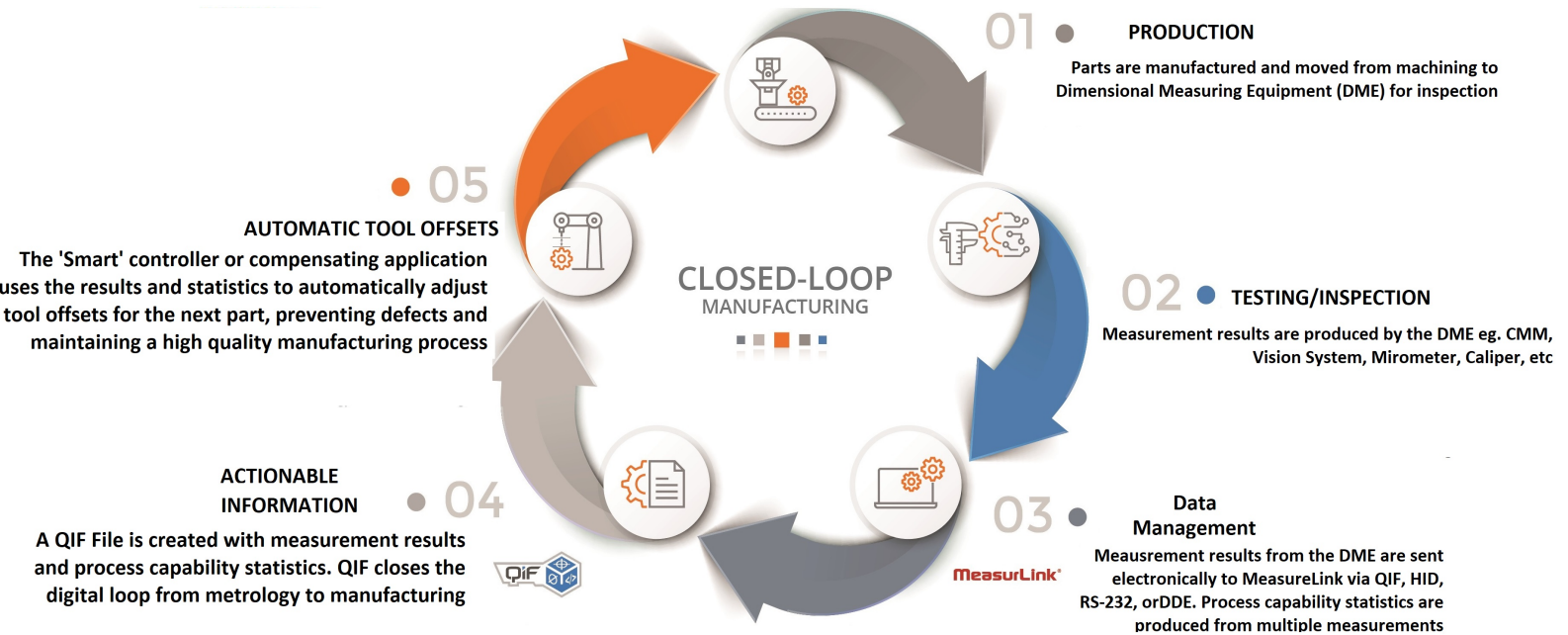
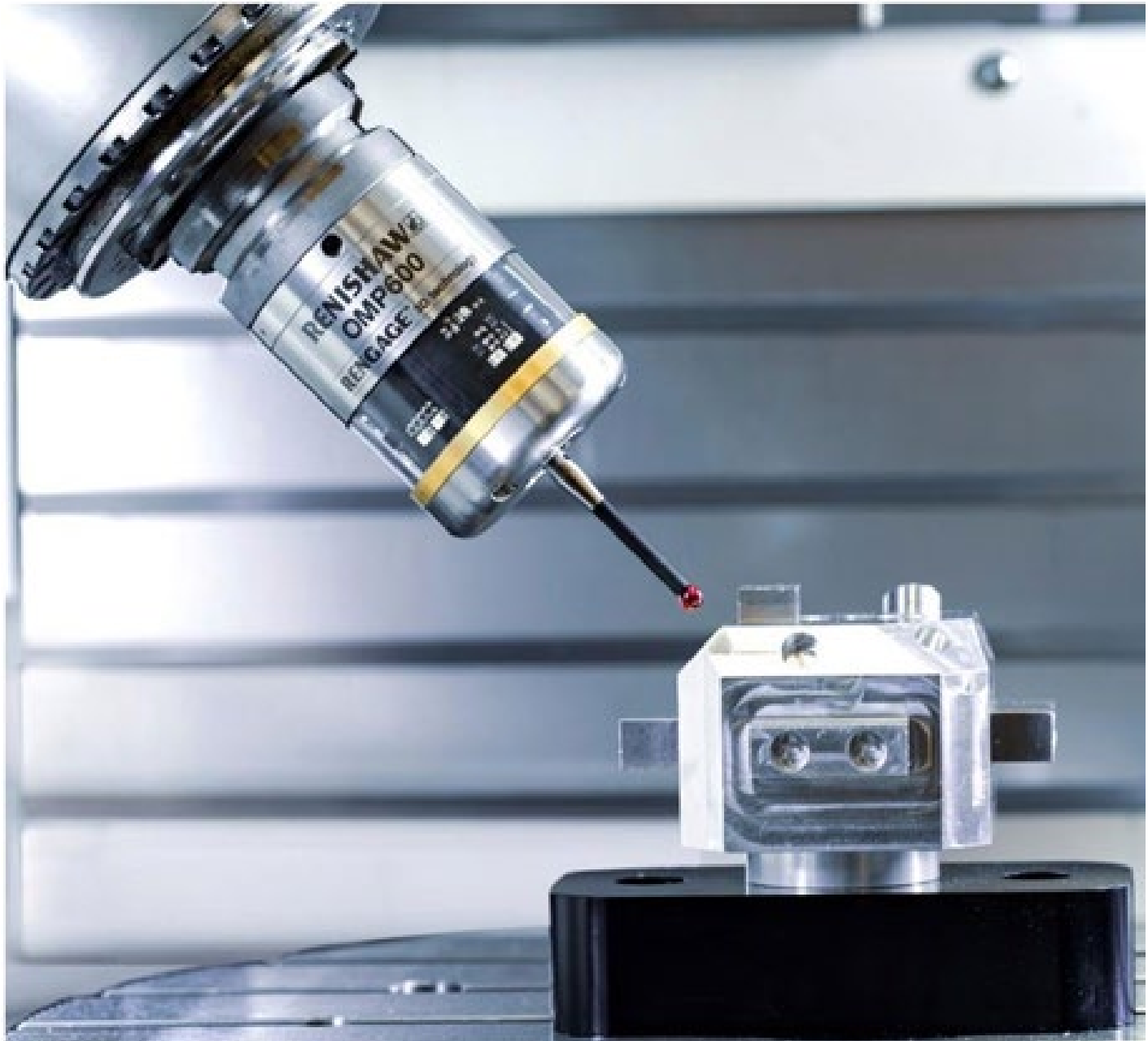


4.0 MANUFACTURING – SMART FACTORY CONCEPT

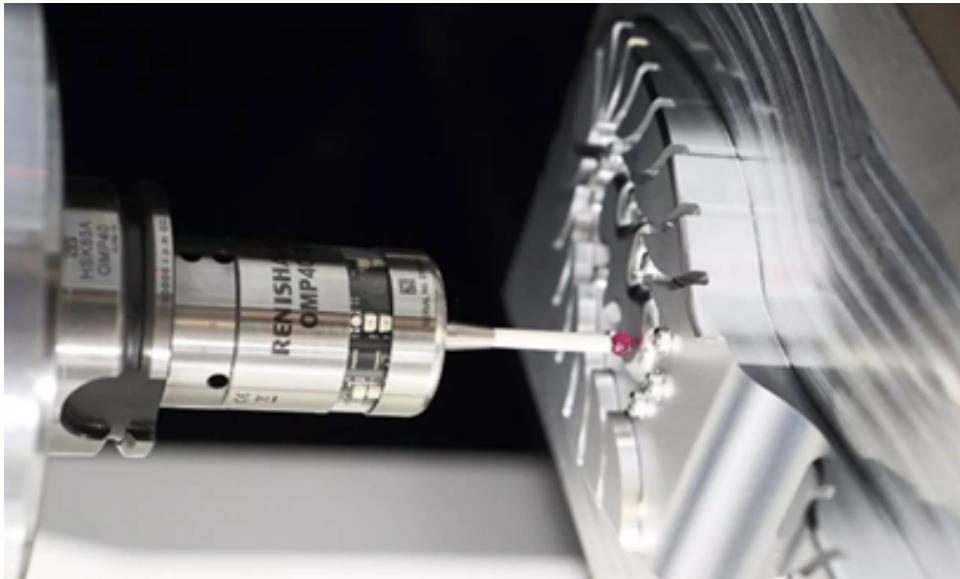


Process Control Through Metrology- Key to the future of CNC Automation



Industrial Metrology

- **Process Control**
- **Process Validation**
- **Process Verification**
- **Continuous Improvement- streamline and optimize**
- **CNC Machine calibration and performance assessment**
- **Consistent process output**
- **Compensate for changes or drift during machining**
- **Verification of parts to meet design intent**

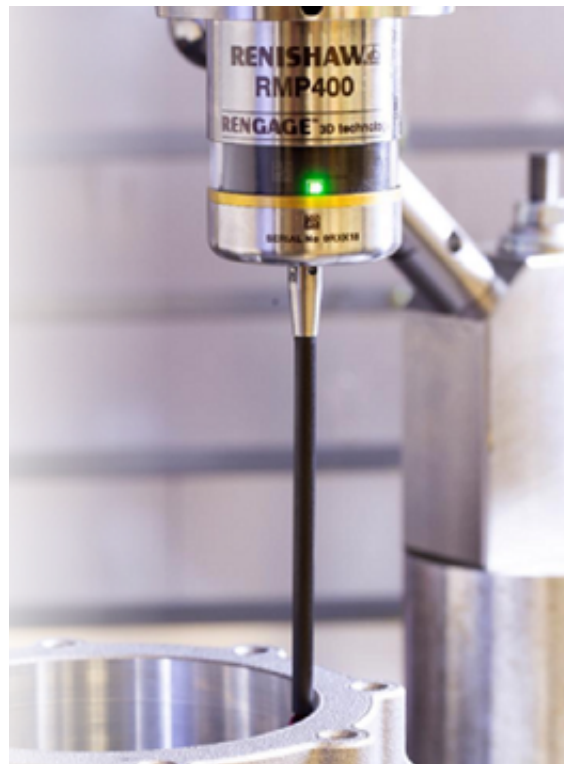


On-Machine Gauging Enables

- **Adapting metal cutting to variations in the machining process**
 - **Part distortion, tool deflection, thermal effects**
- **Updating coordinate systems, parameters and offsets based on actual real time conditions**

Benefits:

- **Processes can respond to actual conditions in order to maintain accuracy**
- **Quicker predictable decision making about reject conditions increases value added process time**
- **Reduced scrap and defects caused by inherent process variations**



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Programming the Machine

Bring in CAD Model to program machine paths/clearances

Align the part

Machine the part

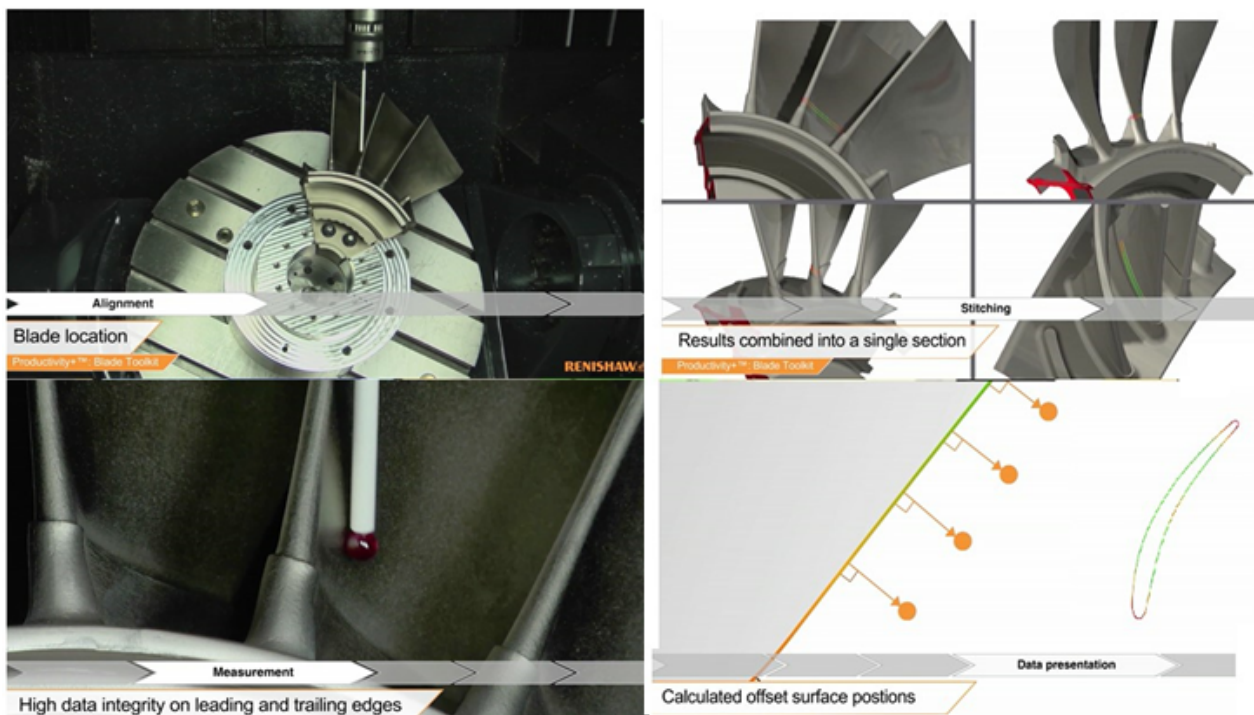
Take measurements on the part

Stitch results

Calculate result deviation from nominal

Correct machining process

Real time measurements taken on the shop floor and feedback offsets to machine tool. Not post process



Inspect Features during machining

- **Collect inspection results to track the process**
 - o **Reduce scrap**
 - o **Unmanned machining**



Tool Monitoring



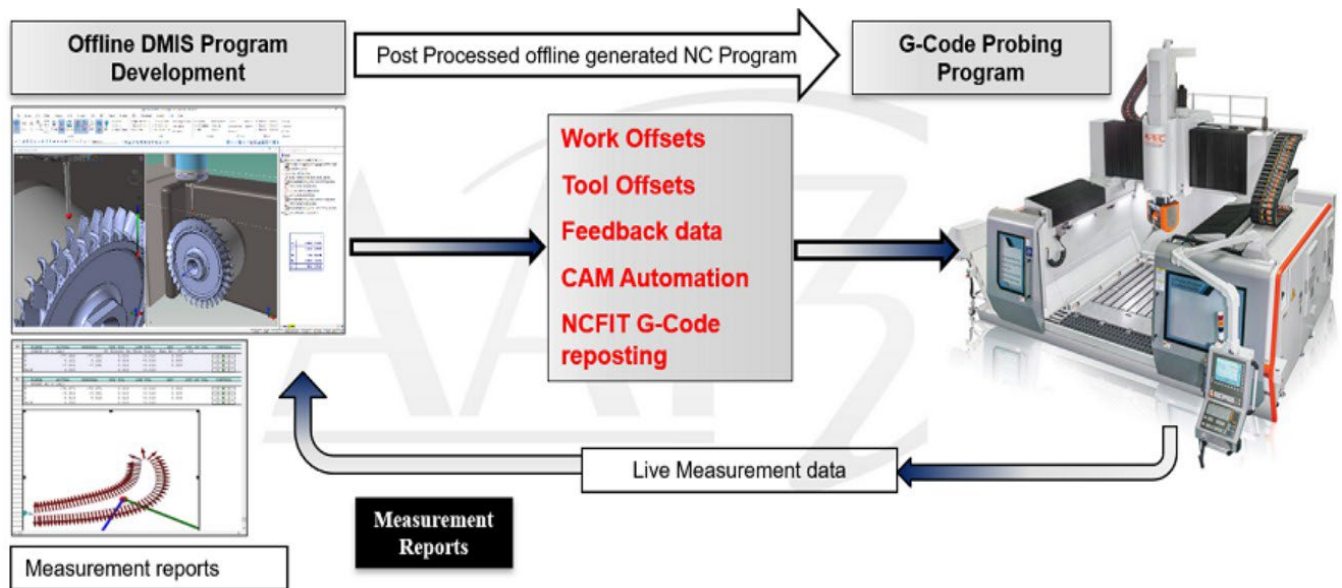
Tool condition monitoring recognizes

- **Presence of the tool**
- **Position of the tool to ensure pull out has not occurred**

Benefits

- **Rapid checks to monitor tooling problems and reduce scrap**
- **Checks voids allowing process to continue with sister tooling avoid waiting for operator**





- **CNC MACHINE CUSTOM MACRO PROGRAMMING**
- **ROBOTICS AND INTEGRATION**
- **MEASURING EQUIPMENT**
- **PROCESS MONITORING-FEEDBACK**
- **PART HANDLING-MACHINE**

