Strengthening Your Model-Based Enterprise with Validation

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Raising
the **Value** of your
Product Data

Introductions

ITI TranscenData

- Private, debt-free, profitable U.S. company since 1983
- International TechneGroup Inc. interoperability business unit
- “Transcend above your data problems”

“Smooth interoperability is a transcendental experience”

Doug Cheney

- US and European upbringing
- Mechanical engineering education
- CAD application development
  - CAD model quality, CAE optimization, assembly tolerancing
- Engineering process consulting
  - CAD to CAD/CAM/CAE interoperability
- International consortia team member
  - ISO, PDES, ProSTEP (LOTAR), OMG, SASIG (AIAG/VDA/JAMA)

Model-Based Enterprise

- **Scope**
  - Model-Based Engineering
  - Model-Based Manufacturing
  - Model-Based Sustainability
- **Objectives include:**
  - The model is the master (minimize use of drawings)
  - Integrate all phases of the product lifecycle
- **Product *Model-Based Design* (MBD) Model**
  - Structure
  - Geometry
  - Annotations (aka 3D PMI, GD&T, FT&A, …)
  - Model attributes
  - Domain-specific data

Why MBE Model Validation?

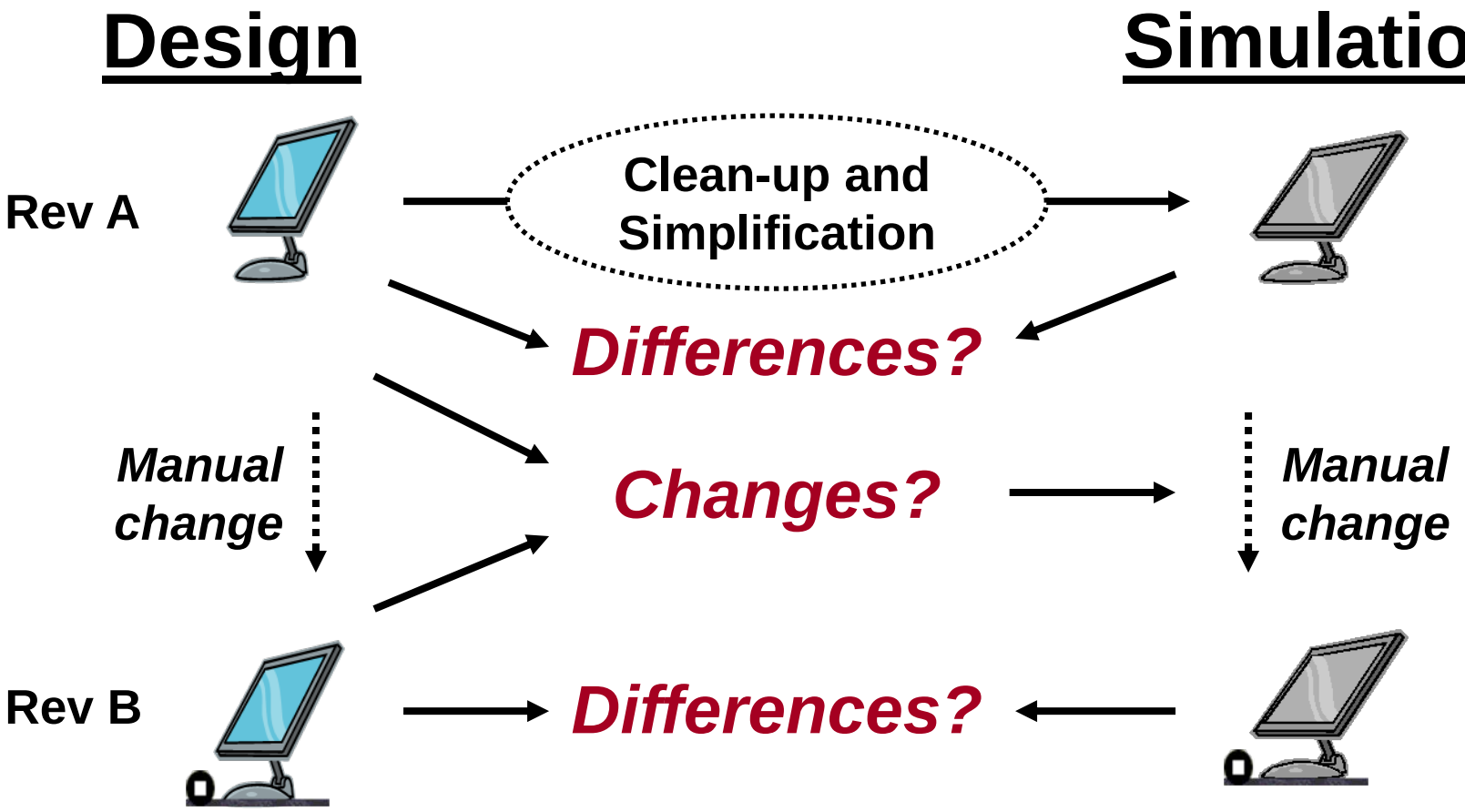
- **If "The model is the master"…**

  …Then downstream modifications must be reconciled with the product design model.

- **If "Integrate all phases of the product lifecycle"…**

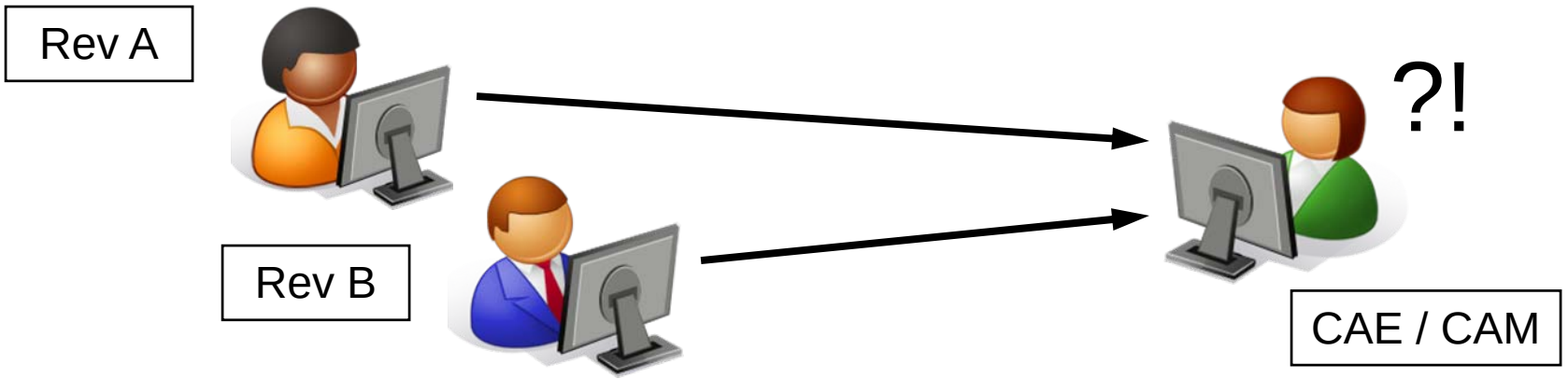
  …Then the design model must be reusable in simulation, manufacturing, support, etc.

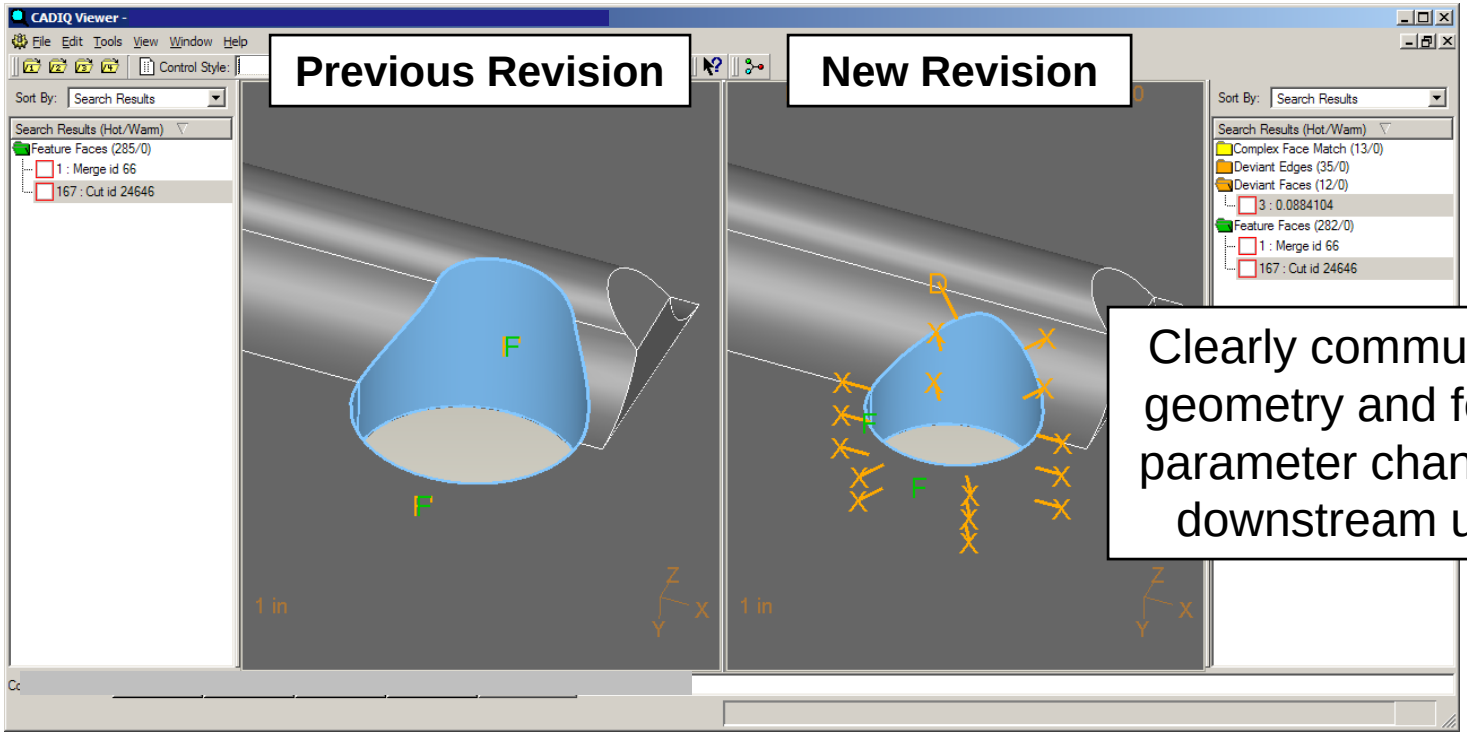
The Need for Simulation Validation



Unacceptable differences and unsynchronized changes undermine MBE integration of design and simulation

Design Change Validation





Clearly communicate geometry and feature parameter changes to downstream users

The Need for Manufacturing Validation

Engineering **Manufacturing**

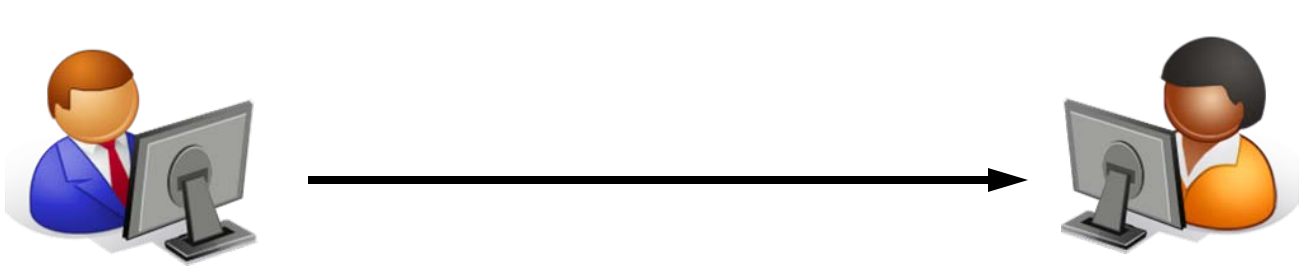
Defects?

Defects and translation differences undermine MBE integration of engineering and manufacturing

Model Validation Categories

Master Model	Derivative Model
Structure	Loss
Completeness	Degradation
Accuracy	Confusion
Complexity	Deviation
Realism	

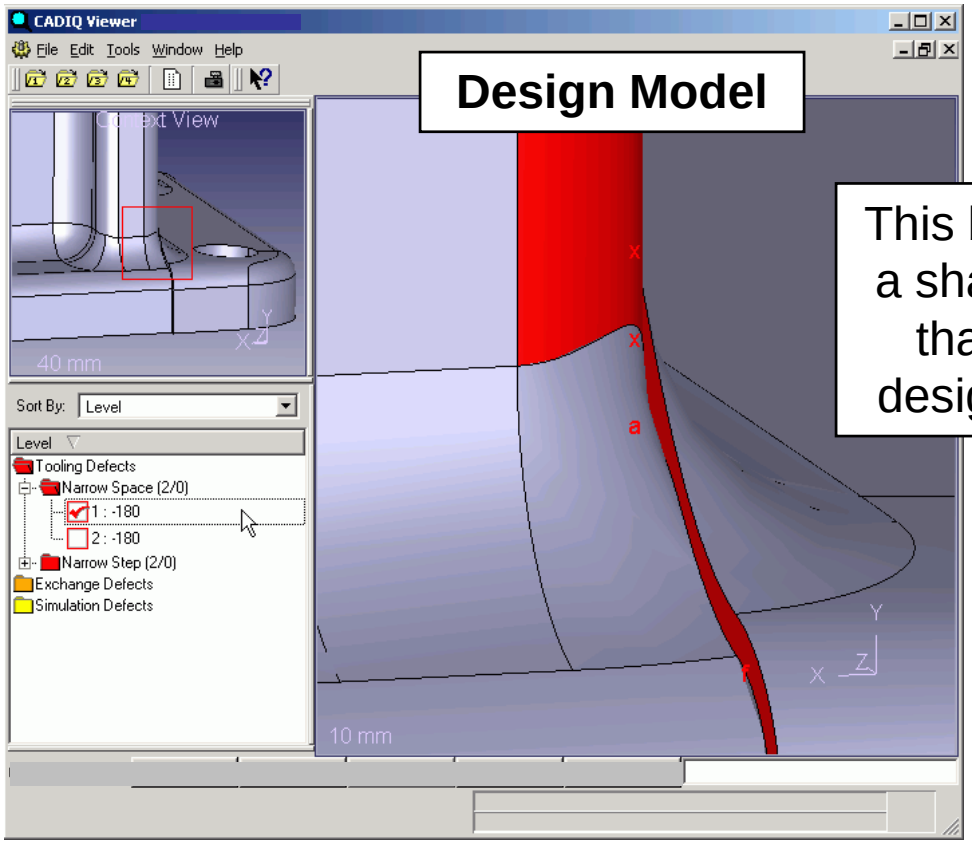
Design for Manufacturing Validation



!

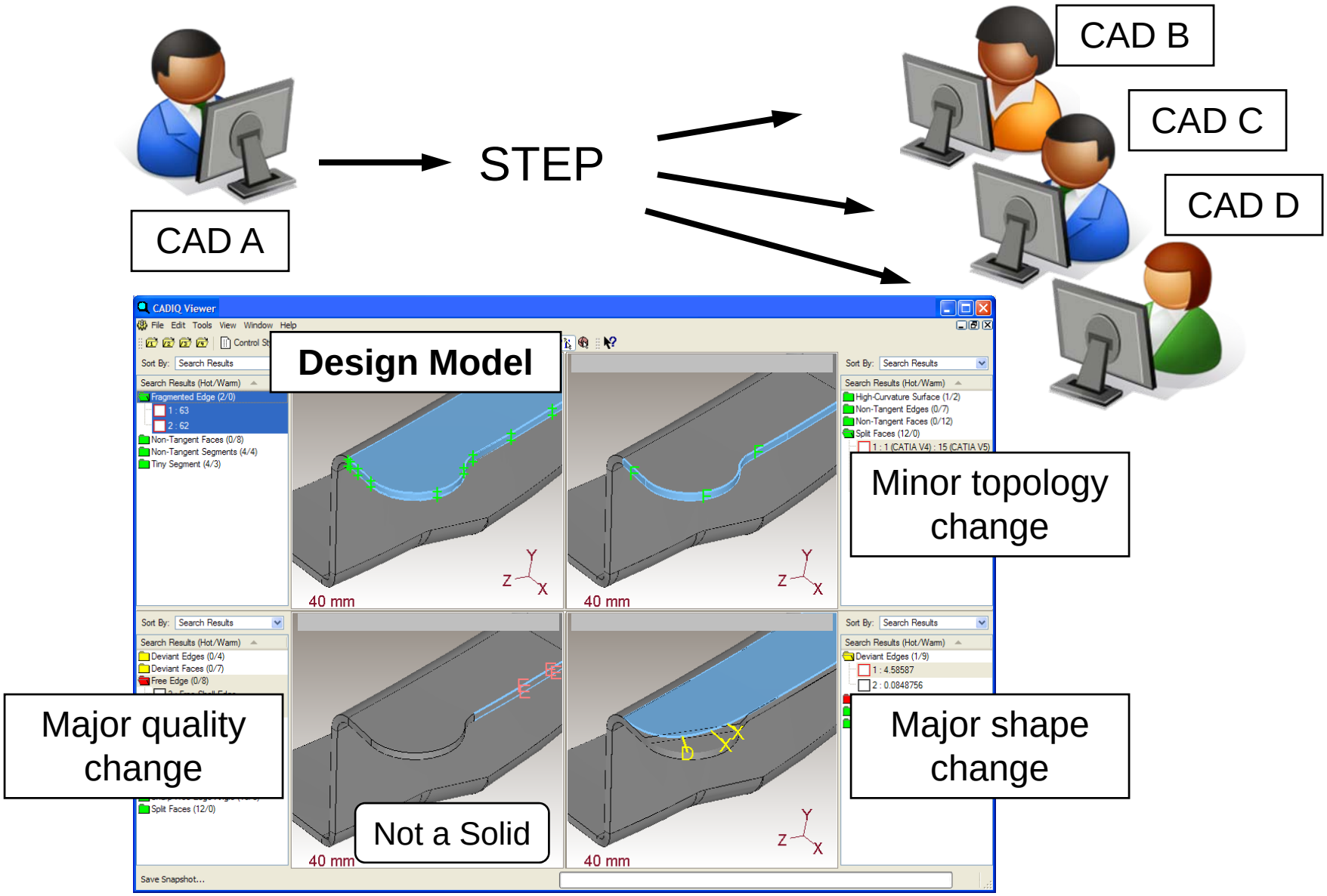
CAD

CAE / CAM



This blend has a sharp offset that is not design intent.

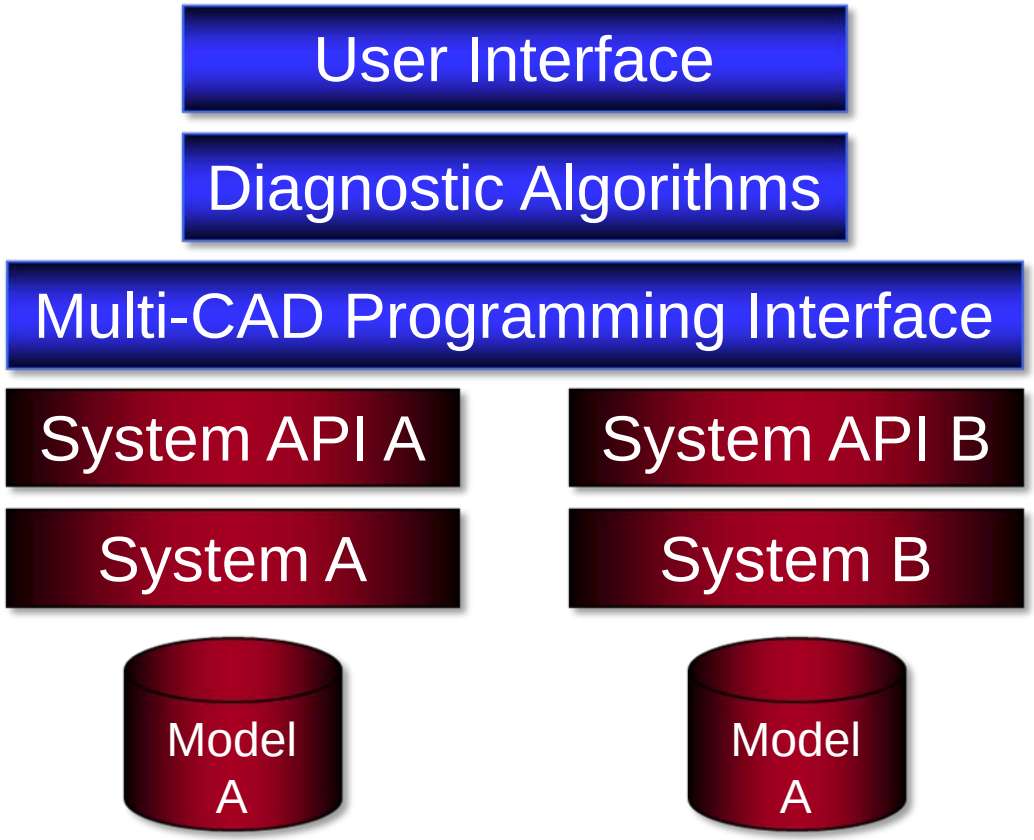
Design Translation Validation



Advantages of Automated Validation

- **Technical**
  - Comprehensive
  - Consistent
  - Repeatable
  - Precise
- **Business**
  - Lower cost (after initial investment)
  - Transferable to extended enterprise
  - Supports process quality improvement
- **Human**
  - Not dependent on human initiative (or lack thereof)
  - Avoid employee burnout

Ideal Validation Software Architecture



Advantages

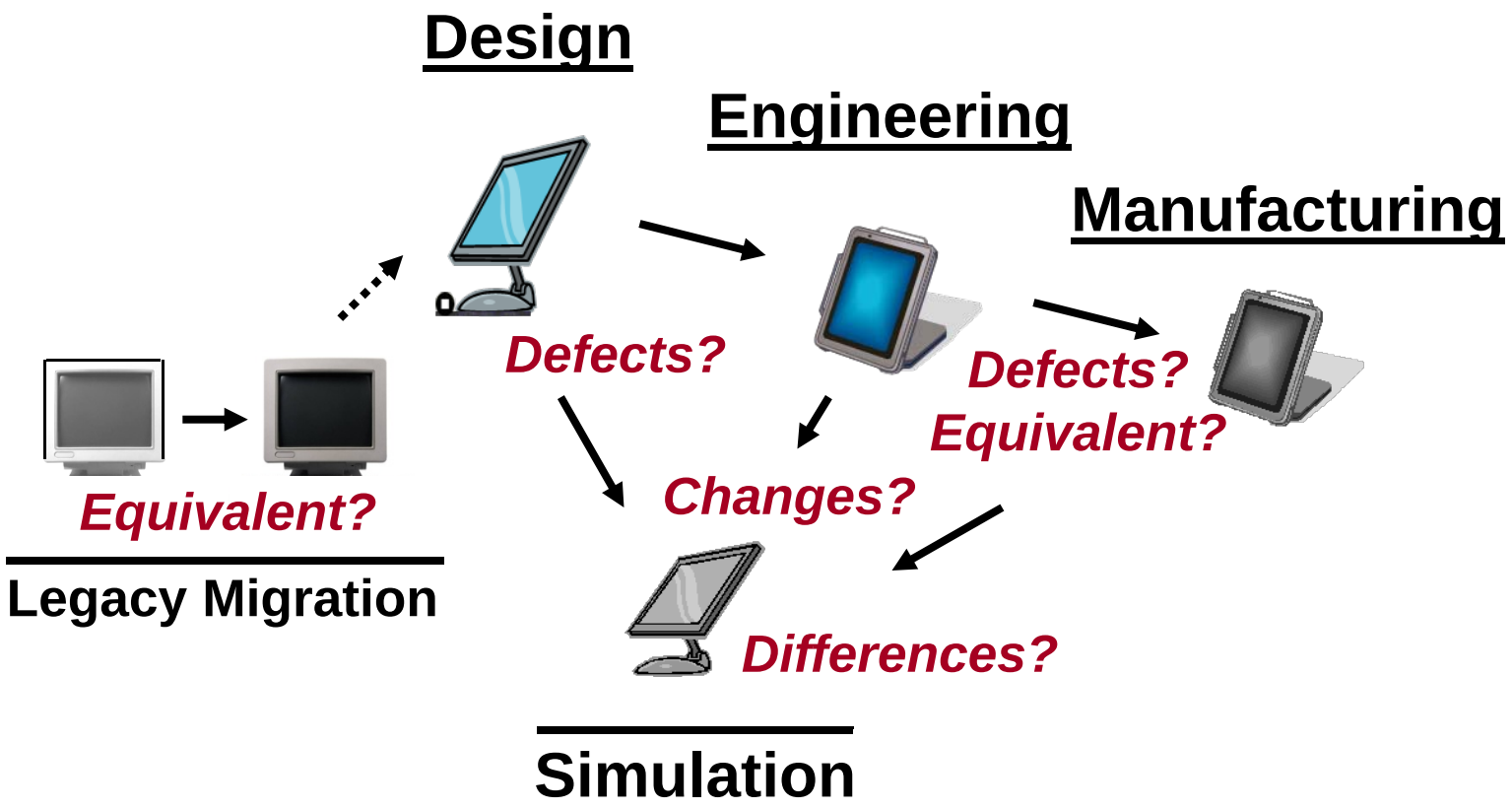
Consistent functionality
No data conversion
Native system evaluators
Access to full data model
Rapid upgrades

Disadvantages

System installation and licensing prerequisites

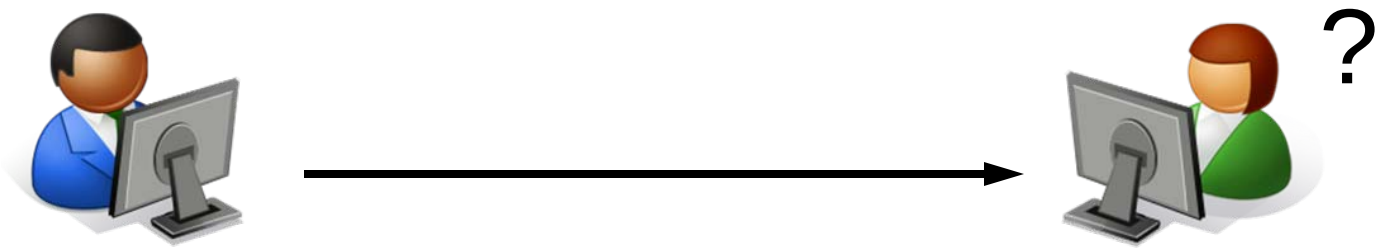
Powered by: python™

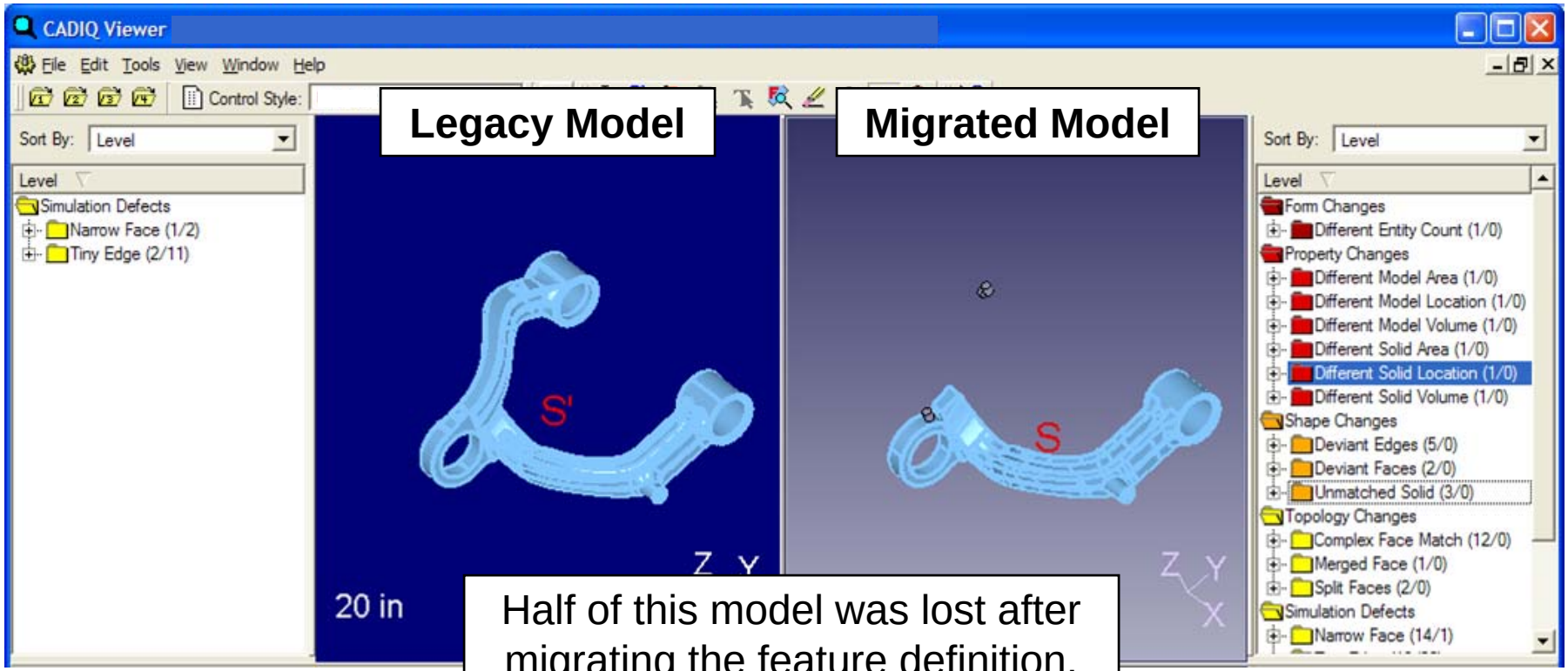
The Need for Legacy Migration Validation



Unacceptable differences introduced during migration undermine MBE reuse of legacy data.

Legacy Migration Validation



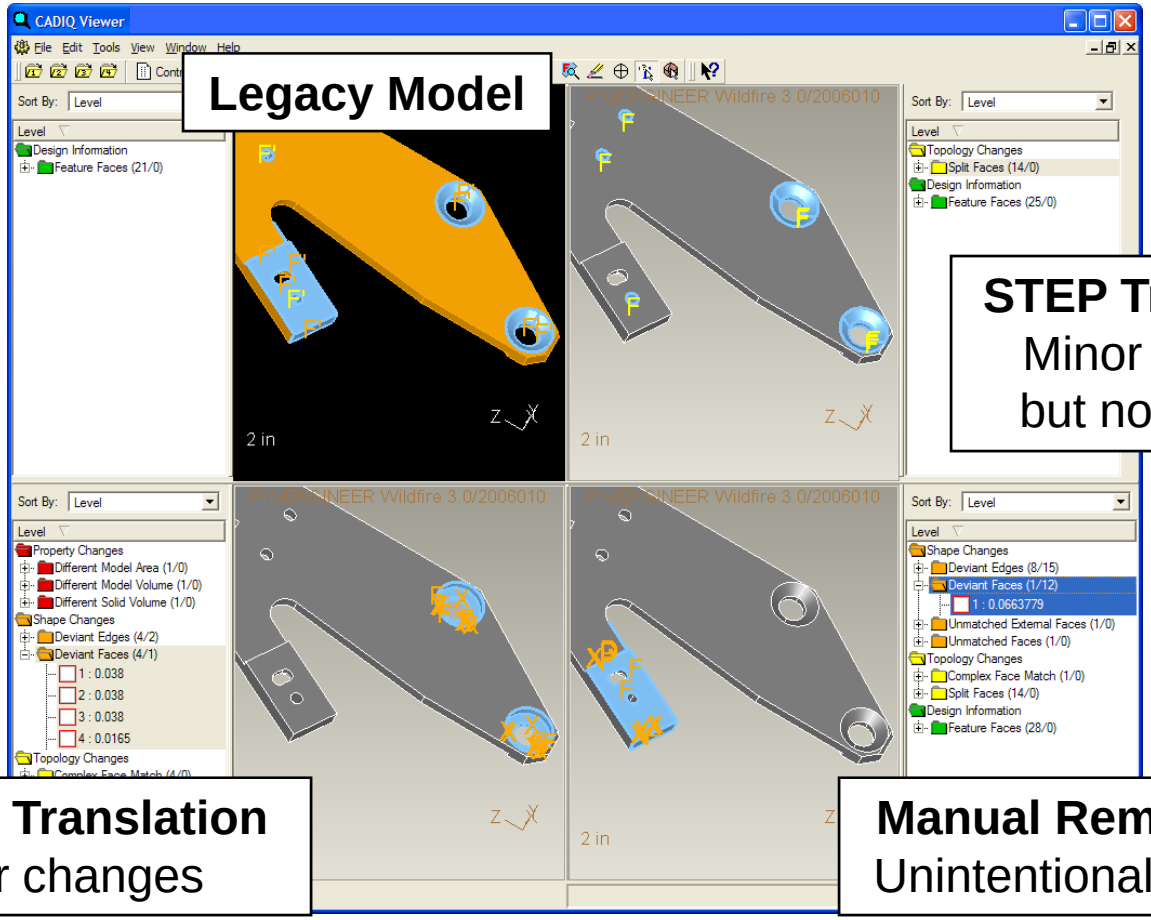


Half of this model was lost after migrating the feature definition.

Legacy Migration Process Evaluation

Which process?

Current CAD

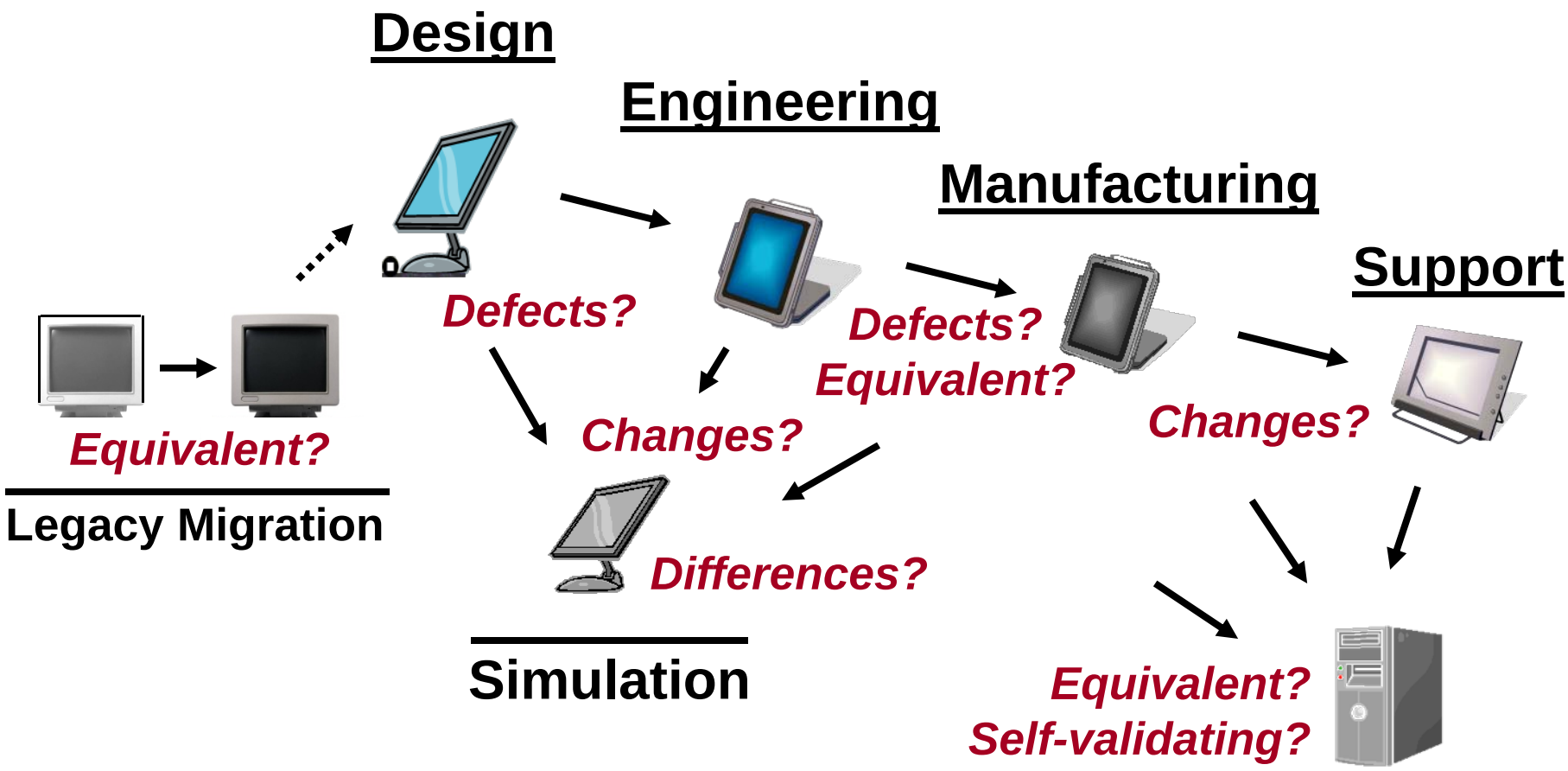


STEP Translation
Minor changes
but no features

Feature Translation
Major changes

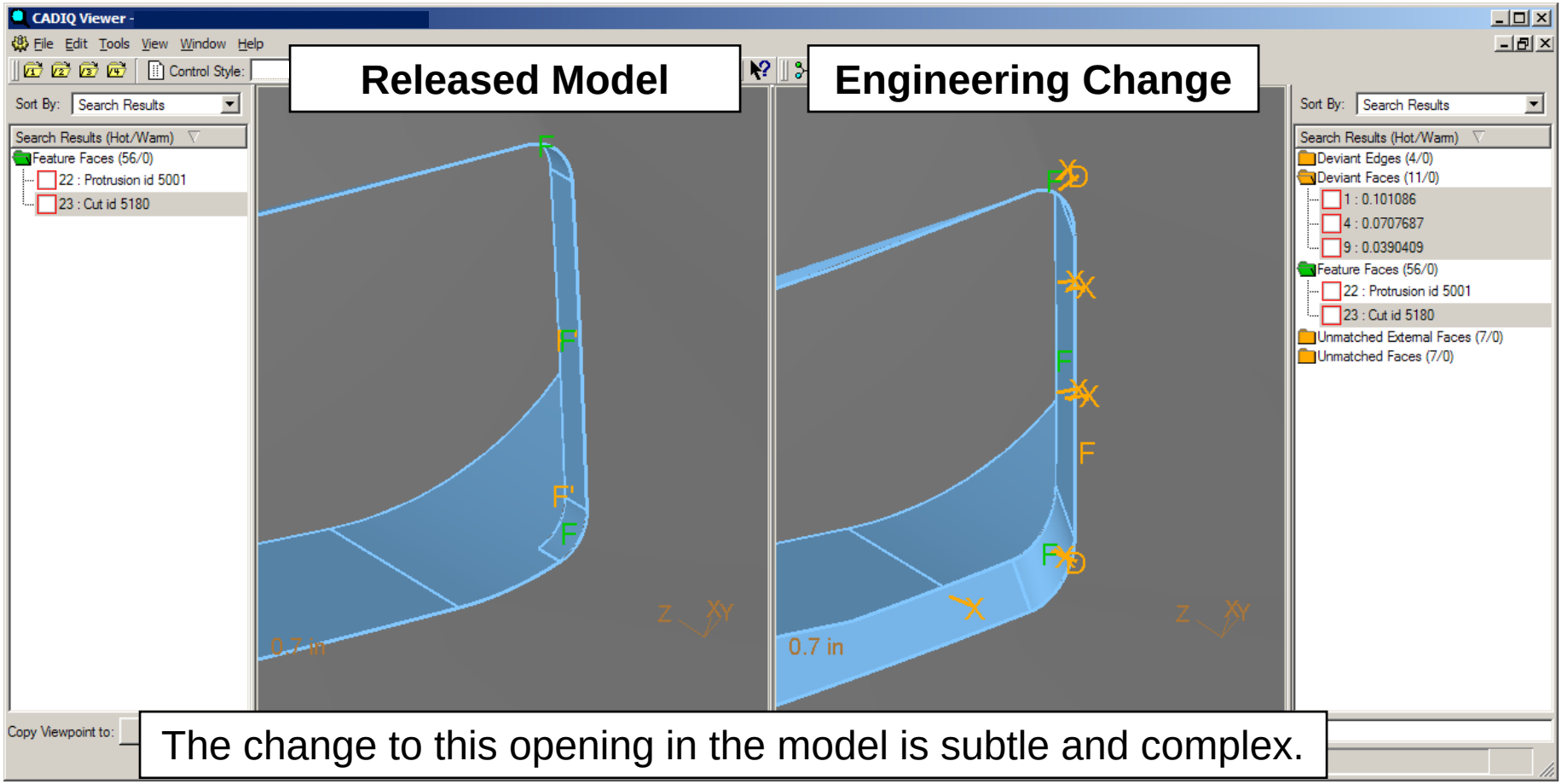
Manual Remastering
Unintentional changes

Product Lifecycle Transition Validation

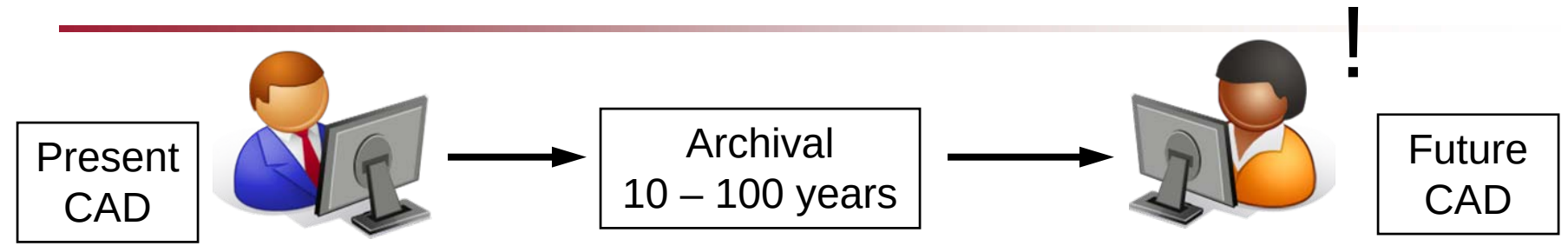


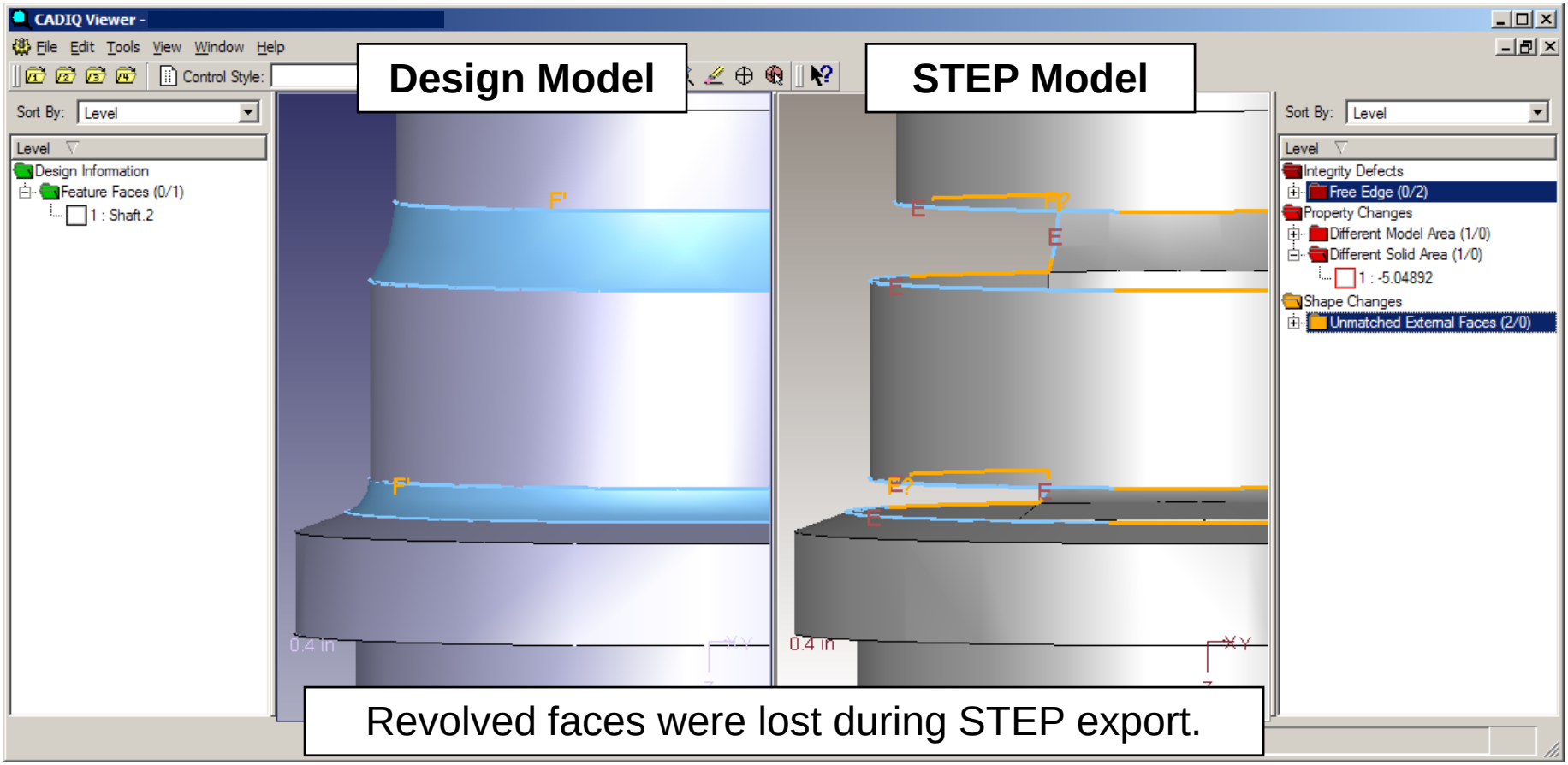
MBE processes are undermined if the model is not validated at critical transitions in the product lifecycle.

Engineering Change Validation

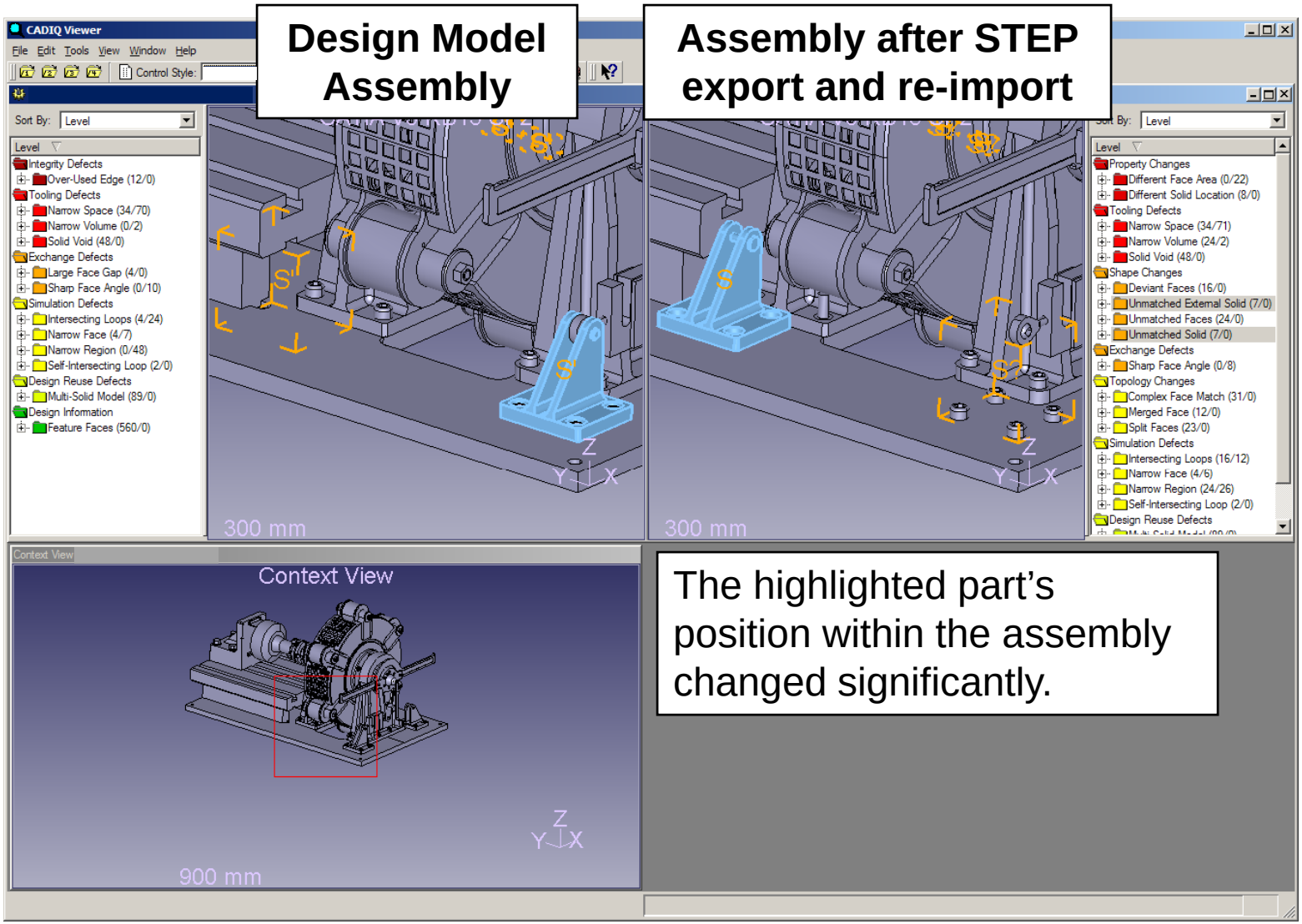


Part Model Archival Validation





Assembly Model Archival Validation



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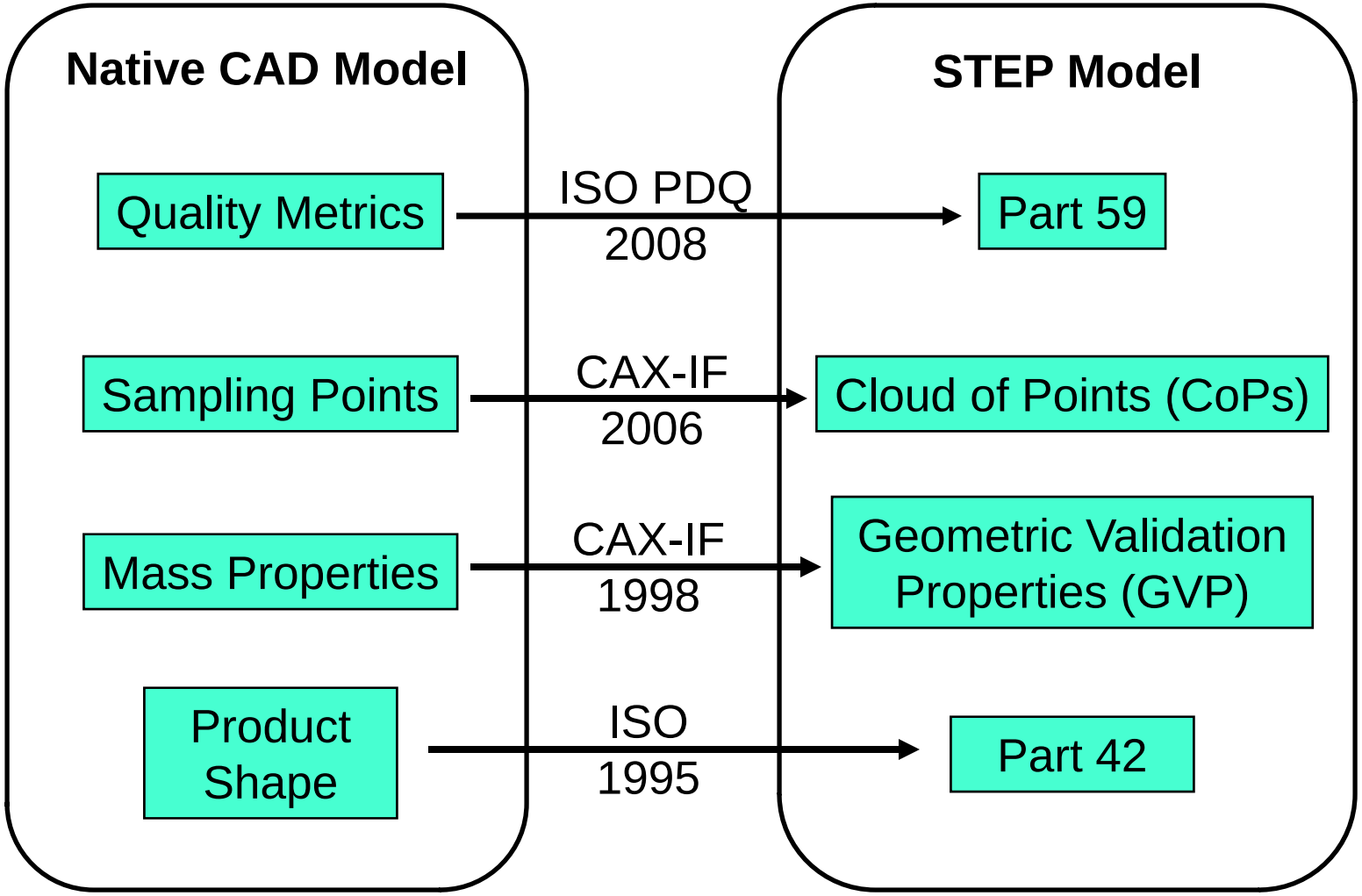
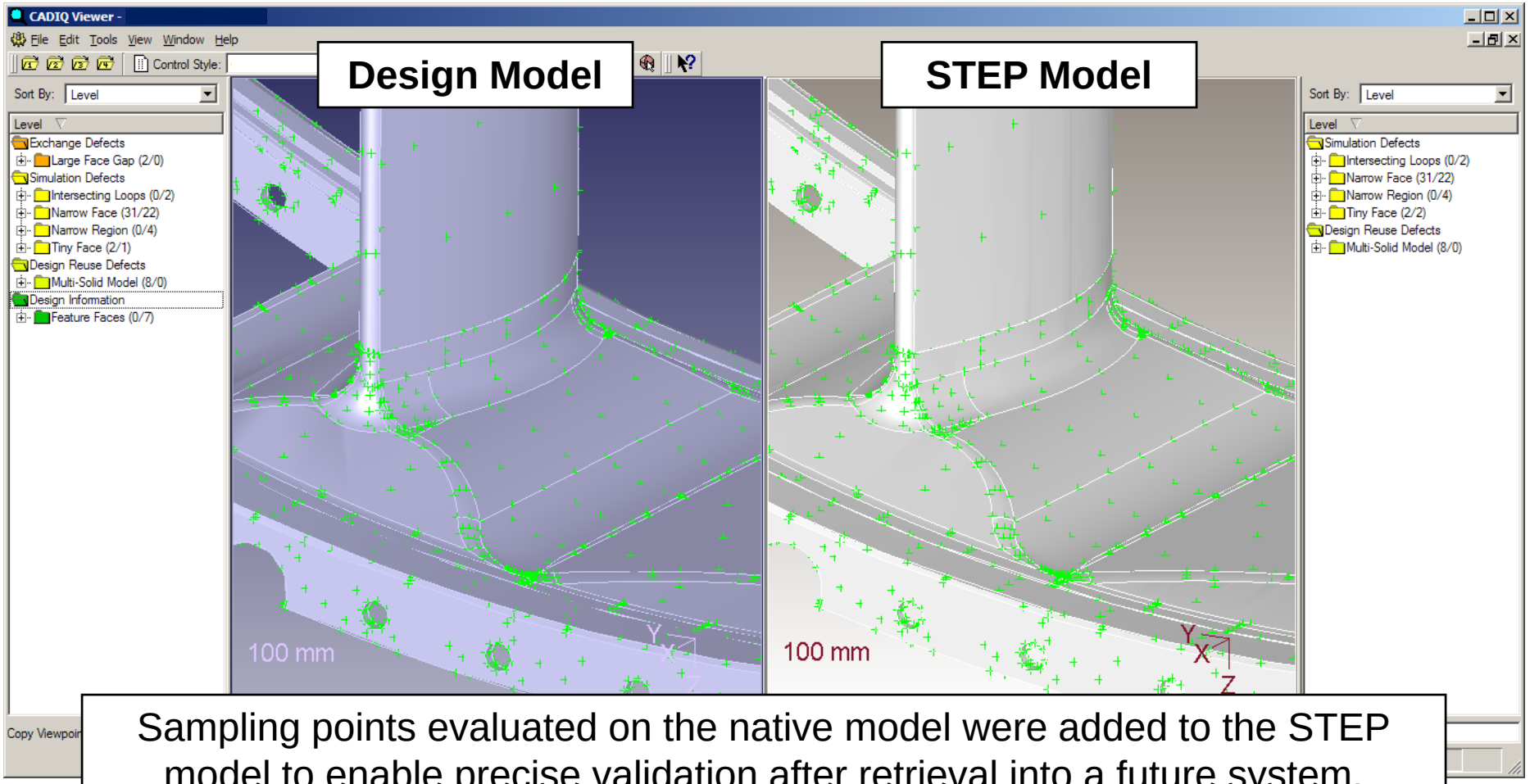
Self-Validating STEP Models



STEP Cloud of Points Example



Sampling points evaluated on the native model were added to the STEP model to enable precise validation after retrieval into a future system.

The Next Frontiers…

- **Product Manufacturing Information (PMI)**
  - 3D geometric dimensions and tolerances (GD&T)
  - Annotations (notes)
- **Domain-Specific Models**
  - Composites
  - Electrical harnesses
- **Dissimilar Models**
  - Wireframe (legacy) data
  - Collaboration (graphics) data
  - Inspection (CMM) data
  - Reverse engineering (point cloud) data

Raising the Value of your Product Data

via integration and interoperability solutions

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