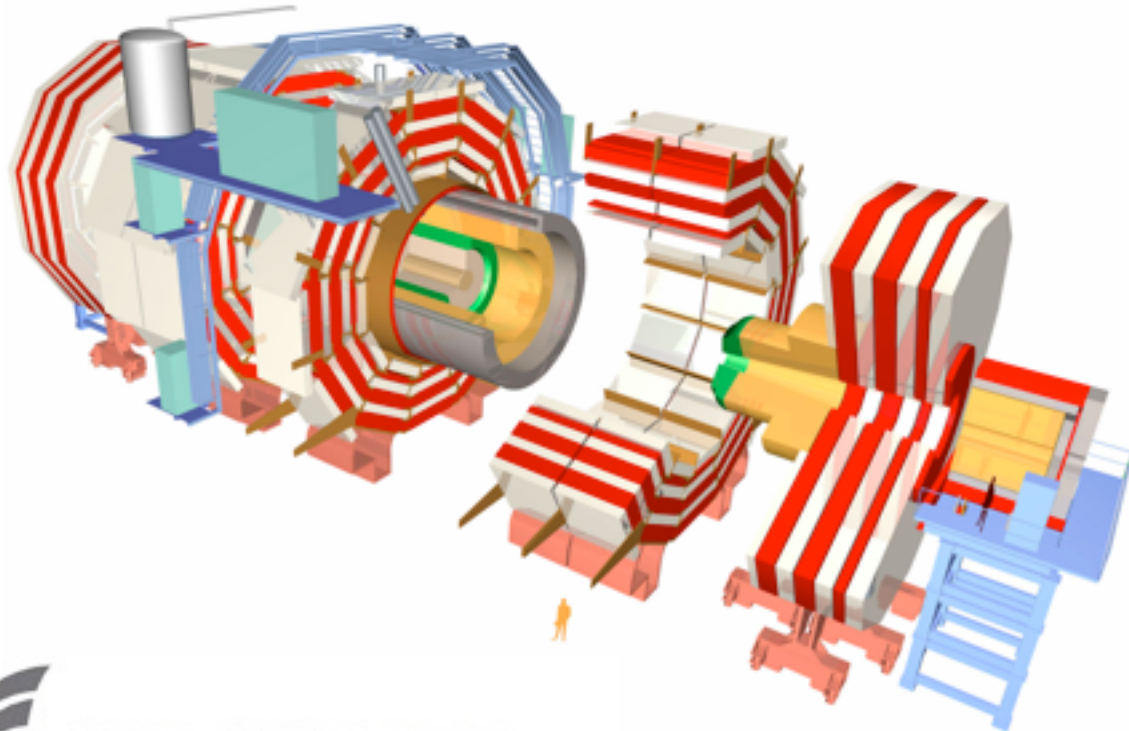
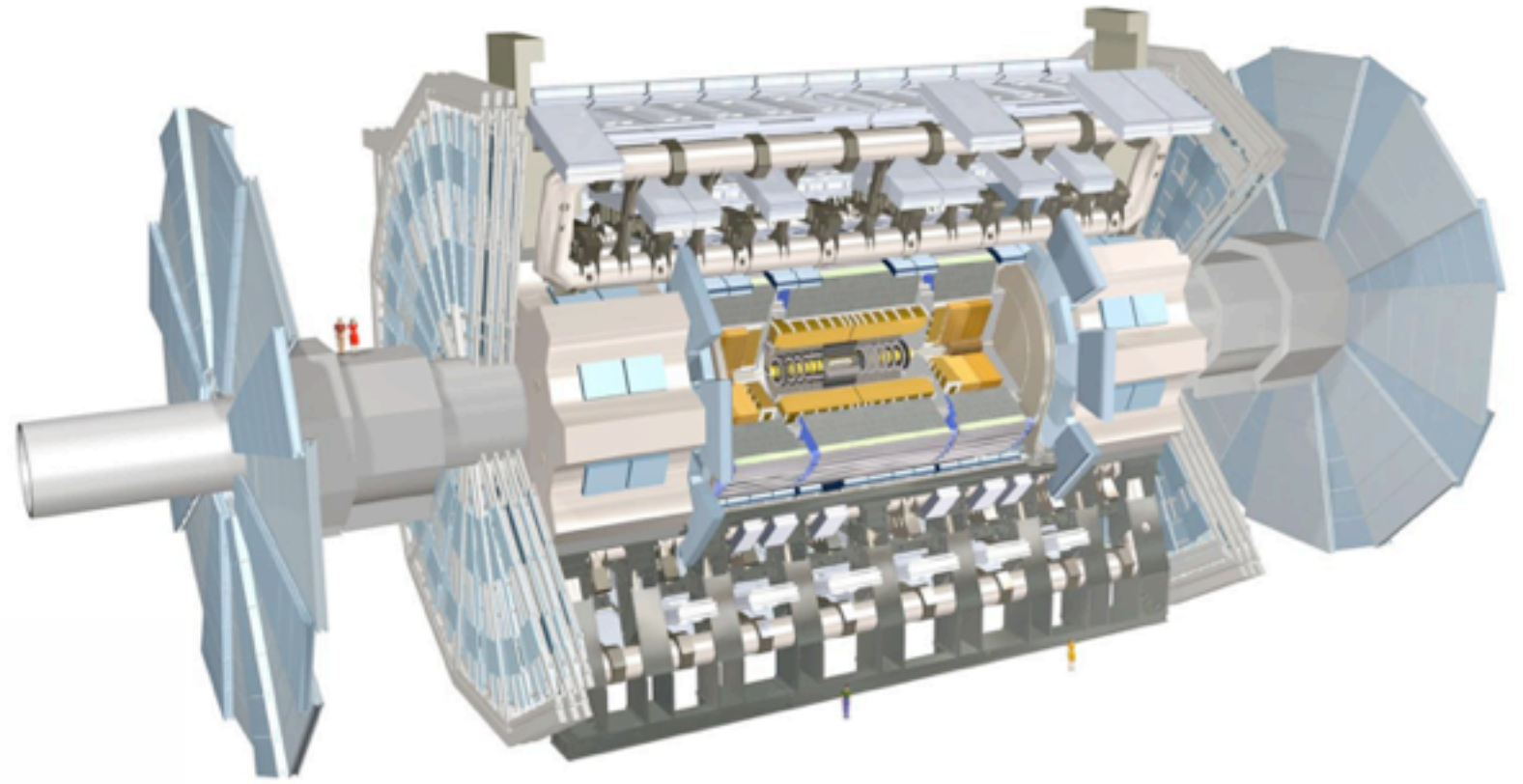


Industrial Assembly Machines

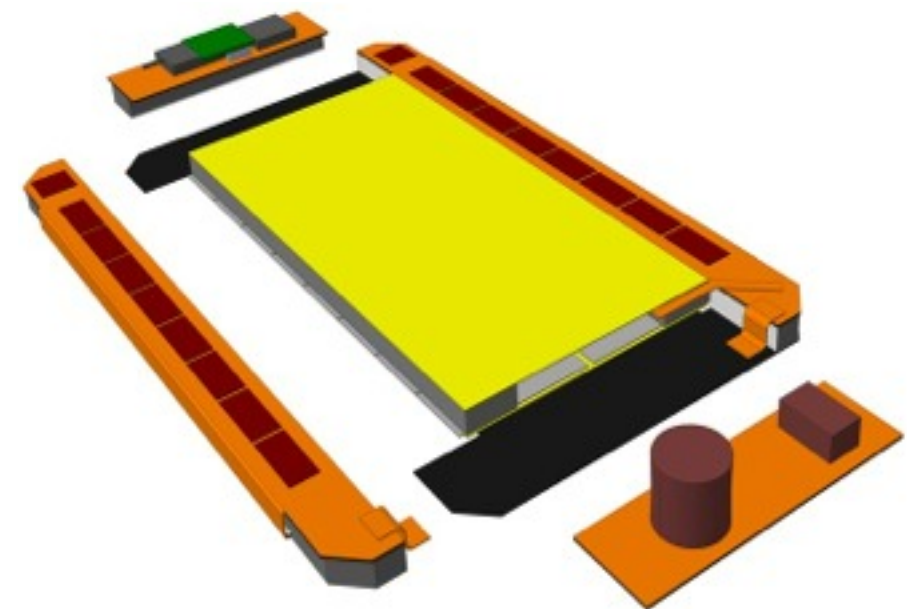
Andreas Mussgiller
Ingrid-Maria Gregor



Terascale Alliance
Detector Workshop,
Goettingen
March 5-7, 2014

Introduction

- Meetings with two companies
 - Häcker Automation
 - ficonTEC
- Both meetings had presentations by company and ATLAS/CMS
- System requirement from ATLAS
 - placement of modules on large support structures such as petals
- Requirements from CMS:
 - double-sided high precision module assembly



Häcker Automation

- Offers base machines with application specific tools and modules
 - 3D Object Measurement resolution of 2 μm in x, y and z
 - 3D Alignment
 - 5 degrees of freedom
 - 1 μm position resolution
 - 0.002° angular resolution
 - Dispensing glue
 - Pick + place
 - 2D and 3D mounting heads with 5 μm precision
 - micro laser soldering
 - 50 μm spot size
 - cost range: few 100k€
- company showed interested in a pre-project and would help to define the specifications and solutions
 - cost range: few 10k€



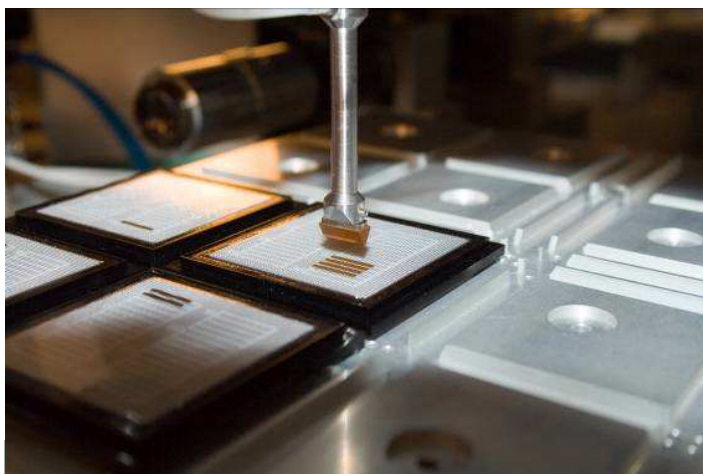
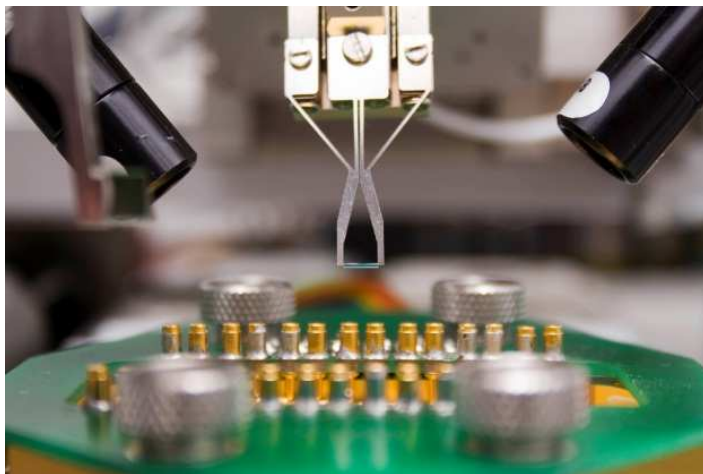
- Offers base machines with application specific tools and modules
 - mechanical and vacuum grippers
 - sub micron precision alignment
 - 6 axis motion ($x, y, z, \vartheta_x, \vartheta_y, \vartheta_z$)
 - Dispensing
 - UV light adhesive curing
 - Multi-axis optical survey
- cost range: 200 - 300 k€
 - company showed interested in a feasibility study
 - would help to define the specifications and solutions
- cost range: O(30k€)
- cost for study will be deducted from total machine cost



- Relative relaxed about our precision requirements of ~20μm

Axis	Repeatability (System 1)	Repeatability (System 2)
X	± 18 nm	± 15 nm
Y	± 14 nm	± 17 nm
Z	± 48 nm	± 47 nm

nm !!



Alignment Engine: Fast, 3-axis integrated ultra-precision submicron BDR motion system

Conclusion

- ATLAS large area placement seems not to be a real challenge for both companies
 - Document for project description in preparation
- There is no off-the-shelf solution for the CMS module production
 - Häcker Automation sees no basic problem but a few challenges
 - Metrology and alignment from both sides is not part of their portfolio
 - ficonTEC is very confident
 - company has many opto-electronics service providers as costumers
 - optical measurements on many axes is part of portfolio
 - CMS module sensor sub-assembly is very special project
 - reusability of such a special machine is not guaranteed
 - alternative strategy could be to go directly to a service provider and ,buy' the final product
- 30 k€ are available within HGF portfolio for feasibility studies
 - will be used for CMS PS module sensor sub-assembly
 - base plate, pixel sensor + pixel chips, two spacers, strip sensor