Graphical Representation through a User Interface for In Situ Scientific Visualization with Ascent

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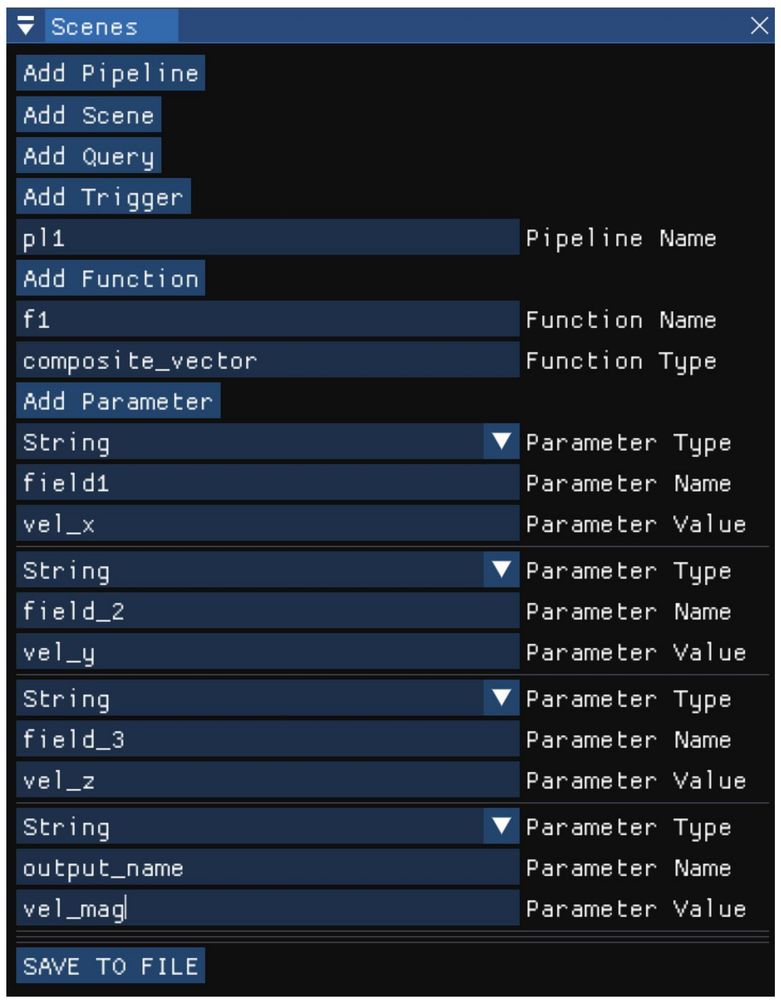

Figure 1: Example of using our user interface to create a yaml file to be used as input into *in situ* visualization software Ascent; output of this example generates the image in Figure 2

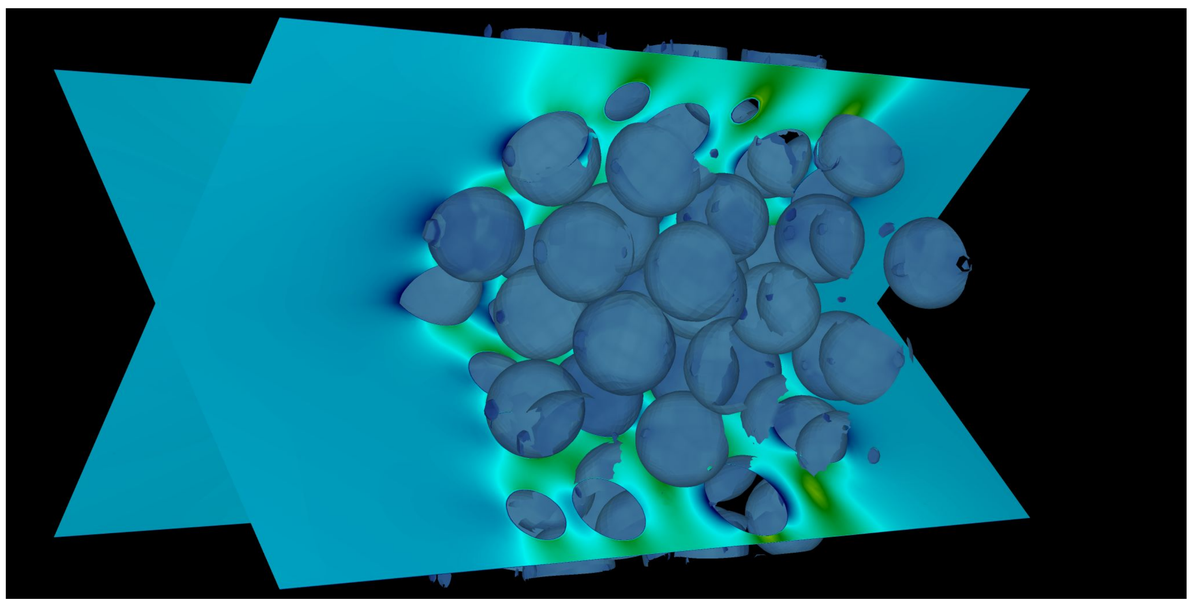

Figure 2: Simulation of a pebble-bed nuclear reactor core with 146 spherical pebbles, rendered using our user interface

Abstract

— This work presents a graphical user interface (GUI) designed to allow users to interactively create scientific visualizations and workflows with the *in situ* visualization software, Ascent [1]. Traditionally, *in situ* pipelines are configured through a YAML file, which can be cumbersome. Our GUI offers an alternative by automating the conversion of user inputs into a format that Ascent can process, eliminating the need for manual file editing. This interactive capability increases the potential for a more diverse group of users to leverage Ascent's powerful visualization tools.

```
Node actions;
Node &add_pipelines = actions.append();
add_pipelines["action"] = "add_pipelines";

Node &pipelines = add_pipelines["pipelines"];
//pipeline 1 (pl1)
pipelines["pl1/f1/type"] = "composite_vector";
Node &f1_parameters = pipelines["pl1/f1/params"];
f1_parameters["field1"] = "vel_x";
f1_parameters["field2"] = "vel_y";
f1_parameters["field3"] = "vel_z";
f1_parameters["output_name"] = "velocity";
pipelines["pl1/f1/params"] = f1_parameters;
```

Figure 3: C++ program to generate identical YAML file as user interface shown in Figure 1. This requires far more programming and background knowledge by the user than using our user interface

Motivation

Ascent enables users to generate an input YAML file that specifies parameters for creating visual outputs, but the process can be difficult for those with little to no visualization knowledge. Our goal is to provide users with a streamlined approach to usability, allowing those with little to no visualization knowledge to be able to generate visuals of their data. Thus, a graphical interface that provides all necessary information without requiring programming skills lowers the barrier to entry and expands its usability to a broader audience

Next Steps

Future work for this project includes expanding usability of different aspects, such as providing a visual representation of camera angles that the user has selected.

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Method

Built with C++ and Interactive Mode Gui (ImGui) to provide user interface widgets necessary to gather input from the user [2]

Utilizing ANARI-SDK infrastructures to support local visualization rendering for future features such as camera placements

Tested user interface against C++ programmed YAML file to generate visualization from NekRS simulation code [3]

Conclusions

— Our user interface successfully replicates YAML files used as input to *in situ* visualization software Ascent

– Users can use graphical tool that manages the hierarchical organization of data behind the scenes, providing an easy-to-use alternative to the traditional approach

References

[1] Ascent. https://ascent.readthedocs.io/en/latest

[2] DearImGui. http://github.com/ocornut/imgui

[3] P. Fischer, S. Kerkemeier, M. Min, Y-H. Lan, M. Phillips, T. Rathnayake, an dE. Merzari. Nekrs, a gpu-accelerated spectral element navier-stokes solver. *Parallel Computing*, (114), 2022.

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