

Architectural Approach to Maximize Throughput for a New Analyzer: The Dimension Vista™ System

W. Devlin, T. Evers, S. Frye, D. Miller, J. Mizzer, E. Nuzzaci, and D. Thompson
Dade Behring Inc., Newark, DE, 19714-6101 USA

Introduction

A traditional approach to menu consolidation has been to connect several dedicated modules with complementary technologies. Each module is essentially a stand-alone instrument with a fixed set of methods. For such an arrangement, system throughput depends on test mix.

General Chemistry	IA / Specialty Chemistry
1200 tests/hr	300 tests/hr

Consider a two-module system where throughput capacities for the general and specialty modules are 1200 and 300 tests/hr respectively. Maximum throughput is achieved only when the workload contains 20% specialty and 80% general chemistry methods. If the workload contains more general chemistry, overall throughput is reduced to as low as 1200 tests/hr.

	Fraction of Specialty Tests				
	0%	5%	10%	15%	20%
General Chemistry	1200	1200	1200	1200	1200
Specialty	0	63	133	212	300
Throughput	1200	1263	1333	1412	1500

Effective throughput is further reduced when running HIL sample integrity checks (hemolysis, icterus, lipemia). For example, when 200 HIL tests/hr are requested, effective general chemistry throughput is reduced to 1000 tests/hr.

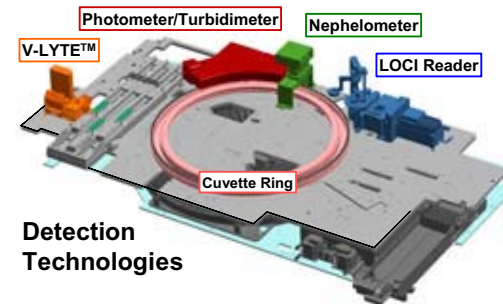
Dimension Vista™ 1500 System

In contrast, the Dimension Vista™ 1500 System does not employ dedicated modules. Each individual system is capable of processing the entire menu of general chemistry and specialty methods including drugs of abuse, therapeutic drugs, immunosuppressive drugs, plasma proteins, and immunoassays. The system is designed to process up to 200 samples/hr, with a typical throughput of 1500 tests/hr. Its architecture allows the system to maintain this level of throughput for a variety of test mix conditions.

Dimension, Vista, LOCI, V-LYTE and Flex are trademarks of Dade Behring, Inc.

New Architectural Approach

The system combines four detection technologies in a single platform.



Detection Technologies

- V-LYTE™ Module for electrolytes
- Photometer/Turbidimeter for general and special chemistries such as DATs, TDMs and ISDs
- Nephelometer for plasma protein assays
- LOCI™ Reader for high sensitivity immunoassays

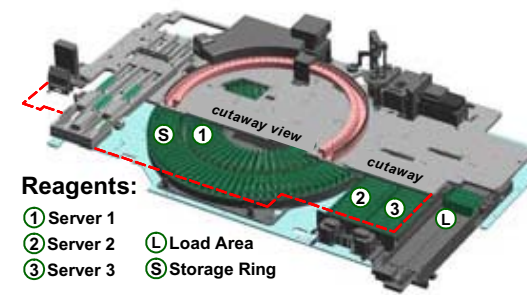
Selected Consumables

Semi-disposable plastic cuvettes are used for photometric, turbidimetric, and nephelometric assays. Disposable vessels are used for LOCI™ immunoassays. Reagents enter the system in Flex® reagent cartridges requiring no manual preparation. Calibrator and QC materials enter the system in dedicated vial carriers or cups.



Reagent System

Each Dimension Vista™ 1500 System includes a refrigerated and humidity controlled storage area for reagents, calibrator, and QC material; with a capacity of over 170 cartridges. This allows simultaneous processing of more than 100 methods and streamlines workflow with auto calibration and auto QC from materials stored on board.

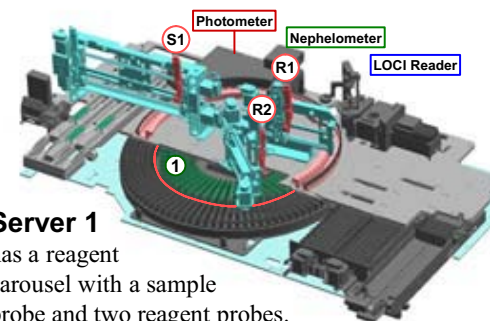


Reagents:

- ① Server 1
- ② Server 2
- ③ Server 3
- L Load Area
- S Storage Ring

Four Independent Processors

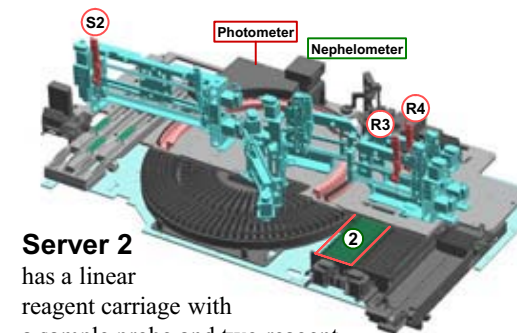
The Dimension Vista™ 1500 System architecture has four independent processors which share a common sample management area. The first processor, the V-LYTE™ module, is designed to process up to 500 tests/hr for electrolytes. It also performs sample dilutions and a portion of the HIL sample integrity requests. The remaining three processors handle reagent-based assays that utilize the photometer/turbidimeter, nephelometer, and LOCI™ reader.



Server 1

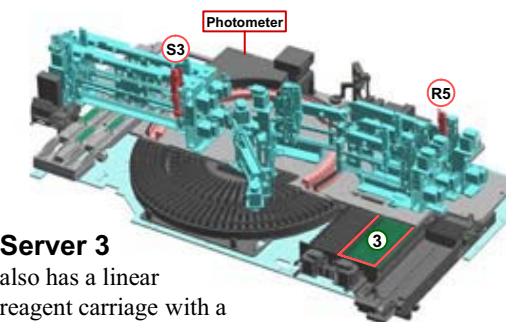
has a reagent carousel with a sample probe and two reagent probes.

The probes dispense fluid to either cuvettes or vessels in random access fashion. It supports various dispense times and processes all reagent-based assays. The design is optimized to deliver 300 tests/hr for a typical mix of specialty methods including DATs, TDMs, ISDs, plasma proteins, and immunoassays. Server 1 throughput is 450-500 tests/hr when processing general chemistry methods.



Server 2

has a linear reagent carriage with a sample probe and two reagent probes. The probes dispense fluid only to cuvettes. Assays are restricted to those with two fixed dispense times. It processes a subset of the photometric, turbidimetric, and nephelometric methods, with a throughput of 450-500 tests/hr.



Server 3

also has a linear reagent carriage with a sample probe and one reagent probe. The probes dispense fluid only to cuvettes and assays are restricted to a single reagent dispense. It processes selected high-volume photometric methods with a throughput of 450-500 tests/hr.

Test Mix Flexibility

Each of the three reagent-based servers is able to process a variety of methods. This architecture allows customizable menu partitioning among servers, balancing workload to meet the test mix demand of individual laboratories. Moreover, the system can automatically rebalance workload as needed to maintain overall throughput.

System Throughput

Overall system throughput is given by the combined output from the V-LYTE™ module and each of the three reagent-based servers. System design is optimized to deliver 1500 tests/hr for a workload containing 20% specialty and 80% general chemistry methods. If the workload contains more general chemistry, throughput exceeds 1500 tests/hr.

	Fraction of Specialty Tests				
	0%	5%	10%	15%	20%
V-LYTE™+Server 2&3	1200	1200	1200	1200	1200
Gen Chem by Server 1	450	329	214	105	0
Specialty by Server 1	0	80	157	230	300
Throughput	1650	1610	1571	1535	1500

A further advantage of the architecture allows HIL sample integrity requests to run without reducing effective throughput. This is possible because the system is able to distribute workload to those processors that are not running at full capacity.

Dimension Vista™ 3000T System *

For higher volume laboratories, two Dimension Vista™ 1500 Systems can be integrated to create a seamless workstation managed by a single operator. This configuration doubles throughput and provides built-in active backup.



Conclusion

The architecture of the Dimension Vista™ 1500 System maintains high throughput for a variety of test mix conditions. The system consolidates workload by allowing simultaneous processing of more than 100 methods and streamlines workflow with auto calibration and auto QC from materials stored on board.

**product under development – not available for sale*