13th Summer School on SCIENTIFIC VISUALIZATION

# Paraview scripting

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# OUTLINE

- Why scripting
- pvbatch and pvpython
- Macros
- Scripting using a tracefile
- Journaling in Paraview GUI
- Hands-on Python Scripting in ParaView

# WHY SCRIPTING

- Automate repetitive tasks (several similar datesets)
- GUI is not useful or unavailable (batch execution)
- In-situ visualization or co-processing (computing+post-processing)

# pvbatch - pvpython

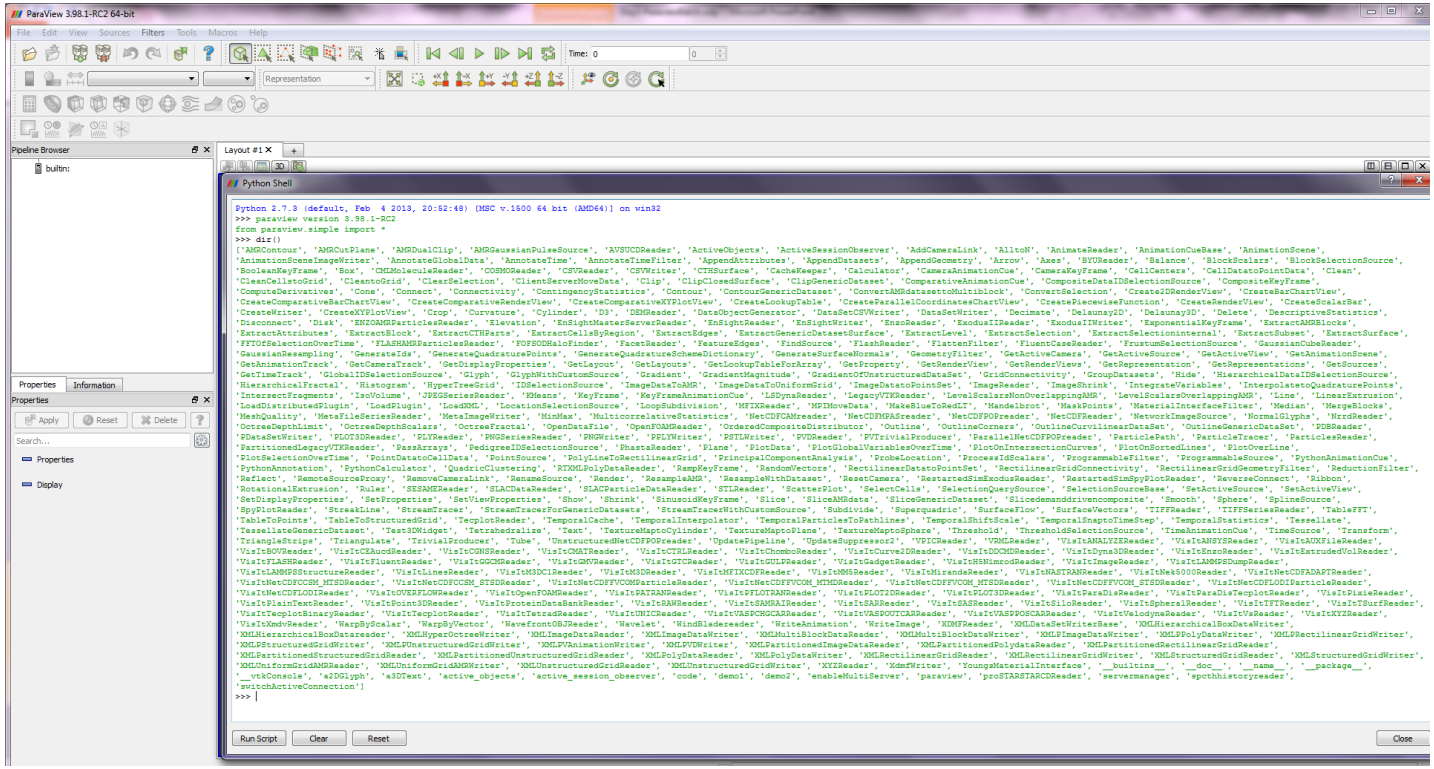
- Paraview contents 2 command lines able to run a python script:
  - pvbatch;
  - pvpython;

The differences is that:

- pvpython is equivalent to the paraview client where the python interpreter plays the role of the GUI (interactive, serial);
- pvbatch: is equivalent to the paraview server where the commands are coming from the python script instead then from a socket plugged to a paraview client (parallel)

# Python interpreter in ParaView

The python interpreter is already runnable from paraview to perfom interactive applications

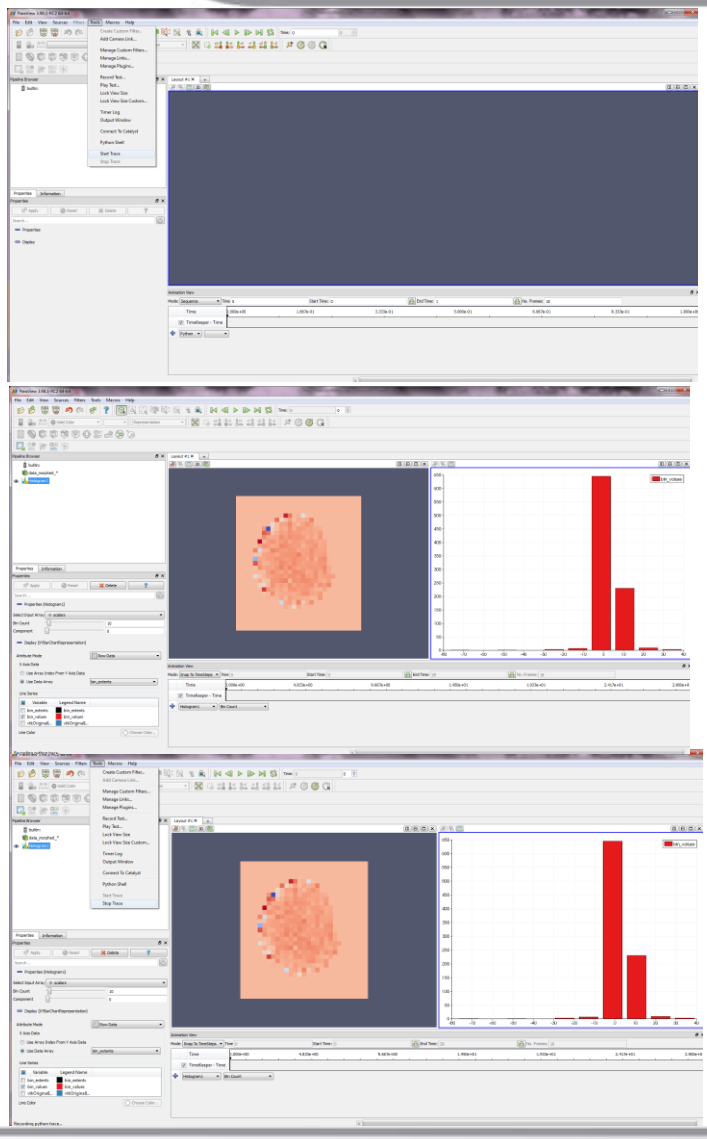


# BUILD A PYTHON SCRIPT IN THE PARAVIEW GUI

1. Start tracing

2. Build your pipeline as usual

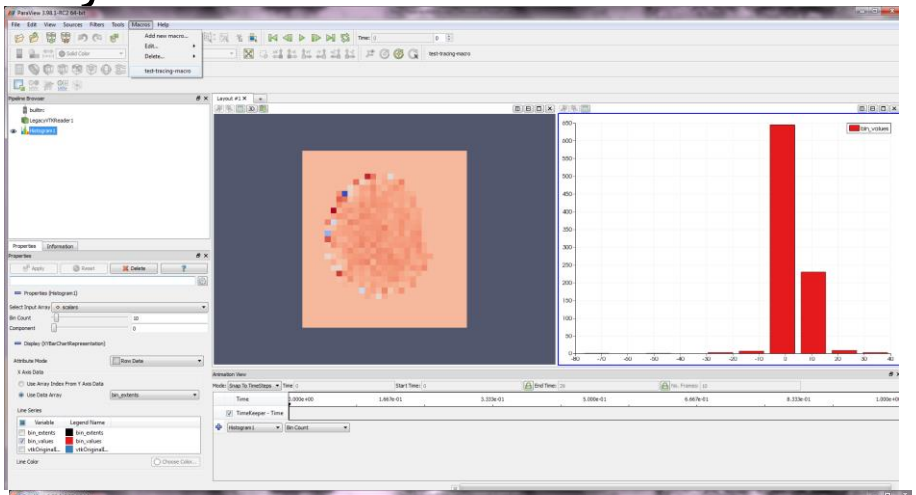
3. Stop tracing and save the trace file with a name



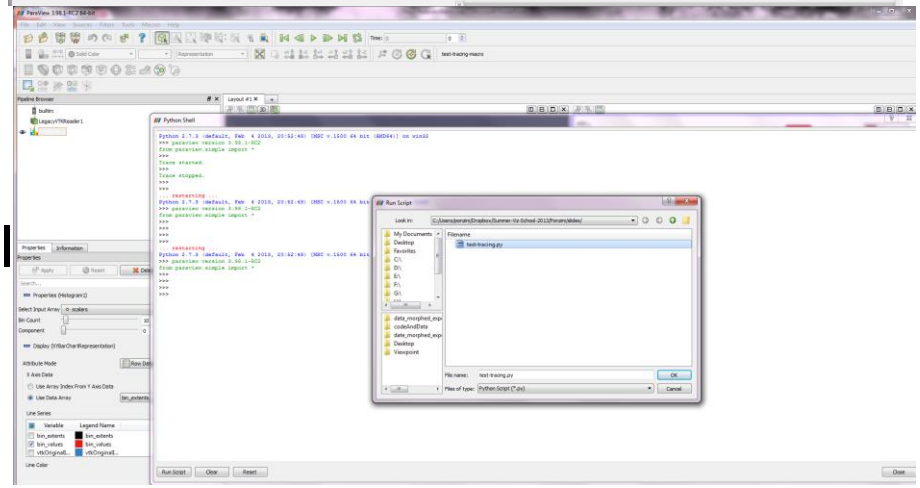
# Use the trace file

You can use the traced file in two ways:

- As a macro



- As a python script using the GUI
- As a python script in batch



# The paraview.simple module

- The first thing any ParaView Python script must do is load the paraview.simple module.

  *from paraview.simple import **

  Or in a save way using the try/except construct

  *try: paraview.simple*

  *except: from paraview.simple import **
- This command is automatically invoked in the ParaView GUI tracing facility, but it must add when you are writing a script to be used in batch either by pvpython or by pvbatch.

- The *paraview.simple* module contains a function for every source, reader,filter, and writer with off-course the same name as shown in the GUI menus but with spaces and special characters removed.

- Each function creates a pipeline object, which will show up in the pipeline browser (with the exception of writers), and returns an object that is a proxy that can be used to query and manipulate the properties of that pipeline object.

# BATCH SCRIPTING IN PYTHON

```
try: paraview.simple
except: from paraview.simple import *
paraview.simple._DisableFirstRenderCameraReset()

data_morphed_ = LegacyVTKReader( FileNames=['C:\\Users\\ponzini\\Dropbox\\Summer-Viz-School-
2013\\Perticoni\\codeAndData\\data_morphed_exported_as_StructuredPoints_VTK\\data_morphed_0.vtk', 'C:\\Users\\ponzini\\Dropbox\\Summer-Viz-School-
2013\\Perticoni\\codeAndData\\data_morphed_exported_as_StructuredPoints_VTK\\data_morphed_1.vtk', 'C:\\Users\\ponzini\\Dropbox\\Summer-Viz-School-
2013\\Perticoni\\codeAndData\\data_morphed_exported_as_StructuredPoints_VTK\\data_morphed_2.vtk', 'C:\\Users\\ponzini\\Dropbox\\Summer-Viz-School-
2013\\Perticoni\\codeAndData\\data_morphed_exported_as_StructuredPoints_VTK\\data_morphed_3.vtk', 'C:\\Users\\ponzini\\Dropbox\\Summer-Viz-School-
2013\\Perticoni\\codeAndData\\data_morphed_exported_as_StructuredPoints_VTK\\data_morphed_4.vtk', 'C:\\Users\\ponzini\\Dropbox\\Summer-Viz-School-
2013\\Perticoni\\codeAndData\\data_morphed_exported_as_StructuredPoints_VTK\\data_morphed_5.vtk', 'C:\\Users\\ponzini\\Dropbox\\Summer-Viz-School-
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2013\\Perticoni\\codeAndData\\data_morphed_exported_as_StructuredPoints_VTK\\data_morphed_29.vtk'] )
```
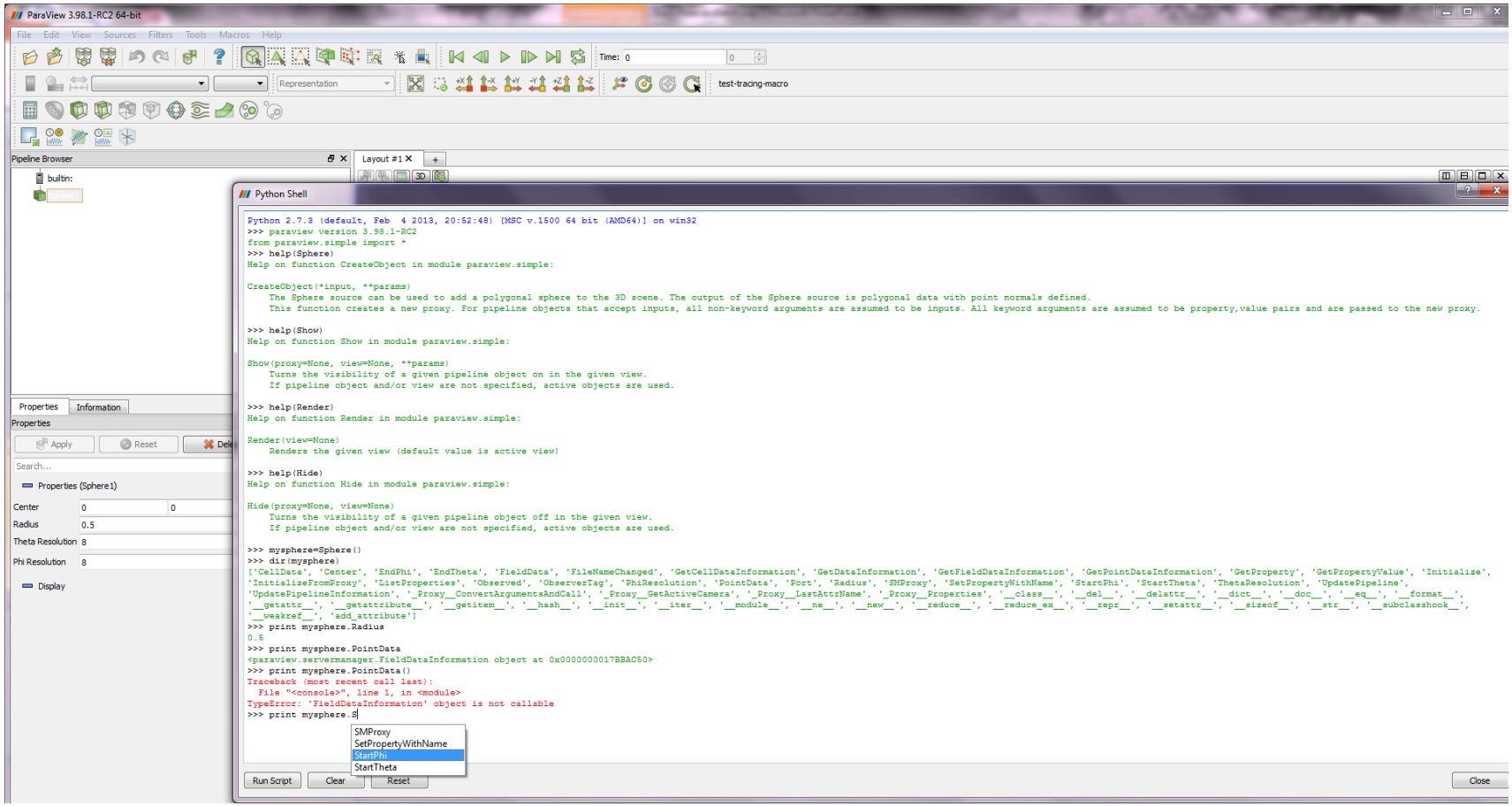

# BATCH SCRIPTING IN PYTHON

```
AnimationScene1 = GetAnimationScene()
AnimationScene1.EndTime = 29.0
AnimationScene1.PlayMode = 'Snap To TimeSteps'

RenderView1 = GetRenderView()
a1_scalars_PVLookupTable = GetLookupTableForArray( "scalars", 1, RGBPoints=[-77.78269958496094, 0.23, 0.299, 0.754,
39.99039840698242, 0.706, 0.016, 0.15], VectorMode='Magnitude', NanColor=[0.25, 0.0, 0.0], ColorSpace='Diverging',
ScalarRangeInitialized=1.0, AllowDuplicateScalars=1 )

a1_scalars_PiecewiseFunction = CreatePiecewiseFunction( Points=[0.0, 0.0, 0.5, 0.0, 1.0, 1.0, 0.5, 0.0] )

DataRepresentation1 = Show()
DataRepresentation1.EdgeColor = [0.0, 0.0, 0.5000076295109483]
DataRepresentation1.SelectionPointFieldDataArrayName = 'scalars'
DataRepresentation1.ScalarOpacityFunction = a1_scalars_PiecewiseFunction
DataRepresentation1.ColorArrayName = 'scalars'
DataRepresentation1.ScalarOpacityUnitDistance = 4.349219049453166
DataRepresentation1.LookupTable = a1_scalars_PVLookupTable
DataRepresentation1.Representation = 'Slice'
DataRepresentation1.ScaleFactor = 3.0

RenderView1.CameraFocalPoint = [14.0, 15.0, 0.0]
RenderView1.CameraPosition = [14.0, 15.0, 10000.0]
RenderView1.InteractionMode = '2D'
RenderView1.CenterOfRotation = [14.0, 15.0, 0.0]
```

# BATCH SCRIPTING IN PYTHON

```
a1_scalars_PVLookupTable.ScalarOpacityFunction = a1_scalars_PiecewiseFunction

ScalarBarWidgetRepresentation1 = CreateScalarBar( Title='scalars', LabelFontSize=12, Enabled=1, LookupTable=a1_scalars_PVLookupTable, TitleFontSize=12 )
GetRenderView().Representations.append(ScalarBarWidgetRepresentation1)

RenderView1.CameraPosition = [14.0, 15.0, 79.27656374961008]
RenderView1.CameraClippingRange = [78.48379811211397, 80.46571220585423]
RenderView1.CameraParallelScale = 20.518284528683193

a1_scalars_PVLookupTable.RGBPoints = [-100.0, 0.23, 0.299, 0.754, 100.0, 0.706, 0.016, 0.15]
a1_scalars_PVLookupTable.LockScalarRange = 1

a1_scalars_PiecewiseFunction.Points = [-100.0, 0.0, 0.5, 0.0, 100.0, 1.0, 0.5, 0.0]

WriteAnimation('C:/Users/ponzini/Dropbox/Summer-Viz-School-2013/Ponzini/tutorial/animation.avi', Magnification=1, Quality=2, FrameRate=1.000000)


Render()
```

# BATCH SCRIPTING IN PYTHON



# BATCH SCRIPTING IN PYTHON

```
Python 2.7.3 (default, Feb 4 2013, 20:52:48) [MSC v.1500 64 bit (AMD64)] on win32
>>> paraview version 3.98.1-RC2
from paraview.simple import *
>>> help(Sphere)
Help on function CreateObject in module paraview.simple:
CreateObject(*input, **params)
The Sphere source can be used to add a polygonal sphere to the 3D scene. The output of the Sphere source is polygonal data with point normals defined.
This function creates a new proxy. For pipeline objects that accept inputs, all non-keyword arguments are assumed to be inputs. All keyword arguments are assumed to be property,value pairs and are passed to the new proxy.

>>> help(Show)
Help on function Show in module paraview.simple:
Show(proxy=None, view=None, **params)
Turns the visibility of a given pipeline object on in the given view.
If pipeline object and/or view are not specified, active objects are used.

>>> help(Render)
Help on function Render in module paraview.simple:
Render(view=None)
Renders the given view (default value is active view)

>>> help(Hide)
Help on function Hide in module paraview.simple:
Hide(proxy=None, view=None)
Turns the visibility of a given pipeline object off in the given view.
If pipeline object and/or view are not specified, active objects are used.
```

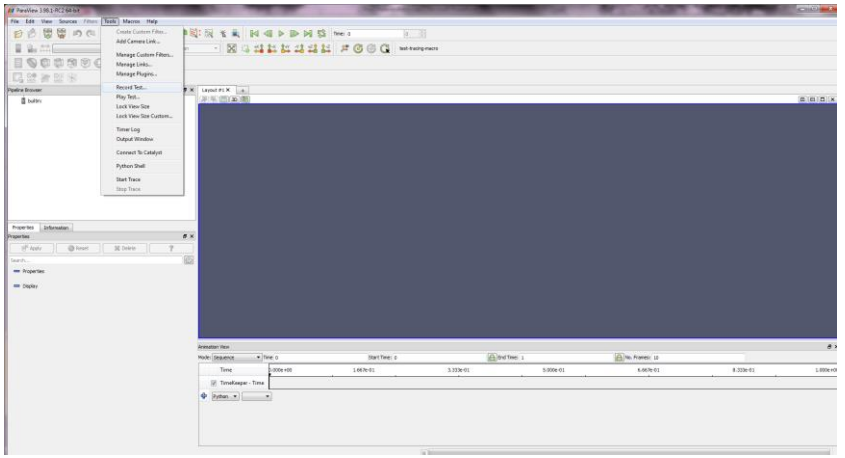
# BATCH SCRIPTING IN PYTHON

```
>>> mysphere=Sphere()
>>> dir(mysphere)
['CellData', 'Center', 'EndPhi', 'EndTheta', 'FieldData', 'FileNameChanged', 'GetCellDataInformation', 'GetDataInformation',
'GetFieldDataInformation', 'GetPointDataInformation', 'GetProperty', 'GetPropertyValue', 'Initialize', 'InitializeFromProxy', 'ListProperties',
'Observed', 'ObserverTag', 'PhiResolution', 'PointData', 'Port', 'Radius', 'SMProxy', 'SetPropertyWithName', 'StartPhi', 'StartTheta',
'ThetaResolution', 'UpdatePipeline', 'UpdatePipelineInformation', '_Proxy__ConvertArgumentsAndCall', '_Proxy__GetActiveCamera',
'_Proxy__LastAttrName', '_Proxy__Properties', '__class__', '__del__', '__delattr__', '__dict__', '__doc__', '__eq__', '__format__', '__getattr__',
'__getattribute__', '__getitem__', '__hash__', '__init__', '__iter__', '__module__', '__ne__', '__new__', '__reduce__', '__reduce_ex__', '__repr__',
'__setattr__', '__sizeof__', '__str__', '__subclasshook__', '__weakref__', 'add_attribute']
>>> print mysphere.Radius
0.5
>>> print mysphere.PointData
<paraview.servermanager.FieldDataInformation object at 0x0000000017BBAC50>
>>> Render()
<paraview.servermanager.RenderView object at 0x0000000018044FD0>
>>> Show()
<paraview.servermanager.GeometryRepresentation object at 0x0000000017A50748>
>>>
```

# Recording a Paraview pipeline

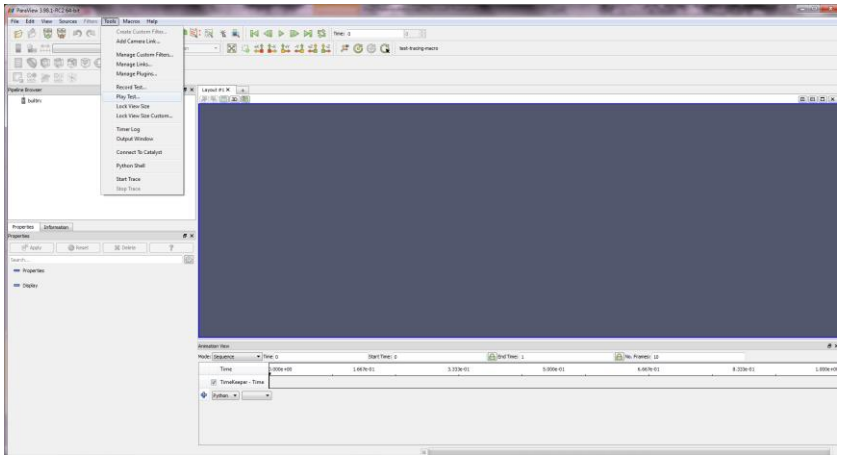
A similar (but different) solution to launch a pipeline in an automated way is to:

- record a test



and then to:

- Play a test



# WORKOUT

- Build a script to process several VTK dataset according to the pipeline obtained during the tutorial of day-3
- Launch the script over the dataset to archive different animations
- Record a test and play it for the above mentioned operations