How to visualize particle data with ParaView

Aug. 31, 2015

Introduction

- This document briefly explains how to visualize particle motions with the ParaView.
  - This explanation includes a transformation of an aspect ratio of a system. You can skip it if an aspect ratio of your data is close to 1.
- The ParaView is an open source application for 3D visualization.
  - See http://www.paraview.org/ for more details.

Preparation (1)

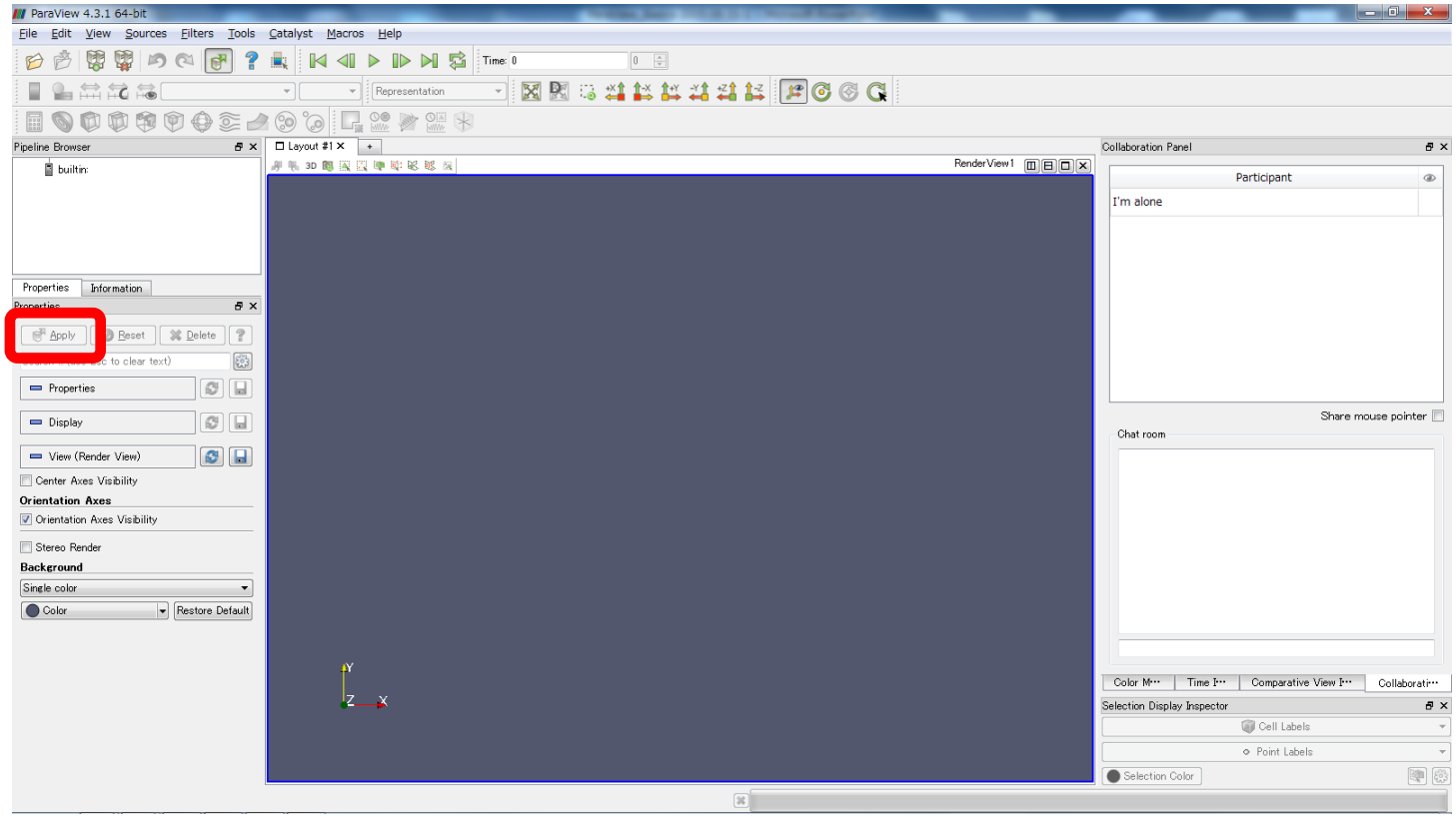
- Prepare data.
  - Each file includes 3D position of all particles at a time step in VTK format.
  - Number of files is number of output time step.
  - Sample Fortran program which produces data files is attached at the end of this slide.

Preparation (2)

- In order to show spherical particles, a following setting is required.
  - Start ParaView
  - [Tools] -> [Manage Plugins] -> [PointSprite_Plugin]
  - Check [Auto Load]
  - Restart ParaView
- This is required only once.

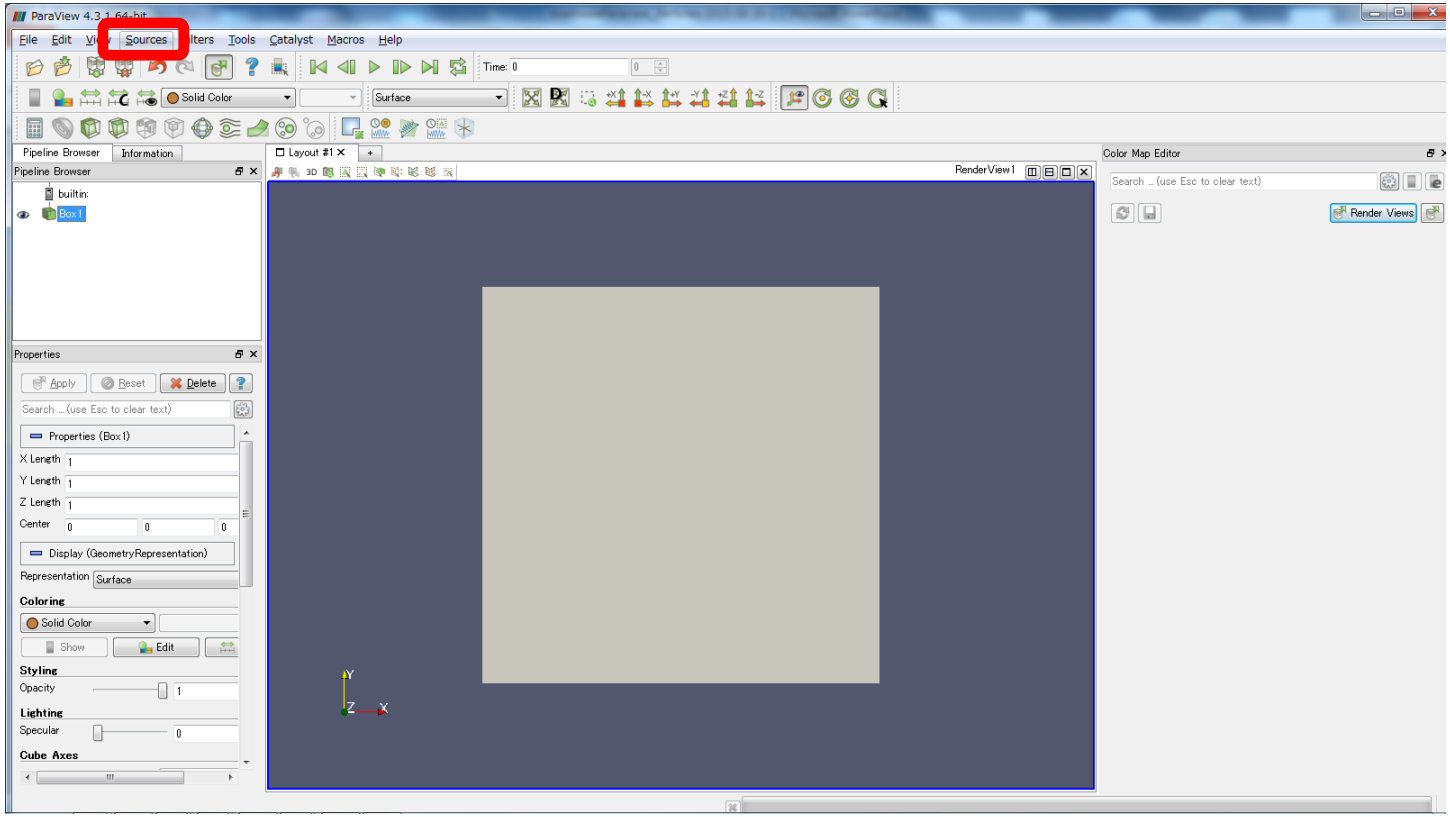
Notice

- Click [Apply] when changes are not reflected.



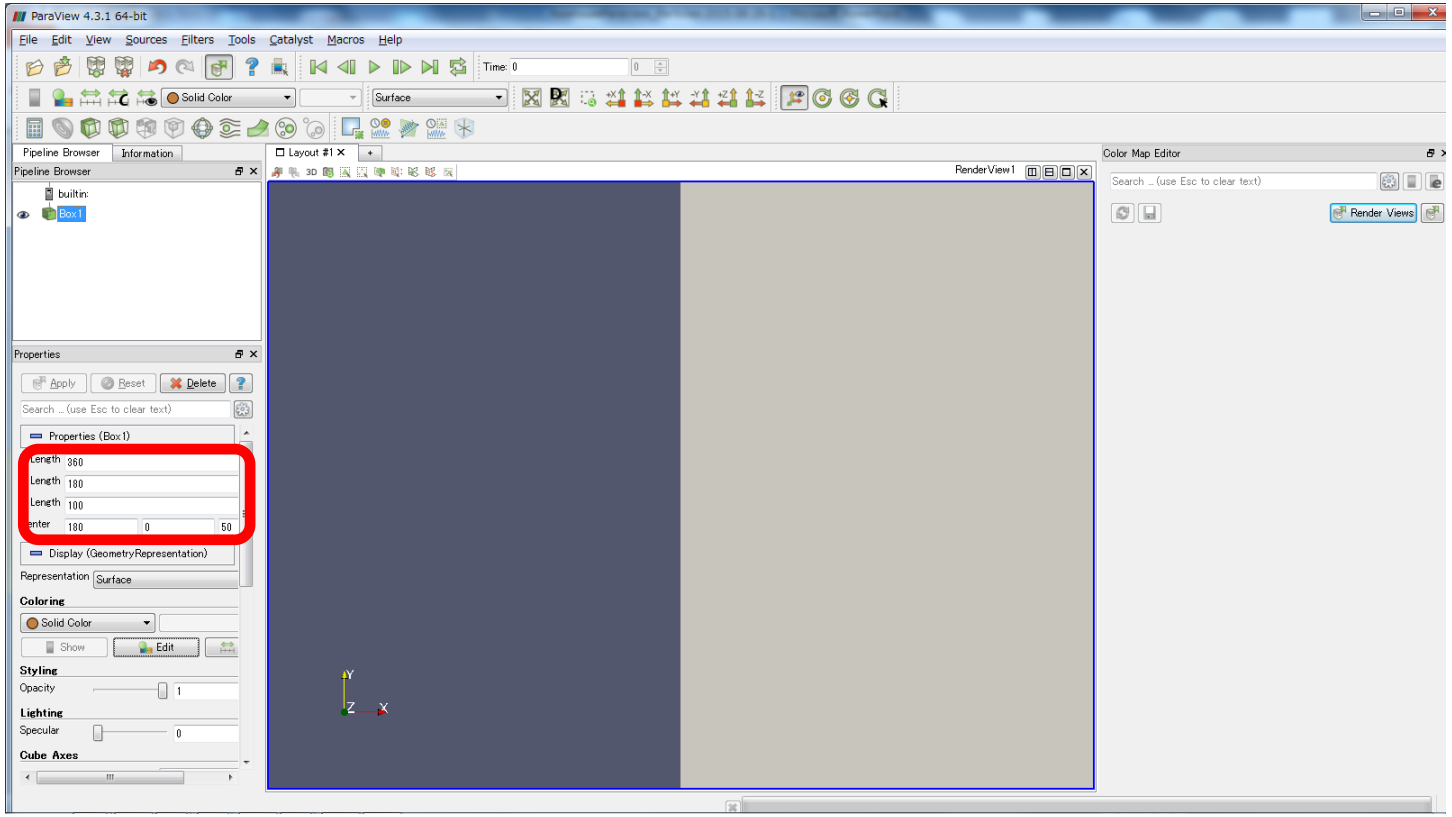
Setting a domain (1)

- [Sources] -> [Box]



Setting a domain (2)

- Change the box size and center coordinate

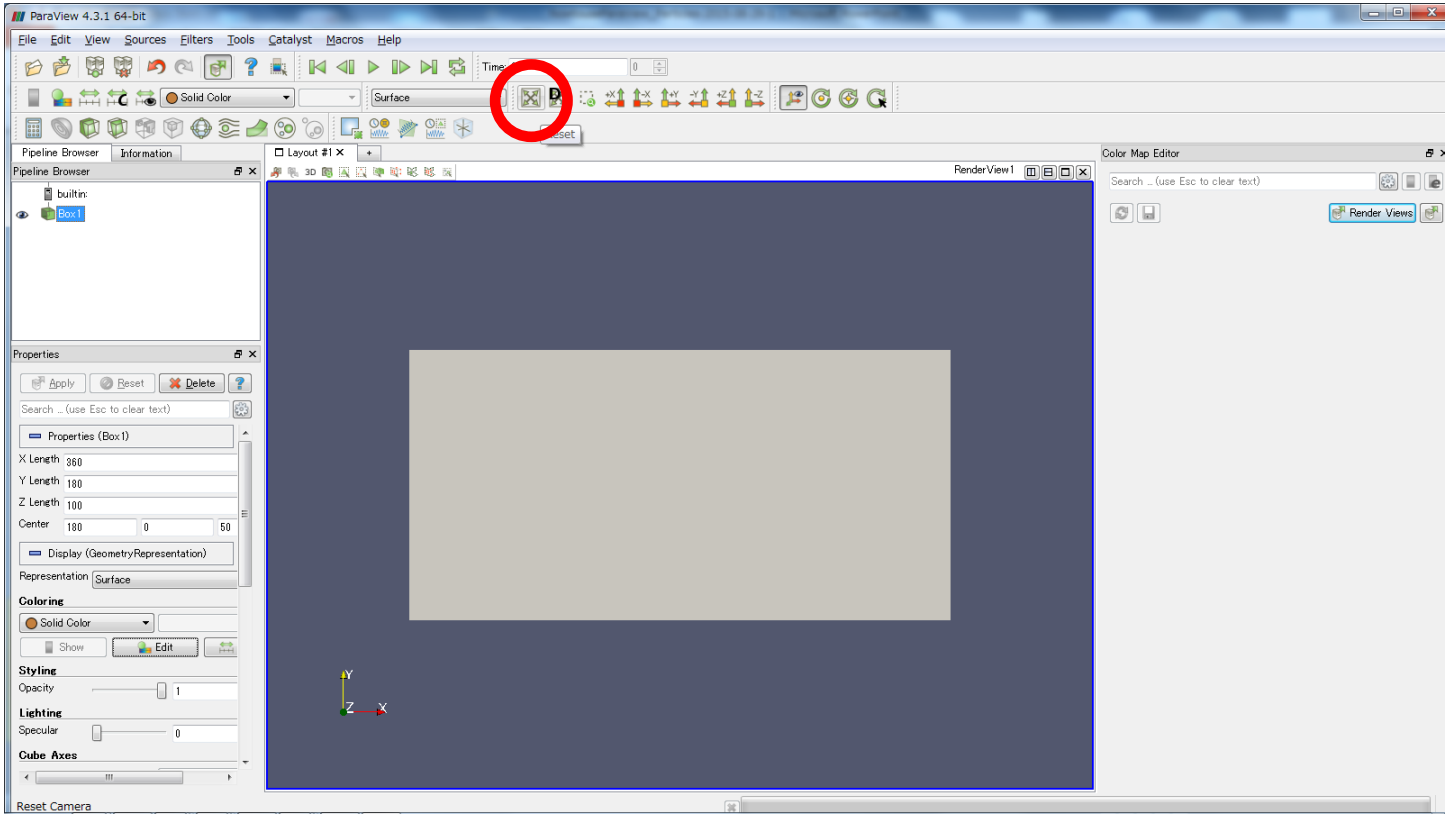


XLength = 360, YLength = 180, ZLength = 100

Center = (180, 0, 50) (“Center” values are coordinate values at the box center.)

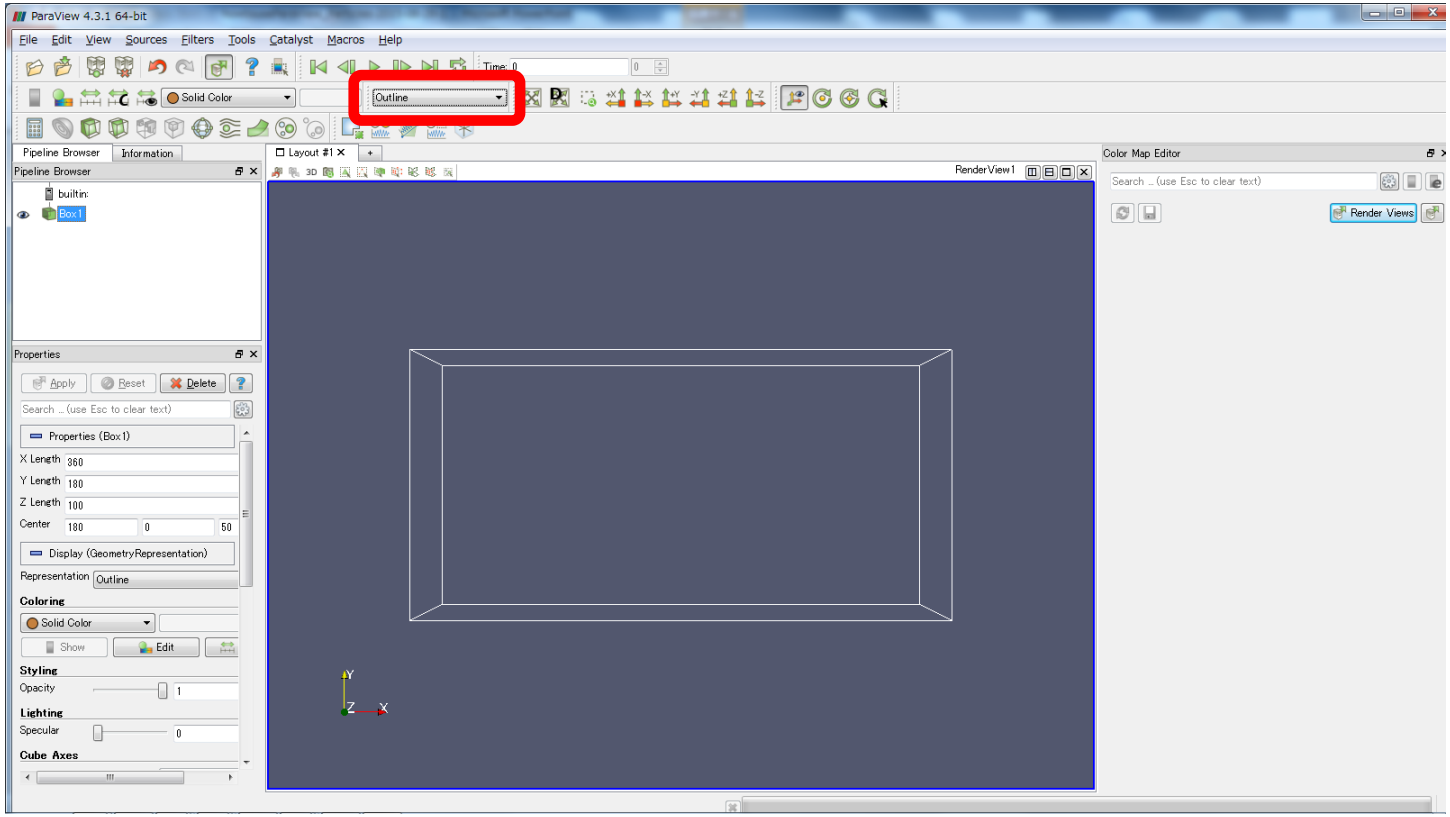
Setting a domain (3)

- Reset the box position

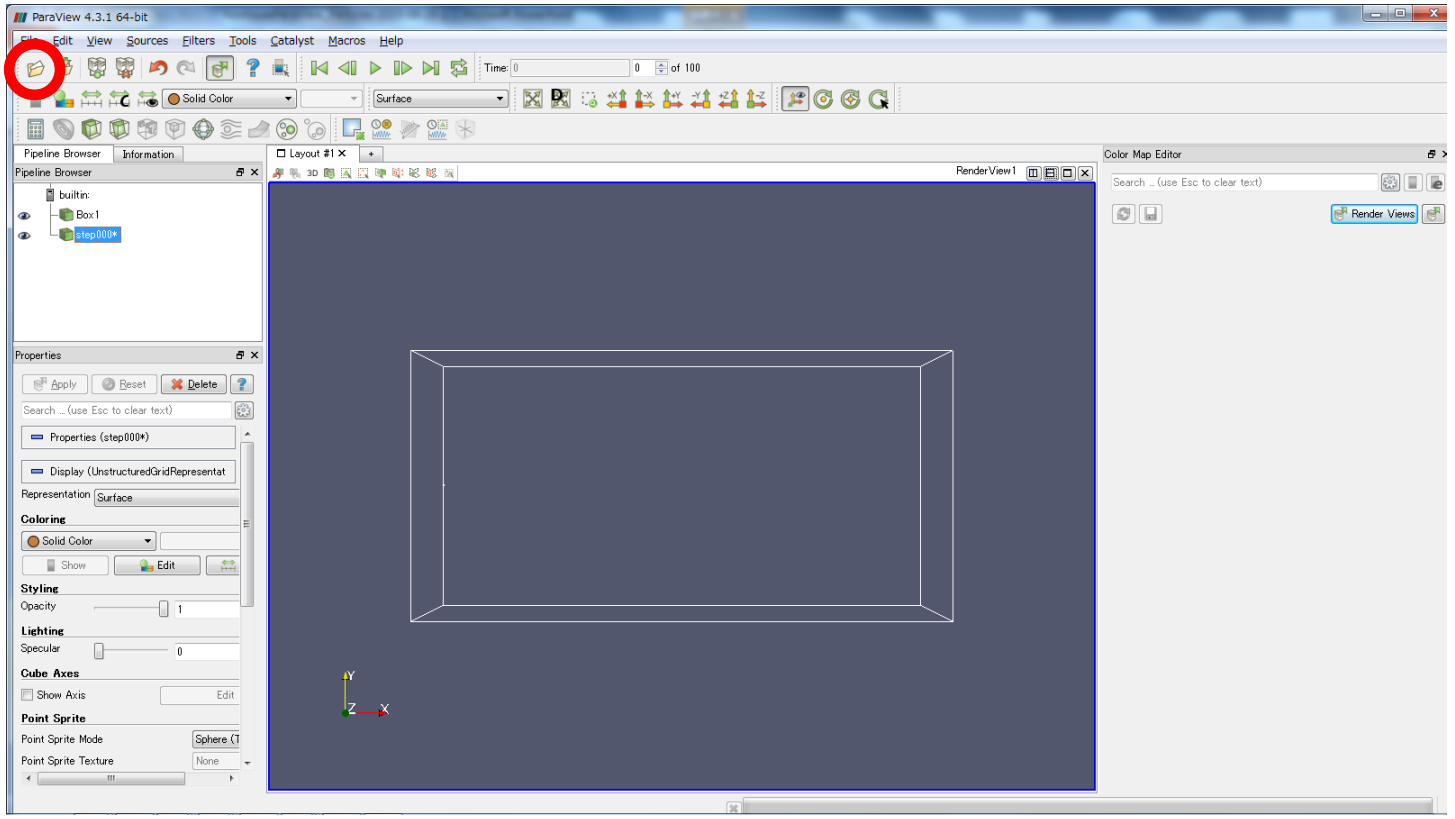


Setting a domain (4)

- Select [Outline] to look inside the domain

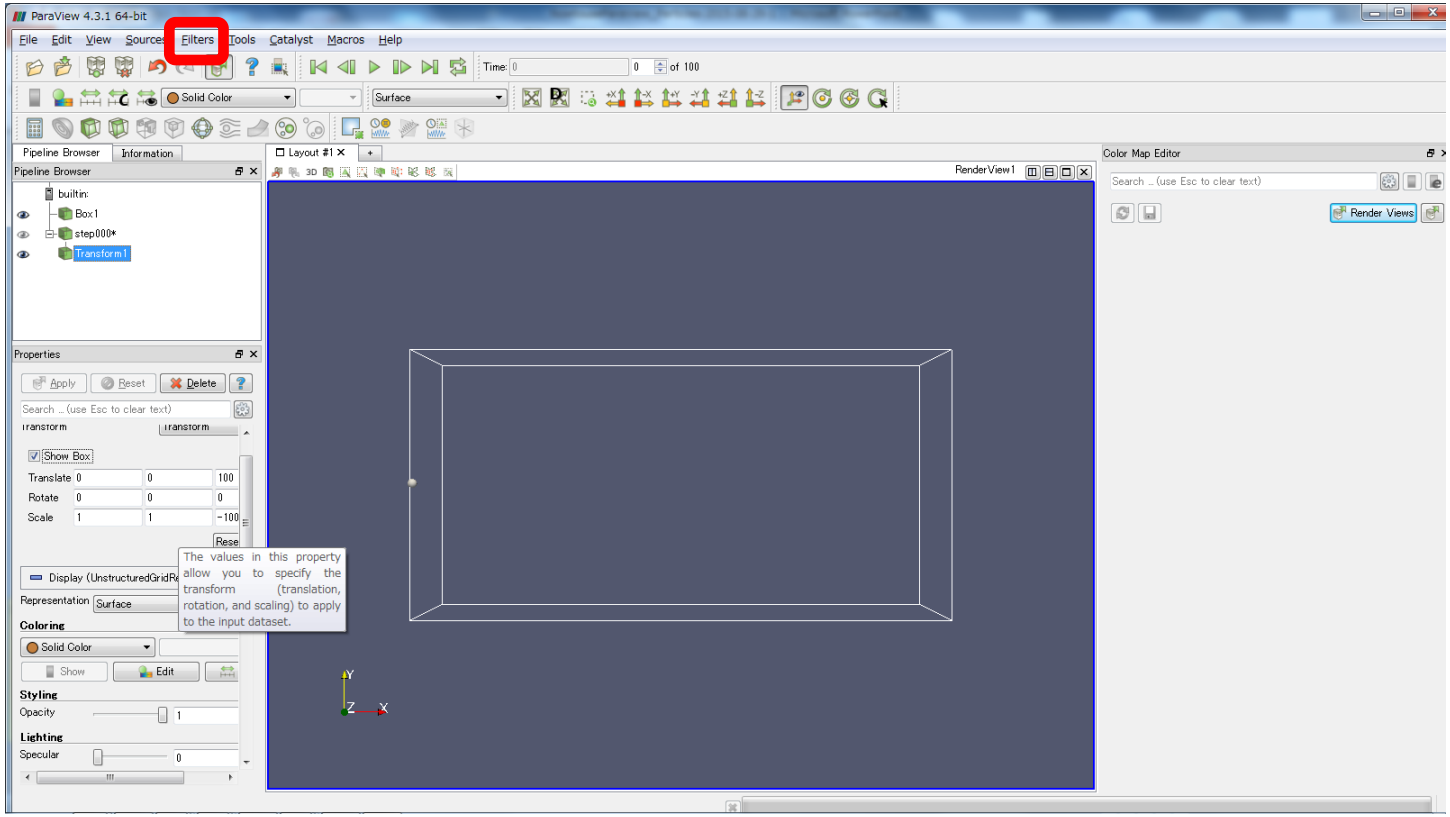


Open series of files



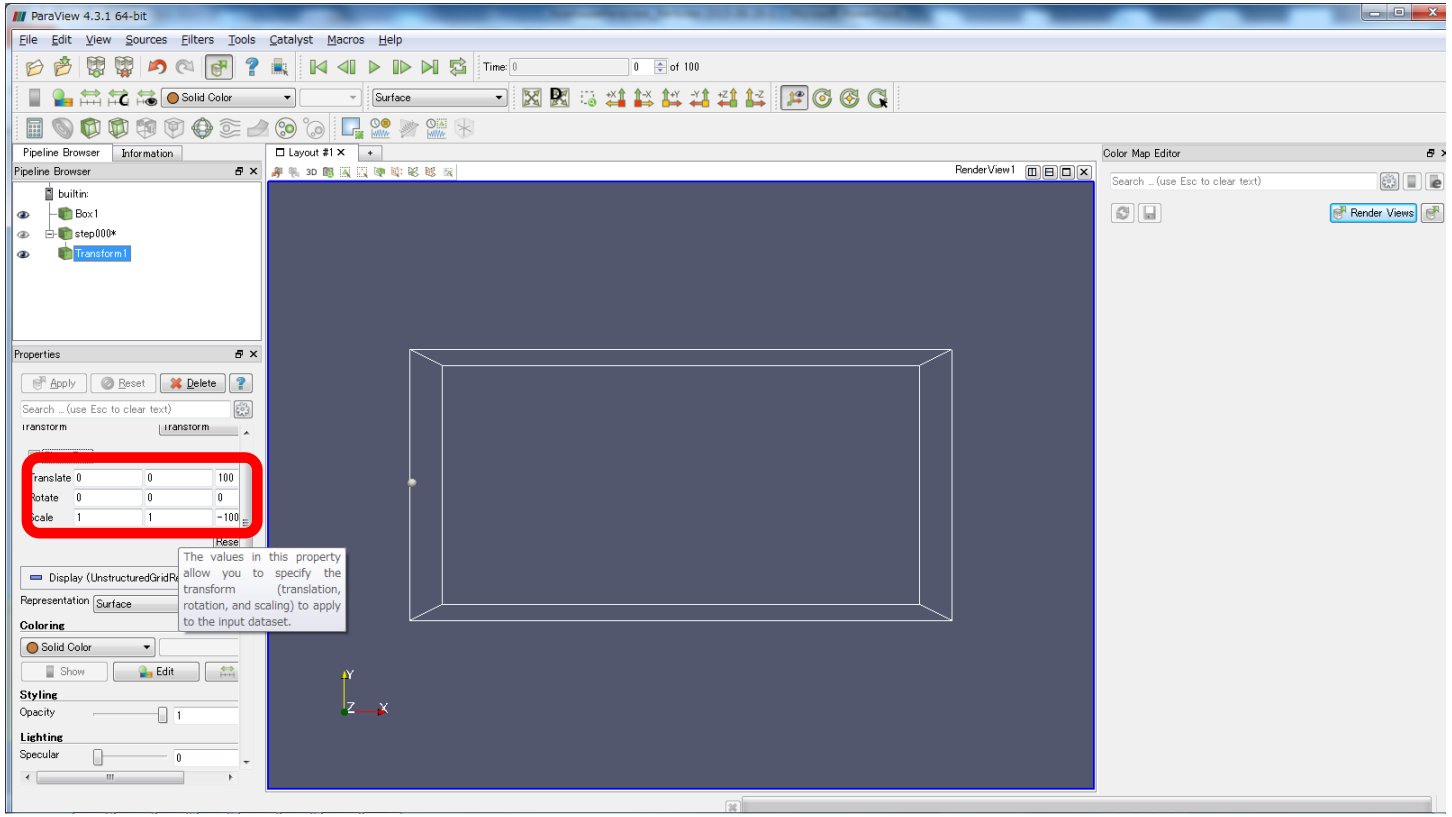
Scaling input values (1)

- [Filters] -> [Alphabetical] -> [Transform]



Scaling input values (2)

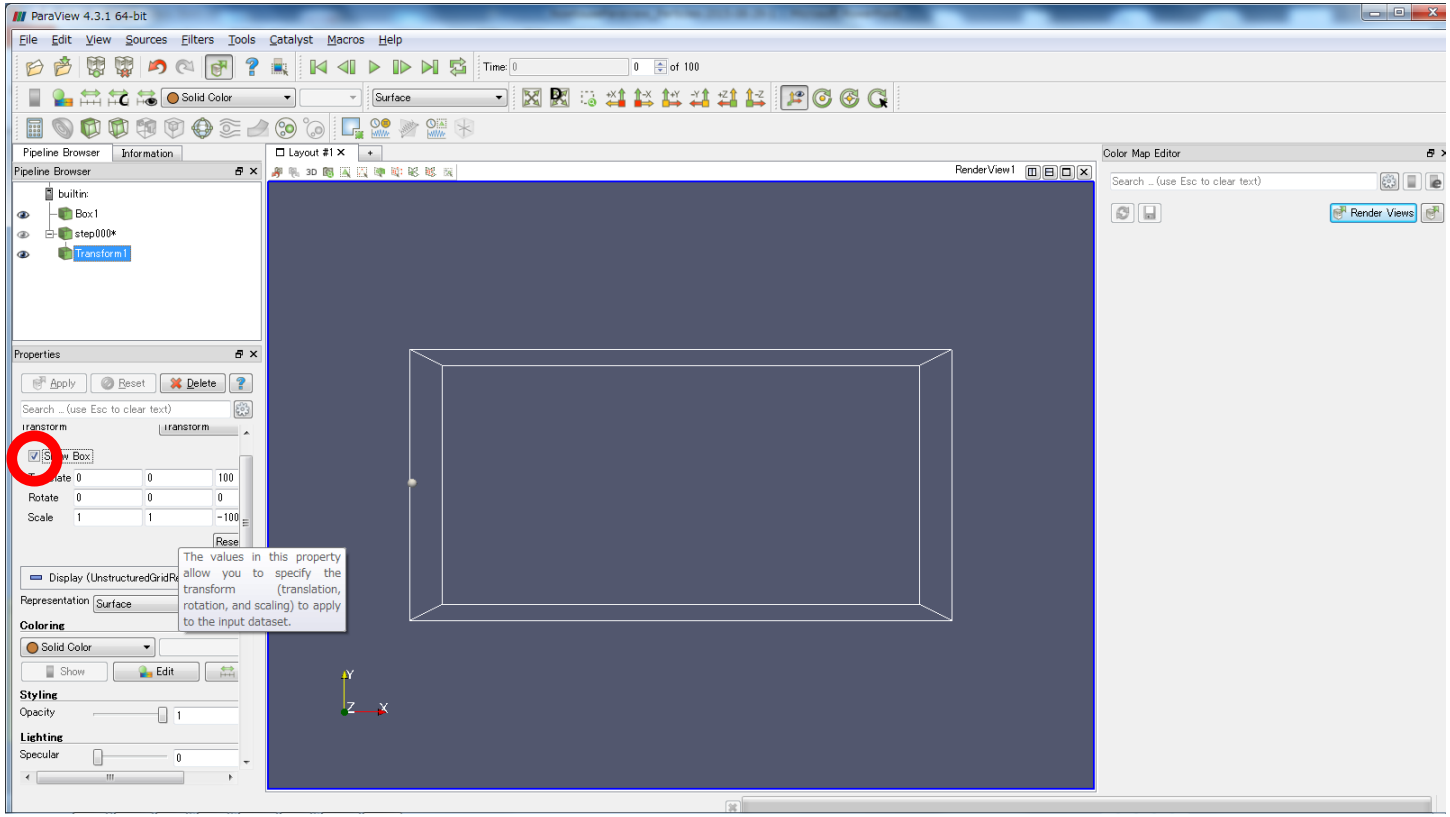
- Set values for scaling



Translate = (0, 0, 100), Rotate = (0, 0, 0), Scale = (1, 1, -100)
Vertical position is reversed and multiplied by 100.

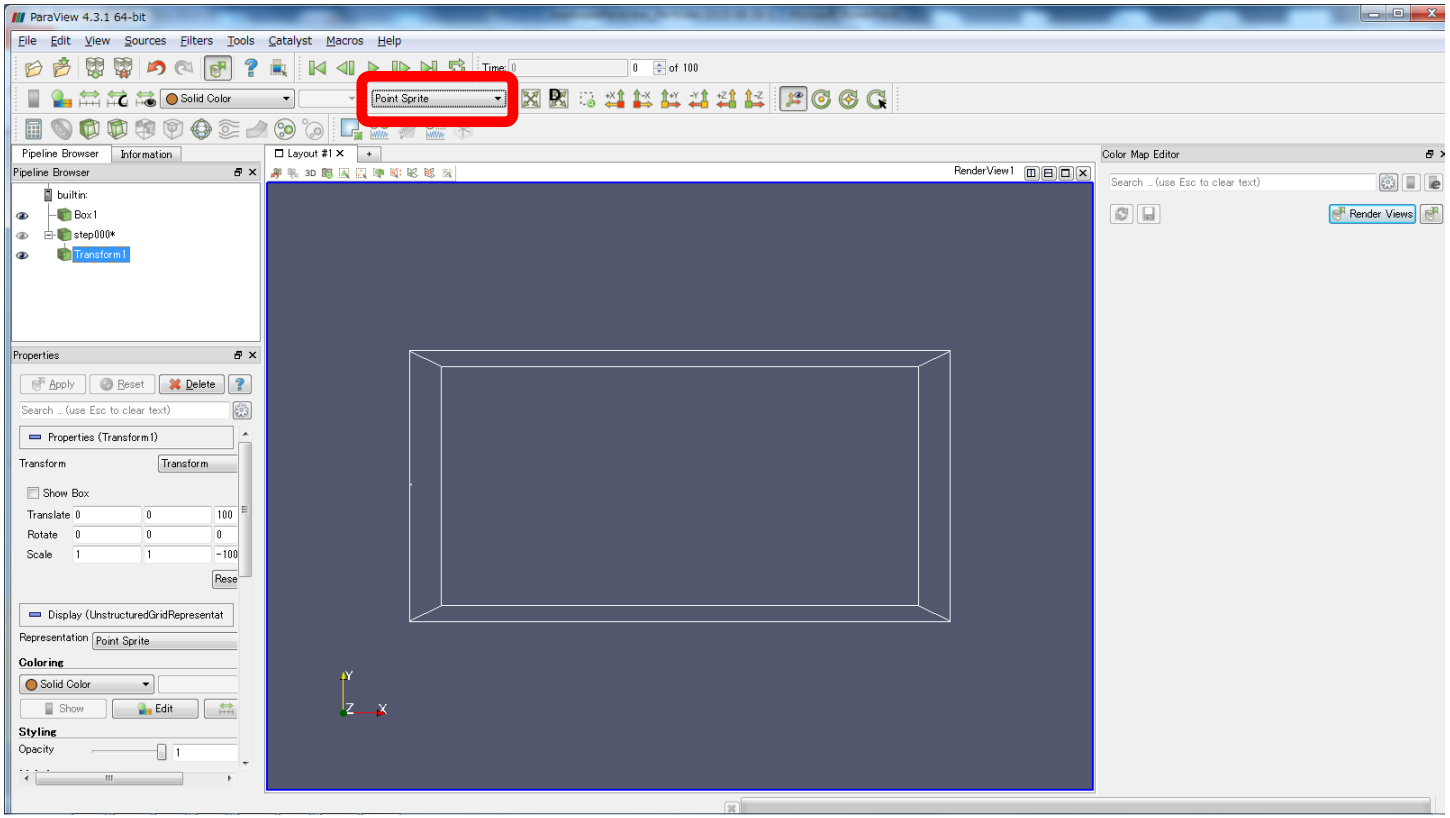
Scaling input values (3)

- Uncheck [Show Box]



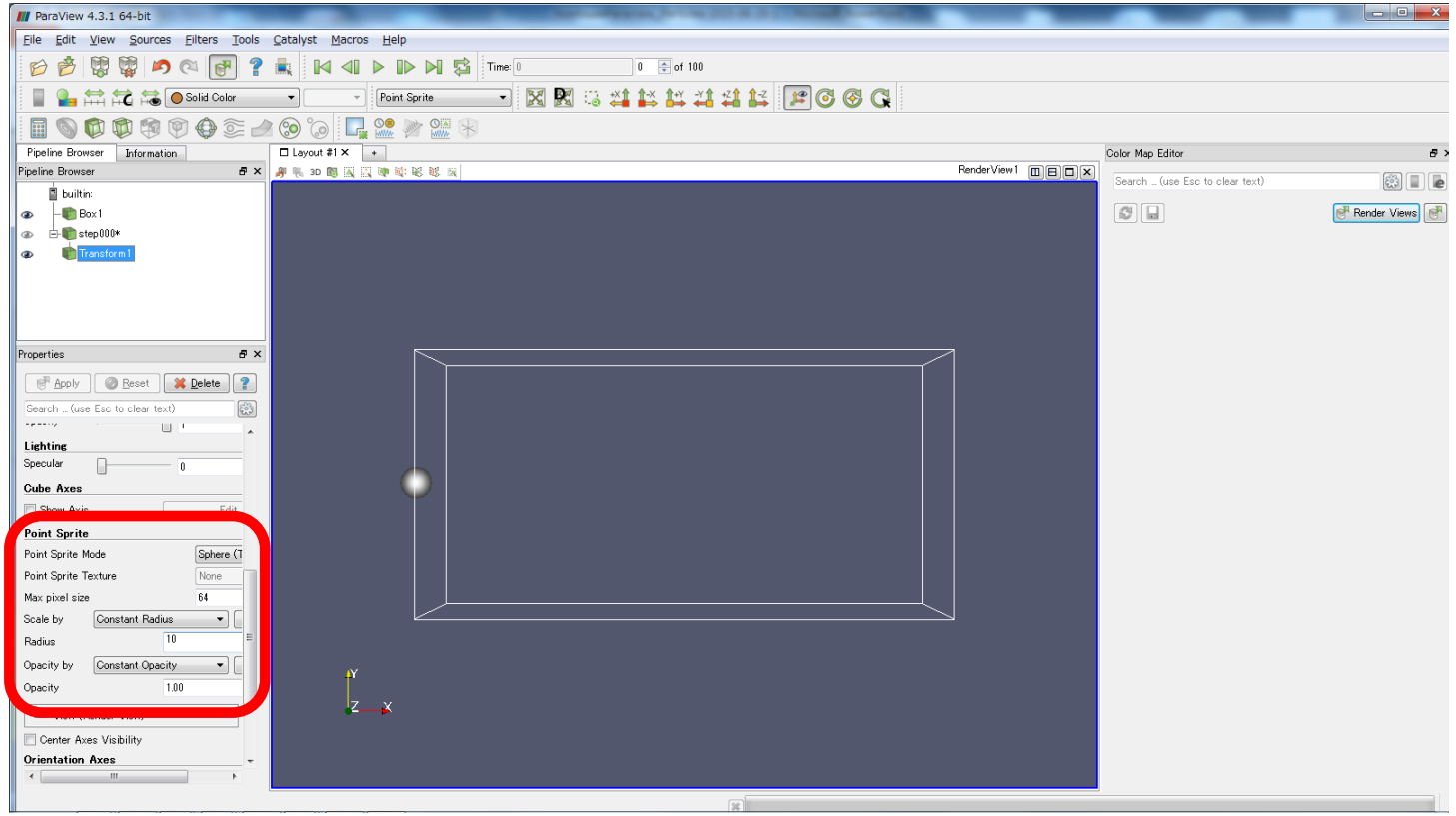
Change radius of particles (1)

- Select [Point Sprite]



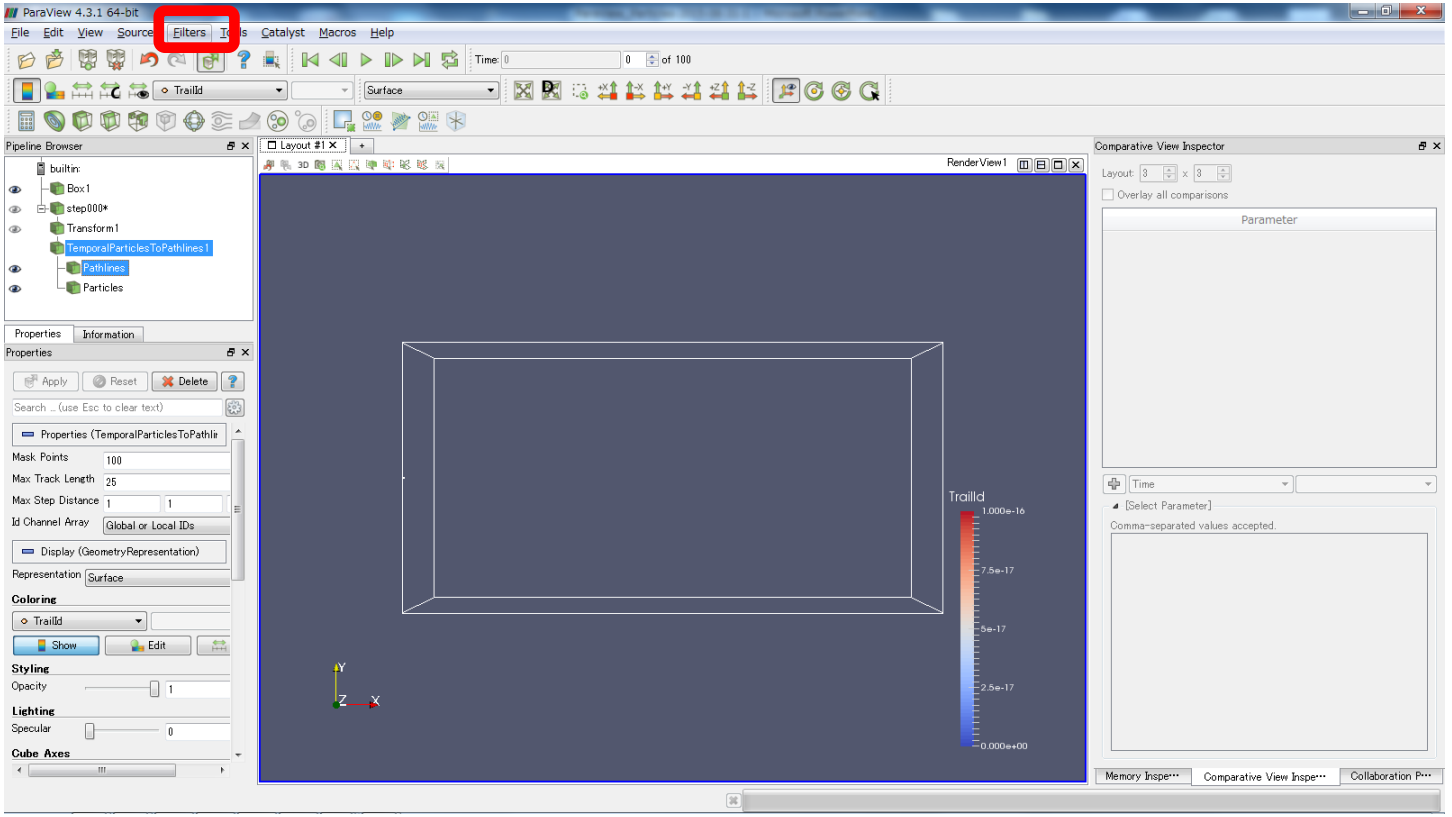
Change radius of particles (2)

- Set radius of particles



Set trajectory pathlines (1)

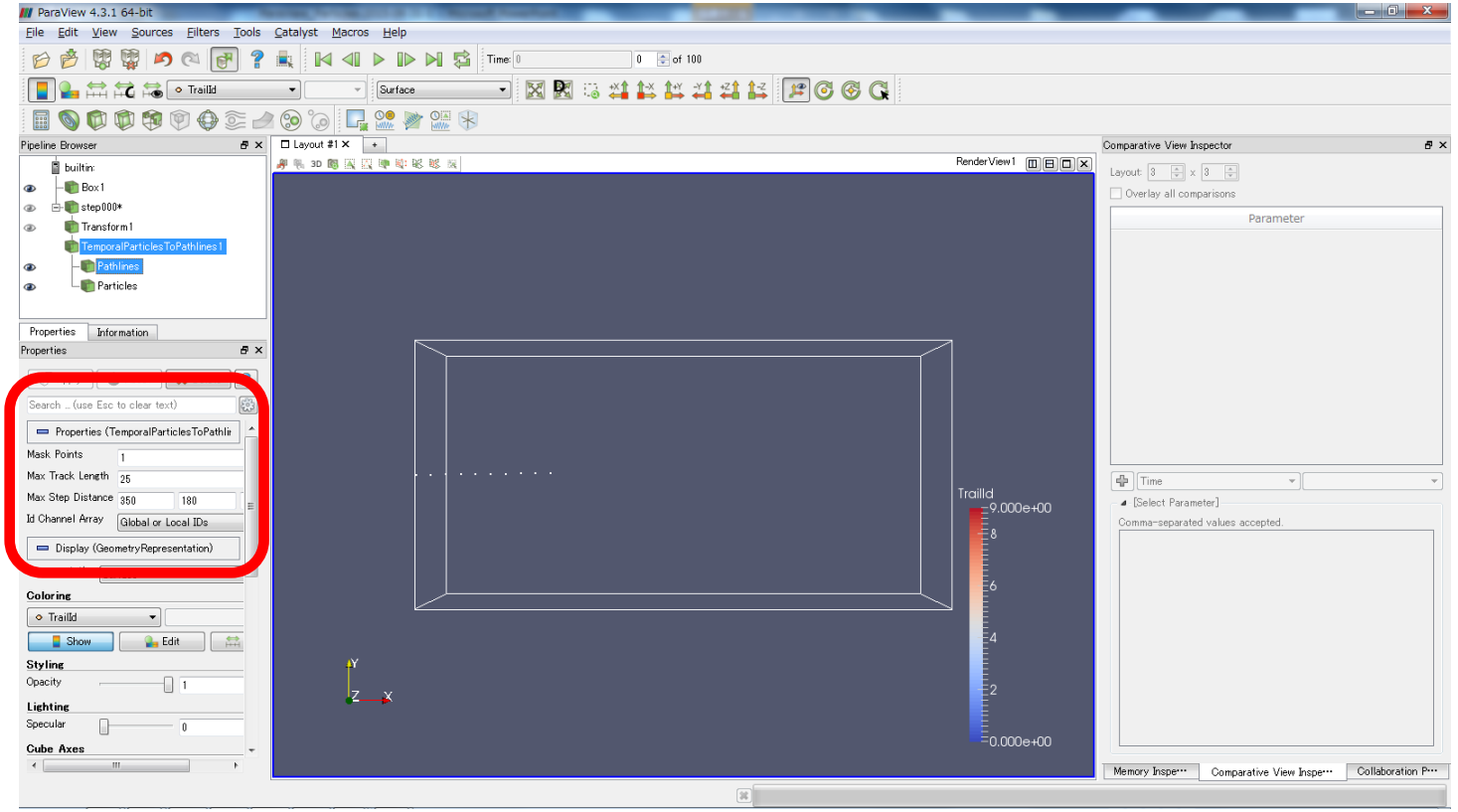
- [Filters] -> [Alphabetical]
  -> [Temporal Particles Pathlines]



(Sample data shown above is changed from previous slide.)

Set trajectory pathlines (2)

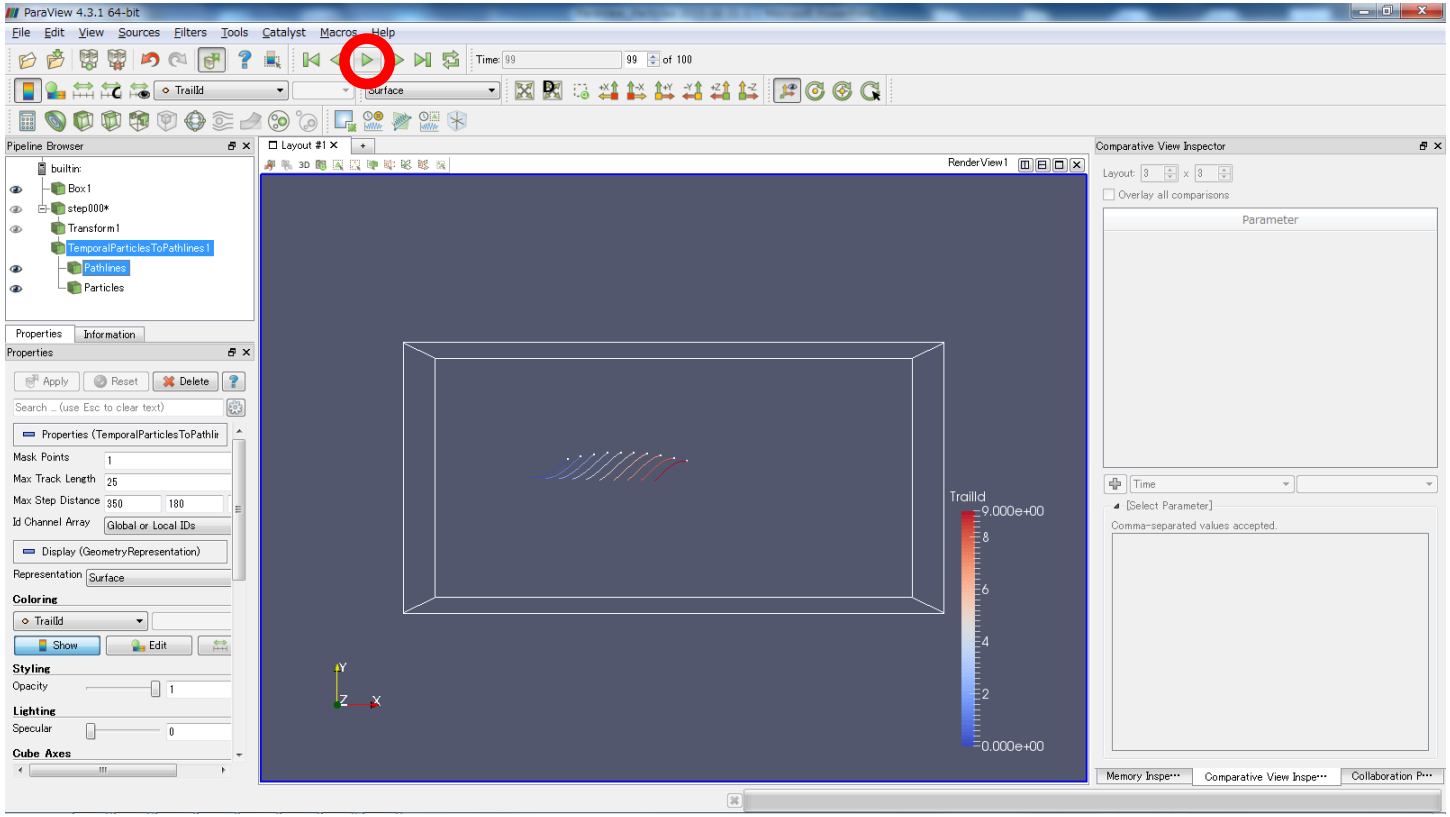
- Set parameters for pathlines



Mask Points = 1, Max Track Length = ???, Max Step Distance = (350, 180, 100)

Animation

- Click ▶ to play a movie



Sample program making data

```
program main

 implicit none

 real(8), parameter :: PI = 3.141592d0

 integer, parameter :: NParcel = 10        ! Number of particles
 real(8)          :: a_ParcelLon(NParcel) ! Parcel position X
 real(8)          :: a_ParcelLat(NParcel) ! Parcel position Y
 real(8)          :: a_ParcelSig(NParcel) ! Parcel position Z

 integer          :: l

 integer          :: t
 integer          :: tmax

 character(len=256) :: FileName
 integer          :: FU = 50

 tmax = 100

 do l = 1, NParcel
  a_ParcelLon(l) =  0.0d0 + 10.0d0 * (l-1)
  a_ParcelLat(l) =  0.0d0
  a_ParcelSig(l) =  0.0d0
 end do

 do t = 1, tmax

   ! Calculate parcel positions
   !
   do l = 1, NParcel
    a_ParcelLon(l) = a_ParcelLon(l) + 1.0d0
    a_ParcelLat(l) = a_ParcelLat(l) &
      & + 1.0d0 * sin( 2.0d0 * PI / 360.0d0 * a_ParcelLon(l) + 2.0d0 * PI / dble( tmax ) * ( t - 1 ) )
    a_ParcelSig(l) = a_ParcelSig(l) + 1.0d0 / dble( tmax )
   end do


   ! Output
   !  A new file is created at each time step.
   !
   write( FileName, '(a,i6.6,a)' ) 'out/step', t, '.vtk'
```