Supplementary figures – Final Report
Marie Curie Actions Career Integration Grant #304099 “LargeFlowVis”

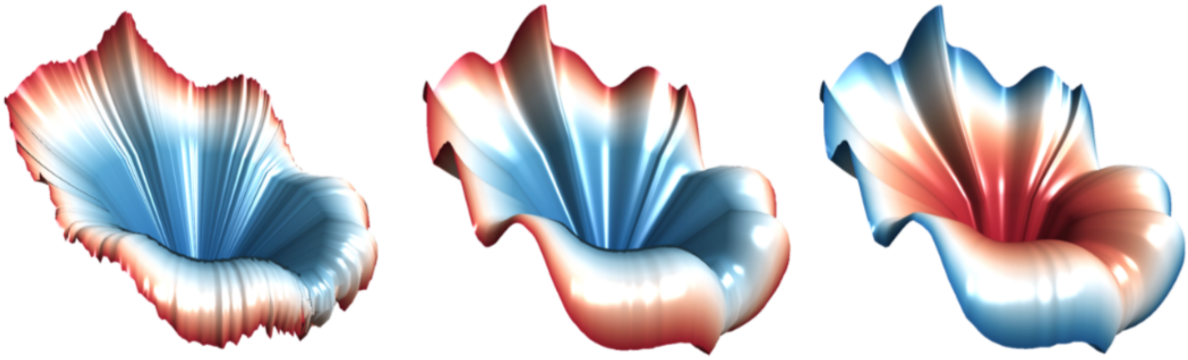

Figure 1: So-called *path surfaces* are used to visualize the transportation behavior of fluid flow: an initially simple surface is deformed by advection in a vector field. The computation of path surfaces from simulation data is numerically challenging, but can be achieved robustly using a Lagrangian interpolation framework developed as part of *LargeFlowVis* (cf. 10.1117/12.2083253).

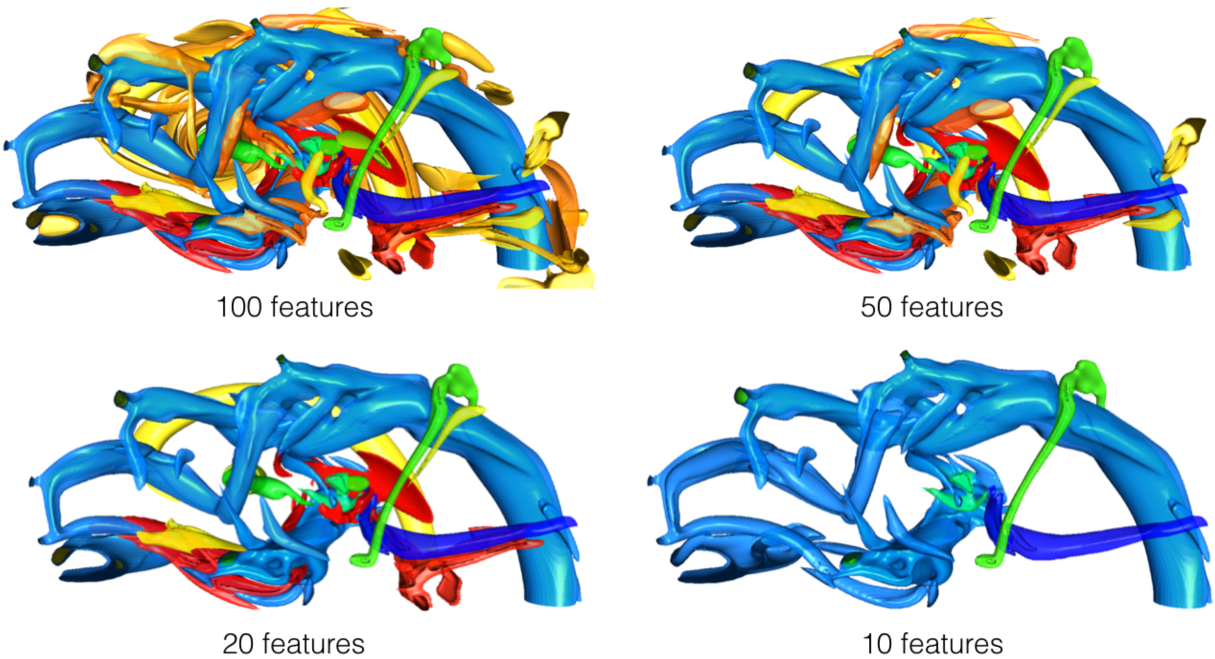

Figure 2: High-fidelity simulation models on large-scale parallel computer systems produce data at high computational throughput. We demonstrate the feasibility and potential of combining in situ topological analysis and compact image-based data representation to address the problem of storage cost. Above, the flexible framework developed as part of the *LargeFlowVis* project admits interactive simplification and visualization of vortices in a large fluid flow dataset on commodity hardware (cf. 10.2312/pgv.20151158).

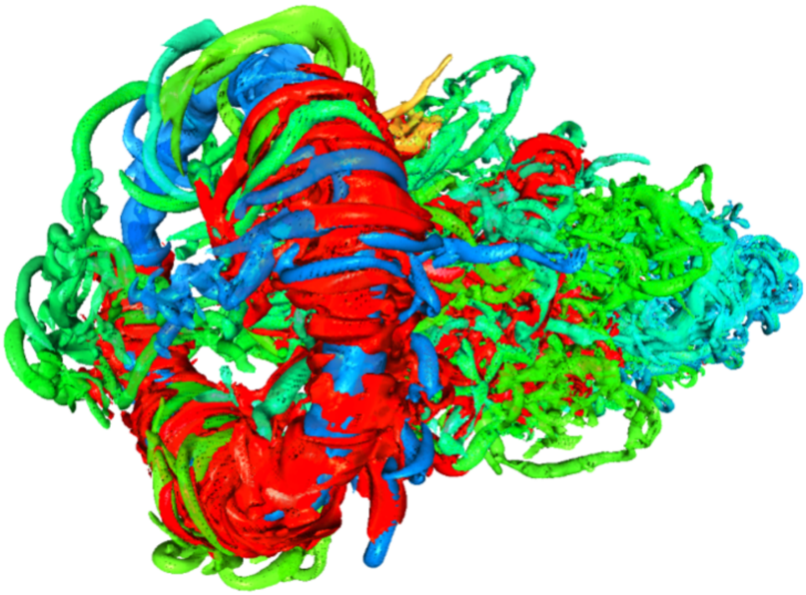

Figure 3: High-fidelity simulation models on large-scale parallel computer systems produce data at high computational throughput. We demonstrate the feasibility and potential of combining in situ topological analysis and compact image-based data representation to address the problem of storage cost. Above, the flexible framework developed as part of the LargeFlowVis project admits interactive simplification and visualization of vortices in a large fluid flow dataset on commodity hardware (cf. 10.2312/pgv.20151158).

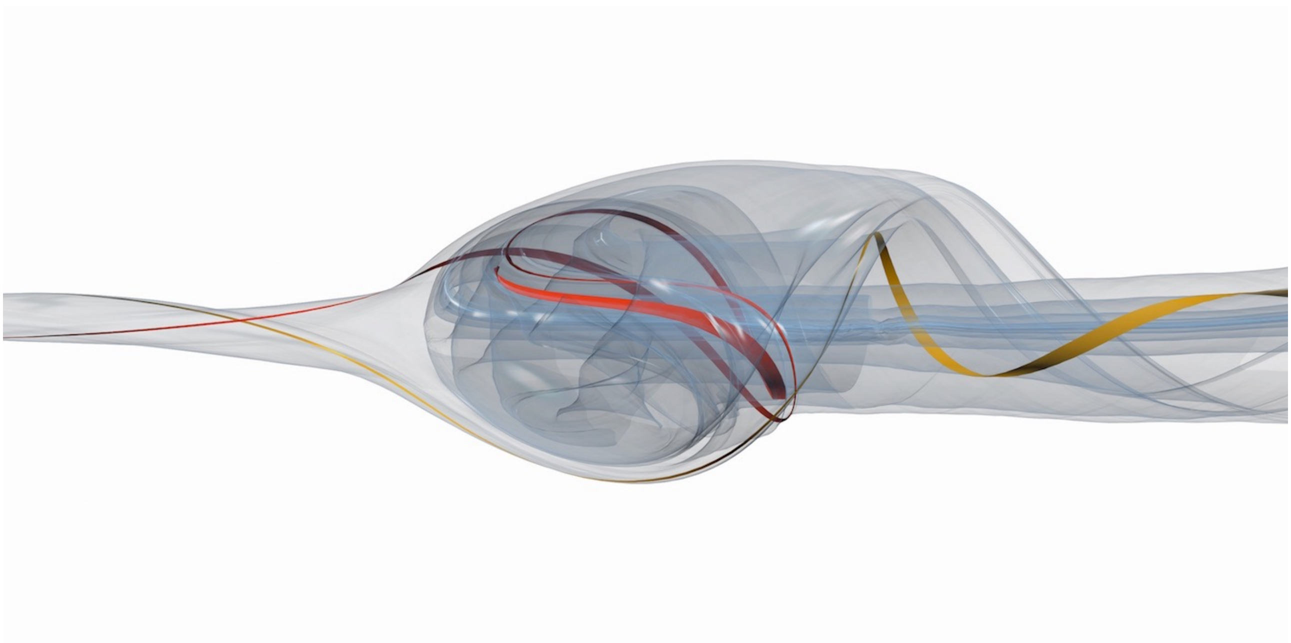

Figure 4: Integral surfaces enable the intuitive visualization of complex flow phenomena from numerical simulation experiments. In this case, the algorithmic framework developed in the *LargeFlowVis* project was leveraged to compute a so-called *stream surface* illustrating a *vortex breakdown bubble*. This sudden disappearance of vortical motion in a flow is still not understood very well, and visualization technique aid in understanding the flow dynamic processes involved.

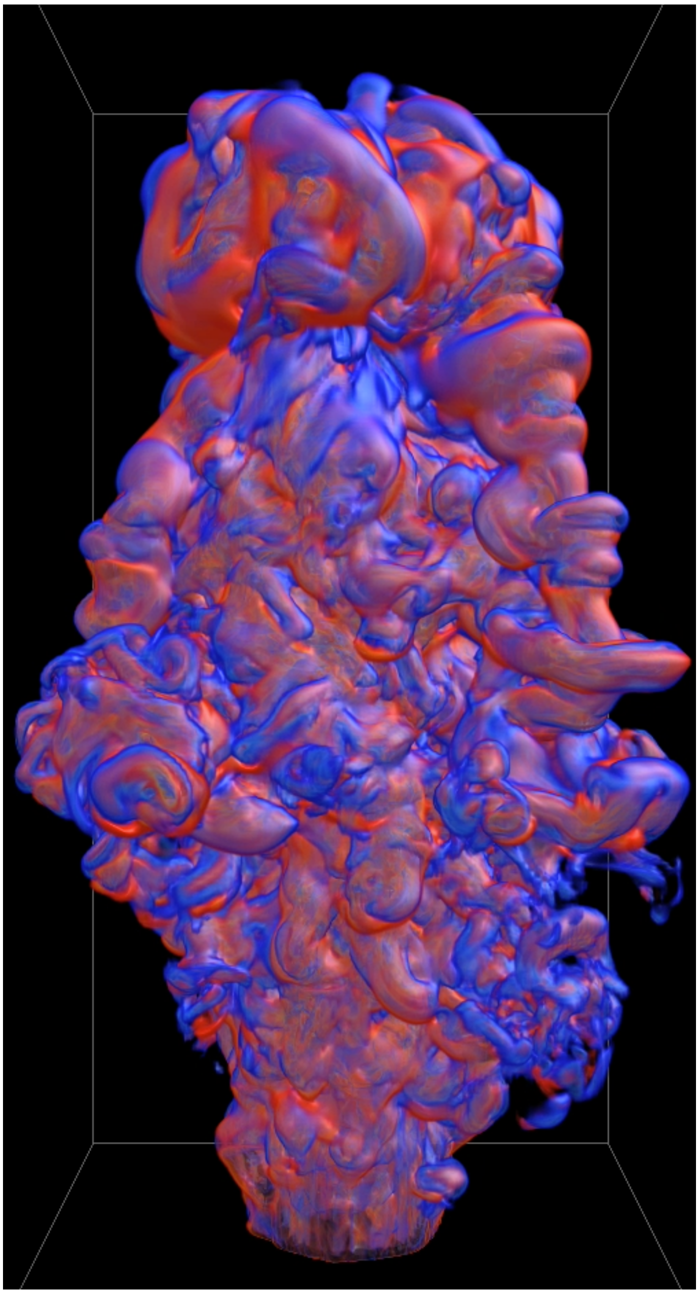

Figure 5: Insight into the dynamical processes occurring within a time-varying fluid flow can be achieved through the visualization of so-called *Lagrangian Coherent Structures.* From a computational standpoint, the identification of these structures is enormously costly as a very large number of virtual particle trajectories must be followed. The novel algorithmic framework developed as part of the *LargeFlowVis* project allows to utilize large-scale supercomputers to this purpose in an efficient and scalable manner.