



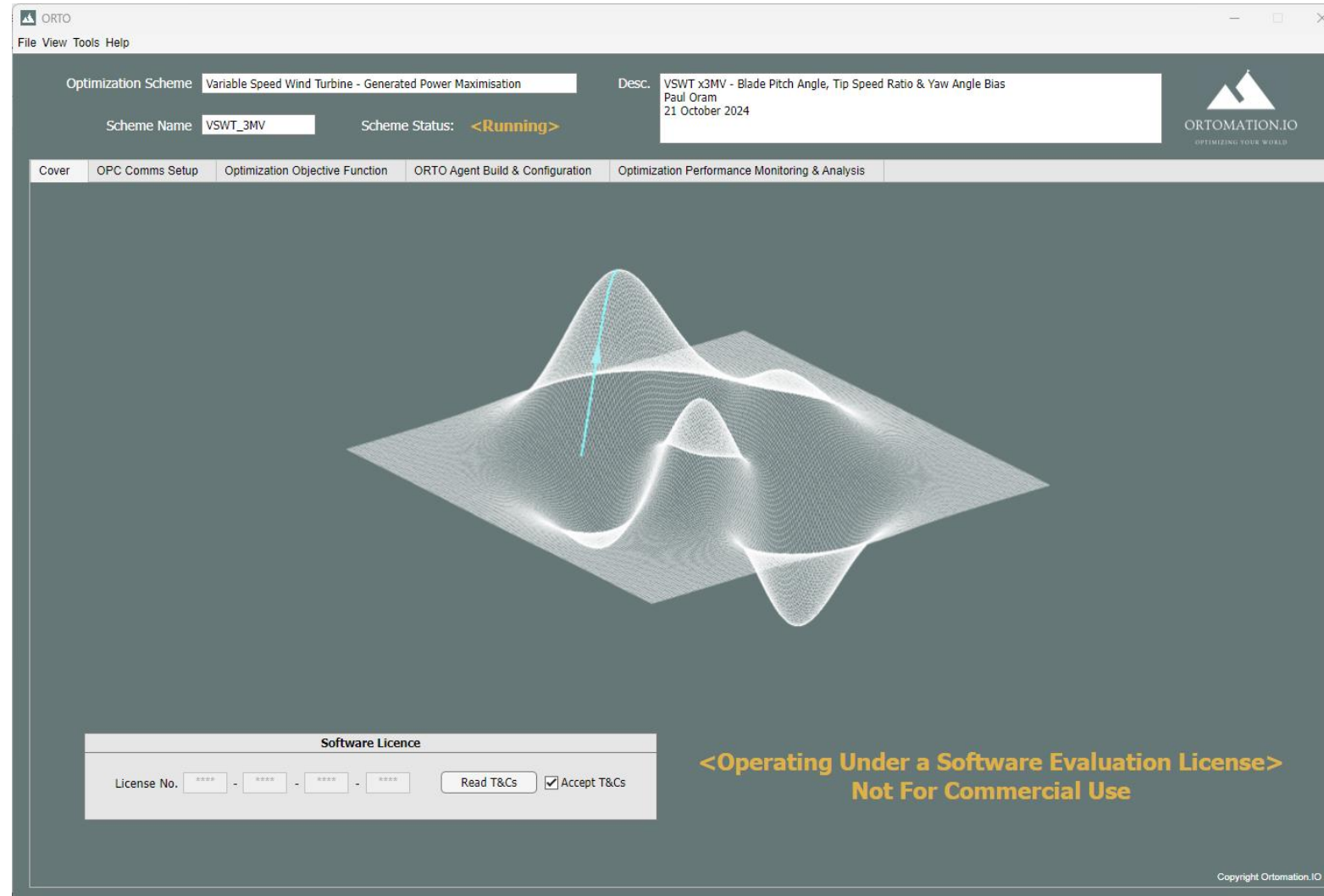
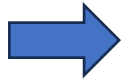
ORTOMATION.IO

OPTIMIZING YOUR WORLD

ORTO Software Quick Guide

Cover Page

Dropdown menus to allow users to load and save scheme configuration files, navigate, find help etc.



Enter license number and agree to T&Cs



ORTOMATION.IO

OPTIMIZING YOUR WORLD

OPC Communications Tab



Select OPC communication protocol

ORTO

File View Tools Help

Optimization Scheme

Variable Speed Wind Turbine - Generated Power Maximisation

Desc.

VSWT x3MV - Blade Pitch Angle, Tip Speed Ratio & Yaw Angle Bias
Paul Oram
21 October 2024

Scheme Name

VSWT_3MV

Scheme Status:

<Running>

ORTOMATION.IO

OPTIMIZING YOUR WORLD

Cover

OPC Comms Setup

Optimization Objective Function

ORTO Agent Build & Configuration

Optimization Performance Monitoring & Analysis

OPCUA TCP Address

opc.tcp://BOOK-4022QBKF0D.home:53530/OPCUA/SimulationServi

OPCUA HTTPS Address

Username

Password

Scheme Communication

UA

DA

Sample Time

5

Secs

OPCDA Server Host

OPCDA Server ID

OPCDA Server Desc.

OPCUA Comms

OPCDA Comms

Reads

	Node Id	*Filter*	Read Tag	Current Value
1	----		----	
2	Simulation		JY218.pv	1932.2718
3	----		----	
4	Simulation		SRC397.pv	8.1704
5	Simulation		PYC281.pv	-0.53702
6	Simulation		YYC621.pv	-9.4405
7	Simulation		SRC397.mode	0
8	Simulation		PYC281.mode	0
9	Simulation		YYC621.mode	0
10	Simulation		PS105.pv	0
11	----		----	
12	Simulation		J1290.pv	1212332.6759
13	----		----	
14	----		----	
15	----		----	

Writes

	Node Id	*Filter*	Read Tag	Current Value
1	----		----	
2	Simulation		SRC397.sp	8.1704
3	Simulation		PYC281.sp	-0.53702
4	Simulation		YYC621.sp	-9.4405
5	----		----	
6	----		----	
7	----		----	
8	----		----	
9	----		----	
10	----		----	

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Header – always displayed

OPC protocol / server description

OPC read / write tag selection

Optimization Objective Function Tab



ORTO

File View Tools Help

Optimization Scheme

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21 October 2024

Scheme Name

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Scheme Status:

<Running>

Cover

OPC Comms Setup

Optimization Objective Function

ORTO Agent Build & Configuration

Optimization Performance Monitoring & Analysis

Maximize

Optimization Variable (OV) Description

Power Generated (normalised)

OV Calc. / Tag

JY218.pv

OV Value

1932.4937

OV Units

W/kg³

OV Range Low

0

High

2600

By manipulating variables:

	MV Tag	Current Value
ORTO Agent 1: MV	SRC397.sp	8.1836
ORTO Agent 2: MV	PYC281.sp	-0.53549
ORTO Agent 3: MV	YYC621.sp	-9.4608
ORTO Agent 4: MV	----	
ORTO Agent 5: MV	----	

Subject to constraints:

	Constraint Logic
C1	PYC281.sp <= 0.00166 * (SRC397.sp * 8) ^ 2 - 0.233 * (SRC397.sp * 8) +
C2	
C3	
C4	
C5	

Paused by:

	Pause Logic
P1	SRC397.mode > 0
P2	PYC281.mode > 0
P3	YYC621.mode > 0
P4	
P5	

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OV tag or calculation
(using read and/or
write tags)

MV selection
(using write tags)

Optimization Variable
(OV) description

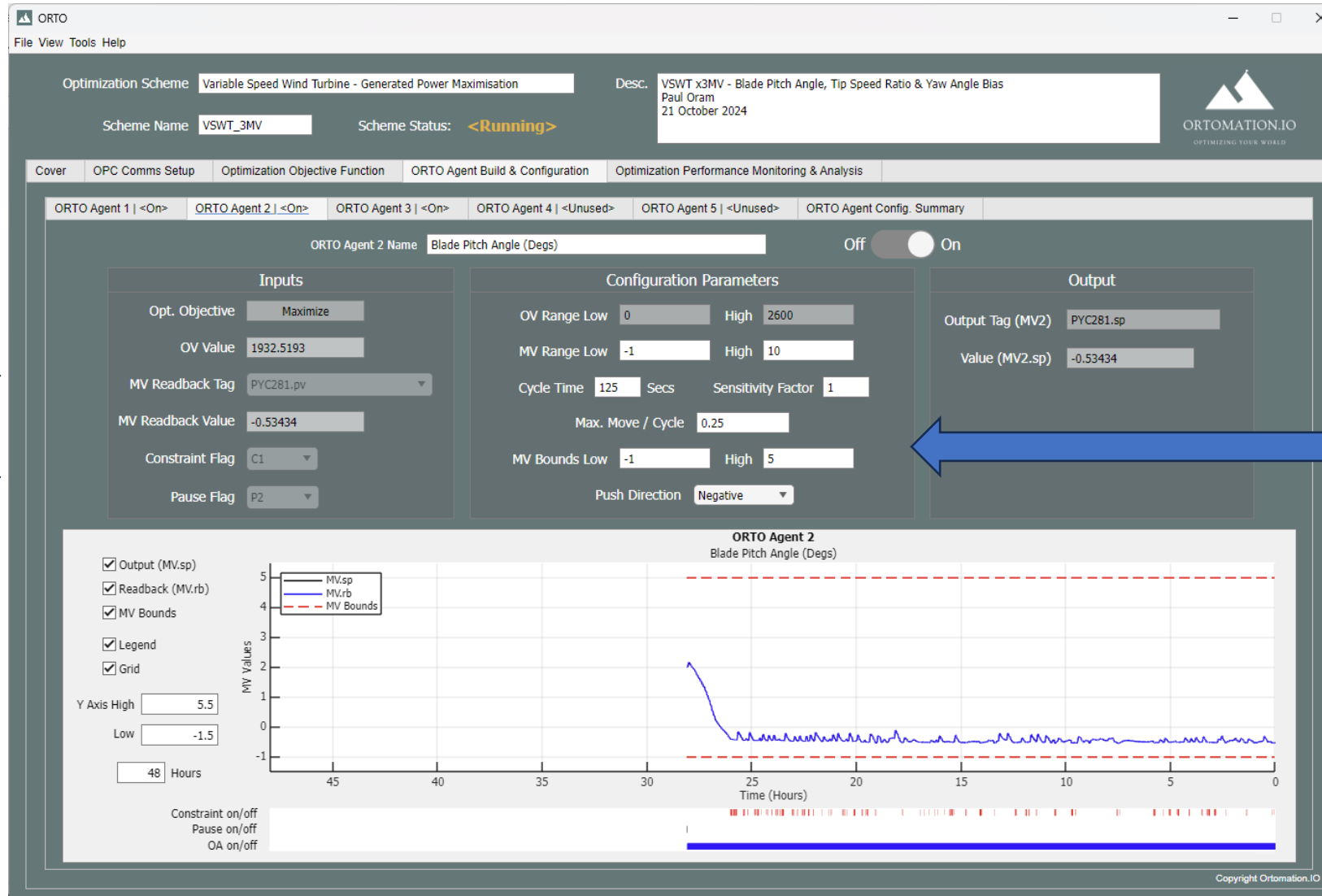
External constraint
logic configuration
(using read or write tags)

External pause
logic configuration
(using read or write tags)

ORTO Agent Build Configuration Tab / ORTO Agent 1..5



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OPTIMIZING YOUR WORLD



Configure up to five agents

Agent Output tag (i.e., the associated MV, copied from previous tab)

ORTO agent configuration parameters

Agent MV, MV RB and upper and lower bounds trends

Bars indicate when agent is constrained, paused and on

Select Readback Tag (from read tag list)

Define the constraint and pause flag applicable to agent

ORTO Agent Build Config. Tab / ORTO Agent Config. Summary Tab



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OPTIMIZING YOUR WORLD

ORTO

File View Tools Help

Optimization Scheme

Variable Speed Wind Turbine - Generated Power Maximisation

Desc.

VSWT x3MV - Blade Pitch Angle, Tip Speed Ratio & Yaw Angle Bias
Paul Oram
21 October 2024

Scheme Name

VSWT_3MV

Scheme Status:

<Running>

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OPTIMIZING YOUR WORLD

Cover

OPC Comms Setup

Optimization Objective Function

ORTO Agent Build & Configuration

Optimization Performance Monitoring & Analysis

ORTO Agent 1 | <On>

ORTO Agent 2 | <On>

ORTO Agent 3 | <On>

ORTO Agent 4 | <Unused>

ORTO Agent 5 | <Unused>

ORTO Agent Config. Summary

	ORTO Agent 1	ORTO Agent 2	ORTO Agent 3	ORTO Agent 4	ORTO Agent 5
On/Off	On	On	On	Off	Off
Optimization Objective	Maximize	Maximize	Maximize	Maximize	Maximize
Optimization Variable (OV) / Calc	JY218.pv	JY218.pv	JY218.pv	JY218.pv	JY218.pv
OA Name	Rotor Blade Speed to Wind Speed Ra...	Blade Pitch Angle (Degs)	Yaw Angle Correction (Degs)		
Manipulated Variable (MV) Readback	SRC397.pv	PYC281.pv	YYC621.pv		
Constraint Flag	C1	C1			
Pause Flag	P1	P2	P3		
OV Range Eng. Units Low	0	0	0	0	0
OV Range Eng. Units High	2600	2600	2600	2600	2600
MV Range Eng. Units Low	0	-1	-20		
MV Range Eng. Units High	10	10	20		
Cycle Time (secs)	250	125	60		
Sensitivity Factor	1	1	10		
Max. Move Size /cycle	0.08	0.25	1		
MV Lower Bound	7.5	-1	-15		
MV Higher Bound	8.5	5	15		
Push Direction	Negative	Negative	Negative	Positive	Positive
MV Output Tag	SRC397.sp	PYC281.sp	YYC621.sp		

Agent assigned to scheme, running

Agent assigned to scheme, not running

Agent unused

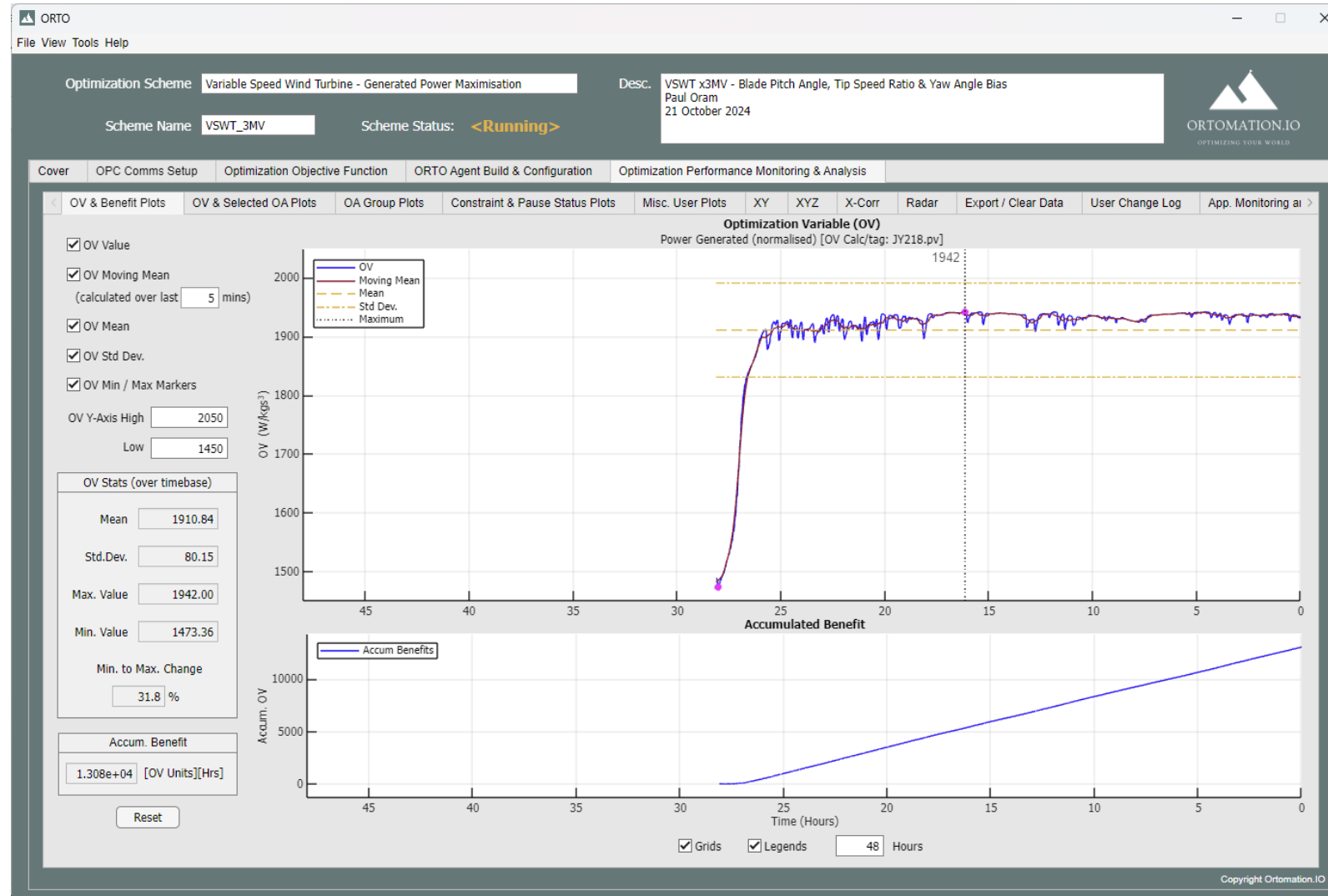
Export .xls

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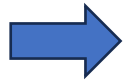


Agent configuration summary table, indicating those running, assigned or not used

Perf. Monitoring & Analysis Tab / Optimization Variable (OV) & Benefit Plots Tab



OV statistics panel



OV plot, with mean and standard deviations.
min and max values shown



Accumulated benefits,
since scheme switched on

Perf. Monitoring & Analysis Tab / OV & Selected ORTO Agent Tab

Select OA to plot



OV plot, with mean and max values shown

Agent MV, MV RB and upper and lower bounds trends

Bars indicate when agent is constrained, paused and on

Perf. Monitoring & Analysis Tab / ORTO Agent Group Plots Tab



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OPTIMIZING YOUR WORLD



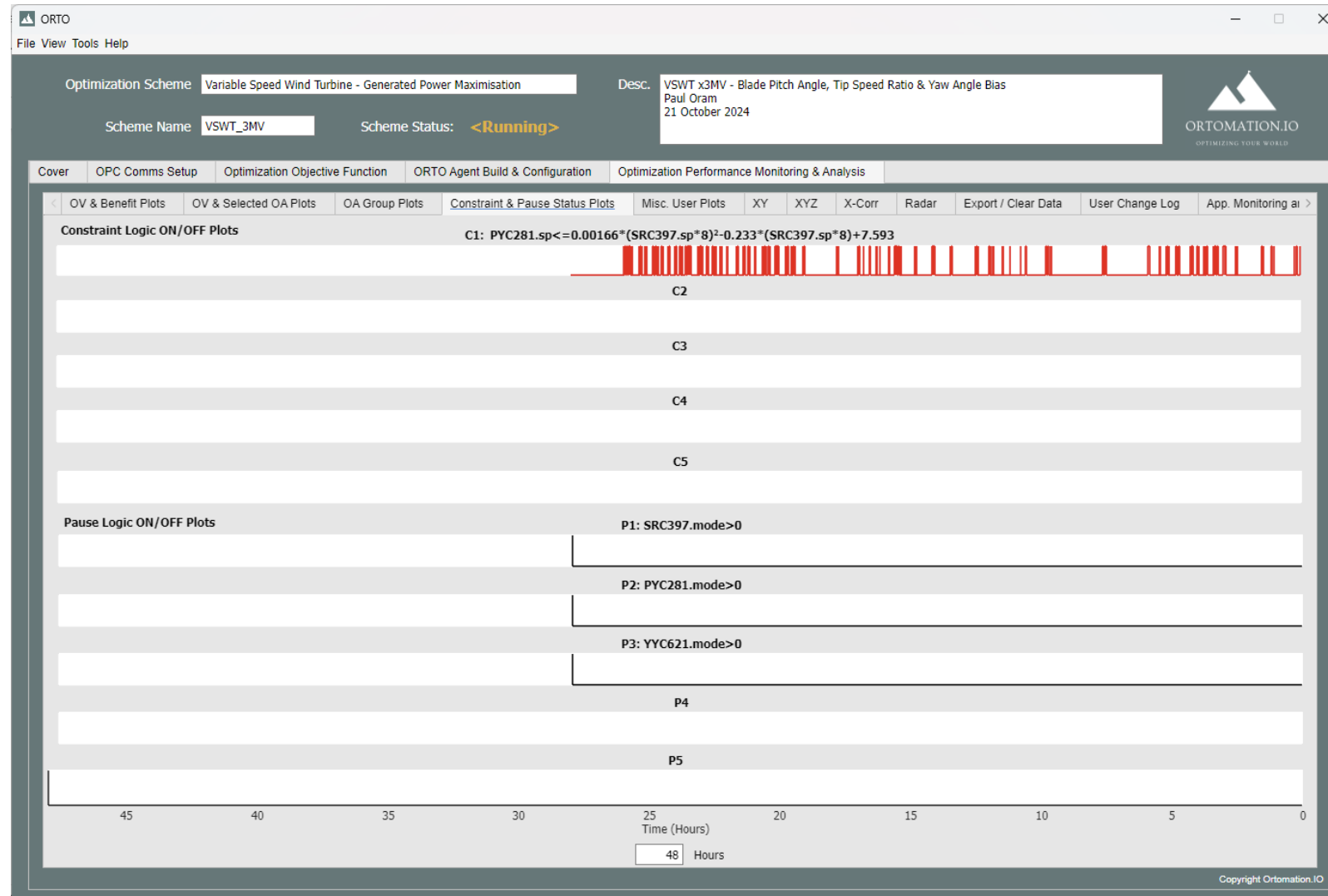
← ORTO Agent SP, MV and bounds plots

Perf. Monitoring & Analysis Tab / Constraint & Pause Flag Plots Tab



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OPTIMIZING YOUR WORLD

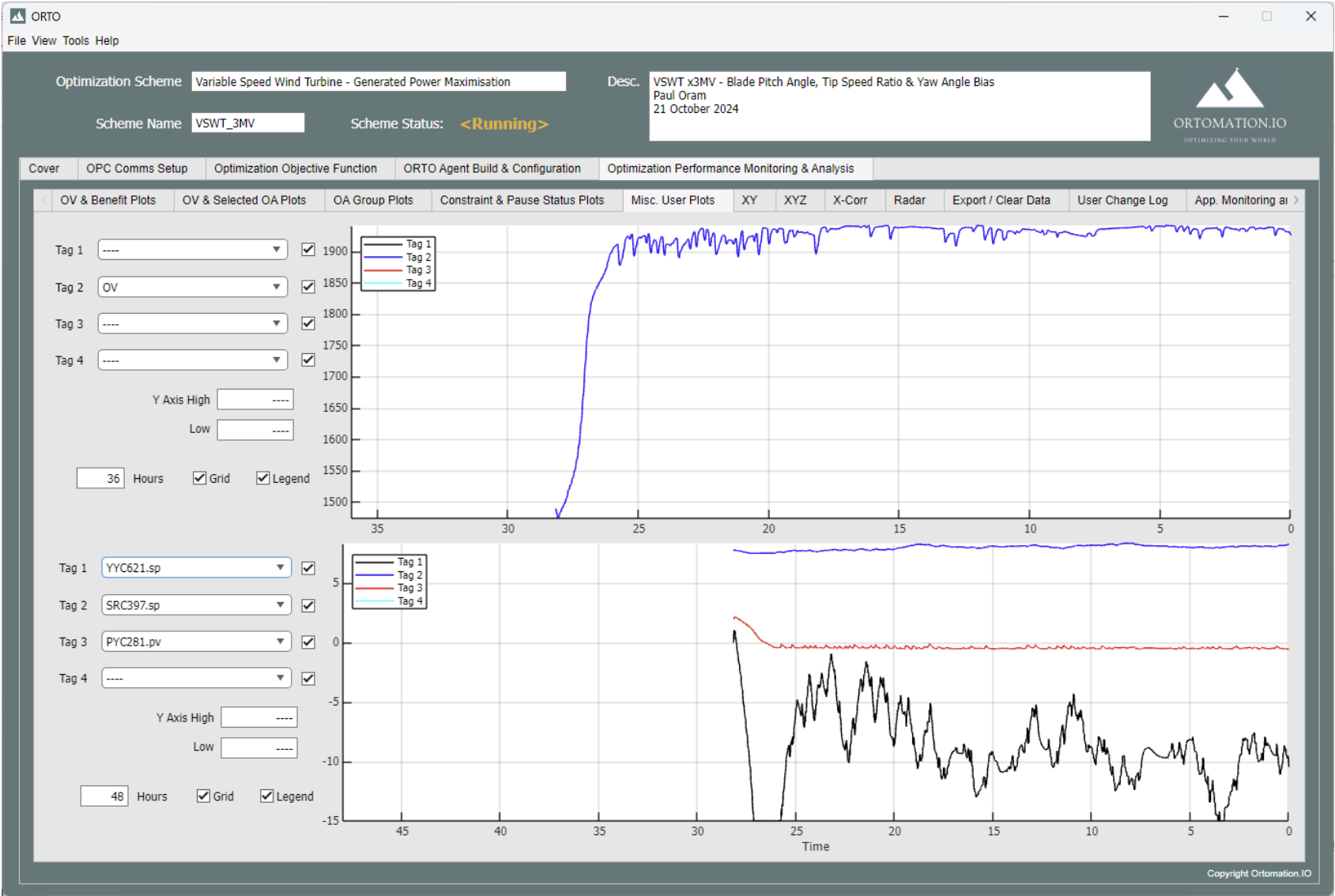


Constraint flags 1-5 statuses

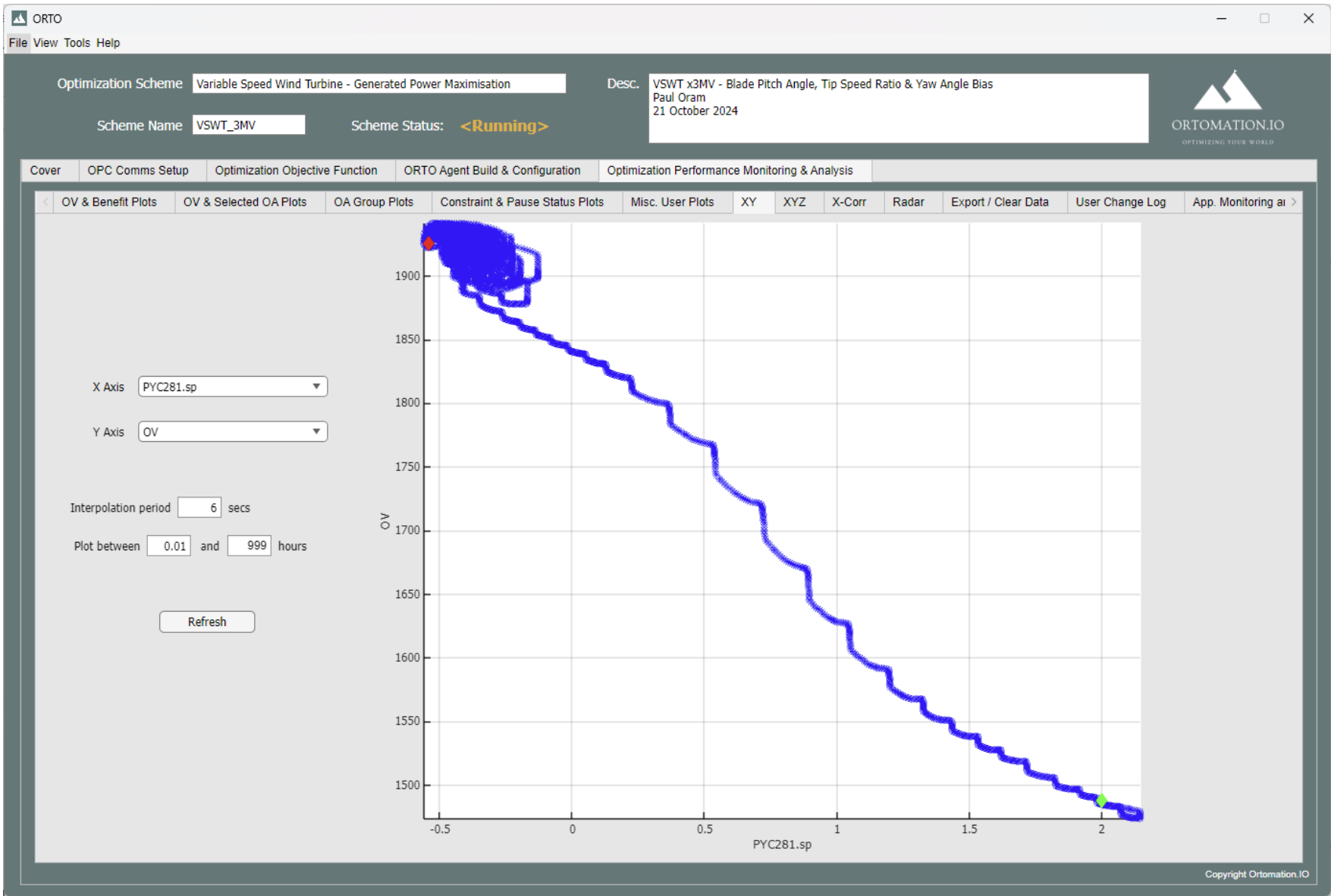


Pause flags 1-5 statuses

Misc. Plots Tab



XY Plot Tab



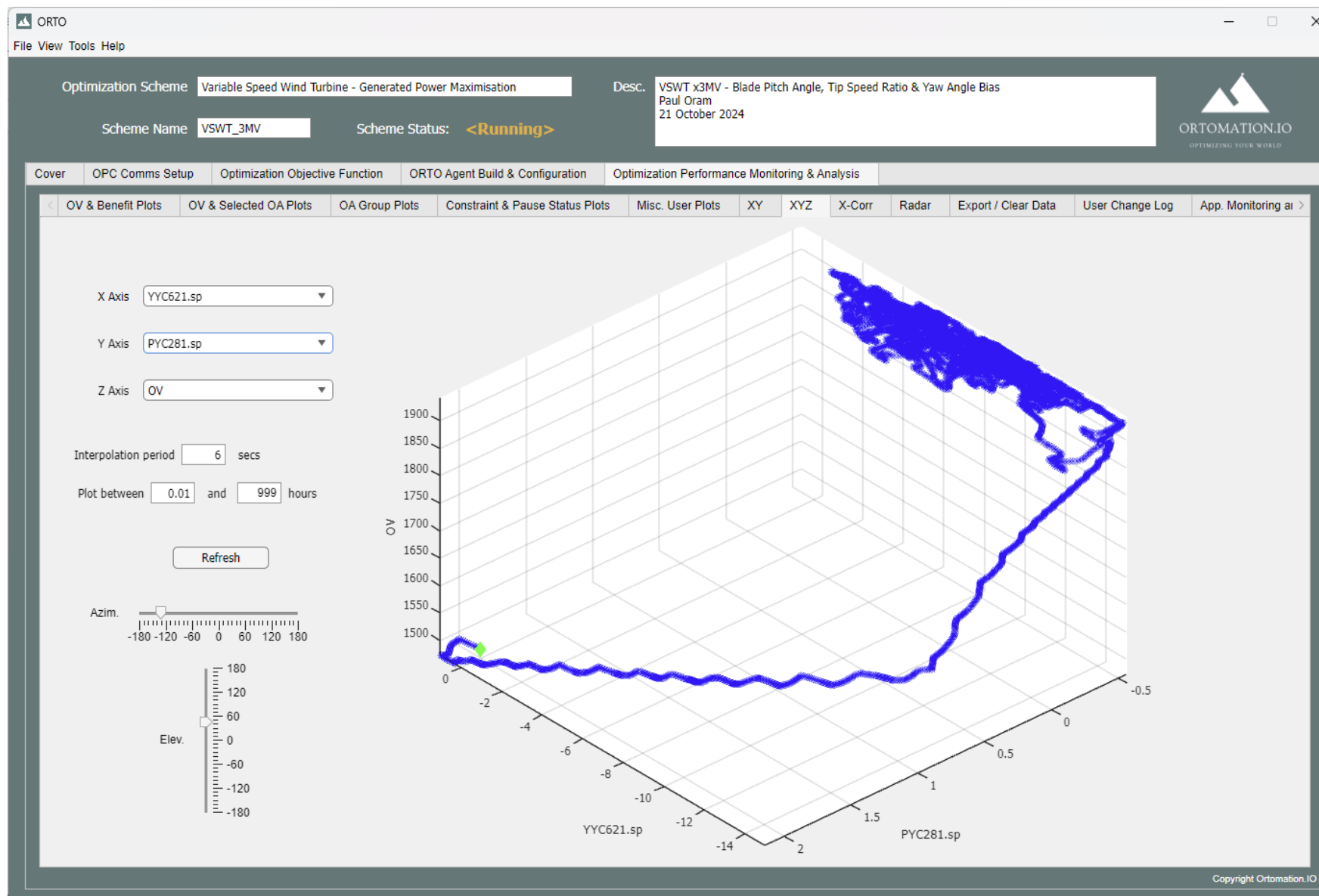
Plot one variable
against another

3D plot



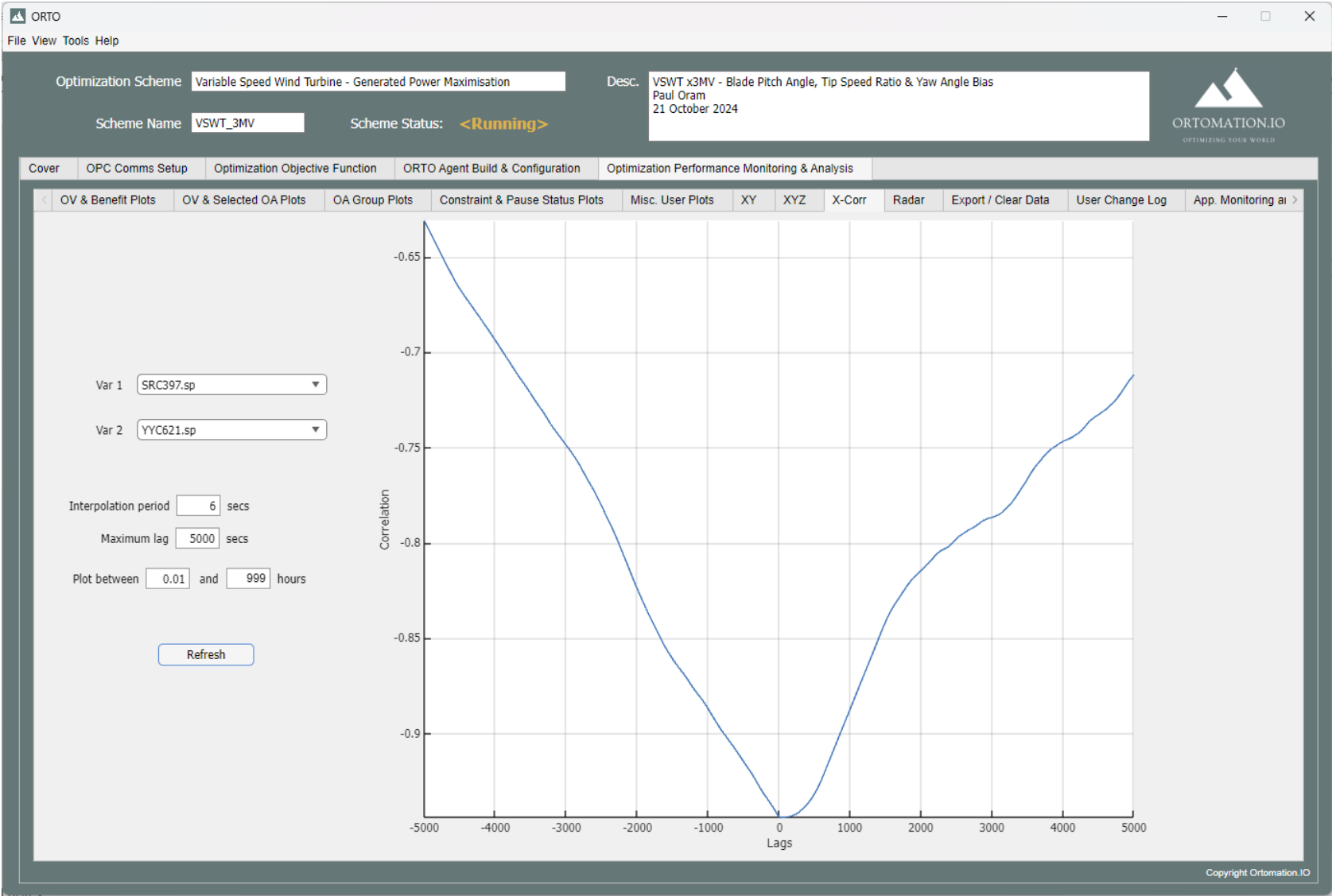
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OPTIMIZING YOUR WORLD



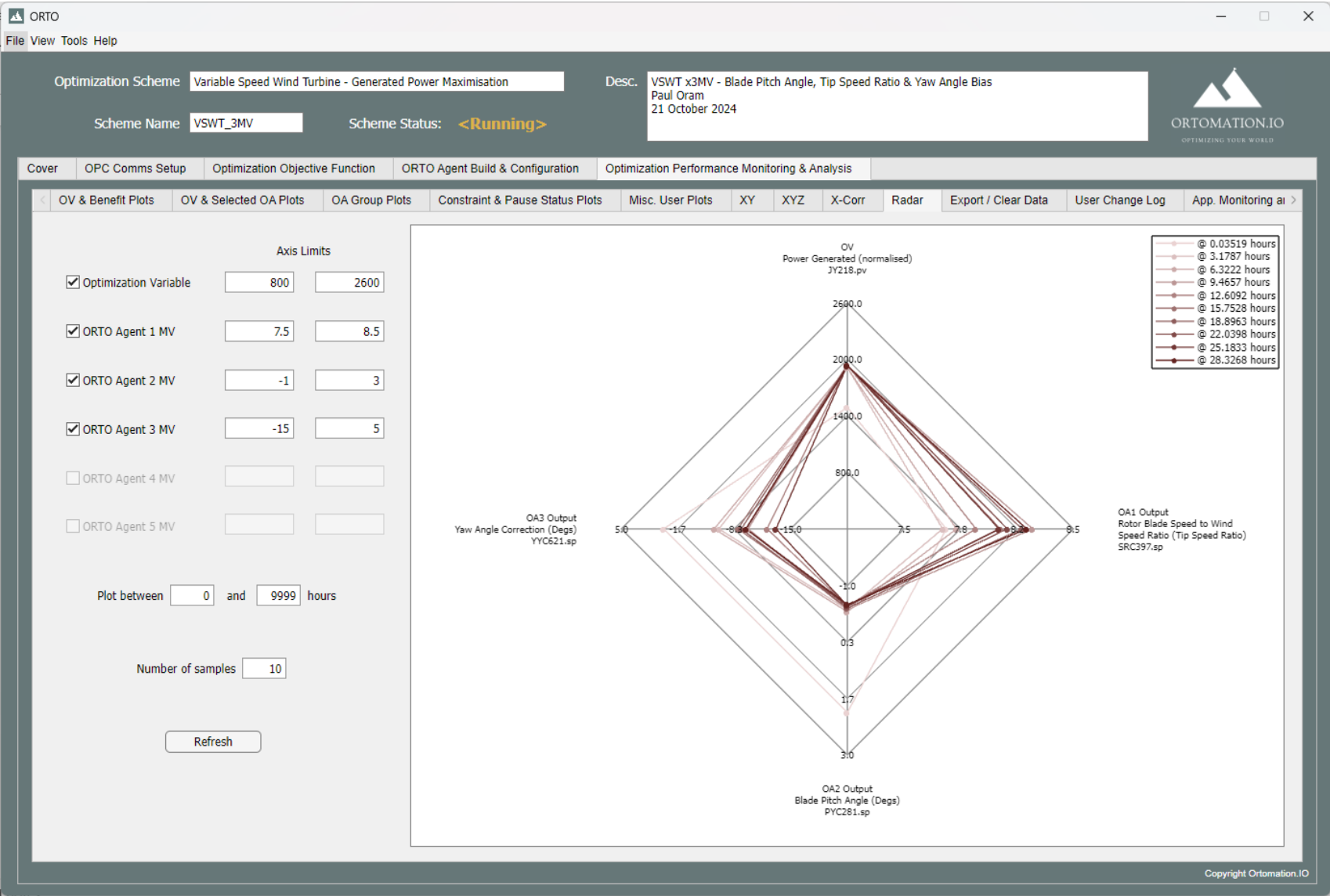
Plot three variables,
for example, to
visualize the 3D plane
between two MVs
and the OV

Cross Correlation Tab



← Perform cross and auto correlations

Radar Plot Tab



← Radar plot for OV and MV moves over a defined period.

Perf. Monitoring & Analysis Tab / Export & Clear Data Tab



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OPTIMIZING YOUR WORLD

ORTO

File View Tools Help

Optimization Scheme: Variable Speed Wind Turbine - Generated Power Maximisation

Scheme Name: VSWT_3MV

Scheme Status: <Running>

Desc: VSWT x3MV - Blade Pitch Angle, Tip Speed Ratio & Yaw Angle Bias
Paul Oram
21 October 2024

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OPTIMIZING YOUR WORLD

Cover OPC Comms Setup Optimization Objective Function ORTO Agent Build & Configuration Optimization Performance Monitoring & Analysis

< OV & Benefit Plots OV & Selected OA Plots OA Group Plots Constraint & Pause Status Plots Misc. User Plots XY XYZ X-Corr Radar Export / Clear Data User Change Log App. Monitoring ar >

Export Process and ORTO Agent Real-time Data

File name: VSWT_3MV_snapshot

Time base: Hours

Save between: 0 and 9999 hours

File Format: ☒ .xls ☐ .bt

OPC Data

☒ Read Data (1-15)
☒ Write Data (1-10)

Objective Function Data

☒ Optimization Variable
☒ Constraint Variable Flags (1-5)
☒ Pause Logic Flags (1-5)

ORTO Agent Input / Output Data

☒ ORTO Agent 1
☒ ORTO Agent 2
☒ ORTO Agent 3
☐ ORTO Agent 4
☐ ORTO Agent 5

Analysis Data

☒ Accumulated Benefit

Export Data

Schedule Export of Process and ORTO Agent Real-time Data

File name: VSWT_3MV_sched

Save every: 24 hours

File Format: ☒ .xls ☐ .bt

OPC Data

☒ Read Data (1-15)
☒ Write Data (1-10)

Objective Function Data

☒ Optimization Variable
☒ Constraint Variable Flags (1-5)
☒ Pause Logic Flags (1-5)

ORTO Agent Input / Output Data

☒ ORTO Agent 1
☒ ORTO Agent 2
☒ ORTO Agent 3
☐ ORTO Agent 4
☐ ORTO Agent 5

Analysis Data

☒ Accumulated Benefit

Schedule Export

Off ☐ On ☒

Clear All Historical Data

Clear Data

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Select real-time data to export

Select real-time data to be exported periodically

Clear data and erase plots

Perf. Monitoring & Analysis Tab / User Change Log Tab



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OPTIMIZING YOUR WORLD

ORTO

File View Tools Help

Optimization Scheme: Variable Speed Wind Turbine - Generated Power Maximisation Desc: VSWT x3MV - Blade Pitch Angle, Tip Speed Ratio & Yaw Angle Bias
Paul Oram
21 October 2024

Scheme Name: VSWT_3MV Scheme Status: <Running>

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OPTIMIZING YOUR WORLD

Cover OPC Comms Setup Optimization Objective Function ORTO Agent Build & Configuration Optimization Performance Monitoring & Analysis

< OV & Benefit Plots OV & Selected OA Plots OA Group Plots Constraint & Pause Status Plots Misc. User Plots XY XYZ X-Corr Radar Export / Clear Data User Change Log App. Monitoring at >

Date / time	Header / Tab Location	ORTO Agent	OA Descriptor	Parameter	Previous Value	New Value
28-Oct-2024 14:39:39	Scheduled data export switched on and writing to: <C:\Users\or...	-	-	-	-	-
28-Oct-2024 14:39:20	<Scheduled data export switched off>	-	-	-	-	-
28-Oct-2024 14:17:38	Real-time data scheduled export to <Dummy (1) (28_Oct_2024 ...	-	-	-	-	-
28-Oct-2024 12:46:32	Real-time data exported to <dummy2 (28_Oct_2024 12_46_25)...	-	-	-	-	-
27-Oct-2024 14:17:28	Scheduled data export switched on and writing to: <C:\Users\or...	-	-	-	-	-
27-Oct-2024 10:18:13	ORTO Agent Build & Configuration	OA3	Yaw Angle Correction (Degs)	Agent On/Off	off	on
27-Oct-2024 10:18:10	ORTO Agent Build & Configuration	OA2	Blade Pitch Angle (Degs)	Agent On/Off	off	on
27-Oct-2024 10:18:08	ORTO Agent Build & Configuration	OA1	Rotor Blade Speed to Wind Speed Ratio (Tip Speed Ratio)	Agent On/Off	off	on
27-Oct-2024 10:17:45	<3MV VSWT OPC UA - 21-10-24.orto> load complete.	-	-	-	-	-
27-Oct-2024 10:17:45	App. Monitoring and Prefs.	N/A	N/A	Data Points per Plot Value	1000	10000
27-Oct-2024 10:17:45	App. Monitoring and Prefs.	N/A	N/A	Data Threshold Compression...	0.3	0.03
27-Oct-2024 10:17:45	App. Monitoring and Prefs.	N/A	N/A	Inactivity Timer Value	30	30
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5	<see new value>	ORTO Agent 5 Name	----	----
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5		Push Direction	Positive	Positive
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5		MV Bounds [High Low]	[---- ----]	[---- ----]
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5		MV Bounds [High Low]	----	[---- ----]
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5		Sensitivity Factor	1	----
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5		Max. Move / Cycle	----	----
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5		Agent Cycle Time	----	----
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5		MV EU Range [High Low]	[---- ----]	[---- ----]
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5		MV EU Range [High Low]	----	[---- ----]
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5		Pause Flag	----	----
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5		Constraint Flag	----	----
27-Oct-2024 10:17:44	ORTO Agent Build & Configuration	OA5		MV Readback Tag	----	----
27-Oct-2024 10:17:43	ORTO Agent Build & Configuration	OA4	<see new value>	ORTO Agent 4 Name	----	----
27-Oct-2024 10:17:43	ORTO Agent Build & Configuration	OA4		Push Direction	Positive	Positive

Export .xls

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All user changes are logged. Logs can be exported as a .xls file.

App. Monitoring and Preferences Tab



ORTO

File View Tools Help

Optimization Scheme: Variable Speed Wind Turbine - Generated Power Maximisation

Desc. VSWT x3MV - Blade Pitch Angle, Tip Speed Ratio & Yaw Angle Bias
Paul Oram
21 October 2024

Scheme Name: VSWT_3MV

Scheme Status: <Running>

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OPTIMIZING YOUR WORLD

Cover

OPC Comms Setup

Optimization Objective Function

ORTO Agent Build & Configuration

Optimization Performance Monitoring & Analysis

< Shift Plots

OV & Selected OA Plots

OA Group Plots

Constraint & Pause Status Plots

Misc. User Plots

XY

XYZ

X-Corr

Radar

Export / Clear Data

User Change Log

App. Monitoring and Prefs.

>

App Performance Monitoring

Total run time

28.41

hours

No. of data records

17144

Execution cycle time

0.1926

secs

Reserved memory

0.4079

GBs

Data memory used

1.922

MBs

App Preferences

Inactivity timer

30

mins

Compression tolerance

0.03

%

No. points / plot

10000

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← ORTO application software monitoring and preferences.