Animations in ParaView

Notes from the EMIx Hackathon, March 2024

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Contents

Setup

1. Import the files `solution.xdmf` and `subdomains.xdmf`

2. Merge their attributes by selecting both in the Pipeline Browser and apply **Filter → Alphabetical → Append Attributes.** We do further processing on the new AppendAttributes1 object.

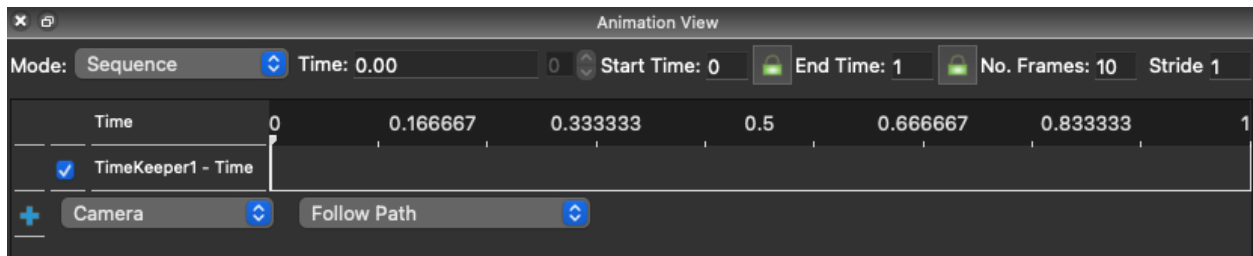3. Separate the intra- and extracellular spaces by applying the **Threshold** filter wrt. f values:

   In this case the ECS has tag 1, and the cells 2-4:
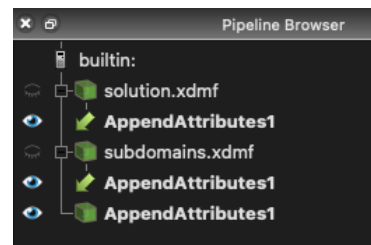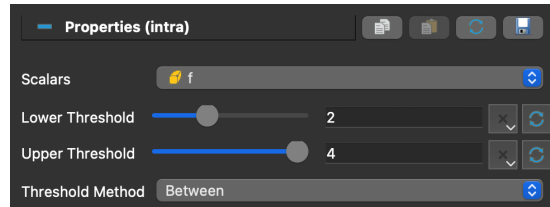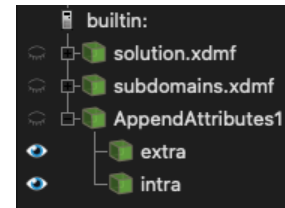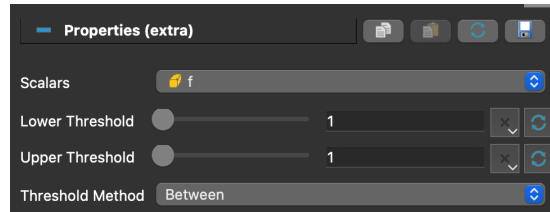
Animation

To bring up the Animation View, **View → Animation View.**

Use the **Sequence** mode. The **Start Time**, **End Time**, and **Stride** do not matter, so just keep the defaults. We control the speed and smoothness with the **No. Frames** and **Frame Rate** (explained later).

Camera animation

Camera: Interpolate cameras

Adding a camera with the **Interpolate Cameras** option allows you to manually pick a set of viewpoints that the camera should use at certain time points, and the camera will follow an interpolated path between them.

Double clicking the new **Camera** opens its **Animation Keyframes**. Here, we can add new positions with **New**. Check **Spline Interpolation** to make transitions smooth (non-linear).
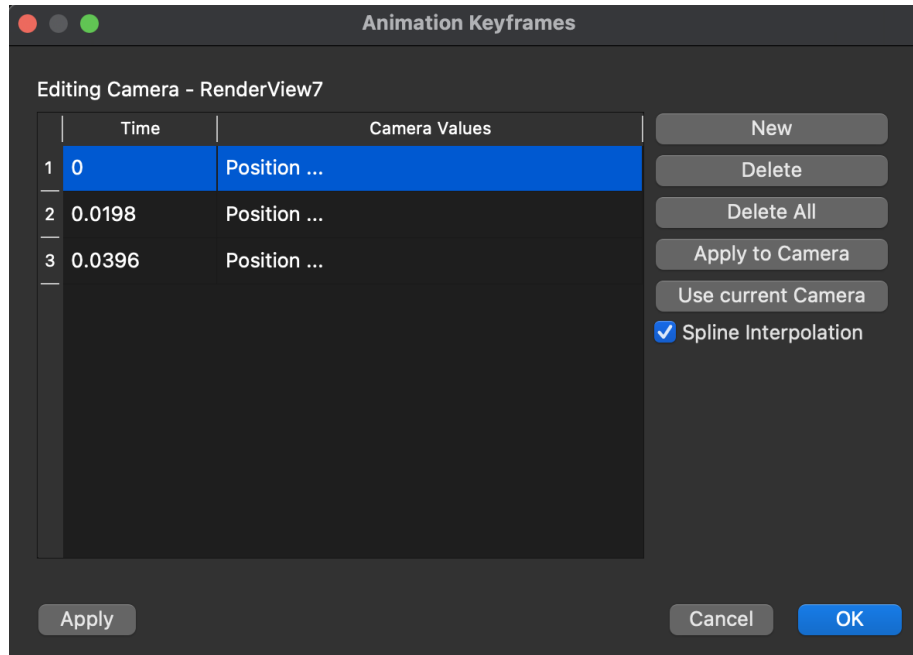
Double clicking a row in the Camera Values columns opens this menu:
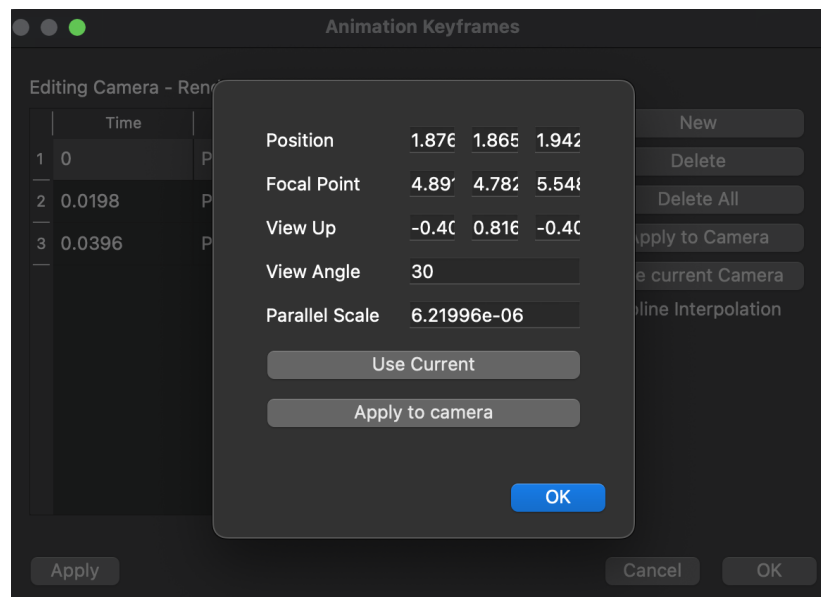
Here, one can either set values manually or click **Use Current** to use the current position in the Render View.

Camera: Follow path

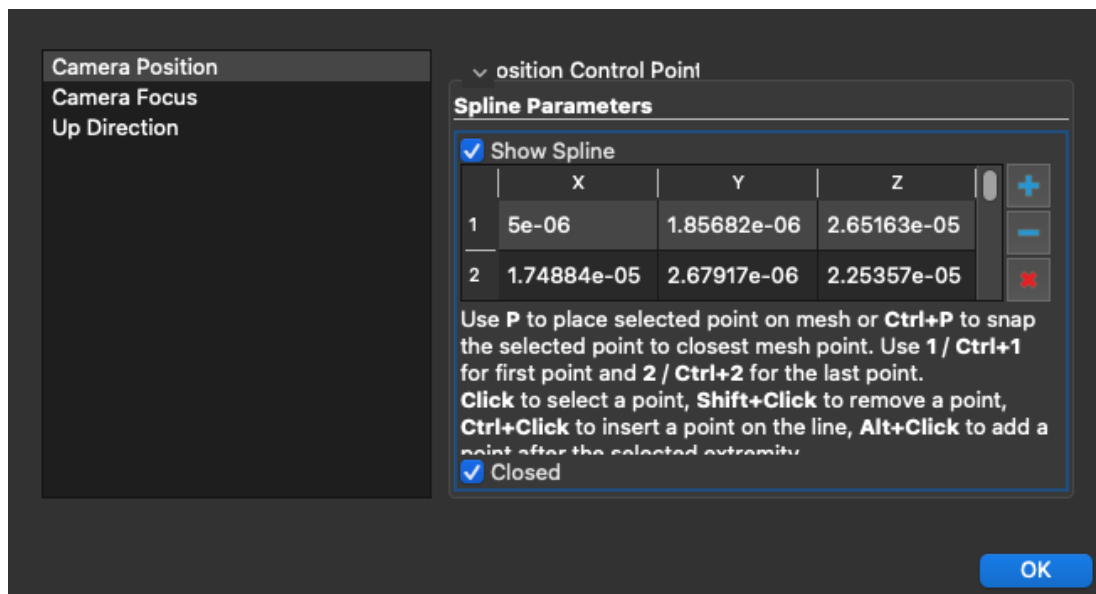Note: ParaView v5.12 appears to have added another way to create this orbit.

Alternatively, we can animate a camera with the **Follow Path** mode:

Double click the new camera to open the Animation Keyframes, then double click the Path at time 0 to open this menu:

We can either adjust the control points manually here, or, with **Show Spline** ticked, do it in the Render View.

- click and drag a control point to move it

- click and drag on the orbit to move it

- right click and drag on the orbit to adjust its radius

- (see also [3] for further explanation)
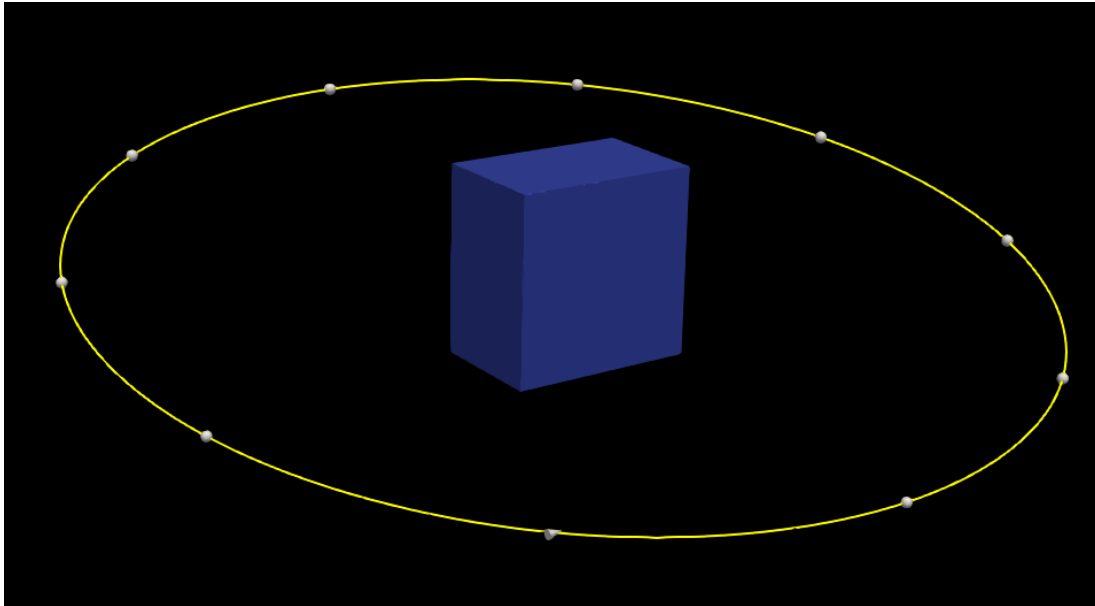
Animating a filter

In addition to animating the camera, we can animate essentially any filter. For example, for clips and slices, we can animate their offsets, normals, opacities, etc., to create effects such as gradual reveal of the intracellular geometry.

Time annotation

Add a time annotation to the video with **Filters → Annotate Time Filter**. Change it's position and appearance under **Properties**.

Consider adjusting the default **Format** to reduce the number of decimals, and adjust the **Scale** to use ms instead of s, for example →

General polishing

Tweaking the legend

Click this button in Properties to open the **Edit Color Legend Properties.**

Note that you get more options by clicking the settings wheel in the upper right corner.

Legend titles

The legend title will default to the property names, e.g. "intra_ion-0". Replace this with more descriptive names with units, for example:

Property name	Suggested legend title
`intra_ion-0`	[Na$^+$]$_i$ (mM)
`intra_ion-1`	[K$^+$]$_i$ (mM)
`intra_ion-2`	[C$^-$l]$_i$ (mM)
`intra_ion-3`	ϕ_i (mV)
`extra_ion-0`	[Na$^+$]$_e$ (mM)
`extra_ion-1`	[K$^+$]$_e$ (mM)
`extra_ion-2`	[Cl$^-$]$_e$ (mM)
`extra_ion-3`	ϕ_e (mV)

Legend label format

See the **Labels** section under the **Edit Color Legend Properties** window.

Consider adjusting the label format by unticking **Automatic Label Format**, and specifying a pattern such as `%-#6.2f` . (Both under **Label Format** and **Range Label Format**) Unticking **Add Range Labels** is also an option.

Colors

The background color can be changed in the bottom of the Properties pane.

For solutions, I use Linear Green for intracellular, and Linear Blue for extracellular.

Depending on the chosen colormap, it may be necessary to invert it to make larger values correspond to darker colors (at least when visualizing concentrations). Invert by clicking the highlighted button in the Color Map Editor →
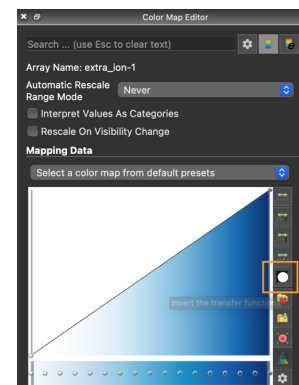
Export animation

Export the animation as an .avi video with **File → Save Animation**.

The number of frames and frame rate will determine the duration and smoothness of the final video. A frame rate of 10 frames per second gives reasonably smooth results, so an easy approach is to

1. Decide on the desired duration T

2. Set No. Frames = T * 10 (under Animation View)

3. Set Frame Rate to 10 (on export)

Additional resources

[1] https://docs.paraview.org/en/latest/UsersGuide/animation.html

[2] https://www.paraview.org/Wiki/Advanced_Animations

[3] https://docs.dkrz.de/doc/visualization/sw/paraview/Camera_and_perspective/camera-orbit/index.html