# SINUMERIK CNC as part of a TIA Portal-based Manufacturing Cell

**Presented by Tiansu Jing**

**Manufacturing in America │ March 20-21, 2019**

**SIEMENS**

*Ingenuity for life*

# The complete product portfolio offers the highest possible of integration from Siemens

| Complete product portfolio for the Digital Enterprise | | | |
|---|---|---|---|
| **SINUMERIK** | **SIMATIC** | **SINAMICS** | **SIMOTICS** |
|  |  |  |  |
| The perfect CNC solution for every machine tool | The Product family for Automation by Siemens | Low-voltage converters - the integrated drive family for every application | The right motor for every motion control task - the widest range of motors worldwide |

**The integrated product portfolio is the basis for highly productive machines and plants for the Digital Enterprise.**

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# The Siemens Motion Control Portfolio
## - the perfect CNC solution for every machine concept

Modularity of the machine concept

☑ SINUMERIK 840D sl

☑ SINUMERIK 828

☑ SINUMERIK 808

Modular machine concepts

☑ SINAMICS drive systems

☑ SIMOTICS motors

Standardized machines

Entry-level machines

Performance
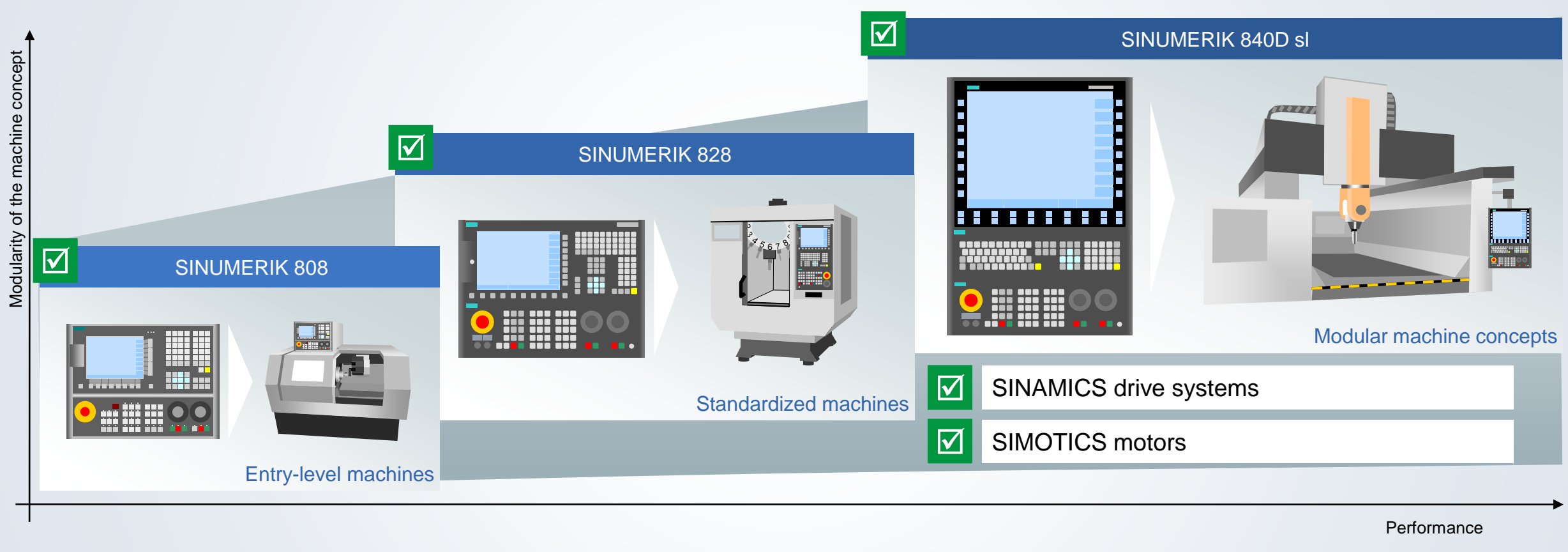
The **SINUMERIK product family** provides perfect solutions for all **machine concepts** – from **attractively priced** CNC entry-level machines to **standardized machine concepts** through to modular **premium-machine concepts**.

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# Traditional way to design the automation cell is to make everything cooperate with each other

― Industrial EtherNet

**840D sl**

OP015    PCU

ET200

HT8

NCU + S120

Milling Machine w/ CNC

**840D sl**

OP015    PCU

ET200

NCU + S120

Turning Machine w/ CNC

**S7-300**

TP9000

IPC

ET200    Hand Terminal

S7-300

S120

Loaders

**S7-300**

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ET200    Hand Terminal

S7-300

S120

Robot loaders

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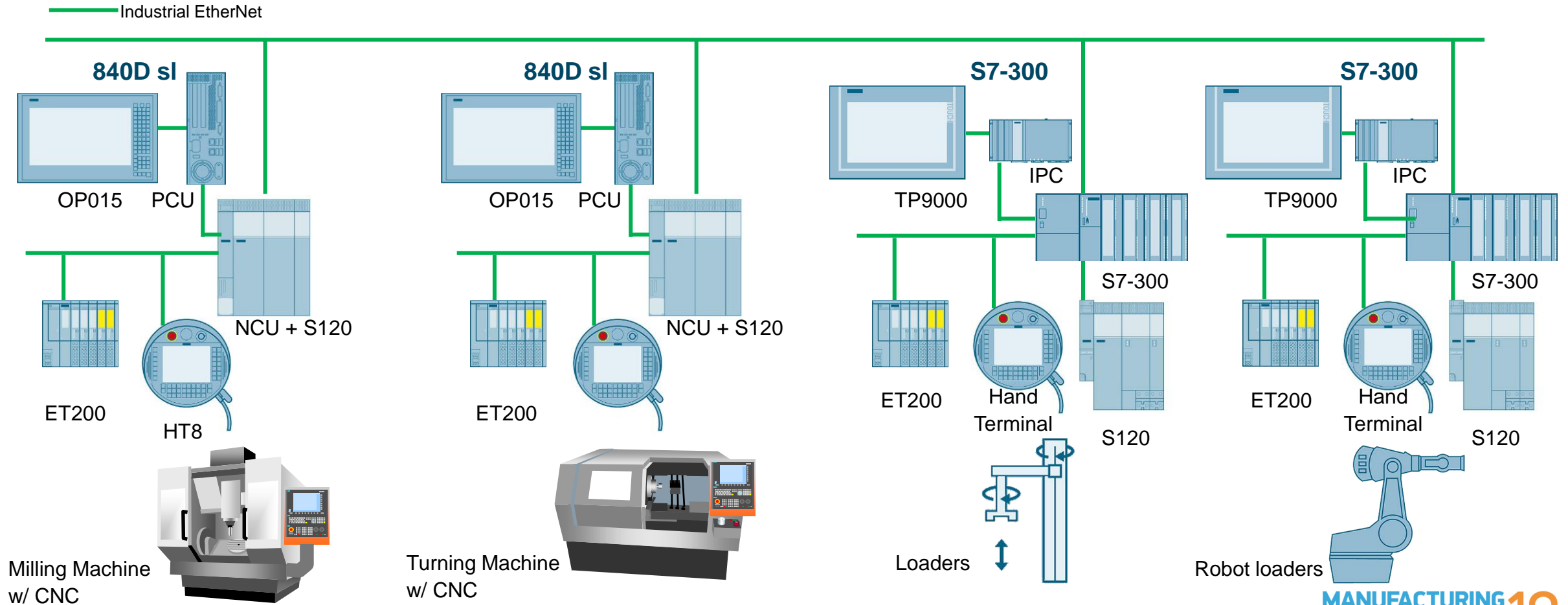
# SINUMERIK blackline plus Panel
## Product families from SIMATIC for the machine tool market

**15"**  **19"**  **22"**  **24"**

**Multi-touch**

### ITC
**SIMATIC Integrated Thin-Client Unit**
- With integrated thin client module
- Transfer of video and data via Ethernet
- Up to 100 m distance between NCU/IPC
- Low mounting depth
- For "embedded" and "Windows-based" architectures

### IFP
**SIMATIC Industrial Flat Panels**
- Transfer of video via the display port
- Transfer of data via USB
- Low mounting depth
- For use with "box" IPC such as IPC 427

### IPC 477E
**SIMATIC Industrial PC (integrated panel PC)**
- Integrated Panel PC concept
- Compact and rugged: SSD and passive cooling
- Dual Core & Quad Core / 64 bit architecture
- Improved performance due to the **Intel Skylake processors (6th Gen.)**
- Selected configurations for SINUMERIK

ITC= Integrated Thin-Client Unit
IFP= Industrial Flat Panel (Monitor)
IPC 477= Industrial PC (integrated Panel PC)

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# Migration SINUMERIK PCU 50.5 to SIMATIC IPC 4x7E - Benefits

## SINUMERIK PCU 50.5 (C/P)



## SIMATIC IPC 4x7E



### Storage

- 240 GB SSD mass storage

### Processor technology

- Powerful Intel processors – scalable from Celeron to Core i5 of 6th generation

### Interfaces

- 4 x USB 3.0 interfaces
- 3 x Gigabit Ethernet interfaces

### Common hardware

- Same hardware as using w/ PLC

### Benefits

- Improvement in speed compared to classic HD hard drive
- Increased service life

- Faster data processing

- Powerful interfaces for faster data transfer

- Simple maintenance

Julian Biberger / Denise Hofmann / DF MC MTS

# PCU 50.5 compared to IPC 427E
# - Overview of technical details

| | PCU 50.5-C | PCU 50.5-P | IPC 427E Standard Performance | IPC 427E High Performance |
|---|---|---|---|---|
| Dimensions | 297 x 267 x 82 mm | 297 x 267 x 82 mm | 262 x 134 x 55,5 mm | 262 x 134 x 55,5 mm |
| Slots | 1x PCIe, 1x PCI | 1x PCIe, 1x PCI | 1x PCIe | 1x PCIe |
| Processor | Celeron P4505 | Core i5-520E | Celeron G3902E 6. Generation | Core i5-6442EQ 6. Generation |
| RAM | 4 GB DDR3 | 8 GB DDR3 | 4 GB DDR4 | 8 GB DDR4 |
| COM | 1 x RS232C | 1 x RS232C | - | - |
| USB | 4 x USB 2.0 | 4 x USB 2.0 | 4 x USB 3.0 | 4x USB 3.0 |
| Ethernet | 2 x Ethernet 10/100/1000 Mbit/s | 2 x Ethernet 10/100/1000 Mbit/s | 3 x Gigabit Ethernet (IE/PN) | 3x Gigabit Ethernet (IE/PN) |
| Graphic | LVDS/DVI | LVDS/DVI | DP | DP |
| Operating system | Win7 Pro EmbSys (64 Bit) | Win7 Pro EmbSys (64 Bit) | Win7 Ultimate or Win10 IoT Enterprise | Win7 Ultimate or Win10 IoT Enterprise |
| Mass storage | 80 GB SSD | 80 GB SSD | 240 GB SSD | 240 GB SSD |

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# TIA Portal engineering for SINUMERIK 840D sl
## The most important highlights for future-oriented engineering

## Safety Integrated plus

- Drive-based Safety Integrated
- System-integrated failsafe logic programming (F-PLC)
- Simple configuration and acceptance

## Flexible libraries

- Easy creation, storage and re-use
- SINUMERIK STEP 7 Toolbox integrated
- Comprehensive version management

## Integrated engineering

- One engineering for all tasks
- Integrated and efficient from configuring through to testing and diagnosing
- Graphic and intuitive through Drag & Drop

## Modern HMI configuration

- A high degree of individualization supported by comprehensive libraries
- SINUMERIK Operate as own "control"
- Access protection, user administration, …

## PLC programming

- Fully symbolic programming
- Powerful SCL High-level language with advanced editor
- Easy-to-use editors for LAD and FBD

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# TIA Portal Engineering for SINUMERIK 840 D sl
## Significant shortening of the engineering times for all applications by means of ...

… support of structured and team-oriented working (libraries, versioning, …)

... easy and intuitive configuration of HMI and the control up to the drive technology (usability, ...)

... powerful editors for programming/parameterization, test and diagnostics (PLC languages, trace, ...)



**All technologies**
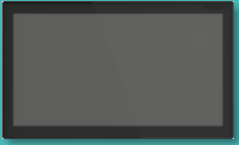
**All industries**

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# Professional operation of machine tools
## The right engineering / runtime system for every customer requirement

| | SINUMERIK 828 | SINUMERIK 840 | | | | |
|---|---|---|---|---|---|---|
| **HMI runs on:** | **PPU** | **NCU** | **PCU / IPC 427E** | **3rd Party PC** | **IPC WIN 7 Embedded 3rd Party PC** | **Comfort Panel** |

| | | SINUMERIK Operate | | | | |
|---|---|---|---|---|---|---|
| **Engineering** | **Create MyHMI /WinCC** | | | **WinCC Runtime** | | |
| | **Create MyHMI /3GL** — C++ | | | **Run MyHMI /3GL** | | |
| | .NET | | | | | |
| | QT | | | | | |
| | **Create MyHMI /PRO** | | **Run MyHMI /Pro** | | | |
| | **ASCII Editor** | **Run MyScreens** | | | | |
| | | **Runtime** | | | | |

**SINUMERIK Integrate Create MyHMI /WinCC – easily and quickly to a highly individualized operating philosophy**

# SINUMERIK Integrate Create MyHMI /WinCC
# The top highlights

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## Configuring instead of programming

- Make professional machine operation easy
- Easily configure data relationships

## SINUMERIK Operate integrated

- Easy integration of the proven SINUMERIK Operate operation
- Flexibly expandable by WinCC

## TIA - Uniformity

- Optimal system integration (with universal use of the TIA Portal)
- Ready for digitalization concepts within the context of Industrie 4.0 (technologies, etc.)

## High degree of individualization

- Comprehensive library of display elements and operator controls
- Integration of customer-specific controls

## Openness

- Integration of any contents (browser, live streams, PDF, etc.)
- Consistent support of standard technologies (e.g. SQL)

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# Why do we have a new Safety Integrated concept for SINUMERIK 840D sl?

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## Safety Integrated → since 1996

- Motion monitoring
  - Safety functions are distributed between **NCK** (SINUMERIK) and **drive** (SINAMICS)

- Safe programmable logic in **NCK** and **PLC**
  - Direct connection of safety-related actuators and sensors to the failsafe I/O from the SIMATIC ET200 range
    - No additional hardware relays required
    - Software-based processing of the digital signals from safety-related sensors and actuators
  - **Two** programs with crosswise data and result comparison
    - Asynchronous subprogram in the **NCK**
    - Standard STEP 7 program in the **PLC**

## Safety Integrated plus → from 2017

- Motion monitoring
  - Safety functions are integrated in the **drive** (SINAMICS)

- Safe programmable logic in the **integrated F-PLC**
  - Direct connection of safety-related actuators and sensors to the failsafe I/O from the SIMATIC ET200 range
    - No additional hardware relays required
    - Software-based processing of the digital and **analog** signals from the safety-related sensors and actuators
  - **One** failsafe program in the F-PLC
    - Failsafe program in **Step 7 TIA-Portal**

**Both versions are offered in parallel. Safety Integrated is just as safe and reliable in the application as Safety Integrated plus**

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# Different concepts for Safety Integrated and Safety Integrated plus with SINUMERIK 840D sl
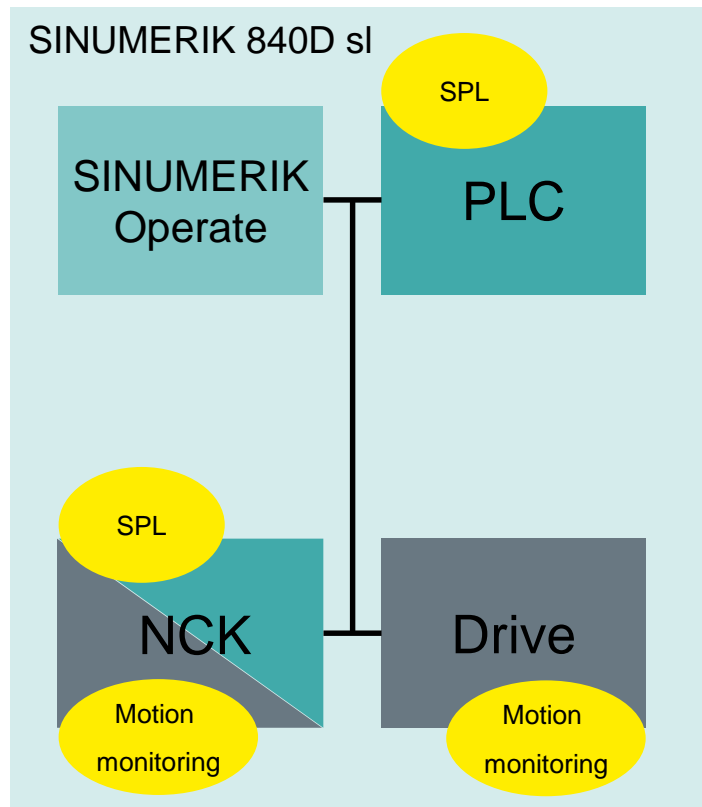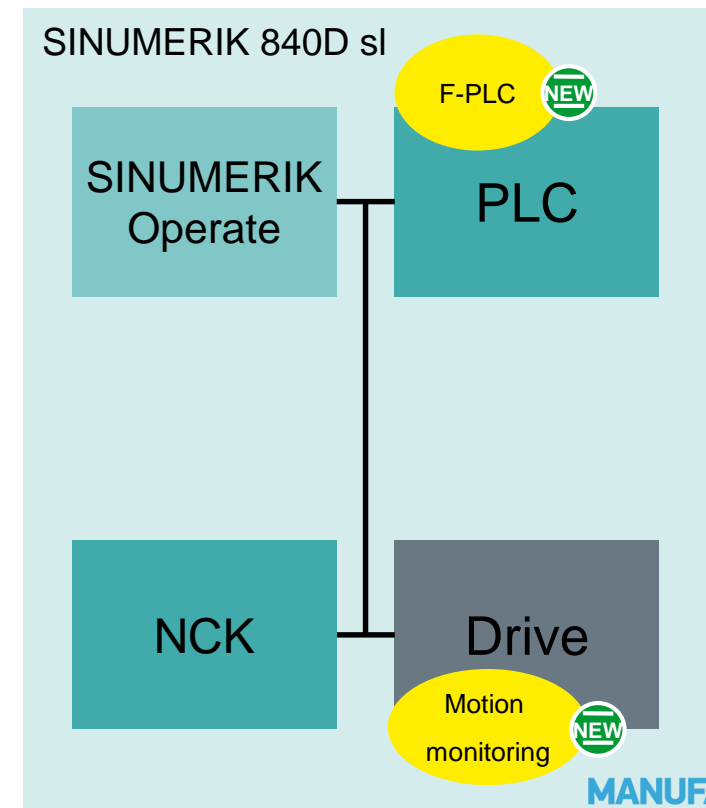
# SINUMERIK Safety Integrated plus
… the most important highlights for the "safe" machines

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## F-PLC integrated +

- Programming the safe logic in TIA Safety Advanced
- Certified F-blocks are available for the failsafe program

## Integrated in SINUMERIK Operate +

- Graphical configuration of the safety functions
- Partially automated acceptance tests, including the required reporting

## Drive-based safety integrated +

- Universal utilization of the SINAMICS Safety Integrated functions
- Safe monitoring of standstill, motion, and position

## Uncompromisingly reliable +

- Fulfills the requirements according to Category 3 / SIL 2 / PL d
- Guaranteed safety for personnel and machinery with high machine productivity

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# With TIA, we design a complicated automation cell as one unit



Industrial EtherNet

**840D sl**

IFP2200

NCU + S120

ET200

HT8

Milling Machine w/ CNC

**840D sl**

IFP2200

NCU + S120

ET200

Turning Machine w/ CNC

**S7-1500F**

IFP2200

S7-1500

ET200

Hand Terminal

S120

Loaders

**S7-1500TF**

IFP2200

S7-1500

ET200

Hand Terminal

S120

Robot loaders

- Share same Panel, IPC, IO and drive system
- Minimize spare parts
- Low Hardware and software maintenance effort
- Common Tool: TIA Portal for PLC, HMI and Safety.
- Commissioned in different facilities with same software tool and integrated on-site

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# With TIA, we design a complicated automation cell as one unit



— Industrial EtherNet

**840D sl** — IFP2200 — ET200 — HT8 — NCU + S120 — Milling Machine w/ CNC

**840D sl** — IFP2200 — ET200 — NCU + S120 — Turning Machine w/ CNC

**S7-1500F** — IFP2200 — ET200 — Hand Terminal — S7-1500 — S120 — Loaders

**S7-1500TF** — IFP2200 — ET200 — Hand Terminal — S7-1500 — S120 — Robot loaders

- Different controller due to different function requirements

- Share same Panel, IPC, IO and drive system
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- Low Hardware and software maintenance effort
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# With TIA, we design a complicated automation cell as one unit



**Industrial EtherNet**

Same Panel and same IPC
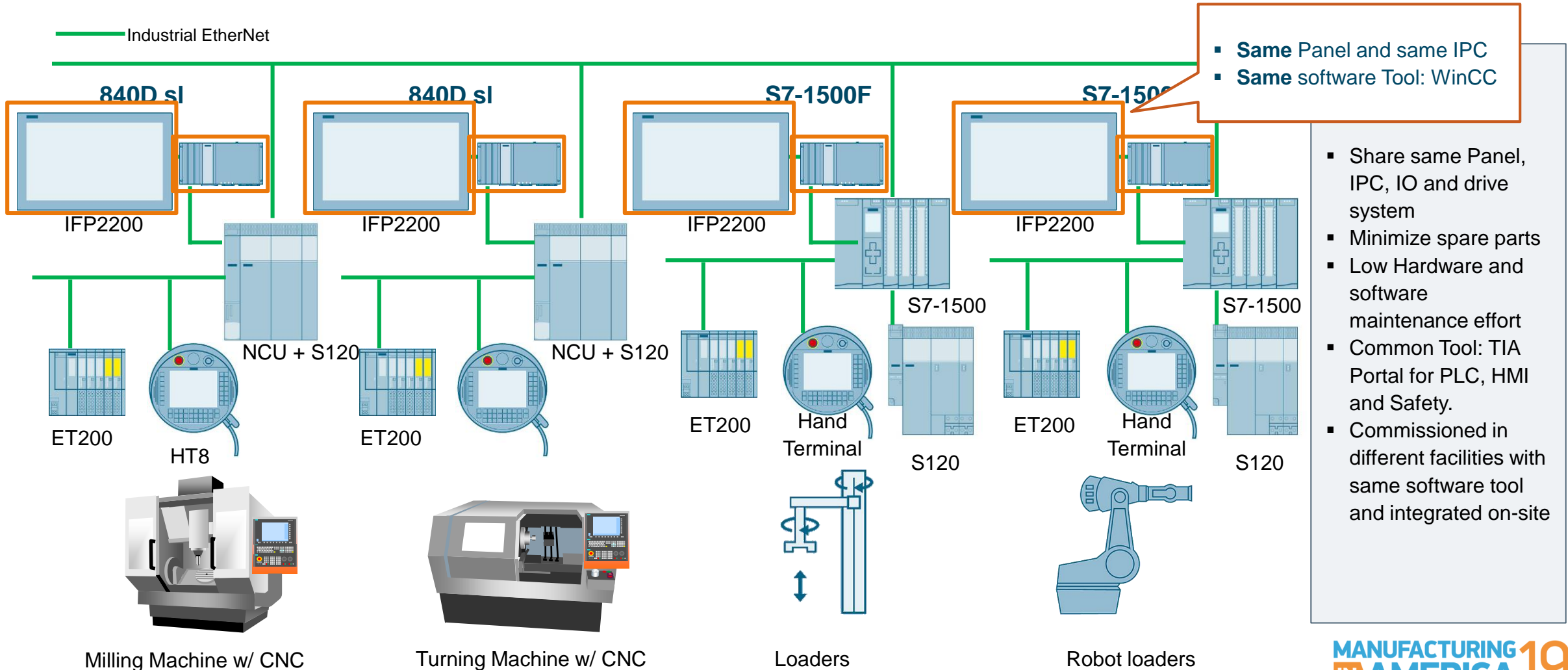Same software Tool: WinCC

- Share same Panel, IPC, IO and drive system
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840D sl — IFP2200 — NCU + S120 — ET200 — HT8 — Milling Machine w/ CNC

840D sl — IFP2200 — NCU + S120 — ET200 — Turning Machine w/ CNC

S7-1500F — IFP2200 — ET200 — Hand Terminal — S7-1500 — S120 — Loaders

S7-1500 — IFP2200 — ET200 — Hand Terminal — S7-1500 — S120 — Robot loaders

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- ■ Share same Panel, IPC, IO and drive system
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- ■ Common Tool: TIA Portal for PLC, HMI and Safety.
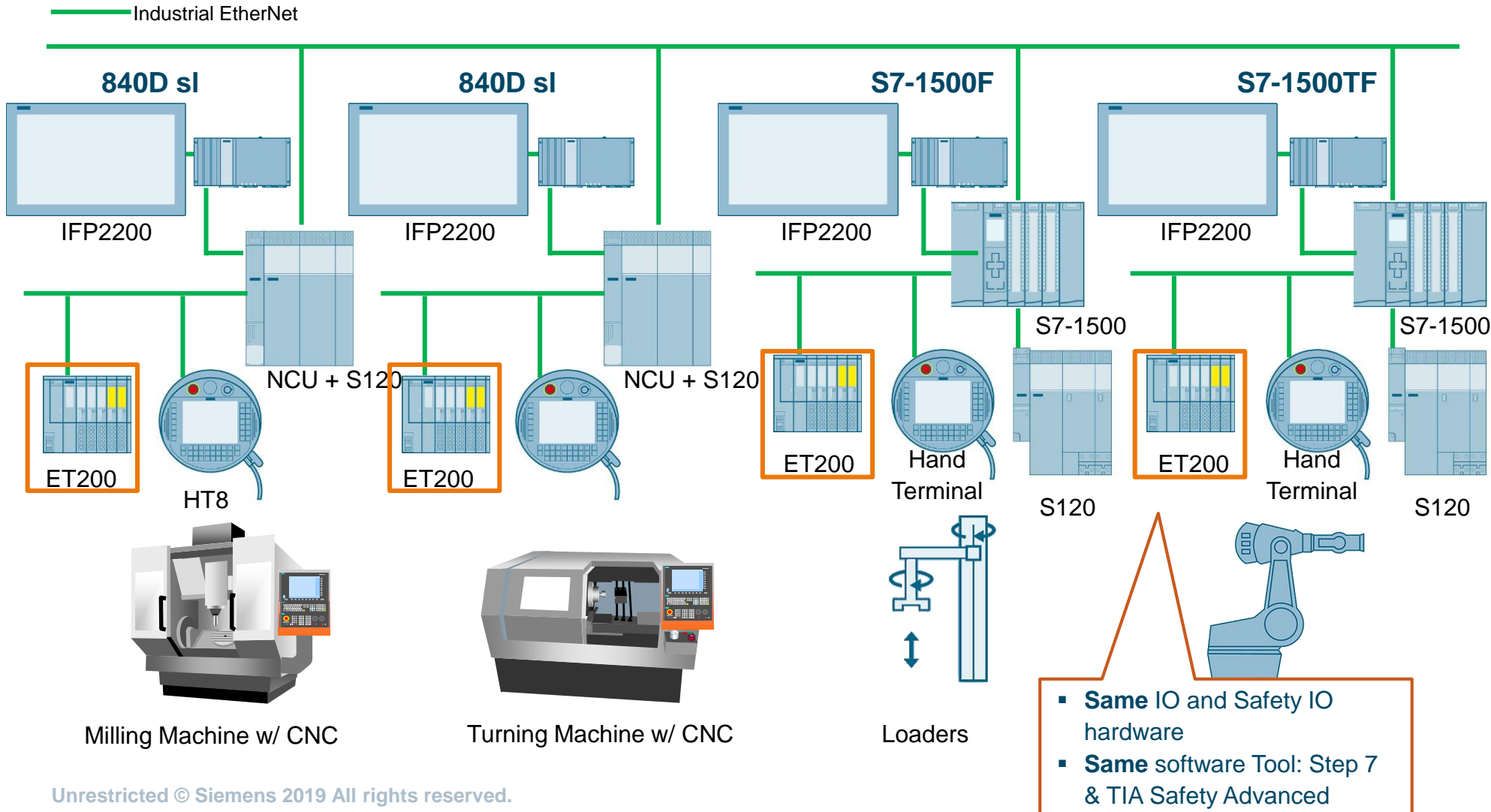- ■ Commissioned in different facilities with same software tool and integrated on-site

- ■ **Same** IO and Safety IO hardware
- ■ **Same** software Tool: Step 7 & TIA Safety Advanced

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# Questions?

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**IN** AMERICA

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