IIoT Smart Factories

USE CASE PEER STRITZINGER GMBH

2021-07-27

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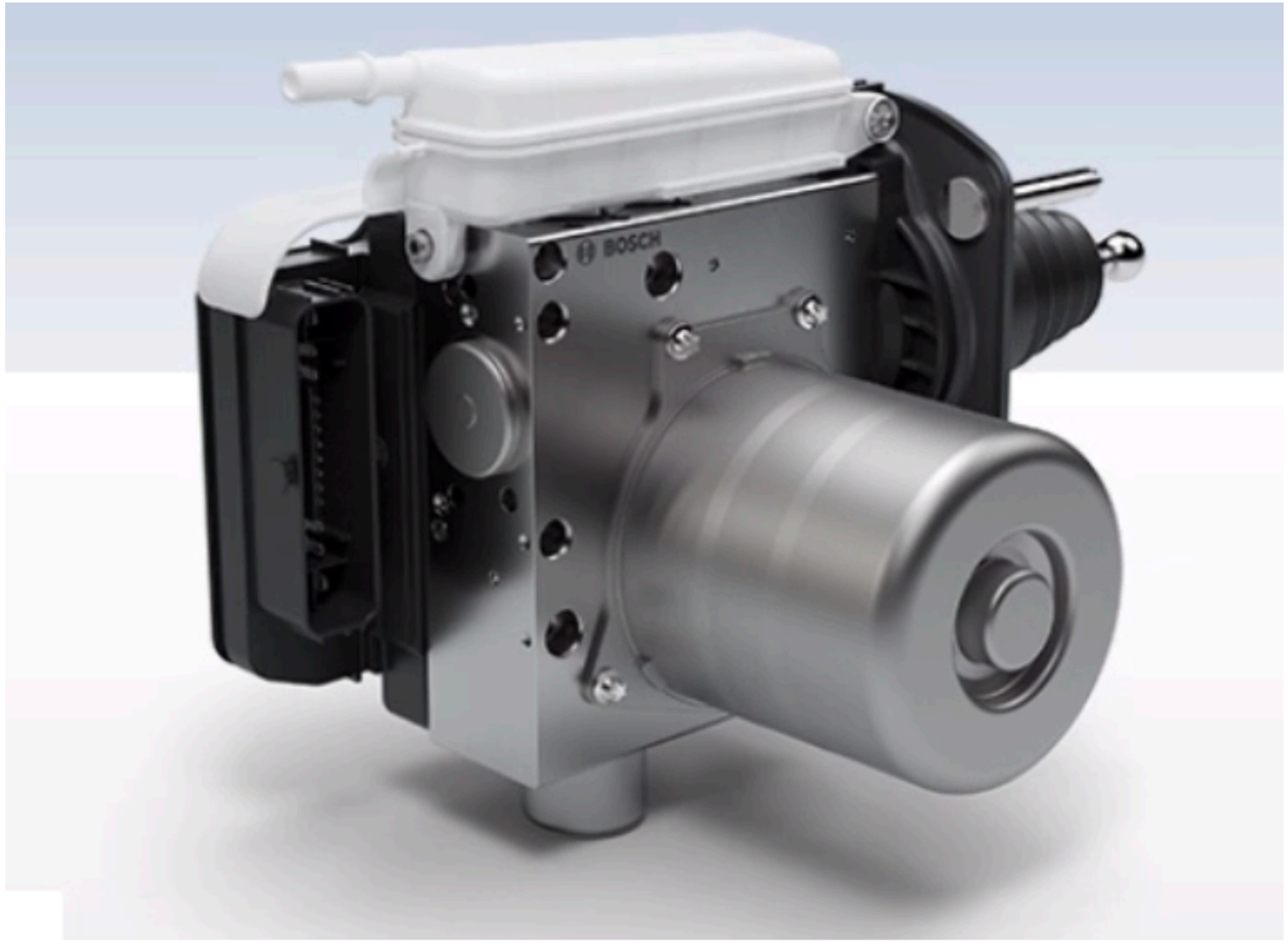
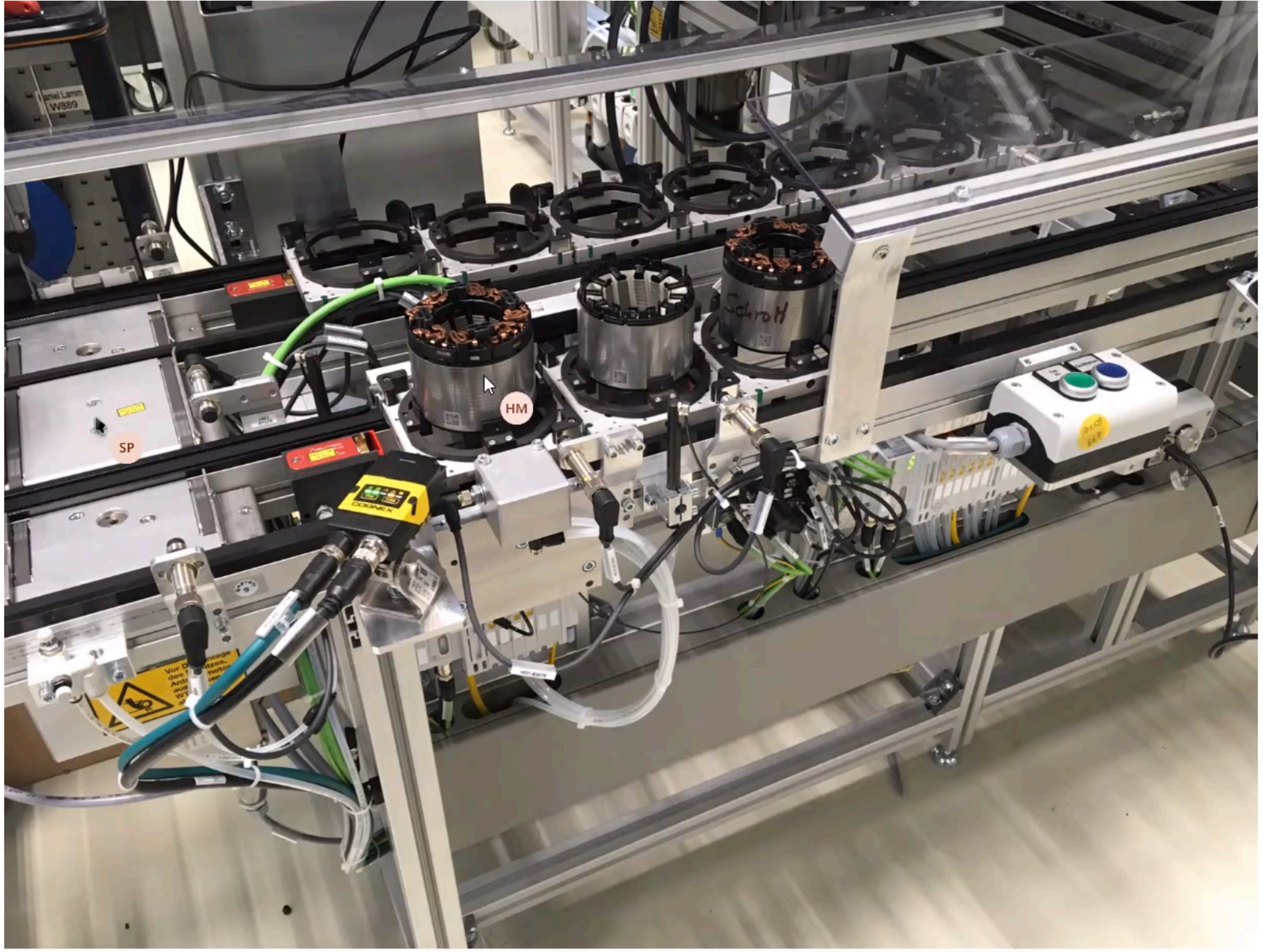
Bosch Integrated Power Break





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High Level User Story (aka Elevator Pitch)

- Plug & Produce
  - Smartness is built into conveyor belt parts
  - Installation without programming
  - Modification in operation without programming
- Adaptive Optimised One Piece Material Flow
  - Workpiece distribution for 100% process utilisation
  - Automatic reaction to changes
  - Time & Cost optimisation (- 40% according to a calculation with a real manufacturing line)

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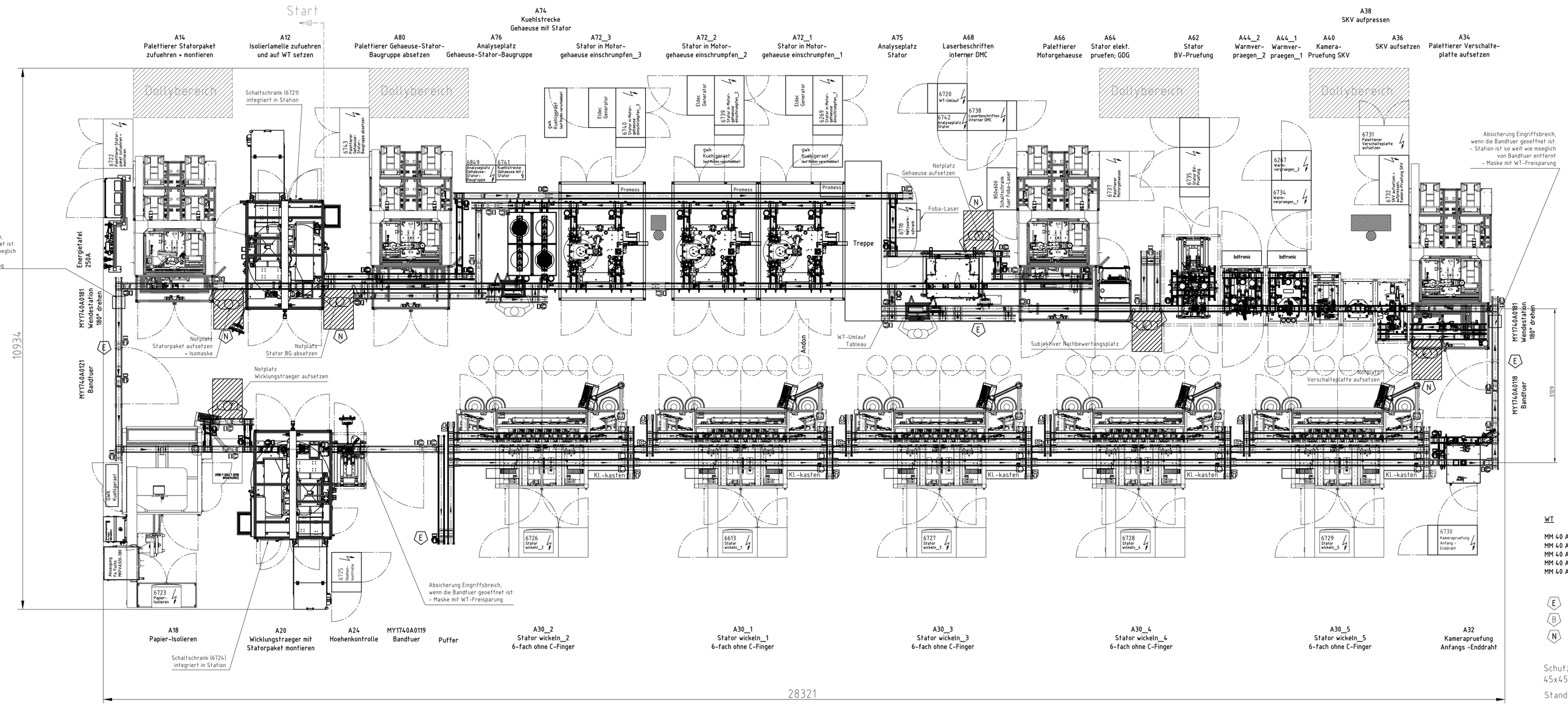

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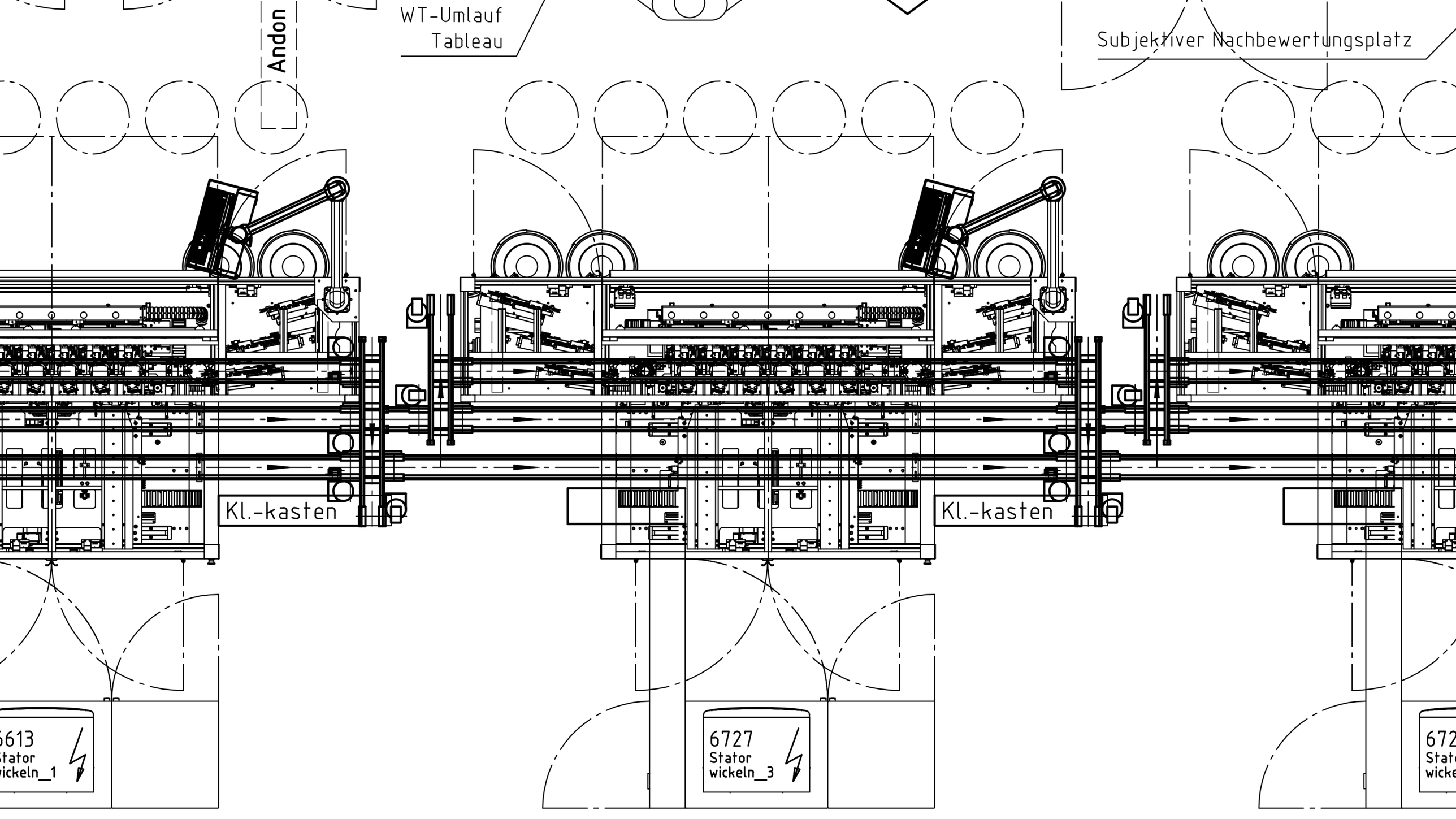
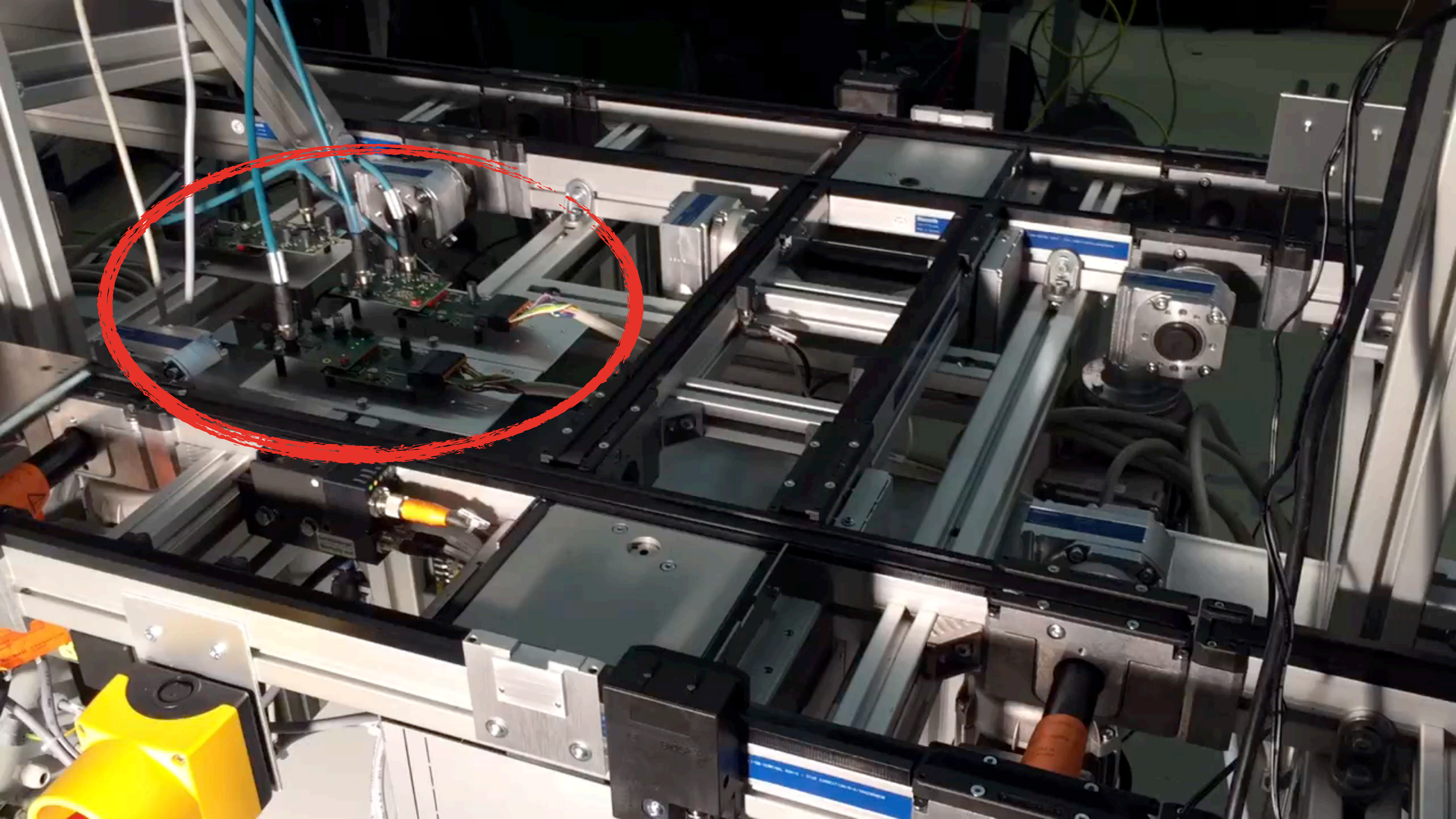
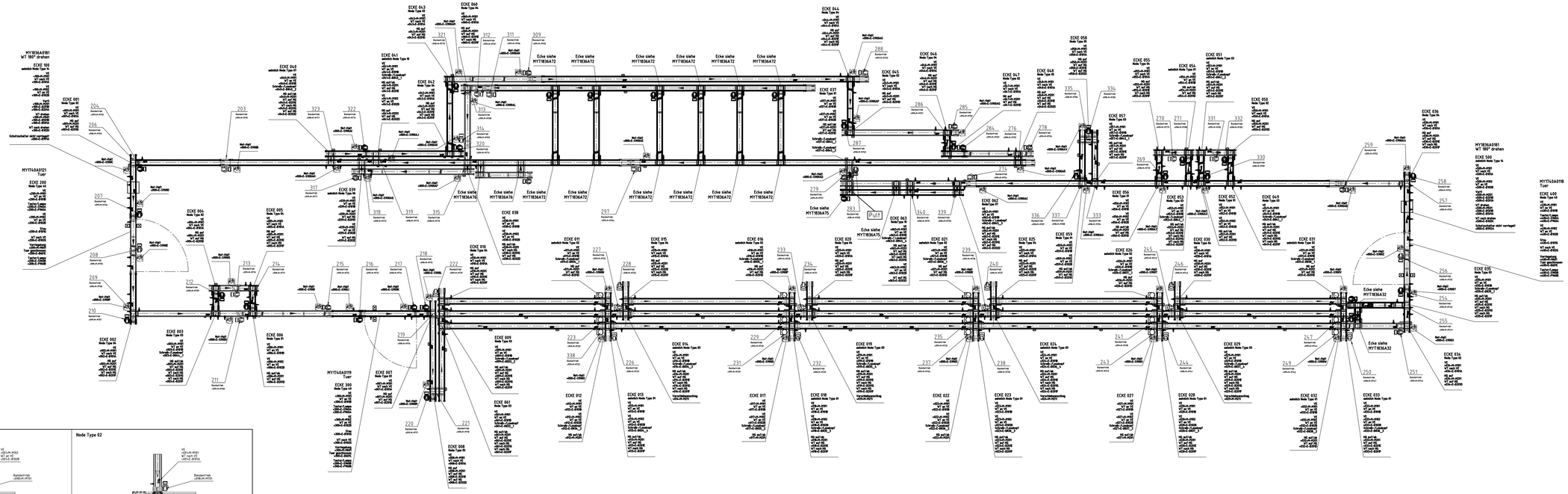
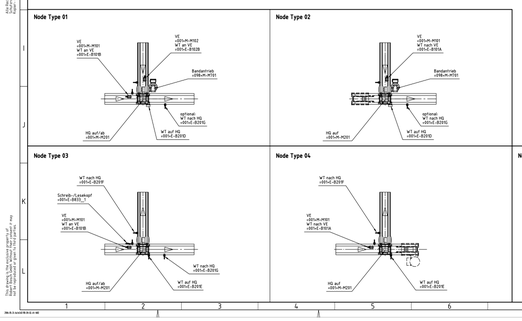

Andon
WT-Umlauf
Tableau
Subjektiver Nachbewertungsplatz
Kl.-kasten
Kl.-kasten
6613
Stator
wickeln_1
6727
Stator
wickeln_3



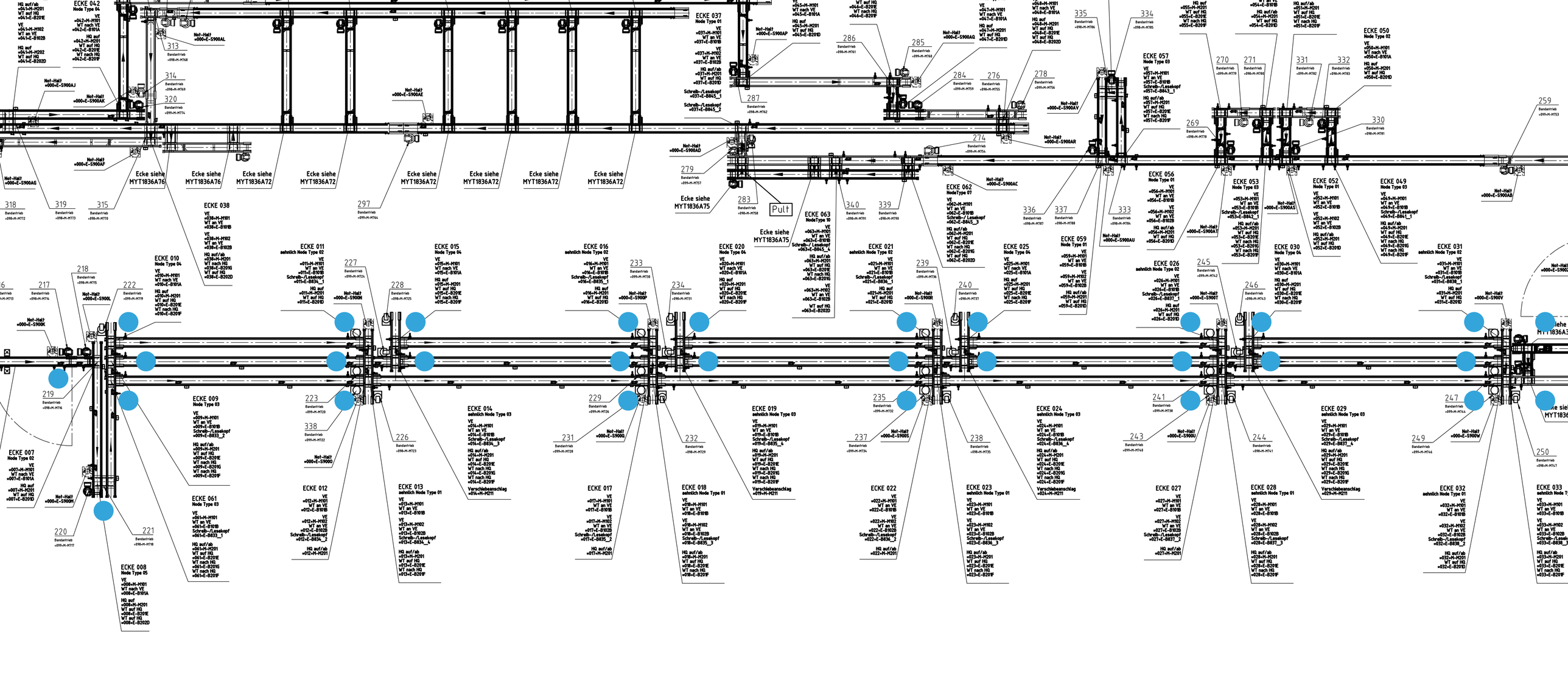




WT-Umlauf
SPL.-Nr. 6720

Stand: 19.03.2020

ED/MF33 - Madlinger
Tel.: 07223/82-1838
Fax: 0711/811513-1838
E-Mail: Heiko.Madlinger@de.bosch.com


ECKE 042
Node Type 04
Ecke siehe MYT1836A76
Ecke siehe MYT1836A72
Ecke siehe MYT1836A75
Pult
ECKE 037
Node Type 01
ECKE 038
ECKE 063
Node Type 10
ECKE 062
NodeType 07
ECKE 057
Node Type 03
ECKE 056
Node Type 01
ECKE 059
Node Type 01
ECKE 053
Node Type 03
ECKE 052
Node Type 01
ECKE 050
Node Type 02
ECKE 049
Node Type 03
ECKE 031
sehnlich Node Type 02
ECKE 010
Node Type 04
ECKE 011
sehnlich Node Type 02
ECKE 015
Node Type 04
ECKE 016
sehnlich Node Type 02
ECKE 020
Node Type 04
ECKE 021
sehnlich Node Type 02
ECKE 025
Node Type 04
ECKE 026
sehnlich Node Type 02
ECKE 030
Node Type 04
ECKE 007
Node Type 02
ECKE 009
Node Type 03
ECKE 014
sehnlich Node Type 03
ECKE 019
sehnlich Node Type 03
ECKE 024
sehnlich Node Type 03
ECKE 029
sehnlich Node Type 03
ECKE 061
Node Type 03
ECKE 012
ECKE 013
sehnlich Node Type 01
ECKE 017
ECKE 018
sehnlich Node Type 01
ECKE 022
ECKE 023
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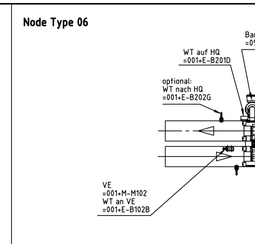
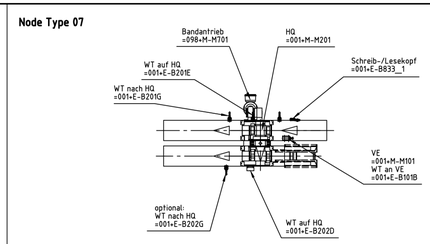
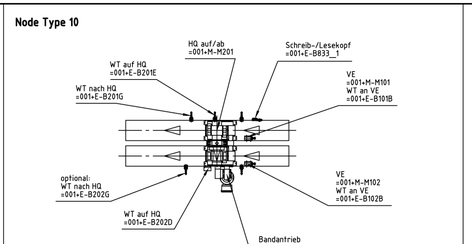
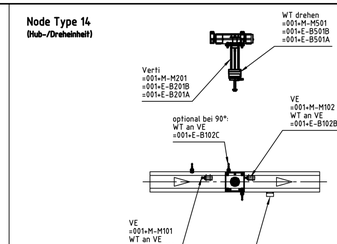
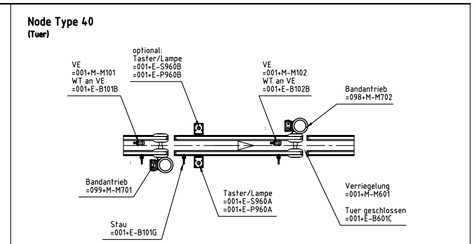
ECKE 027
ECKE 028
sehnlich Node Type 01
ECKE 032
sehnlich Node Type 01
ECKE 008
Node Type 05
Pult

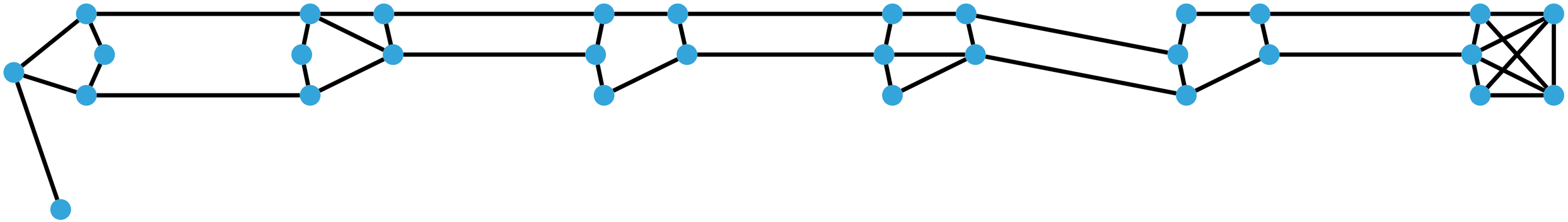

Node Type 06
Bandantrieb
=098-M-M701
HQ
=001+M-M201
WT auf HQ
=001+E-B201D
optional:
WT nach HQ
=001+E-B202G
VE
=001+M-M101
WT an VE
=001+E-B101B
VE
=001+M-M102
WT an VE
=001+E-B102B
WT auf HQ
=001+E-B202E


Node Type 07
Bandantrieb
=098-M-M701
HQ
=001+M-M201
WT auf HQ
=001+E-B201E
WT nach HQ
=001+E-B201G
Schreib-/Lesekopf
=001+E-B833_1
VE
=001+M-M101
WT an VE
=001+E-B101B
optional:
WT nach HQ
=001+E-B202G
WT auf HQ
=001+E-B202D


Node Type 10
HQ auf/ab
=001+M-M201
Schreib-/Lesekopf
=001+E-B833_1
WT auf HQ
=001+E-B201E
WT nach HQ
=001+E-B201G
VE
=001+M-M101
WT an VE
=001+E-B101B
optional:
WT nach HQ
=001+E-B202G
VE
=001+M-M102
WT an VE
=001+E-B102B
WT auf HQ
=001+E-B202D
Bandantrieb
=098+M-M701


Node Type 14
(Hub-/Dreehnheit)
WT drehen
=001+M-M501
=001+E-B501B
=001+E-B501A
Verti
=001+M-M201
=001+E-B201B
=001+E-B201A
optional bei 90°:
WT an VE
=001+E-B102C
VE
=001+M-M102
WT an VE
=001+E-B102B
VE
=001+M-M101
WT an VE
=001+E-B101A
WT nach Drehen
=001+E-B102H


Node Type 40
(Tuer)
VE
=001+M-M101
WT an VE
=001+E-B101B
optional:
Taster/Lampe
=001+E-S960B
=001+E-P960B
VE
=001+M-M102
WT an VE
=001+E-B102B
Bandantrieb
=098+M-M702
Bandantrieb
=099+M-M701
Taster/Lampe
=001+E-S960A
=001+E-P960A
Verriegelung
=001+M-M601
Tuer geschlossen
=001+E-B601K
Stau
=001+E-B101G



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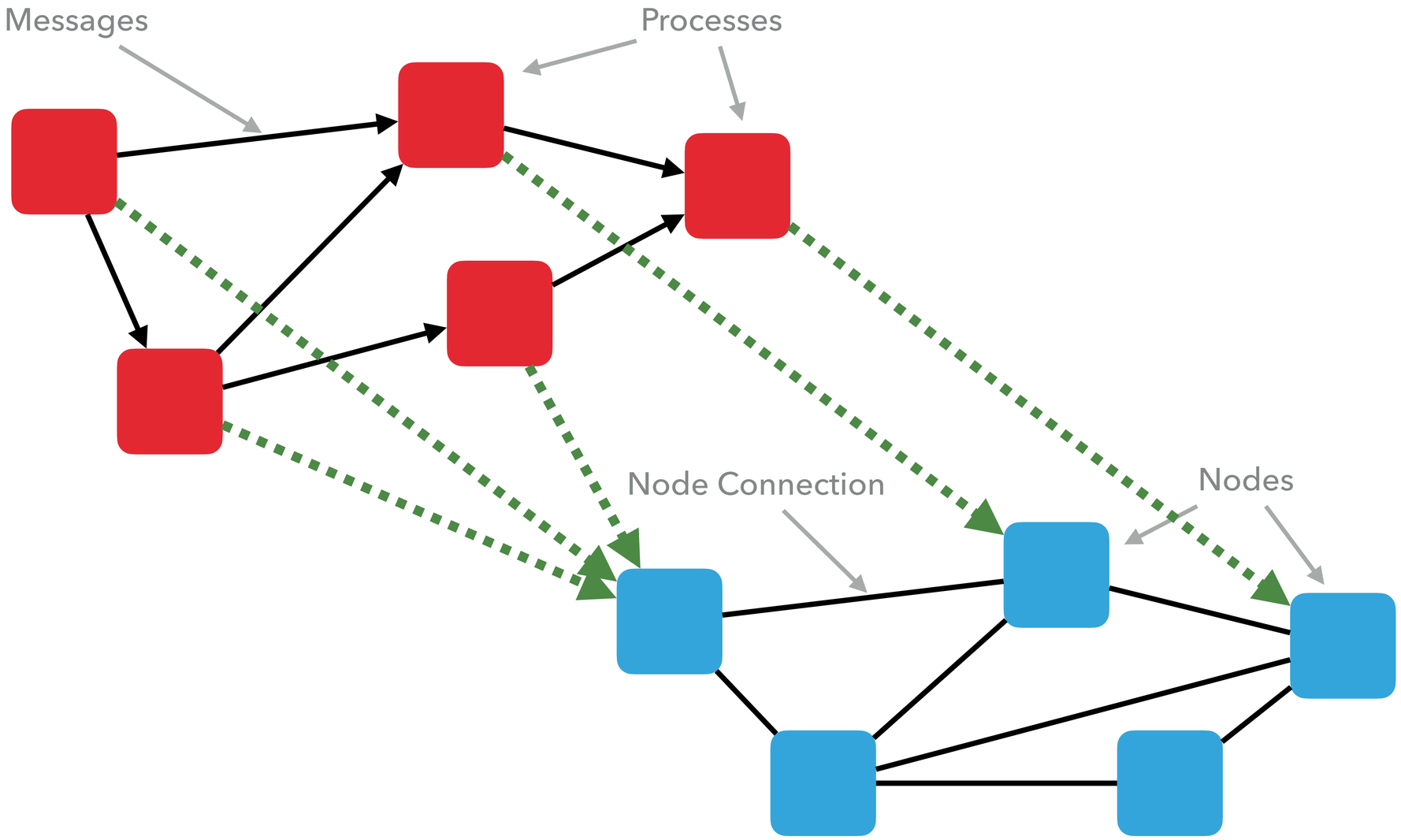
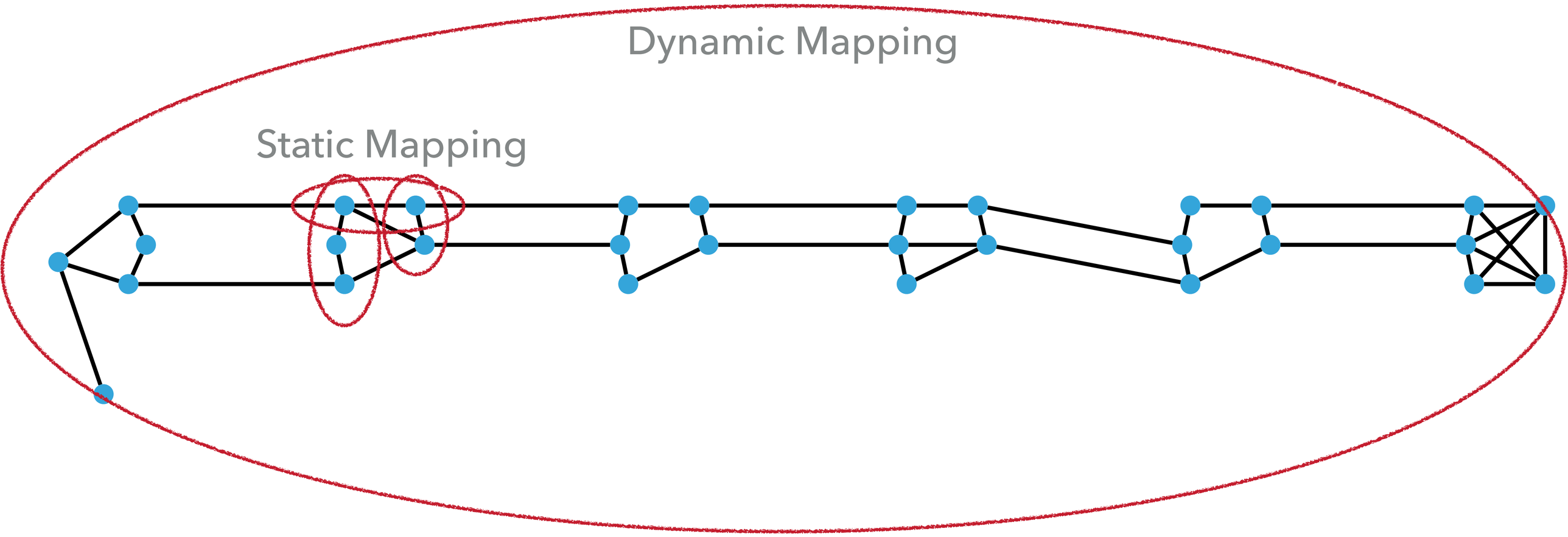
Mapping Processes to Nodes



Modes of Operation

- **Relatively Static Mapping:**
  - Distributed calculation of good enough mapping of processes to nodes
  - Occasional recalculation when preconditions change
- **Very Dynamic Mapping:**
  - Processes migrate and spawn regularly
  - Migration decision from local and regional knowledge



Erlang + Unikernel

Deploying Erlang directly on Real and Virtual Hardware

https:/www.grisp.org

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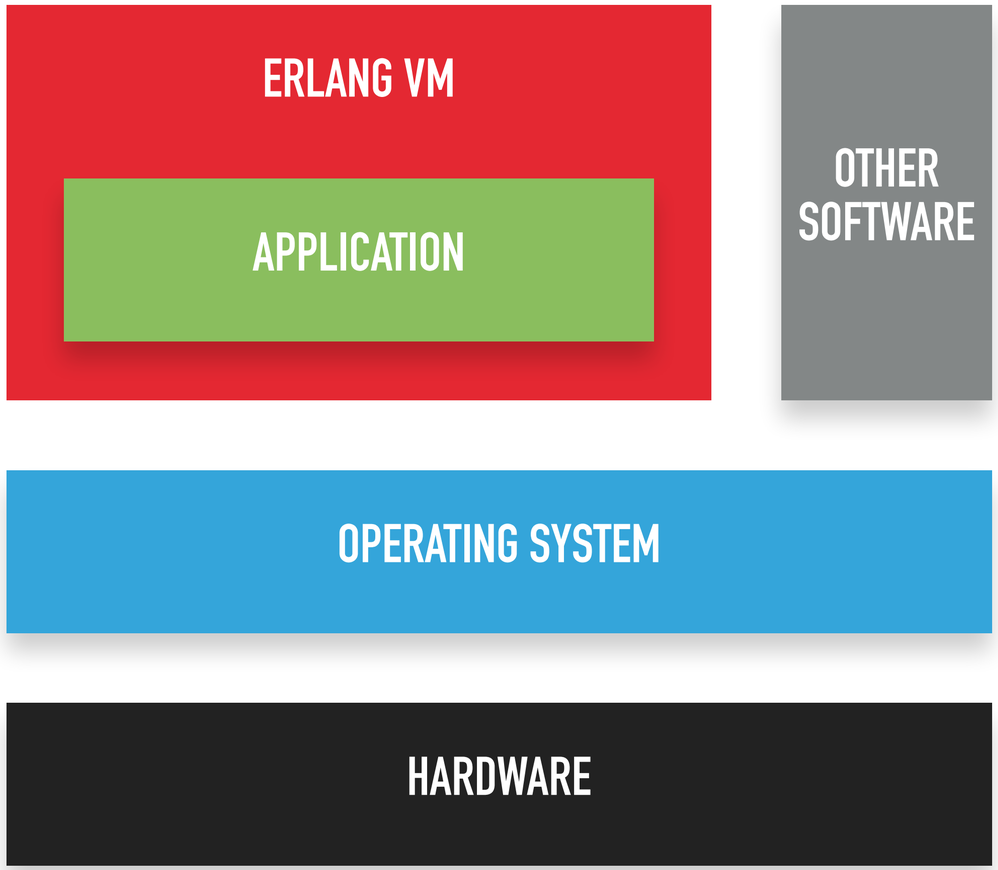
Research questions

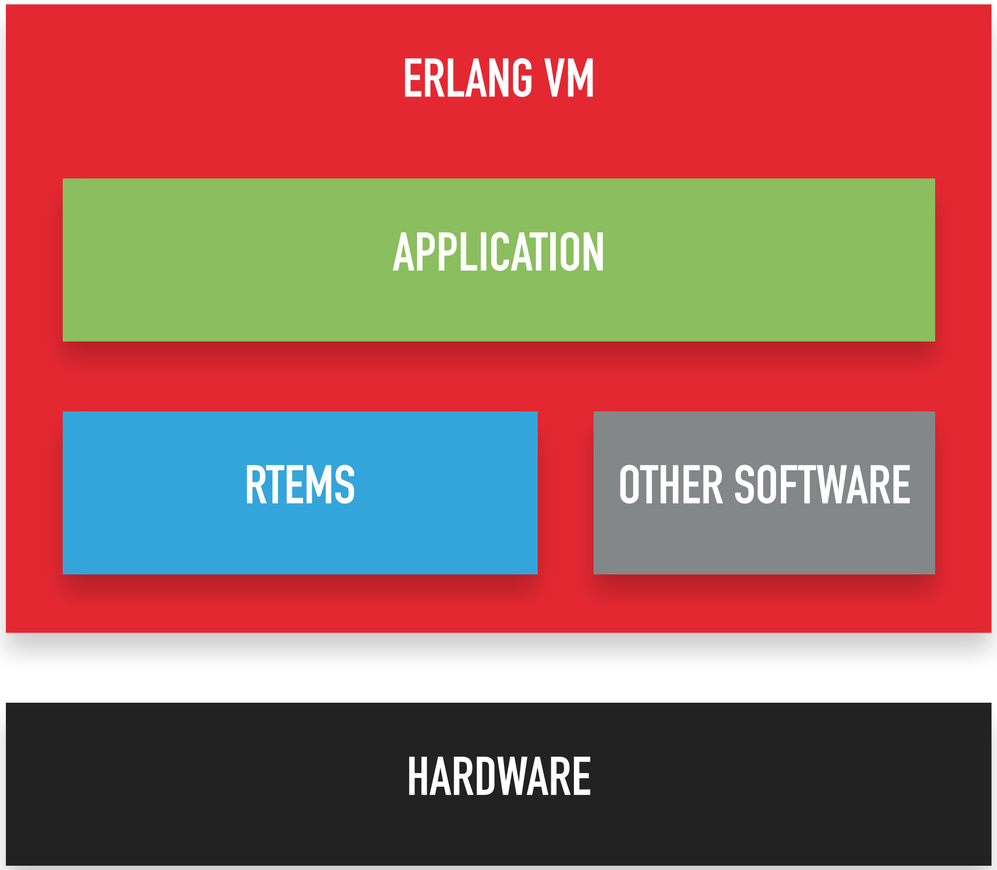
- Can a distributed orchestrator map the computation in these cases
- Can we successfully run a distributed online planning algorithm on a mesh of IoT systems only?
- How could a generic extensible solution look like?
- Possible extension: Ethernet TSN path control and reservation

TRADITIONAL ARCHITECTURE

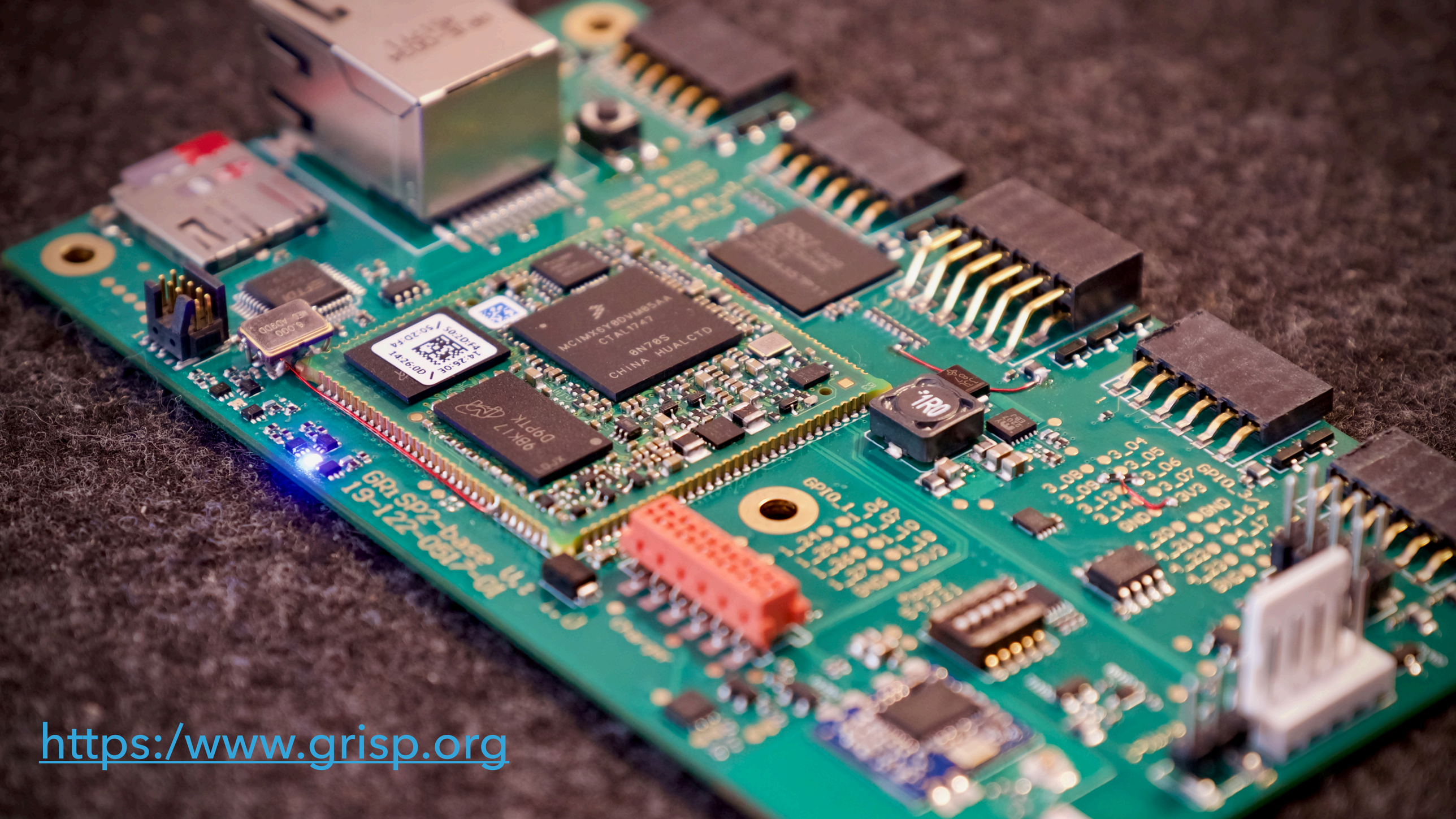


VS

GRiSP



https:/www.grisp.org


https:/www.grisp.org

IoT Devices

Micro Server	>= 1000 MIPS	>= 1GB	
Large Grisp Node	500 MIPS	512MB	GRISP 2
Medium GRiSP Node	100 MIPS	64MB	GRiSP 1
Small GRiSP Node	30 MIPS	8MB	SoC