Ansys 2022/R2
Engineering What's Ahead.

Ansys ACT Customization Guide for Fluent

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Introduction

This guide assumes that you are familiar with the general ACT usage information in the *ACT Developer's Guide*. This first section provides ACT usage information specific to Fluent:

ACT Start Page and Tool Access

UDF Folder

While Fluent does not currently support using ACT to deliver custom features via extensions, it does support using UDF libraries (p. 1) for feature creation. Fluent also supports target product wizards, which are described in the subsequent section (p. 3).

Note:

For information on all ACT API changes and known issues and limitations that may affect your existing ACT extensions, see Migration Notes and Known Issues and Limitations in the *Ansys ACT Developer's Guide*.

ACT Start Page and Tool Access

From a stand-alone instance of Fluent, you access the ACT Start Page by doing one of the following:

- During startup, select the **Load ACT** check box in the **Fluent Launcher**.
- When Fluent is running, click **Arrange the workspace** and then **ACT**, which toggles between showing and hiding the **ACT Start Page**.
- Enter the text command **`file/load-act-tool`**.

The **ACT Start Page** opens as a new component in the Fluent layout.

The **ACT Start Page** for a stand-alone instance of Fluent has an icon for accessing the Extension Manager. However, when Fluent is opened within Workbench, the **ACT Start Page** accessed by using one of the previous methods does not have the icon. This is because you must manage extensions from the **ACT Start Page** for Workbench.

Once accessed, the **ACT Start Page** and ACT tools are all used as described in the *Ansys ACT Developer's Guide*.

UDF Folder

When creating an extension for Fluent, in the XML file, the element **`<simdata>`** can have a child **`<udf>`** element. This element specifies the location of the folder containing UDF libraries.

```
<simdata context="Fluent">
 <udf folder="udf_library"></udf>
  </simdata>
```

The path that you supply for the UDF folder uses the same logic as the path that you supply for the extension's IronPython script, where **`src`** is the path relative to the extension folder:

```
<script src="main.py"/>
```

Paths for both of these elements are relative to the extension folder. However, the element **`<script>`** requires a *file relative path*, while the element **`<udf>`** requires a *folder relative path*.

Sample XML code for a Fluent extension with the element **`<udf>`** follows. The extension `FluentTest` is a theoretical example.

```
<extension name="FluentTest" version="1" icon="icon.png">
  <guid>36DB3B25-C5E2-4E43-9A04-BA53AA7DC05A</guid>
  <author>Ansys, Inc.</author>
  <interface context="Fluent"></interface>
  <description>A sample extension for Fluent with UDF encapsulation</description>
  <script src="main.py" />
  <simdata context="Fluent">
 <udf folder="udf_library"></udf>
  </simdata>
</extension>
```

Because the UDF libraries in the specified folder are packaged with the extension, when this extension is installed, these libraries can be loaded.

When you specify the UDF folder name in the element **`<udf>`**, do not specify a Fluent version. The extension automatically appends the Fluent version in which the extension is running to the name of the folder. However, because UDF libraries are version-dependent, you must name each of the real UDF folders with the specified name followed by an underscore and the version.

In the previous example, the name specified for the UDF folder is **`udf_library`**. However, the real folders are named **`udf_library`** followed by an underscore and then the Fluent versions. The extension searches for the name given in the element **`<udf>`** followed by the Fluent version in which you are running the extension.

Thus, the naming convention of the UDF folder in the XML file is *`foldername`*, and the naming convention for the real folder is *`foldername_Fluent_version`*.

Fluent Wizards

You can use ACT to create target product wizards for Fluent. The supplied package ACT Wizard Templates contains a folder named **`Templates-FluentWizard`**. In this folder are two extension examples, **`FluentDemo1`** and **`FluentDemo2`**, along with their sample input files. For download information, see Extension and Template Examples.

This section describes the supplied Fluent wizards for importing MSH and CAS files:

Fluent Wizard (MSH Input File)

Fluent Wizard (CAS Input File)

Note:

You use the Extension Manager to install and load extensions and the Wizards launcher to start a target product wizard.

Fluent Wizard (MSH Input File)

The supplied extension **`FluentDemo1`** includes a target project wizard for Fluent named **`Simple Analysis (Fluent Demo 1)`**. This Fluent wizard imports an MSH file, runs a simple analysis, generates results, and displays the results in a custom panel in the user interface. This example can be used in either of the following scenarios:

- Within a Workbench project that contains a **Fluent (with Fluent Meshing)** system
- In a Fluent stand-alone project with **Meshing Mode** selected

The following topics describe the extension **`FluentDemo1`**:

Defining FluentDemo1

Defining Functions for FluentDemo1

Reviewing the Wizard in FluentDemo1

Defining FluentDemo1

The file `FluentDemo1.xml` follows. For both the elements **`<extension>`** and **`<wizard>`**, the attribute **`context`** is set to **`Fluent`**.

```
<extension name="FluentDemo1" version="1">
 <guid>A0A3E28C-E094-4B2D-8A91-A0B0884D1AE2</guid>
 <author>Ansys, Inc.</author>
 <description>This extension demonstrates how to create a wizard in Fluent (.msh file import).</description>

 <script src="main.py" />

 <interface context="Fluent">
```

```
  <images>images</images>
 </interface>

  <uidefinition>

  <layout name="ResultsView">
   <component
    name="Title"
    topAttachment=""
    topOffset="10"
    leftAttachment=""
    leftOffset="10"
    rightAttachment=""
    rightOffset="10"
    bottomOffset="10"
    bottomAttachment="Properties"
    widthType="Percentage"
    width="100"
    heightType="FitToContent"
    height="200"
    componentType="startPageHeaderComponent" />
   <component
    name="Properties"
    topAttachment="Title"
    leftAttachment=""
    leftOffset="10"
    rightAttachment=""
    rightOffset="10"
    bottomAttachment="Report"
    bottomOffset="10"
    widthType="Percentage"
    width="100"
    heightType="Percentage"
    height="20"
    componentType="propertiesComponent" />
   <component
    name="Report"
    topAttachment="Properties"
    leftAttachment=""
    leftOffset="10"
    rightAttachment=""
    rightOffset="10"
    bottomAttachment="Chart"
    bottomOffset="10"
    widthType="Percentage"
    width="100"
    heightType="Percentage"
    height="40"
    componentType="helpContentComponent" />
   <component
    name="Chart"
    topAttachment="Report"
    leftAttachment=""
    leftOffset="10"
    rightAttachment=""
    rightOffset="10"
    bottomAttachment="Submit"
    bottomOffset="10"
    widthType="Percentage"
    width="100"
    heightType="Percentage"
    height="40"
    componentType="chartComponent" />
   <component
    name="Submit"
    topAttachment="Chart"
    leftAttachment=""
    leftOffset="10"
    rightAttachment=""
    rightOffset="10"
    bottomAttachment=""
```

```
    bottomOffset="10"
    widthType="Percentage"
    width="100"
    heightType="FitToContent"
    height="50"
    componentType="buttonsComponent" />
  </layout>

 </uidefinition>


 <wizard name="Simple Analysis (Fluent Demo 1)" version="1" context="Fluent" icon="wizard_icon">
  <description>Generate the mesh and solve the analysis.</description>

  <step name="Analysis" caption="Analysis" version="1">
   <callbacks>
    <onrefresh>ImportMesh</onrefresh>
    <onupdate>CreateAnalysis</onupdate>
   </callbacks>

   <property name="velocity" caption="Velocity" control="float" default="3" />
  </step>

  <step name="Results" caption="Results" version="1" layout="ResultsView@FluentDemo1">
   <callbacks>
    <onrefresh>CreateReport</onrefresh>
   </callbacks>

   <property name="pressure" caption="Pressure Drop" control="text" readonly="true" />
  </step>

 </wizard>

</extension>
```

Custom Layout Definition

The element **`<uidefinition>`** defines a custom layout named **`ResultsView`** for the Fluent wizard. It is made up of five custom components: **`Title`**, **`Properties`**, **`Report`**, **`Chart`**, and **`Submit`**. The **`Properties`**, **`Report`**, and **`Chart`** components are views, and the **`Submit`** component is a button.

Wizard Definition

In the element **`<wizard>`**, the attribute **`name`** is set to **`Simple Analysis (Fluent Demo 1)`**.

Step Definition

The element **`<step>`** defines a step in the wizard. This wizard has two steps: **`Analysis`** and **`Results`**. For each step:

- The attribute **`layout`** specifies the custom layout to apply to the step. For the step **`Results`**, **`layout`** is set to **`ResultsView@FluentDemo1`**. The custom layout **`ResultsView`** is defined in the element **`<uidefinition>`**.
- Any element **`<property>`** specifies a property and property attributes to be used in the step.
  - For the step **`Analysis`**, the property **`velocity`** is defined. The attribute **`caption`** is set to **`velocity`**.

  - For the step **`Results`**, the property **`pressure`** is defined. The attribute **`caption`** is set to **`Pressure`**.

- The element **`<callbacks>`** specifies callbacks to functions defined in the script `main.py`. For callback descriptions, see Reviewing the Wizard in FluentDemo1 (p. 7).

Defining Functions for FluentDemo1

The IronPython script `main.py` follows. This script defines all functions executed by the callbacks in the extension's XMLfile:

- The function **`ImportMesh`** is invoked by the callback **`<onrefresh>`** in the step **`Analysis`**.
- The function **`CreateAnalysis`** is invoked by the callback **`<onupdate>`** in the step **`Analysis`**.
- The function **`CreateReport`** is invoked by the callback **`<onrefresh>`** in the step **`Results`**.

```
def ImportMesh(step):
    tui = ExtAPI.Application.ScriptByName("TUI")

    tui.SendCommand("""switch-to-meshing-mode""")
    tui.SendCommand("""/file/read-mesh "{0}" """.format(System.IO.Path.Combine(
ExtAPI.Extension.InstallDir,"final.msh")))
    tui.SendCommand("""switch-to-solution-mode yes yes""")
    tui.SendCommand("""/display/mesh ok""")
    tui.SendCommand("""/display/views/restore-view right""")

def CreateAnalysis(step):
    tui = ExtAPI.Application.ScriptByName("TUI")

    res = System.IO.Path.GetTempFileName()
    img = System.IO.Path.GetTempFileName()+".jpg"
    curve = System.IO.Path.GetTempFileName()
    tui.SendCommand("""/define/boundary-conditions/velocity-inlet inlet no no yes yes no {0} no 0""".format(step
    tui.SendCommand("""/solve/initialize/hyb-initialization""", True)
    tui.SendCommand("""/solve/iterate 50""", True)
    tui.SendCommand("""/display/mesh ok""", True)
    tui.SendCommand("""/display/views/restore-view right""", True)
    tui.SendCommand("""/display/set/contours/filled-contours? yes""", True)
    tui.SendCommand("""/display/set/contours/surfaces wall inlet outlet ()""", True)
    tui.SendCommand("""/display/contour pressure 0 2""", True)
    tui.SendCommand("""/display/save-picture "{0}" """.format(img), True)
    tui.SendCommand("""/surface/rake-surface rake-5 0 0 0 0 0 1 50""", True)
    tui.SendCommand("""/plot/plot-direction 0 0 1""", True)
    tui.SendCommand("""/plot/plot yes "{0}" yes yes no no pressure yes 0 0 1 rake-5 ()""".format(curve), True)
    tui.SendCommand("""/report/surface-integrals/area-weighted-avg inlet () pressure yes "{0}" """.format(res),

    val = 0.
    n = 0;
    with System.IO.StreamReader(res) as reader:
        while n!=5:
            line = reader.ReadLine()
            if line!=None:
                n+=1
        str = line.Substring(32)
        val = System.Double.Parse(str, System.Globalization.CultureInfo.InvariantCulture)

    x=[]
    y=[]
    n = 0;
    with System.IO.StreamReader(curve) as reader:
        while n!=5:
            line = reader.ReadLine()
            if line!=None:
                n+=1
```

```
        while not line.StartsWith(")"):
            tab = line.Split("\t")
            x.Add(System.Double.Parse(tab[0], System.Globalization.CultureInfo.InvariantCulture))
            y.Add(System.Double.Parse(tab[1], System.Globalization.CultureInfo.InvariantCulture))
            line = reader.ReadLine()
    System.IO.File.Delete(res)
    System.IO.File.Delete(curve)

    step.NextStep.Properties["pressure"].Value = val
    step.NextStep.Attributes["img"] = img
    step.NextStep.Attributes["x"] = x
    step.NextStep.Attributes["y"] = y

def CreateReport(step):
    graph = step.UserInterface.GetComponent("Chart")
    graph.Title("Static Pressure")
    graph.ShowLegend(False)
    graph.Plot(step.Attributes["x"],  step.Attributes["y"], key="Static Pressure", color='g')

    help = step.UserInterface.GetComponent("Report")
    help.SetHtmlContent(ExtAPI.Extension.InstallDir,"""<center><img style="height:250px" src="{0}"></center>""".
```

Reviewing the Wizard in FluentDemo1

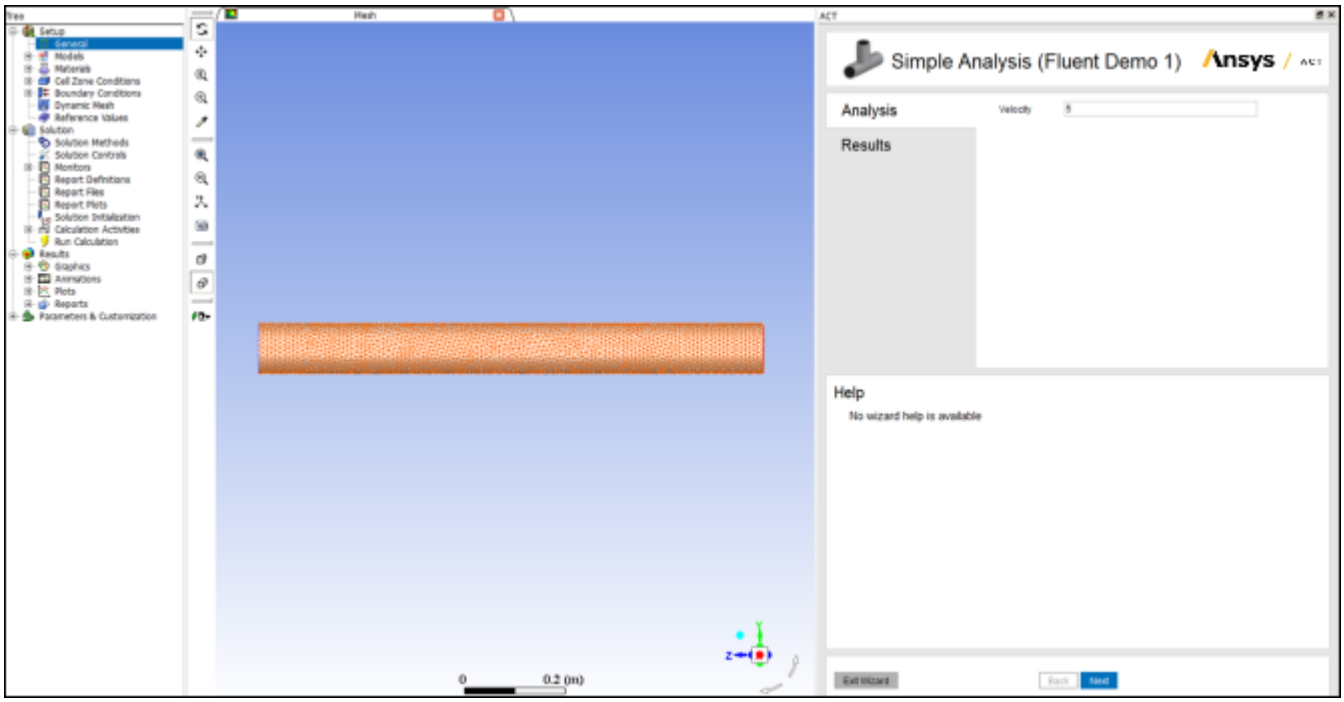
This section reviews the user interface and the processes performed in each step of the wizard **`Simple Analysis (Fluent Demo 1)`**.

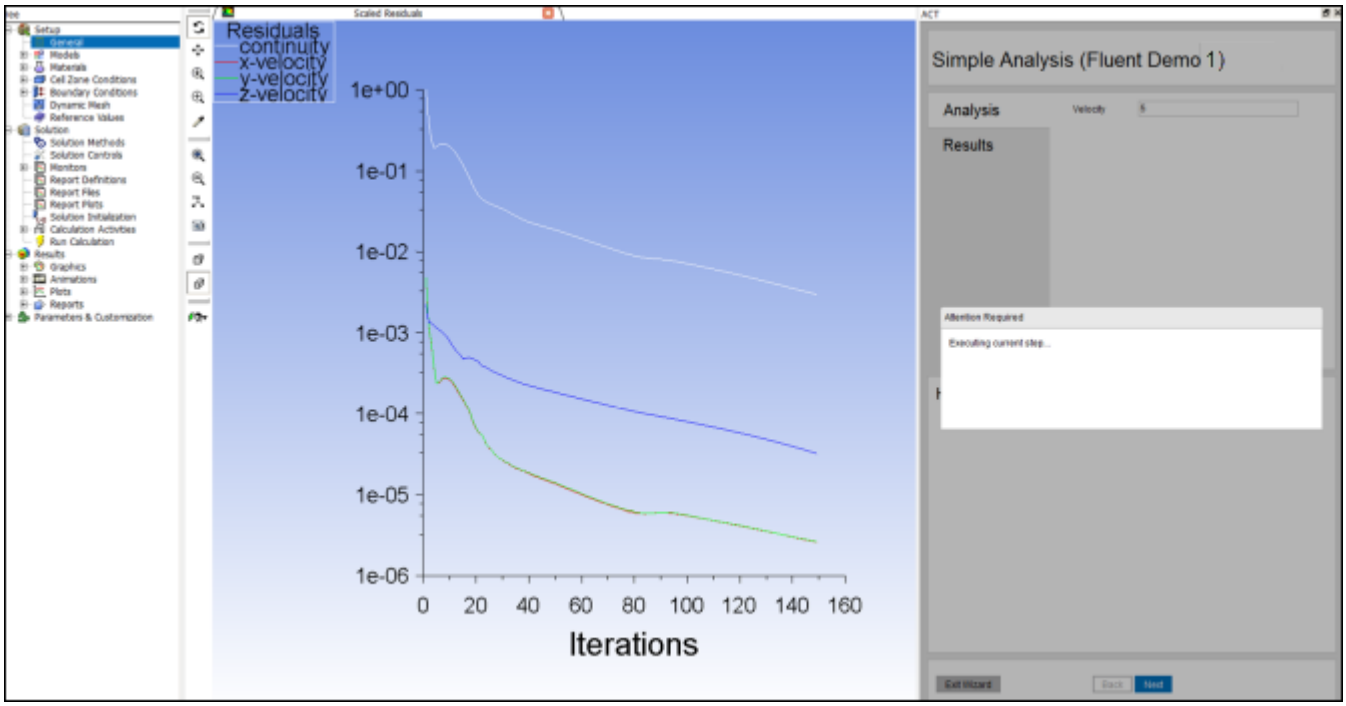
Reviewing the Analysis Step

The first step is **Analysis**, which imports the mesh file and creates the analysis. It requires that a value be specified for the property **`Velocity`**.

In this step:

- The callback **`<onrefresh>`** invokes the function **`ImportMesh`**. This function imports the file `final.msh` and displays the mesh in the **Mesh** view.
- The callback **`<onupdate>`** invokes the function **`CreateAnalysis`** when **Next** is clicked. This function sets up the analysis.
  - The element **`<property>`** defines the property **`Velocity`**. This property is shown in Fluent as a float field with a default value of **3**. You enter the desired value. In this example, a value of **5** is entered.
  - Also defined are additional actions to be performed as part of the analysis.
  - Intermediate results are shown dynamically in the **Scaled Residuals** window as the analysis is performed.





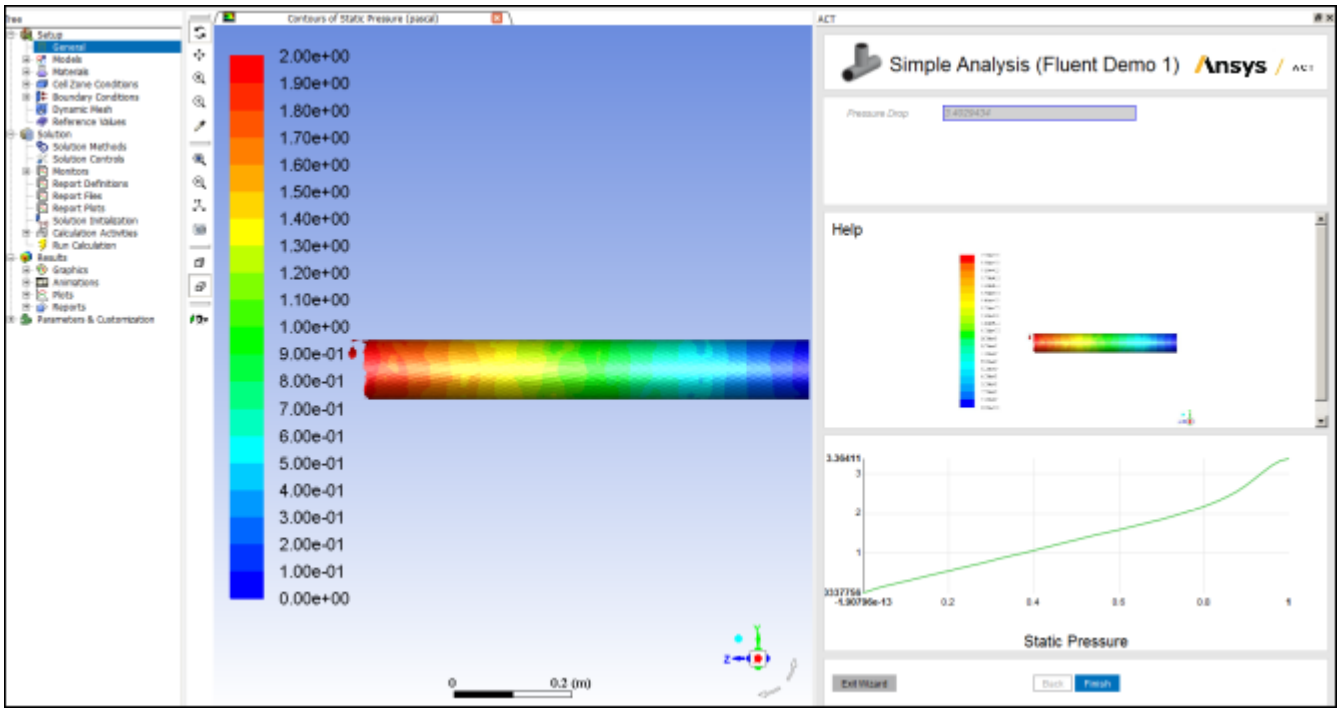
Reviewing the Results Step

The second step is **Results**, which creates a report of the results.

In this step:

- The callback **`<onrefresh>`** invokes the function **`CreateReport`**.

- The element **`<layout>`** specifies the custom layout to apply to the results. This is a child element within the element **`<uidefinition>`**.
- The wizard takes the results obtained and displays them:
  - The element **`<property>`** defines the property **`PressureDrop`**. This calculated value is displayed in Fluent as a ready-only field.
  - The static pressure results are shown in the **Graph** and **Contours** views.



Fluent Wizard (CAS Input File)

The supplied extension **`FluentDemo2`** includes a target project wizard for Fluent named **`Simple Analysis (Fluent Demo 2)`**. This Fluent wizard imports a CAS file, runs a simple analysis, generates results, and displays the results in a custom panel in the user interface. This example can be used in either of the following scenarios:

- Within a Workbench project that contains a **Fluent** or **Fluent (with CFD-Post)** system
- In a Fluent stand-alone project with **Meshing Mode** not selected

The following topics describe the extension **`FluentDemo2`**:

Defining FluentDemo2
Defining Functions for FluentDemo2
Reviewing the Wizard in FluentDemo2

Defining FluentDemo2

The XML extension definition file `FluentDemo2.xml` follows.

```
<extension name="FluentDemo2" version="1">
    <guid>49B358FB-EAFB-4678-BBBD-82E949B46F70</guid>
 <author>Ansys, Inc.</author>
 <description>This extension demonstrates how to create a wizard in Fluent (.cas file import).</description>

 <script src="main.py" />

 <interface context="Fluent">
  <images>images</images>
 </interface>

  <uidefinition>

  <layout name="ResultsView">
   <component
    name="Title"
    topAttachment=""
    topOffset="10"
    leftAttachment=""
    leftOffset="10"
    rightAttachment=""
    rightOffset="10"
    bottomOffset="10"
    bottomAttachment="Properties"
    widthType="Percentage"
    width="100"
    heightType="FitToContent"
    height="200"
    componentType="startPageHeaderComponent" />
   <component
    name="Properties"
    topAttachment="Title"
    leftAttachment=""
    leftOffset="10"
    rightAttachment=""
    rightOffset="10"
    bottomAttachment="Report"
    bottomOffset="10"
    widthType="Percentage"
    width="100"
    heightType="Percentage"
    height="20"
    componentType="propertiesComponent" />
   <component
    name="Report"
    topAttachment="Properties"
    leftAttachment=""
    leftOffset="10"
    rightAttachment=""
    rightOffset="10"
    bottomAttachment="Chart"
    bottomOffset="10"
    widthType="Percentage"
    width="100"
    heightType="Percentage"
    height="40"
    componentType="helpContentComponent" />
   <component
    name="Chart"
    topAttachment="Report"
    leftAttachment=""
    leftOffset="10"
    rightAttachment=""
    rightOffset="10"
    bottomAttachment="Submit"
    bottomOffset="10"
    widthType="Percentage"
    width="100"
    heightType="Percentage"
    height="40"
    componentType="chartComponent" />
```

```
    <component
     name="Submit"
     topAttachment="Chart"
     leftAttachment=""
     leftOffset="10"
     rightAttachment=""
     rightOffset="10"
     bottomAttachment=""
     bottomOffset="10"
     widthType="Percentage"
     width="100"
     heightType="FitToContent"
     height="50"
     componentType="buttonsComponent" />
   </layout>

  </uidefinition>


  <wizard name="Simple Analysis (Fluent Demo 2)" version="1" context="Fluent" icon="wizard_icon">
   <description>Generate the mesh and solve the analysis.</description>

   <step name="Analysis" caption="Analysis" version="1">
    <callbacks>
     <onrefresh>ImportModel</onrefresh>
     <onupdate>CreateAnalysis</onupdate>
    </callbacks>

    <property name="velocity" caption="Velocity" control="float" default="3" />
   </step>

   <step name="Results" caption="Results" version="1" layout="ResultsView@FluentDemo2">
    <callbacks>
     <onrefresh>CreateReport</onrefresh>
    </callbacks>

    <property name="pressure" caption="Pressure Drop" control="text" readonly="true" />
   </step>

  </wizard>

 </extension>
```

Definitions follow for elements in the XML extension definition file `FluentDemo2.xml`.

Custom Layout Definition

The element **`<uidefinition>`** defines a custom layout named **`ResultsView`** for the Fluent wizard. It is made up of five custom components: **`Title`**, **`Properties`**, **`Report`**, **`Chart`**, and **`Submit`**. The **`Properties`**, **`Report`**, and **`Chart`** components are views, and the **`Submit`** component is a button.

Wizard Definition

The element **`<wizard>`** has the attribute **`name`** set to **`Simple Analysis (Fluent Demo 2)`**.

Step Definition

The element **`<step>`** defines each step in the wizard. This wizard has two steps: **`Analysis`** and **`Results`**. For each step:

The attribute **layout** specifies the custom layout to apply to the step. For the step **Results**, **layout** is set to **ResultsView@FluentDemo2**. The custom layout **ResultsView** is defined in the element **<uidefinition>**.

- Any element **<property>** specifies a property and property attributes for the step.
  - For the step **Analysis**, the property **velocity** is defined. The attribute **caption** is set to **Velocity**.

    For the step **Results**, the property **pressure** is defined. The attribute **caption** is set to **Pressure**.
- The element **<callbacks>** specifies callbacks to functions defined in the script `main.py` For more information, see ??? (p. 13).

Defining Functions for FluentDemo2

The IronPython script `main.py` follows. This script defines all functions executed by the callbacks in the XML extension definition file:

- The function **ImportModel** is invoked by the callback **<onrefresh>** in the step **Analysis**.
- The function **CreateAnalysis** is invoked by the callback **<onupdate>** in the step **Analysis**.
- The function **CreateReport** is invoked by the callback **<onrefresh>** in the step **Results**.

```
def ImportModel(step):
    tui = ExtAPI.Application.ScriptByName("TUI")

    tui.SendCommand("""/file/read-case "{0}" """.format(System.IO.Path.Combine(
ExtAPI.Extension.InstallDir,"final.cas")))
    tui.SendCommand("""/display/mesh ok""")
    tui.SendCommand("""/display/views/restore-view right""")

def CreateAnalysis(step):
    tui = ExtAPI.Application.ScriptByName("TUI")

    res = System.IO.Path.GetTempFileName()
    img = System.IO.Path.GetTempFileName()+".jpg"
    curve = System.IO.Path.GetTempFileName()
    tui.SendCommand("""/define/boundary-conditions/velocity-inlet inlet no no yes yes no {0} no 0""".format(step
    tui.SendCommand("""/solve/initialize/hyb-initialization""", True)
    tui.SendCommand("""/solve/iterate 50""", True)
    tui.SendCommand("""/display/mesh ok""", True)
    tui.SendCommand("""/display/views/restore-view right""", True)
    tui.SendCommand("""/display/set/contours/filled-contours? yes""", True)
    tui.SendCommand("""/display/set/contours/surfaces wall inlet outlet ()""", True)
    tui.SendCommand("""/display/contour pressure 0 2""", True)
    tui.SendCommand("""/display/save-picture "{0}" """.format(img), True)
    tui.SendCommand("""/surface/rake-surface rake-5 0 0 0 0 0 1 50""", True)
    tui.SendCommand("""/plot/plot-direction 0 0 1""", True)
    tui.SendCommand("""/plot/plot yes "{0}" yes yes no no pressure yes 0 0 1 rake-5 ()""".format(curve), True)
    tui.SendCommand("""/report/surface-integrals/area-weighted-avg inlet () pressure yes "{0}" """.format(res),

    val = 0.
    n = 0;
    with System.IO.StreamReader(res) as reader:
        while n!=5:
            line = reader.ReadLine()
            if line!=None:
                n+=1
        str = line.Substring(32)
```

```
        val = System.Double.Parse(str, System.Globalization.CultureInfo.InvariantCulture)

    x=[]
    y=[]
    n = 0;
    with System.IO.StreamReader(curve) as reader:
        while n!=5:
            line = reader.ReadLine()
            if line!=None:
                n+=1
        while not line.StartsWith(")"):
            tab = line.Split("\t")
            x.Add(System.Double.Parse(tab[0], System.Globalization.CultureInfo.InvariantCulture))
            y.Add(System.Double.Parse(tab[1], System.Globalization.CultureInfo.InvariantCulture))
            line = reader.ReadLine()
    System.IO.File.Delete(res)
    System.IO.File.Delete(curve)

    step.NextStep.Properties["pressure"].Value = val
    step.NextStep.Attributes["img"] = img
    step.NextStep.Attributes["x"] = x
    step.NextStep.Attributes["y"] = y

def CreateReport(step):
    graph = step.UserInterface.GetComponent("Chart")
    graph.Title("Static Pressure")
    graph.ShowLegend(False)
    graph.Plot(step.Attributes["x"],  step.Attributes["y"], key="Static Pressure", color='g')

    help = step.UserInterface.GetComponent("Report")
    help.SetHtmlContent(ExtAPI.Extension.InstallDir,"""<center><img style="height:250px"
src="{0}"></center>""".format(step.Attributes["img"]))
```

Reviewing the Wizard in FluentDemo2

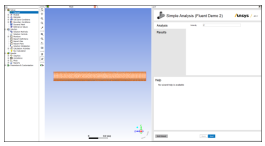
This section reviews the wizard interface and the processes performed in each step of the wizard **`Simple Analysis (Fluent Demo 2)`**.

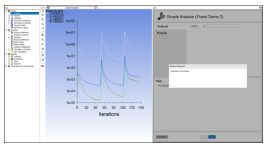
Reviewing the Analysis Step

The first step is **Analysis**, which imports the CAS file and creates the analysis. It requires that a value be specified for the property **`Velocity`**.

In this step:

- The callback **`<onrefresh>`** invokes the function **`ImportModel`**. This function imports the file `final.cas` and displays the model in the **Mesh** view.
- The callback **`<onupdate>`** invokes the function **`CreateAnalysis`** when the step's **Next** button is clicked. This function sets up the analysis.
  - The element **`<property>`** defines the property **`Velocity`**. It is shown in Fluent as a float field with a default value of **`3`**. You can enter the desired value. In this example, a value of **`2`** is entered.
  - Also defined are additional actions to be performed as part of the analysis.
  - Intermediate results are shown dynamically in the **Scaled Residuals** window as the analysis is performed.





Reviewing the Results Step

The second step is **Results**, which creates a report of the results.

In this step:

- The callback **`<onrefresh>`** invokes the function **`CreateReport`**.
- The attribute **`<layout>`** specifies the custom layout to apply to the results. Custom layouts are defined in the element **`<uidefinition>`**.
- The wizard takes the results obtained and displays them:
  - The element **`<property>`** defines the property **`PressureDrop`**. This calculated value is displayed in Fluent as a ready-only field.
  - The static pressure results are shown in the **Graph** and **Contours** views.