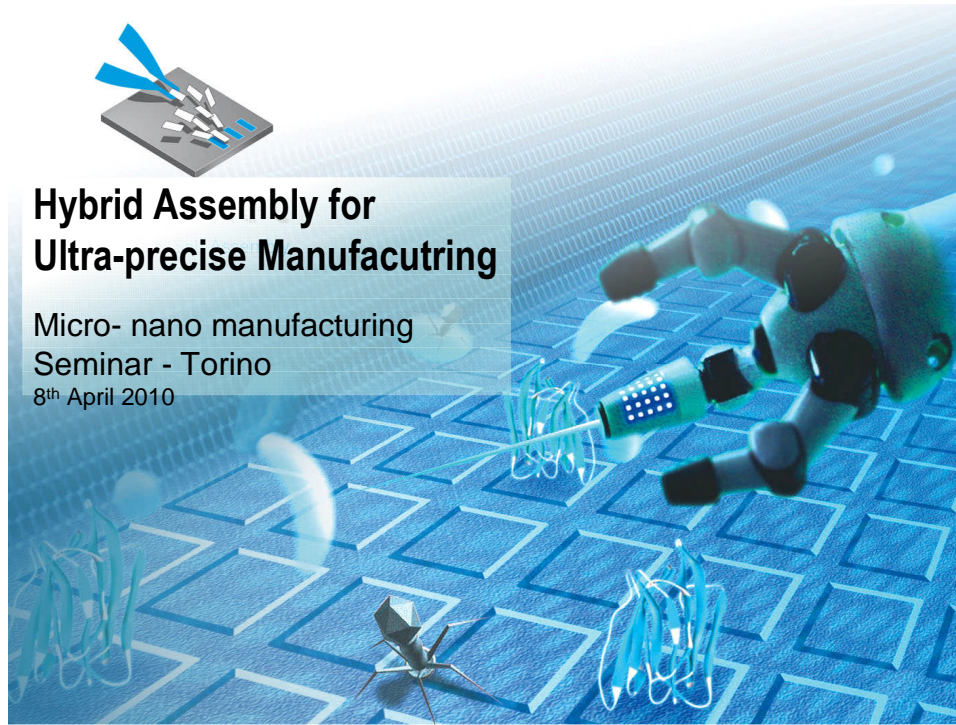


Hybrid Assembly for Ultra-precise Manufacutring

Micro- nano manufacturing
Seminar - Torino
8th April 2010



Hybrid Assembly Overview –Implementation

Core idea - Implementation

The Hybrid Assembly Technology Challenge

Robotics – Self-assembly – Hybrid assembly

Summary - Industrial Application cases for Hybrid assembly

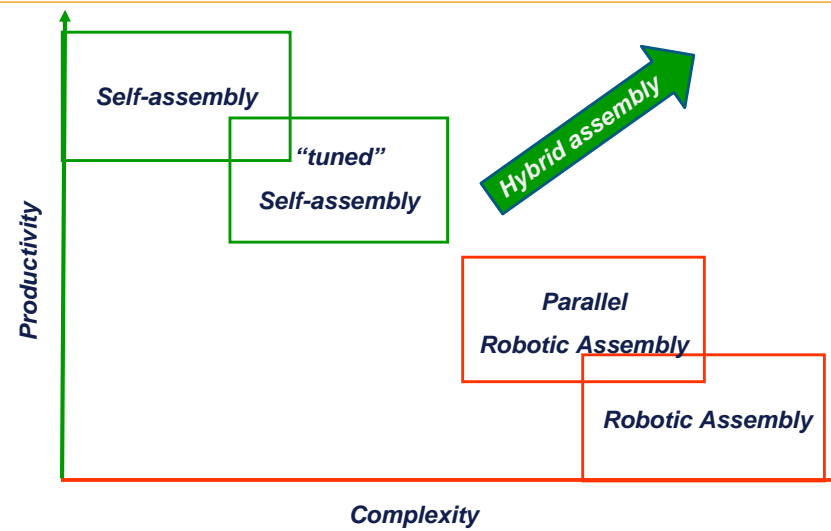
Mechatronics – IT- Electronics – Bio/Pharma



Definition - Hybrid Assembly

csem

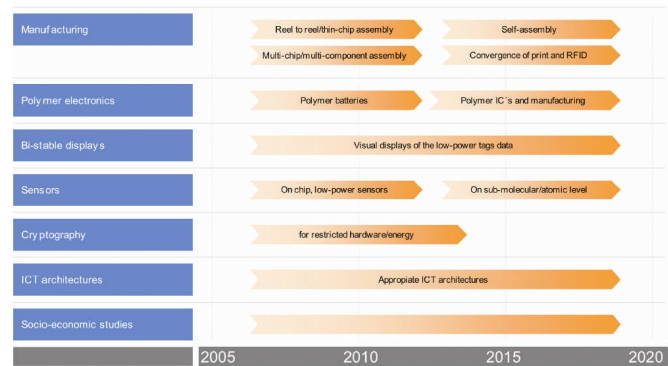
„Hybrid manufacturing process based on positional- and self-assembly for complex micro-products“



„Trend towards more complex and more miniaturized micro- and nano products“



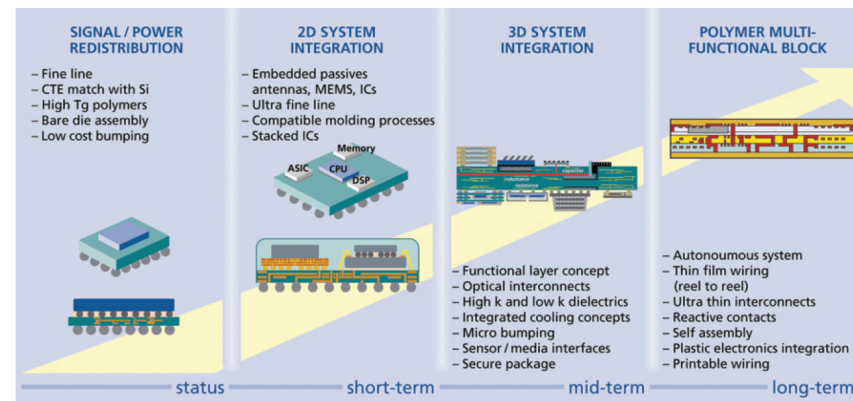
EPOSS
European Technology Platform
on Smart Systems Integration



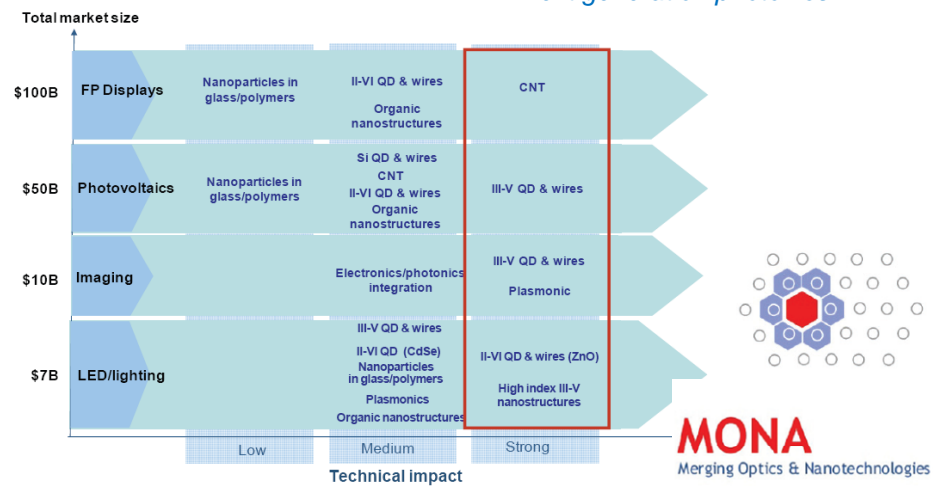
... *Manufacturing technologies for future RFID chips*



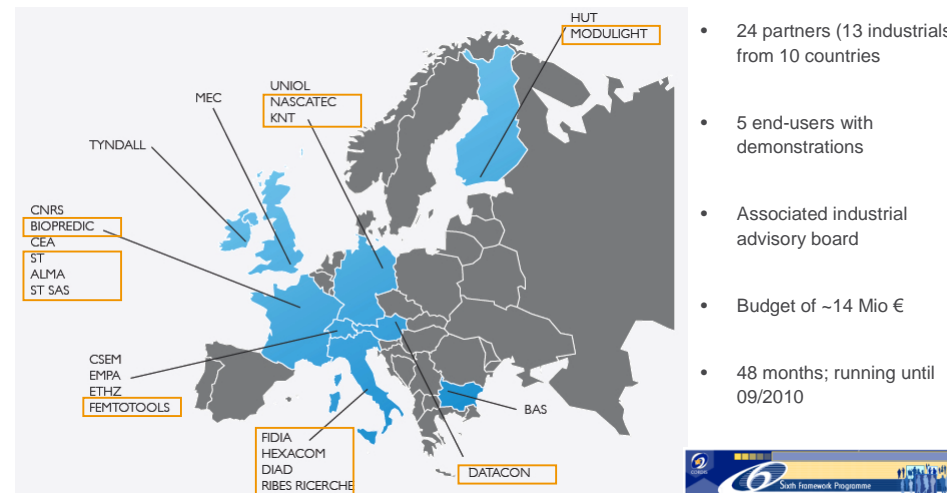
... *Complex integrated electronics*



... Next generation photonics



HYDROMEL - Project key figures



Hybrid Assembly Overview –Implementation

Core idea - Implementation

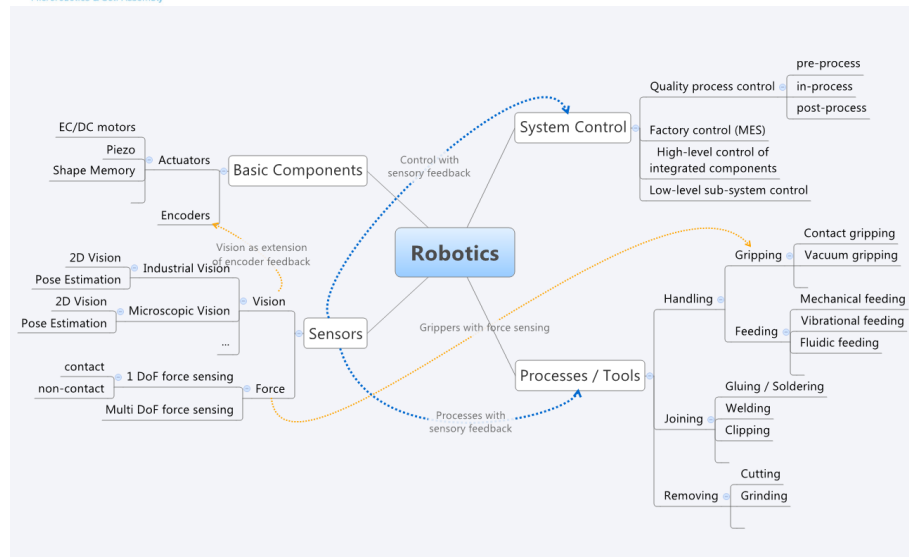
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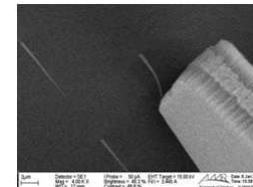
Mechatronics – IT- Electronics – Bio/Pharma

Robotics – Technology Selection



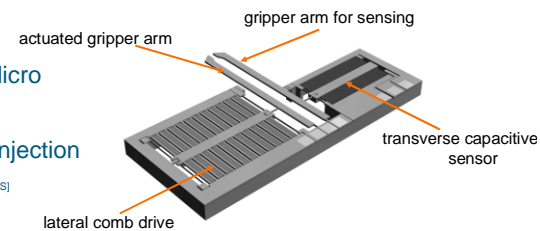
Robotics Highlights

- Vision algorithms (2D-6D)
 - 3D vision for in-depth analysis of SEM scenarios / stereo vision / depth of focus vision [UNIOI]
 - 6D vision for model-based pose estimation [ETHZ]

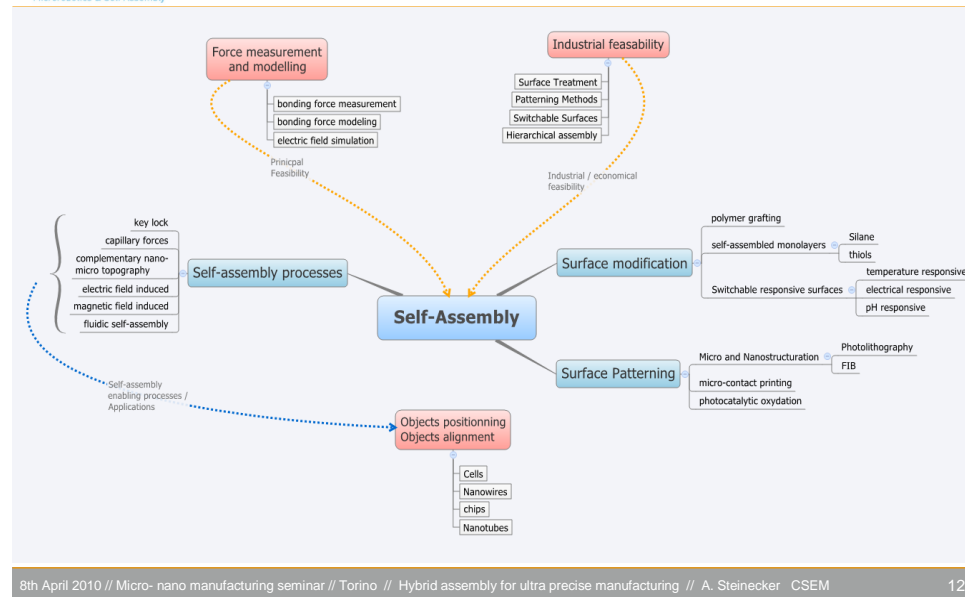


Force-controlled grippers

- Assessment of gripper for Micro assembly [FemtoTools]
- save cell manipulation and injection tools have been designed [BAS]



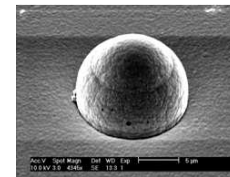
Self Assembly – Technology Selection



Self-assembly Highlights

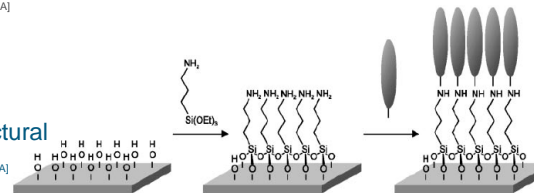
- Structuring

- Design and processing of mechanical features for self-alignment [CSEM]
- Patterning techniques [CSEM, CEA]



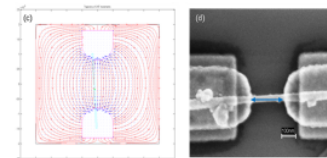
- Surface modifications

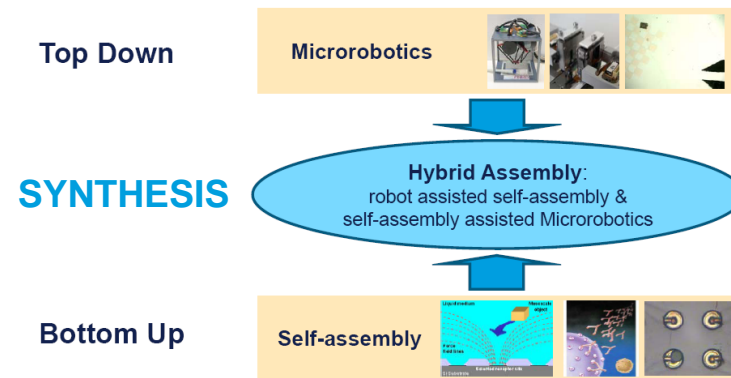
- Study of chemical and structural patterning of surfaces [CSEM, CEA]



- Control

- Switchable assembly [CEA, CSEM, CNRS]
- Hierarchical assembly [TYNDALL, ETHZ]

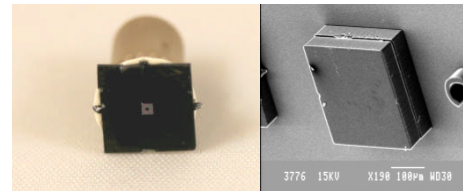




Robotics with Self Assembly

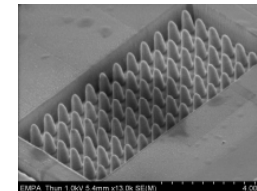
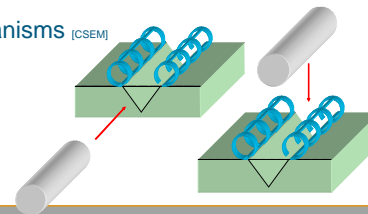
- Tool improvement

- Capillary gripper [HUT]
- Gripper with nanostructures [EMPA]
- Gripper with switching [CNRS]



- Process improvement

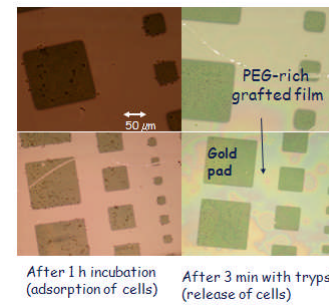
- Clipping mechanisms [CSEM]



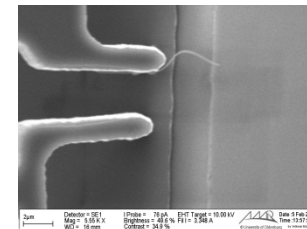
Bottom-up oriented synthesis

Self Assembly with Robotics

- Self assembly substrates
 - Thermally responsive surfaces
 - Structured surfaces
 - Subsequent robotic handling



- NanoHandling
 - Self-assembled nanowires can be accessed and manipulated



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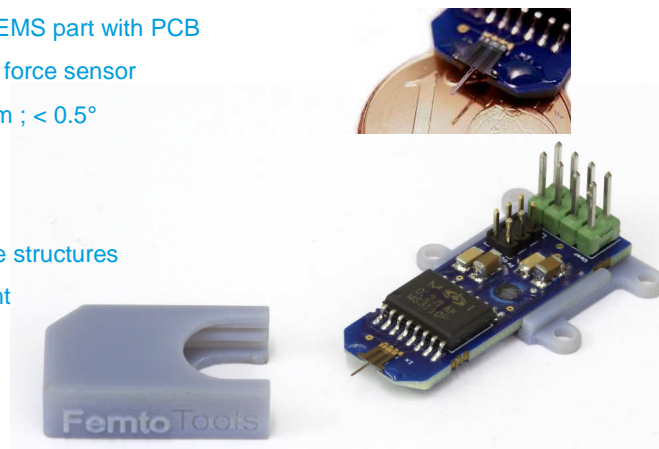
Mechatronics – IT- Electronics – Bio/Pharma

Assembly task [CSEM, FEMTOTOOLS]

- Connection of MEMS part with PCB
- Fine gripper with force sensor
- Accuracy < 10 μm ; < 0.5°

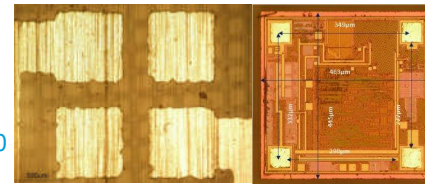
Challenge

- Handling of brittle structures
- Precise alignment
- Bonding



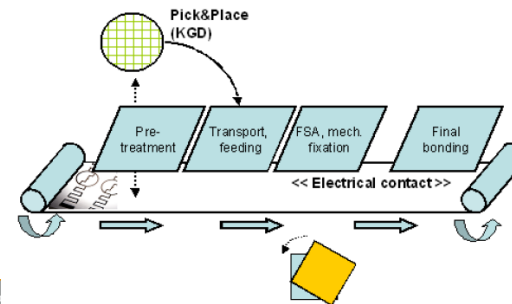
Assembly Task [HUT, ETHZ, CEA, DATACON]

- Throughput: 100.000 - 200.000 UPH
- Accuracy: 20-30 μm , 0.1 deg
- Materials: Si components / substrate PET
- Size: 200 x 200 x 50 μm to 500 x 500 x 150 μm
- Low cost, parallelisation



Hybrid approach:

- Coarse positioning mechatronics
- Capillary self-alignment



Definition - Hybrid Assembly

Hybrid Assembly is applied in two scenarios

- « Classical » robotics that benefit from self-assembly technologies
 - **Top-down** oriented
 - E.g. Surface modifications of grippers
 - improved feeding
 - ...
- Self-assembly that benefits from robotics
 - **Bottom-up** oriented
 - Robots for fast object pre-positioning
 - Robots for selective correction
 - ...



Outlook

csem

Next steps

- *Project end September 2010*
- *Finalization of demonstrator systems (until mid 2010)*

Get in contact with HYDROMEL

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- www.hydromel-project.eu

... thank you for your attention!