Preparation for October 5th demonstration to Boeing, ISO and MTConnect

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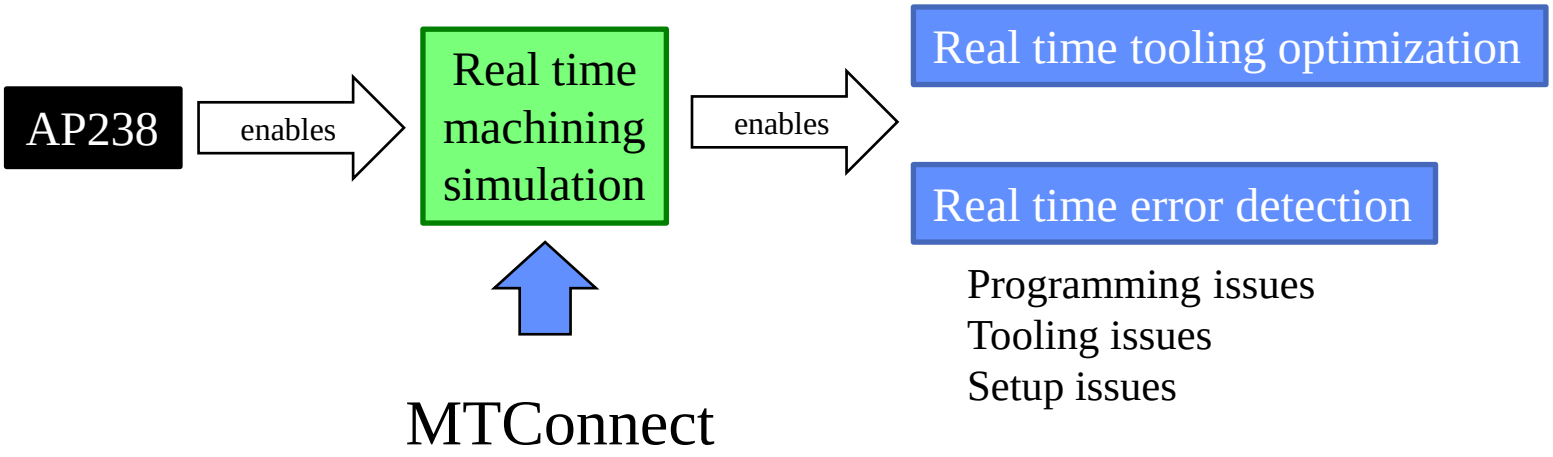
Demonstration Goals

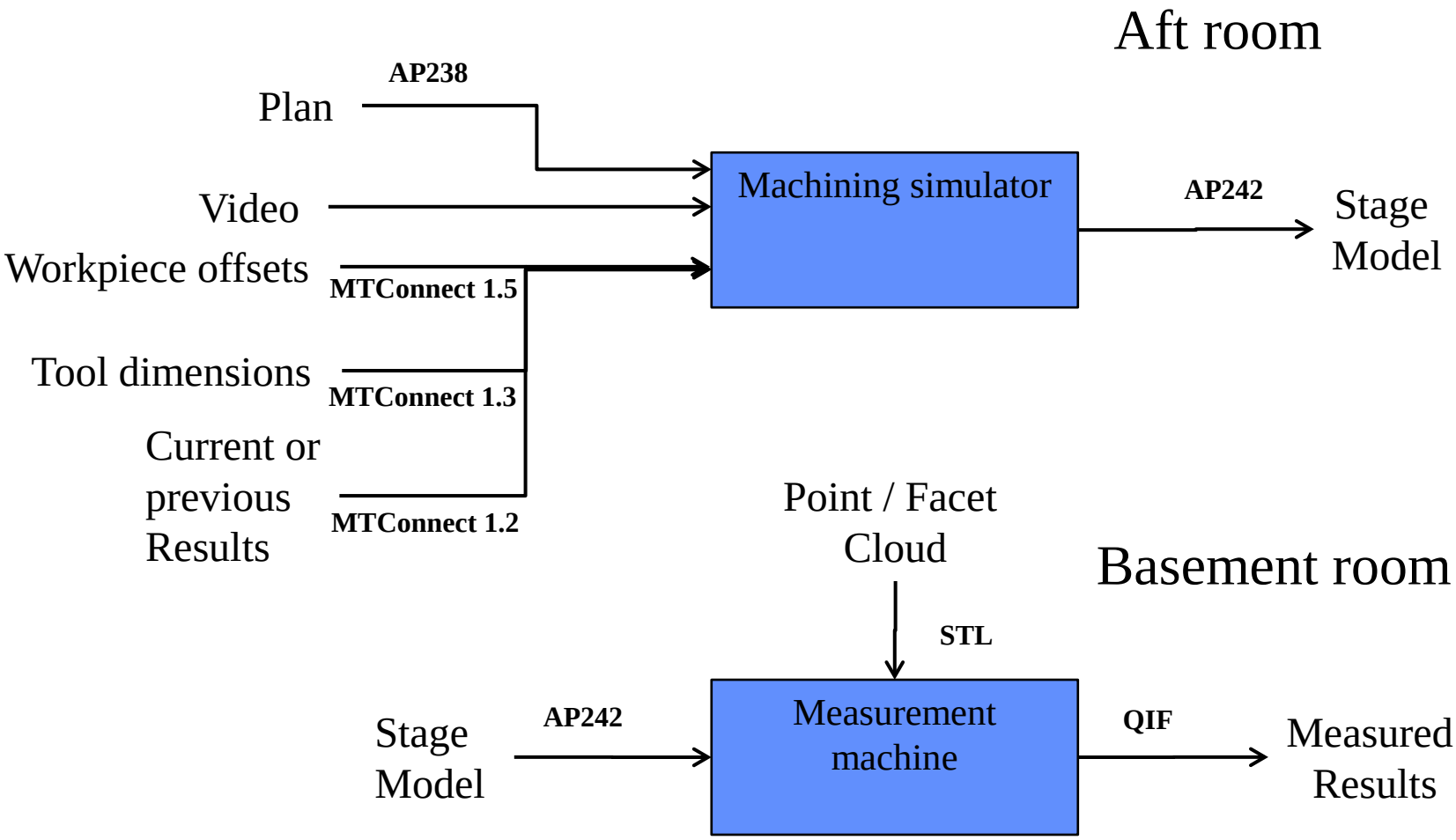
- Discuss value of the STEP-NC AP238 as a model based standard for interoperable CNC programs
- Show it enabling real time machining simulation and
  - Reducing tool wear by > 15%
  - Automating error detection



Audiences

Time Slot	Who	Key Take Away's
8:30AM to 10AM Aft room Basement room	Boeing	1. STEP-NC uses GD&T models to ensure quality. 2. STEP-NC enables interoperability across CAD, CAM and CNC. 3. STEP-NC allows manufacturing solution sharing with the supply chain.
10:30AM to Noon Aft room Basement room	ISO STEP	1. Understand how STEP-NC extends STEP. 2. Message for vendors and users in home country (STEP machining > 15% better). 3. Vision for how it will be adopted.
12:30PM to 2PM Aft room Basement room	MTConnect Tag	1. Planning, machining and inspection related by UUID's in MTConnect, STEP and QIF. 2. GD&T for measuring in-process models. 3. Verification of setup, tooling and program.

Demonstration Activities



Actual measurement uses stage model with GD&T
Virtual measurement uses stage model with generated mesh and GD&T

Upstairs Demo Sequence
Digital twinning on the shop floor

- Inputs: Video feed and MTConnect feed
- Outputs: Real time model of the part and the machine

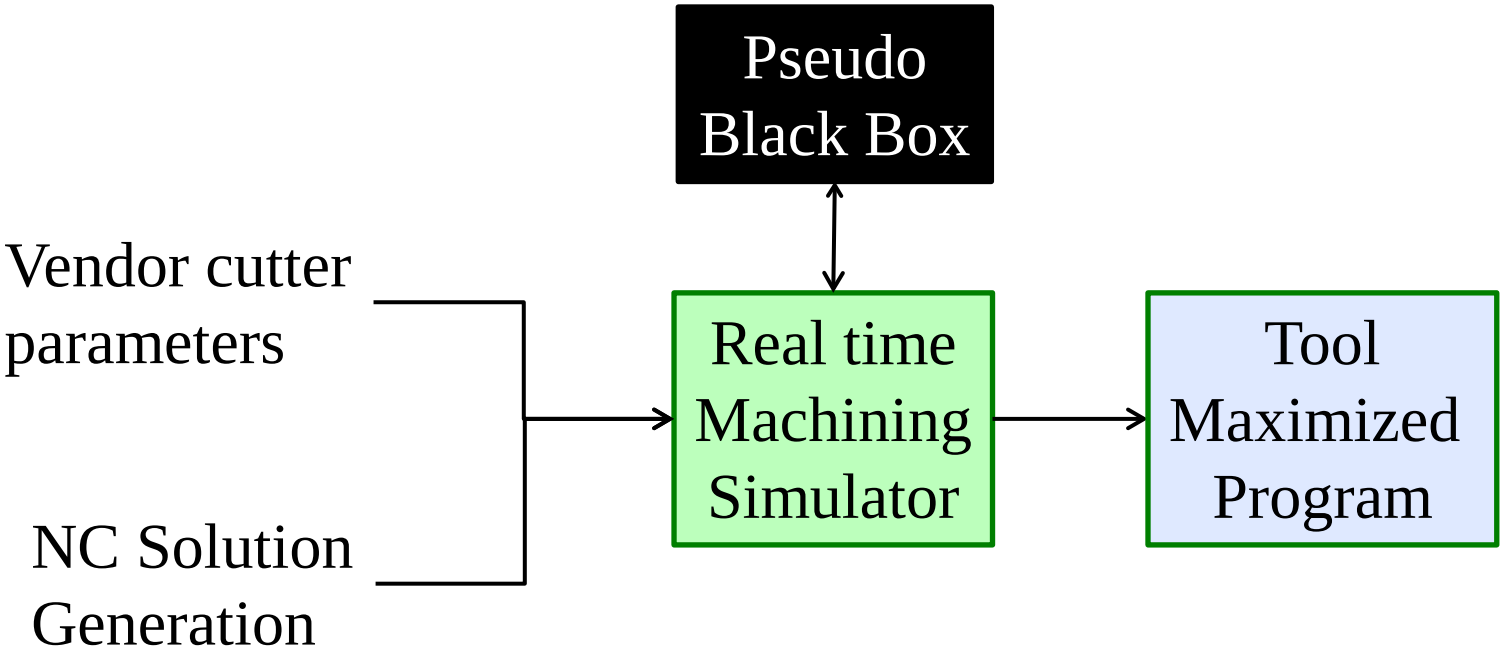
- Demonstrate two of the benefits

1. Tooling optimization using cross section data
2. Automated Tool Try Out (TTO) verification
   A. Detection & prevention of tooling issues
   B. Detection & prevention of workpiece setup issues

Additional Benefits

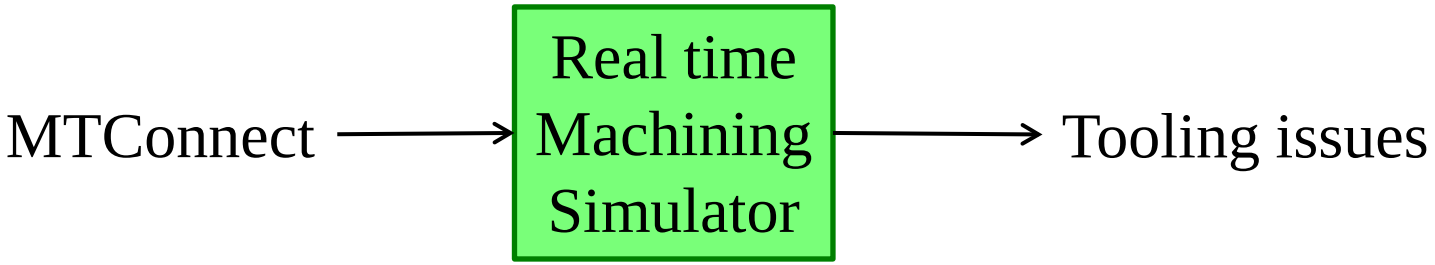
- Other benefits of machine twinning
  - Program re-entry after unplanned stop
  - New forms of adaptive control
    - Roughing vs finishing
    - Surface finish, thin wall, tight tolerance
  - In-process model measurement
  - In-process model monitoring
  - Data sharing of machine geometry and kinematics
  - Third party optimization and verification
  - Archiving and big data analysis

Tooling optimization



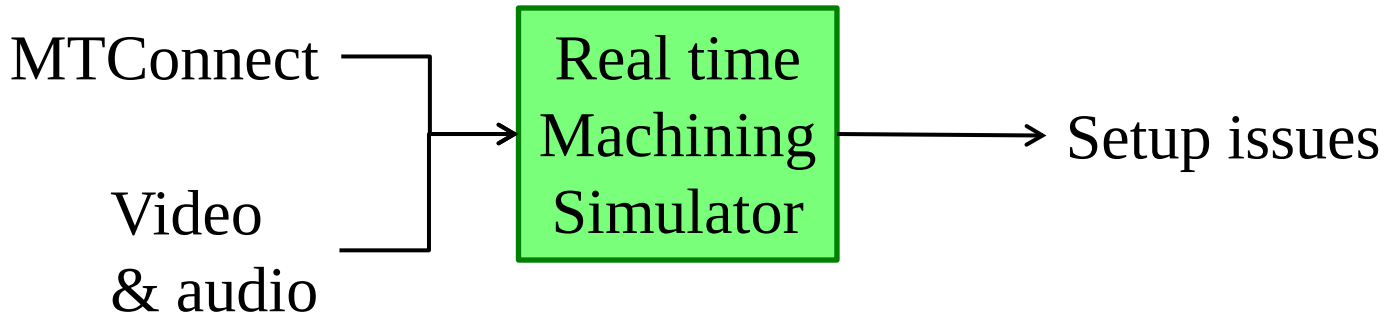
- Simulator computes cut cross section
- Vendor recommends chip thickness
- Black box optimizes feeds in real time

Tooling Issue detection



- Tool dimensions issues
  - Too little “stick out” causes a collision
  - Cutting edge insufficient for engagement
  - Insufficient tool life to complete operation

Setup Issue detection

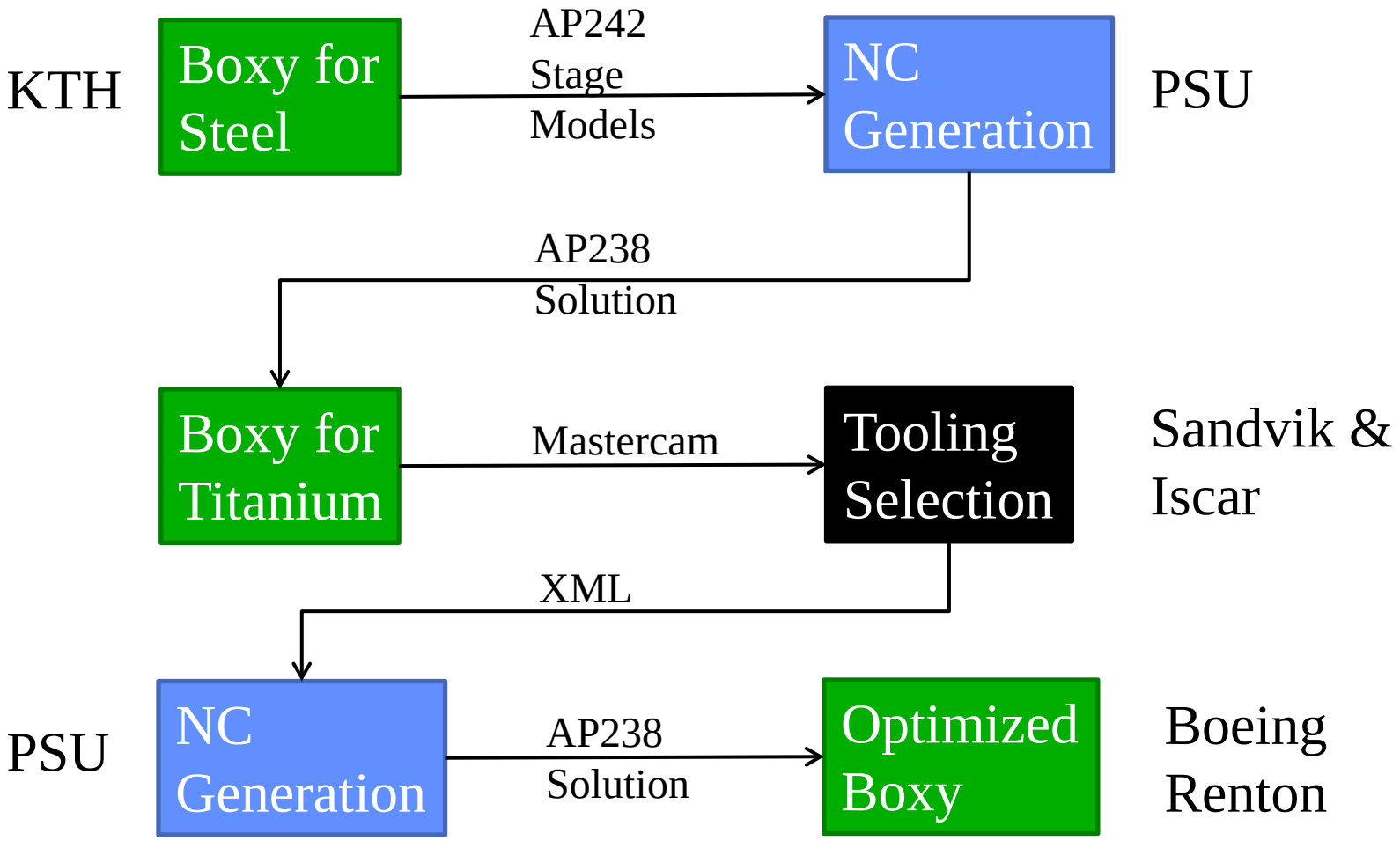


- Sound does not correspond to machining simulation
  - Starts too early, or too late
  - Does not increase or decrease as engagement changes
- Model does not meet requirements when measured
  - Too much material (shows as blue in color map)
  - Too little material (shows as red in color map)

Upstairs Demo Sequence
How to make the data

- Using a CAM system in the traditional way but posting a model instead of codes
- Running new expert systems that use stage models to make intelligent processes
- What is a stage model?
  - Before and after CAD models
  - With GD&T (best), without (use defaults)

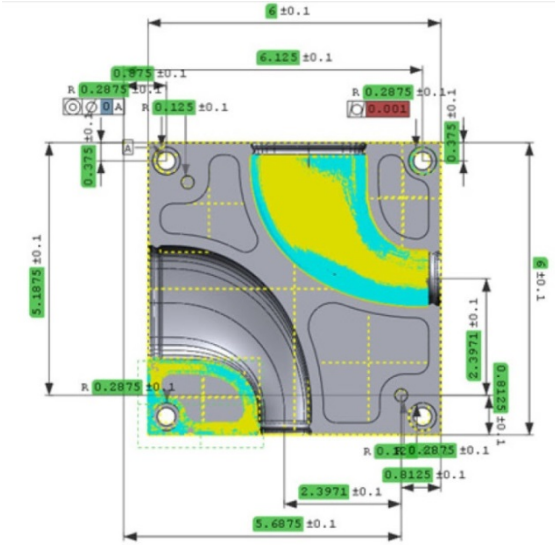
NC Generation



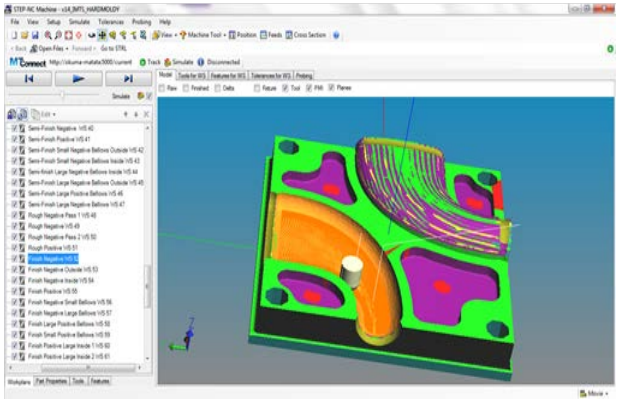
Basement Sequence

- Now we have our part lets see if it is correct
- Upstairs we have been measuring it in a virtual CMM
  - Measurement of the CAM plan
  - Measurement of the machining results as reported by MTConnect
- Downstairs in the basement we have a real CMM that completely verifies the stage models

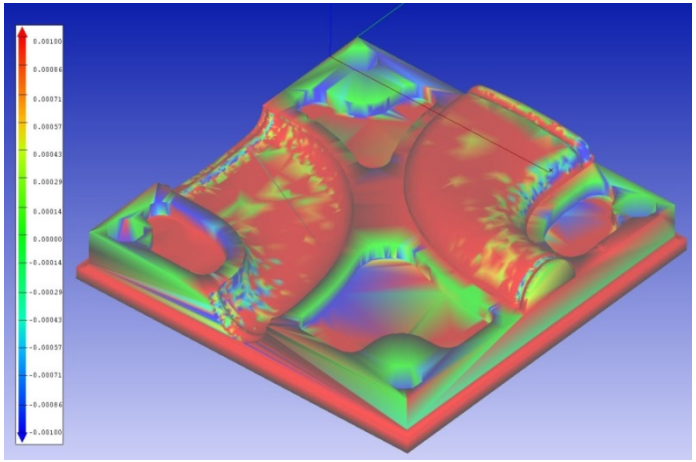
Integration of Machining and Measurement



Part with GD&T



Real time mesh generation

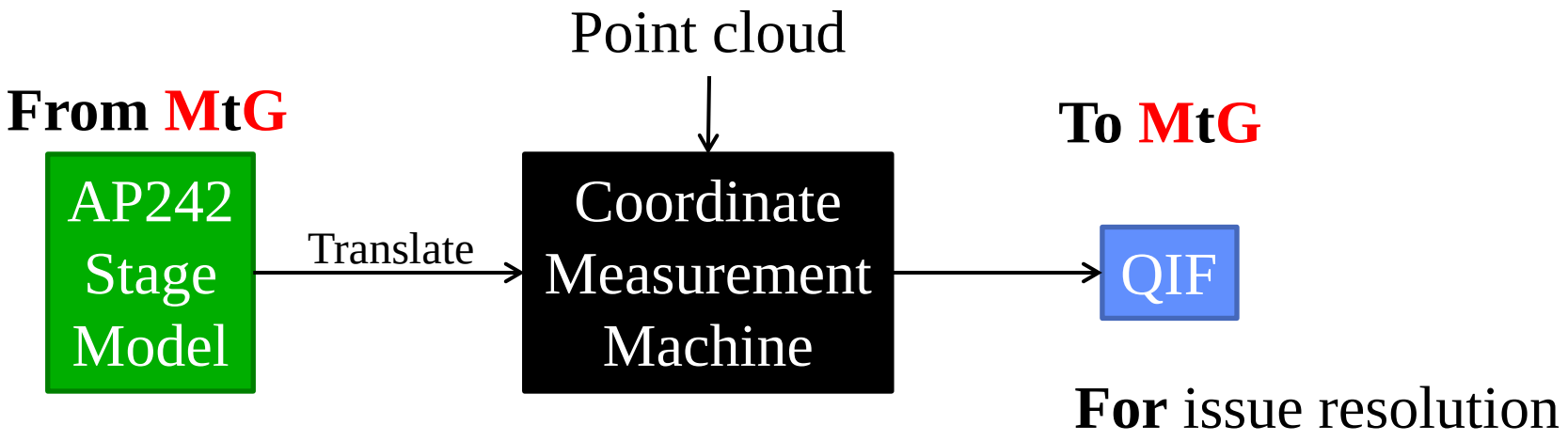


Virtual metrology

Actual metrology

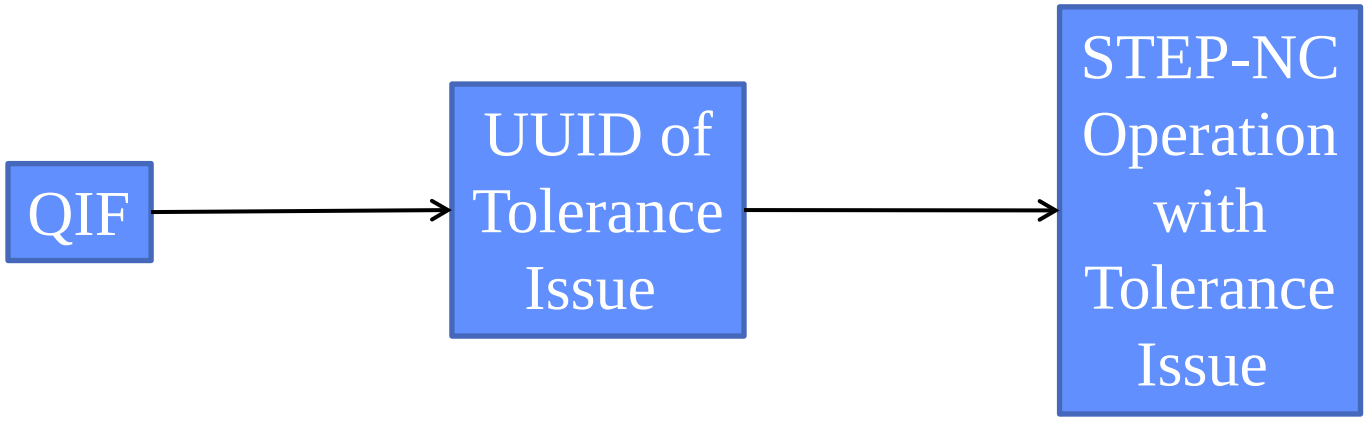
Basement Room

- Measurement of previously machined parts
  - Translation of stage model to ACIS
  - Touch probe measurement on a CMM
  - QIF results report

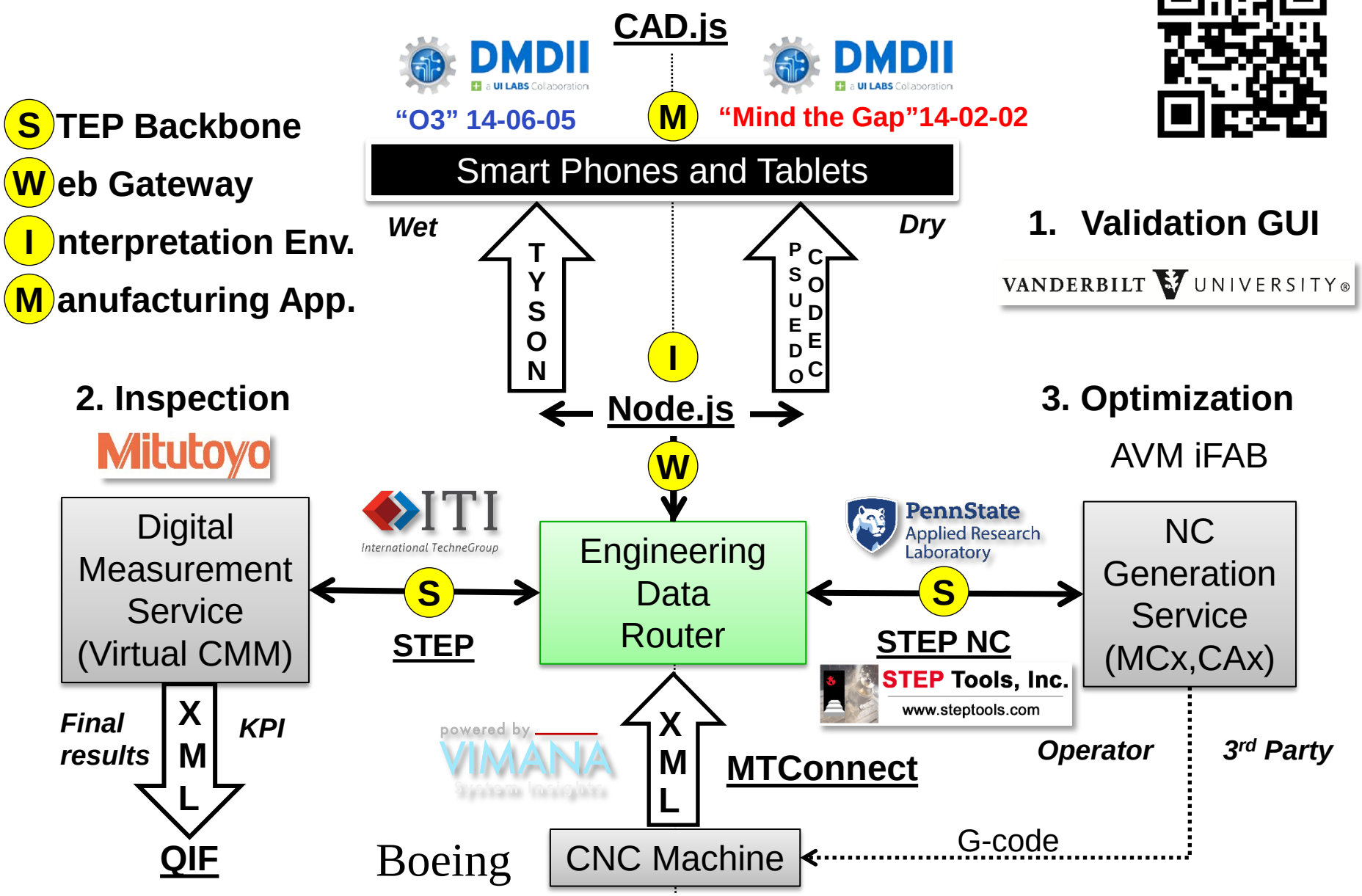


Resolving Measurement Issues

- When there is an issue
  1. Find the machining program that made the tolerance
     - Using intelligent UUID's
  2. Find the operation responsible for the tolerance
     - Using the STEP-NC information model



Credits


STEP Backbone
Web Gateway
Interpretation Env.
Manufacturing App.
CAD.js
DMDII
a UI LABS Collaboration
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"O3" 14-06-05
M
"Mind the Gap"14-02-02
Smart Phones and Tablets
Wet
Dry
TYSON
PSUEDO
CODEC
I
Node.js
W
1. Validation GUI
VANDERBILT UNIVERSITY
2. Inspection
Mitutoyo
3. Optimization
AVM iFAB
Digital Measurement Service (Virtual CMM)
ITI
International TechneGroup
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STEP
Engineering Data Router
PennState
Applied Research Laboratory
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