

PI Vision: Basics

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Introduction

In this session we will use the latest features of the PI Vision in order to build extensive, rich, and informative displays. We will be heavily leveraging PI Asset Framework throughout this course in order to showcase the incredible strengths and abilities of the latest release of PI Vision. We will investigate new PI Vision features by building five main displays and by covering the basic display management and administration tasks.

Objectives

The following goals will be accomplished upon finishing the course:

- Understand how to search for important Events, PI Tags, and AF Elements and Attributes using the PI Vision Search Pane
- Familiarization with all key features available in PI Vision, from Ad Hoc Trending to calculations
- Understand the importance and use of each of the eight main symbols. Understand how they can be used to work together in order to display data quickly, easily, and efficiently
- Utilize templates in AF to create one display that may be reused with many different assets
- Be able to perform simple PI Vision Administrator tasks

Your PI System

This course uses a simplified PI system including the PI Data Archive, PI Asset Framework, and PI Vision all bundled together on one production server. Each student will have their own client machine to access PI Vision remotely. Each client machine is deployed using a Microsoft Azure environment so we will connect to them using Remote Desktop.

The servers of importance are:

- PISRVO1
 - PI Data Archive 2018 SP3
 - PI AF Server 2018 SP3
 - PI AF Client 2018 SP3
 - PI Vision 2020
 - We will not have direct access to this machine
- PICLIENT01
 - Server to make client connections to PI Vision
 - Shortcut to open PI Vision is available on Desktop
 - PI ProcessBook 2015 (will not be used in this course)
 - PI ProcessBook to PI Vision 2020 Migration Utility (will not be used in this course)

Approach

TechCon Labs, LLC has had the PI System for years but has just recently starting using PI Vision. So far, they have only used PI Vision as a tool to view Imported PI ProcessBook Displays.

You have been hired as a consultant by TechCon Labs, LLC to help them get the most value out of their PI System and visualize their data accordingly. TechCon Labs, LLC needs a quick and efficient way to monitor their 60 Wells, 27 Well Pads, and eight Production Areas. They estimate that you'll need to create around 100 displays, and they have allotted two full weeks for the job.

As an expert on PI Vision, you will help TechCon Labs, LLC build displays that showcase important events and data within the company. With your in-depth knowledge of PI Vision as well as your comprehensive understanding of element and attribute templates within AF, you know that you'll only need to create 5 displays and that it should take just under three hours to complete.

PI Vision Introduction

TechCon Labs, LLC would like a quick PI Vision introduction before you build all their displays. Once all the content is created, they want to make sure that everyone has a general idea of how to navigate PI Vision and create simple ad-hoc displays.

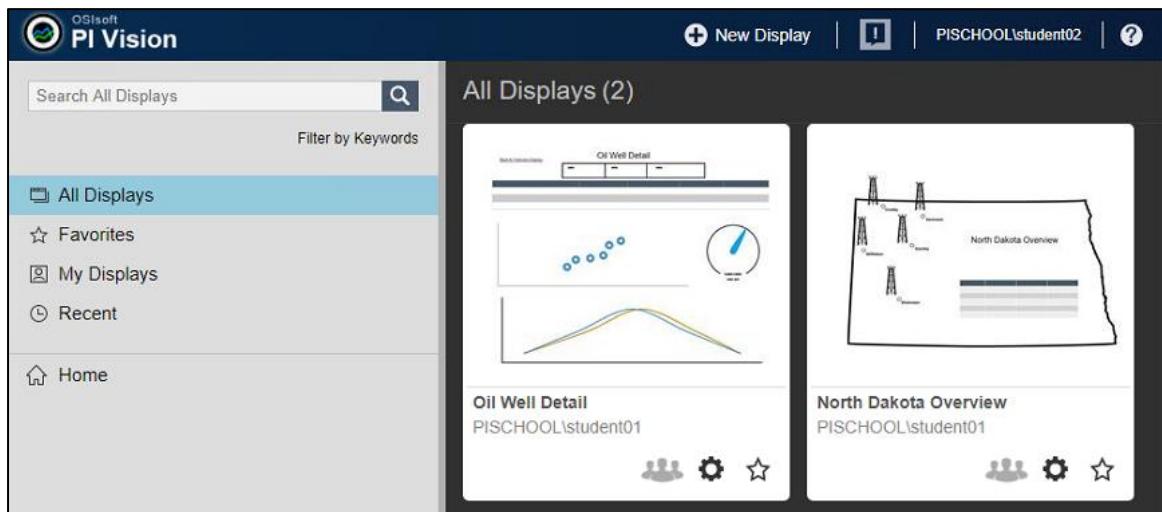
PI Vision is a web browser-based application that lets you retrieve, monitor, and analyse process information. PI Vision is supported by most modern browsers on a wide variety of computers, including tablets and phones running iOS or Android operating systems. PI Vision allows:

- Searching for, and visualising time-series and other PI System data.
- Saving displays for later use and further analysis.
- Reusing displays for multiple assets.
- Viewing PI ProcessBook displays.
- Sharing displays with other members of a group or anyone with access to PI Vision.

PI Vision Home Page

The home page is the starting point for PI Vision navigation. From here you can create displays as well as browse through your own and public displays.

The icon that reads **OSIsoft PI Vision** is the **home button**; this may be used at any time to return to the home page. Over to the right of the top bar is the **new display button**, which is used to open the editor to a fresh empty display waiting to be built. On the left side of the home page, we have **navigation options**; the purpose of these options is to help you find your displays as quickly as possible.



If you know the name of your display and want to jump right to it, you can search for it in the display **search box**. Alternatively, keywords can be associated with each display and by filtering on those keywords you can find the display or group of displays you have in mind. The “**All displays**” category will list all the displays that you have access to. This includes displays you own and displays that have been shared with you. If you're a PI Vision admin you also have the option of showing all displays owned by all users here as well.

The “**Favorites**” category lists all the displays that you have marked as favorite; displays can be favorited by clicking the star icon to the bottom right of their thumbnail when viewed in a list. “**My Displays**” lists all the displays that are owned by you. The “**Recent**” category lists all the displays that you have recently viewed. As a side note, in every one of these lists, displays are sorted locally by their

most recent access date. So, for example while “My Displays” will only list displays you own, they will also be ordered by how recently you have viewed each one.

Below the four default display categories is where you can build out your own display folder hierarchy. If additional organization is required, you can create folders to store your displays in, as well as child folders and so on; the folder hierarchy works much like your typical file system does so we encourage you to organize your displays in a way that makes sense to you.

The home folder is reserved for all your displays that have not yet been assigned to any other folder; if a folder based organizational style does not appeal to you, the home folder will operate very similarly to the “All Displays” category. Organizing your displays into folders will have no bearing on what each one of the default display categories returns. Even if a favorite display is tucked away in a folder three levels deep, you will still find it in your favorites. To the right of the navigation options, you'll find a list of displays that corresponds to the folder or category you're currently browsing.

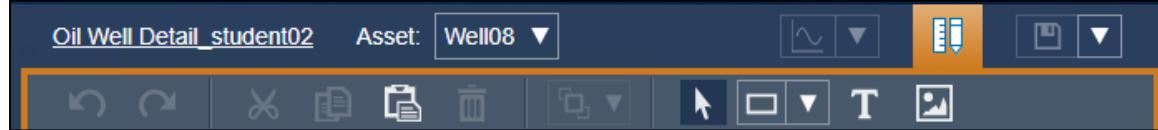
PI Vision Display Modes

There are two separate modes within PI Vision. You can only build and edit displays while in Design Mode. Look for the ruler and pencil icon in the top right corner of the toolbar. When in Design Mode this icon, as well as the border of the display, will be highlighted in orange:

Monitor Mode:



Design Mode:



To the far right we have our **Save** button; when we've made a change to our display this button becomes active, and we can save the edits that we've made. Using the drop down to the right of the floppy disk we also have the option to save as a new file or display or export data on the display to a CSV or XML format. Below this we have our **toolbar**; the toolbar consists of primarily editing and formatting functions, as well as static elements such as text boxes and geometric shapes.

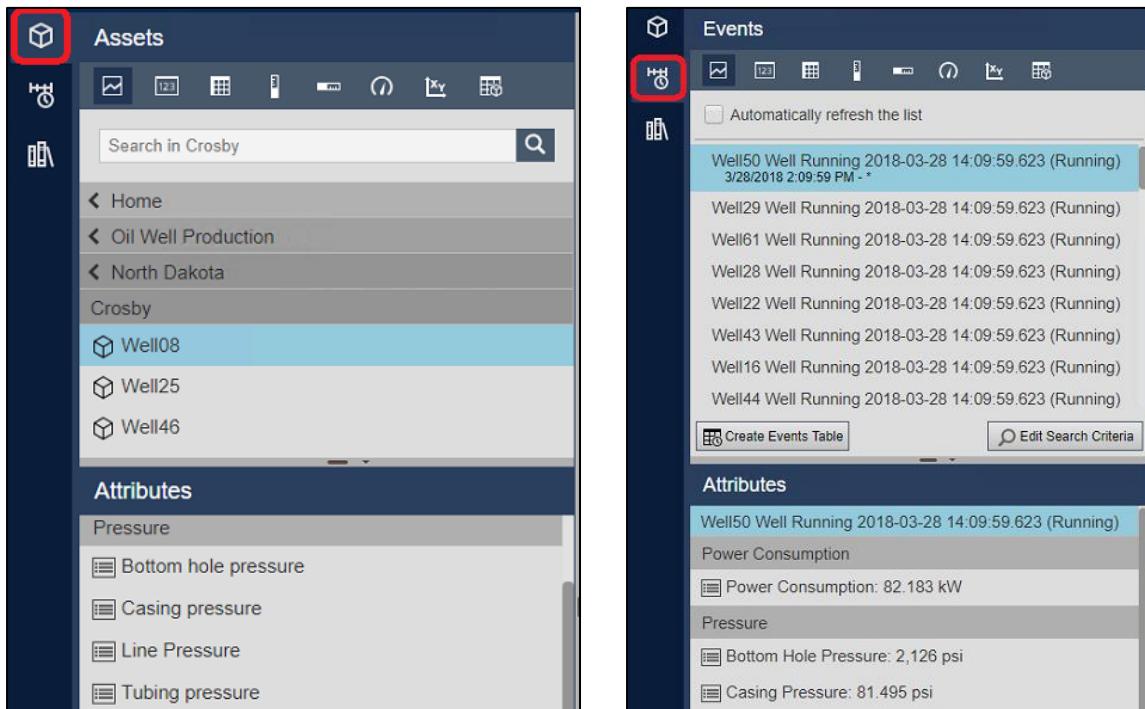
Let's add something to our display. We'll create a text box by clicking on the **capital T** and then clicking again inside the display window. A few things just happened here: first and foremost, text pops up on our display; a panel also appeared on the right side of the window which we'll call the **configuration pane**, where we can control what text is shown as well as a few styling options. Notice also that a new icon depicting a **ruler and a pencil** appeared to the left of our Save button.

This button toggles between **modify mode** and **monitor mode**.

Items on the display will respond differently to button clicks depending on which mode is currently active. In **modify mode** the icon will have an orange background and you will also find an orange border around the entire display window. Other options on the toolbar include undo, redo, cut, copy, paste, and delete. Which may also be invoked using standard keyboard shortcuts. This is also where you'll find the arrangement functions. To the left of the display viewport, we have the **assets pane**, **events pane**, and **graphics library**. The three may be cycled between using the three vertically aligned icons on the far left.

Asset Pane & Events Pane

The Asset Pane is used to find AF Elements and Assets as well as PI Points. AF Attributes can be found in the Attributes section. If the particular asset you are working with has related events they will be populated in the Events Pane:



The **assets pane** is where the bulk of our display content will come from. At the top of the panel, we have our data symbol list in order trend, value, table, vertical gauge, horizontal gauge, radial gauge, XY plot and asset comparison table. PI Vision also supports extensibility which means you can write your own symbols using JavaScript in HTML if you feel motivated to do so.

Below the symbol list is a search box that we can use to find specific assets, attributes, and PI tags. Underneath that is our navigation structure, at the topmost level our PI and AF databases. Asset framework databases have a hierarchical structure which means they can be explored level by level, while PI data archives have a flat hierarchy and must be searched. Beneath the navigation structure is an attribute list; when we select an asset from the navigational structure its attributes will populate the list below which may then be used on the display. To build data symbols on the display we want to first click on a symbol from the list of selected and then find our data item which will be a PI tag or attribute and click and drag it onto the display.

The **events pane** taps into the power of event frames and their relation to our assets; by default, this pane will populate with events related to assets represented on the display that were active within the time range of the display.

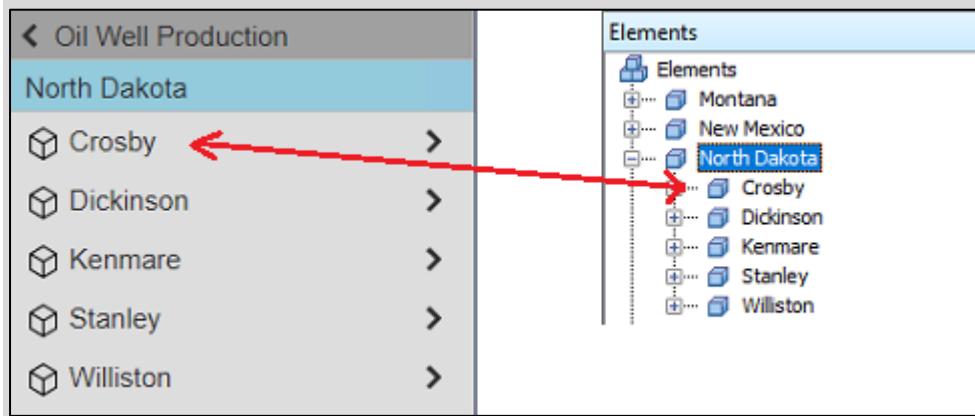
The built-in PI Vision **graphics library** provides scalable vector graphics representing many process components and equipment to help you add more detail and context to your displays. Graphics may be added to your display either by dragging and dropping them from the library pane or by selecting them first and then drawing a placement rectangle on the display.

At the bottom of the display is the **time bar**; the time bar controls the time range of the display and therefore the data that's represented. To the bottom left and right you can find the start and end times of the display and both values may be replaced simply by entering your desired times into the

boxes directly. The box in the center indicates the time coverage of the display and may be set to common intervals such as one hour, one day etc. by clicking on it. The arrows to the left and the right of this indicator are used to jump forward or backward in time an amount equal to the duration of the display. The Now button may be used to jump to the current time setting the display and time to start. When the Now button is green the display's end time is current and will update in real time.

Note:

In this course we will be working with the Oil Well Production AF Database on the PISRV01 AF Server. The Assets viewable in the PI Vision Search Pane are AF Elements created with PI System Explorer. The AF Structure has been built prior to beginning work on the PI Vision displays, which is recommended in order to take advantage of PI Vision's most powerful features.



Each element can have its own set of permissions, which is also enforced within PI Vision.

PI Vision Symbols

Trend	Value	Table	Radial Gauge	Horizontal Gauge	Vertical Gauge	XY Plot	Asset Comparison Table

Trend Symbol: Trends display a line chart depicting a variable's value over time. The x-axis measures time while the y-axis measures the value of the variable. Trends may contain multiple traces and optionally each trace may have its own y-axis scale. The time range covered by the trend matches that of the display.

Value symbol: Displays the current value of a PI tag or attribute. If the display time range is set in the past, then the value symbol will display the value of that variable at the display's end time. In addition to the value, the symbol may optionally show a label containing the element name and/or the attribute PI tag name, a timestamp of the value or the unit of measurement.

Table symbol: Displays a table of PI tags and attributes; the columns on the table can be customized to include but are not limited to the tag or attribute name, the value, the timestamp, unit of measurement, summary statistics, such as averages mins and maxes and a sparkline which is a small

trend that takes up a data cell. Tables may also include multiple data items with each contained in its own row in the table. In addition, data items do not need to be related to one another.

Gauge symbol: Comes in three different varieties vertical, horizontal, and radial. Gauges provide a graphical view of the current value reading; like the basic value symbol if a display time range is set in the past the display value of the gauge will be the value of the variable at the display's end time. In addition to the graphic this symbol can optionally show a label containing the element name and/or the attribute or PI tag name, a text representation of the value and the unit of measurement.

XY plot symbol: Displays a graph of plotted points to show if a relationship exists between sets of data. It supports multiple dependent variables on the y-axis that may be plotted against a single independent variable on the x-axis. It also supports plotting multiple dependent variables against multiple independent variables. Variables may be plotted against theoretical reference curves to compare against performance benchmarks as well.

Asset comparison table: Displays a comparison of shared attributes across multiple assets. Each row of the asset comparison table represents a unique asset; each column represents an attribute or property of each asset. That said, the available columns depend on the assets represented in the table. Dynamic search criteria may also be specified to further define which assets are sourced for the table.

Arranging and adding to the PI Vision display

The editing toolbar allows you to add shapes, text, or images, as well as arrange objects on the display. The table below describes some of the options available in the tool bar.

	Static Shapes	Static shapes add rectangles, circles, lines, arcs, or polygons to the display. Right click to format the shape or add multi-state.
	Text	Add a line of text to the display. Add a hyperlink to the text and search for an existing display to link to. Right click to format the text or add multi-state.
	Image	Add an image to the display. Supports most file formats including JPG, TIF, GIF (Static and animated), BMP, and SVG. The maximum image size is 2 MB.
	Arrange	To arrange multiple objects by aligning them or bringing one of them backward or forward, click the Arrange button on the editing toolbar. There are many options for arranging or aligning display objects, including sending an object forward or back, aligning multiple objects and distributing objects on the display.

Challenge 1: Create an Overview Display

Introduction

In this section we'll put the concepts we just learned to work and build a display from scratch. The display will be simple, but we'll make use of some powerful features to provide a great value to tech con labs. We'll start by preparing the display with some static features, such as a text box title and a background image before introducing dynamic content in the form of PI System data. Lastly, we'll make use of assets from the graphics library and multi stating to add additional layers of analysis.

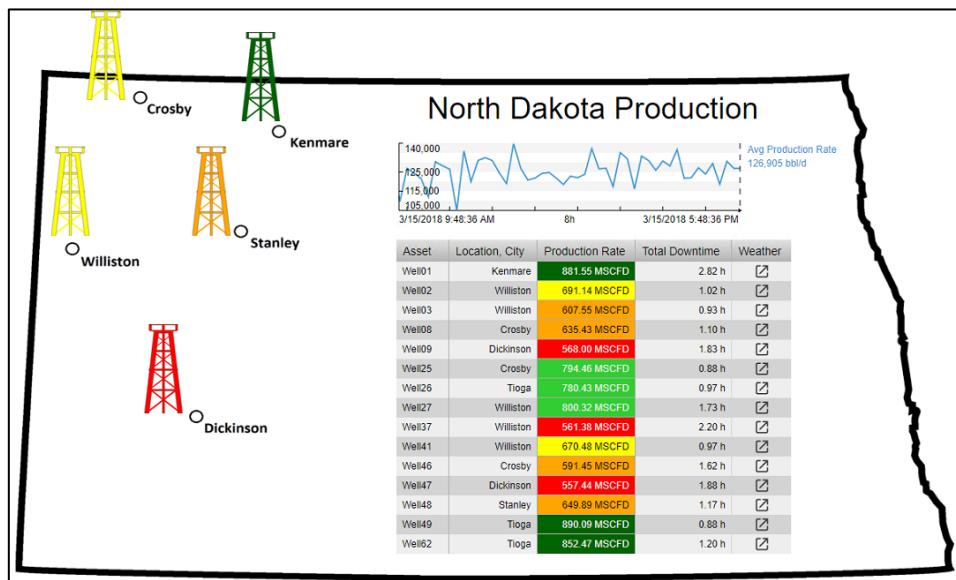
Before we start, let's briefly discuss multi-state behavior which we'll make use of in this section. Many symbols in PI Vision may be configured to exist in one of multiple states that represent discrete performance bands or statuses; each state maps a discrete value or range of values to a color and the multi stated symbols are then colored to represent their current state. The state depends on which process variable the symbols multi-state behavior is associated with and as the process value changes, the symbol's coloration changes in response to the change of state.

Overall, multi states provide an additional visual indicator into the state of your processes.

Challenge Overview

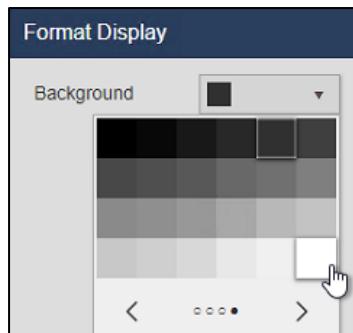
TechCon Labs has identified production within the state of North Dakota as a strategic area to monitor in the next several months. The TechCon Labs management team has requested a dashboard from which they can see any under-performing Well Pads or Oil Wells within the state at a single glance. If management is impressed by the resulting dashboard, they plan to approve additional project resources to continue the project.

Below, the team has provided an illustration of what they would like this overview display to look like:



1.1: Prepare the Display

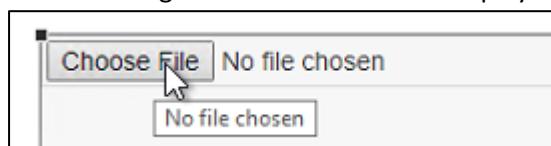
1. On the PI Vision Homepage, click the **New Display** button at the top right-hand side of the screen.
2. Right-click anywhere on the background of the display and select **Format Display...** to open up the configuration pane.
3. Open the **Background** drop-down color selector and choose the white background:



4. Click the **Image** button on the toolbar:



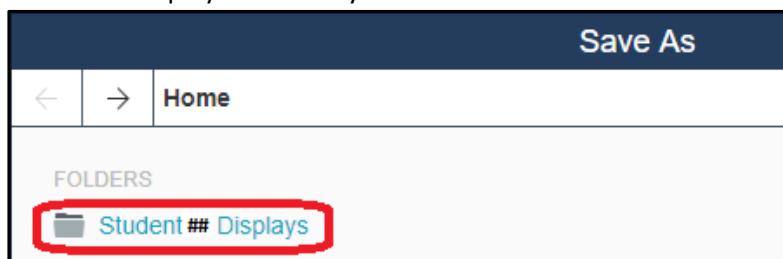
5. Click and drag to outline most of the display area, and then click **Choose File**:



6. Select the file **C:\Class Files\north_dakota.gif** from the file explorer. If you do not see the image in this folder, please let your instructor know.
7. Click on the **Save** button in the top right of the browser window:



8. Select the Display Folder for your user account:

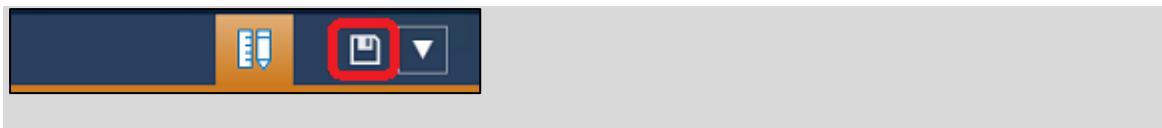


9. Save the display with the name **North Dakota Overview** followed by your student number.
For example: *North Dakota Overview_Student##*.
10. Click the **Design button** (ruler and pencil) to place the display back into Design Mode:

Note:

The workbook does not explicitly call for the display to be saved again until it is completely finished.

However, it is a good idea to make incremental saves after every couple steps to make sure no work is ever lost. This can be done at any time by clicking the **Save** button again.



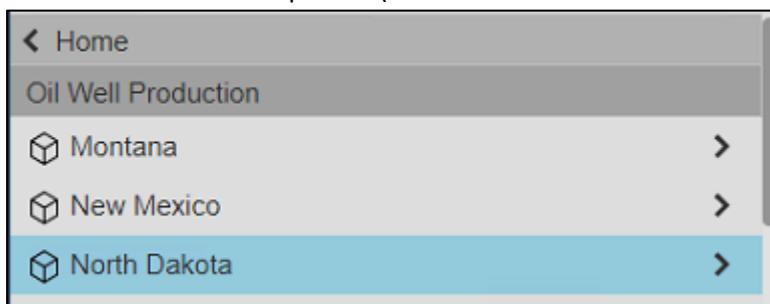
11. Click the **Text** button on the toolbar:



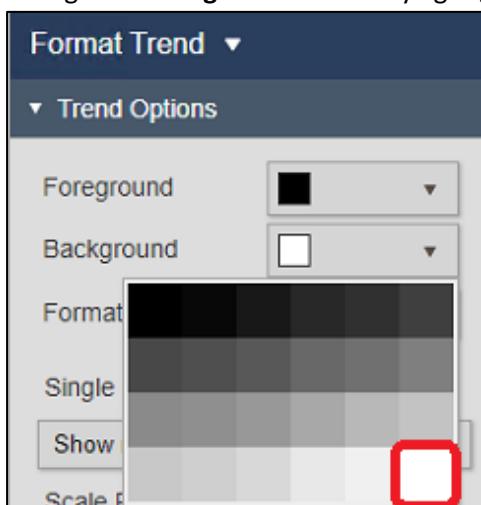
12. Click on the upper right area of the state image and type "North Dakota Production" in the **Format Text** field of Configuration Pane.
13. In the same Configuration Pane, set the **Font Size** to 28.

1.2: Add PI Data

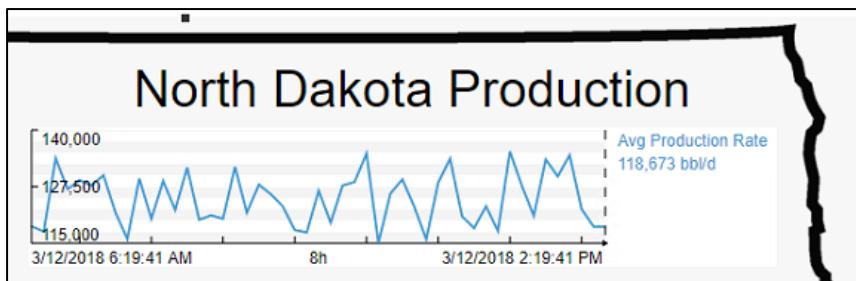
1. In the Asset Pane to the left of the display workspace, find the **Oil Well Production** database and click on the rightmost ">" to drill down into the database. On the first level of the database, find and click on the **North Dakota** element. If the Asset Pane is collapsed, click on the **Assets** icon to expand it (see Asset Pane & Events Pane section for a refresher).



2. Verify the Trend symbol type is highlighted, and click and drag the **Avg Production Rate** attribute on the display to fill the area below the text symbol that reads "North Dakota Production".
3. Right-click on the symbol and select **Format Trend**.
4. Change the **Background** from very light grey to white



5. Resize the trend to only occupy a narrow band below the display title in the top right corner of the North Dakota outline:



6. Drill down into the **North Dakota** and **Crosby** elements in the Asset Pane to find **Well08** and click on it.
7. Below the Asset Pane under **Attributes**, find the **Location, City** attribute:

8. Select the **Asset Comparison Table** symbol and then click and drag the **Location, City** attribute onto the bottom right area of the North Dakota state outline on the display:



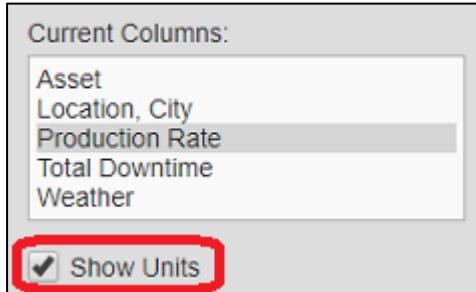
9. Right-click on the table symbol and select **Configure Table...**:
10. Under **Additional Attributes**, select **Production Rate** and click the upwards pointing arrow to add an additional attribute column:

11. Repeat the previous step (10) for the **Total Downtime** and **Weather** attributes to add a fourth and fifth attribute column to the table.
12. In the **Style** section of the configuration pane, select the middle option to use a light color scheme



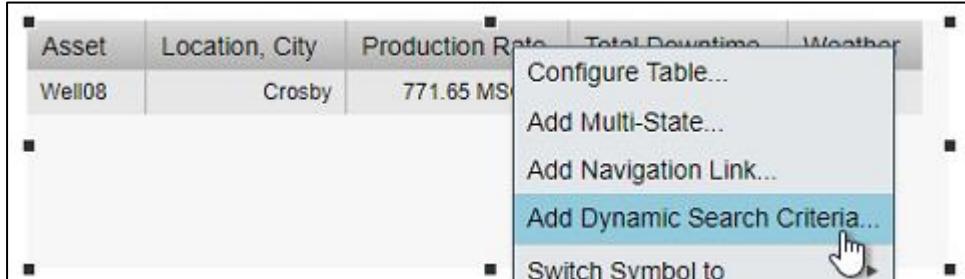
13. Resize the symbol area and the table columns so that no text is cut off either in the column headers or in the data cells.

14. In the configuration pane, highlight the **Production Rate** column and click the **Show Units** checkbox:



15. Repeat the previous step (14) to show units for the **Total Downtime** attribute column as well.

16. Right click on the Asset Comparison Table symbol and select **Add Dynamic Search Criteria...**



17. Modify the **Search Root** to include all of North Dakota and click the checkbox to **Return All Descendants**. Then, click **Refresh**:



18. Resize the symbol again so that all rows are shown and there are no scroll bars.

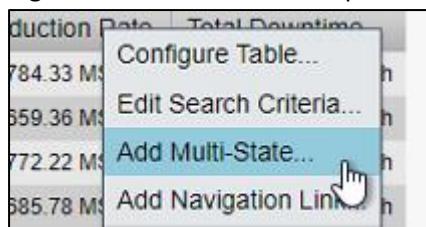
Note:

The icons in the **Weather** column can be clicked to open a link containing weather information for the appropriate city. Behind the scenes, this is an AF Attribute that contains a URL as its value.

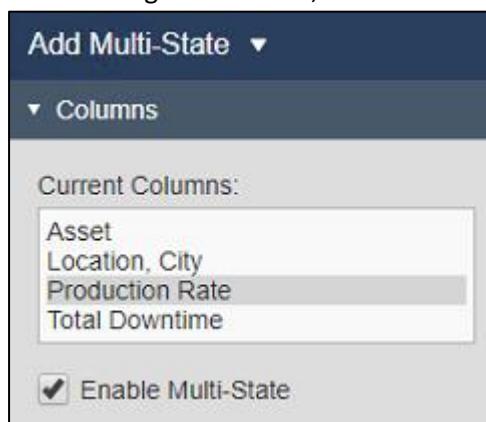
1.3: Configure Multi-Stating

For this part of the exercise will be utilizing multi states to provide quick insight into the performance of each of our wells and well pads. Let's start with the well-focused asset comparison table.

1. Right-click on the Asset Comparison Table symbol and select **Add Multi-State...**:



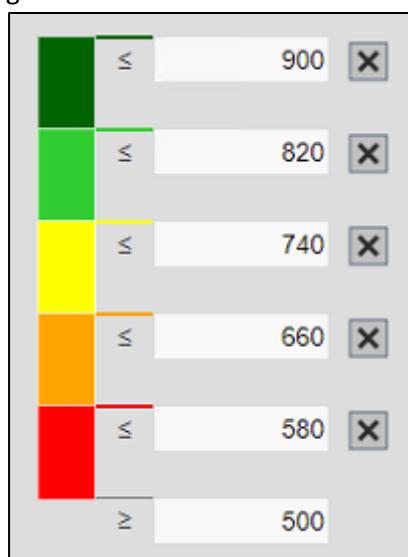
2. In the Configuration Pane, select **Production Rate** and select **Enable Multi-State**:



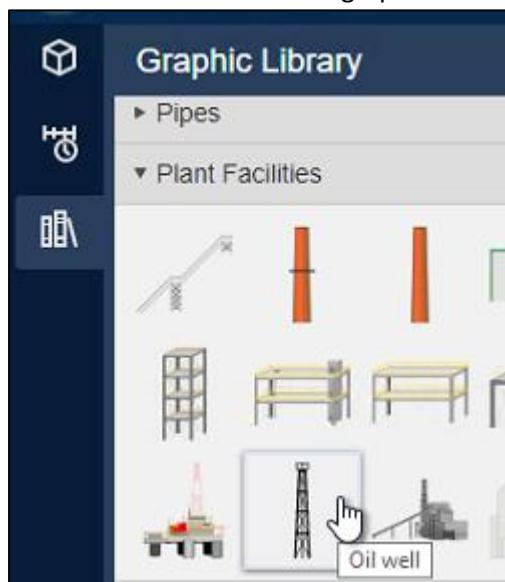
Note:

You may notice this checkbox is grayed-out in some of the other columns. This is because attributes must contain numeric values or be configured with digital states to be eligible for Multi-Stating.

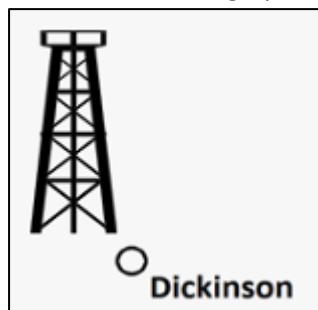
3. Modify the State colors so low values are shown in red and high values in green with a color gradient in between:



4. On the left-hand side of the display, open the Graphic Library locate the **Plant Facilities** section. Select the **Oil Well** graphic:



5. Draw the **Oil Well** graphic next to **Dickinson** on the map:



6. Right-click on the graphic and select **Configure Multi-State...**.
7. Drill down into the **North Dakota** element in the Asset Pane and highlight **Dickinson**.
8. Click and drag the **Avg Production Rate** attribute under the **Multi-State Attribute** header in the rightmost configuration pane.
9. Repeat step 3 to modify the State colors so low values show in red and high values in green.
10. Select the **Oil Rig** graphic on the display and click **Copy** on the toolbar



11. Click **Paste** four times



Note:

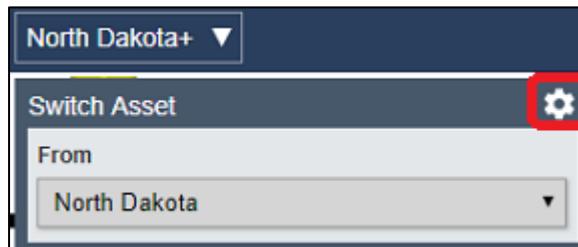
The keyboard shortcuts **Ctrl + C** and **Ctrl + V** may also be used to copy and paste, respectively.

12. Click and drag the four new **Oil Well** graphics so there is one next to each production area
13. Repeat steps 6-9 to replace the Multi-state Attribute with the **Avg Production Rate** for the corresponding production area (**Crosby | Avg Production Rate**, **Kenmare | Avg Production Rate**, etc).

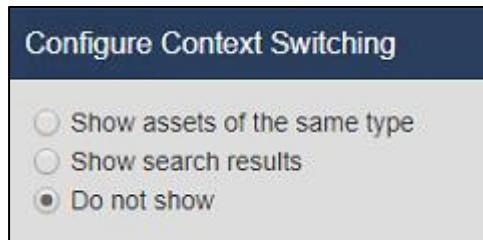
Note:

Be sure to replace the Multi-State data item rather than removing the existing item (using the trashcan graphic) and adding the new one. If the item is removed, the Multi-State colors will need to be re-configured each time.

14. Open the Asset drop-down menu on the top of the display and then click the configure button



15. Under **Configure Context Switching** in the configuration pane, select **Do not show**:



Note:

Since this is an overview display, we are hiding the context switching menu. This display is designed to always show the same data items. We will later be creating other displays that are meant to have a swappable asset context, and therefore will have the menu enabled.

16. In the top right corner, click the **Save** button:



Challenge 2: Create a Well Pad Drill-in Display

Introduction

The North Dakota overview display provided visibility into our operations from a very high level, but now we'd like to take a microscope to this by building out a screen specific to our oil wells the most discreet production component we have data for. Throughout this process, we'll review working with text boxes to provide a descriptive title for our display and we'll introduce static shapes that can be used in a variety of ways to enhance your displays content.

We'll work extensively with the most fundamental data symbol: the value and explore how we can customize the information it displays. Lastly, we'll touch on collections and context switching to exemplify the versatility and dynamism of even the simplest of displays.

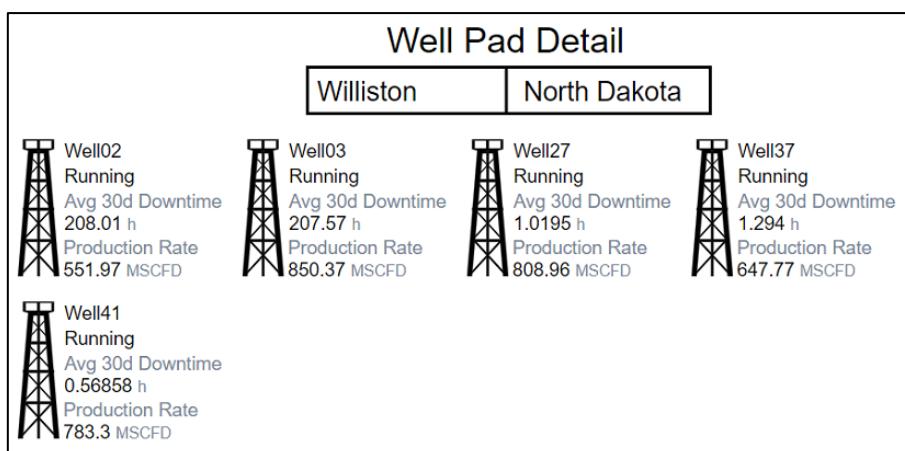
Before we start it's important to know what a **symbol collection** is. A symbol collection is a group of one or more static or dynamic symbols that are extended to a predefined set of assets. Each asset is represented by its own copy of the symbol group. The collection of assets can be defined in several ways with the most common being like assets or those built from the same asset template.

The collection may also be defined by asset name masking and additional filters may be applied to further define the assets represented, such as those currently in a downtime state or those that have met their production quotas for the month. Symbol collections are dynamic which means that the assets that they can display change in real time. When assets that meet the collection's, criteria are added or removed from your asset framework the collection will expand or contract in response to those changes. Likewise, collections that track the status of a group of assets will flex as assets enter or exit the predefined state.

Challenge Overview

The TechCon Labs management team has taken a look at the North Dakota dashboard and they think this PI Vision project has potential. However, they would also like to have a more detailed dashboard for each well pad.

Below, the team has provided an illustration of what they would like these well pad displays to look like:



Since there are five different production areas and each one has a variable number of oil rigs, the executive team has allotted a week to build a specialized display for each area. However, because you are familiar with the latest *collection* and *asset-relative* functionality in PI Vision, you believe you can satisfy the design requirements with a single display.

2.1: Prepare the Display

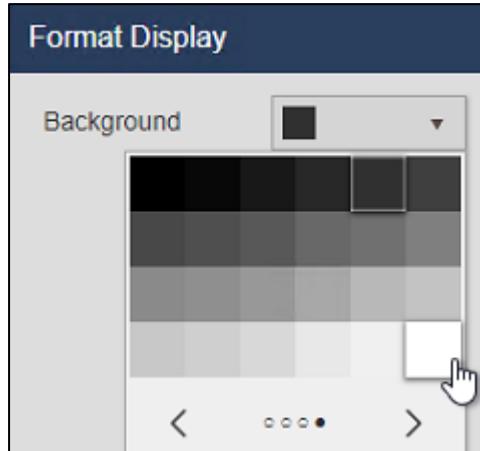
1. On the PI Vision home page, click the **New Display** button at the top right-hand side of the screen

Note:

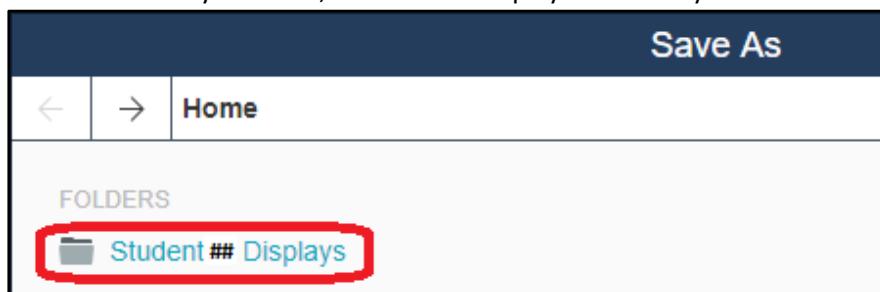
At any time, you may return to the PI Vision home page by clicking on the *PI Vision* logo in the top left of the page. But please remember to save the display you are currently working on as any unsaved changes will be lost.



2. Right-click anywhere on the background of the display and select **Format Display** to open up the configuration pane.
3. Change the display **Background** color from the default dark gray to white:



4. Highlight the **Text** button on the toolbar and then click on the top middle area of the display and type “Well Pad Detail” under the **Format Text** header in the configuration pane.
5. In the same Configuration Pane, set the **Font Size** to 26.
6. Click on the **Save** button in the top right of the browser window.
7. If it is not already selected, click on the Display Folder for your user account



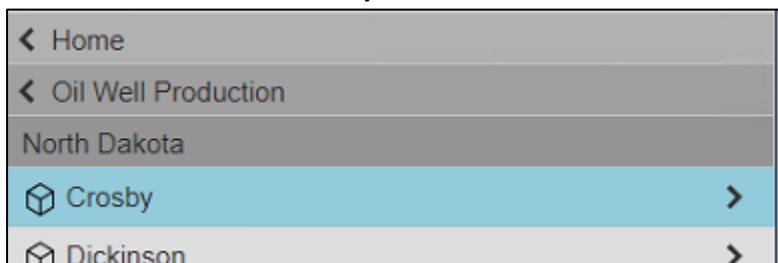
8. Save the display with the name **Well Pad Detail** followed by your student number. For example: *Well Pad Detail_Student##*.

2.2: Add PI Data for the Well Pad

1. Click the **Design button** to place the display back into Design Mode



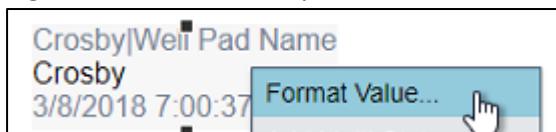
2. Drill down into the **North Dakota** element under the **Oil Well Production** database in the Asset Pane and find the **Crosby** element:



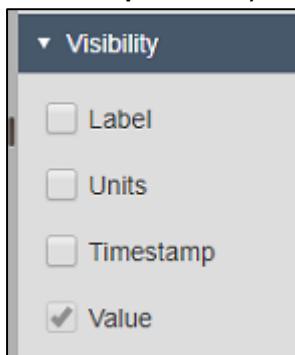
3. Select the **Value** symbol type at the top of the search pane:



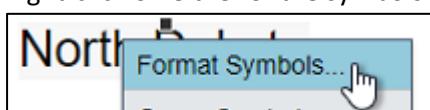
4. Click on the **Well Pad Name** attribute and drag it onto the display below the "Well Pad Detail" text symbol.
5. Right-click on the value symbol and select **Format Value...**



6. Expand the **Visibility** section of the configuration pane and deselect **Label**, **Units**, and **Timestamp**. We only want to display the name of this well pad:



7. With the **Value** symbol still highlighted, click on the **Production Area Name** attribute and drag it onto the display below the "Well Pad Detail" text symbol and to the right of the well pad name.
8. Right-click on the value symbol and select **Format Value...**
9. Repeat step 6 to remove the **Label**, **Units**, and **Timestamp** from the **Production Area Name**.
10. Select both Value symbols by holding the **Ctrl** key and clicking on each in turn.
11. Right-click on either of the symbols and select **Format Symbols...**:



12. In the Configuration Pane, set the **Font Size** of both symbols to 20.

13. With both value symbols still selected, click the **Align Top** option in the **Arrange** dropdown menu on the toolbar. This will adjust the vertical positions of all currently selected symbols to align to the top of the topmost symbol in the selected group:



14. From the **Shape** dropdown menu on the toolbar, select the **Rectangle**:



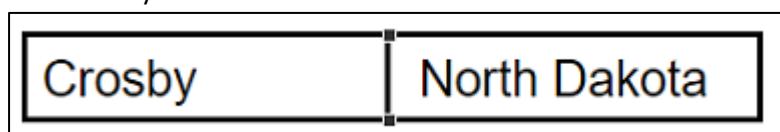
15. With the rectangle shape selected, click and drag on the display to draw a rectangle around the two existing Value symbols.

16. In the **Arrange** dropdown menu, select **Send to Back** to move the rectangle underneath the two Value symbols:



17. Expand the **Shape** dropdown menu on the toolbar and select the **Line**.

18. While holding down **Shift**, trace a line to divide the rectangle into two sections containing one value symbol each:

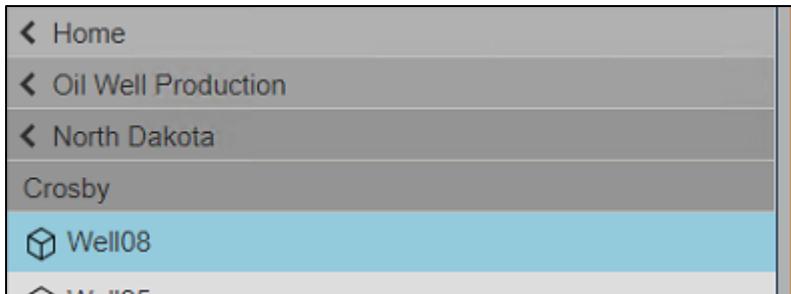


Note:

Holding down **Shift** while drawing will cause the **Line** shape to “snap” to the closest 45° angle.

2.3: Add PI Data for the Well Pad's Wells

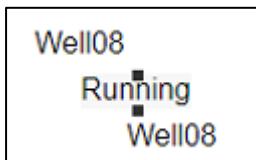
1. Drill down into the **North Dakota** and **Crosby** elements under the **Oil Well Production** database in the Asset Pane and find the **Well08** element:



2. Verify the **Value** symbol is still selected:



3. Find the **Well Name** attribute and drag it onto the display.
4. Right-click and **Format [this] Value...** to deselect the **Label**, **Units**, and **Timestamp** options underneath the **Visibility** section of the configuration pane (see 2.2, steps 5-6 for a refresher).
5. **Copy** this symbol and **Paste** it two times.
6. Find the **Status Message** attribute underneath **Well08** in the Asset Pane. Drag it onto the second **Well08** Value symbol. The second Value symbol should now read the status message rather than the well name:



7. Find the **Avg 30d Downtime** attribute underneath Well08 in the Asset Pane and drag it onto the third **Well08** Value symbol:



8. Right-click on the third value symbol and select **Format Value**.
9. In the **Visibility** section, check the boxes for **Units** and **Label**. Using the drop-down menu, select the second label instance (where it only includes the name of the attribute and not the name of the element):

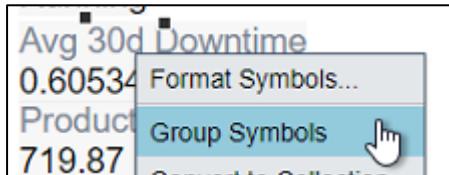


10. **Copy** the **Avg 30d Downtime** Value symbol and **Paste** it one time.

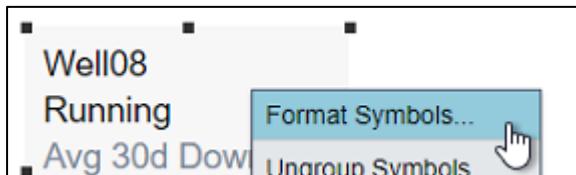
11. Click and drag the fourth value symbols so there is no overlap



12. Find the **Production Rate** attribute and drag it onto the newly created fourth Value symbol.
13. Click and drag a selection box around the value symbols to select all four simultaneously.
14. From the **Arrange** dropdown menu, select **Align Left**. This will horizontally adjust the position of all currently selected symbols to align with the leftmost symbol in the selected group.
15. With all four of the symbols still selected, right-click any one of the symbols and select the **Group Symbols** option:



16. Right-click on any of the four symbols again and select **Format Symbols...**



17. Set the **Font Size** to 14
18. On the left-hand side of the display, open the **Graphic Library**, find the **Plant Facilities** section, and select the **Oil Well** graphic from Challenge 1 (page 21).
19. Draw the **Oil Well** graphic right next to the four values symbols that were most recently added



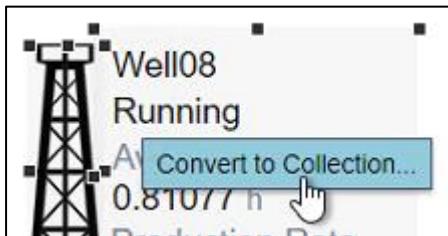
2.4: Create a Collection

So far, our display is looking good, but it only shows one oil well at the Crosby well pad and we know for a fact that Crosby has three wells. But we also went through a lot of trouble to set up our group of symbols for well08. It'd be inconvenient to go through that same process all over again for each of the other two wells. And what if our one of our well pads has more than three wells or less than three wells?

We can't go updating the design of this display each time we want to look at a different well pad. So, this is where collections come in. As I mentioned earlier collections excel in scenarios where we want to apply a symbol structure and styling to dynamic collections of assets. One of their biggest strengths is support for dynamic asset counts, which means you as the display creator don't need to know exactly how many of an asset exist before building out a display. And later down the line should you introduce new assets or remove existing ones the collection will automatically flex in response to those changes.

Our goal then is to build a collection out of our oil well symbol group.

1. Select all of the Value symbols created in the previous section including the **Oil Well** graphic, right-click on any one of those items, and select the **Convert to Collection...** context option:



2. Resize the collection area so that all Oil Wells can be show in a horizontal row



3. Open the Asset drop-down menu on the top of the display and then click the configure button



4. Toggle the **Context Switching** option to use **Show search results** and verify that the North Dakota element is set as the **Search Root**.
5. Open the Asset Dropdown menu and click **Williston** to change the display context



6. Save the display.

Challenge 3: Modify an Existing Oil Well Display

Introduction

In this section our approach will be slightly different. Instead of creating a third display from scratch we'll be building off the work our colleague has already done.

We'll be taking a step back outside the PI Vision display editor to perform some simple display management tasks. There exists a display we'd like to use and adapt for our purposes, but we need to either gain ownership of it or produce an editable copy to do so. As it has been marked read only by our colleague. Originally adapted from an existing PI ProcessBook file, this display focuses on an individual oil well and several of the KPIs we're interested in. But it still has some marks of its legacy origins that we'd like to modernize while also introducing asset event tracking for further insight into our oil well's performance.

Since this section touches on PI Vision's support for visualizing events, it's important to understand just what an **event frame** is. In the real-world things happen and we call these occurrences events; they may be planned such as the transition between operator shifts or they may be unplanned such as an equipment outage that halts production entirely. Regardless of an event's nature it takes place in time and typically has a clearly defined start and end. This start and end time frame our event and enable more accurate analysis within the bounds.

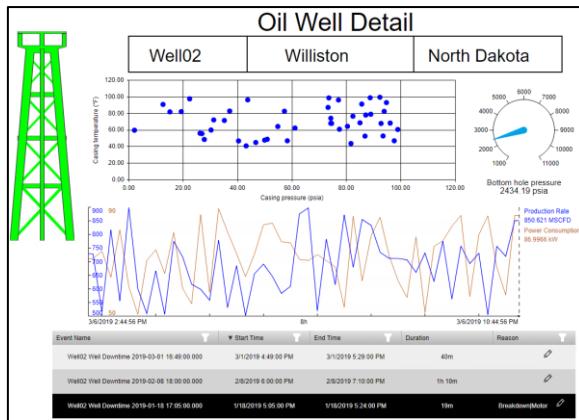
Event frames therefore capture these events and information about them, enabling analysis of those events to determine root cause, operational impact, and mitigation strategies to employ in the future. Just as elements allow you to collect and store data about assets, event frames allow you to collect and store data about events.

Challenge Overview

The TechCon Labs management team is again satisfied with your work and would like to take this a step further. This time they have requested a dashboard for each oil well within North Dakota. There is an existing PI ProcessBook display that served this purpose before and should be used as a model. In addition to the items on that display, the dashboard must also include a way to view and classify recent downtime events for the oil rig.

Management was surprised by the quick turnaround on the last stage of the project, but they still figure so many displays will take at least a week to build. With your experience building the previous two displays, you are confident that only a single display is needed here. To make matters easier, a colleague of yours has already migrated the PI ProcessBook display into PI Vision. But they forgot to transfer ownership of the display to you before they left for vacation! As a result, you'll need to find this migrated display and create a copy that you can adapt for downtime event analysis.

With your additions to the original display, the management team expects this display to look something like the following:



3.1: Find and Copy the Migrated PI ProcessBook Display

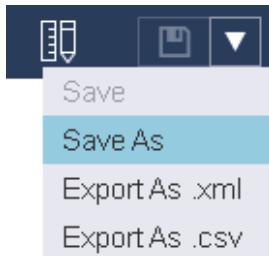
1. Click on the PI Vision icon in the top-left of the browser window to return to the display homepage.
2. Navigate to the Home folder at the top of the display folder navigation tree:



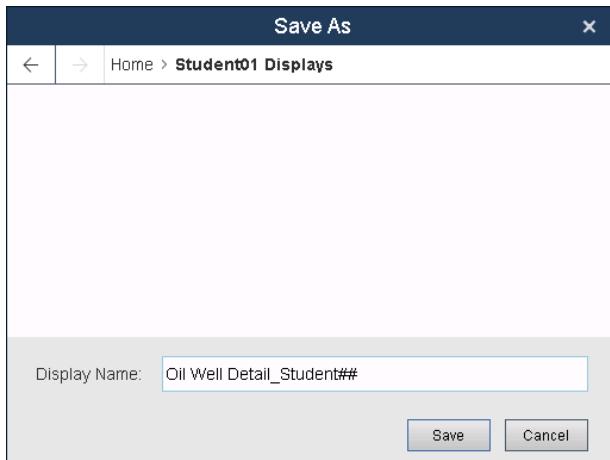
3. Find and open the display named **Oil Well Detail** located here.
4. In the top-left corner of the display, you should see the words “read-only” next to the display name. No changes may be made to this copy of the display. Instead, an editable copy must be made:



5. In the top-right corner of the display, click the dropdown next to the Save button and select **Save As:**



6. Name the display something like **Oil Well Detail_Student##** and save it to your display folder:



7. You are now the owner of an editable copy of this display. To further show this, you should now see your saved display under **My Displays**:

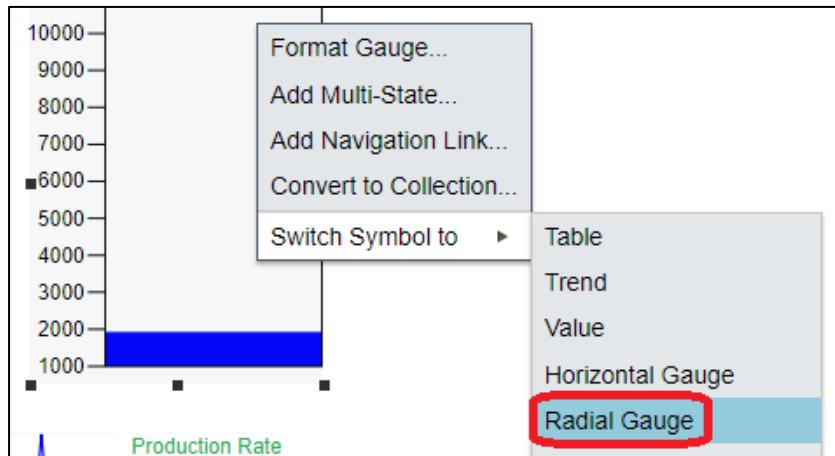


3.2: Modernize Gauge Symbol and Update XY Plot

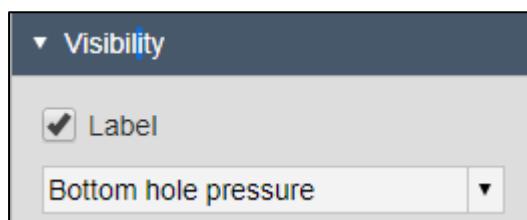
1. Click on the **Design** button in the top right corner of the window to switch to Design Mode



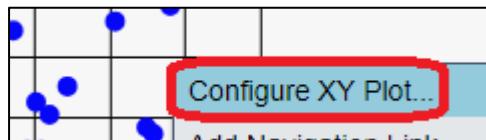
2. Right-click on the Vertical Gauge and select **Switch Symbol to Radial Gauge**



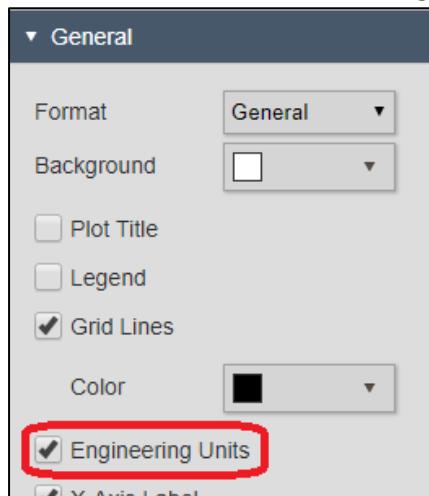
3. In the Visibility section, use the **Label** dropdown menu and select to show only the attribute name:



4. Right-click on the XY Plot and select **Configure XY Plot...**



5. In the General section of the Configuration Pane, enable **Engineering Units**



3.3: Introduce Downtime Event Tracking

Another modern feature unique to PI Vision is support for event frames. Our previous well pad detail display included the 30-day average downtime for each one of its wells, but on our oil well detail display it would be even better if we could explore and track each one of the downtime events for that well, complete with start and end times and reason codes for the downtime event.

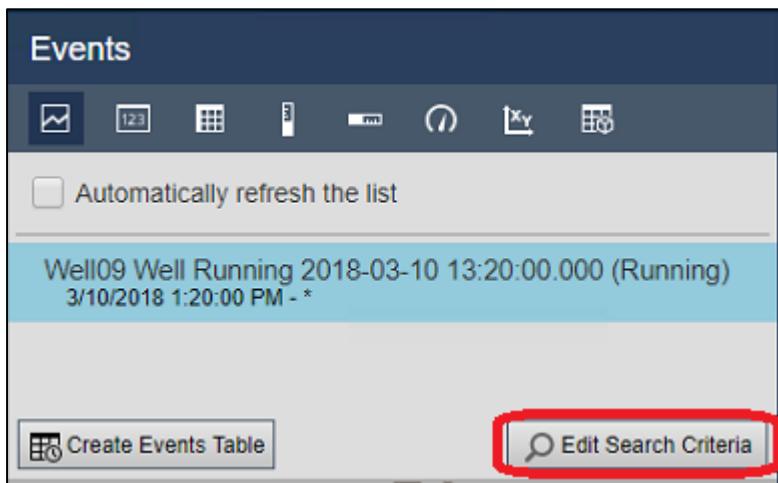
Here's where the events table comes in. Like how the asset comparison table allows us to view multiple assets simultaneously and compare their attribute values, the events table allows us to view multiple events simultaneously and compare their attribute values. To the left of the asset pane below the Graphic Library is the event pane. By default, the events pane lists all the events related to assets currently on the display that were active at any point between the start and end time of the display. But we can change this behavior by editing the search criteria.

For example, let's say we want to view all events active within the last two months.

1. Open the Events Pane beneath the Asset Pane on the left-hand side PI Vision:



2. Click **Edit Search Criteria**:



Note:

By default, the Events Pane returns events active at any point between start and end time of the display and related to any assets currently on the display.

3. Select **Custom Time Range** from the Time Range dropdown list, specify “*-2mo” (two months ago) as the Start Time, and click **Apply** to save the changes:

Edit Search Criteria

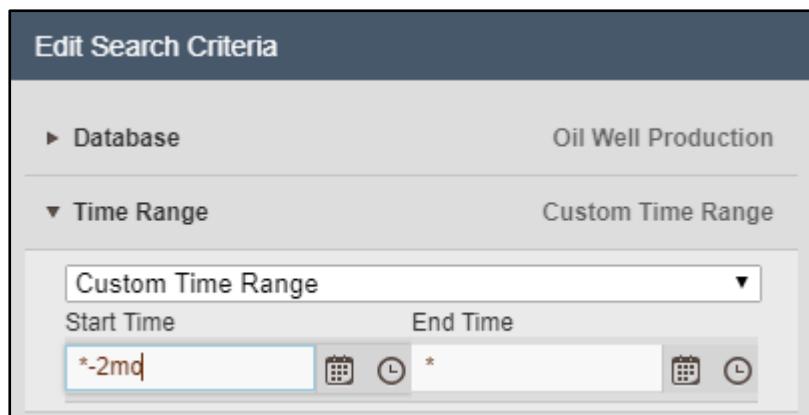
► Database Oil Well Production

▼ Time Range Custom Time Range

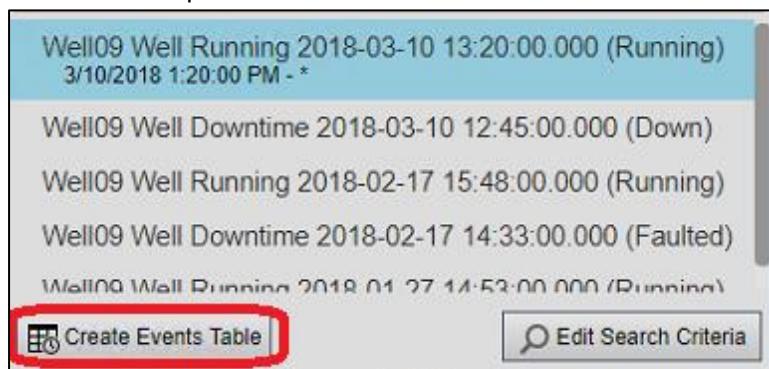
Custom Time Range ▾

Start Time End Time

*



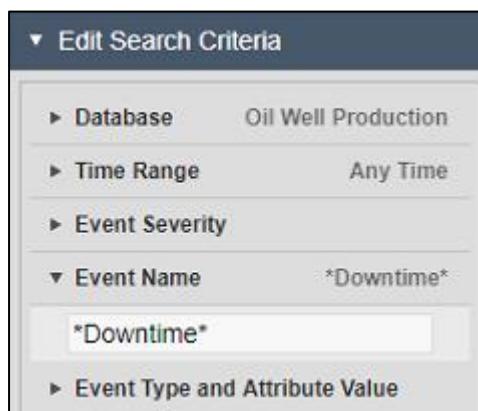
4. Click **Create Events Table** and drag the resulting symbol beneath the Production Rate vs Power Consumption trend:



5. In the Configuration Pane, deselect the columns **Asset** and **Acknowledgement**, and select the columns **Duration** and **Reason**.
6. In the **Style** section of the Configuration Pane, Select the Light color scheme:



7. In the **Edit Search Criteria** section of the Configuration Pane, add an **Event Name** search filter for “*Downtime*” and then click **Apply**:



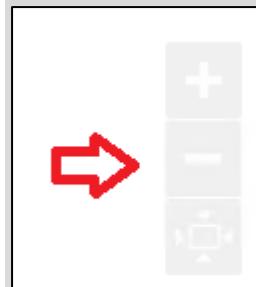
8. Resize the Events Table symbol outline and columns so that no nothing is cut off or wraps to the next line:

Event Name	Start Time	End Time	Duration	Reason
Well09 Well Downtime 2018-02-17 14:33:00.000	2/17/2018 2:33:00 PM	2/17/2018 3:48:00 PM	1h 15m	
Well09 Well Downtime 2018-03-10 12:45:00.000	3/10/2018 12:45:00 PM	3/10/2018 1:20:00 PM	35m	

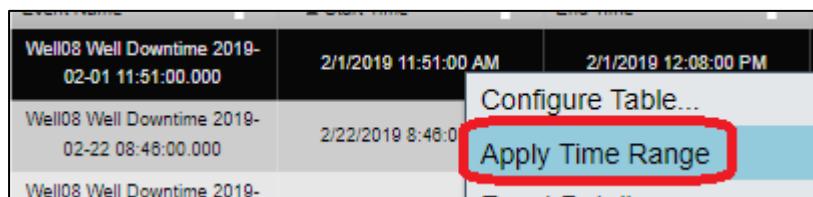
9. Place the Events Table symbol at the bottom of the display and adjust the position of other symbols if desired.

Note:

If needed, the **Zoom Out** button is located in the bottom right of the display.



10. Right click on an Event in the table and select **Apply Time Range** to set the display Start Time and End Time to match the downtime event:



11. Click the Pencil graphic in the **Reason** column for the same Event in the table, and then expand the Reason hierarchy to select a Pump Breakdown as the reason for the downtime:



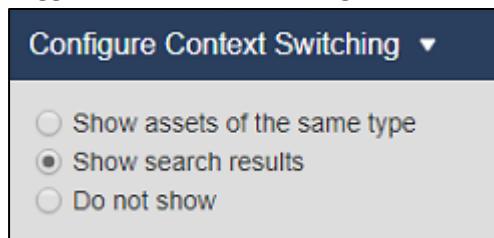
Note:

Setting the Reason Code in PI Vision saves the information on the underlying event. Going forward, anyone that views this particular event will see an explanation of what caused the downtime.

12. Open the Asset drop-down menu on the top of the display and then click the configure button



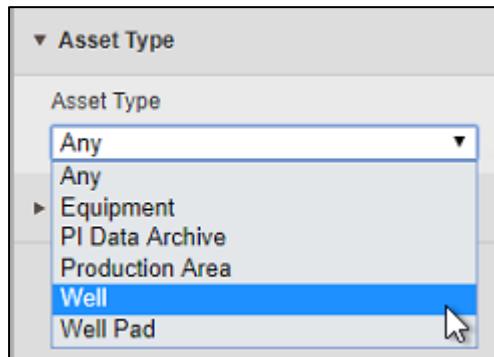
13. Toggle the Context Switching to **Show search results**



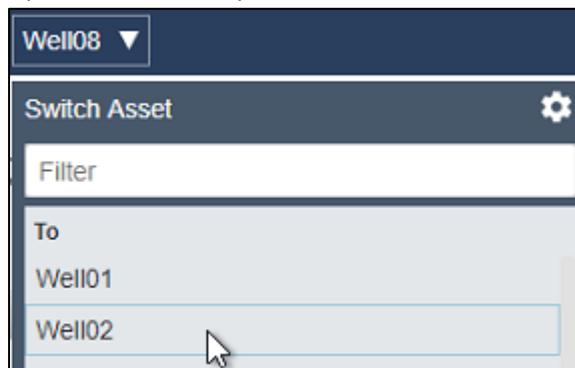
14. Adjust the search root to “North Dakota” and enable **Return All Descendants**



15. In the **Asset Type** dropdown menu, select Well



16. Open the Asset dropdown menu and click **Well02** to change the display context



17. Save the display.

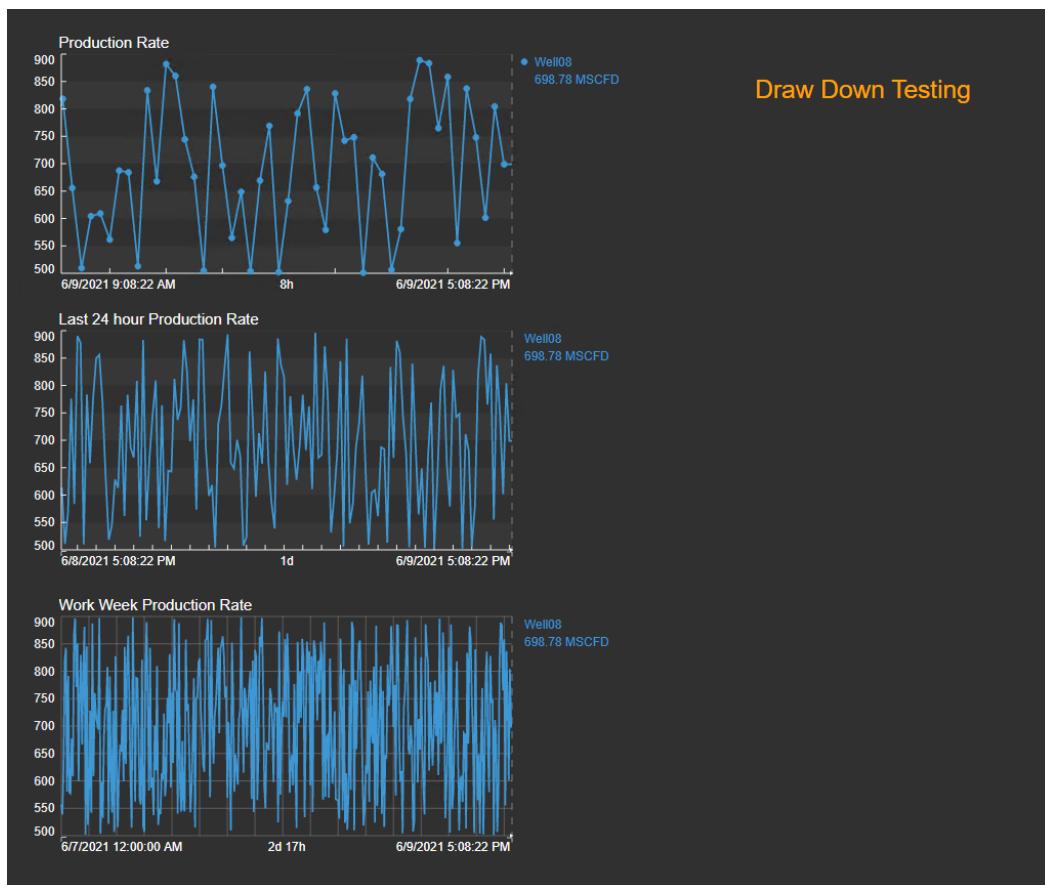
Challenge 4: Explore new options to work with symbols in PI Vision 2020

You heard about some of the new options PI Vision 2020 offers and want to try them out. In the past, the TechCon Labs management team has asked for displays showing trends with different time ranges. Now it is possible to do this. You want to create a demo display to show this and other new possibilities to the management.

You want to demonstrate the following features:

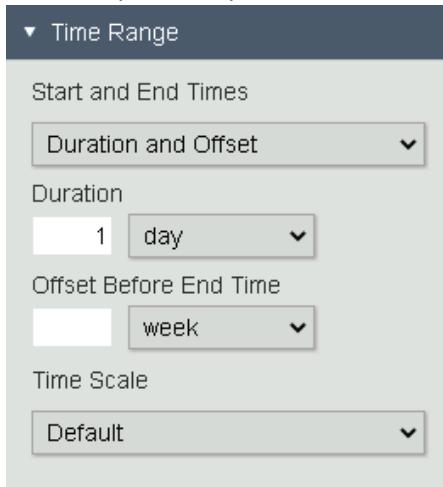
- You would like to display the Production Rate of Well08 in a trend covering the time range of the display and at the same time see the data for the last 24 hours and for the current work week in two separate trends on the same display.
- Set a descriptive plot title for each of the trends.
- Change the legend label to display the asset name instead of the attribute name.
- Place the scale labels outside of the plot area.
- Use data markers on a trend line.
- Change the grid style to use lines.
- Configure a status message to show up only when the status is different from Running.

The complete demo display should look something like the following:

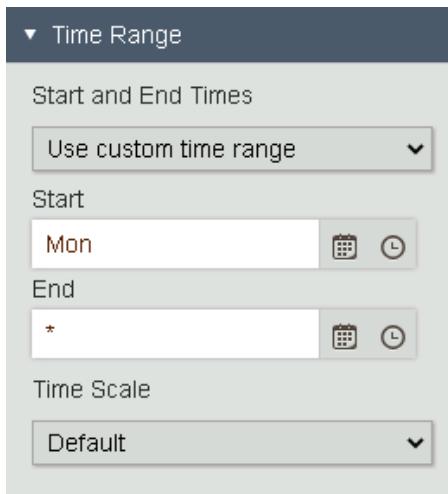


4.1: Create a display with multiple time ranges

1. Select the trend symbol, then search for Well08 and drag the Production Rate attribute on to the display area.
2. Drag Production Rate on the display in another trend or copy and paste the first trend. Right click the trend and select Configure Trend option.
3. Open up Time Range and select Duration and Offset. Make the Duration 24 hour and offset 0. This will give a trend with the same end time as the previous trend but with a start time 24 hours previously.



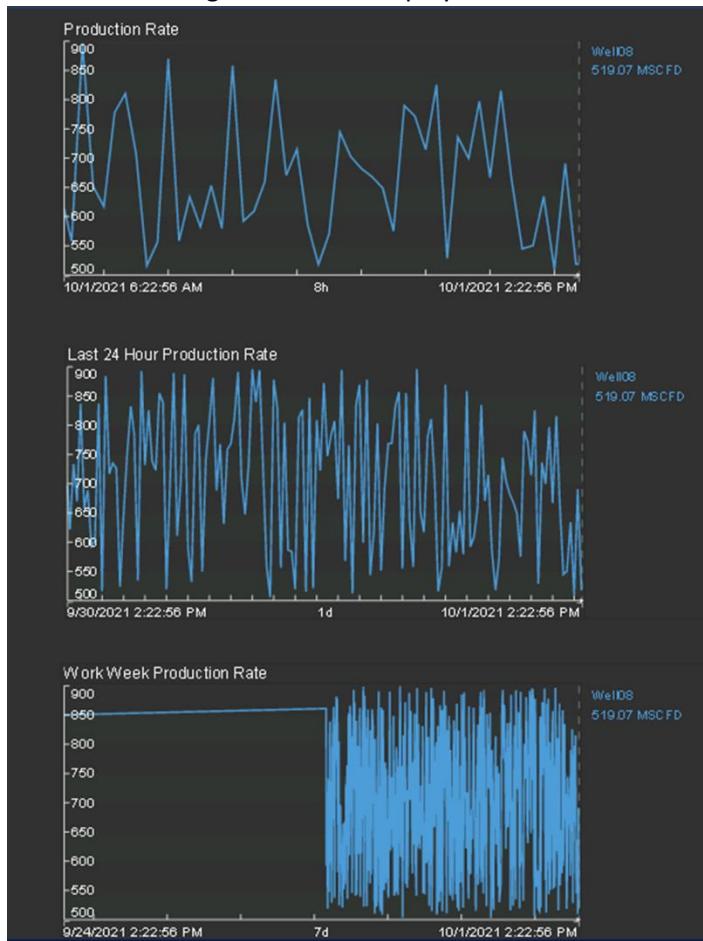
4. Create another trend and select Use custom time range. Specify Monday (or Mon) as the start and * as the End.



Note:

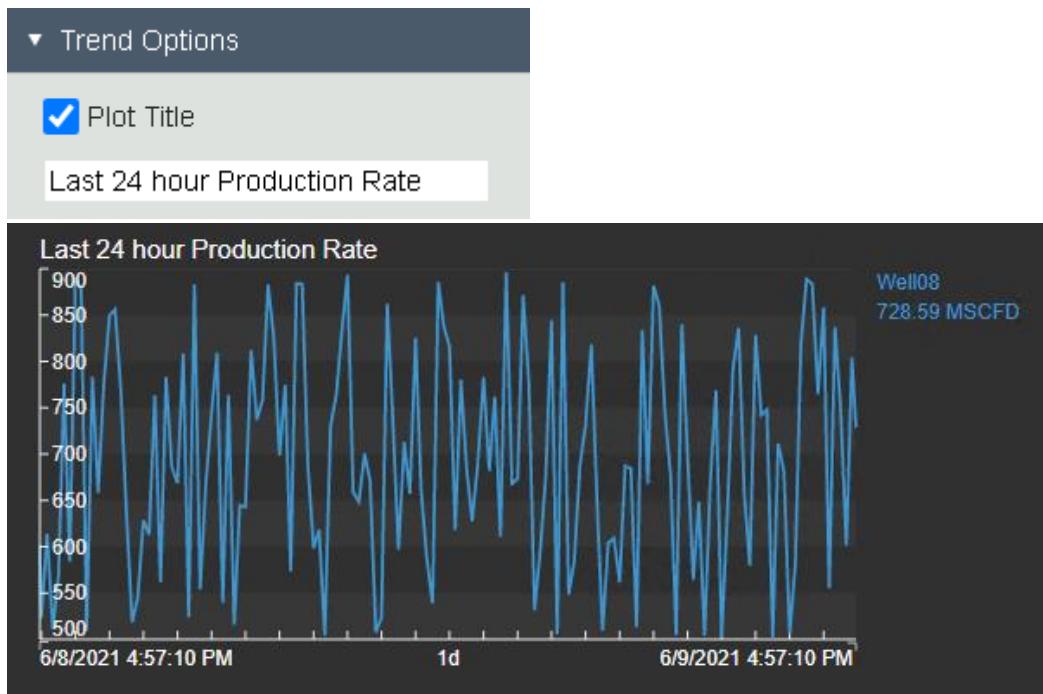
To learn more about the options for entering the Start and End times see [PI time](#) on OSIsoft Documentation.

5. After these configurations the display should look similar to the one shown below.



4.2: Explore the new configuration options for trends.

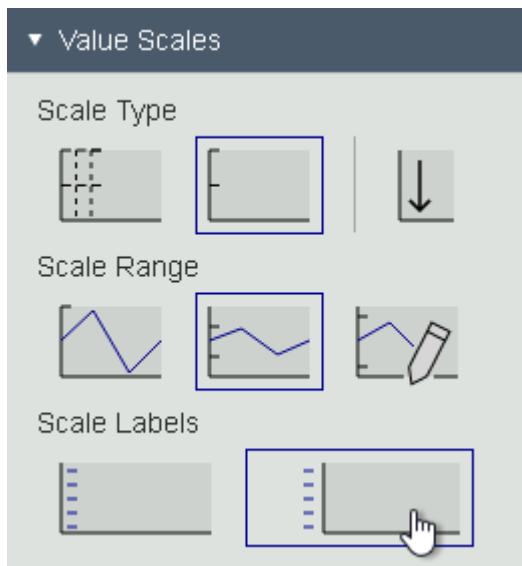
1. Set a descriptive plot title for each of the trends, for example *Last 24 hour Production Rate* for the trend in the middle.



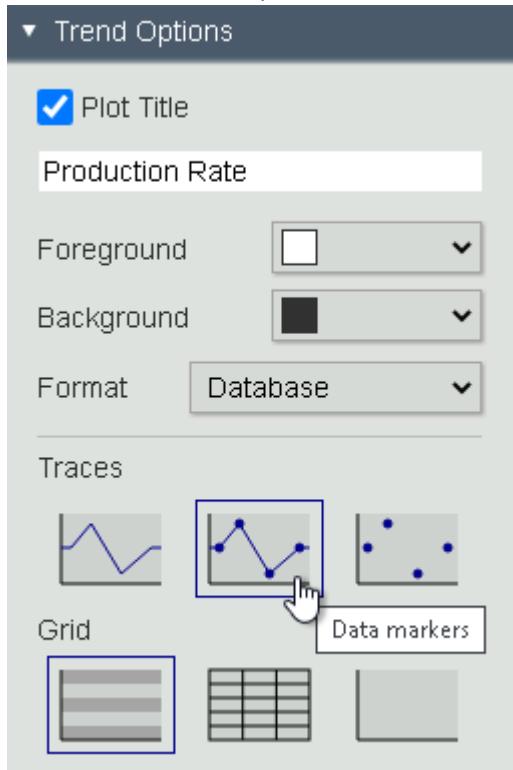
2. Since the plot titles are stating that we are looking at the Production Rate we do not need to have this again in the legend. Instead, we would like to see the Well name in the legend. Under Trace Options expand the drop-down menu for Legend Label and select Well08.



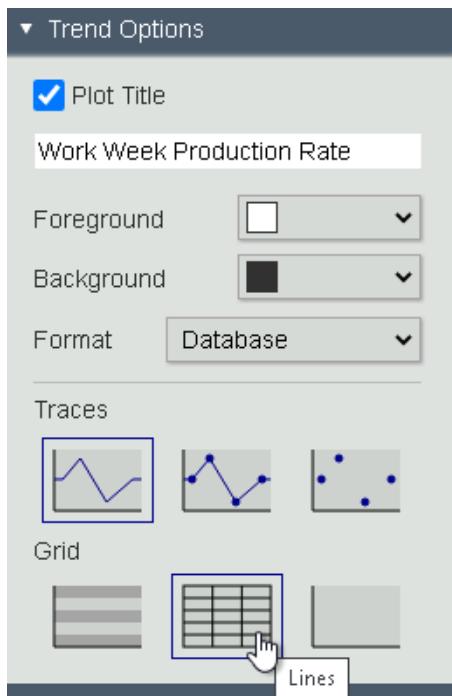
3. To have a clear view onto the data at the start time of each trend we want to display the Scale Labels outside of the plot area. Under Value Scales click on the Scale Labels symbol for Outside plot area.



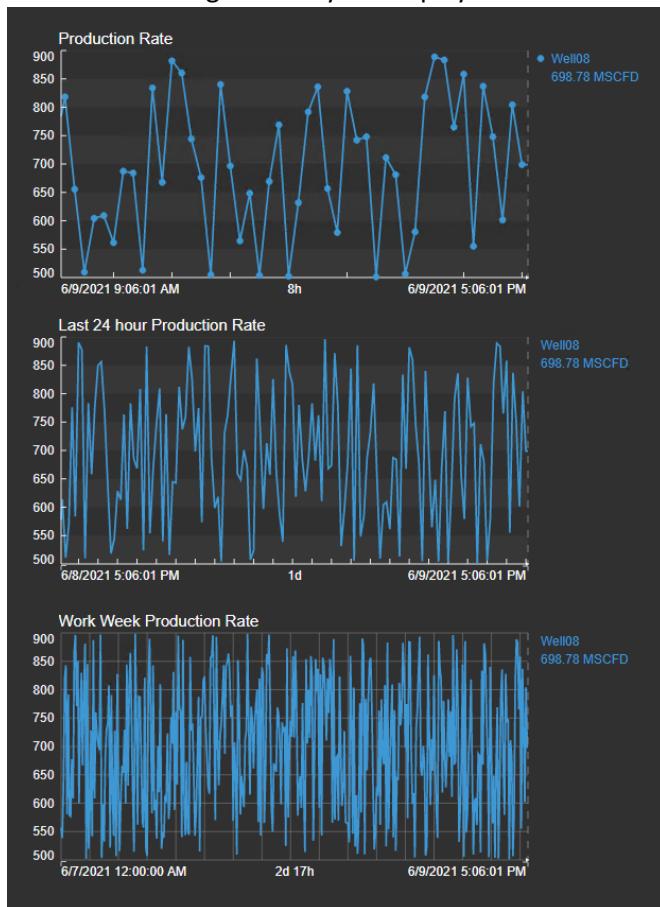
4. For the trend using the display time range we would like to display data markers on the line trace. Under Trend Options click the Traces symbol for Data markers.



5. Since time range of the Work Week trend will vary we want to use a different grid style to make this clearer. Under Trend Options click on the Grid symbol for Lines.



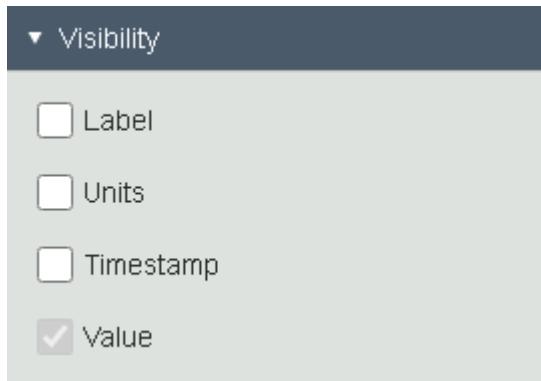
6. After these configurations your display should look similar to the one shown below.



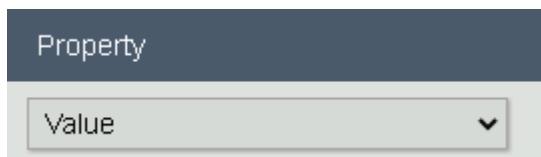
4.3: Hide Status Message

You have heard that PI Vision 2020 also introduced the option to hide symbols using the Multi-State functionality. You want to make use of this for displaying the Status Message on the display only when it is any other State than Running.

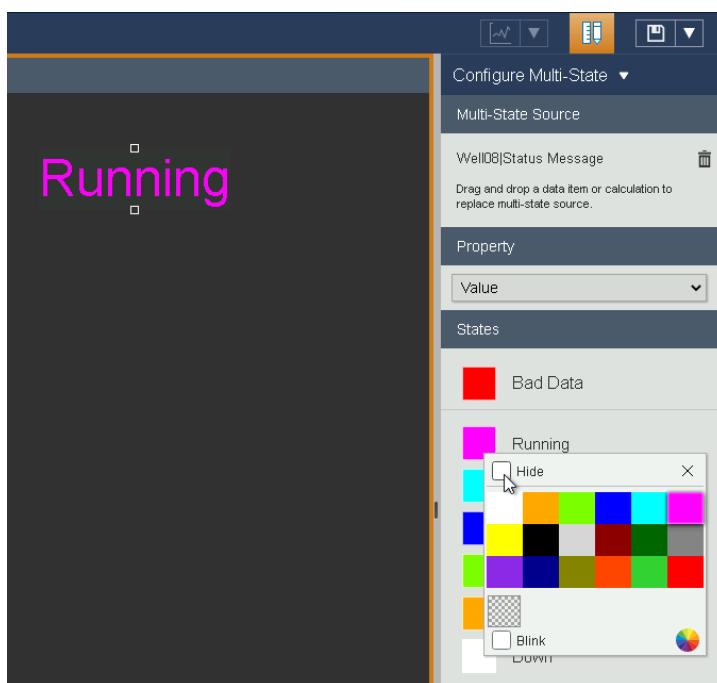
1. Select the Value symbol and drag the attribute Status Message onto the display. In the Format Value menu under Visibility uncheck all but Value.



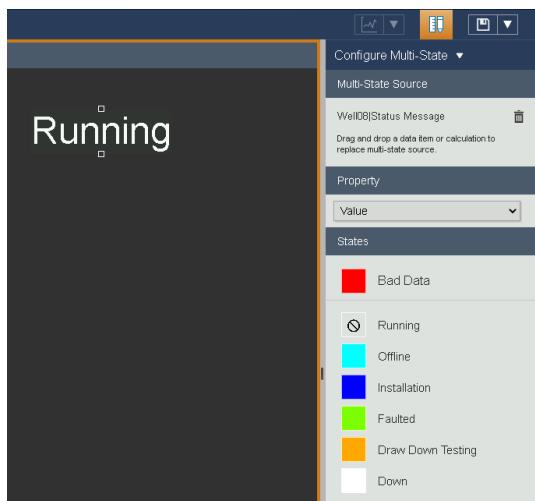
2. Right click on the symbol and select Configure Multi-State. The color of the states should apply to the Value only. Under Property select Value from the drop-down menu.



3. Under States, click on Running and tick the check box for Hide.



4. The value Running is shown again in the original color as long as we are in Design mode.



5. Click on Modify Display to exit Design mode to see that the value is not shown any more when the attribute is in the state Running.

Challenge 5: Calculations

Introduction

In PI Vision 2020 you can create on-the-fly calculations so you can analyze a process in real time.

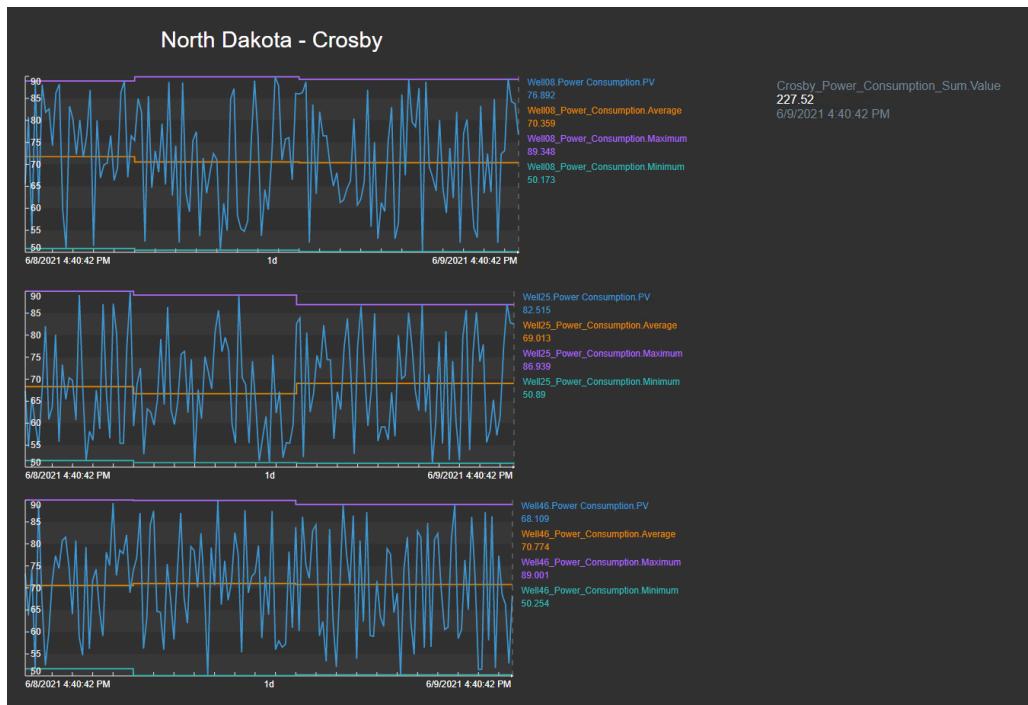
You'll notice that our left-hand pane in PI Vision has an added tab for Calculations. Here we can build out quick calculations to get added insight from our displays. This includes summary calculations like minimum, maximum and average, basic arithmetic operators and PI Vision Calculations also supports using performance equation functions. You can use a calculation on any PI Vision symbol or configuration that supports a data item. Currently the calculations feature supports PI Points.

Challenge Overview

The team at the Crosby site is still using displays which are based on PI Tags. Originally those were migrated PI ProcessBook displays containing PI Calculation data sets. Through the migration to PI Vision displays the data sets became PI Vision Calculations. The team has asked you to perform some modifications on the Crosby Power Consumption display.

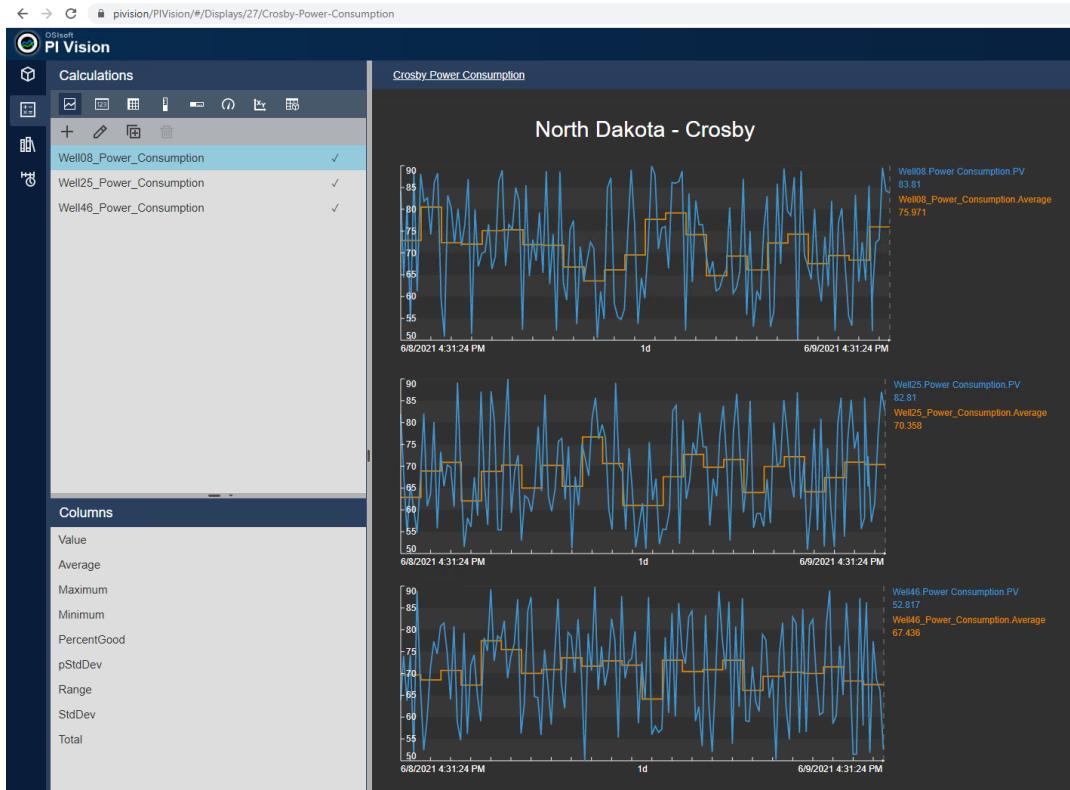
- Make use of the existing PI Vision Calculations and add the minimum and maximum values to the trends.
- Instead of the 1-hour Calc Interval you want to see the calculation results for each shift. Edit the calculation to set the Calc Interval to 8 hours, enable the Sync Time and set it to 06:00:00 to match the shift schedule with 8-hour shifts starting at 6 am.
- You also want to know the sum of the current Power Consumption over all wells at the site.
Tip: Select the three trends and click the plus sign to create a new calculation.

The result should look like the picture shown below.

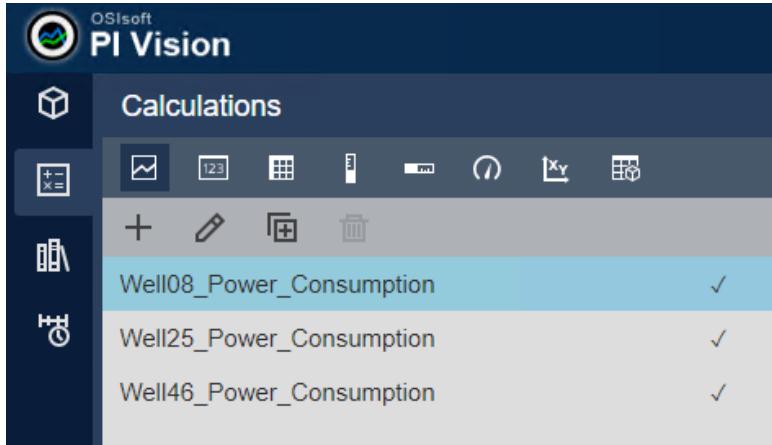


5.1: Add Minimum and Maximum values from an existing Calculation

1. Open the display Crosby Power Consumption. The display is set to ready only so you need to save the changes under a different name. Click the Save button and select Save As to save a copy of the display.



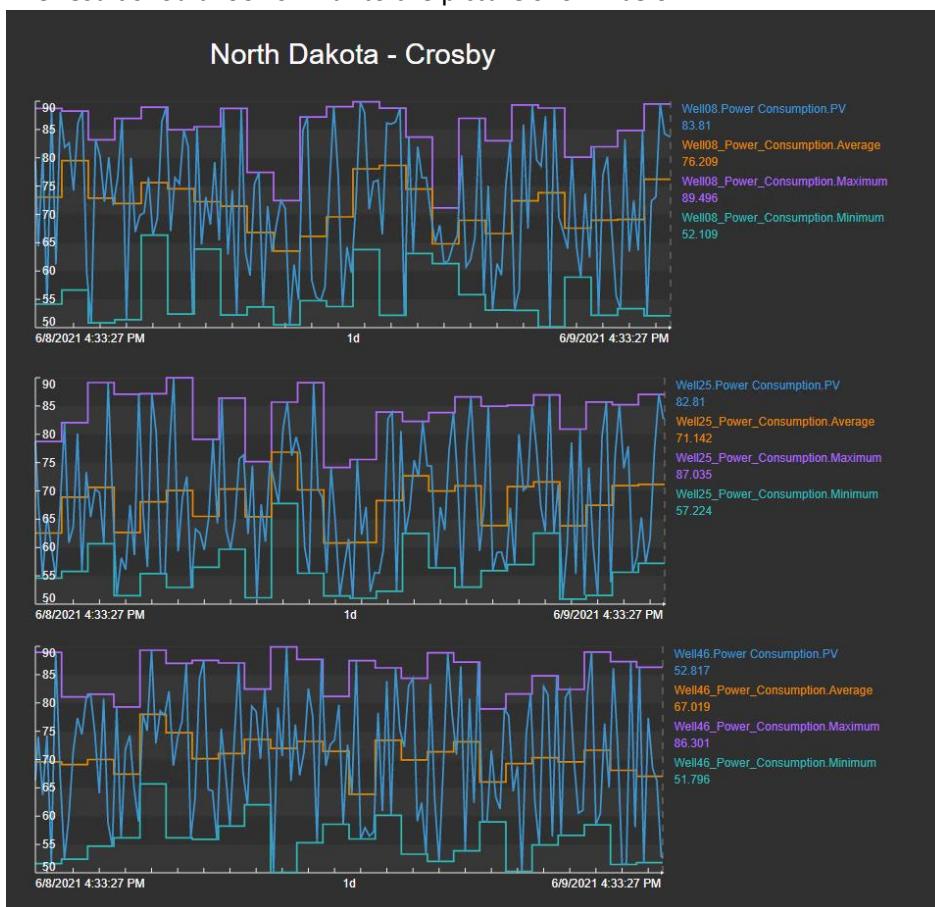
2. Click Calculations on the left side of the screen. The list shows three calculations for the Power Consumption of the three wells in Crosby. The tick mark shows that the calculation is already used on the display.



3. We want to make use of the calculations by adding the Minimum and Maximum values to the trends. Drag and drop the Minimum and Maximum from the Columns list to each of the trends. Make sure to use the correct calculation for each well.

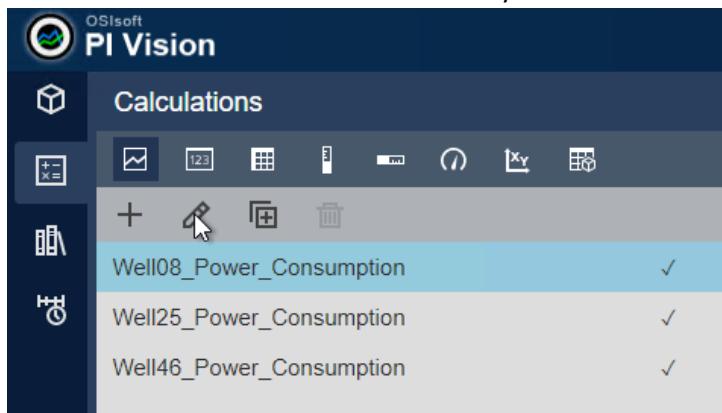
Columns
Value
Average
Maximum
Minimum
PercentGood
pStdDev
Range
StdDev
Total

4. The result should look similar to the picture shown below.

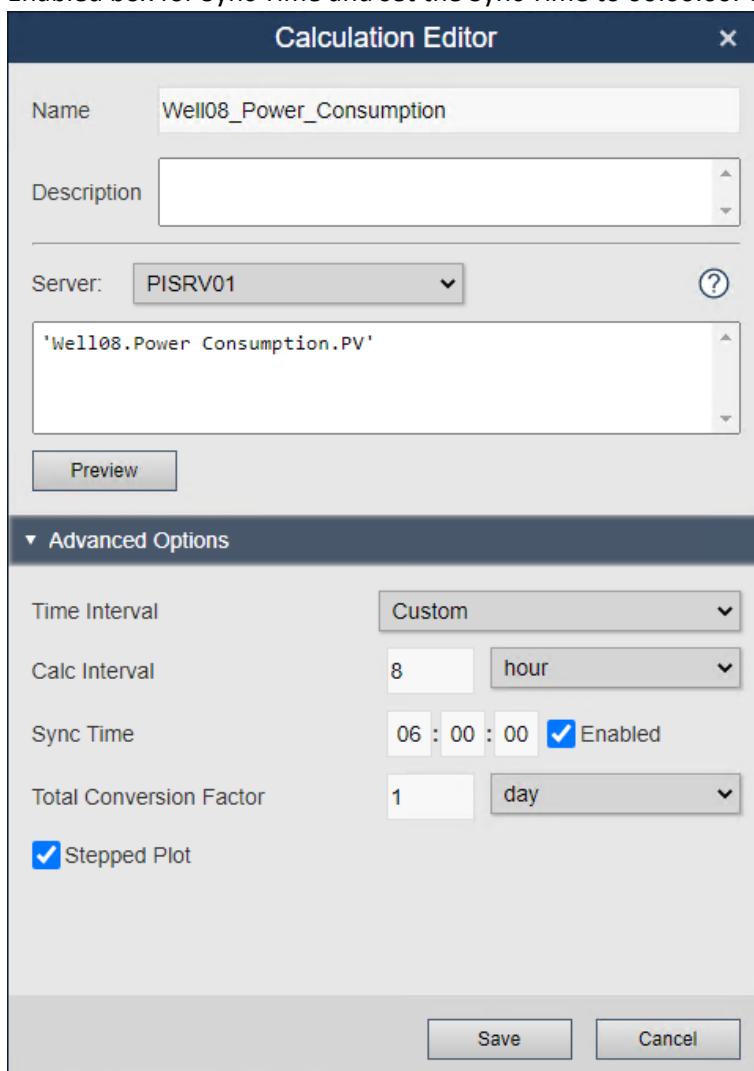


5.2: Edit a Calculation

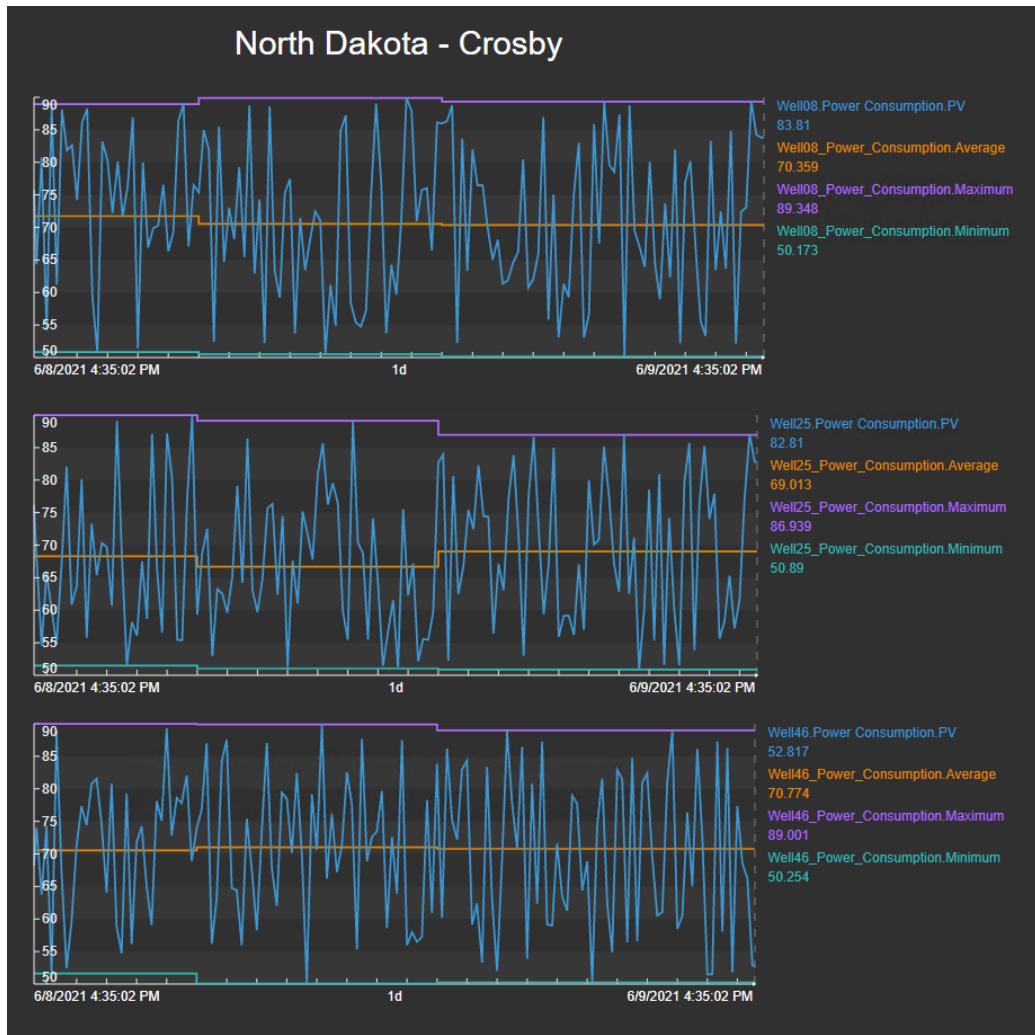
1. We want to edit the existing calculations to use the shifts as a calculation basis.
2. Select a calculation and click on the Edit symbol.



3. Under Advanced Options in the Calculation Editor set the Calc Interval to 8 hours. Click the Enabled box for Sync Time and set the Sync Time to 06:00:00. Click Save.

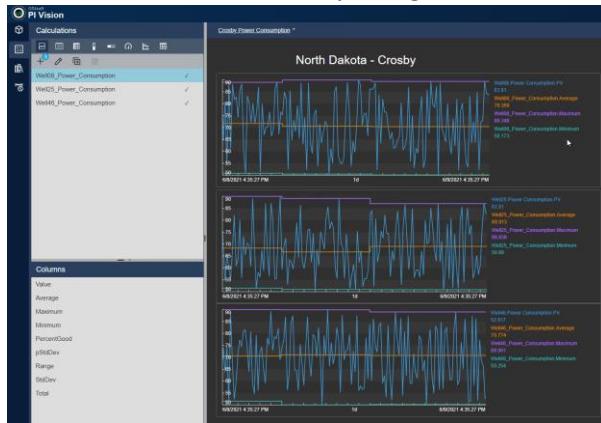


4. Repeat this for all three calculations. The resulting trends should look similar to the picture below.

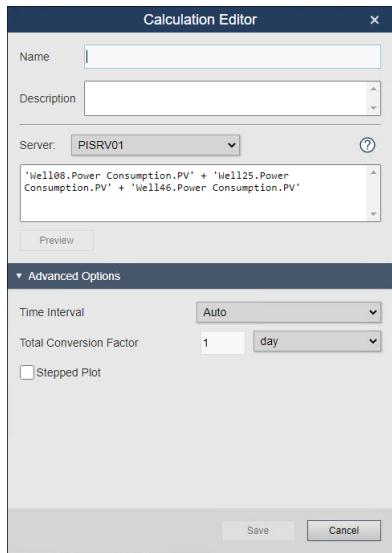


5.3: Create a new Summary Calculation

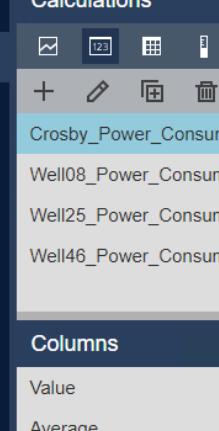
1. We want to create a new summary calculation to determine the sum of the current Power Consumption over the three wells in Crosby.
2. Select the three trends. Click **Add Calculation With Selected Symbols**. The number above the icon indicates how many PI tags will be included in the calculation.



3. The Calculation Editor opens with a preconfigured calculation adding the three PI Tags together. Since we want to determine the sum, we can leave the calculation as it is and give it a name, for example Crosby_Power_Consumption_Sum.

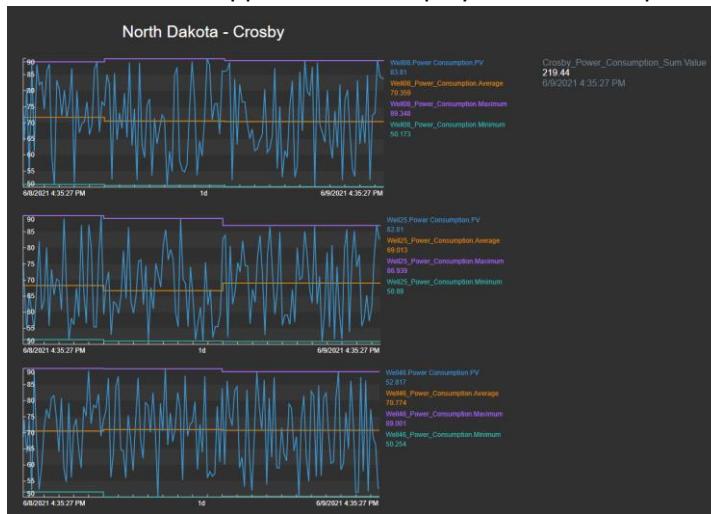


4. The new calculation appears on the list. Select the Value symbol and drag the Value from the Columns list on the display.



The screenshot shows the PI Vision software interface. The top navigation bar includes the PI Vision logo and the title 'PI Vision'. Below the navigation bar, the 'Calculations' section is active, indicated by a blue background. This section contains a toolbar with various icons for data manipulation, followed by a list of calculations. The first calculation in the list is 'Crosby_Power_Consumption_Sum', which is currently selected, as indicated by the blue background and a small minus sign icon to its right. Below this, three other calculations are listed: 'Well08_Power_Consumption', 'Well25_Power_Consumption', and 'Well46_Power_Consumption', each with a checkmark icon to its right. Below the 'Calculations' section, the 'Columns' section is visible, showing a list of statistical columns: 'Value', 'Average', 'Maximum', 'Minimum', 'PercentGood', 'pStdDev', 'Range', 'StdDev', and 'Total'. The 'Value' column is the first item in this list.

5. The value should appear on the display similar to the picture shown below.



(Optional) Challenge 6: Link displays together

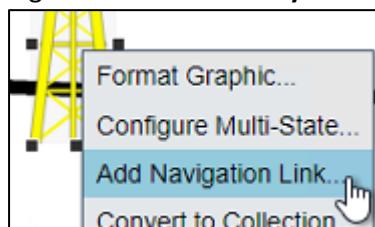
At this point, the TechCon Labs management team is very pleased with the dashboards you have created. But they are concerned that the navigation from one display to another by first returning to the PI Vision home page is a bit cumbersome. They have requested that the overview and detail displays be linked together, preferably in an intuitive way that benefits infrequent or inexperienced users of PI Vision. For example, when a user wants to know more information about a specific well pad or oil well, they should be able to just click on it.

As a side note, the director mentioned they feel that the borders of the current dashboards are too cluttered with functional items such as the toolbar and other functional items. If all goes well with the display linking, they would also like you to design a way to present these displays in a more focused manner.

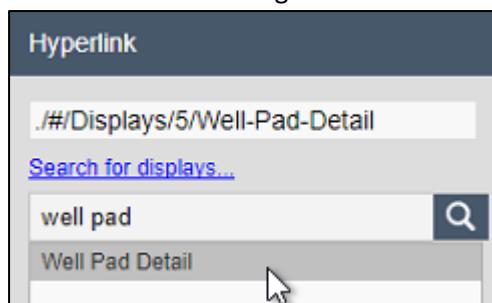
Fortunately, you are familiar with all the latest navigation and URL functionality in PI Vision and know that this can be implemented on the existing dashboards fairly easily.

6.1: Update the North Dakota Overview Display

1. On the PI Vision Home page, open your **North Dakota Overview** display.
2. Click on the **Design** button on the far-right side of the toolbar to enter **Design Mode**.
3. Right-click on the **Crosby Oil Well** graphic and select **Add Navigation Link...**



4. Verify that **Open hyperlink to another page** is selected under the **Action** header:
5. In the **Hyperlink** section, click **Search for displays...** and find the **Well Pad Detail** display that was created in Challenge 2:



6. In the Asset Pane, drill down into the **Oil Well Production** database to find the **Crosby** element.
7. Click and drag the **Crosby** asset into the **Asset Context** field in the configuration pane.



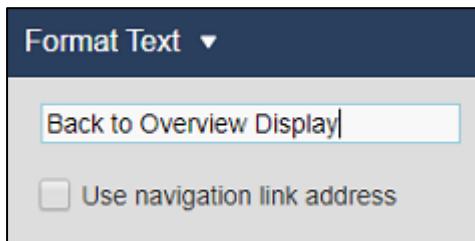
Note:

This **Asset Context** field determines which asset will be selected when the linked display is opened. In some scenarios this does not need to be explicitly set. For example: when using links within Collections and Asset Comparison Tables, PI Vision is able to automatically determine the appropriate asset.

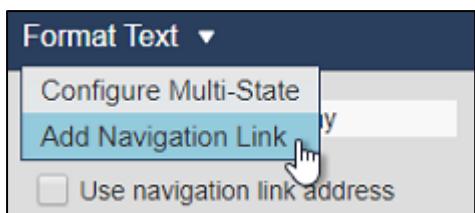
8. Repeat steps 3-8 for the **Kenmare**, **Williston**, **Stanley**, and **Dickinson Oil Well** graphics using the **Kenmare**, **Williston**, **Stanley**, and **Dickinson** assets from the Asset Pane.

6.2: Update the Well Pad Detail Display

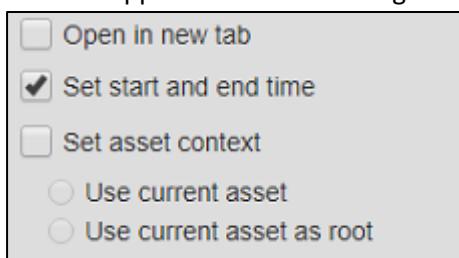
1. Click on the ruler and pencil icon on the right side of the toolbar to switch to **Monitor Mode**.
2. Double-click on the **Oil Well** graphic next to **Crosby** to activate the newly added Navigation Link and open the **Well Pad Detail** display.
3. Click on the ruler and pencil icon again to switch back to Design Mode.
4. Select the **Text** button on the toolbar and click on the top left corner of the display. Type “Back to Overview Display” under **Format Text** on the configuration pane.



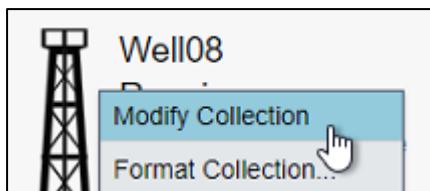
5. Set the **Font Size** to 12.
6. Click the **Format Text** header to open the configuration menu and select **Add Navigation Link**:



7. Under the **Hyperlink** header search for and select the **North Dakota Overview** display.
8. Deselect the **Set asset context** option. The **North Dakota Overview** display is not currently built to support context switching:



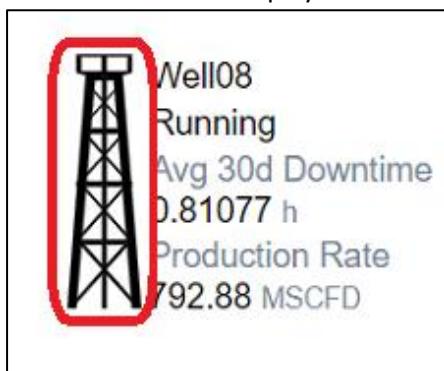
9. Right-click anywhere on the **Oil Well** collection and select **Modify Collection**:



10. Right-click on the Oil Well graphic and select **Add Navigation Link...**
11. Under the **Hyperlink** header, search for and select the **Oil Well Detail** display.
12. Save the display.

6.3: Update the Oil Well Detail Display

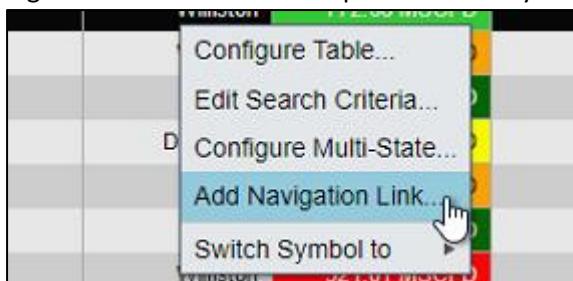
1. On the **Well Pad Detail** display, select the “Back to Overview Display” text symbol and copy it using either the toolbar icon or the keyboard shortcut (Ctrl + C).
2. Click on the ruler and pencil icon on the right side of the toolbar to switch to **Monitor Mode**.
3. Double-click on an **Oil Well** graphic within the collection to activate the Navigation Link to the **Oil Well Detail** display:



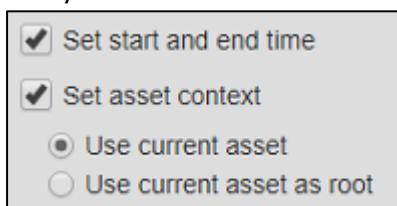
4. Click on the ruler and pencil icon again to switch back to **Design Mode**.
5. Paste the copied “Back to Overview Display” text symbol from earlier into the top left corner of the display using either the toolbar icon or the keyboard shortcut (Ctrl + V).
6. Click on the ruler and pencil icon on the right side of the toolbar to switch to **Monitor Mode**.
7. Single-Click on the Text symbol to return to the **North Dakota Overview** display.



8. Right-click on the Asset Comparison Table symbol and select **Add Navigation Link...**



9. Under the **Hyperlink** header, search for and select the **Oil Well Detail** display.
10. Verify that **Set start and end time** and **Set asset context** are selected:



11. Save the display.

12. Click on the first well under the **Asset** column of the Asset Comparison Table:

Asset	Location, City	Production Rate	Total Downtime
Well01	Kenmare	634.97 MSCFD	2.8167 h
Well02	Williston	712.33 MSCFD	1.0167 h

13. Click on the ruler and pencil icon again to switch back to **Design Mode**.

14. Click the **Text** icon on the toolbar:

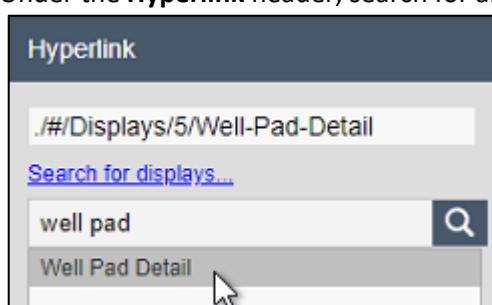


15. Create a Text symbol in the top left corner of the display that reads "Back to Well Pad Display".

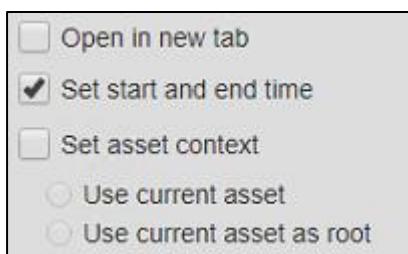
16. Change the **Font Size** to 12.

17. Right-click on the Text symbol and select **Add Navigation Link...**

18. Under the **Hyperlink** header, search for and select the **Well Pad Detail** display.



19. Deselect the **Set asset context** checkbox. Only the **Set start and end time** option should be selected:



It is expected that our link to the **Well Pad Detail** display from the **Oil Well Detail** display will not update the city context of the display. This would be possible to do if we get a bit creative, but it is outside the scope of this course.

20. Save the display.

6.4: Experiment with URL Parameters

In the browser address bar, add the string **?mode=kiosk&hideToolbar&hideTimebar** to the URL and click refresh. The result should be a cleaner, more streamlined display view that hides elements from the topbar, the toolbar, and the timebar:

Secure | <https://pivision/PIVision/#/Displays/6/Oil-Well-Detail?mode=kiosk&hidetoolbar&hidetimebar>

Oil Well Detail

[Back to Overview Display](#) [Back to Well Pad Display](#)

Well65	Stanley	North Dakota
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Note:

Navigate through the three different displays while changing the asset and time context to verify all the displays link functionality is working. Once you are finished, you will need to manually remove the URL parameters from the URL in order to begin the next challenge.

(Optional) Challenge 7: Collection Search Criteria

The PI Vision dashboards have become heavily used within the team monitoring North Dakota operations. Word has spread and there is interest from the executive management team in expanding the use of PI Vision to cover all of North American production. Before that, however, they would like to see something a bit different from any existing dashboard. On a single display, they would like to see the lowest performing Oil Wells in all of North America.

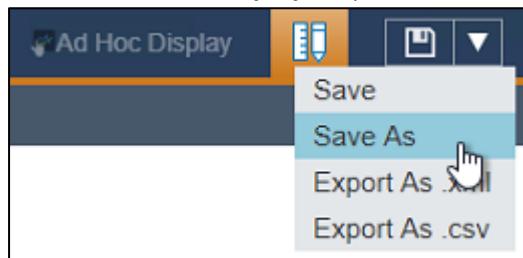
The management team knows this sounds like a tricky request and has offered to bring in developers in case a programmatic solution is needed. But your experience with PI Vision asset collections tells you that this will not be necessary.

So that they have an idea of the final product, you have provided the team a sketch of what this display will ultimately look like:

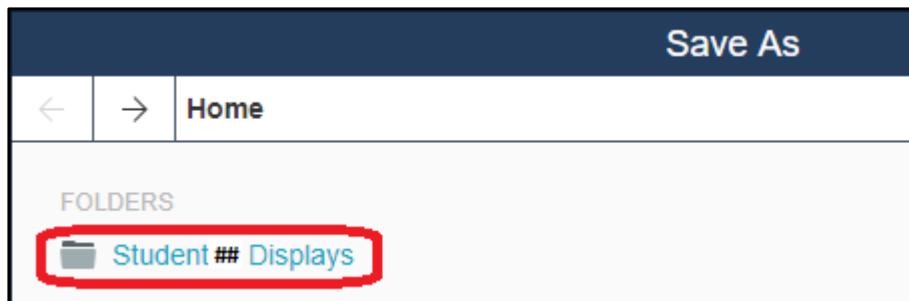
Low Performing Wells				
 Well01 Running Avg 30d Downtime 2.0278 h Production Rate 504.05 MSCFD	 Well09 Running Avg 30d Downtime 1.3199 h Production Rate 503.91 MSCFD	 Well10 Running Avg 30d Downtime 1.6918 h Production Rate 503 MSCFD	 Well17 Running Avg 30d Downtime 0.74393 h Production Rate 555.17 MSCFD	 Well24 Running Avg 30d Downtime 0.89991 h Production Rate 510.46 MSCFD
 Well27 Running Avg 30d Downtime 1.2479 h Production Rate 510.03 MSCFD	 Well29 Running Avg 30d Downtime 0.65994 h Production Rate 586.34 MSCFD	 Well33 Running Avg 30d Downtime 0.77992 h Production Rate 534.73 MSCFD	 Well40 Running Avg 30d Downtime 0.74393 h Production Rate 513.19 MSCFD	 Well42 Running Avg 30d Downtime 0.40796 h Production Rate 537.45 MSCFD
 Well44 Running Avg 30d Downtime 0.76792 h Production Rate 503.74 MSCFD	 Well50 Running Avg 30d Downtime 0.9959 h Production Rate 512.19 MSCFD	 Well53 Running Avg 30d Downtime 1.4879 h Production Rate 505.85 MSCFD	 Well54 Running Avg 30d Downtime 1.2839 h Production Rate 562.55 MSCFD	 Well57 Running Avg 30d Downtime 1.0439 h Production Rate 514.38 MSCFD

7.1: Filter Collection Assets with Asset Attribute Criteria

1. From the PI Vision home page open your **Well Pad Detail** display.
2. Click on the ruler and pencil icon again to switch to **Design Mode**.
3. Click on the **Save Display** drop-down menu and select **Save As**:



4. If it is not already selected, click on the display folder for your user account:



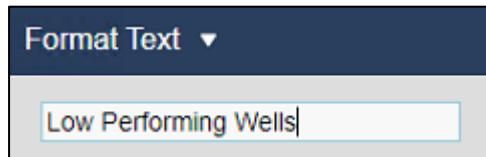
5. Name the display "Low Performing Wells" followed by your student number. For example: *Low Performing Wells_Student##*.
6. Saving the display will have returned you to **Monitor Mode**, so click on the ruler and pencil icon again to switch back to **Design Mode**.
7. Delete the Text symbol navigating to the **North Dakota Overview** display and the City & State value symbols. When selected, an item on a display can be deleted by clicking the trash bin icon in the toolbar, or by pressing the **Backspace** or **Delete** key on your keyboard:



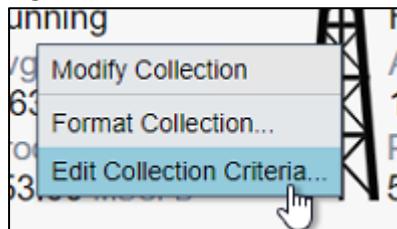
8. Right-click on the **Well Pad Detail** text symbol and select **Format Text**:



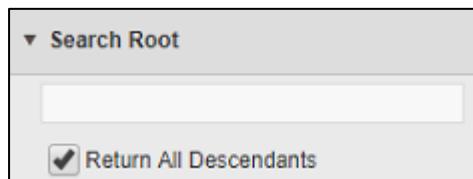
9. Change the text to "Low Performing Wells":



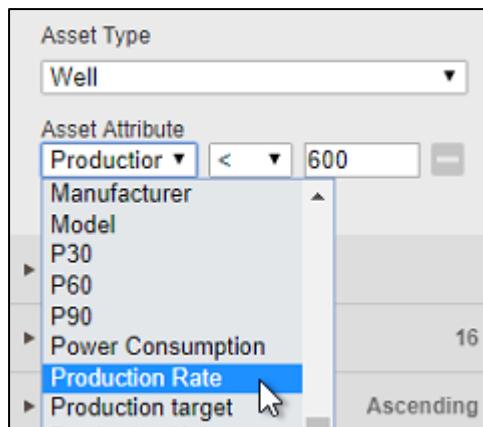
10. Right-click on the Oil Well collection and select **Edit Collection Criteria...**:



11. Remove the **Search Root** and select **Return All Descendants**:



12. Verify that the **Asset Type** is set to **Well**. Then set an **Asset Attribute** filter for a **Production Rate** value of less than 600 MSCFD:

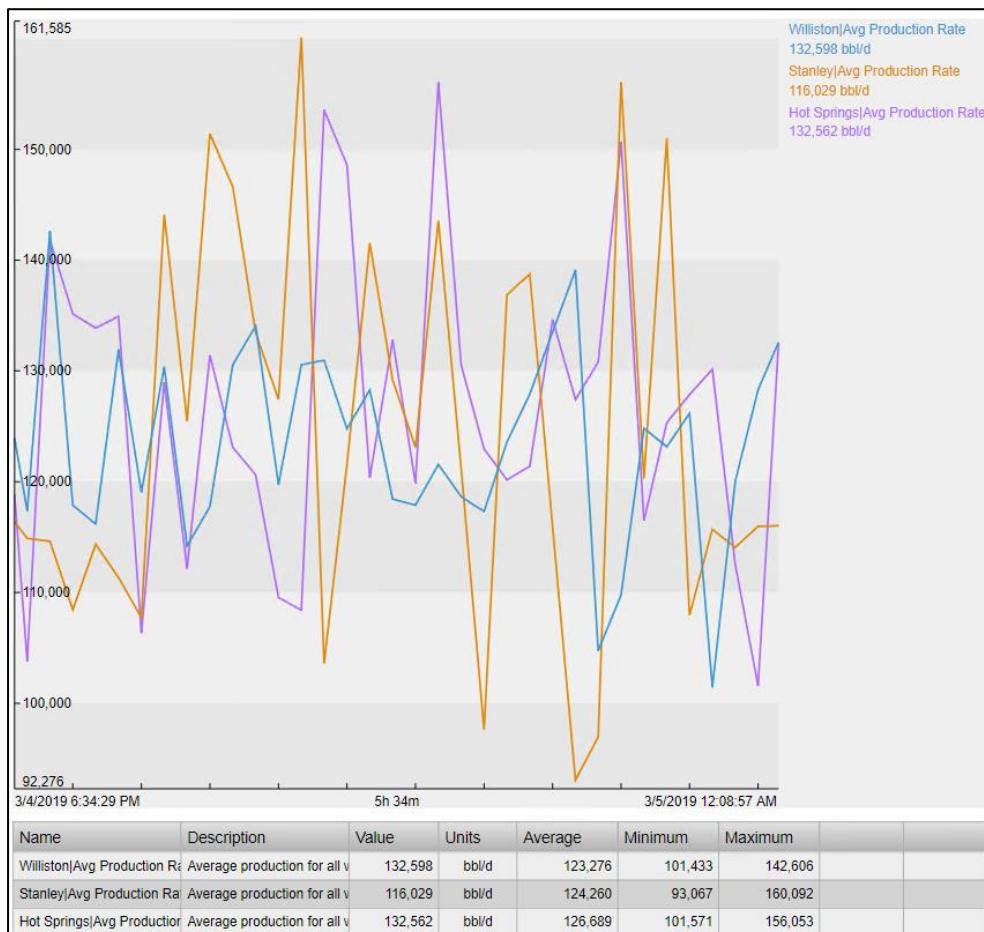


13. Save the changes to the display.

(Optional) Challenge 8: Ad Hoc Analysis

Another request has come in from some members of the engineering team. For the most part, they are happy with the dashboards that have been created so far. But they would like to select a few different items from the displays and do some additional analysis when they investigate specific issues. If they identify something of interest, they would like to be able to share their findings with a colleague.

Fortunately, you remember that PI Vision revamped its ad hoc display functionality with an enhanced workspace. You gather the team members for a quick demo.



8.1: Explore the Ad Hoc Workspace

1. From the PI Vision home page open the **Oil Well Detail** display.
2. While holding the **Ctrl** key, click on the Trend and Radial Gauge symbols and then the **New Ad Hoc Trend** button in the top right:



3. Toggle between the different **Scale** and **Range** settings in the top left:



4. Highlight traces by selecting rows in the **Summary Table** at the bottom of the window:

	Name	Descript
	Well08 Production Rate	
	Well08 Power Consumption	
	Well08 Bottom hole pressure	The down

5. Toggle the visibility of the **Power Consumption** trace by clicking the checkbox and remove the **Bottom hole pressure** trace by clicking the trash can graphic:

Name		
<input checked="" type="checkbox"/>		Well08 Production Rate
<input checked="" type="checkbox"/>		Well08 Power Consumption
<input checked="" type="checkbox"/>		Well08 Bottom hole pressure

6. Set a custom scale by entering zero for the **Production Rate** trace's scale **Bottom**

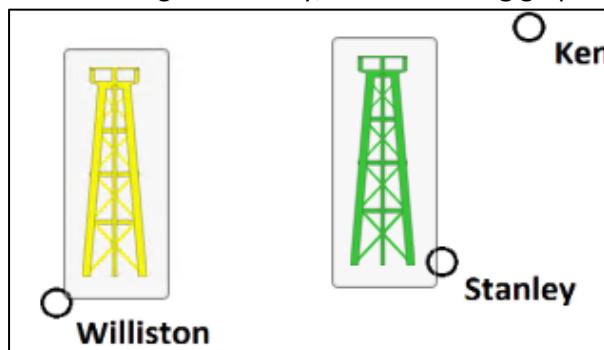
Top	Bottom
900	0

7. Close the Ad Hoc Workspace with the **Hide** button in the top right

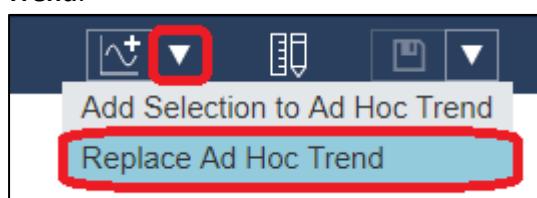


8.2: Add Data from Multiple Sources to Ad Hoc Workspace

1. Click the **Back to Overview Display** link to open the **North Dakota Overview** display.
2. While holding the **Ctrl** key, click the **Oil Rig** graphics next to **Williston** and **Stanley**



3. Open the **Ad Hoc Trend** dropdown menu in the top left and then select **Replace Ad Hoc Trend**:



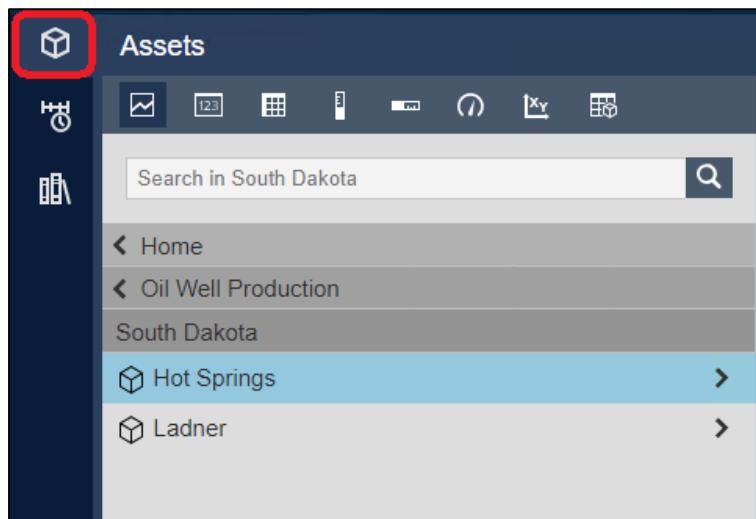
4. In the top right, toggle off the **Summary Table**



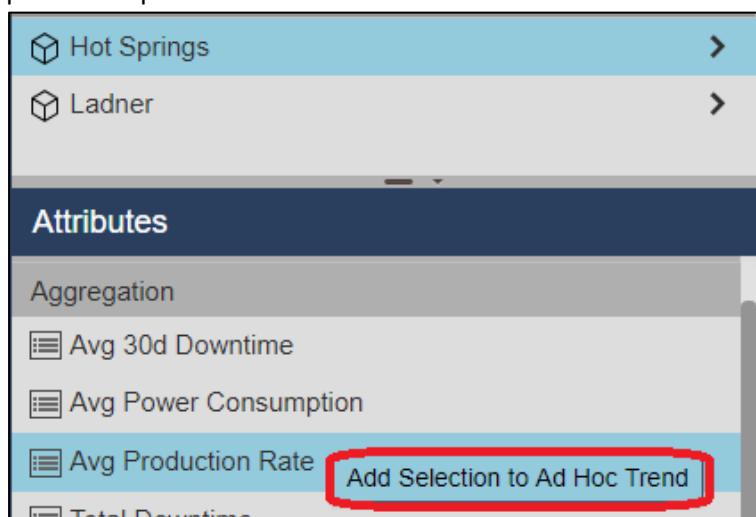
5. Close the **Ad Hoc Workspace** by clicking the **Hide** button



6. Open the Asset Pane and drill down to the **Hot Springs** element under **South Dakota** in the **Oil Well Production** database:



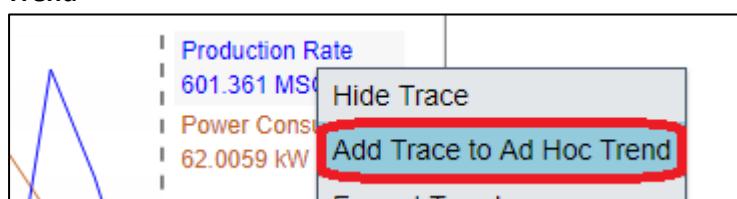
7. With **Hot Springs** is still selected, right-click the **Avg Production Rate** attribute in the bottom part of the pane and click **Add Selection to Ad Hoc Trend**:



8. Click on **Well63** in the Asset Comparison Table to open the **Oil Well Detail** display:



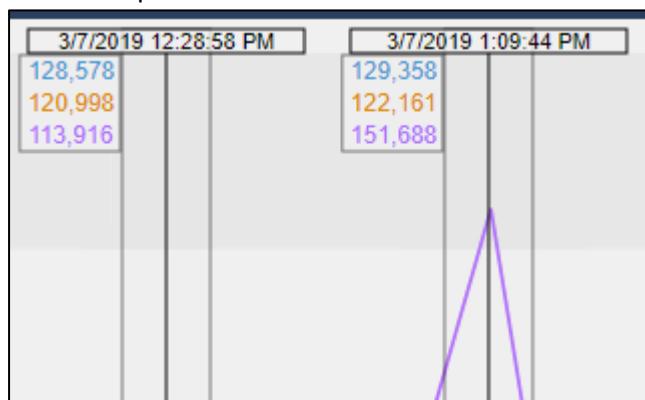
9. Right-click on the **Production Rate** trace in the trend legend and select **Add Trace to Ad Hoc Trend**



10. Reopen the **Ad Hoc Workspace** by clicking the **Ad Hoc Trend** icon in the toolbar:

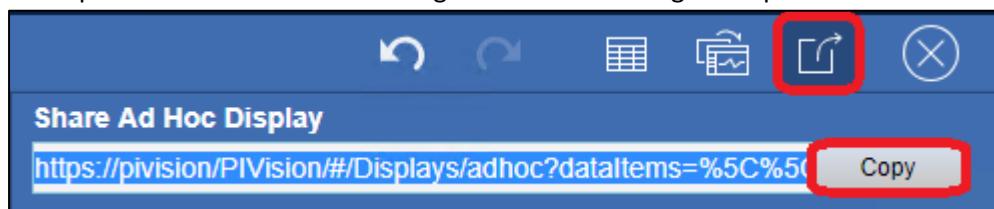


11. Click anywhere in the trend area to add trend cursors that display the exact value of each trace at a specific moment in time:



8.3: Export Ad Hoc Workspaces

1. From within the **Ad Hoc Workspace** click the **Share** button and then the **Copy** button to load the clipboard with a URL that will regenerate the existing workspace:



2. Open a new browser tab by clicking the plus icon on the top left, paste (Ctrl + V) the URL from the clipboard, and hit the **Enter** key:



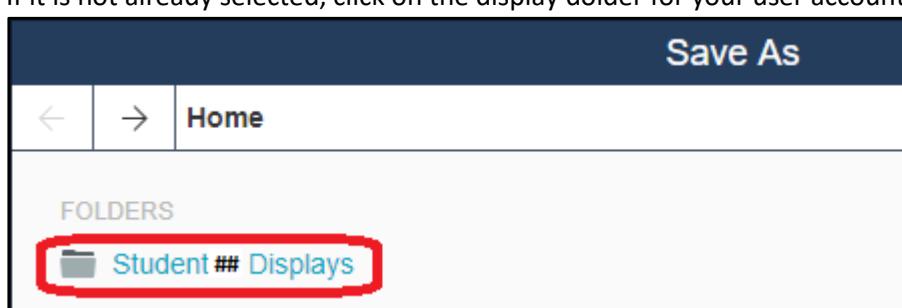
3. Close the new browser tab and return to the original tab with the **Ad Hoc Workspace** open
4. Click the **Summary Table** button to toggle the table back onto the **Ad Hoc Workspace**



5. Click on the **Convert** button to place the **Ad Hoc Workspace** contents into an **Editor Display** that can be permanently saved and shared:



6. Click on the Save drop-down menu and select **Save As**
7. If it is not already selected, click on the display folder for your user account:

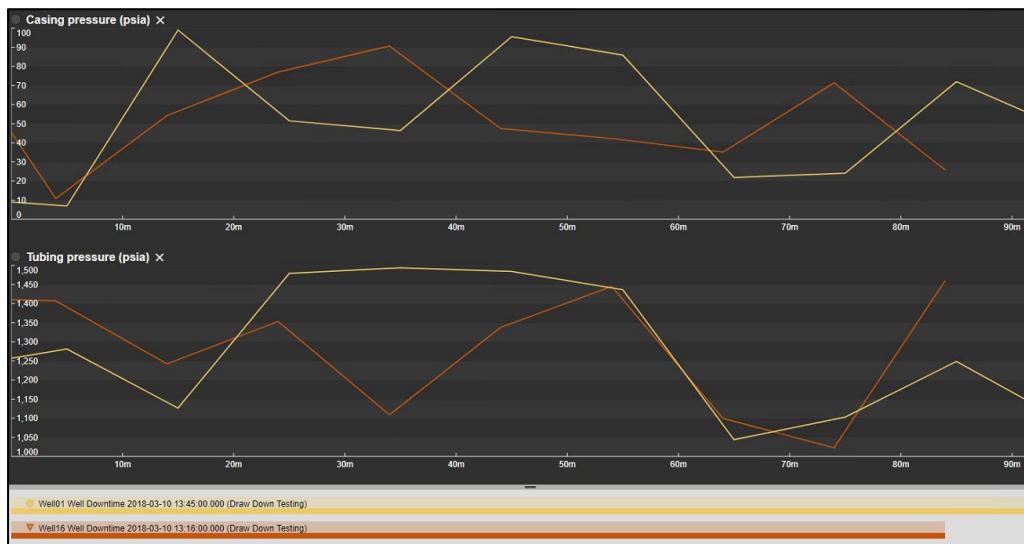


8. Name the display “Production Anomaly Data” followed by your username. For example: *Production Anomaly Data_Student##*.
9. Adjust any formatting as needed and save the changes.

(Optional) Challenge 9: Compare Downtime Events

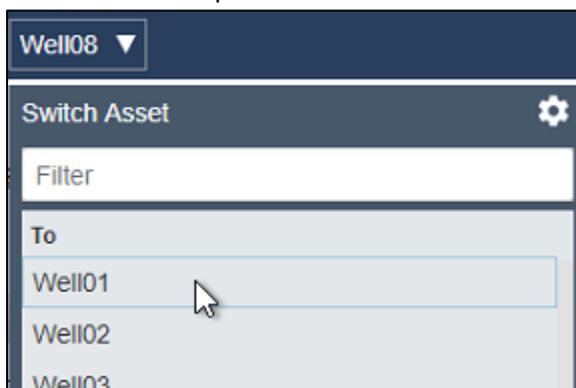
A new type of request has come in from a member of the engineering team. They would like to compare the time series data that occurred during two different times that oil wells were down. Specifically, there were events on Well01 and Well16 that seemed very similar and the team would like to take a closer look.

The engineering team has correctly noted that is not possible to overlay timeseries data on standard PI Vision dashboards and has asked if there are any workarounds. Luckily, you just came across the documentation of Event Comparison displays so you know how to do this.



9.1: Compare Events from the Event Details View

1. From the PI Vision home page, open the **Oil Well Detail** display.
2. Use the Asset drop-down menu to switch the display asset context to **Well01**:



3. Double-click on the most recent Downtime event in the Events Table symbol to open the **Event Details** window:

Event Name	▲ Start Time	End Time
Well01 Well Downtime 2018-02-17 15:33:00.000	2/17/2018 3:33:00 PM	2/17/2018 4:50:00 PM
Well01 Well Downtime 2018-03-10 13:45:00.000	3/10/2018 1:45:00 PM	3/10/2018 3:17:00 PM

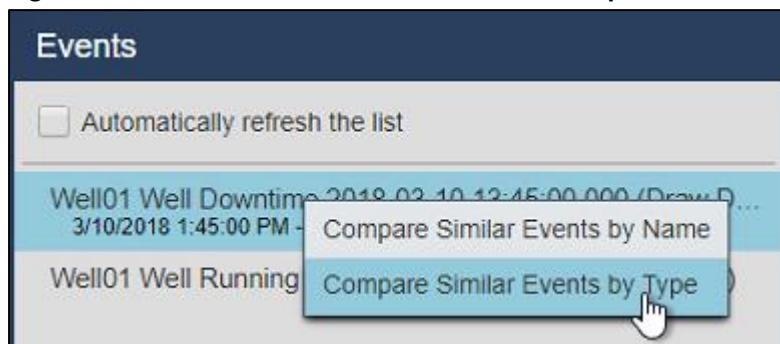
Note:

Alternately it is possible to view the event details by right-clicking on an Event in the Events Pane. Events will automatically populate this list if any of the assets on the display have active events within the time range of the display. It is also possible to manually search for Events by modifying the Search Criteria.

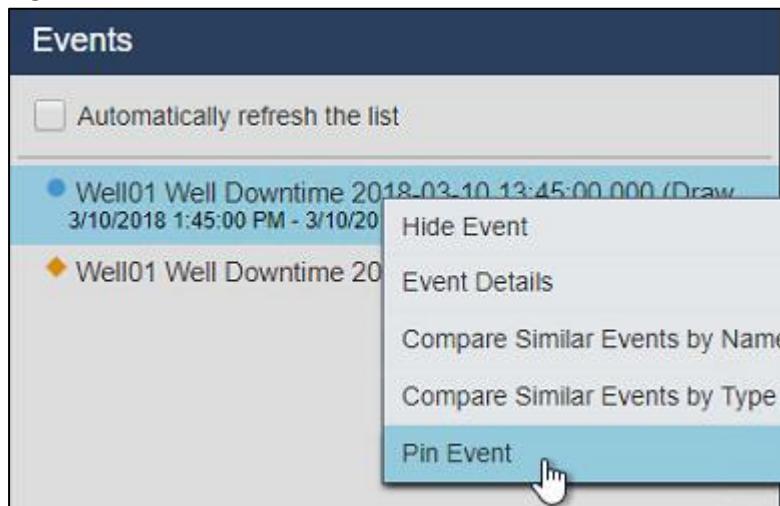
4. Open the Events Pane



5. Right-click on the Downtime Event and select **Compare Similar Events by Type**:



6. Right-click on the same Downtime event and select **Pin Event**



7. Click on **Edit Search Criteria** to open the search criteria:

Events

Automatically refresh the list

★ Pinned

Well01 Well Downtime 2018-03-10 13:45:00.000 (Draw ...
3/10/2018 1:45:00 PM - 3/10/2018 3:17:00 PM

Search Results

Well01 Well Downtime 2018-02-17 15:33:00.000 (Draw ...
2/17/2018 3:33:00 PM - 2/17/2018 4:50:00 PM

 Edit Search Criteria



8. Set the Event Name filter to “Well16*”, the Asset Name filter to “Any”, and then click **Apply**:

▼ Event Name Well16*

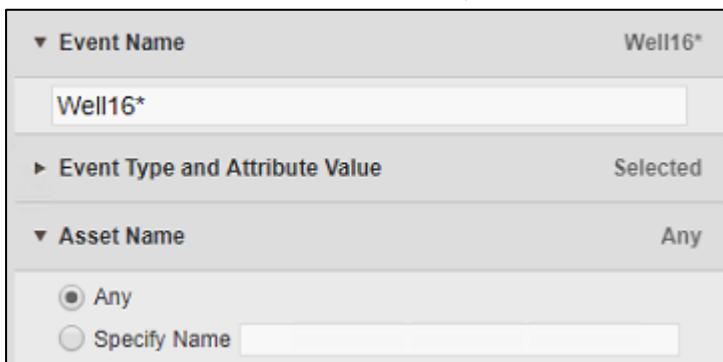
Well16*

► Event Type and Attribute Value Selected

▼ Asset Name Any

Any

Specify Name



9. Click and drag the **Casing pressure** and **Tubing pressure** attributes onto the display.
10. Save the display as “Downtime Event Comparison” followed by your student number.

(Optional) Challenge 10: Manage PI Vision Displays and User settings

Now that you have seen how to create displays within PI Vision, you may wonder how to keep track of and manage a large number of displays.

Role-Based User Access

PI Vision provides for two different user roles to facilitate system manageability. The two types are:

Publisher

- Designed for subject matter experts and content creators.
- May create and save new dashboards and analysis views.
- Equivalent to the traditional PI Vision User in previous versions.

Explorer

- Can use the full power of existing displays, including context and time manipulation
- Can create ad-hoc displays
- May not save any new displays or changes to existing displays

Users are assigned roles on an AF Identity basis. The PI Vision Admin site is used to manage these settings.

Note:

For security and organizational purposes OSIsoft recommends separating users into Publishers and Explorers. However, these designated access groups are not mandatory and the universal PI Vision User role may still be used. Use the PI Vision Admin site to manage these settings.

Display Folders

Another thing to note is that PI Vision allows the use of display folders to organize displays and to manage user access.

- Users can be set to have read permission to the displays contained within specific folders.
- As appropriate, users can also be given permission to edit the displays within a folder and/or add new displays to folder.

PI Vision administrators can control access to these folders on an AF Identity basis from the PI Vision home page.

10.1: Finding and Categorizing Displays

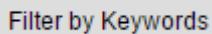
1. PI Vision allows you to add keywords to displays so that they can be organized into one or more groups. To add a keyword to a display, select its gear icon from the PI Vision home page:



This will bring up the display settings dialog that you can use to manage displays you have created. You may add keywords here to help organize your displays. Simply type any text

you like into the Keyword box. To add multiple labels at a time, separate them with a semicolon.

2. Once you have added a few labels, click **Filter by Keywords** on the homepage.

A rectangular button with the text "Filter by Keywords" in a blue font, enclosed in a thin black border.

This will bring up a tag cloud of the keywords that have been created on this server. The cloud is weighted so that labels that appear more in displays will be larger. Clicking a label from within the cloud will filter the list of displays to only those which have the selected label.

3. Another way to filter is by clicking the **Related Displays** button.



This shows all displays that contain any of the keywords associated with the selected display.

4. In addition to keywords, you can also mark a display as a favorite by clicking the star under a display.



5. Using the navigation pane you can filter displays to see only Favorites, displays that were created by you, or displays that you have recently viewed.

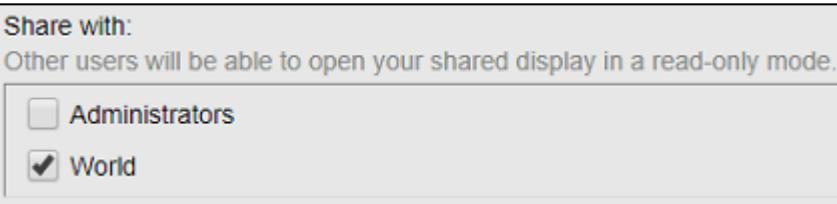


10.2: Controlling Access to a Display

1. When you create a display, it will initially be set to Private, denoted by the single person icon on the PI Vision Home Page.



2. If you would like to share a display that you have created, click the gear graphic to open the Display Settings menu and then check the boxes next to the groups with which you would like to share your display.



After at least one group is selected, the display will change to Public, denoted by the three-person icon on the home page.



3. Also available is the option to make the display Read-only, which will prevent other users from making any modifications to the display.
4. The display owner is located below the display name. If needed, the display owner can be changed by PI Vision administrators

TechCon Lab
PISCHOOL\student01

5. You can also delete your display using the **Delete display** button

Delete display

10.3: Organizing Displays with Folders

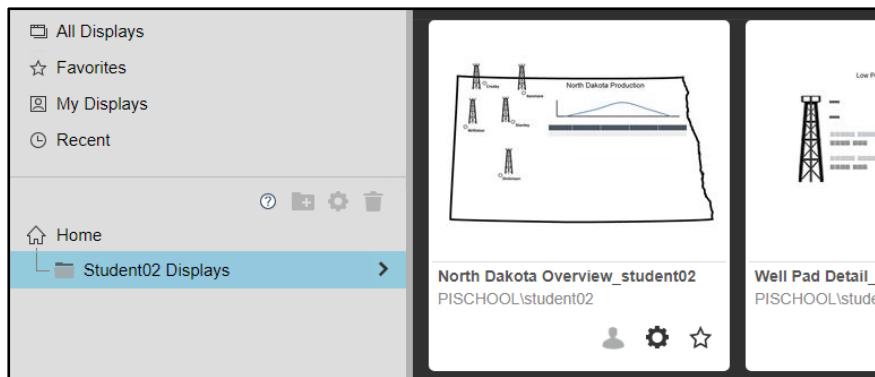
1. To move a display to a folder, first hover over the display and click the checkmark in the bottom left corner to select it. Then, click the Move button and select a destination folder



2. On the bottom left section of the home page, you will see the Display Folders for which you have permission. At the root level, the folder configuration buttons will be grayed out unless you are a PI Vision administrator



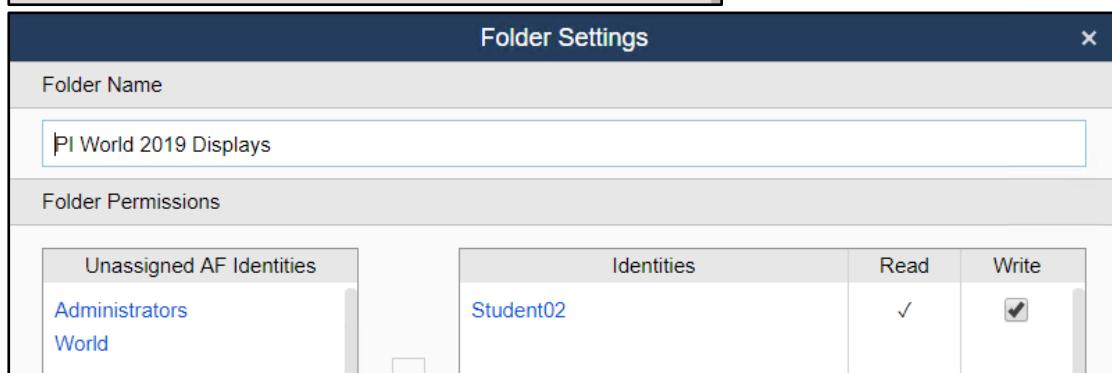
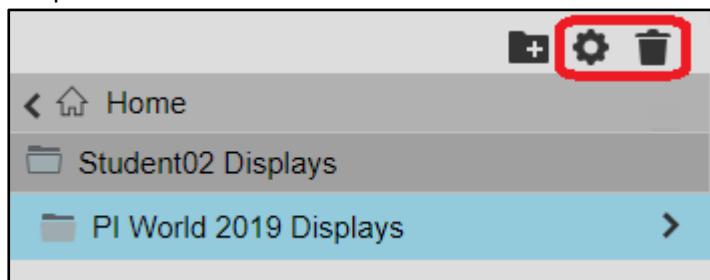
3. When you select a Folder, you will see the displays within it to which you have permission



4. Since you have write permission within the Display Folder created for your user account, you may add child folders. Click on the **Student## Displays** folder and then click on the new folder graphic.



5. Since you have write permission at the parent level of this new child folder, you may manage the permissions on the folder or delete.



If you delete a Display Folder, any subfolders will also be deleted. Any displays in the selected folder or subfolders will be moved to **Home**, the root level above any display folders.

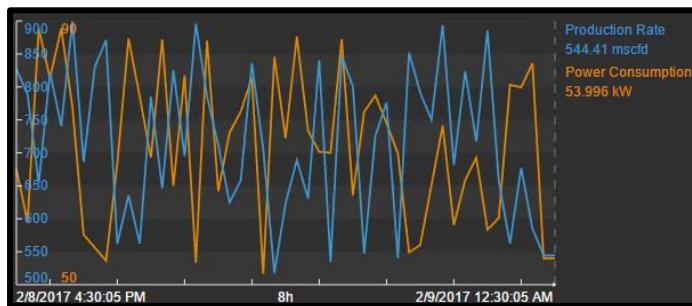
Appendix

Interacting with Data Symbols

In PI Vision, data is visualized with symbols. Below are the eight built-in symbols included with every installation of PI Vision:



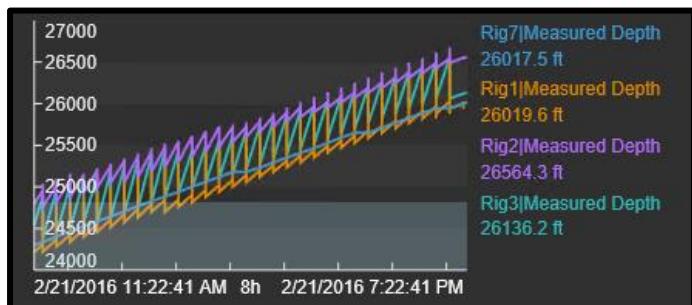
Trend



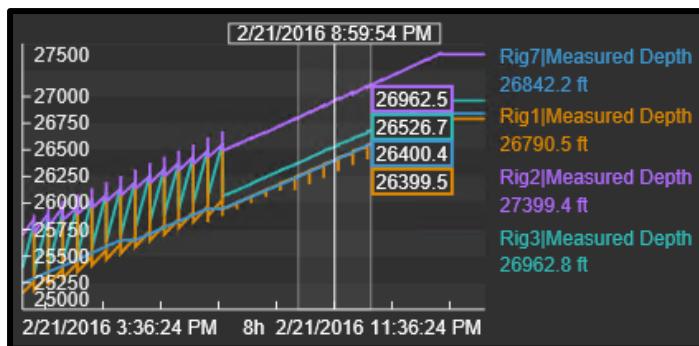
When in Design Mode, right-click on the trend and select Format Trend in order to bring up the design options for the trend

- Trend Options are used to change the Foreground and Background colors, choose between single or multiple scales, and set the scale range
- Trace Options allows you to customize the color, weight, style, and scale range of individual traces. You can also delete traces from this section
- The Use Default Settings button allows you to reset all trend options

In Monitor Mode, use the bottom third of the trend area to shift the time context of the trend



When in Monitor Mode you can add a cursor by simply clicking on the trend. A cursor automatically populates on all trends within that display. Drag the cursor to change positions, and drag it off of the trend in order to get rid of it.



In Monitor mode, click on the data item in order to highlight it on the trend

Value

The Value Symbol populates with the asset name, timestamp, UOM, and value:



Format the Value by right-clicking on the value and selecting Format Value. This allows you to change the Fill, Text, and Value color as well as changing what attributes are displayed within the Value symbol

Table

The table symbol displays multiple attributes or PI Points concisely in a table format

Name	Description	Value	Units	Trend	Minimum	Maximum
Well10 Power Consumption		78.774	kW		51.656	88.861
Well10 Line Pressure		1,150.2	psia		1,000.3	1,495.3
Well10 Gas Gravity	Hydrocarbon gas density	0.99625			0.65047	1.1484
Well10 Casing temperature	The temperature in the drill	90.987	°F		40.94	96.279

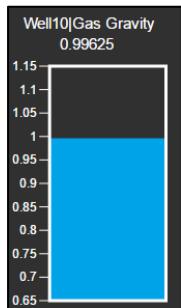
- Add data items to the table by dragging the data item onto the table
- Get rid of data items by clicking on the row of your choice and then clicking the delete button



- If you select a data item in a table you can then drag that data item onto a trend in order see historical values
- Dragging a data item off of a table onto a blank space in the display will create a separate object for that data item while in display monitoring mode. The object type will depend on which symbol is selected above the search pane.
- Right-click on the table and select 'Table Columns' to pick which columns to display

Vertical and Horizontal Gauges

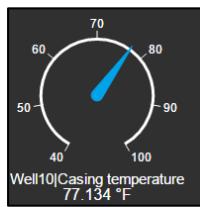
The Vertical and Horizontal Gauges display a singleton in a bar format:



You can format the Bar, Fill, Outline, and Value color, Outline weight, and Visibility of the Vertical Gauge by right-clicking on the gauge and selecting Format Gauge

Radial Gauge

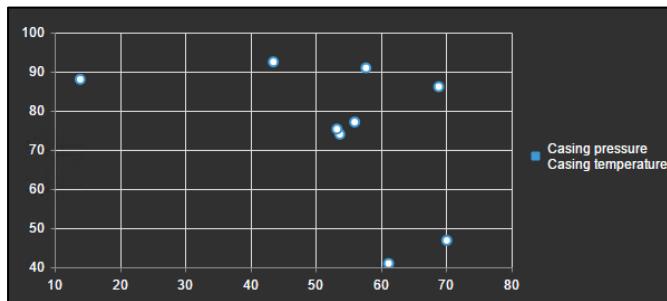
The Radial Gauge symbol displays a singleton in a gauge format:



Right-click on the gauge and click Format Gauge to bring up the possible format options. Here it is possible to change the stylings, visibility, and Scale start and end of the gauge

XY Plot

The XY plot displays a graph of plotted points that helps to show if a relationship exists between sets of data



Right-clicking on the XY plot and selecting Format XY Plot allows for the customization of the Source data, associated X and Y scales, as well as general styling of the XY plot

Asset Comparison Table

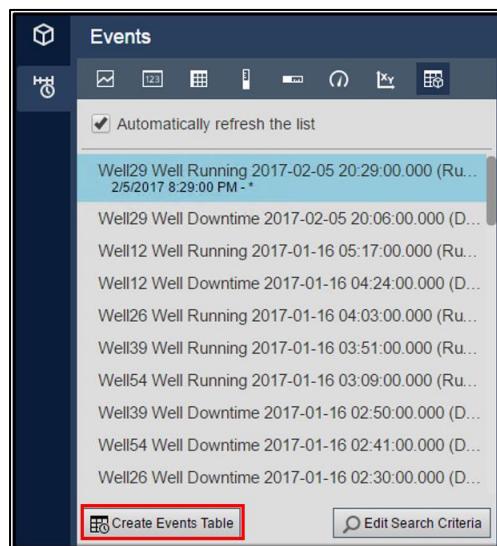
If the same attributes exist for multiple Elements, the Asset Comparison table allows us to display them all in a single table:

Asset	Bottom hole pressure	Casing pressure	Casing temperature	Gas Gravity
Well06	2,450.6	42.19	68.595	1.0575
Well10	3,667.3	55.874	40.802	0.76351
Well23	6,718.9	50.124	51.177	0.72927

Right-click on the Asset Comparison table and select Format Table in order to select which attributes and assets to display in the table

Events table

The Events Table button is available in the Events Search Pane



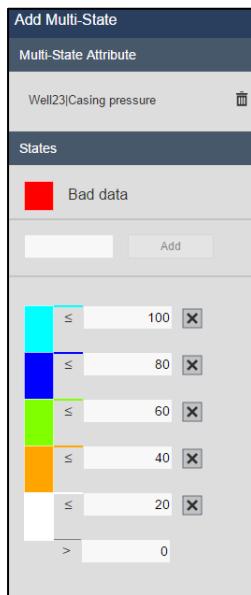
It creates a dynamically updating table of current events

Event Name	Asset	Start Time	End Time
Well29 Well Running 2017-02-05 20:29:00.000	Well29	2/5/2017 8:29:00 PM	In Progress
Well29 Well Downtime 2017-02-05 20:06:00.000	Well29	2/5/2017 8:06:00 PM	2/5/2017 8:29:00 PM
Well12 Well Running 2017-01-16 05:17:00.000	Well12	1/16/2017 5:17:00 AM	2/3/2017 12:07:01 AM

Right-click on the Events Table and click on Table Configuration to edit the Table Columns and Dynamic Criteria that determine which events to show

(Context Option) Multi-States

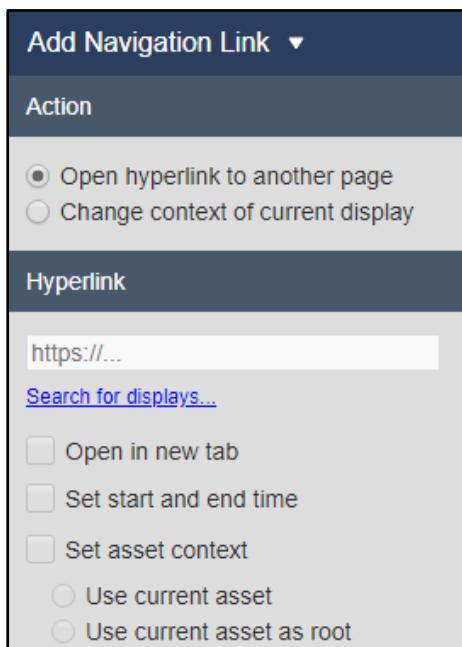
Value symbols and all Gauge Symbols can be modified to become multi-state symbols



Right-click on the symbol and select Add Multi-State in order to configure the Multi-State symbol. The trigger tag and states can be configured here

(Context Option) Navigation Links

Every symbol can be configured with a navigation link. Navigation links allow users to link from one PI Vision display to another, from a PI Vision display to a separate website, or change the asset context of the current display:



Navigation links are activated by clicking on those symbols configured to use them.

(Context Option) Collections

- Every symbol has the option to convert it to a collection
- A collection is a dynamically updating group of symbols that leverages Element templates in AF

(Context Option) Switch Symbol

- Each symbol has a menu option that allows a user to switch a symbol into a different type of symbol
- This saves a user from having to recreate a symbol from scratch if they would like to change the symbol type

Ad Hoc Trend Workspace

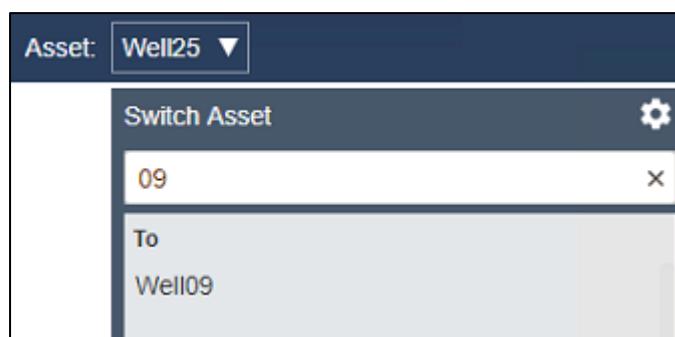
- Selecting any number of symbols and/or data items and then the Ad Hoc Trend button will open a new window designed for Ad Hoc analysis
- Optionally view a table with statistics for all data items
- Toggle Trend options with single clicks without navigating a configuration menu
- Add multiple cursors to the trend
- Publish as a display and share with other users



Asset Dropdown

Opening the Asset dropdown menu gives a list of possible Assets to which the display context could be switched

If the list of Assets is very long, it is possible to enter a filter:



By default, the menu will populate with similar Assets to the current context. If appropriate, click the gear button to customize the Asset search criteria

References

Consult these resources for assistance with PI Vision that can be found in <https://my.osisoft.com> and <https://docs.osisoft.com/>.

