
ficonTEC
photonics assembly & testing

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PHOTONICS DAYS Berlin Brandenburg innovationconference

Integration of assembly process of high-speed photonic transceivers into a standard manufacturing system as basis for mass manufacturing

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Masstart

Mass manufacturing of Transceivers for Terabit/s era to bring the cost down to **€ 1/Gb/s** or even lower in mass production

Four demonstrators:

- **400Gb/s** 4-channel PSM4 module in QSFP-DD format
- **800Gb/s** 8-channel WDM module in a QSFP-DD format
- **1.6 Tb/s** 16-channel WDM on-board module
- Tunable single-wavelength coherent transceiver with 600Gb/s capacity

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Mass manufacturing of Transceivers for Terabit/s era to bring the cost down to **€ 1/Gb/s** or even lower in mass production

To achieve this, multiple new concepts are introduced:

- WAFT for spot size and pitch converters
- 3D packaging via through silicon vias
- New laser chip design
- …(you have seen in the previous presentations)

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Mass manufacturing of Transceivers for Terabit/s era to bring the cost down to **€ 1/Gb/s** or even lower in mass production

To achieve this, multiple new concepts are introduced:

However:

Testing and assembly remains **THE** cost driver for photonics assembly and packaging

Global Partner for assembly and testing

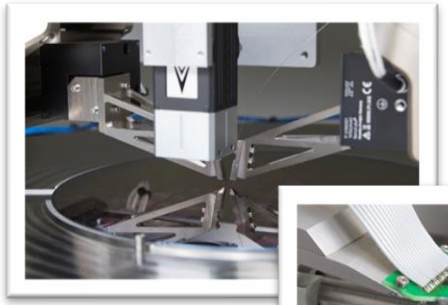
20 years of experience

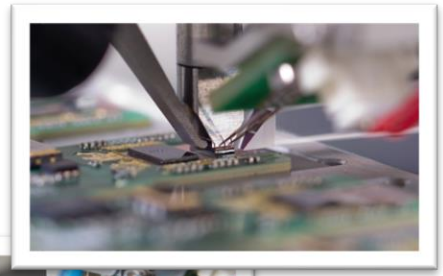
Over 900 installed Machines

Employees worldwide:

Achim:	170 employees
Shanghai:	10 employees
USA:	5 employees
Thailand:	10 employees
Estonia:	15 employees

Value chain of QFSP module





Wafer level

Chip level

Passive bonding

Active bonding

Active assembly

Chip Test

~~Separation~~

Chip Bonding

~~Wire Bonding~~

Module Assembly

~~Packaging~~

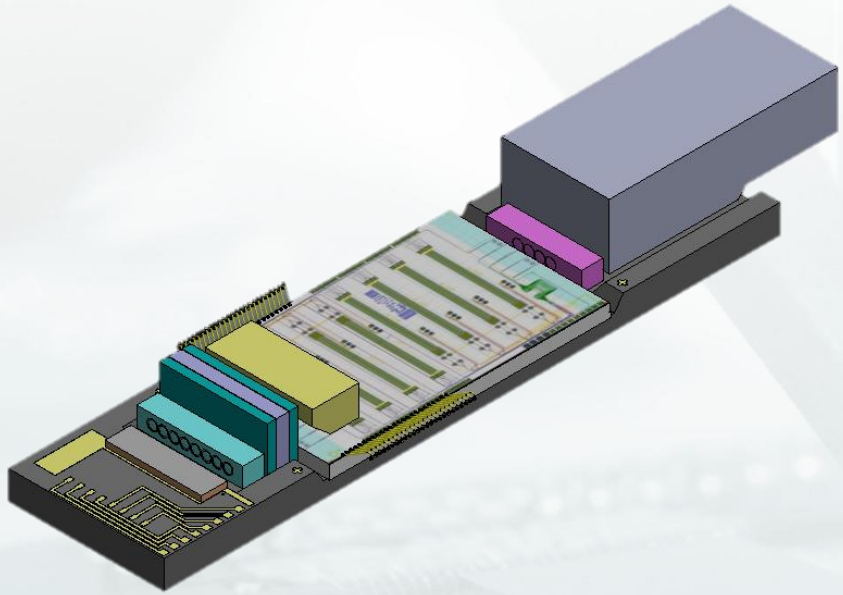
Lens Assembly

Fiber Assembly

EoL Test

Solution provider for the photonics assembly + testing

Demonstrator 1: Tx of QSFP-DD format with 400G

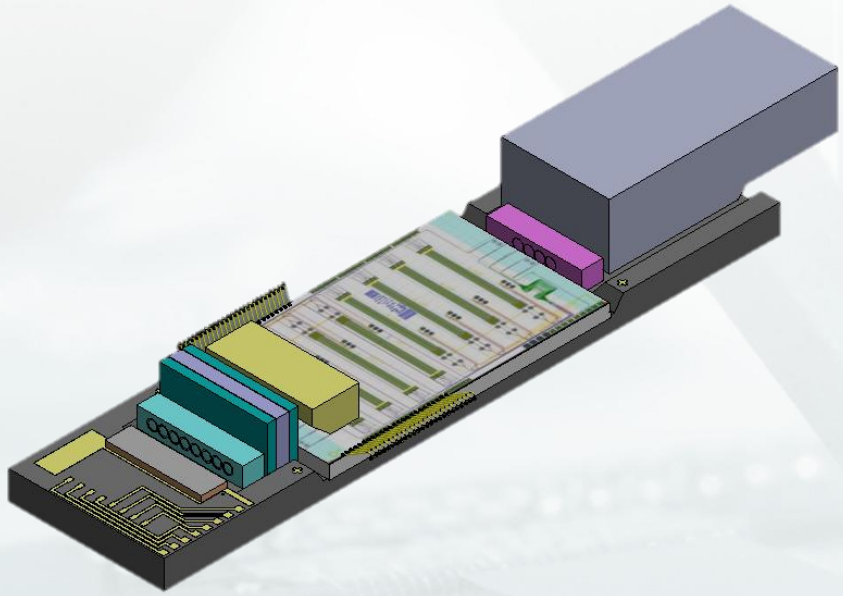


Design: Dust Photonics

Total of 7 optical components:

- Laser array
- Two Lens array
- Isolator
- Prism
- Si-PIC
- Fiber array

Demonstrator 1: Tx of QSFP-DD format with 400G



Design: Dust Photonics

Passive steps (vision based alignment):

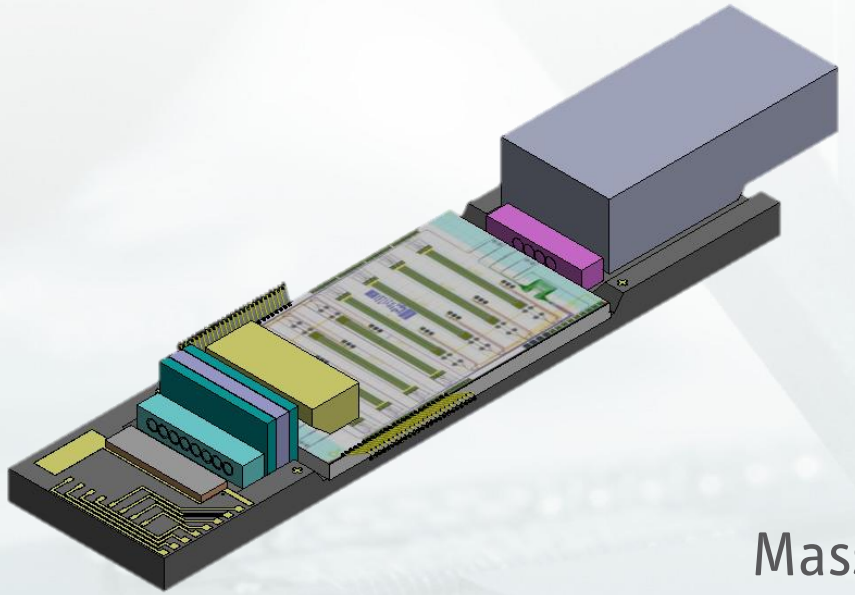
- Laser array
- Si-PIC
- Prism
- Isolator

1st step

Active steps (power module):

- Laser lens array
- Fiber/lens array

Demonstrator 1: Tx of QSFP-DD format with 400G



Design: Dust Photonics

Passive steps (vision based alignment):

- Laser array
- Si-PIC
- Prism
- Isolator

1st step

MASSTART

Masstart goals (FIC):

- **Verify feasibility of passive alignment concept**
- **Cost efficient passive assembly solution**

Keys to lower assembly costs for passive step

1. Close collaboration between product owner and assembly partner

   → Ensure easy assembly strategy

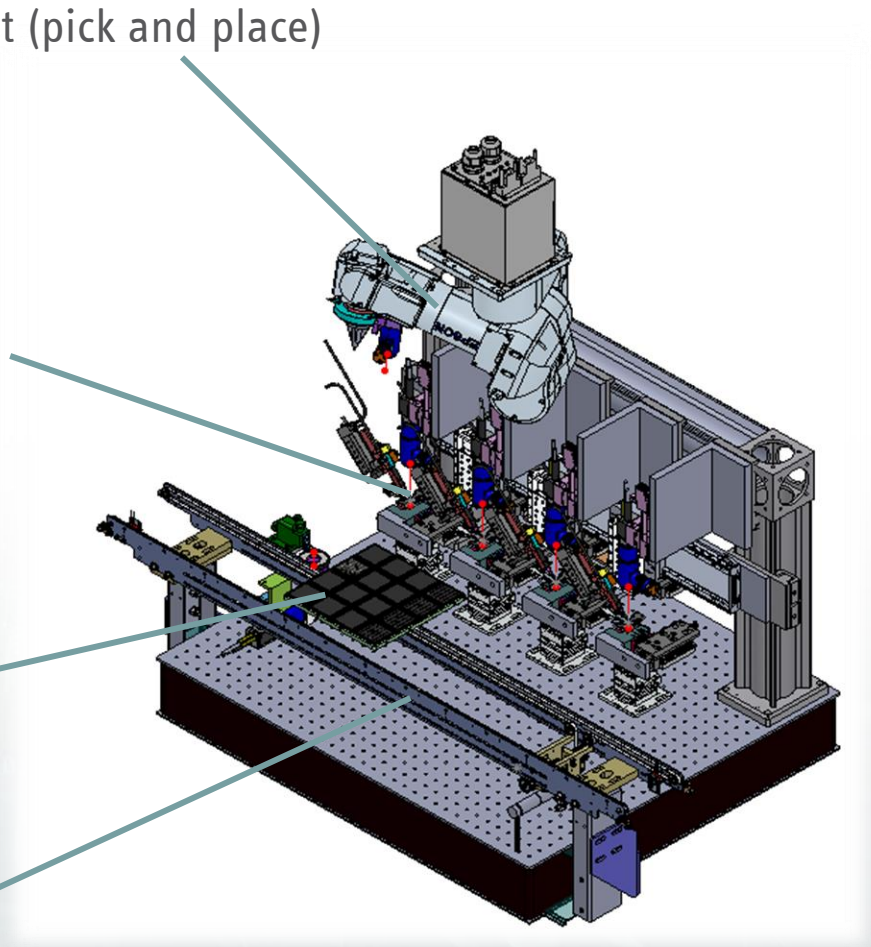
2. Final product cost defined by
   - Machine costs
   - Footprint / Clean room area
   - Throughput
   - (running costs)

Passive assembly concept Masstart

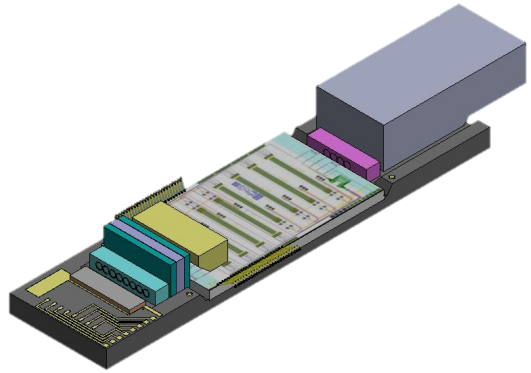
Final cost defined by

- Machine costs
- Footprint / Clean room area
- Throughput

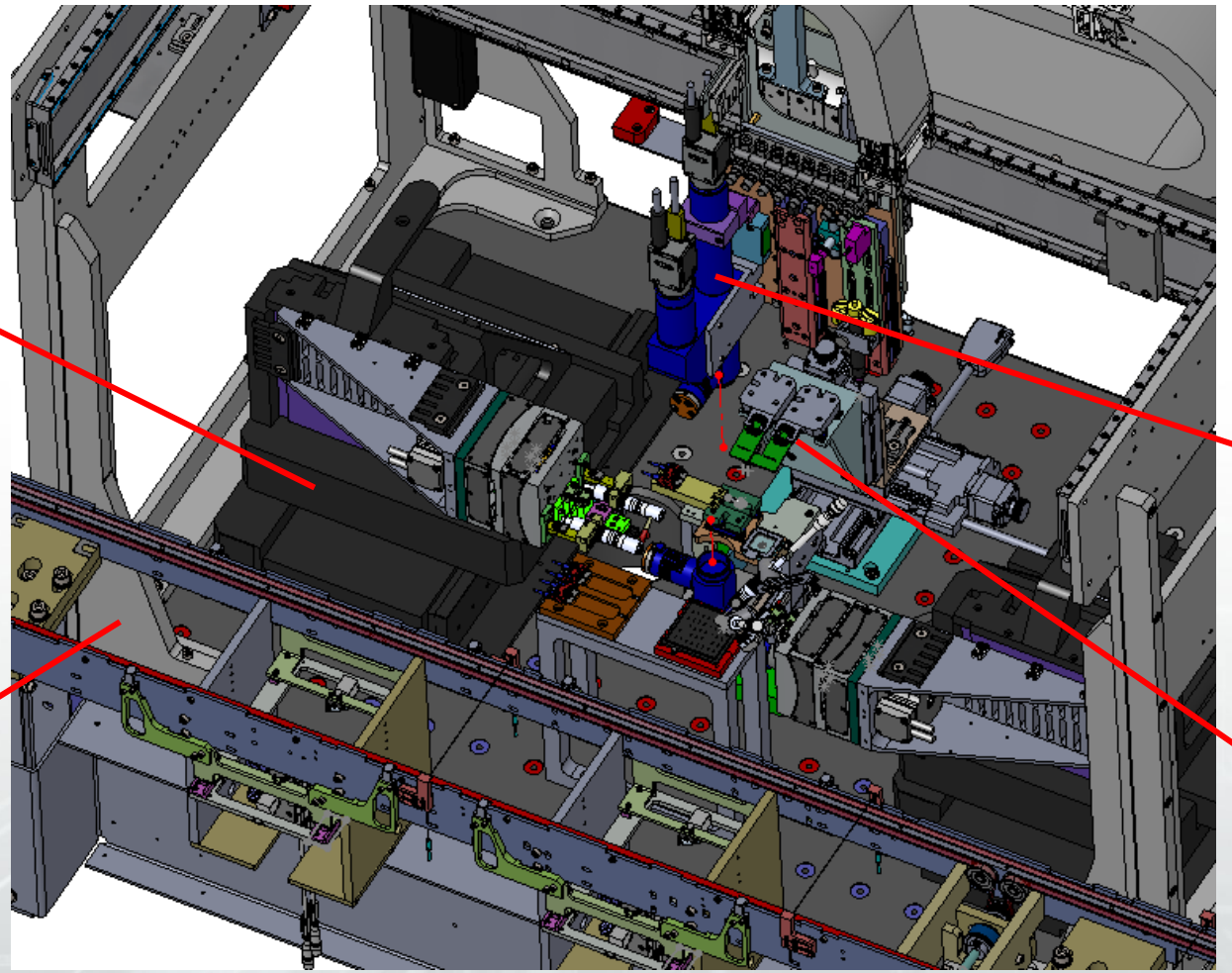
Throughput of all assembly steps!



Active assembly concept Masstart



2x 6-axes engines for active alignment of µ-lens arrays + Fiber array unit

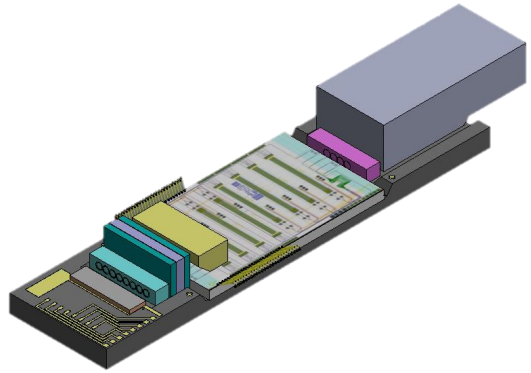


High resolution dual view camera for passive pre-alignment

Conveyor for higher automation level

Probe cards for pad probing

Active assembly concept Masstart



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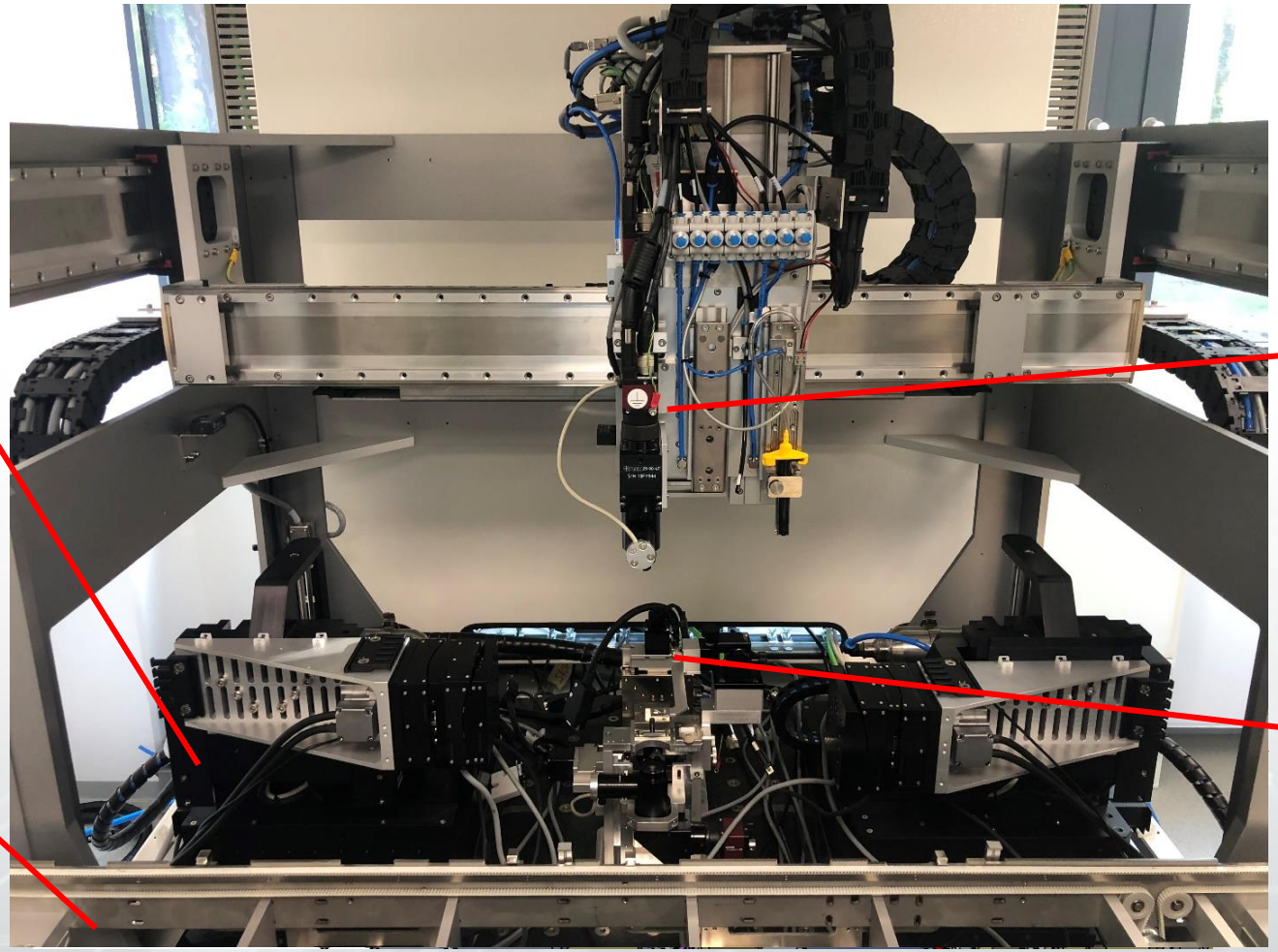

High resolution dual view camera for passive pre-alignment

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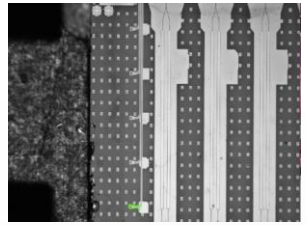
Conveyor for higher automation level

Assembly status

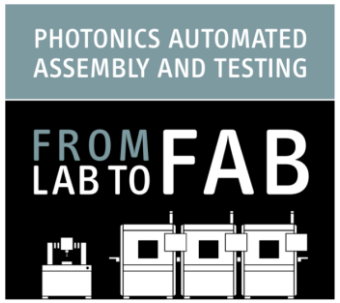


Active assembly machine

Passive assembly machine

- Hardware finished for passive + active assembly machines
- Process development ongoing
- Next steps:
  - First builds
  - Connect machines

From Prototype Machines to Mass Production



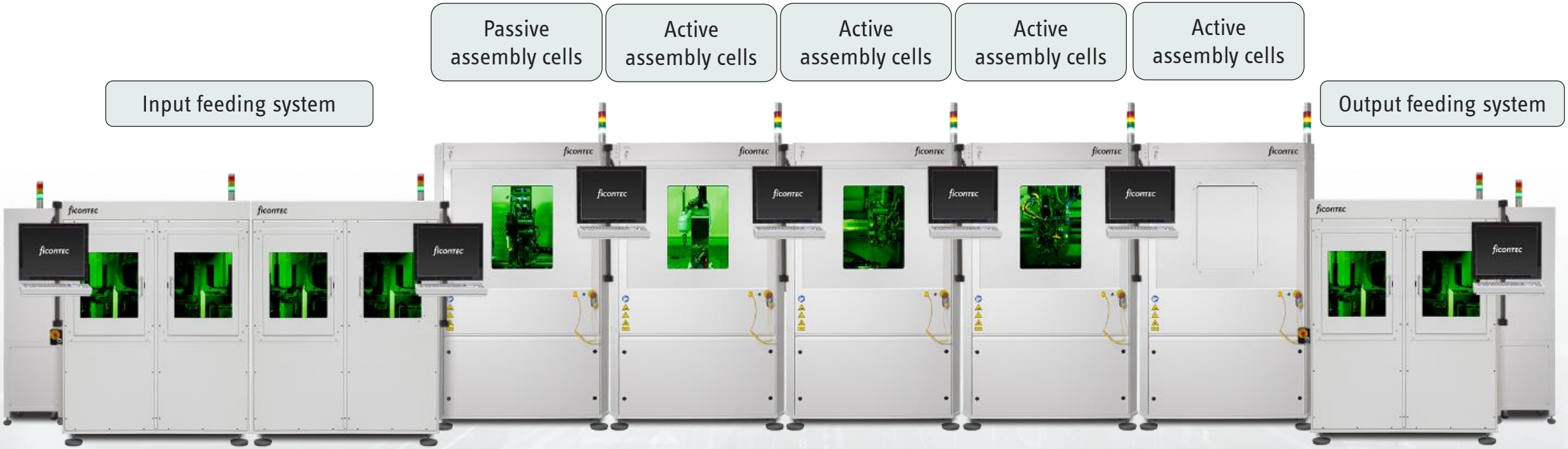
Fully automated Production Line consisting of several Feeders, Passive and Active Attachment, EoL test and Laser marking

Automated Production System consisting of 1 Input Feeder; 1 System; 1 Output Feeder

Production System with Development capability

Lab System with Production capability

Possible layout of mass manufacturing line for data center interconnects



Installation of production line

Conclusions

- Assembly is (and will remain) the cost driver for photonic products
- Last decade was mainly on improving individual assembly machines
- Next decade will be on introducing a higher level of automation
  (multiple stations within one machine, connected machines, line control, …)

https://masstart.eu

Masstart results:

- High throughput machine for passive 1-2 um alignment
- Integration of passive and active machines into one assembly line

Thank you!

For further information please feel free to contact Moritz.Seyfried@ficontec.com