PHILIPS

Quality Assurance of Systems

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challenged by MNT

Ludo Stulens, Philips Applied Technologies

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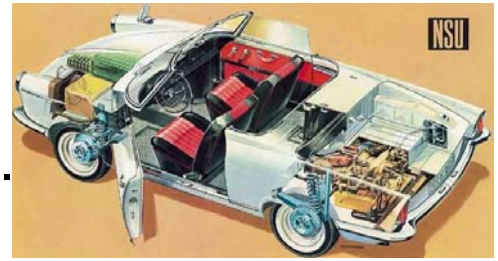
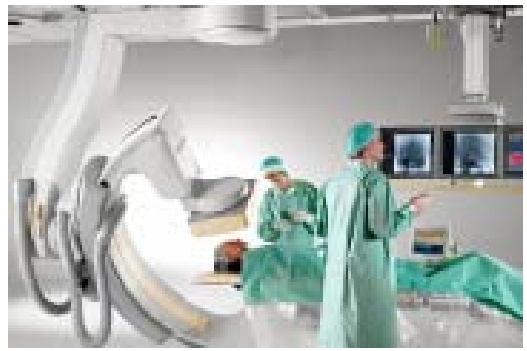
What is a system?

- A composition of subsystems, modules, components..



- A combination of different technologies
  (mechanics, electronics, sw, optics,…)

- Performing a number of specified functions by interaction with its environment or user.

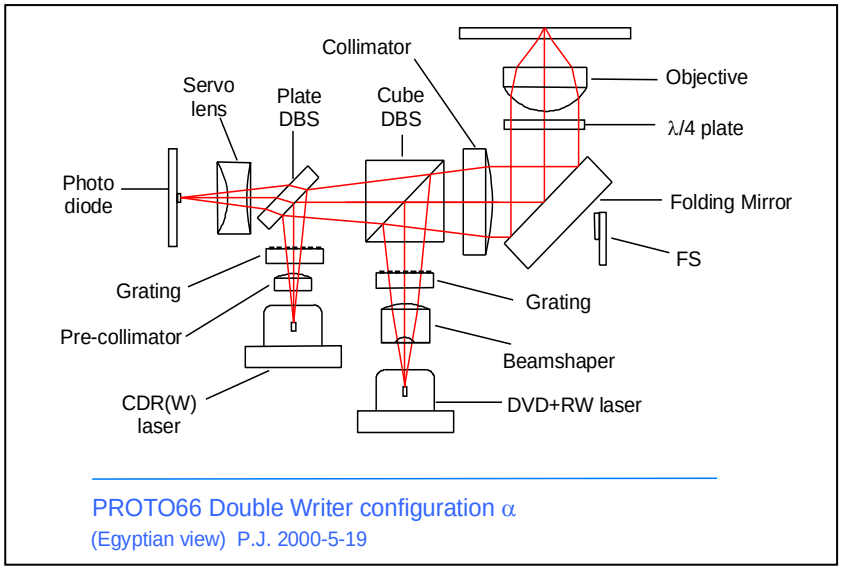


Characteristics of system tests

- Test systems for SYSTEMS are mainly dedicated:
  - Each generation of a system differs very much from the previous
  - Systems have a specific footprint and interconnects
  - Special signals, environmental conditions are needed to test it in its final function
  - Human interaction even may be needed
- The lifetime of the test system is equal to the product's lifetime:
  - Changing performance
  - Changing technology
  - Changing geometry
  - Changing features
- Must therefore be cheap:
  - Test only system level relevant things, composing components are tested before.
  - Build the tester for a system with cheap building blocks.
- Cycle time is often long and labor intensive
  - Handling, connecting, creating right test environment, performing functional tests,…
  - Try to introduce parallel test whenever possible

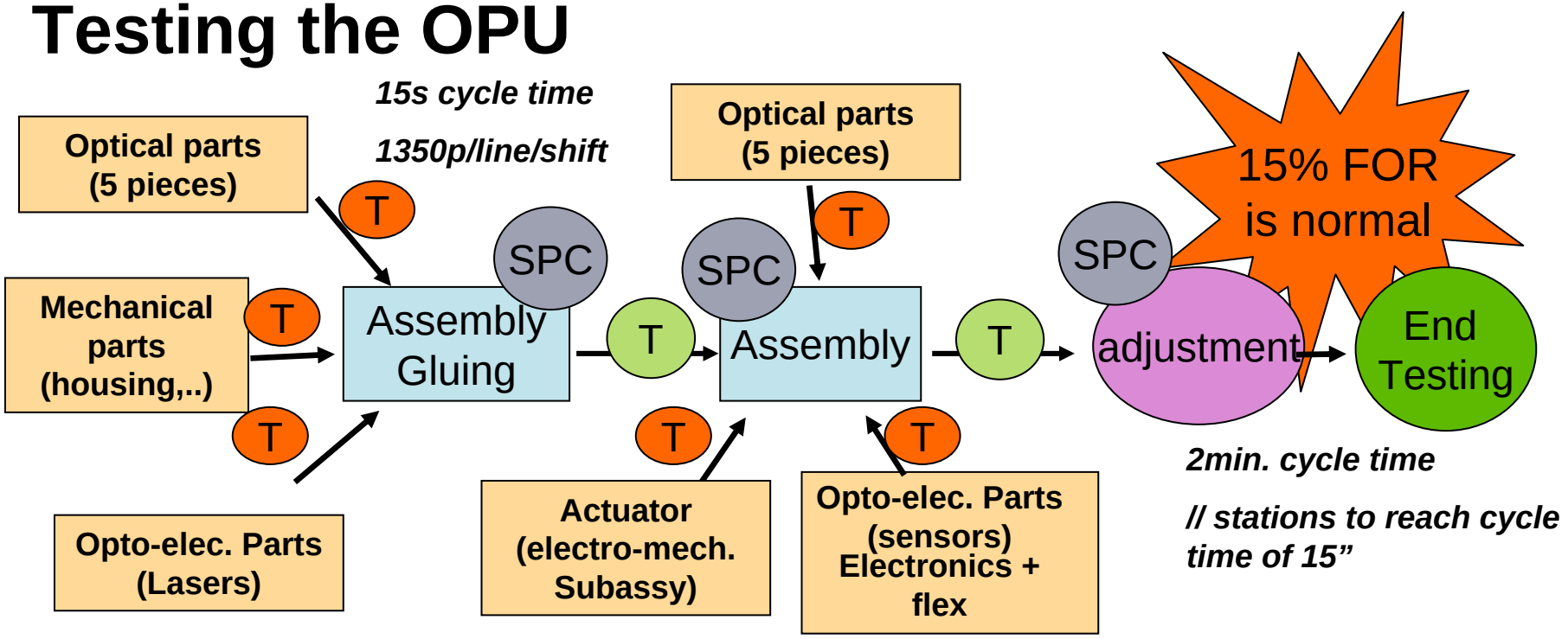
testing an OPU – a large MOEMS

- Multi Technology:
  - Mechanics
  - Optics,
  - Electronics
  - Embedded SW
- Complex functionality
  - Generation of read / write laser beam
  - Detecting reflected beam
  - Focusing and tracking
  - Conditioning / transfer data & control signals
- Diversity in end user functionality:
  - read → CDR → CDRW → DVD → DVDRW
  - Specification: read/write speed, audio, data, video
  - Geometry: VLP, CD player, laptop drive, 8-cm DVD
- Technology: changing every generation
  - discreet to one chip solution,
  - Laser … laser module with reading, optical beam splitters,…
  - Glass lenses to plastic
- Market:
  - From low volume → high volume, OEM, automotive,…
  - TTM, TTV, costs



PROTO66 Double Writer configuration α
(Egyptian view) P.J. 2000-5-19

Testing the OPU



- Each component is tested by the supplier. Some parameters of parts 100% checked before delivery.
- SPC on all processes (gluing, fixating, screwing, pressing, …), for each product
- Structural testing on subassy (optical alignment, laser beam quality,..)
- Adjustment a must to align optical light path and performance quality
  (full functional test used to find optimal performance of OPU)
  Adjustment to adjust laser powers & signal parameters for compliance
- All OPU 100% functional tested on playability and performance in application

Challenges of MEMS in volume production

- There is no real separation between making a ‘component’ and assembling that ‘component’, so testing the component before mounting is impossible: it must be first time right (but it will not always be!!!)
    - Etching a beam or spring is also partially assembling it
    - Making a dielectric is mounting it.
- Intermediate products do not always have a testable functionality and can therefore only be tested structurally. But since the components are already partially mounted, they are difficult (or not) to measure.
    - Indirect measurements and SPC/sample test are alternatives.
    - Process control via PCM’s is no guarantee for 100% yield (in no SPC)
- In today's MEMS processes, a process step can introduce defects or unwanted variation in structures that were built in a previous process step
    - Removing a sacrificial layer may also etch other parts
- When building a MEMS in a system, parameter variation and interactions between components may result in poor performance on system level and will have to be tested there.

Challenges of MEMS in volume production

- What can we do?
  - Designers must take care that critical parameters are matched with the machine or process capabilities to achieve high Cpk's in the process.
  - Make critical parameters testable as soon as possible in the supply chain. Test your M(O)EMS device full functional before integrating it in the system.
  - Prepare the design and process for functional test, you will need it.
  - Define and execute stress tests that can find "weak" devices that will give reliability problems at your customer. Correct these "weaknesses in the design or process, or stress test at the end of the line.

What about BioMEMS

- Mostly used for diagnostic purposes, thus measuring instruments!!
- They are intended to be disposable and for one-time-use!!
- They must be cheap and produced in high volume!!
- They will be operated by people with little knowledge of the test.

Challenges:

- How to ensure the accuracy and GR&R of the measurement, if we can not test it functionally before shipment?
- The product must test itself during or after use and show this to the user (like a control dot in a pregnancy test), this must be taken into account during design of the test procedure and the design of the product.
- How to check the sensor sensitivity and the proper working of the microfluidic parts during the manufacturing process? It should be done in a non-functional way, because a functional test will destroy the device. But is this feasible?