19 MAY 2022

AF Analytics: Best Practices and Troubleshooting

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Presentation Agenda

- Intros
- Best practices for PI Analysis Service
  - Server defaults
  - Evaluation threads
- Best practices for analyses
  - Part 1: Use Variables
  - Part 2: Data Density and Data Pattern
  - Part 3: Input Attributes
  - Part 4: Analyses in Warning or Error
  - Part 5: Scheduling
- Monitoring
- What’s up and coming?
- Questions

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PI Analysis Best Practices

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Overall Service

How can we help the service use all the power of its machine?

- Adjust Number of Evaluation Threads
  - Make use of entire CPU
- Adjust Events to Queue Before Skipping
  - Minimize skipped evaluations
- Adjust Number of Recalculation Threads
  - Improve recalculation experience
- Use templates
  - Help the service with scheduling
- Proactively monitor the service health
  - Use PI Interface for Performance Monitoring

Call PI Technical Support before changing server-wide configuration!

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Use Variables

What is easier to calculate if we need to do several tasks in parallel?

- $X = (V_1 * T^{V_2} + V_3) * He * \frac{\frac{\bar{M}*p}{\mathbb{R}*T}}{\frac{\bar{M}*611.2*\exp\left(\frac{17.62*T}{243.12+T}\right)}{\mathbb{R}*T}}$

- $p_{sat} = 611.2 * \exp\left(\frac{17.62*T}{243.12+T}\right)$
- $f = \frac{\bar{M}*p}{\mathbb{R}*T}$
- $f_{Sat} = \frac{\bar{M}*p_{Sat}}{\mathbb{R}*T}$
- $\rho = \frac{f}{f_{Sat}}$
- $V = (V_1 * T^{V_2} + V_3) * He$
- $X = V * \rho$

- where
  - T, p are measurement data
  - $V_1, V_2, V_3, He, \bar{M}, \mathbb{R}$ are (material-specific) constants

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Use Variables

What is easier to calculate if we need to do several tasks in parallel?

- Keep analysis from doing identical tasks multiple times
- Simplify scheduling
- Avoid multiple calls for the same data
- Easier readable for users
- Keep syntax simple
  - Speeds up evaluation

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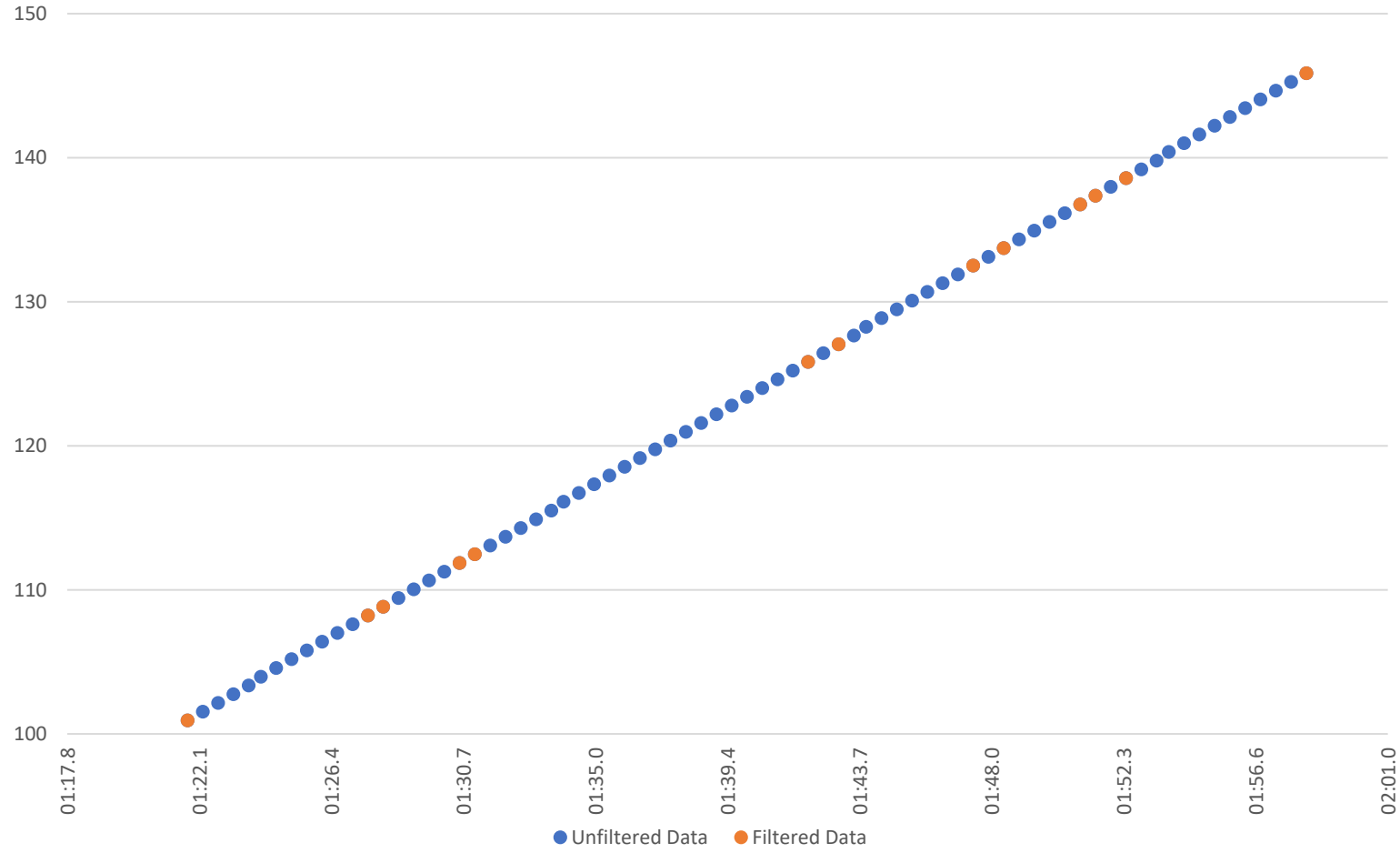
Data Density and Data Pattern

Do we really need this many events to be stored?



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Data Density and Data Pattern

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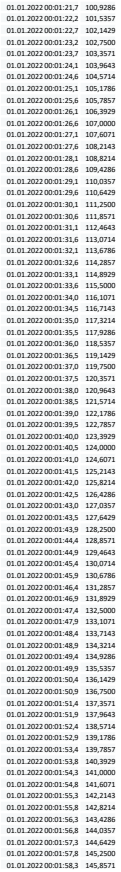

01.01.2022 00:01:21,7	100,9286
01.01.2022 00:01:27,6	108,2143
01.01.2022 00:01:28,1	108,8214
01.01.2022 00:01:30,6	111,8571
01.01.2022 00:01:31,1	112,4643
01.01.2022 00:01:42,0	125,8214
01.01.2022 00:01:43,0	127,0357
01.01.2022 00:01:47,4	132,5000
01.01.2022 00:01:48,4	133,7143
01.01.2022 00:01:50,9	136,7500
01.01.2022 00:01:51,4	137,3571
01.01.2022 00:01:52,4	138,5714

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Data Density and Data Pattern

Do we really need this many events to be stored?

- Do not send more data to PI than needed
  - Review Exception and Compression settings
  - Review Data Source

- Use periodic scheduling to control data density

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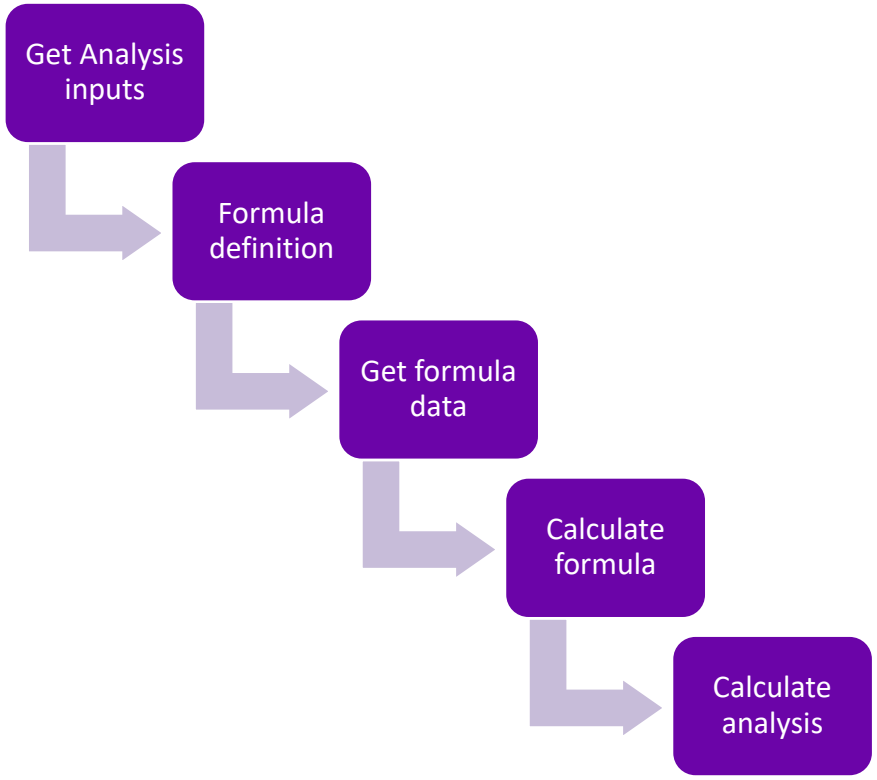
Input Attributes

Where does our data come from?

- Use PI Points wherever possible
- For Table Lookups
  - Use Parametrized Queries
  - Keep Tables as small as possible
- Try to avoid Formula Data References
- Try to avoid extensive Analysis Data References



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Analyses in Warning or Error

Why are our Log Files growing that much?

- Analysis Service tries to restart analyses in error every 15 minutes

- Writing to the log is expensive

Analyses

4 total analyses selected (4 on this page)

Status	Element	Name
!	Element 4	Analysis_in_Error
!	Element 3	Analysis_in_Error
!	Element 1	Analysis_in_Error
!	Element 2	Analysis_in_Error

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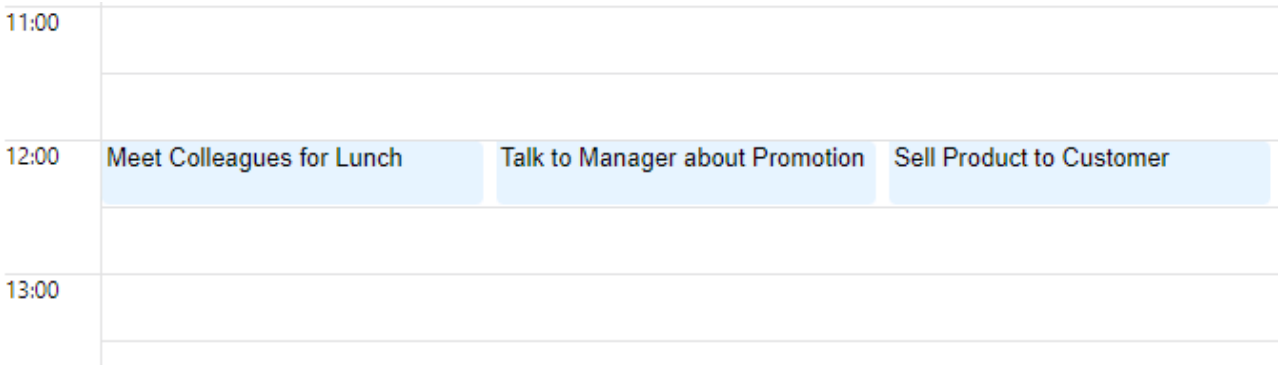
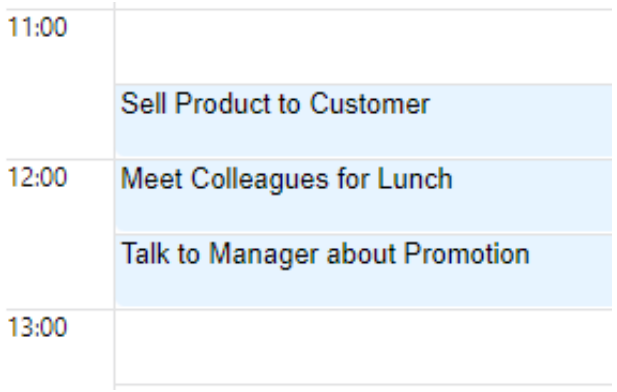
Scheduling

How can we help planning an execution?





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Scheduling

How can we help planning an execution?

- Use templates

- Periodic scheduling gives you control
  - Use offsets
- Natural scheduling is controlled by the data source

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Finding the ~~needle~~ in the haystack elephant

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What does a struggling PI Analysis Service look like?

- **Evaluation Skipped Count** keeps increasing
- **Maximum Latency** is high
- **Evaluation Count** has reached max capacity

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Proactive monitoring

- Use PI Interface for Performance Monitor
- Build logic to alert for issues
- Services engagement available to assist

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Trademarks of a bad analysis

- Long-running
- Calculated too often
- Long dependency chain

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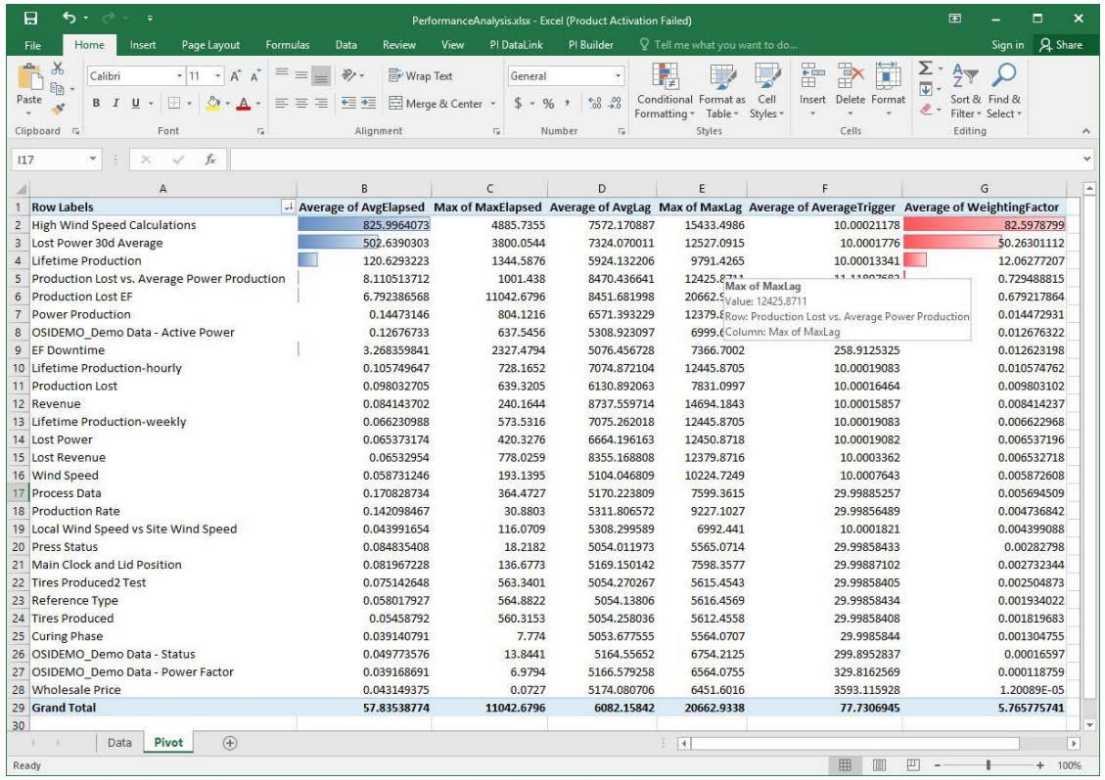
How can I tell which Analyses are misconfigured?

We're already in a bad state…

- Today
  - Contact support or schedule a Service engagement
- Coming soon
  - Self-service tools to identify expensive analyses



Row Labels	Average of AvgElapsed	Max of MaxElapsed	Average of AvgLag	Max of MaxLag	Average of AverageTrigger	Average of WeightingFactor
High Wind Speed Calculations	825.9964073	4885.7355	7572.170887	15433.4986	10.00021178	82.5978799
Lost Power 30d Average	502.6390303	3800.0544	7324.070011	12527.0915	10.0001776	50.26301112
Lifetime Production	120.6293223	1344.5876	5924.132206	9791.4265	10.00013341	12.06277207
Production Lost vs. Average Power Production	8.110513712	1001.438	8470.436641	12425.8711		0.729488815
Production Lost EF	6.792386568	11042.6796	8451.681998	20662.9338		0.679217864
Power Production	0.14473146	804.1216	6571.393229	12379.8716		0.014472931
OSIDEMO_Demo Data - Active Power	0.12676733	637.5456	5308.923097	6999.6		0.012676322
EF Downtime	3.268359841	2327.4794	5076.456728	7366.7002	258.9125325	0.012623198
Lifetime Production-hourly	0.105749647	728.1652	7074.872104	12445.8705	10.00019083	0.010574762
Production Lost	0.098032705	639.3205	6130.892063	7831.0997	10.00016464	0.009803102
Revenue	0.084143702	240.1644	8737.559714	14694.1843	10.00015857	0.008414237
Lifetime Production-weekly	0.066230988	573.5316	7075.262018	12445.8705	10.00019083	0.006622968
Lost Power	0.065373174	420.3276	6664.196163	12450.8718	10.00019082	0.006537196
Lost Revenue	0.06532954	778.0259	8355.168808	12379.8716	10.0003362	0.006532718
Wind Speed	0.058731246	193.1395	5104.046809	10224.7249	10.0007643	0.005872608
Process Data	0.170828734	364.4727	5170.223809	7599.3615	29.99885257	0.005694509
Production Rate	0.142098467	30.8803	5311.806572	9227.1027	29.99856489	0.004736842
Local Wind Speed vs Site Wind Speed	0.043991654	116.0709	5308.299589	6992.441	10.0001821	0.004399088
Press Status	0.084835408	18.2182	5054.011973	5565.0714	29.99858433	0.00282798
Main Clock and Lid Position	0.081967228	136.6773	5169.150142	7598.3577	29.99887102	0.002732344
Tires Produced2 Test	0.075142648	563.3401	5054.270267	5615.4543	29.99858405	0.002504873
Reference Type	0.058017927	564.8822	5054.13806	5616.4569	29.99858434	0.001934022
Tires Produced	0.05458792	560.3153	5054.258036	5612.4558	29.99858408	0.001819683
Curing Phase	0.039140791	7.774	5053.677555	5564.0707	29.9985844	0.001304755
OSIDEMO_Demo Data - Status	0.049773576	13.8441	5164.55652	6754.2125	299.8952837	0.00016597
OSIDEMO_Demo Data - Power Factor	0.039168691	6.9794	5166.579258	6564.0755	329.8162569	0.000118759
Wholesale Price	0.043149375	0.0727	5174.080706	6451.6016	3593.115928	1.20089E-05
Grand Total	**57.83538774**	**11042.6796**	**6082.15842**	**20662.9338**	**77.7306945**	**5.765775741**

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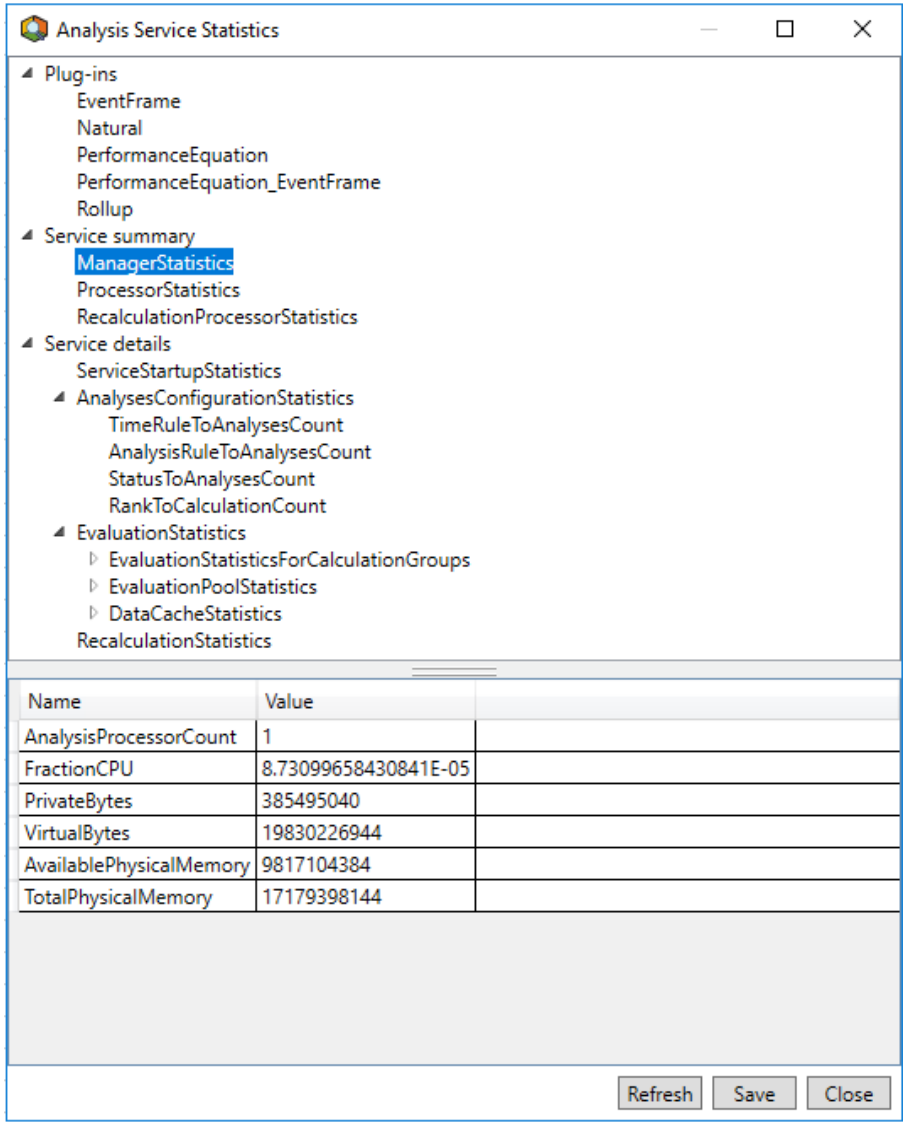
Planned enhancements

Currently being worked on

- Easily identify expensive analytics
- Visually represent service health
- Usability improvements of the management pane



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DEMO

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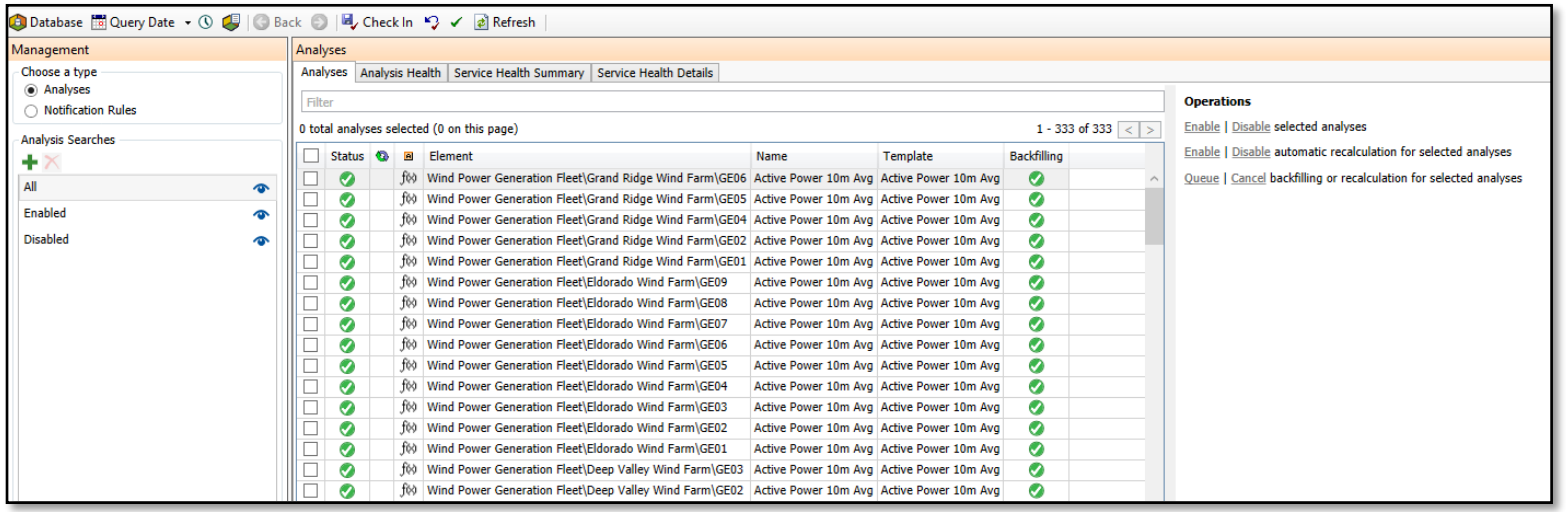
PI System Explorer Features

Currently being worked on

- Ready by the end of the year
- Please give us your feedback



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Summary

- Follow best practices to avoid issues
  - PI Analysis Service Best Practices
    - Server defaults
    - Evaluation threads
  - Best practices for analyses
    - Use Variables
    - Data Density and Data Pattern
    - Input Attributes
    - Analyses in Warning or Error
    - Scheduling
- If you run into issues today, contact us
- More tools to assist in this effort are coming!

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