Laboratory Automation: The Critical Role of Pathology Informatics

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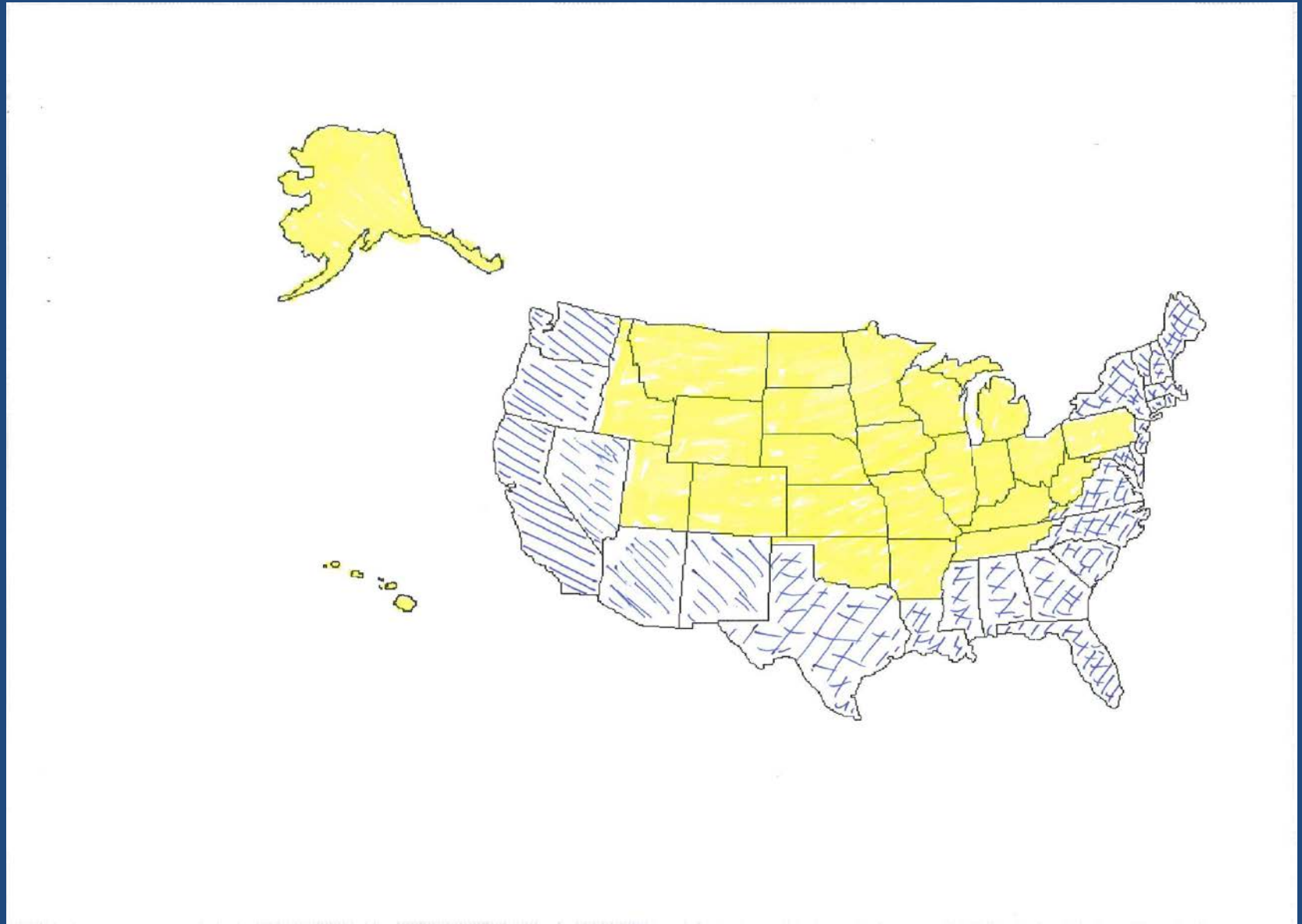
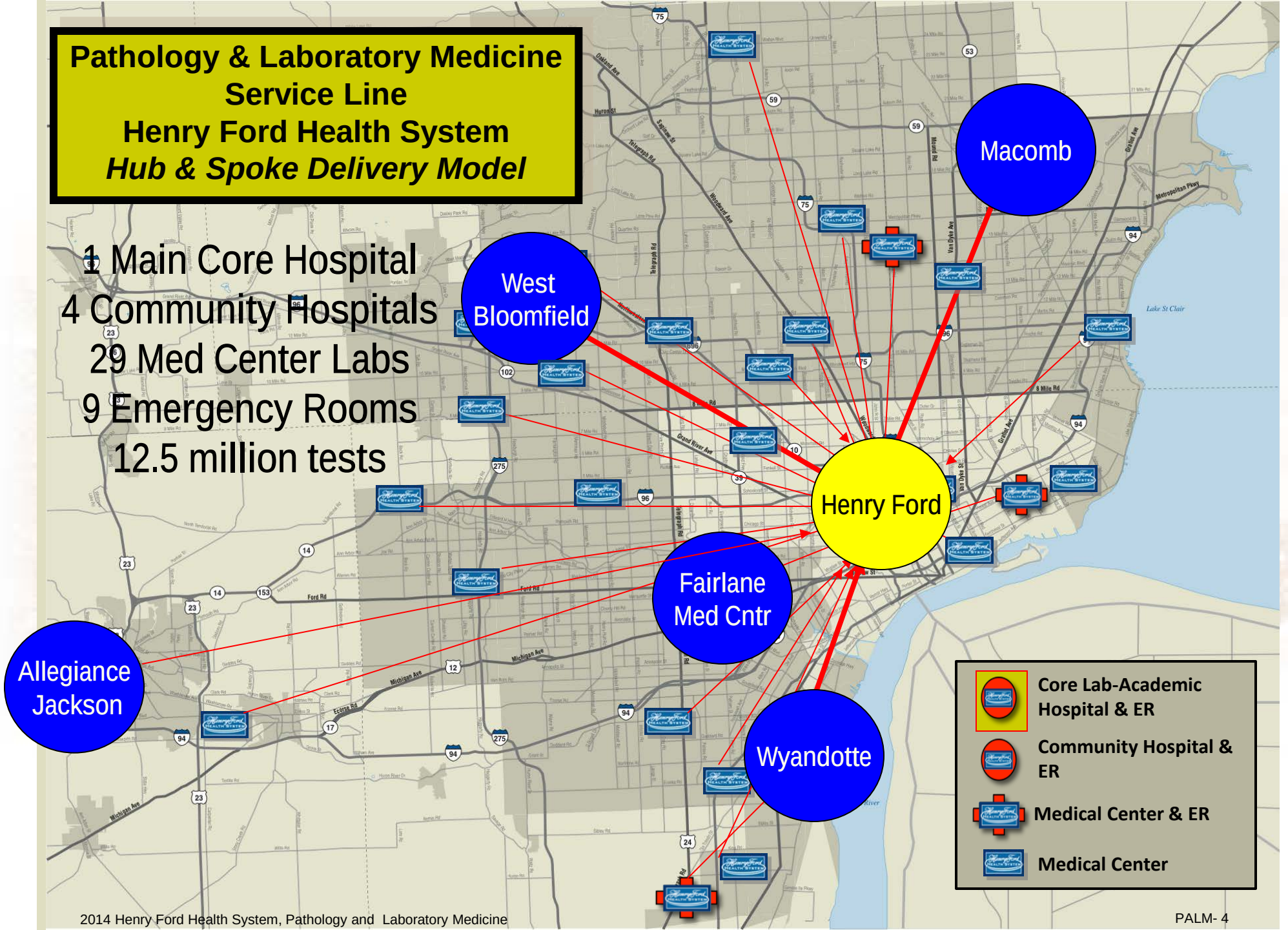
Disclosures

I have no relevant financial relationships within the past 12 months with commercial interests that provide products and/or services related to the content of this CME activity.

The US Midwest



Pathology & Laboratory Medicine Service Line
Henry Ford Health System
Hub & Spoke Delivery Model



Types of Automation

Standalone

Proprietary System

Open Systems

Standalone: Automate 2550

Open System

Beckman Coulter (Heme / Chem / IA)

Siemens (IA)

Stago (Coagulation)

BioRad or other (future)

Add Lab Capacity + Help with Labor shortage

Sequencing

Contracting
Site Preparation
Release for Shipping
Field Service / Application Specialist
Training
Validation (AMR,CRR)
Middleware
Interface Lab Automation System to LIS
LIS Verification

Sequencing / Involving Informatics

Contracting
Site Preparation
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Training
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Middleware
Interface Lab Automation System to LIS
LIS Verification

Functions: These are Complex Systems

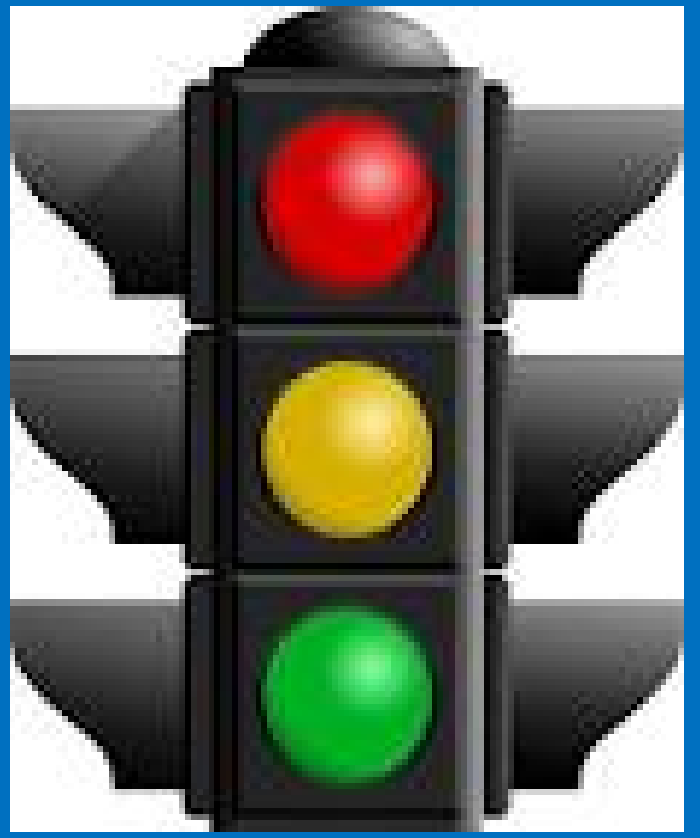
"In-Lab-ing"
Centrifuging
De-capping
Sorting
Distributing
Re-capping
Storing
Discarding

At the intersection of **Progress** and **Challenge** is a traffic light called Pathology Informatics

Go Fast

Wait

STOP



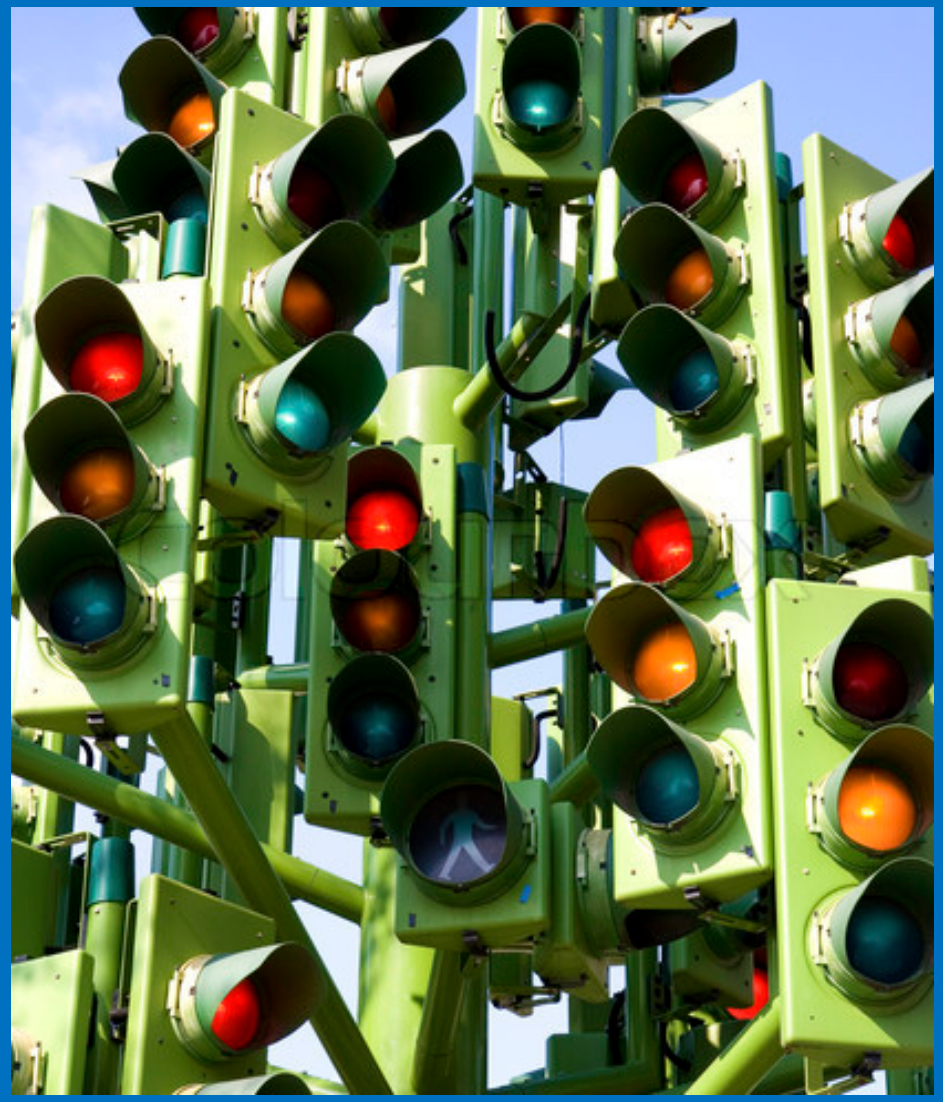
A Rush Hour of Informatics Challenges

Site Prep: Go Fast, Go Slow

Delivery Dates

- Application Specialists
- Legacy Systems AND New Systems
- Middleware
- Coordination with Corp IT and Vendor(s)

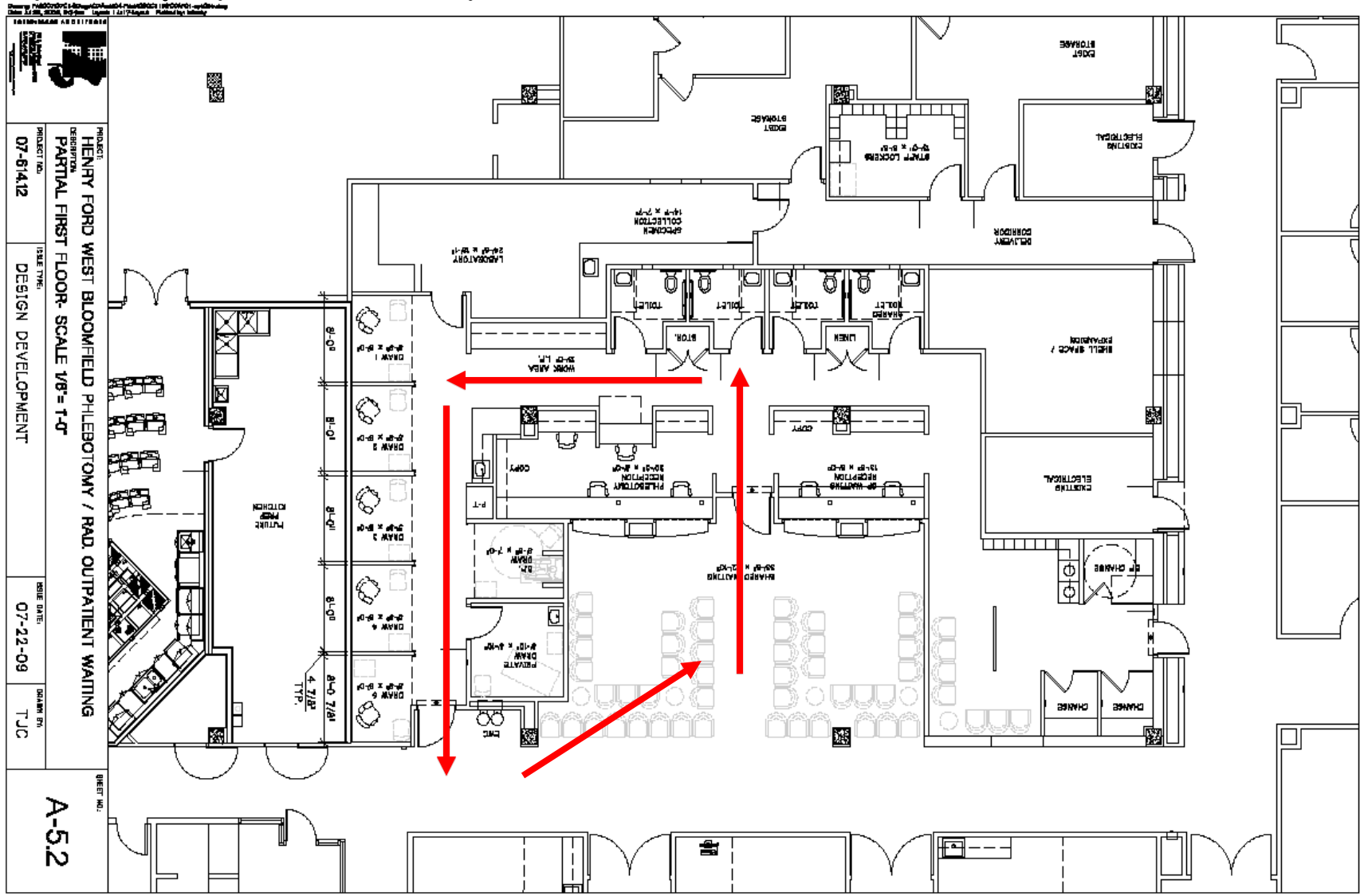
Decommissioning



Automation will generally work exactly the same anywhere in the world. Planning for work streams and off-line testing makes all the difference.

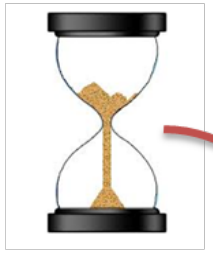
LEAN Lab Design

Form Follows Function



7 Types of Waste

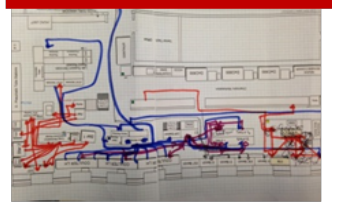
Waiting



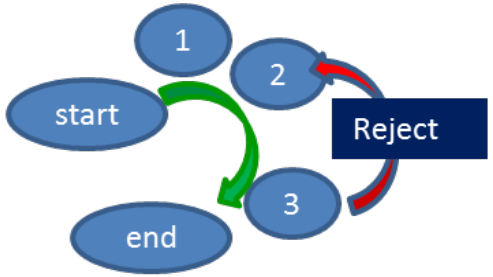
Overproduction

Transportation

Motion

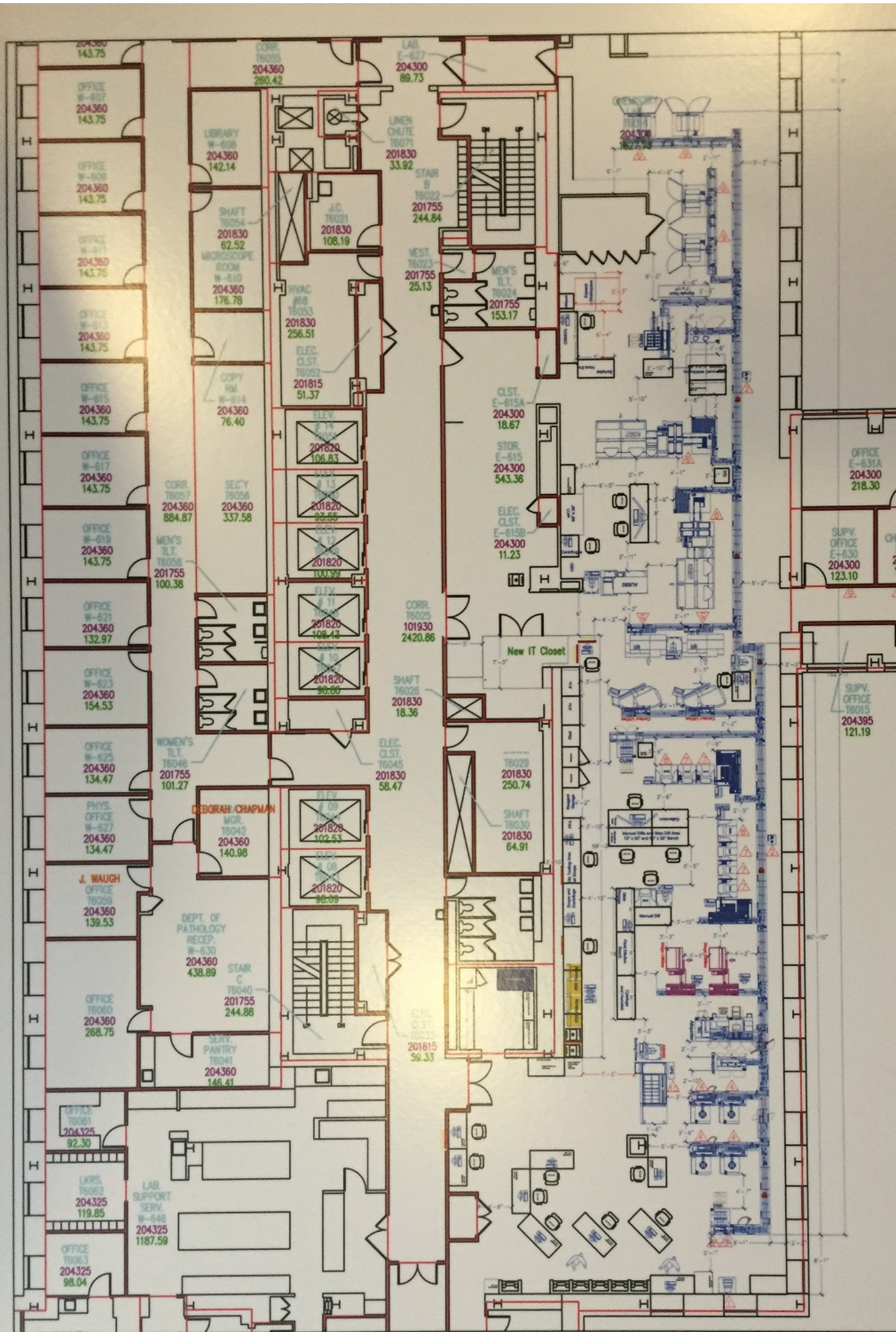


Rework



Defects

Inventory



DESIGN ACCEPTANCE					
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	SIGNATURE:			SIGNATURE:	

BECKMAN COULTER

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HENRY FORD H		
FILE NAME		
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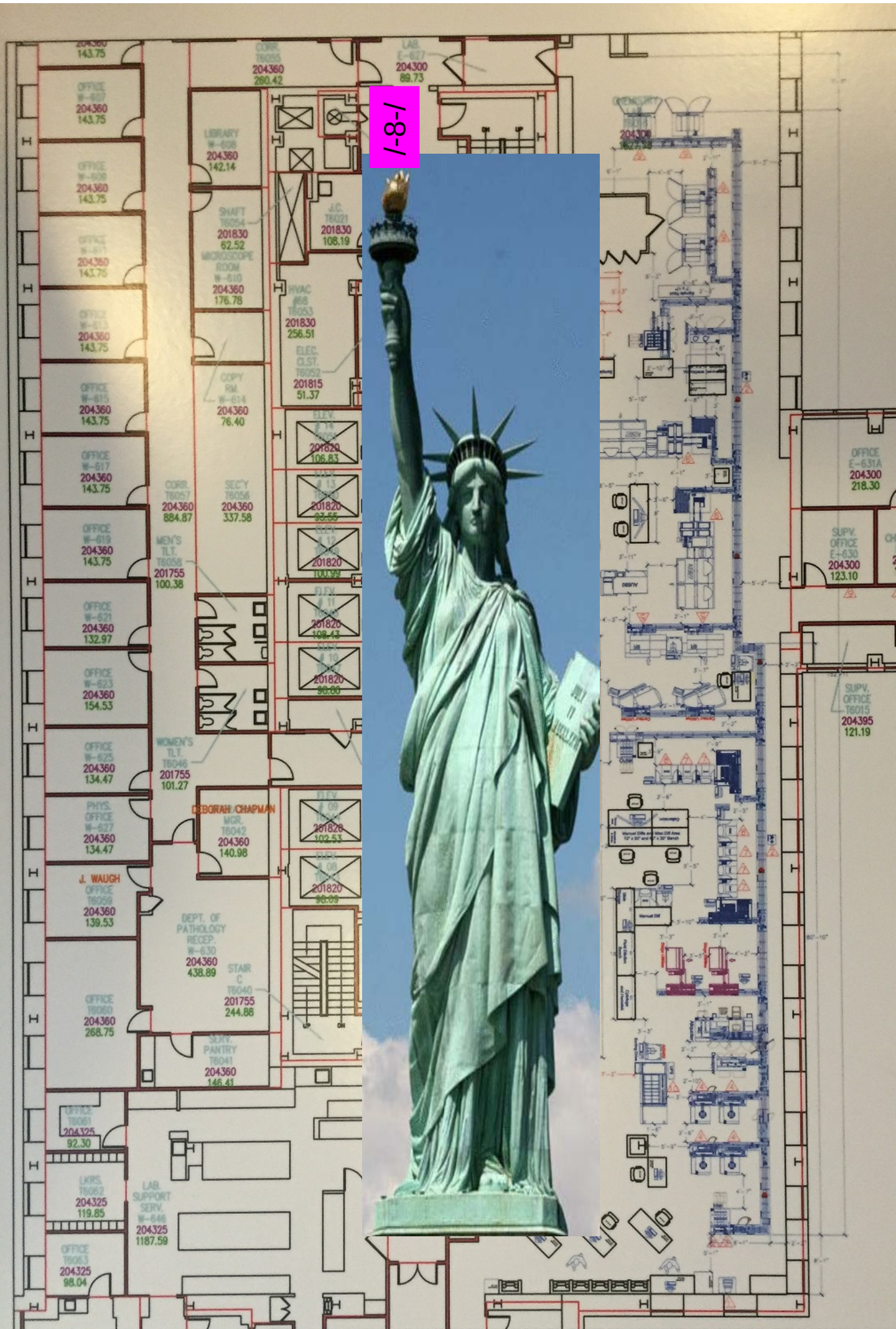
03/17/2016	B. Huang	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DRAWN BY:
B. Huang

(3P), Production, Preparation, and Process

GOALS:

- Reduce Specimen Handling (1 touch to the line)
- Reduce Human Motion
- Reduce Variation in Specimen Delivery
- Implement Visual Controls
- Mistake Proof, ID Defects
- Improve Standard Work
- Maintain 30 minute STAT Turnaround Time

(3P), Production, Preparation, and Process

Work streams

Kaizens: 3-4 Day Deep Dives

Pathology Informatics involved in providing data.

(3P), Production, Preparation, and Process

Work Streams

In-Patient

Outpatient

Outreach

Work Streams (different informatics challenges)

In-Patient

Outpatient

Outreach

Research

Home Health

Dialysis

Employee Health

School based clinics

Whole blood samples

Have You Ever Been in this Meeting?

Q: Making progress?

A: Yes…

Everything worked but the Label Printing

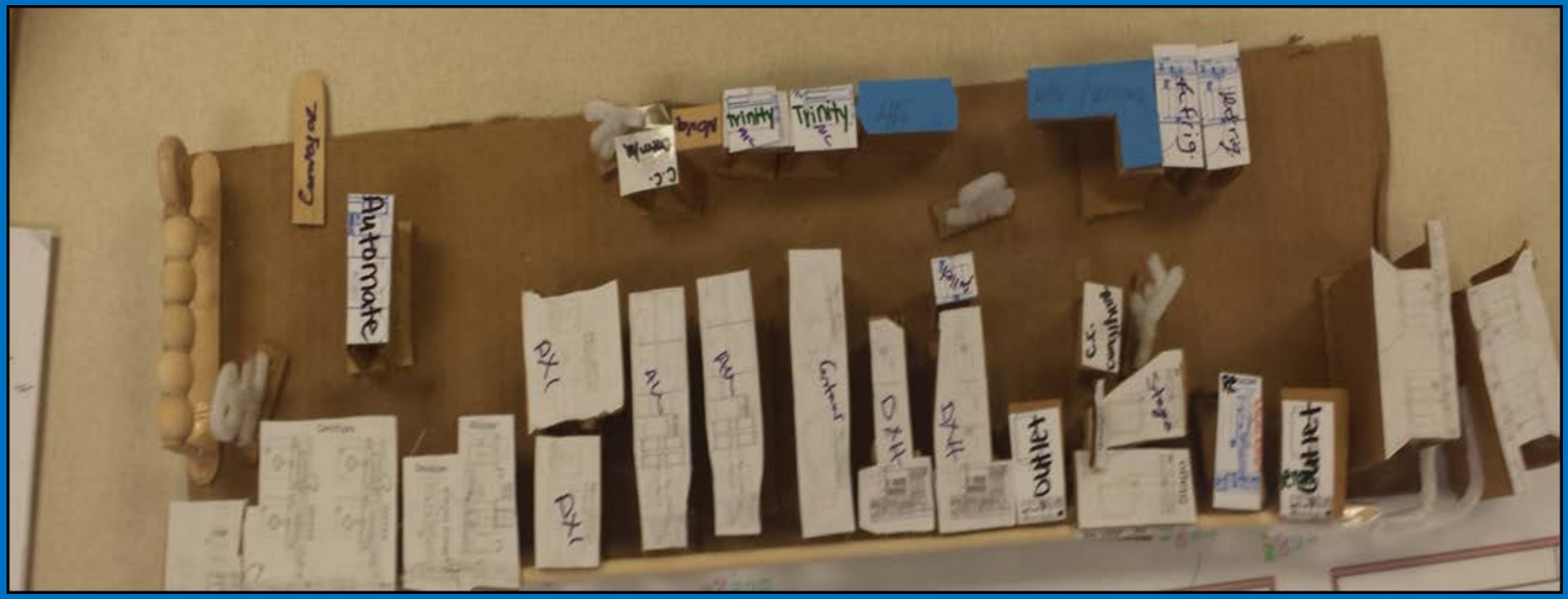
(3P), Production, Preparation, and Process

Kaizens (total of 11)

How to layout the automation

Instrument Placement Optimize Coag / Chem / IA

Revise, Revise, Revise USE DATA from PI



(3P), Production, Preparation, and Process

Kaizens

Consider Volume by Time of Day
Delivery Times and Locations
Optimize Instrument Placement

What About the Other Stuff ?

Urinalysis

Sed Rate

A1C

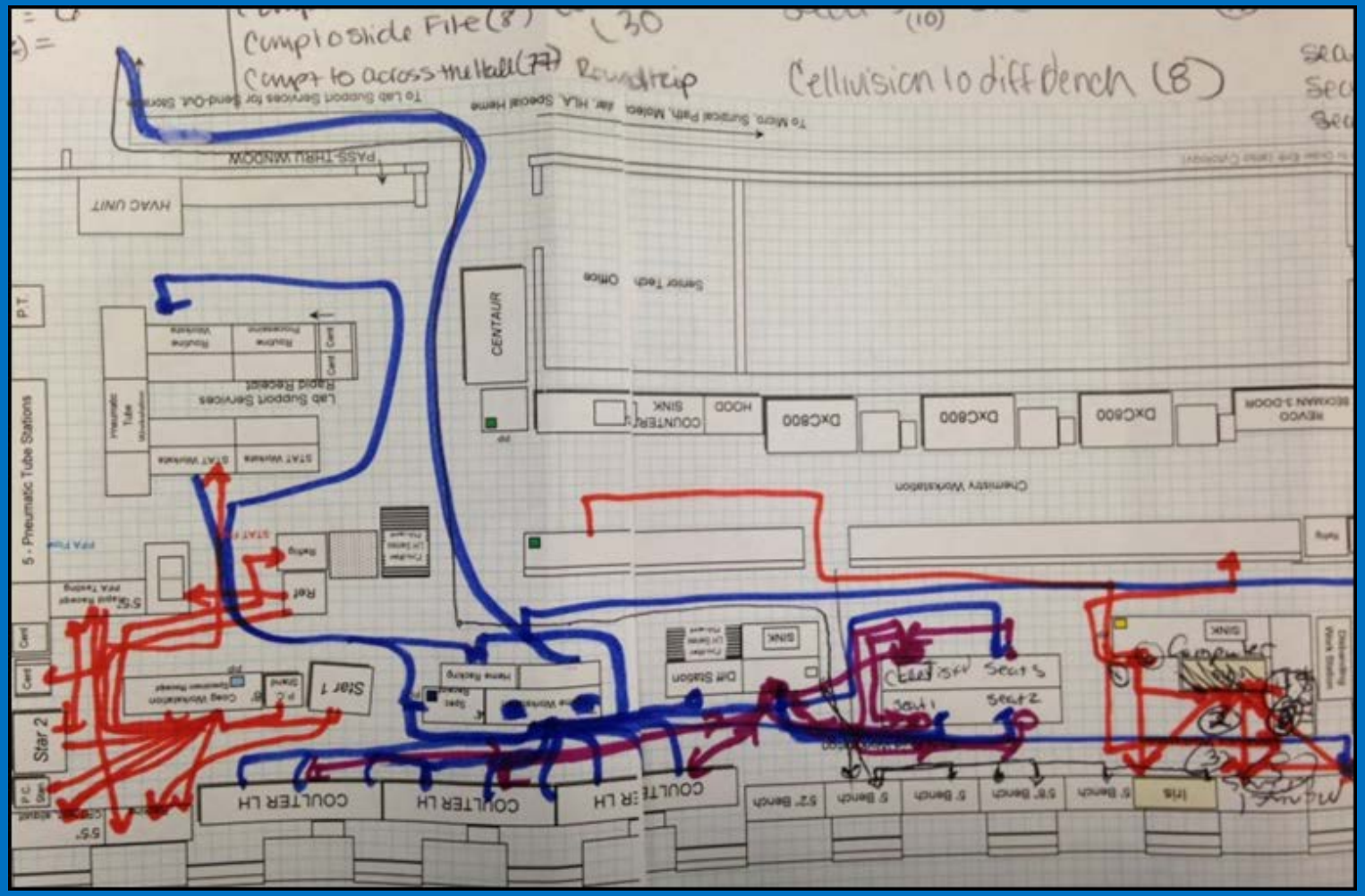
Serology

Sendouts

Electrophoresis

Lead, Allergy, Specific Proteins

What About the Other Stuff ?



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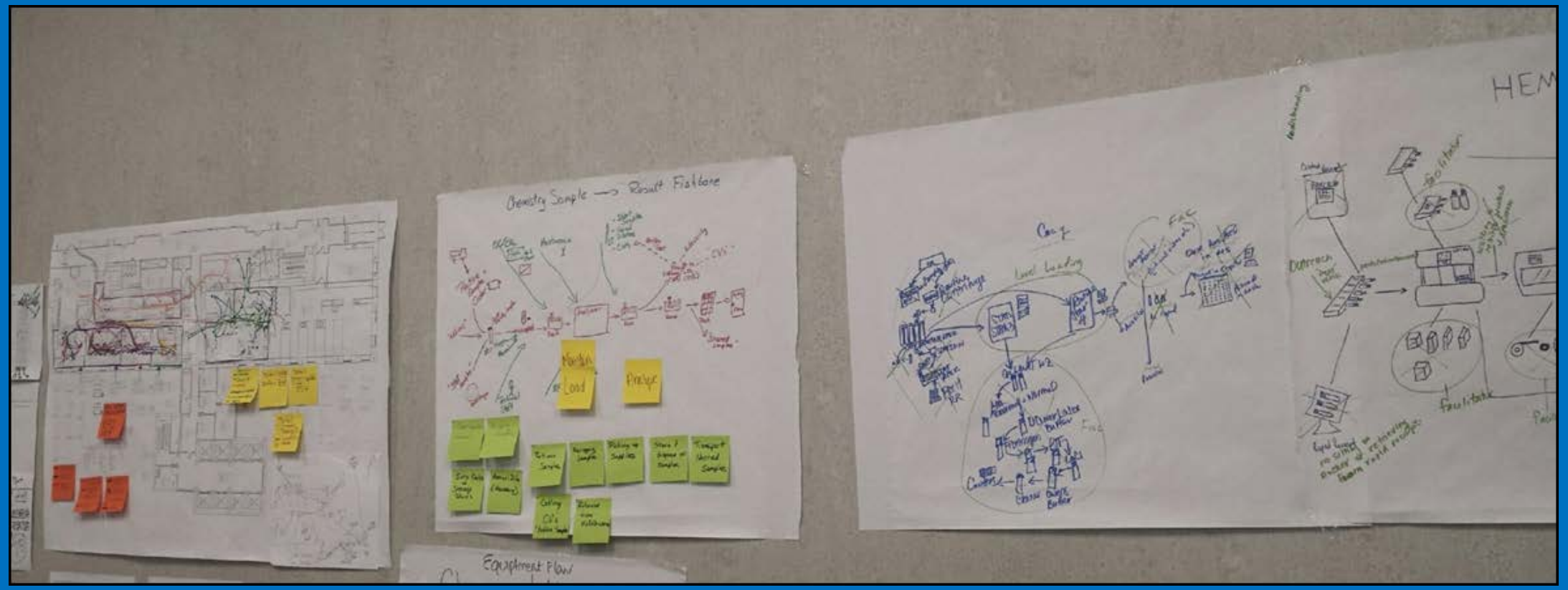
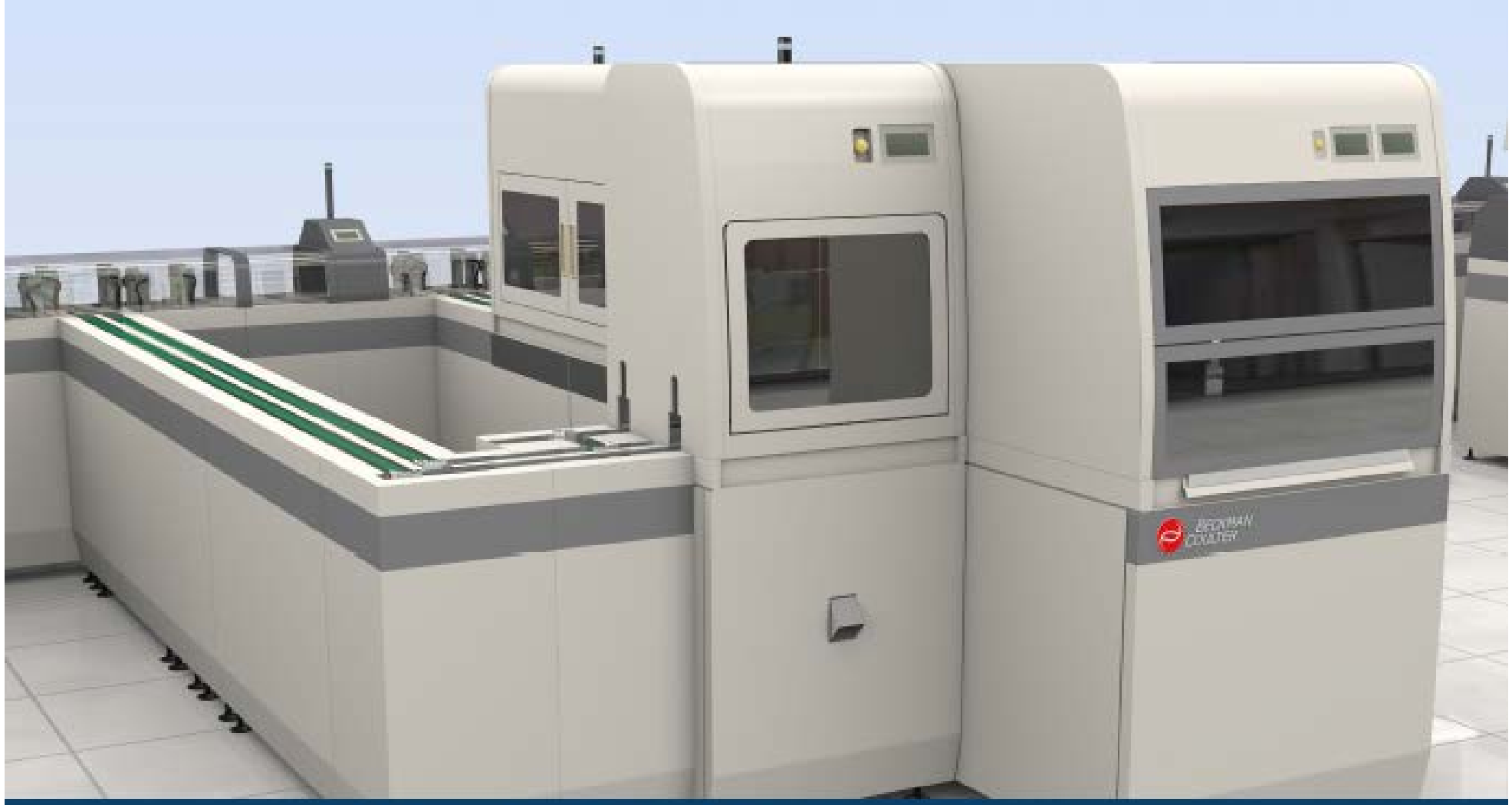




STATION 12 | OUTLET

SAMPLES CAN EXIT AUTOMATION SYSTEM FOR:

- Manual inspection
- Off-line analysis
- Send-out testing

Consider Location of OUTLETS

Redesign Manual Workstations

- Sed Rate, A1C
- Serology
- Sendouts
- Electrophoresis
- Lead, Allergy, Specific Proteins
- including UA and ABG iCa not on the automation line

Pathology Informatics…Network Drops, Instrument Moves

(3P), Kaizens

Reagents, JIT Delivery, Inventory, Storage

Handoffs to other Technical Areas

Try-Storm Receipt and Delivery

Plan Gravity Conveyor

Process for Downtime

Metrics, Leading and Lagging, Daily Mgt

Customer Service, Critical Value

Henry Ford Health System

PATHOLOGY AND LABORATORY MEDICINE

1. Dynamic Inlet
2. Centrifuges (4)
3. Sample Preparation
4. Coagulation
5. Command Central-Hematology
6. Hematology
7. Immunoassay 1
8. Immunoassay 2
9. Chemistry
10. Command Central-Chemistry
11. Recapper
12. Outlet
13. Stockyards (rear)
14. Stockyards (front)

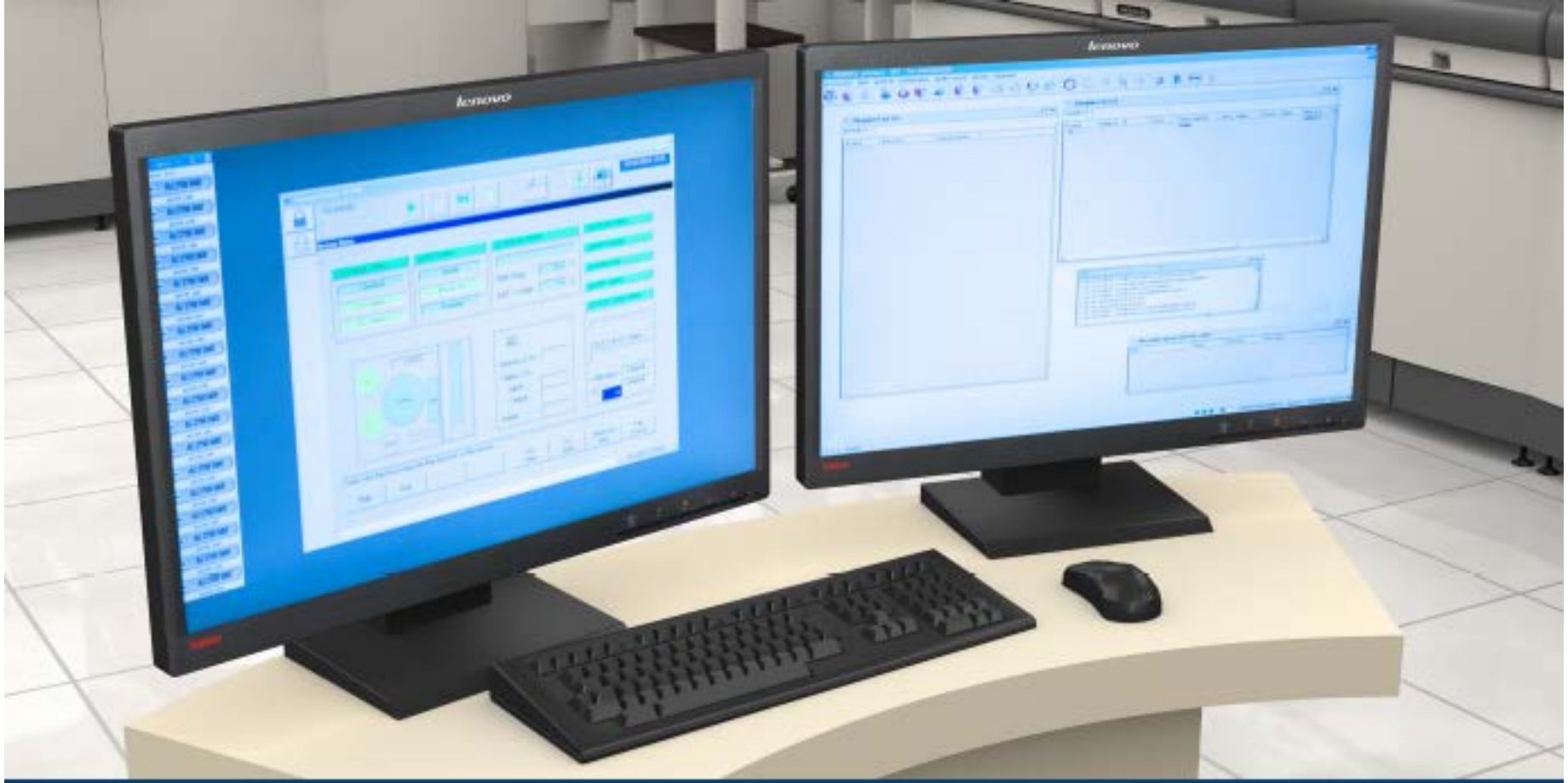
meanwhile...Middleware

- Server Placement – Local vs Remote
- Vendor supplied and supported
  - Service Level Agreement
  - Not on our network…a separate firewall,
  - patches, antivirus, data center access, remote access tool
  - IT Team, Project Mgr, Data Center, Help Desk, Server Team, Security (Network and Data Center)
- Virtualization and Co-location, Disaster recovery

Open Systems: Some Limitations

Middleware Workstation (Command Central)

- Connecting vs Seeing the full instrument
- Reagent Status, QC in or out
- Not Perfect but better cooperation



STATION 5 | COMMAND CENTRAL HEMATOLOGY

COMPLETE LABORATORY MANAGEMENT FROM A SINGLE WORKSTATION BY ONE TECHNOLOGIST

- Improves lab efficiency
- Maximizes instrument uptime
- "Anytime" view of components
  - Lab Information system
  - Middleware
  - 5 hematology systems
  - 2 slidemaker/stainers

The Buildout

Automation Shipped from Japan

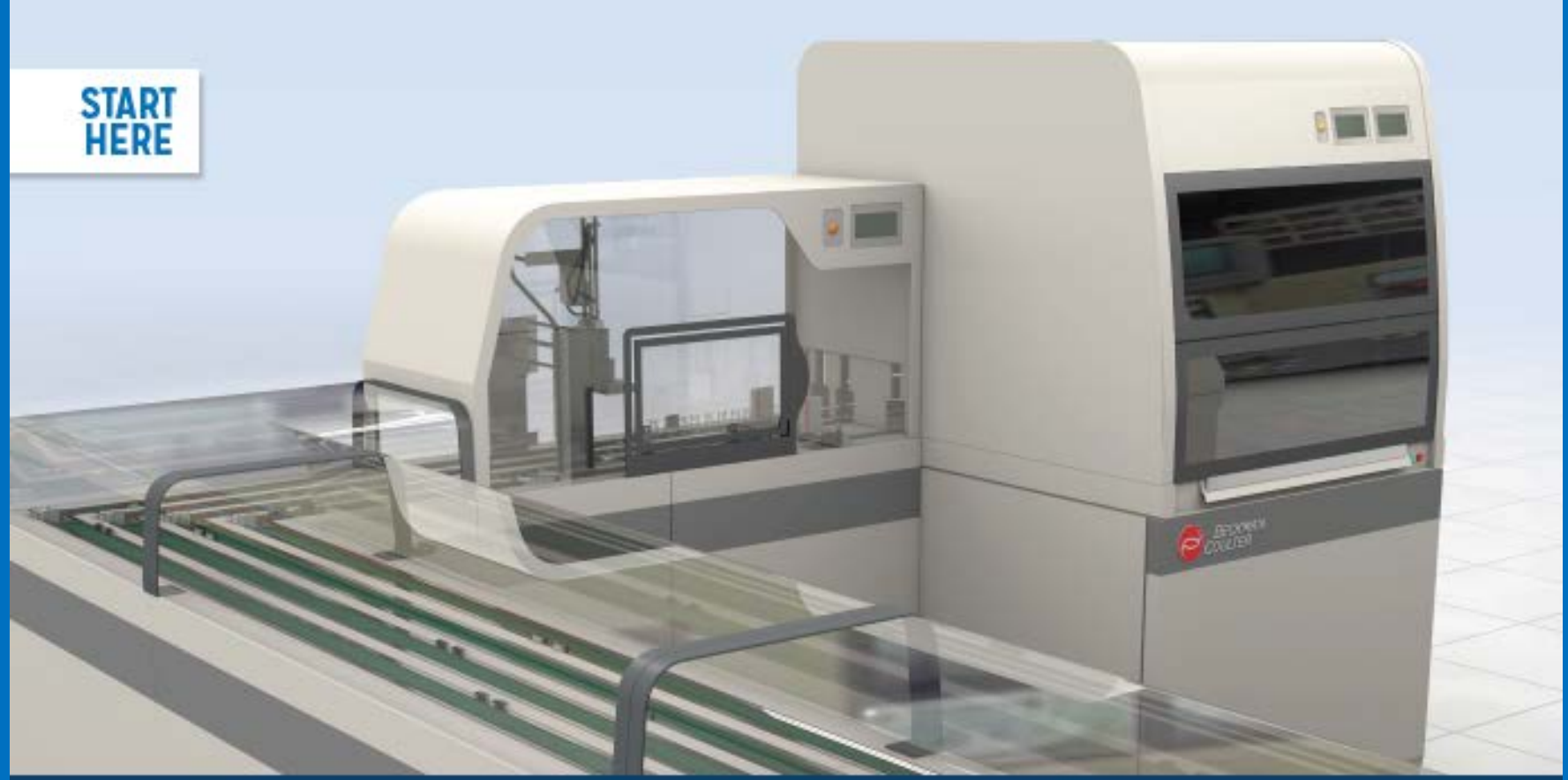
New Instruments Placed on “footprint”

Refrigerated Storage Units Placed Early

16 weeks to Assemble Automation and Connect Inst

Validate LIS – LAS, Centrifuges, All Routing

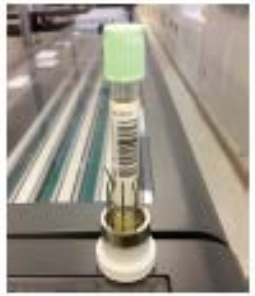
2.0 FTE Pathology Informatics assigned Full Time



STATION 1 | DYNAMIC INLET

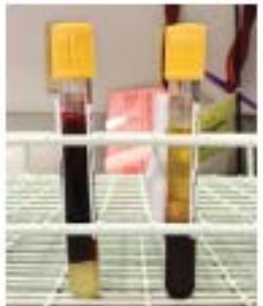
- Barcoded sample loaded in a "puck" containing an RFID* chip
- Capacity is 1,200 samples per hour

*Radio Frequency Identification enables tracking of sample on the line.



STATION 2 | CENTRIFUGES (4)

Separate serum or plasma from blood cells for coagulation, chemistry and immunoassay tests.



STATION 3 | SAMPLE PREPARATION

DECAPPING

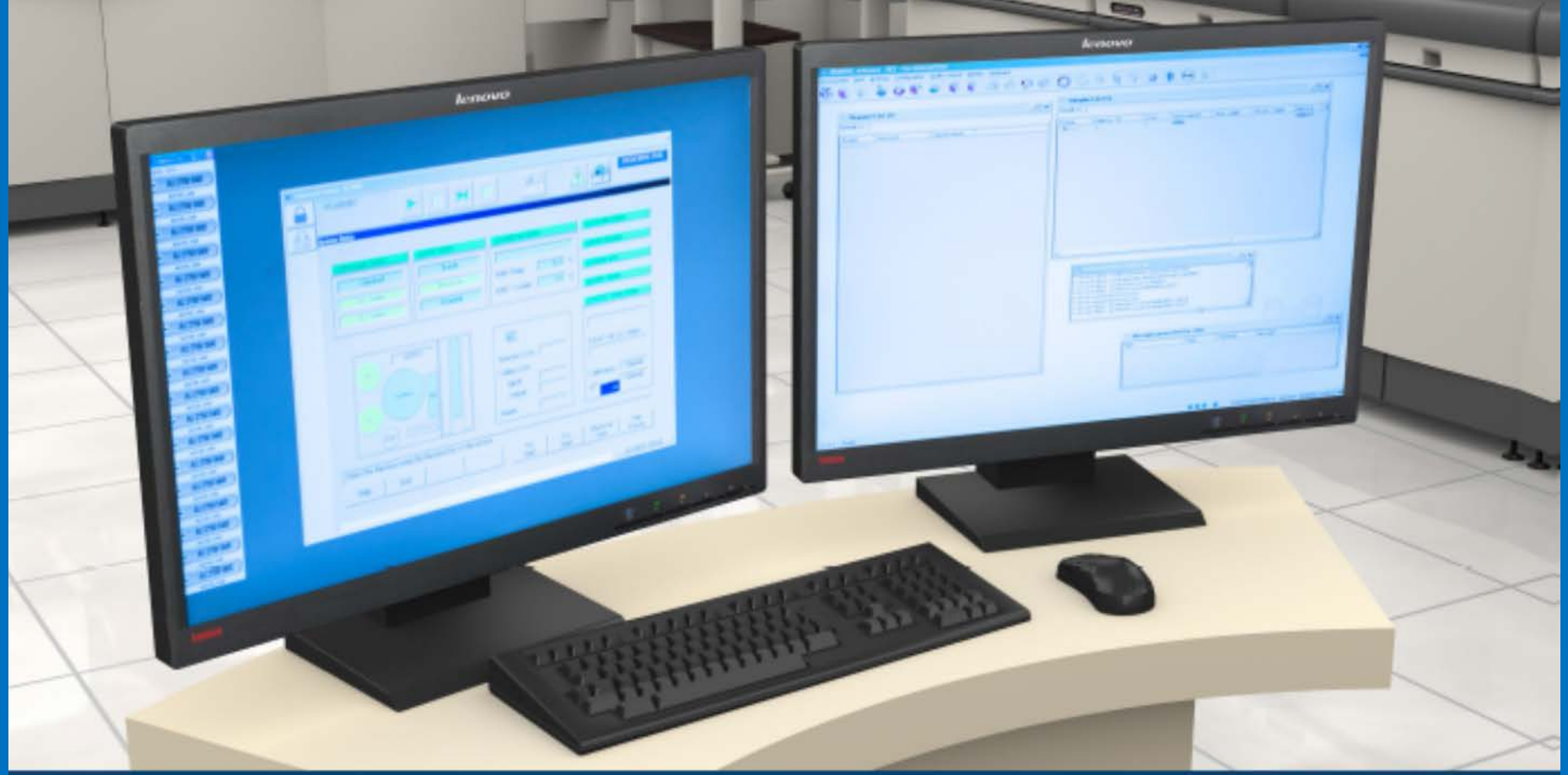
Removes tube caps to enable aspiration.

ALIQUOTTING

Divides a single patient sample into multiple, labelled "daughter tubes".

STATION 4 | COAGULATION

Testing for hemostasis activity assays (PT, aPTT), and clotting proteins (fibrinogen, D-dimer).



STATION 5 | COMMAND CENTRAL HEMATOLOGY

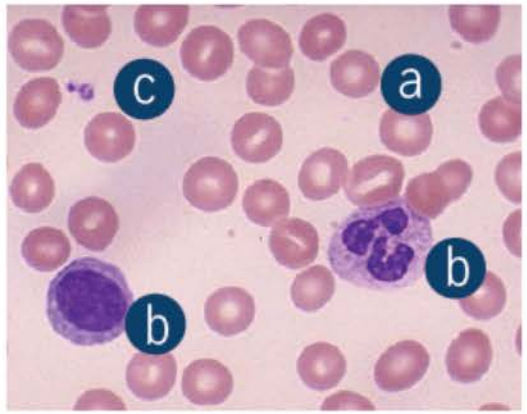
COMPLETE LABORATORY MANAGEMENT FROM A SINGLE WORKSTATION BY ONE TECHNOLOGIST

- Improves lab efficiency
- Maximizes instrument uptime
- "Anytime" view of components
  - Lab Information system
  - Middleware
  - 5 hematology systems
  - 2 slidemaker/stainers

STATION 6 | HEMATOLOGY

HEMATOLOGY

- Red blood cells (a)
- White blood cells with differential (b)
- Platelets (c)
- Hemoglobin



CELL COUNTERS

- 500 samples per hour

SLIDE-MAKER STAINER

- Prepares blood for morphologic analysis of cell types
- 280 slides per hour

STATION 7 | IMMUNOASSAY 1

Performs specialized tests such as cardiac, infectious disease, tumor markers, and more.

- One system can run 240 tests/hour

STATION 8 | IMMUNOASSAY 2

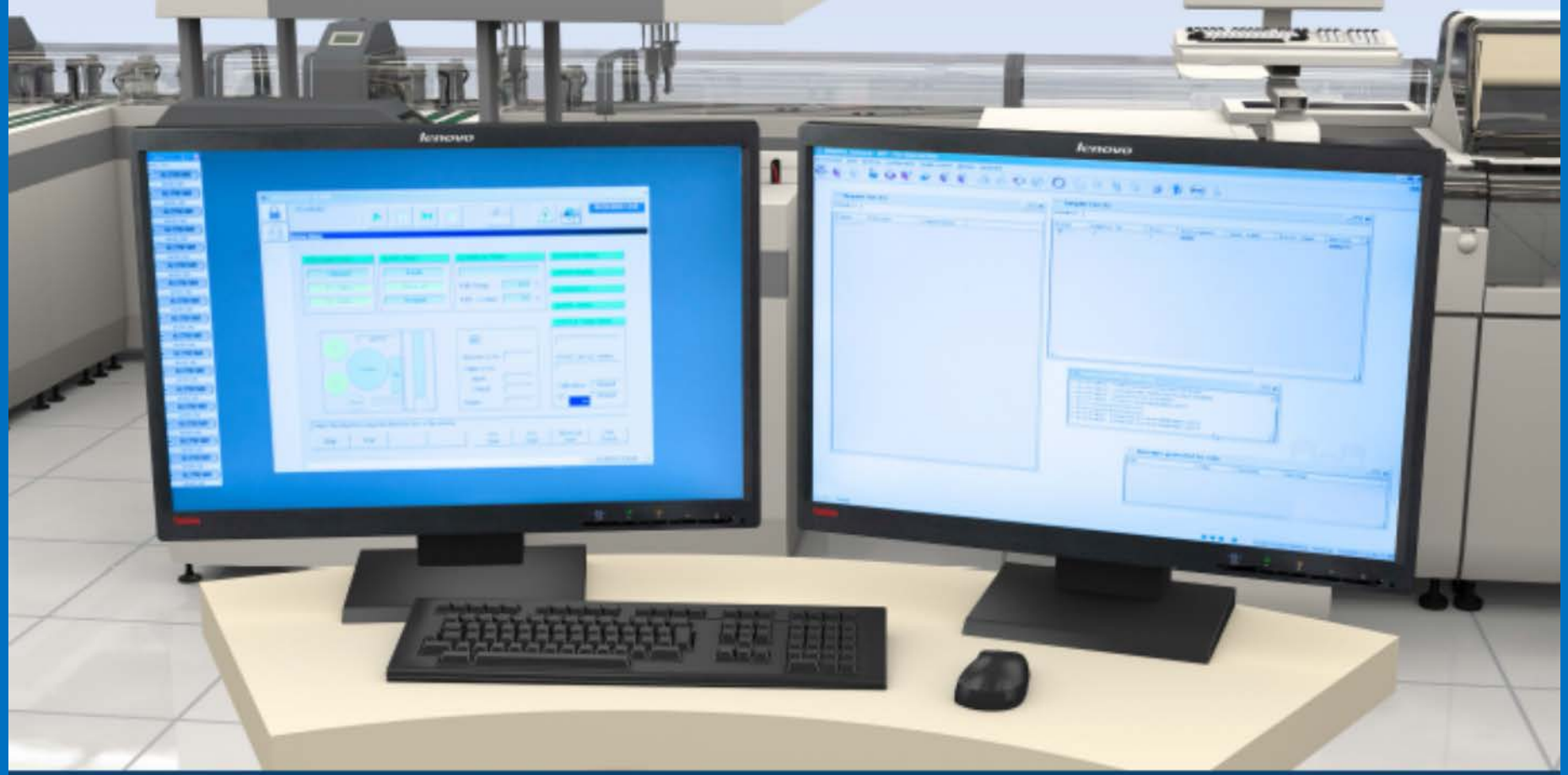
Performs specialized tests such as cardiac, anemia, reproductive, thyroid function and more.

- One system can run 400 tests/hour

STATION 9 | CHEMISTRY

Two chemistry analyzers performs more than 50 tests at 6,000 tests/hour each:

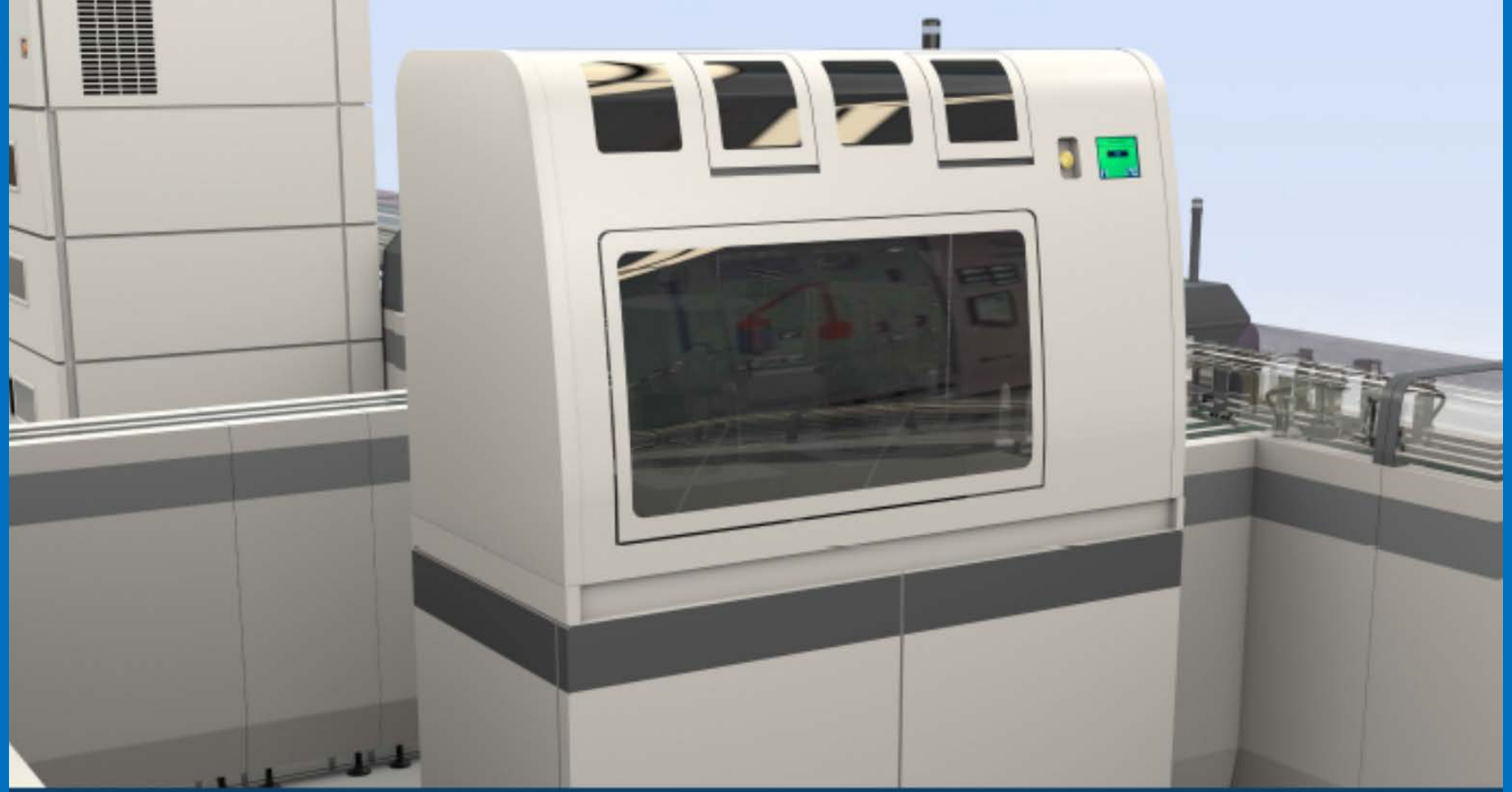
- Chemistry panels including basic metabolic, lipid, liver and renal
- Therapeutic drugs
- Drugs of abuse
- Urine chemistries



STATION 10 | COMMAND CENTRAL CHEMISTRY

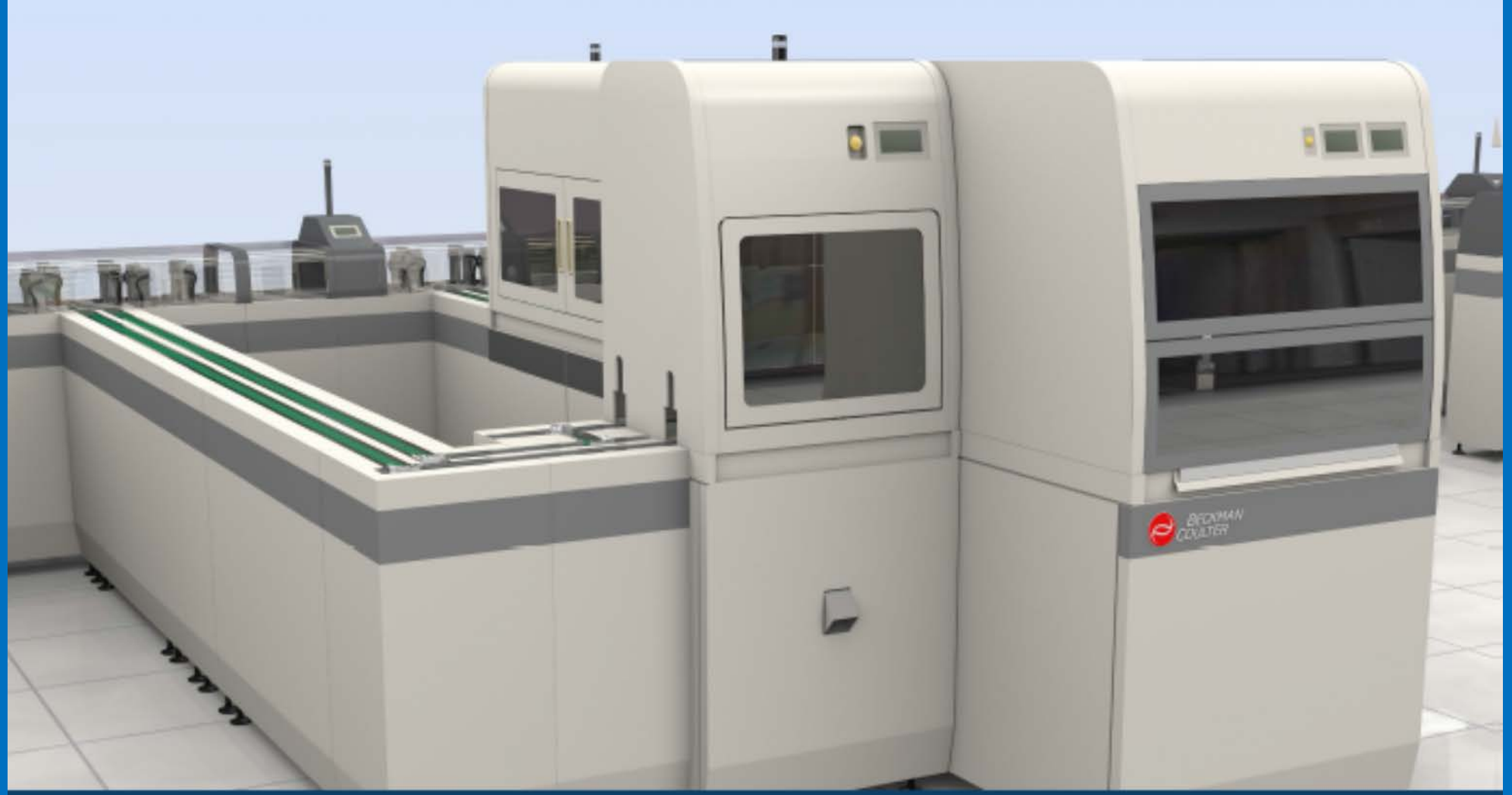
COMPLETE LABORATORY MANAGEMENT FROM A SINGLE WORKSTATION USING 1.0 FTE

- Improves lab efficiency
- Maximizes instrument uptime
- "Anytime" view of components
  - Lab Information system
  - Middleware
  - 3 chemistry analyzers
  - 2 immunoassay systems



STATION 11 | RECAPPER

Automated recapping of sample tubes to prevent evaporation during storage.



STATION 12 | OUTLET

SAMPLES CAN EXIT AUTOMATION SYSTEM FOR:

- Manual inspection
- Off-line analysis
- Send-out testing

STATION 13 | STOCKYARDS

STORAGE UNITS (REAR VIEW)

- Hold over 5,000 samples each
- We store > 20,000 samples
- Refrigerated and ambient temperatures
- On-line retrievable for add-ons, repeats
- Automatic discard to biohazard waste disposal

STATION 14 | STOCKYARDS

STORAGE UNITS (FRONT VIEW)

- Hold over 5,000 samples each
- We store > 20,000 samples
- Refrigerated and ambient temperatures
- On-line retrievable for add-ons, repeats
- Automatic discard to biohazard waste disposal

RESULTS

159’, 53 yards, 48.5 meters

Reduced Sample Touches

Hematology 26 ➡ 2

Chemistry 17 ➡ 2

Shared Samples Higher

RESULTS

Steps Traveled by All Staff 24/7

Saved Steps 45,345

25.8 miles

41.5 km

12.6 hours Time in Motion