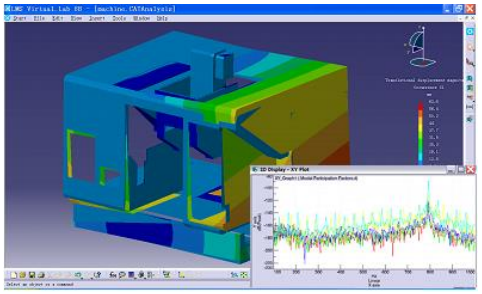
山衛科技
Samwell Testing Inc.



數位品質4.0論壇 – QIF應用

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山衛科技 (Samwell Testing INC.)
工程服務部 專案經理
TEL: +886-953-640-178
dave@samwells.com

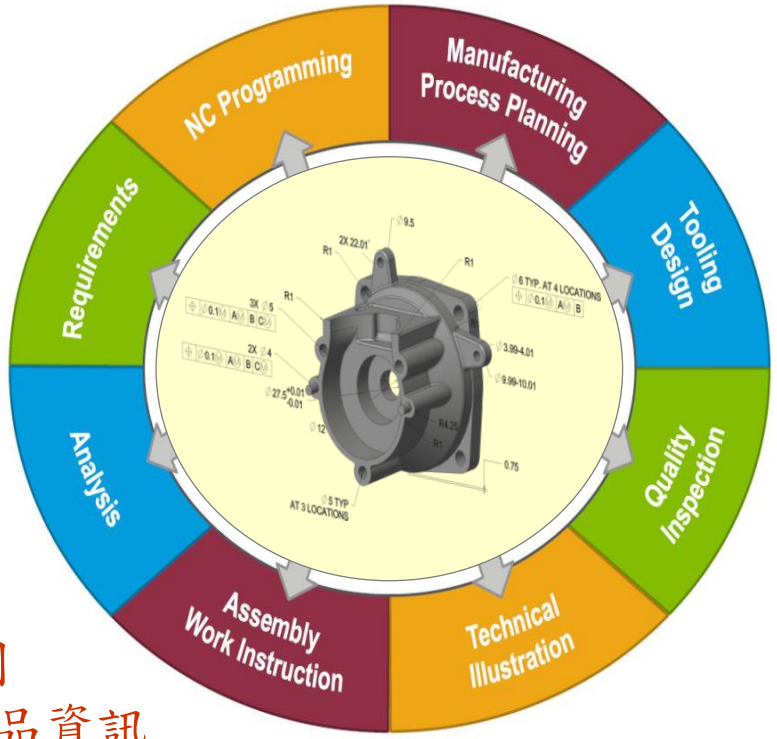
大綱

- QIF簡介
- QIF MBD品質流程
  - MBD模型準備
  - 模型驗證
  - 測量計畫準備
  - 自動化測量流程案例(CMM)
  - 測量結果分析流程案例(Laser Scanner)
- 結論

當前的挑戰 – 工業4.0數位轉型

- 工業4.0 – 生產製造領域的數位化轉型

- 工業4.0數位轉型所帶來的效益：
  - 自動化再提升 – 降低成本
  - 生產流程管理精進 – 提升品質
  - 減少人工，減少發生錯誤的機會
  - 可重複利用既有資訊



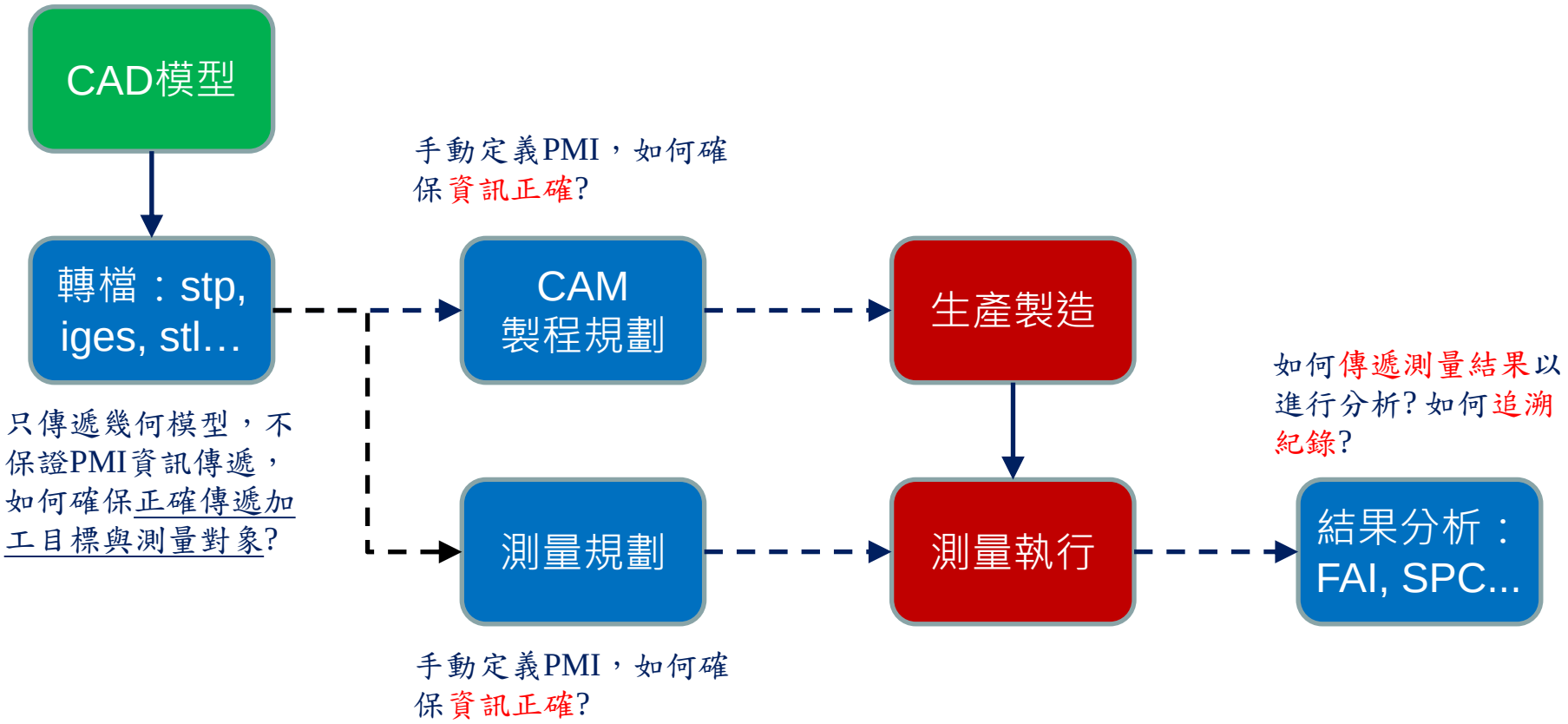
- 工業4.0對於生產資訊的要求：
  - 工程資訊須為機械可讀的(M2M溝通)
  - 以具有工程註記之3D模型取代2D工程圖
  - 在產品生命周期中，可重複利用既有產品資訊

For What Purpose? Why?

→ QIF MBD

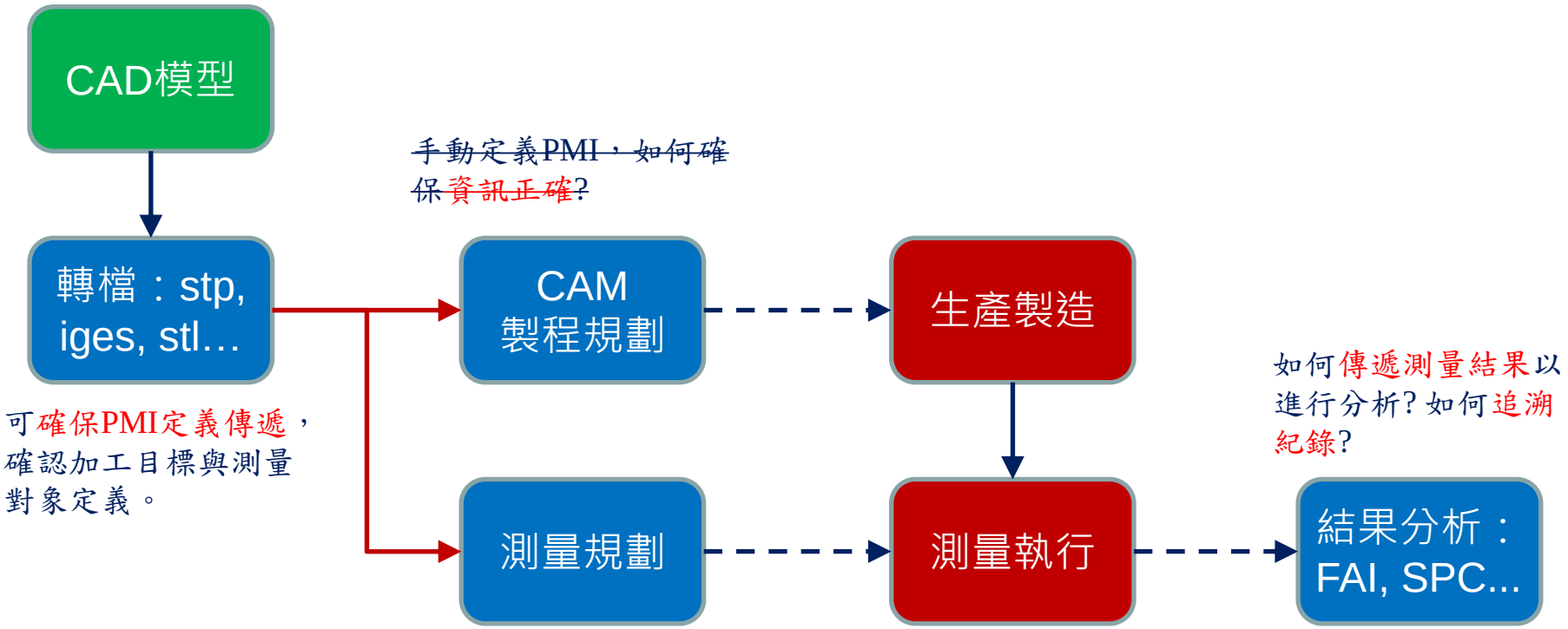
What if… 沒有MBD的世界

- 自動化實作的挑戰 – 資訊傳遞介面



What if… 有MBD的世界

- 自動化實作的挑戰 – 資訊傳遞介面

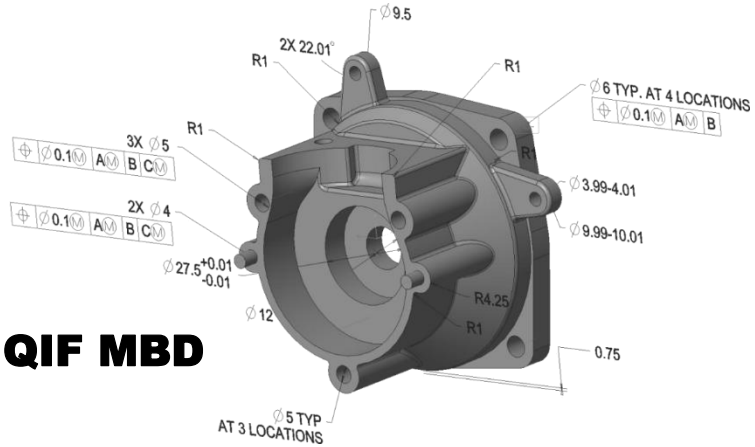


QIF – 讓您充分發揮MBD的優勢

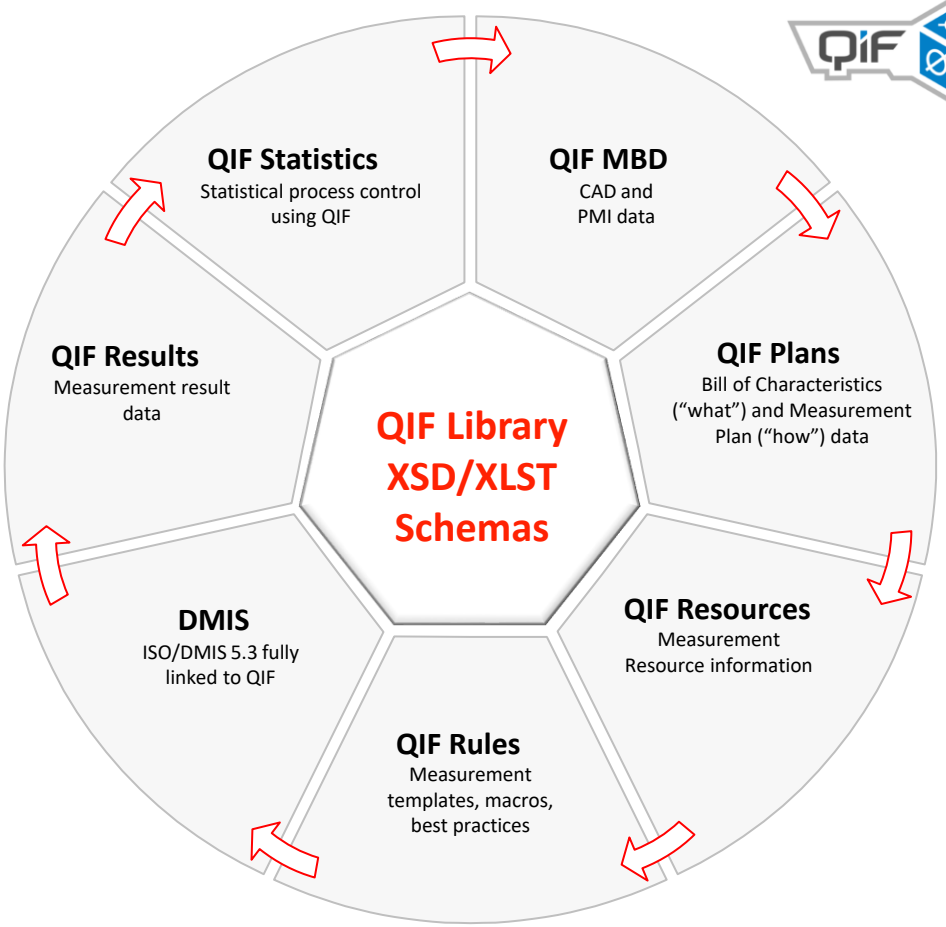
- QIF：Quality Information Framework

- ANSI QIF Standard

✓ 為了支援數位計量而設
✓ 資料模型連結MBD + PMI
✓ 100%滿足協作需求
✓ 模組化資料結構
✓ XML元件資料庫
✓ 軟體應用與整合容易
✓ 作為MBD資料的容器



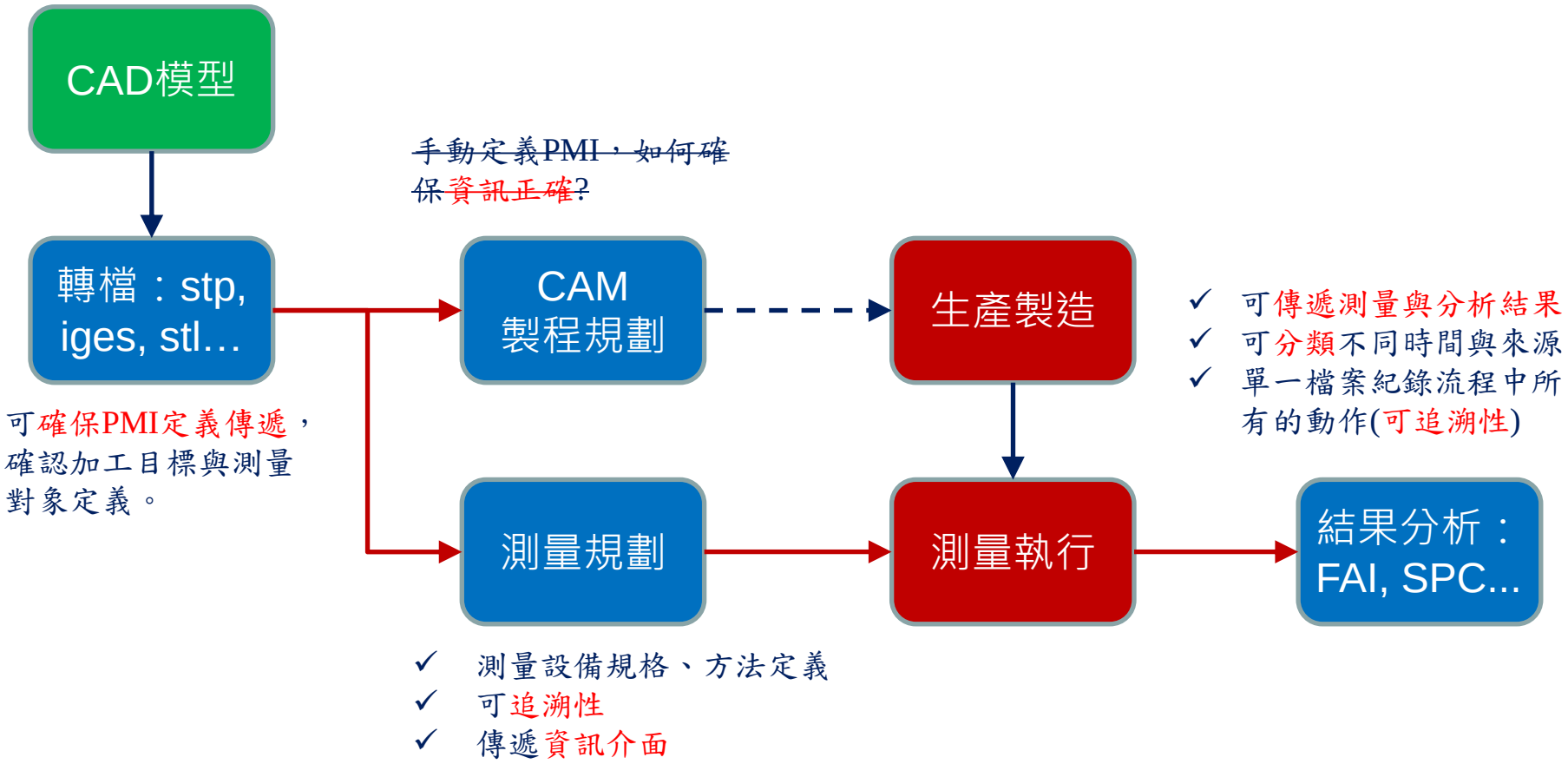
QIF MBD



Components of QIF standard

採用QIF的世界

- QIF提供資訊串接的接口，讓自動化品質流程成為可能!



QIF標準發展史

QIF development started in 2007 triggered by NIST
QIF v1.0 was approved by ANSI on December, 19th 2013
QIF v2.0 was approved by ANSI on October, 31th 2014
QIF v2.1 was approved by ANSI in 2016
QIF v3.0 was approved by ANSI on December 2018
目前已成為ISO標準 (ISO 23952)

A Major Breakthrough for the Manufacturing Quality

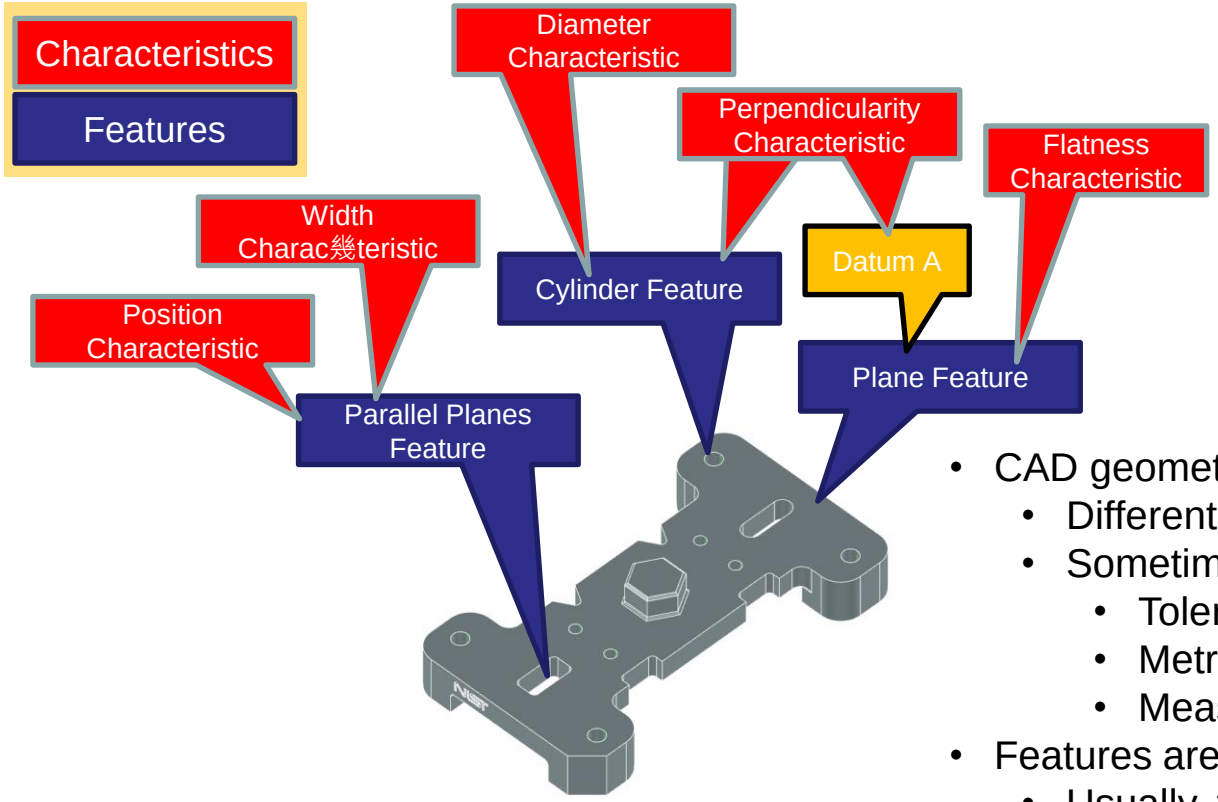
Digital Metrology Standards Consortium (DMSC) recently announced the release of the updated version of the Quality Information Framework (QIF) Standard: QIF 3.0.

ANSI


DMSC Member Companies
Member companies and organizations of the Digital Metrology Standards Consortium aka DMSC, Inc. represent some of the most innovative, progressive, and advanced organizations in the world today, who are on the cutting edge of research and technology in the field of digital metrology.
ACTION ENGINEERING
Schneider Electric
UNC CHARLOTTE
CAPVIDIA
TechAzul
HIGH QA
HIGH QUALITY AUTOMATION
Deere & Company
Mitutoyo
Mitutoyo America Corporation
innovalia METROLOGY
INNOVATION AND ACCURACY
AAT3D
Metrology Solutions for Smart Manufacturing
RENISHAW
apply innovation™
Honeywell
METROSAGE
NIST
ITI
International TechneGroup
STEP Tools, Inc.
www.steptools.com
QIF SOLUTIONS
KOTEM
A Quality Vision International Company
ELYSIUM
TDP 360
LK metrology
Origin
metrologic group
PURDUE UNIVERSITY
ZEISS
SAMWELL GROUP
ogp
HIGDTC
LOCKHEED MARTIN

QIF資料模型簡介

The fundamental constructs behind QIF:
Features (幾何特徵) & Characteristics (特性，GD&T、材料等加工資訊)



- CAD geometry is wrapped by ***Features***
  - Different concept from CAD features!
  - Sometimes referred to as:
    - Tolerance Features
    - Metrology Features
    - Measurement Features
- Features are referenced by ***Characteristics***
  - Usually, these are GD&T

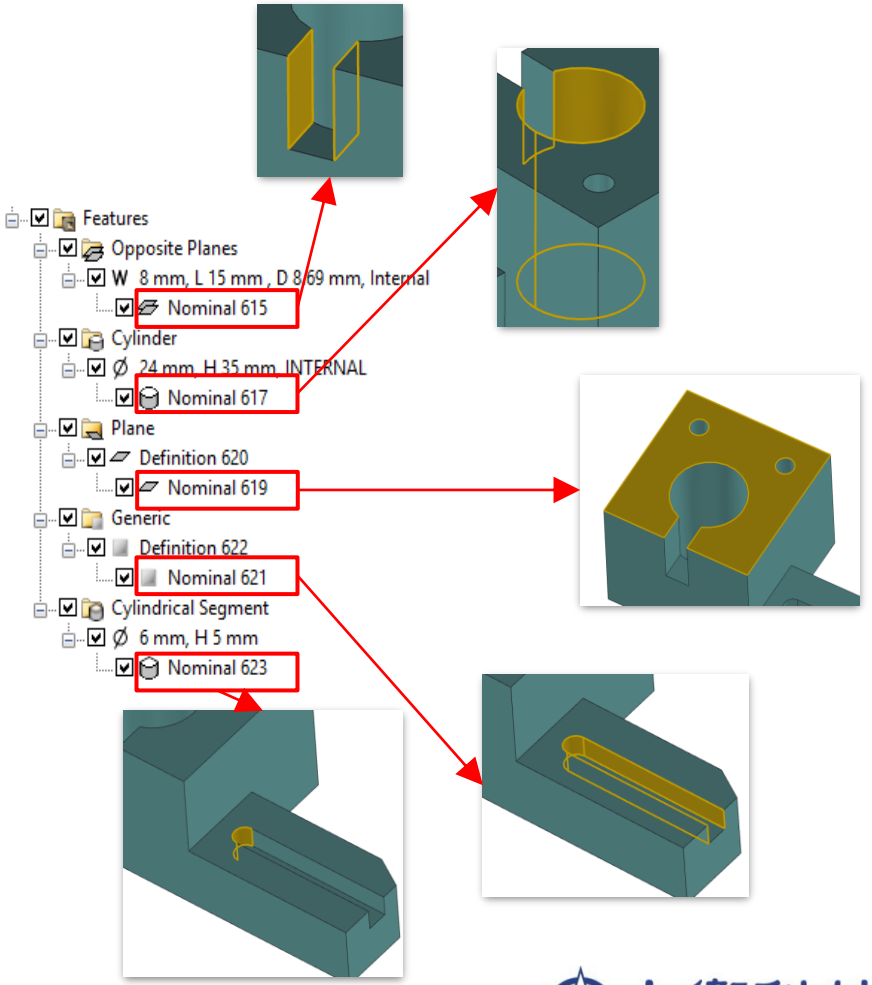
支援ASME Y14.5 GD&T、ISO GPS

QIF品質資訊模型

- QIF支援29種幾何特徵定義

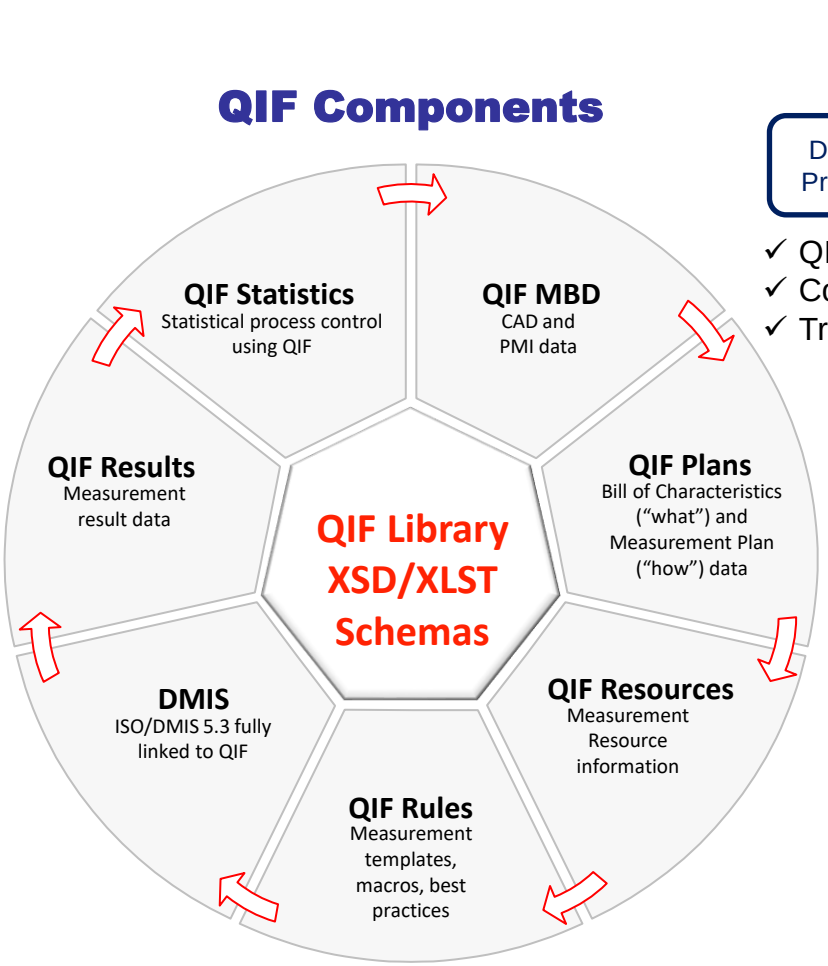
29 Metrology Features

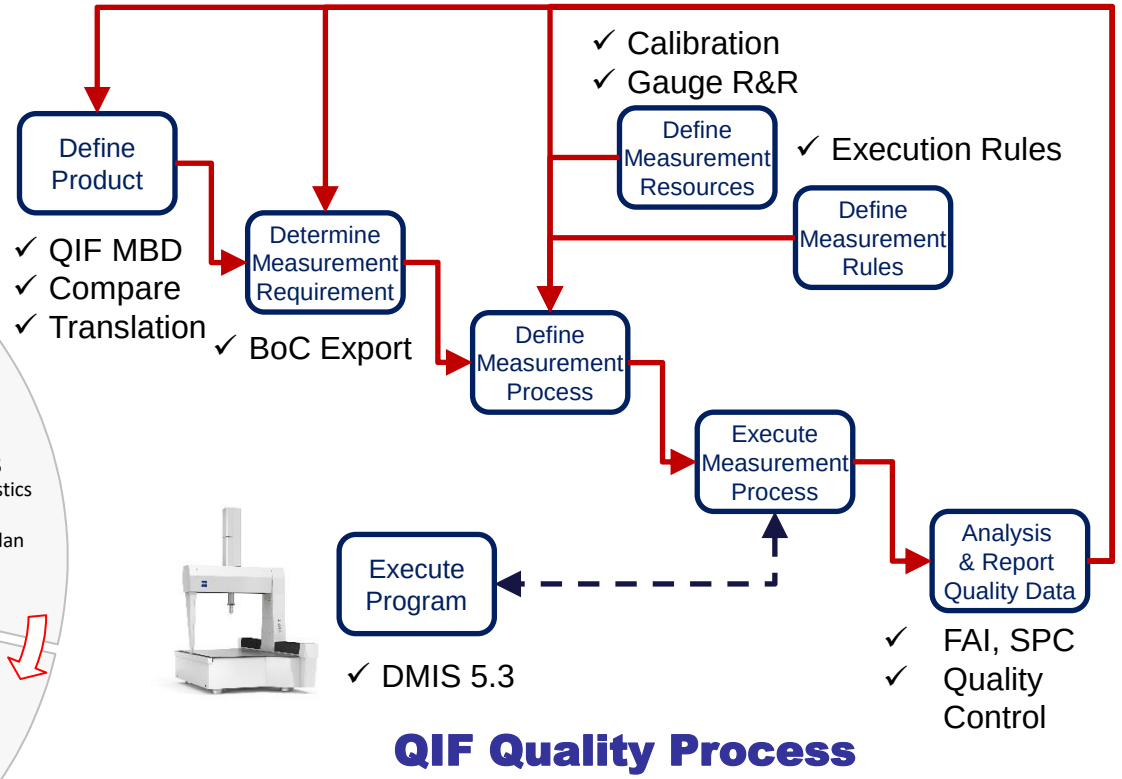
QIF Feature	QIF Feature
Arc	OppositePlanes
Circle	Pattern
Compound	Plane
Cone	Point
ConicalSegment	PointDefinedCurve
ExtrudedCrossSection	PointDefinedSurface
Cuboid	ProfileGroup
Cylinder	RunoutGroup
CylindricalSegment	Sphere
EdgePoint	SphericalSegment
Ellipse	SurfaceOfRevolution
ElongatedCylinder	Threaded
Generic	ToroidalSegment
Line	Torus
OppositeLines	



QIF品質資訊架構

- QIF架構不僅止於提供MBD資訊定義，整體品質工作流程各階段所需的資訊，都已包含在QIF架構之中。





- QIF格式也提供自定義資訊的輸入，包含定義文字與圖形，使用者能擴充QIF檔案內容來滿足其使用需求。

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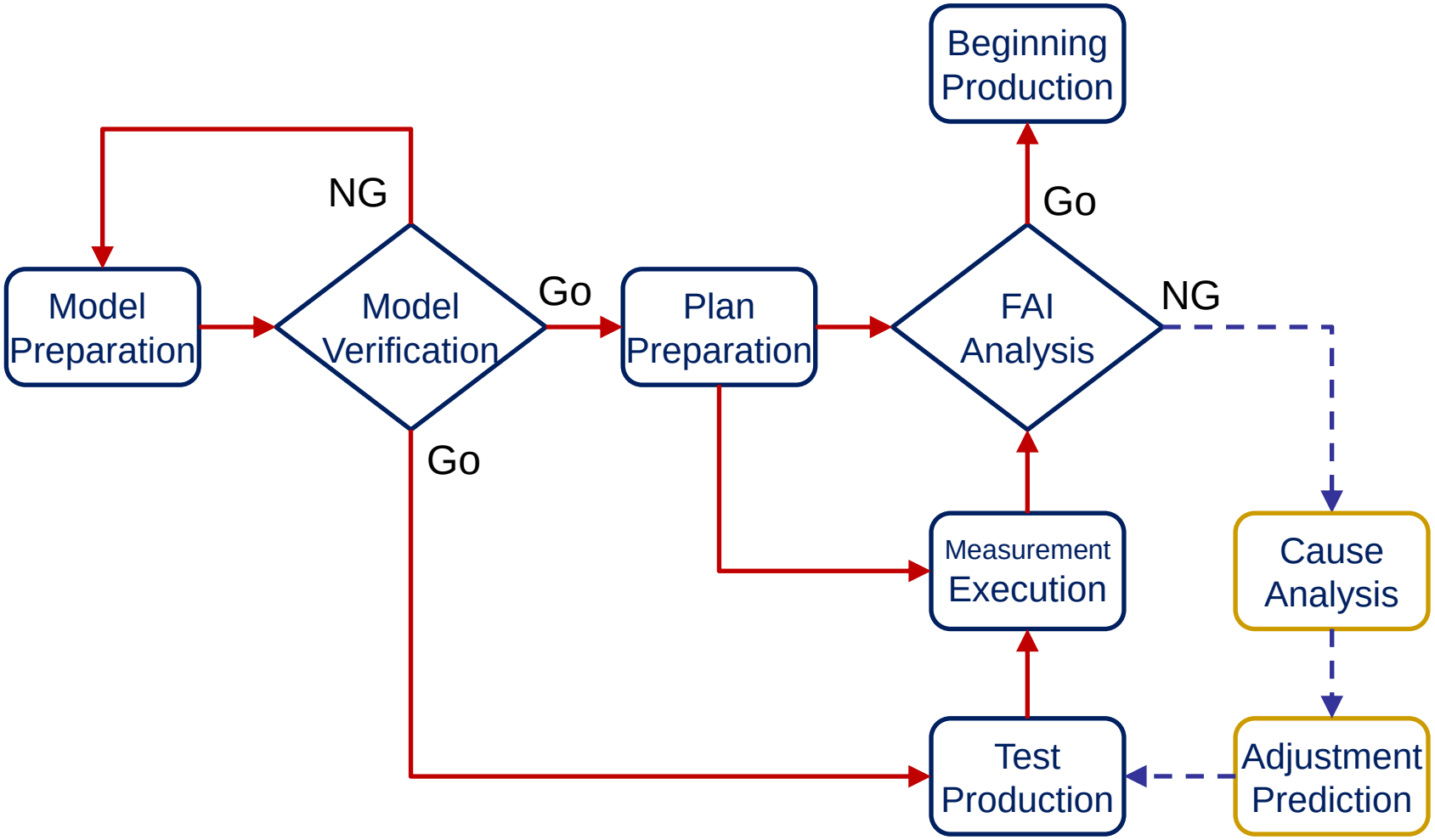
QIF MBD品質工作流程



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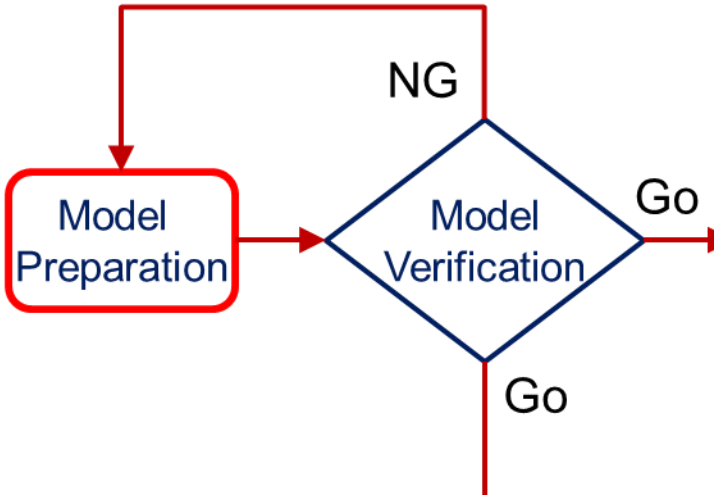
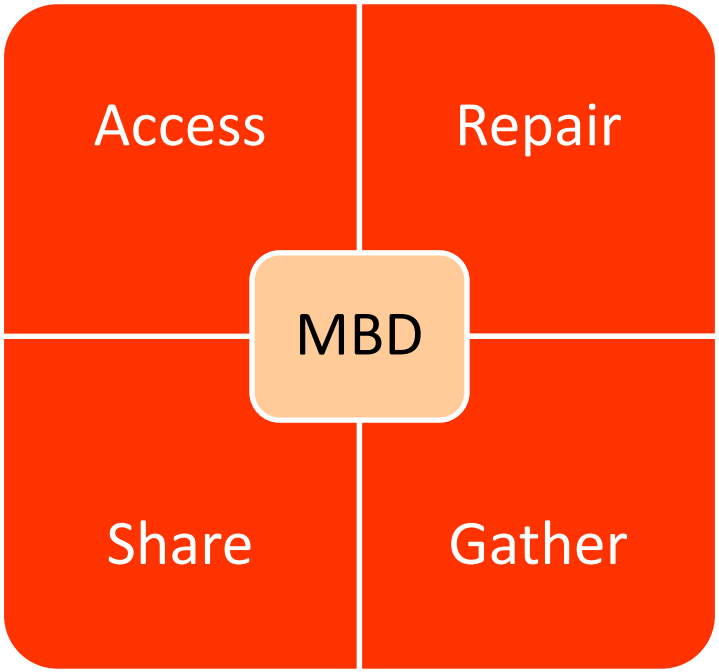
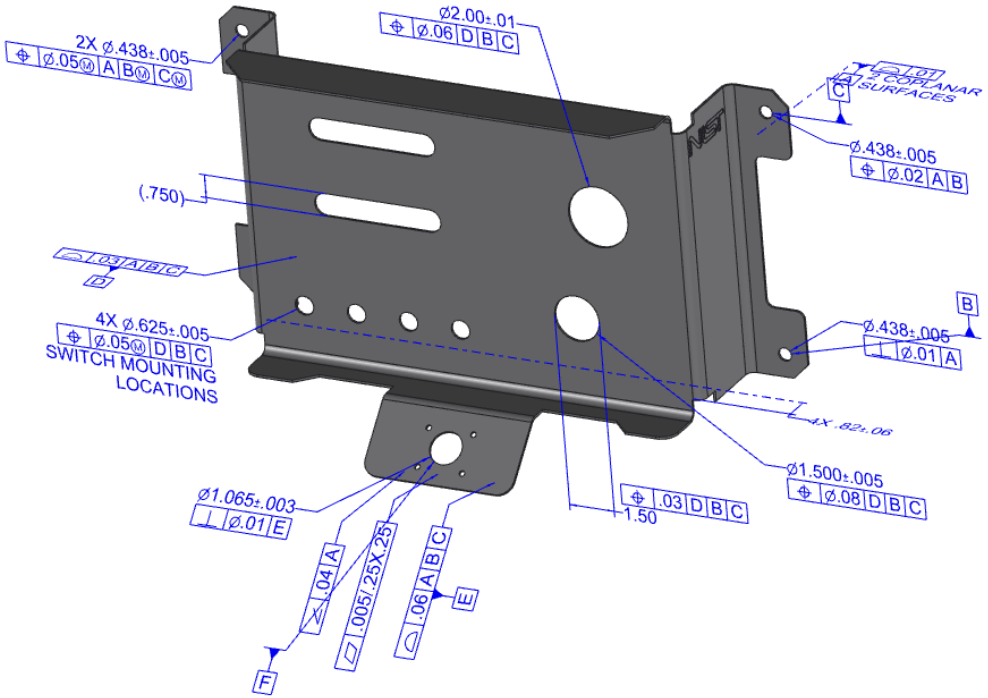


QIF MBD模型準備

- 我們利用MBDVidia進行QIF轉檔、PMI定義檢查與修復、蒐集與分析測量結果，以及將所有結果輸出至QIF檔案中，讓後續的軟體做深入的分析。





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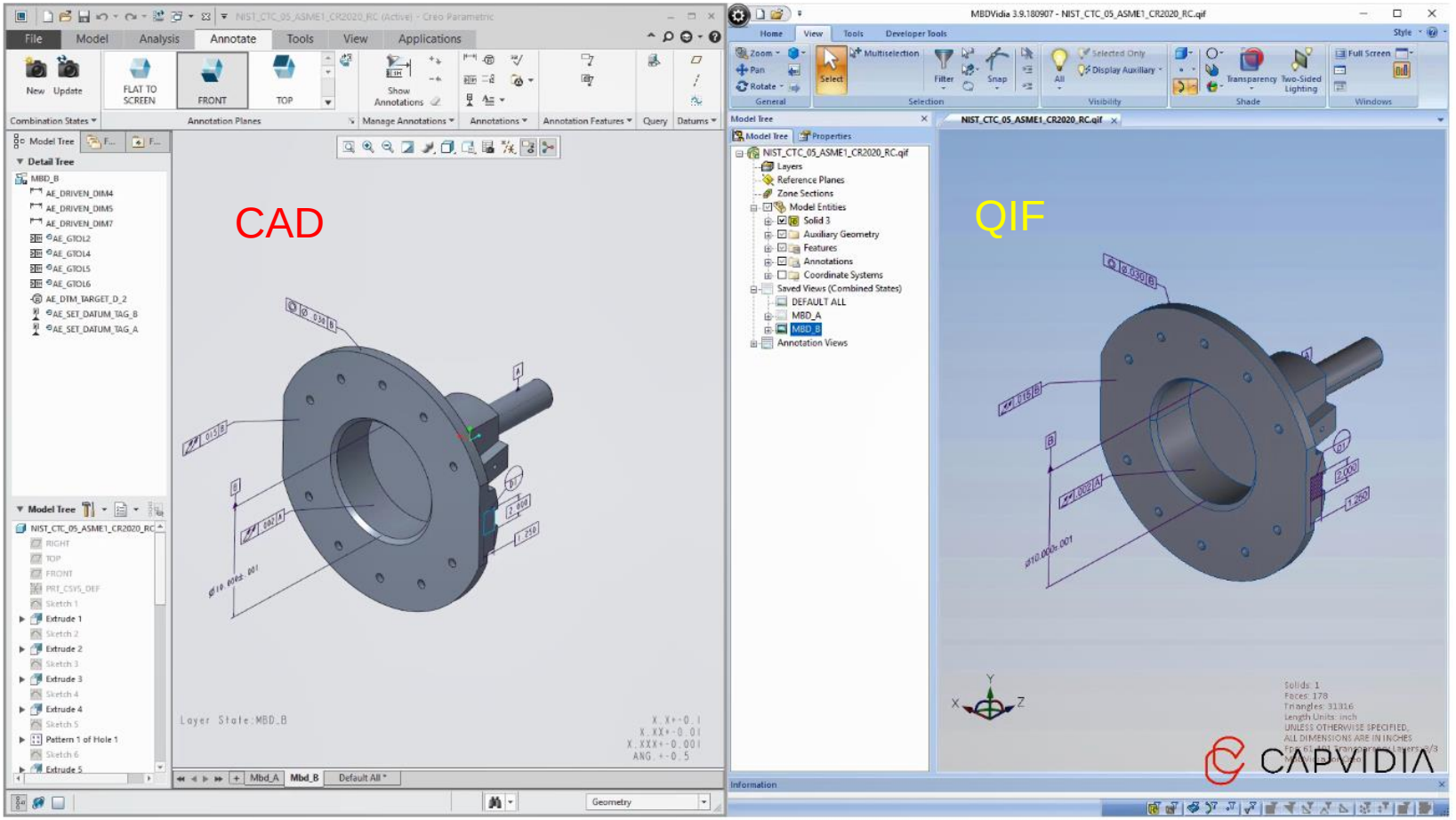
MBD模型準備 – 影片

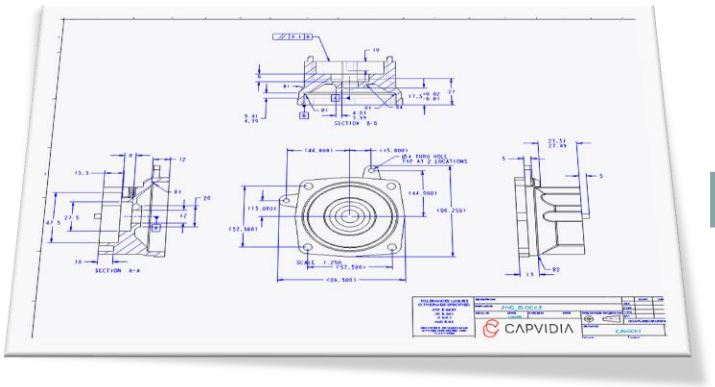
- QIF檔案將保留原始CAD幾何特徵與PMI定義資訊



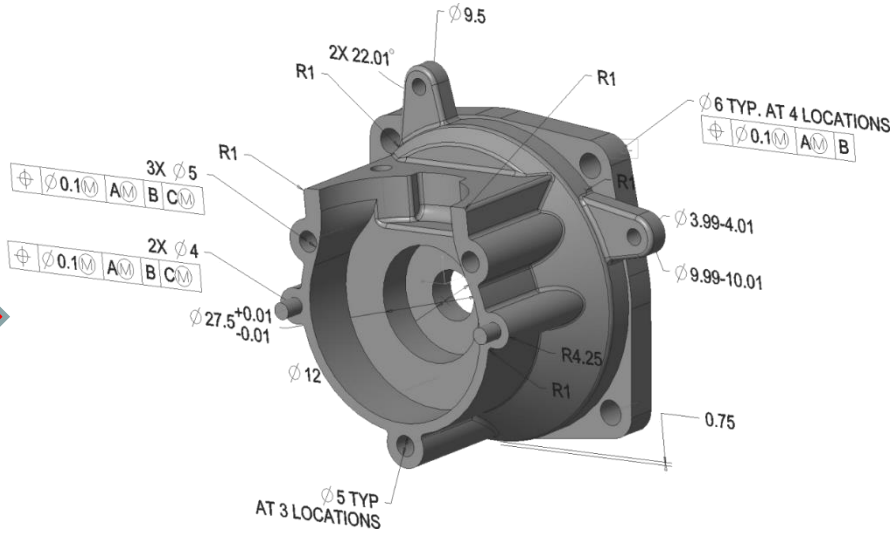
Assign PMI from 2D Plot to 3D Model

- MBD的工作流程中，需要我們將PMI註記加到3D CAD模型上；但是我們過去工作產生的資料，PMI只存在於2D工程圖上，如要轉到3D模型上將是很大量的工作，該如何解決?

- 影片：MBDVidia提供將2D工程圖上的PMI與3D模型同步化功能!



2D drawing



3D MBD annotated model

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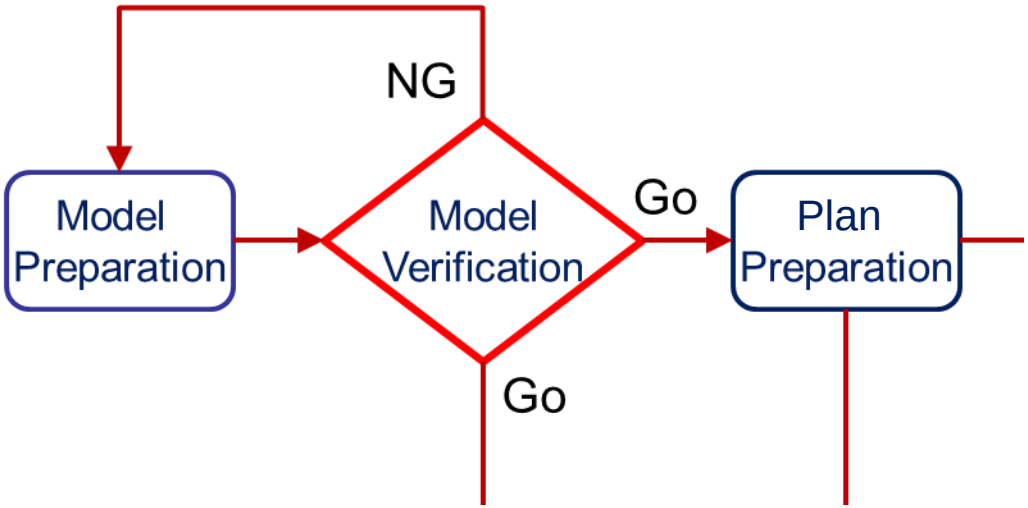
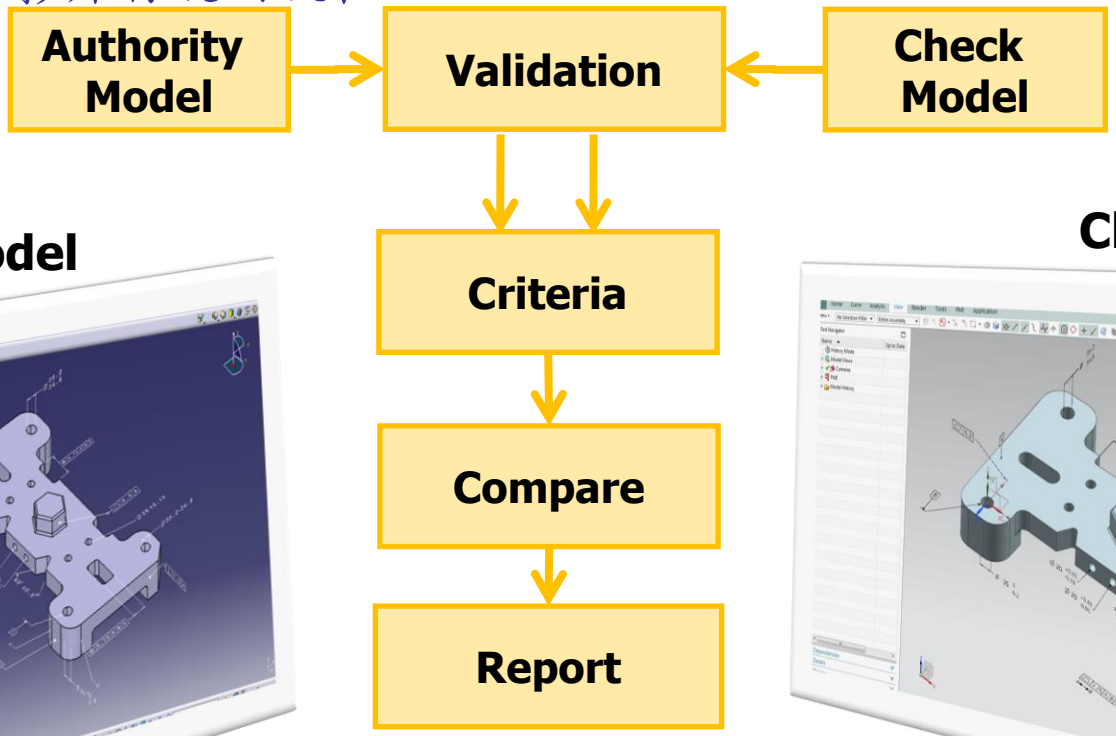
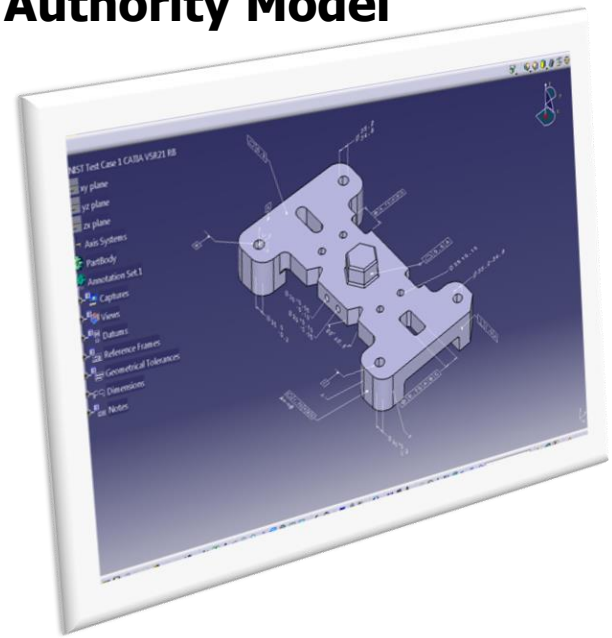


模型驗證

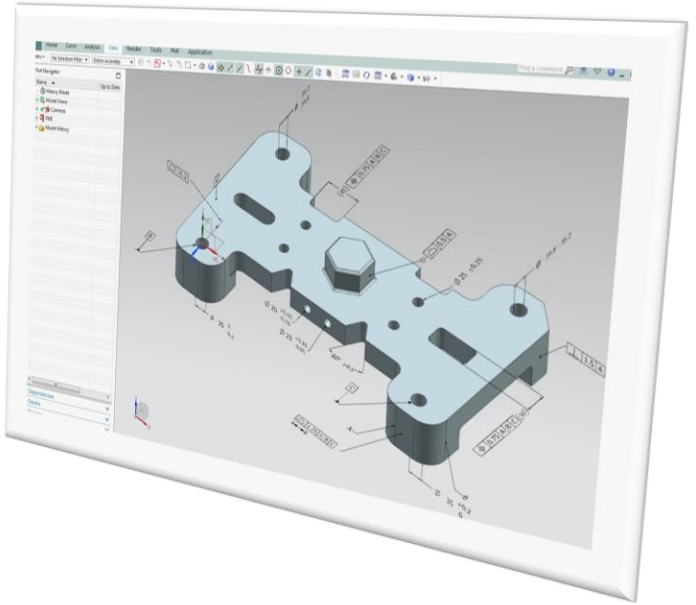
- 我們利用CompareVidia來協助比對轉檔後的模型與原始模型之間的差異，以下影片將說明流程。



Authority Model



Check Model



播放影片

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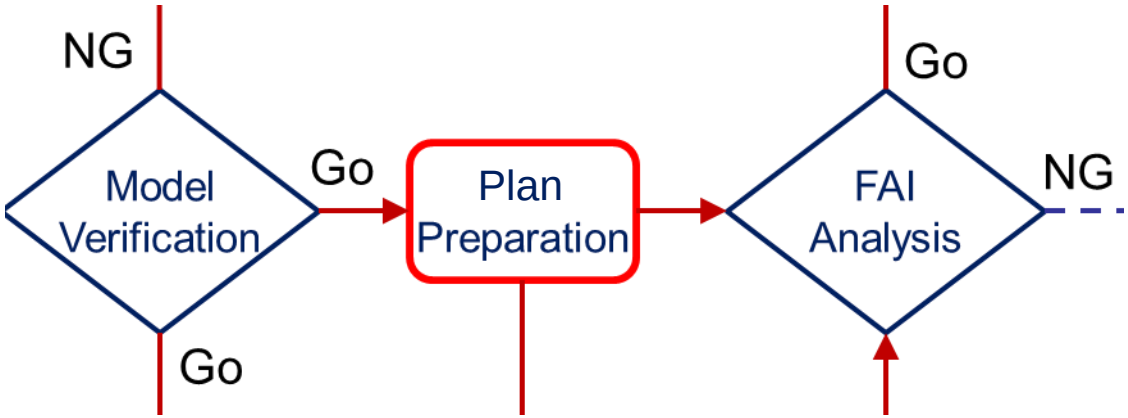
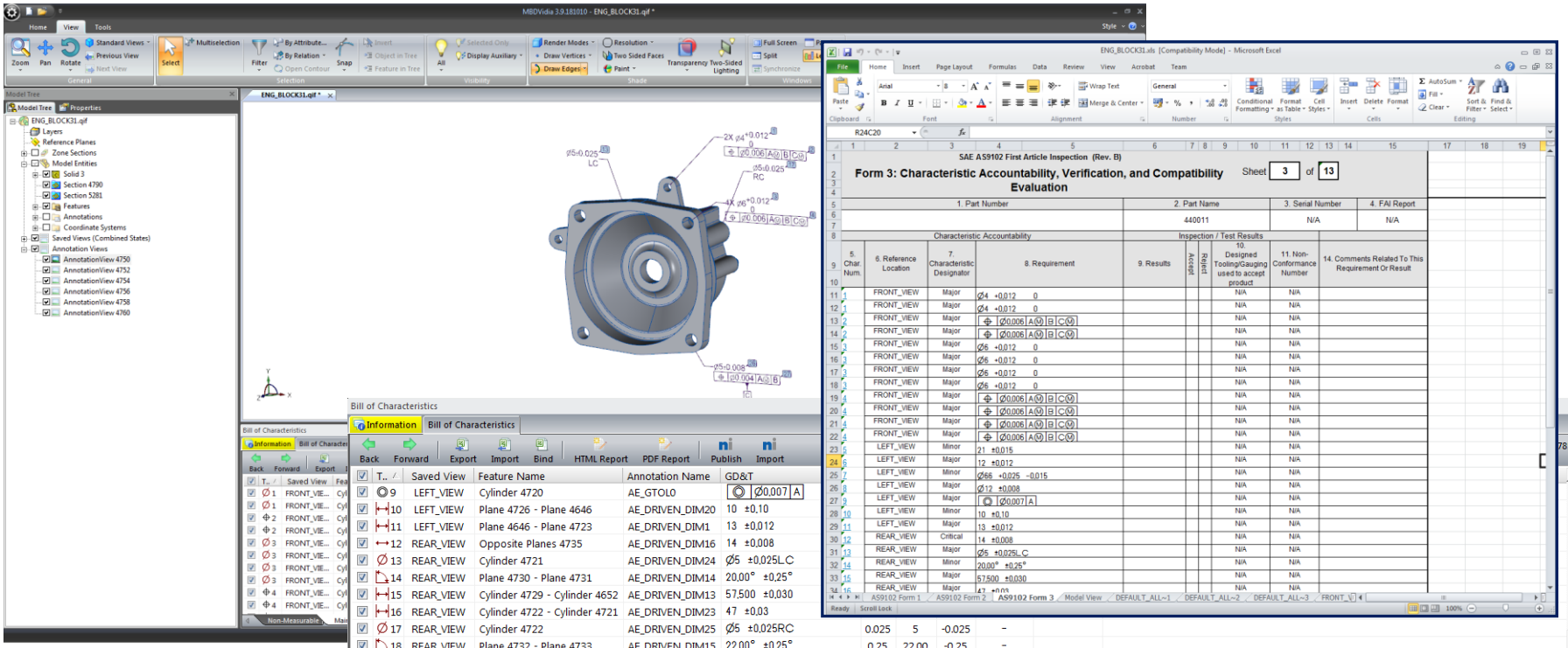


測量計畫準備

- QIF檔案是XML架構的檔案，因此應用軟體可輕易的搜尋QIF檔案中紀錄的資訊。透過MBDVidia來讀取QIF模型中關於PMI的定義(BoC)，這些資訊將是我們檢核製造成果的標的，然後轉成Excel表格輸出。



測量計畫準備

- QIF檔案可記錄可用設備規格，以及測量時的設備與治具選用，以及測量規則等，進而達成高度自動化工作流程。

```
<Rules>
  <DMESelectionRules n="6">
    <DMEDecisionRule>
      <DMEThen n="1">
        <DMEDecisionClass>
          <Must/>
          <DMEClassName>ALLDMES</DMEClassName>
          <ParameterConstraints n="1">
            <DMEParameterConstraint>
              <ParameterName>Resolution</ParameterName>
              <Comparison>LESSOREQUAL</Comparison>
              <Times>
                <ArithmeticConstant val="0.1"/>
                <ArithmeticCharacteristicParameter>
                  <Parameter>Tolerance</Parameter>
                </ArithmeticCharacteristicParameter>
              </Times>
            </DMEParameterConstraint>
          </ParameterConstraints>
        </DMEDecisionClass>
      </DMEThen>
    </DMEDecisionRule>
```

上述QIF檔案之內文定義了測量設備選定規則：測量解析度必須小於公差值之1/10。

```
<MeasurementResources>
  <Version>
    <TimeCreated>2015-05-28T17:44:00</TimeCreated>
    <ThisInstanceQPId>0673a750-094e-11e5-b939-0800200c9a66</ThisInstanceQPId>
  </Version>
  <MeasurementDevices n="1">
    <Micrometer id="4">
      <Name>Mike</Name>
    </Micrometer>
  </MeasurementDevices>
</MeasurementResources>
<Rules>
  <FeatureRules>
    <IfThenElseFeatureRules n="3">
      <IfThenCylinderRule>
        <ThenPoints>
          <NumberOfPoints>23</NumberOfPoints>
        </ThenPoints>
      </IfThenCylinderRule>
      <IfThenCircularArcRule>
        <ThenPoints>
          <PointDensity>0.8</PointDensity>
        </ThenPoints>
      </IfThenCircularArcRule>
      <Else>
        <ThenPoints>
          <MinPoints>13</MinPoints>
        </ThenPoints>
      </Else>
    </IfThenElseFeatureRules>
    <MaxFeatureRules n="2">
      <IfThenSurfaceRule>
        <GreaterThan>
          <FeatureArea/>
          <ArithmeticConstant val="10"/>
        </GreaterThan>
        <ThenPoints>
```

左側QIF內文在“測量資源”部分定使用設備與操作員。“測量規則”部分定義針對不同幾何形狀下的必須測量點數。

Raytheon 案例

- 利用QIF格式來建立BoC列表，測量計畫列表準備時間大幅減少至原本的19%。

ROI Analysis:

Current Workflow	
Total hours, existing manual workflow	**16 Hours**

New MBD Workflow	
MBDVidia	5 Minutes
FormatWorks import of Creo file	5 Minutes
Checkmate Setup Parameters	5 Minutes
Checkmate Auto Programming	
Accessibility	15 Minutes
Sorting for dependencies	1 Minutes
Auto Coordinate Systems	1 Minutes
Probe moves/rotations	1 Minutes
Collision detection	20 Minutes
Manual editing (estimate)	120 Minutes
Post process program	5 Minutes
Total, New MBD Workflow	178 Minutes
Total, New MBD Workflow	**2.97 Hours**

Time reduction	
MBD Workflow time vs. Manual Workflow Time	19%
MBD Workflow decreases total time by:	**81%**

ROI Analysis	
Hours saved on MBD Workflow	13.03
Number of parts programmed per year	80
Total yearly labor reduction	**1,042 hours**

Raytheon Origin

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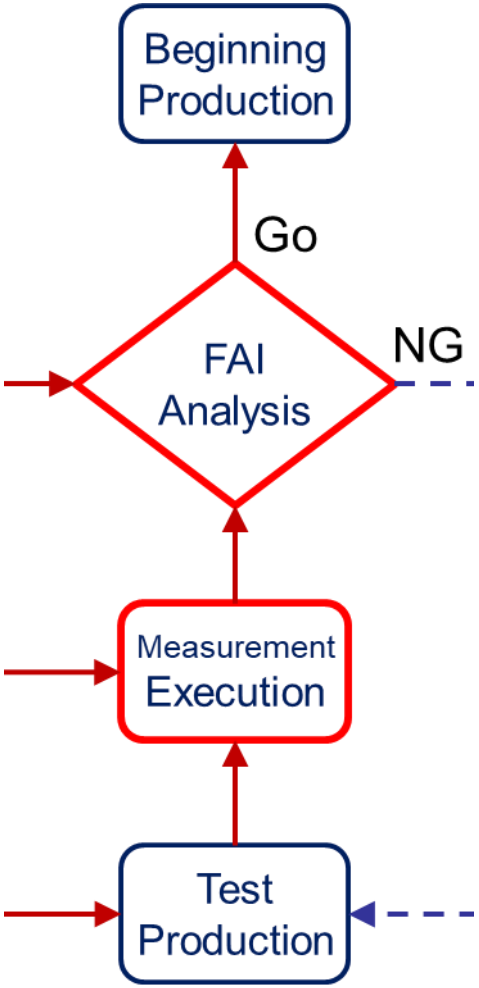
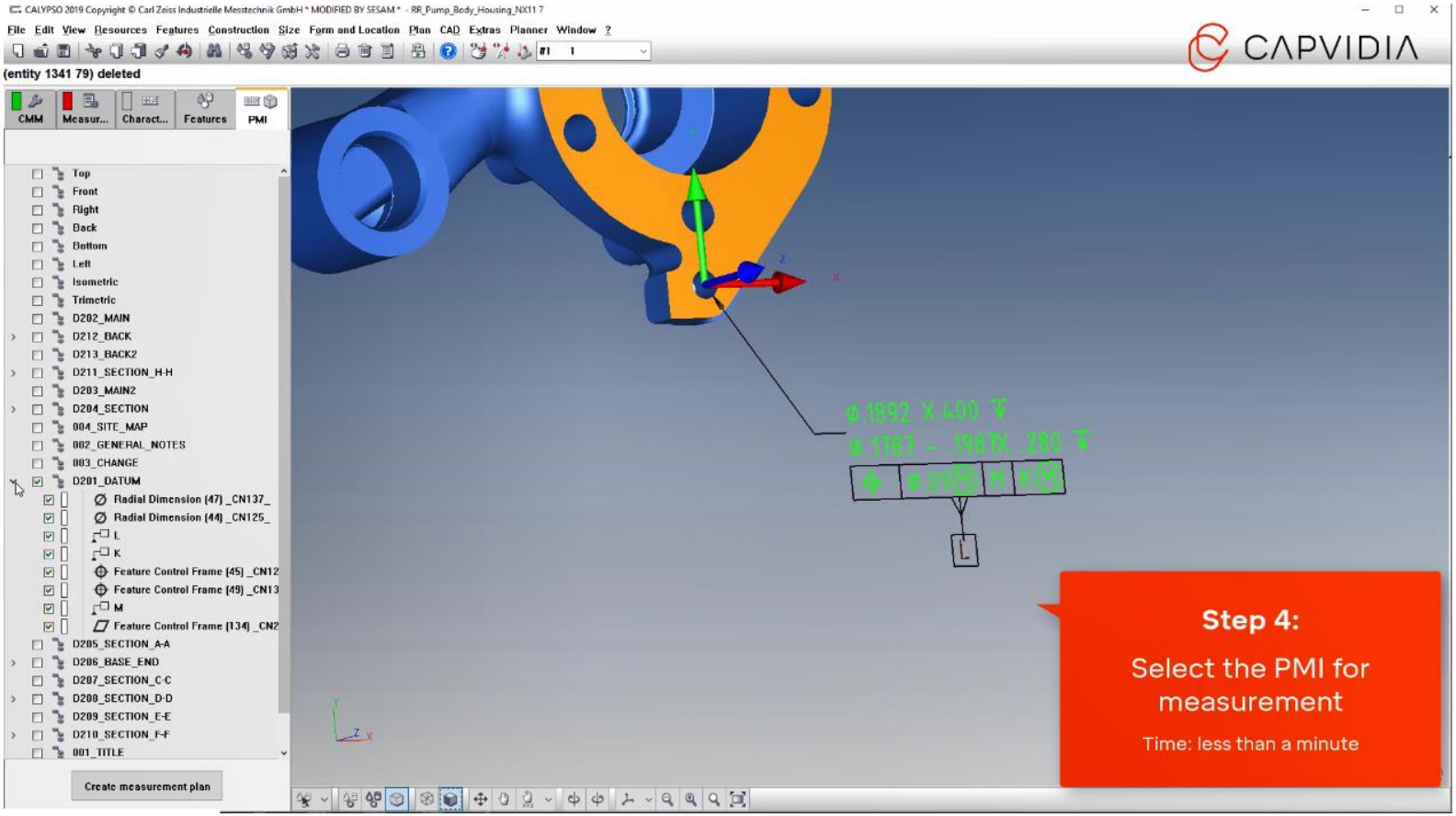


QIF MBD在CMM測量應用

- 透過QIF傳遞模型定義，可大幅減少測量計畫設定時間。



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QIF MBD效能

- Workflow Comparison

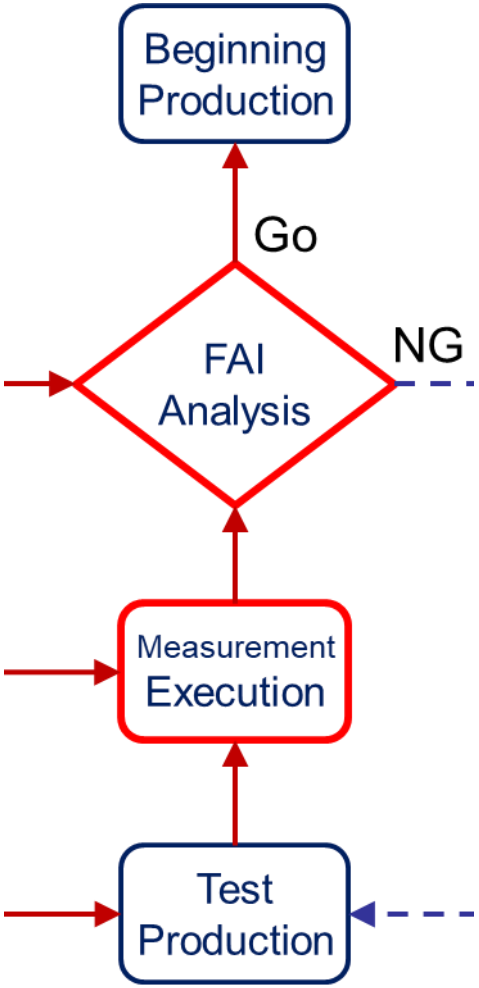
Manual CMM Programming	
Tasks: • Manipulate CAD model • Define features to measure • Define filters • Correlate features • Define scanning paths, probing points and parameters • Define feature frames and tolerances for output • Simulate for collision detection • Output	
TOTAL	**5 hours**

MBD-Based Programming	
Open NX model	A few seconds
Export NX to QIF MBD	A few seconds
Open QIF in CALYPSO	A few seconds
Select the PMI for measurement	Less than a minute
Create measurement program	2 minutes
Cleanup measurement program	5 minutes
TOTAL	**10 minutes**

97% REDUCTION IN TIME

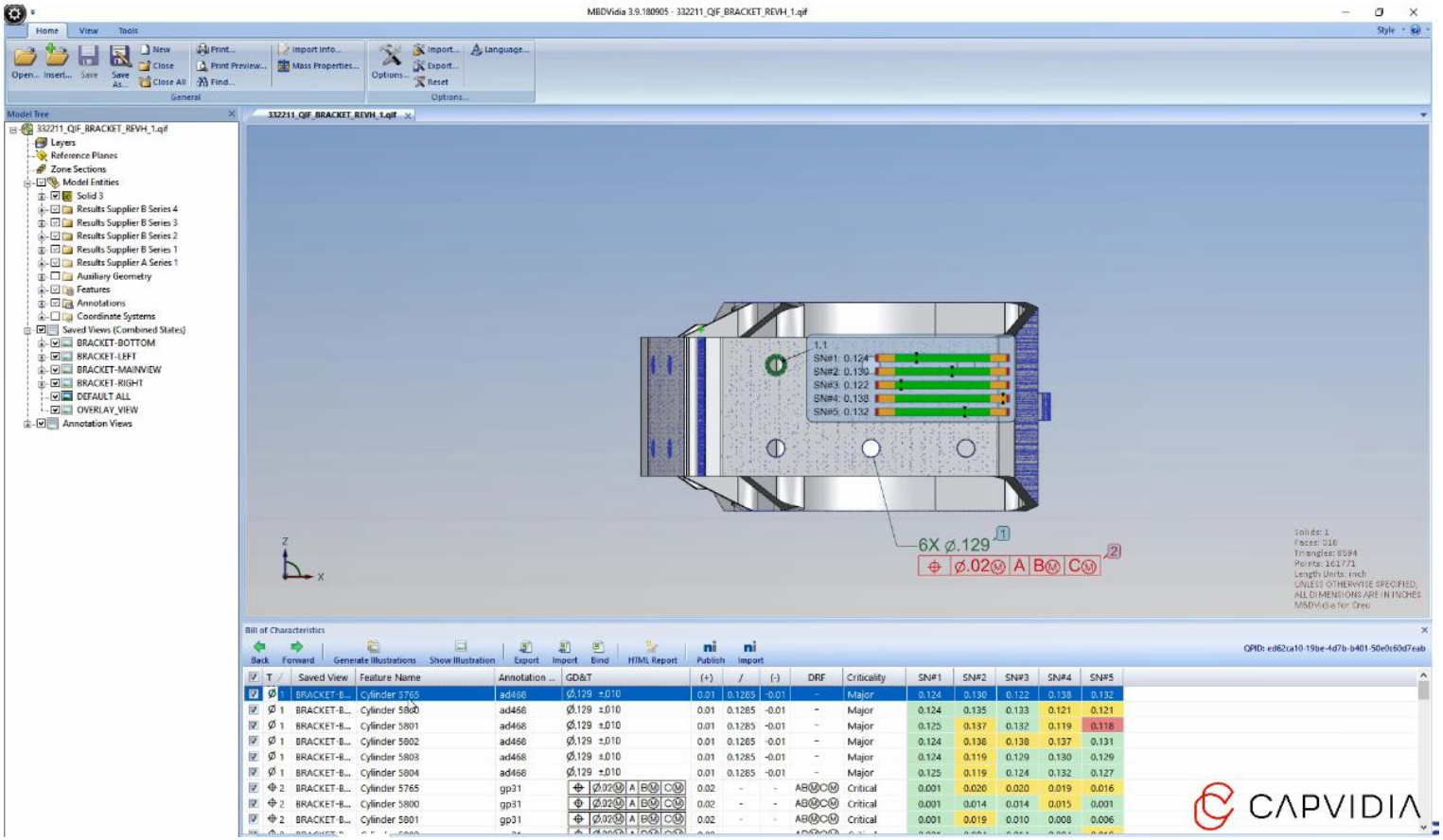
大綱

- QIF簡介
- QIF MBD品質流程
  - MBD模型準備
  - 模型驗證
  - 測量計畫準備
  - 自動化測量流程案例(CMM)
  - 測量結果分析流程案例(Laser Scanner)
- 結論



QIF MBD在雷射掃描測量應用

- QIF檔案可將模型定義傳遞至雷射掃描軟體(如SmartProfile)中，對測量結果分析與比對其幾何形狀跟尺寸是否符合設計。
- 可透過QIF檔案輸出結果給其他軟體做FAI分析。



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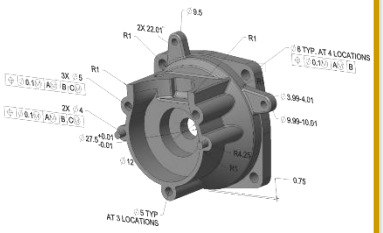
QIF – 數位品質流程



MBD(QIF MBD)
- 幾何模型與PMI定義
- 語意(Semantic)式定義
- XML架構 – 開放的檔案架構。

MBD

Input

測量計畫(QIF Plan)
- 直接採用PMI定義
- 自定義測量對象

測量資源(QIF Resources)
- 定義測量設備之精度、可測量空間範圍等性能規格

測量規則(QIF Rules)
- 定義測量方法
- 定義測量設備選用規則
- 定義測量環境條件

測量

Input

Feedback

Input

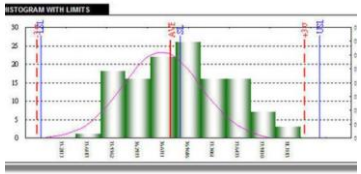
製造

Feedback

結果分析

ISO
ICS › 25 › 25.040 › 25.040.40
ISO 23952
Automation systems and integration — Quality information framework (QIF) — An integrated model of manufacturing quality information

GENERAL INFORMATION



測量結果(QIF Results)
- 可紀錄測量結果。
- 依據紀錄PMI項目、時間、來源等做分類。

統計分析(QIF Statistics)
- FAI分析
- SPC分析
- 紀錄分析結果

Thank you!