



Raising  
the **Value** of your  
Product Data

# **CAD Model Verification, Validation and Comparison**

**TTI** TranscenData

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# International TechneGroup Inc. (ITI)

## ■ Background

- Founded in 1983 by Dr. Jason Lemon
- Privately Held
- Headquarters - Cincinnati, OH

## ■ Global Presence

- North America
- Europe
- Asia Pacific

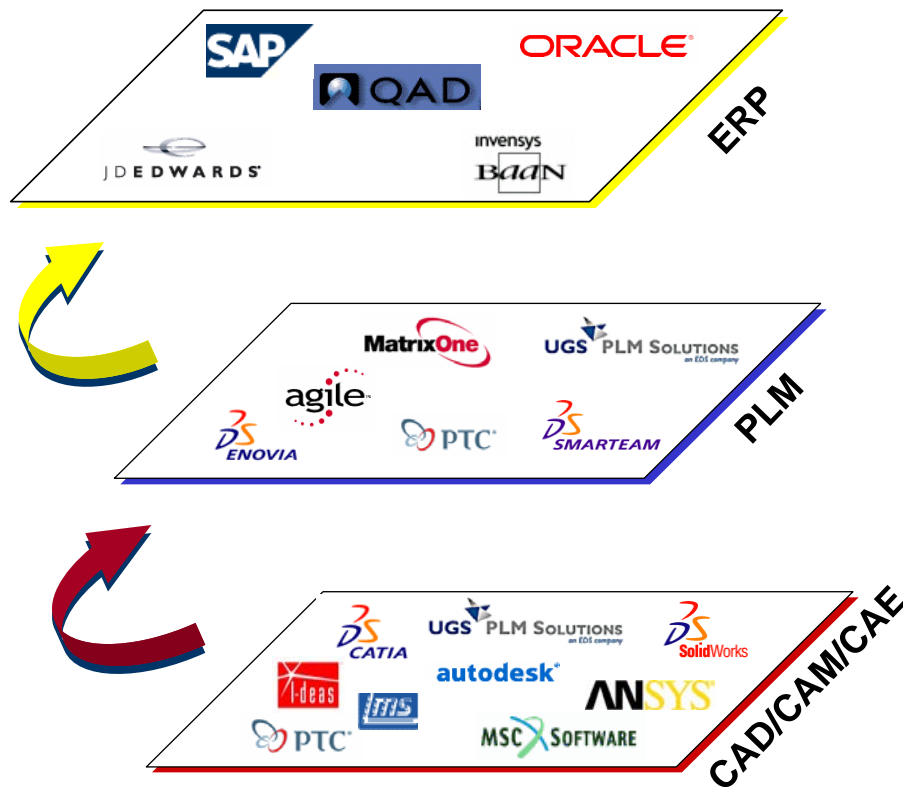
## ■ Business Offerings

- Engineering Process Improvement Consulting (CP/PD™)
- Analysis, Simulation, Test, and Reliability Engineering Services
- ***Product Data Integration & Interoperability (TranscenData Business)***



# ITI TranscendData Business Focus

Engineering is hard . . .

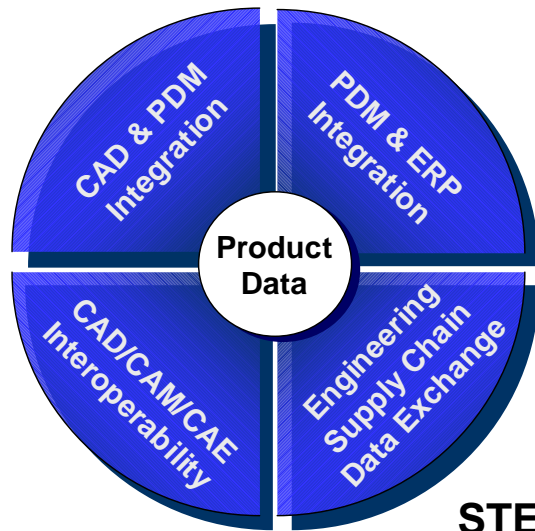


## Solution Set

- CAD & PLM Integration
- PLM & ERP Integration
- CAD Model Quality, Translation & Distribution

Sharing your product data should be easy!

# ITI TranscenData History



## Automation & Comparison

- DEXcenter
- CADIQ V4

## PDM Systems Integration

- Vendor/OEM Programs
- PDM/CAD & PDM/ERP

## Quality Testing and Repair

- Acquired FEES Ltd. with CADfix
- CADIQ

## STEP Translator Development

- Vendor/OEM Programs
- STEP/PDES Inc. Development Effort

## IGES Translator Development

- Vendor/OEM Programs
- IGES Standard Development Effort
- IGESworks

Mid 80s

Early 90s

Late 90s

Today

# CADIQ Product Overview

## ■ Native CAD Interfaces (API)

- CATIA V4 and V5, I-deas, Pro/E, SolidWorks, Unigraphics
- Parasolid, STEP and IGES

## ■ Specialized User Interface

- Multi-CAD, multi-platform batch analysis with statistics
- Rapid graphical viewing of diagnostic feedback
- Side-by-side viewing of 2, 3 or 4 equivalent models

## ■ Model Quality Diagnostics

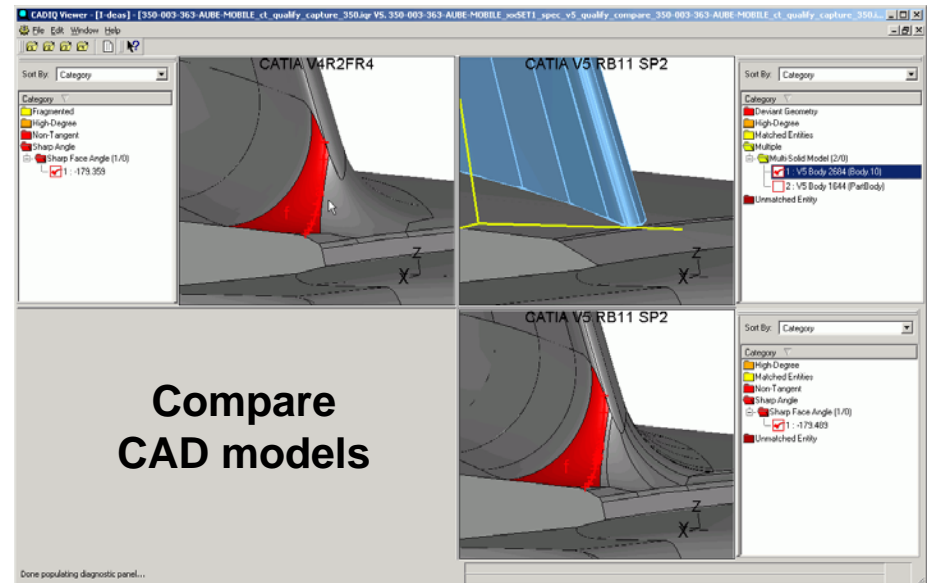
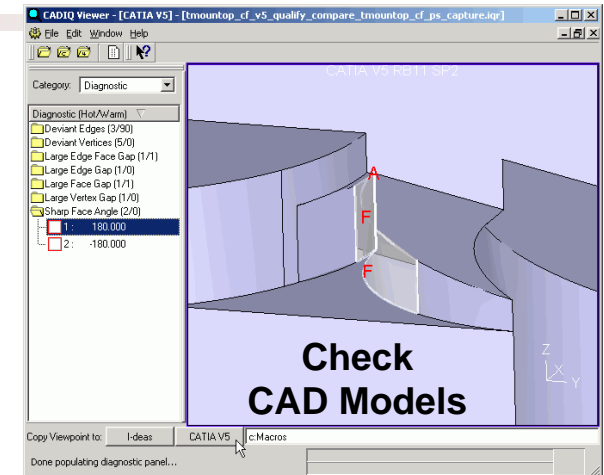
- Invalid geometry
- Unrealistic/ambiguous features

## ■ Model Comparison Diagnostics

- Unacceptable changes after translation
- Undocumented changes between revisions
- Unintentional changes between revisions

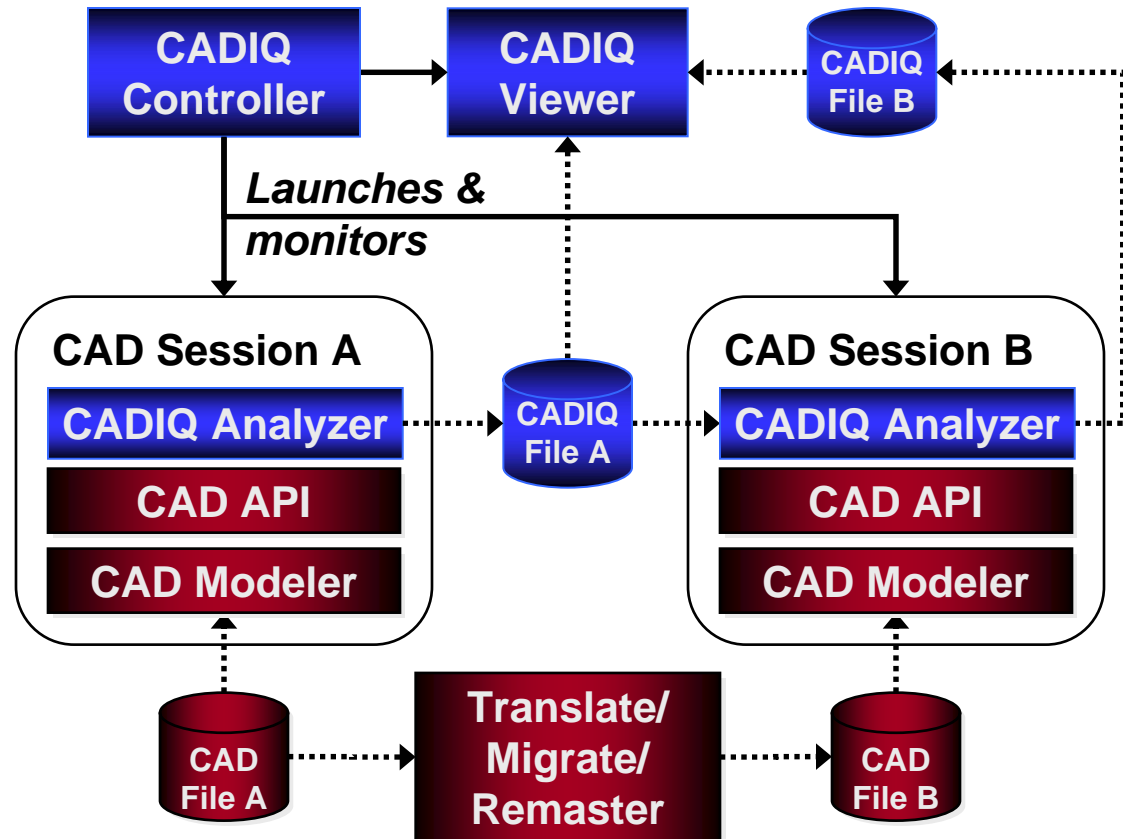
## ■ System Integration Options

- Embedded CAD utility
- DEXcenter
- PDM Workflow

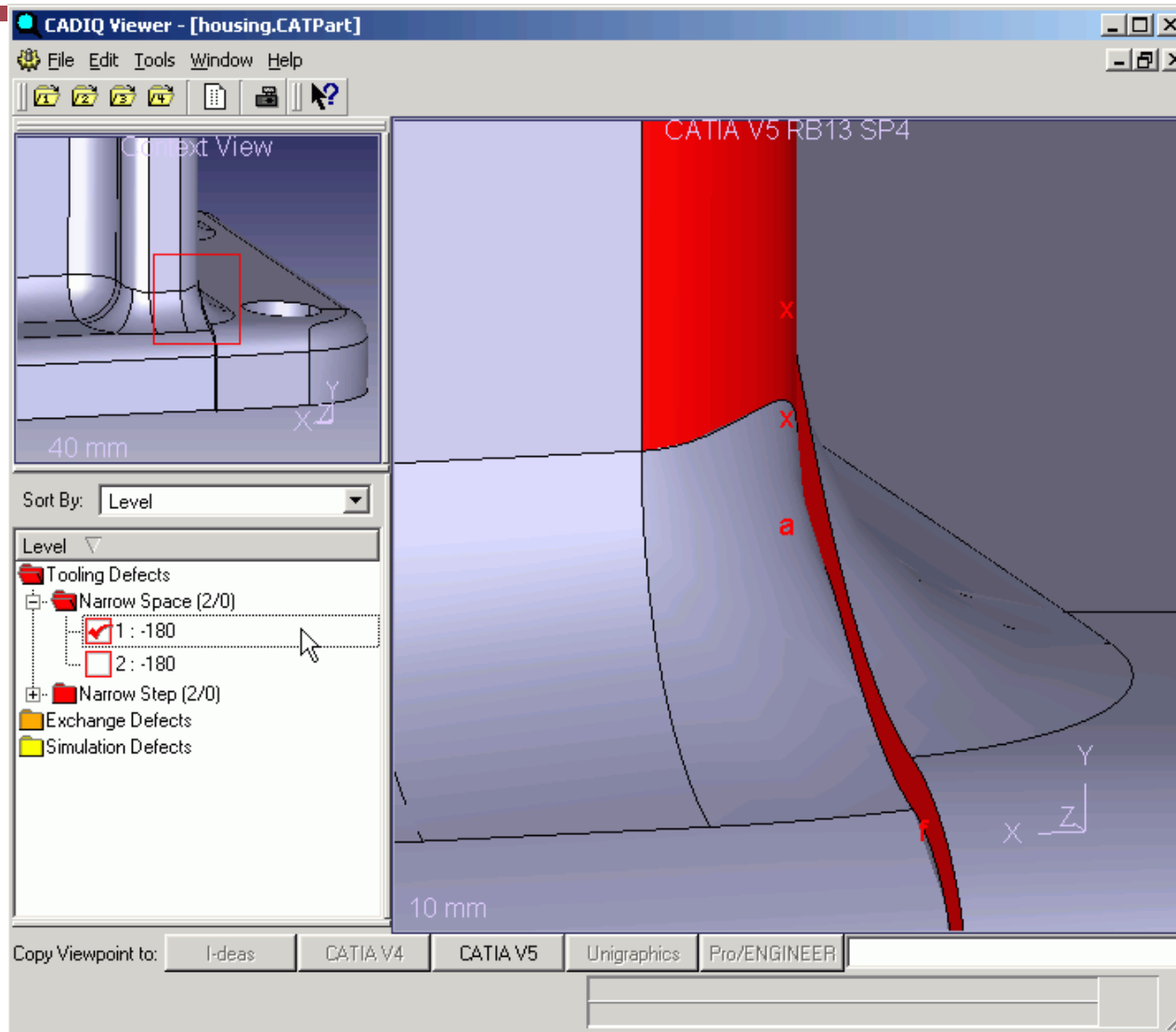


# CADIQ Software Architecture

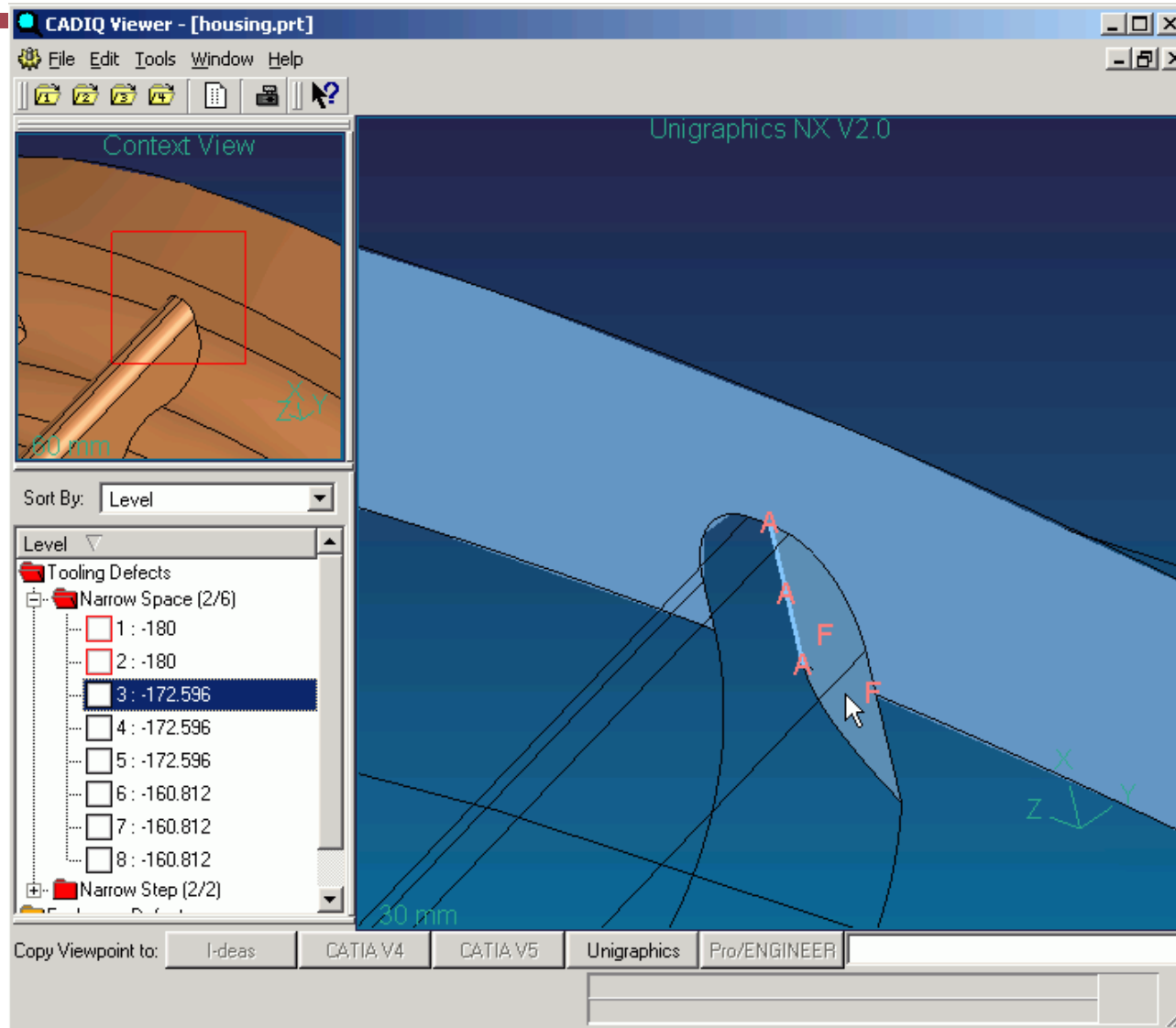
- Sampling points are evaluated by the native CAD system
- Only topology & sampling points are translated by CADIQ between the CAD systems
- Point projections are performed by the target CAD system
- Quality analysis is performed on each model in its own CAD system



# Design Verification for Simulation: Unrealistic Blend



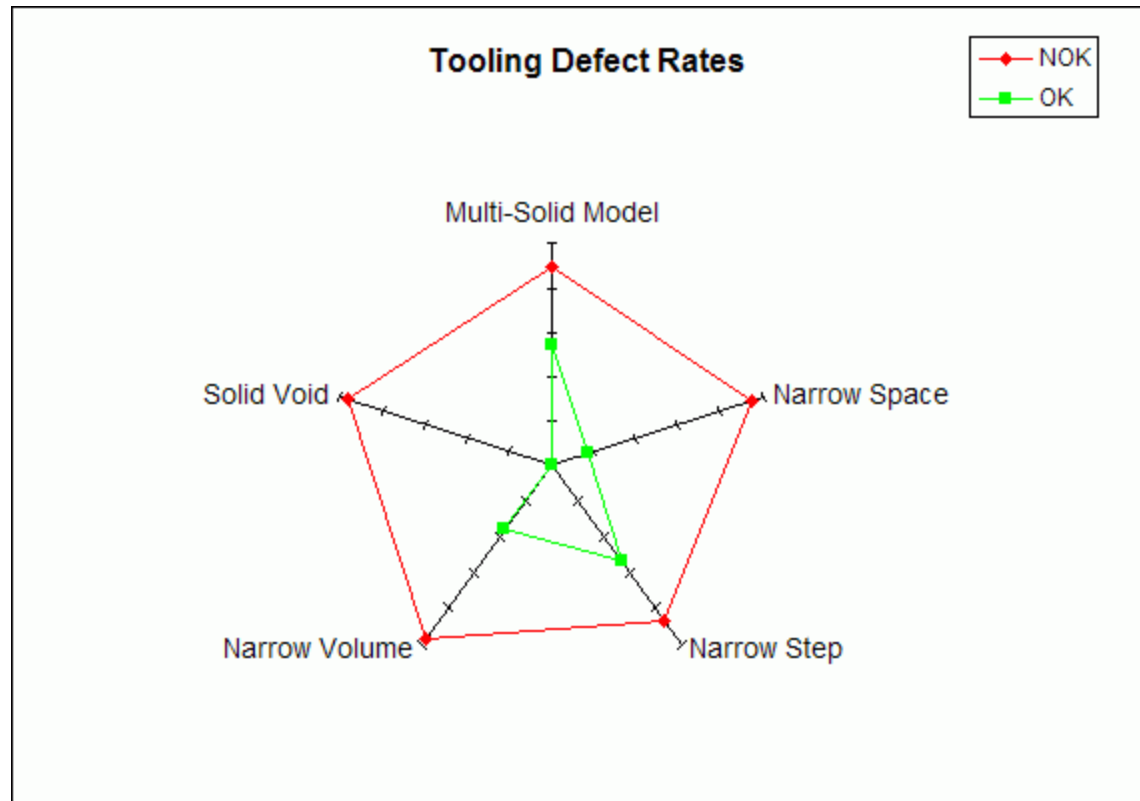
# Design Verification for Simulation: Crack Between Rib and Body





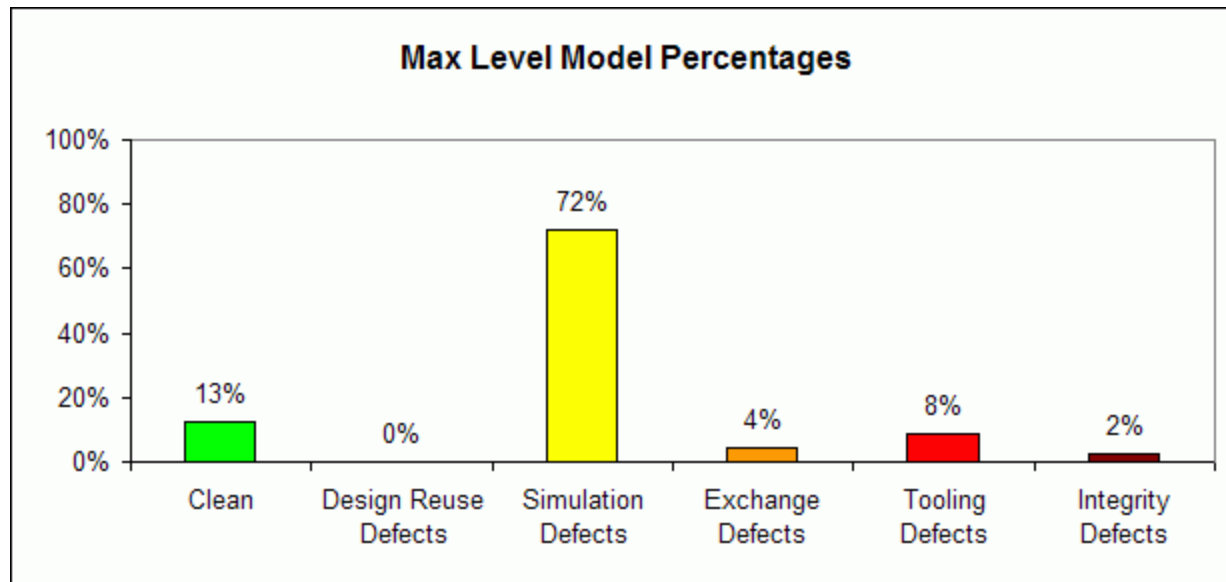
# Diagnostic Correlation Statistics

- Identify good (OK) and bad (NOK) models for a specific downstream process
- Determine which diagnostics are significant



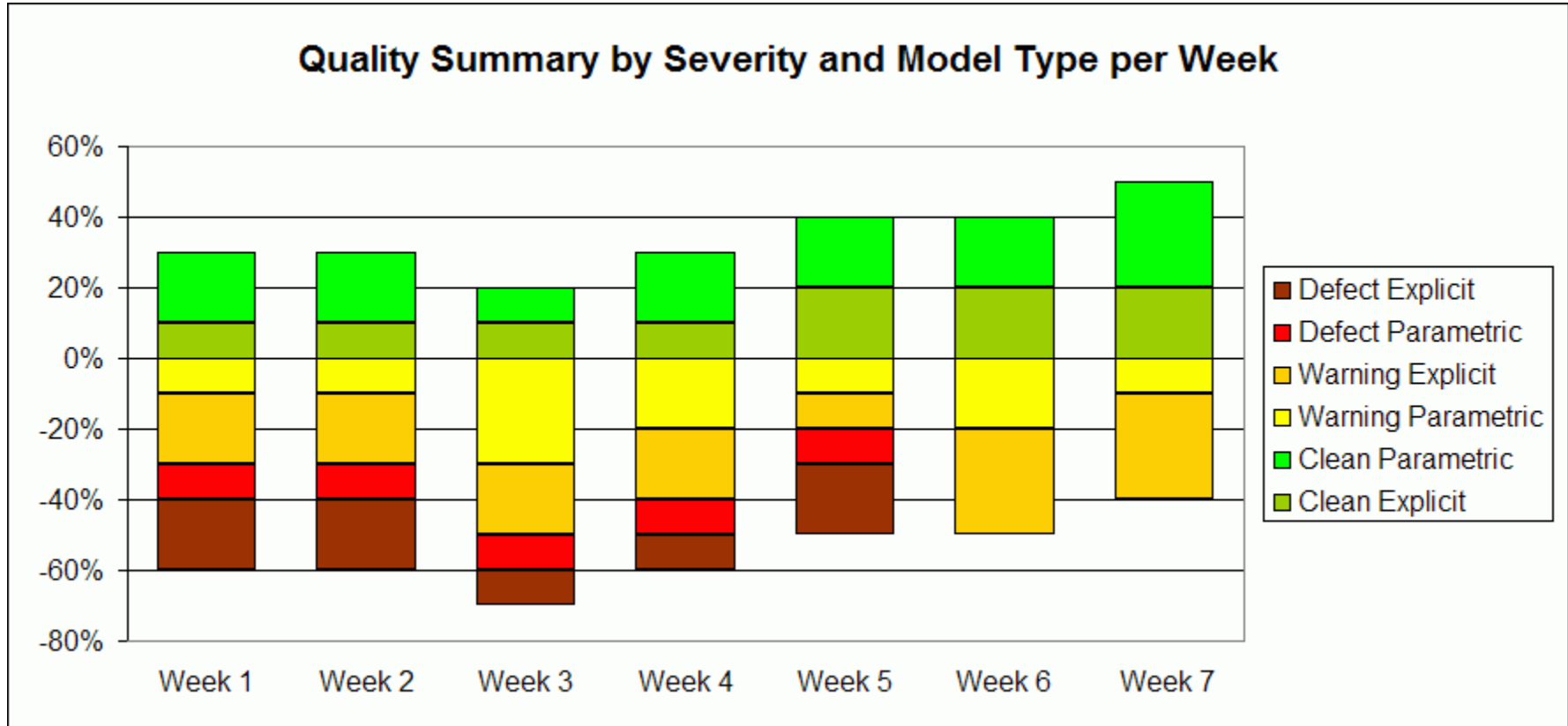
# Quality Control Statistics

- **Classify a model for downstream reuse**
  - “Concept model” vs. “Engineering model”
- **Summarize the quality of the CAD models for a specific design project**



# Quality Control Statistics (cont)

- Track the quality of the models in a project over time
  - Severity: Defect, Warning or Clean (for downstream reuse)
  - Type: Parametric or Explicit (no features/history)



# Expanding the Definition of “Bad CAD”

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## ■ Invalid geometry (Verification)

- Impedes reuse of native model in most CAx processes

## ■ Unrealistic features (Verification)

- Require geometry changes during CAE/CAM model reuse
- Can cause divergence between CAE and CAM models

## ■ Unacceptable changes (Validation)

- Introduced during translation, migration, remastering or archiving
- Introduced during rework for CAE/CAM reuse

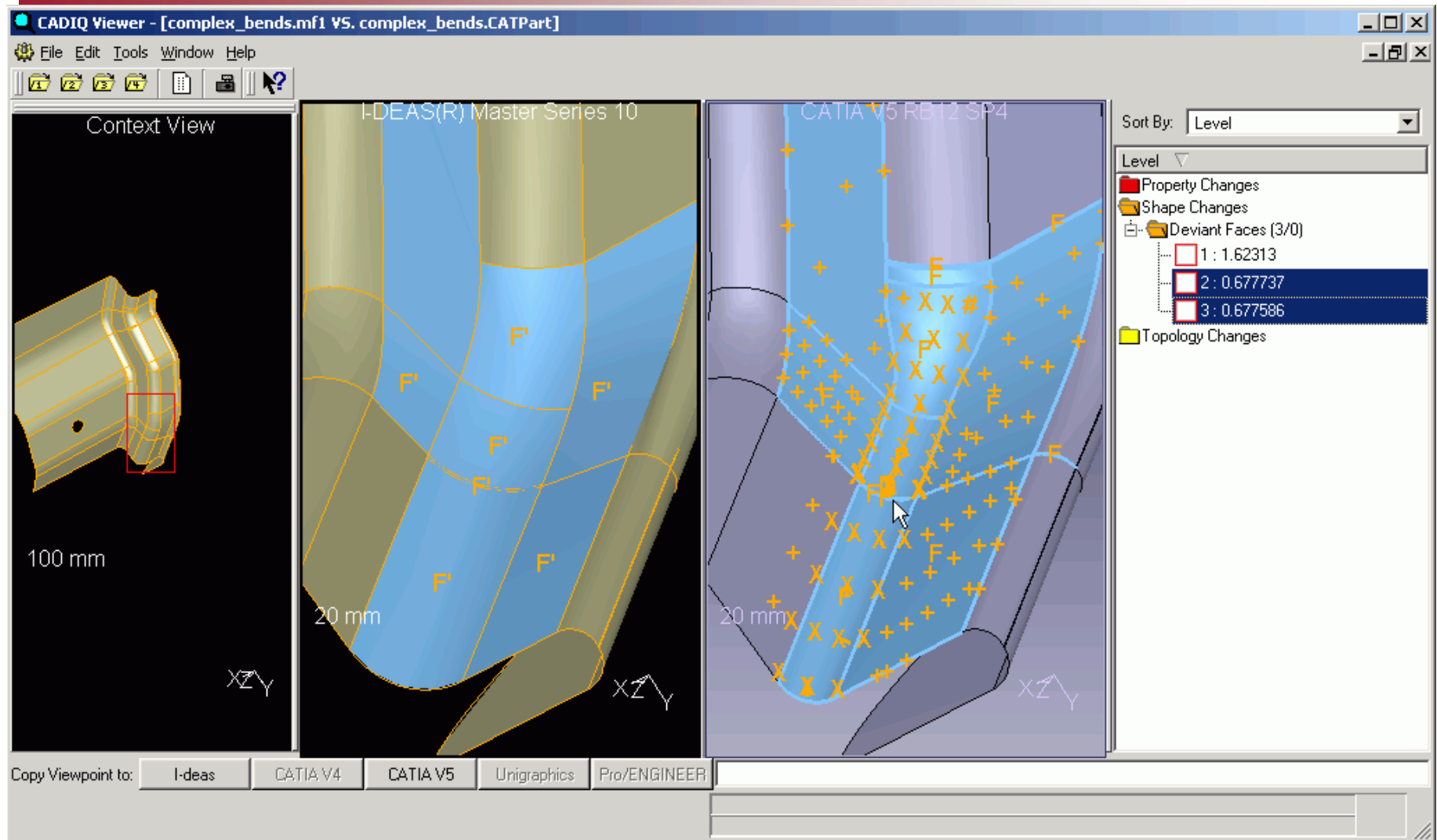
## ■ Undocumented changes (Comparison)

- Between design revisions or for an engineering change order

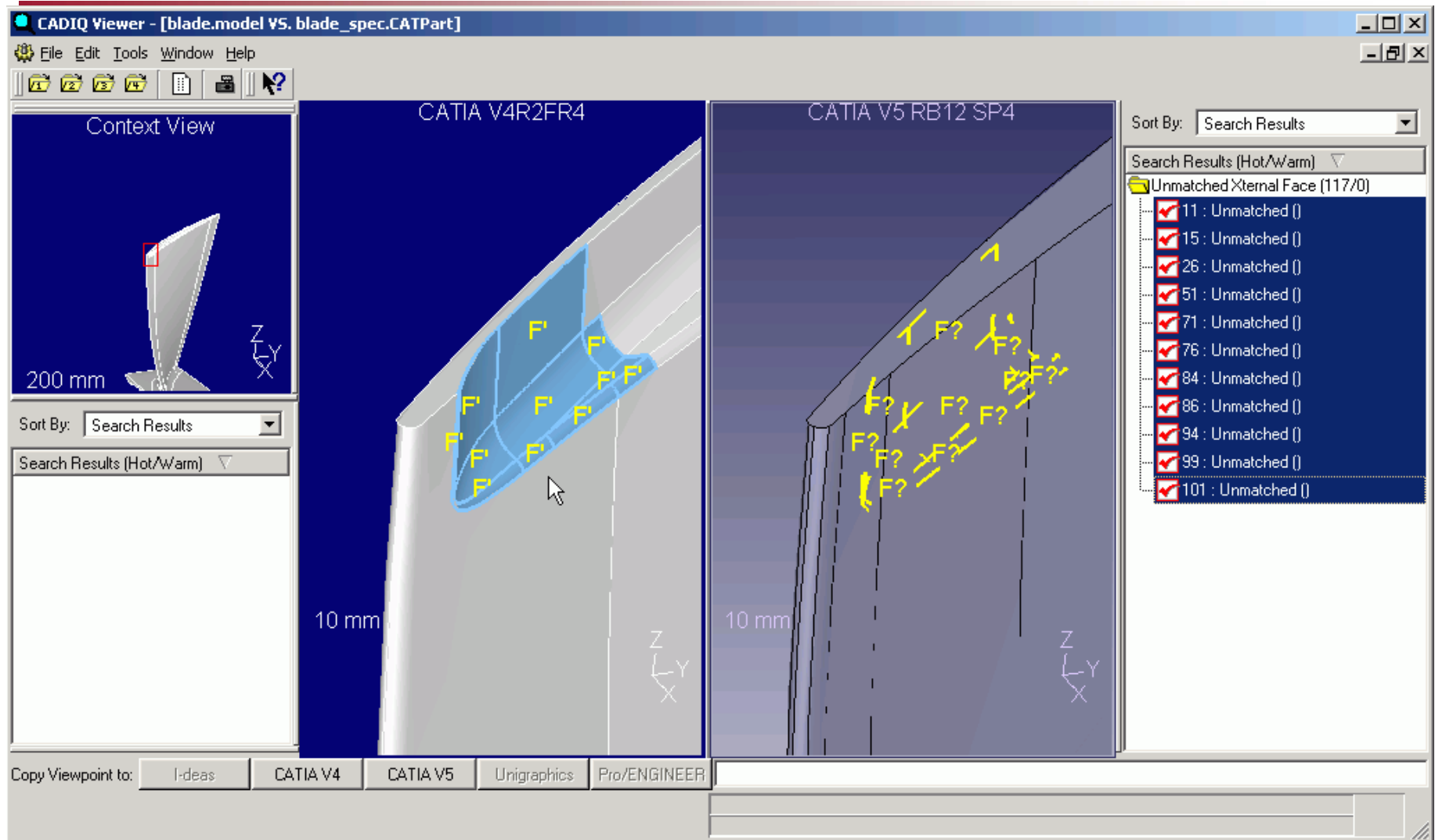
## ■ Unintentional changes (Comparison)

- Between design revisions or for an engineering change order
- Caused by complex parametric relationships unknown to user

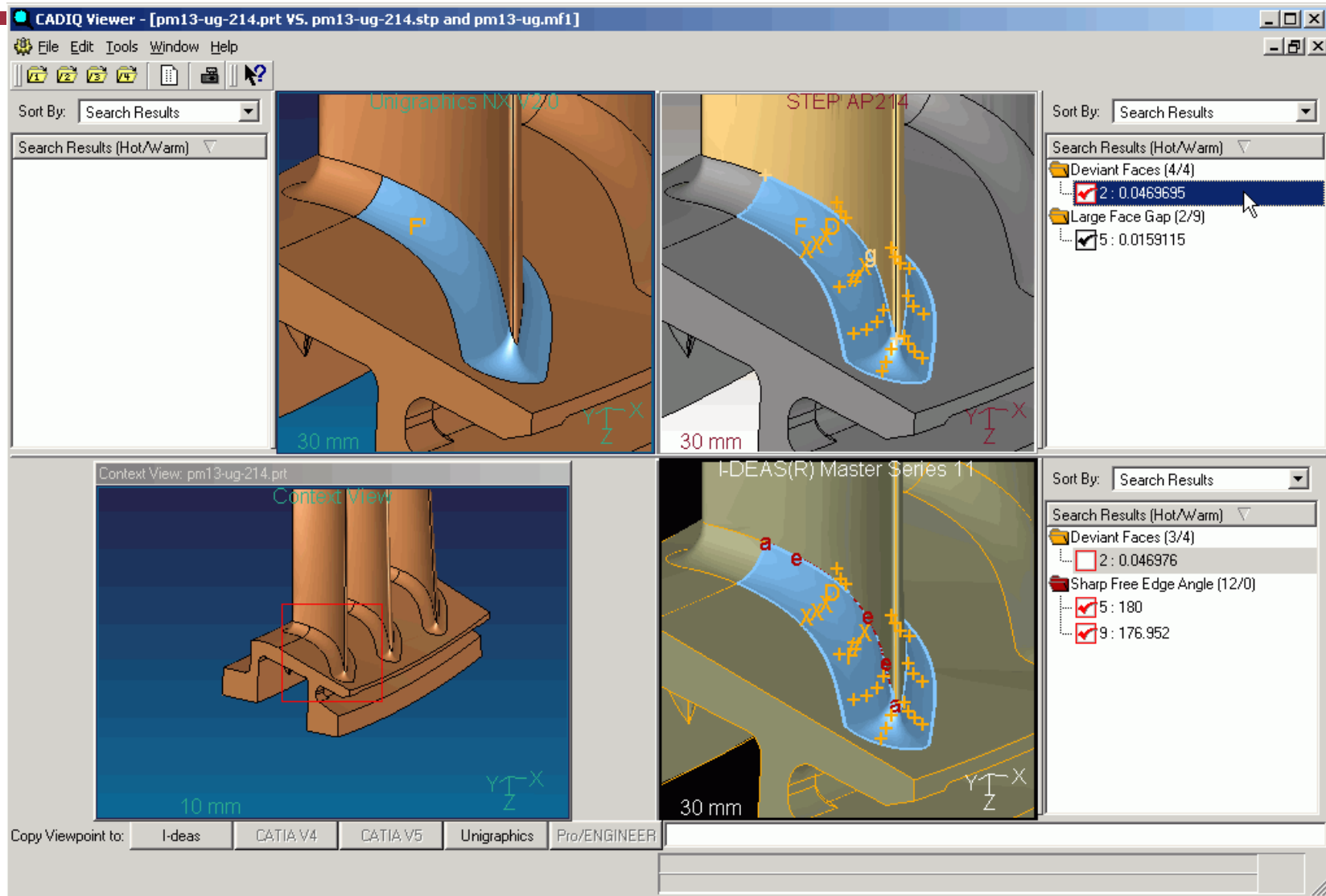
# Direct Translation Validation: Shape Change in Complex Blends



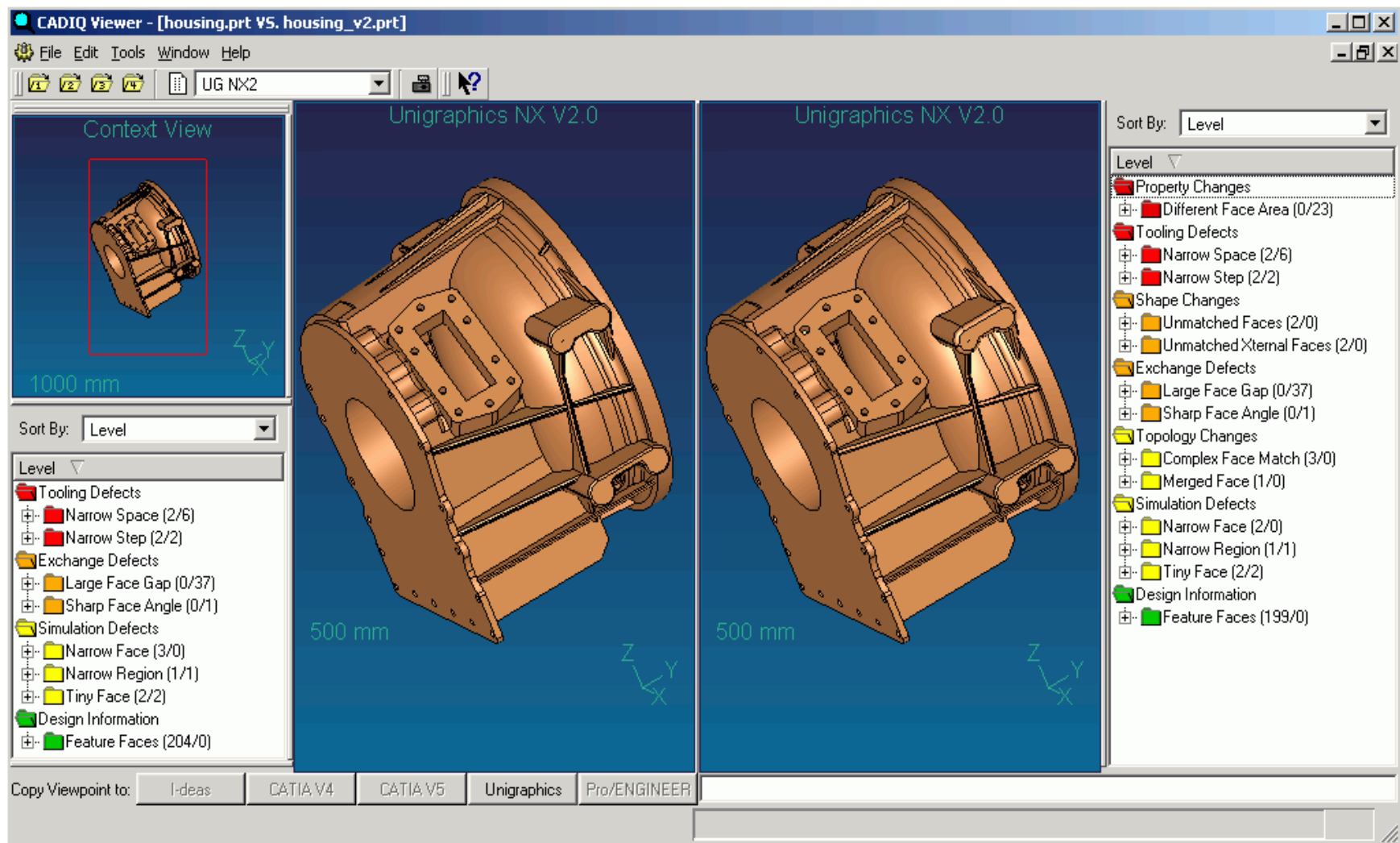
# Feature Translation Validation: Feature Dropped with No Error in Process



# STEP Translation Validation: Surface Approx. Creates Open Solid

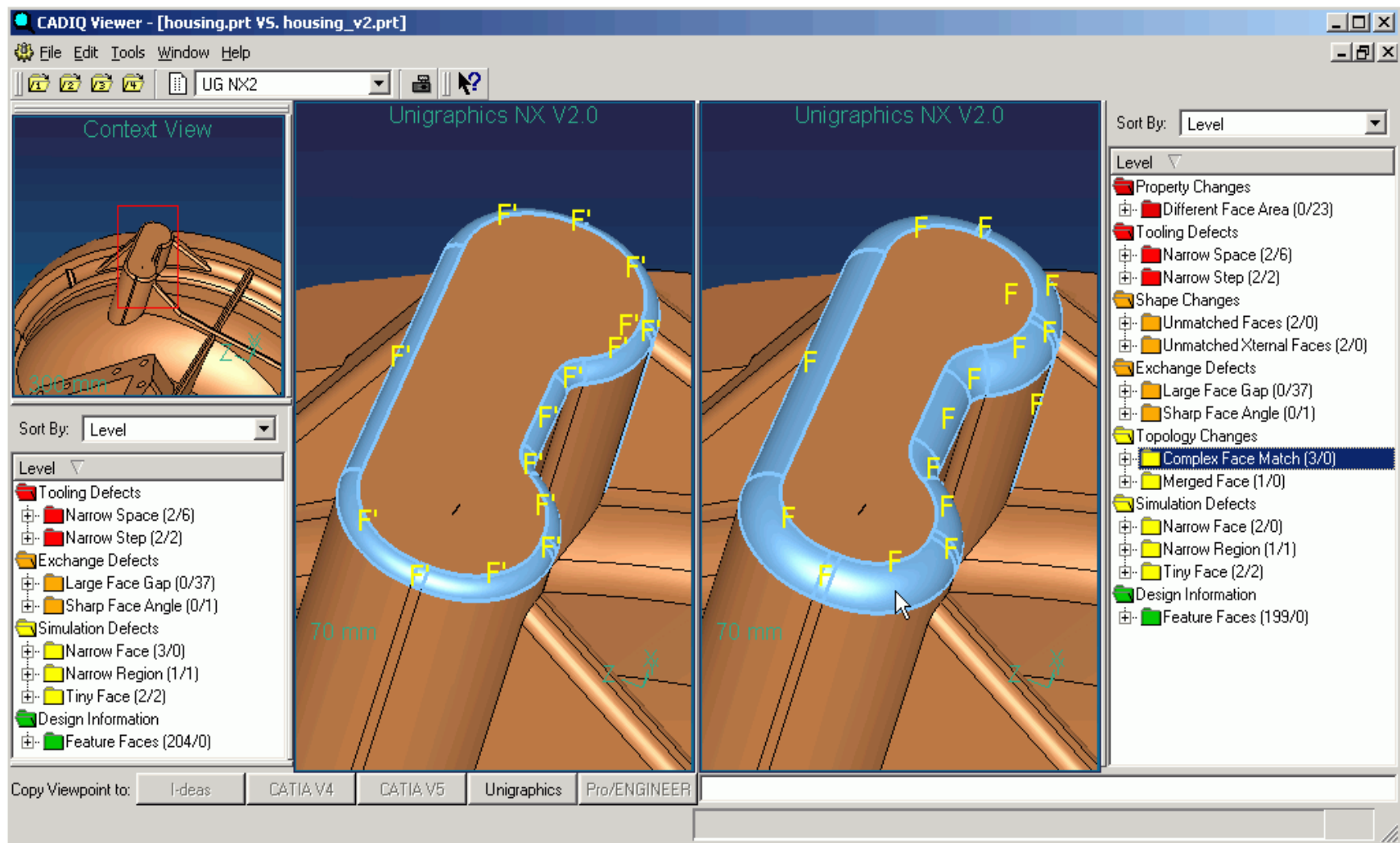


# Comparing Part Revisions

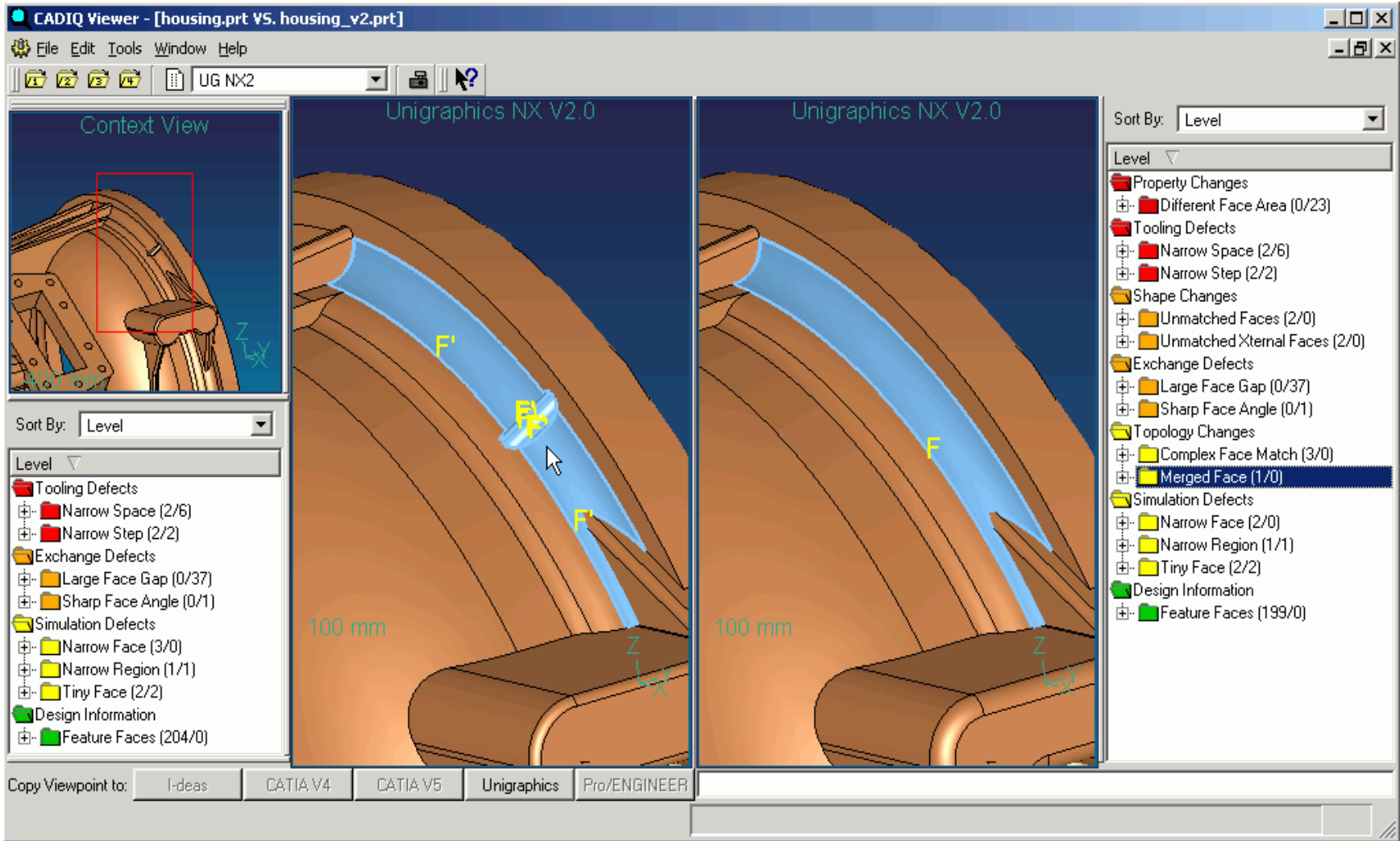




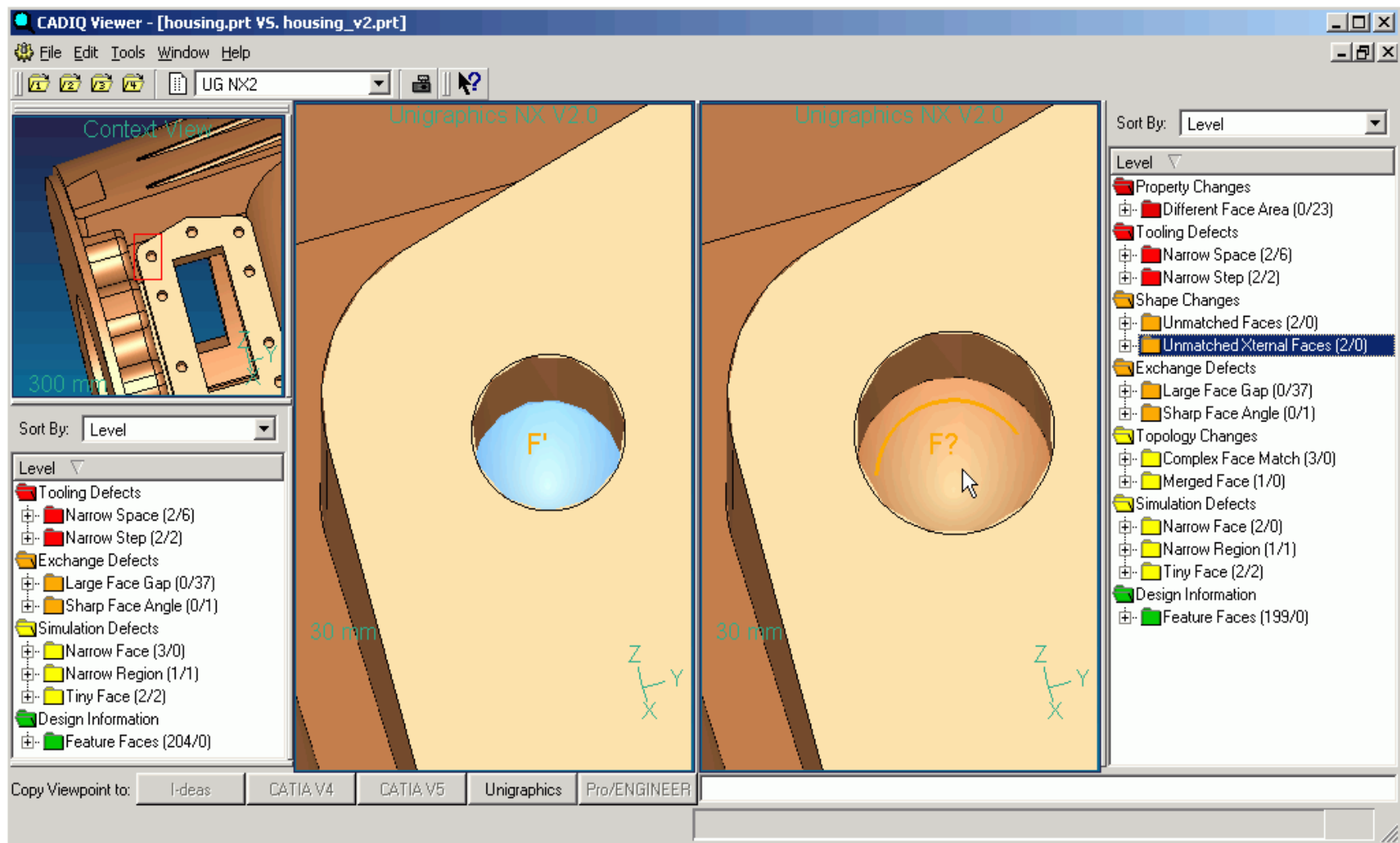
# Comparing Part Revisions: Fillet Radius Increased



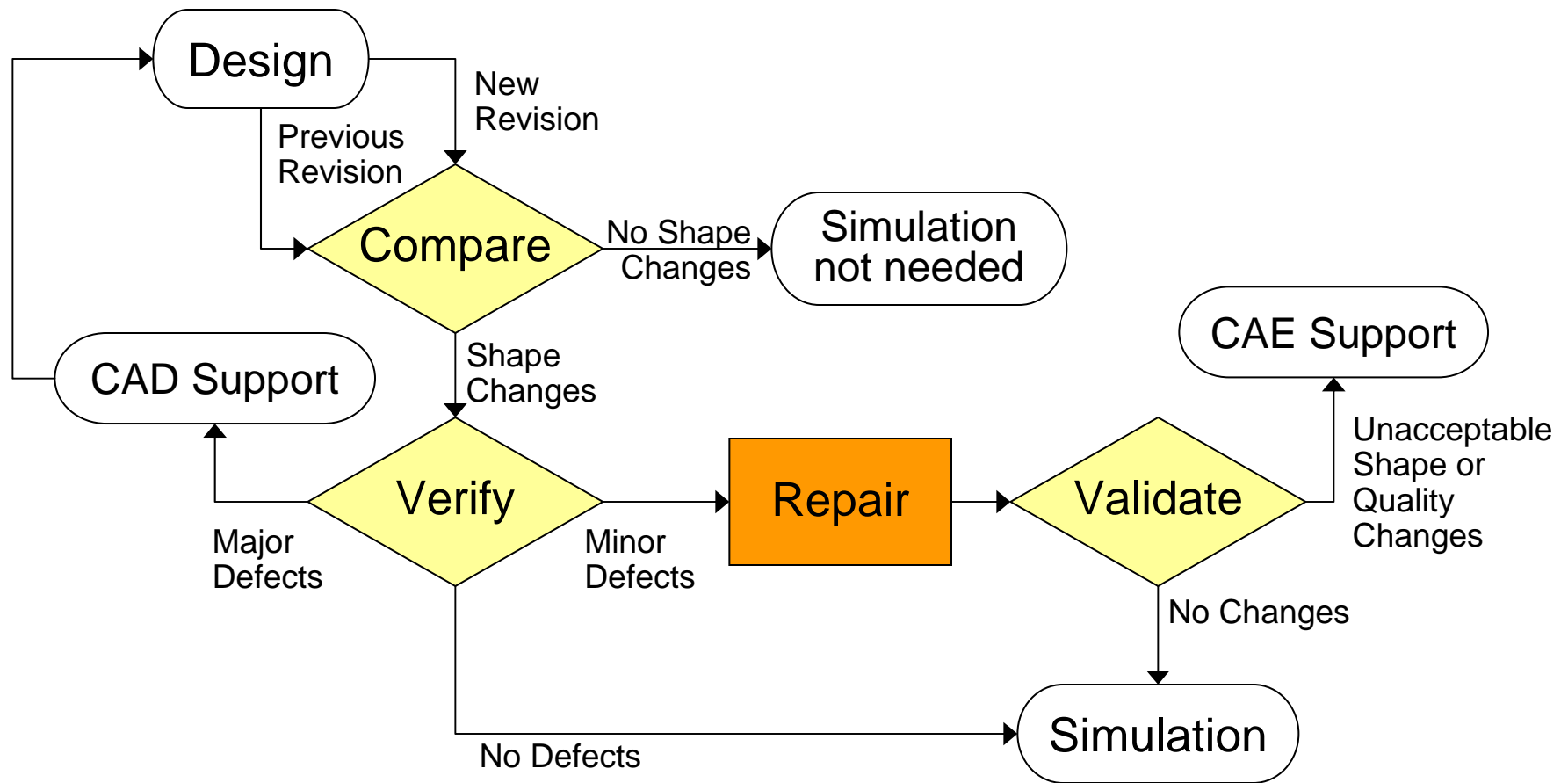
# Comparing Part Revisions: Small Feature Suppressed



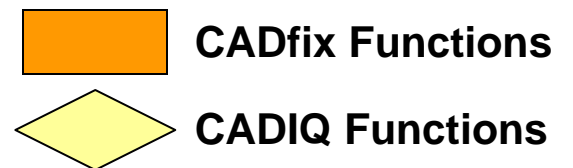
# Comparing Part Revisions: Hole Diameter Increased



# Design Verification for Simulation/Tooling

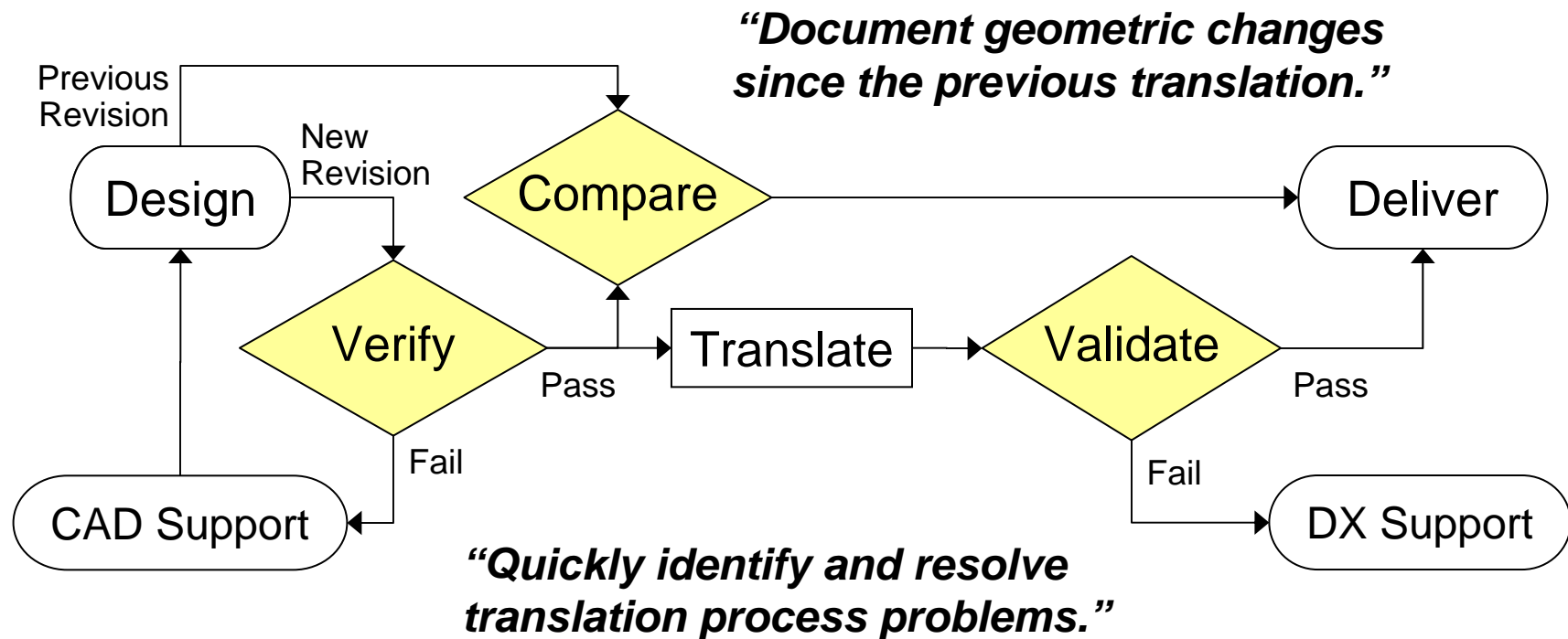


***“Minimize CAD rework for simulation.”***



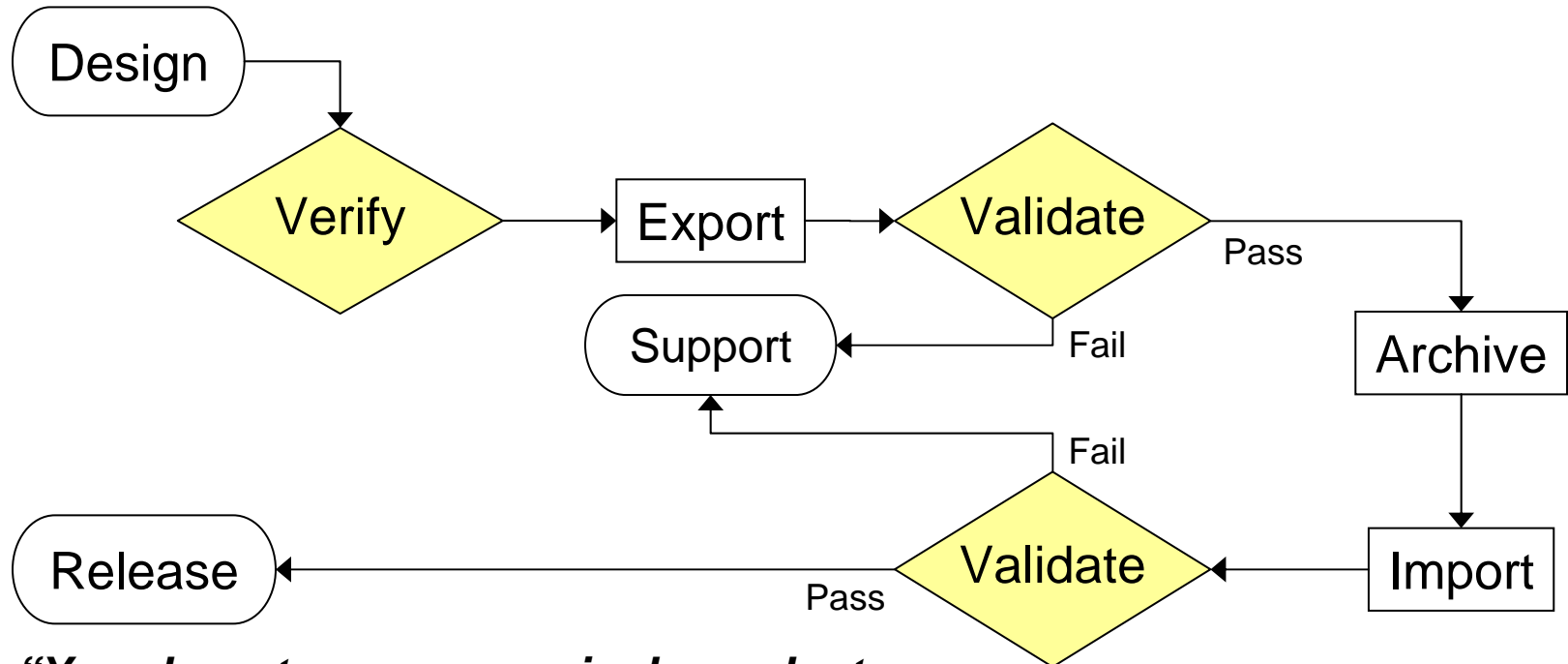
# Translation Validation

- Verify native model for downstream reuse
- Validate that translated model has equivalent quality and shape
- Identify process issues for Support to resolve



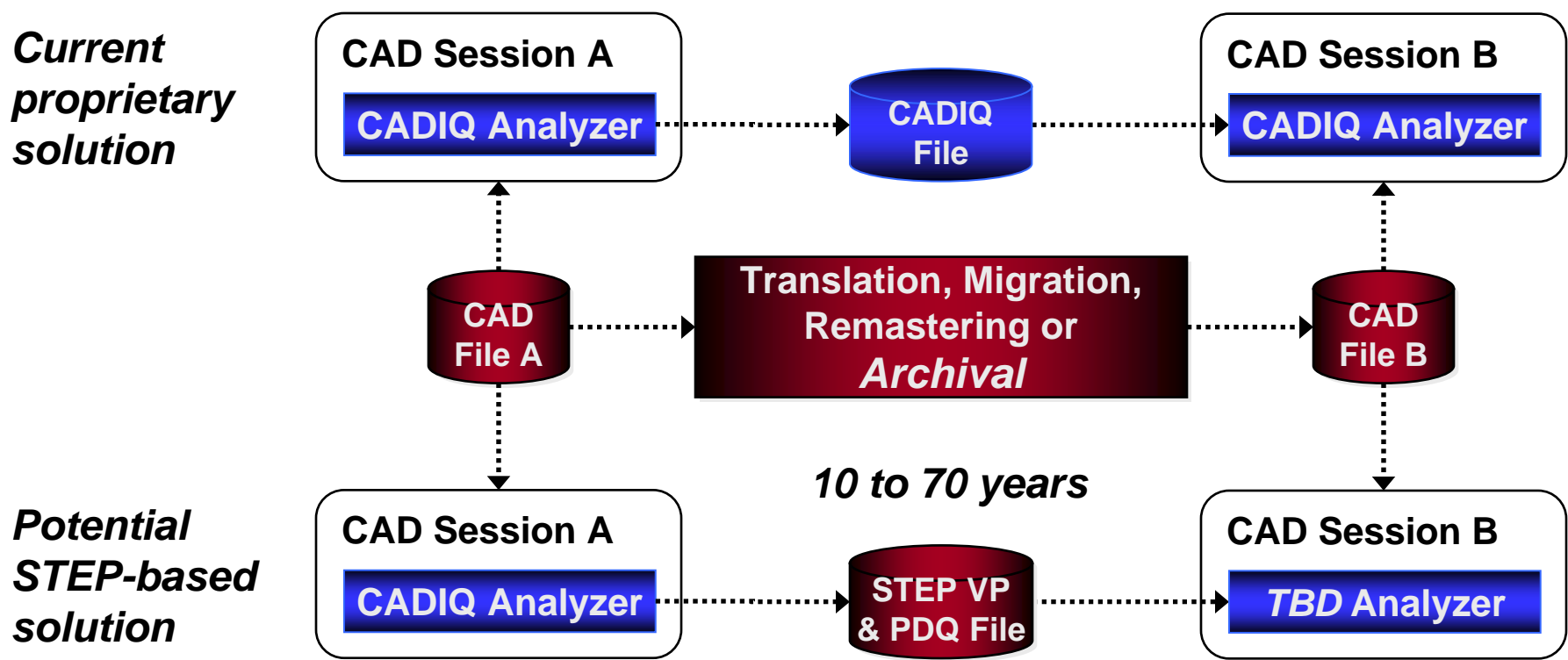
# Validation for Long-term Preservation

- Verify native model for downstream reuse
- Validate that STEP export has equivalent quality and shape
- Validate that STEP import has equivalent quality and shape



***“Your long-term revenue is dependent on long-term preservation of your digital data.”***

# Proprietary vs. STEP-Based Validation



**“Create a self-validating STEP archive model.”**

# New STEP Development Activities



*PDES, Inc.*

## ■ CAX-IF Validation Properties Recommended Practices

- Extend STEP to capture native validation properties
- Developed in 1998 by CAX Implementers Forum (mass props only)
- Supported by most STEP translation vendors
- Extended in 2001 to include assembly part/instance mass props
- Supported by a few STEP translation vendors
- 2<sup>nd</sup> extension proposal being developed to add face sampling points

## ■ ISO 10303 Part 59 “Quality of Product Shape Data”

- Extend STEP to capture native geometric quality data
- Based on SASIG (VDA, JAMA/JAPIA, AIAG) PDQ specification
- Proposed by Japan at fall 2004 ISO meeting
- Working draft delivered at fall 2005 ISO meeting
- Targeting completion in fall 2006 for AP203 Edition 2



# Raising the Value of your Product Data

Ensure CAD  
Model Quality

Maximize CAD  
Model Re-use

Facilitate Global  
Product  
Development

Enable Engineering  
Supply Chain  
Data Exchange

**Product Data Integration & Interoperability Solutions**