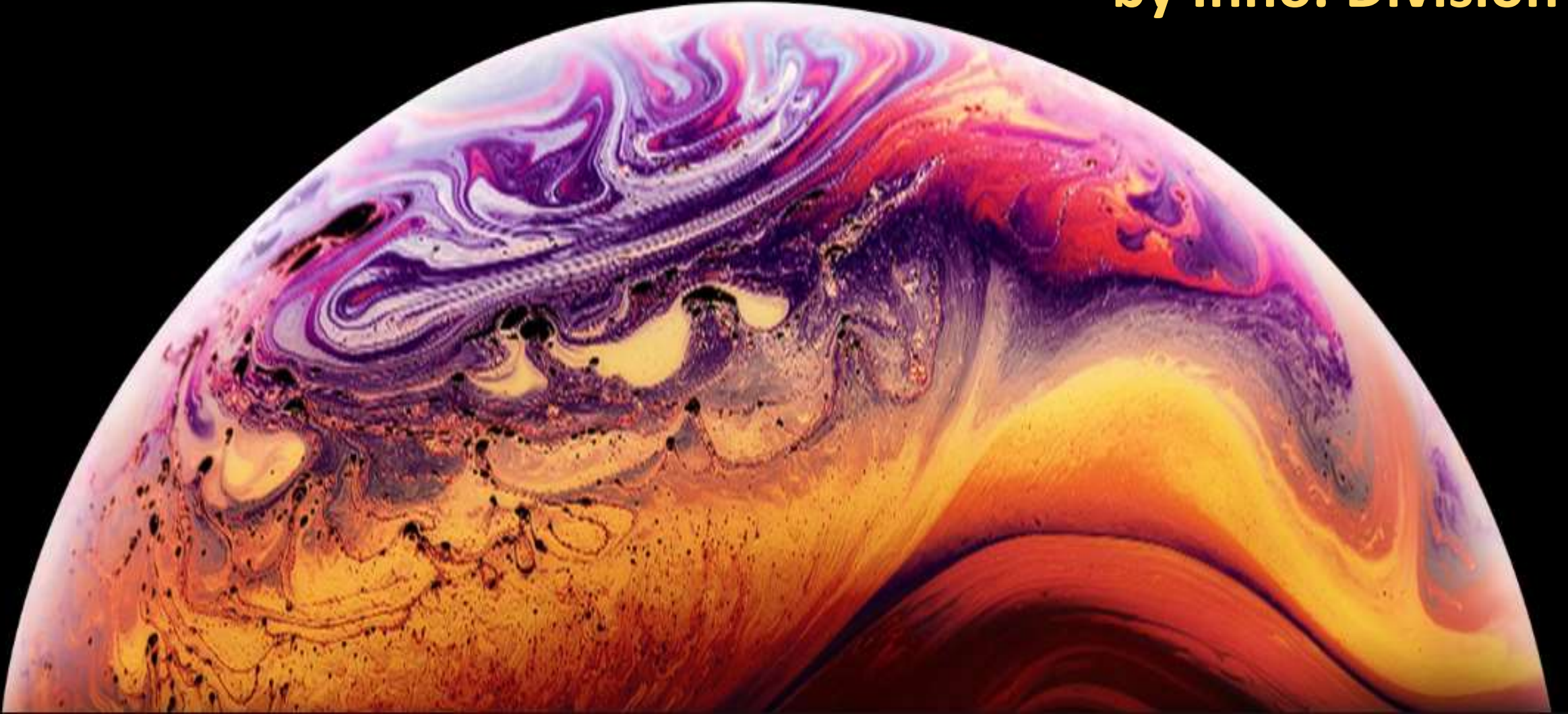


Ai-Sensor project

by Inno. Division



AGENDA

- **Background**
- **Proof of Concept (POC)**
- **Prototype Model**
- **Next Step**

Background: RVP

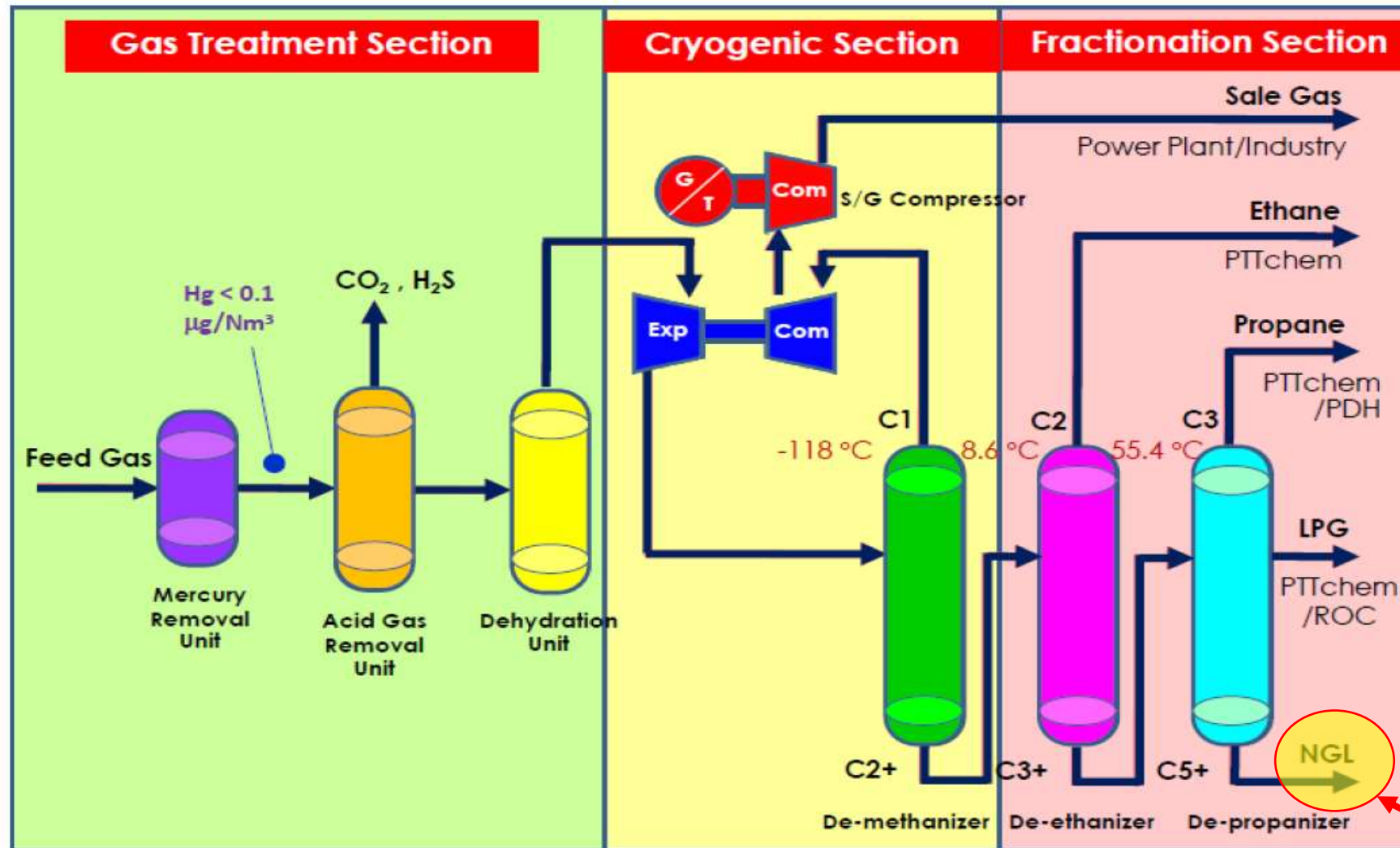


Fig. 1 ภาพรวม Process ของโรงแยกก๊าซธรรมชาติ

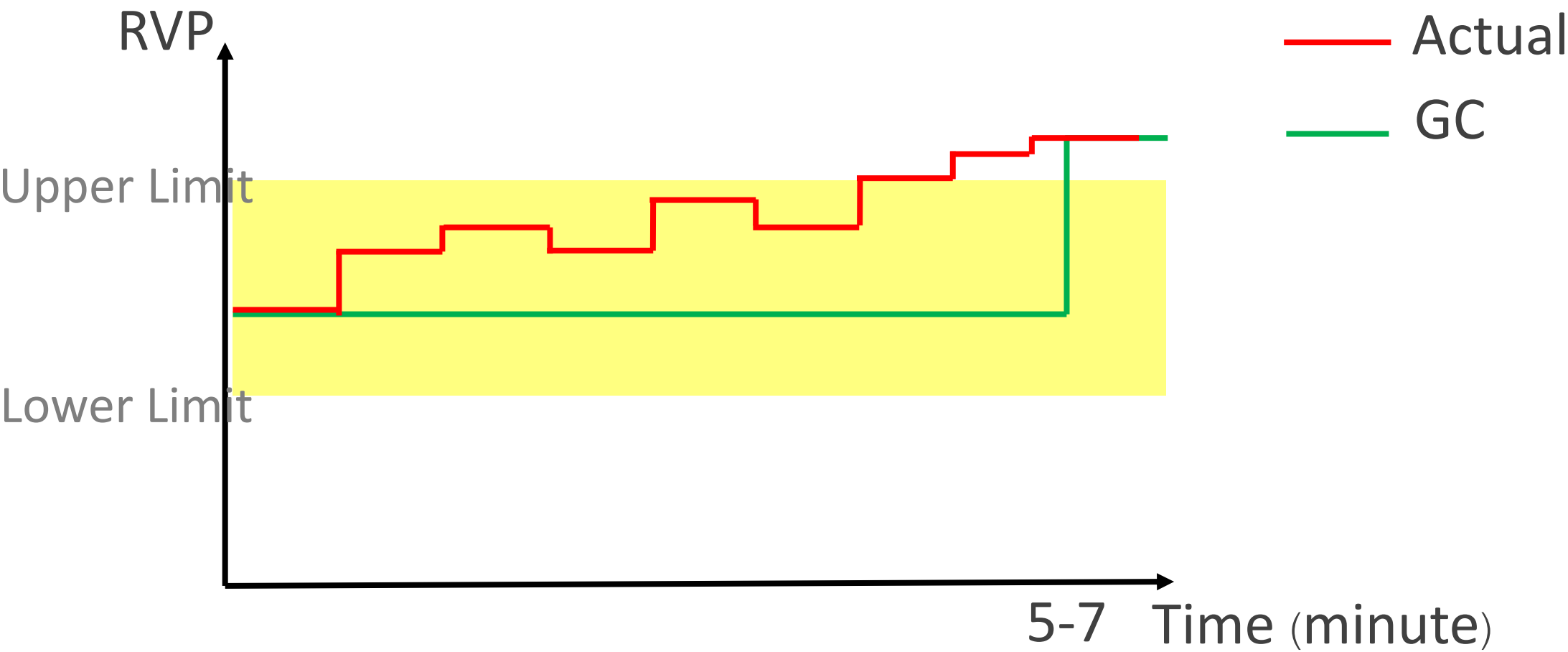
The spec. of NGL is control by RVP (Reid Vapor Pressure) spec.

Background: On-Line RVP Analyzer



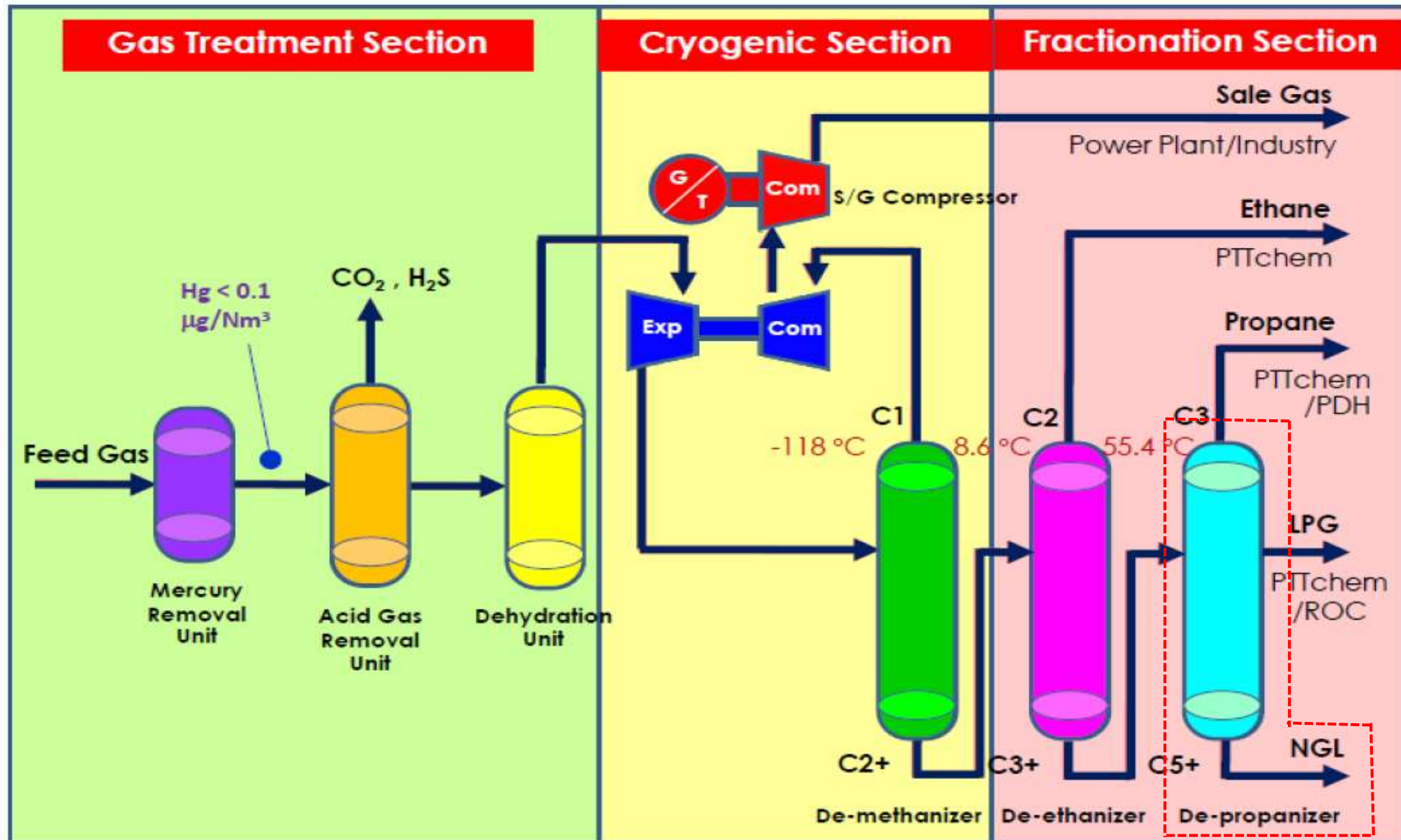
This device is used in the plant to online measure the RVP value for NGL. The interval of measurement is 5-7 minute/time.

Background: Pain Point

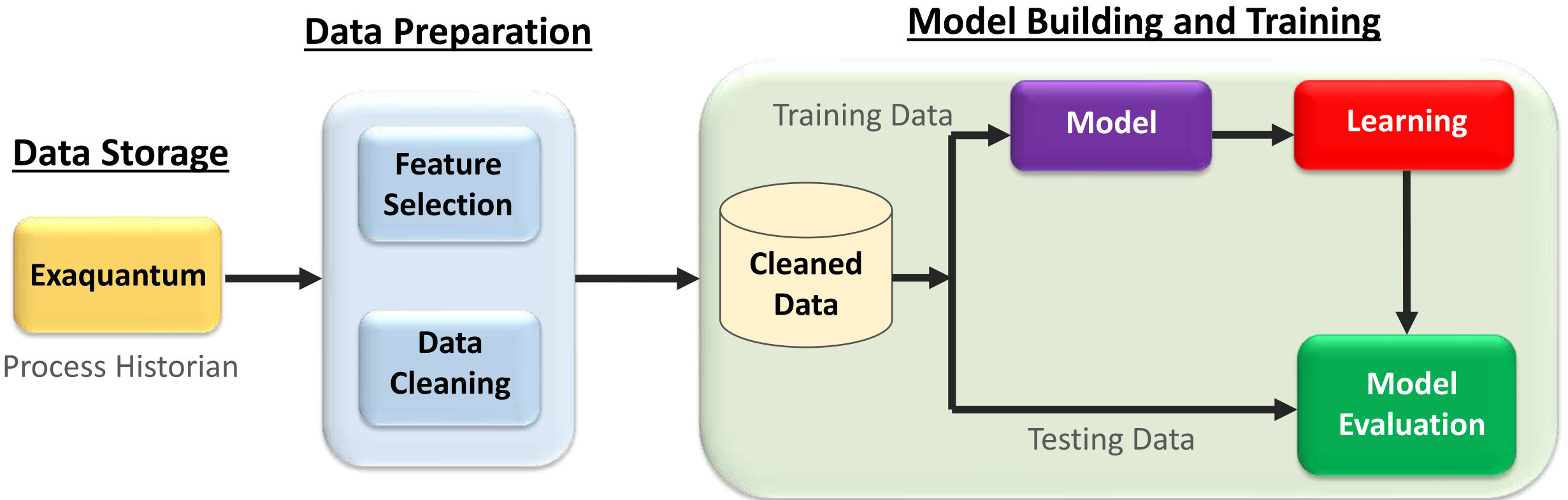


The wide interval time of measurement can lead to mis-operation issue.

Scope of Work

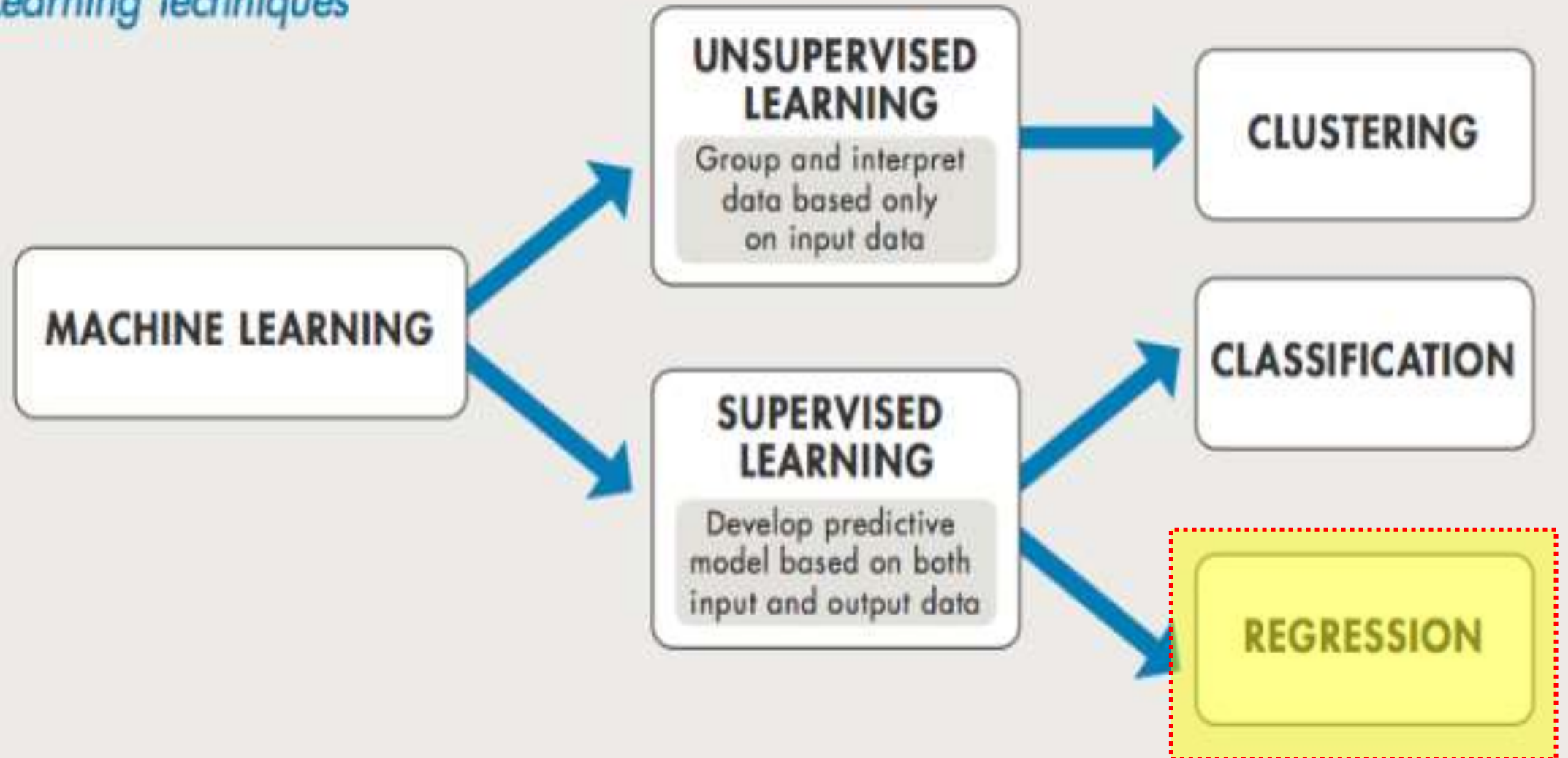


Concept

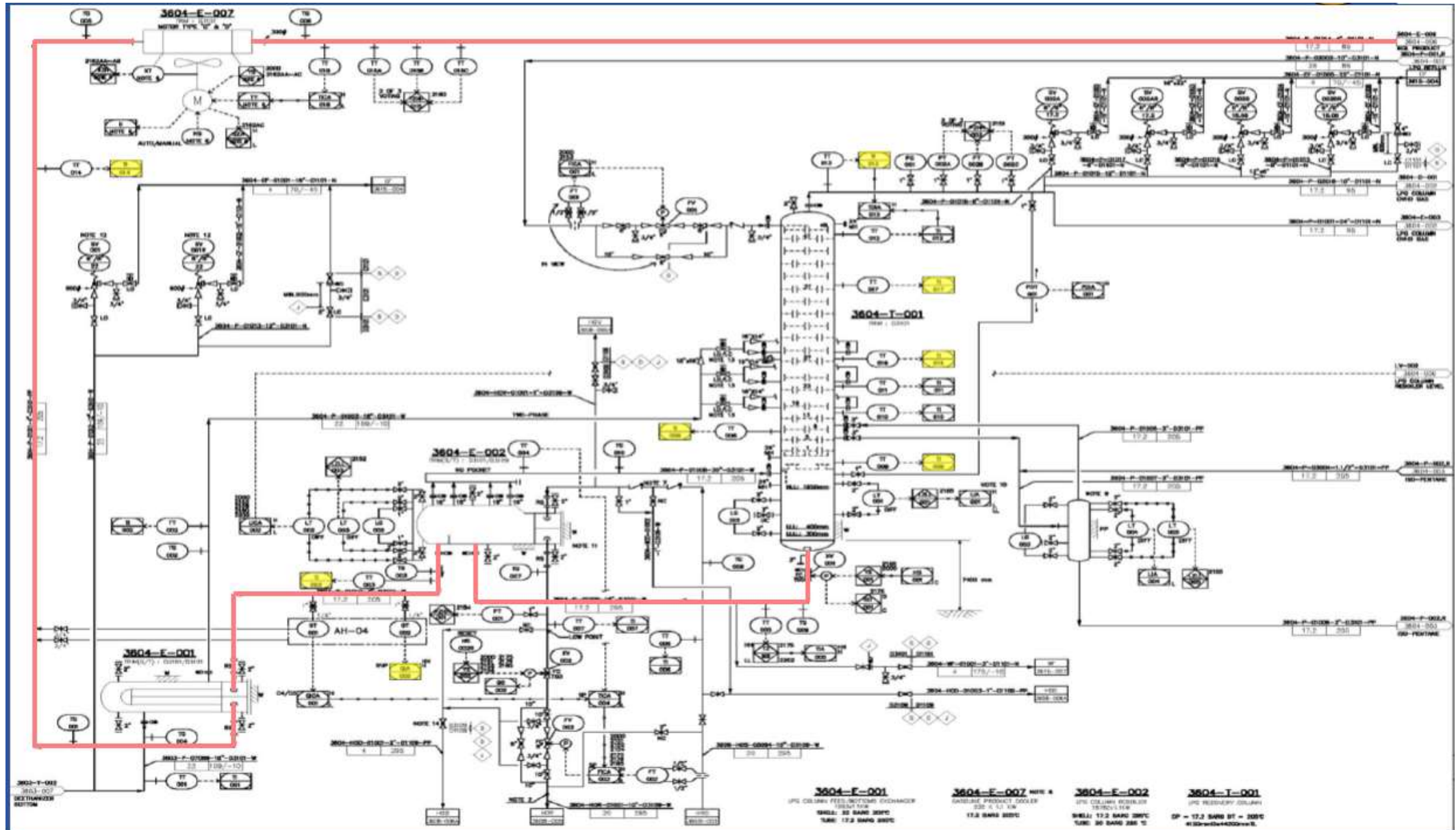


Proof of Concept

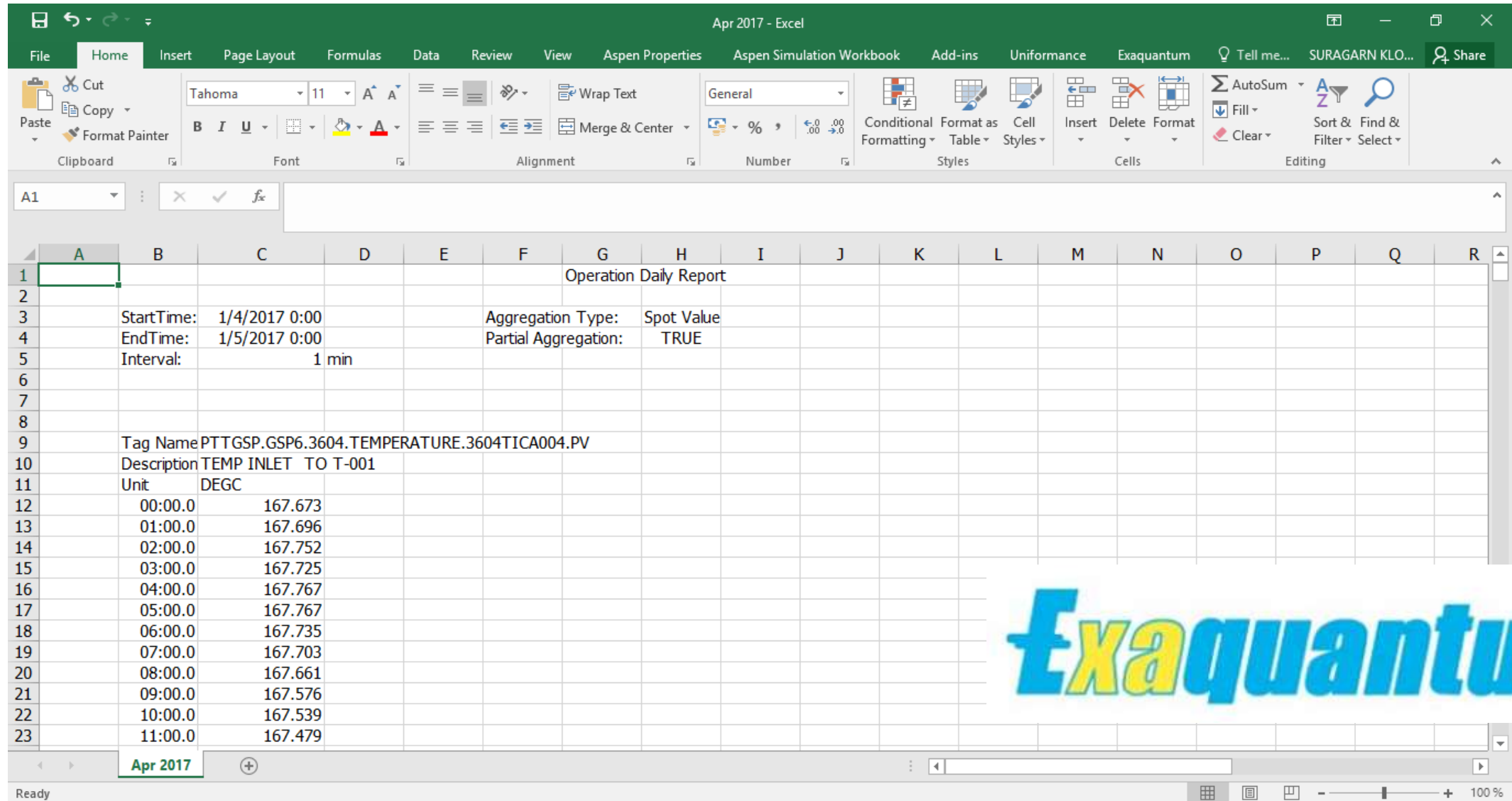
Machine Learning Techniques



Proof of Concept



Proof of Concept



Apr 2017 - Excel

File Home Insert Page Layout Formulas Data Review View Aspen Properties Aspen Simulation Workbook Add-ins Uniformance Exaquantum Tell me... SURAGARN KLO... Share

Clipboard Font Alignment Number Styles Cells Editing

Operation Daily Report

StartTime: 1/4/2017 0:00
EndTime: 1/5/2017 0:00
Interval: 1 min

Aggregation Type: Spot Value
Partial Aggregation: TRUE

Tag Name PTTGSP.GSP6.3604.TEMPERATURE.3604TICA004.PV
Description TEMP INLET TO T-001
Unit DEGC

00:00.0	167.673
01:00.0	167.696
02:00.0	167.752
03:00.0	167.725
04:00.0	167.767
05:00.0	167.767
06:00.0	167.735
07:00.0	167.703
08:00.0	167.661
09:00.0	167.576
10:00.0	167.539
11:00.0	167.479

Apr 2017

Ready

Exaquantum

Data Extraction via Exaquantum: Each Tag per file & 1 min Interval for 1 month as CSV

Proof of Concept

Book1 - Excel

File Home Insert Page Layout Formulas Data Review View Aspen Properties Aspen Simulation Workbook Add-ins Uniformance Exaquantur

Clipboard Font Alignment Number Styles Cells

R12

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1														
2	Tag Name	FI051B	FICA012	PIA010	TI049	TIA052	TI002	TI008	TI005	TICA004	RVP			
3	1/4/2017 0:00	774.098	363.151	27.664	96.464	9.634	67.916	140.951	156.555	167.673	13.006			
4	1/4/2017 0:01	775.396	360.066	27.666	96.413	9.642	67.939	140.952	156.555	167.696	13.006			
5	1/4/2017 0:02	779.987	358.613	27.674	96.393	9.706	67.966	141.004	156.647	167.752	13.007			
6	1/4/2017 0:03	779.176	356.178	27.682	96.368	9.72	68.01	141.044	156.665	167.725	13.007			
7	1/4/2017 0:04	780.482	357.494	27.686	96.359	9.73	68.032	141.05	156.702	167.767	13.006			
8	1/4/2017 0:05	782.353	358.434	27.683	96.375	9.778	68.077	141.095	156.757	167.767	13.006			
9	1/4/2017 0:06	786.882	364.757	27.677	96.387	9.819	68.099	141.114	156.683	167.735	13.084			
10	1/4/2017 0:07	786.834	363.586	27.673	96.431	9.839	68.094	141.094	156.702	167.703	13.082			
11	1/4/2017 0:08	782.987	356.11	27.666	96.479	9.865	68.123	141.099	156.702	167.661	13.083			
12	1/4/2017 0:09	784.12	358.947	27.671	96.509	9.906	68.121	141.079	156.683	167.576	13.083			
13	1/4/2017 0:10	781.944	365.287	27.667	96.555	9.918	68.101	141.097	156.683	167.539	13.083			
14	1/4/2017 0:11	780.727	370.226	27.667	96.559	9.924	68.101	141.062	156.628	167.479	13.083			
15	1/4/2017 0:12	785.053	357.067	27.672	96.614	9.937	68.1	141.064	156.61	167.488	13.006			
16	1/4/2017 0:13	789.303	362.852	27.672	96.591	9.944	68.083	141.025	156.573	167.397	13.005			
17	1/4/2017 0:14	787.185	367.782	27.672	96.587	9.972	68.032	141.022	156.573	167.355	13.006			
18	1/4/2017 0:15	786.944	370.115	27.68	96.57	9.949	68.03	141.033	156.537	167.293	13.006			
19	1/4/2017 0:16	778.613	361.271	27.686	96.518	9.926	67.997	141.01	156.519	167.254	13.006			
20	1/4/2017 0:17	781.881	361.074	27.689	96.496	9.97	67.984	141.003	156.464	167.22	13.006			
21	1/4/2017 0:18	785.119	366.176	27.699	96.473	9.948	68.006	141.031	156.464	167.162	13.027			
22	1/4/2017 0:19	788.459	372.729	27.703	96.481	9.982	68.022	141.031	156.409	167.103	13.028			
23	1/4/2017 0:20	791.918	373.857	27.711	96.47	9.936	68.029	141.012	156.372	167.034	13.027			

Sheet1

Ready

- 9 Feature
- 1 Target
- 30 Days Period
- 430,000 Cells of Data



Proof of Concept

Microsoft Azure Machine Learning Studio (classic)

SURAGARN KLOMKAO-Fr...

GSP6 RVP

Finished running ✓

Properties Project

Experiment Properties

START TIME 8/4/202...

END TIME 8/4/202...

STATUS CODE Finished

STATUS DETAILS None

Prior Run

Summary

Enter a few sentences describing your experiment (up to 140)

Decision Forest

Boosted Decision Tree

Neural Network

Metrics

Mean Absolute Error	Root Mean Squared Error	Relative Absolute Error	Relative Squared Error	Coefficient of Determination
0.083197	0.112994	0.388169	0.192059	0.807941

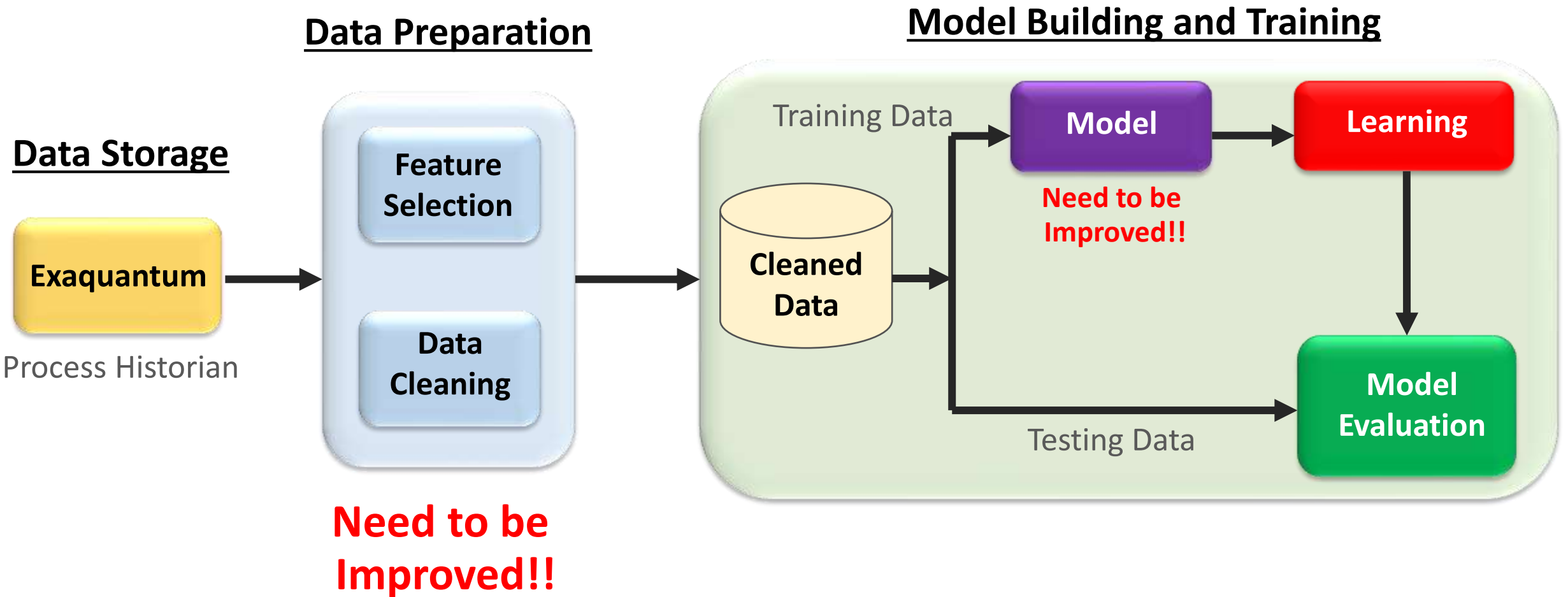
Metrics

Mean Absolute Error	0.089778
Root Mean Squared Error	0.118103
Relative Absolute Error	0.418872
Relative Squared Error	0.209819
Coefficient of Determination	0.790181

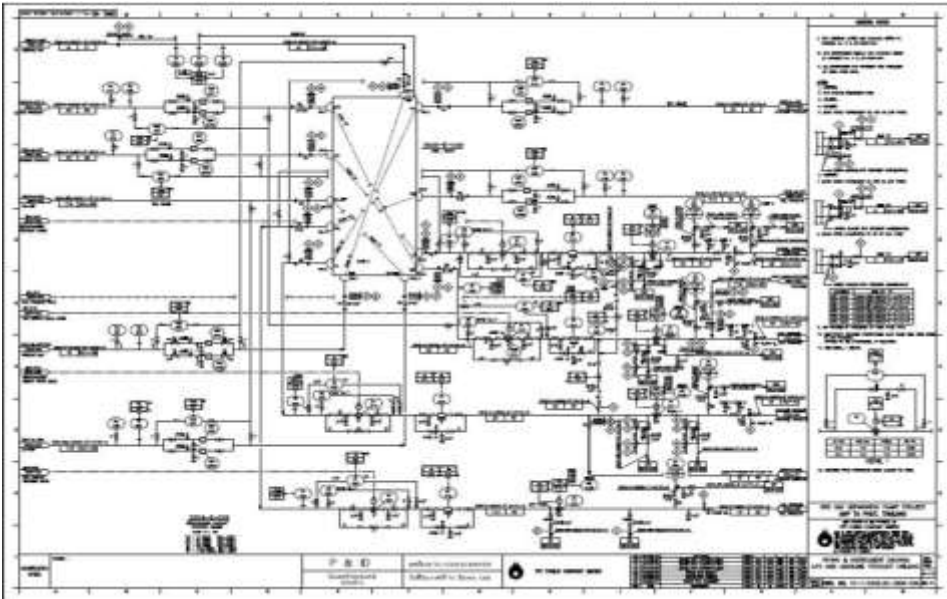
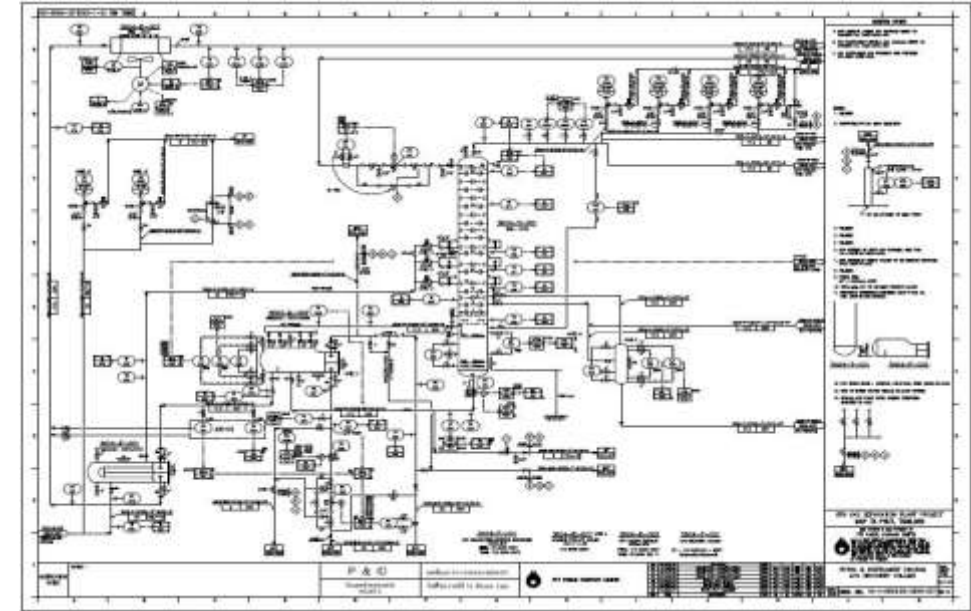
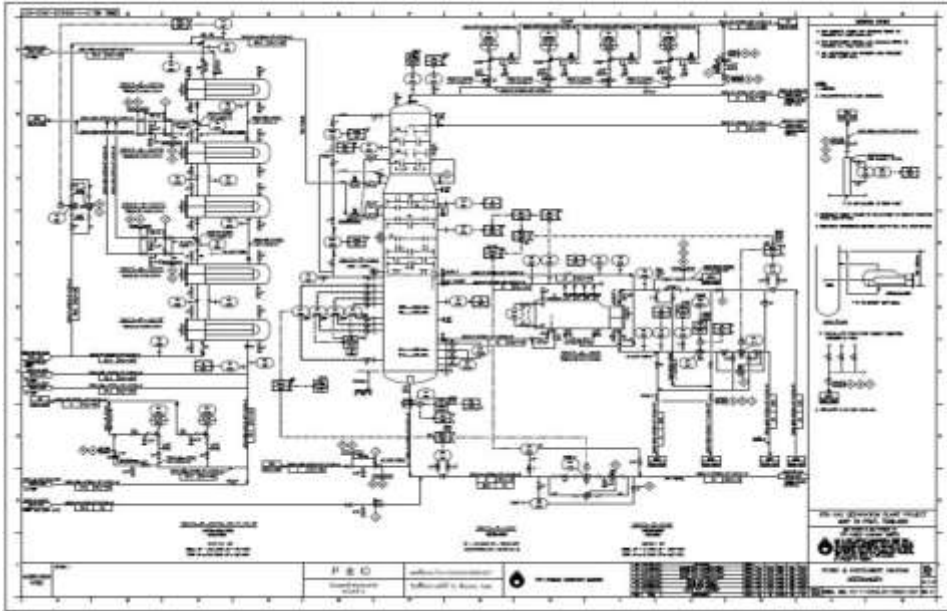
Metrics

Mean Absolute Error	0.120323
Root Mean Squared Error	0.160135
Relative Absolute Error	0.561386
Relative Squared Error	0.385739
Coefficient of Determination	0.614261

Concept

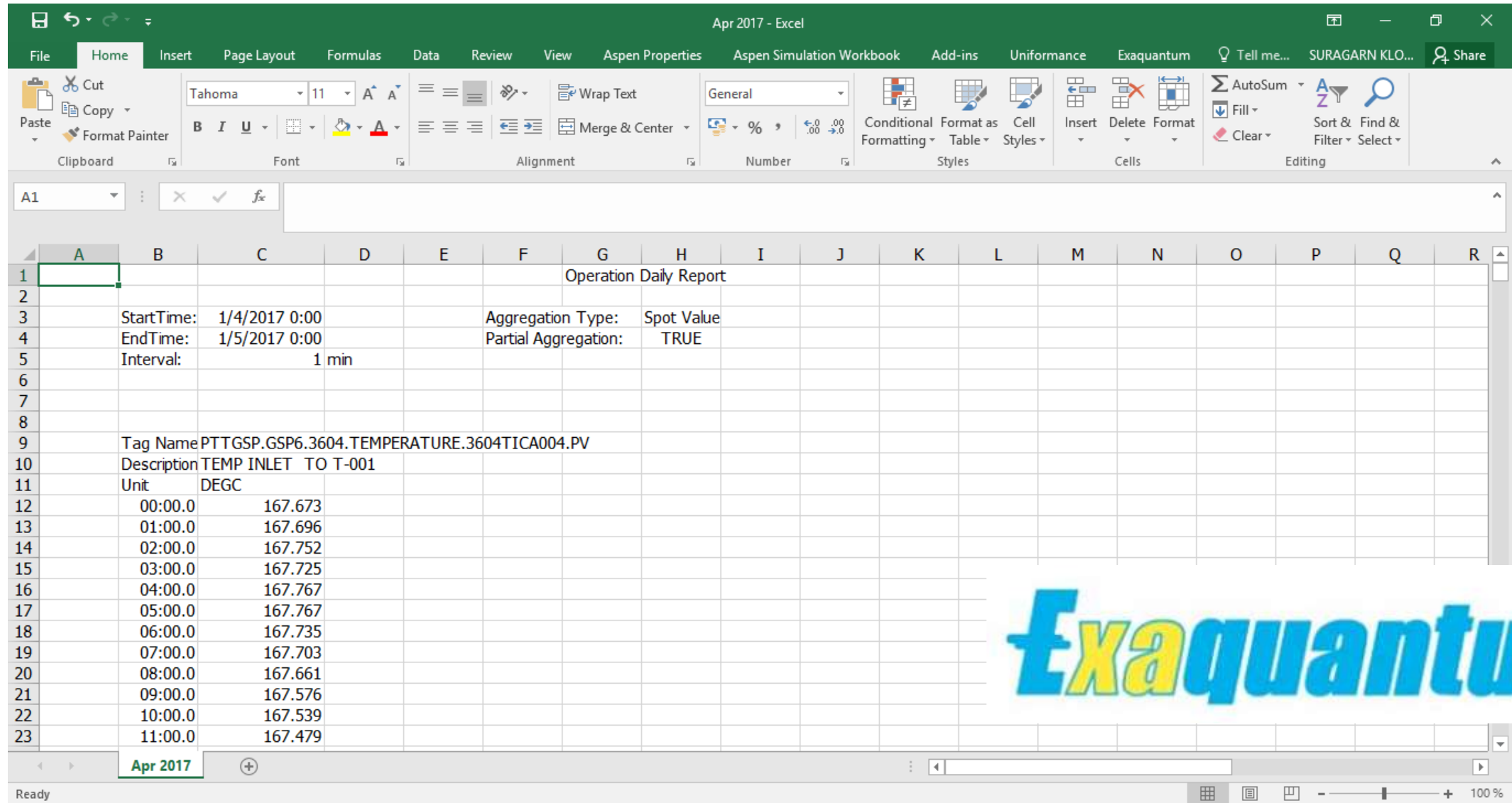


Data Preparation: Feature Selection



- **Feed Inlet**
- **DeEthanizer Column**
- **LPG Recovery Column**
- **NGL Product to Storage**

Data Preparation: Pack Data



Apr 2017 - Excel

File Home Insert Page Layout Formulas Data Review View Aspen Properties Aspen Simulation Workbook Add-ins Uniformance Exaquantum Tell me... SURAGARN KLO... Share

Clipboard Font Alignment Number Styles Cells Editing

Operation Daily Report

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1																		
2																		
3		StartTime:	1/4/2017 0:00			Aggregation Type:	Spot Value											
4		EndTime:	1/5/2017 0:00			Partial Aggregation:	TRUE											
5		Interval:	1 min															
6																		
7																		
8																		
9		Tag Name	PTTGSP.GSP6.3604.TEMPERATURE.3604TICA004.PV															
10		Description	TEMP INLET TO T-001															
11		Unit	DEGC															
12		00:00.0	167.673															
13		01:00.0	167.696															
14		02:00.0	167.752															
15		03:00.0	167.725															
16		04:00.0	167.767															
17		05:00.0	167.767															
18		06:00.0	167.735															
19		07:00.0	167.703															
20		08:00.0	167.661															
21		09:00.0	167.576															
22		10:00.0	167.539															
23		11:00.0	167.479															

Apr 2017

Ready

Exaquantum

Data Extraction via Exaquantum: Each Tag per file & 1 min Interval for 2.5 Years as CSV

Data Preparation: Pack Data

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\550335> .\sqlite3 -header -csv D:/AiSensor/GSP6Ready/GSP6Pack.db -SELECT RVP.dt as dt, RVP.Value as RVP, FT051B.Value as FT051B, Q1051A.Value as Q1051A, Q1051B.Value as Q1051B, Q1051C.Value as Q1051C, Q1051D.Value as Q1051D, Q1051E.Value as Q1051E, Q1051F.Value as Q1051F, Q1051G.Value as Q1051G, Q1051H.Value as Q1051H, Q1051I.Value as Q1051I, Q1051J.Value as Q1051J, Q1051K.Value as Q1051K, FICA012.Value as FICA012, PIA010.Value as PIA010, TI049.Value as TI049, TIA052.Value as TIA052, FICA002.Value as FICA002, PDIA001.Value as PDIA001, PT002B.Value as PT002B, TI001.Value as TI001, TI002.Value as TI002, TI003.Value as TI003, TIA005.Value as TIA005, TI006.Value as TI006, TI007.Value as TI007, TI008.Value as TI008, TI009.Value as TI009, TI010.Value as TI010, TI011.Value as TI011, TI012.Value as TI012, TI013.Value as TI013, TI016.Value as TI016, TI017.Value as TI017, TICA004.Value as TICA004 FROM RVP LEFT JOIN FT051B ON RVP.dt = FT051B.dt LEFT JOIN Q1051A ON RVP.dt = Q1051A.dt LEFT JOIN Q1051B ON RVP.dt = Q1051B.dt LEFT JOIN Q1051C ON RVP.dt = Q1051C.dt LEFT JOIN Q1051D ON RVP.dt = Q1051D.dt LEFT JOIN Q1051E ON RVP.dt = Q1051E.dt LEFT JOIN Q1051F ON RVP.dt = Q1051F.dt LEFT JOIN Q1051G ON RVP.dt = Q1051G.dt LEFT JOIN Q1051H ON RVP.dt = Q1051H.dt LEFT JOIN Q1051I ON RVP.dt = Q1051I.dt LEFT JOIN Q1051J ON RVP.dt = Q1051J.dt LEFT JOIN Q1051K ON RVP.dt = Q1051K.dt LEFT JOIN FICA012 ON RVP.dt = FICA012.dt LEFT JOIN PIA010 ON RVP.dt = PIA010.dt LEFT JOIN TI049 ON RVP.dt = TI049.dt LEFT JOIN TIA052 ON RVP.dt = TIA052.dt LEFT JOIN FICA002 ON RVP.dt = FICA002.dt LEFT JOIN PDIA001 ON RVP.dt = PDIA001.dt LEFT JOIN PT002B ON RVP.dt = PT002B.dt LEFT JOIN TI001 ON RVP.dt = TI001.dt LEFT JOIN TI002 ON RVP.dt = TI002.dt LEFT JOIN TI003 ON RVP.dt = TI003.dt LEFT JOIN TIA005 ON RVP.dt = TIA005.dt LEFT JOIN TI006 ON RVP.dt = TI006.dt LEFT JOIN TI007 ON RVP.dt = TI007.dt LEFT JOIN TI008 ON RVP.dt = TI008.dt LEFT JOIN TI009 ON RVP.dt = TI009.dt LEFT JOIN TI010 ON RVP.dt = TI010.dt LEFT JOIN TI011 ON RVP.dt = TI011.dt LEFT JOIN TI012 ON RVP.dt = TI012.dt LEFT JOIN TI013 ON RVP.dt = TI013.dt LEFT JOIN TI016 ON RVP.dt = TI016.dt LEFT JOIN TI017 ON RVP.dt = TI017.dt LEFT JOIN TICA004 ON RVP.dt = TICA004.dt" > GSP6.csv
>>
```



Pack Data to only 1 file and via PowerShell

Data Preparation: Pack Data

Jan 2017 - Excel (Product Activation Failed)

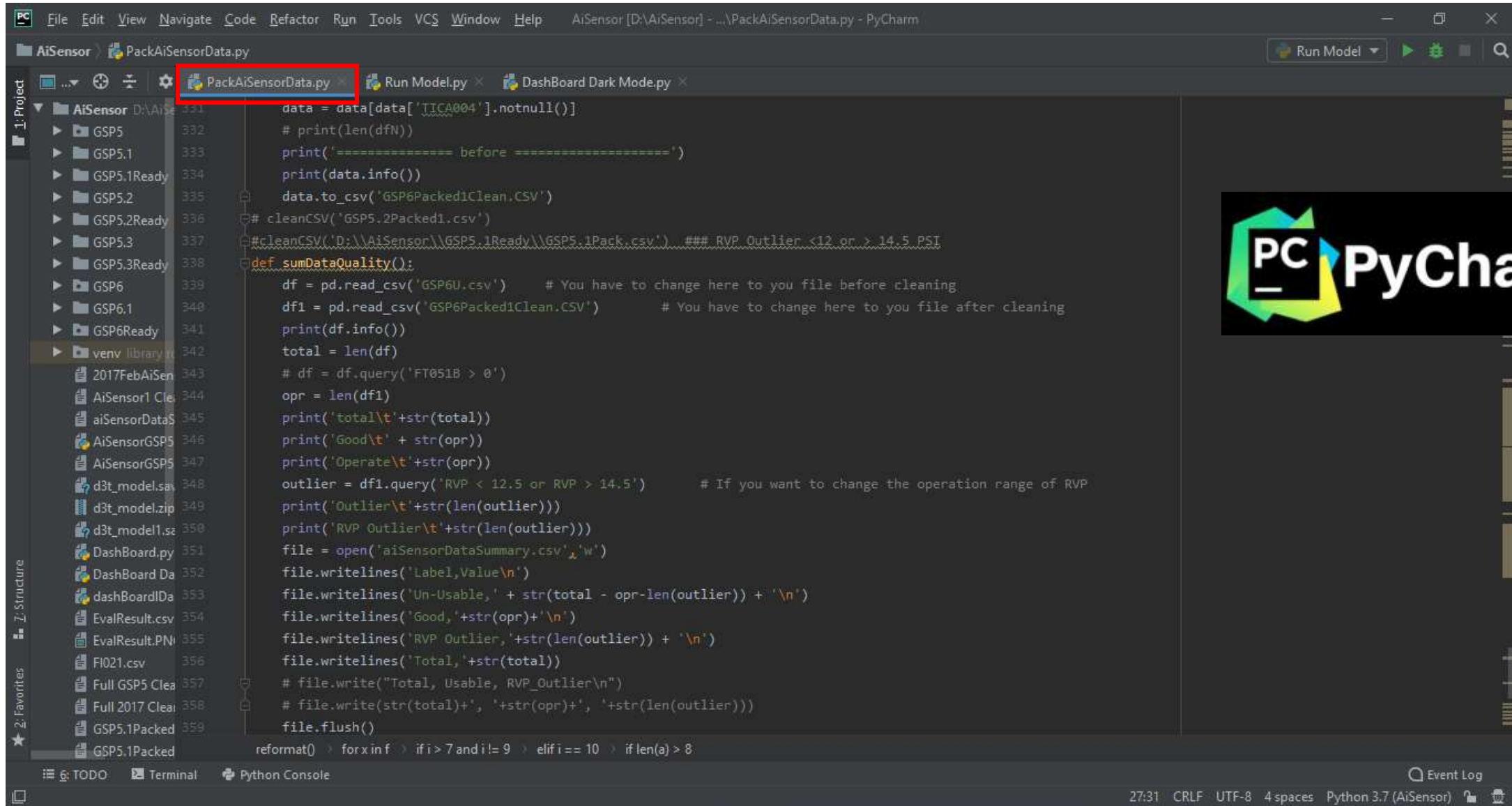
FileHomeInsertPage LayoutFormulasDataReviewViewAspen PropertiesAspen Simulation WorkbookAdd-insExaquantumTell me...SURAGARN KLOMKAOShare

A1


Tag Name

Tag Name	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G	PTTGSP.G
1/1/2017 0:00	137.245	65.232	7.848	4.55	0.192	18.393	0.041	1.011	0.199	1.071	1.136	0.326	0.001	80.684	83.951	584.266	86.451	75.723	162.781	156.845	168.73	80.558	79.334	55.787	24			
1/1/2017 0:01	136.53	65.232	7.848	4.55	0.192	18.393	0.041	1.011	0.199	1.071	1.136	0.326	0.001	80.704	83.951	584.606	86.413	75.079	162.792	156.848	168.743	80.566	79.311	55.573	24			
1/1/2017 0:02	135.899	65.232	7.848	4.55	0.192	18.393	0.041	1.011	0.199	1.071	1.136	0.326	0.001	80.696	84.01	584.18	86.445	75.627	162.808	156.864	168.747	80.559	79.3	55.663	24			
1/1/2017 0:03	137.17	65.132	7.859	4.55	0.19	18.473	0.043	1.015	0.188	1.098	1.138	0.315	0.001	80.697	84.01	584.773	86.411	75.26	162.838	156.832	168.731	80.544	79.306	55.442	24			
1/1/2017 0:04	137.287	65.132	7.859	4.55	0.19	18.473	0.043	1.015	0.188	1.098	1.138	0.315	0.001	80.669	84.01	584.022	86.411	74.546	162.819	156.826	168.729	80.511	79.193	55.266	24			
1/1/2017 0:05	135.829	65.132	7.859	4.55	0.19	18.473	0.043	1.015	0.188	1.098	1.138	0.315	0.001	80.64	83.956	584.549	86.454	74.687	162.845	156.81	168.709	80.475	79.227	55.292	24			
1/1/2017 0:06	137.516	65.132	7.859	4.55	0.19	18.473	0.043	1.015	0.188	1.098	1.138	0.315	0.001	80.605	84.005	585.859	86.454	74.274	162.879	156.825	168.711	80.434	79.216	55.227	24			
1/1/2017 0:07	137.665	65.179	7.88	4.553	0.191	18.417	0.039	1.012	0.185	1.105	1.13	0.308	0.001	80.569	84.005	584.511	86.494	74.49	162.817	156.811	168.716	80.383	79.157	55.128	24			
1/1/2017 0:08	137.637	65.179	7.88	4.553	0.191	18.417	0.039	1.012	0.185	1.105	1.13	0.308	0.001	80.527	84.005	584.427	86.494	74.205	162.861	156.8	168.71	80.321	79.091	55.171	24			
1/1/2017 0:09	137.646	65.179	7.88	4.553	0.191	18.417	0.039	1.012	0.185	1.105	1.13	0.308	0.001	80.463	84.005	585.344	86.531	74.225	162.867	156.816	168.729	80.268	79.051	54.97	24			
1/1/2017 0:10	137.788	65.179	7.88	4.553	0.191	18.417	0.039	1.012	0.185	1.105	1.13	0.308	0.001	80.421	84.005	584.08	86.531	74.075	162.85	156.819	168.726	80.209	78.98	54.896	24			
1/1/2017 0:11	136.497	65.287	7.843	4.524	0.19	18.412	0.037	1.009	0.185	1.077	1.132	0.304	0.001	80.366	84.061	584.938	86.559	74.43	162.88	156.804	168.746	80.15	78.96	54.95	24			
1/1/2017 0:12	137.862	65.287	7.843	4.524	0.19	18.412	0.037	1.009	0.185	1.077	1.132	0.304	0.001	80.307	84.061	584.737	86.559	74.269	162.891	156.829	168.779	80.094	78.886	54.964	24			
1/1/2017 0:13	139.744	65.287	7.843	4.524	0.19	18.412	0.037	1.009	0.185	1.077	1.132	0.304	0.001	80.264	84.101	584.039	86.525	74.084	162.924	156.818	168.787	80.058	78.839	54.731	24			
1/1/2017 0:14	137.731	65.287	7.843	4.524	0.19	18.412	0.037	1.009	0.185	1.077	1.132	0.304	0.001	80.231	84.022	583.501	86.525	74.312	162.944	156.826	168.822	80.016	78.833	54.693	24			
1/1/2017 0:15	137.439	65.274	7.878	4.57	0.194	18.365	0.038	1.018	0.181	1.055	1.14	0.286	0.001	80.154	84.136	584.657	86.525	74.281	163.037	156.842	168.83	79.989	78.803	54.662	24			
1/1/2017 0:16	137.694	65.274	7.878	4.57	0.194	18.365	0.038	1.018	0.181	1.055	1.14	0.286	0.001	80.168	84.136	583.939	86.525	73.523	163.054	156.859	168.872	79.941	78.79	54.585	24			
1/1/2017 0:17	138.696	65.274	7.878	4.57	0.194	18.365	0.038	1.018	0.181	1.055	1.14	0.286	0.001	80.15	84.175	584.962	86.525	73.706	163.062	156.861	168.879	79.928	78.769	54.486	24			
1/1/2017 0:18	138.918	65.274	7.878	4.57	0.194	18.365	0.038	1.018	0.181	1.055	1.14	0.286	0.001	80.124	84.142	584.49	86.454	74.379	163.051	156.852	168.932	79.907	78.732	54.409	24			
1/1/2017 0:19	137.01	65.251	7.944	4.534	0.199	18.343	0.043	1.02	0.181	1.052	1.14	0.293	0.001	80.088	84.142	586.306	86.454	73.742	163.038	156.837	168.943	79.86	78.727	54.271	24			
1/1/2017 0:20	137.925	65.251	7.944	4.534	0.199	18.343	0.043	1.02	0.181	1.052	1.14	0.293	0.001	80.061	84.142	585.923	86.415	73.34	163.035	156.824	168.946	79.828	78.687	53.978	24			
1/1/2017 0:21	137.557	65.251	7.944	4.534	0.199	18.343	0.043	1.02	0.181	1.052	1.14	0.293	0.001	80.026	84.142	586.248	86.415	73.12	163.044	156.799	168.961	79.809	78.661	53.825	24			
1/1/2017 0:22	138.347	65.251	7.944	4.534	0.199	18.343	0.043	1.02	0.181	1.052	1.14	0.293	0.001	79.985	84.142	586.684	86.415	73.336	163.02	156.754	168.946	79.738	78.677	53.501	24			
1/1/2017 0:23	137.343	65.221	7.874	4.57	0.195	18.334	0.04	1.017	0.211	1.062	1.14	0.336	0.001	79.954	84.105	585.879	86.441	73.257	163.009	156.725	168.959	79.691	78.644	52.911	24			
1/1/2017 0:24	137.325	65.221	7.874	4.57	0.195	18.334	0.04	1.017	0.211	1.062	1.14	0.336	0.001	79.892	84.134	585.248	86.478	73.43	163.033	156.677	168.925	79.622	78.624	52.354	24			
1/1/2017 0:25	137.482	65.221	7.874	4.57	0.195	18.334	0.04	1.017	0.211	1.062	1.14	0.336	0.001	79.842	84.134	584.707	86.519	73.293	162.999	156.654	168.933	79.546	78.613	51.878	24			
1/1/2017 0:26	136.562	65.221	7.874	4.57	0.195	18.334	0.04	1.017	0.211	1.062	1.14	0.336	0.001	79.783	84.134	585.29	86.519	73.502	163.097	156.631	168.872	79.491	78.607	51.706	24			
1/1/2017 0:27	137.369	65.316	7.878	4.561	0.195	18.318	0.037	1.016	0.18	1.083	1.127	0.29	0.001	79.764	84.134	585.217	86.519	73.623	163.073	156.604	168.869	79.475	78.627	51.831	24			
1/1/2017 0:28	137.813	65.316	7.878	4.561	0.195	18.318	0.037	1.016	0.18	1.083	1.127	0.29	0.001	79.717	84.134	584.911	86.558	73.711	163.09	156.616	168.869	79.456	78.642	52.315	24			
1/1/2017 0:29	136.843	65.316	7.878	4.561	0.195	18.318	0.037	1.016	0.18	1.083	1.127	0.29	0.001	79.716	84.196	584.628	86.494	73.791	163.16	156.625	168.914	79.498	78.647	52.691	24			
1/1/2017 0:30	137.986	65.316	7.878	4.561	0.195	18.318	0.037	1.016	0.18	1.083	1.127	0.29	0.001	79.73	84.196	584.873	86.457	74.224	163.236	156.645	168.961	79.549	78.669	53.065	24			
1/1/2017 0:31	136.718	65.328	7.859	4.553	0.194	18.308	0.034	1.035	0.179	1.078	1.143	0.289	0.001	79.753	84.231	585.602	86.381	73.761	163.275	156.669	169.008	79.604	78.724	53.748	24			
1/1/2017 0:32	137.353	65.328	7.859	4.553	0.194	18.308	0.034	1.035	0.179	1.078	1.143	0.289	0.001	79.818	84.265	586.216	86.381	74.385	163.233	156.681	169.06	79.671	78.744	54.15	24			
1/1/2017 0:33	137.736	65.328	7.859	4.553	0.194	18.308	0.034	1.035	0.179	1.078	1.143	0.289	0.001	79.855	84.265	587.426	86.318	73.932	163.288	156.713	169.143	79.711	78.766	54.304	24			
1/1/2017 0:34	137.144	65.328	7.859	4.553	0.194	18.308	0.034	1.035	0.179	1.078	1.143	0.289	0.001	79.912	84.265	5												

Data Preparation: Data Cleaning

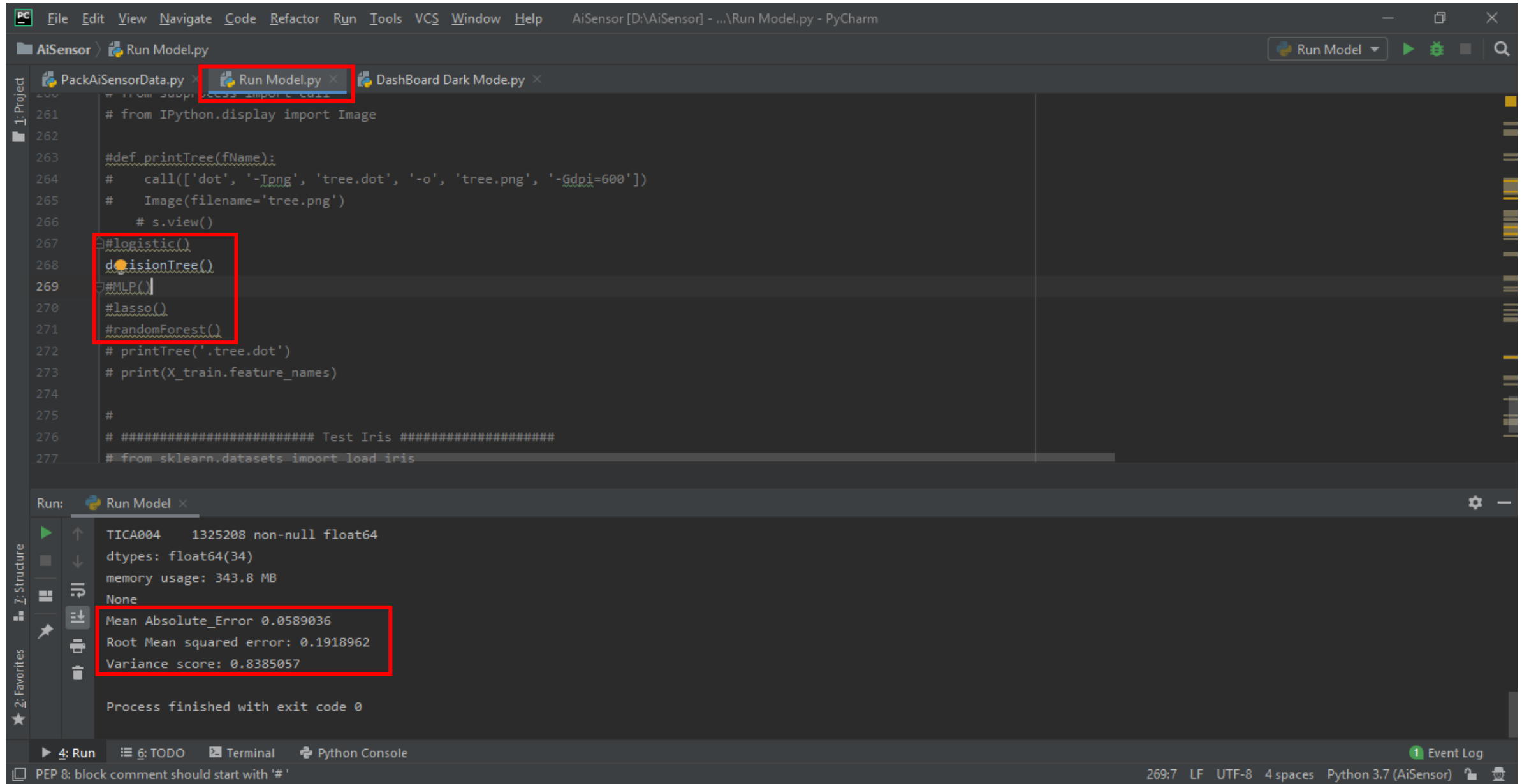


```
File Edit View Navigate Code Refactor Run Tools VCS Window Help AiSensor [D:\AiSensor] - ...\PackAiSensorData.py - PyCharm
PackAiSensorData.py Run Model.py Dashboard Dark Mode.py
1- Project
  AiSensor D:\AiSensor
    GSP5
    GSP5.1
    GSP5.1Ready
    GSP5.2
    GSP5.2Ready
    GSP5.3
    GSP5.3Ready
    GSP6
    GSP6.1
    GSP6Ready
    venv library
    2017FebAiSensor
    AiSensor1 Clean
    aiSensorDataSummary
    AiSensorGSP5
    AiSensorGSP5
    d3t_model.sav
    d3t_model.zip
    d3t_model1.sav
    Dashboard.py
    Dashboard Data
    dashboardData
    EvalResult.csv
    EvalResult.PNG
    FI021.csv
    Full GSP5 Clean
    Full 2017 Clean
    GSP5.1Packed
    GSP5.1Packed
2- Favorites
def sumDataQuality():
    data = data[data['TICA004'].notnull()]
    # print(len(df))
    print('===== before =====')
    print(data.info())
    data.to_csv('GSP6Packed1Clean.CSV')
    # cleanCSV('GSP5.2Packed1.csv')
    # cleanCSV('D:\\AiSensor\\GSP5.1Ready\\GSP5.1Pack.csv') ### RVP Outlier <12 or > 14.5 PSI
    df = pd.read_csv('GSP6U.csv') # You have to change here to you file before cleaning
    df1 = pd.read_csv('GSP6Packed1Clean.CSV') # You have to change here to you file after cleaning
    print(df.info())
    total = len(df)
    # df = df.query('FT051B > 0')
    opr = len(df1)
    print('total\t'+str(total))
    print('Good\t' + str(opr))
    print('Operate\t'+str(opr))
    outlier = df1.query('RVP < 12.5 or RVP > 14.5') # If you want to change the operation range of RVP
    print('Outlier\t'+str(len(outlier)))
    print('RVP Outlier\t'+str(len(outlier)))
    file = open('aiSensorDataSummary.csv','w')
    file.writelines('Label,Value\n')
    file.writelines('Un-Usable,' + str(total - opr-len(outlier)) + '\n')
    file.writelines('Good,'+str(opr)+'\n')
    file.writelines('RVP Outlier,'+str(len(outlier)) + '\n')
    file.writelines('Total,'+str(total))
    # file.write("Total, Usable, RVP_Outlier\n")
    # file.write(str(total)+' '+str(opr)+' '+str(len(outlier)))
    file.flush()
    reformat()
    for x in f:
        if i > 7 and i != 9:
            elif i == 10:
                if len(a) > 8
```



NULL & Zero Value & Outlier (RVP <12.5 or RVP >14.5 psi)

Prototype Model Development



The image shows a PyCharm IDE interface for a project named 'AiSensor'. The main editor window displays the file 'Run Model.py'. A red box highlights the 'Run Model.py' tab in the top toolbar. Another red box highlights a list of model selection options in the code: `#logistic()`, `decisionTree()`, `#MLP()`, `#lasso()`, and `#randomForest()`. The bottom panel shows the 'Run' output, with a red box highlighting the performance metrics: `Mean Absolute_Error 0.0589036`, `Root Mean squared error: 0.1918962`, and `Variance score: 0.8385057`. The status bar at the bottom indicates the file encoding is UTF-8 and the Python version is 3.7.

```
File Edit View Navigate Code Refactor Run Tools VCS Window Help AiSensor [D:\AiSensor] - ...Run Model.py - PyCharm
```

Run Model.py

```
261 # from IPython.display import Image
262
263 #def printTree(fName):
264 #    call(['dot', '-Tpng', 'tree.dot', '-o', 'tree.png', '-Gdpi=600'])
265 #    Image(filename='tree.png')
266 #    s.view()
267 #logistic()
268 decisionTree()
269 #MLP()
270 #lasso()
271 #randomForest()
272 # printTree('.tree.dot')
273 # print(X_train.feature_names)
274
275 #
276 # ##### Test Iris #####
277 # from sklearn.datasets import load_iris
```

Run: Run Model ×

```
TICA004 1325208 non-null float64
dtypes: float64(34)
memory usage: 343.8 MB
None
Mean Absolute_Error 0.0589036
Root Mean squared error: 0.1918962
Variance score: 0.8385057

Process finished with exit code 0
```

4: Run 6: TODO Terminal Python Console

PEP 8: block comment should start with '#'

269:7 LF UTF-8 4 spaces Python 3.7 (AiSensor)

Prototype Model Development

The screenshot shows a Windows File Explorer window titled 'AiSensor'. The address bar indicates the path: This PC > DATA (D:) > AiSensor. The left sidebar shows the navigation pane with 'DATA (D:)' selected. The main pane displays a list of files and folders with columns for Name, Date modified, and Type. A red box highlights the following files:

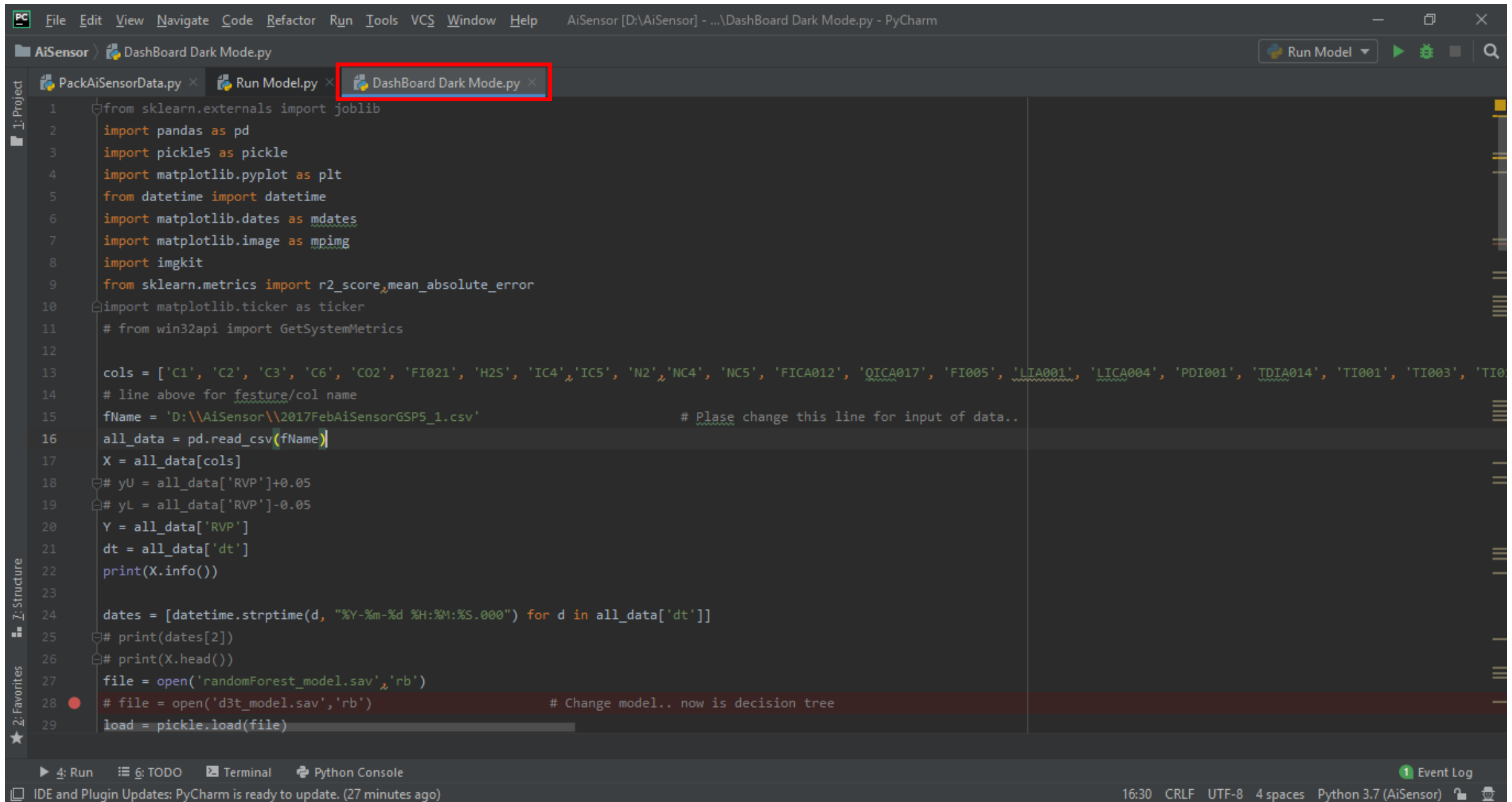
Name	Date modified	Type
d3t_model.sav	6/8/2020 15:00	SAV File
d3t_model1.sav	2/8/2019 10:57	SAV File
linear.sav	5/8/2020 15:24	SAV File
randomForest_model.sav	5/8/2020 15:16	SAV File

At the bottom of the window, it shows '45 items' and '1 item selected 143 MB'.

Prototype Model Results

	Mean Absolute Error	Root Mean Square Error	R-Square
LASSO	0.244	0.445	0.13
DECISION TREE	0.058	0.191	0.84
RANDOM FOREST	0.058	0.137	0.92
MLP	-	-	-

Prototype Model Visualization

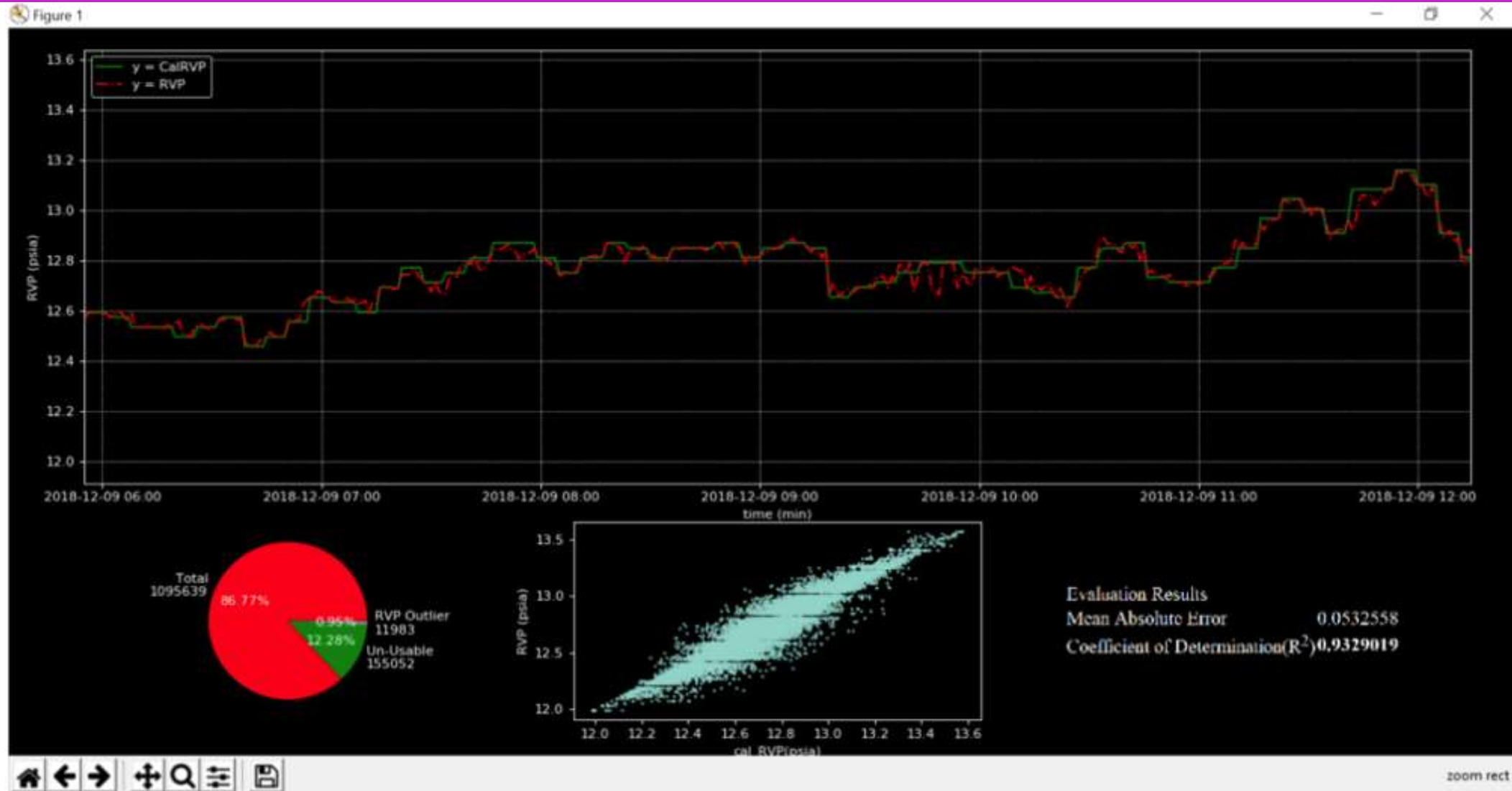


The image shows a PyCharm IDE window with a Python script titled 'Dashboard Dark Mode.py'. The script is used for data analysis and model visualization. It imports various libraries including sklearn, pandas, pickle, matplotlib, and datetime. The script reads a CSV file, processes the data, and prints information about the dataset. It also includes comments about loading a model, with a note to change the model to a decision tree.

```
1 from sklearn.externals import joblib
2 import pandas as pd
3 import pickle5 as pickle
4 import matplotlib.pyplot as plt
5 from datetime import datetime
6 import matplotlib.dates as mdates
7 import matplotlib.image as mpimg
8 import imgkit
9 from sklearn.metrics import r2_score, mean_absolute_error
10 import matplotlib.ticker as ticker
11 # from win32api import GetSystemMetrics
12
13 cols = ['C1', 'C2', 'C3', 'C6', 'CO2', 'FI021', 'H2S', 'IC4', 'IC5', 'N2', 'NC4', 'NC5', 'FICA012', 'OICA017', 'FI005', 'LIA001', 'LICA004', 'PDI001', 'TDIA014', 'TI001', 'TI003', 'TI004']
14 # line above for feature/col name
15 fName = 'D:\\AiSensor\\2017FebAiSensorGSP5_1.csv' # Please change this line for input of data..
16 all_data = pd.read_csv(fName)
17 X = all_data[cols]
18 # yU = all_data['RVP']+0.05
19 # yL = all_data['RVP']-0.05
20 Y = all_data['RVP']
21 dt = all_data['dt']
22 print(X.info())
23
24 dates = [datetime.strptime(d, "%Y-%m-%d %H:%M:%S.000") for d in all_data['dt']]
25 # print(dates[2])
26 # print(X.head())
27 file = open('randomForest_model.sav', 'rb')
28 # file = open('d3t_model.sav', 'rb') # Change model.. now is decision tree
29 load = pickle.load(file)
```

The IDE interface includes a menu bar (File, Edit, View, Navigate, Code, Refactor, Run, Tools, VCS, Window, Help), a toolbar with 'Run Model' and other icons, and a status bar at the bottom showing '16:30 CRLF UTF-8 4 spaces Python 3.7 (AiSensor)'.

Prototype Model Visualization



GSP#6 RVP Prediction Model: $R^2 = 0.92$, Error = 0.05 psi

***GSP#5 RVP Prediction Model: $R^2 = 0.93$, Error = 0.05 psi**



RQE Results

The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Date	Time	RQE	ACTUAL										
2	6/20/2019	10:41:56	13.29613	13.02214										
3	6/20/2019	10:42:56	13.29613	12.96661										
4	6/20/2019	10:43:56	13.29613	12.96754										
5	6/20/2019	10:44:56	13.29613	12.96762		R SQUARE =	0.60							
6	6/20/2019	10:45:56	13.29613	12.96728										
7	6/20/2019	10:46:56	15.90379	12.96699										
8	6/20/2019	10:47:56	13.47598	12.96784										
9	6/20/2019	10:48:56	13.22392	12.90713										
10	6/20/2019	10:49:56	13.20567	12.90722										
11	6/20/2019	10:50:56	13.1592	12.90773										
12	6/20/2019	10:51:56	13.15214	12.9081										
13	6/20/2019	10:52:56	12.90871	12.90757										
14	6/20/2019	10:53:56	12.9634	12.90823										
15	6/20/2019	10:54:56	12.98591	13.02652										
16	6/20/2019	10:55:56	12.99635	13.02629										
17	6/20/2019	10:56:56	13.09446	13.02631										
18	6/20/2019	10:57:56	13.11872	13.02678										
19	6/20/2019	10:58:56	13.16121	13.02702										
20	6/20/2019	10:59:56	13.19178	13.02694										
21	6/20/2019	11:00:56	13.2162	13.47241										
22	6/20/2019	11:01:56	13.2383	13.47312										

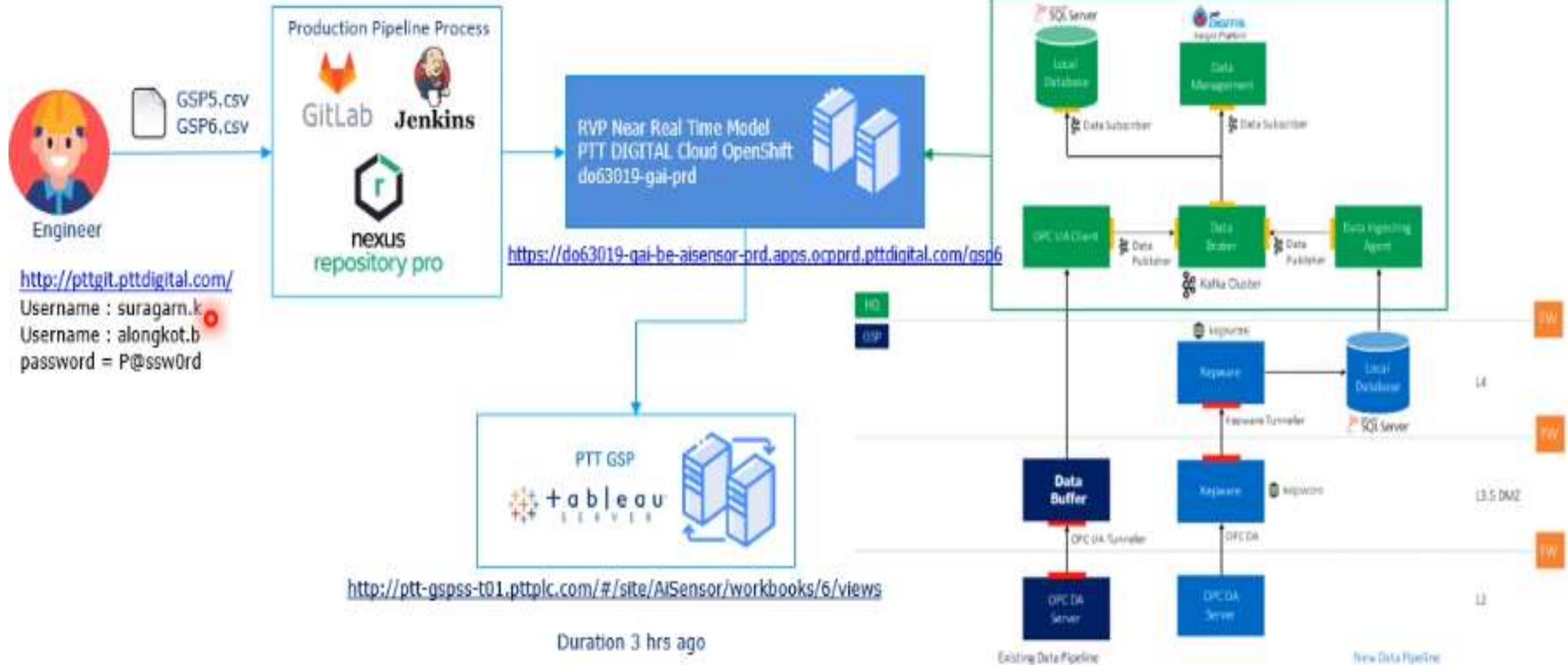
The formula bar shows the formula for cell G5: `=RSQ(C2:C30529,D2:D30529)`.

Benchmarking

<u>Method</u>	<u>Interval</u>	<u>R-Square</u>
RVP On-Line	5-7 min	1
RQE 	1 min	0.6++
AI Sensor 	1 min	0.9++

Next Step (Currently on work)

2.2 กระบวนการทำงานในการดำเนินธุรกิจ



Next Step

- **Energy Index Prediction**
- **WI prediction**
- **Other Prediction Model**

What I have Learned

- **Data Preparation is the Key**
“Garbage-In Garbage Out”
- **Simple is the Best**
- **AI is not everything**

Q&A