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Building User-specific Dashboards from Legacy Views with AVEVA™ PI Vision

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Agenda

- Intro
- Challenge: Migrate thousands of displays from a legacy system quickly to PI Vision
- Solution: Use the PI Vision API to programmatically build PI Vision displays
- Benefits
- **PI Vision API Bonus tips**
- Questions

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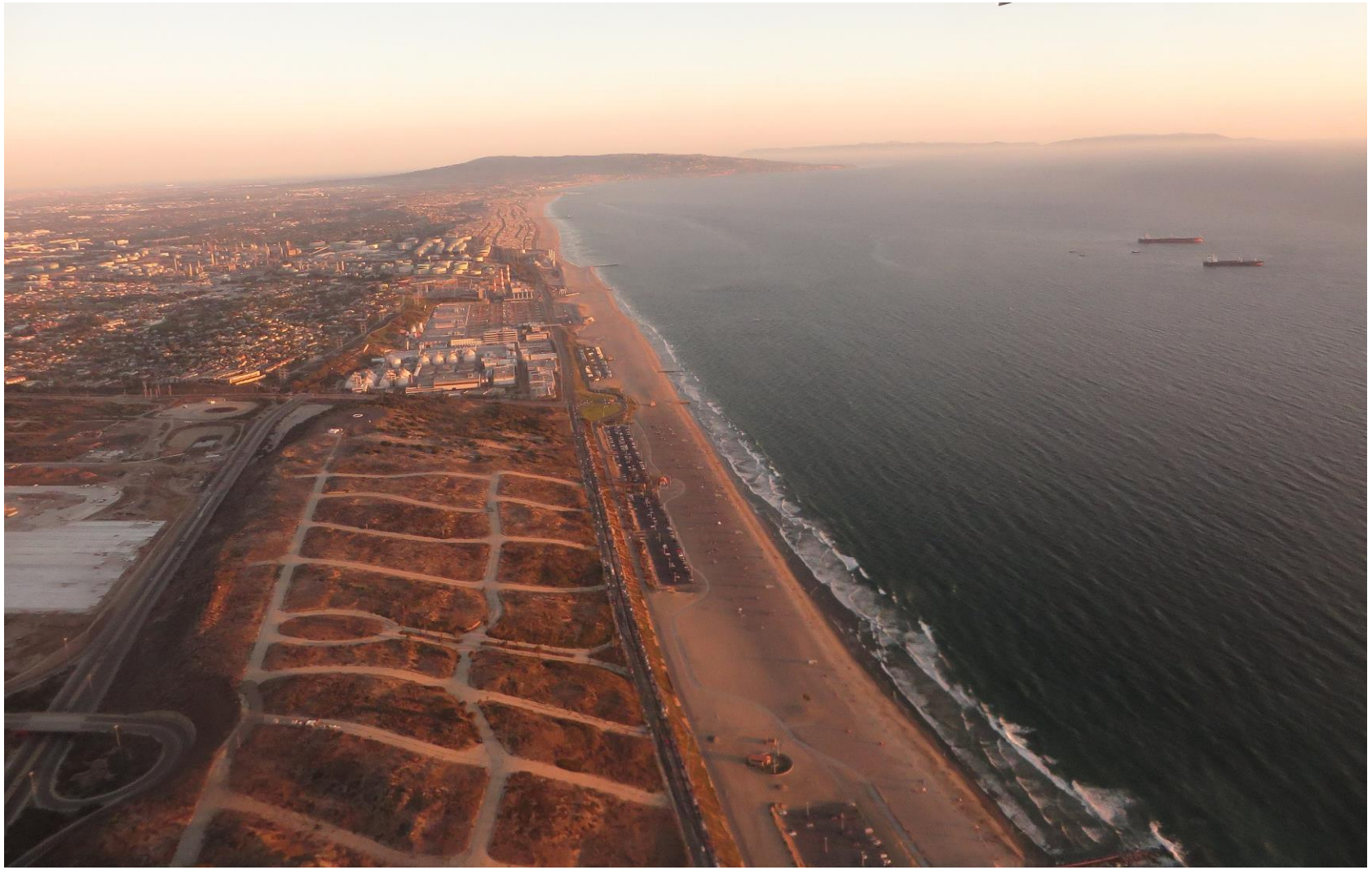
Intro



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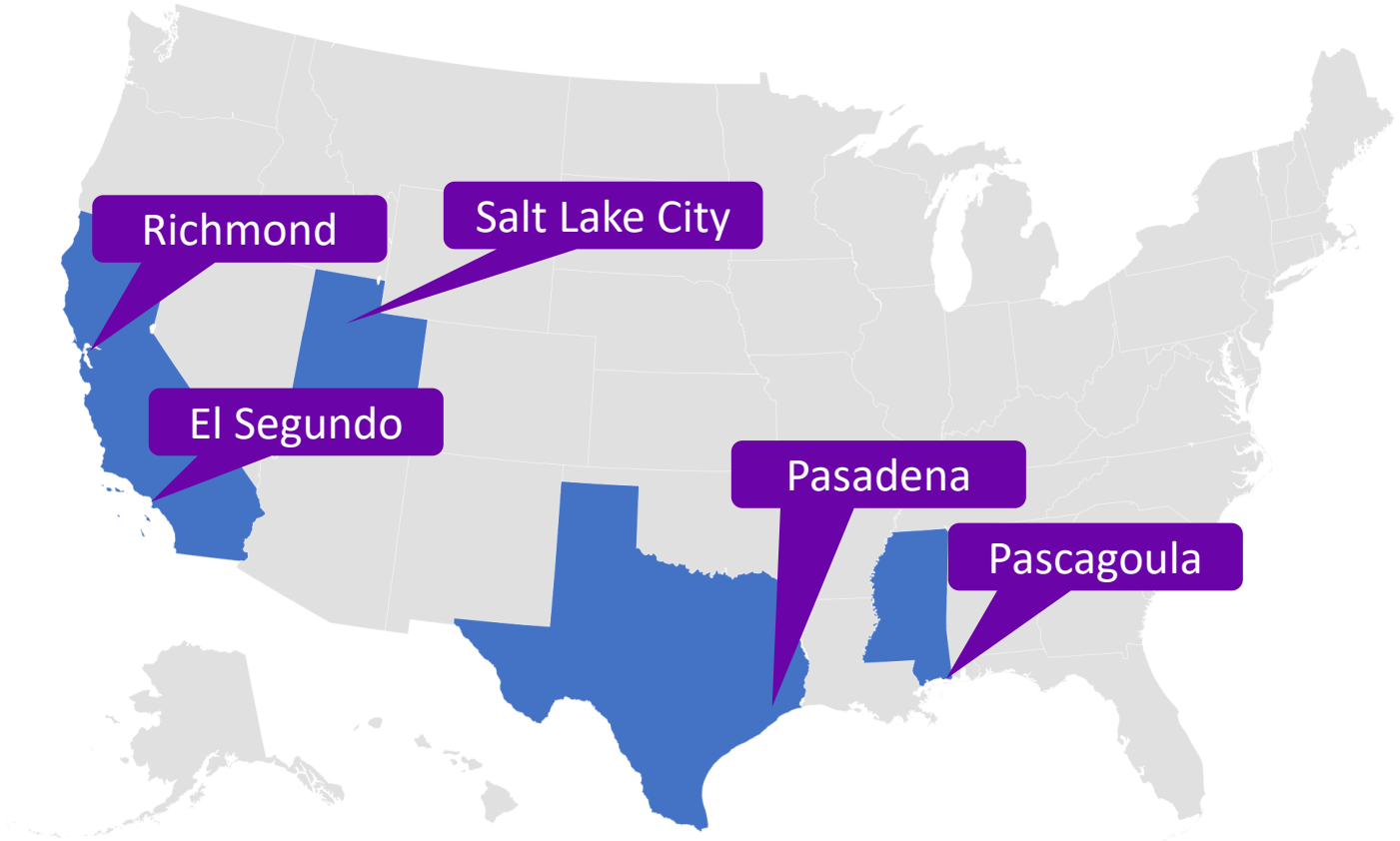
Chevron Domestic Refineries

I serve in a technical advisory role for all Chevron refineries and liaison with our central PI team

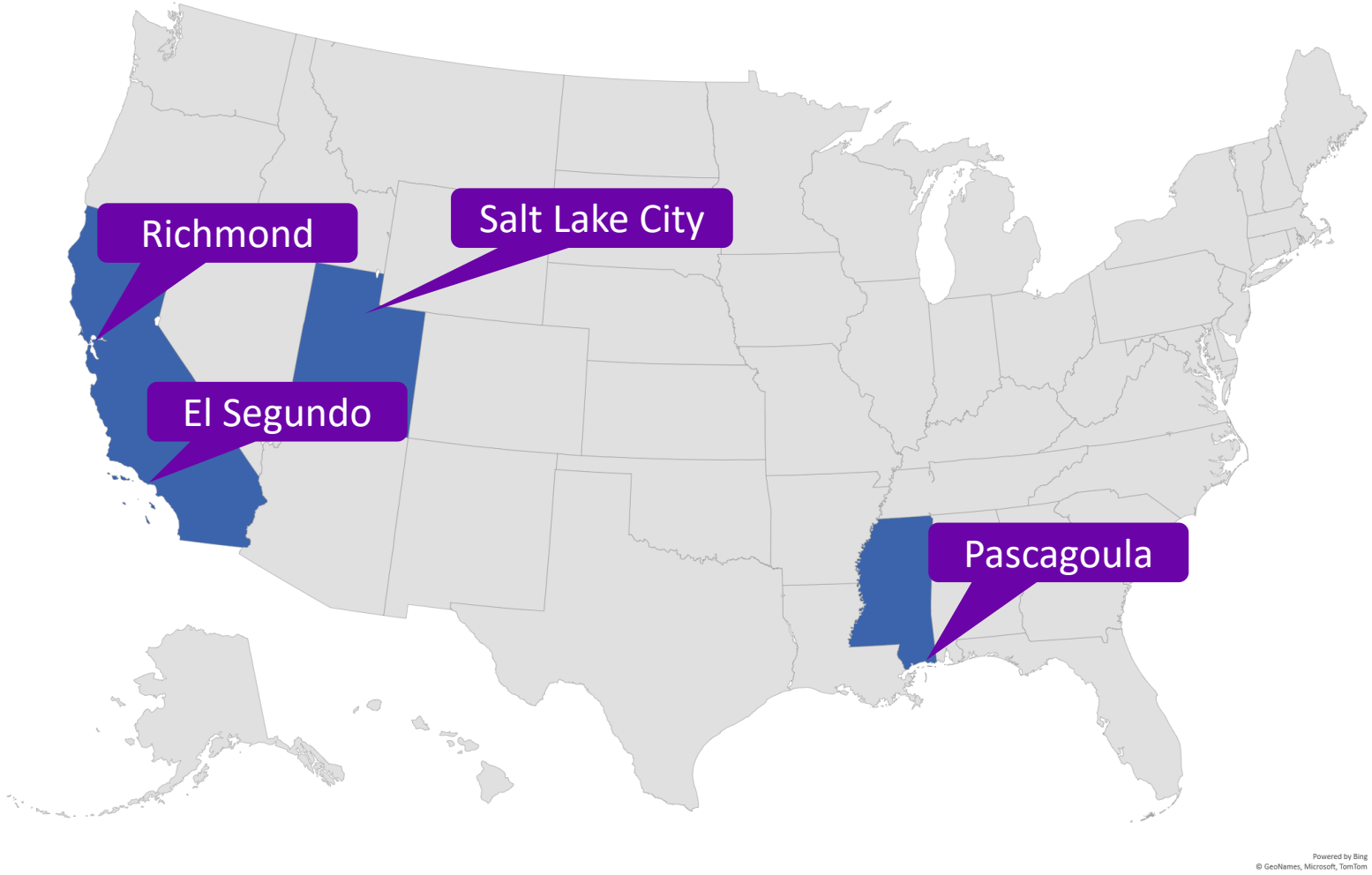


Legacy Visualization = “LVIZ”

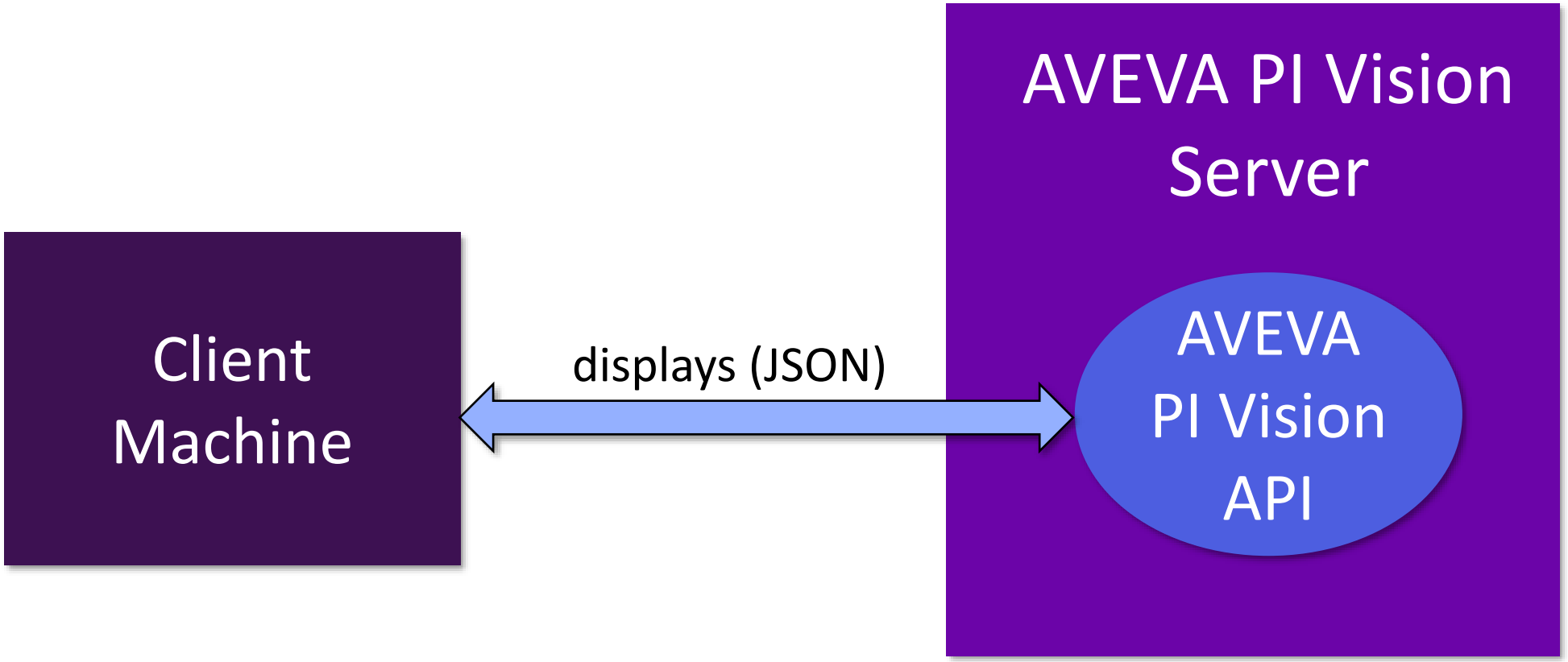
LVIZ =

Elvis Deployments

Challenge: Migrate thousands of displays from a legacy system **fraught with security vulnerabilities** to PI Vision



PI Vision API to the rescue!



Nota Bene

PI Vision API ≠ PI Web API

Important Note

With experienced PI administrators and internal development resources, Chevron was able to go beyond the supported capabilities of AVEVA™ PI Vision and create a customized solution to meet their specific needs. This presentation celebrates Chevron's achievement in going beyond what is available out-of-the-box and is not intended to imply or warrant the functionality they describe for general usage of AVEVA™ PI Vision.

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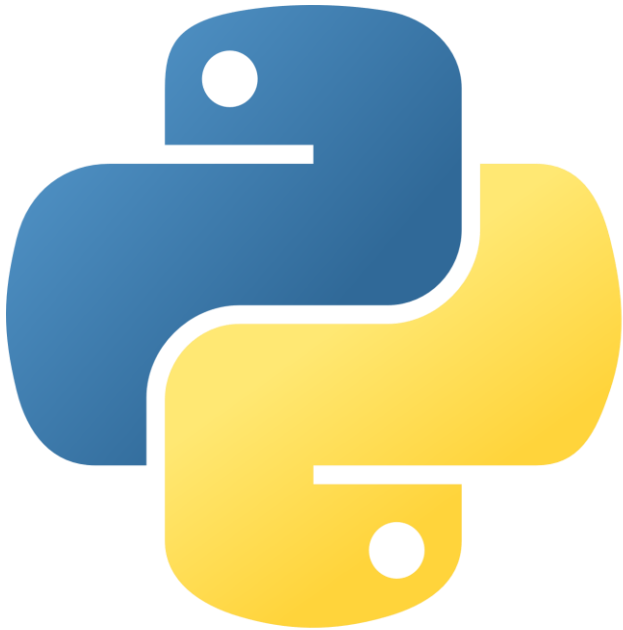
PI Vision API Client Options

- C#
- cURL
- Golang
- PowerShell
- Python
- Rust
- Many other options – just need to be able to consume (and publish) JSON data from an HTTP-based endpoint.



- The PI Vision API opens many new doors of possibility in the realm of PI Vision!

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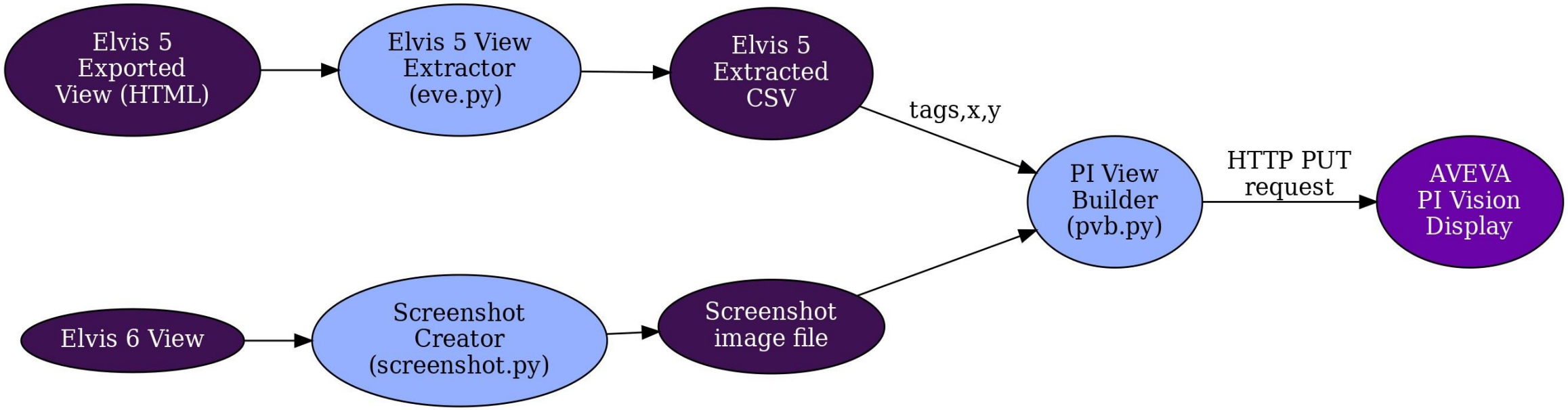
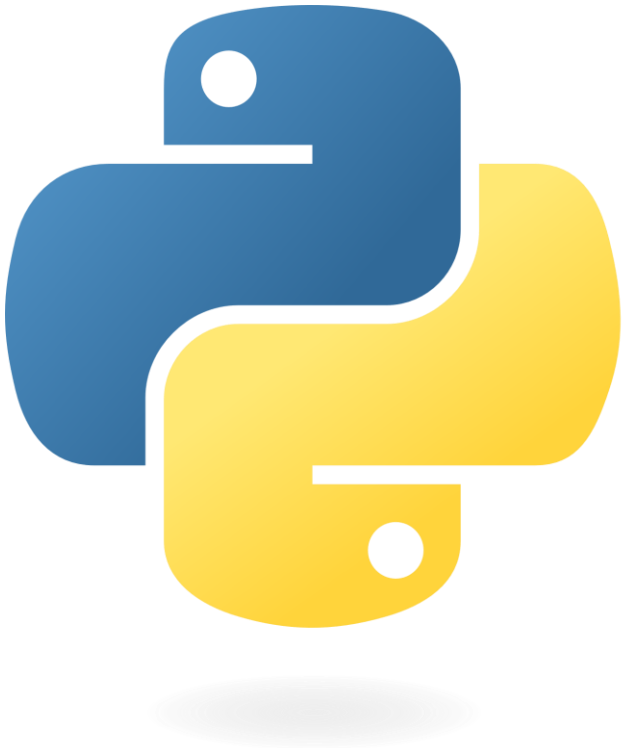
High Level Architecture Overview

Phase 1: **Pure PI tag-based conversion** rather than leveraging PI AF capabilities



Key Python Packages Used

- pythonnet (Python/C# interop) to invoke .NET libraries
  - PI AF SDK
  - .NET WebClient to get and post JSON data (could not use the Python *requests* module due to authentication challenges)
- BeautifulSoup4 (bs4)
- cssutils
- pyautogui
- Pillow



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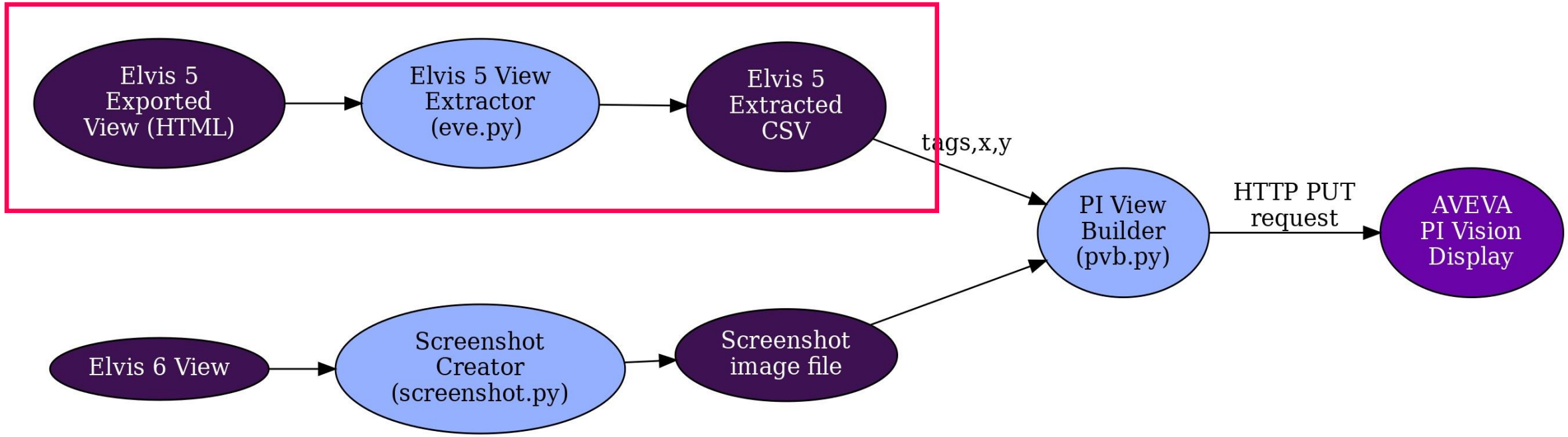
High Level Architecture Overview



Elvis 5 Exported View (Fragment)

18. Template at (677,554)

Template			
Component	View	Drillable	Template Settings
Controller_TS	Name: HorizValve Device: Desktop Orientation: Landscape	Use View Properties	Component View List Member: BaseTag Expression: "22FC101"

19. Template at (44,511)

Template			
Component	View	Drillable	Template Settings
Controller_TS	Name: HorizValve Device: Desktop Orientation: Landscape	Use View Properties	Component View List Member: BaseTag Expression: "22FC105"

Elvis 5 Exported HTML (Fragment)

BeautifulSoup web scraping saves the day!

```
<tr>
  <td width="3%"><br />18.</td>
  <td><br />Template at (677,554)</td>
</tr>
<tr>
  <td></td>
  <td>
    <table
      border
      cellspacing="0"
      cellpadding="0"
      width="100%"
      HEIGHT="50%"
    >
      <tr bgcolor="#FFFFCC">
        <td colspan="4">
          <center>Template</center>
        </td>
      </tr>
      <tr bgcolor="#FFFFCC">
        <td width="20%"><center>Component</center></td>
        <td width="30%"><center>View</center></td>
        <td width="10%"><center>Drillable</center></td>
        <td width="40%"><center>Template Settings</center></td>
      </tr>
```

```
<tr>
  <td>Controller_TS</td>
  <td>
    Name: HorizValve<br />
    Device: Desktop<br />
    Orientation: Landscape<br />
  </td>
  <td>Use View Properties</td>
  <td>
    <table
      border
      cellspacing="0"
      cellpadding="0"
      COLS="2"
      width="100%"
    >
      <tr bgcolor="#CCCCCC">
        <td colspan="2" width="30%">
          <center>Component View List</center>
        </td>
      </tr>
      <tr bgcolor="#CCCCCC">
        <td width="10%"><center>Member</center></td>
        <td width="20%"><center>Expression</center></td>
      </tr>
      <tr>
        <td>BaseTag</td>
        <td>"22FC101"</td>
      </tr>
    </table>
```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Elvis View Extractor (eve.py)

```
C\..> python eve.py -h
usage: eve.py [-h] [-p] [-n] site html_file_or_directory

Extract PI tags and their X/Y coordinates into a CSV file from the HTML files created during the Elvis 5 view export process

positional arguments:
  site                  Name of the site. Sites are retrieved from the sites.csv config file. Valid options include: ese,pas,ric,slc
  html_file_or_directory
                        HTML file to process or directory of HTML files to process all at once

options:
  -h, --help            show this help message and exit
  -p, --prod            use the prod PI server rather than the dev PI server to fetch PI tag values
  -n, --nopi            bypass fetching PI metadata from server
```


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Elvis 5 Exported View CSV result

	A	B	C	D	E	F	G	H	I	J
1	**Display Name**	**Row**	**X**	**Y**	**Symbol**	**Tag Name**	**Description**	**UOM**	**PointType**	**Extended Props**
2	FCC	18	677	554	HorizValve	22FC101	Description 1	MBPD	Float32	BaseTag:22FC101
3	FCC	19	44	511	HorizValve	22FC105	Description 2	LB/HR	Float32	BaseTag:22FC105
4	FCC	20	207	215	HorizValve	22LC450	Description 3	PCT	Float32	BaseTag:22LC450
5	FCC	24	359	393	VertBar30_PV	22LC460	Description 4	PCT	Float32	BaseTag:22LC460
6	FCC	27	391	240	Description_11pt	22TI4614	Description 5	DEGF	Float32	
7	FCC	28	455	237	TagUnit	22TI4614	Description 6	DEGF	Float32	
8	FCC	29	391	261	Description_11pt	22TI4609	Description 7	DEGF	Float32	
9	FCC	30	455	258	TagUnit	22TI4609	Description 8	DEGF	Float32	
10	FCC	31	353	191	TagUnit	22TI460	Description 9		Float32	
11	FCC	32	391	282	Description_11pt	22TI4615	Description 10	DEGF	Float32	
12	FCC	33	455	279	TagUnit	22TI4615	Description 11	DEGF	Float32	
13	FCC	34	391	302	Description_11pt	22TI4616	Description 12	DEGF	Float32	
14	FCC	35	391	322	Description_11pt	22TI4617	Description 13	DEGF	Float32	
15	FCC	36	455	300	TagUnit	22TI4616	Description 14	DEGF	Float32	

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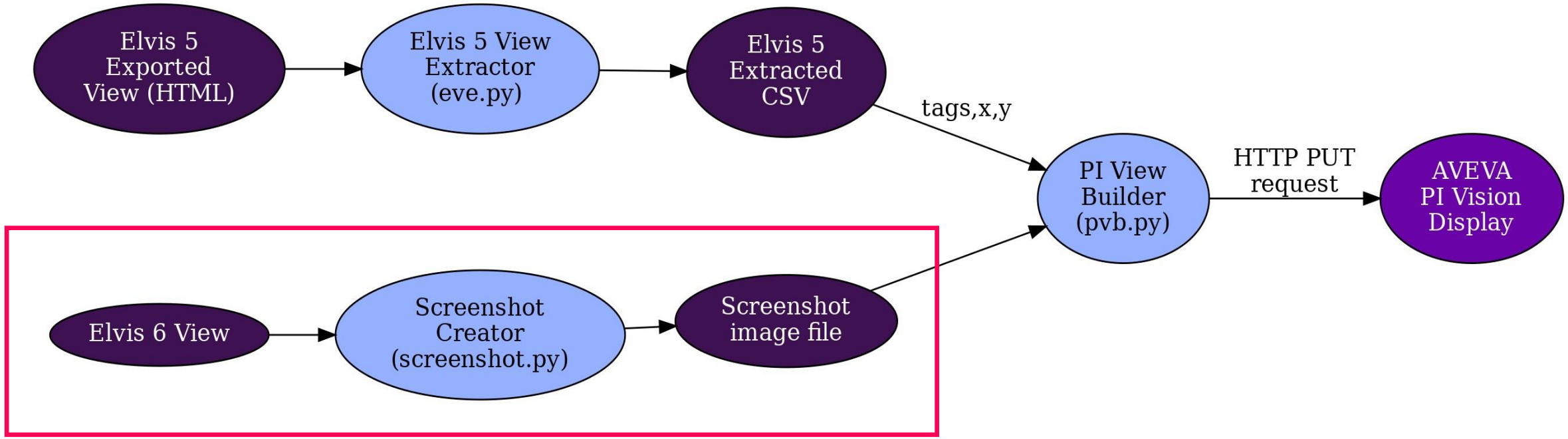
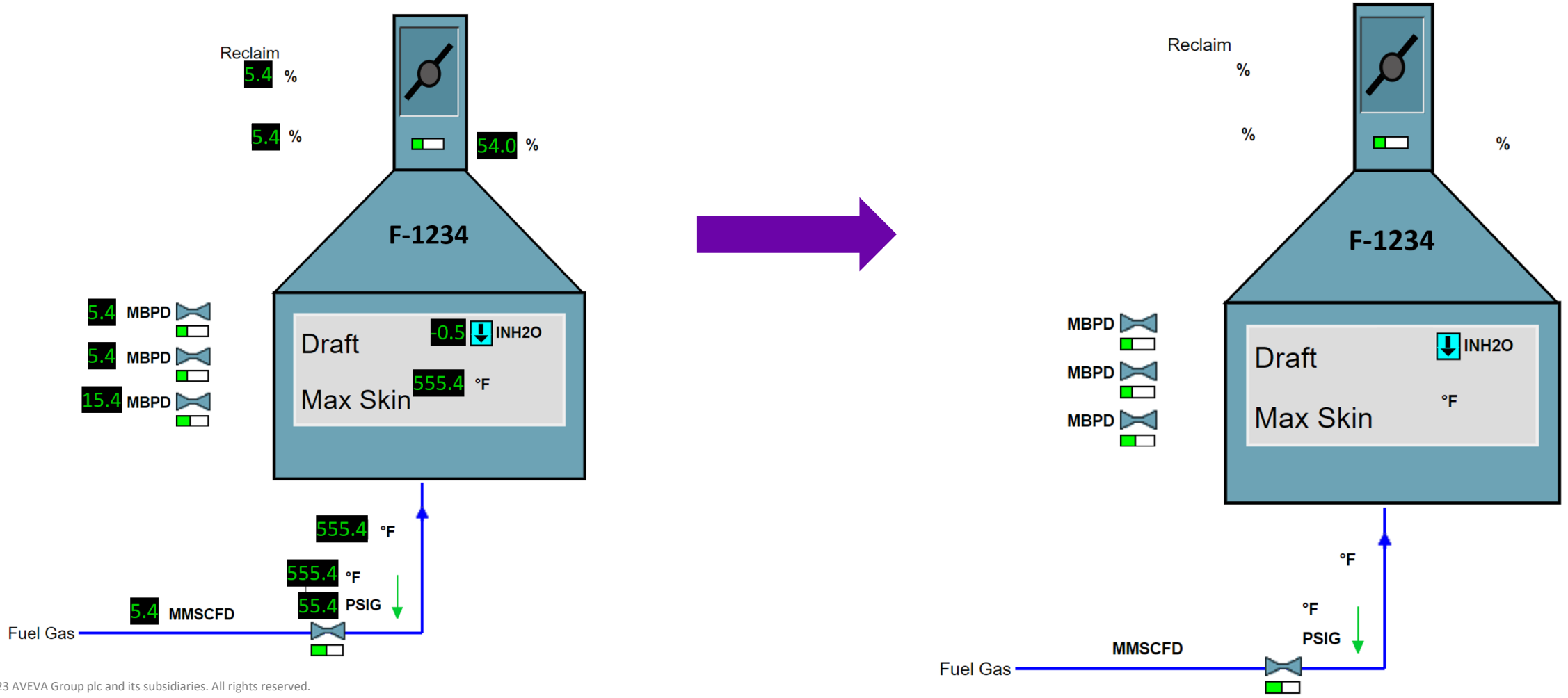
High Level Architecture Overview



Screenshot element zapping



Screenshot Creator (screenshot.py)

Result: Image without live elements

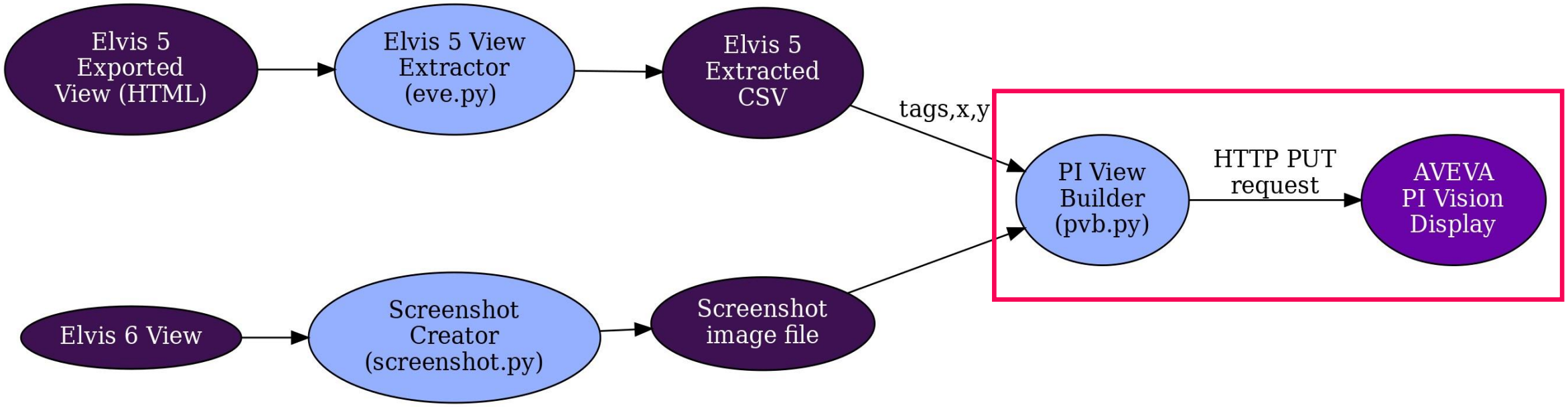
```
C\...>python screenshot.py -h
usage: screenshot.py [-h] [-f] [-z] site group

Create background images for PI Vision displays from Elvis 6 HTML5 views

positional arguments:
  site                  Name of the site. Sites are retrieved from the sites.csv config file. Valid options include: ese,pas,ric,slc
  group                 Group to process. Separate multiple groups with commas and no spaces. Example: fcc1,fcc2

options:
  -h, --help            show this help message and exit
  -f, --force-elvis6    Force an update of the offline files from the Elvis 6 server even if the files already exist
  -z, --zap             Zap elements manually from the display before saving a screenshot
```

High Level Architecture Overview



Elvis 5 Exported View CSV result

	A	B	C	D	E	F	G	H	I	J
1	**Display Name**	**Row**	**X**	**Y**	**Symbol**	**Tag Name**	**Description**	**UOM**	**PointType**	**Extended Props**
2	FCC	18	677	554	HorizValve	22FC101	Description 1	MBPD	Float32	BaseTag:22FC101
3	FCC	19	44	511	HorizValve	22FC105	Description 2	LB/HR	Float32	BaseTag:22FC105
4	FCC	20	207	215	HorizValve	22LC450	Description 3	PCT	Float32	BaseTag:22LC450
5	FCC	24	359	393	VertBar30_PV	22LC460	Description 4	PCT	Float32	BaseTag:22LC460
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11	FCC	32	391	282	Description_11pt	22TI4615	Description 10	DEGF	Float32	
12	FCC	33	455	279	TagUnit	22TI4615	Description 11	DEGF	Float32	
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15	FCC	36	455	300	TagUnit	22TI4616	Description 14	DEGF	Float32	

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PI Vision JSON symbol templates

Mapped to symbols defined in the CSV

```
{
    "DataSources": [
        "pi:\\\\{{pi_server}}\\{{tag}}"
    ],
    "Name": "Symbol35",
    "SymbolType": "horizontalgauge",
    "Configuration": {
        "DataShape": "Gauge",
        "Height": 11.197997404893931,
        "Width": 24.862637362637262,
        "Fill": "#22b14c",
        "Background": "#ffffff",
        "Stroke": "#414853",
        "StrokeWidth": 2,
        "ValueStroke": "#414853",
        "ShowLabel": false,
        "ShowValue": false,
        "ShowUOM": true,
        "Top": 70.87,
        "Left": 809.72,
        "FormatType": "F1",
        "ValueScaleSettings": {
            "MinType": 2,
            "MinValue": -30,
            "MaxType": 2,
            "MaxValue": 100
        },
        "ValueScale": false
    }
}
```

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PI Vision JSON symbol templates

Dynamic Expression Syntax

```
51      {
52          "DataSources": [
53              "pi:\\\\{{pi_server}}\\{{tag1}}.op"
54          ],
55          "Name": "Symbol30",
56          "SymbolType": "horizontalgauge",
57          "Configuration": {
58              "DataShape": "Gauge",
59              "Height": 10.1123595505617774,
60              "Width": 23.595505617977636,
61              "Fill": "#7fff00",
62              "Background": "#ffffff",
63              "Stroke": "#000000",
64              "StrokeWidth": 2,
65              "ValueStroke": "black",
66              "ShowLabel": false,
67              "ShowValue": false,
68              "ShowUOM": false,
69              "Top": "{{y+50}}",
70              "Left": "{{x-18}}",
71              "ValueScale": false,
72              "LinkURL": ""
73          }
74      },
```

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PI View Builder (pvb.py)

Result: PI Vision Display of legacy converted display including background screenshot

```
C\...>python pvb.py -h
usage: pvb.py [-h] [-u] [-p] [-b] site group

Build PI Vision displays using CSV files and screenshots created using eve.py and screenshot.py respectively

positional arguments:
  site           Name of the site. Sites are retrieved from the sites.csv config file. Valid options include: ese,pas,ric,slc
  group          Group to process. Separate multiple groups with commas and no spaces. Example: fcc1,fcc2

options:
  -h, --help     show this help message and exit
  -u, --update   update the display on the PI Vision web server in addition to writing the results to a JSON file
  -p, --prod     use the prod environment rather than the dev environment
  -b, --browser  launch web browser after display is updated on the PI Vision web server (must be used with --update to work)
```

Note: The PI Vision API officially supports just the import and export of displays. We created symbols and exported displays as a starting point to ensure the JSON conformed to standards before programmatically building the PI Vision displays.

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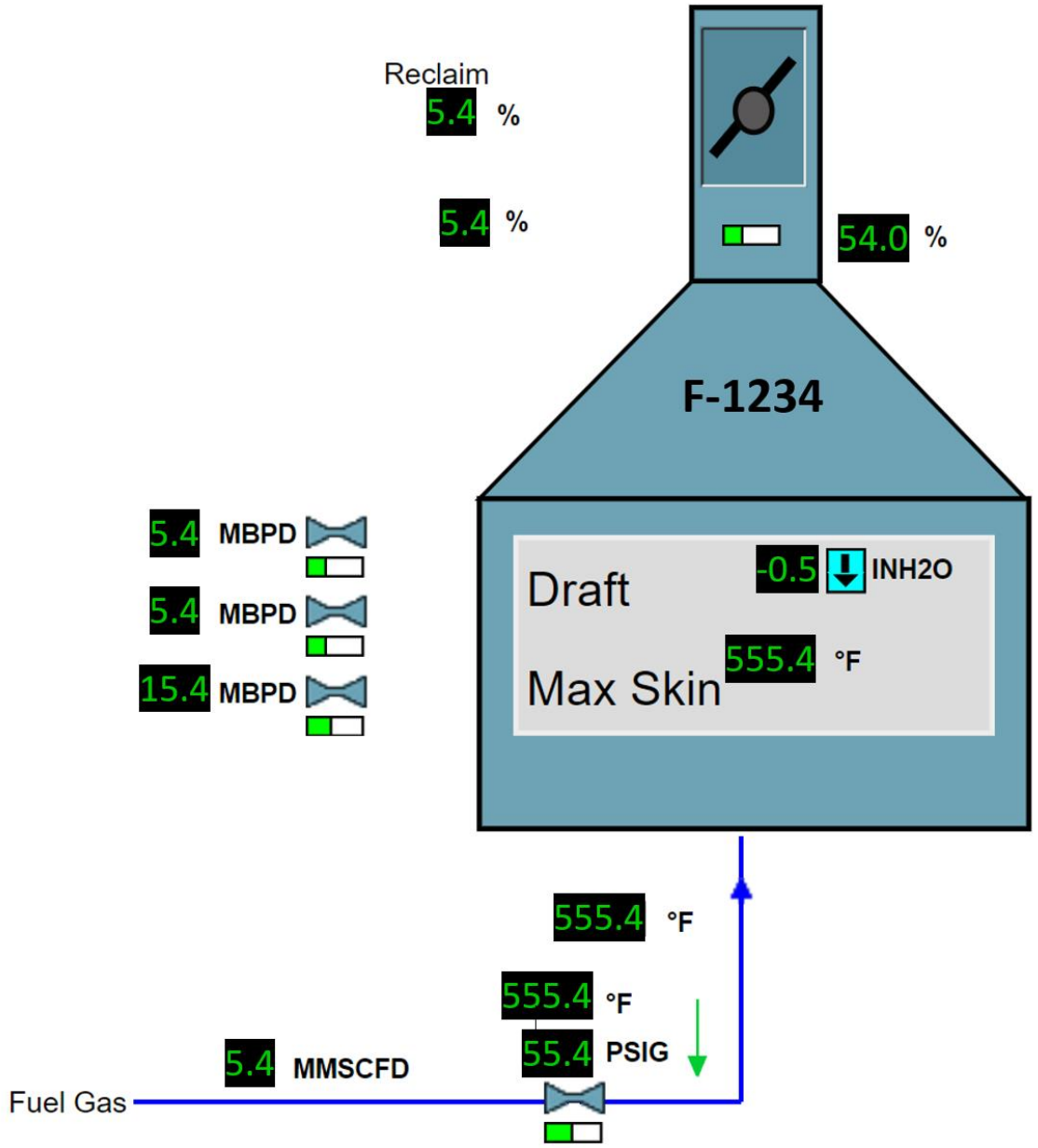
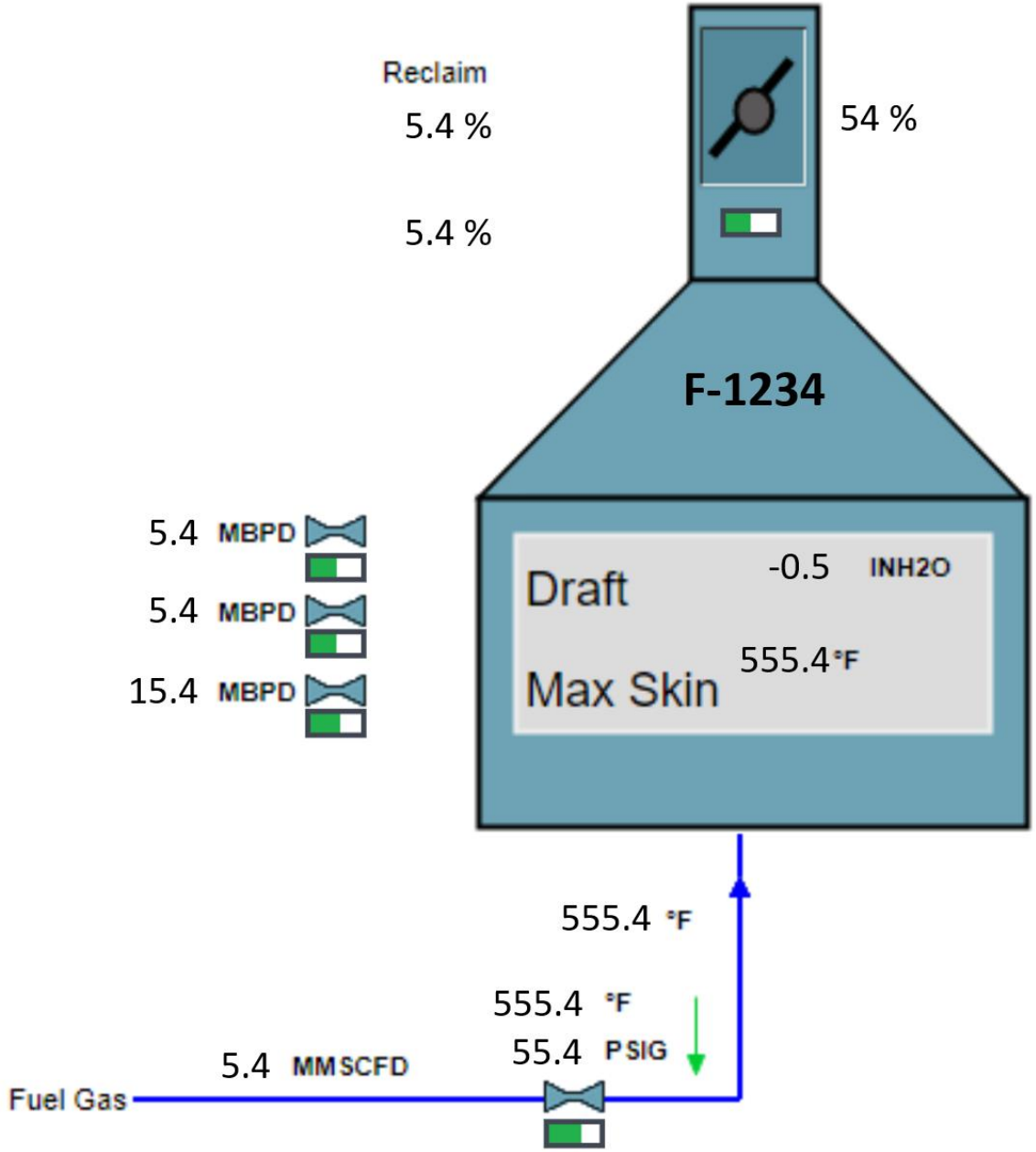
Final Result: Elvis graphic



Final Result: AVEVA PI Vision Graphic



Surgeon (surgeon.py)

Perform surgery on an existing PI Vision display rather than regenerating it completely

```
C\...>python surgeon.py -h
usage: surgeon.py [-h] [-u] [-p] [-b] site group

positional arguments:
  site           Name of the site. Sites are retrieved from the sites.csv config file. Valid options include: ese,pas,ric,slc
  group          Group to process. Separate multiple groups with commas and no spaces. Example: fcc1,fcc2

options:
  -h, --help     show this help message and exit
  -u, --update   update the display on the PI Vision web server in addition to writing the results to a JSON file
  -p, --prod     use the prod environment rather than the dev environment
  -b, --browser  launch web browser after display is updated on the PI Vision web server (must be used with --update to work)
```

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Chevron saves money and increases reliability using the PI Vision API to convert legacy displays

Challenge

- We (Chevron) were faced with a situation in our domestic refineries where we needed to convert hundreds of complex legacy data visualization views built over 20 years residing in a non-AVEVA PI system to AVEVA PI Vision—and we needed to do it expeditiously.

Solution

- We leveraged the AVEVA PI Vision API in conjunction with Python to programmatically build the PI Vision displays rather than creating each new PI Vision display manually.

Results

- **Hundreds of hours saved building new PI Vision displays manually.**
- **Increased accuracy and reliability since the human element of transcribing PI tags (i.e., swivel chair interface) was removed.**
- **We grew our capabilities to use the PI Vision API in other future contexts beyond legacy display conversion.**

PI Vision API Bonus tips

We have just scratched the surface in terms of the flexibility and power the PI Vision API provides

- Create trends or tabular displays automatically from a spreadsheet or simple markdown document
- Find PI tag dependencies
- Count equipment such as pumps, etc. based on symbols present in the views
- Search/replace symbols made across many displays in your solution
- Adjust links in displays after the fact due to a new URL
- **The PI Vision API opens many new doors of possibility in the realm of PI Vision**

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Special thanks

- Billy Crosby
- Tom Hosea
- Bryan Klosiewicz
- Brent Bregenzer
- James Owens
- The entire Chevron PI team

Dave Johnson

Senior Software Engineer

- Chevron
- dave.johnson@chevron.com

Questions?

Please wait for the microphone.

State your name and company.

Please remember to…

Navigate to this session in the mobile app to complete the survey.

Thank you!

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