Why Your Lab Automation Regularly Fails to Meet Essential Turnaround Times: Secrets to Optimize and Turbocharge Your Existing Instrumentation

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Lab Quality Confab 2018

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Presentation Goals

- Understand patient services that require essential turnaround times (TAT)
- Recognize the financial impact of not meeting these essential TATs
- Discuss ways to measure TAT in the work value stream
- Learn how to optimize the design of an automation line
- Describe alternative ways to design work processes to ensure essential TAT

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Patients Requiring Essential Turnaround Times

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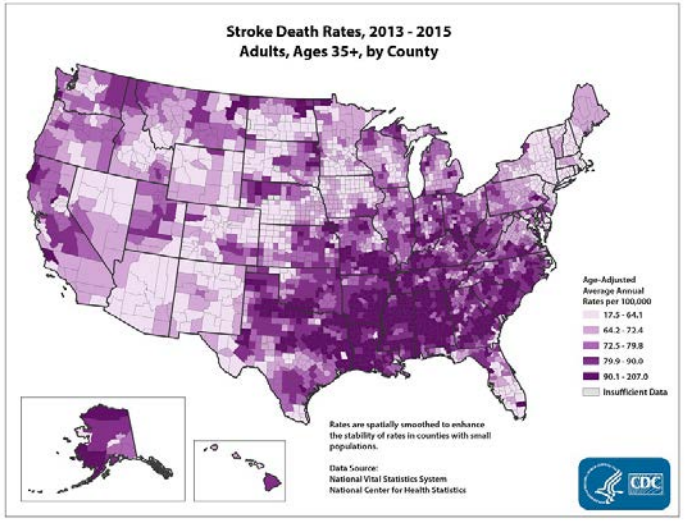
Essential TAT – Stroke patients

- Over 800,000 stroke patients annually
- Over 140,000 deaths annually
- Estimated US cost $38B
- Evidence-based - early treatment means less patient disability and cost



cdc.gov

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Essential TAT – Cardiac and Stroke

- Over 1.5M heart attacks and strokes annually
- Over 800,000 deaths annually
- Estimated US cost $320B

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Hospital Certifications – Heart/Stroke

- Certifications
  - The Joint Commission: Four levels of Stroke Certifications (CSC, TSC, PSC, ASRH)
    - 1,248 US healthcare system designated as stroke centers
  - American Heart Association: Cardiovascular Center of Excellence (CVCOE)
  - **Lab requirements - Available 24/7**
    - **Lab results reported within 45 minutes of patient arrival**
    - **May include CBC, PT/INR, Chemistries, Troponin**

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Value of Stroke Certification (per TJC)

- Designates a commitment to excellence in stroke patient care
- Assists in providing consistent care - reduced variation, with fewer errors
- Provides improved patient outcomes
- Organizes teams across the continuum of care
- Strengthens community confidence in quality, safety, and treatment
- Provides a competitive edge — marketing, contracting and reimbursement
- Has potential to increase patient volumes due to EMS routing protocols
- Enhances the ability to attract top-level talent

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Financial Impact of Certifications

- Medicare reimbursement for the stroke DRGs can range from $4,400 to over $16,000 per case
- Contribution margins of 35% to 45% if treated effectively and efficiently
- Stroke patients require additional services to transition to full recovery, adding additional revenue.

Bacvhik, S., & Lang, S. (2015, June), *Recognizing the Clinical and Financial Value of Stroke Care.* Retrieved from https://www.cathlabdigest.com/article/Recognizing-Clinical-Financial-Value-Stroke-Care

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Essential TAT - Trauma Patients

- Trauma centers vary in their specific capabilities and are identified by "Level" designation: Level-I being the highest, to Level-V being the lowest

- A hospital receives trauma center status by meeting specific criteria established by the American College of Surgeons (ACS) and passing a site review by the Verification Review Committee

- According to CAP, trauma surgeons have the shortest TAT requirements – under 30 minutes for hemoglobin, glucose, and potassium

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Measuring Turnaround Times

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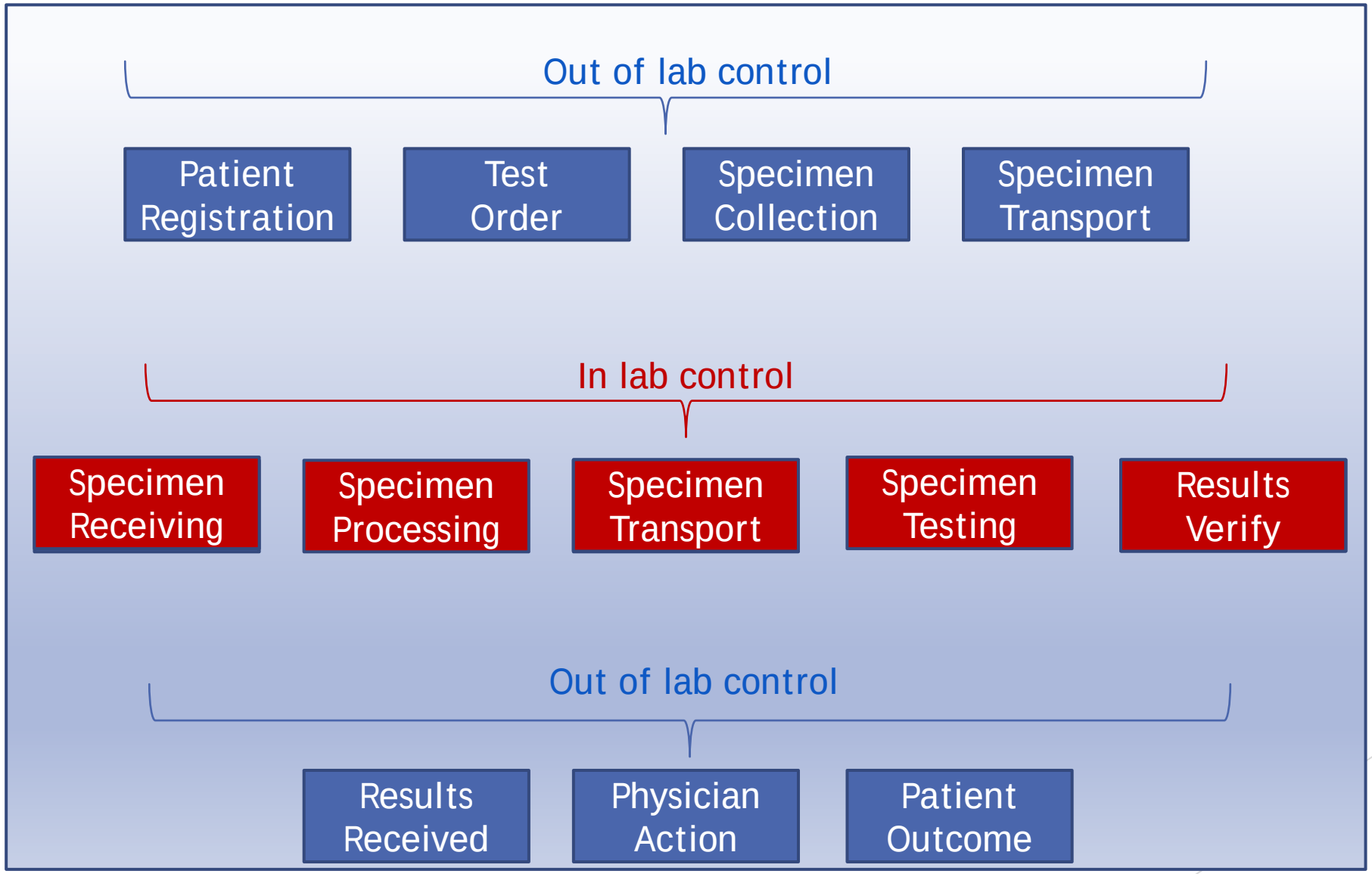
Process Flow – How do we measure?



Process Flow – What Should We Measure?

Common	Better	Best
▶ Receipt-to-Result	▶ Order-to-Collect ▶ Collect-to-Receipt ▶ Receipt-to-Result	▶ Door-to-Order ▶ Order-to-Collect ▶ Collect-to-Receipt ▶ Receipt-to-Result ▶ Result-to-Physician ▶ Physician-to-Treatment ▶ Treatment-to-Outcome
Lab measures TAT	ED measures TAT	Value-based measure

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Pre-analytical Factors that Impact TAT

- **Patient registration**
  - Is there adequate staff 24/7?
  - Is there a mini-reg to expedite?
  - Is there a triage process?
- **Test order**
  - Are there pre-defined order-sets to expedite?
  - How many screen “clicks” required to place order?
  - Is it easy to find the correct order-set (or too much customization)?
  - Are orders entered before collection?

Pre-analytical Factors that Impact TAT

- **Specimen collection**
  - ED collect vs lab phlebotomist
  - Are collection supplies conveniently located (in ED room)?
  - Are there issues with hemolysis? Protocols that require redraw?
  - Does phlebotomist have to "travel" to ED?
  - Are there rainbow draws?
  - Are hand-held (rovers) used for specimen collection? Are all specimens labeled with a lab-ready label (no in-lab relabeling)?
- **Specimen transport to lab**
  - Is there a convenient pneumatic tube station in the ED; is lab location # listed?
  - Is the PTS point-to-point?
  - Are there adequate # of tubes?
  - Is there an alarm to let sender know that specimen was sent?

Pre-analytical Factors that Impact TAT

- **Specimen receiving**
  - Is barcode scanner readily available to “receive”
  - If automation line, is it set to “receive” in-lab?
  - Is there a visual cue that lab has received an ED stat?
  - Is there a visual cue that lab has received a Stroke or Cardiac stat?

- **Specimen processing**
  - Is automation line used “to process”?
  - Are stat spins used for stats?
  - Is there an alarm to let sender know that specimen was sent?

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Consequence of Not Meeting Essential TAT

- Hospital loses its accreditation as a comprehensive stroke center or cardiac center
- ED or critical care ask for POC devices or a stat lab
  - Increase cost – more than 10x over in-lab testing
  - Increases the lab budget
  - Lack of correlation between results
- Opens the door for POC sales rep

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Point-of-Care – Troponin

- "Test results are not interchangeable from one device to another. This means that each device has its own reference interval information." *Paula Caposino, PhD, branch chief of cardio renal diagnostics in FDA's Office of In Vitro Diagnostics and Radiological Health*

- Some POC devices used in ED settings have a limited temperature and humidity ranges. Nurses in those settings are not likely to have time to read and understand those limitations. It is important to note when test conditions are not within range.

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Automation Line Design

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How Automation Contributes to TAT Failures – Line Design

- Placement of the line
- Proximity of front-end loader to specimen receiving
- Length of the line
- Balance loading of centrifuges
- Using multi-sized tubes (must designate centrifuge for balancing)
- Centrifuge spin-time
- Coagulation specimens requiring longer spin times
- Queuing or dwell time
- Factory default reset
- No priority lanes
- Stockyard retrieval delays – add-ons

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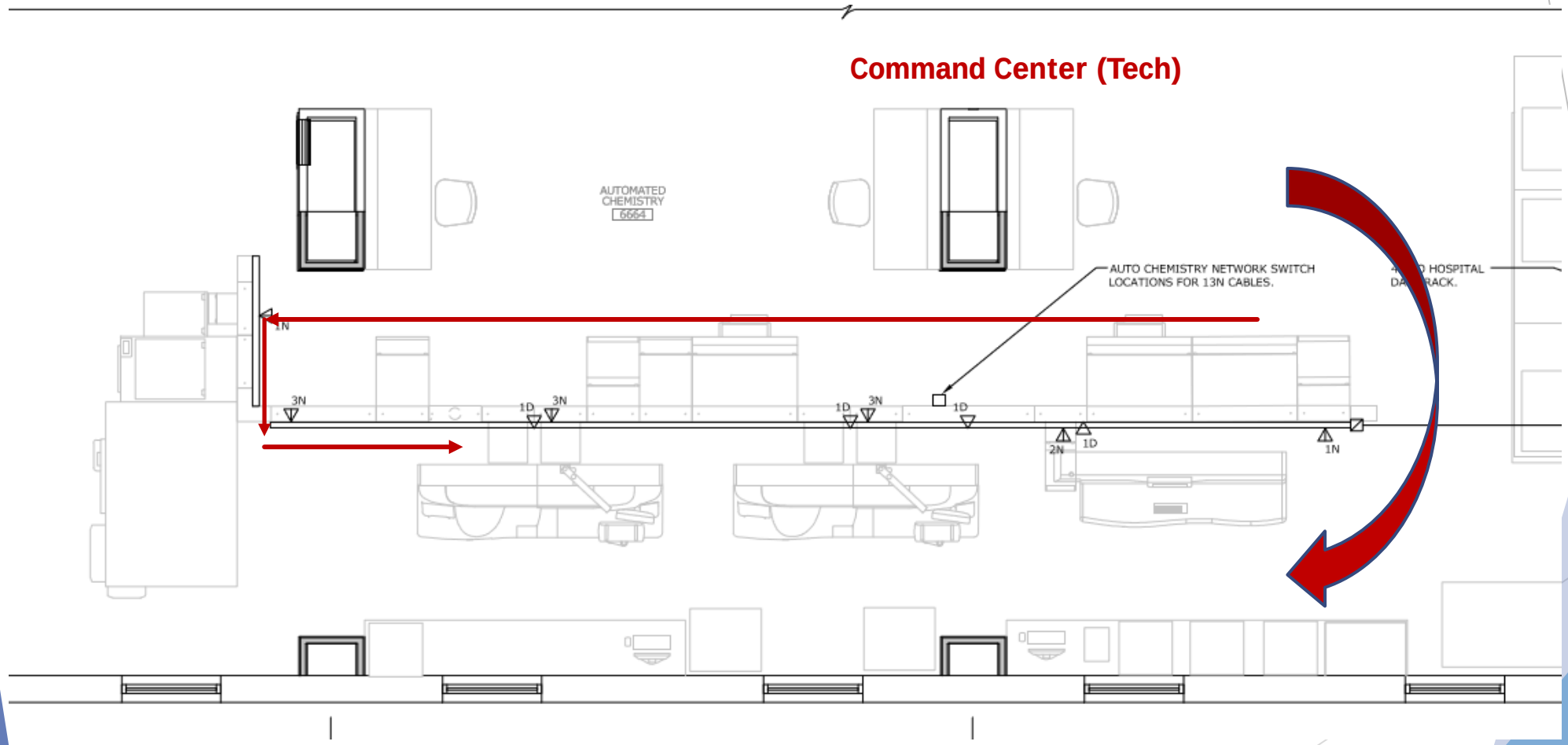
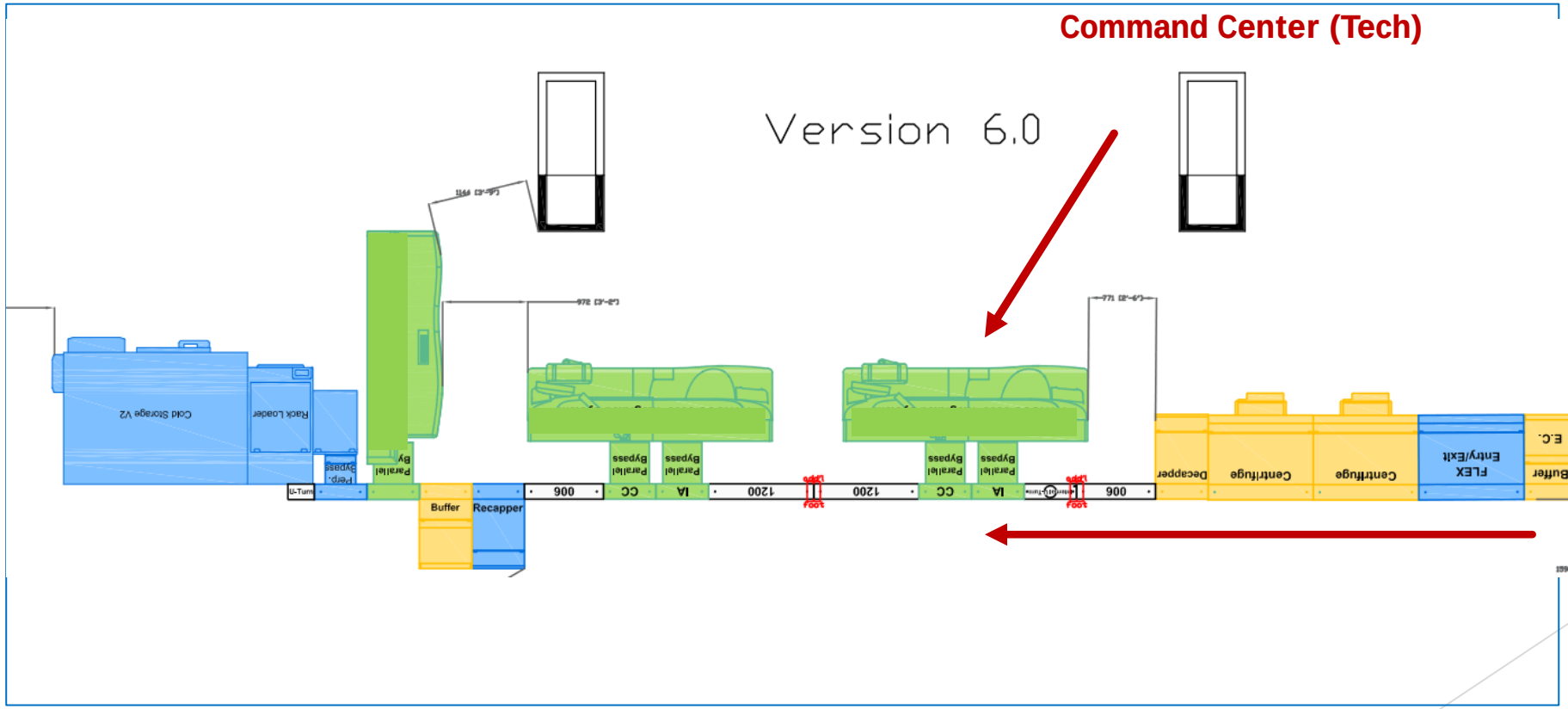
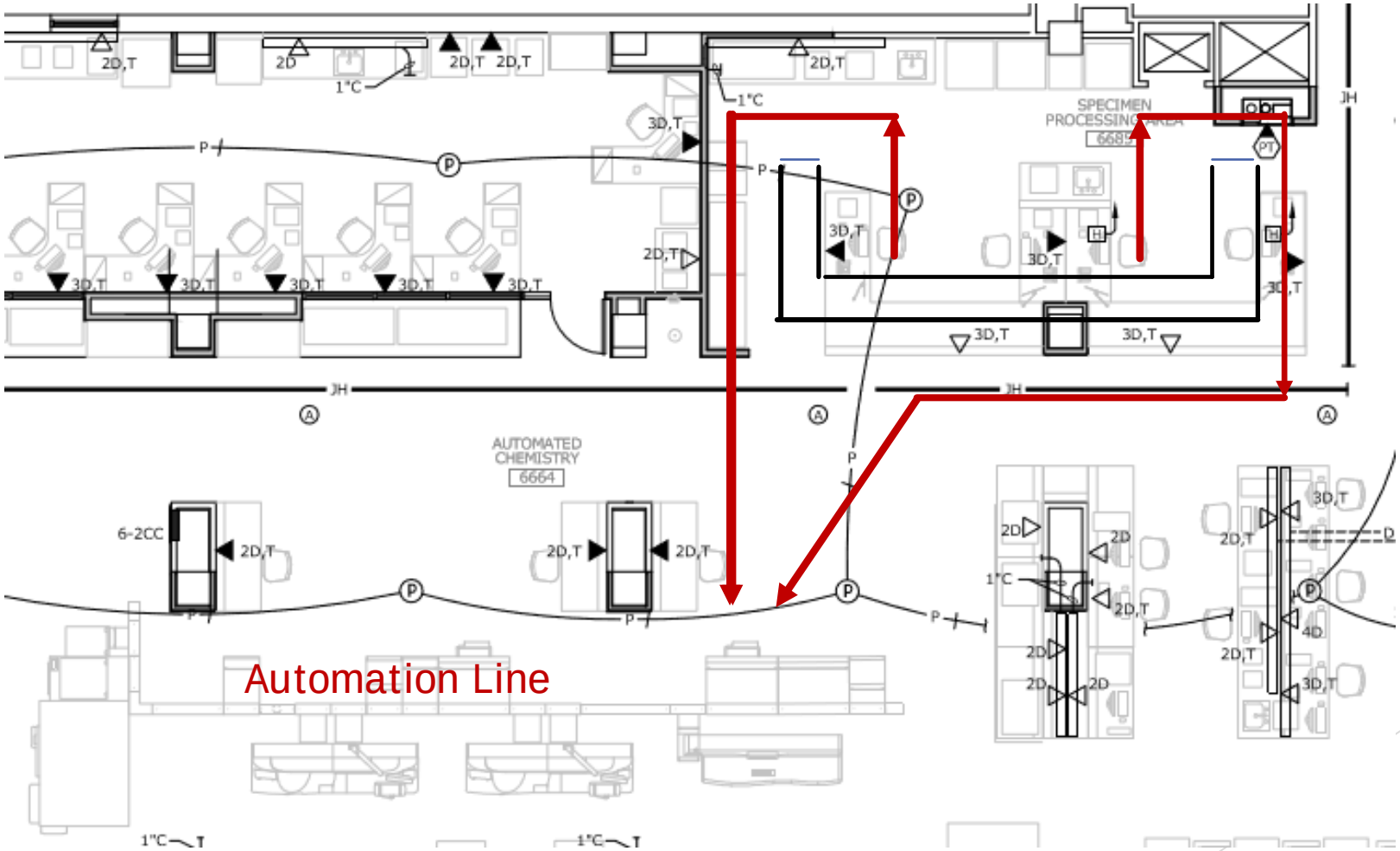
Example: Line is Backwards/Too Long



Redesigned Line



Process Barrier – Extra Steps



CENTRIFUGE

- Centrifugation of sample tubes
- Additional Dual Centrifuge Upgrade available for improved system throughput
- Load balancing for the centrifuge

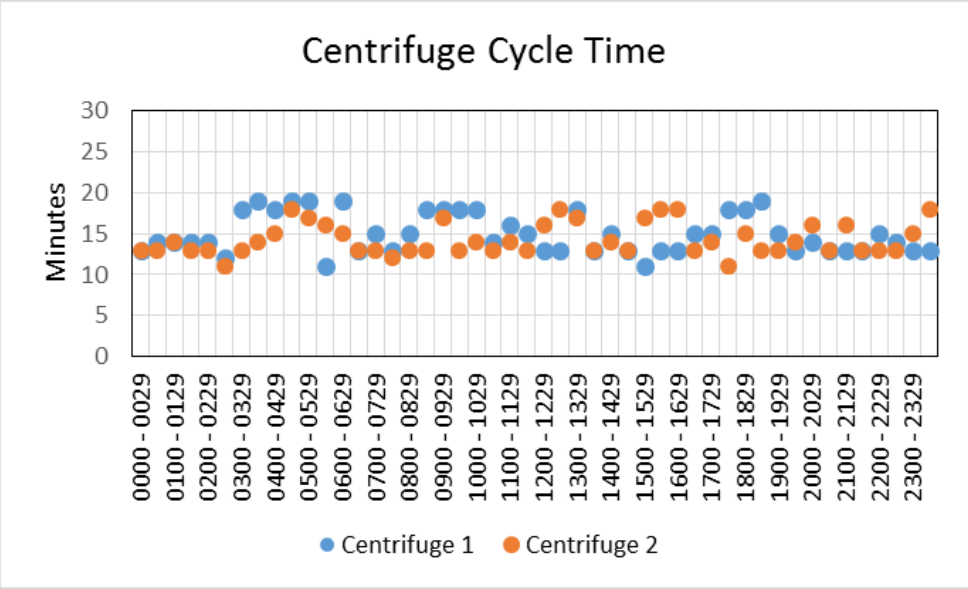
Rotational Speed	3,000 rpm (max)
Rotational Force	2,100*g* (13 x 100 mm tubes)
Load Capacity	Up to 40 tubes/spin

Dimensions	**H**	**W**	**D**	**Wt**
Centrifuge	1,120 mm 44.1 in	590 mm 23.2 in	795 mm 31.3 in	215 kg 474.0 lbs

Capacity	**Samples/hr**
Centrifuge	300/hr (450/hr Dual) (with 4 minute spin time)

Dual centrifuges does not mean double the thru-put

Does Balanced Loading Really Help?



Balanced Loading of Centrifuges		
	6 minute spin at 4,000 RPM	
	Centrifuge 1	Centrifuge 2
Mean	14.5	14.7
StDev	2.1	2.1
Minimum	10.7	10.6
Maximum	20.7	25.8
n	2,000	3,000

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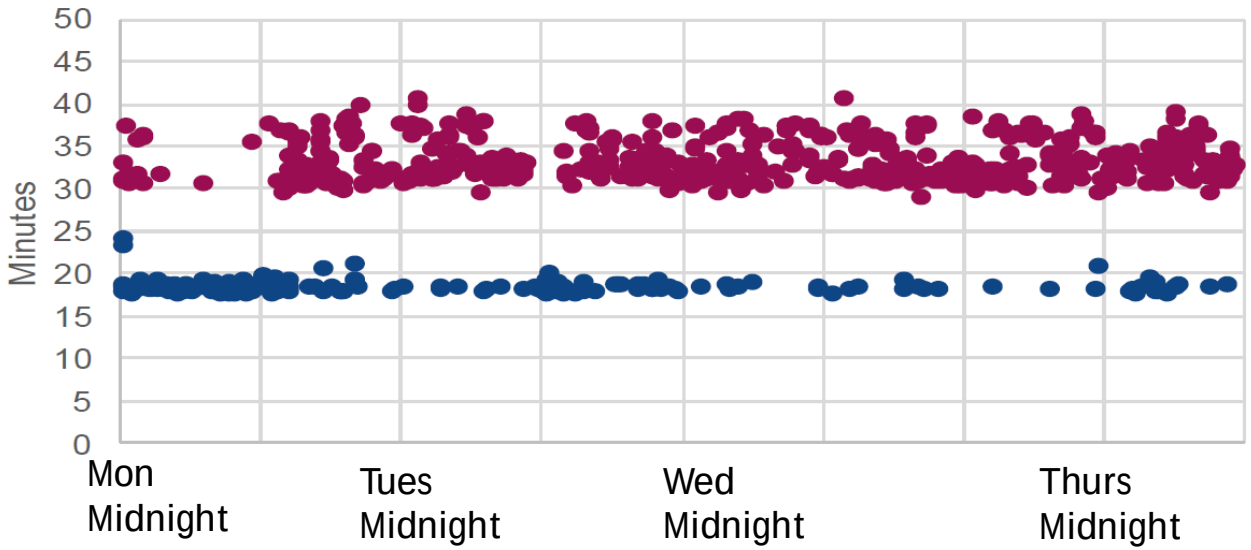
Troponin: Barcode Read to Result – Pre-Spun vs. Line-spun



	Pre-Spun	Line-spun
Mean	18.5	33.3
StDev	0.8	2.3
Minimum	17.7	29.1
Maximum	24.1	40.7
n	200	600

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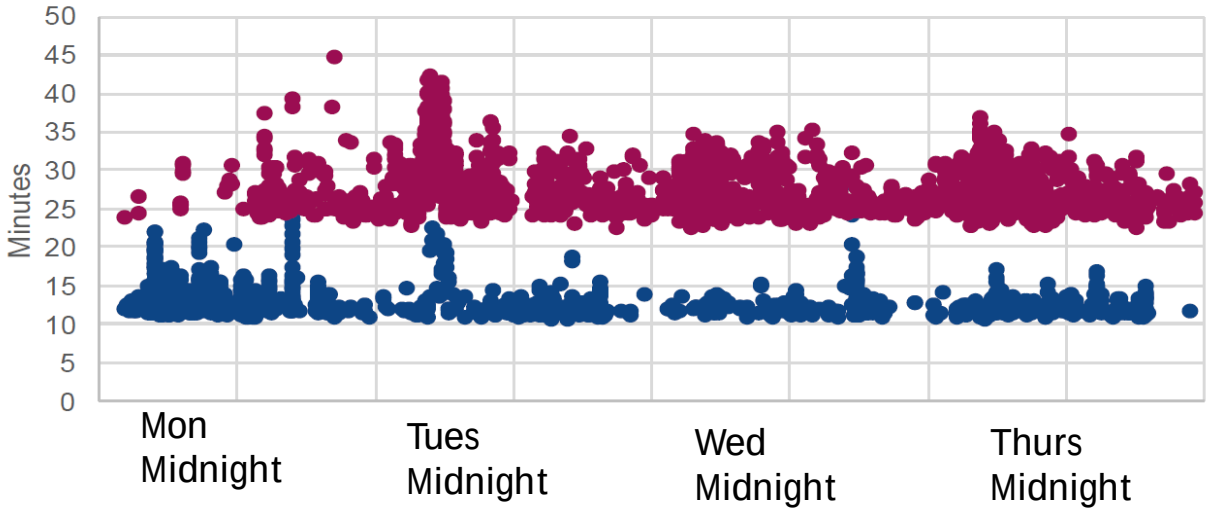
BMP/CMP: Barcode Read to Result –Pre-Spun vs Line-spun



	Pre-spun	Line-spun
Mean	13.1	28.2
StDev	2.2	3.3
Minimum	10.7	22.5
Maximum	28.1	44.8
n	1,300	2,200

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Other Options for Workflow

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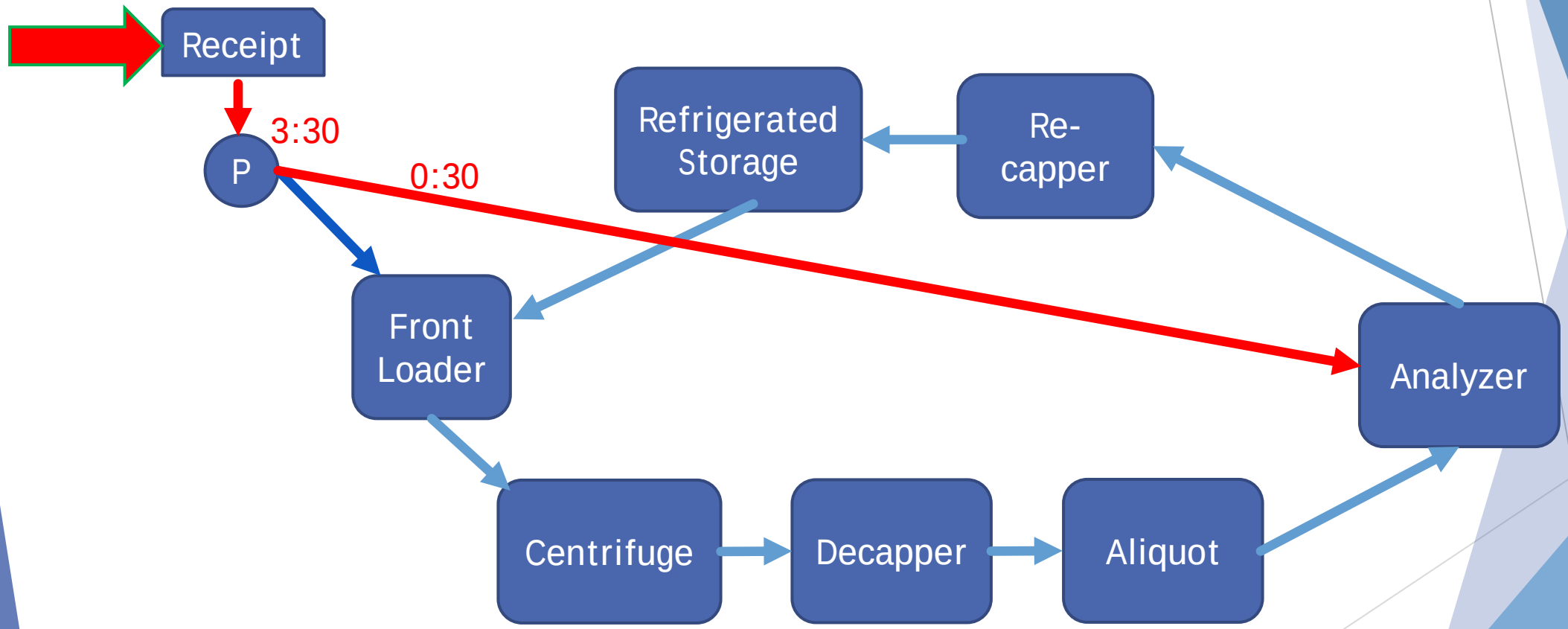
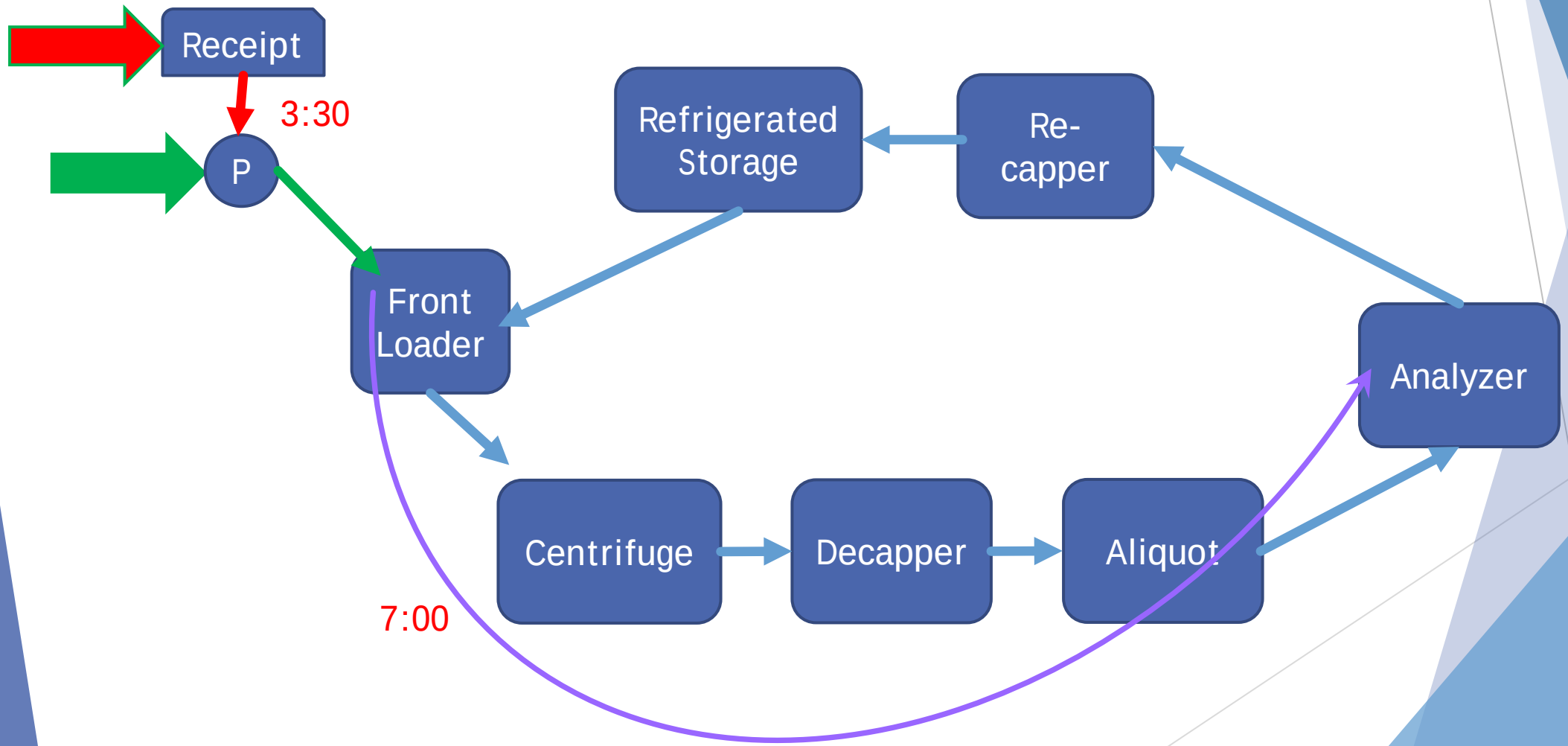
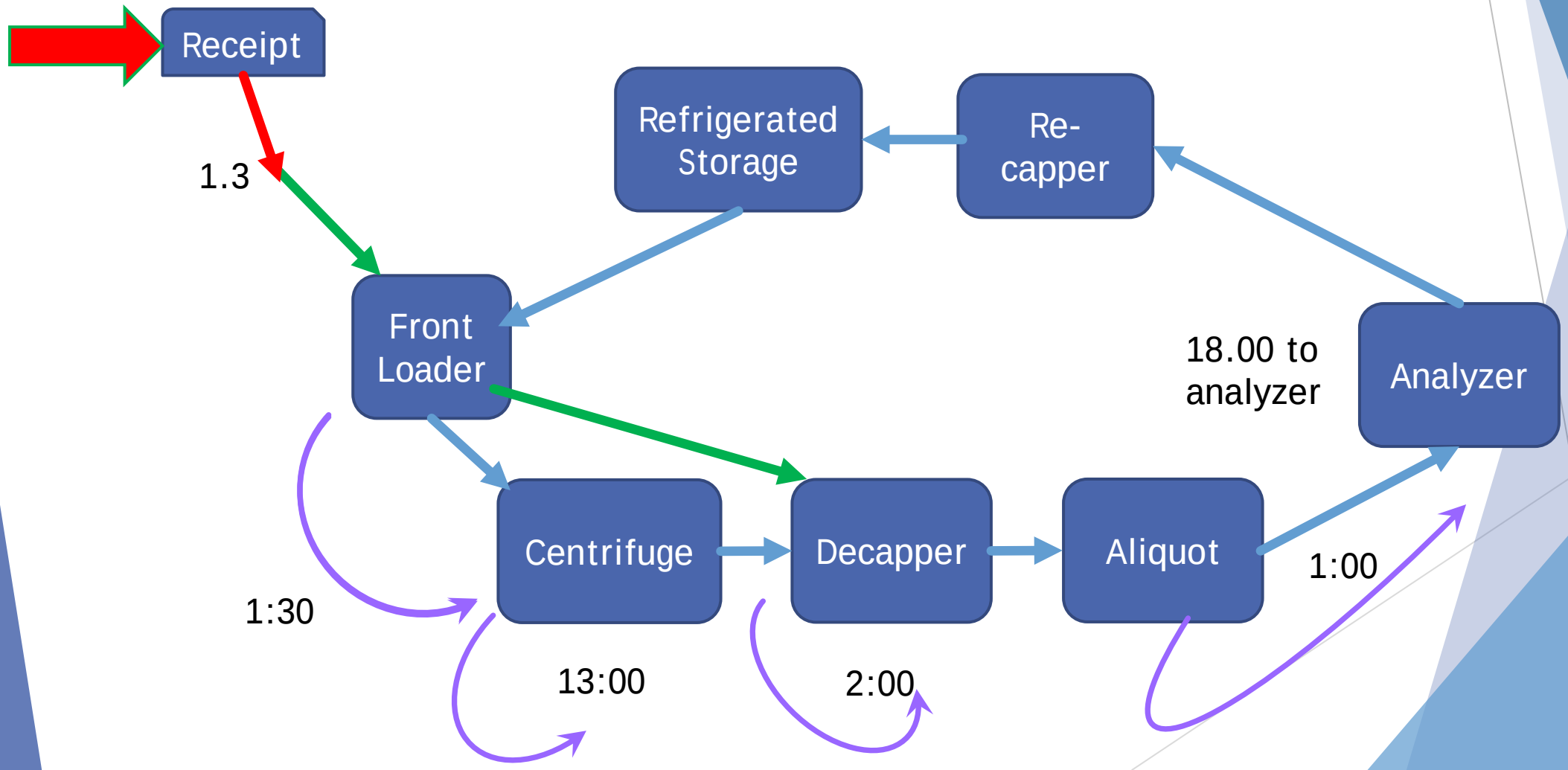
Option 1 - By-pass Line, Stat Spin, Use Analyzer Stat Mode



Option 2 – Stat Spin, Line Delivers to Analyzer



Option 3 – Line Centrifuge



Lessons Be Learned

- Design the automation line to meet process TAT
- Proximity of front-end loader should be near specimen receiving
- Don't always "believe" the instrumentation vendors as to line design
- Use a stop watch to really understand each step in the process
- Measure turnaround time for the full value stream – not just receipt to result (in-lab)
- Longer tracks mean longer time

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