Development and management of a new CoreLab automation system

Alessandra Celli (acelli@usl4.toscana.it), Alessio Menicacci (almenicacci@usl4.toscana.it), Serena Baglioni (sbaglioni@usl4.toscana.it),
Alfredo Ruggeri (aruggeri@usl4.toscana.it), Patrizia Casprini (pcasprini@usl4.toscana.it)

Central Laboratory Unit, S. Stefano Hospital, Prato (Italy)

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Background and Aim:

Prato S. Stefano Hospital is one of the 14 major hospitals in Tuscany. It is a polyclinic for acute and complex cases with 540 beds. The laboratory processes 4,000 tubes per day on average.

Since 2007, Prato Hospital has had a Corelab with analyzers (DxC, DxI) connected to the automated system Power Processor (PP) provided by Beckman Coulter. When the New Hospital opened in 2014, the automated system was replaced by the new High Speed automated system Power Express (PE) for managing analytical platforms AU5822, AU680, DxI of Beckman Coulter. The aim of the work is the performance comparison between the two systems regarding the management of pre-analytical to post-analytical phases on the analyzers. This work will track the effectiveness of the new platform PE, using the 3rd and 4th Quarter data in 2014 for total tests (Overall), clinical chemistry tests (CC), STAT profile and Troponin. PE was installed in the month of June 2014.

Methods:

To standardize the method of evaluation, KPI data: samples (#Tube), tests (#Test), Turn Around Time (TAT), has been extracted using the software Labitup Millenium (Sisge-Vision IT Group).

Observation period (PO) is 91 days, comparing 4th Quater 2012 (PP) against 4th Quater 2014 (PE). The KPIs are related to the total tests (Overall), clinical chemistry (CC), emergency (STAT profile) and troponin (TnI). To evaluate the efficiency of PE, KPIs were evaluated for 3rd and 4th Quarter in 2014. The statistical box-whiskers plot has been used to describe the distribution of TAT.

Comparison between the two automations

- Test Consolidation on few Analyzers (CC and Serology)
- Simplification of sample management
- Traceability along the analytical route
- High integration and automated management of pre-analytical, analytical and post-analytical phases
- TAT reduction (time from check-in to test result).
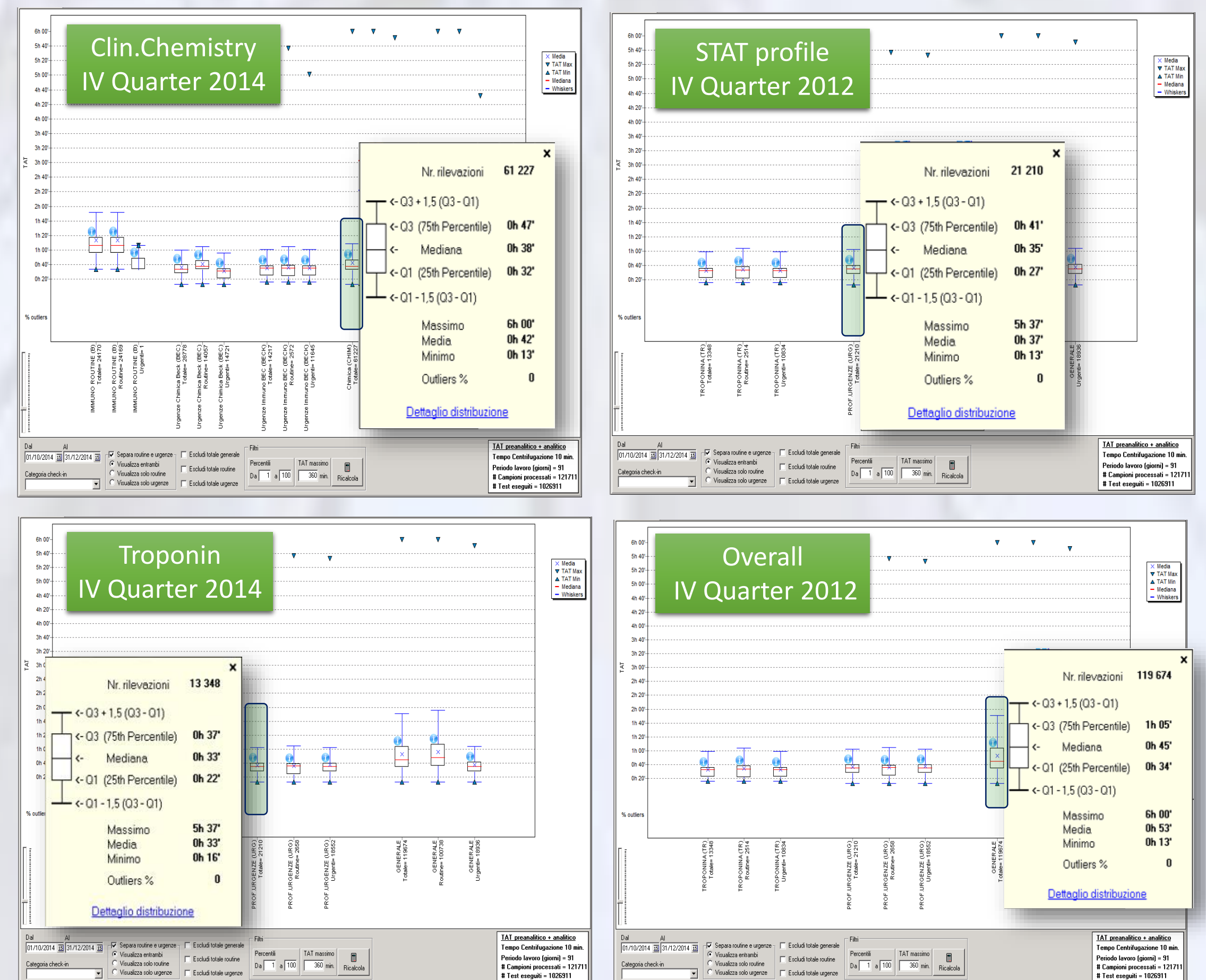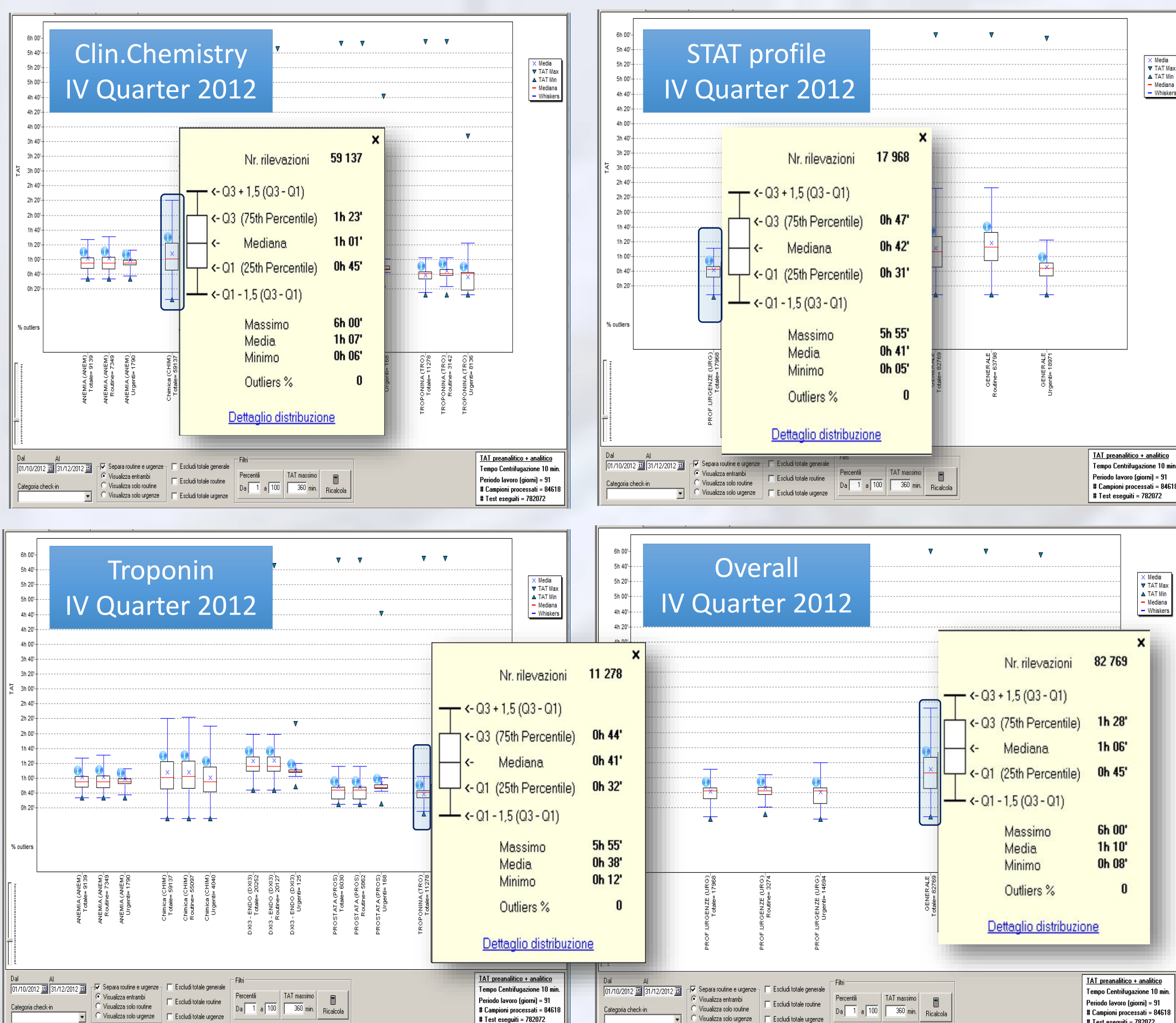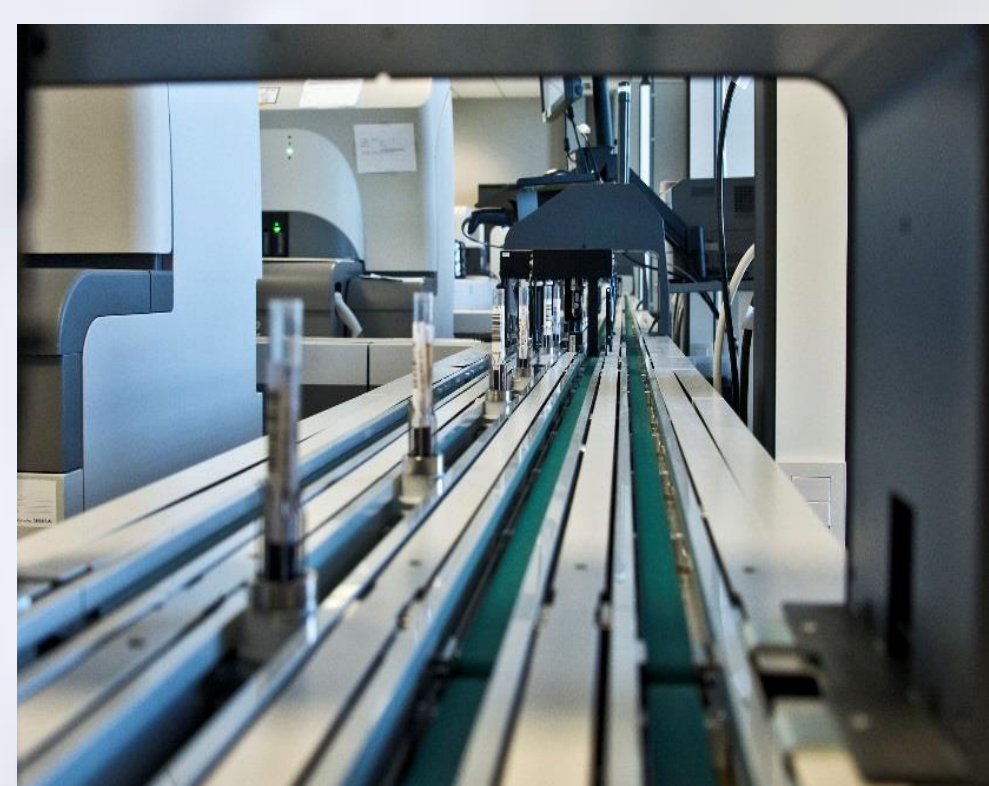- FTE (Full-time equivalent) reduction

- Further reduction of the TAT
- Best usage of human know-how: more time for validation and process control
- Total operator safety. Minimum bio-hazard
- "One Touch" Automatic workflow from check-in to storage
- Endocrinology tests consolidation on automation system

Power Processor   Vs.   Power Express

Power Express: comparison period 3rd and 4th quarter 2014

Despite the increased samples to process, the average running time has not changed significantly; Indeed, we actually note a decrement of TAT for tests of paramount importance such as STAT profile and Urgent tests such as cardiac Troponin.

Comparison between the two automations

	PP (2012)	PE (2014)	Δ (Abs.)	Δ (%)
Samples CC	59137	61227	+ 2090	+ 3.5
STAT profile	17968	21210	+ 3242	+ 18.0
Test TROPONIN	11278	13348	+ 2070	+ 18.4
Overall	82769	119674	+ 36905	+ 44.6
Tests performed	782072	1026911	+ 244839	+ 31.3
Median CC	1h 01'	0h 38'	- 23'	- 37.7
Median STAT	0h 42'	0h 35'	- 7'	- 16.7
Median TROPONIN	0h 41'	0h 33'	- 8'	- 19.5
Median Overall	1h 06'	0h 45'	- 21'	- 31.8

	2014 3th Quarters	2014 4th Quarters	Δ (Abs.)	Δ (%)
Clinical Chemistry	56030	61227	+ 5197	+ 9.3
STAT panel	18708	21210	+ 2502	+ 13.4
TROPONIN	11212	13348	+ 2136	+ 19.1
Overall	108718	119674	+ 10956	+ 10.1
Tests performed	935081	1026911	+ 91830	+ 9.8
Median CC	0h 36'	0h 38'	+ 2'	+ 5.6
Median STAT	0h 35'	0h 35'	± 0'	± 0.0
Median TROPONIN	0h 33'	0h 33'	± 0'	± 0.0
Median Overall	0h 43'	0h 45'	+ 2'	+ 4.7

Results:

During the Observation Period, PP performed 82,769 samples (782,072 tests) and PE 119,674 samples (1,026,911 tests). PE has processed 44.6% more than PP in numbers of Tube. Instruments connected to PE (AU5822/AU680/3 DxI) performed 244,839 tests (+31.3%) compared to the PP configuration (3 DxC/2 DxI). TAT Routine PP CC (59,137 samples) median of 1h 01min - STAT panel (17,968 samples) median of 0h 42min - TnI (11,278 samples) median of 0h 41min. TAT Routine PE CC (61,227 samples) median of 0h 38min - STAT panel (21,210 samples) median of 0h 35min- TnI (13,348 samples) median of 0h 33min. The analysis workload of PE in the 3rd and 4th quarters in 2014 increased 10.1% (Overall) regarding the numbers of Tube (+10,956) and the numbers of Test (+91,830), but average execution time was unchanged for STAT panel (0h 35min), TnI (0h 33min) and only +2min for CC (0h 36min/0h 38min). Both PP and PE have refrigerated storage units for the automatic management of rerun or additional test requests, to simplify and reduce the TAT.

Conclusion:

Results show the new configuration has improved KPIs of PE compared with PP. PE allows higher consolidation levels for endocrinology and serology tests, workload increase (31.3%) and TAT reduction - Overall (-31.8%), STAT (-16.7%), TnI (-19.5%).

This leads to two important conclusions, which represent the philosophy of implementation in terms of the productive process currently underway in the Laboratory of Prato .

1. The PE system is able to manage different types of samples and tests with different priorities and vastly different run times (clinical chemistry and Infectious Serology).

2. The PE system is capable of handling large workloads. There was no significant difference in the performance of PE compared with PP, even though PE processed 10% more workload, which ensured urgent samples to be processed in the highest priority.