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Real-time Visualization and On-the-fly Post-processing in iconCFD

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Agenda

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- iconCFD V5 Integration
- Demo: CHT Case
- Demo: Piston Pump
- Summary and Outlook

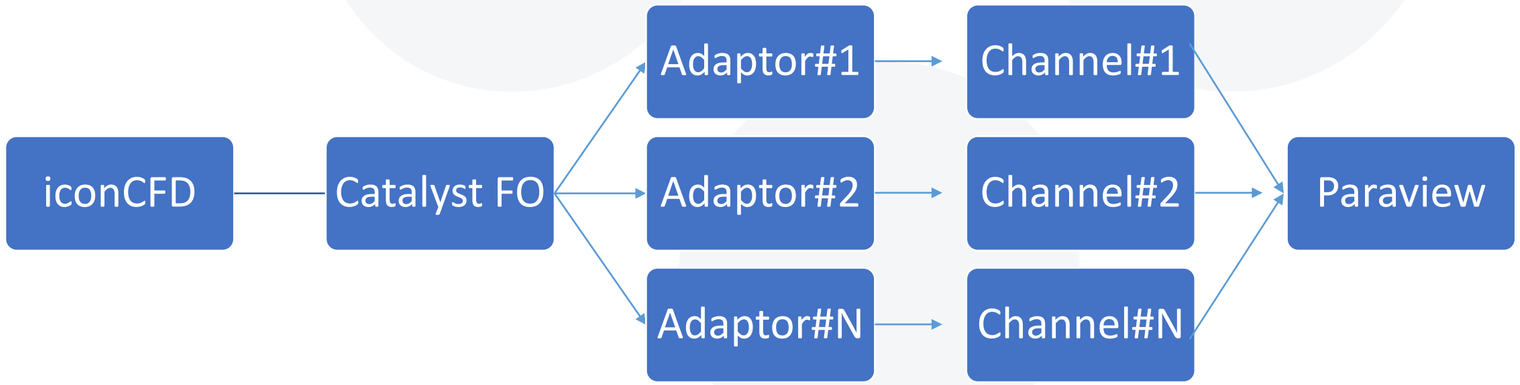
Introduction

- CFD simulations tend to produce large amounts of data that need to be analyzed and visualized efficiently
- Traditional post-processing methods have some drawbacks, such as:
  - They require a lot of disk space to store the data
  - They take a long time to load and process the data
  - They limit the interactivity and flexibility of the analysis
- In-situ post-processing can alleviate all those issues
  - The post-processing utilizes the data in memory, making the data dumps redundant
- Paraview-Catalyst framework provides such real-time visualization capability
- In iconCFD V5 it is now possible to utilize this framework to
  - Observe live data
  - Interactively create a post-processing pipeline for later use

iconCFD V5 Integration

Adaptor

- IconCFD data needs to be communicated to ParaView
- The communication on the iconCFD site is handled via the Catalyst function object
- The Catalyst function object uses adaptors to supply data to ParaView
  - Adaptor can adapt:
    - Volume data
      - Cell centred
      - Face centred
    - Poly data



iconCFD V5 Integration

Communication

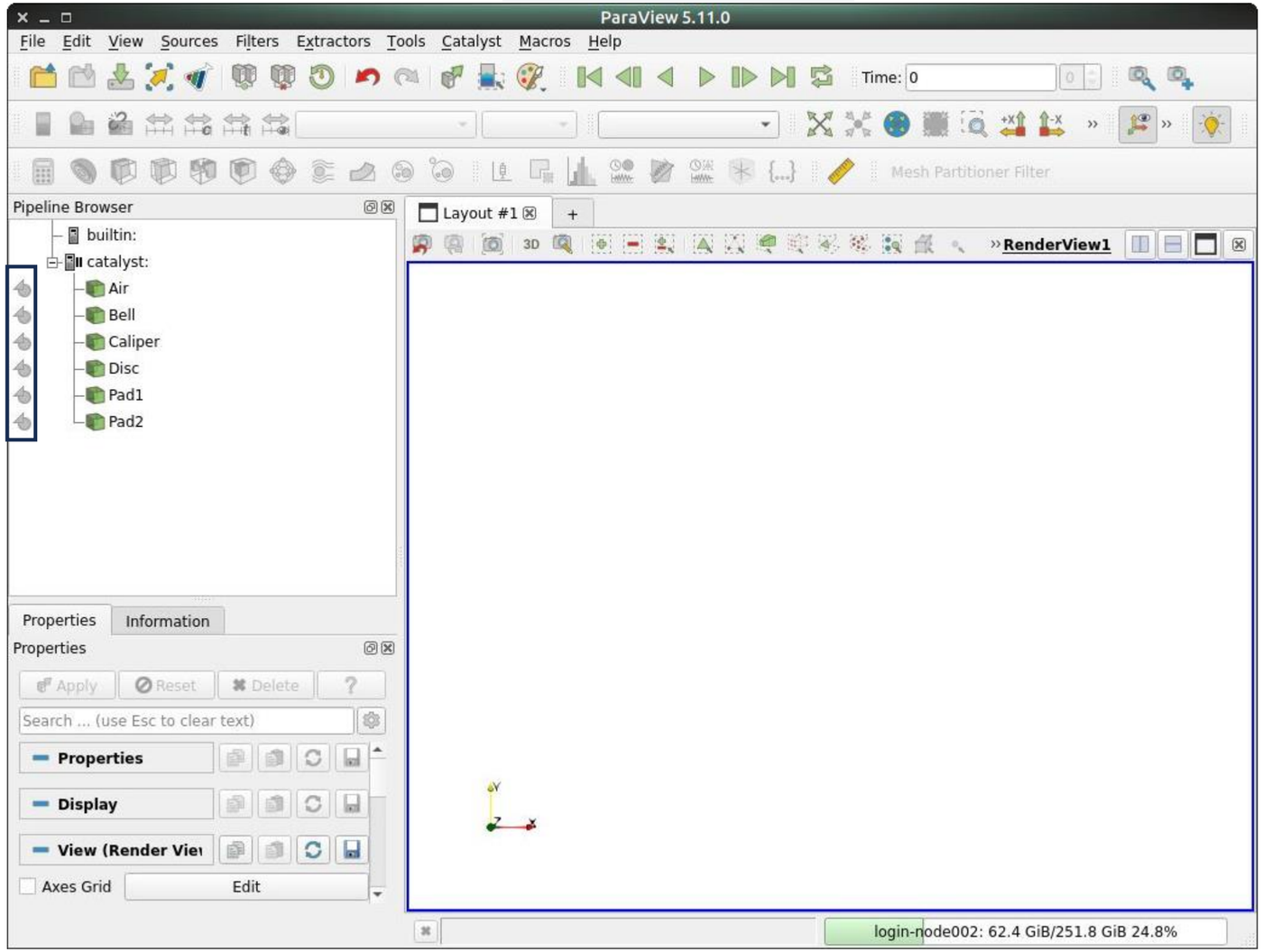
- ParaView pipeline can be controlled via a Python Script
- This applies to ParaView-Catalyst as well
  - Specifies data producers (from channels)
  - Registers producers
  - Determines if live connection is required
  - Defines post-processing pipeline
- Catalyst function object enables to define pipelines to use or sets the most minimal one if nothing is provided
  - The only required information is the hostname and port for live reverse connection from the simulation
  - Paraview pipeline can be then setup using the GUI

Catalyst Demo

CHT Case

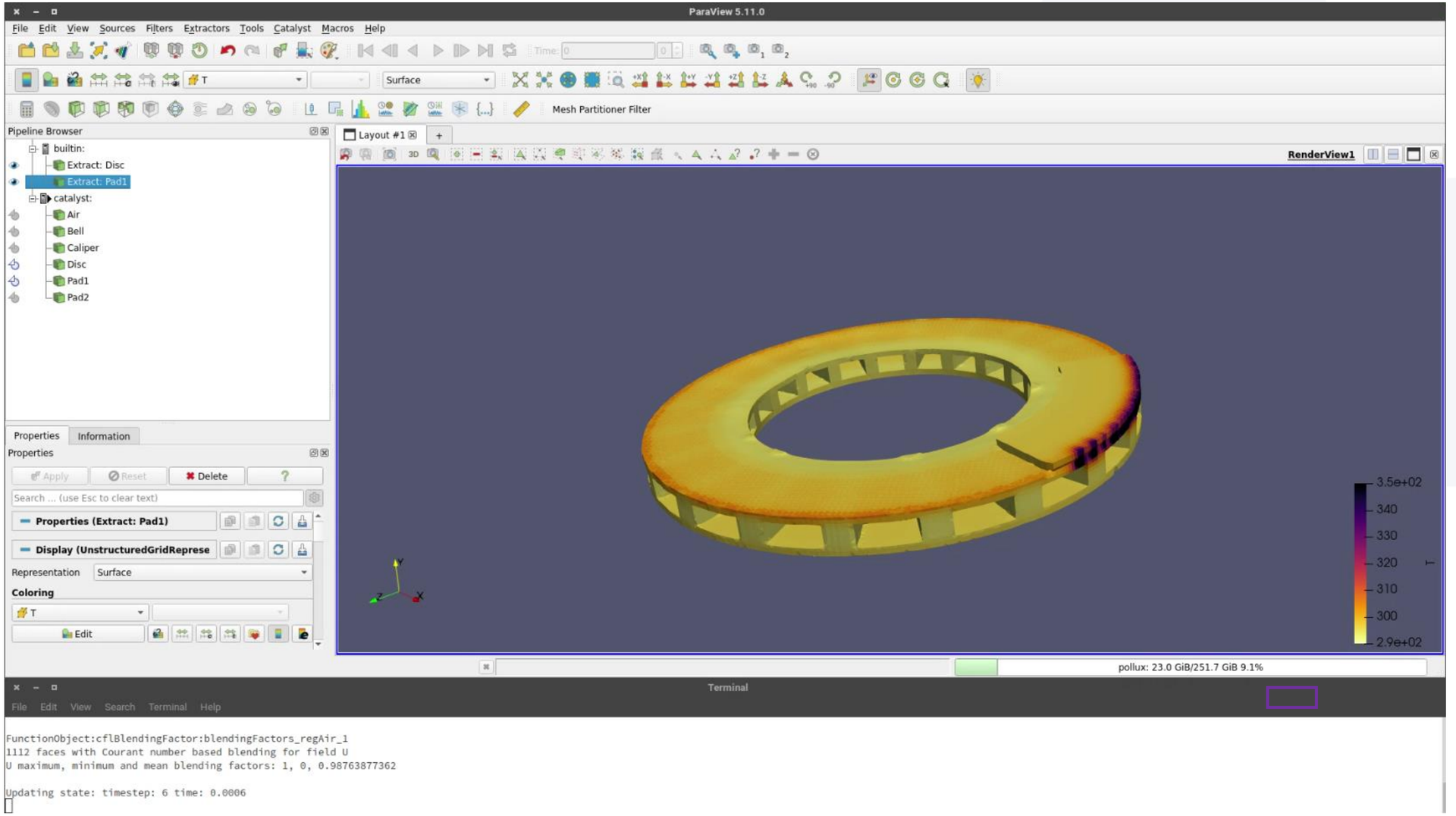
- CHT case with 6 regions
- Each region as one channel

```
from paraview.simple import *
from paraview import catalyst
options = catalyst.Options()
options.EnableCatalystLive = 1
options.CatalystLiveURL = 'login-node002:22222'

Air = TrivialProducer(registrationName='regAir')
Bell = TrivialProducer(registrationName='regBell')
Disc = TrivialProducer(registrationName='regDisc')
Pad1 = TrivialProducer(registrationName='regPad1')
Pad2 = TrivialProducer(registrationName='regPad2')
Caliper = TrivialProducer(registrationName='regCaliper')

def catalyst_execute(info):
    global Air, Bell, Disc, Pad1, Pad2, Caliper
    Air.UpdatePipeline()
    Bell.UpdatePipeline()
    Disc.UpdatePipeline()
    Pad1.UpdatePipeline()
    Pad2.UpdatePipeline()
    Caliper.UpdatePipeline()
```



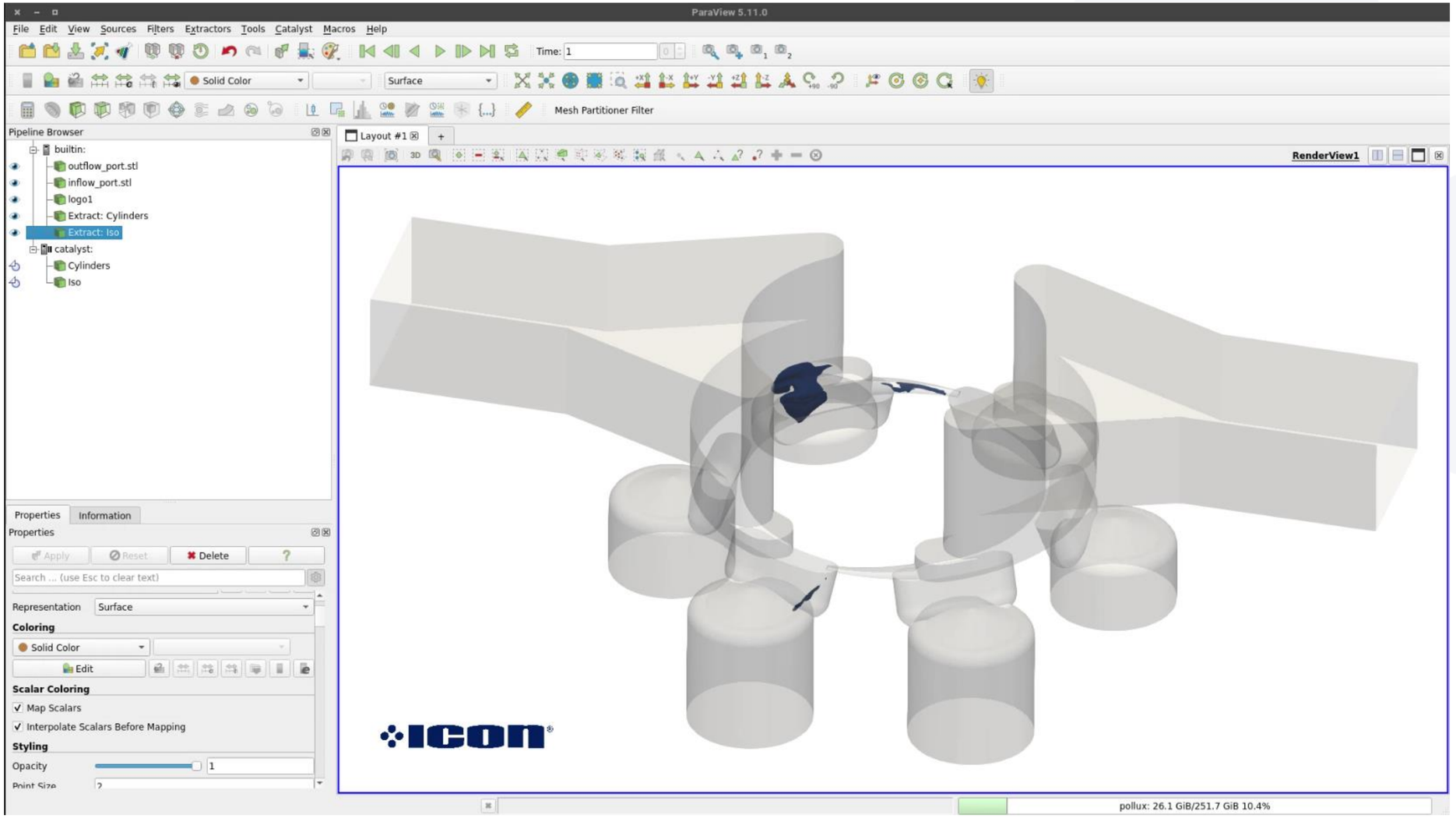
Catalyst Demo

CHT Case



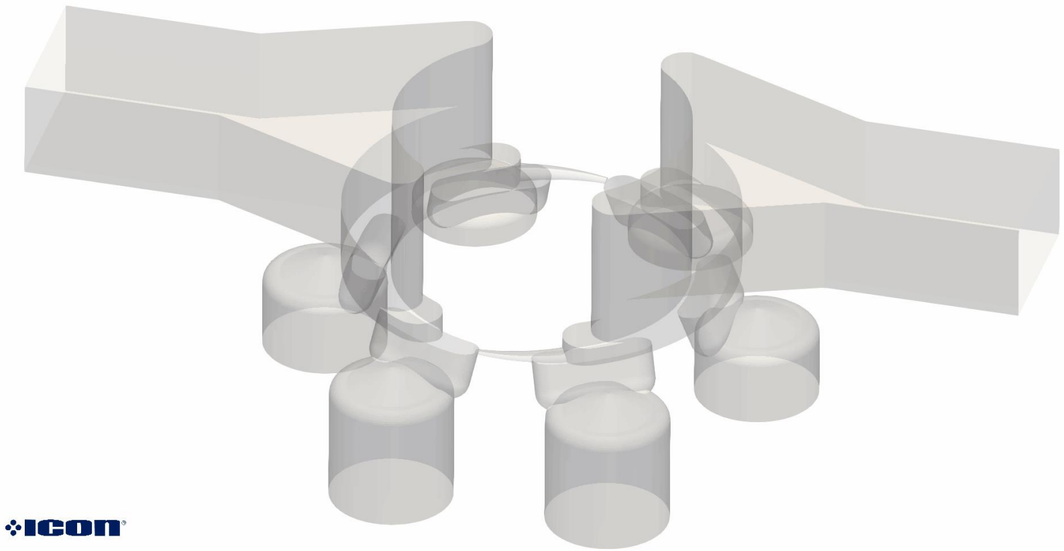
Catalyst Demo

Piston Pump



Summary and Outlook

- Description of the integration of Catalyst framework in iconCFD V5 has been provided
  - Catalyst function objection provides a straightforward interface to connect iconCFD simulation data to ParaView
- The fundamentals of how Catalyst can be used through illustrative examples has been demonstrated
- There is potential to significantly save disk space and post-processing time with Catalyst
  - There is a memory overhead for using Catalyst
- iconCFD Process V5 will support catalyst functionality in upcoming releases



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