Welcome to the 2020 GPDIS Virtual Session # 3

These sessions will be recorded

All attendees will remain on mute.

If you have a question please place it in the chat to "All Attendees".

CAMSC **MBSE** **ET/IT** **3D MBD** **DevOps** **PLM Roadmap** **PDES**

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Global Product Data Interoperability Summit | **2020**

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Connecting the Digital Enterprise

History and Focus of GPDIS

- **Global Product Data Interoperability Summit (GPDIS) was formed in 2009. It was the consolidation of two conferences (Data Exchange and SOA Deep Dives) addressing integration technologies along with the non-proprietary exchange of data**

- **GPDIS functions as a communications hub for industry principals to foster knowledge through the exchange of ideas, solutions and methods.**

2020 Theme: The Great Race of Digital Transformation

How is your model based enterprise today?

- **Together we will explore digital transformation and what it will take us to FULLY achieve it. Using the Great Race as a metaphor, we will explore the building blocks of digital transformation and how interoperability will enable the digital transformation journey for industry.**

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The Only Thing Constant is Change

Jennifer Herron, DMSC Board of Director,
Action Engineering CEO & Founder

GLOBAL PRODUCT DATA INTEROPERABILITY

SUMMIT 2020

Virtual Sessions

ACTION ENGINEERING

Jennifer Herron

EXPERTISE

- MBD and MBE Solution Architecture
- MBD Pilot Planning
- MBD Modeling Standards and Best Practices
- Multi-CAD MBD Authoring and Publishing
- Multi-CAD MBD and GD&T Coaching
- Strategic MBD and MBE Implementation Coaching
- MBD Supply Chain Readiness Coaching

CREDENTIALS

- Board Member, Digital Metrology Standards Consortium (DMSC)
- Vice-Chair, MBE ASME Committee
- Member, ASME IAB
- Member AIAG TDP Working Group
- Certified Scrum Product Owner®
- Engineer in Training (EIT), Missouri
- Certified SolidWorks Associate
- Patent for Toroidal Propulsion and Steering System (Snake)

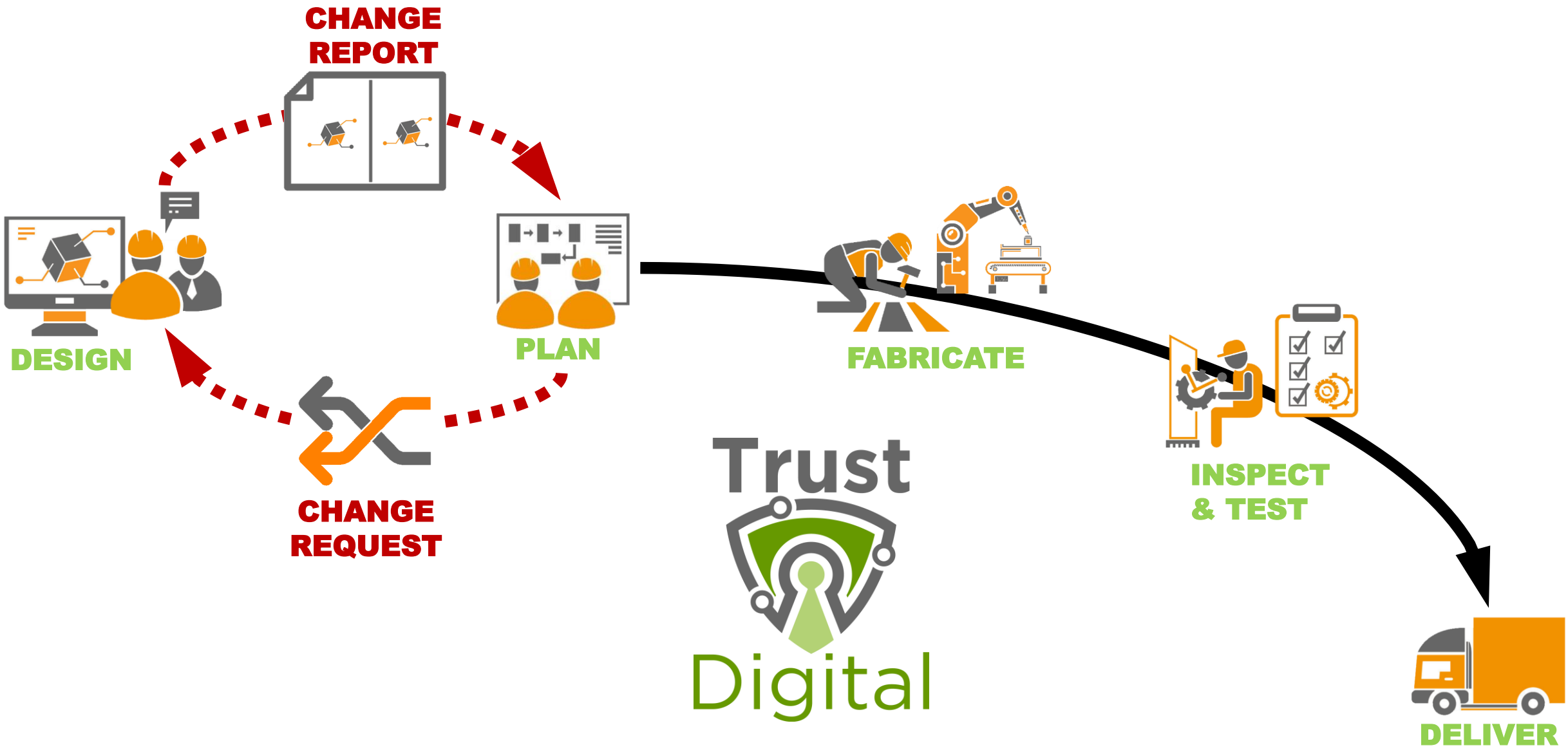
PUBLICATIONS

- *Re-Use Your CAD: The Model-Based CAD Handbook* – Edition 1 and Edition 2
- Industry Blogs

QUOTE

If you are going to CHANGE the results of your business, you have to change the WAY you do business.

Changes are Costly



Graphics courtesy of Action Engineering

Teamwork Works!

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Digital Metrology Standards Consortium DMSC

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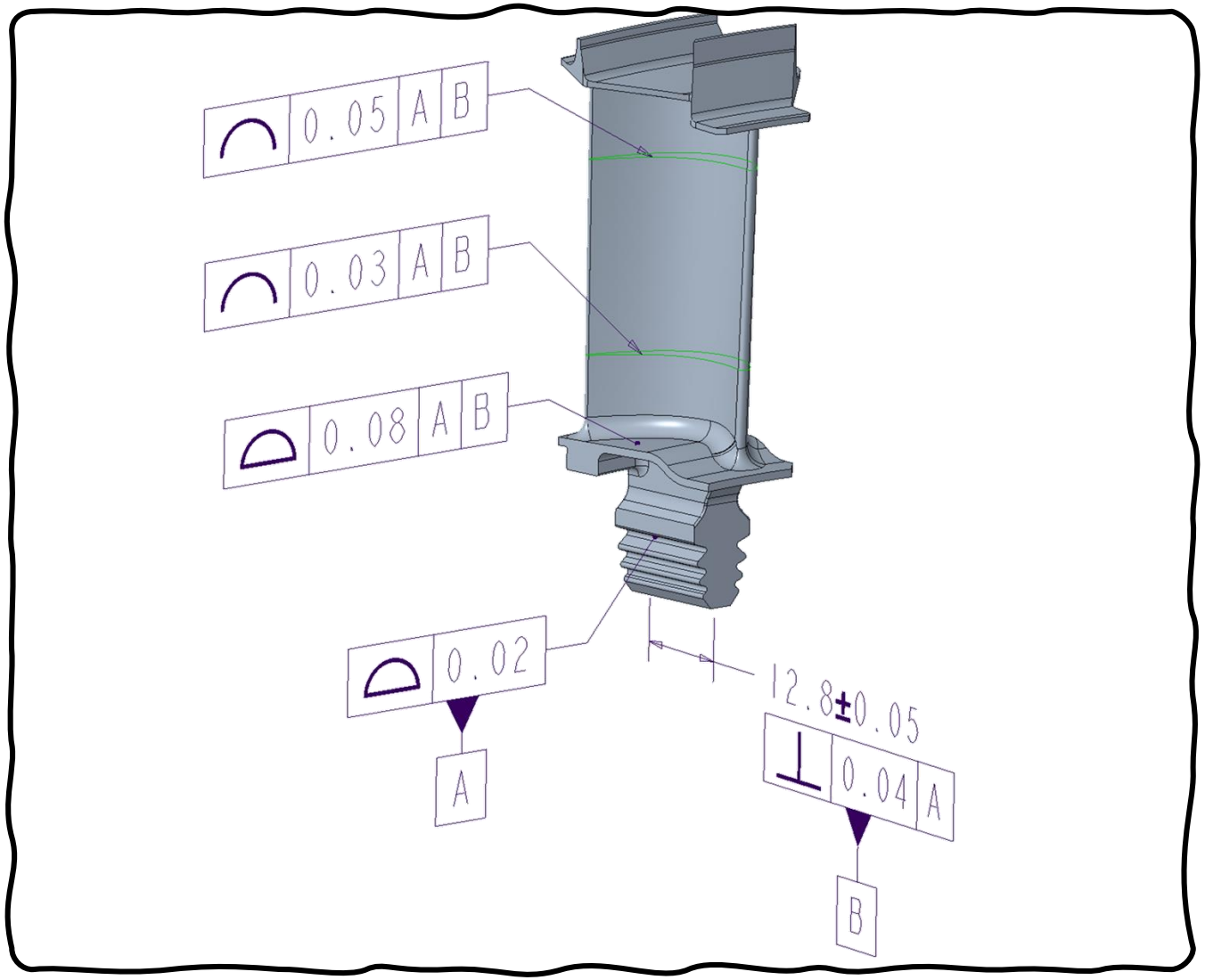
3D Product Definition



Airfoil model courtesy of Action Engineering

A little story about how work is done today

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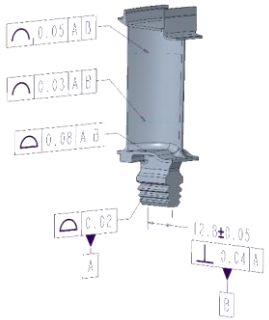

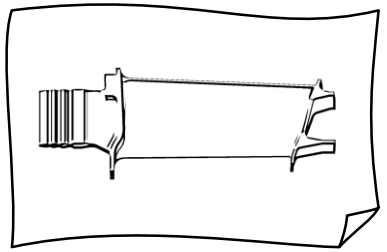

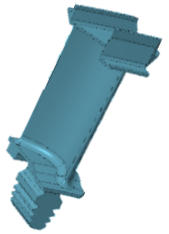

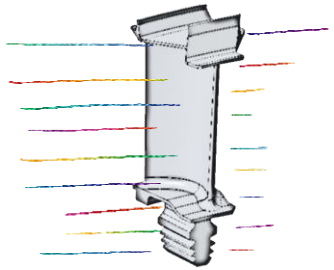

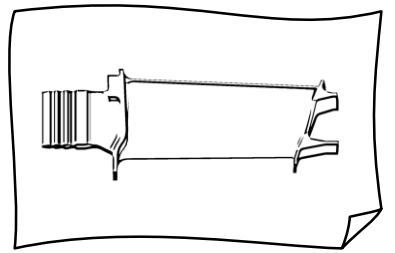

Eliminate waste using 3D data

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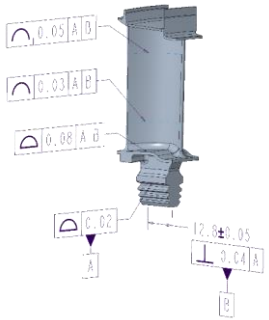

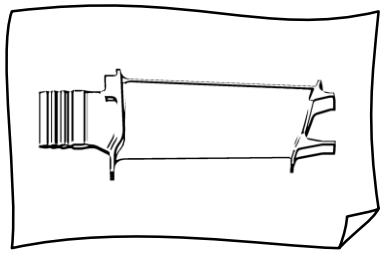

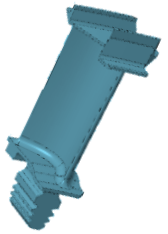

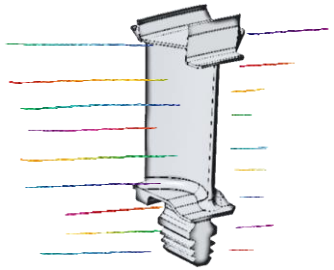

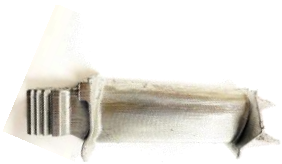

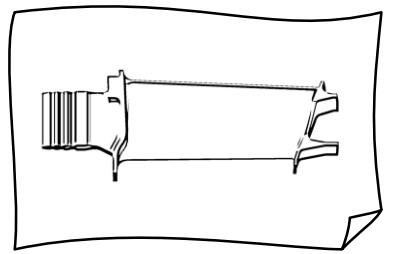

Now we need to revise the engineering

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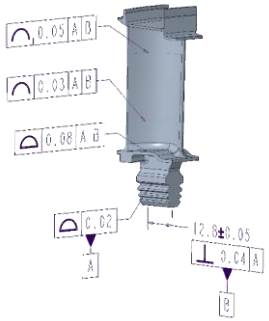
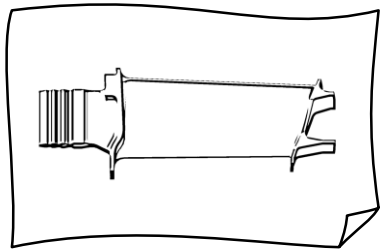
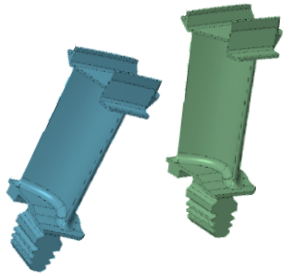
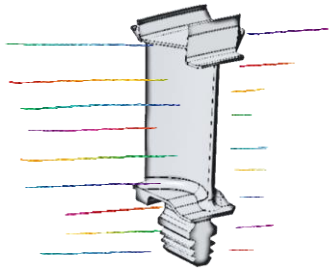
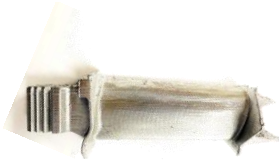
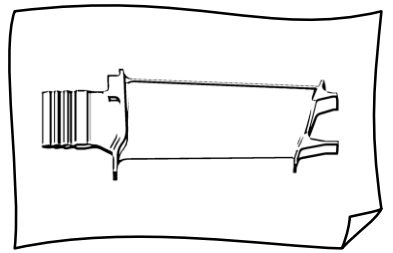




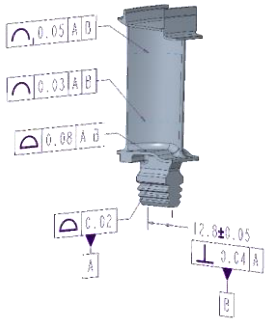


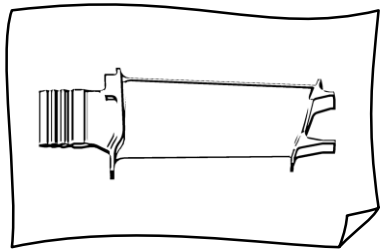


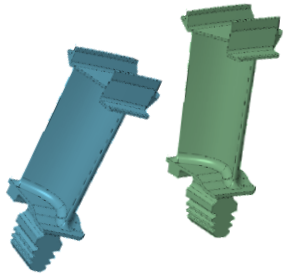


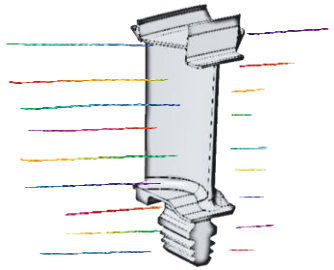


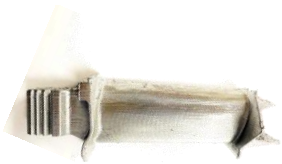
Eliminate waste AGAIN and leverage automated change reports

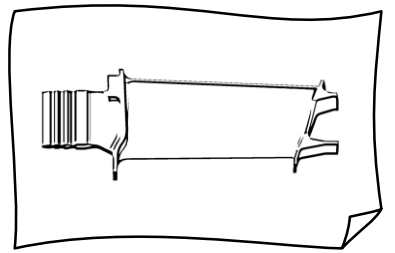












Using 3D data can reduce error and increase throughput

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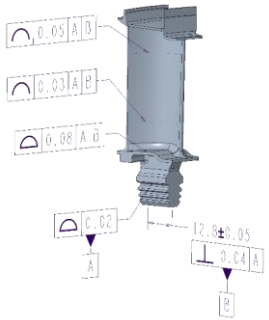
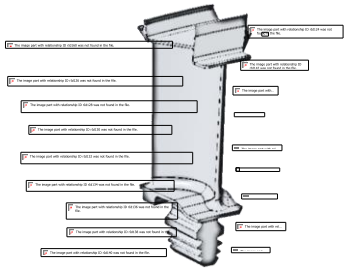
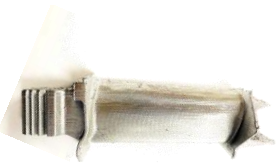
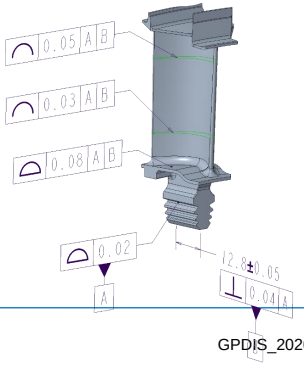


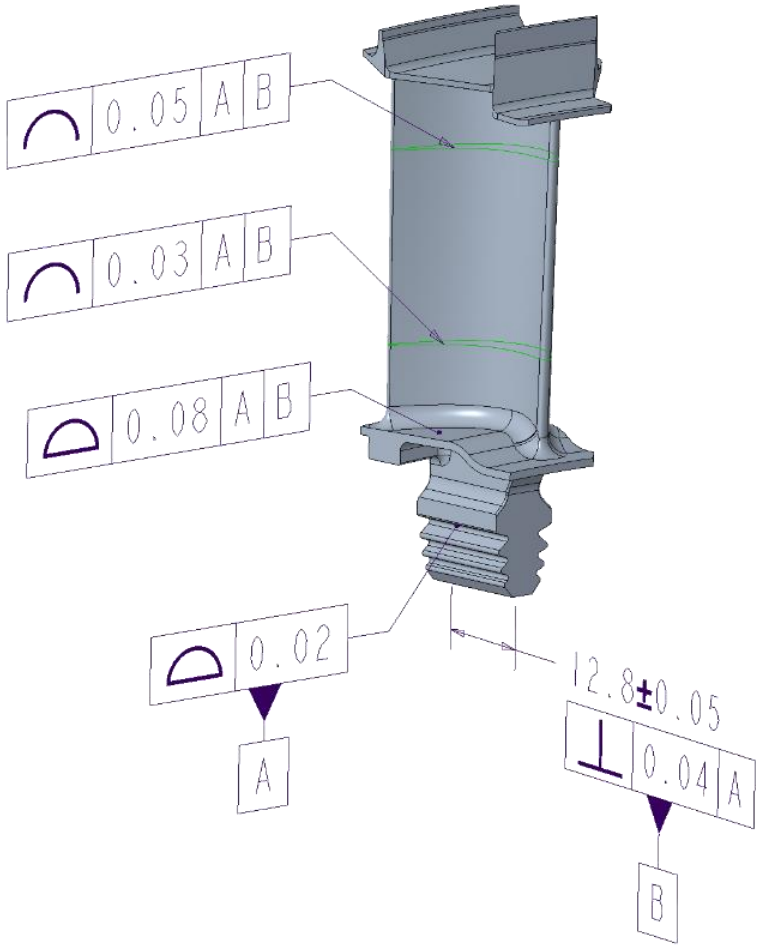






Engineering changes happen!

REV A

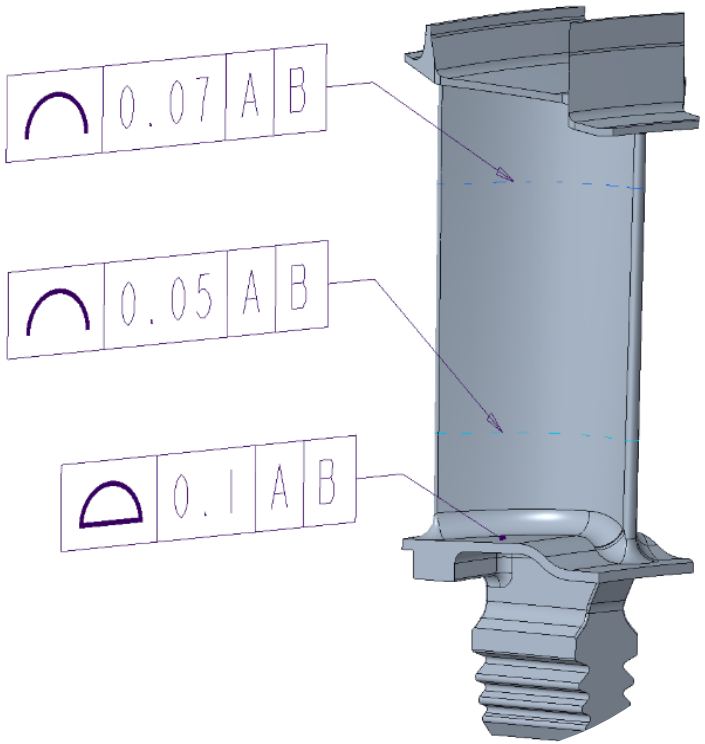


From 0.05 to 0.07

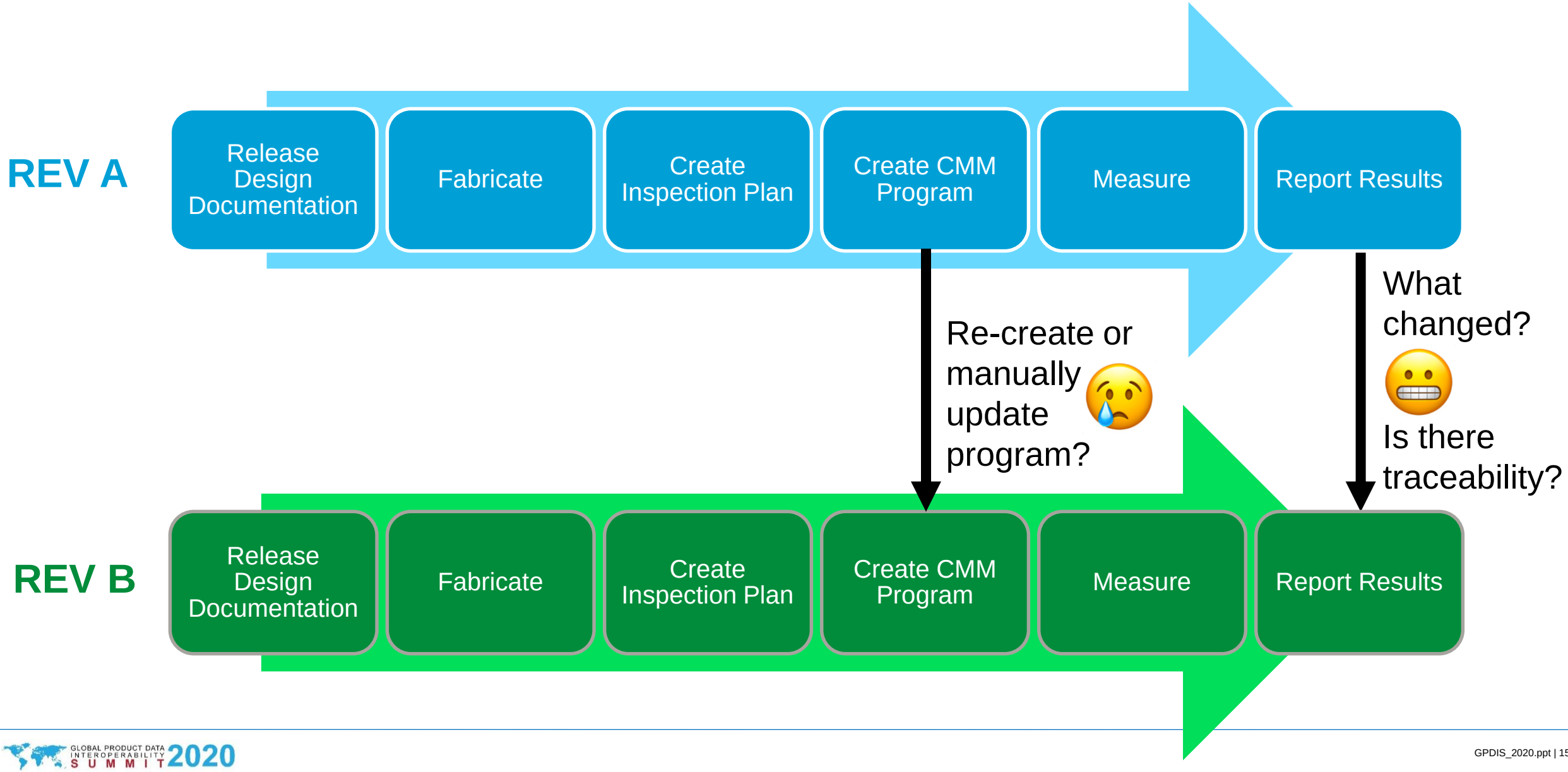
From 0.03 to 0.05

From 0.08 to 0.1

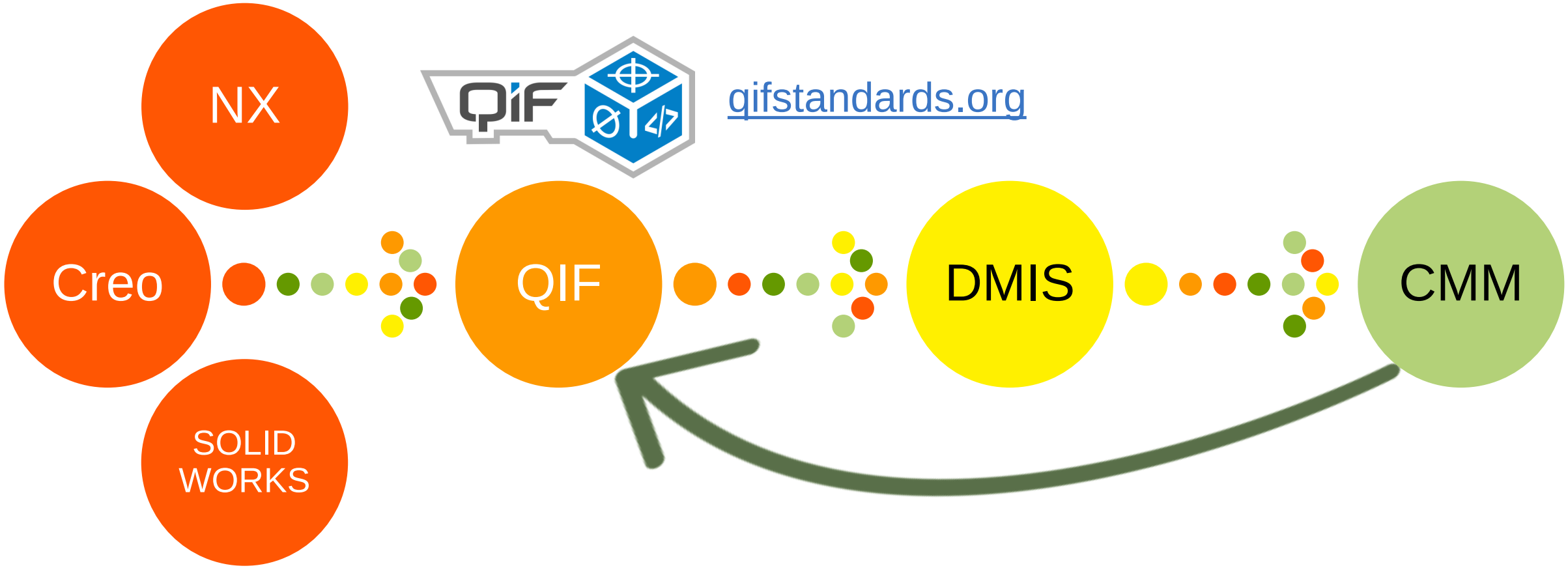
REV B



What is the problem?



What tools are available to make this happen?



qifstandards.org

What is a QPId?

QIF Persistent Identifier (QPId) *noun* Cu·pid \ˈkyü-pəd\

- Universally Unique Identifier (UUID) (adopted by Microsoft as GUID)
  - ISO/IEC 9834-8
  - 550e8400-e29b-41d4-a716-446655440000

- QPIds uniquely identify
  - QIF Document
  - QIF Plan
  - QIF Result
  - QIF Rule Set
  - Feature Item
  - Characteristic Item
  - Product Item
  - Resource Item

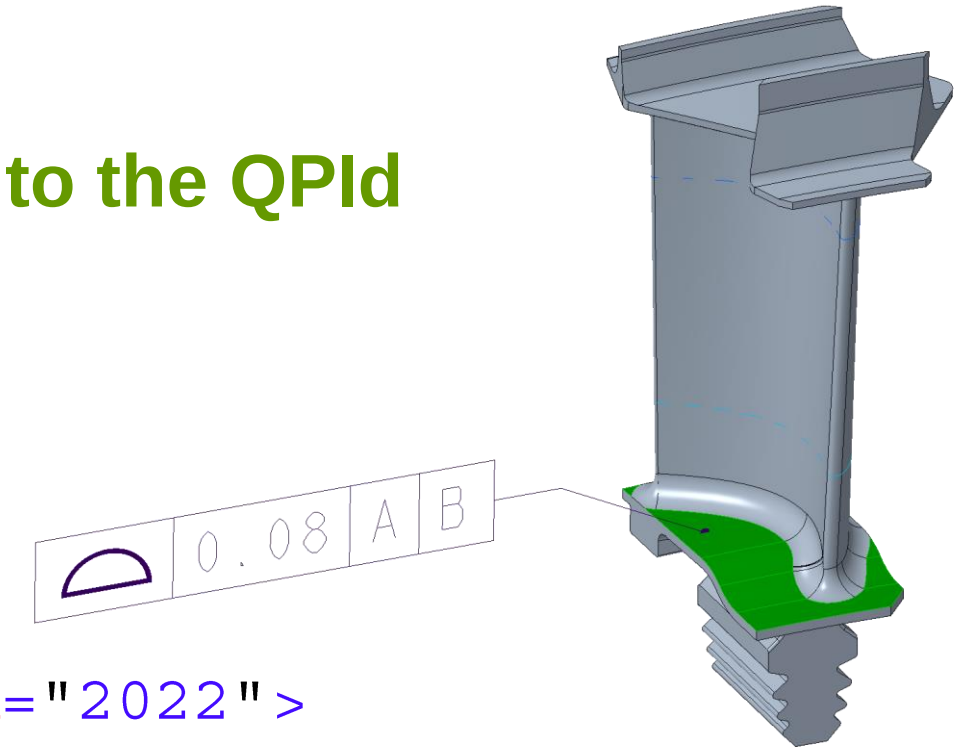
An Important Mechanism that facilitates Lifecycle Connectivity w/ Traceability

File identified with QPId

```
<QPId>906c4d97-5a81-4ccb-b328-2bab6b800765</QPId>
```

Platform geometry features are appended to the QPId

```
<GenericFeatureNominal id="3178">
```



Surface profile ID

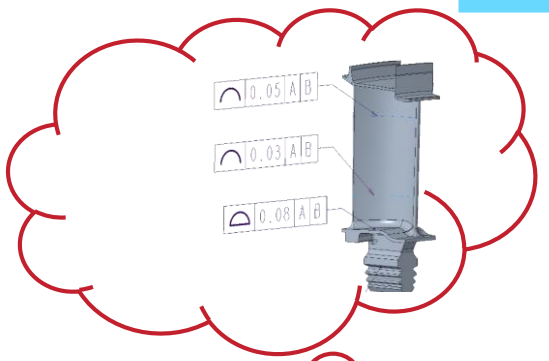
```
<SurfaceProfileCharacteristicNominal id="2022">
```

Problem Solved

Automatically generated Feature IDs and QPIDs

REV A

Release Design Documentation → Fabricate → Create Inspection Plan → Create CMM Program → Measure → Report Results



Persistent Feature IDs and QPIDs

😊

🤩

REV B

Release Design Documentation → Fabricate → Create Inspection Plan → Create CMM Program → Measure → Report Results

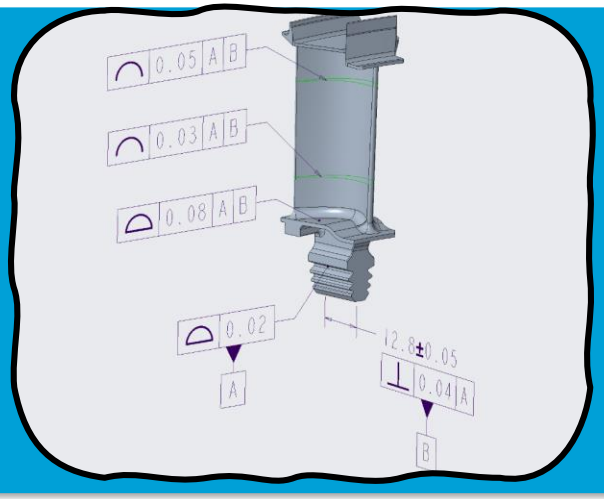
Unique IDs created for new tolerance values

Automatically updated CMM programs

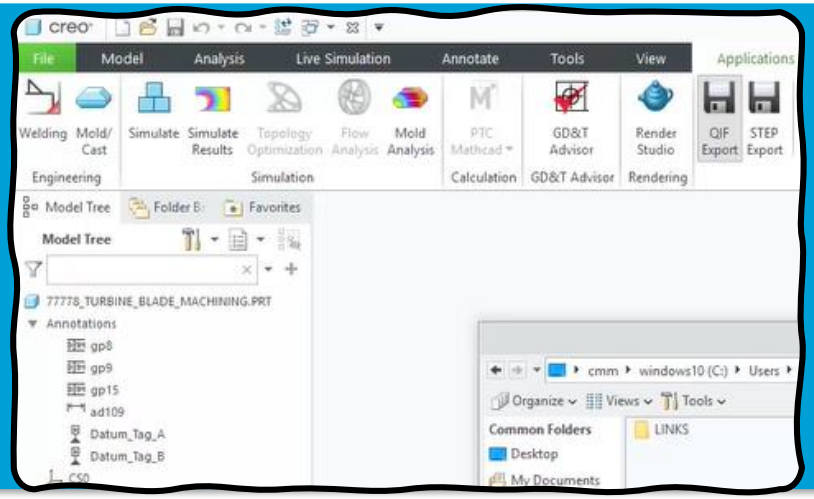
Automatically generated comparison results

Solving the Problem…

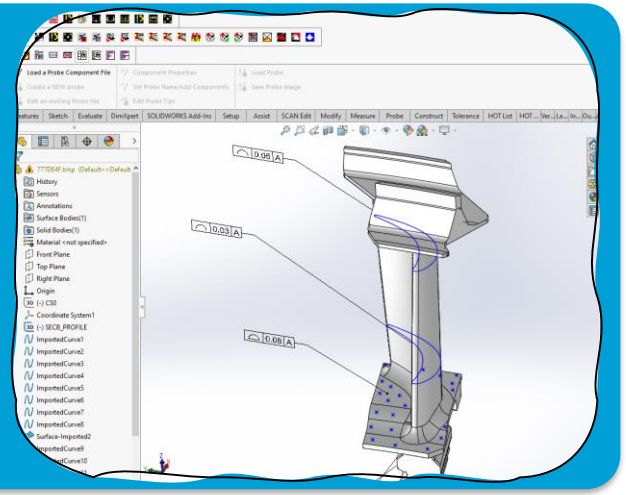
Revision A



Creo Model

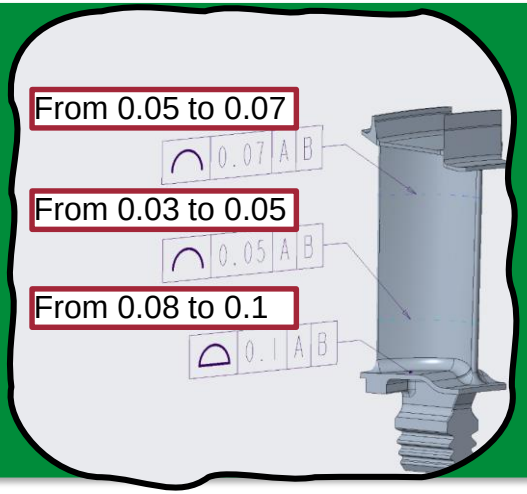


Publish

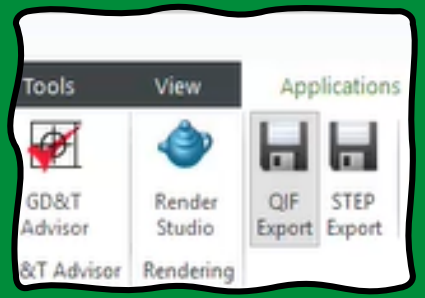


Simulate Inspection

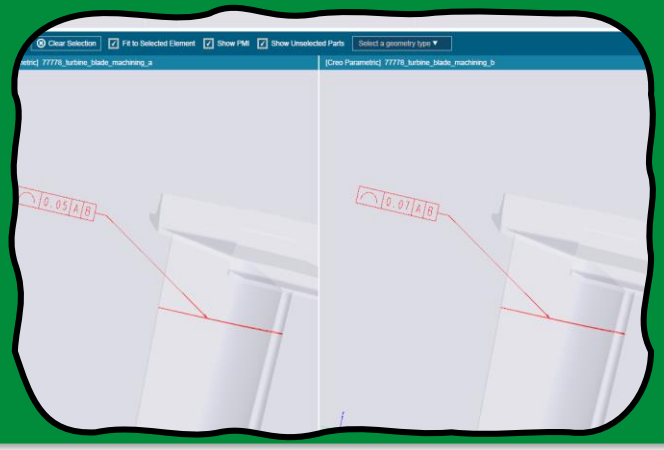
Revision B



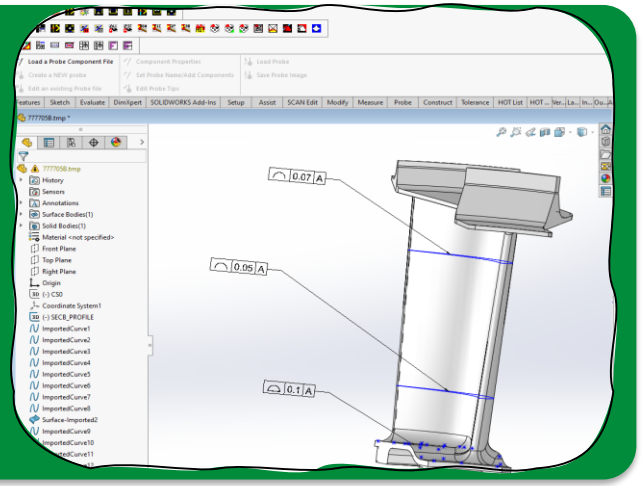
Make Changes



Publish

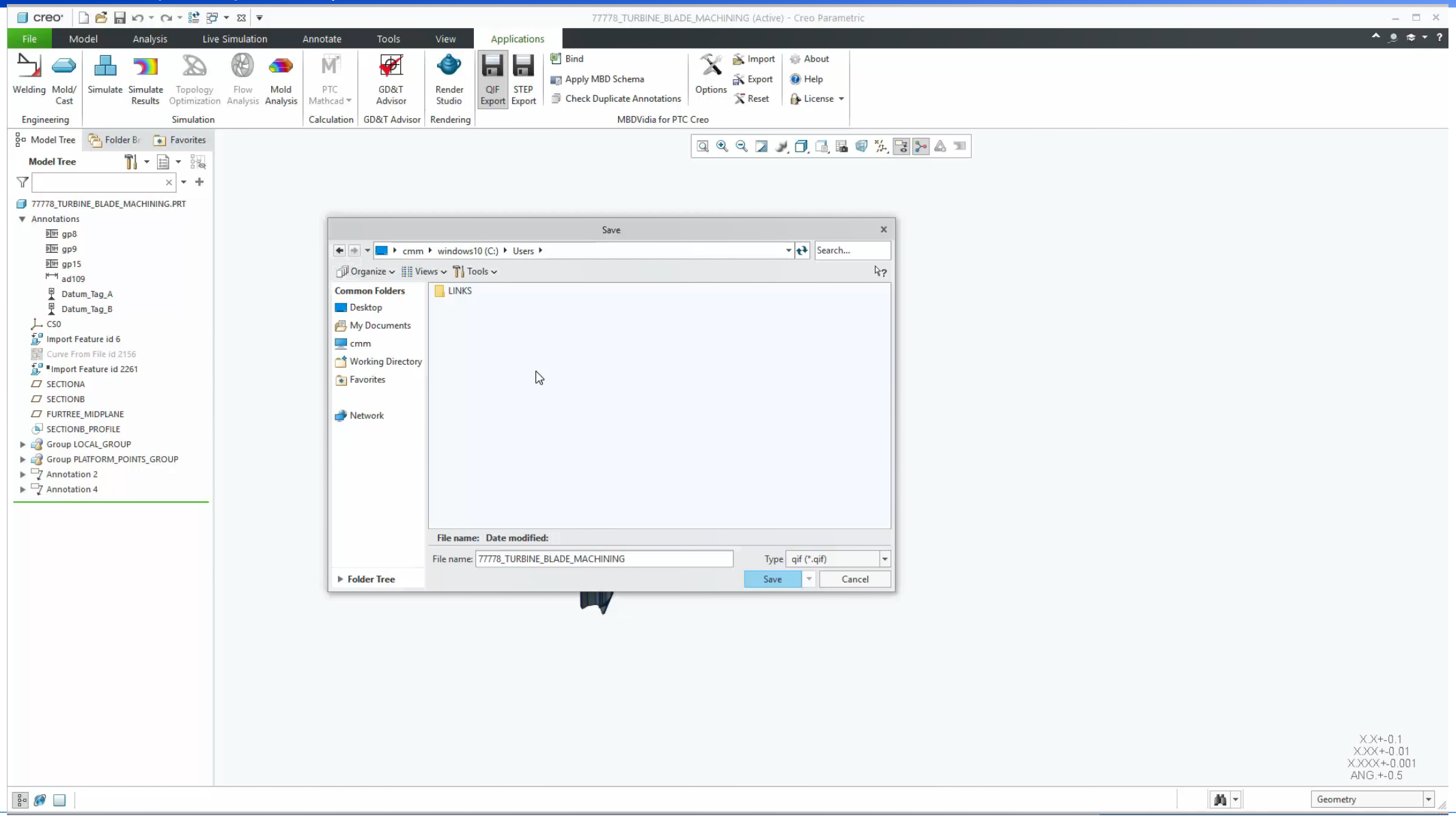


Compare Rev A to B



Update Inspection Simulation for Rev B

Creating a QIF file



Simulation courtesy of Capvidia

How QIF works in the code: features and MBD

The QIF Feature

- Geometry controlled by the Profile Tolerance
- Contains a reference to all the CAD surfaces it references

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  <Name>Nominal 3178</Name>
  <FeatureDefinitionId>2000</FeatureDefinitionId>
  <EntityInternalIds n="8">
    <Id>592</Id>
    <Id>607</Id>
    <Id>616</Id>
    <Id>621</Id>
    <Id>701</Id>
    <Id>710</Id>
    <Id>719</Id>
    <Id>732</Id>
  </EntityInternalIds>
</GenericFeatureNominal>
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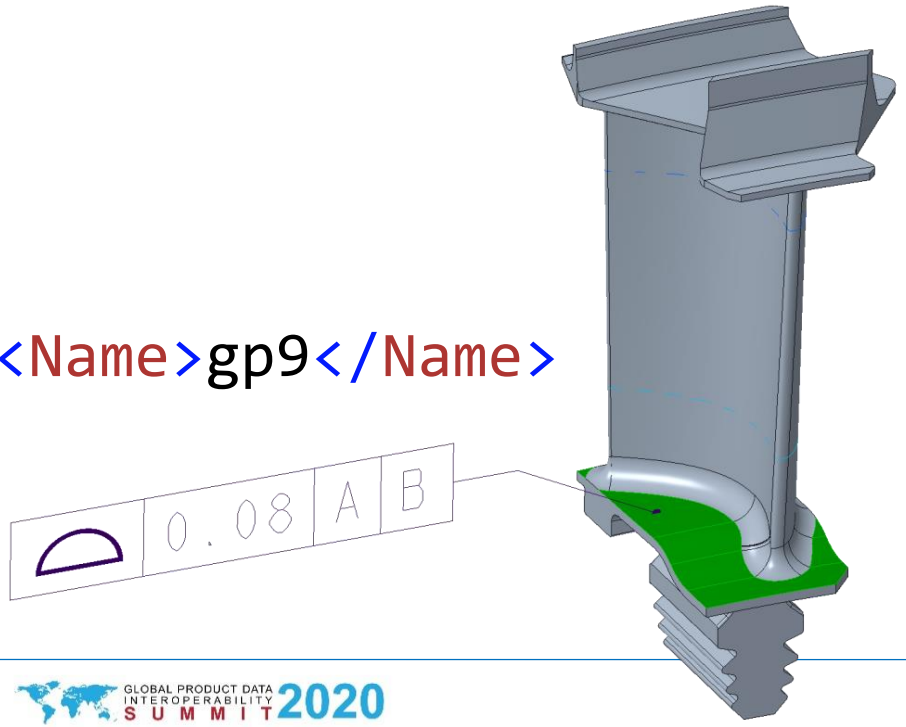

<Name>gp9</Name>

The QIF Tolerance – Example of Profile Tolerance

- Geometric Tolerance Control Frame is digitally associated to the supplemental geometry curve

Definition

```
<SurfaceProfileCharacteristicDefinition id="2021">
  <StatisticalCharacteristic>false</StatisticalCharacteristic>
  <ToleranceValue decimalPlaces="2">0.08</ToleranceValue>
  <DatumReferenceFrameId>2020</DatumReferenceFrameId>
  <Extent>
    <ExtentEnum>UNDEFINED</ExtentEnum>
  </Extent>
</SurfaceProfileCharacteristicDefinition>
```

Nominal

```
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  <CharacteristicDefinitionId>2021</CharacteristicDefinitionId>
  <FeatureNominalIds n="1">
    <Id>3178</Id>
  </FeatureNominalIds>
  <Name>gp9</Name>
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```
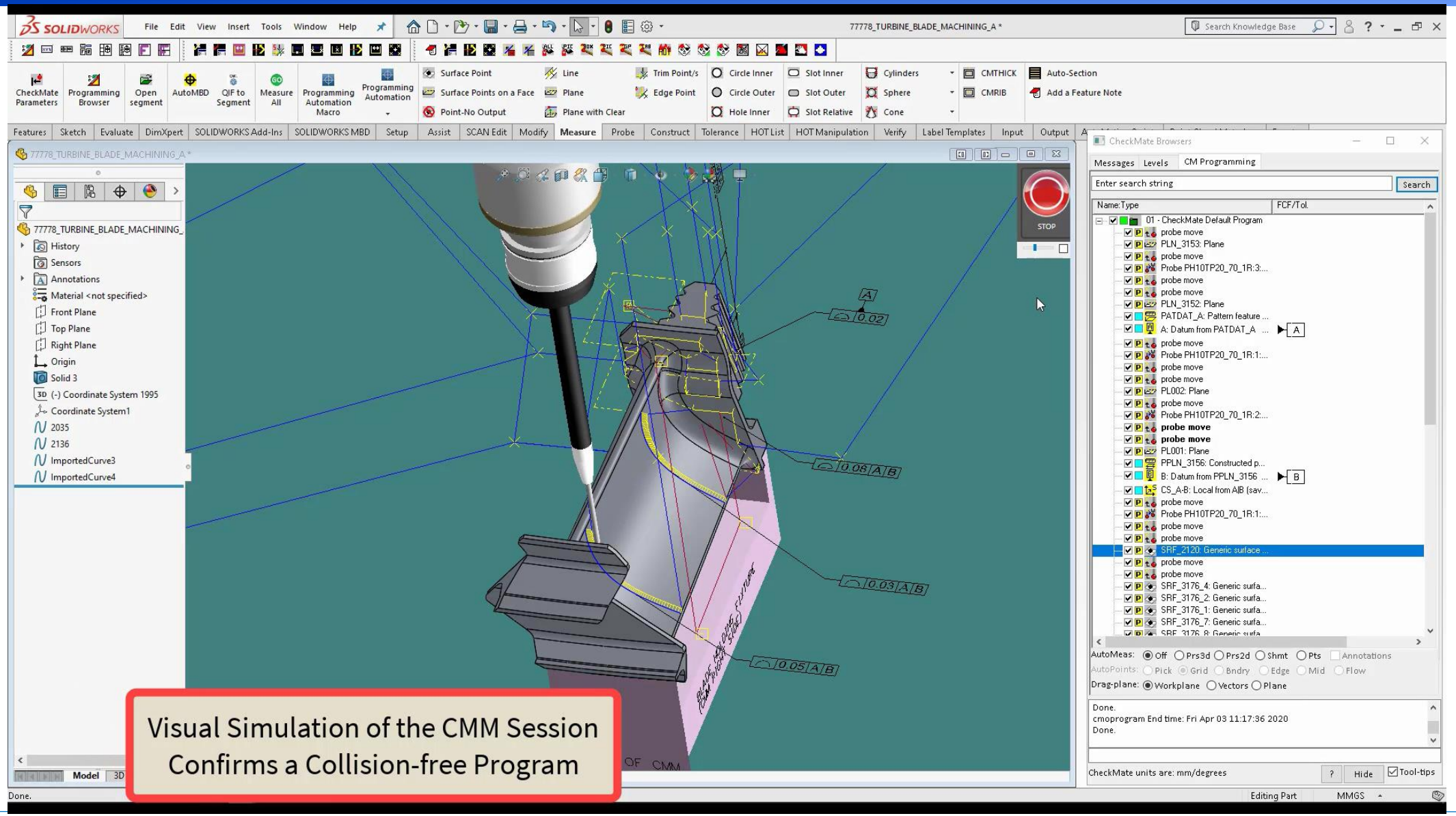

CMM Programming using QIF



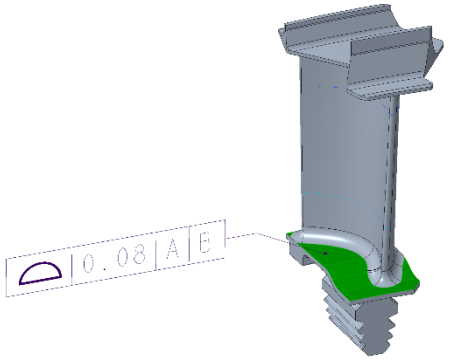
Visual Simulation of the CMM Session Confirms a Collision-free Program

Simulation courtesy of Origin International

How QIF records measurement results

The QIF Results – Measurement of Profile Tolerance

- Geometric Tolerance Control Frame is digitally associated to the supplemental geometry curve




```
<SurfaceProfileCharacteristicNominal id="2022">
  <CharacteristicDefinitionId>2021</CharacteristicDefinitionId>
  <FeatureNominalIds n="1">
    <Id>3178</Id>
  </FeatureNominalIds>
  <Name>gp9</Name>
</SurfaceProfileCharacteristicNominal>
```

```
<SurfaceProfileCharacteristicItem id="3318">
  <Name>3318</Name>
  <FeatureItemIds n="1">
    <Id>3316</Id>
  </FeatureItemIds>
  <CharacteristicNominalId>2022</CharacteristicNominalId>
</SurfaceProfileCharacteristicItem>
```

Measurement

```
<SurfaceProfileCharacteristicActual id="3319">
  <Status>
    <CharacteristicStatusEnum>UNDEFINED</CharacteristicStatusEnum>
  </Status>
  <CharacteristicItemId>3318</CharacteristicItemId>
  <FeatureActualIds n="1">
    <Id>3317</Id>
  </FeatureActualIds>
  <ActualComponentId>3221</ActualComponentId>
  <Value decimalPlaces="3">0.07569325845234</Value>
</SurfaceProfileCharacteristicActual>
```

Recording Measurement Results

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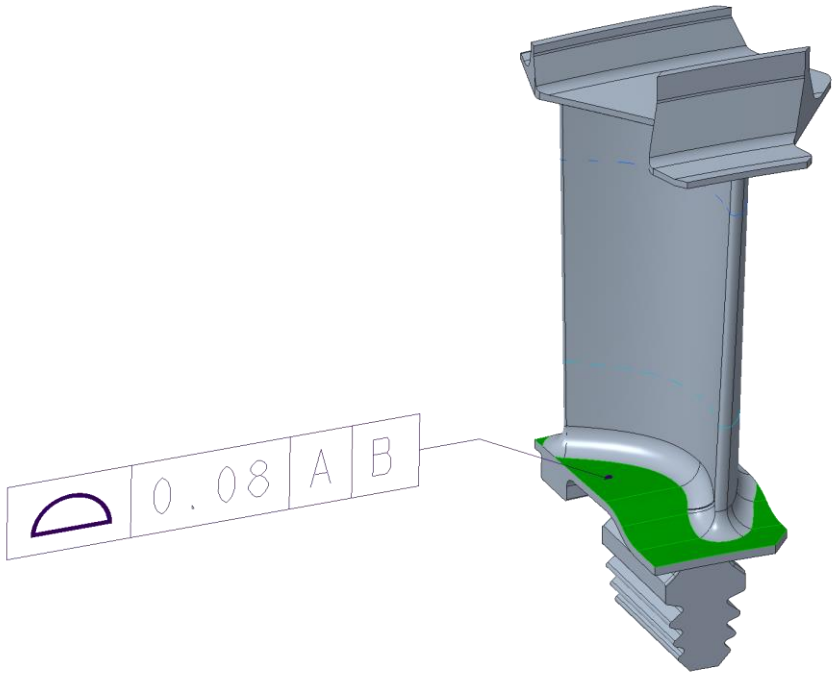


MBDVidia 4.0.200207 - 77778_TURBINE_BLADE_MACHINING_A.qif *

Home | View | Tools | Style

Zoom | Standard Views | Pan | Previous View | Rotate | Next View | General

Select | Multiselection | Frontfaces | Filter | Snap | Selection

All | Selected Only | Display Auxiliary | Visibility

Render Modes | Draw Vertices | Draw Edges | Transparency | Two-Sided Lighting | Shade

Full Screen | Panels | Split | Legend | Synchronize | Windows

Model Tree

- Annotations
  - Characteristics
    - gp8
    - gp15
    - gp9
      - SurfaceProfileActual 3319
      - SurfaceProfileActual 3323
      - SurfaceProfileActual 3327
      - SurfaceProfileActual 3331
      - SurfaceProfileActual 3335
    - AE_GTOL3
    - AE_GTOL4
    - ad109
  - Datum Entities
  - DRFs
- Coordinate Systems
- Saved Views (Combined States)
  - 01-MODEL-ONLY
  - 02-DATUM-REF
  - 03-FEATURES
    - A
    - B
    - ad109
    - AE_GTOL3
    - gp15
    - gp8

77778_TURBINE_BLADE_MACHINING_A.qif *

7
14727-01: 0.01
14727-02: 0.06
14727-03: 0.02
14727-04: 0.01
14727-05: 0.07

Bill of Characteristics

Bill of Characteristics | Information

ISIR (Report Type) | Reset | Decolorize | Re-Balloon | Export | Import | Bind | HTML Report | PDF Report | Publish | Import | Thermometers (Measurement Visualization) | QPID: d2af3f94-8ea5-4604-94d7-4

T	Saved View	Feature Name	Annotation ...	GD&T	(+)	/	(-)	DRF	14727-01	14727-02	14727-03	14727-04	14727-05
⟷3	* multiple	-	ad109	12.80 ±0.05	0.05	12.80	-0.05	-	12.78	12.86	12.77	12.80	12.80
⊥ 4	* multiple	Opposite Planes 3158 (B)	gp15	⊥ 0.04 A	0.04	-	-	A	0.04	0.04	0.01	0.04	0.03
⊥ 4	* multiple	-	gp15	⊥ 0.04 A	0.04	-	-	A	0.00	0.01	0.01	0.00	0.03
6	* multiple	Generic 2120	AE_GTOL3	⌓ 0.05 A B	0.05	-	-	AB	0.00	0.03	0.06	0.04	0.00
7	* multiple	Generic 3178	gp9	⌓ 0.08 A B	0.08	-	-	AB	0.01	0.06	0.02	0.01	0.07
8	DEFAULT ALL	Generic 2221	AE_GTOL4	⌒ 0.03 A B	0.03	-	-	AB	0.02	0.01	0.03	0.02	0.01

Non-Measurable | Main

Airfoil model courtesy of Action Engineering and Graphics courtesy of Capvidia

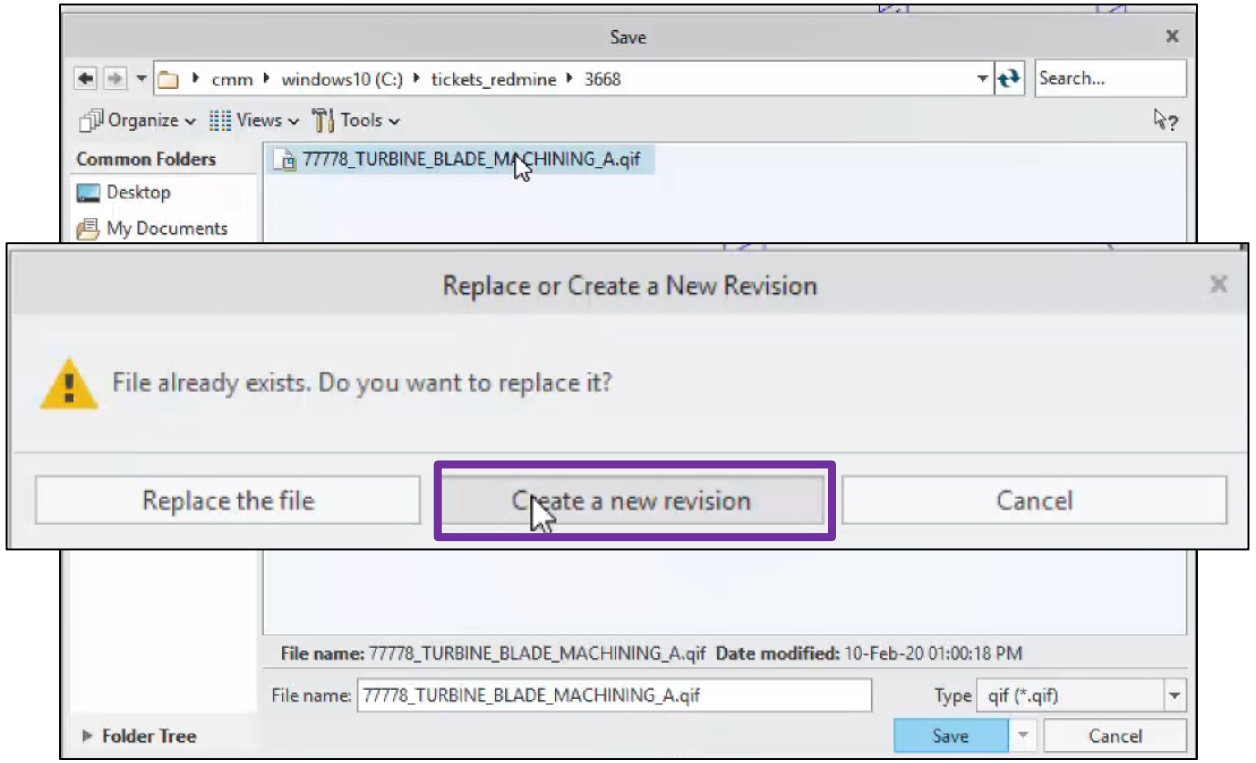
Revision A and Revision B in the code

REV A

```
39058   <SurfaceProfileCharacteristicDefinition id="2021">
39059     <StatisticalCharacteristic>false</StatisticalCharacteristic>
39060     <ToleranceValue decimalPlaces="2">0.08</ToleranceValue>
39061     <DatumReferenceFrameId>2020</DatumReferenceFrameId>
39062     <Extent>
39063       <ExtentEnum>UNDEFINED</ExtentEnum>
39064     </Extent>
39065   </SurfaceProfileCharacteristicDefinition>
```

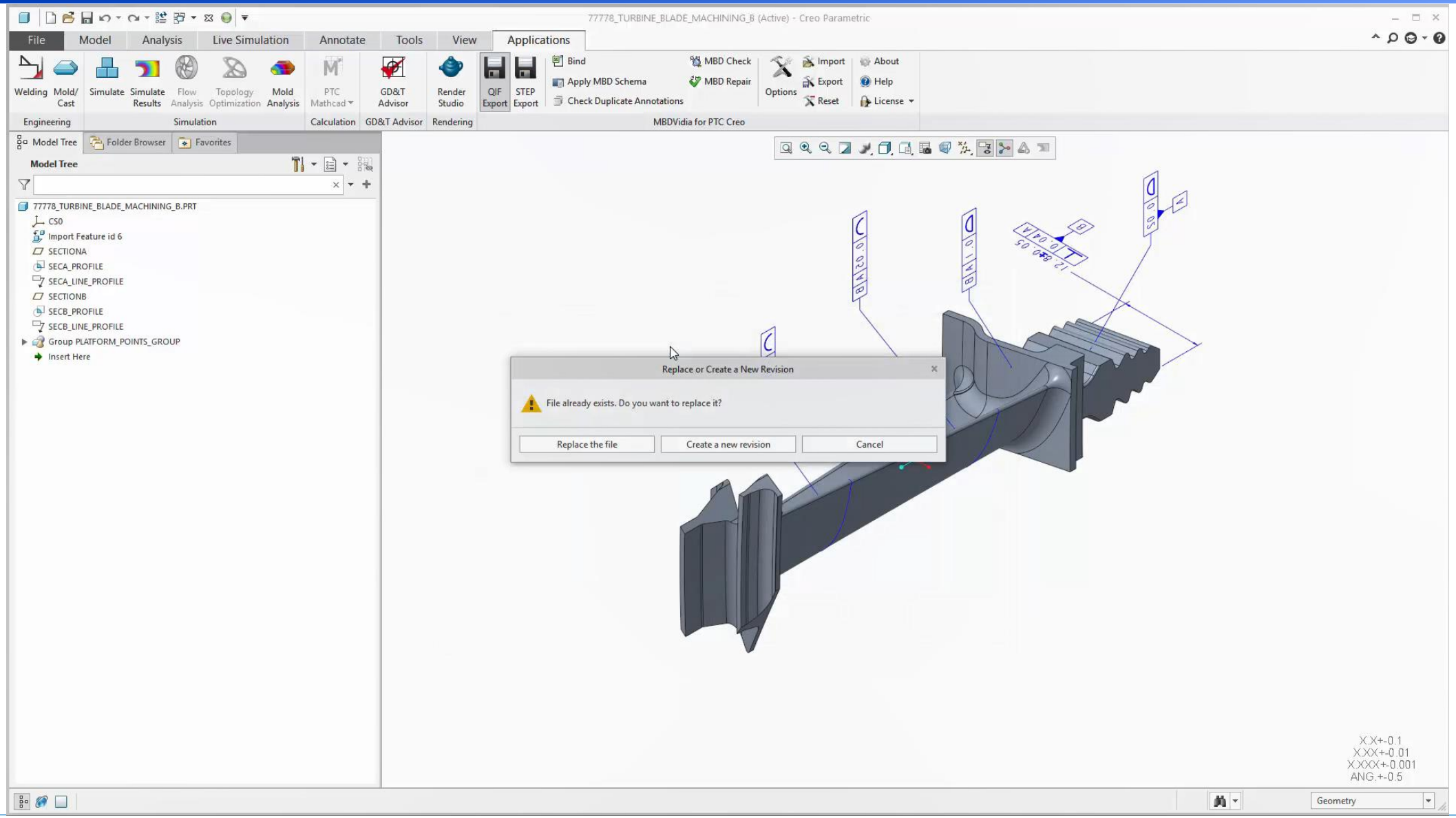
REV B

```
39072   <SurfaceProfileCharacteristicDefinition id="5223">
39073     <StatisticalCharacteristic>false</StatisticalCharacteristic>
39074     <ToleranceValue decimalPlaces="2">0.1</ToleranceValue>
39075     <DatumReferenceFrameId>5222</DatumReferenceFrameId>
39076     <Extent>
39077       <ExtentEnum>UNDEFINED</ExtentEnum>
39078     </Extent>
39079   </SurfaceProfileCharacteristicDefinition>
```



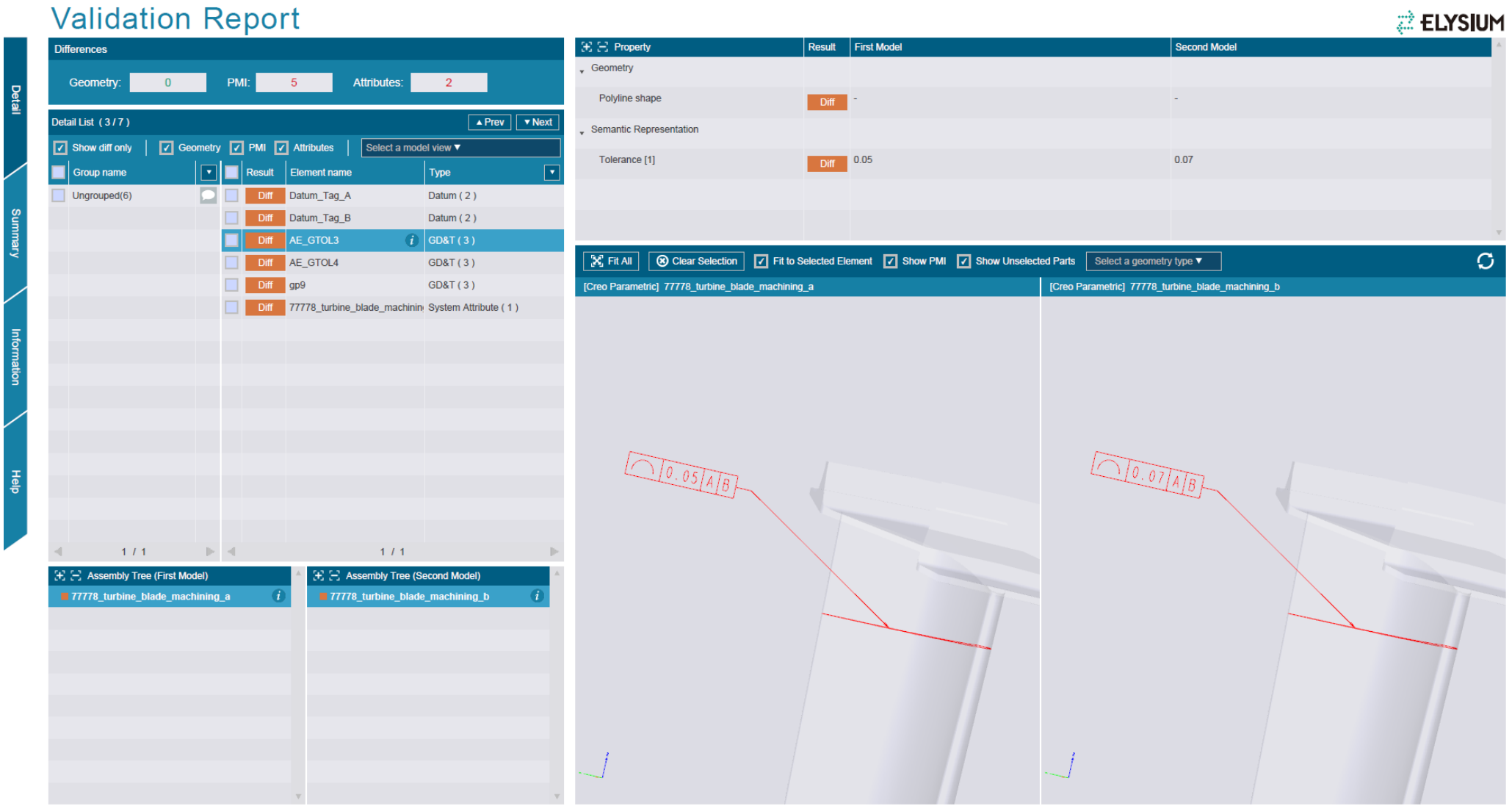
Graphics courtesy of Capvidia

Creating a QIF Revision



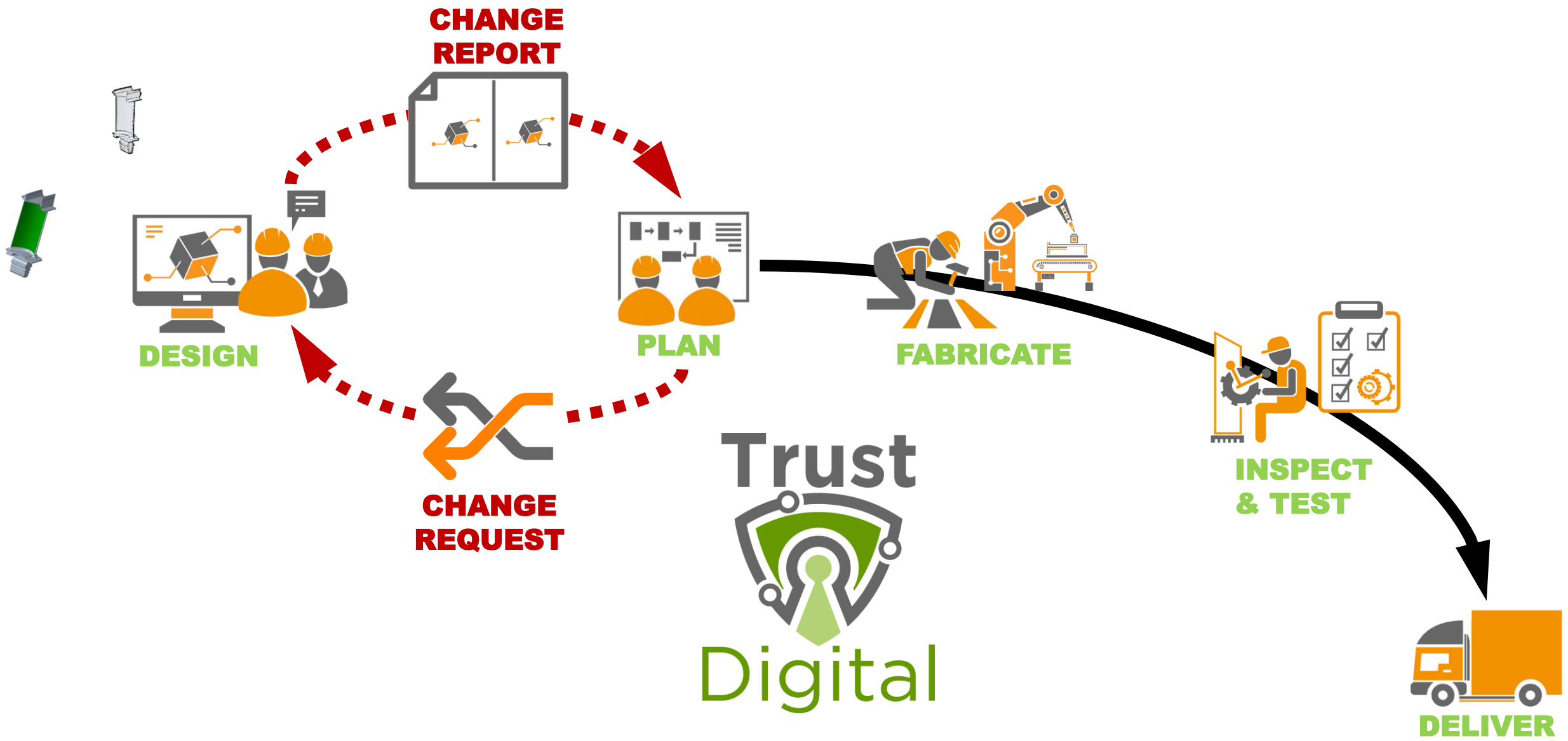
Simulation courtesy of Capvidia

Automate comparison change reporting documentation



Simulation courtesy of Elysium

Persistent trustworthy data is worthy to create



Graphics courtesy of Action Engineering

Learn about the QIF Standard (now an ISO standard)

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qifstandards.org

Graphics courtesy of the DMSC

The History of QIF

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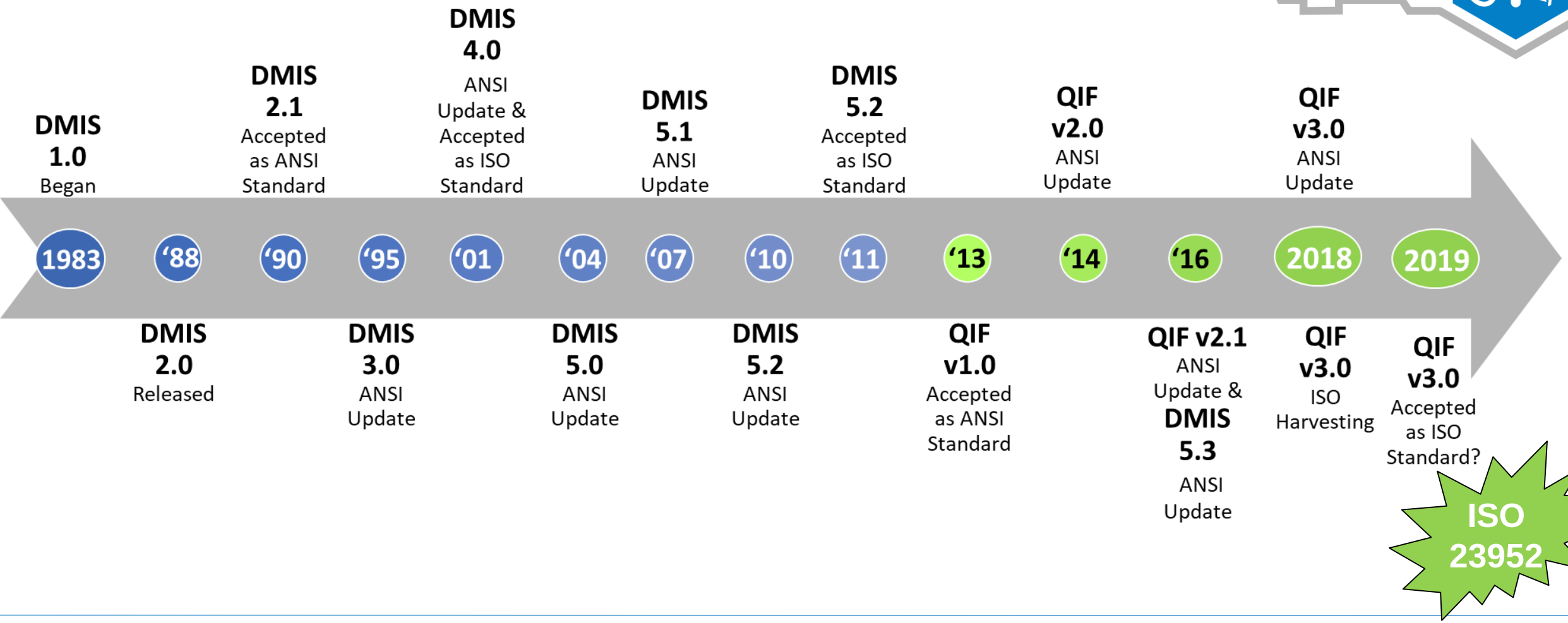
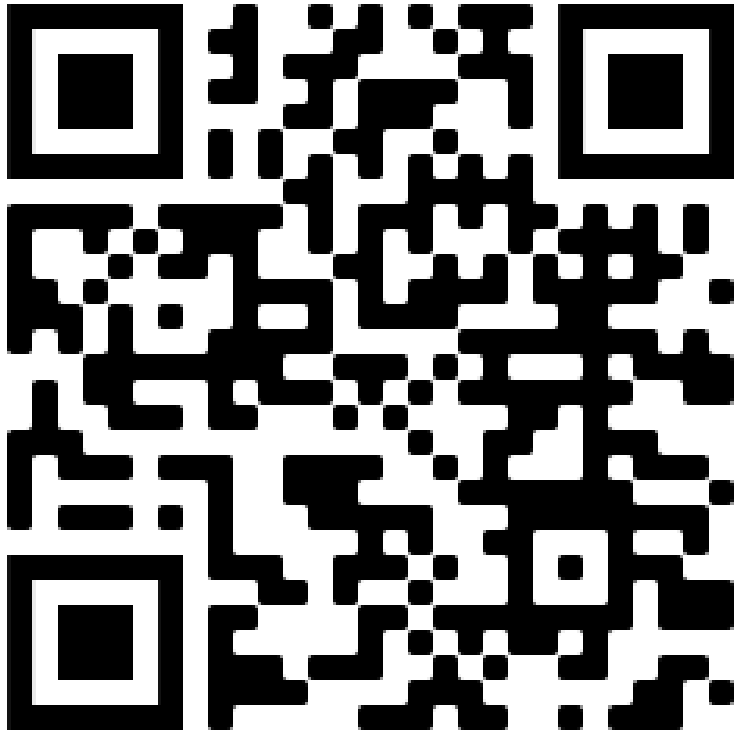


Want to know more?

- **Movies**
- **Models**
- **Sample 3D data**
- **Links**



https://www.action-engineering.com/metromeet-2020

*Note this presentation was adapted from a keynote delivered in March 2020 at Metromeet in Spain

Thank you attending this session

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Please join us for the next Session on Tuesday, November 24th

2:00 PM - 2:55 PM ET **Rusty Rentsch, VP, Aerospace Industries Association (AIA)** **Bassam Zarkout & Jim Morrish, Co-Chairs, Industrial Internet Consortium Digital Transformation (IIC)** **Dr. Ravi Kumar, Chair, SAE International Digital Communications committee** **Panel Discussion** **How Emergent Technology is Transforming the Aerospace and Defense (A&D) industry** **Link to Abstract**
3:00 PM - 3:30 PM ET **Abhijit Bhattacharjee, Senior Applications Engineer** **MathWorks** **Building AI Systems**

Recordings and presentation decks can be found under the 2020 Presentations at https://gpdisonline.com/event-history/