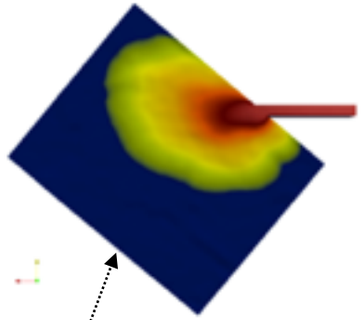

In-situ visualization

user steering

online
data analyses
and monitoring

Provenance
Database

libMesh-sedimentation workflow code instrumenta

```
...
...
p = load_parameters()
for (unsigned int t_step = p.init_tstep;
     (t_step < p.n_time_steps) && (time < p.tmax);
     t_step++) {
  provenance.initTimeIteration();
  if ( parameters_modified() ) {
    p = reload_parameters();
  }
  ...
  for (unsigned int nonlinear_step = 0;
       p.nonlinear_step < p.max_nonlinear_steps;
       ++nonlinear_step) {
    provenance.initFluidSolver();
    flow_system.solve();
    ...
    provenance.finalizeFluidSolver();
  }
  ...
  provenance.finalizeTimeIteration();
}
...
```

libMesh-sedimentation workflow