FISBA Innovators in Photonics

High precision automated tab assembly

Hansruedi Moser & Guido Bonati für den CSEM Workshop am 24.02.2022

FISBA

INTRO

FIGURES

- Established in 1957
- Located in St. Gallen, Switzerland
- Subsidaries in Germany, USA and China
- Annual Turnover >65 Million USD
- Privately owned

BUSINESS FIELDS

- LIFE SCIENCE
  Cytometry, Endoscopy, Intra Oral
- ADVANCED MANUFACTURING
  Fiber Laser Pumping, Direct Diodelasers
  Semicon Vision Systems
- DEFENCE
  Optoelectronical Components and Systems

PRODUCT/TECHNOLOGY RANGE

- Optical and Mechanical Engineering Services
- Flats and Classic lenses, PML Asheres Production
- Optical Coatings
- EO Assemblies, High precision micro assembly
- SM Laser Systems 400…1600nm, <100mW

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PRODUCT

FAC MARKETS

- Used to collimate semiconductor lasers
- Huge demand generated due to the success of fiberlasers (IPG, China)
- Niche Markets for special assemblies <1.000.000 p.a.

WHY SPECIALS

- In special arrangements, people like to mount underneath the lens or above, dependin on their geometry
- High precision arrangements need an highly accurate thickness of the glue film
- Customers pay for this assemblies as it saves them even higher costs in their process

ALTERNATIVES

- Manuel mounting in china by using fixtures possible individual quality check as costs as well precision is historically worse

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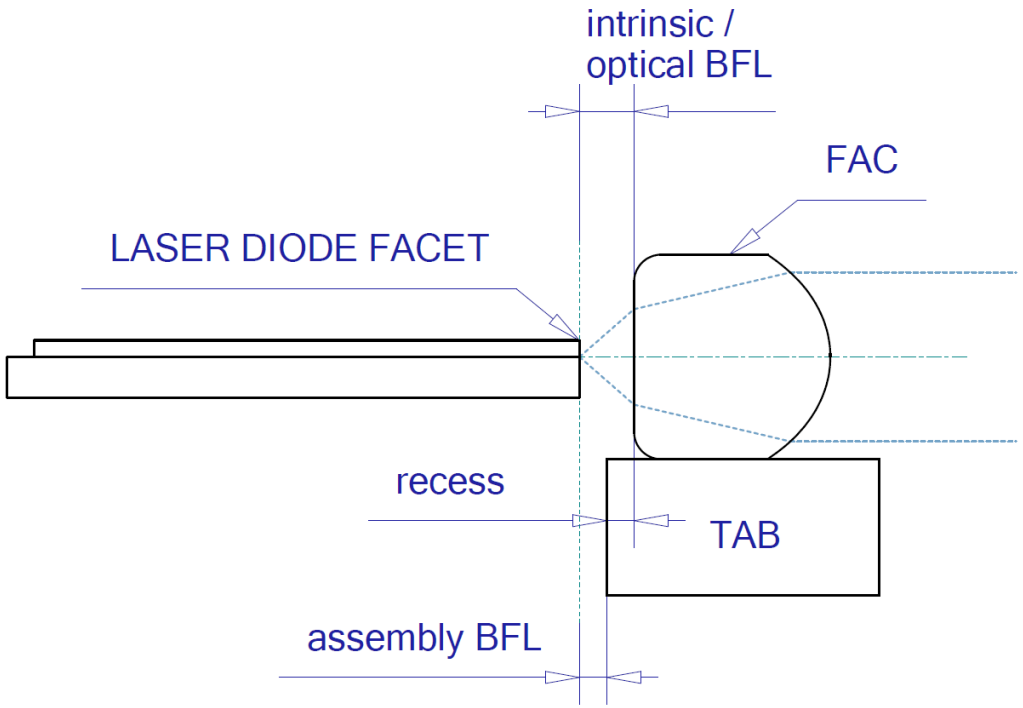
FAC on bottom tab assembly



- Intrinsic / optical back focal length (BFL) determinig the distance to the laser diode facet
- «assembly BFL» (bonding gap) = BFL – recess
- Goal: assembly of FAC on tab with low variance for bonding gab, therefore with low tolerance in the «assembly BFL»
- Tolerance +/- 5 micron

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Automation Platform

- 6-axis Micromanipulator plus gantry
- Glue Dispenser
- Machine Vision for passive alignment
- Beam Diagnostic System with Laser Diode bar (IR) for aktive alignment
- Tray access via gantry
- 24h Autonomous Operation, <1‰ Failure Rate

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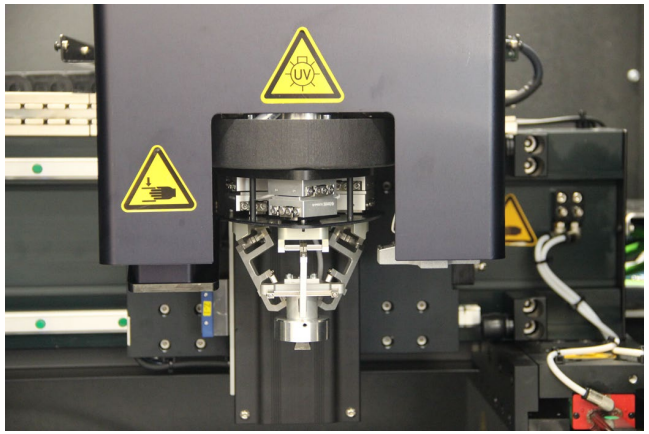
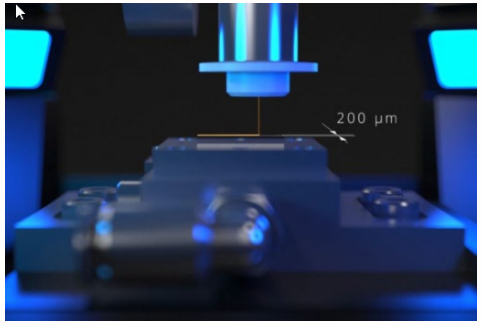
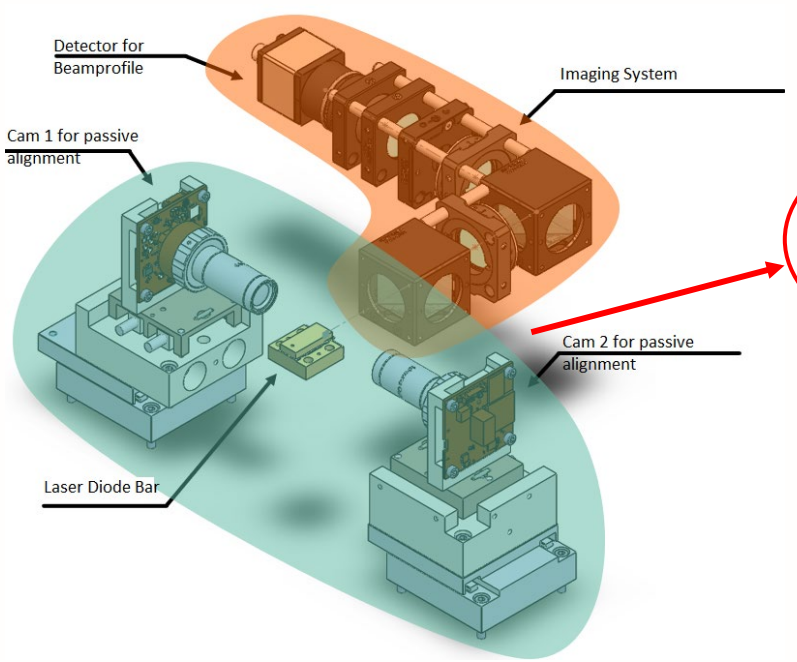
Modules



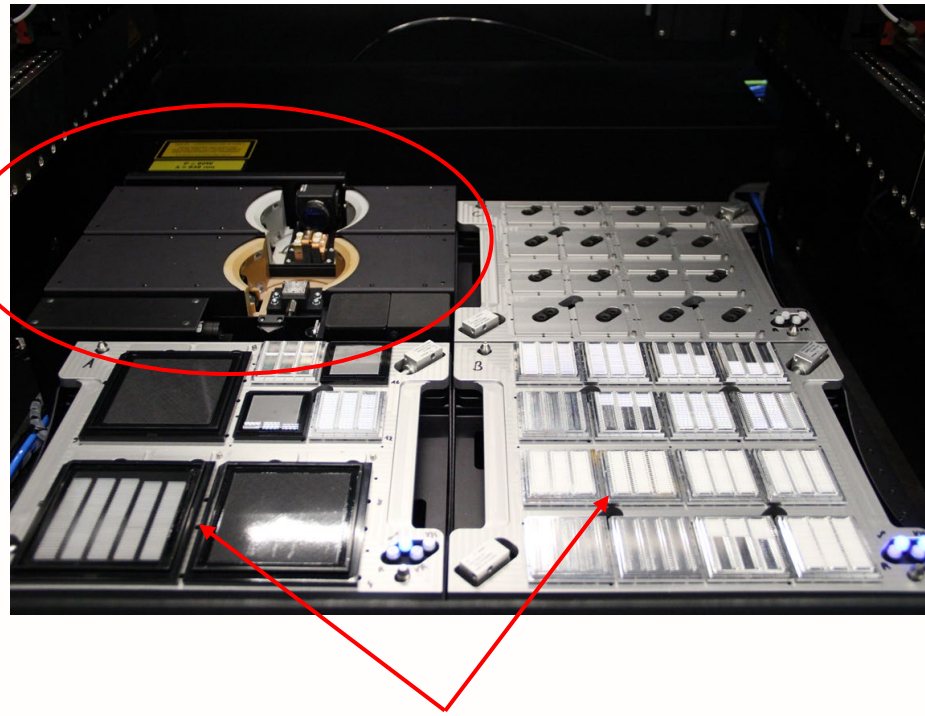
6-axis Micromanipulator



Jet-dispenser



Passive and active measuring system



Variable Trays

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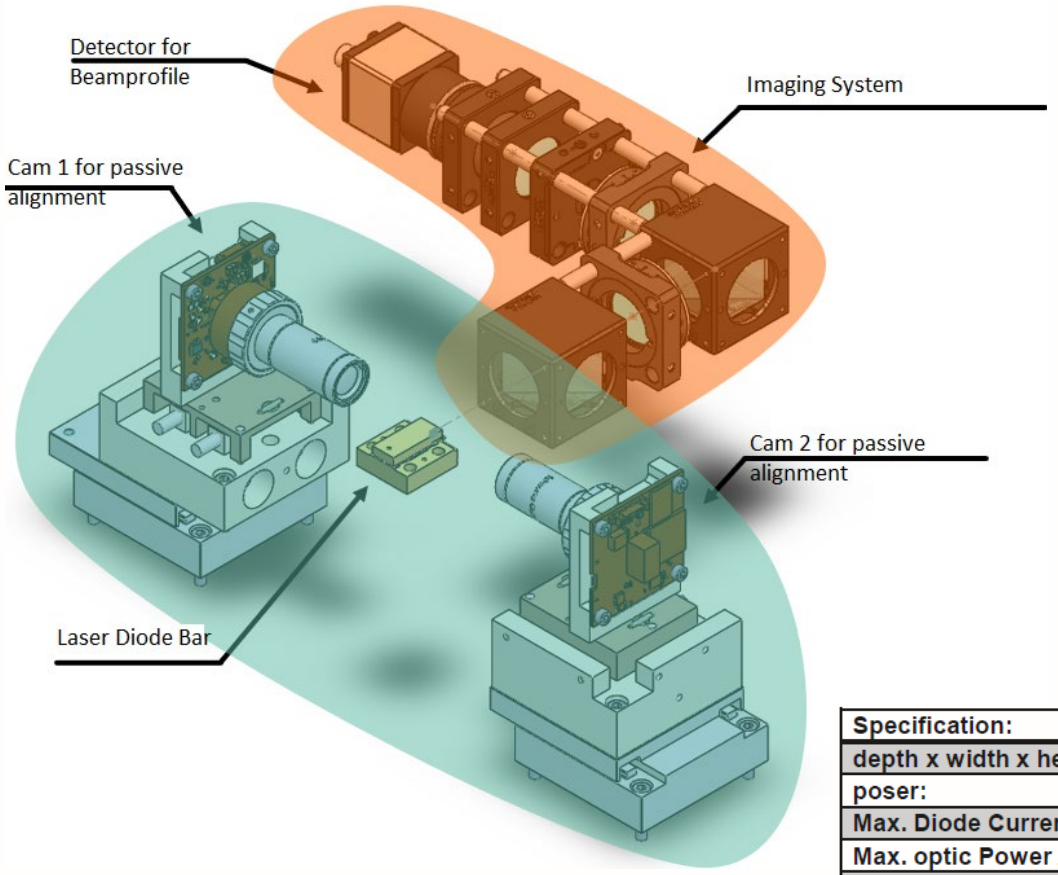
Beam diagostic measurement system



- Two independent measurement system for BFL and Laser beam parameters such as smile and residual divergence
- Passive CMOS imaging with resolution of 1.3 micron / pixel
- Active Laserbeam profiling with resolution of 0.032 micron / pixel (@ EFL of FAC at 600 micron)
- Allowing automated routine-based full positioning measurement and bonding cycle

Specification:	
depth x width x height (incl. SVM)	250 x 350 x 127 mm
poser:	5V DC
Max. Diode Current:	50A
Max. optic Power Ausgangsleistung:	dependent on diode laser used
Measurement resolution passive image:	1,325 µm/px
Measurement resolution active position (Fast-Axis):	dependent on EFL (f) [mm] of FAC-Lens under test: $A = 5{,}3 * 10^{-5} * f_{FAC}$ for a FAC-Lens with f=0,6mm this results in a resolution of 0,032 [µm/px]

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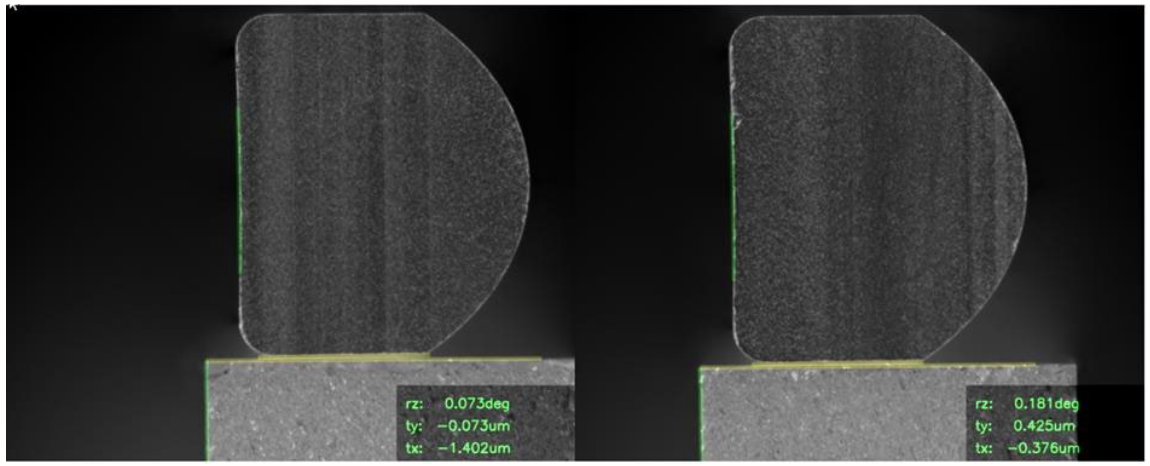
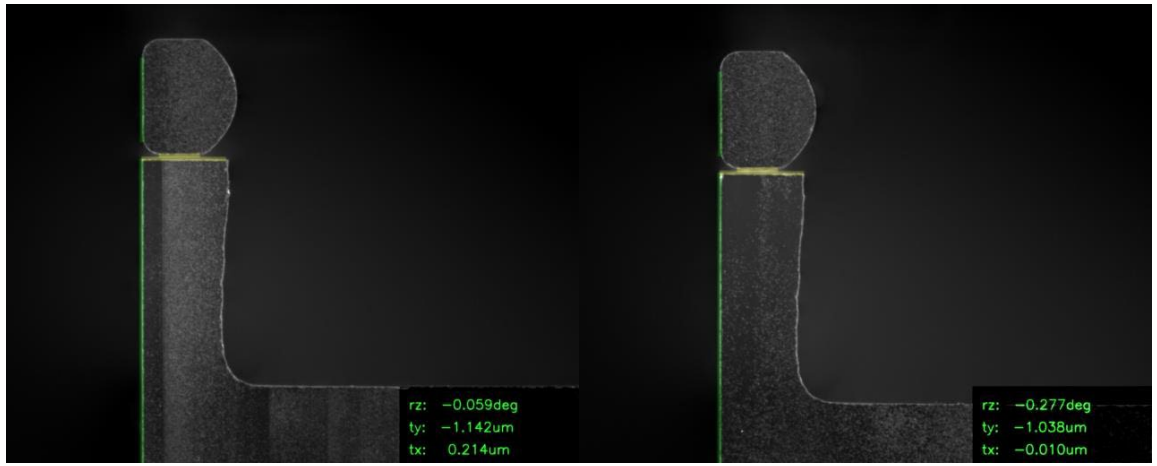
Assembly examples



FAC 600 on bottom tab (EFL = 600 micron)



FAC 200 on bottom tab (EFL = 200 micron)

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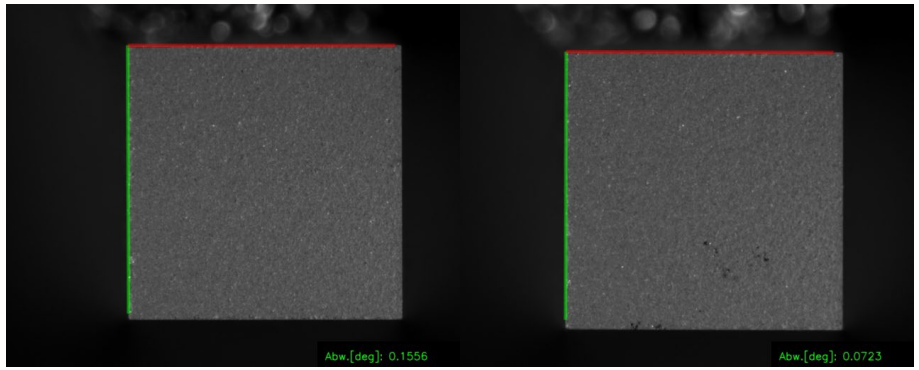
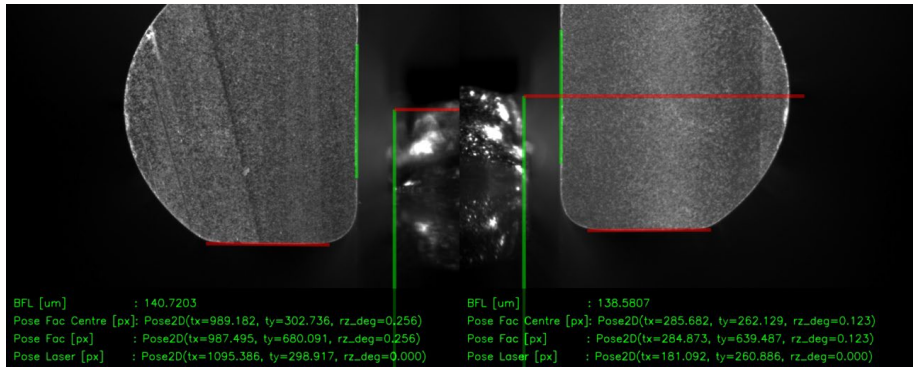
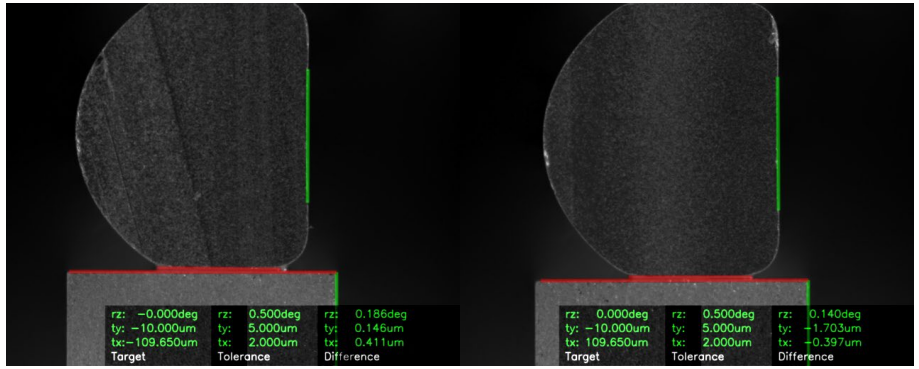
Assembly steps (FAC 600 on bottom tab)

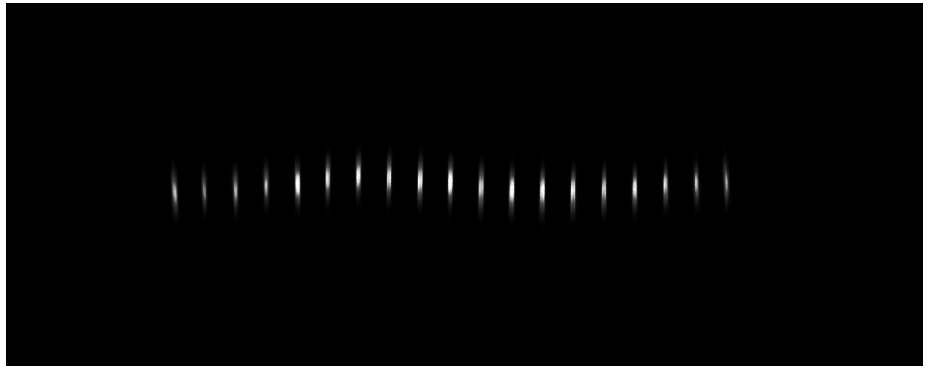


Passive measurement of bottom tab



Aktive measurement of BFL FAC





Passive measurement and bonding with recess = BFL FAC – fix «assembly BFL» (30 micron)

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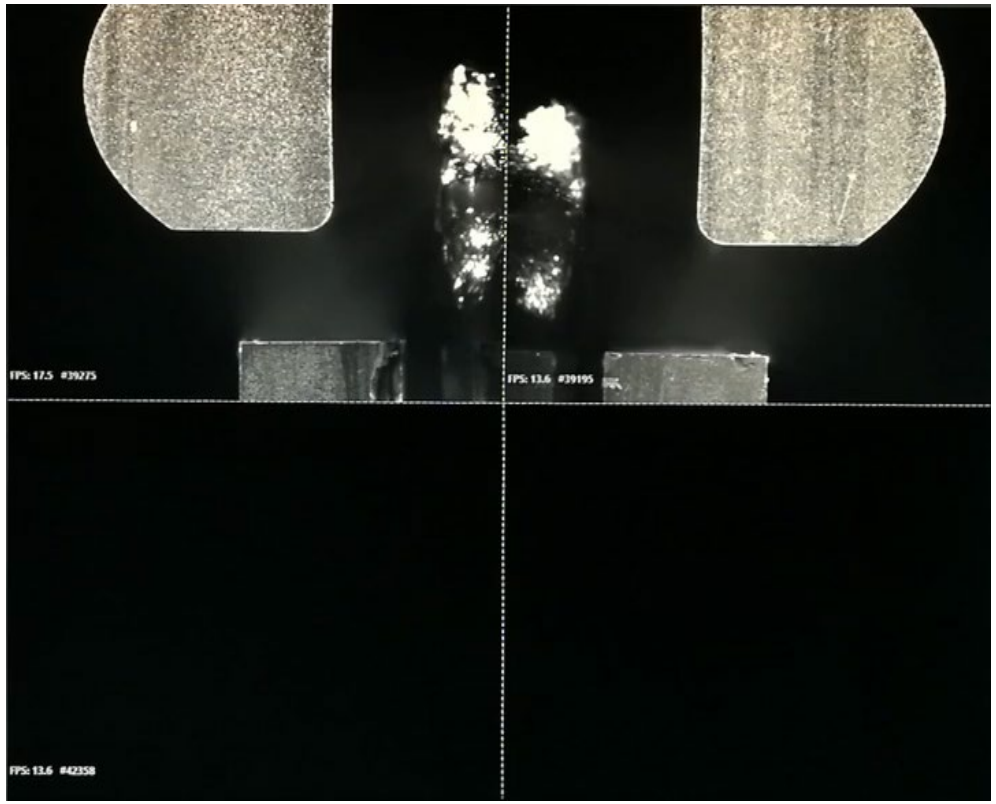
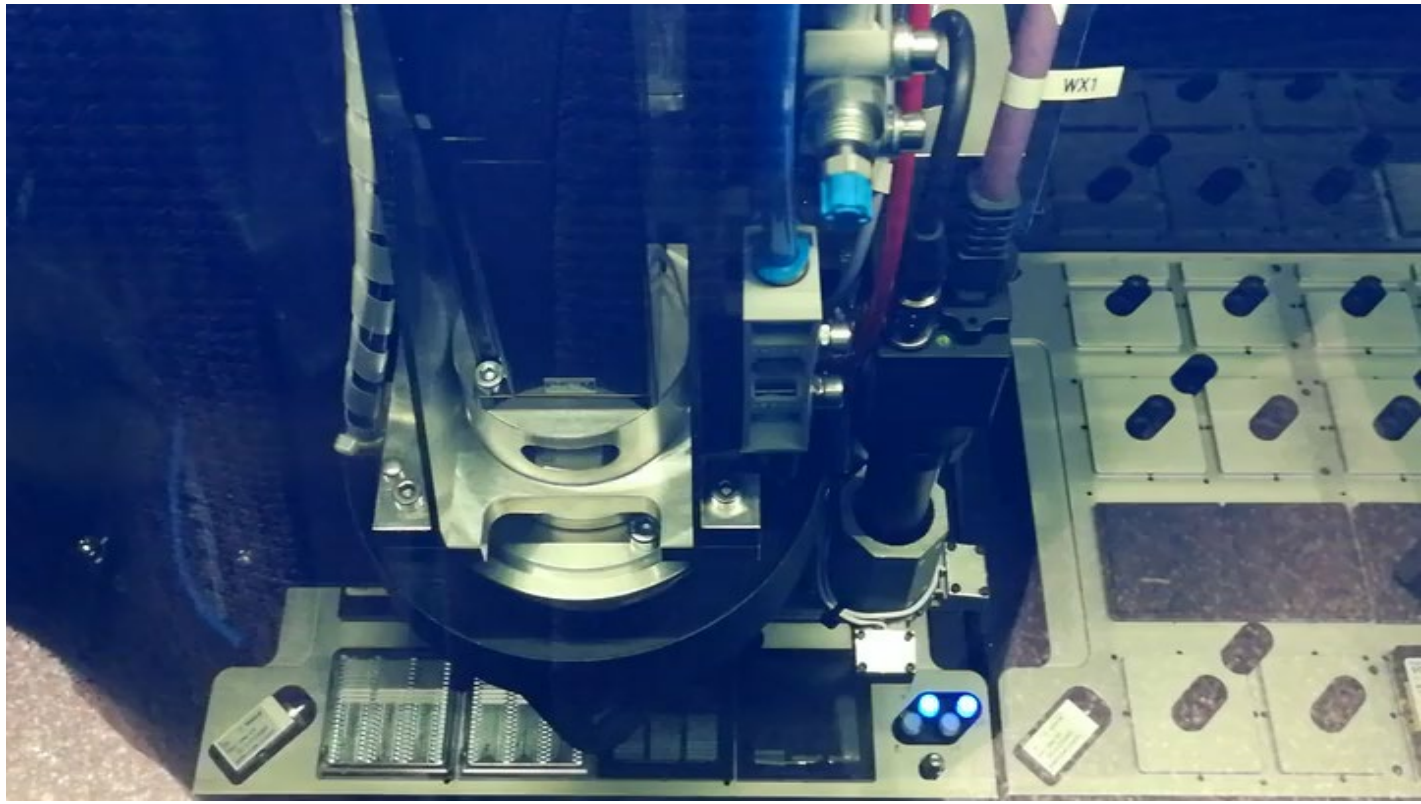
Videos / Closeup der Kameras (links)





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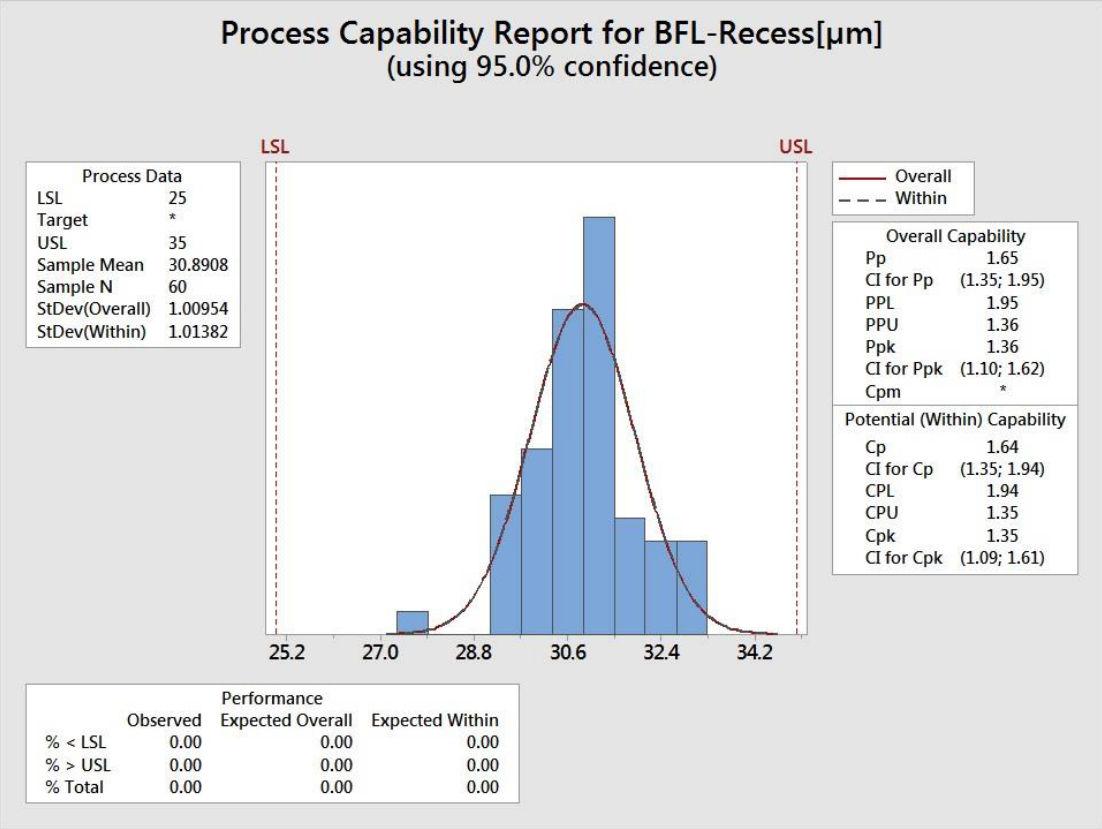
Process Capability for assembly BFL



FAC 600 on bottom tab with «assembly BFL» = 30 micron

- A lot of 60 pieces FAC's with EFL of 600 micron was subject to a process capability test for the «assembly BFL» measurement
- A standard deviation for the «assembly BFL» of +/- 1.0 micron is achieved
- The process capability of Ppk of 1.36 is indicative for a stable process

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