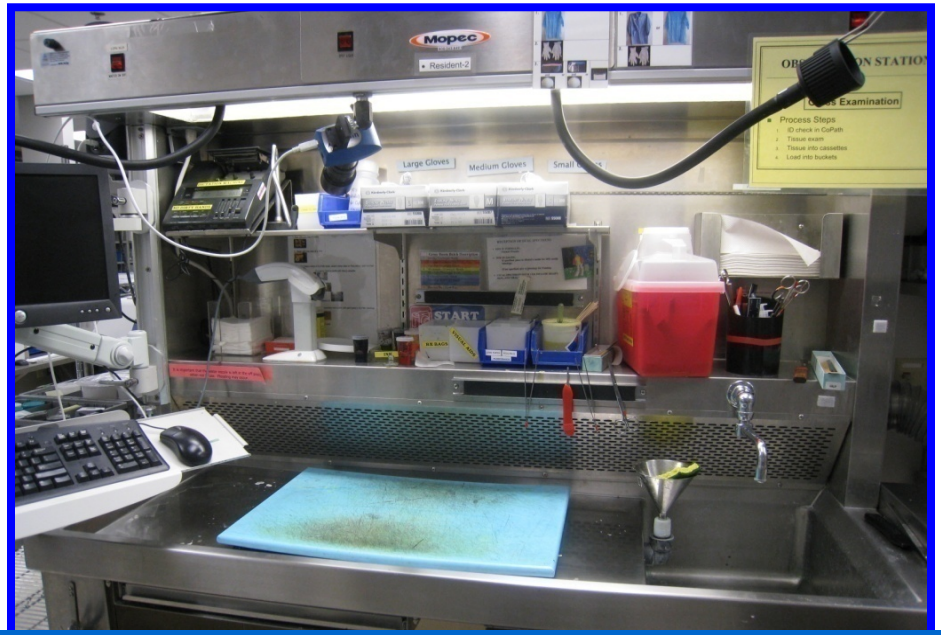
What Does Lean Surgical Pathology Look Like?

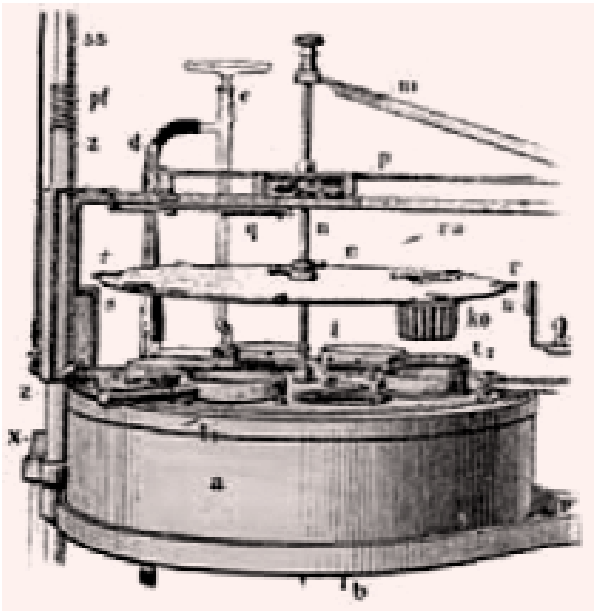


Arizona Society of Pathologists Fall Meeting

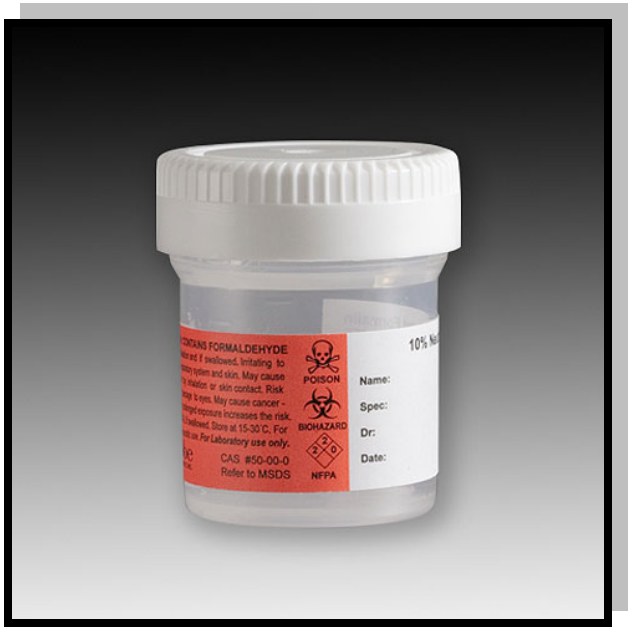
Richard J Zarbo MD

The way it was is !

Cycle time = 14 hrs

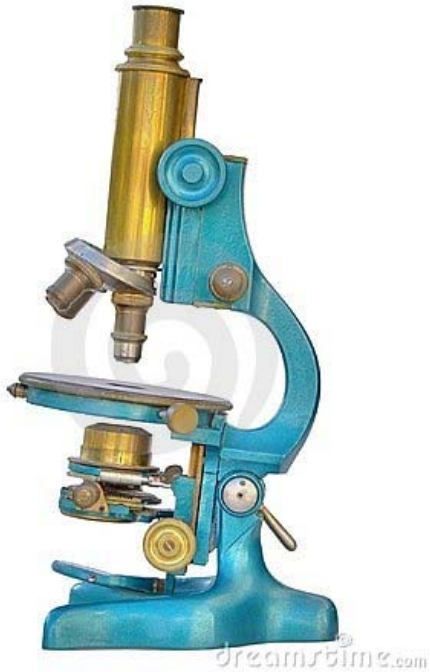


1909
Arendt



1893
Blum

Cycle time = ? hrs



1850s
Virchow

Identify the Goal

Articulate the Vision & Means & Goals

- All specimens from any Operating Room or client within are transported, grossed and processed within the day of surgery at Core AP Lab
- Continuous flow processing for Biopsies & Large Specimens using Lean processes with short cycle times
- 80% of all Biopsy reports within 2 days & all Large specimens reports in 3 days

Educate the Leaders & Teams

How Do You Get There?

Management system

- That mines creativity of people, educated and structured to contribute to improving the work daily

PDCA (Plan Do Check Act)-based

- Customer focused continuous improvements

Continual work redesign (to achieve) :

- Continuous flow
- With minimal waste,
- Defined connections, &
- Defined pathways

Know What is Ideal Work

Strive for the IDEAL Condition

Delivery of products & services should pursue the Ideal

Production that is

- Defect Free (goal is zero, meets customer expectation)
- On demand (supplied when you want it, in right version)
- Immediate (now, no waiting)
- One at a time (single piece flow, batch size of 1)
- Continuous flow (no batches, queues)
- Minimal waste (materials, labor, energy, other resources)
- Safely for every employee
  - Physical, emotional, professional

Focus teams on Eliminating the Wastes

LEAN Tools to Improve Workflow

- Standard work
- Mistake proofing
- Batch size reduction
- Level load
- Work simplification, posted job aides
- Visual displays, controls & and color coding
- White boards, Deviation Management Process, Daily Management Boards
- Kanban inventory and production signals
- “Stop the line” (Specimen labeling and acceptability rehabilitation process)

Structure the Teams

Surgical Pathology Path of Workflow

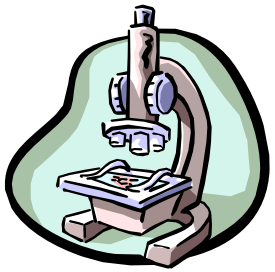
START

Human Tissue

Processing Technology

END

Diagnostic Report



PATHOLOGY WORK STATIONS

Surgery

Specimen delivery

1 Specimen accession

2 Gross dissection

3 Tissue fixation & processing

Paraffin embedding

Slide cutting

Slide staining

Slide label & delivery

6 Report generation & delivery

5 Residents

Pathologist interpretation

4

Identify the Defects

Survey Defects Work In-Process

Poor quality of service or product that makes you:

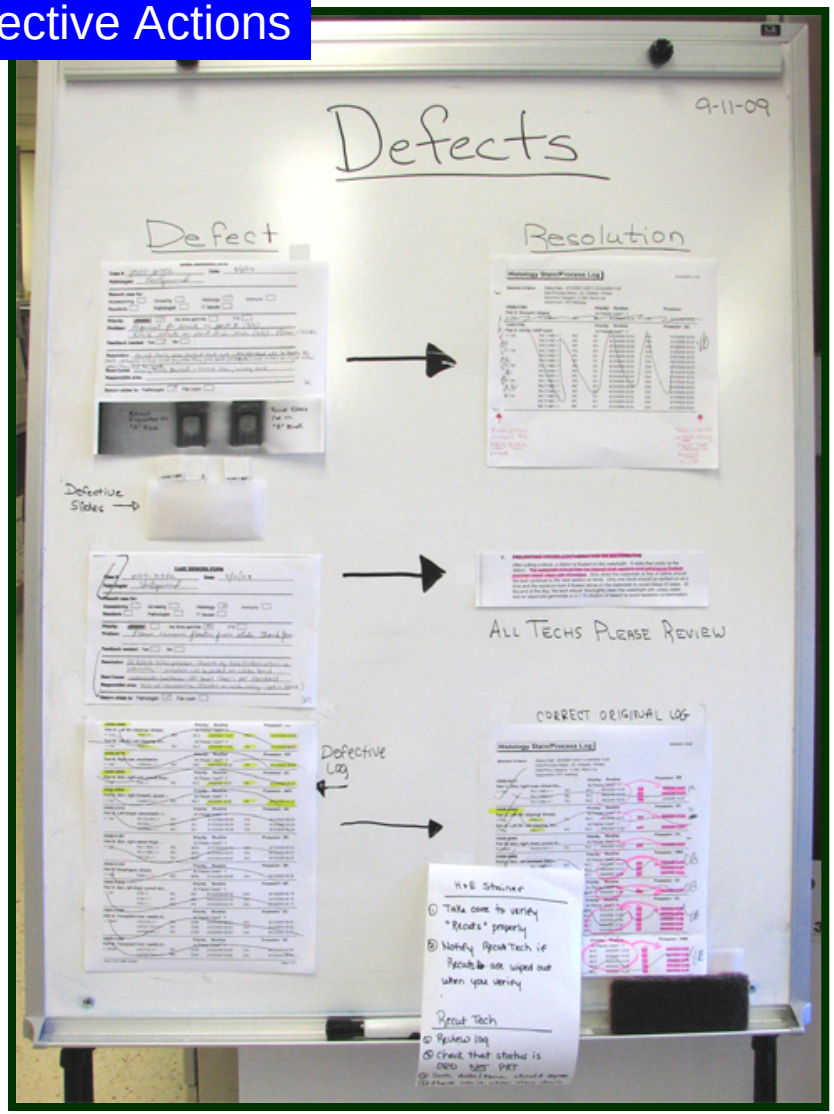
- **Stop your work**
- **Reject it**
- **Return it to sender**
- **Delay your work to fix it yourself**
- **Not pleased, could be better**

= variation = bad
= poor quality

Defect Board- Make Defects & Resolution Visible

Rework Pathway for Corrective Actions

- Histology Core lab weekly Quality Huddle
- Lab meets to review past week's defects
- Defects are posted on white board with resolution for all to see, obtain clarification, suggestions and for all to learn from



Even More Sophisticated Daily Management Board

Simplify
Rid Un-needed
Process Steps

LEAN LESSON

Lean Principle- Start with Work Simplification

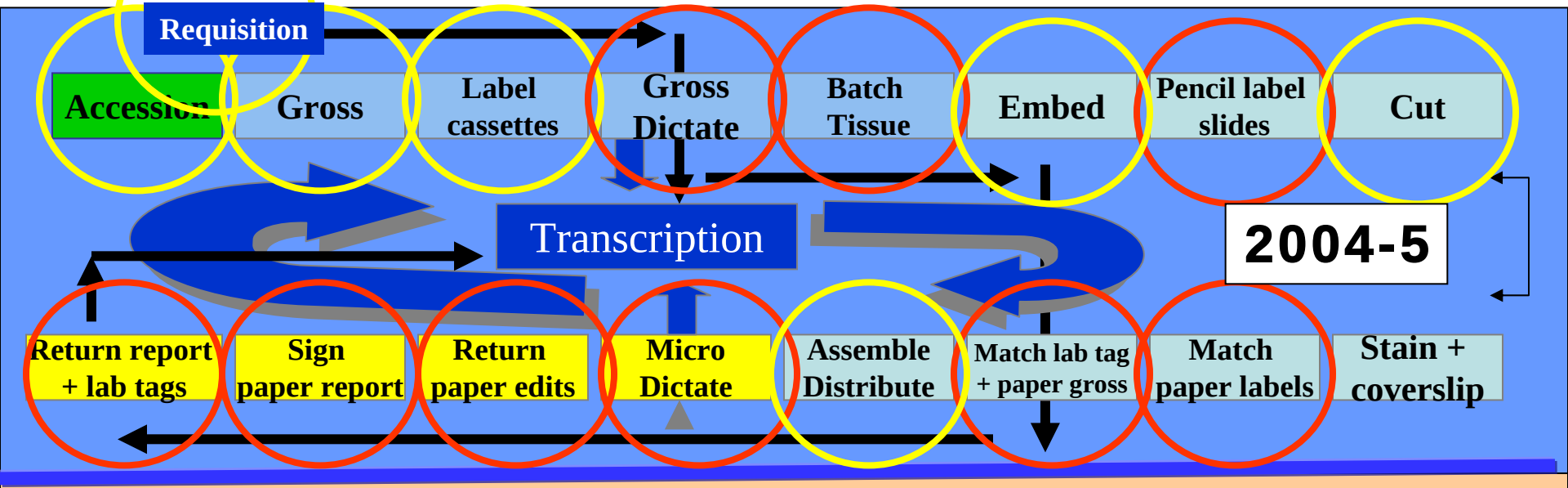
"Every well thought-out process is simple."

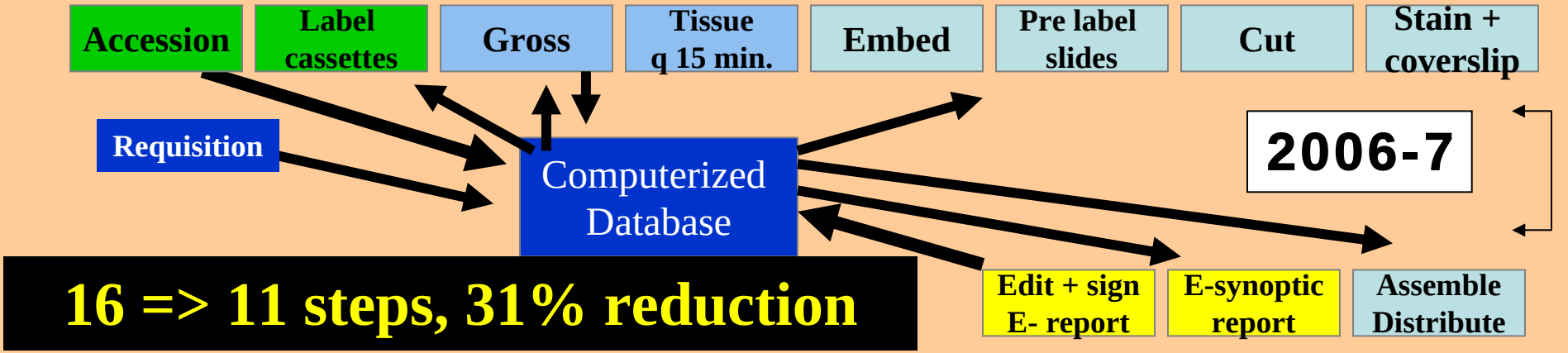
– Henry Ford

Transition to Paperless Barcoded Workflow in AP

Process modified

Process eliminated





16 => 11 steps, 31% reduction

Process Map 2004-5

5 Accession

- Verify patient ID, info
- Obtain SP # from LIS
- Pencil write SP # on container & lab tag
- Place many Lab Tags & containers in baggies in bucket for Gross pick up
- Retype SP# & part into standalone cassette printer

6 Gross

- Pencil write tissue type & cut directions on side cassette
- Dictate clinical information
- Dictate gross description
- Deliver cassettes in batches to Processor
- Deliver tapes & lab tags to Transcription
- Load Processors at end shift

7 Transcription

- Transcribe gross dictation
- Deliver gross dictation to Histology
- Transcribe microscopic dictation
- Deliver micro dictation to Pathology
- Transcribe corrections
- Enter Snomed codes
- Finalize signed reports

9 Histology

- Embed large batches
- Match master list & assemble cases
- Pencil write all slides w/ SP# & part & level
- Cut each cassette to protocol log sheet or penned cassette directions
- Stain & coverslip
- Retype SP# & part into standalone label printer
- Reassemble slide cases by matching lab tag & dictated paper gross
- Match & stick paper labels to pencil labeled slides
- Verify w/ gross & lab tags, assemble on trays & distribute to pathologists

8 Pathology

- Verify & dictate Pat. Info from lab tag & gross
- Dictate DX & microscopic
- Dictate billing codes
- Deliver tape to transcription
- Edit paper report
- Return edits to transcription
- Sign paper report
- Return report & lab tags to transcription

35 = number of steps

Process Map 2009

9 Accession

- Verify patient ID, info
- Obtain SP # from LIS
- Assign part type to ea. container tied to cut protocol & bill code
- Enter all clinical information
- Print & afix barcode lab tag label
- Print & afix barcode container label
- Collate barcode etched cassettes w/ container
- Place barcoded lab tag, containers, cassettes in work tray
- Image barcoded lab tag into LIS

80%

4 Gross

- Open Case in LIS by lab tag barcode
- Verify cassette ID
- Enter gross -2 numbers- into LIS template
- Deliver cassettes in q 15 min. to Processor

33%

0 Transcription

100%

6 Histology

- Embed small batches
- Match master list & assemble cases
- Print Stainershield labels for ea. cassette by barcode
- Cut each cassette to slide label directions
- Stain & coverslip
- Verify in LIS, assemble labeled slides on trays & distribute to pathologists

33%

4 Pathology

- Open case in LIS by slide barcode
- View imaged Requisition & verify ID & info
- Use LIS synoptic or Quiktext or type DX
- Electronic Sign-out

50%

29% reduction overall steps

24 = number of steps

31% reduction overall

Simplify = Safer

Safer Work Simplification Redesign

3 FTE Transcription

1.4 FTE Manual labeling

eliminated

1.3 FTE Mis-ID corrections

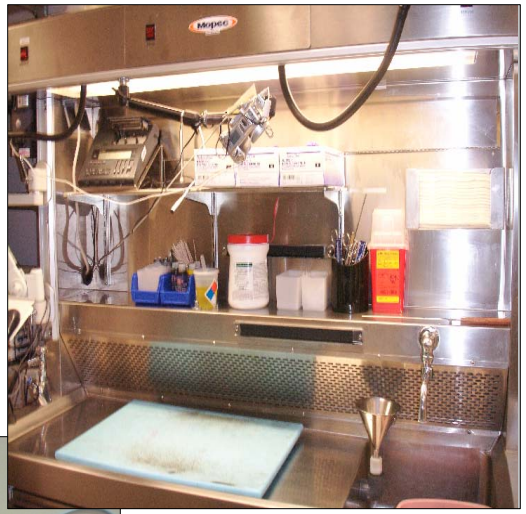
Standardize Activities, Connections & Pathways

Key Lean Process Changes 2004-2008

- Organized workflow, visual standard work, priority specimen streams

Key Lean Process Changes 2004-2008

- Laboratory structural redesign, work cell design & standardization

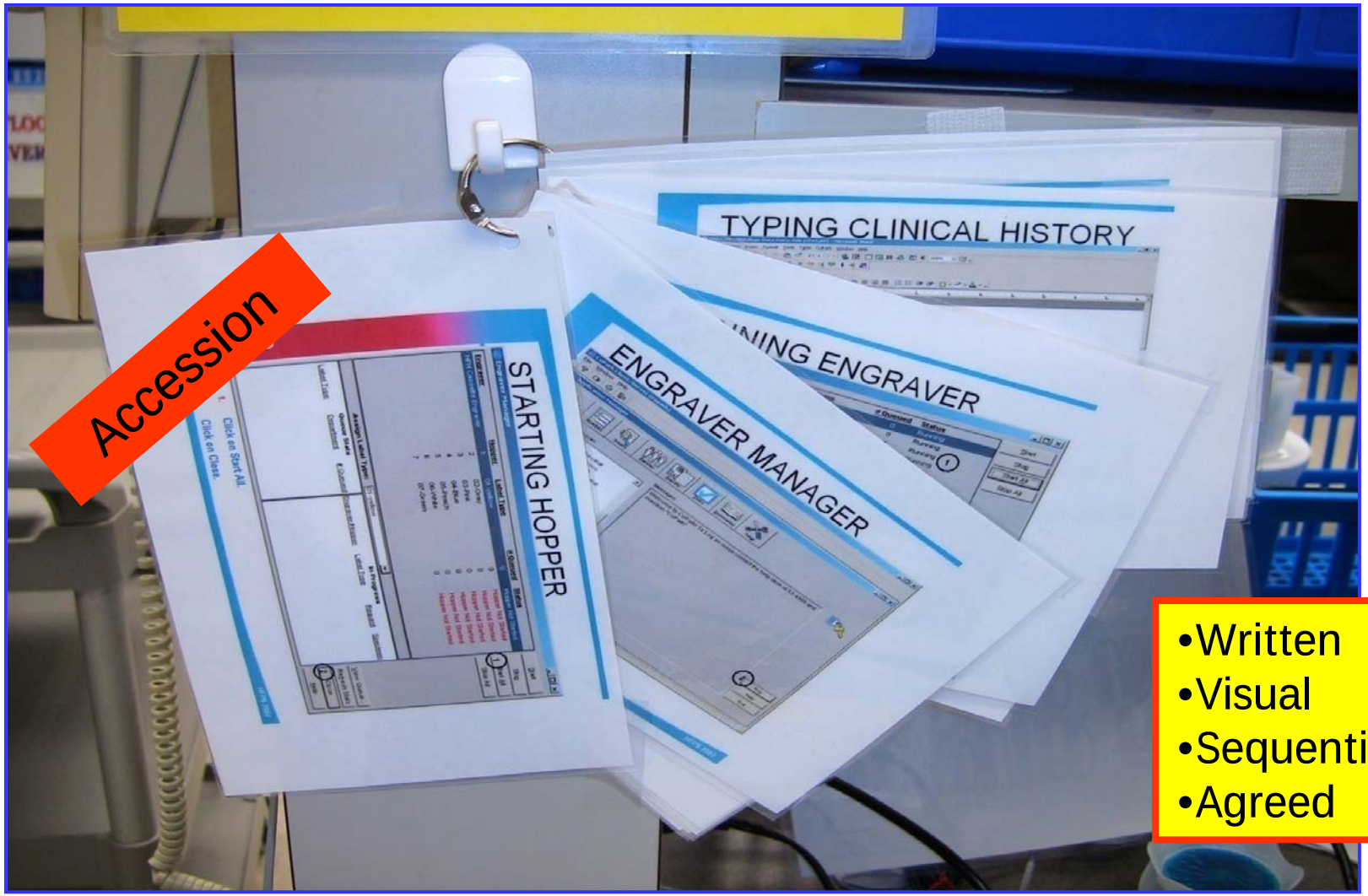


- Linear flow
- U-shaped individual workcells

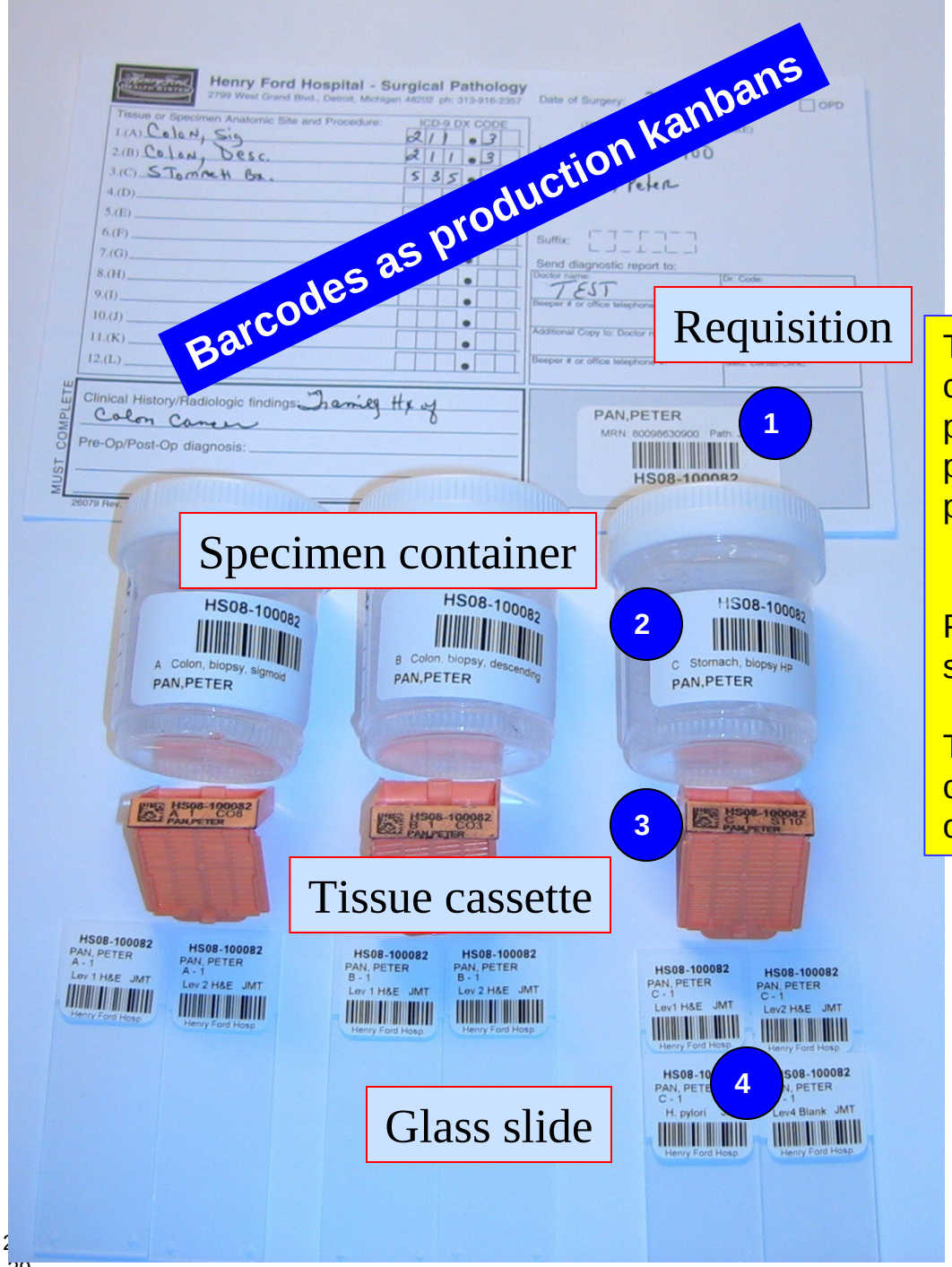
Standard Work

Standard Work

Posted at work stations



Barcode Standardized Work Processes



This case is submitted in 3 specimen containers consisting of:
part A - sigmoid colon biopsy,
part B - transverse colon biopsy and
part C - stomach biopsy with standing preorder for Helicobacter pylori immunostain.

Protocol driven information is reflected in the slide labels dictating 2 levels cut for each part.

The stomach biopsy protocol, part C, calls for an additional 2 blanks slides to be cut, one for the immunostain & a 4th left unstained.

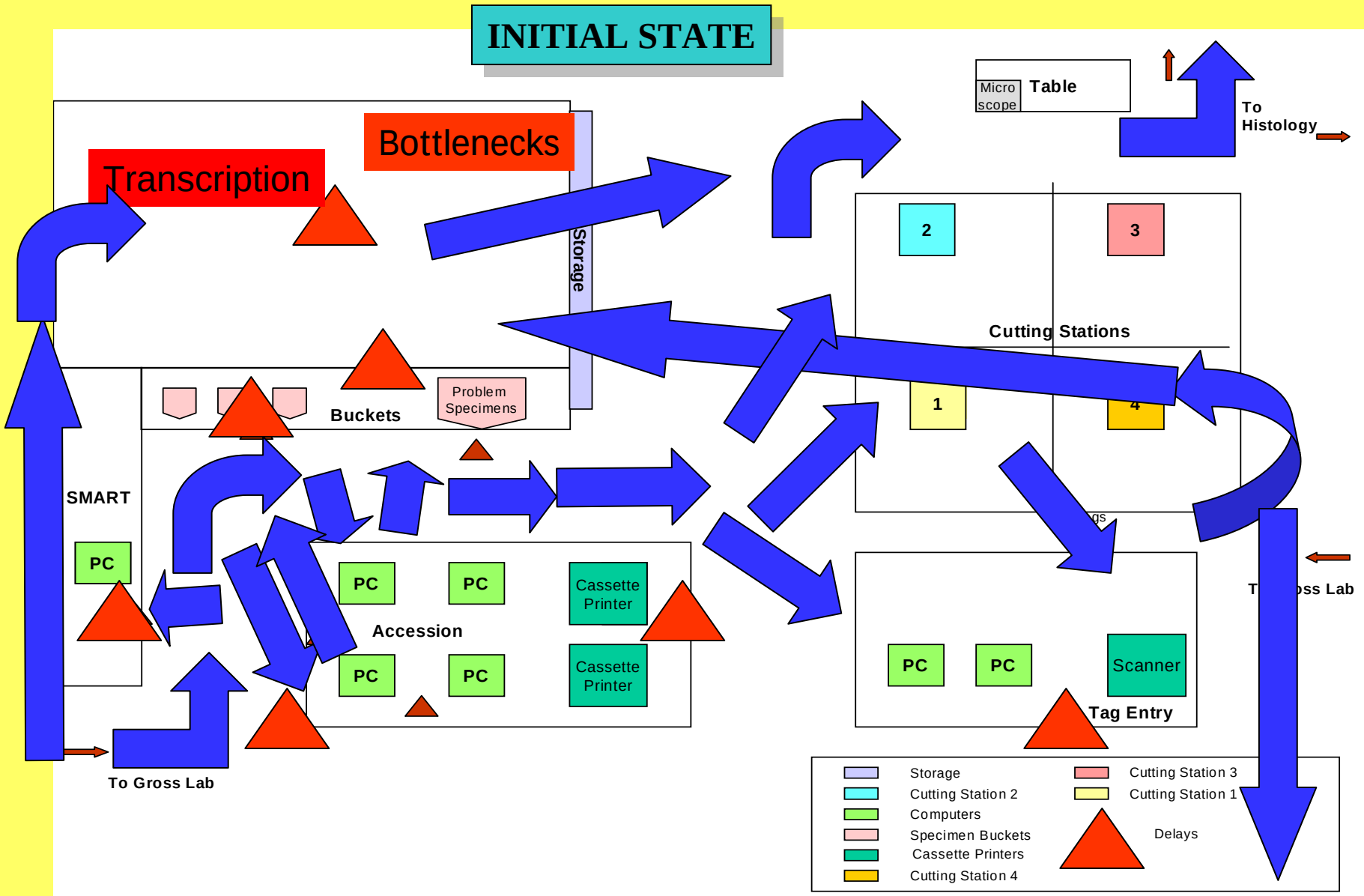
All barcodes generated at Accession & Microtome

Workplace Design Follows Standardization

Gross Lab Process Map- January 2006

Baseline

Volume 45,000

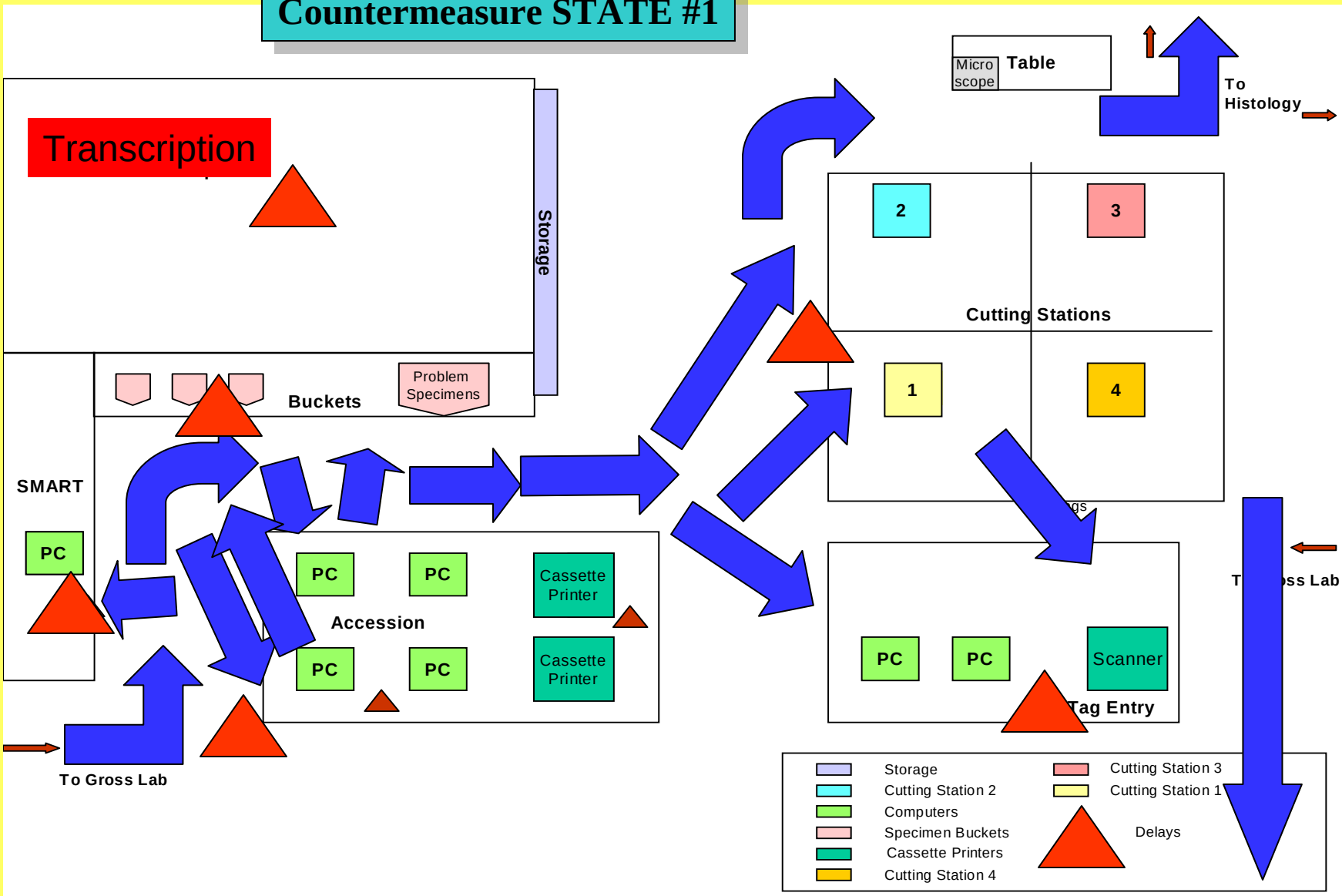


Gross Lab Process Map- March 2006

2 months

Volume 45,000

Countermeasure STATE #1

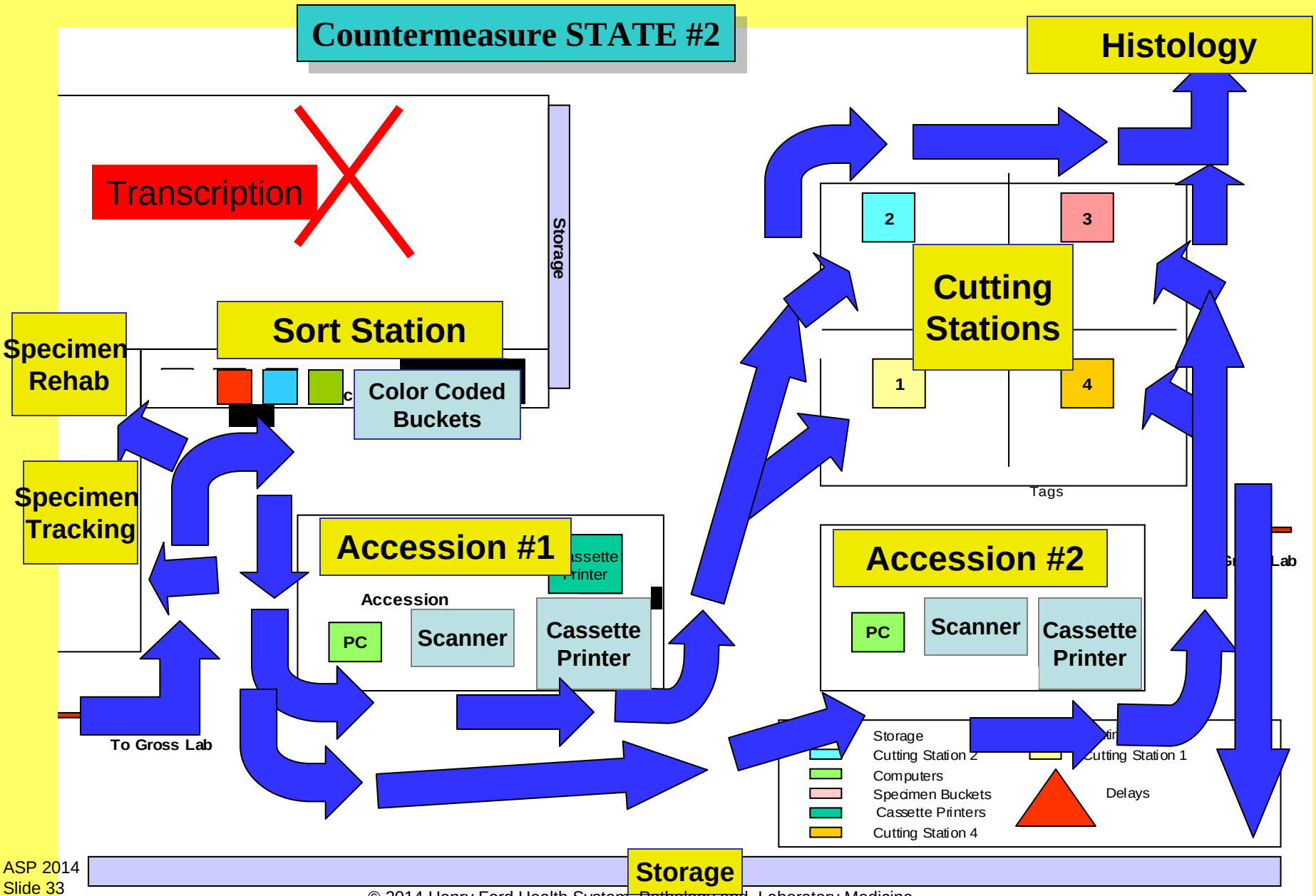


Storage

Gross Lab Process Map- January 2007

1 year

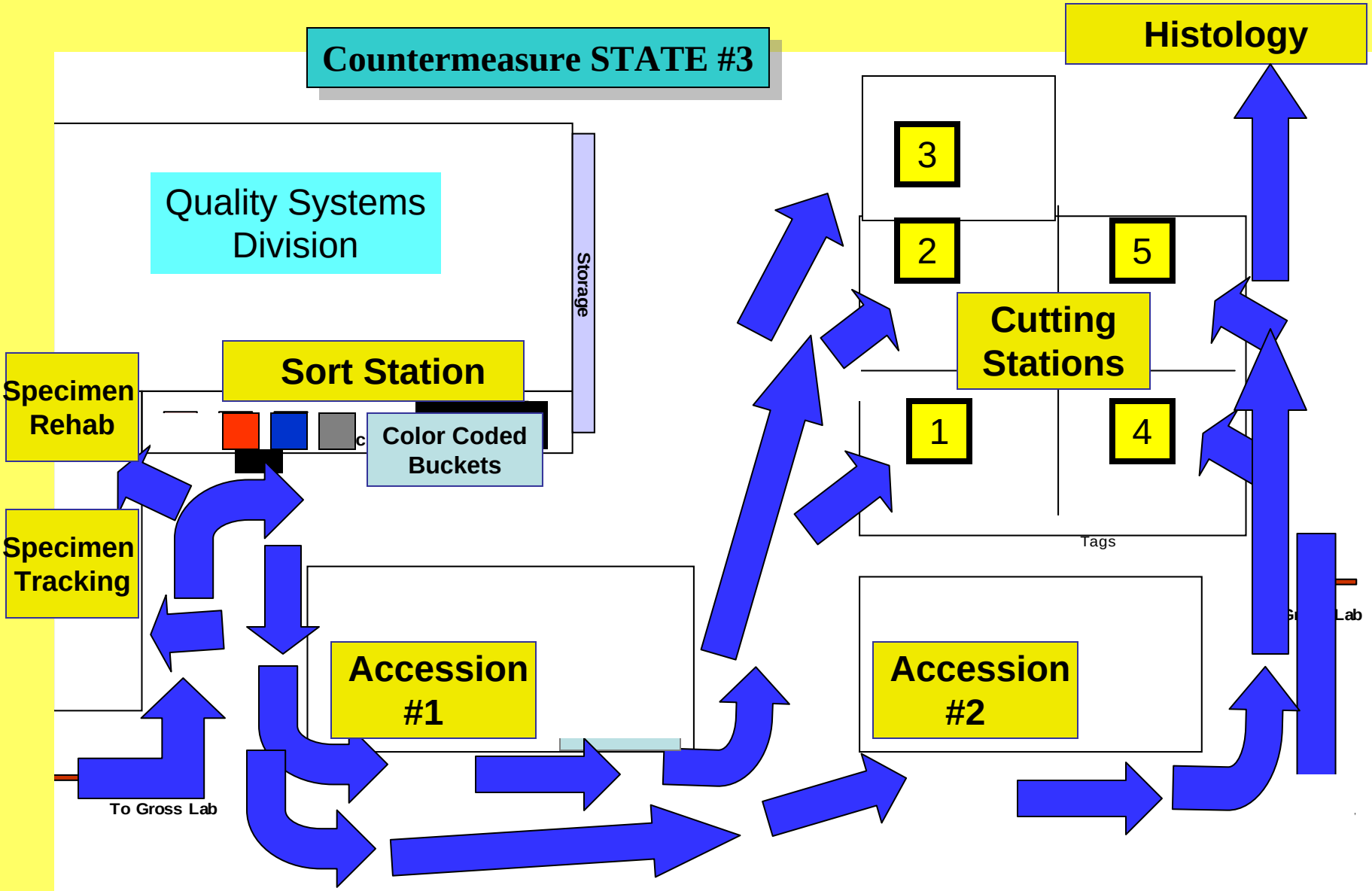
Volume 45,000



Gross Lab Process Map- June 2011

6 years

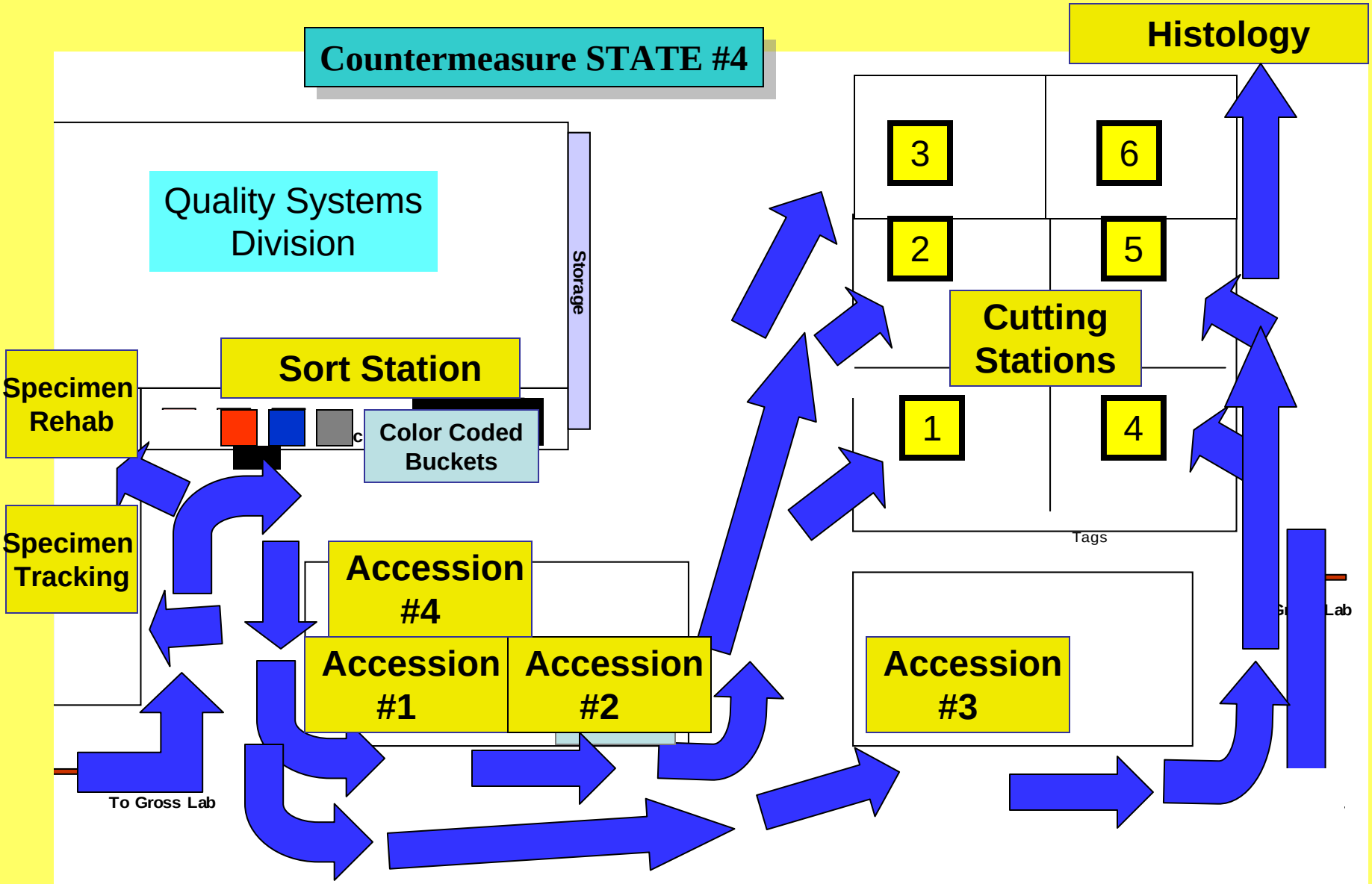
Volume 65,000



Gross Lab Process Map- October 2012

7 years

Volume 80,000



Designing Pull

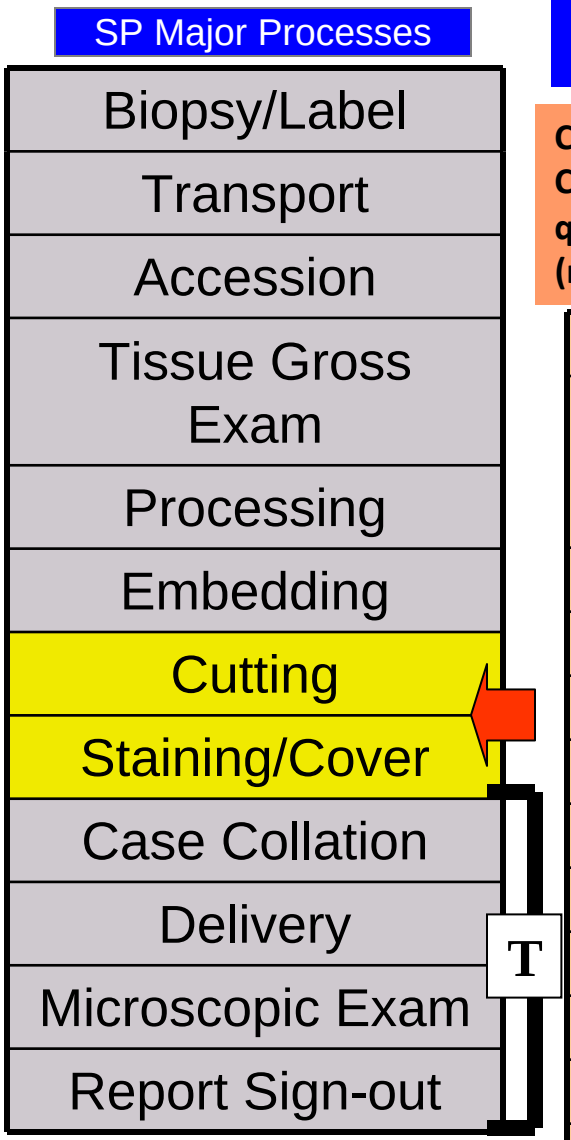
Designing Pull for Histology Bottleneck

Time delay waiting for stainer rack to fill

Cut slides → Stainer

- Reduce Batch Size from Cutter to Stainer
  - Goal: Level throughput
  - Rate limiting step: Stainer capacity = 60 slides every 20 mins.
  - Set auditory timer to signal pull of cut slides
  - To stainer every 20 minutes, regardless batch
  - Measure TAT from slide delivery to sign-out
  - End outcome measure = influence on Pathologist signout (global goal)

Histology- Internal Specimen Pull Report TAT Outcome March 2006



Current: No time schedule for hand-off, wait for full rack of 60 slides
Change: Pull biopsies, via auditory timer, whenever cut slides are ready q 20 mins from Cutting to Staining stations
(run rate 60 per run, q 20 mins)

Pre	N=	327		Post	N=	168	
Signout Time **T**	# cases	% by hrs	Cum %	Signout Time	# cases	% By hrs	Cum %
1 hour	66	20		1 hour	42	25	
2 hrs	88	27	47	2 hrs	29	17	42
3 hrs	24	7	54	3 hrs	23	14	56
4 hrs	20	6	60	4 hrs	23	14	70
5 hrs	27	8	68	5 hrs	5	3	73
6 hrs	11	4	72	6 hrs	2	1	74
7 hrs	6	2	74	7 hrs	3	2	76
8 hrs	15	5	79	8 hrs	18	10	86
9hrs	5	2	**81%**	9hrs	11	7	**93%**

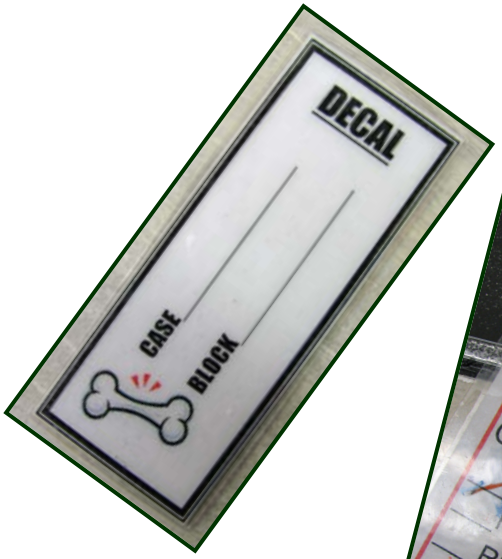
Improvement = **12%**

Production Kanbans

Production Kanban Cards- Visual Aids

- **Decal placeholder card**

-To alert tech that block from case will be missing at cutting



- **Re-embed card**

-Alerts embedder why block is melting on embedding center;

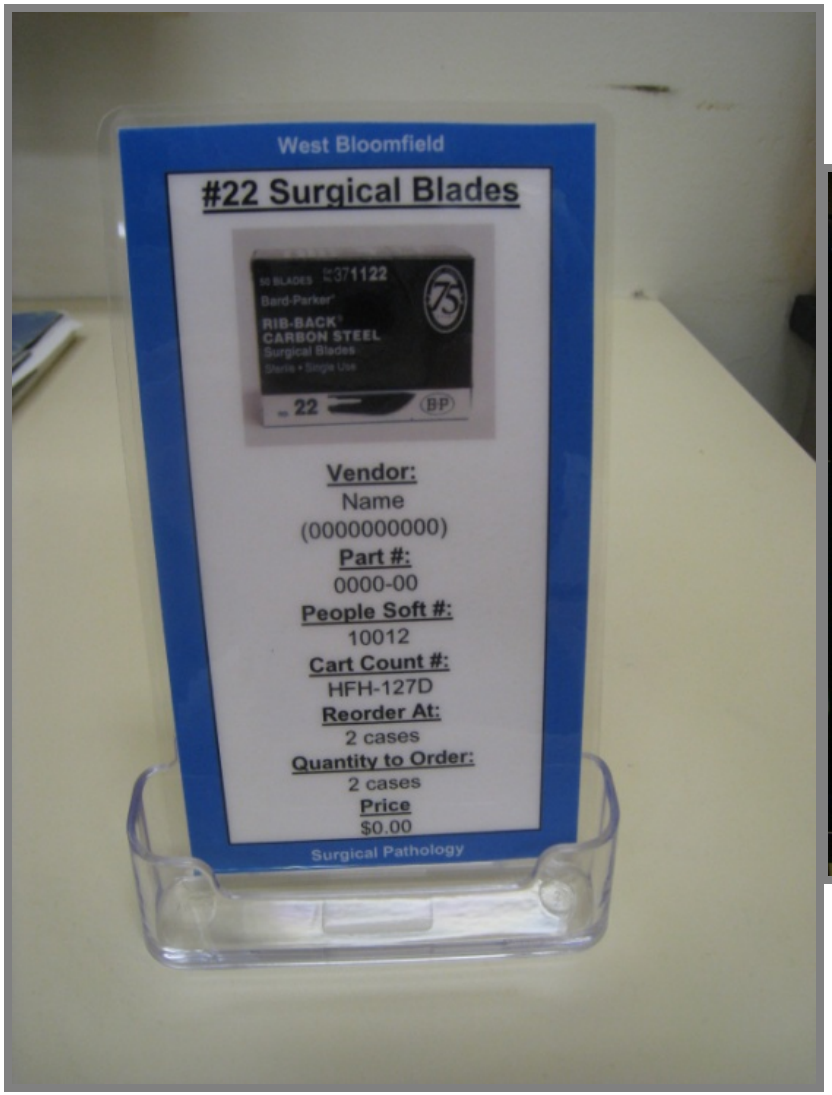
-Has tech's name so it can be returned for cutting

- **Instrument status card**

-Alerts tech that solutions are not changed yet

Inventory Kanbans

Reorder Kanbans for Inventory



Continuous Flow

Lean Operational Efficiency

- **Continuous flow goal**
  - **Centralized production** for Accession, Gross, Histology, all Stains and Slide disbursement
- **Operational challenges**

Work simplification and mistake-proofing

  - **Original condition-** Barcoded operation with transcription-less & paper-less gross, histology and signout
  - **Challenge- same-day metrics of successful production and defect resolution between hospitals**

Load leveling

  - **Original condition-** 1 histology shift
  - **Challenge- Match courier with specimen availability and workers with volumes of work around the clock**

Batch size reduction

  - **Original condition-** overnight large specimen batch processors, same-day rapid cycle processing of small biopsies only since 2004
  - **Challenge- rapid cycle processing of large specimens & biopsies**

Lean = Minimal Batch Sizes & No Waiting

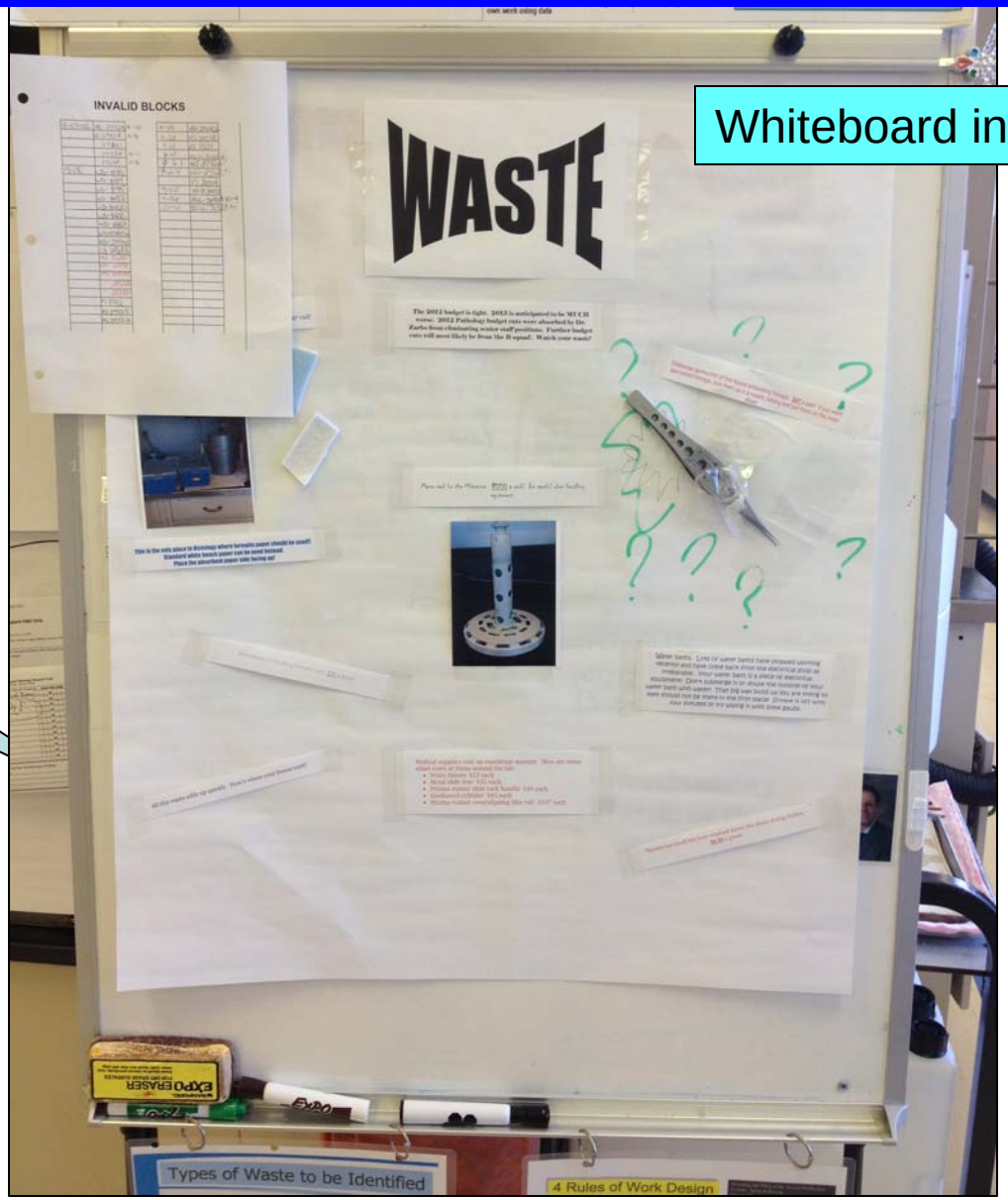
Common Challenges

Key Problems

- Core AP Lab operations
  - Specimen accession, gross exam, histology, IHC, molecular studies
  - Serving 4 hospitals up to 30 miles away
  - Specimen delivery efficiency
  - Production efficiency
  - Timeliness of slide production & return delivery
- Large specimen resections timely triage to Tumor Board presentations at 4 hospitals

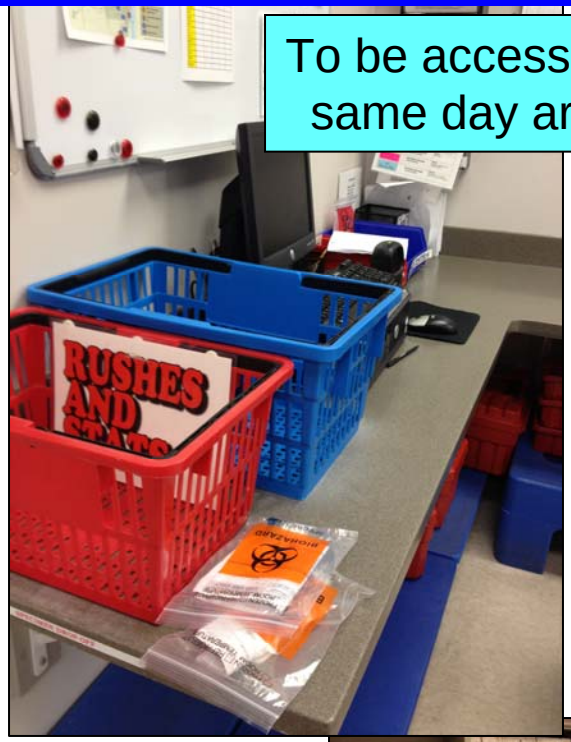
In Search of a Batch

"All this waste adds up quickly. Here's where your bonus went!"



Whiteboard in Histology

7 AM SP Core Lab- Accession & Gross



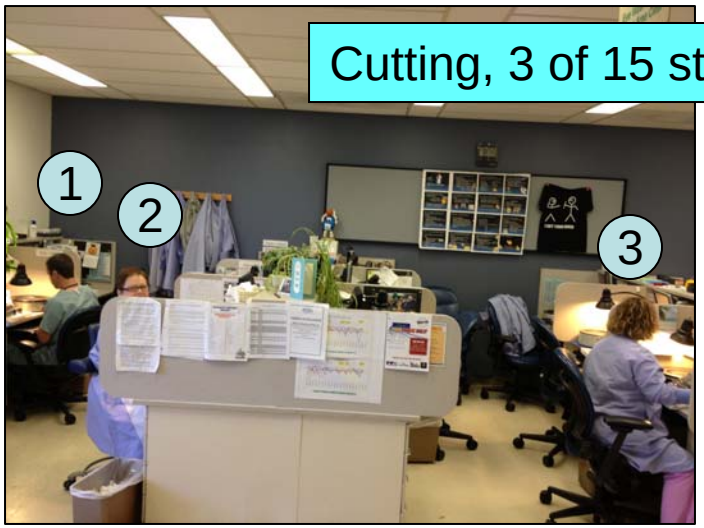
To be accessioned same day arrival

Accessioned previous evening

Gross from previous evening

7 AM SP Core Lab- Histology

To be embedded



Cutting, 3 of 15 stations

Blocks to be cut

Slides to be stained

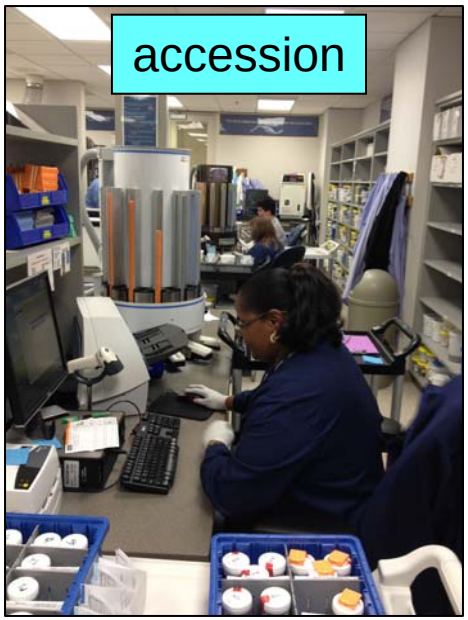
Cases delivered

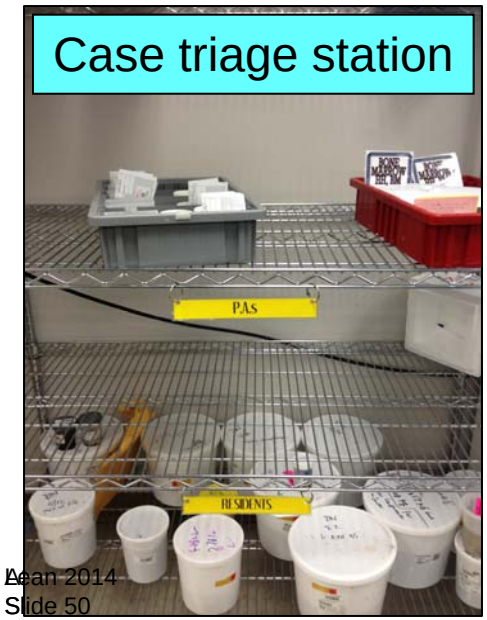
4 PM SP Core Lab- Level Load, Pull

courier

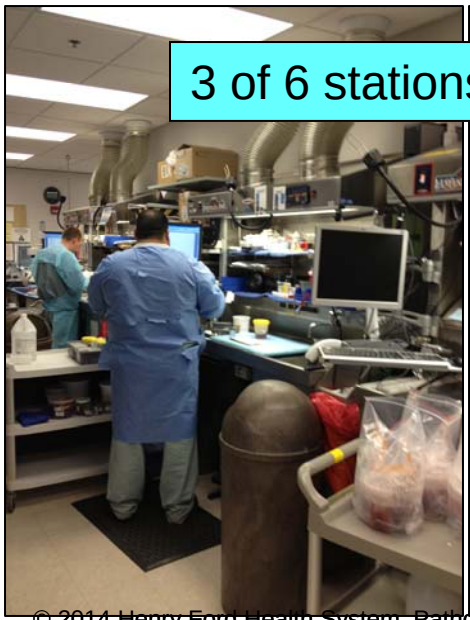
“pull”

sort


accession



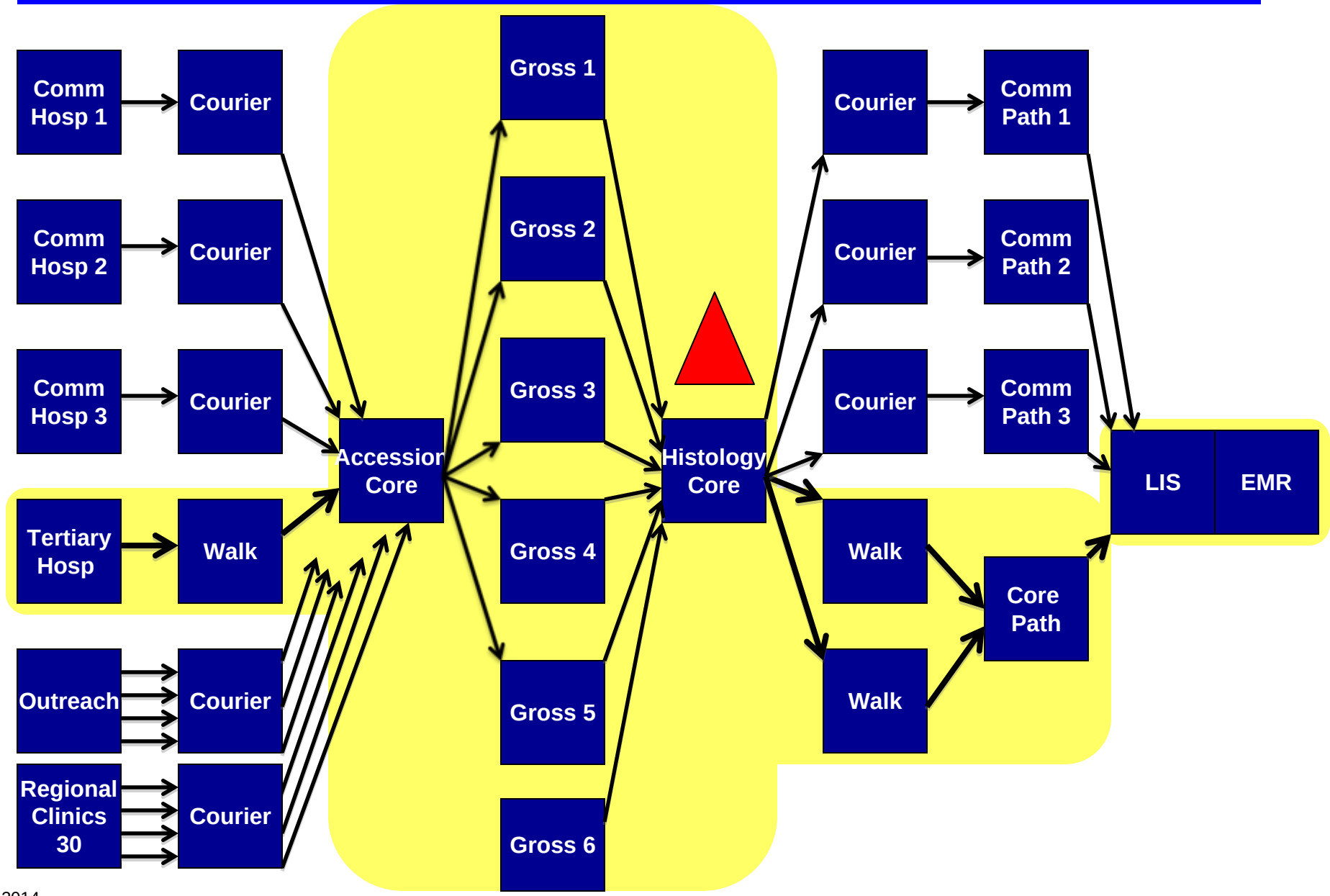
Case triage station


3 of 6 stations working

Outbound hospital slides

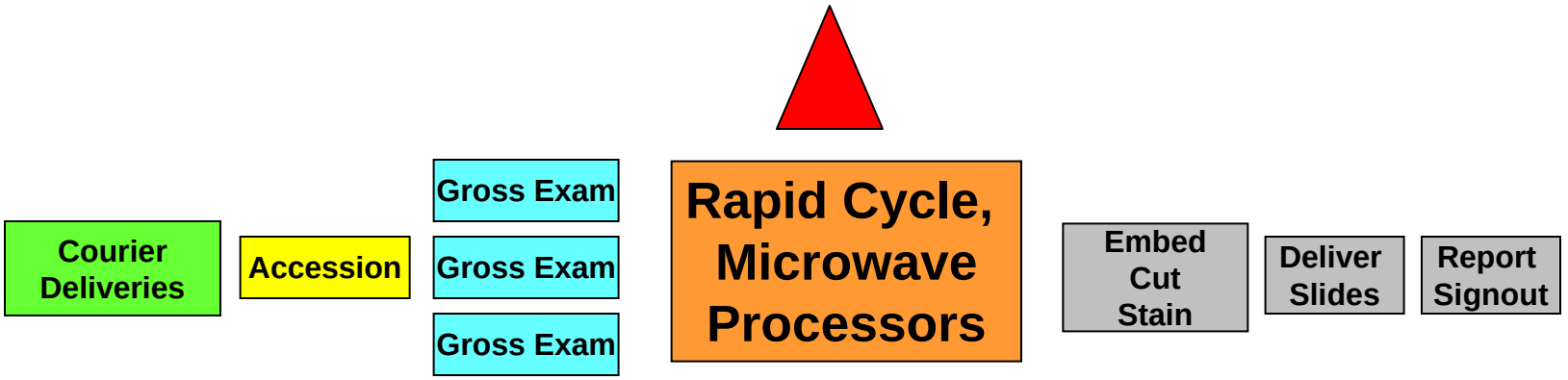
Promoting Technology

SP Bottlenecks & Challenges



Continuous Flow Promoted by Technology

Small Batches, Rapid Cycle Times Promote Flow



MoTown Motion- Continuous Flow

Bergamo Boulevard

Woodward Avenue

Histology Processing Flow

Processor Finish Time	Convntnal Overnight Medium	Convntnal Overnight Large 1	Convntnal Overnight Large 2	Convntnal Overnight Breast	Convntnal Overnight Prostate	Convntnal Midday Medium	Microwave Biopsy
4am							
5							
6							
7							
8							
9							
10							
11							
12pm							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12am							
1							
2							
3							

Cycle Time
10-12 hrs

Cycle Time
4 hrs

Cycle Time
1.5 hrs

Before

Conventional
Overnight processing
Large & Medium & Derm

Microwave
Same Day processing
Biopsies
from previous day
and
early same day Biopsies
in mornings
except Prostate and Breast

Histology Processing Flow

Processor Finish Time	Convntnal Overnight Cell Block	Convntnal Overnight Large 1	Convntnal Overnight Breast	Convntnal Overnight Large 2	Convntnal Midday Large	Microwave Large 1	Microwave Large 2	Microwave Macroblock Prostate 1	Microwave Macroblock Prostate 2	Microwave Biopsy 1 Biopsy 2
4am										
5										
6										
7										
8										
9										
10										
11										
12pm										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12am										
1										
2										
3										

Cycle Time 10 hrs

Cycle Time 1.5 hrs

Cycle Time 5 hrs

Cycle Time 7 hrs

After

LEAN LESSON

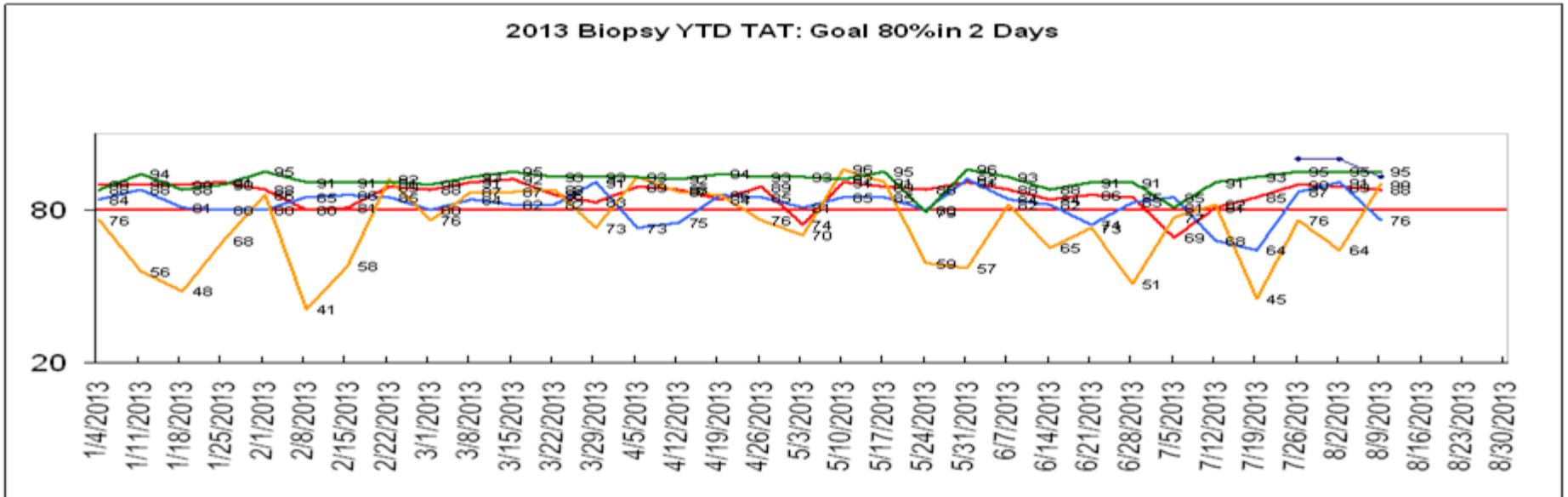
New Technology

"Your methods are formed by
what you are trying to do;
they do not determine your purpose.
To my mind it is starting wrong
to put methods ahead of purpose."

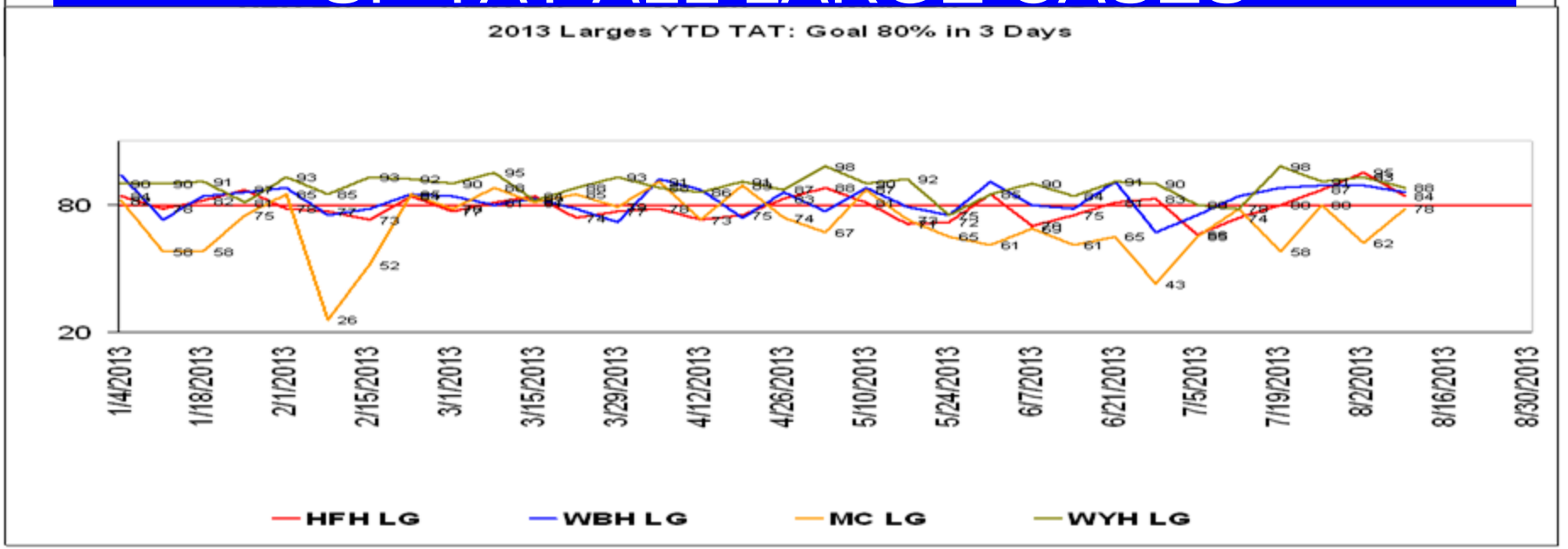
– Henry Ford

Creating Flow = Faster

SP TAT ALL BIOPSY CASES



SP TAT ALL LARGE CASES



LEAN LESSON

Lean Principle- Time Waste

"Time waste differs from material waste in that there can be no salvage. The easiest of all wastes, and the hardest to correct, is the waste of time, because wasted time does not litter the floor like wasted material."

– Henry Ford

LEAN LESSON

People solving problems continuously

Don't Be Overwhelmed

"Nothing is particularly hard
if you divide it into small jobs."

– Henry Ford