

# ISO 23247 Digital Twin Three Use Cases

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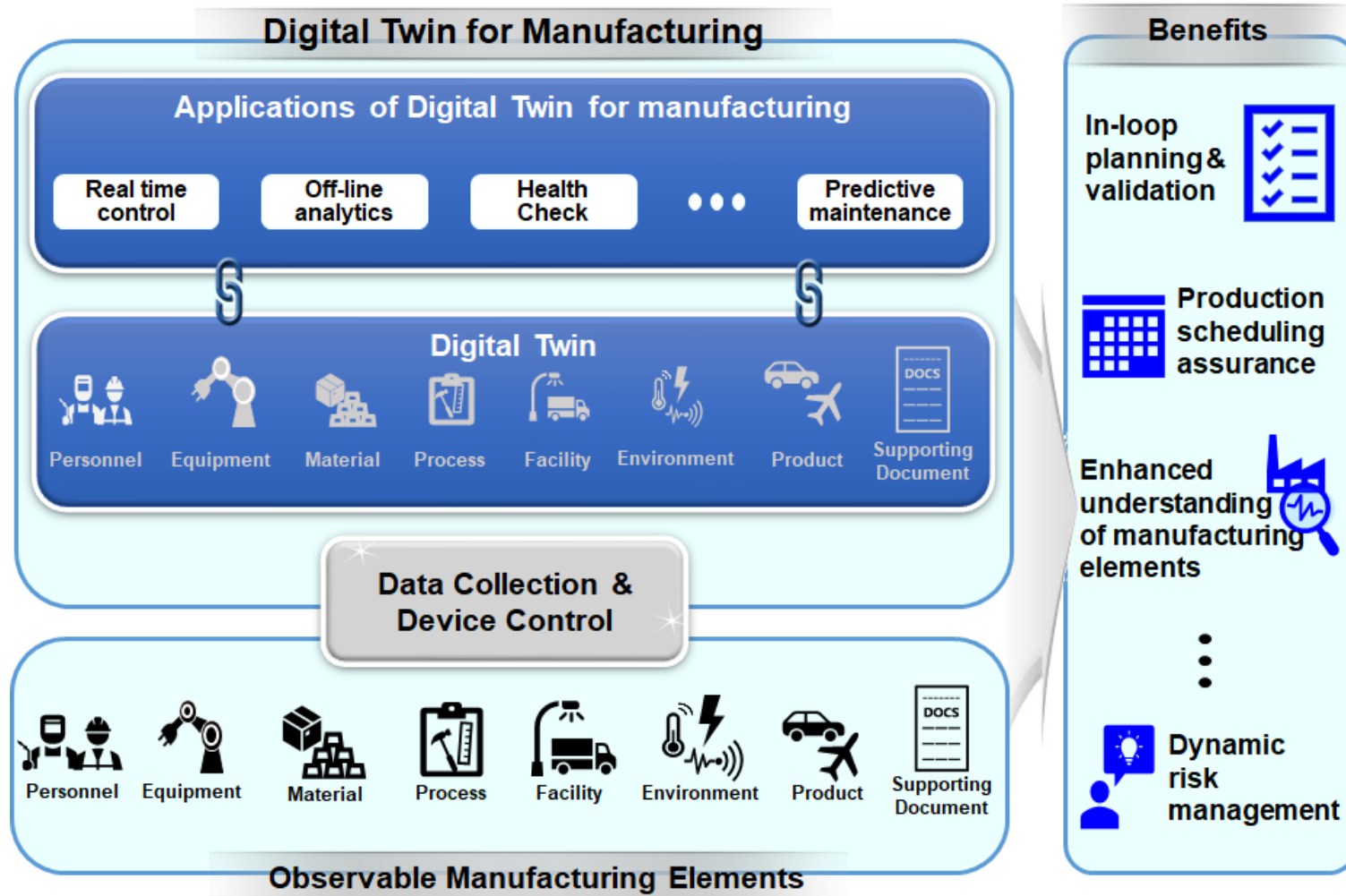
“The Holey Professor”

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# Who are we – ISO TC184/SC4 WG15

- ISO – International Standards Organization
  - Geneva, Switzerland
- TC184 – Industrial automation standards
  - Chair – Patrick Lamboley, AFNOR, France
- SC4 – Industrial Data
  - Chair – Kenny Swope, Boeing, USA
- WG15 – Digital Manufacturing
  - Convenor – Martin Hardwick, STEP Tools, Inc., USA
  - Boeing, Lockheed Martin, Raytheon, NIST, Sandvik, Iscar, Mitutoyo, DMSC (QIF), MTCConnect, KTH Sweden, ETRI Korea

# Digital Twin framework for manufacturing

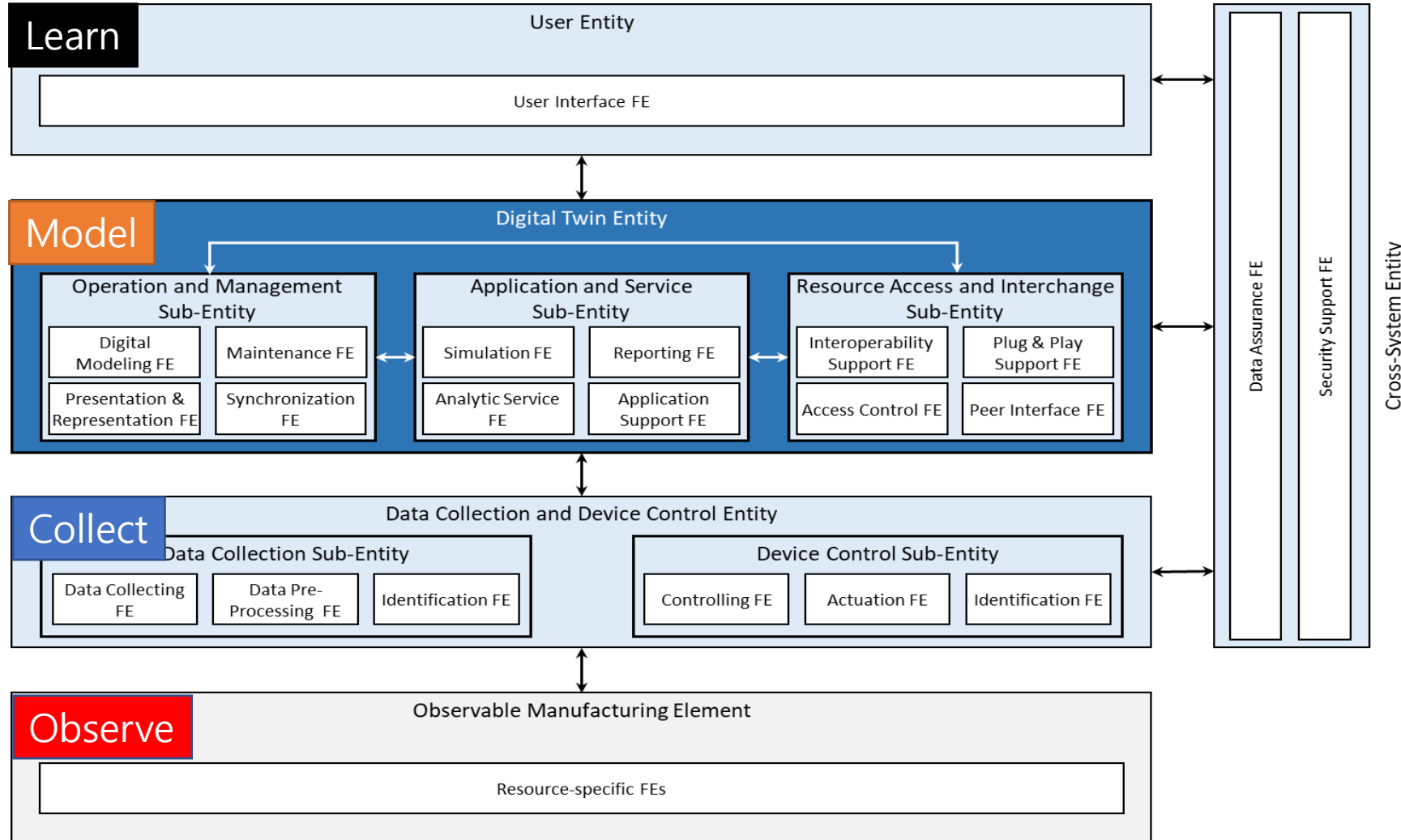


“Twin”

“Framework”

“Manufacturing”

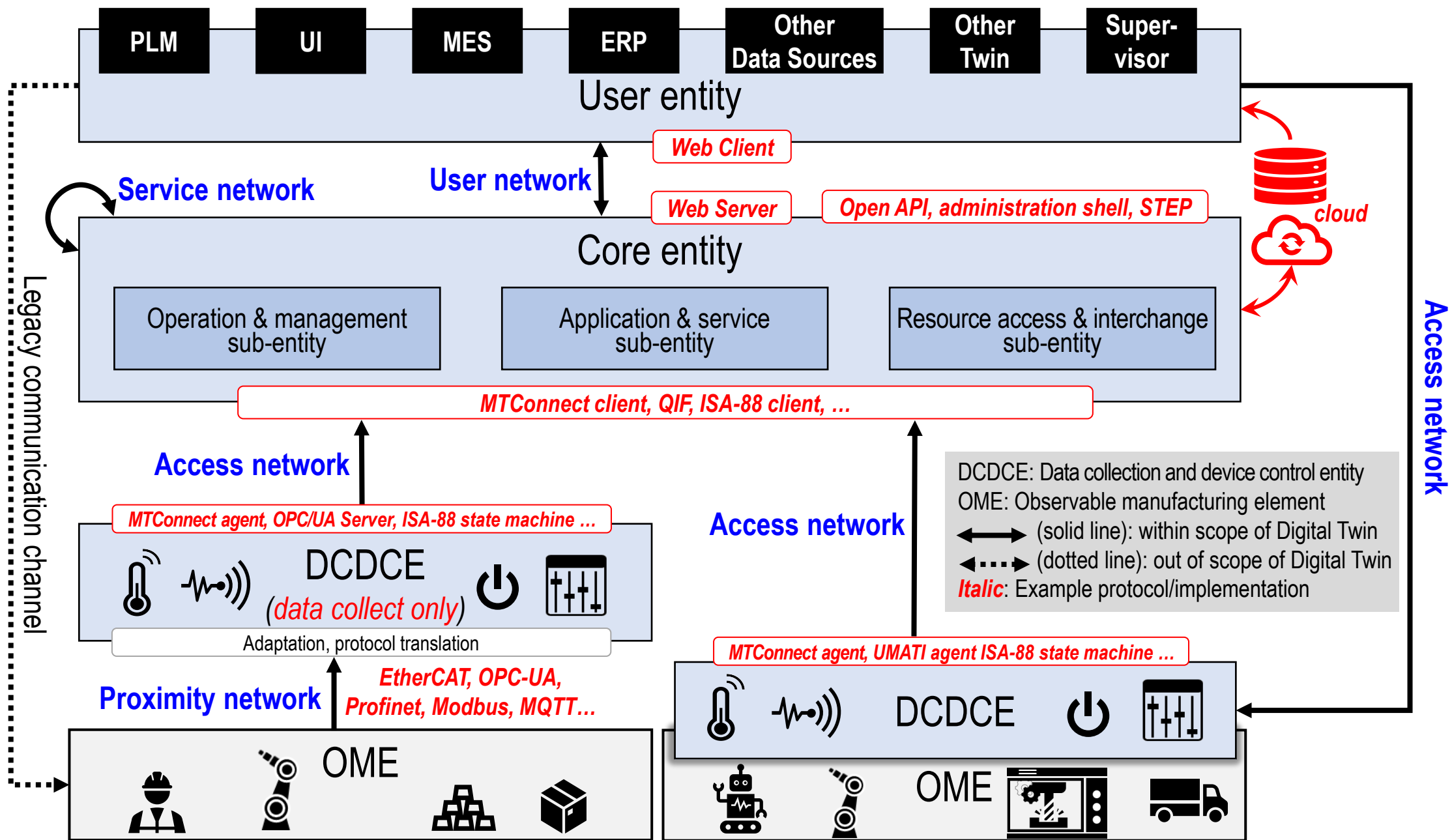
# ISO 23247



ISO 23247 is layered on the IoT architecture ISO 30141

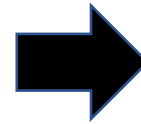
DIS ballot ends on September 30

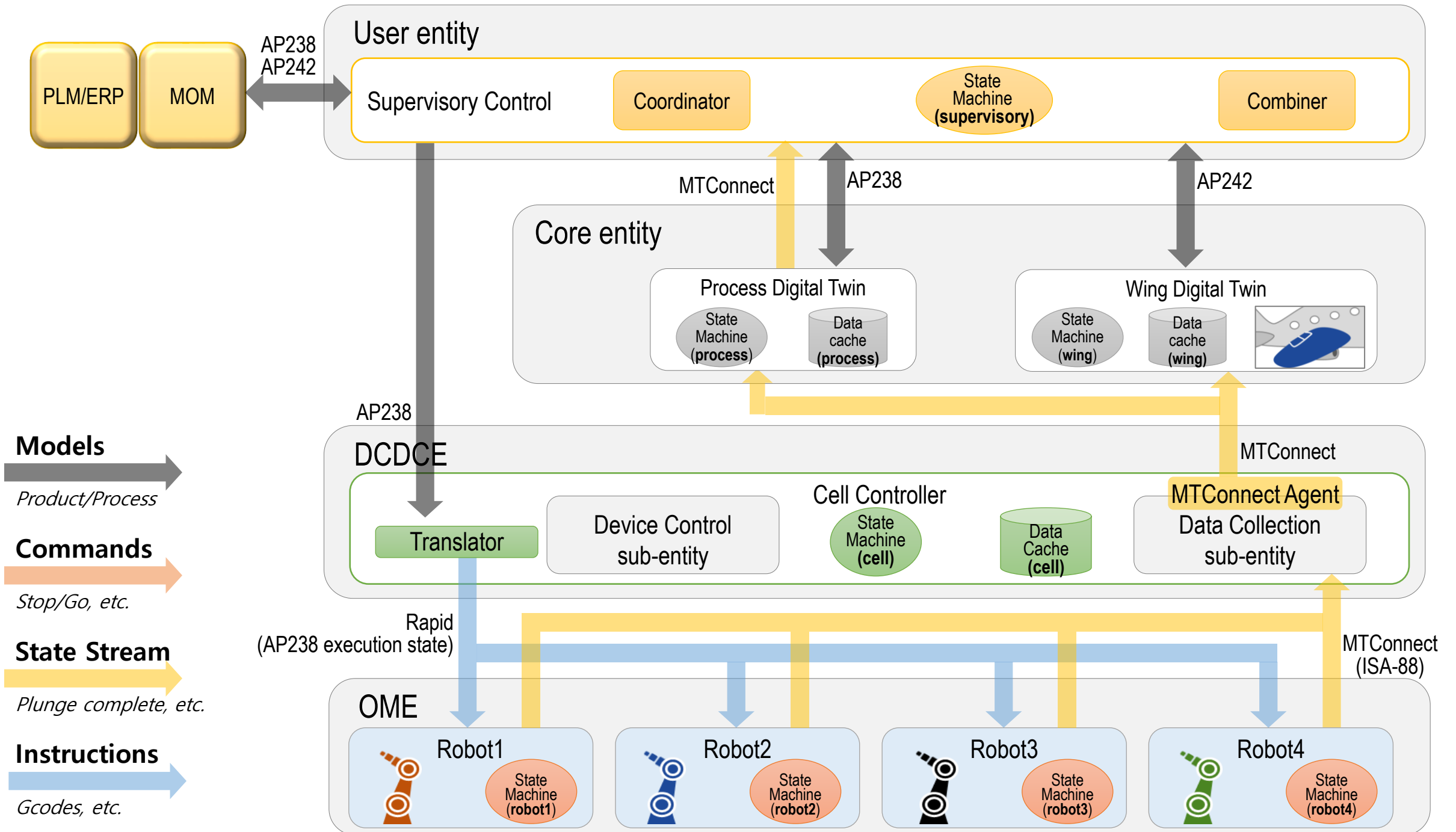
# Options



# Use Case 1 – flexible schedule for robot drill & fill

- Manual -> Automatic
- Massive monolithic machines -> Robot cells
- Static processes -> dynamic processes
- Non-Optimized -> Optimized

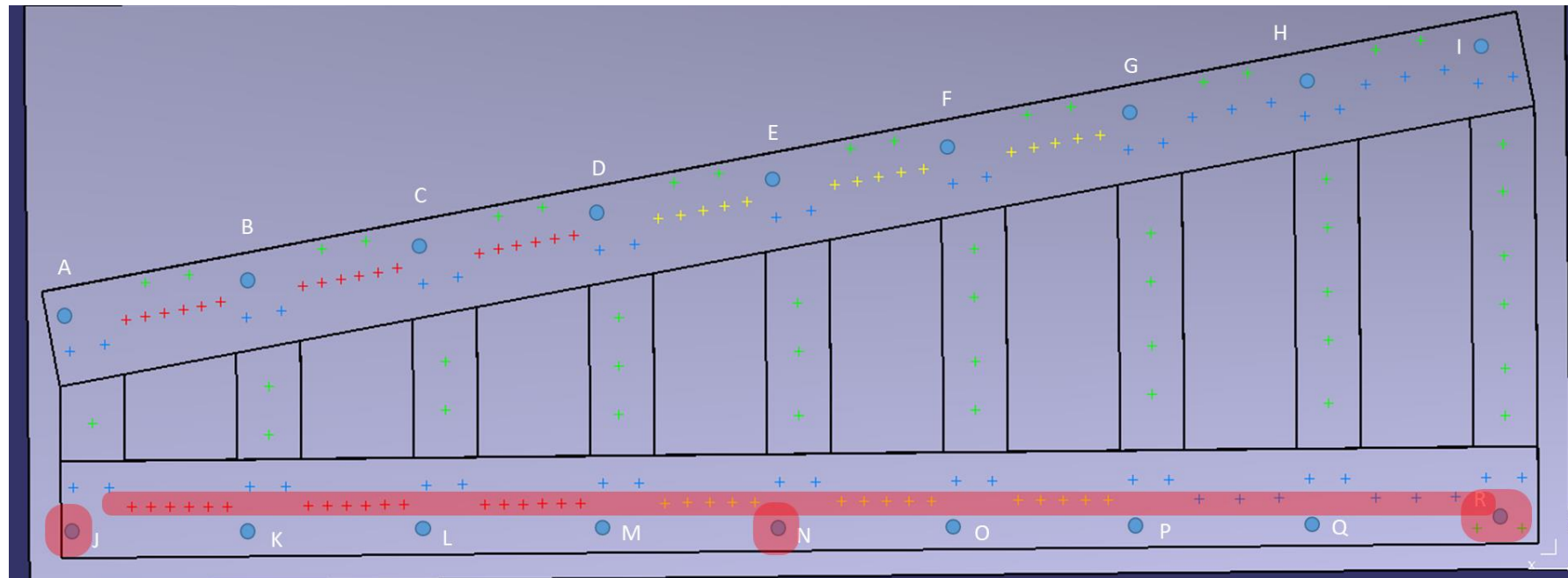






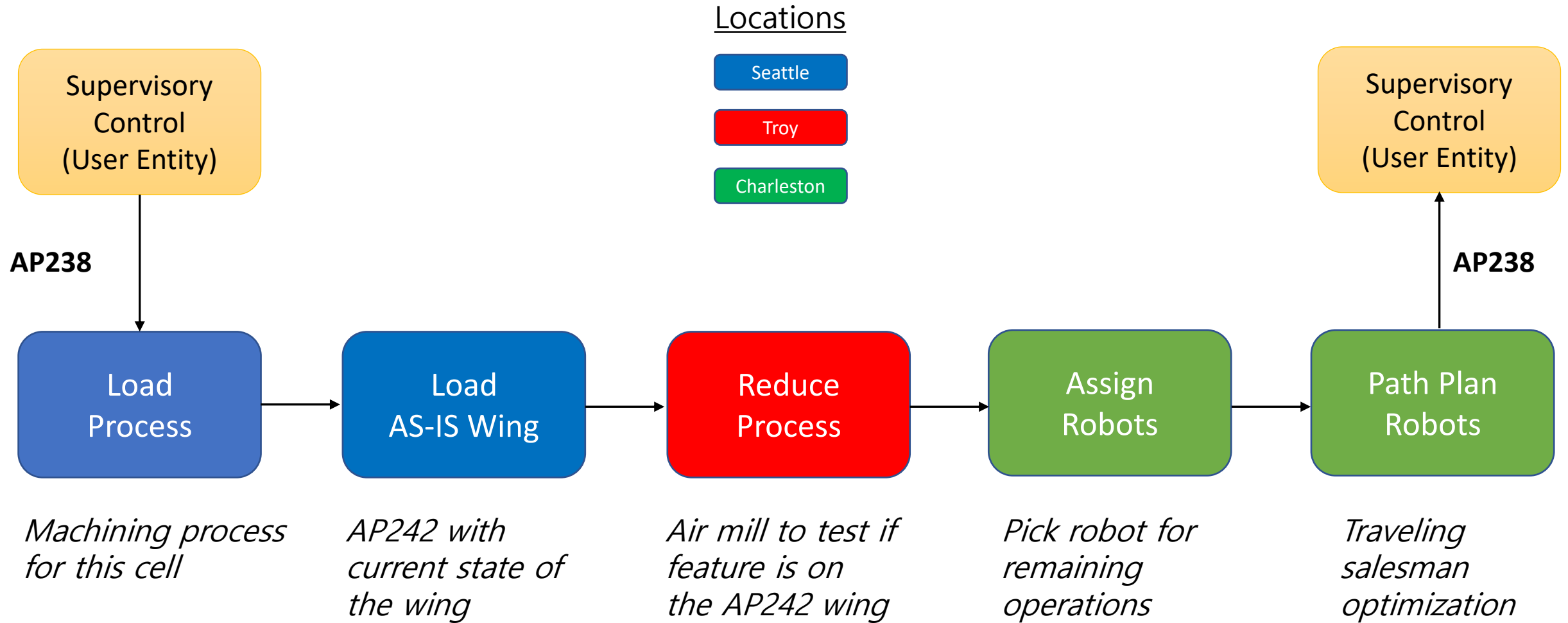
# Large Aerospace Structures

- 1000s of holes and fasteners
  - "Condition of Assembly (COA)" can vary
    - Holes drilled already (prior work)
    - Holes not to be drilled (missing bracket)
- "One-Up-Assembly (OUA)" requirements mean the process sequence has constraints
- Any variations/exceptions must be tracked for validation and subsequent work (becomes new COA)

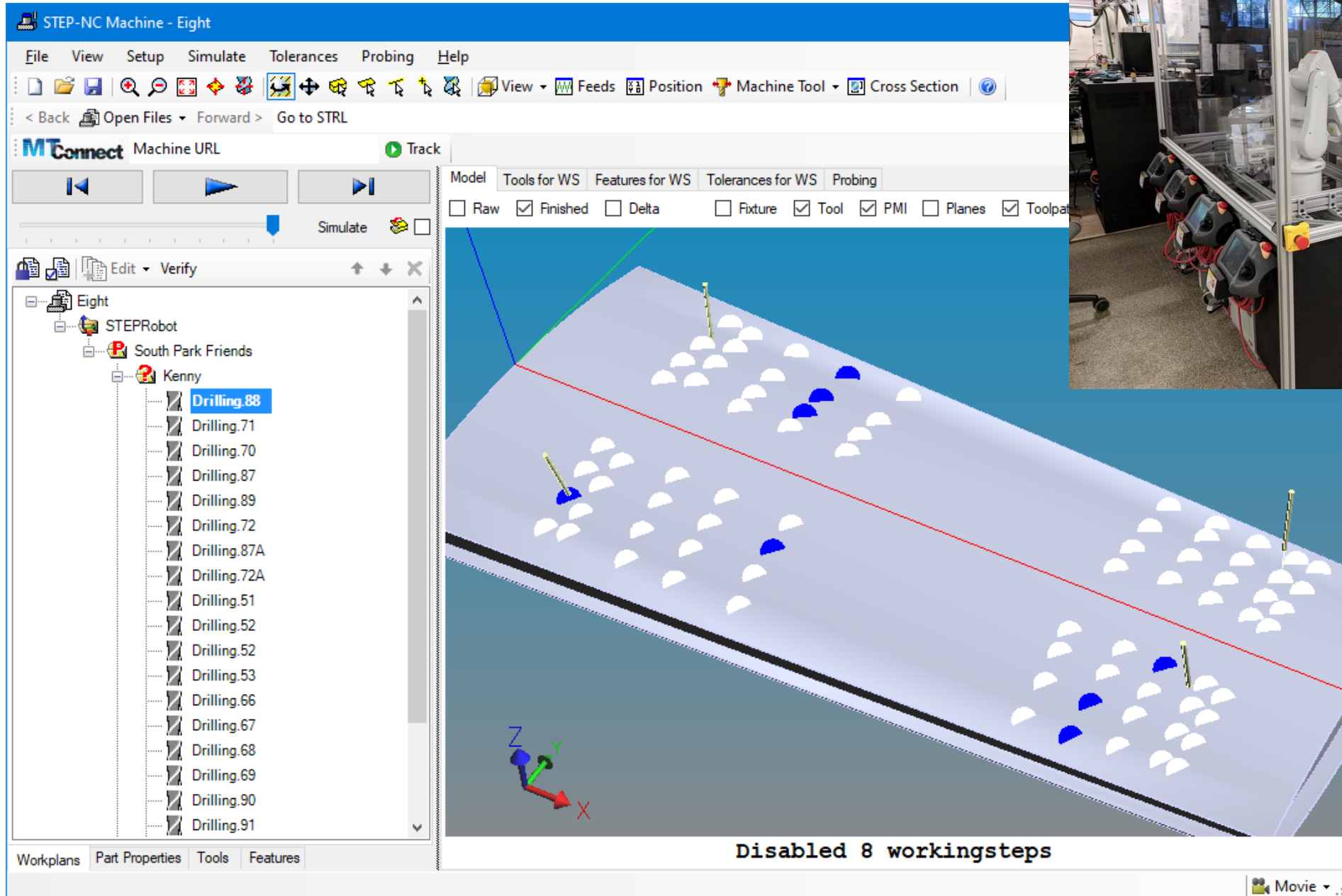




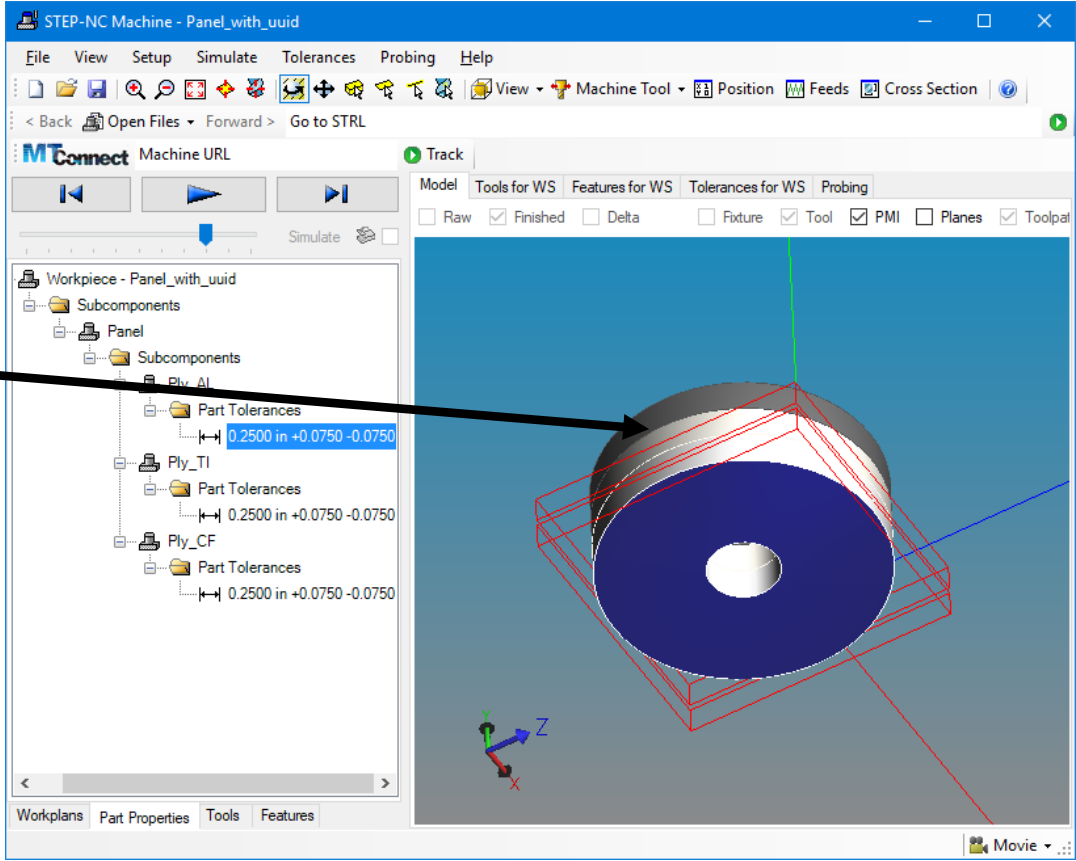
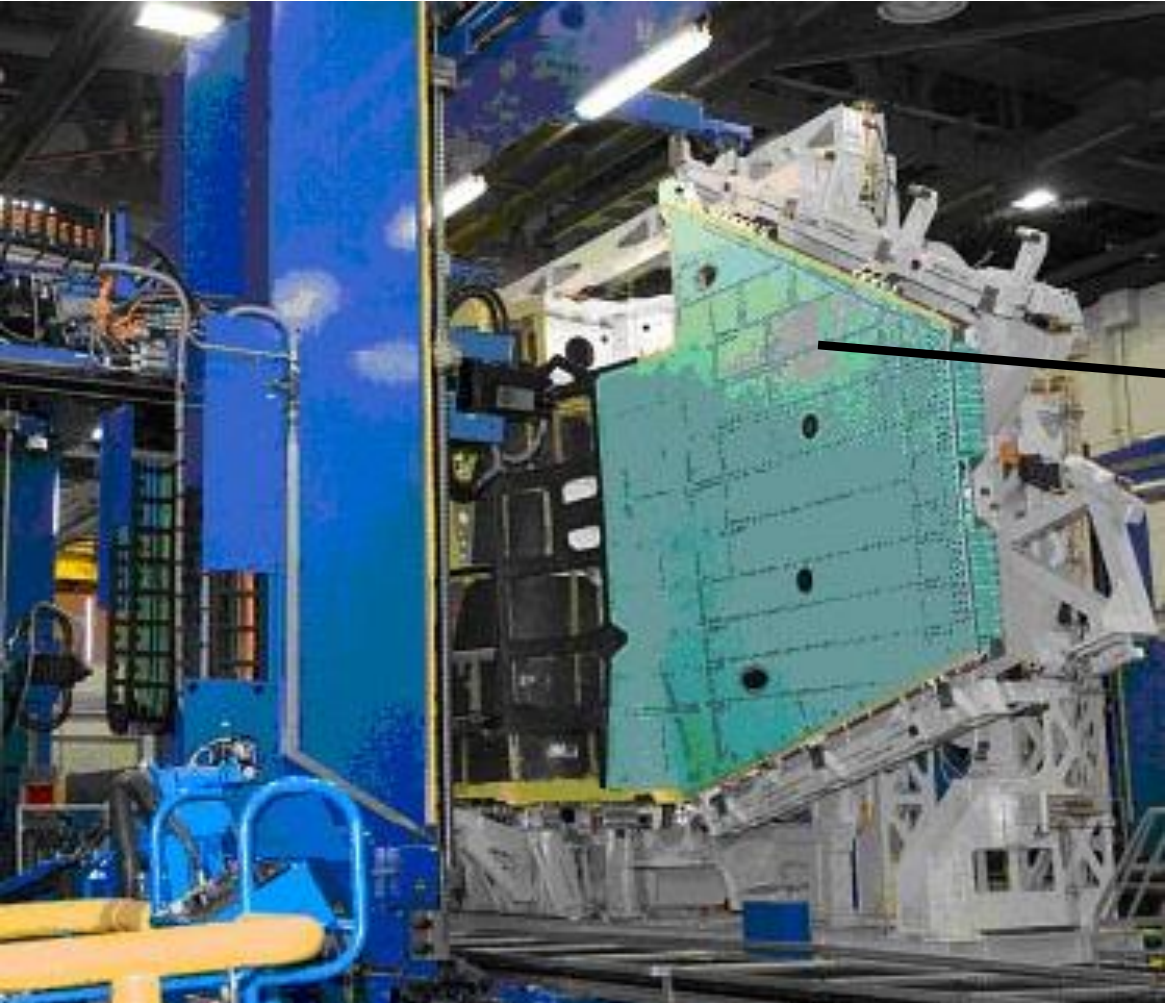
# Data Preparation



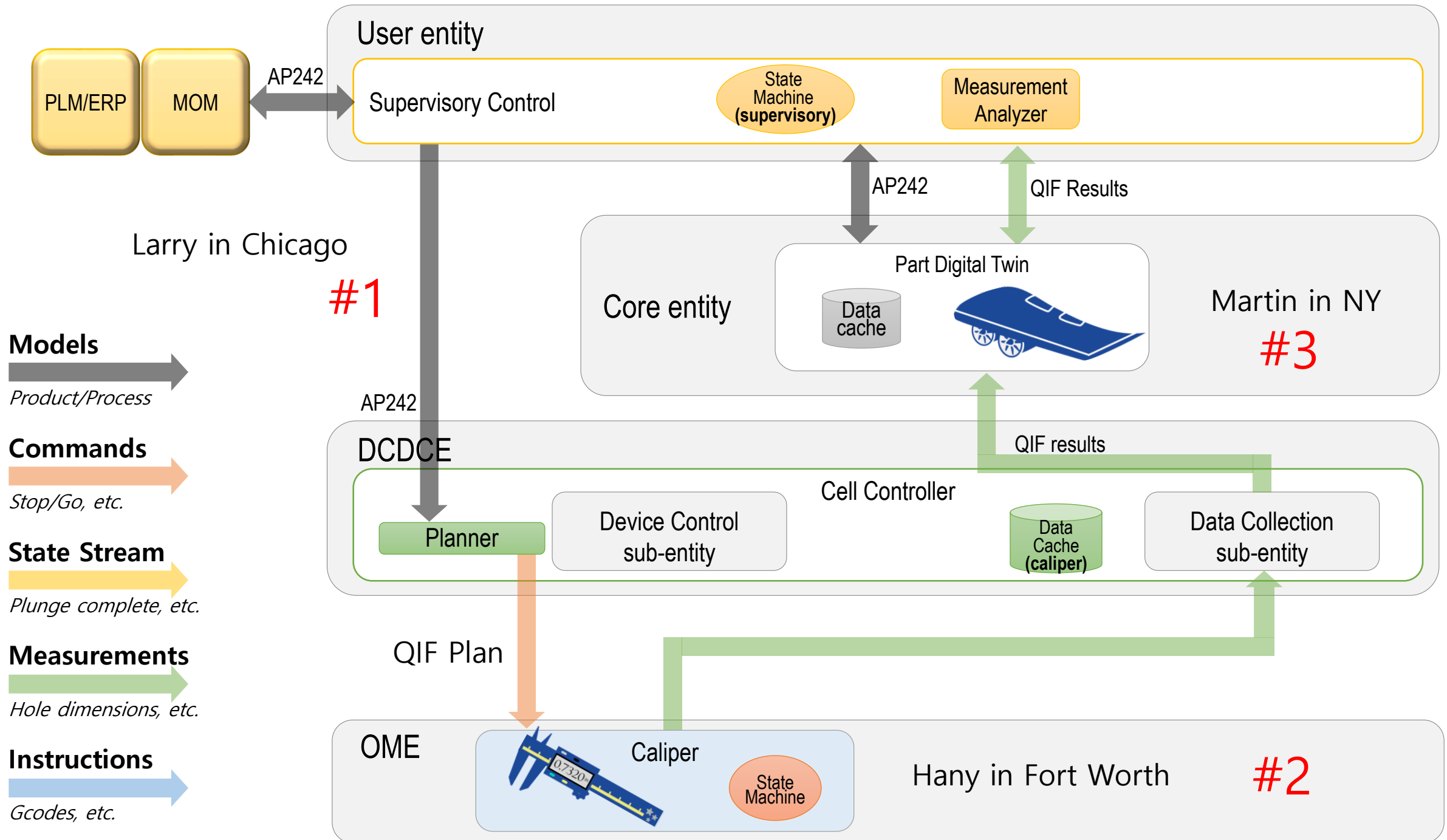
# Reduced Process



# Use Case 2 – weight reduction

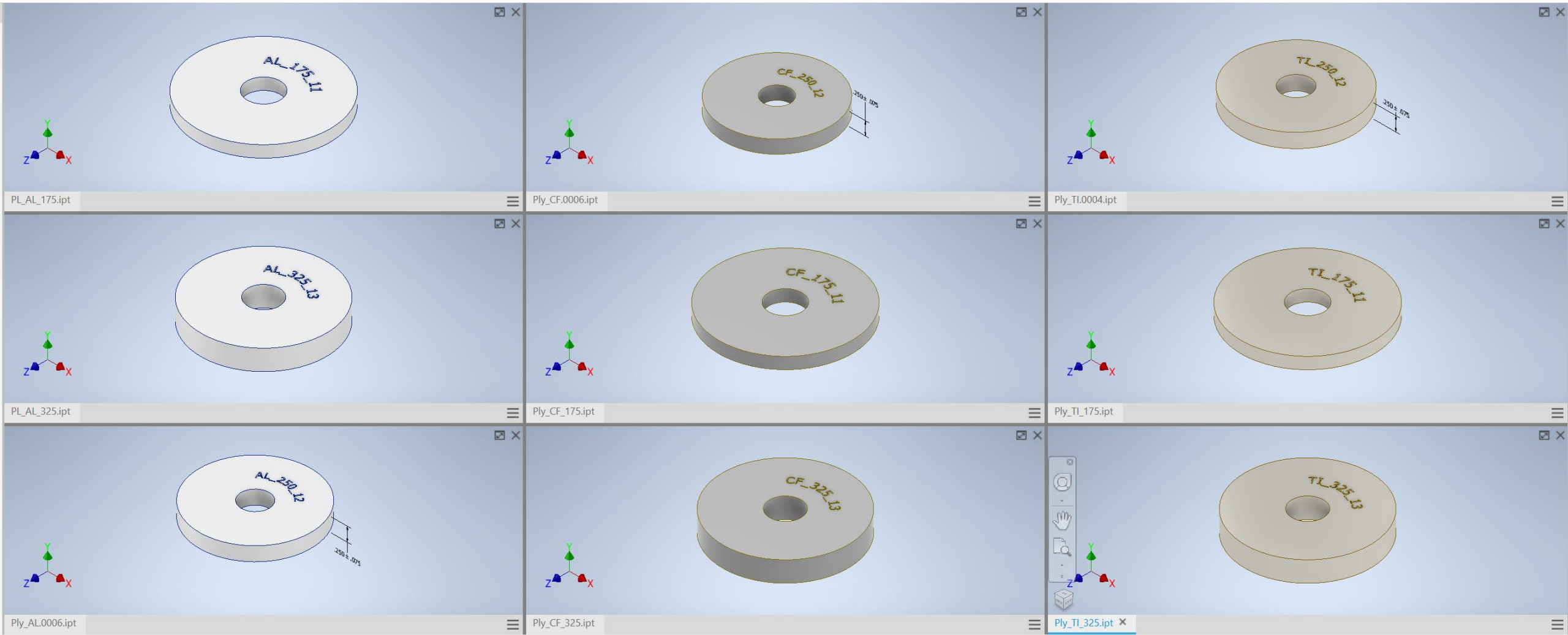


Exact match of fastener to hole depth can reduce weight by 500lb





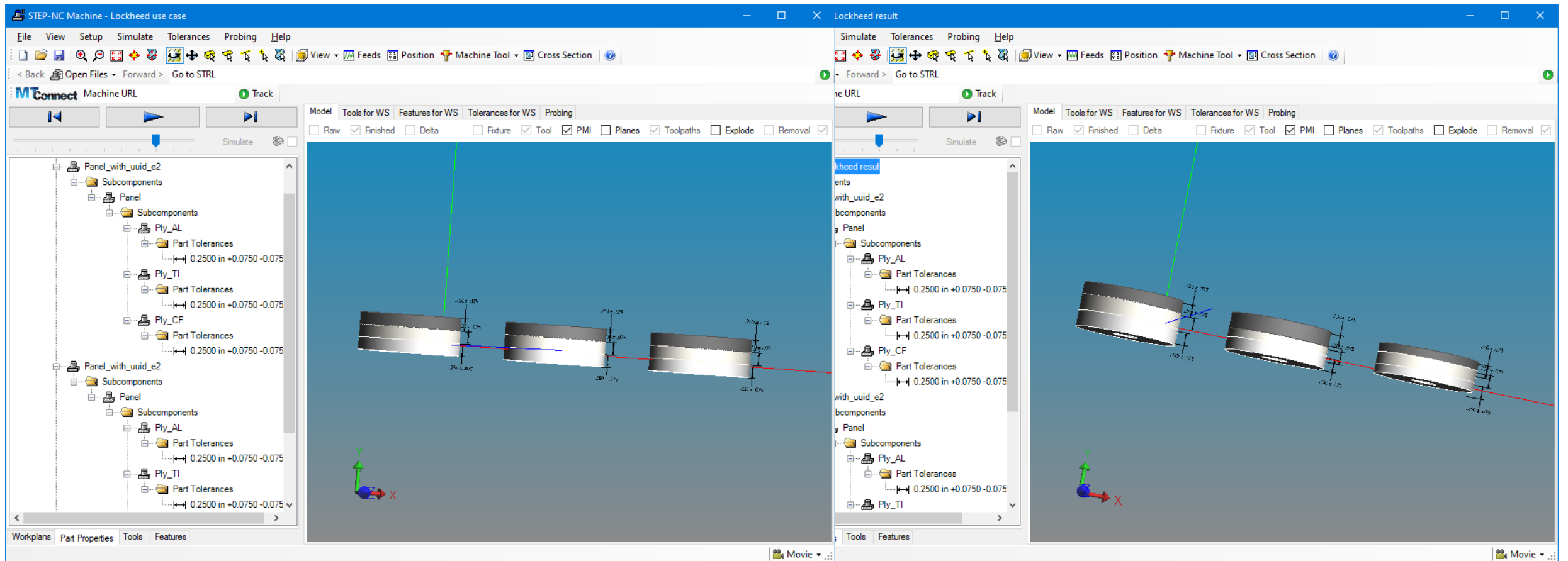
# Measurement samples



# Digital Gage makes QIF Results

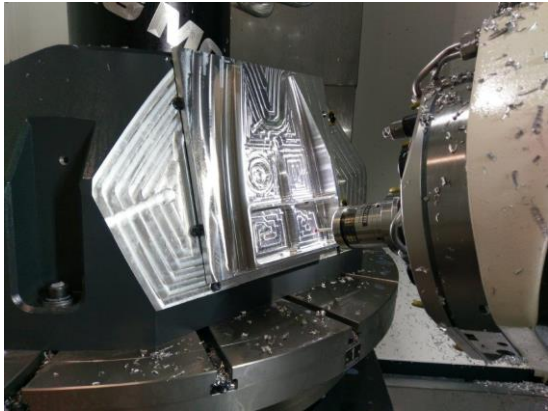


# Three stacks before and after QIF Results applied

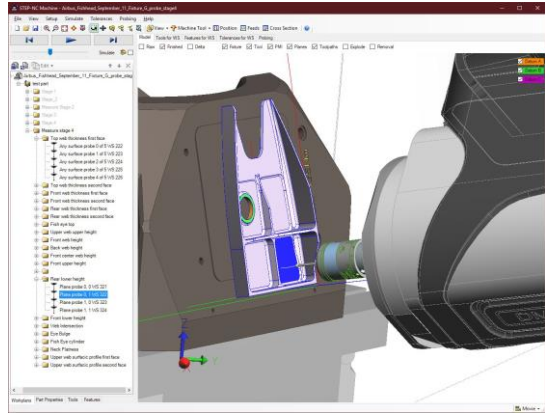




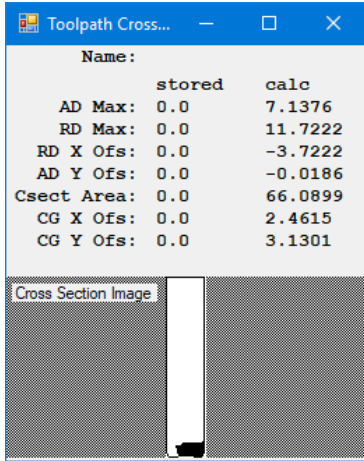
# Use Case 3 – tool life optimization



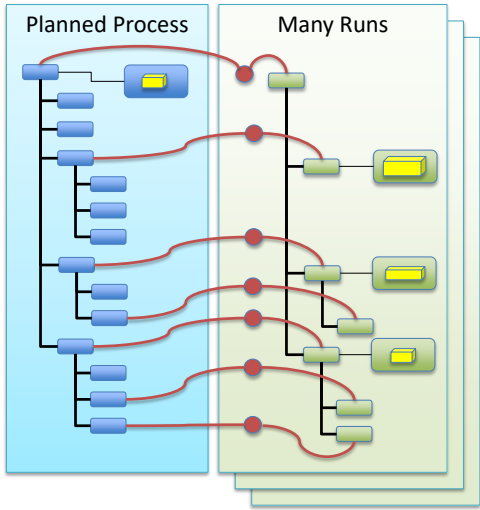
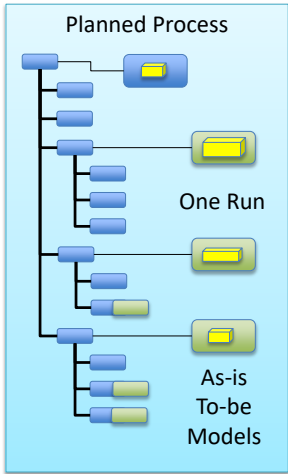
Machine parts



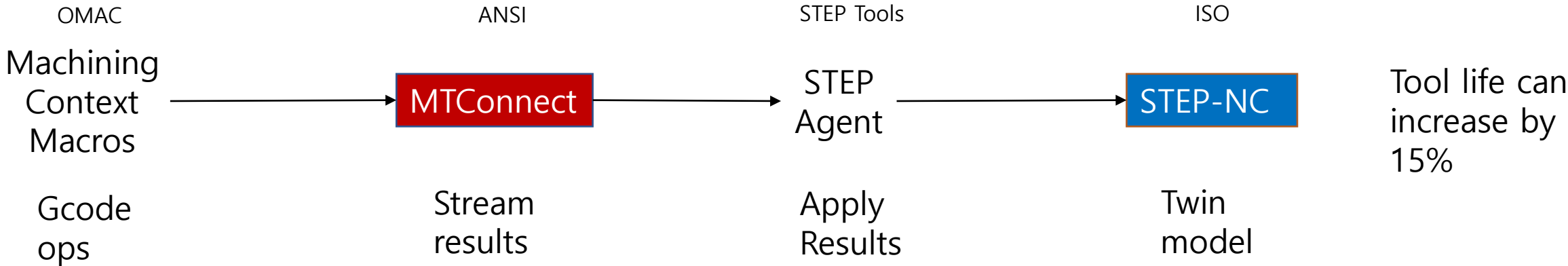
Monitor tool diameter



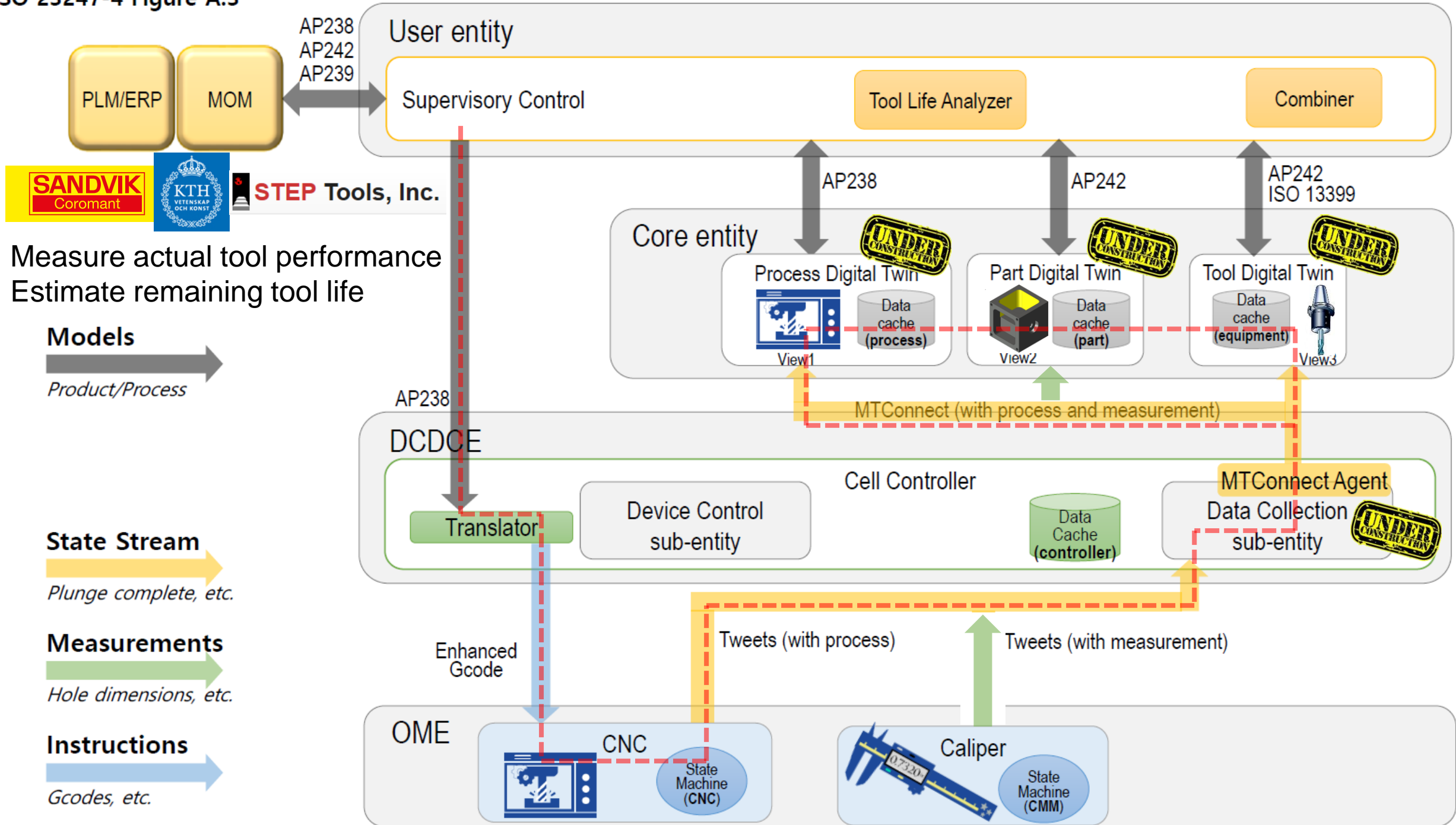
Compute tool engagement



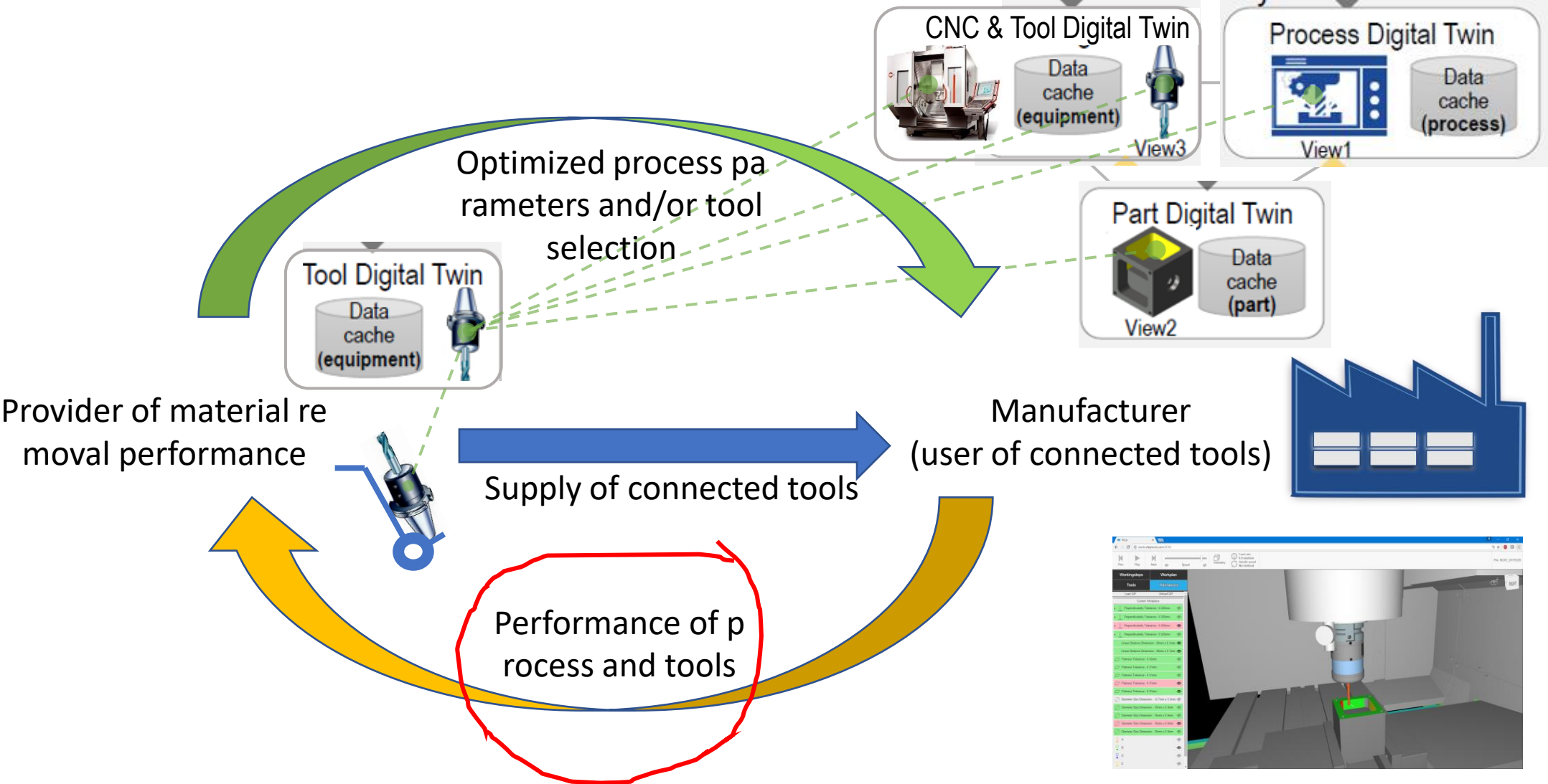
Store linked data



ISO 23247-4 Figure A.3



# Material Removal Performance as a Service -a "new" business model



# Digital Twin machining



- Real time twinning from MConnect
  - <10Hz trace plan data
  - >30Hz model run data
- Open stack
  - STEP in Node.js
  - View in Three.js
  - UI in React.js

# Concluding remarks

- ISO 23247 defines a framework divided into four layers
  - Observation, Collection, Modeling and Learning
  - Connected by networking protocols (nothing mandatory)
  - Implemented by data protocols (nothing mandatory)
- for digital twins of observable elements
  - Products and processes on the manufacturing shop floor
  - Synchronized with digital twins in software systems
  - So that applications can make savings by measuring