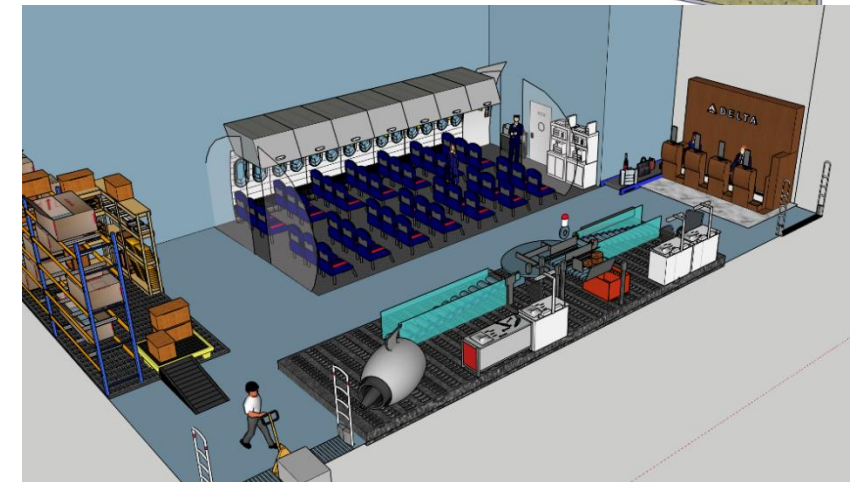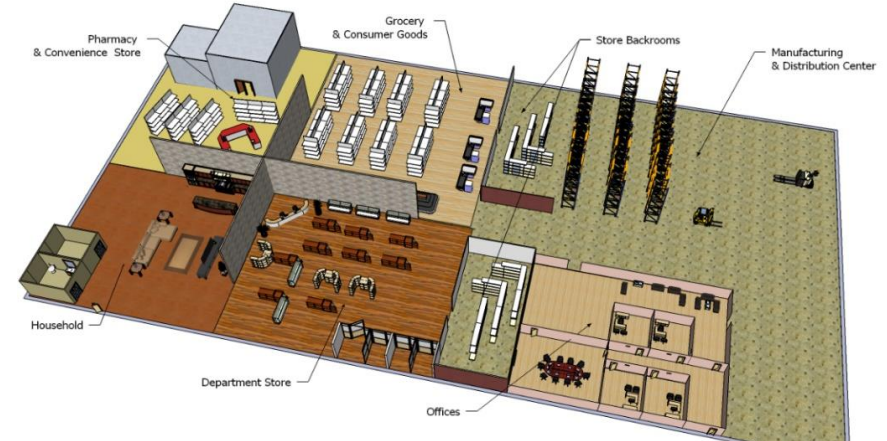# 6C – RFID Tag Spec

RFID Lab @ Auburn

RFID Lab @ Auburn University

- Focus on business case and value
- 18 years
- Retail, Aerospace, Food, and Logistics
- Education, Research, and Support
  to enable successful adoption of RFID

RFID Team

- 120 students
- 15 staff

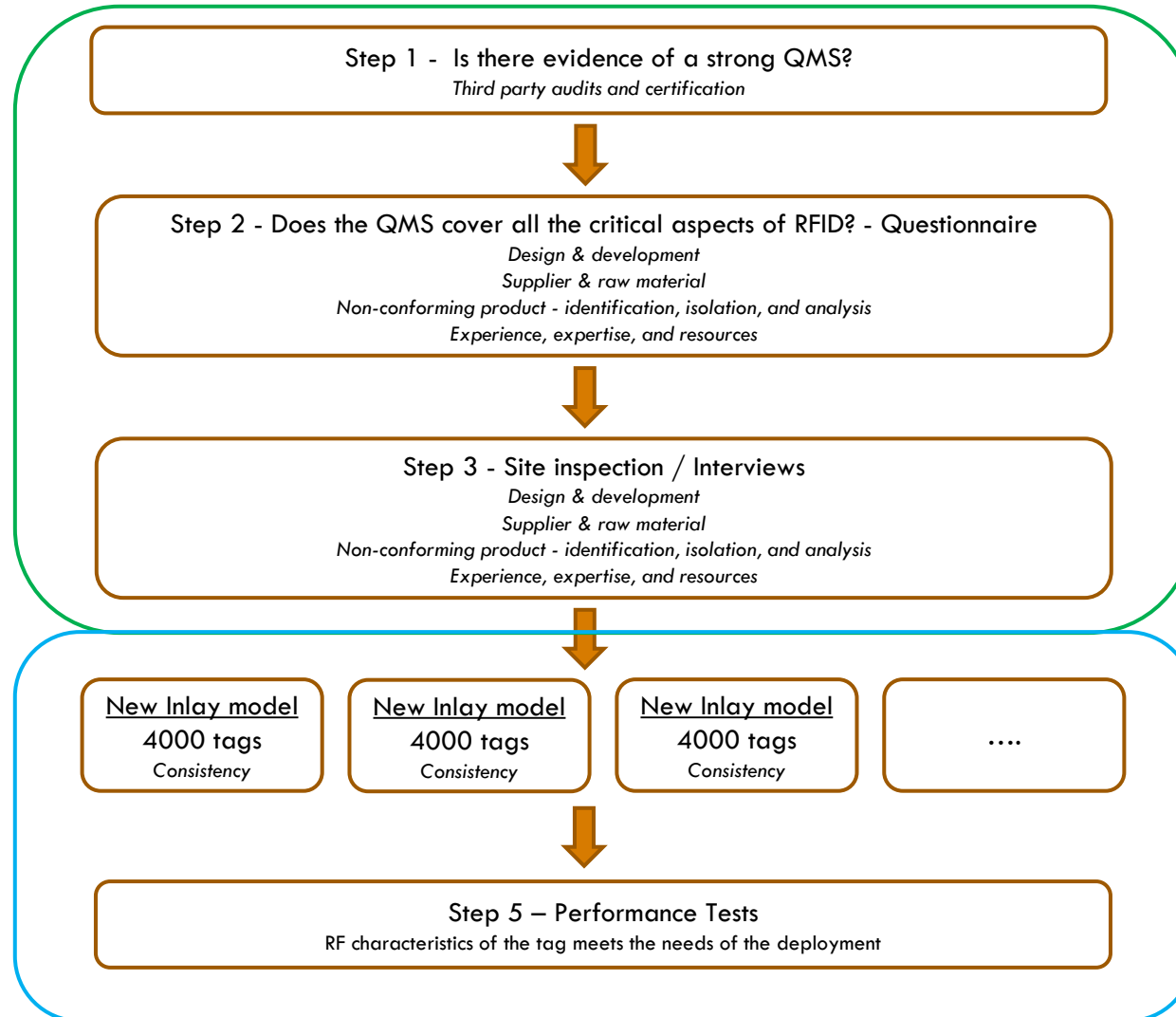- Business
- Engineering
- Human sciences

ARC Program

What is the ARC program?

- Goal – Help end users choose RFID tags that meet the Performance + Quality + Reliability requirements of their deployment

ARC Overview

Step 1 - Is there evidence of a strong QMS?
Third party audits and certification

Step 2 - Does the QMS cover all the critical aspects of RFID? - Questionnaire
Design & development
Supplier & raw material
Non-conforming product - identification, isolation, and analysis
Experience, expertise, and resources

Step 3 - Site inspection / Interviews
Design & development
Supplier & raw material
Non-conforming product - identification, isolation, and analysis
Experience, expertise, and resources

Quality Certification
RFID inlay manufacturer

New Inlay model
4000 tags
Consistency

New Inlay model
4000 tags
Consistency

New Inlay model
4000 tags
Consistency

….

Step 5 – Performance Tests
RF characteristics of the tag meets the needs of the deployment

Performance Certification
RFID inlay model
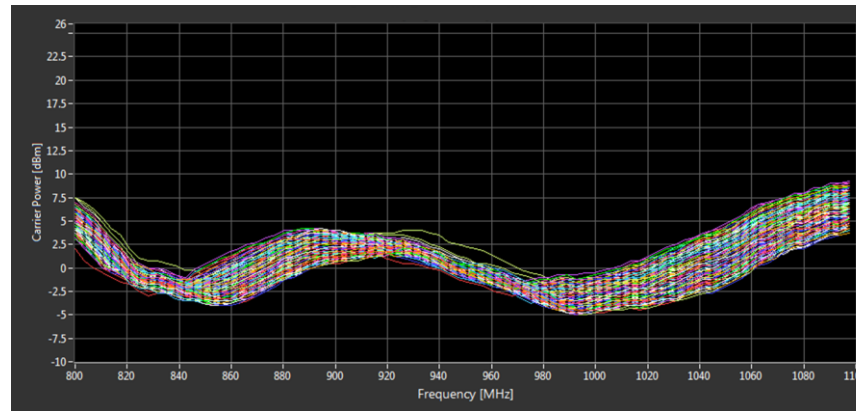
Tag Quality

Tag Quality
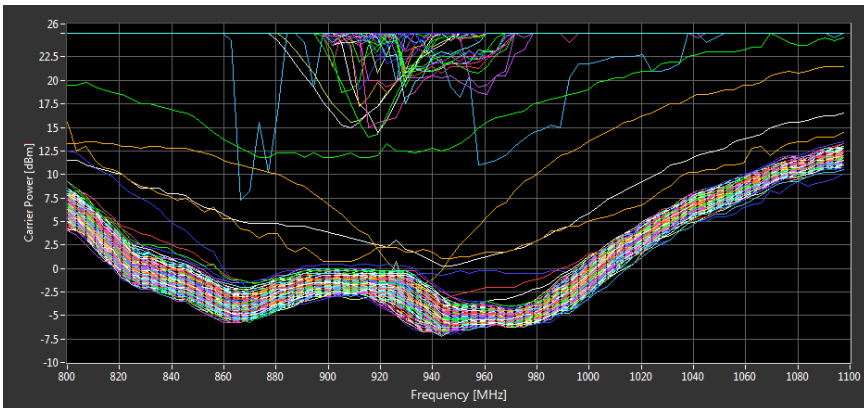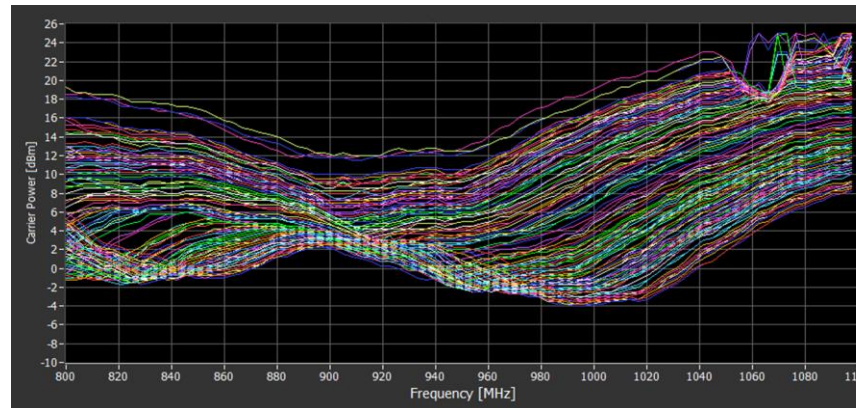

1 Tag
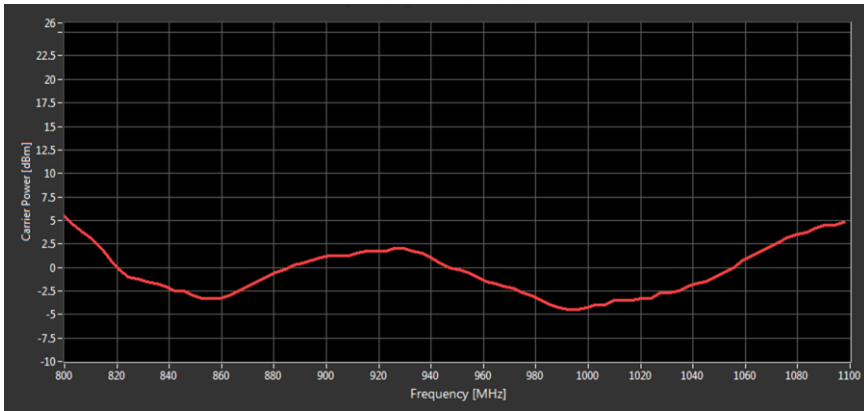
10,000 Tags – Good Quality

10,000 Tags – Bad Quality

10,000 Tags – Bad Quality

Ability to deliver consistency and reliability over large volume/time

Tag Quality

□ Ensure that RFID tag supplier has Quality Management System that covers the critical aspects of designing and manufacturing of RFID tags

□ *Focus areas,*
- *Design & development*
- *Supplier & raw material*
- *Non-conforming product - identification, isolation, and analysis*
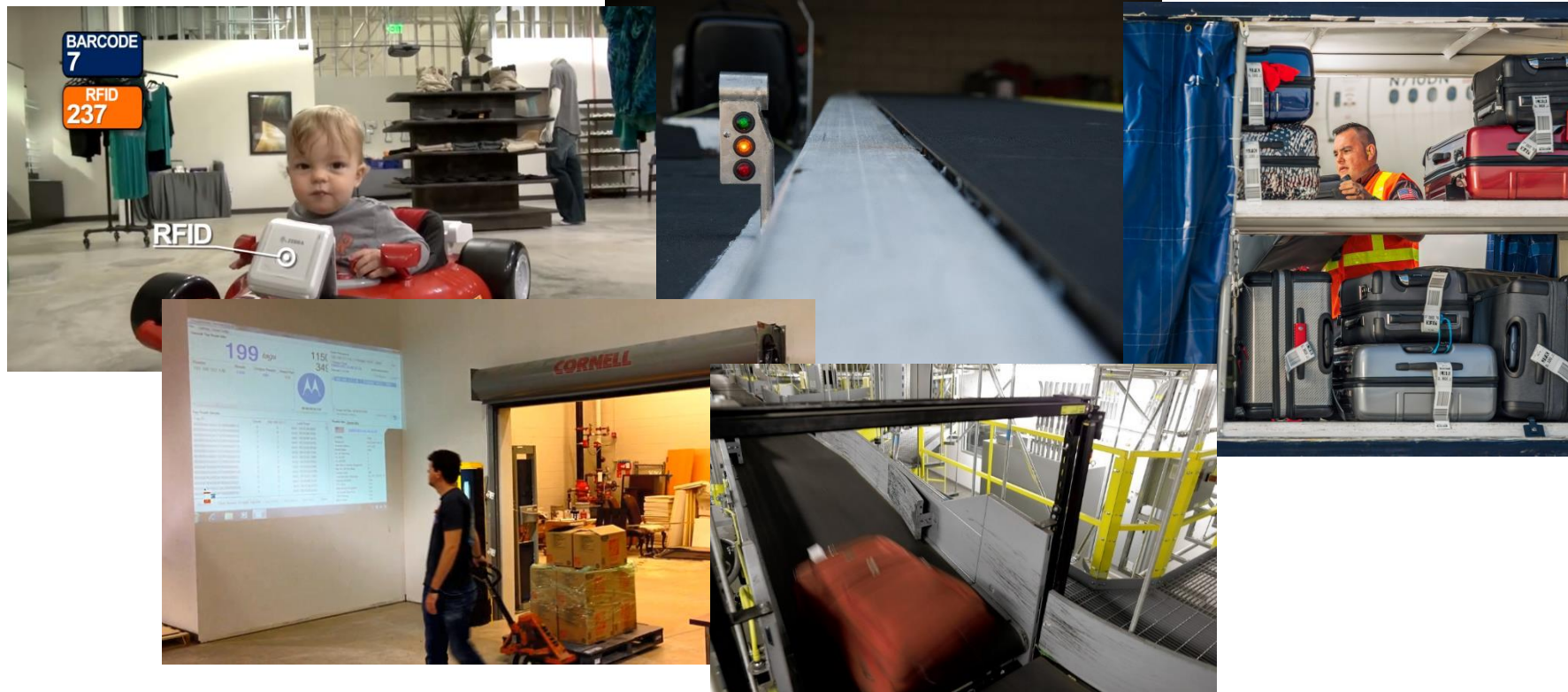- *Experience, expertise, and resources*

Tag Performance

Tag Performance

□ Tag performance is ensuring that we can read the tag reliably when we tried to read them in various scenarios

Tag Performance

Step 1

Identify the requirement of the deployment (Spec)

Spec A
Spec B
Spec C
Spec D
Spec F
Spec G
Spec I
Spec K
Spec M
Spec N
Spec Q
Spec U

Tag Performance

Spec J + Tag Database

Step 2

Spec + Tag Database

= Approved Tag list

Approved Inlay List - Spec J

Sort By:

Company

Silicon

Dimension 2

Model

Dimension 1

Company: Avery Dennison
Model: AD-236u7
Silicon: NXP UCODE 7
70 mm x 14.5 mm

Company: Checkpoint
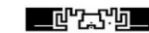Model: Triumph 2
Silicon: NXP UCODE 7
70 mm x 14 mm

Company: Smartrac
Model: Belt
Silicon: NXP UCODE 8
70 mm x 14 mm

Company: Avery Dennison
Model: AD-385u8
Silicon: NXP UCODE 8
50 mm x 30 mm

Company: SML
Model: MAZE_R6
Silicon: Monza R6
68 mm x 14 mm

Company: Smartrac
Model: Belt
Silicon: NXP UCODE 7
70 mm x 10 mm

Tag Spec for 6C

Tag Performance

Step 1

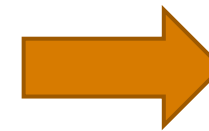Identify the requirement of the deployment (Spec)
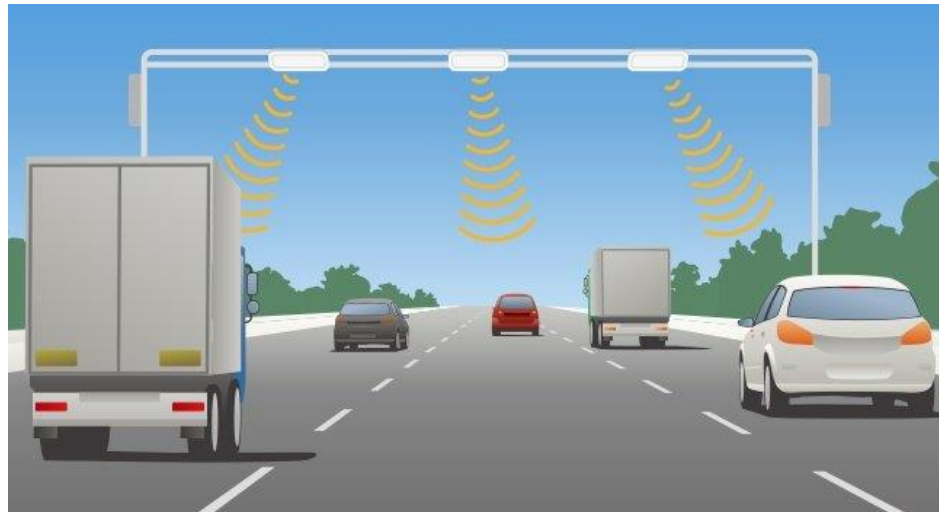
Tagged Item

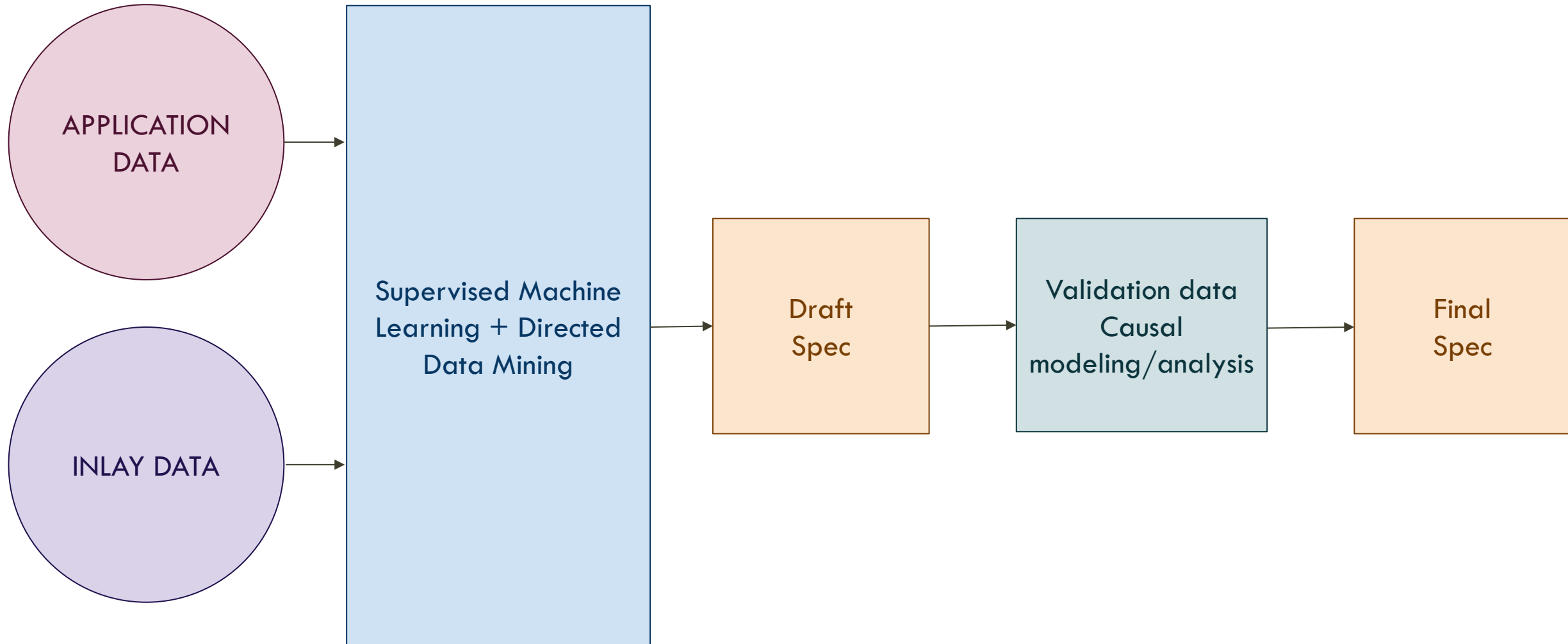Reader infrastructure

Usecase

Tagging location

Environment

….

Spec F1
Spec F2
Spec F4

Spec Development Process
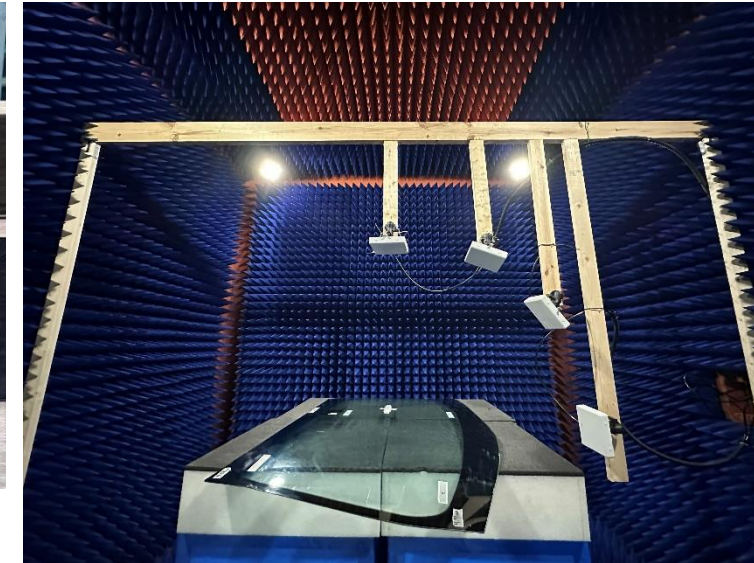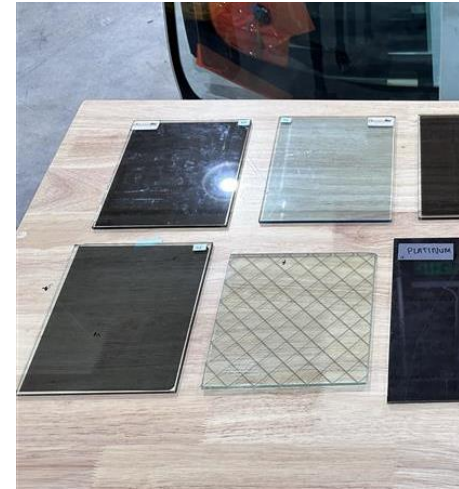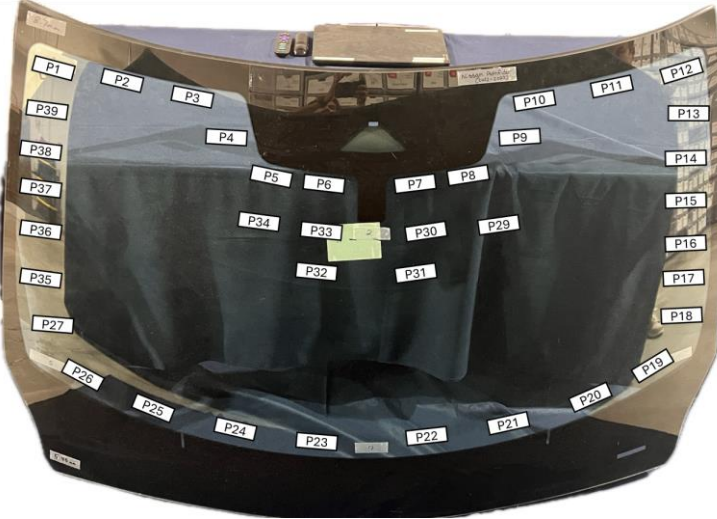
Spec Development overview

Spec Development overview

APPLICATION DATA

The first set of data comes from the real-world environment.
The goal of this dataset is to capture data from the use case or application.
This was achieved by a combination of site visits, interview, survey, and field testing.

Spec Development overview

INLAY DATA

- The second set of data comes from the anechoic chamber.

- The measurements are taken in multiple different test configurations that cover a range of RF dielectrics and product configurations.

- The test configurations are designed to assess/profile various RF performance characteristics of the tag and tagged products.

Spec Development overview

APPLICATION DATA

INLAY DATA

Supervised Machine Learning + Directed Data Mining
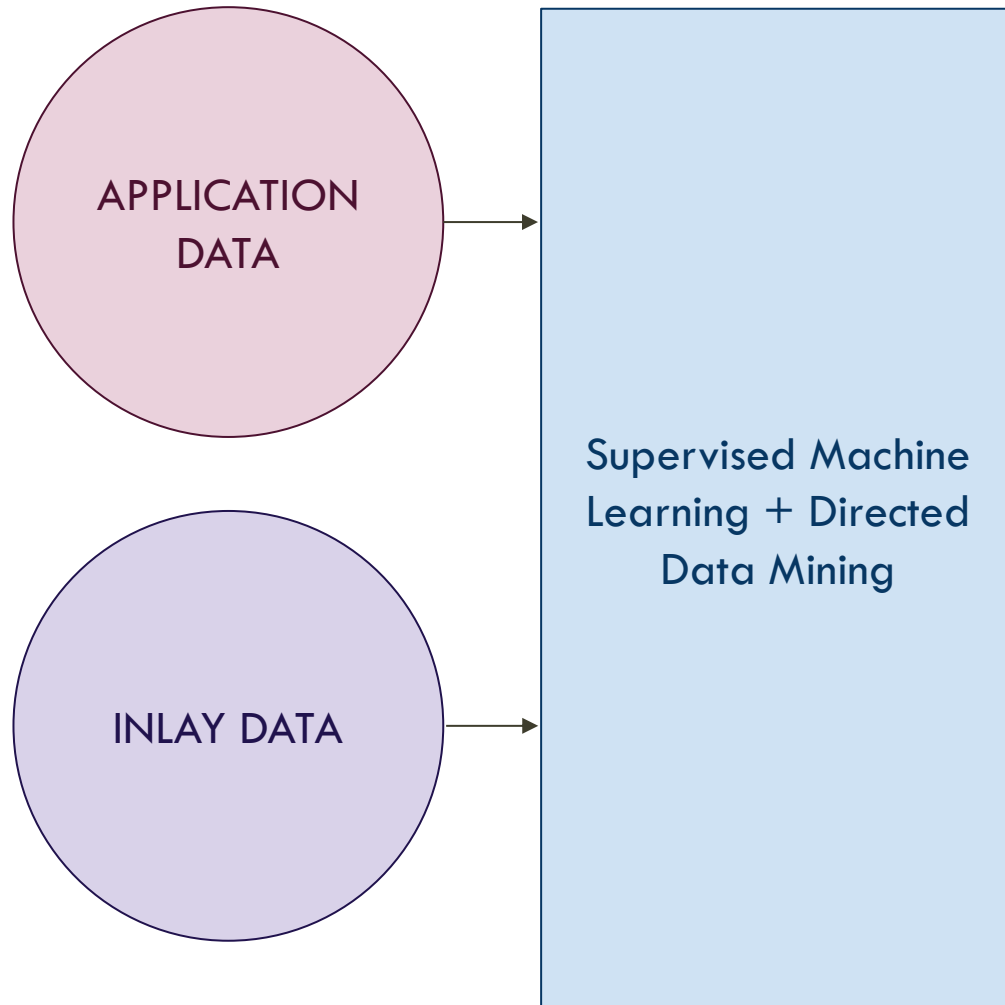
Once we have both the datasets, we use we use a combination of supervised-learning and directed data mining to determine which RF performance characteristics of the tag (dataset 2) influence the performance of the tag in the use case (dataset 1).

The RF performance characteristics (dataset 2) that predict the performance of the tag in the use case and the metrics behind them (dataset 1) is essentially what becomes the requirements in the Specs.

Spec Development overview
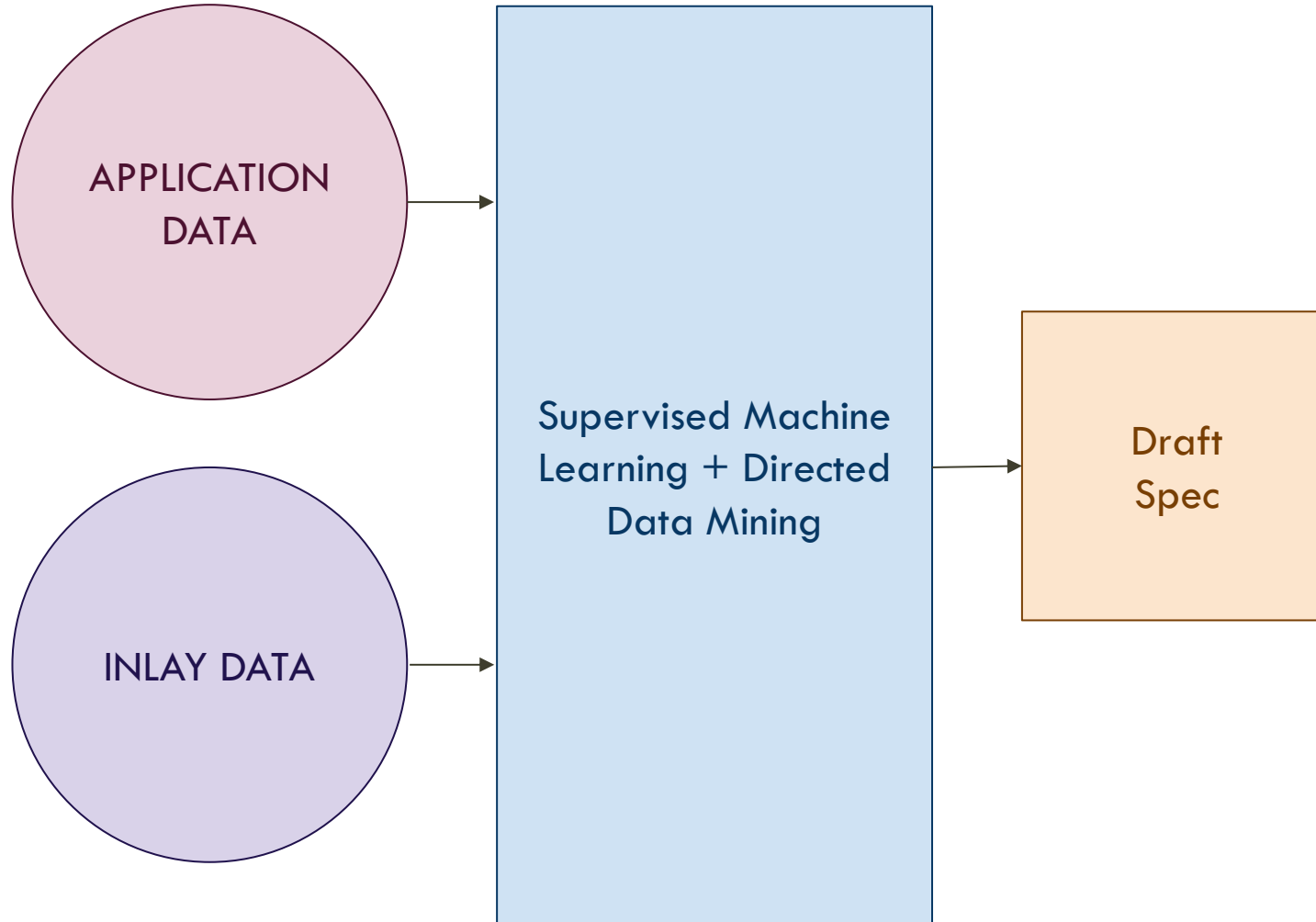
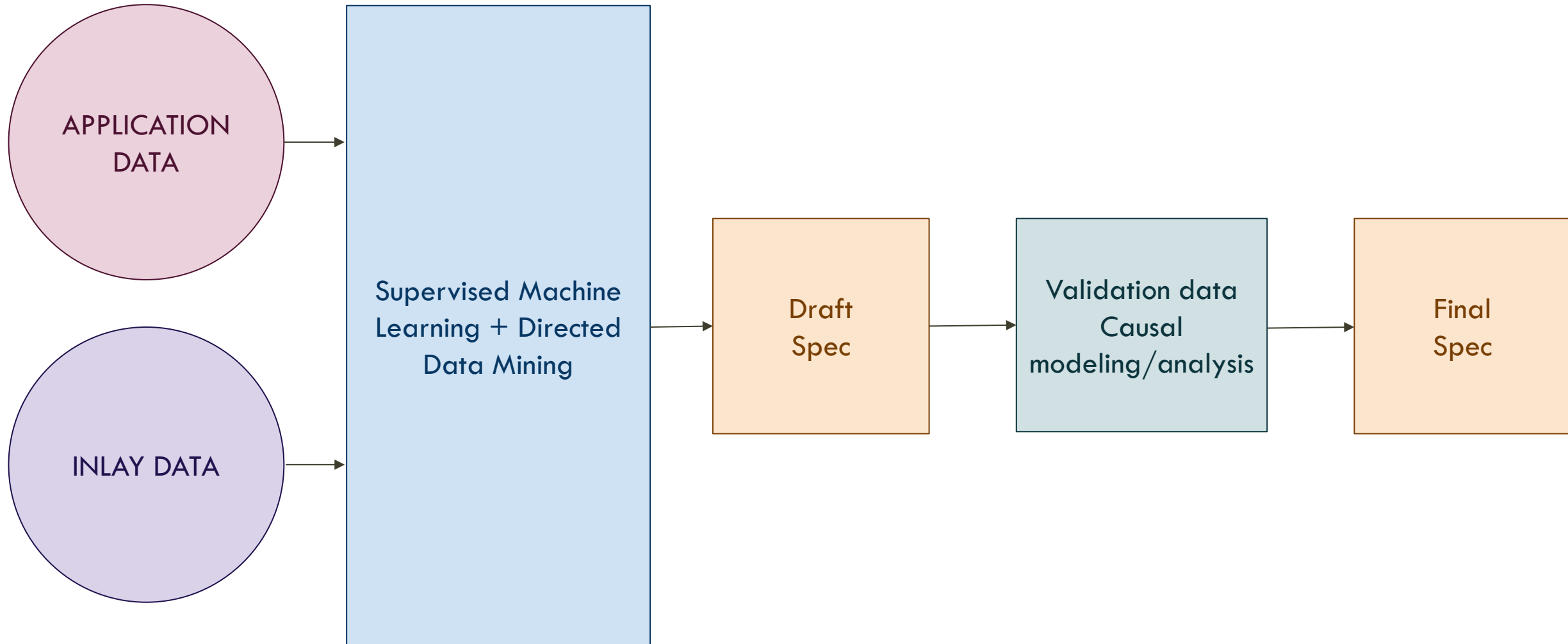| Position 0 Ant 1	Position 0: Ant 2	Position 0: Ant 3	Position 0: Ant 4
-9	-8	-8	-8
Position 30: Ant 1	Position 30: Ant 2	Position 30: Ant 3	Position 30: Ant 4
-7	-6	-6	-5.5
Position 60: Ant 1	Position 60: Ant 2	Position 60: Ant 3	Position 60: Ant 4
-2	NA	NA	NA
Position 120: Ant 1	Position 120: Ant 2	Position 120: Ant 3	Position 120: Ant 4
-2	NA	NA	NA
Position 150: Ant 1	Position 150: Ant 2	Position 150: Ant 3	Position 150: Ant 4
-7	-6	-6	-5.5
Position 180: Ant 1	Position 180: Ant 2	Position180: Ant 3	Position 180: Ant 4
-9	-8	-8	-8
Position 210: Ant 1	Position 210: Ant 2	Position 210: Ant 3	Position 210: Ant 4
-7	-6	-6	-5.5
Position 240: Ant 1	Position 240: Ant 2	Position 240: Ant 3	Position 240: Ant 4
-2	NA	NA	NA
Position 300: Ant 1	Position 300: Ant 2	Position 300: Ant 3	Position 300: Ant 4
-2	NA	NA	NA
Position 330 Ant 1	Position 330: Ant 2	Position 330: Ant 3	Position 330: Ant 4
-7	-6	-6	-5.5

APPLICATION DATA

INLAY DATA

Supervised Machine Learning + Directed Data Mining

Draft Spec

Spec Development overview

Spec Development overview

☐ The first dataset that is noisy, uncontrolled, and complex which involves a lot of effort/time/expertise to accurately capture and understand comprehensively.

☐ The second dataset is standard, accurate, and repeatable.

☐ The approach we take is to put the initial investment towards understanding the first data, establish the correlation to the second dataset, and then communicate the requirement in the context of the second data set to make the development/validation of tags scalable/accurate.

New Specs

RFID Tag Requirements (Performance, Quality, Reliability)

Spec F1 – Windshield

Spec F2 – Headlight*

Spec F4 – License Plate

RFID Tag Placement Guideline (Draft Template)

ARC Test Methodology**

ARC Test Equipment**

*F1/F2 can be single Spec/Tag. We have separated it if there is a need for separate tags
**Existing Documents

Next steps

- Review and provide comments by Nov 15, 2024
- Publish the Spec to the RFID tag manufacturing community
- RFID Inlay Manufactures identify/design tags that meet the requirement of the Spec
- Tags sent to Auburn for Certification

Thank you!

arc@rfidlab.org