



Real-Time Machine Monitoring

NI Hardware & Software Solutions

Zsolt Budai & Sándor Gergely

Industrial Engineering Manager

Senior Process Engineer

The World of Converged Devices



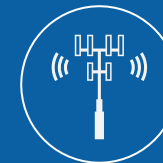
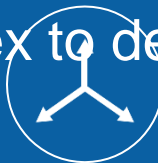
More capability defined in software



Functions change rapidly



Increasingly complex to design and test



Mission Statement



NI equips engineers and scientists with systems that accelerate productivity, innovation, and discovery.



OPERATIONS IN
50+ COUNTRIES

\$1.29

BILLION
IN 2017

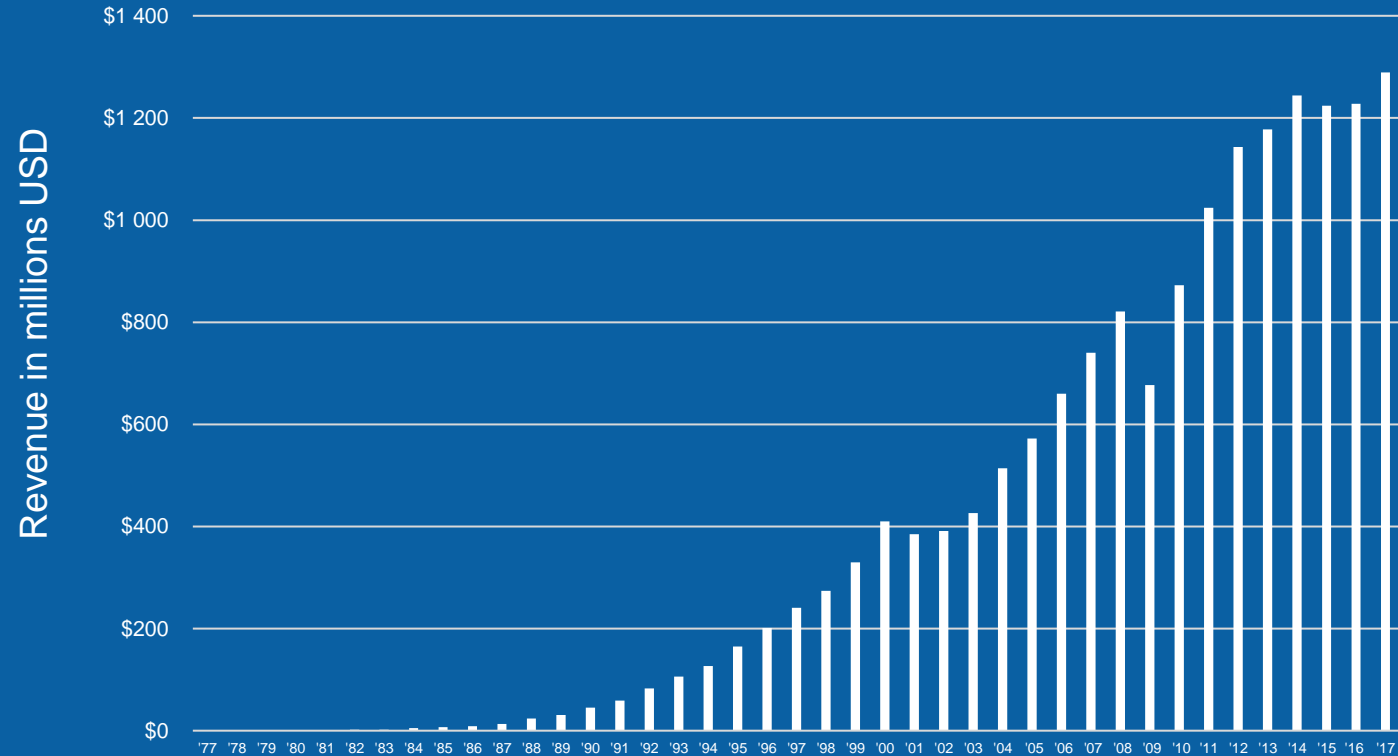


35,000+
CUSTOMERS WORLDWIDE



16%
INVESTMENT IN R&D

Long-Term Track Record of Growth



A software-centric platform that accelerates the development and increases the productivity of test, measurement, and control systems.

Flexible Software Protects Your Investments



James	Channel 1	0.034
Tim	Channel 2	0.0790
Charles	Channel 1	0.35
	Channel 2	0.783
	Channel 2	0.839

▶ LabVIEW™

TestStand

VeriStand

DIAdem

NI InsightCM™ Enterprise

Multisim

LabWindows™/CVI

Measurement Studio

Third-Party Software



Modular Hardware Allows You to Customize



Complete I/O Coverage
With More Than 600 Modules



Highest Data Throughput
With PCI Express



Software Extensibility
With Apps, IP, and Toolkits



Parallel Measurement Execution
With Latest Multicore Processors



Real-Time Measurements
With Timing and Synchronization



Measurement Acceleration
With User-Programmable FPGAs



Reduced Size, Power, and Weight
With Form Factor Variants



Increased Measurement Range
With Latest ADC/DAC

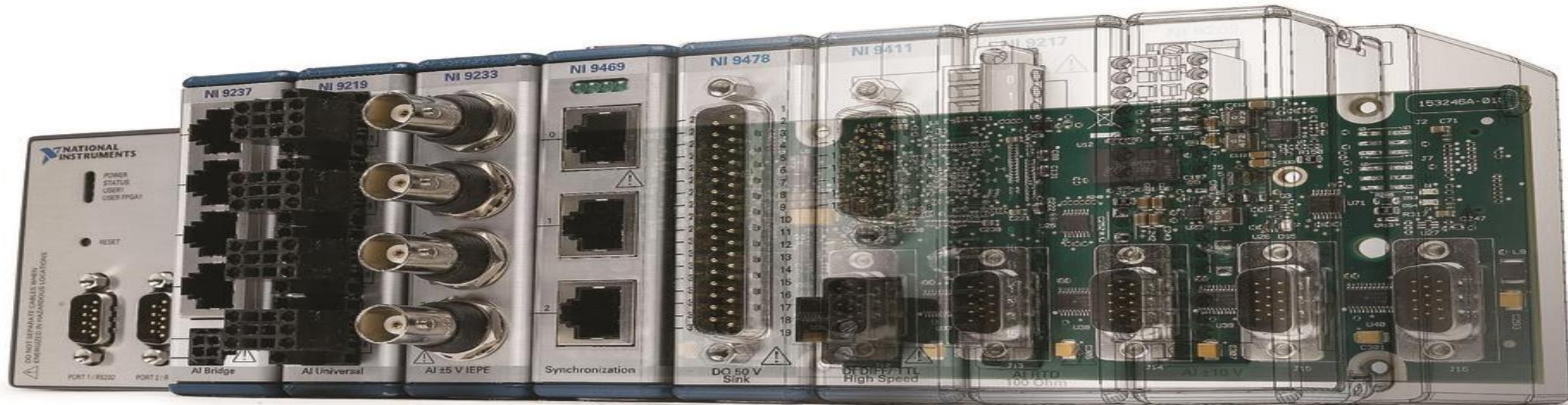
Monitoring our Production

SMT Technology Overview:

Surface-mount technology (SMT) is a method for producing electronic circuits in which the components are mounted or placed directly onto the surface of printed circuit boards (PCBs).

An electronic device so made is called a surface-mount device (SMD).

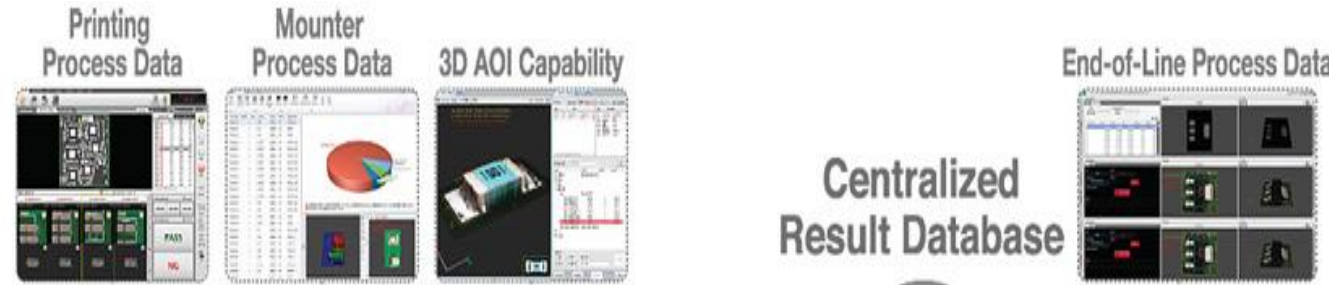
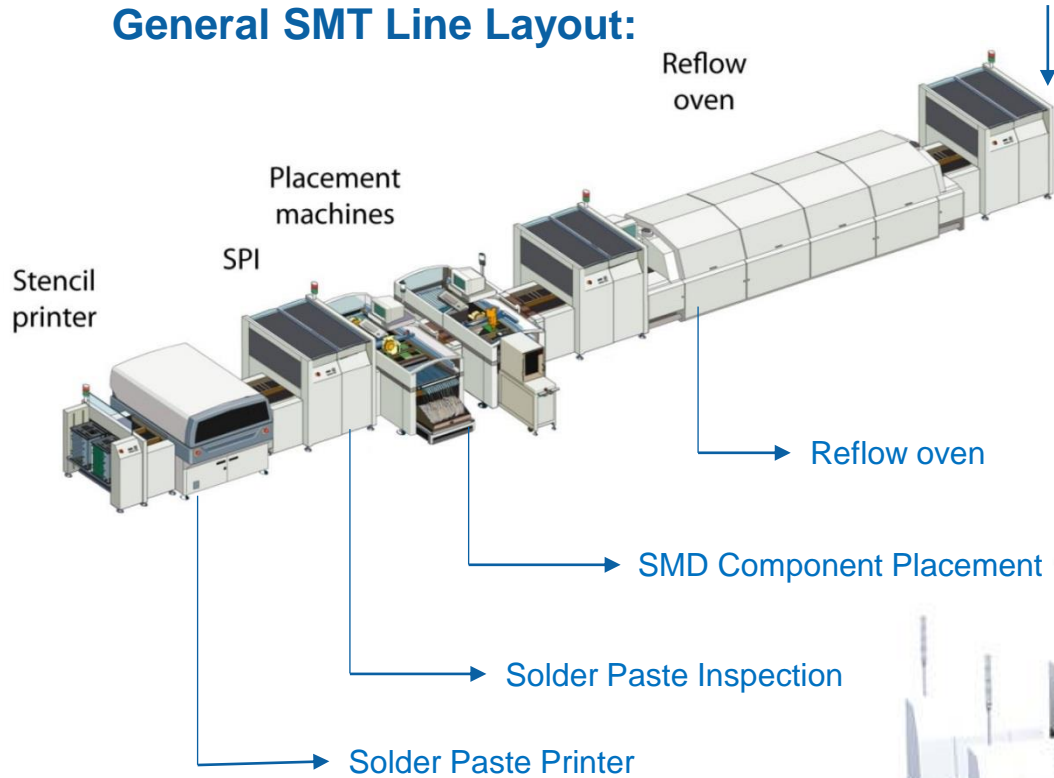
In industry, it has largely replaced the through-hole technology construction method of fitting components with wire leads into holes in the circuit board. Both technologies can be used on the same board, with the through-hole technology used for components not suitable for surface mounting such as large transformers and heat-sinked power semiconductors.



SMT Technology Overview:

Automated Optical Inspection

General SMT Line Layout:

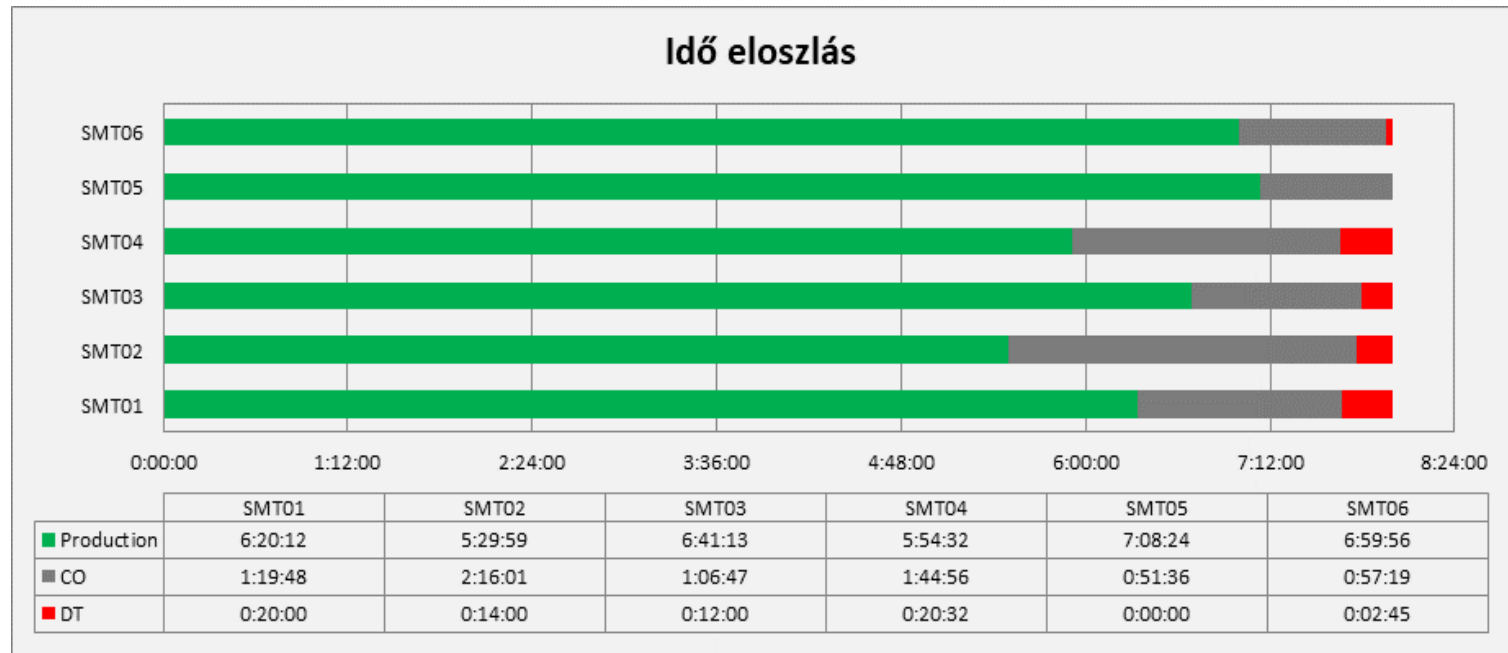


Real Time SMT monitoring:

Performance Monitoring solution automatically captures and tracks run-time, setup-time, idle-time, and downtimes for pick and place machines using machine performance data captured in real time.

Why we need it?- to measure and know

- Machine availability
- Machine utilization
- Flexibility
- Efficiency
- Flexibility
- Downtimes
- Competitiveness
- Continuous improvement



Real Time SMT monitoring:

What's on the market...

Advantages:

- Real Time
- All data available
- Easy reporting
- User friendly
- Email notification

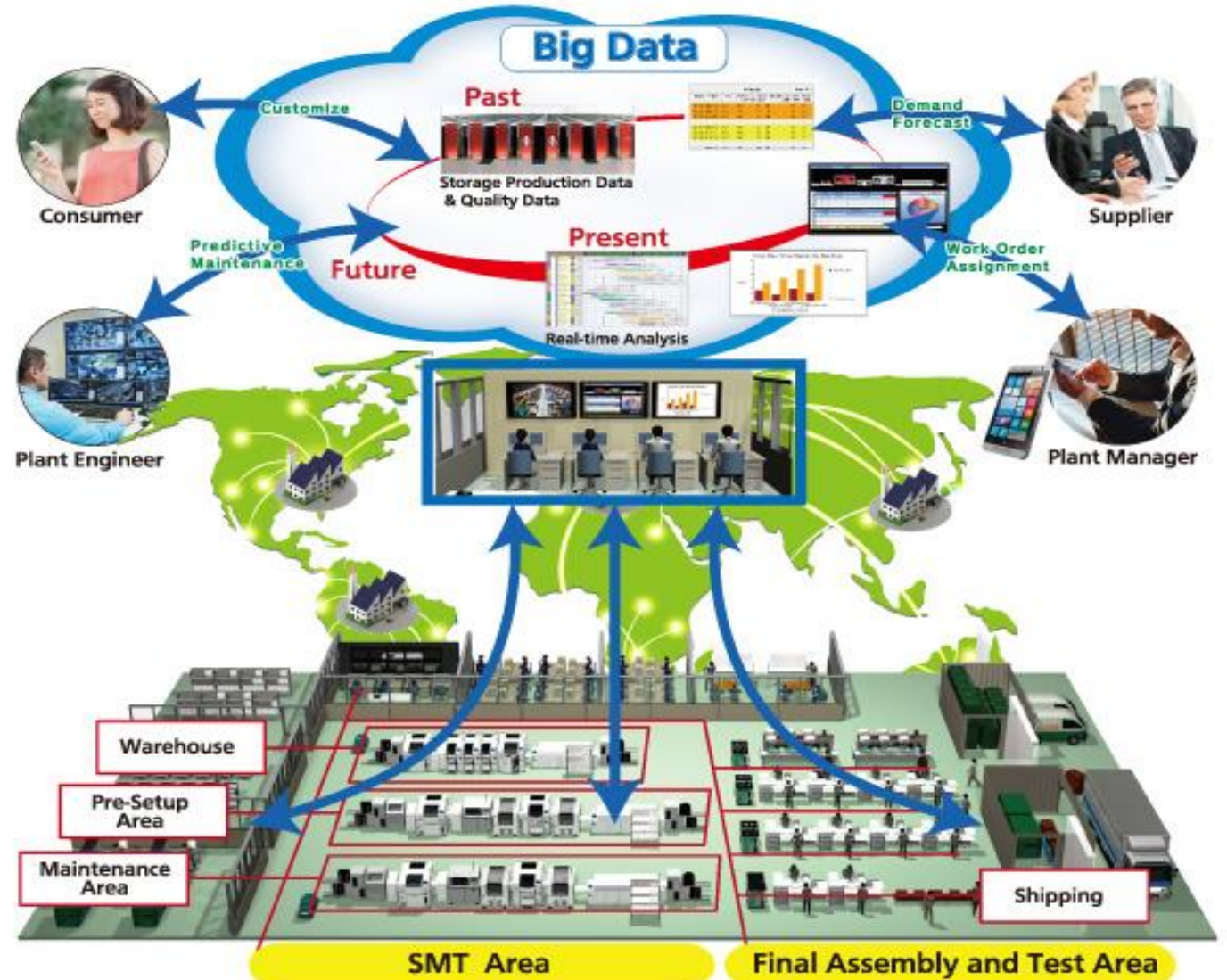


Real Time SMT monitoring:

What's on the market...

Disadvantages:

- It cannot be customized
- It can not be extended
- Full line solution is not available
- Very expensive



Real Time SMT monitoring:

What we have:

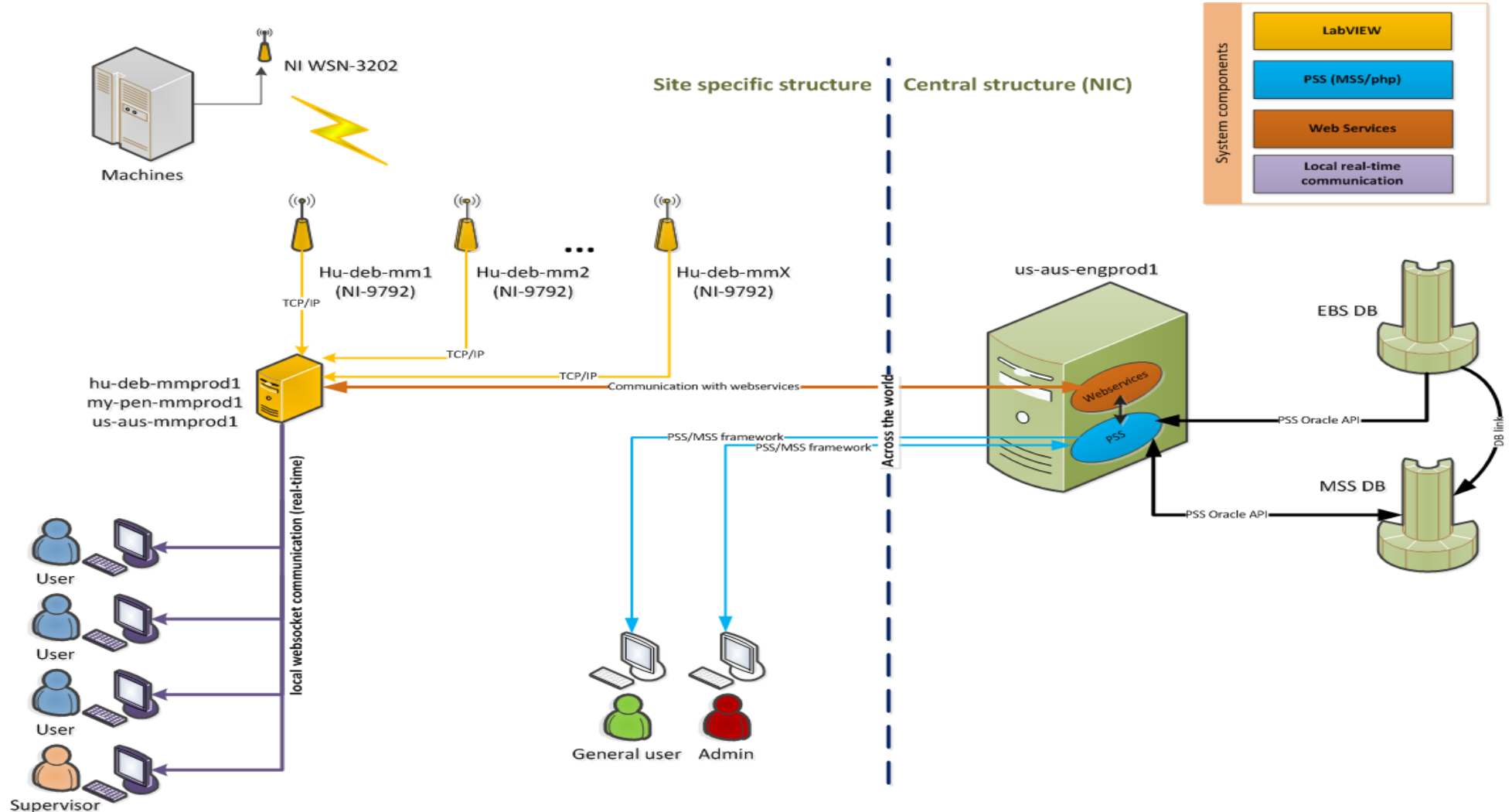
Own hardware and software solutions:

- NI WSN (wireless sensor networks) system
 - NI WSN 9792 - Gateway
 - NI WSN 3202 – Node
- NI Labview software



Real Time SMT monitoring:

NIH Site hardware architecture:

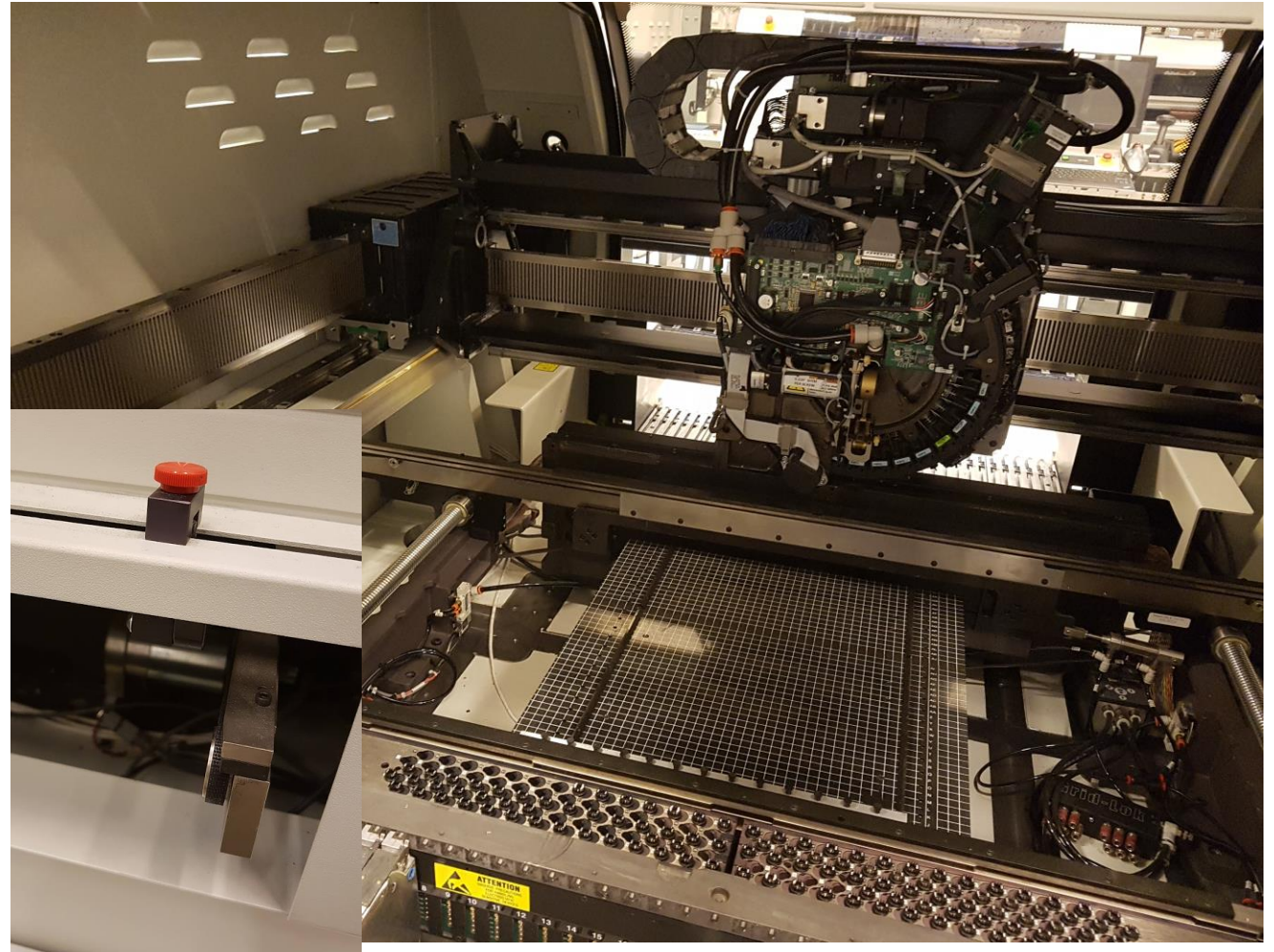
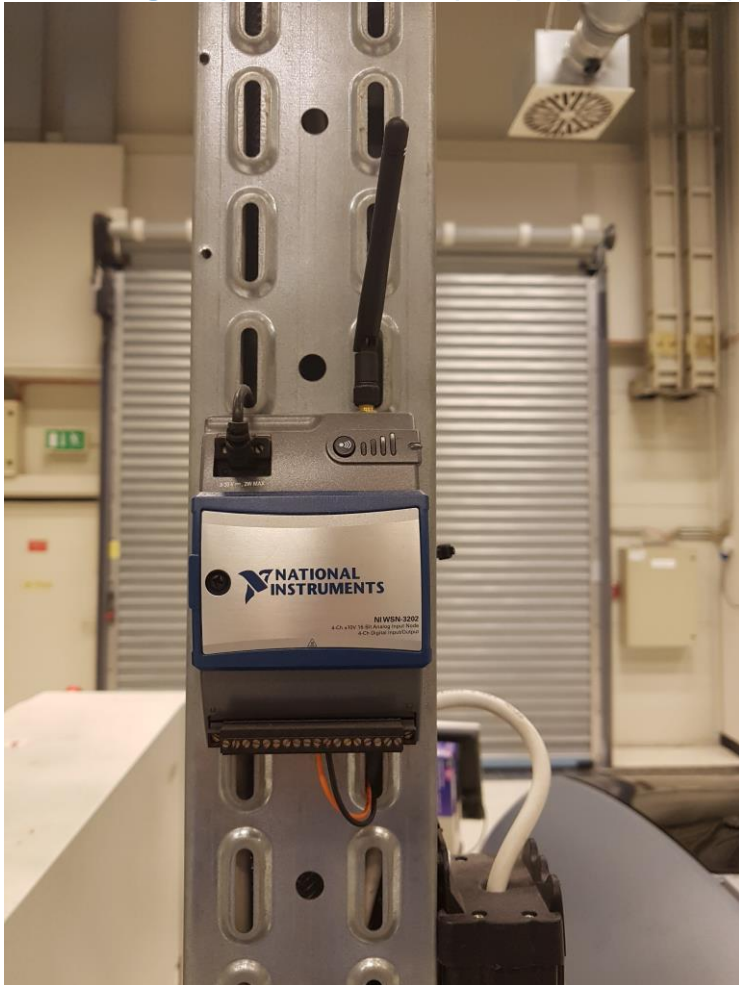


Real Time SMT monitoring:



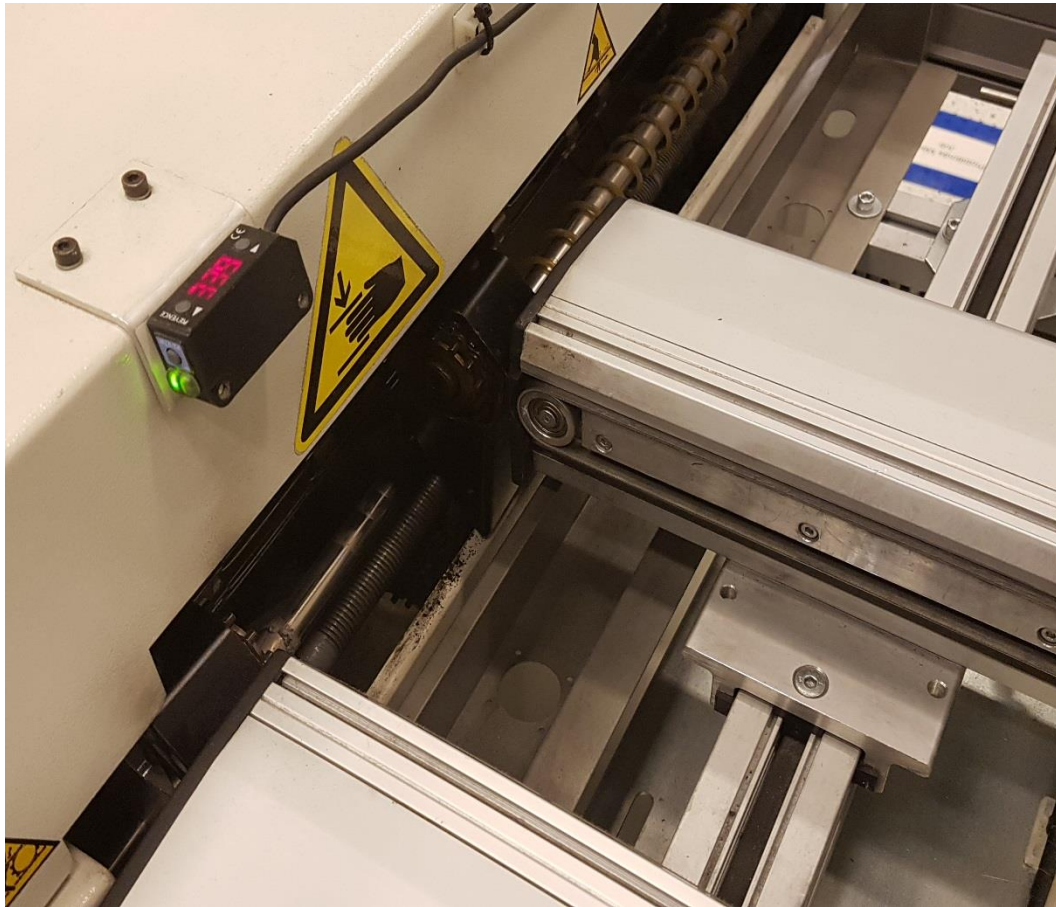
Real Time SMT monitoring:

NIH Site Hardware architecture:



Real Time SMT monitoring:

NIH Site Hardware architecture:



Real Time SMT monitoring:

NIH Site MM Website: Production history

SMT Production Status

Next Refresh: 5

SMT01

SMT02

SMT03

SMT04

SMT05

SMT06



Machine Monitor Support Site

SMT Support Statistic Admin

Cycle Times

Lines: All View Running Jobs: No

1 50

Search

Last job started at: 2018-10-01 Go Today

Export...

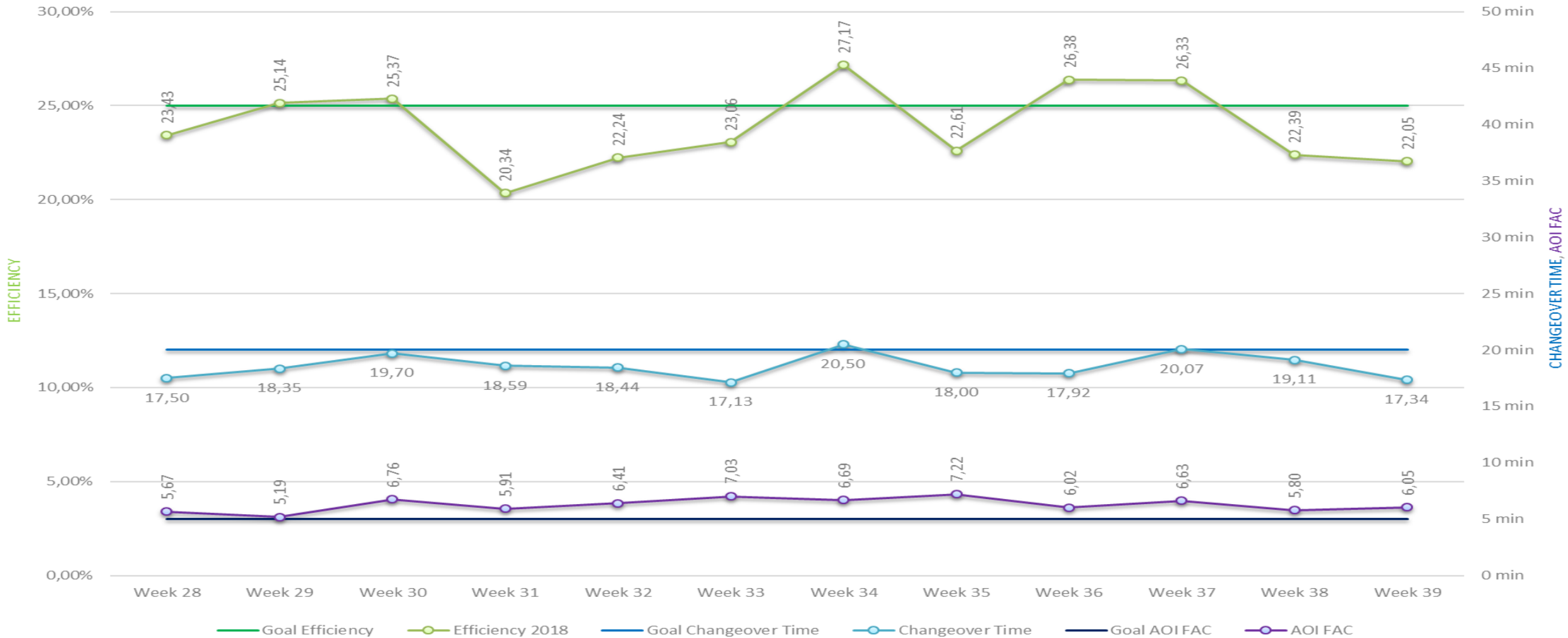
Start Date	JOB	Line	Part number	Description	Quantity	Cir/PCB	Shift	Bottom			Top			ChangeOver Time (min)		Line Cycle Time		Run Time			Reeling		Comment	FAC				
								Changeover Start	Changeover End	Job End	Changeover Start	Changeover End	Job End	Bottom	Top	Bottom	Top	Theoretical	Real	Eff.	Bottom	Top						
2018-09-29 18:50:08	LF003196075	SMT01	154226A-01L	CCA,TB-4322,8 CH-CH ISOLATED AO	62	2	A				2018-09-29 20:02:39	2018-09-29 21:04:30			1:01:51	0:00:00	0:00:00						0	1				
2018-09-29 17:20:59	LF003195735	SMT04	196806C-01L	CCA,SWITCH PXIE-CA3 FOR CMI	204	3	A	2018-09-29 17:28:50	2018-09-29 17:43:00	2018-09-29 19:13:54	2018-09-29 19:13:54	2018-09-29 19:29:05			0:14:10	0:15:11	0:00:00	0:00:00						1	1			
2018-09-29 17:19:38	LF003196026	SMT05	189206G-01L	CCA,NI 9474, 8-CHANNEL HIGH-SPEED 24 VDC SOURCING DIGITAL OUTPUT MODULE	136	4	A				2018-09-29 19:02:02	2018-09-29 19:27:03	2018-09-29 21:06:01			0:25:01	0:00:00	0:02:26 (FUJIS)	0:01:04 (ALH11)	1:22:50	1:38:58	84%		1	1			
2018-09-29 16:56:12	LF5718181	SMT01	159000B-11L	CCA, NI PXIE-4080 ANALOG DAUGHTER BOARD	24	1	A	2018-09-29 17:21:11	2018-09-29 17:31:08	2018-09-29 18:02:49	2018-09-29 18:54:10	2018-09-29 19:07:35	2018-09-29 20:02:39			0:09:57	0:13:25	0:01:04 (ALH11)	0:01:04 (ALH11)	0:51:44	1:26:45	60%		0	3			
2018-09-29 16:45:32	LF003195902	SMT05	188524M-15L	CCA,PXI-DFC 2.0,ARBS,32MB/CH,XC2V1500-SFF8961	12	2	A	2018-09-29 17:55:11	2018-09-29 18:02:58	2018-09-29 18:13:37	2018-09-29 18:44:49	2018-09-29 18:48:18	2018-09-29 19:02:02			0:07:47	0:03:29	0:02:45 (FUJIS)	0:01:24 (FUJIS)	0:24:58	0:24:23	102%		0	3			
2018-09-29 16:14:25	LF5708852	SMT05	188524M-15L	CCA,PXI-DFC 2.0,ARBS,32MB/CH,XC2V1500-SFF8961	12	2	A	2018-09-29 16:49:34	2018-09-29 17:14:04	2018-09-29 17:55:11	2018-09-29 18:13:37	2018-09-29 18:22:07	2018-09-29 18:44:49			0:24:30	0:08:30	0:07:43 (FUJIS)	0:02:02 (FUJIS)	0:58:35	1:03:49	92%		3	3			
2018-09-29 16:08:42	LF5718205	SMT06	157420E-02L	CCA,NI PXIE-4137 SYSTEM SMU	150	1	A	2018-09-29 18:01:49	2018-09-29 18:19:25							0:17:36		0:00:00	0:00:00					1				
2018-09-29 16:06:17	LF5718179	SMT01	159000B-12L	CCA, NI PXIE-4082 ANALOG DAUGHTER BOARD	12	1	A	2018-09-29 16:37:47	2018-09-29 16:56:03	2018-09-29 17:21:11	2018-09-29 18:02:49	2018-09-29 18:24:04	2018-09-29 18:54:10			0:18:16	0:21:15	0:01:35 (ALH11)	0:02:31 (ALH11)	0:49:15	0:55:14	89%		3	2			
2018-09-29 15:32:55	LF003195964	SMT03	191316F-01L	CCA,NI 9401,8 CHANNEL 10MHZ TTL DIO MODULE	684	4	A	2018-09-29 11:48:08	2018-09-29 12:01:20	2018-09-29 17:23:14	2018-09-29 17:31:56	2018-09-29 17:40:35			0:13:12	0:08:39	0:00:00	0:00:00						0	0			
2018-09-29 14:17:34	LFNST5720037	SMT04	189252G-01L	CCA,PCI-6723,32-CHANNEL AO	20	1	A				2018-09-29 16:12:36	2018-09-29 16:29:31	2018-09-29 17:28:50			0:16:55	0:00:00	0:00:00	0:00:00			0:59:19	0%		0			
2018-09-29 13:26:10	LF5720083	SMT04	192416F-01L	CCA,NI PCI-4461 2AI 2AO, BASEBOARD	22	1	A	2018-09-29 14:26:22	2018-09-29 14:44:10	2018-09-29 15:25:24	2018-09-29 15:25:24	2018-09-29 15:34:02	2018-09-29 16:12:36			0:17:48	0:08:38	0:00:00	0:00:00			1:19:48	0%		1	1		
2018-09-29 13:19:13	LF5717413	SMT05	193331H-16L	MCC,CCA,USB-1408FS-MM	100	2	A				2018-09-29 15:16:38	2018-09-29 15:34:33	2018-09-29 16:49:34			0:17:55	0:00:00	0:01:09 (FUJIS)	0:00:00	0:57:53	1:15:01	77%		1	1			
2018-09-29 12:08:13	LF5720082	SMT04	187123R-01L	CCA,NI 4472 FOR PXI,DSA, 8 IN,SINGLE-SLOT	6	1	A	2018-09-29 12:33:14	2018-09-29 13:38:04	2018-09-29 13:52:32	2018-09-29 13:52:32	2018-09-29 14:13:09	2018-09-29 14:26:22			1:04:50	0:20:37	0:00:00	0:00:00			0:27:41	0%		0	1		



Real Time SMT monitoring:

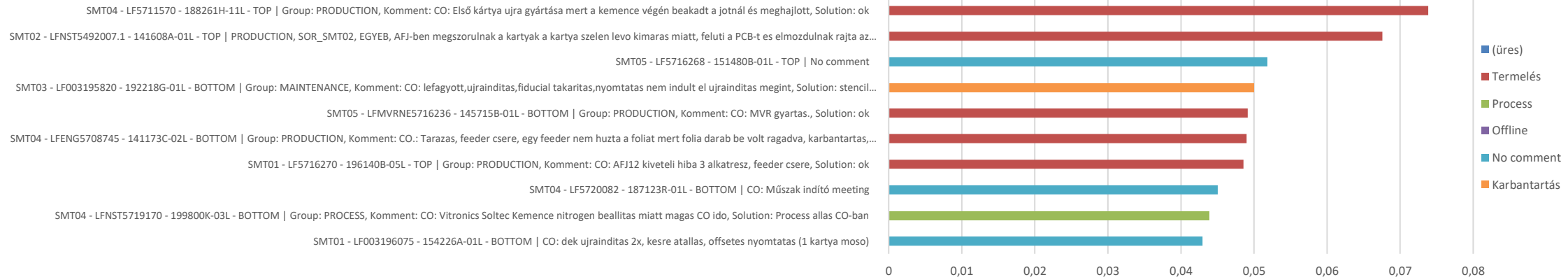
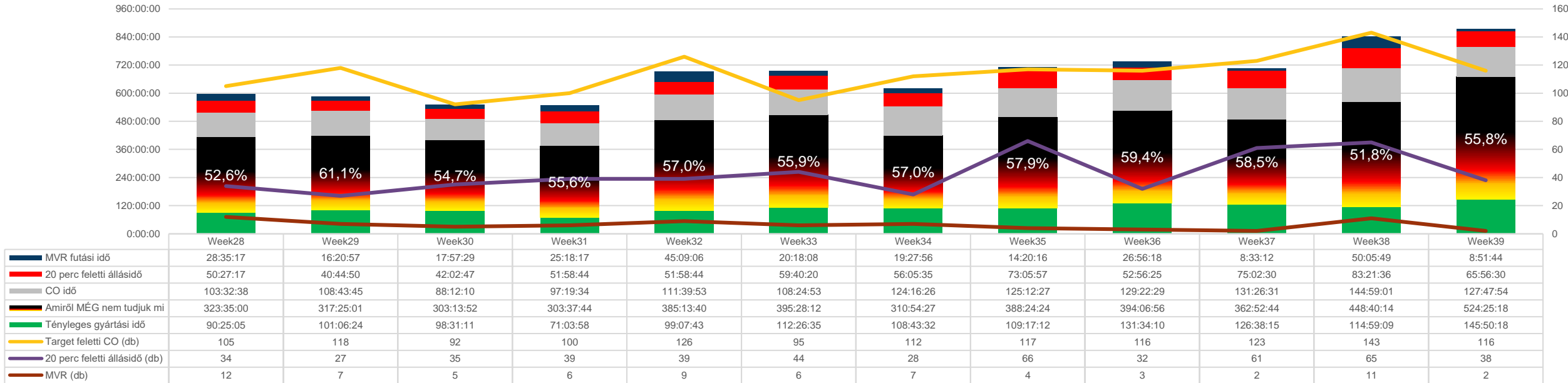
Key Performance Indicator (KPI): Weekly SMT Metrics

NIH SMT Efficiency; Changeover time, AOI FAC by weeks



Real Time SMT monitoring:

Key Performance Indicator (KPI): Weekly Downtime SMT Metrics



Real Time SMT monitoring:

Machine Monitor system extension: SMT LED visualization

1. Problem statement:

The downtime reaction time was too high, because the information it was available only the Machine Monitor system.

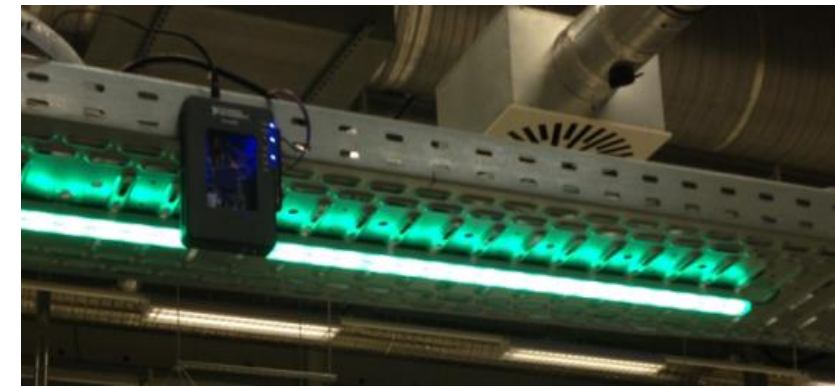
3. Result

- Real time good visible line status
- Reaction time reduction
- Correct downtime data
- Support the open manufacturing

The total savings: **105000\$**

2. Solution:

We made a LED visualization system from own hardware and software. (myRIO and LabView) The LED system based on Machine Monitor, so the two system work each other



Real Time SMT monitoring:

Machine Monitor system extension: SMT LED visualization



Real Time SMT monitoring:

Machine Monitor system extension: SMT LED visualization

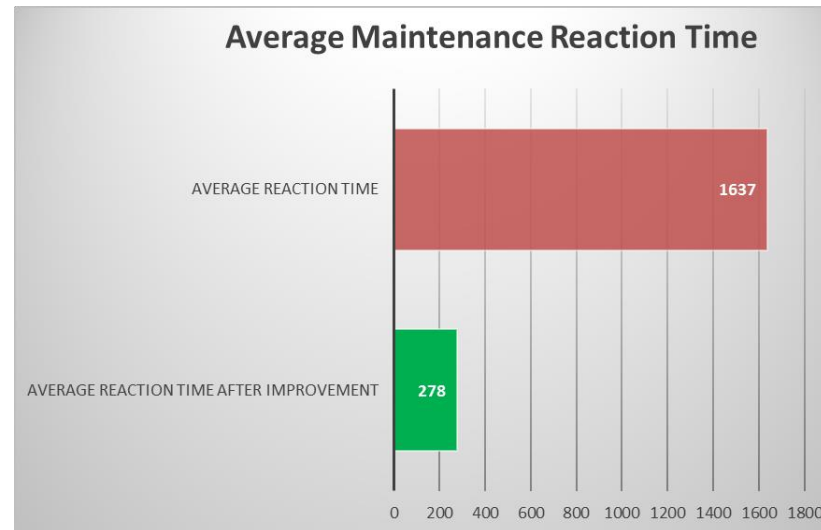
1. Problem statement:

The downtime reaction time was too high, because the information it was available only the Machine Monitor system.

2. Solution:

We made a LED visualisation system from own hardware and software. (myRio and LabView) The LED system based on Machine Monitor, so the two system work each other.

The total savings: **88000\$**

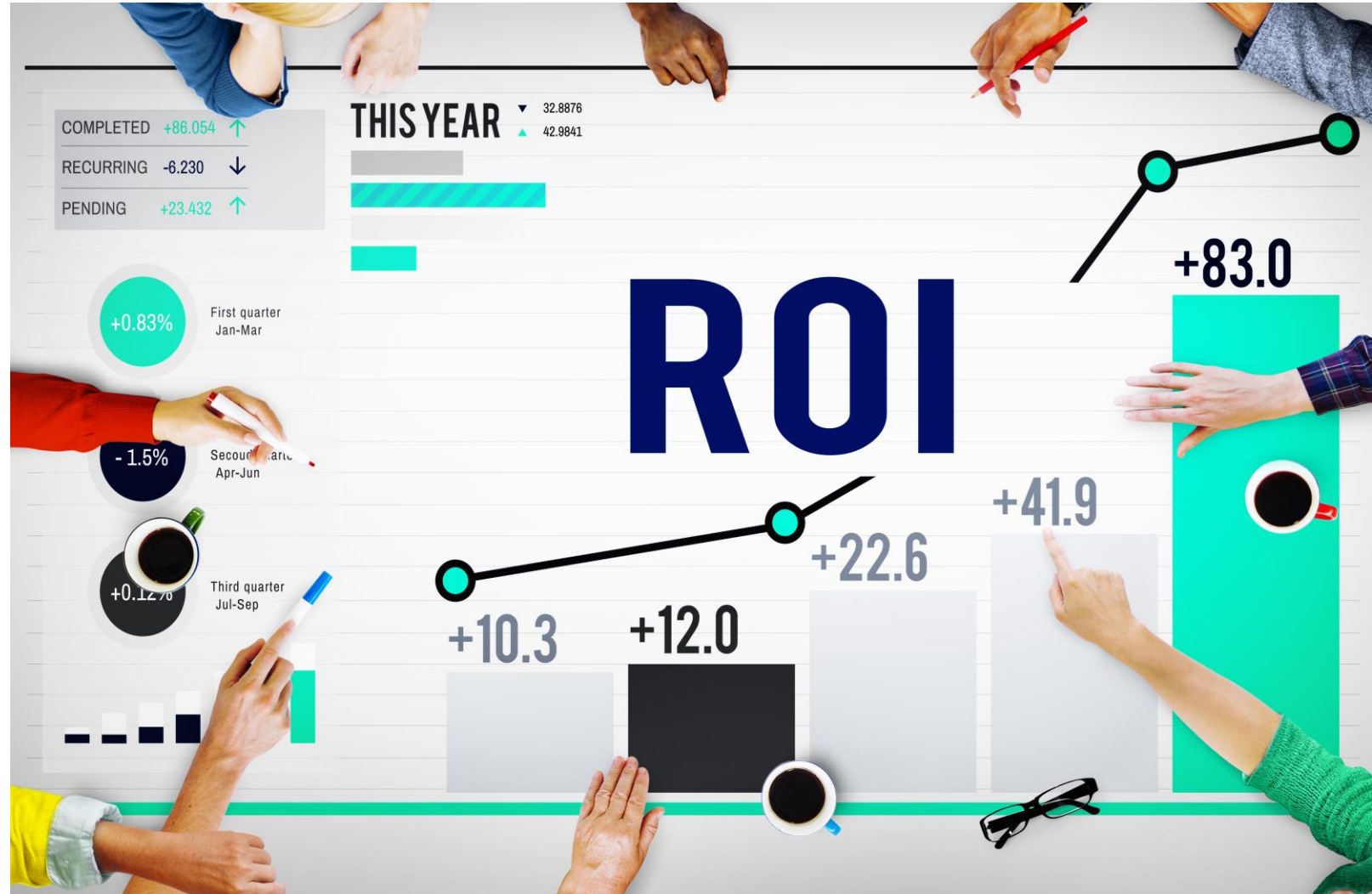


Real Time SMT monitoring:

Conclusion:

why is it important?

- Machine availability
- Machine utilization
- Flexibility
- Efficiency
- Flexibility
- Downtimes
- Competitiveness
- Continuous improvement
- Return of investment
- On time delivery



Contact us



facebook.com/nihdeb/



hungary.ni.com/karrier_debrecen



linkedin.com/company/3433/



toborzok@ni.com