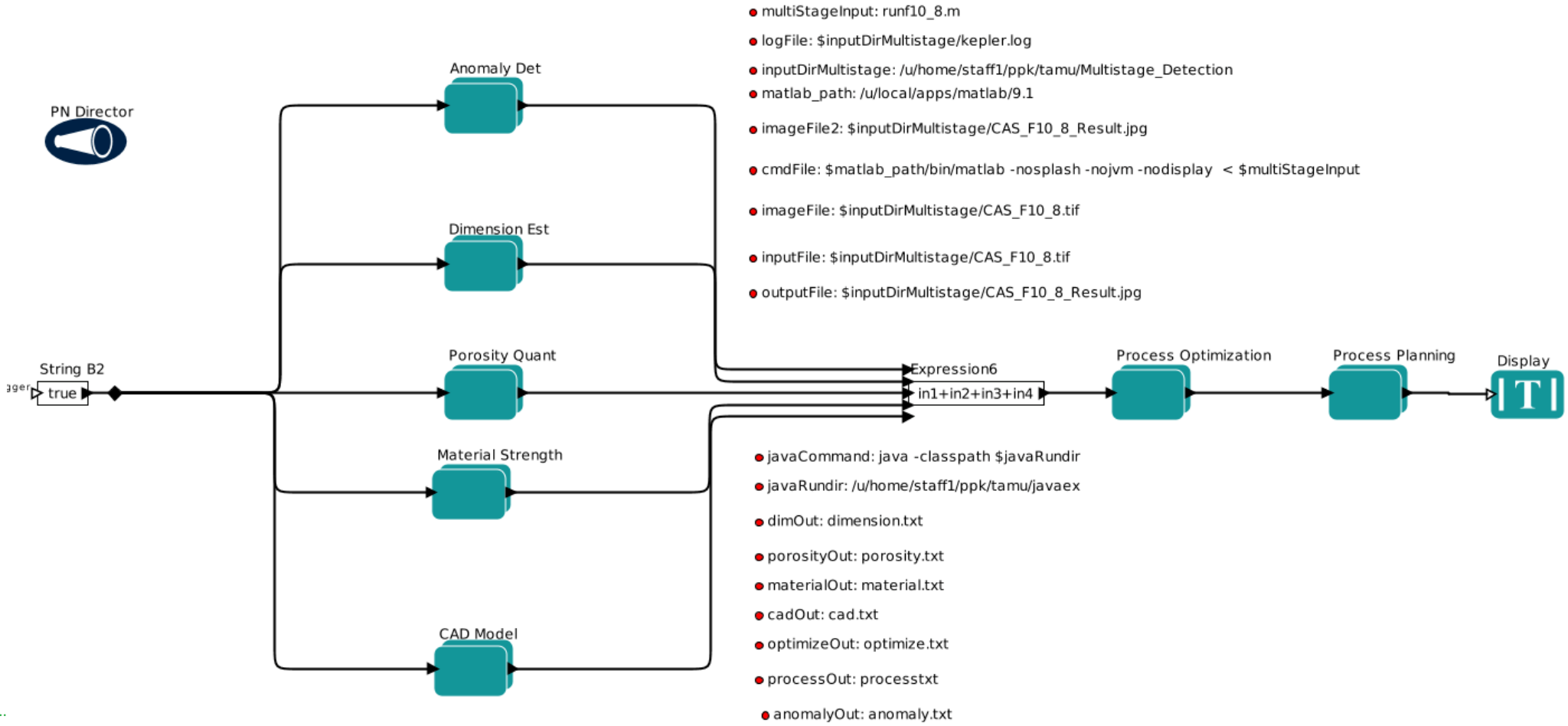




The User Dashboard

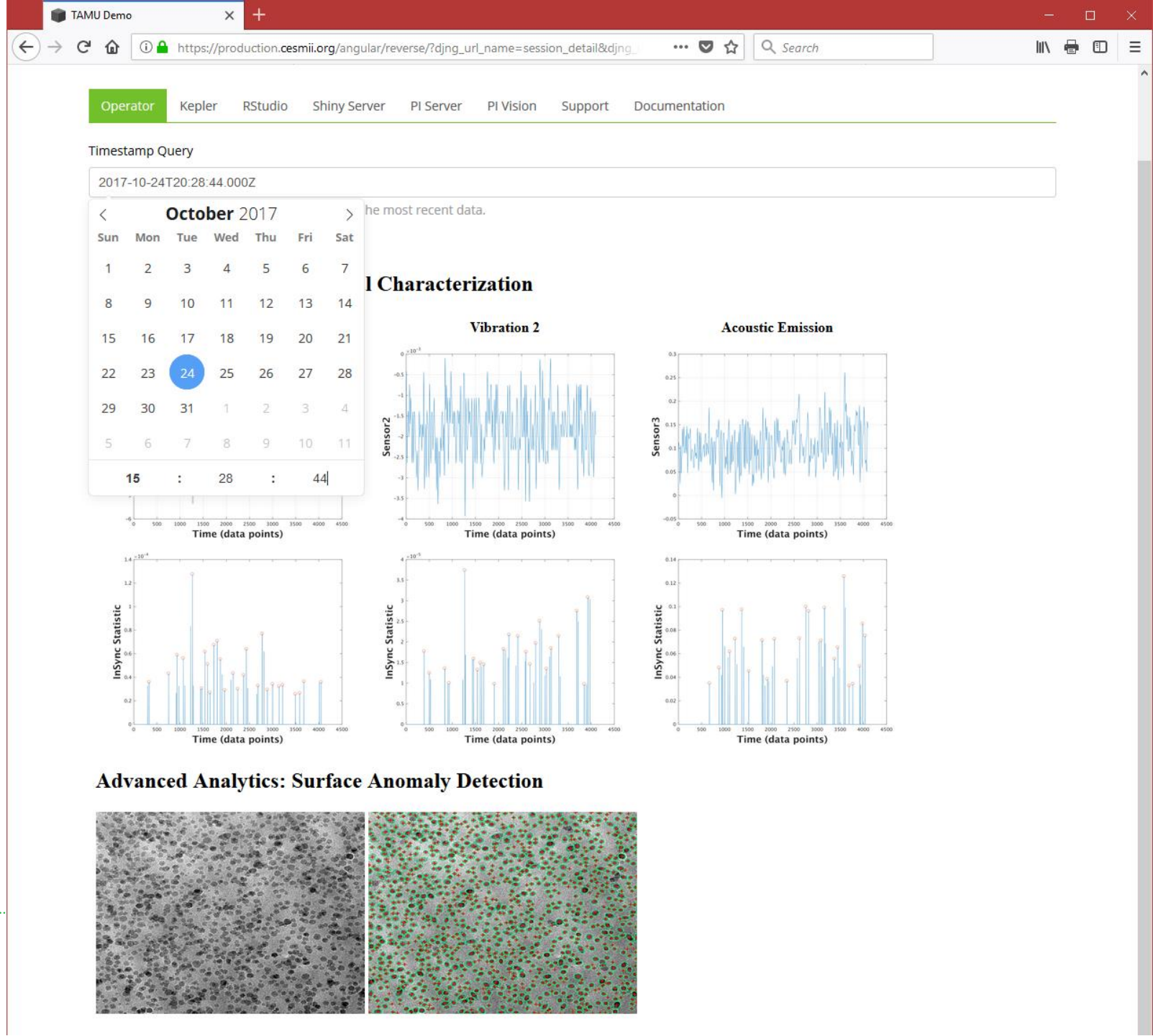


Orchestration: Composing the Computational Workflow

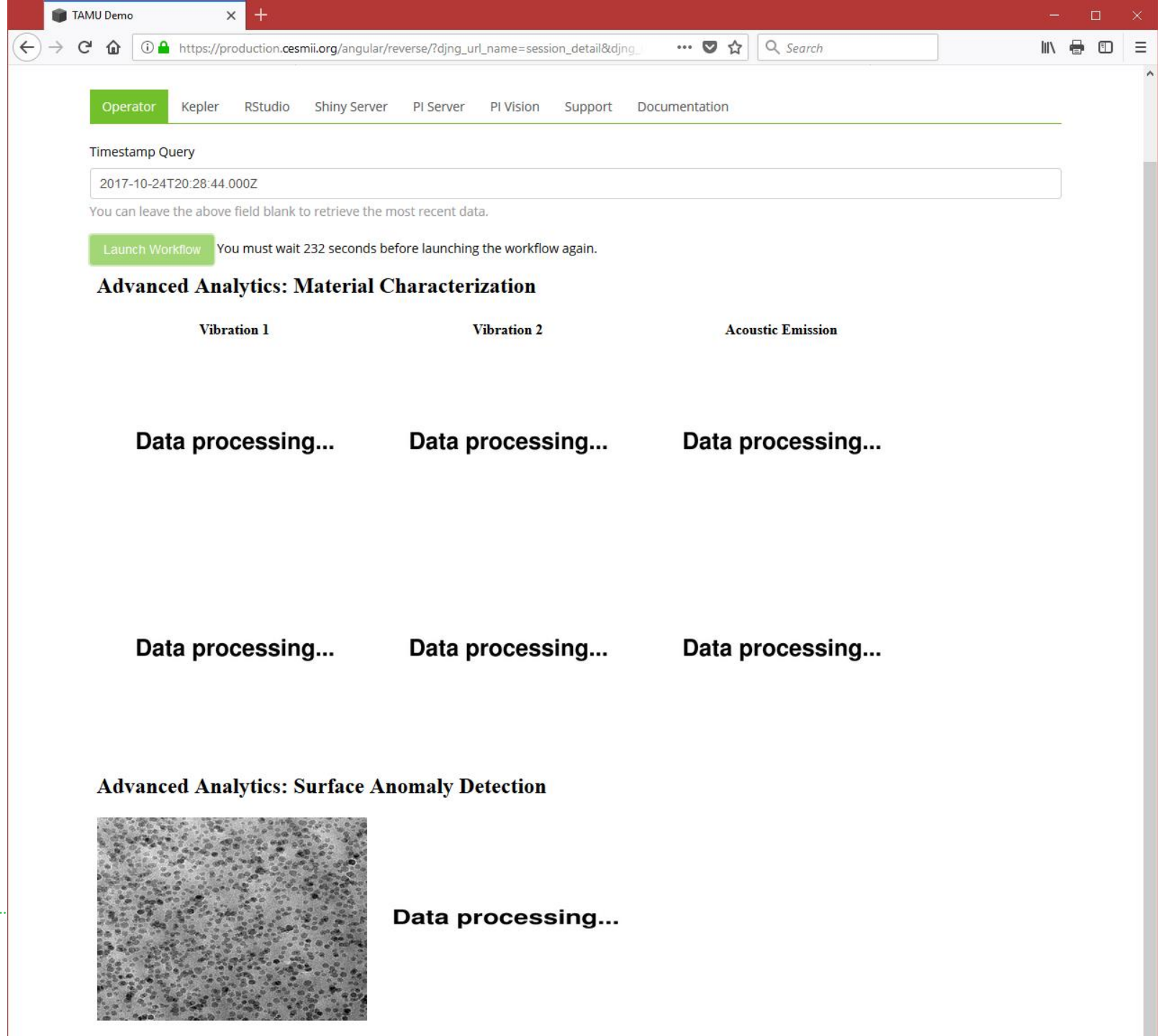


CESMII

Back to the User Dashboard

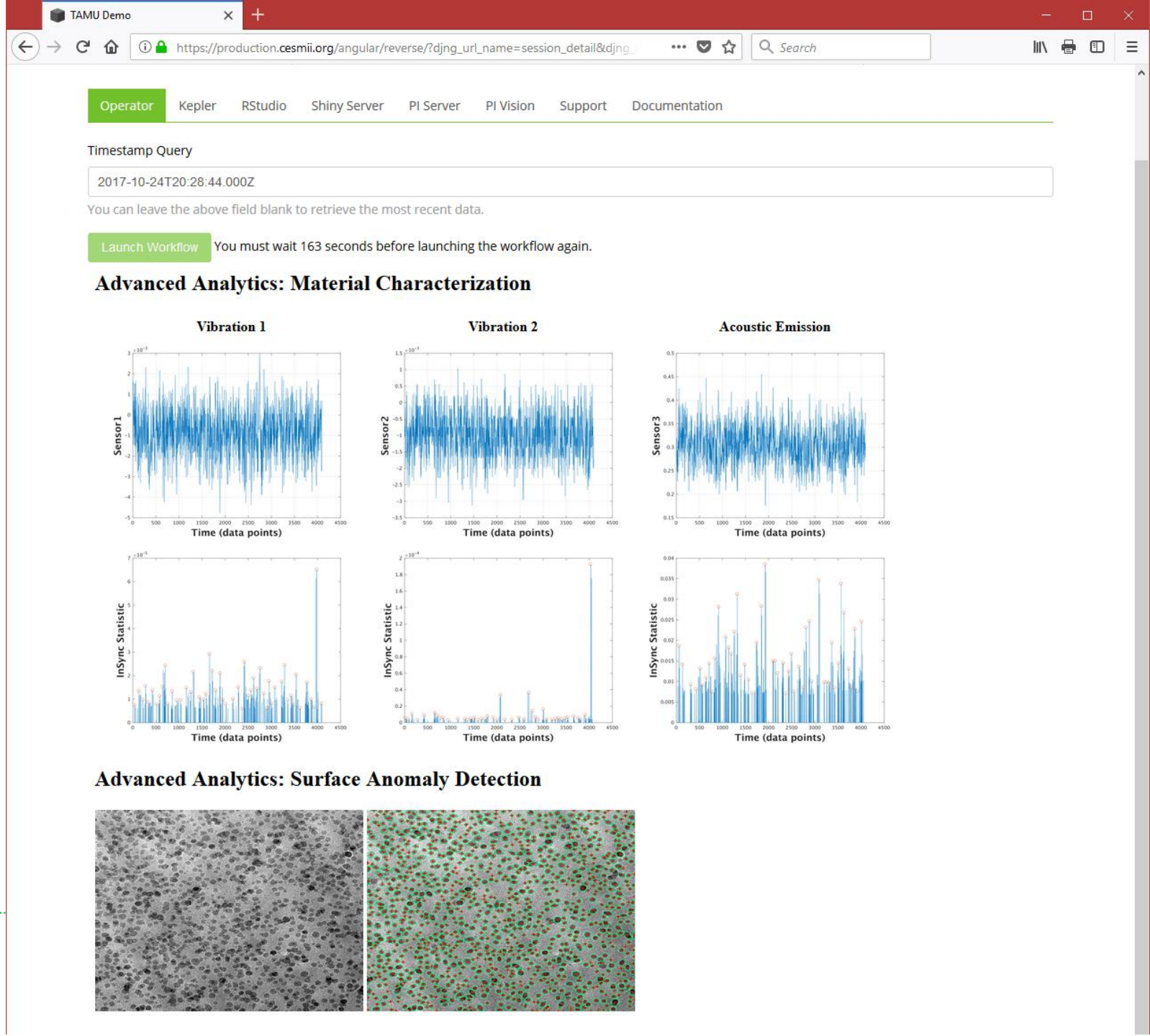


Launch the Workflow



CESMII

Finally,
The Results!



CESMII

Conclusion

- Implement Sensor Wrapper to gather data on site
- Create Smart Manufacturing infrastructure to enable use of advanced analytics
- Provide feedback required to improve material/part quality while reducing time and energy costs

Conclusion: What Value was Achieved?

- The Smart Solution: Manage properties in real-time across the operations in this application
- Added to the SM Platform™ Portfolio: demonstrated the utility of cloud orchestration (regardless of where your “cloud” is)
- Created additional avenues for better operational information (real-time material property management across multiple systems)
- Created reusable SM Products™
  - Sensor wrappers for commercial products
  - Analytic tools for materials characterization
  - Configurable Workflow (hardware, software, and connectors)

Contact: Dean Schneider

Gulf Coast Regional Manufacturing Center

Clean Energy Smart Manufacturing Innovation Institute

Dean.Schneider@CESMII.org
979-458-0251

https://twitter.com/SMCoalition

Facebook.com/SMLeadershipCoalition

http://www.linkedin.com /groups /Smart-Manufacturing-Leadership-Coalition

Accelerating
Your Smart Manufacturing Transformation