



Instrumentation company challenges

Michele Verdi

18th, May, 2016

Instrumentation company challenges

- **Product-related challenges –what large size implies**
 - generally high cost of large components
 - endogenous deflections due to mounting condition and weight distribution, with consequent difficulties in simulating real use conditions during the measuring process
 - deflections provoked by weight on reference plates
 - thermal part stabilization
- **Process-related challenges – what large size implies**
 - potential need of feature measurement during the manufacturing process
 - high difficulties, risks and costs in moving them from one site to another
 - need to size the inspection time vs. the production cadence
 - environment constraints (temperature, vibrations, pollution)
 - application and accessibility constraints
- **Data collection/analysis challenges**
 - Instrument performance on large scale metrology applications

Example: AIRBUS jet engine pylon



The AIRBUS jet engine pylon measurement challenge

- **Constraints: large dimensions and increase of production cadence**
 - The production of pillars increased by 54% in the period between 2006 and 2010 from the original 600 pylons/year, exceeding the capacity of the metrology lab, based already on LEICA LDT500 laser trackers
 - Lack of space made impossible to double the metrology lab
- **The solution**
 - a solution consisting in placing 2 laser tracker systems in parallel and synchronizing the measurements was investigated and positively evaluated
 - The solution was mainly based on a software adaptation
 - The solution solved the AIRBUS problem using the existing measuring systems just optimizing their use
- **Lesson learnt:**
 - AIRBUS managed his instrumentation problems determined by the increase of production cadence applying a SW tool
 - Partnership with LEICA was surely a key factor in this brilliant problem solving activity and solved such instrumentation problem

Example: monitoring of wind turbine tripods



The HGG profiling equipment challenge

- **Constraints: large dimensions and deformation**

- HHG was asked to manufacture wind energy tripods (foundation structures) 400 t 60 m long, 6 m diameter steel tubes
- Such a tube is deformed up to 20 mm for its weight when placed on the cutting machine. Moreover, the tube is rotating on the machine cutting bed and ovality changes with the movement of the tube
- The tube weight determines a cm magnitude order sag effect and stresses the structural frame of the cutting machine itself
- A single tube costs 100 k€

- **The solution**

- Use a laser tracker AT901 measuring by retroreflectors positioned at every reference sections of tube the bending of the tube, and the position of the cutting head , and compensate such deflections

- **Lesson learnt:**

- HHG was able to overcome the large size and the deflection problems in his manufacturing process by using large scale metrology capabilities

Example: improve CMM throughput for aerospace components



China aerospace company throughput challenge

- **Constraints: large aerospace component measurement in less time**
 - A China aircraft company asked for a CMM solution for inspecting aerospace components like wings and fuselage
 - The problem was the need of a fully automatic machine able to perform measurement in less time
 - A traditional gantry CMM was the solution for the automatic measurement but not suitable for customer throughput needs
- **The solution**
 - Use a dual carriage gantry CMM
 - The dual carriage system is able to perform correlated measurements decreasing dramatically the machine throughput
 - Acceptance test was performed using the correlated dual carriage systems
- **Lesson learnt:**
 - CMM technology can evolve in order to provide fully automated inspections fitting challenging throughput needs
 - In few words, fitting quality needs at a double speed ..

Example: measurement of railway heavy components



German railway company – weight challenge

- **Constraints: very heavy railway part measurement**
 - A German company manufactures very heavy railway components. They can reach 12 m length, 3 m height, 5 m diameter, up to 35 tons weight
 - Such extreme weight can determine consistent deflection on coordinate machine foundations
- **The solution**
 - Use a gantry coordinate measuring machine with a special foundation able to limit deflections when such extreme weight is positioned on it
 - A 80 m³ special foundation inertial block was designed and implemented in customer's site for supporting weight and avoiding undesired deflections on gantry machine
 - The installation was also including a proper internal transportation system able to move 20 tons components
- **Lesson learnt:**
 - Large components measurement requires particular attention in avoiding deflection effects on inspection machines
 - Such phenomena, if not properly considered, can seriously compromise the quality of the parts

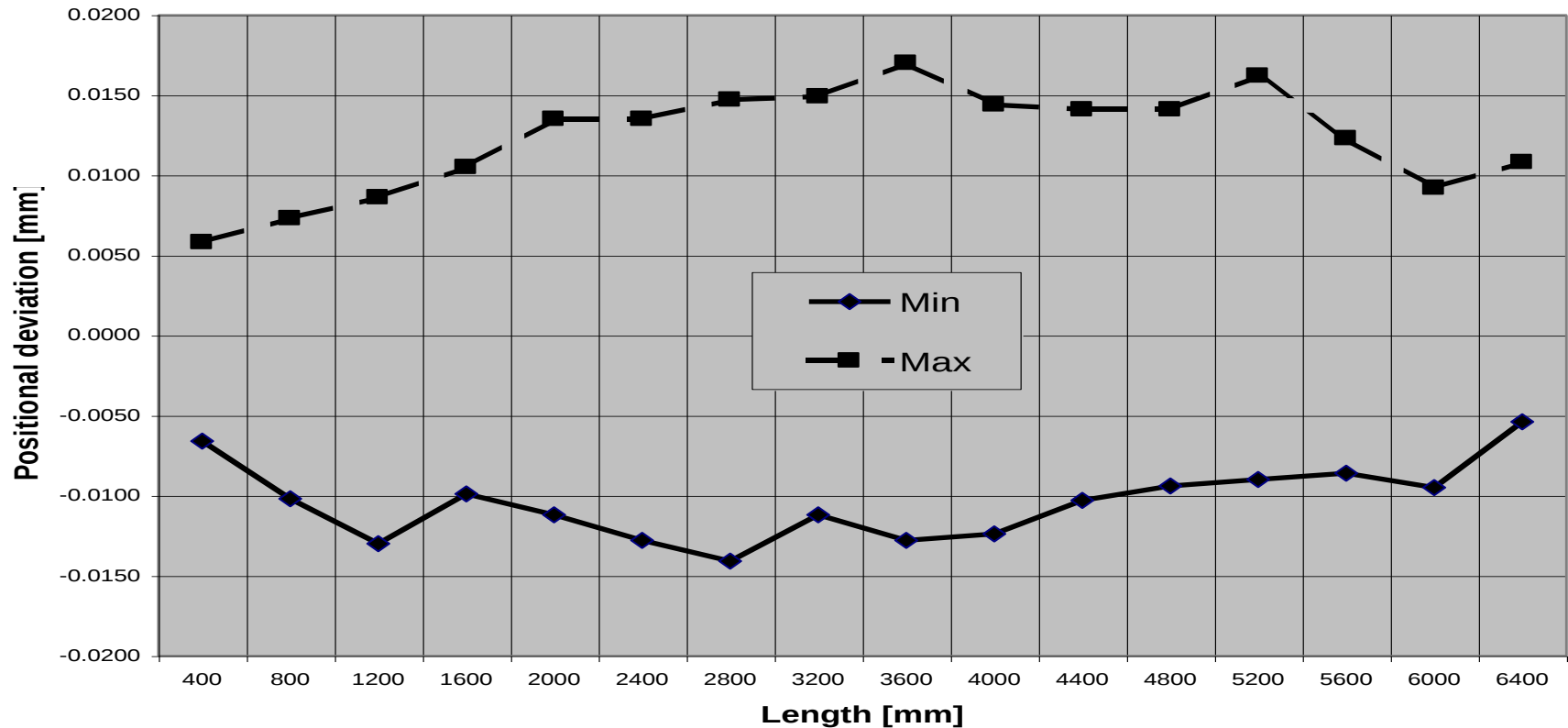
Example: large CMM performance in variable temp. conditions



Spanish aerospace company environment challenge

- **Constraints: large CMM in variable temperature conditions**
 - A Spanish aircraft company asked for a large CMM solution for inspecting aerospace components like wings and fuselage
 - The problem was the need of measuring in an environment characterized by large temperature fluctuations and the impossibility of improving environment conditions for both costs and accessibility reasons
- **The solution**
 - Apply proper thermal compensation on machine structure for compensating thermal expansion effects as well structural deformation due to temperature stratification in the machine beams
- **Lesson learnt:**
 - CMM technology can provide proper answer for large scale automated inspections also in harsh temperature environments
 - In few words, fitting quality needs without spending a fortune in conditioning systems ..

Example: large CMM performance in variable temp. conditions



19 micron position error with variation of 4.2 degrees