

# **Feature and Topology Detection**

## **Greater possibilities with Capvidia extension and PARTsolutions**

**Cadenas Industry Forum**  
**February 5th, 2015**

**Thomas Tillmann**

**Capvidia GmbH**

**Company Overview**

**Application Areas**

**Capvidia Solution Portfolio**

**Feature Recognition Technology used by Cadenas PARTsolutions**

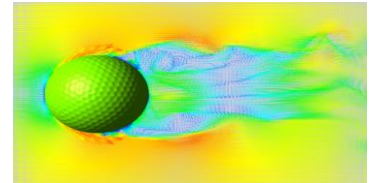
**3D CAD Data Exchange and Repair Technology used by Cadenas PARTsolutions**

**Q&A**

# Company Overview

## Capvidia

- Founded in 1994
- Development of software engineering applications
- Engineering software, services, software components
- 75 + programmers & scientists (20% PhD)
- Global company: Europe, North America, Russia, Japan, China
- CAD data translation and CFD
- Cap = Capturing  
vidia = Knowledge (in Sanskrit)



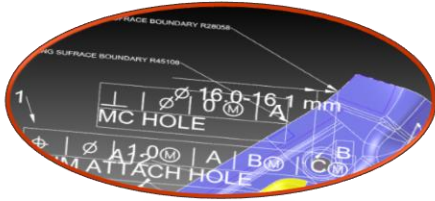
## Mission

Capturing knowledge into engineering software applications

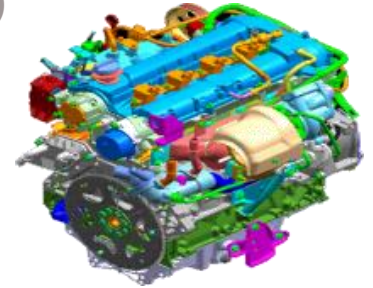
## Vision

Provide solutions for 3D CAD data integrity to secure company intellectual property and investments

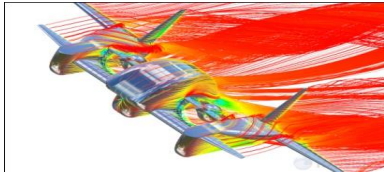
## 3D CAD Data Interoperability



- CAD Data Translation
- CAD Data Repair
- CAD Data Feature Recognition
- CAD Data Validation (CAD + Metadata)
- CAD Data Quality Assessment
- CAD Visualization & Collaboration
- Reverse Engineering



## CFD Simulation



- Multi-Physics (Fluid-Structure-Interaction)
- External Internal Aerodynamic
- Turbo Machinery
- Multi-Phase Flows, Free Surface Simulation
- Parallel Processing & Optimization

## CAD Interoperability - **3DTransVidia, FormatWorks \***

- Precise CAD data translation with automatic repair & healing
- MBD and PMI support
- Features

## CAD Validation & Revision Control – **CompareVidia, CompareWorks \***

- Multi level and multi criteria CAD data validation
- MBD and PMI support

## CAD Quality – **QualityVidia, PDQWorks \***

- PDQ Standards (AIAG D15, VDA 4955, JAMA, MIL STD 31000A, etc)
- User/Process driven quality criteria
- Long term CAD data archiving (ISO 10303 STEP)

## MBD – **MBDVidia**

- Native, neutral, PMI CAD formats
- Automatic Ballooning
- Bill of Characteristics
- Reporting

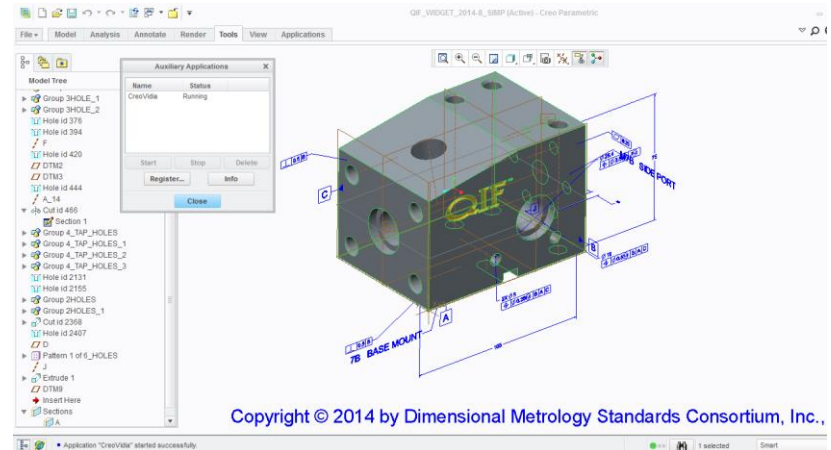
\*) **Solidworks PlugIn**

## QIF – **CreoVida (PTC-Creo PlugIn)**

- Produce/Consume QIF format
- Automatic metrological feature recognition
- Capvidia SDK for integration of QIF into metrology applications

## Reverse Engineering – **ReverseVida**

- Point Clouds => Triangulated representation (mesh)
- Automatic mesh conversion to parametric representation



# Strategic Partnerships & Alliances

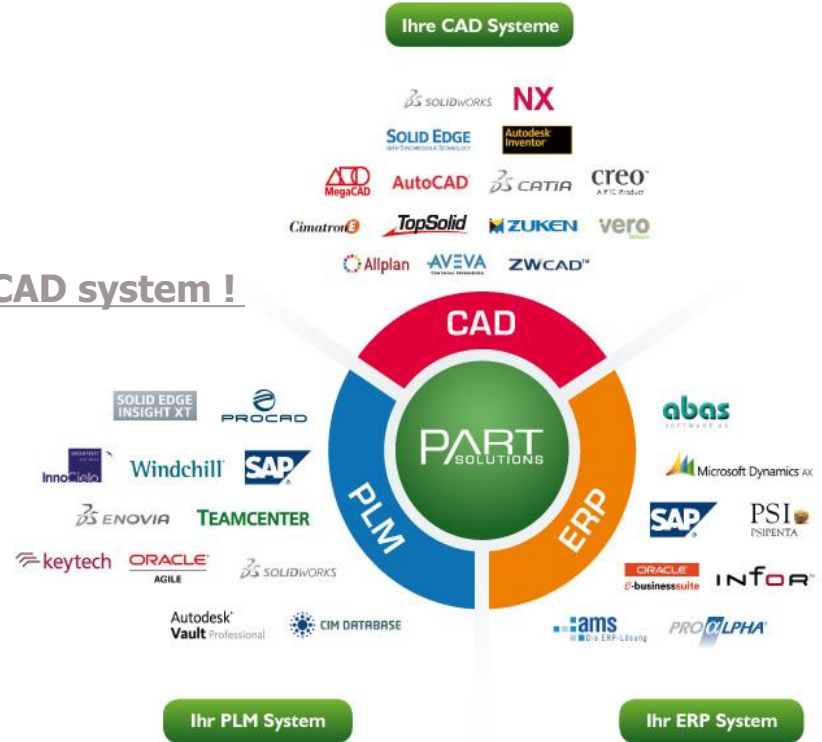


# Topology Reconstruction and Feature Recognition Capvidia Extension for PARTsolutions



## PARTsolutions **before** CAPVIDIA:

- Recognition of only base features
- Not reliable feature recognition
- Support of native formats requires CAD system !
- No automatic CAD repair
- No automatic STL repair



## PARTsolutions **with** CAPVIDIA:

- **Advanced and reliable feature recognition**
- **Access to native CAD data without CAD seat required**
- **Adding STEP support**
- **Automatic repair & healing for native CAD and STL models**
- **Improved CAD quality with STEP export**
- **Improved performance**
- **Higher reliability**

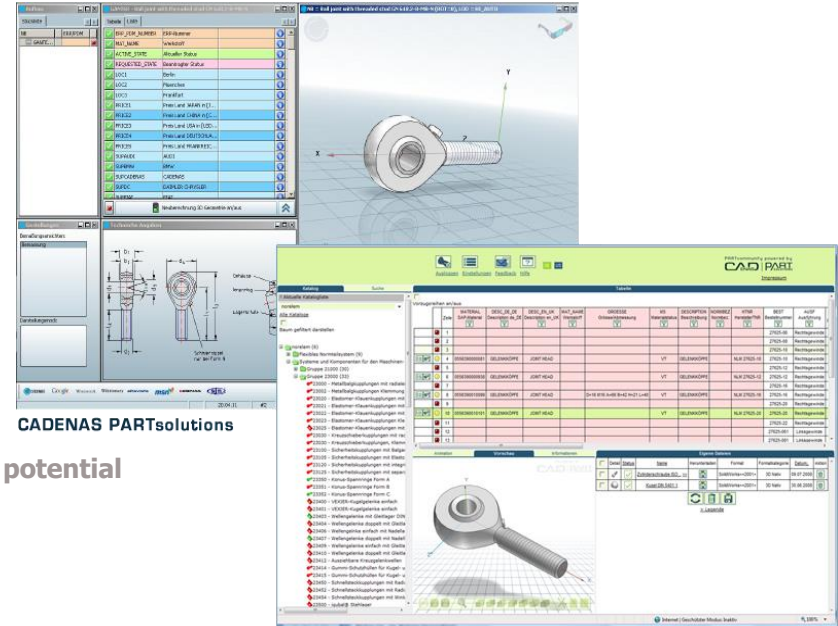


## Drivers for CAPVIDIA partnership

- Access to feature recognition technology
- Multi-CAD access to native CAD data without CAD license
- Access to CAD repair tools
- Capvidia STEP format support
- Cutting development cost and time by using Capvidia SDK
- Possible extensions: access to PMI (GD&T and FT&A)

## Benefits:

- PARTsolutions helps companies to utilize maximum savings potential
- Cost reduction
- Reduced duplicate of parts
- All information at a glance
- More freedom for creative ideas = Engineering instead of managing
  - *Detailed search according to pre-defined shapes in components and assemblies*
  - *More reliable and flexible search*
  - *Reuse of designs and work procedures*

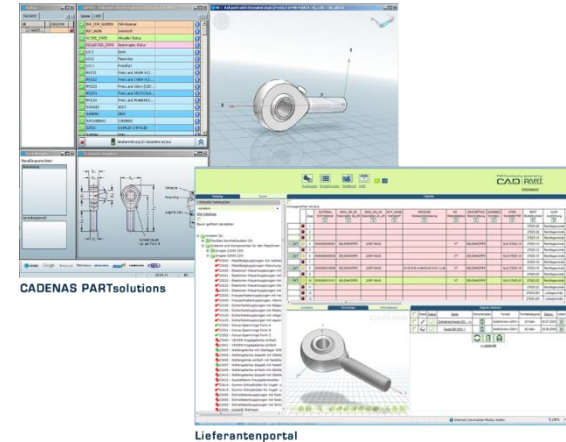


CADENAS PARTsolutions

Lieferantenportal

## Benefits:

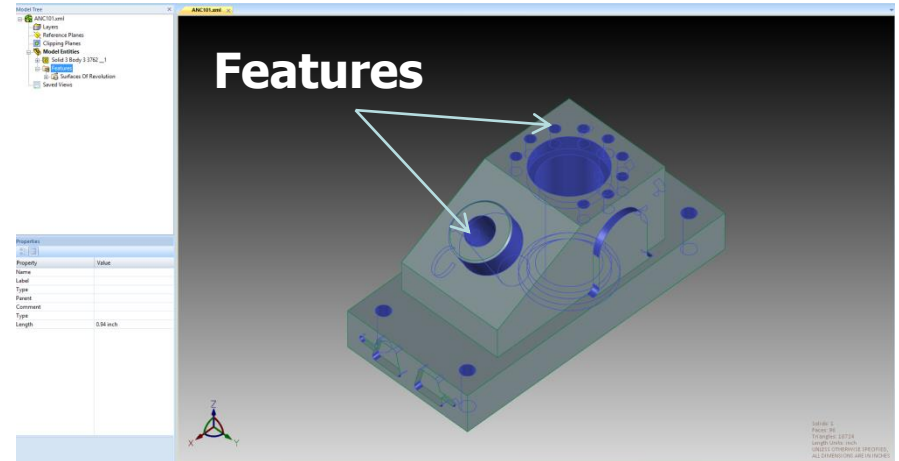
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## Available extensions to Cadenas PARTsolutions:

- Recognition of cylindrical elements
- Detection of long holes
- Recognition of parallel faces
- Angle detection
- Coaxial feature sequences
- Bore patterns (\*)
- Step bore holes (\*)

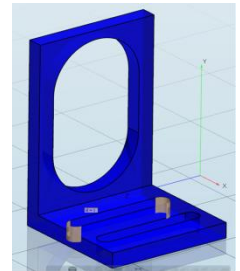
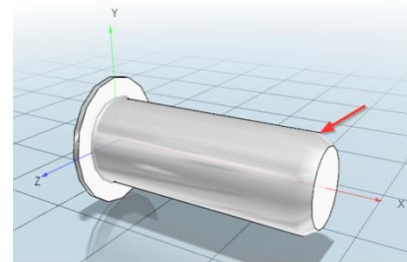
(\*) in preparation



# PARTsolutions with CAPVIDIA Features

## Why Features Defection is important to CADENAS PARTsolutions?

- Higher flexibility & efficiency with part search
- More information ⇔ more efficient search results
- Time savings in part management process
- Better predictability: build vs. buy
- Geometric based search is more reliable
- Feature based search criteria defined by the user
- Feature attributes (length, diameter, etc.) can be used as search criteria
- Class-encompassing search results that correspond to user requirements

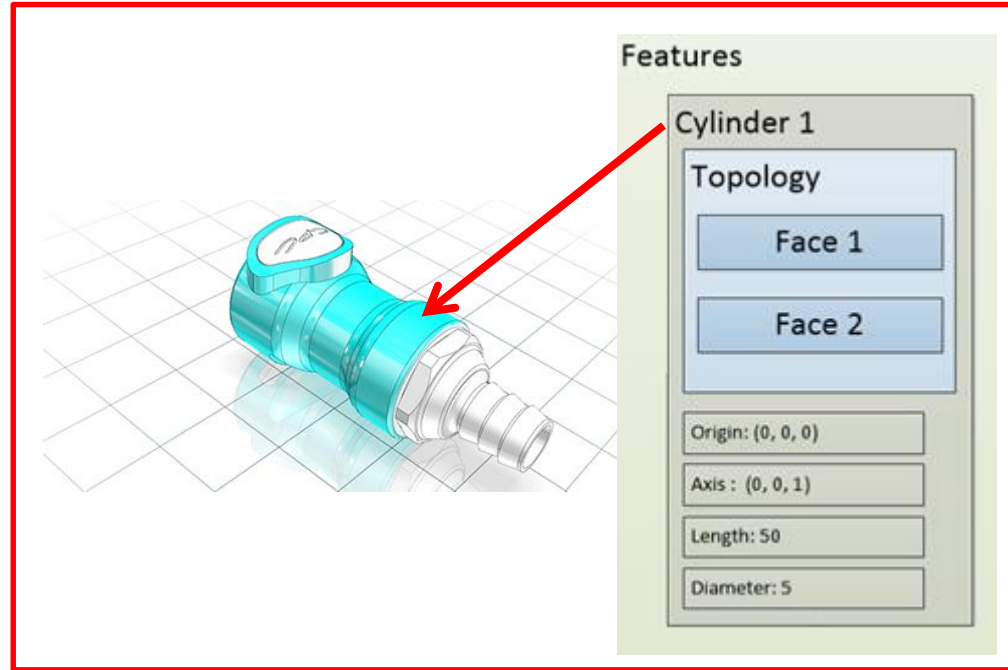


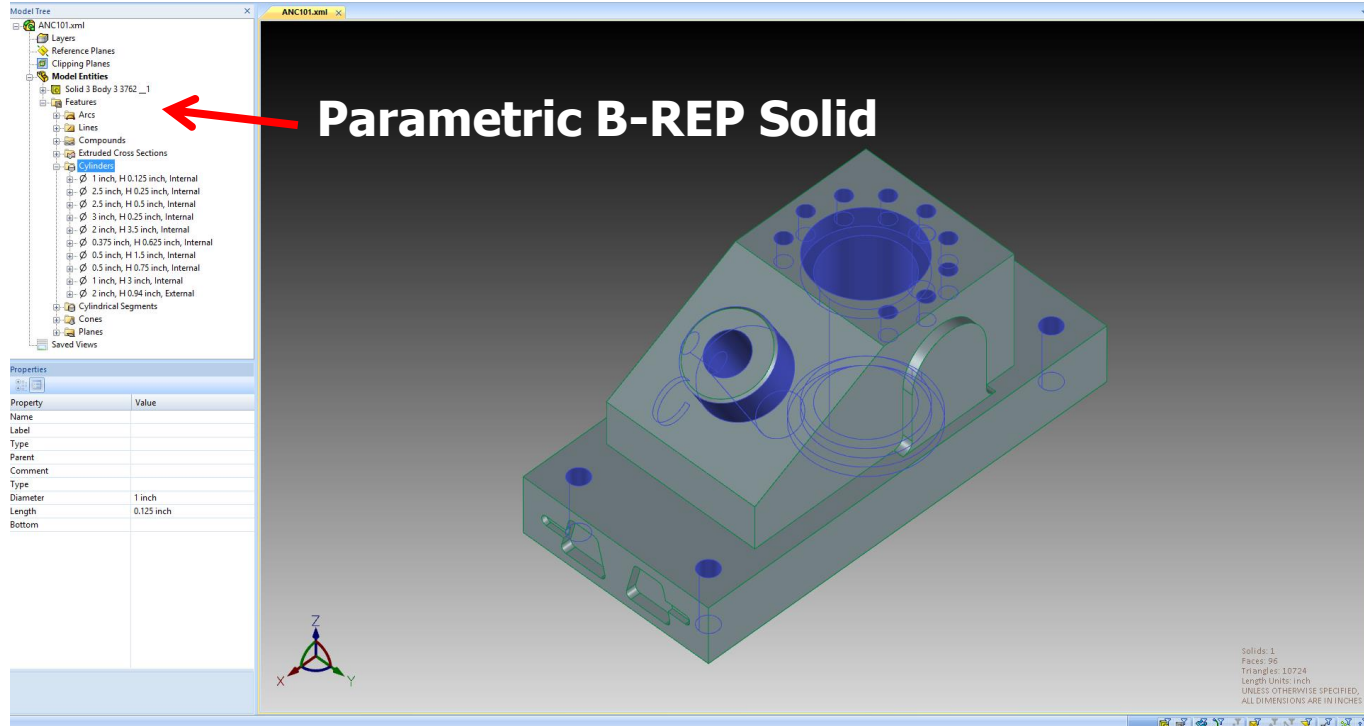
Geometry

Topology

now with

Features

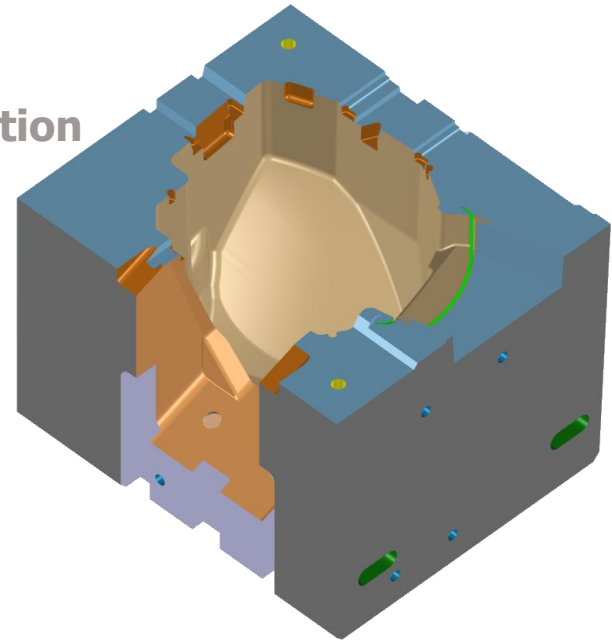




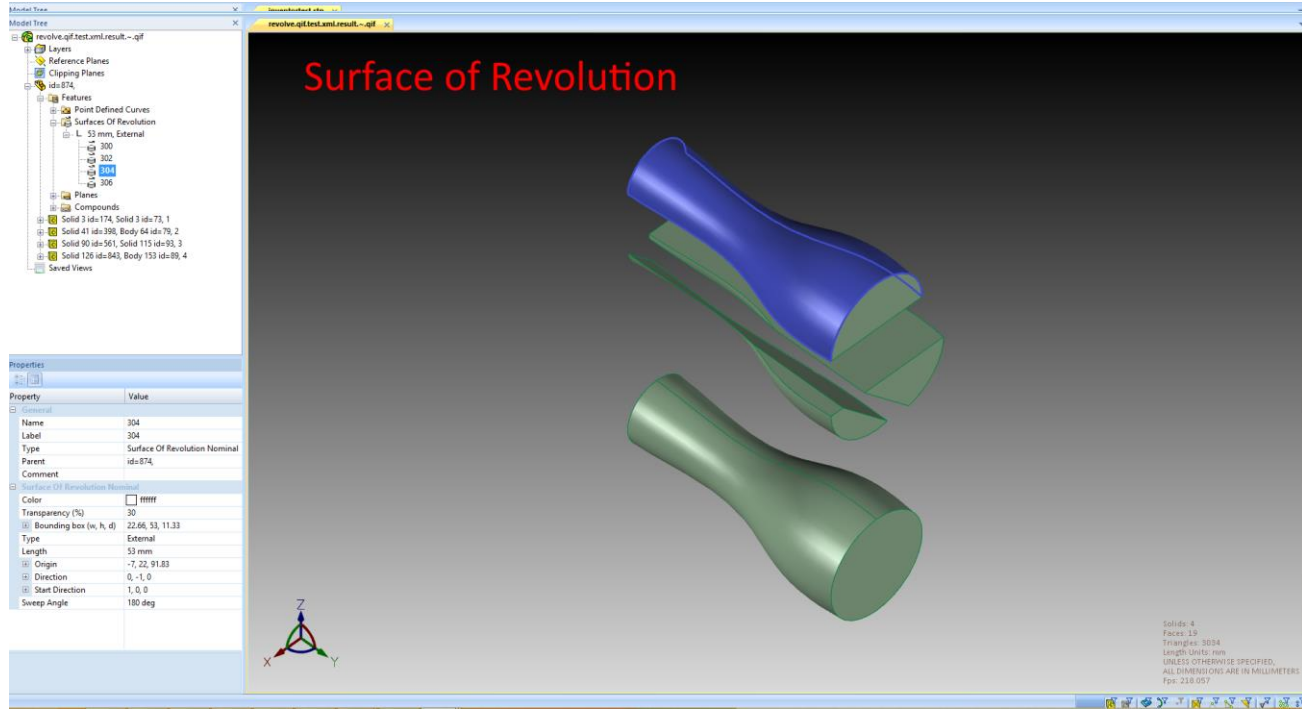


# Supported Features

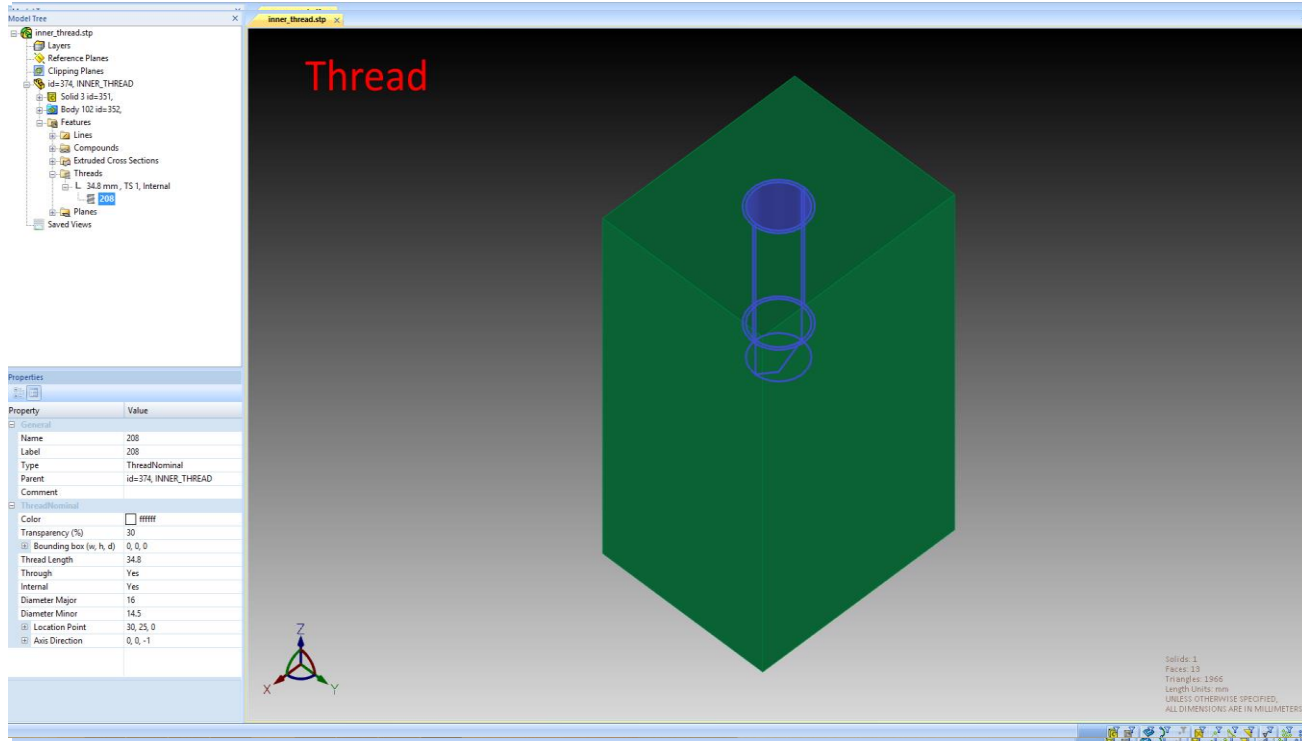
- Arc
- Circle
- Cone
- Cylinder
- Ellipse
- Elongated Cylinder
- Extruded Cross Section
- Line
- Opposite Planes
- Compound Feature (coaxial, coplanar)
- Plane
- Point Defined Curve
- Point
- Sphere
- Surface Of Revolution
- Torus
- Thread



# Examples



# Examples

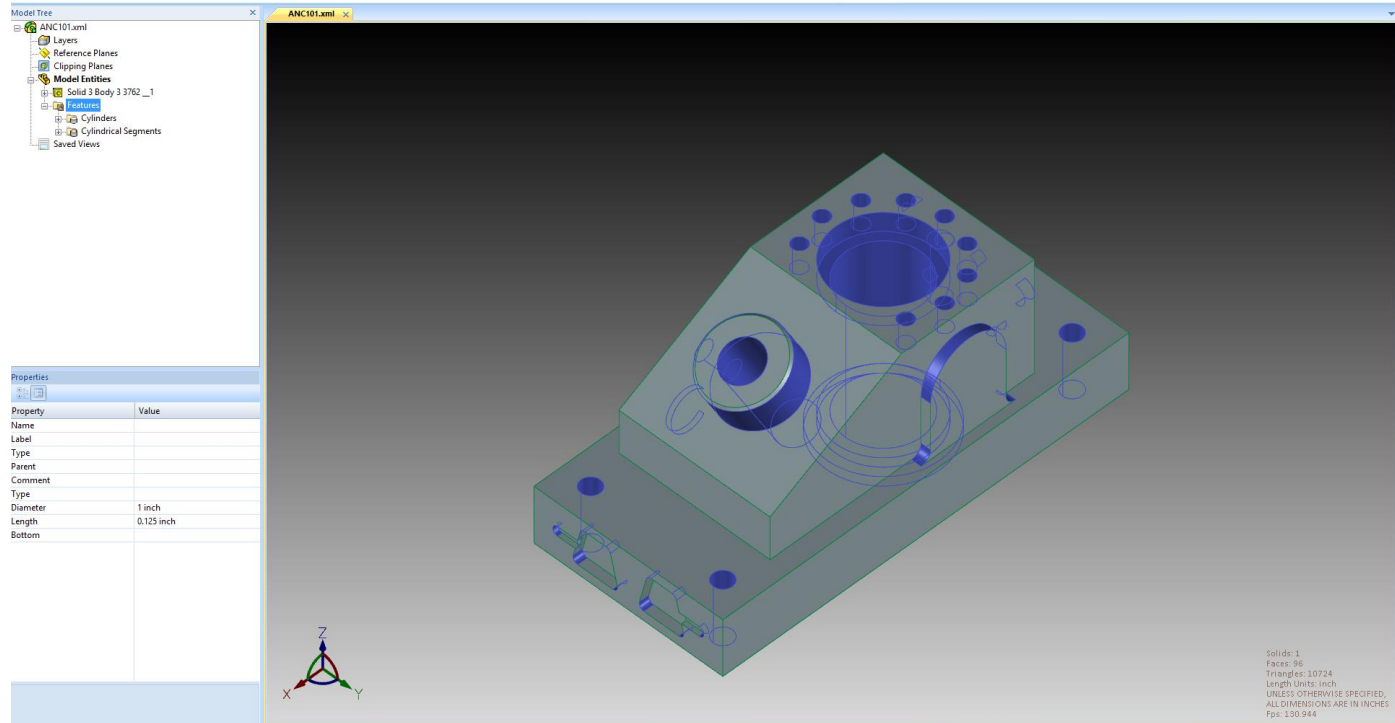


```
<OptionsSet name="FeaturesRecognition">  
  <opt name="CreateFeaturesMode" val="1" values="Disabled|Visible Only|Connected with PMI Only|Visible and Connected with PMI Only|All Objects" />  
  <opt name="OneFeatureMode" val="1" label="One Feature Mode" description="One Feature Mode" type="bool" />  
- <opt name="RecognitionPriority" label="Features recognition priority list" description="Features recognition priority list">  
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  <Sphere />  
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  <Thread />  
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  <Sor />  
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  <Ellipse />  
  <Point />  
</opt>
```

- Turn On/Off features by type
- Priority list
- Multi-feature mode

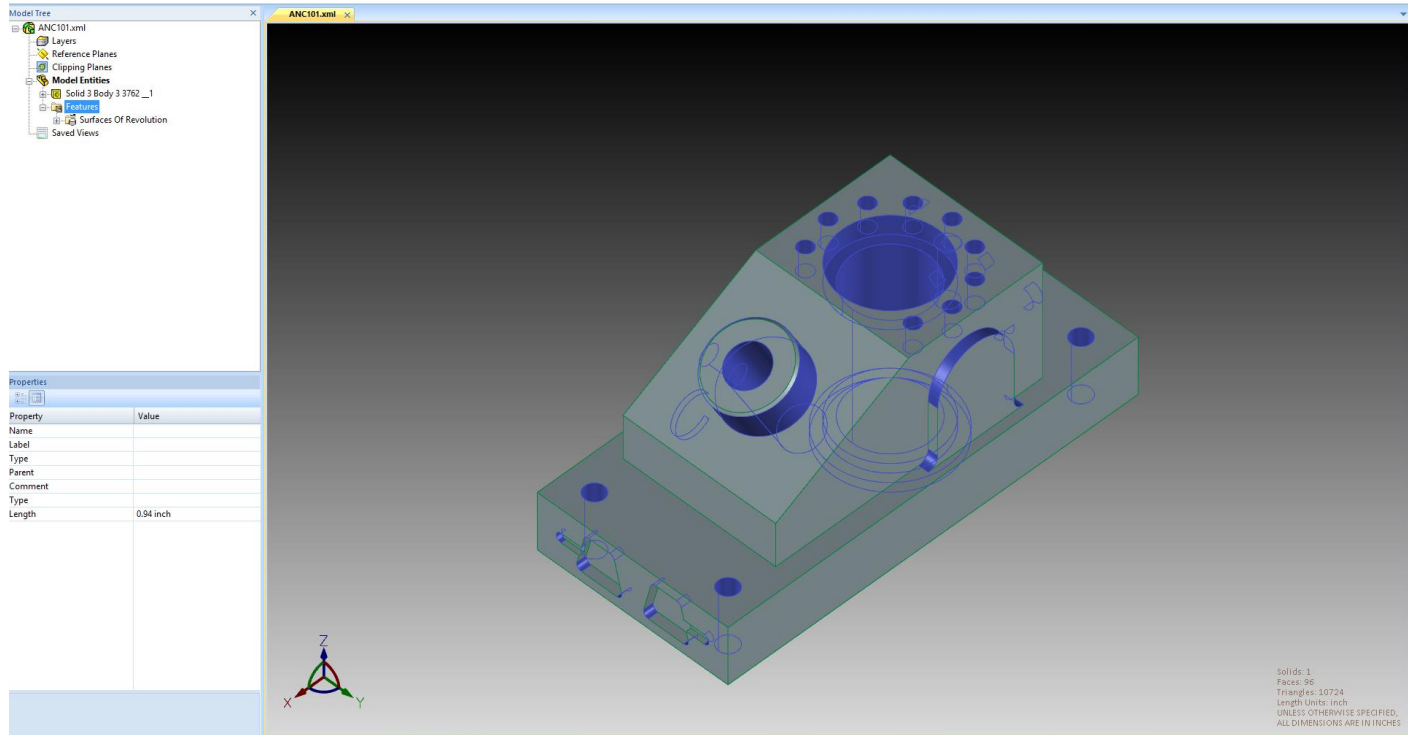
# Recognize Only Specified Features

```
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  - <opt name="RecognitionPriority" label="Features recognition priority list" description="Features recognition priority list">  
    <Cylinder />  
  </opt>  
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```



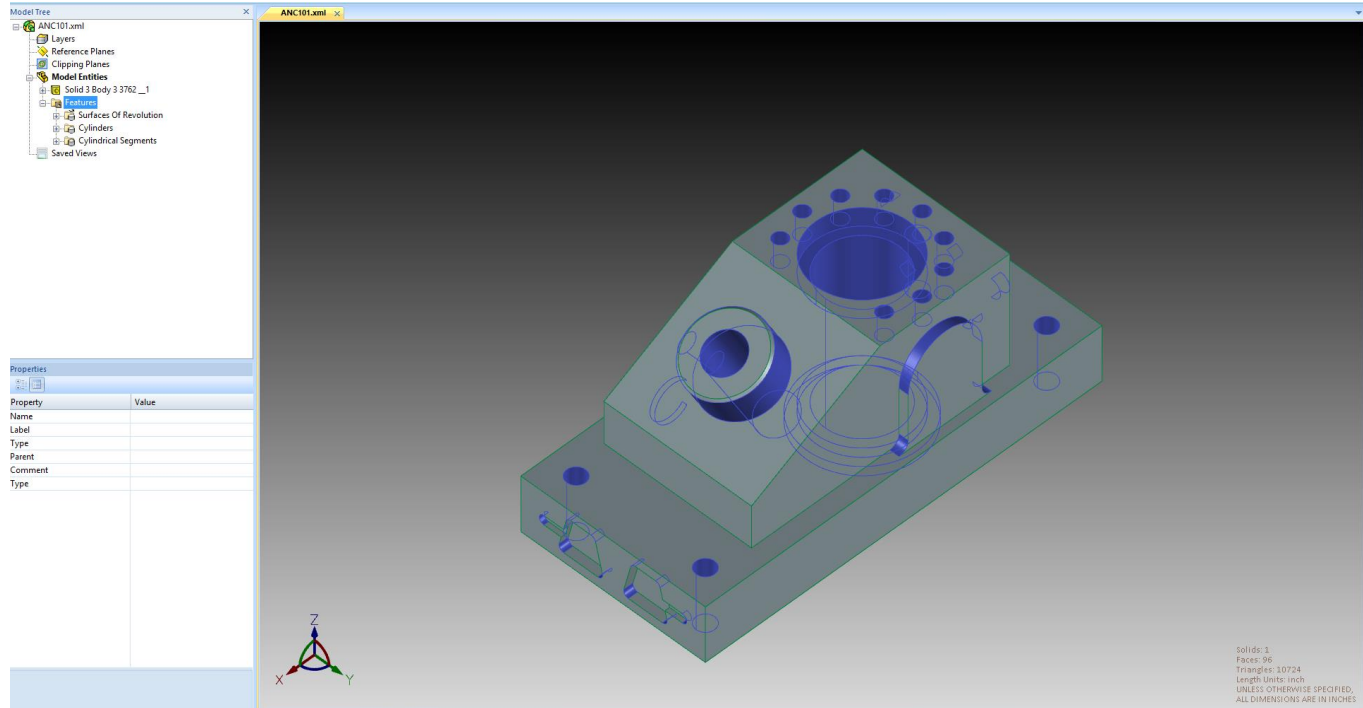
# Change Feature Priority

```
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  - <opt name="RecognitionPriority" label="Features recognition priority list" description="Features recognition priority list">  
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```

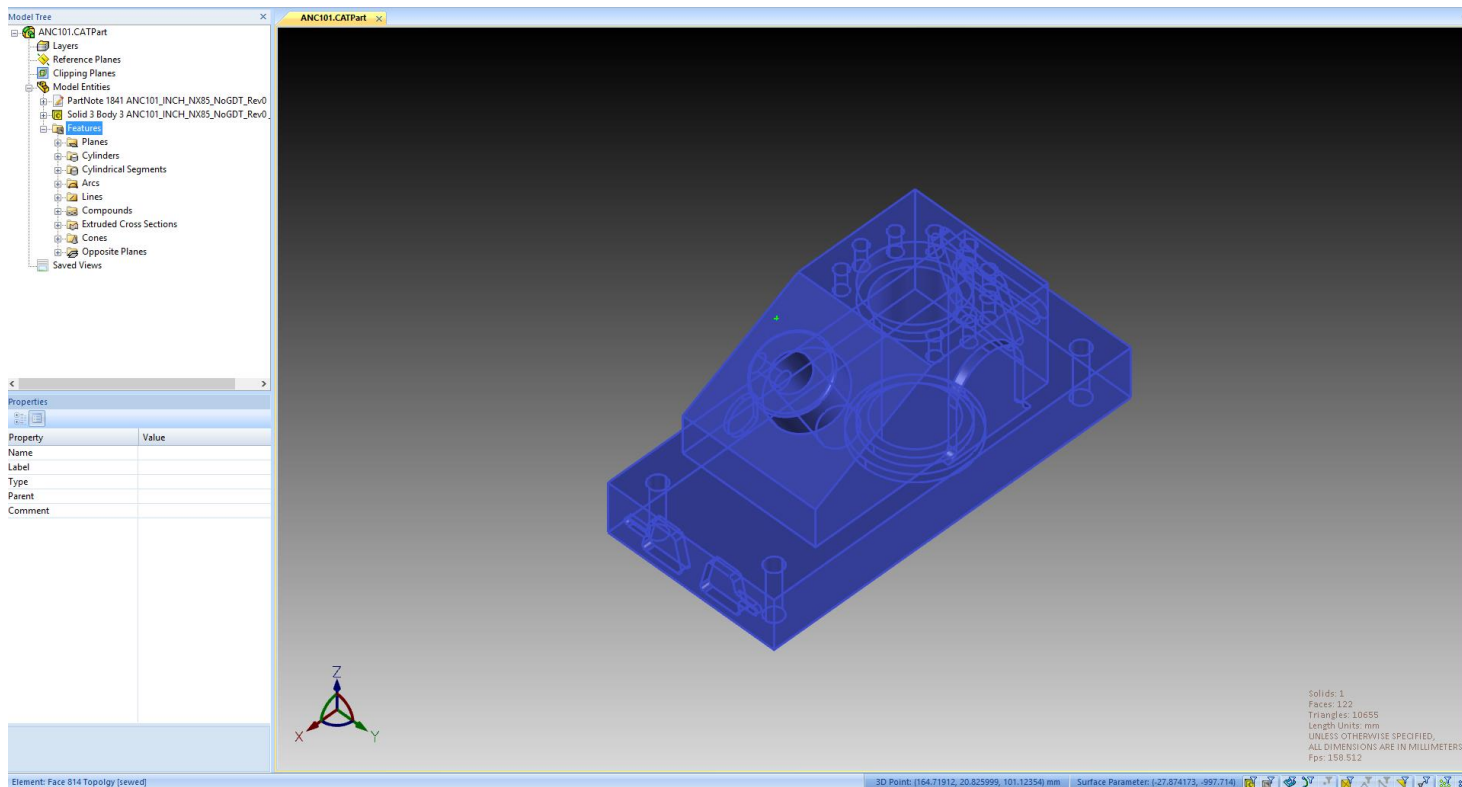


# Multi-Feature Mode

```
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  - <opt name="RecognitionPriority" label="Features recognition priority list" description="Features recognition priority list">  
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  </opt>  
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```

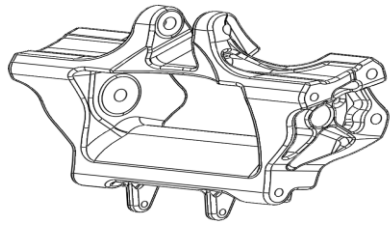


# Automatic Features Recognition

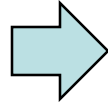




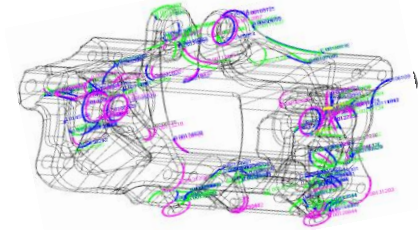
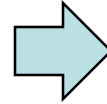
# **3D CAD Data Exchange Precise Repair and Healing Technology**



**Original Model**



**TRANSLATION**

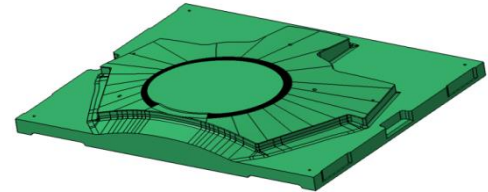
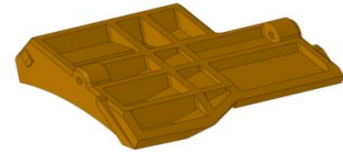
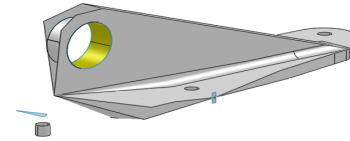


**Resulting Model**

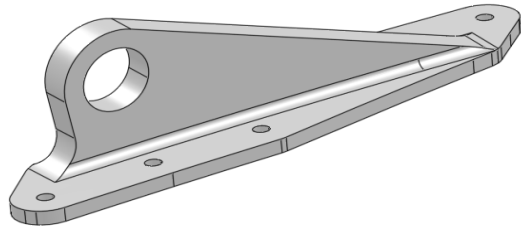
**CAD Data Inconsistencies are related to:**

- **Kernel differences**
- **Model tolerance**
- **File formats**

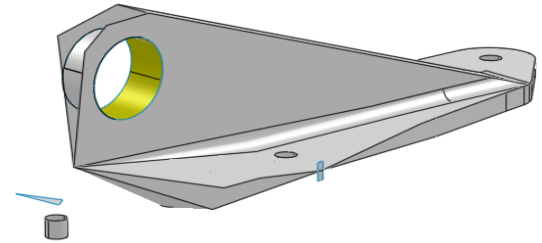
- **Import Errors**
- **Model Deformation**
  - **Visible**
  - **Non visible**
- **Surface Curvature Loss**
- **Surface Tangency Loss (G1/G2)**
- **Entity Definition Change**
- **1000+ Surfaces that will not knit**
- **Uncontrolled Model Changes**
- **Surface Explosion**



# Model deformation



Source CAD - Solid



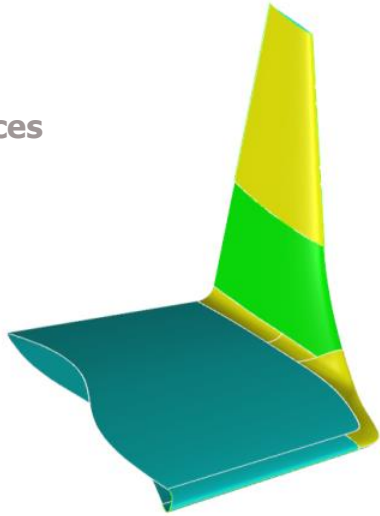
Target CAD - Geometry deformation

System CAD	Tolerance [mm]
CATIA V4	0.1 – 0.02
CATIA V5	0.001
I-DEAS	0.01
UGS NX	0.0254
SolidWorks	0.0254
Parasolid	0.0254
ACIS	0.001

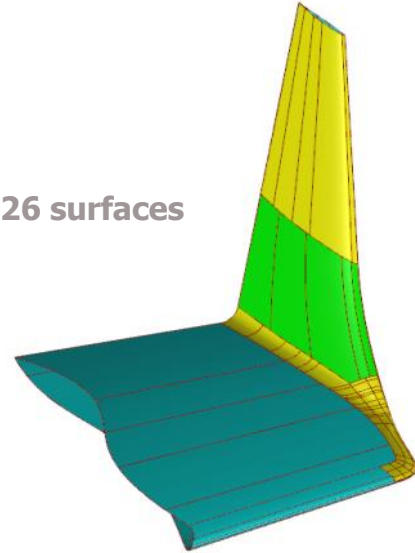
# Topology changes

## Surface fragmentation in data translation

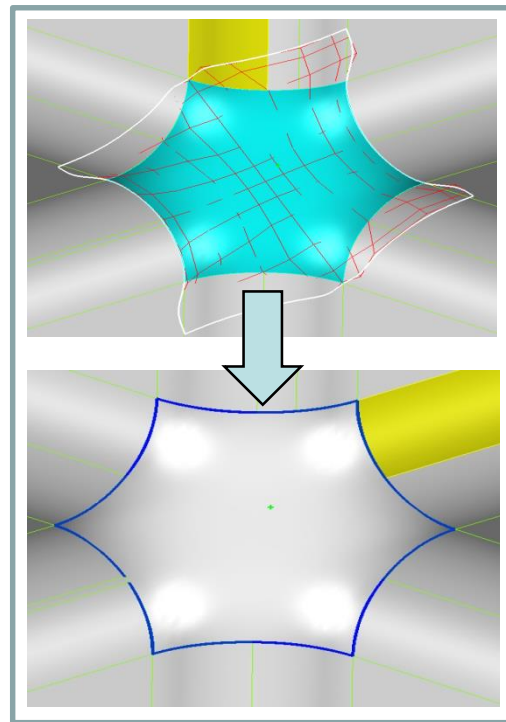
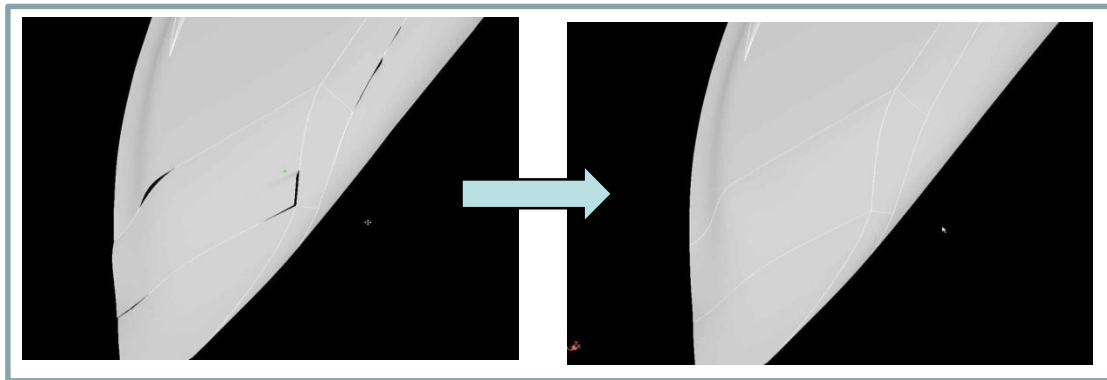
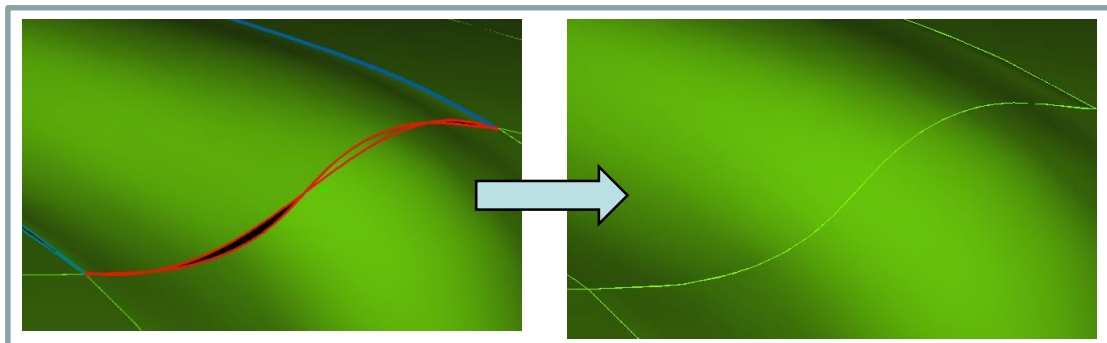
13 surfaces



226 surfaces

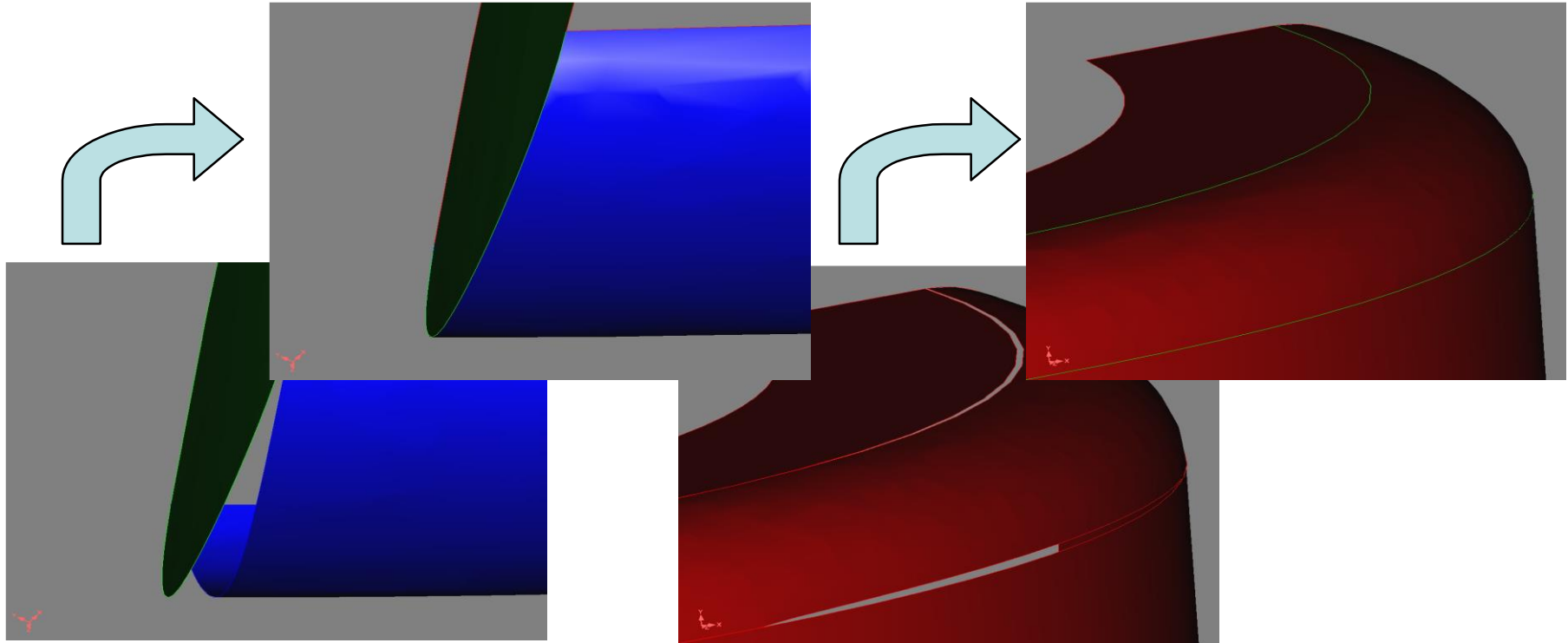


## Surface Fitting Functions



# Automatic Repair

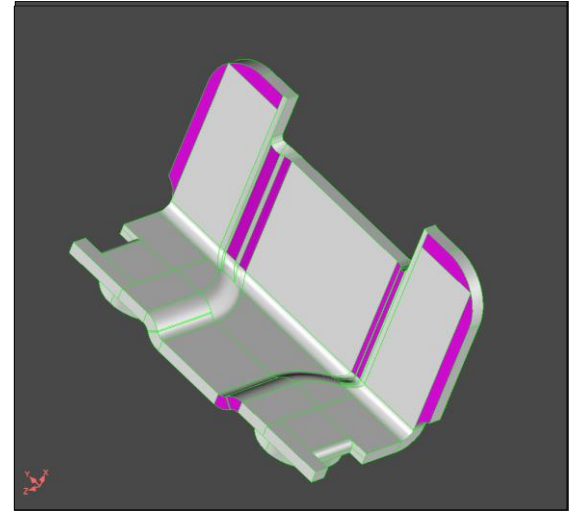
3D TransVidia automatically detects gaps and chooses the best method to close them



# Automatic Repair Summary

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- **Maintains design intent**
- **Prevents model deformations**
- **Data format independent**
- **Corrects Geometry**
- **Eliminates gaps and overlaps**
- **Adds missing surfaces**
- **Correct trimming contours (2D/3D)**
- **Eliminate intersections and self-intersections**
- **Surface simplification**
- **Restoring topology**





# Supported CAD Formats

## Native CAD Formats

- CATIA V4, CATIA V5/V6
- ACIS
- SolidWorks
- NX
- SolidEdge
- Parasolid
- JT
- Pro/E, Creo
- Inventor



## Neutral CAD Formats – Capvidia technology

- STEP AP203/AP214/AP242
- CapXML
- QIF
- IGES
- VDA-FS
- STL, VRML

# Evaluation License:

[www.cadenas.de](http://www.cadenas.de)  
[www.capvidia.com](http://www.capvidia.com)

## Q&A