



MARCIUS YUKIO NISHIDA

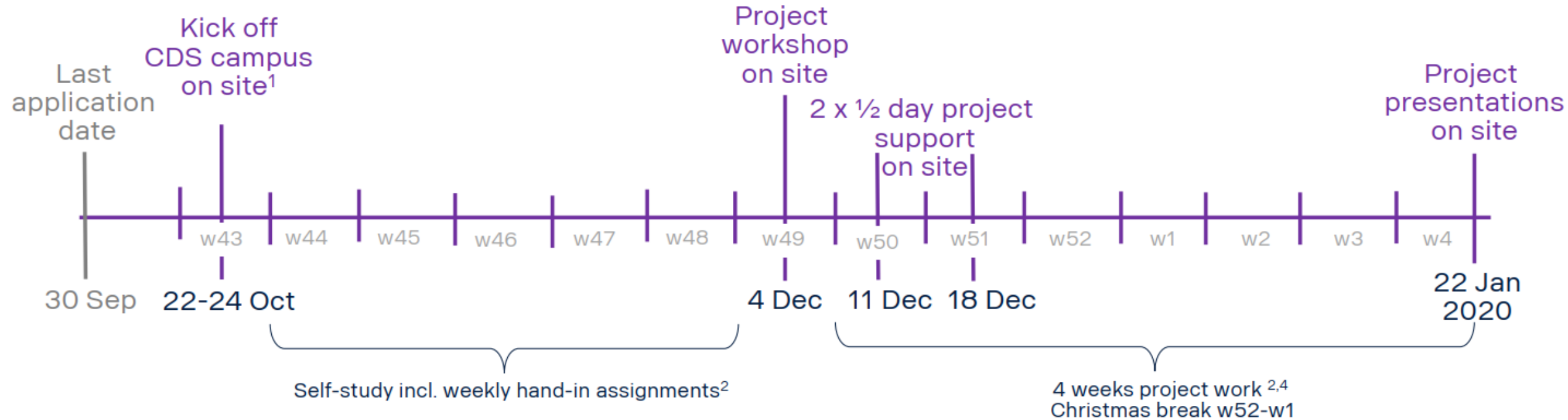
# **BUSINESS CASE TIGHTENING IN CHASSIS WORKSHOP**

**SCANIA**

# Set-up Citizen Data Scientist program



Combient + IXAD

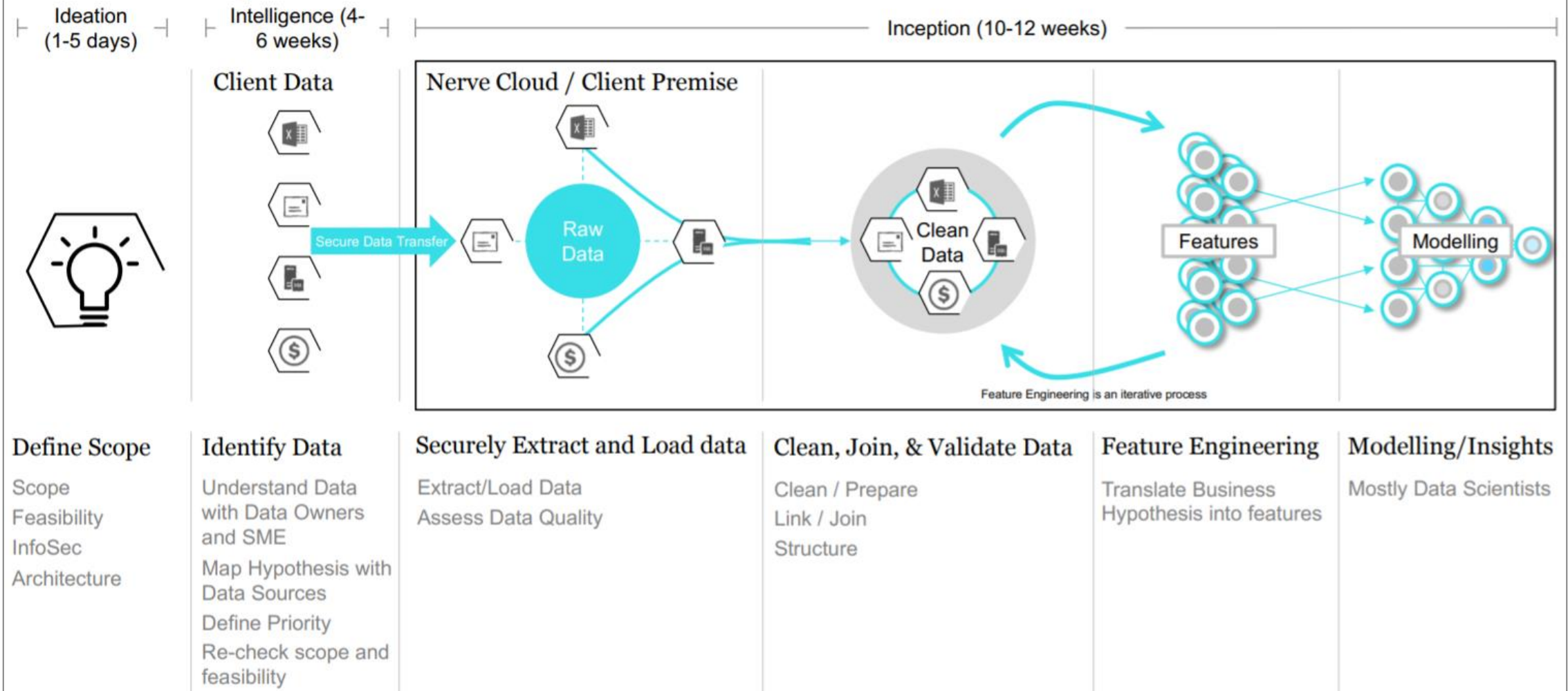


Also including:

- 1) Data lake introduction
  - 1) Getting started with Python
  - 2) Weekly 1/2 day "co-location" sessions with Scania data scientists w44-48 and w2-3
  - 4) Project case mentoring
- Project case inspirational session and evaluation (during October)

# Building a data pipeline from scratch in a large project

## Data Engineers work alongside Data Scientists to play a critical role in Analytics





Idea

MONA

tasks



DATABASE

Popid:

Status: All

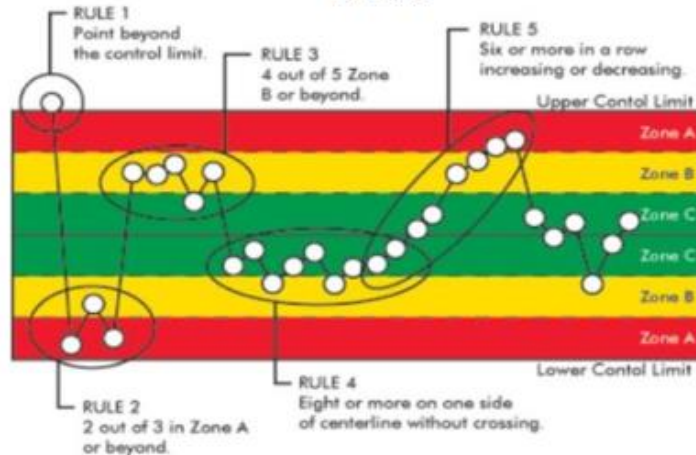
Search

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PA 1.1.1 P1	Catã ferro 1100 47Nm2	2	2	47.17 Nm	OK	OK	2018-01-19 10:37:55	
FA 1.1.2 P3	LT11231004 15mm 30N 2AP	2	2	33.01 Nm	OK	OK	2018-01-19 10:37:52	
FA 1.1.5 P4	Coxim do cambio 112Nm	4	5	115.25 Nm	OK	OK	2018-01-19 10:37:54	
PA 3.2.2 P3	Rasperto Filtro 27Nm	1	1	27.04 Nm	OK	OK	2018-01-19 10:37:51	
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PA 3.2.2 P3	Filtro baixo	4	4	29.05 Nm	OK	OK	2018-01-19 10:37:49	
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PA 1.1.5 P5	Coxim 112 Nm	1	5					
FA 1.1.2 P3	LT11231001 15mm 78N AAP	4	4					
PA 1.2.1 P1	AbraçTubo Direção Suporte	1	1					
FA 5.1 P5	Sup da Naja 20Nm	0	0					
FA 3.2.2 P3	Filtro baixo	0	4					
FA 3.2.2 P1	Banco Cx Bateria LE 6-6Nm	6	6					
PA 1.1.1 P1	Catã plastic 1100 47Nm	1	1					
FA 1.1.2 P3	LT11231001 15mm 78N AAP	3	4					
FA 3.2.2 P1	Banco Cx Bateria LE 6-6Nm	5	6					

TRACEABILITY TDS  
RESULTS + CURVES



CEP CRITERIA  
RULES

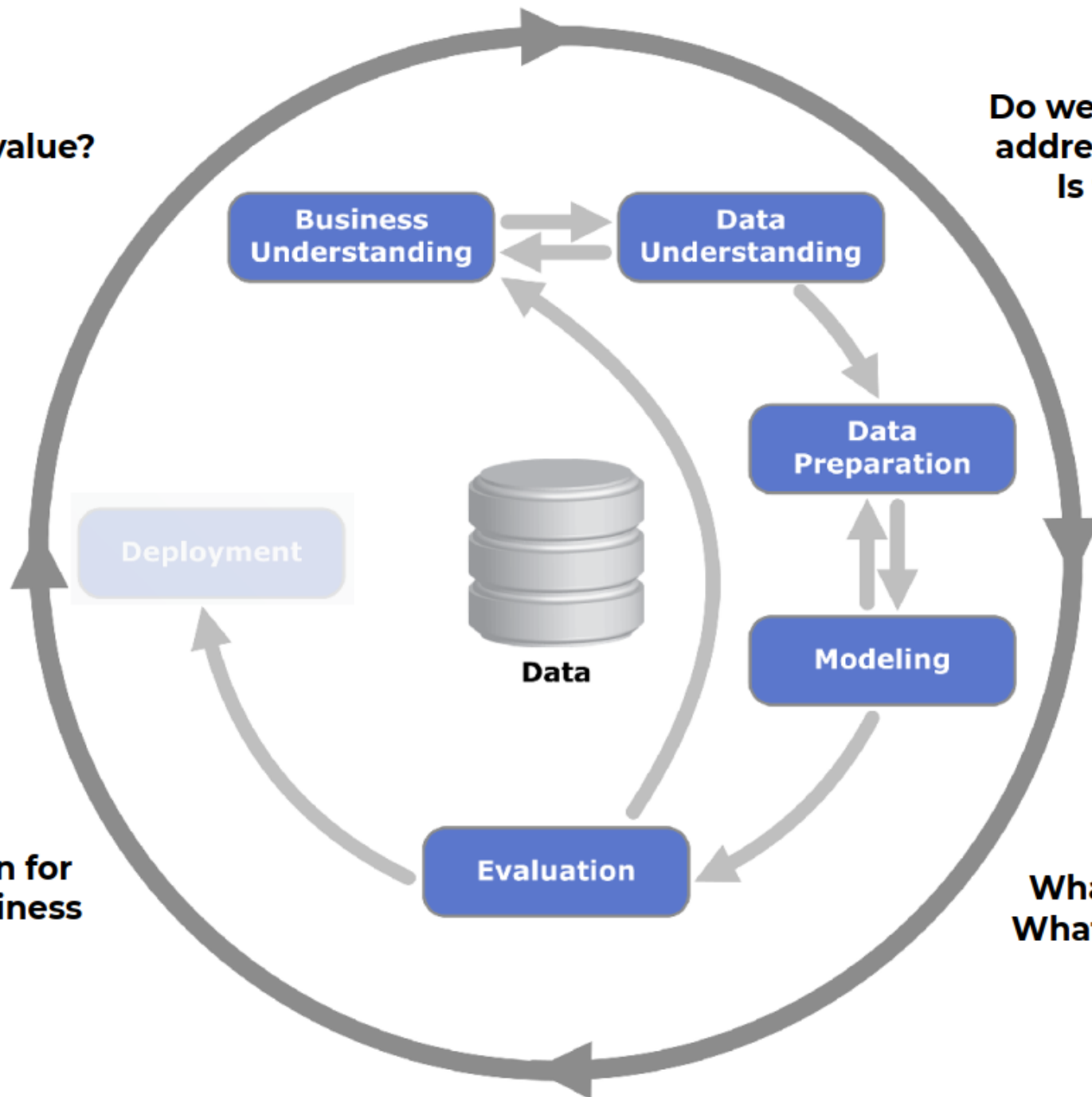


TORQUE TEAM  
SUPERVISOR

TOOL SSB 65364  
FA2.1 Pset 2  
REACTION BAR  
FAILURE WARNING  
RULE 3

PROGRAMMER  
PREVENT REACTION

**What is the business value?**



**Do we have the data required to address the business question?  
Is the quality sufficient?**

**Relevant evaluation for addressing the business question?**

**What models could we try?  
What are the features/labels?**

# Business Problem?



- **Main problem:** Deviation on the tightening creating problems on the quality;
- **Question:** What is tools that is candidate to be failed according to predictive model?
- If we will have that information previously so nutrunners could be checked before avoiding risks on the assembly line.

# Proposal



- **Data:** Tightening data is being collected daily into local database in Chassis workshop;
- **Methods:** Supervised Learning using the algorithms Decision Tree, Random Forests and Logistic Regression comparing the accuracy;
- We have used basically four tools:
  - Python with Data Lake and Spark
  - Alteryx(temporary license)
  - Analysis Services for Data Mining
  - PowerBI



# Result



- Python: We have had high score on the model;
- <https://l4510p.sss.se.scania.com:8000/user/ssbmyn/lab>

```
----- Decision trees -----
      precision    recall  f1-score   support

     0       0.98      0.98      0.98      14219
     1       1.00      1.00      1.00     174162

 avg / total       1.00      1.00      1.00     188381
```

```
----- Logistic Regression -----
      precision    recall  f1-score   support

     0       0.99      0.69      0.81      14219
     1       0.98      1.00      0.99     174162

 avg / total       0.98      0.98      0.97     188381
```

```
----- Random forest -----
      precision    recall  f1-score   support

     0       0.99      0.98      0.99      14219
     1       1.00      1.00      1.00     174162

 avg / total       1.00      1.00      1.00     188381
```

```
----- Random forest - Confusion Matrix -----
Predict    0      1    All
Real
0      13931    288   14219
1         93 174069 174162
All    14024 174357 188381
```



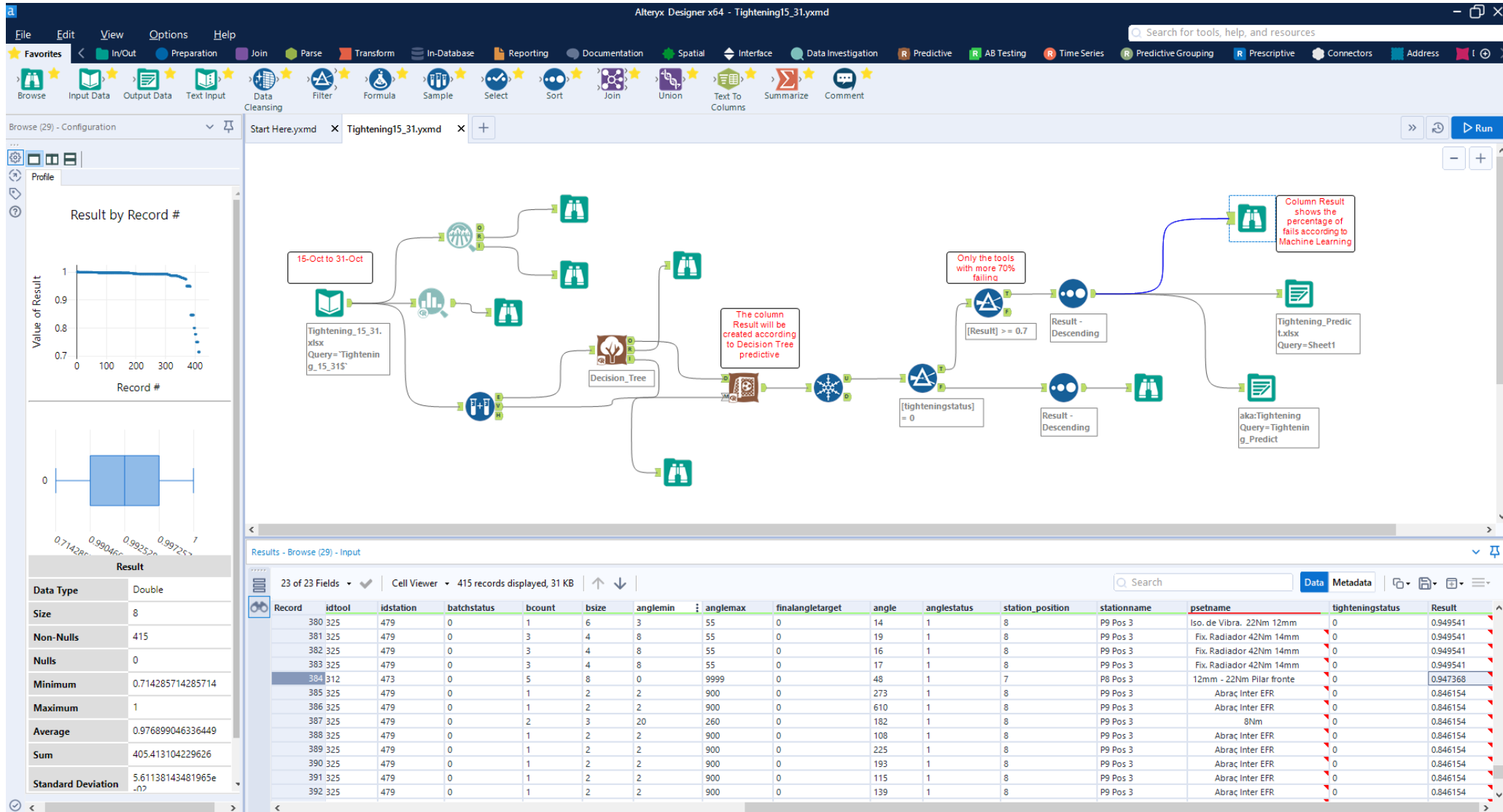
# Result



- Alteryx tool: is for Self-Service Data Analytics;
- Alteryx Designer empowers data analysts by combining data preparation, data blending, and analytics - predictive, statistical and spatial using the same intuitive user interface, no coding required;
- More details: <https://www.alteryx.com/>
- We have developed the same model in Alteryx where the final result has been saved on the SQL-Server table.

# Result

- The Result column has been created by predictive model with score(how many percent %) it can be failed.

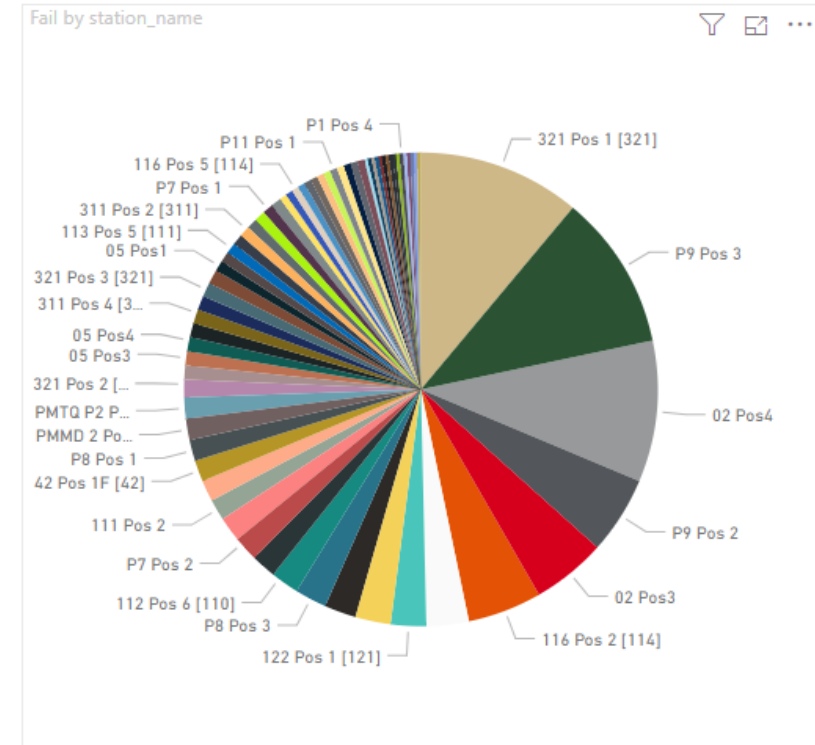
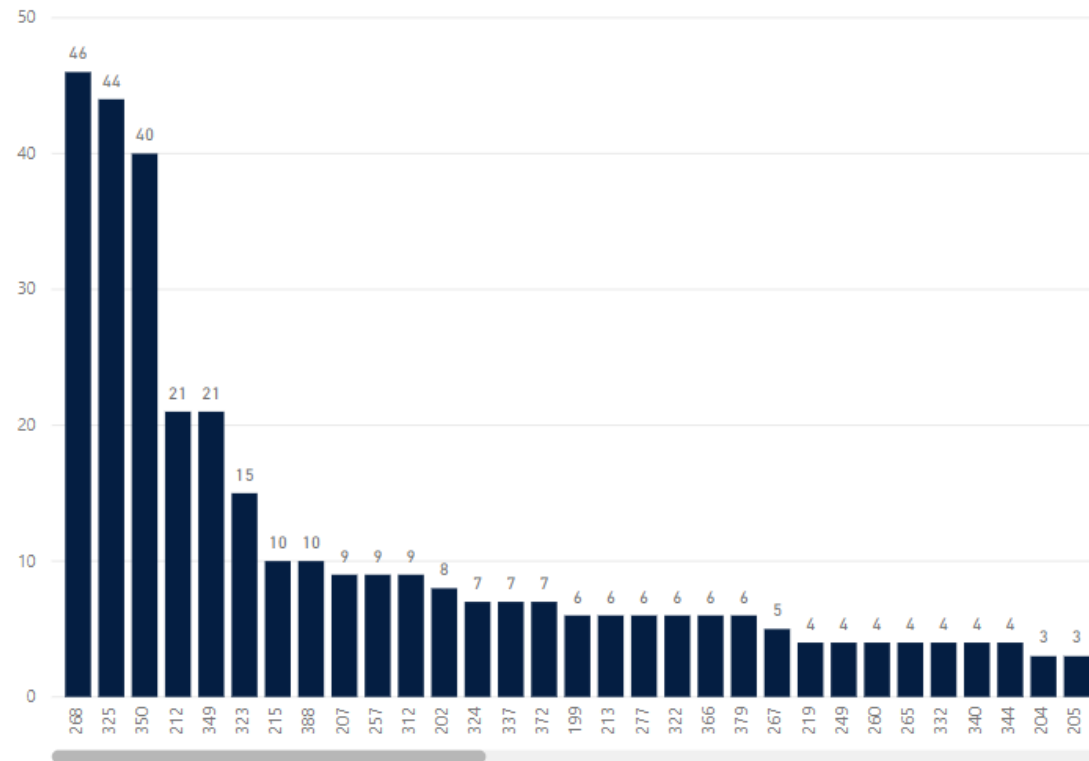


# Result

- PowerBI Report

15/10/2019 to 31/10/2019 - Fails by Nutrunners by predictive model

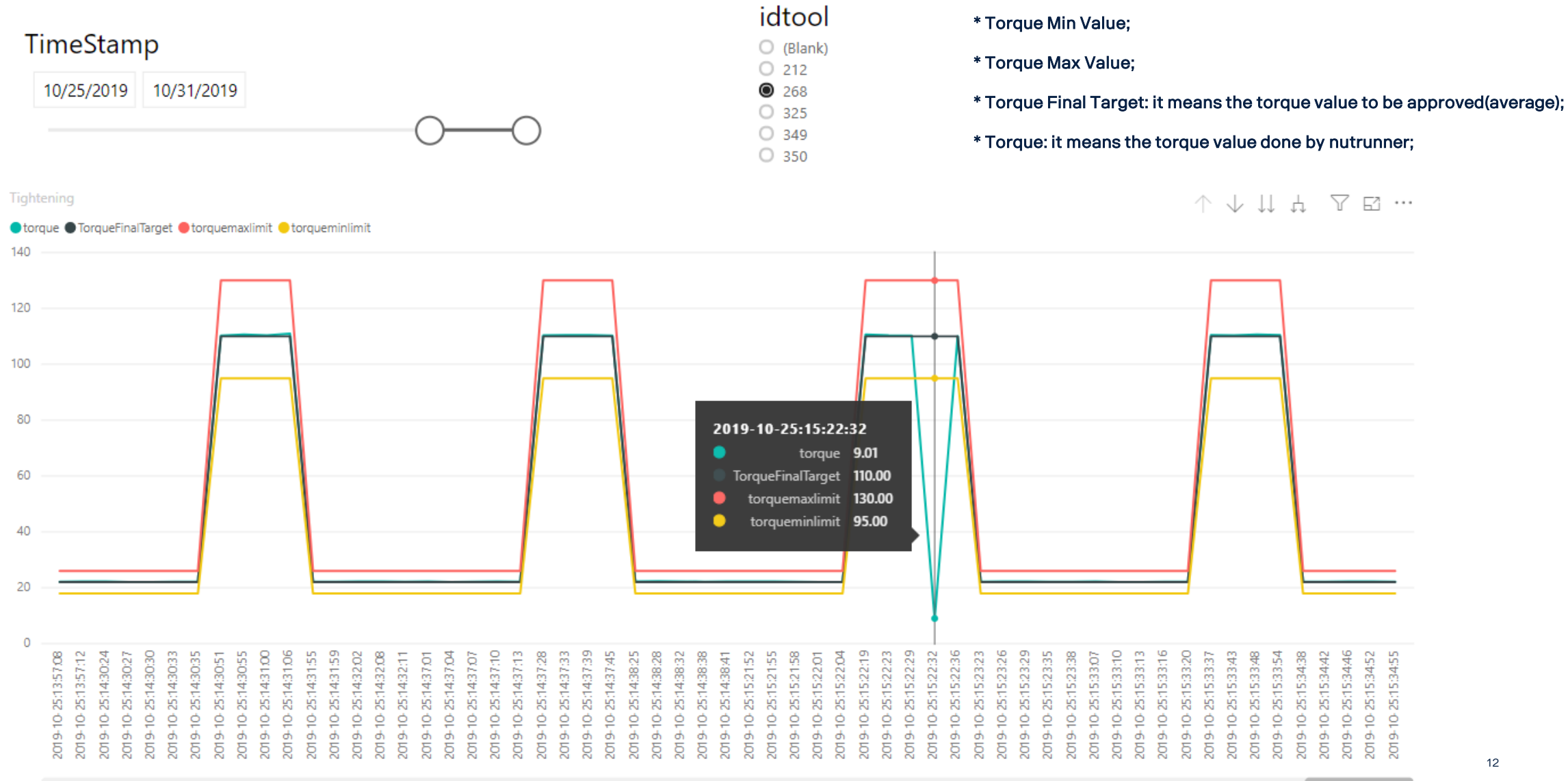
Fails by Nutrunner



# Result



- PowerBI Report: Log by Nutrunners - behavior.



# Conclusion

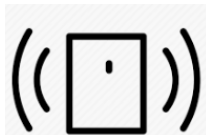


- For the main proposal the model is OK and we could use this in production environment to make sure if that model makes sense or not.
- Step 2: Why that tool(nutrunner) is failing? Do we need more data like for every rotation on the bolt?
- Regarding Citizen Data Scientist:
  - Education is really good and the network to Europe is very important also;
  - Deployment model should be included on the education;
  - Costs is very expensive for Brazil.

What is tool that is candidate to be failed according to predictive model?



Social Media



Devices & Sensors



Databases



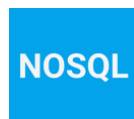
External Data

Data Sources

Data Processing



02/May to 31/Oct



Specialized Systems



Data Warehouse



Analysis Services

Data Storage & Data Processing

15/Oct to 31/Oct using Spark



AI & Predictive Analytics  
Machine Learning  
R, Python,  
Alteryx, Analysis  
Services, APIs

Modern AI



Alerts  
Score Cards



Dashboards  
Tendency  
Map



Application  
Integration

Saving the  
result on the  
CSV File and  
also in SQL-  
Server



Analytical  
Report and  
Operational



Self-Service BI



Business Intelligence

# Suggested future work?



- Very important to keep in touch to everyone -> Data Science collaboration Forum at Scania -> March, April, May, June;
- More business case from Brazil, Europe or Kaggle;
- I am starting my journey in Advanced Analytics;
- Share the knowledge in Advanced Analytics and create a data scientists team in Brazil;
- How to have/share Self-Service Analytics in all Scania? Many business case could be used in all Scania.



# Acknowledgment

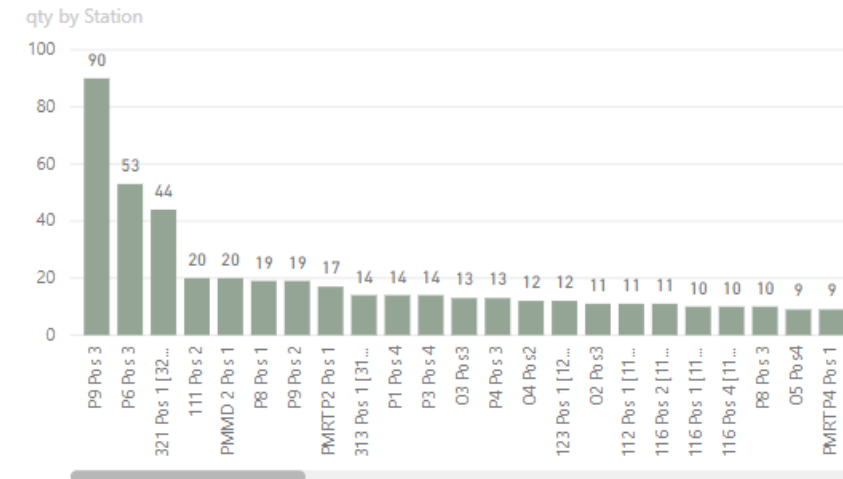
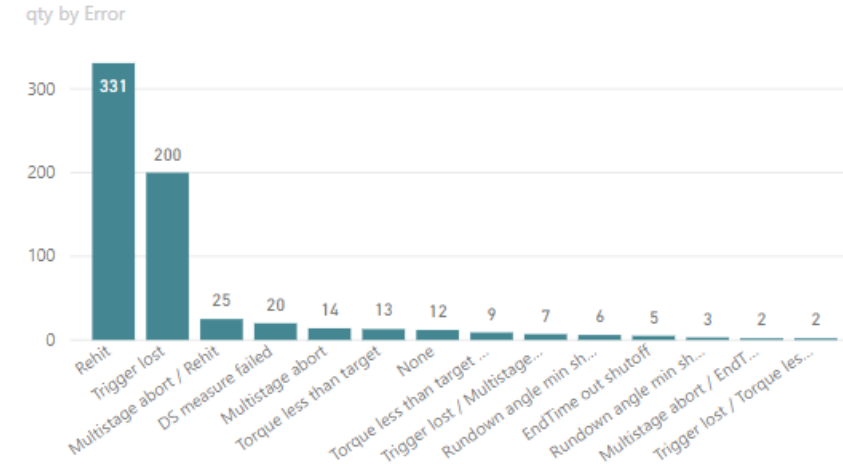
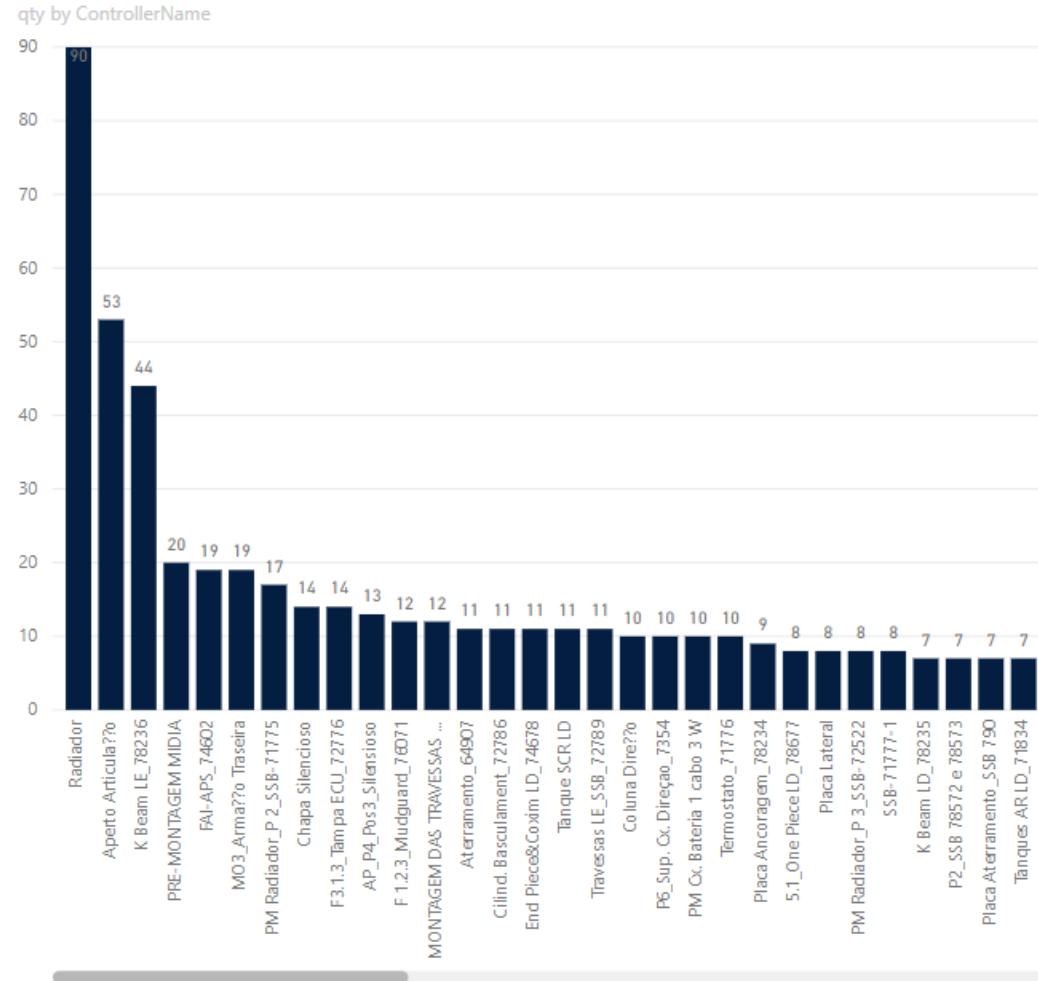


- Thank you for Scania-IT in Brazil and in Sweden and I had opportunity to participate on the Citizen Data Scientist;
- Thank you for Chassis Workshop team;
- Thank you very much for IXAD, Data Lake team and also for Combient and let's keep in touch!

# New PowerBI Report



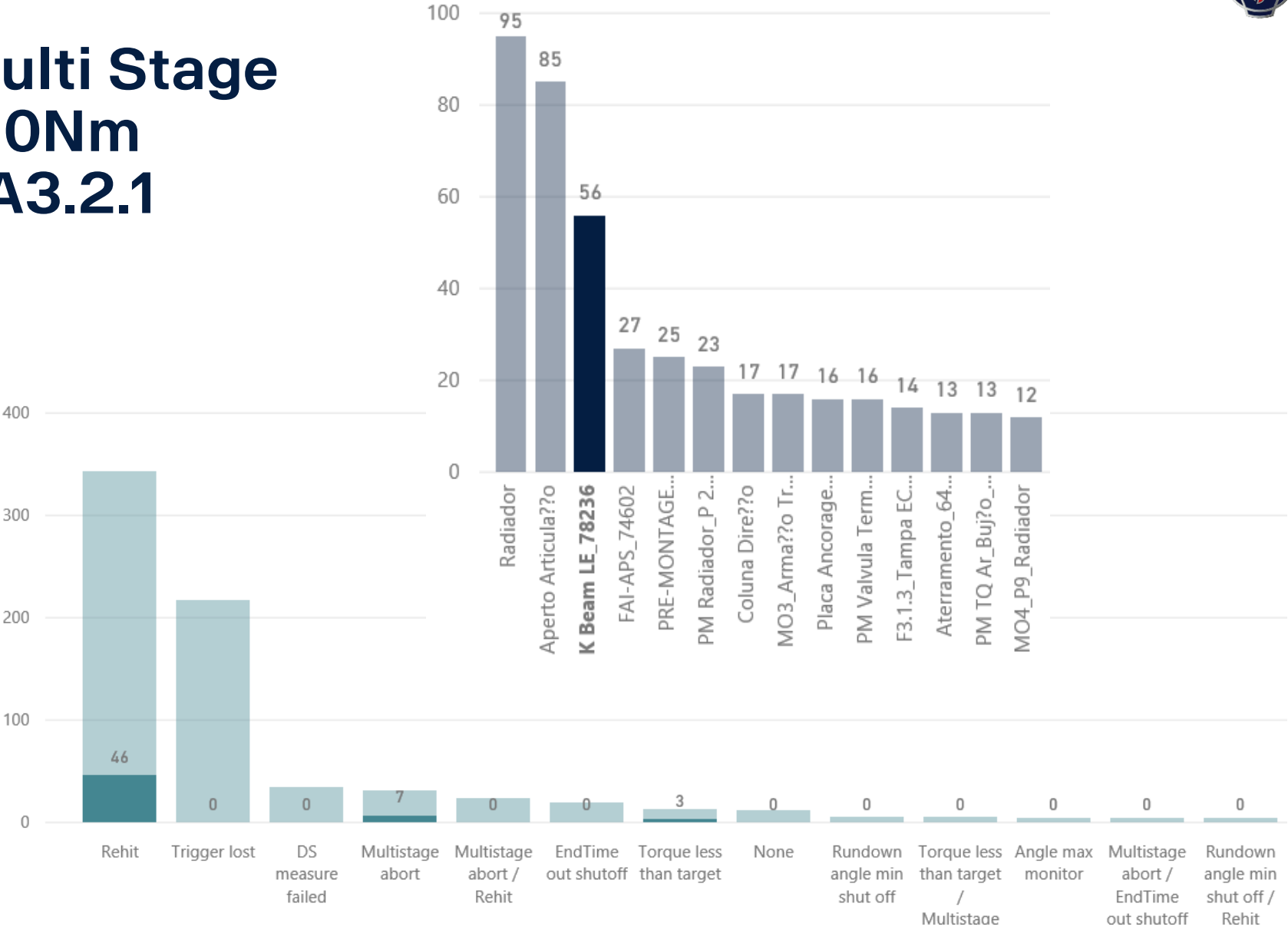
## Fails by Nutrunners - Predictive Model - Last 30 days



# Pilot on production



## Multi Stage 110Nm FA3.2.1



# Pilot on production



Prog-4 (K Beam 110Nm) - PF-K Beam LE\_78236

Resumo de Prog

Programação

Controlo

Binário

Angulo

Velocidade y Rampa

Tempo

Contar Lote

High speed rundown

Posicionamento

Gradiente adequado

PVT completo com encosto

Programação +

Programming ++

Config prog

Programação estatística

Prog auto

Programação rápida

Ajuda de programação

Fechar

Binário

Começo de ciclo

Primeiro objectivo

Min Binário Final

Objectivo final

Max Binário final

Ciclo completo

Aprox completa

Medir torque em

Limite de desaperto

Angulo

Começo final angulo

Medir ang até

Angulo final min

Angulo objectivo

Angulo final max

Angulo aprox min

Angulo aprox max

Final angle max mon

Angulo de reaperto

Angle search

Comparar

Desfazer Comp.

Ler

Guardar

25,00

Nm

80,00

Nm

95,00

Nm

110,0

Nm

130,0

Nm

15,00

Nm

Não usado

Nm

Torque máximo

Nm

50,00

Nm

70,00

Nm

Angulo pico

Graus

0

Graus

Não usado

Graus

20

Graus

Não usado

Graus

Não usado

Graus

50

Graus

Não usado

Graus

Não usado

Graus

Não usado

Graus

Prog-4 (K Beam 110Nm) - PF-K Beam LE\_78236

Resumo de Prog

Programação

Controlo

Binário

Angulo

Velocidade y Rampa

Tempo

Contar Lote

High speed rundown

Posicionamento

Gradiente adequado

PVT completo com encosto

Programação +

Programming ++

Config prog

Programação estatística

Prog auto

Programação rápida

Ajuda de programação

Fechar

Velocidade y Rampa

Velocidade arranque suave

Velocidade etapa 1

Velocidade etapa 2

Velocidade desaperto

Rampa desaperto

Rampa etapa 1

Rampa etapa 2

Ergorampa

Velocidade etapa zoom

Unidade de velocidade

Tempo

Tempo final

Tempo arranque suave

Tempo arranq feram

Tempo abortar ciclo

Temporizador da catraca

Comparar

Desfazer Comp.

Ler

Guardar

10

%

80

%

40

%

96

%

0

%

0

%

20

%

Não usado

%

Não usado

%

%

0,20

Seg

0,5

Seg

0,0

Seg

30,0

Seg

Não usado

Seg

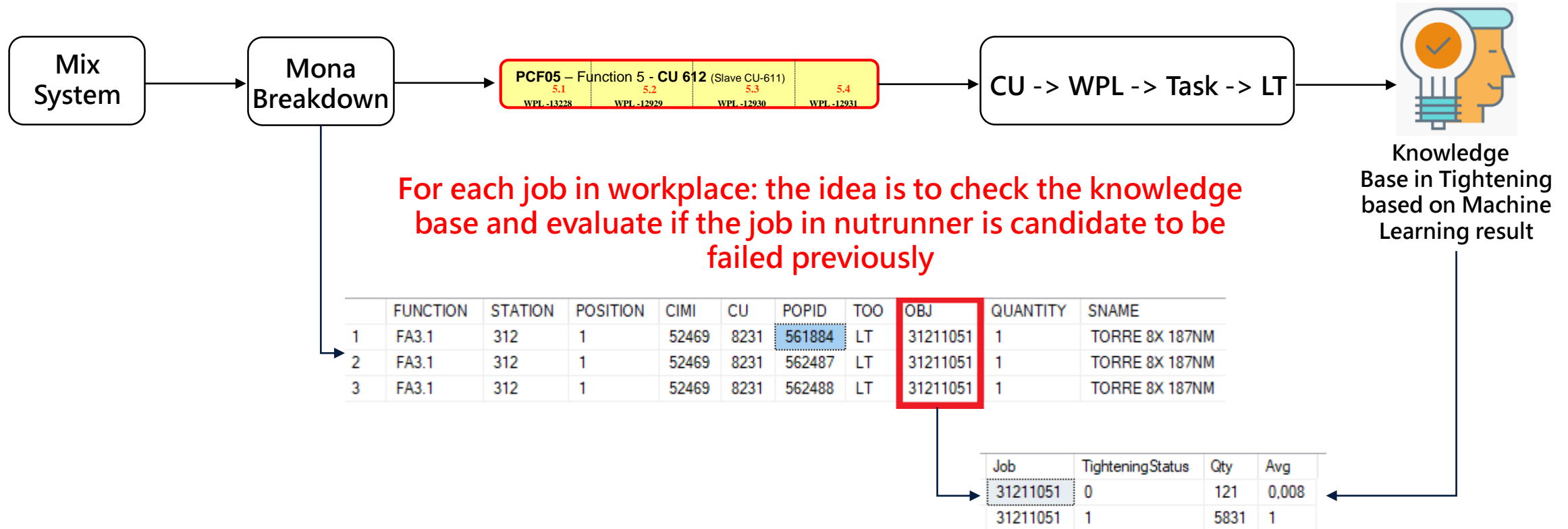
Multitapa:9 (K Beam 110)												
Resultados total de resultados dentro de lim est												
Estado glob	Estado do	Bin	Data	Temp	ado Cód	ID pro	Estrateg	Status lo	ID Jo	Eventos		
NOK	Baixo	5,72	12/03/2020	12:40:35	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		
NOK	Baixo	6,14	12/03/2020	13:02:46	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		
NOK	Baixo	5	12/03/2020	15:34:13	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		
NOK	Baixo	5,32	12/03/2020	16:04:08	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		
NOK	Baixo	7,39	13/03/2020	08:07:45	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		
NOK	Baixo	5,35	13/03/2020	08:38:09	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		
NOK	Baixo	5,61	13/03/2020	08:38:13	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		
NOK	Baixo	5,28	13/03/2020	08:52:53	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		
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NOK	Baixo	5,16	13/03/2020	08:59:47	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		
NOK	Baixo	8,39	13/03/2020	09:07:54	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		
NOK	Baixo	5,9	13/03/2020	09:37:12	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		
NOK	Baixo	6,11	13/03/2020	11:59:48	32111052	9	Multitapa	Lote NOK	2	Multitapa abortada		

Multitapa:9 (K Beam 110)												
Resultados total de resultados dentro de lim est												
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NOK	Baixo	6,03	13/03/2020	08:45:22	32111052	9	Multitapa	Lote NOK	2	Gatillo solto : Multitapa abortada		
NOK	Baixo	5,21	13/03/2020	09:07:44	32111052	9	Multitapa	Lote NOK	2	Gatillo solto : Multitapa abortada		
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NOK	Baixo	62,61	13/03/2020	13:57:34	32111052	9	Multitapa	Lote NOK	2	Gatillo solto : Multitapa abortada		
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NOK	Baixo	6,09	13/03/2020	14:38:22	32111052	9	Multitapa	Lote NOK	2	Gatillo solto : Multitapa abortada		
NOK	Baixo	6,61	16/03/2020	08:10:06	32111052	9	Multitapa	Lote NOK	2	Gatillo solto : Multitapa abortada		
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OK	OK	22,05	OK	20	0	OK	38	17/03/2020	15:31:46	2	32111053	568773	F0400735	Não usado	7	Bin / Mon	5601	1125	0	Lote NOK	Aperto	3	1446	
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OK	OK	22,23	OK	34	0	OK	46	17/03/2020	15:38:42	3	32111053	569152	F0400735	Não usado	7	Bin / Mon	5617	1130	0	Lote OK	Aperto	3	1450	
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OK	OK	22,12	OK	19	0	OK	27	17/03/2020	15:46:21	2	32111053	571428	F0400735	Não usado	7	Bin / Mon	5630	1132	0	Lote NOK	Aperto	3	1454	
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OK	OK	22,21	OK	22	0	OK	37	17/03/2020	15:53:47	2	32111053	569654	F0400735	Não usado	7	Bin / Mon	5644	1135	0	Lote NOK	Aperto	3	1458	
NOK	OK	20,11	Alto	47	0	OK	45	17/03/2020	15:53:51	2	32111053	569654	F0400735	Não usado	7	Bin / Mon	5645	1136	0	Lote NOK	Aperto	3	1458	Angulo alto : Bin menor que objetivo
OK	OK	22,12	OK	19	0	OK	22	17/03/2020	15:53:54	3	32111053	569654	F0400735	Não usado	7	Bin / Mon	5646	1137	0	Lote OK	Aperto	3	1458	
OK	OK	22,09	OK	15	0	OK	25	17/03/2020	16:00:57	1	32111053	567714	F0400735	Não usado	7	Bin / Mon	5658	1138	0	Lote NOK	Aperto	3	1462	
OK	OK	22,2	OK	24	0	OK	35	17/03/2020	16:01:01	2	32111053	567714	F0400735	Não usado	7	Bin / Mon	5659	1139	0	Lote NOK	Aperto	3	1462	
NOK	OK	19,85	Alto	46	0	OK	45	17/03/2020	16:01:04	2	32111053	567714	F0400735	Não usado	7	Bin / Mon	5660	1140	0	Lote NOK	Aperto	3	1462	Angulo alto : Bin menor que objetivo
OK	OK	22,12	OK	33	0	OK	21	17/03/2020	16:01:08	3	32111053	567714	F0400735	Não usado	7	Bin / Mon	5661	1141	0	Lote OK	Aperto	3	1462	
OK	OK	22,11	OK	15	0	OK	22	17/03/2020	16:08:37	1	32111053	571427	F0400735	Não usado	7	Bin / Mon	5673	1142	0	Lote NOK	Aperto	3	1466	
OK	OK	22,13	OK	20	0	OK	26	17/03/2020	16:08:41	2	32111053	571427	F0400735	Não usado	7	Bin / Mon	5674	1143	0	Lote NOK	Aperto	3	1466	
NOK	OK	20,98	Alto	47	0	OK	37	17/03/2020	16:08:45	2	32111053	571427	F0400735	Não usado	7	Bin / Mon	5675	1144	0	Lote NOK	Aperto	3	1466	Angulo alto : Bin menor que objetivo
OK	OK	22,13	OK	16	0	OK	21	17/03/2020	16:08:48	3	32111053	571427	F0400735	Não usado	7	Bin / Mon	5676	1145	0	Lote OK	Aperto	3	1466	



# Next steps after business validation



- Predict in real-time for a specific tool
- Save the information for each rotation in the bolt for a specific tool