

# Shop floor metrology and process data

- critical enablers for smart manufacturing

**RENISHAW**  
apply innovation™



**Paul Maxted**  
Director of Industrial Metrology Applications  
Renishaw plc



# Global manufacturing challenges and opportunities...

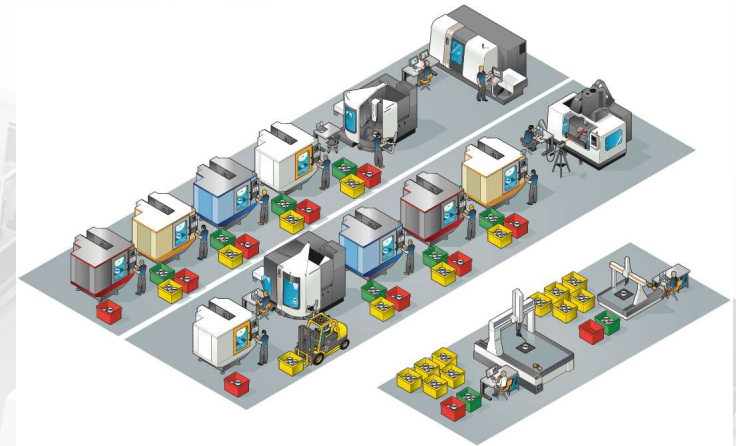
- More CNC automation – increased utilisation, reduced labour
- Skills shortages – availability of traditionally skilled people
- Cost effective reshoring and flexible, resilient supply chains
- Digitalisation – technology and software across manufacturing (Industry 4.0)
- Reduced product life cycles, frequent design iterations and efficiency
- More focus on sustainability, reuse and environmental impact of manufacturing...

...These will drive the Metrology requirements for future factories.

# Bringing metrology to the shop floor

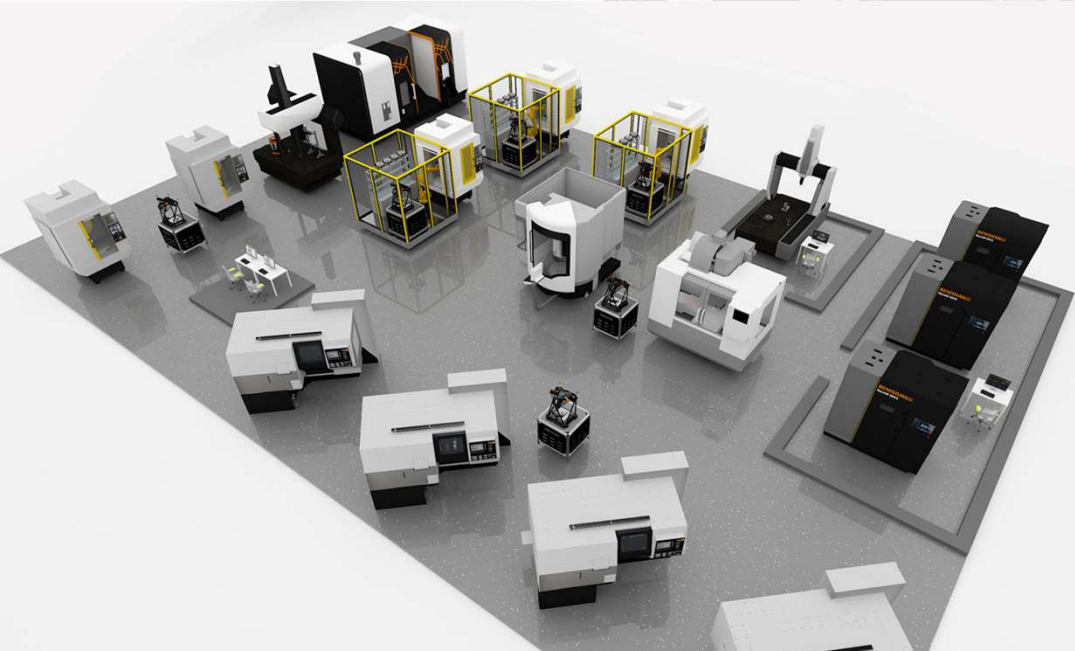
## A Traditional CNC factory

- Remote Quality function
- Delays in availability of measurement data
- Low productivity / infrequent measurements
- Quality blindspots
- Skilled interpretation for process control
- Manual intervention & update
- Barrier to full automation of CNC processes





# Bringing metrology to the shop floor

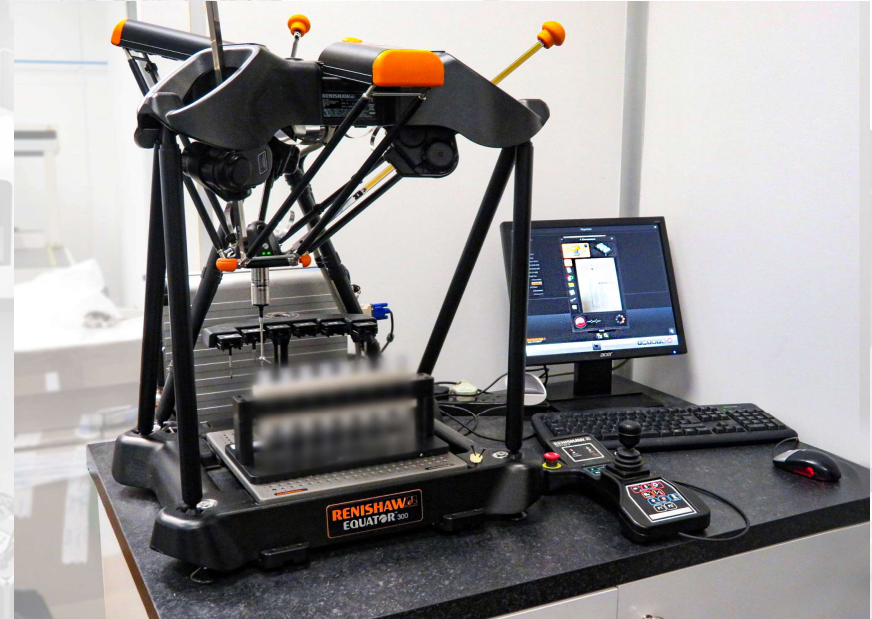


## Smart factory

- Point of manufacture measurements
- Real time, closed loop feedback
- Quicker response & control
- Fewer quality issues
- Automated process – less skills
- Metrology enabled automation
- Higher productivity



# Integrating metrology in CNC processes



Machine setting

Tool setting

Part setting

Tool  
breakage  
detection

On machine  
measurement

Off machine  
measurement

Tracking and  
control

Adjust tooling

# Automation of CNC manufacturing



Factory automation reduces manual loading and part handling activities...



Integrated metrology automates remaining manual processes...

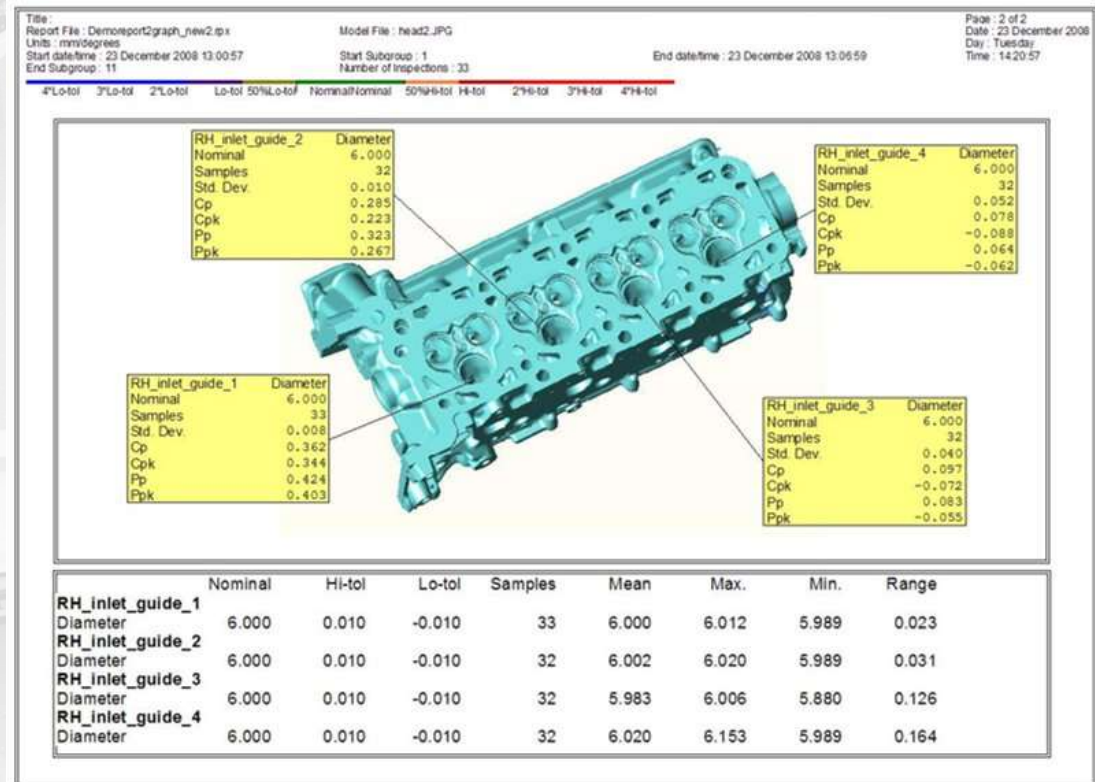




# Metrology for quality control

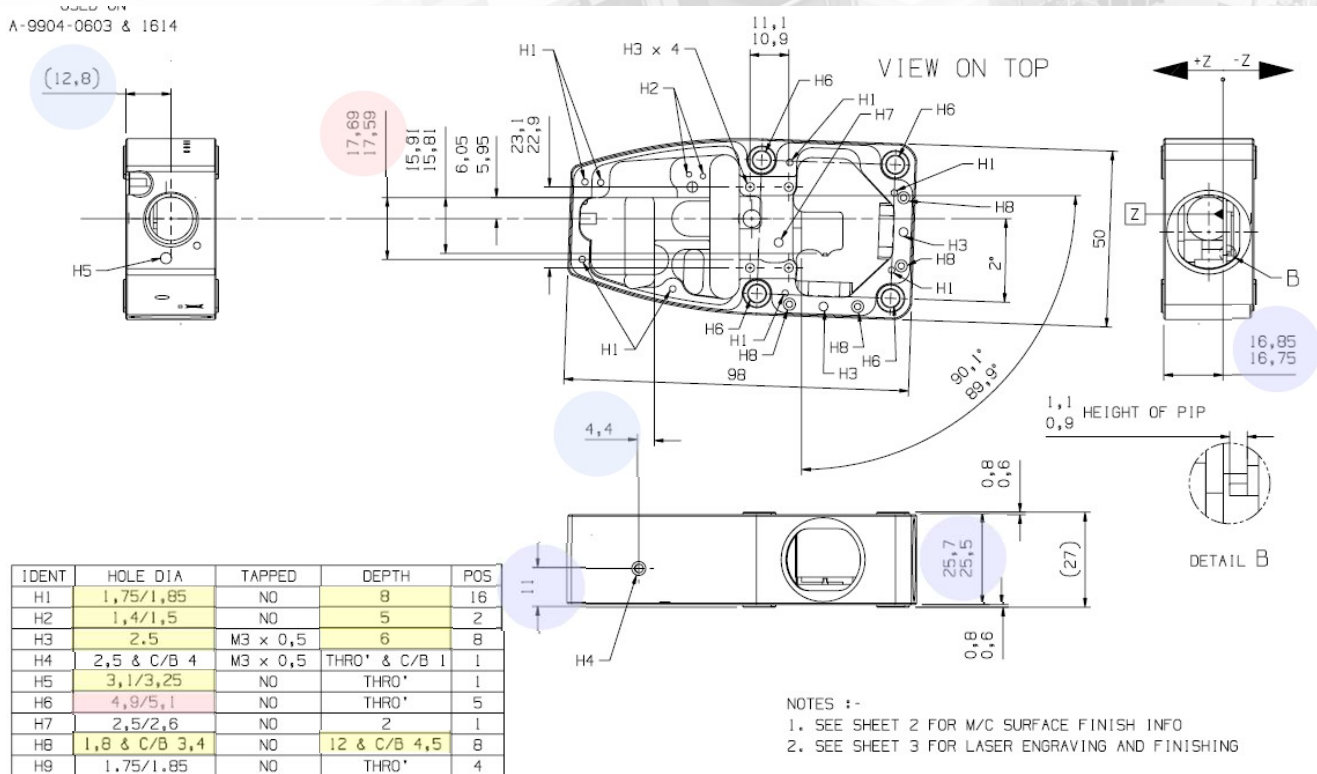
## Quality control

- All dimensions and tolerances on model / drawing
- Manufacturing method unknown
- Mandatory in some industries
- Often in remote inspection room
- After the part has been completed
- Delayed results and action



# Metrology for process control

WELD ON  
A-9904-0603 & 1614

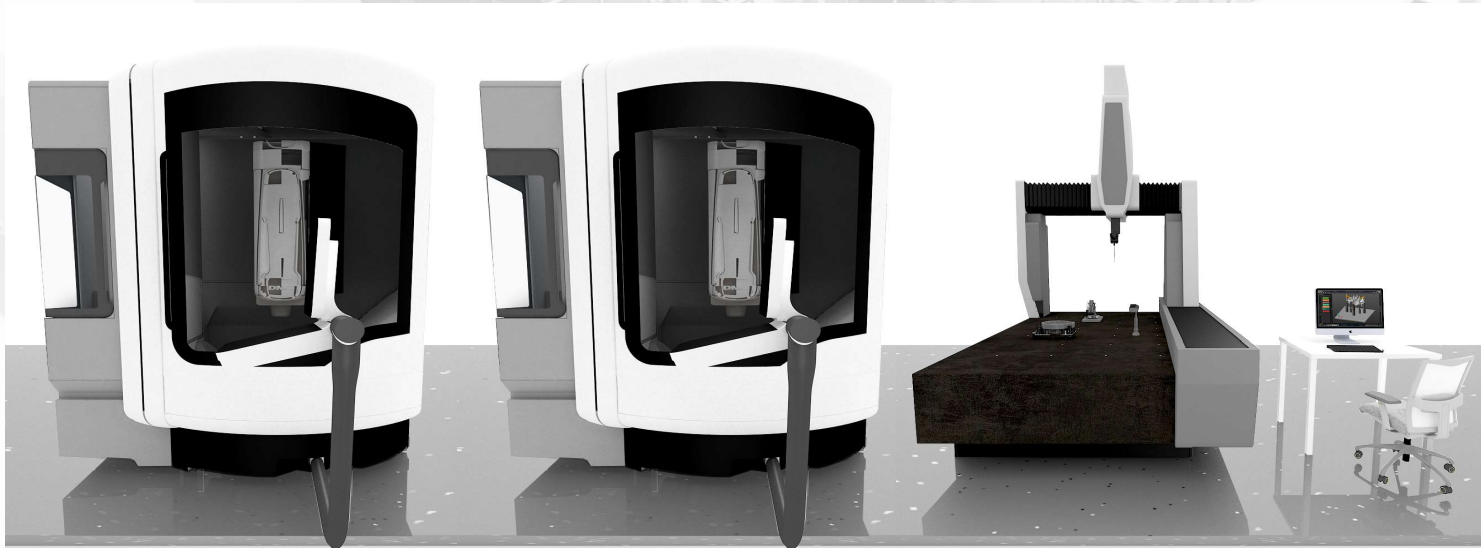


## Process control

- Limited number of dimensions have impact on a CNC process
- Tool offsets
- Work offsets
- Tool performance (size, position)
- Immediate action on data
- Point of manufacture metrology



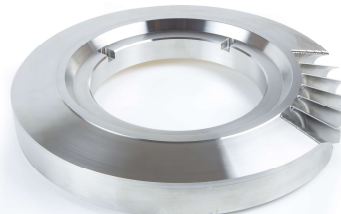
# Manufacturing process data



Part  
information

Conformance

Process  
outcomes



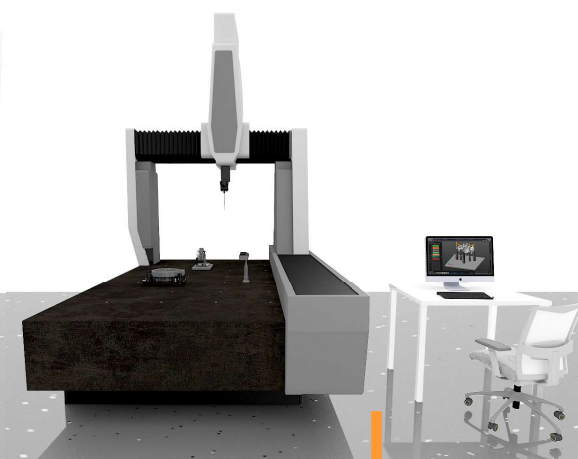
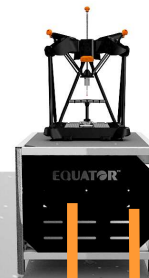
# Manufacturing process data



Current  
status

Machine  
performance

Job  
performance



Device / machine  
information

Post process  
information

In-process  
information

Pre-process  
information

In-process  
information

Part information

In-process  
information

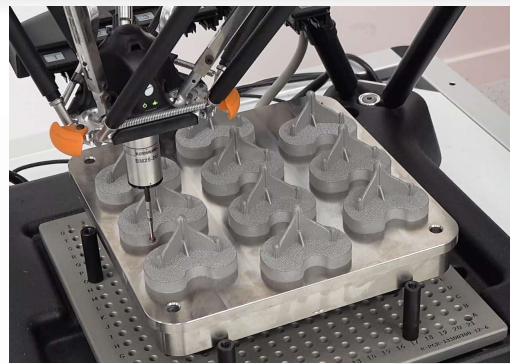
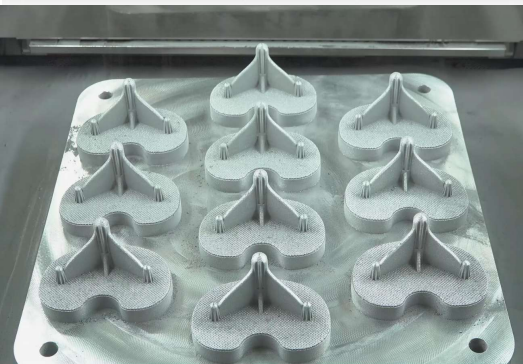
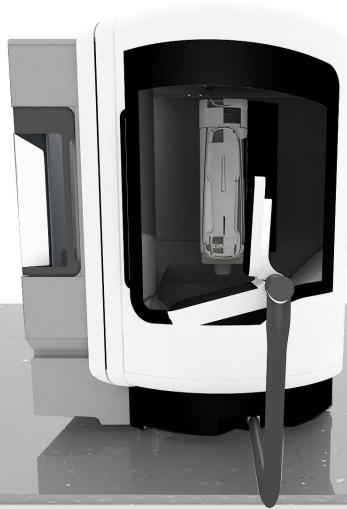
Pre-process  
information

Post process  
information

Device / machine  
information

Device / machine  
information

# End to end process and quality data...





# Process and design optimisation...

