



Data-driven Prognosis, Health Monitoring, and Control for Smart Manufacturing

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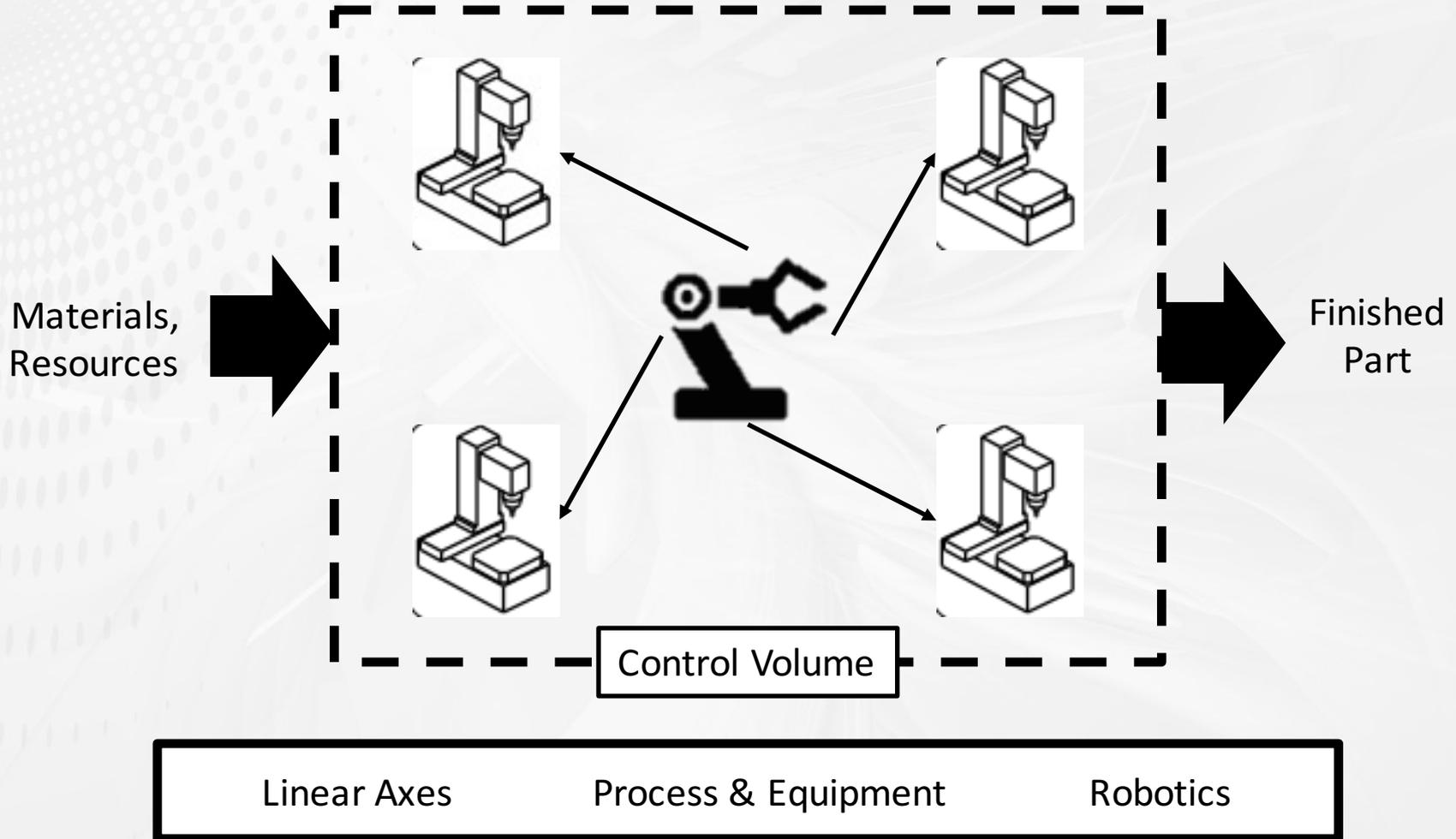
Intelligent Systems Division

Data Can Improve Production Control

- Complex system, sub-system, and component interactions/relationships within manufacturing systems make it challenging to determine the specific influences on performance
- Increasing interest and ability to leverage data and analysis to generate actionable intelligence about system interactions/relationships for control
- No uniform process exists that guides sensing, monitoring, and control at all levels from the component to the system to the enterprise



Dynamic Control of Production Cell



Research Focus

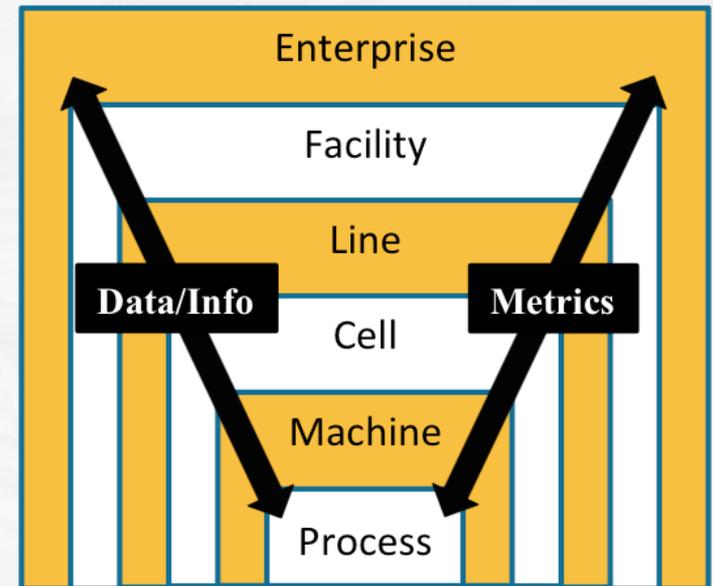
- Identify data and information needed to make an informed decision with respect to setting and updating control points
- Define data collection requirements to minimize the collection of "big data."
- Determine appropriate structure, organization, and analysis of data to gain actionable intelligence
- Enable feedback of intelligence through the system to update control for optimal production
- **Expected Impact:** Improved decision-making support and automation with a focus on vendor-neutral approaches and plug-and-play solutions

Research Focus based on Roadmap Action Plan developed from the results of a PHM Workshop
More information see <http://www.nist.gov/el/isd/phm4sms-workshop.cfm>



Research Thrust: Manufacturing Process and Equipment Monitoring

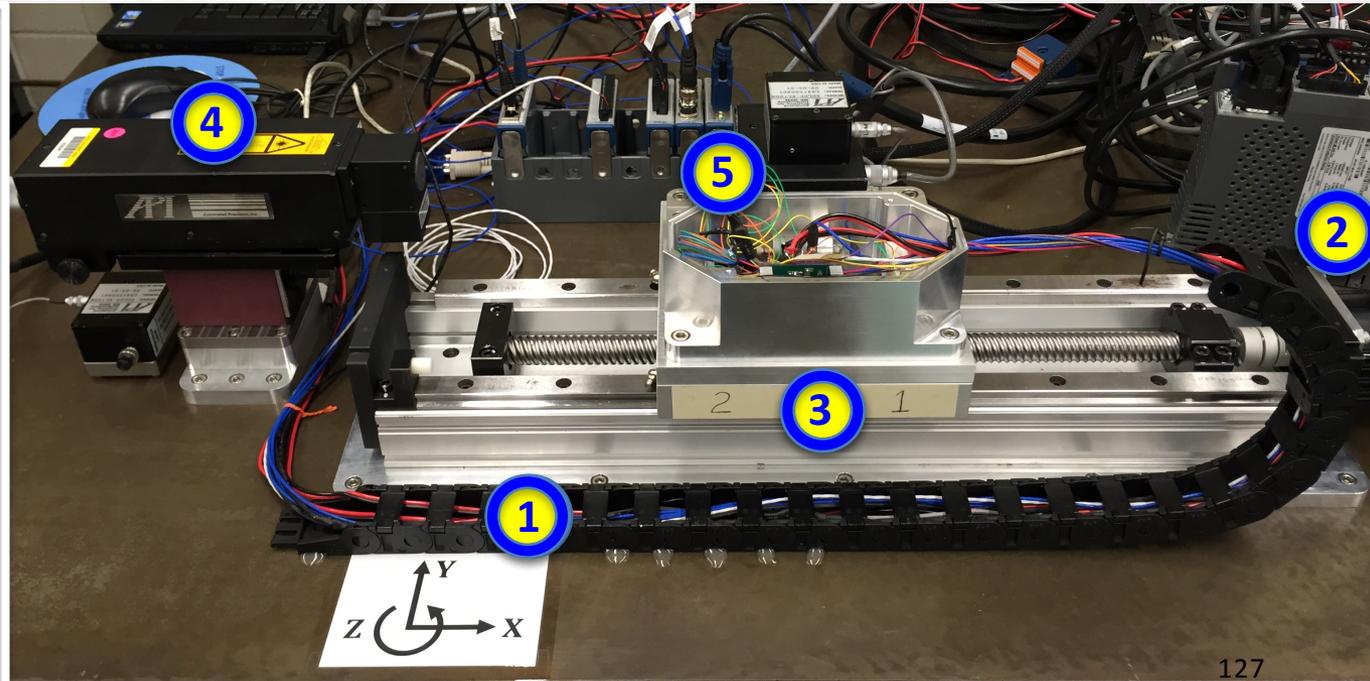
- **GOAL:** Identify high-value data sources and most appropriate opportunities to collect data to avoid the big data challenge to improve monitoring and control?
- **Infrastructure:** How can we collect data from manufacturing systems across multiple sensing and control levels?
- **Data:** What is the right way to collect the best data available?
- **Actionable Intelligence and Control:** How can I apply machine learning to diagnosis and predict system performance and use this knowledge for control?



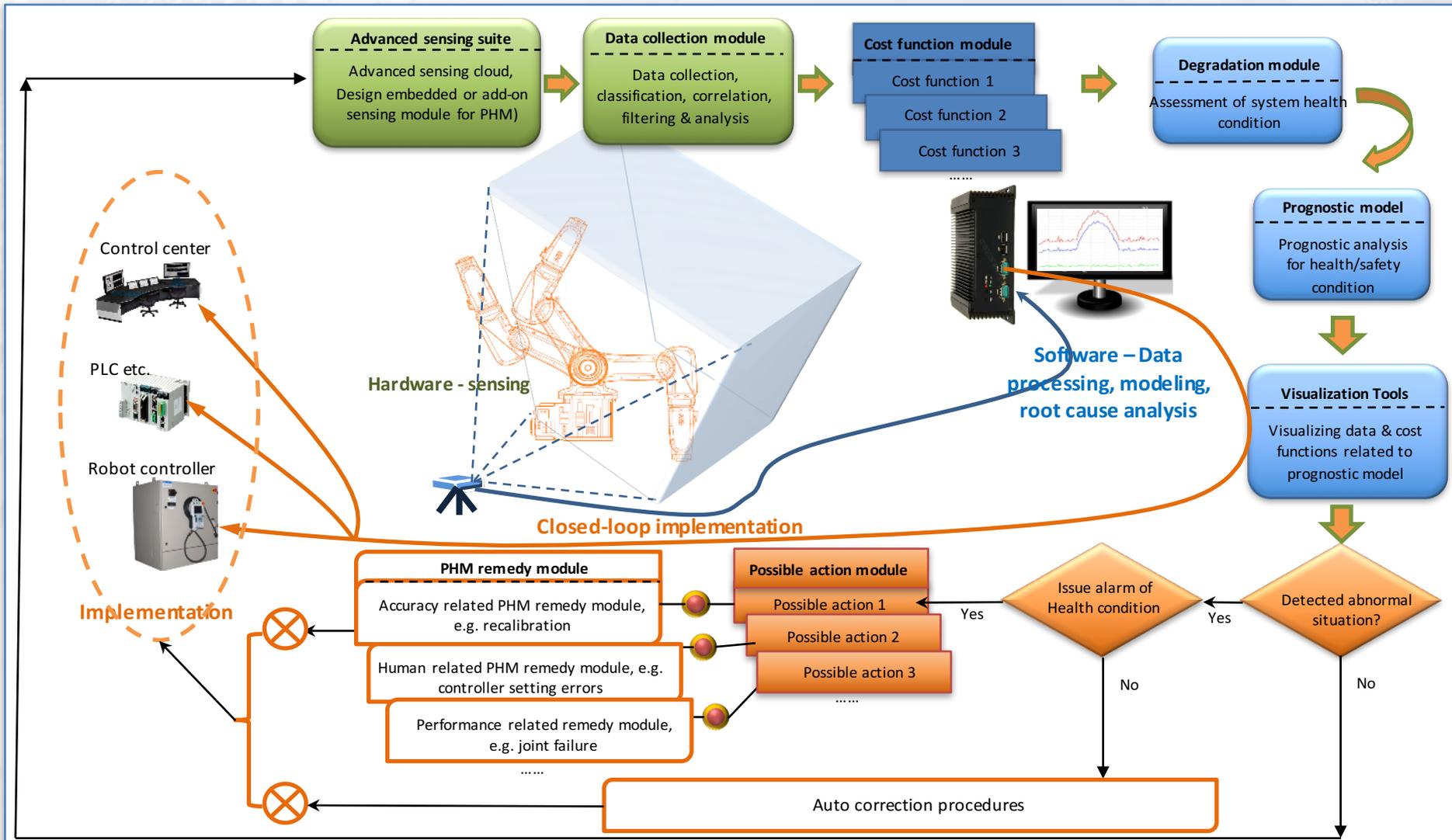
Research Thrust: Machine Tool Linear Axes Diagnostics & Prognostics

- **Goal:** Develop sensor-based method with inertial measurement unit (IMU) for quick and accurate tracking of machine tool linear axis errors
- Test bed was constructed with laser-based system for V&V
- Initial data sets collected with positive preliminary results
- Method will be applied in Summer 2016 on multi-axis machine tool

- 1 Linear Slide
- 2 DC Motor with Encoder
- 3 Sensor Box
- 4 Laser
- 5 Laser Sensor Boxes



Research Thrust: PHM for Robotics



Some Next Steps

- Use Case Development
- Reference Datasets
- Standards
- Guidelines

