



Report of Visionair visit

Number and acronym of project: 83 - Evaluating the turbulent incompressible flow and the particle tracking in the Axialzyklon with a high-resolution model

Access provider: HLRS (University of Stuttgart)

User: Markus Lenarcic

Start date: 14.4.2013

End date: 27.4.2013

Challenges: To get an appropriate approximation of the real, highly turbulent flow and the particle tracking in the *Axialzyklon*, a wide range of parameters must be correct chosen or adjusted in the course of a CFD-simulation using *ANSYS CFX* as well as in the subsequent 3D-visualization using *COVISE*.

At first, a high resolution physical model with restricted differences to the real geometry must be created, a proper turbulence model and time discretization is needed as well. The deployed numerical methods must be stable and accurate. The turbulence model correlates with the space discretization and must be adapted for a proper interaction.

Further challenges are to consider transient flow behavior and particle tracking in the flow field with seedings interacting with each other.

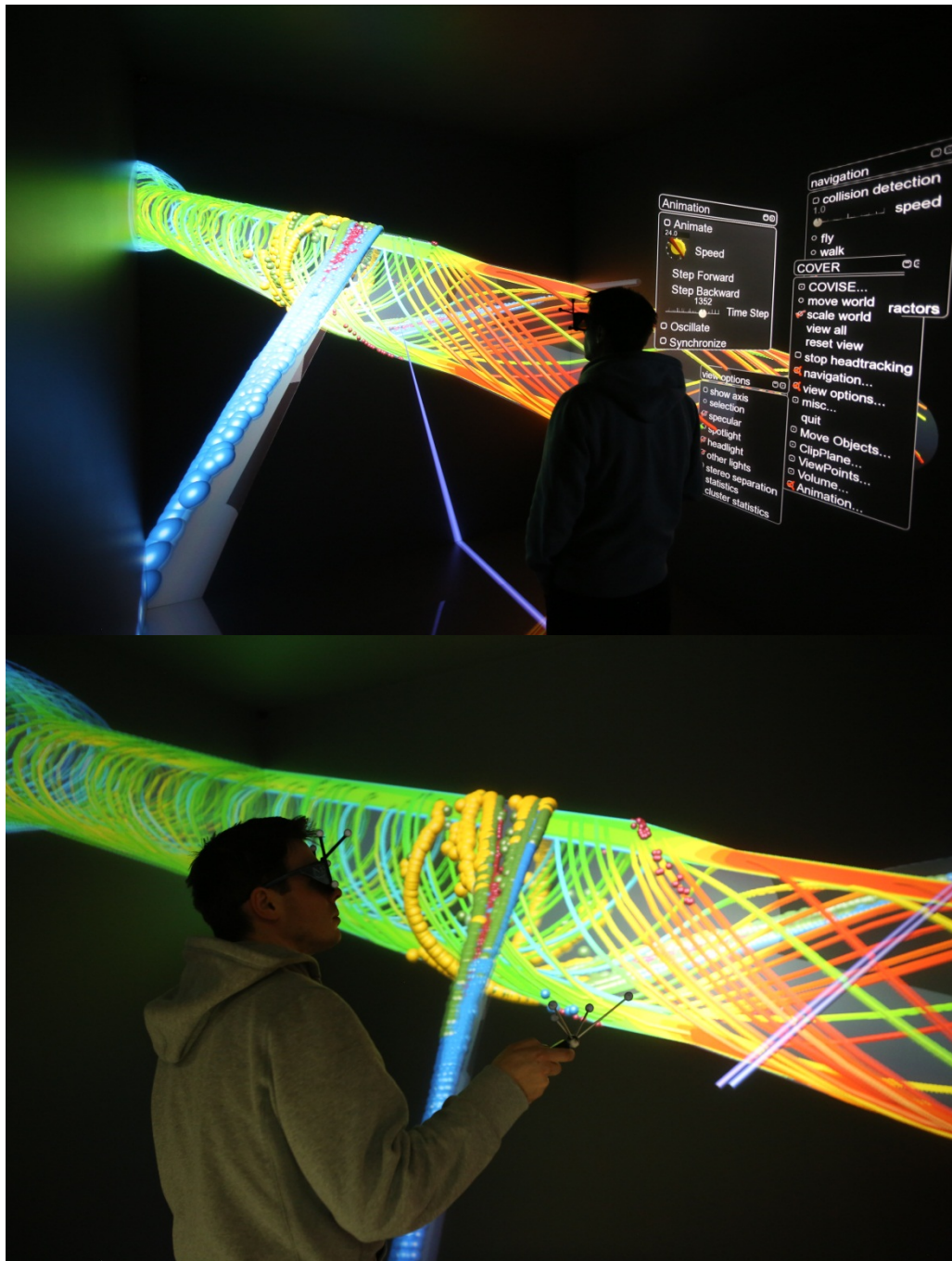
To evaluate the conducted CFD-simulations regarding separation efficiency of the *Axialzyklon*, 3D-visualizations are carried out in *COVISE*. Thereby, challenges occur during conversation of the large amount of multiple datasets from the *ANSYS CFX* into *COVISE*. In order to speed up this conversation, the *ReadCFX* module should be modified within *COVISE*. For enabling different colors of the various particles, the *Material* and *OpenCover* modules have to be adapted as well (only if the render method is set to *ARB Point Sprites*, which needs much less memory than *polygon* rendering).

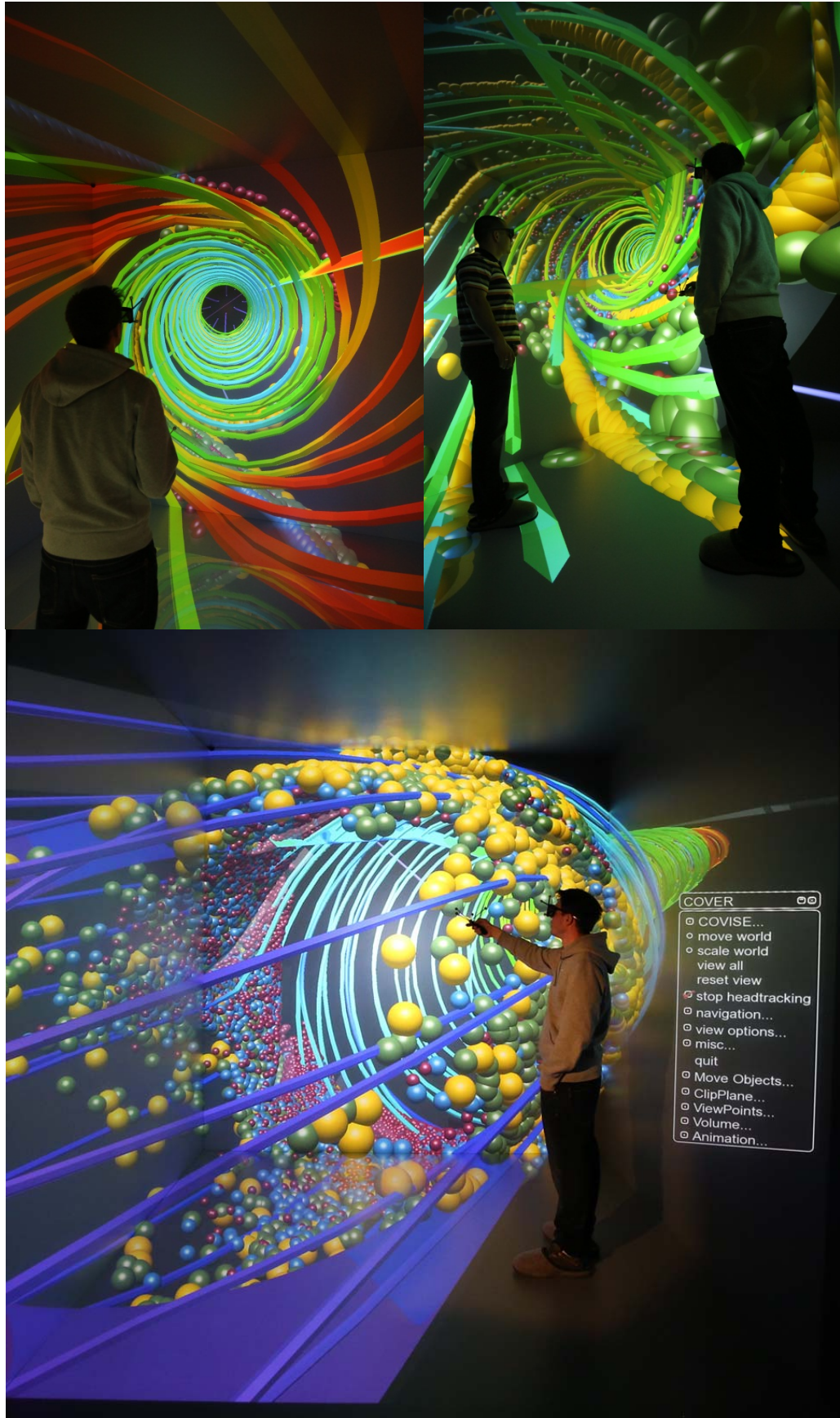
Work description:

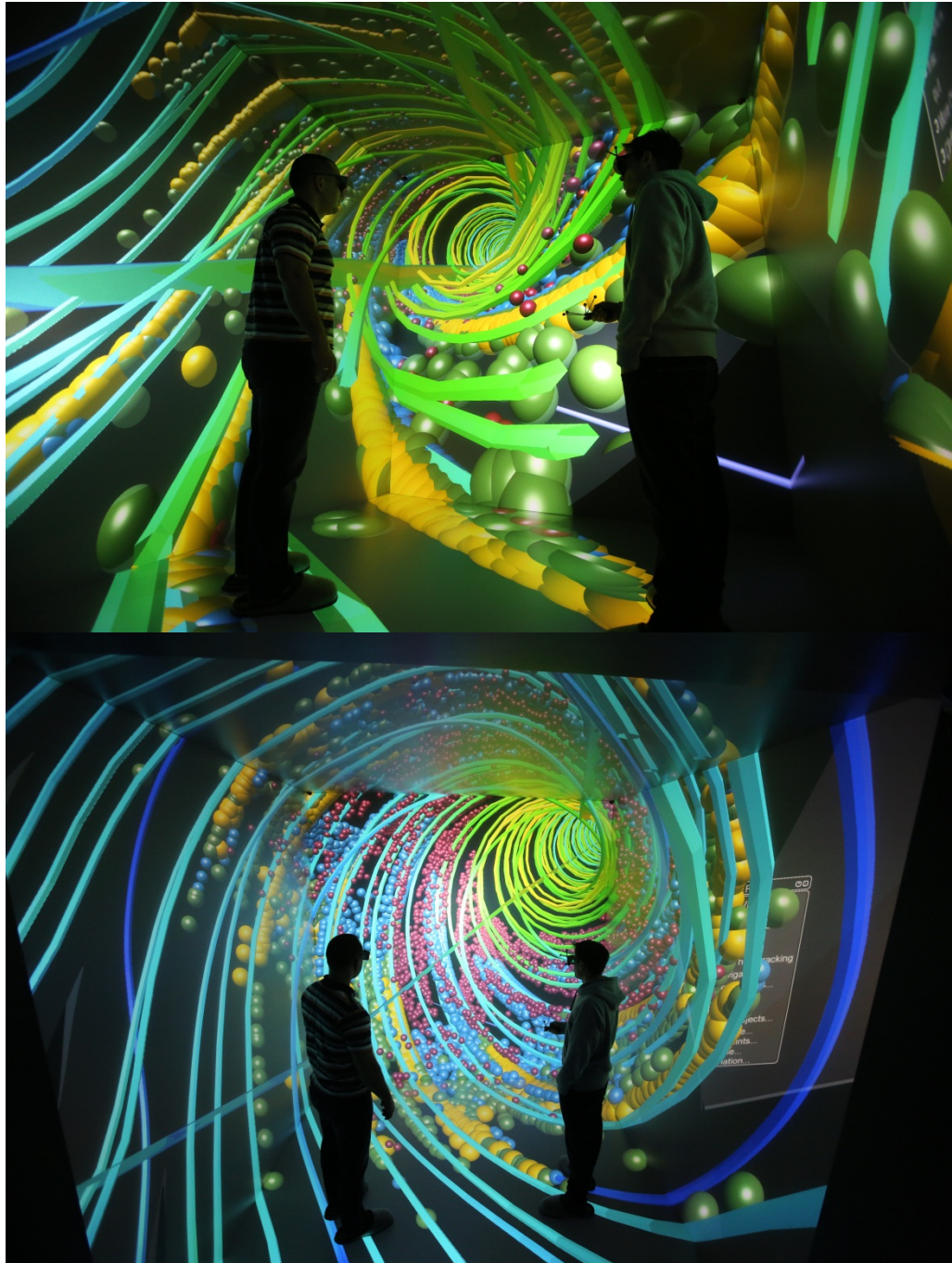
- 1) Setting-up CFD-simulations of the *Axialzyklon* including particle tracking and considering transient flow behaviour
- 2) Preparing the calculated CFD-solutions for 3D-visualizations in *COVISE*
- 3) Converting the large amount of CFD-data from *ANSYS CFX* into *COVISE* format
- 4) Adapting the *Material* and *OpenCover* module within *COVISE* in order to enable different colors of the various particles if render method is set to *ARB Point Sprites*
- 5) Setting-up generic workflow for the 3D-visualization of the *Axialzyklon*
- 6) Setting-up 3D-visualizations of the *Axialzyklon* in *COVISE* with focus on particle-tracking considering massive particles interacting with the flow field

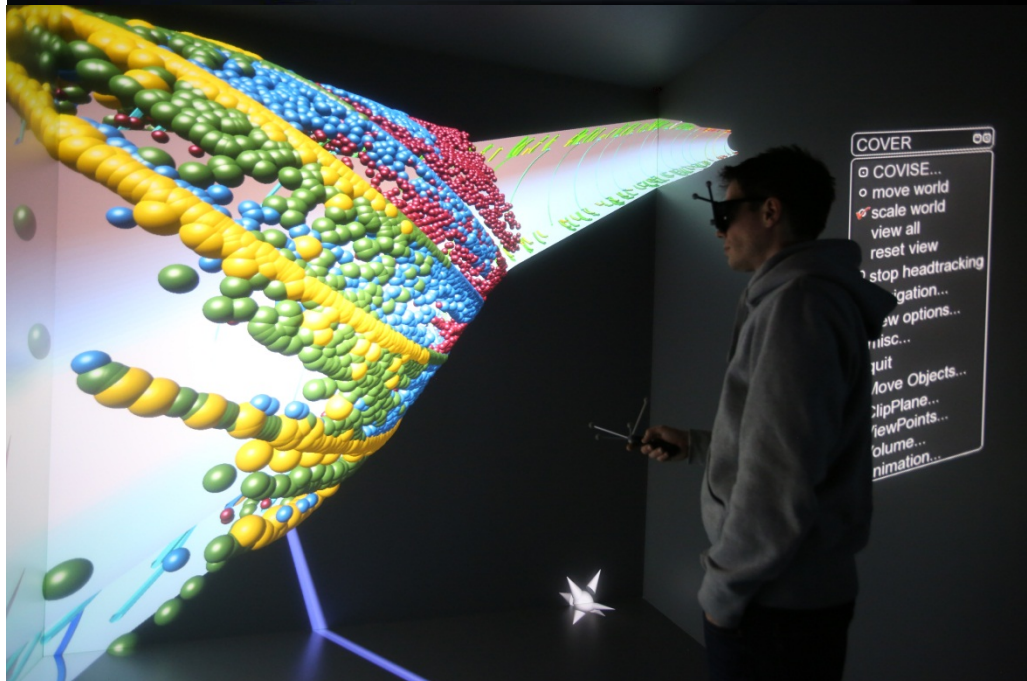
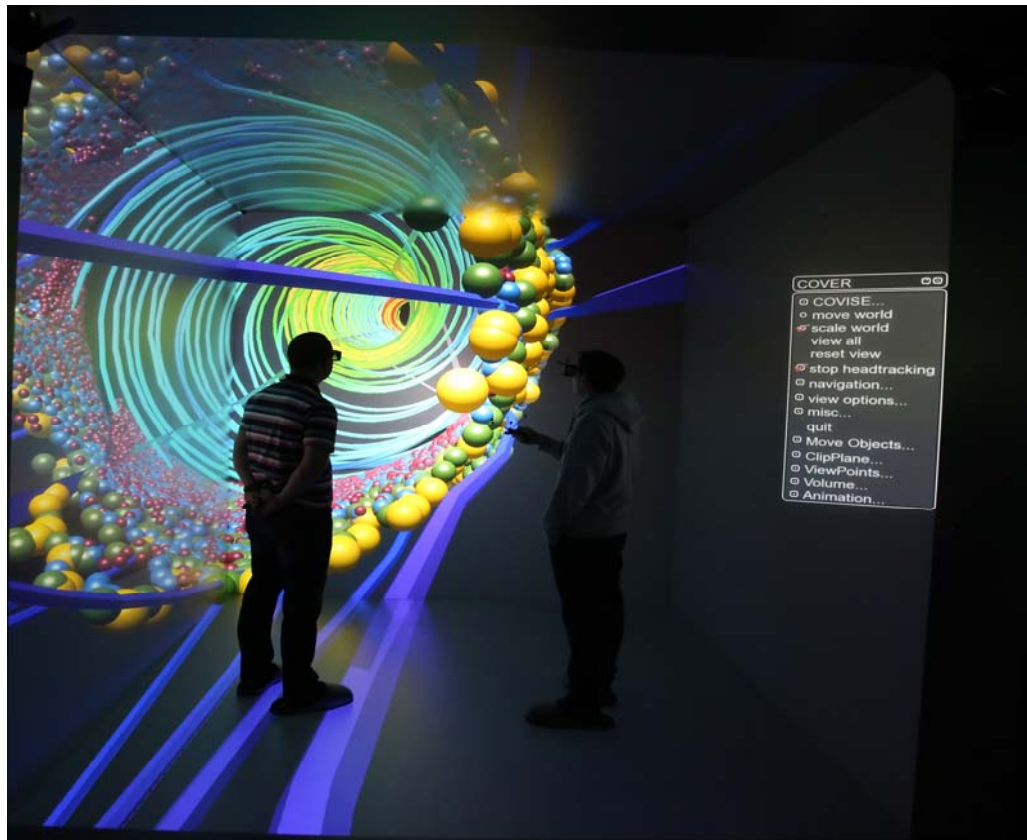
Results: The main objective to visualize the 3D turbulent incompressible flow and the particle tracking of different massive particles in the *Axialzyklon* with a high-resolution model was achieved. Therefore, the large amount of CFD-data was converted into *COVISE* format and modules like the *Material* and the *OpenCover* modules were modified in order to obtain high efficient visualizations of the various particles displayed in different colors.

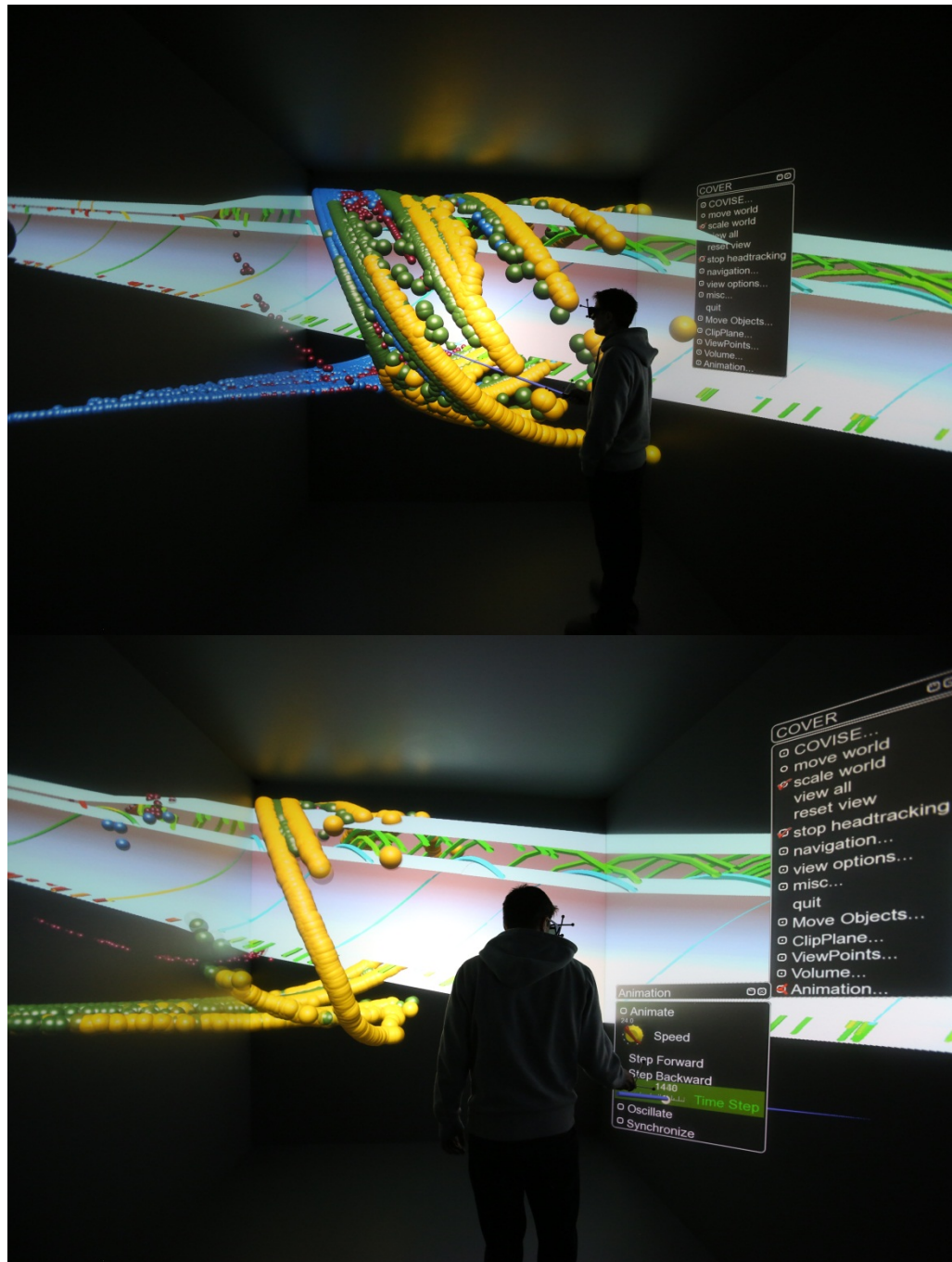
Additionally, with the acquired knowledge of using *COVISE* and the support by *HLRS* the proposer should be now enable to train other users in basics of 3D-visualizations at the Vienna University of Technology.











Future work:

- 1) Evaluating the 3D-visualizations and the existing CFD-simulations with consisting measurement data by comparing separation efficiency
- 2) Afterwards, with the help of 3D-visualizations, design and construction of the *Axialzyklon* could be evaluated and – if necessary – improved as well
- 3) The *Tracer* module within *COVISE* could be extended to support a visualization of massive particles (including particle-tracking) independently from the CFD-simulation
- 4) The *ReadCFX* module within *COVISE* could be modified in order to speed up conversation of dataset from *ANSYS CFX* to *COVISE*



Signatures:

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Markus Lenarcic (User)

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Wolfgang Schotte (HLRS)