馬路科技
3D列印+3D掃描

3D光學量測
應用於MIM製程檢測

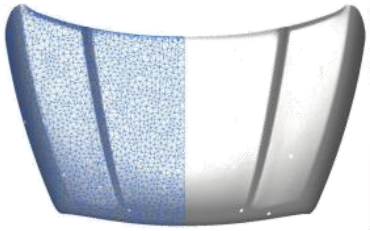
Kevin Lin 林彥宇

馬路科技顧問(股)公司簡介

馬路科技
3D列印+3D掃描

產品解決方案

馬路科技 RAT 3D列印+3D掃描

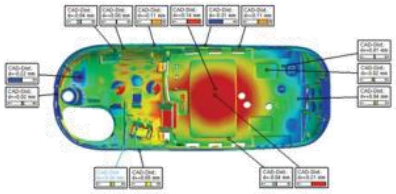


逆向工程 (RE)

- ATOS 光學掃描
- TRITOP 光學式三次元
- Imageware 逆向建面

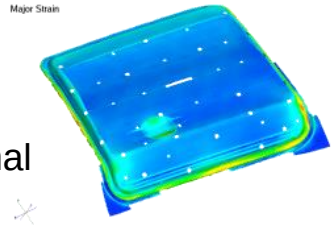
自由造型設計 (ID)

- FreeForm 觸覺式設計



電腦輔助檢測 (CAV)

- ATOS 照相式掃描
- TRITOP 光學式三次元
- GOM Inspect Professional 參數式檢測軟體



變形檢測 (Deformation)

- ARAMIS 應變分析
- ARGUS 鈑金成型性分析
- PONTOS 動態點座標量測

快速成型設備 (RP)

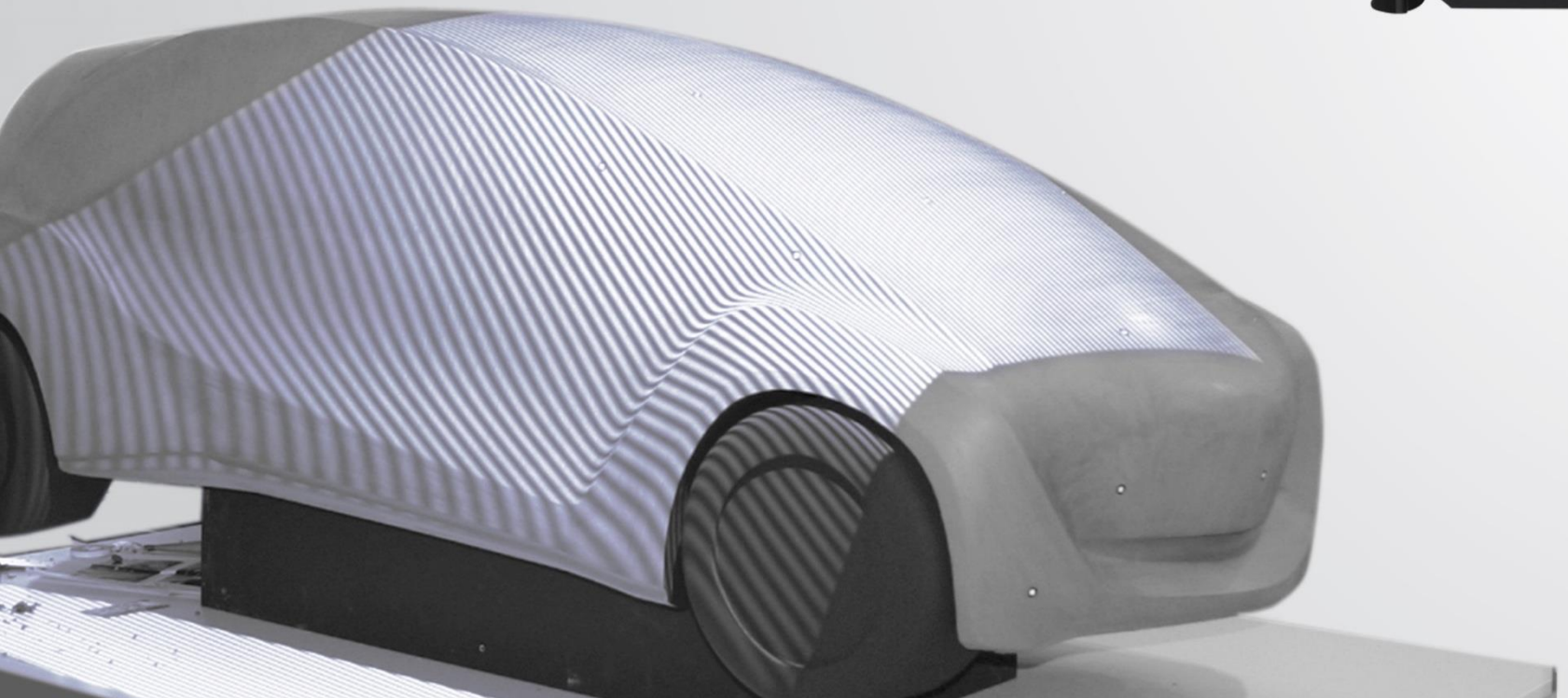
- SLA 樹脂雷射硬化成型
- SLS 粉末雷射燒結成型
- Projet 樹脂列印成型
- Zprinter 粉末列印成型

移動式三次元 (PCMM)

- FARO GAGE
- FARO ARM
- FARO Laser Tracker

3D測量系統

ATOS Core



ATOS Core 高精度3D量測系統

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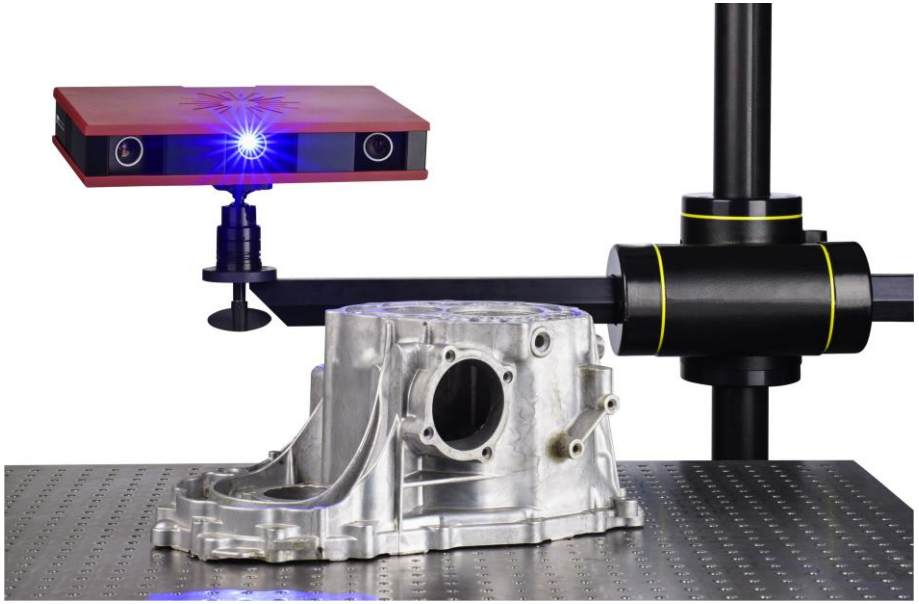
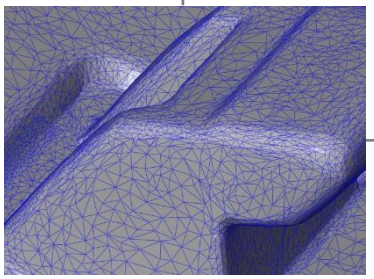
3D列印+3D掃描

- Optical 3D scanner for three-dimensional component measurement and inspection
- Any object size, surface characteristics and component complexity
- Full-field, precise 3D coordinates
- Non-contact



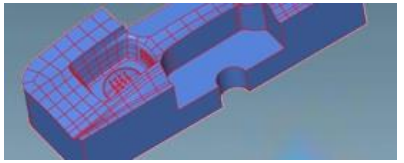
ATOS Core 高精度3D量測系統

馬路科技 RAT 3D列印+3D掃描

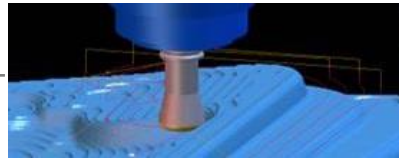


3D Mesh (STL)
High resolution for finest details
Measurement of small radii

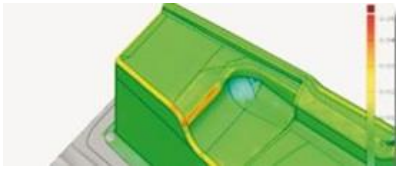
Data for follow-on processes



Additive Manufacturing



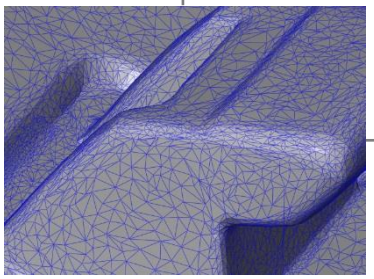
CNC Machining



Quality Control

ATOS Core 高精度3D量測系統

馬路科技 RAT 3D列印+3D掃描



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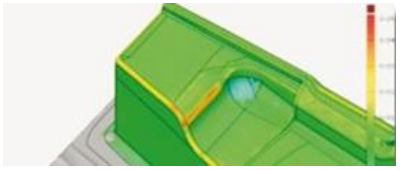

Quality Control

ATOS Core 高精度3D量測系統

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3D列印+3D掃描

Step 1
Measurement

Step 2
Evaluation

Step 3
Inspection
Report/Table

ATOS Core 高精度3D量測系統

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3D列印+3D掃描

Fringe projection supplies precise
3D coordinates for each pixel

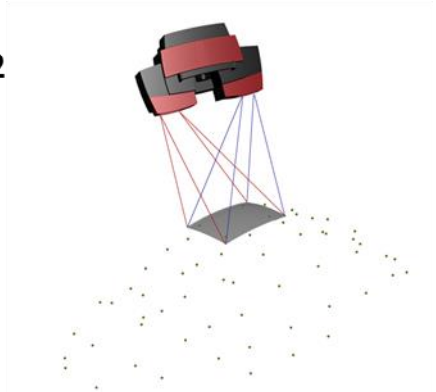
ATOS Core 高精度3D量測系統

馬路科技
3D列印+3D掃描

1

Fringe projection supplies precise
3D coordinates for each pixel

2



Approx. 2 seconds for each individual measurement of 12 million points

ATOS Core 高精度3D量測系統

馬路科技
3D列印+3D掃描

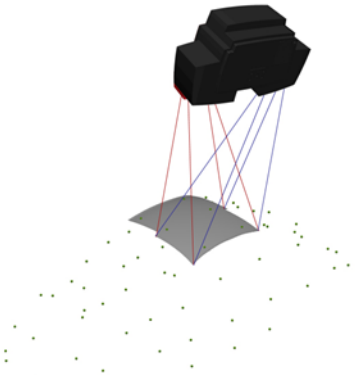
1

Fringe projection supplies precise
3D coordinates for each pixel

2

Approx. 2 seconds for each individual measurement of 12 million points

3



Measurement from different directions

ATOS Core 高精度3D量測系統

馬路科技
3D列印+3D掃描

1

Fringe projection supplies precise
3D coordinates for each pixel

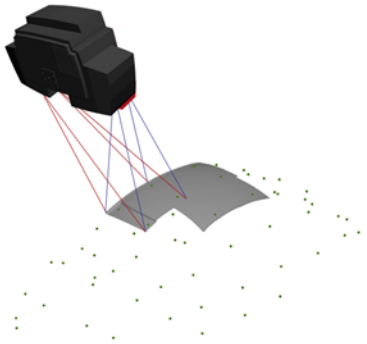
2

Approx. 2 seconds for each individual measurement of 12 million points

3

Measurement from different directions

4



Automatic transformation of single measurements

ATOS Core 高精度3D量測系統

馬路科技 RAT
3D列印+3D掃描

1

Fringe projection supplies precise
3D coordinates for each pixel

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Approx. 2 seconds for each individual measurement of 12 million points

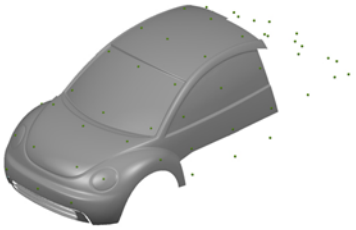
3

Measurement from different directions

4

Automatic transformation of single measurements

5



Polygonization of individual measurements to eliminate overlapping areas

ATOS Core 高精度3D量測系統

馬路科技
3D列印+3D掃描

1

Fringe projection supplies precise
3D coordinates for each pixel

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Approx. 2 seconds for each individual measurement of 12 million points

3

Measurement from different directions

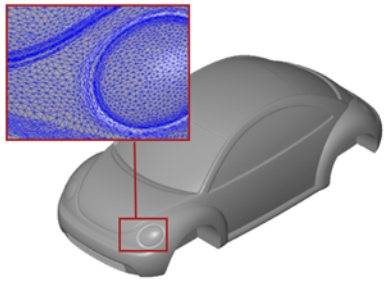
4

Automatic transformation of single measurements

5

Polygonization of individual measurements to eliminate overlapping areas

6



The result:
A complete 3D point cloud (STL triangular mesh)

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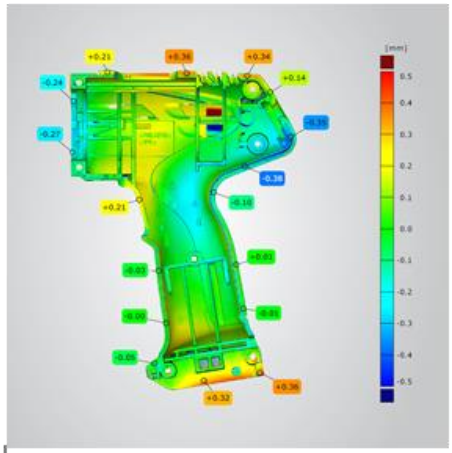
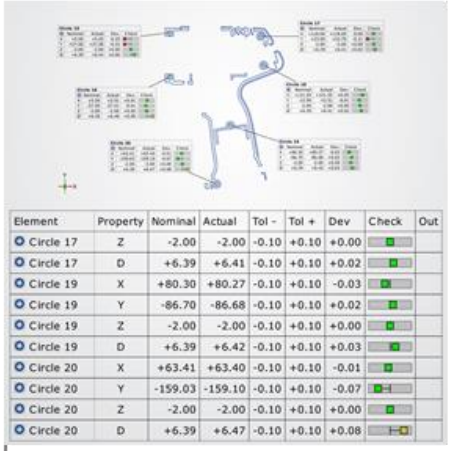
3D列印+3D掃描

Step1
Measurement



Step 2
Evaluation



Element	Property	Nominal	Actual	Tol -	Tol +	Dev	Check	Out
Circle 17	Z	-2.00	-2.00	-0.10	+0.10	+0.00		
Circle 17	D	+6.39	+6.41	-0.10	+0.10	+0.02		
Circle 19	X	+80.30	+80.27	-0.10	+0.10	-0.03		
Circle 19	Y	-86.70	-86.68	-0.10	+0.10	+0.02		
Circle 19	Z	-2.00	-2.00	-0.10	+0.10	+0.00		
Circle 19	D	+6.39	+6.42	-0.10	+0.10	+0.03		
Circle 20	X	+63.41	+63.40	-0.10	+0.10	-0.01		
Circle 20	Y	-159.03	-159.10	-0.10	+0.10	-0.07		
Circle 20	Z	-2.00	-2.00	-0.10	+0.10	+0.00		
Circle 20	D	+6.39	+6.47	-0.10	+0.10	+0.08		

Step 3
Inspection Report/Table

多樣的定位方式

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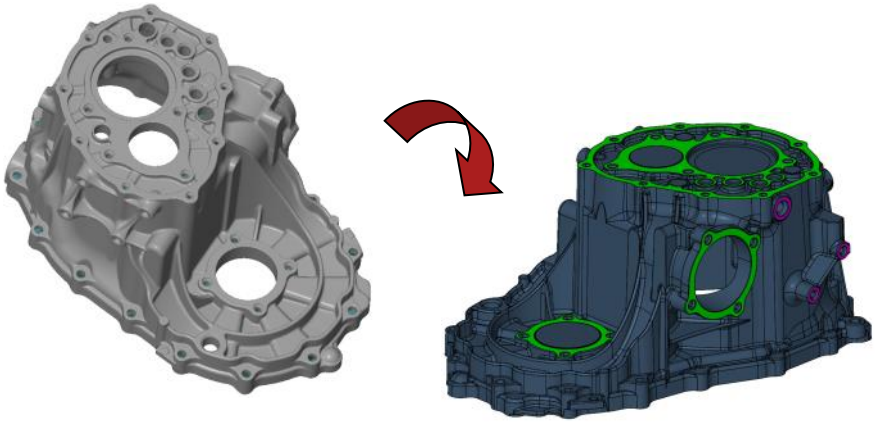
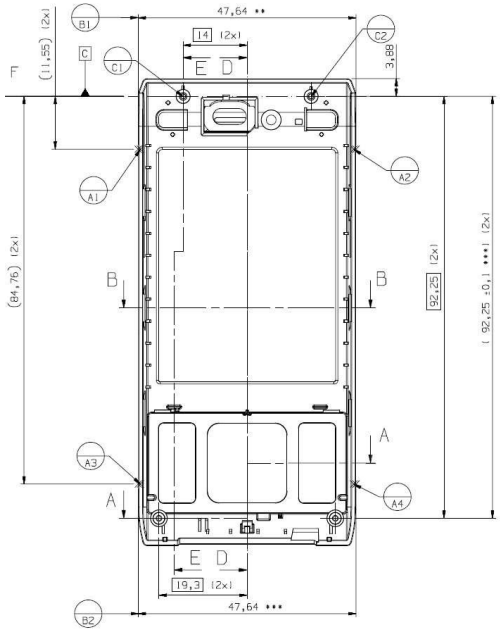
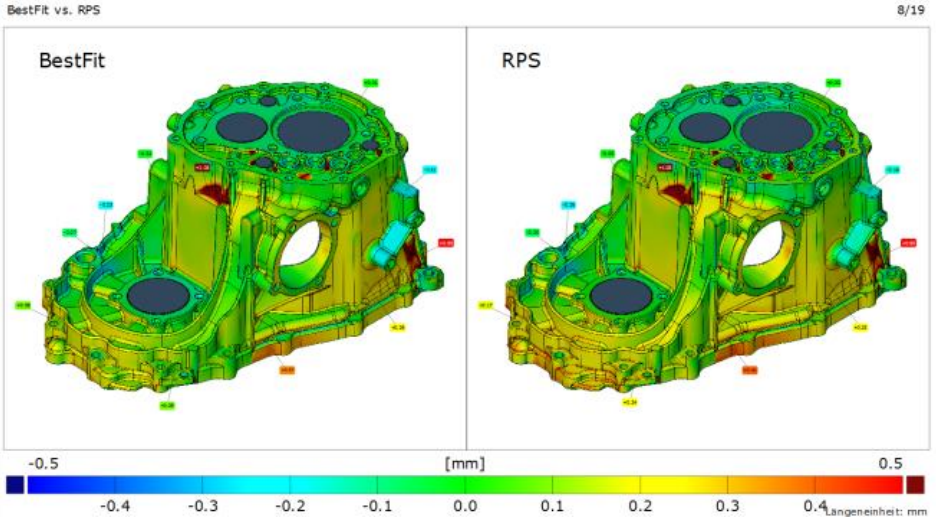
- Flexible alignment of measurement data to CAD
- Different alignment options, RPS, 3-2-1, best fit,…







分析及檢測-誤差色彩圖

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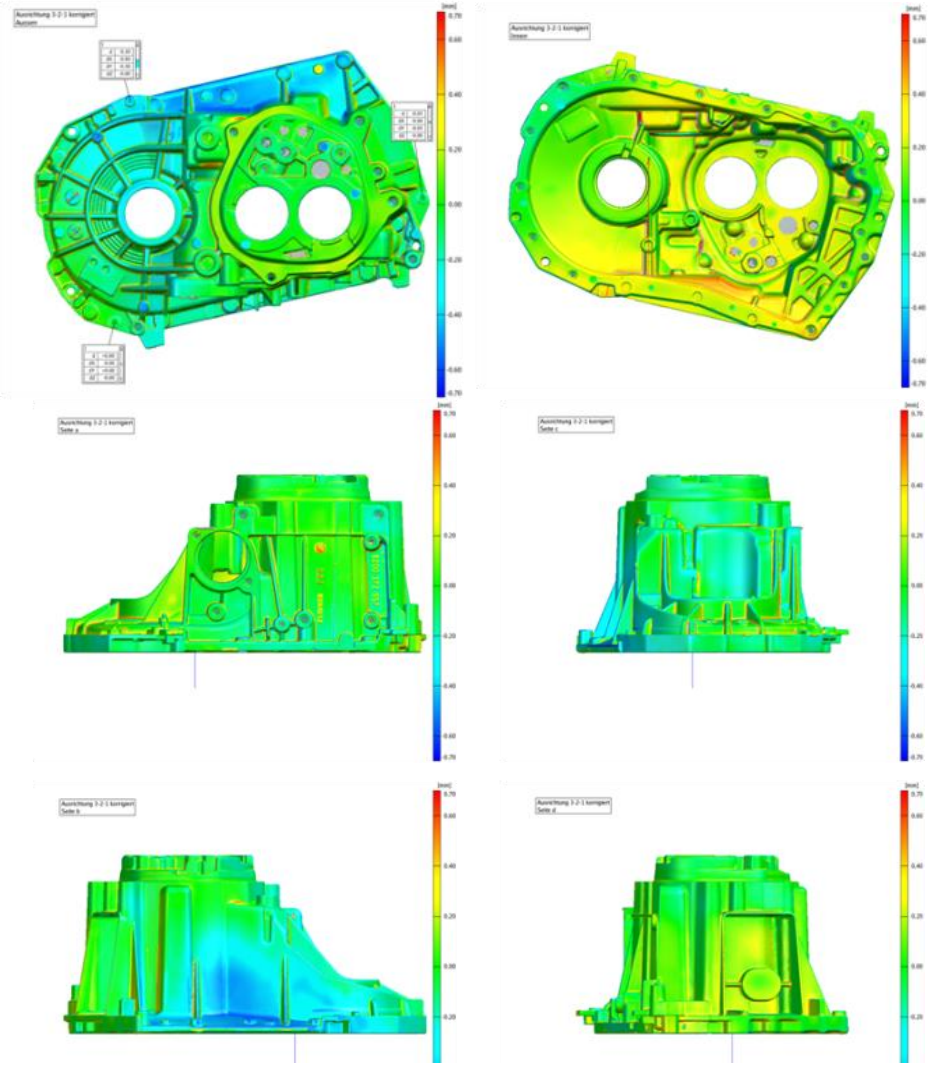
3D列印+3D掃描

- 與CAD全曲面比對誤差色彩圖
- 3D曲面及尺寸管制
- 翹曲變形
- 凸陷及縮痕
- 縮水



分析及檢測-剖面分析

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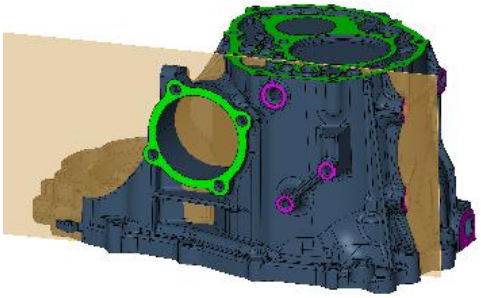
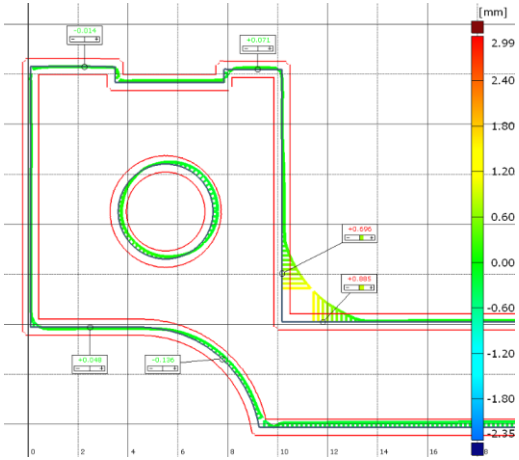
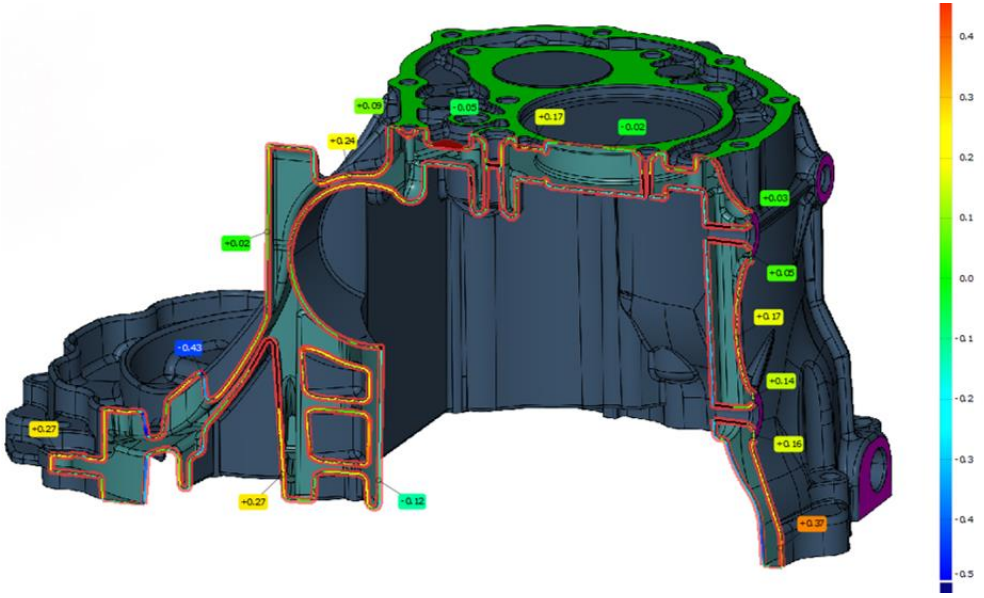
- 任意位置作2D檢測剖面
- 點資料剖與CAD剖面比對
- 剖面位置在模型顯示
- 針狀圖
- 誤差標記點
- 公差帶顯示

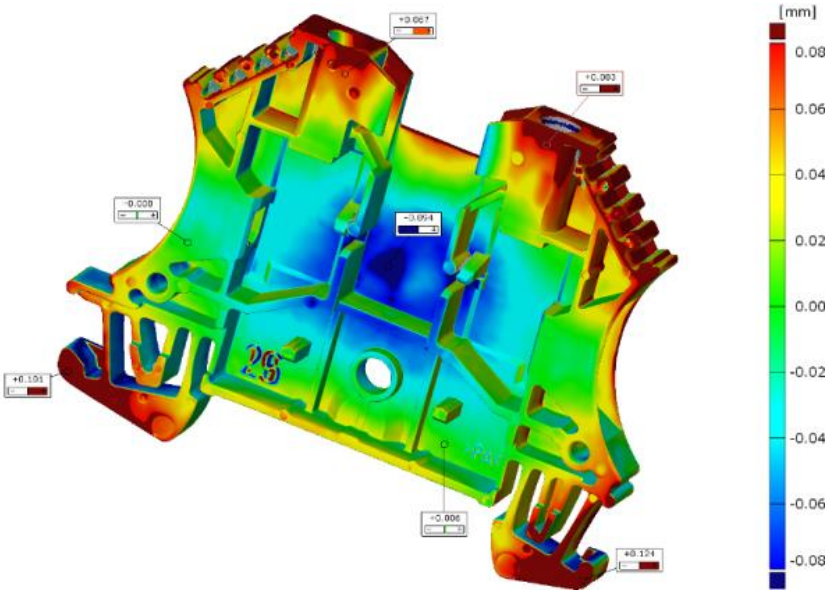


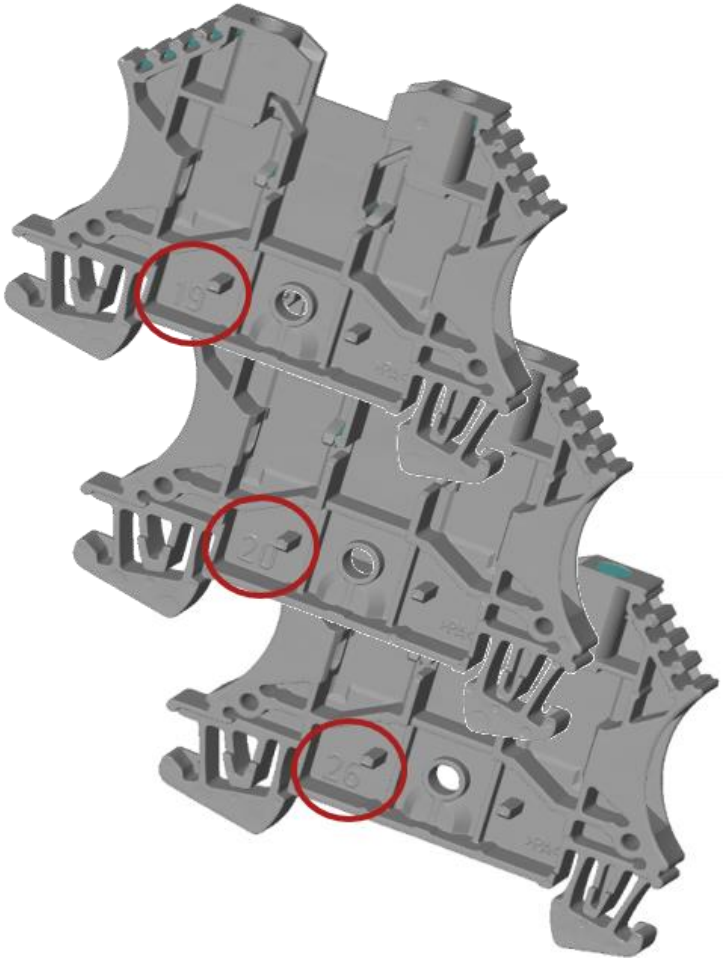




分析及檢測-點資料互相比對

- 比對不同模穴的射出件
- 比對不同供應商的零件
- 改變射出條件前後的工件比對





分析及檢測-厚度分析

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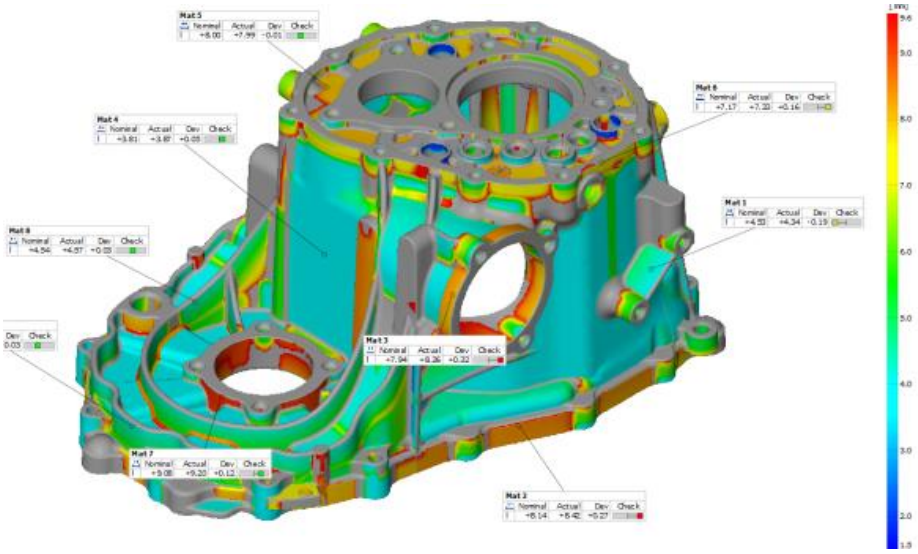
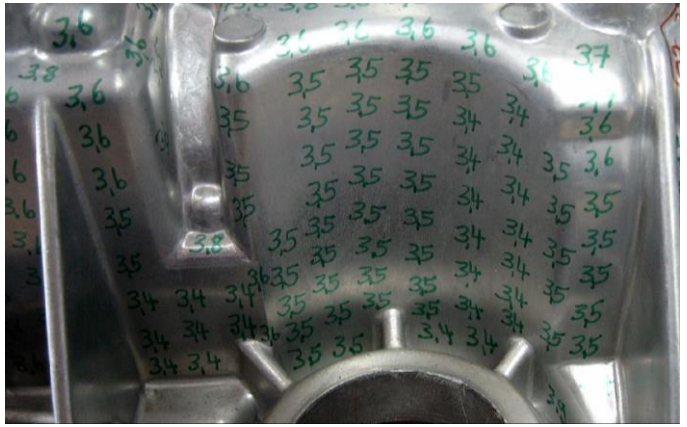
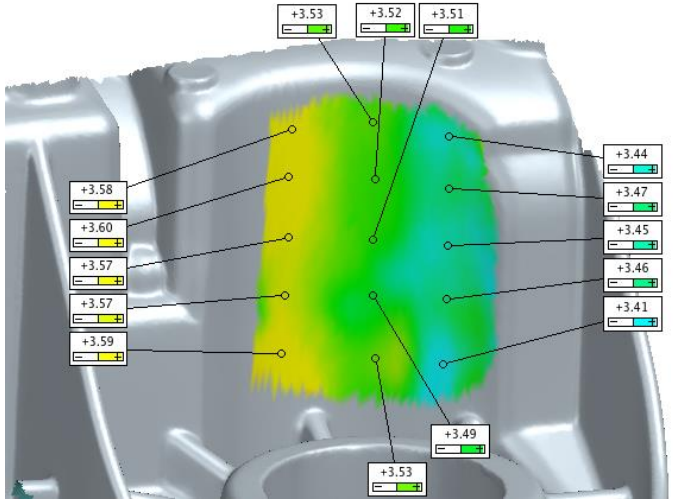
3D列印+3D掃描

- 全域的材料肉厚分析 - 識別凹陷及縮痕
  位置, 材料堆積區域, 縮孔發生位置

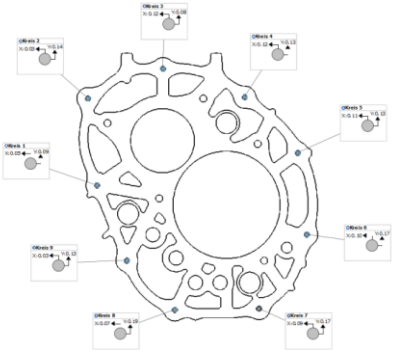


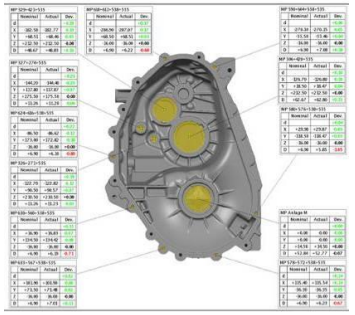


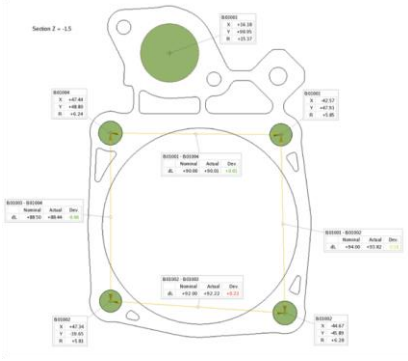


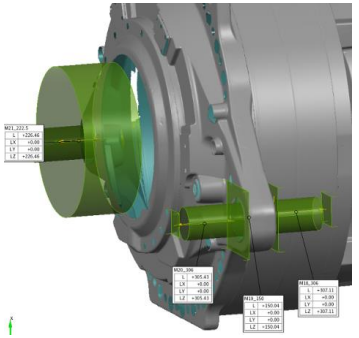
分析及檢測-尺寸量測

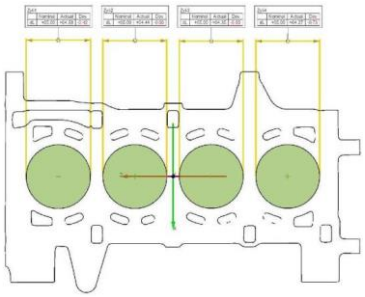
- 完整的 FAI 三次元檢測報表
  - 位置尺寸
  - 距離尺寸
  - 角度尺寸
  - 直徑尺寸
- 幾何特徵的建立
  - Best-Fit
  - Cheby-Fit
  - 手動建立
- 虛擬尺規
- 3D尺寸量測或2D剖面尺寸量測
- 自定義報表內容及格式

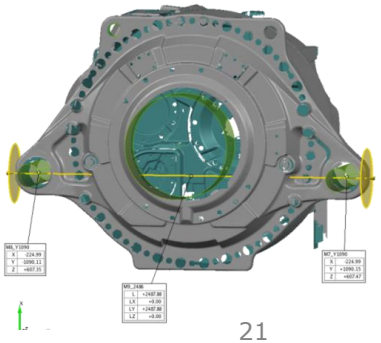








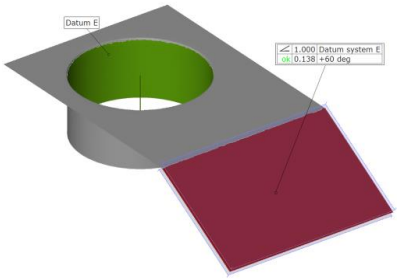


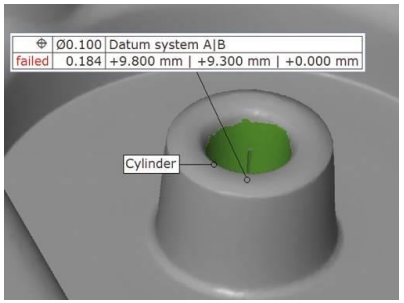


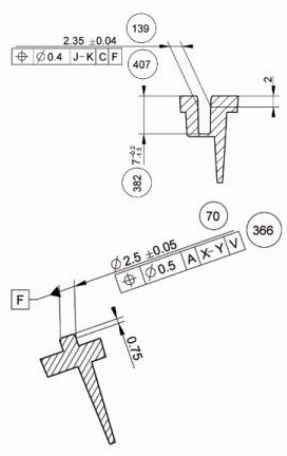
分析及檢測-幾何公差與尺寸(GD&T)

馬路科技 RAT 3D列印+3D掃描

- 在密集網格資料上依選取範圍計算 GD&T 數值而非只是由少數點計算
- 快速及自動特徵選取及擬合
- 可建立多個參考座標系
- 直覺容易解讀的視覺化GD&T量測結果顯示
- 依循 EN ISO 1101 & ASME Y 14.5 標準

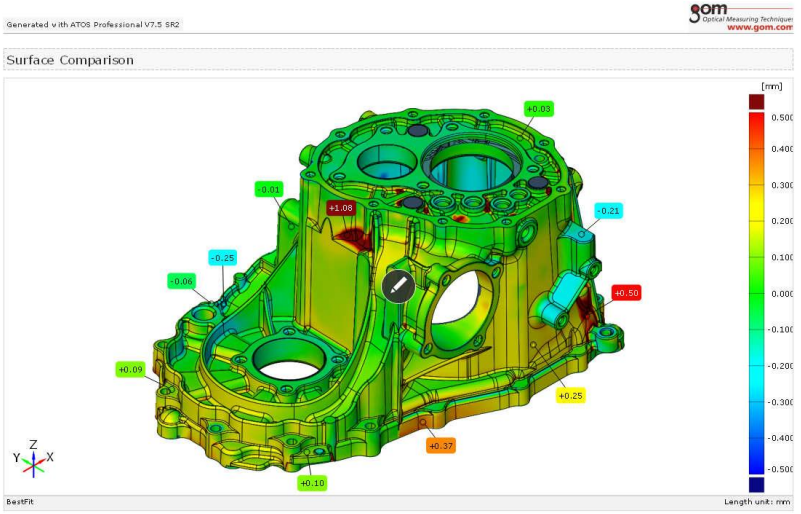


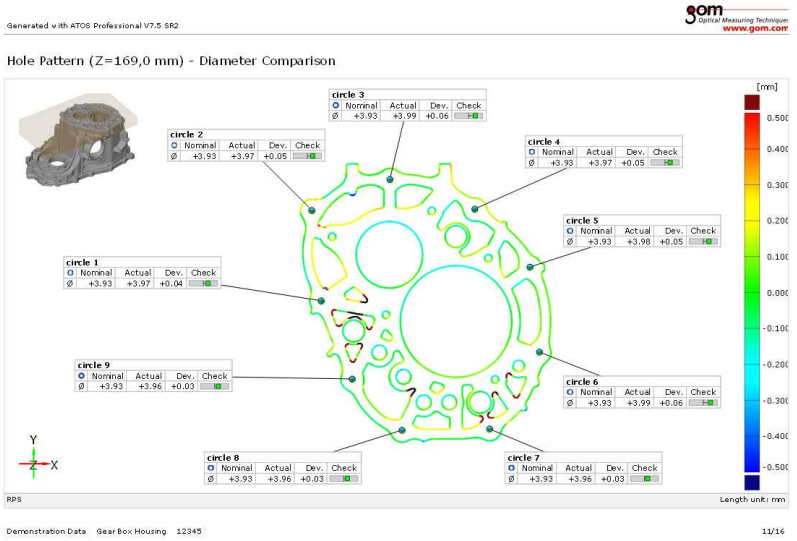




分析及檢測-檢測報表

- 建立畫面截圖或是檢測內容表單
- 容易自定義的報表內容
- 單一報表可以建立多張截圖作為比較
- 表單自動由顯示畫面或選取的物件產生
- 所有的截圖與表單與3D畫面連結並可自動更新
- 同一報表可以有多個對位方式
- 輸出 PDF 或 JPG





試模應用

成型條件檢測用於先行決定何種條件式最佳成型條件。在階段性試模後先行檢測成品, 此時不需要量測所有尺寸, 只需透過色彩圖即可分析結果, 節省量測尺寸時間。

試模條件影響

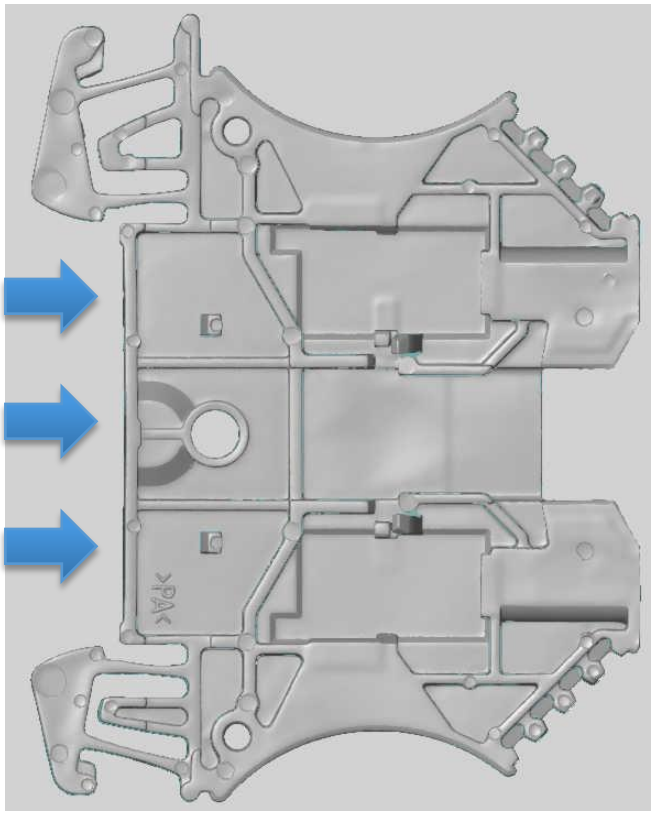
- 成型條件差異比較
- 保壓時間差異比較
- 進料點差異
- 不同模穴比較

同零件不同條件的差異分析 / 進料點差異分析

馬路科技 RAT 3D列印+3D掃描

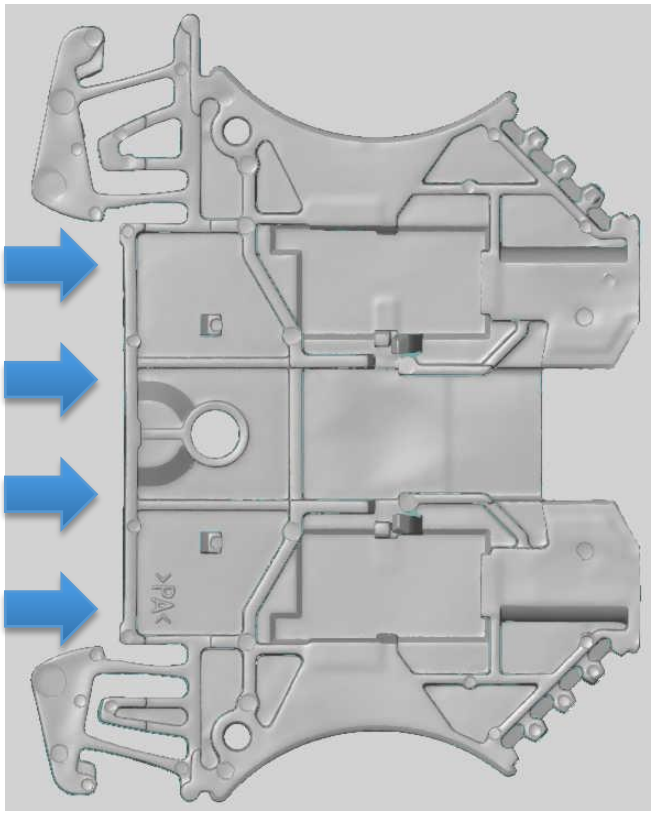
3個進料點

進料點



4個進料點

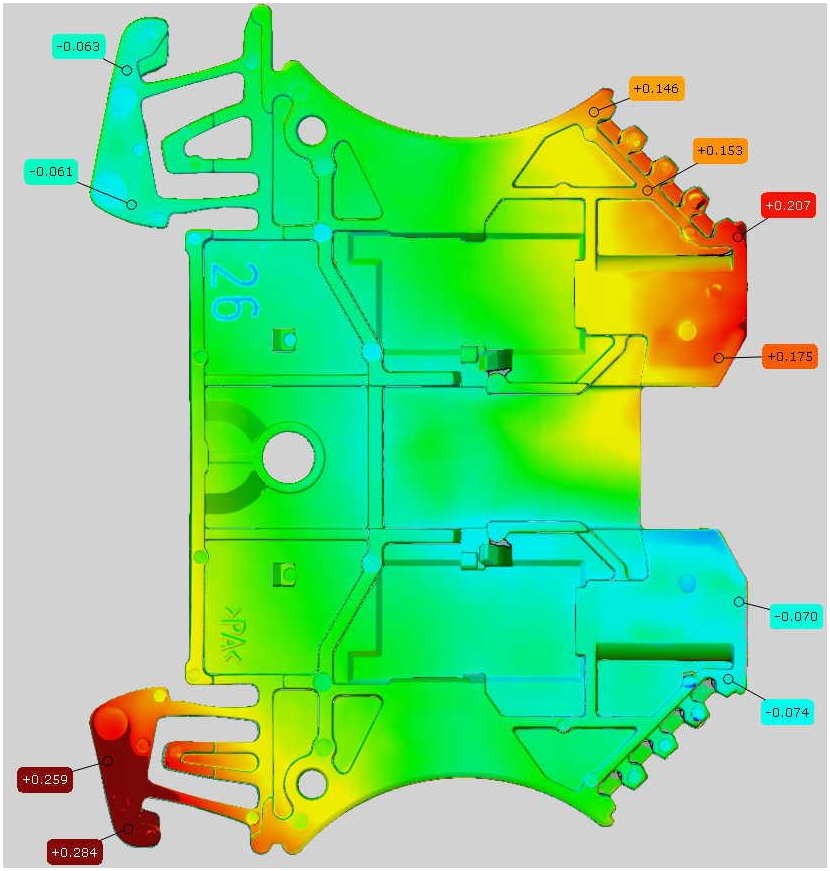
進料點



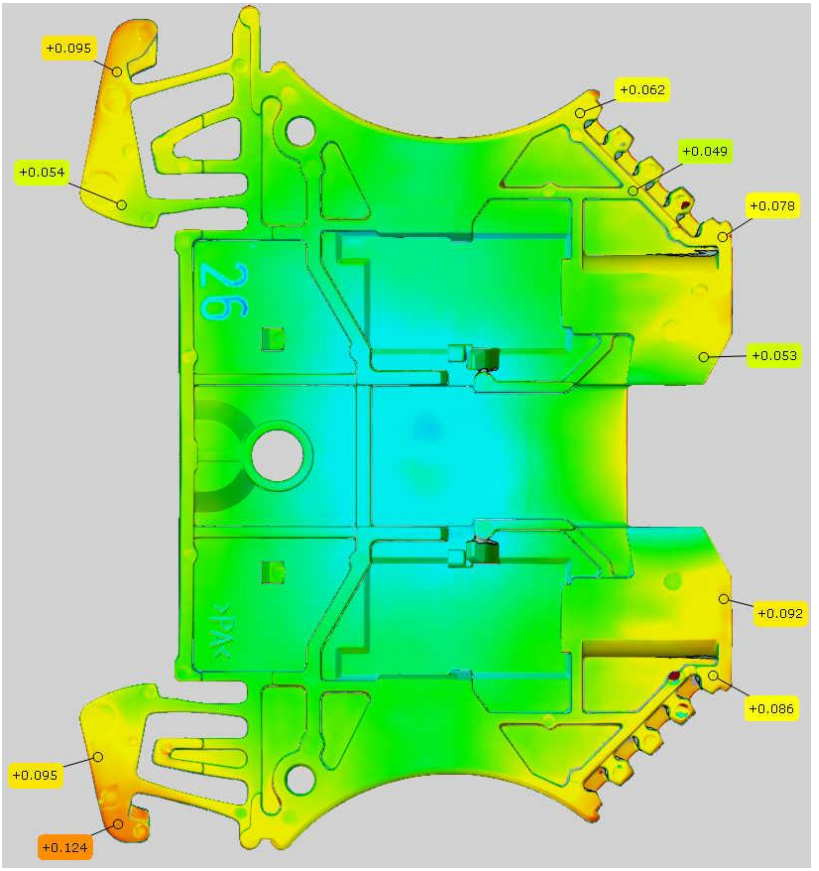
同零件不同條件的差異分析 / 進料點差異分析

馬路科技 RAT 3D列印+3D掃描

3個進料點



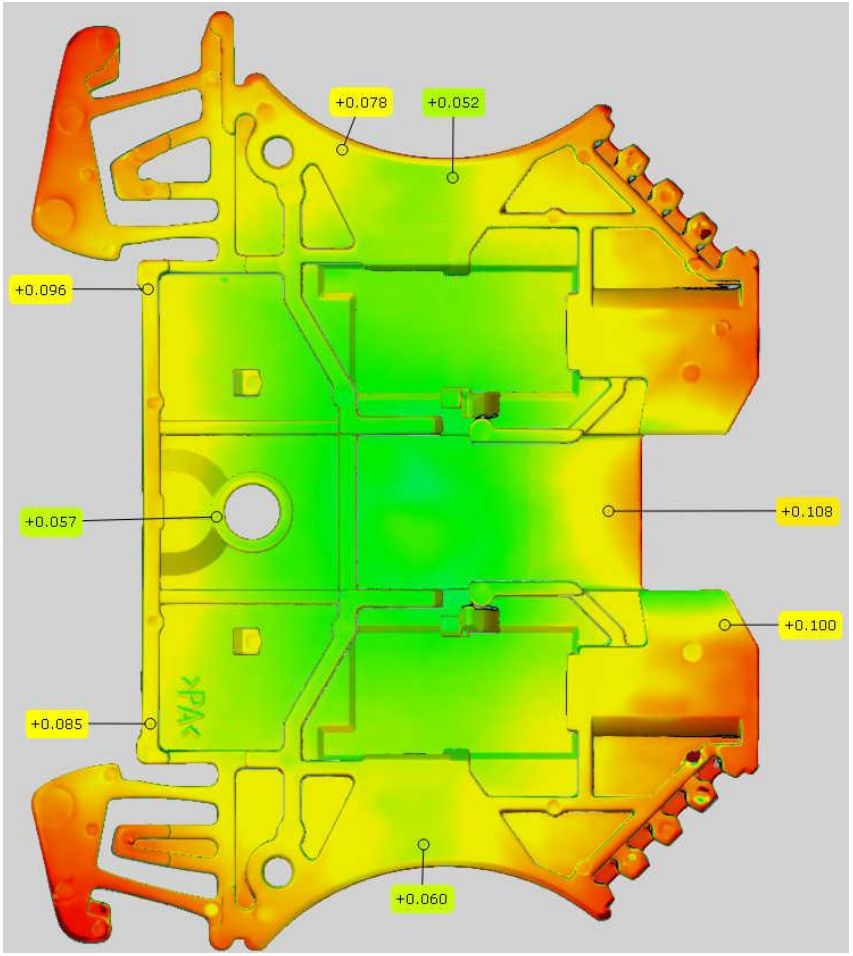
4個進料點



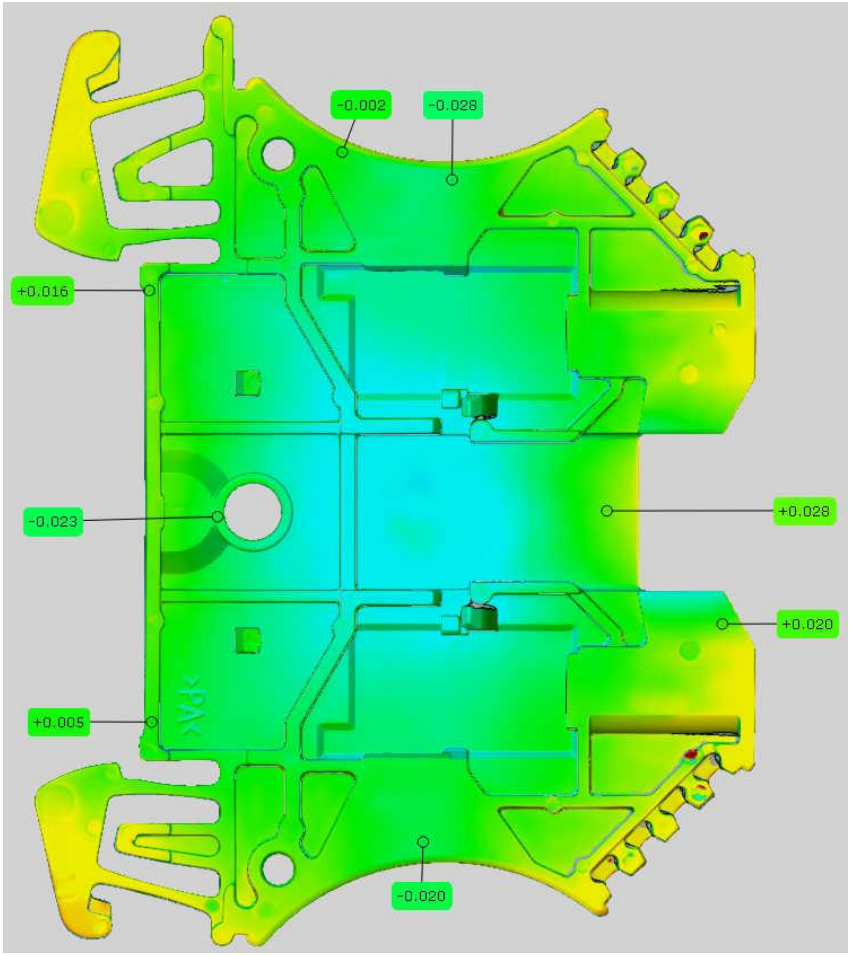
同零件不同條件的差異分析 /保壓時間差異

馬路科技
3D列印+3D掃描

條件A



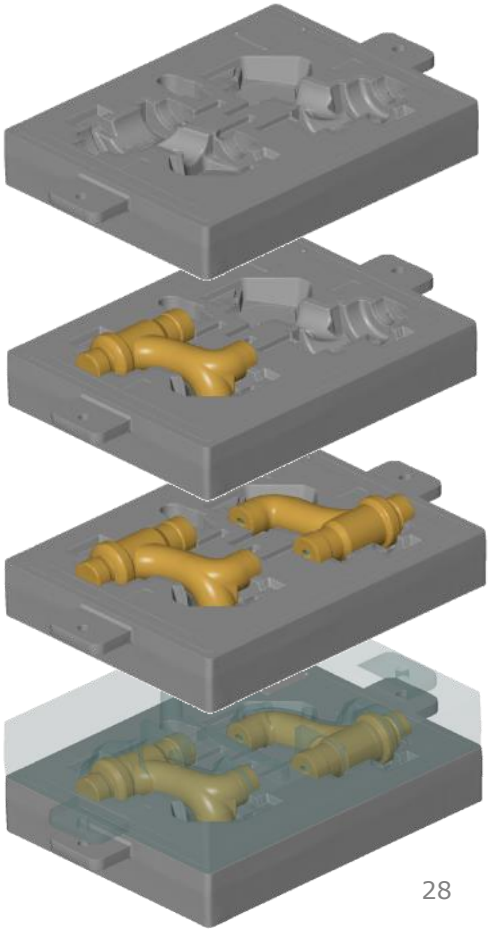
條件B



多零件虛擬裝配

馬路科技
3D列印+3D掃描

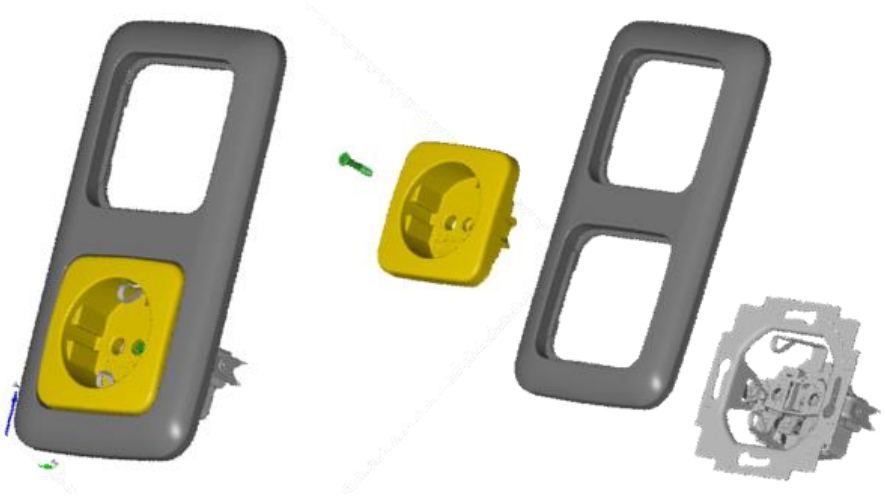
- 零件在組立狀態先量測外形及標籤點
- 各別零件拆開後進行完整掃描
- 以參考點將各別的零件對位到原先組立狀態的共同座標系

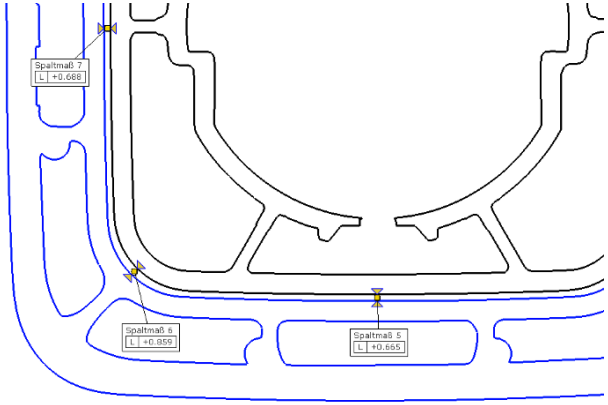


多零件虛擬裝配

馬路科技
3D列印+3D掃描

- 以虛擬尺規或距離量測作間隙分析
- 任一點資料為參考, 以誤差比對分析與對手件的間隙 (全曲面間隙色彩圖)
- 應用面向：間隙分析, 干涉分析...等



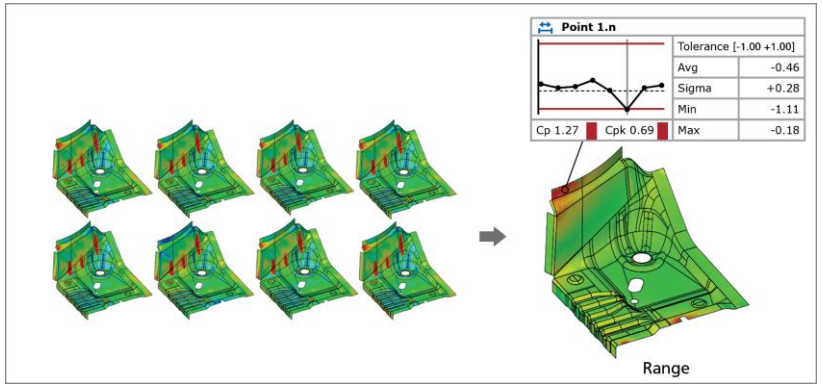


製程品質管制分析

馬路科技
3D列印+3D掃描

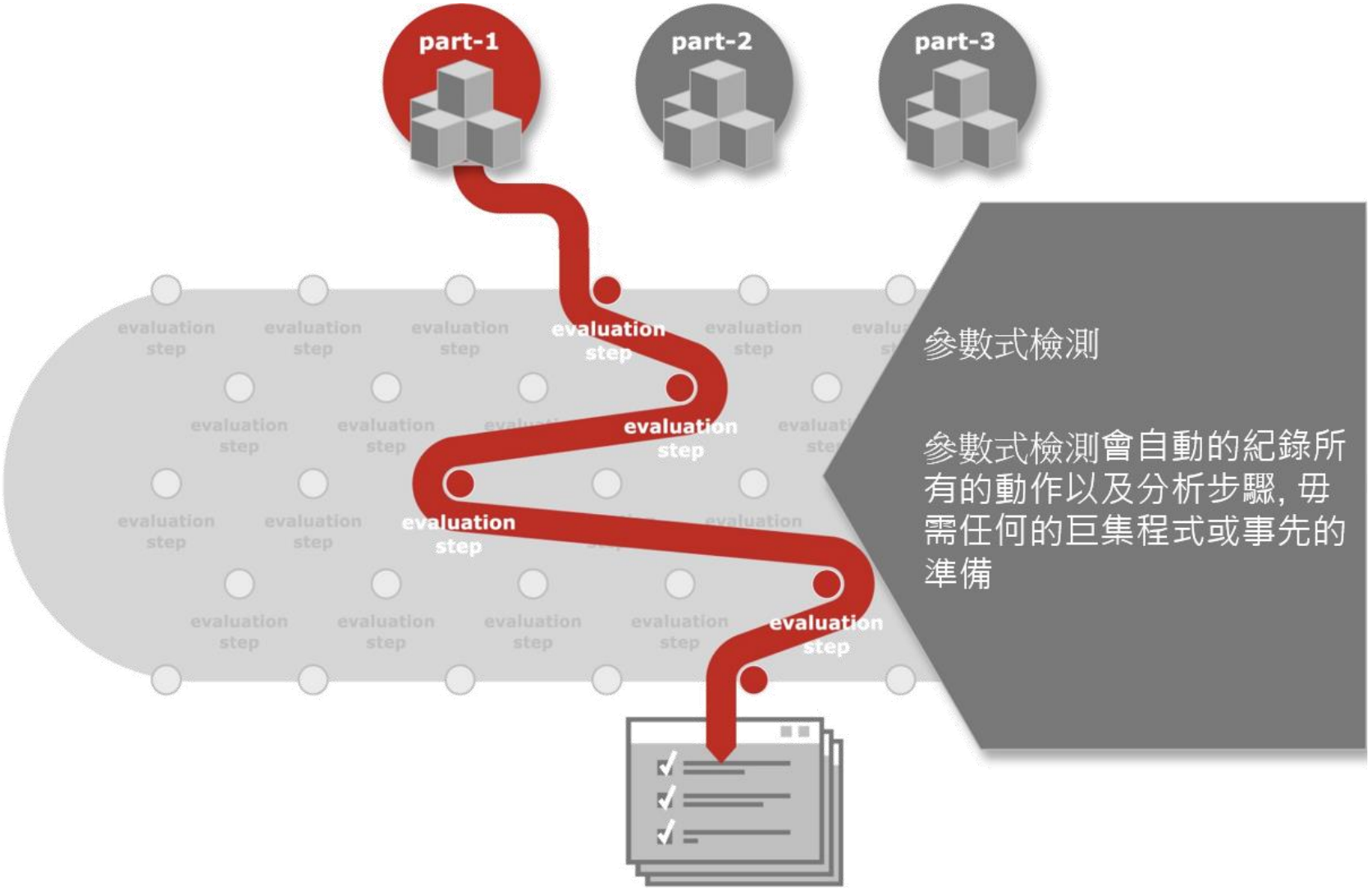
Trend analysis 趨勢分析應用

- Control Chart & Colormap
- Pp / Ppk
- Cp / Cpk
- Sigma
- Max. / Min.
- Average
- Range



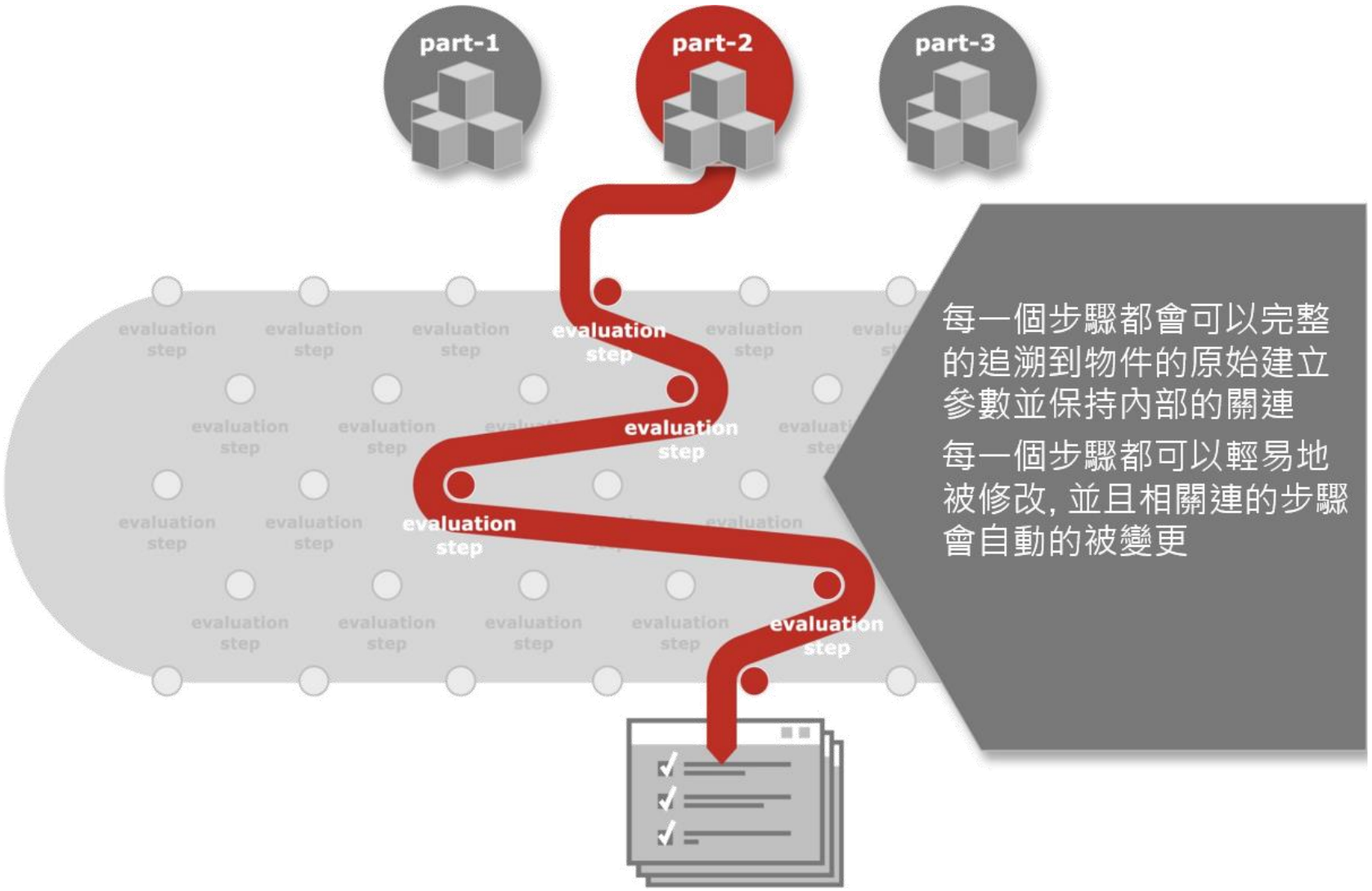
參數式檢測 (Teaching by Doing)

馬路科技
3D列印+3D掃描



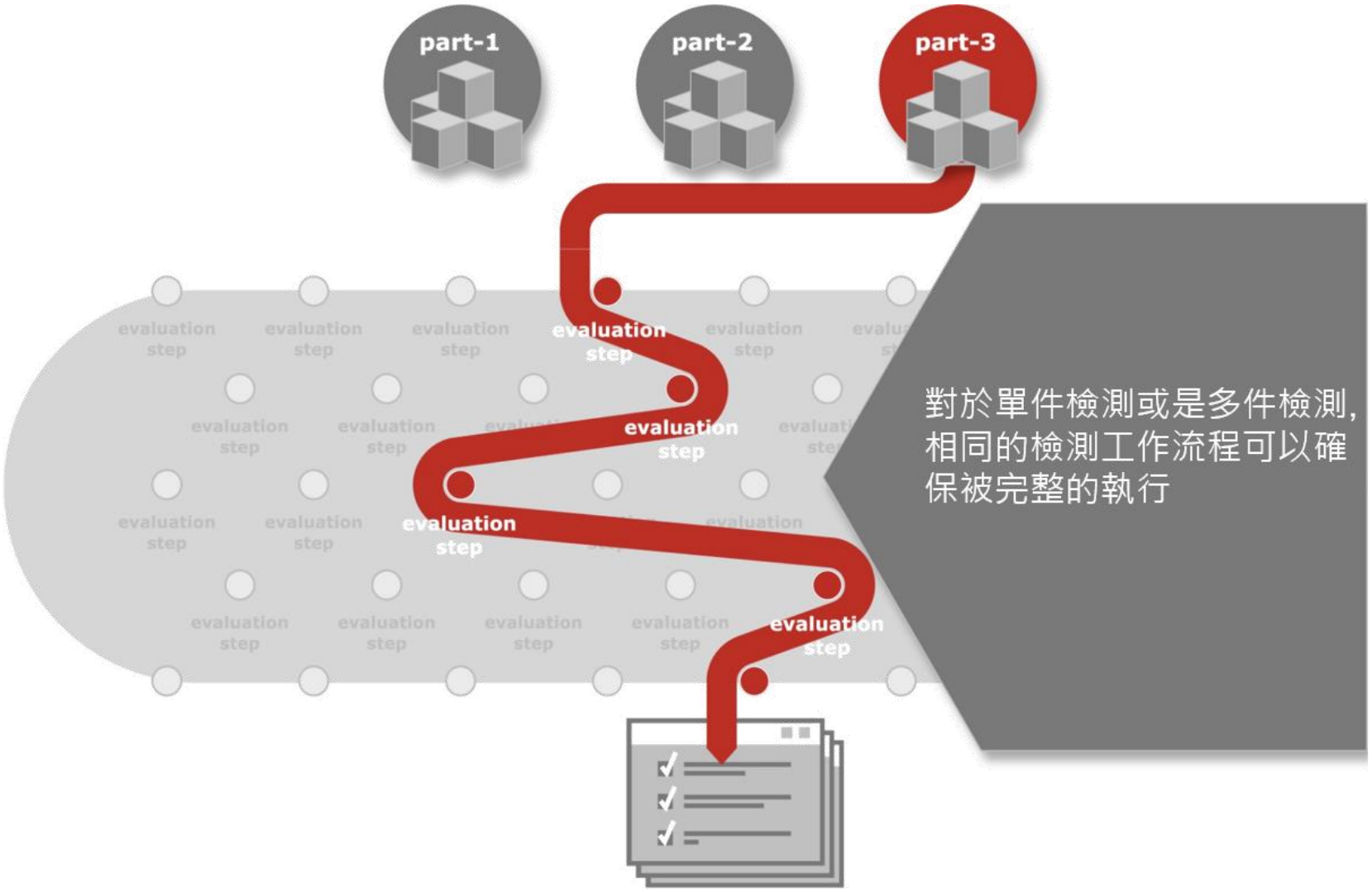
參數式檢測 (Teaching by Doing)

馬路科技
3D列印+3D掃描

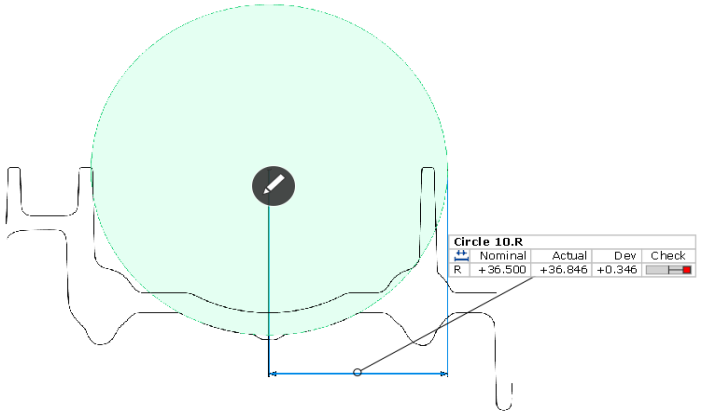


參數式檢測 (Teaching by Doing)

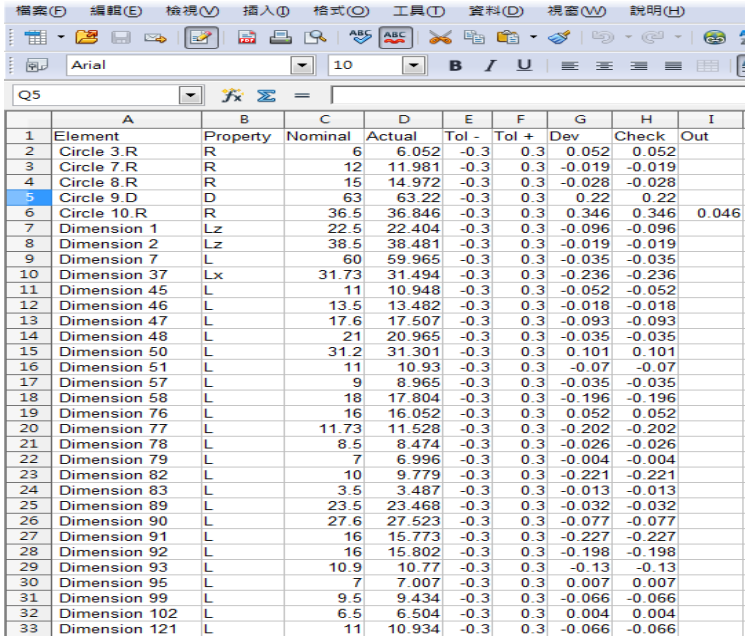
馬路科技
3D列印+3D掃描



重覆件全尺寸檢測



完全不需編輯任何程式，所有檢測內容與資料製作過程步驟，都自動記錄下來，作第二件檢測報告時，僅須導入量測資料重新更新運算，即可快速完成第二件報告。



	A	B	C	D	E	F	G	H	I
1	Element	Property	Nominal	Actual	Tol -	Tol +	Dev	Check	Out
2	Circle 3.R	R	6	6.052	-0.3	0.3	0.052	0.052	
3	Circle 7.R	R	12	11.981	-0.3	0.3	-0.019	-0.019	
4	Circle 8.R	R	15	14.972	-0.3	0.3	-0.028	-0.028	
5	Circle 9.D	D	63	63.22	-0.3	0.3	0.22	0.22	
6	Circle 10.R	R	36.5	36.846	-0.3	0.3	0.346	0.346	0.046
7	Dimension 1	Lz	22.5	22.404	-0.3	0.3	-0.096	-0.096	
8	Dimension 2	Lz	38.5	38.481	-0.3	0.3	-0.019	-0.019	
9	Dimension 7	L	60	59.965	-0.3	0.3	-0.035	-0.035	
10	Dimension 37	Lx	31.73	31.494	-0.3	0.3	-0.236	-0.236	
11	Dimension 45	L	11	10.948	-0.3	0.3	-0.052	-0.052	
12	Dimension 46	L	13.5	13.482	-0.3	0.3	-0.018	-0.018	
13	Dimension 47	L	17.6	17.507	-0.3	0.3	-0.093	-0.093	
14	Dimension 48	L	21	20.965	-0.3	0.3	-0.035	-0.035	
15	Dimension 50	L	31.2	31.301	-0.3	0.3	0.101	0.101	
16	Dimension 51	L	11	10.93	-0.3	0.3	-0.07	-0.07	
17	Dimension 57	L	9	8.965	-0.3	0.3	-0.035	-0.035	
18	Dimension 58	L	18	17.804	-0.3	0.3	-0.196	-0.196	
19	Dimension 76	L	16	16.052	-0.3	0.3	0.052	0.052	
20	Dimension 77	L	11.73	11.528	-0.3	0.3	-0.202	-0.202	
21	Dimension 78	L	8.5	8.474	-0.3	0.3	-0.026	-0.026	
22	Dimension 79	L	7	6.996	-0.3	0.3	-0.004	-0.004	
23	Dimension 82	L	10	9.779	-0.3	0.3	-0.221	-0.221	
24	Dimension 83	L	3.5	3.487	-0.3	0.3	-0.013	-0.013	
25	Dimension 89	L	23.5	23.468	-0.3	0.3	-0.032	-0.032	
26	Dimension 90	L	27.6	27.523	-0.3	0.3	-0.077	-0.077	
27	Dimension 91	L	16	15.773	-0.3	0.3	-0.227	-0.227	
28	Dimension 92	L	16	15.802	-0.3	0.3	-0.198	-0.198	
29	Dimension 93	L	10.9	10.77	-0.3	0.3	-0.13	-0.13	
30	Dimension 95	L	7	7.007	-0.3	0.3	0.007	0.007	
31	Dimension 99	L	9.5	9.434	-0.3	0.3	-0.066	-0.066	
32	Dimension 102	L	6.5	6.504	-0.3	0.3	0.004	0.004	
33	Dimension 121	L	11	10.934	-0.3	0.3	-0.066	-0.066	

優點：

- 無需透過程式編寫, 來達成自動化
- 所有量測內容均相同
- 檢測報告可直接輸出Excel檔, 與廠內FAI表格整合
- 大幅提升量測效率

ATOS Core 高精度3D量測系統

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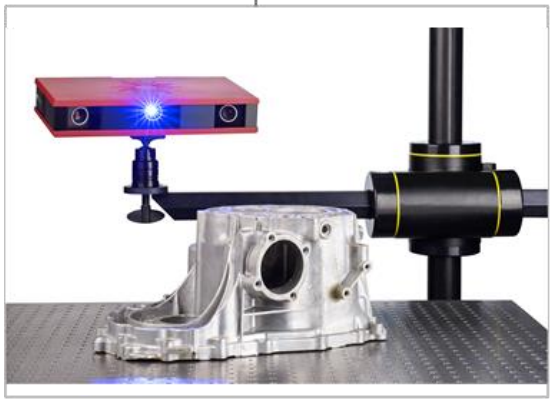
3D列印+3D掃描

One sensor head | modular design | easy setup



Mobile Measurement System

Stationary System

Automated Measuring Cell

ATOS Core 高精度3D量測系統

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- Automated 3D measuring technique
- Mobile standard coordinate measurement machines
- For various part sizes and applications

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Thank you for your attention.

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