

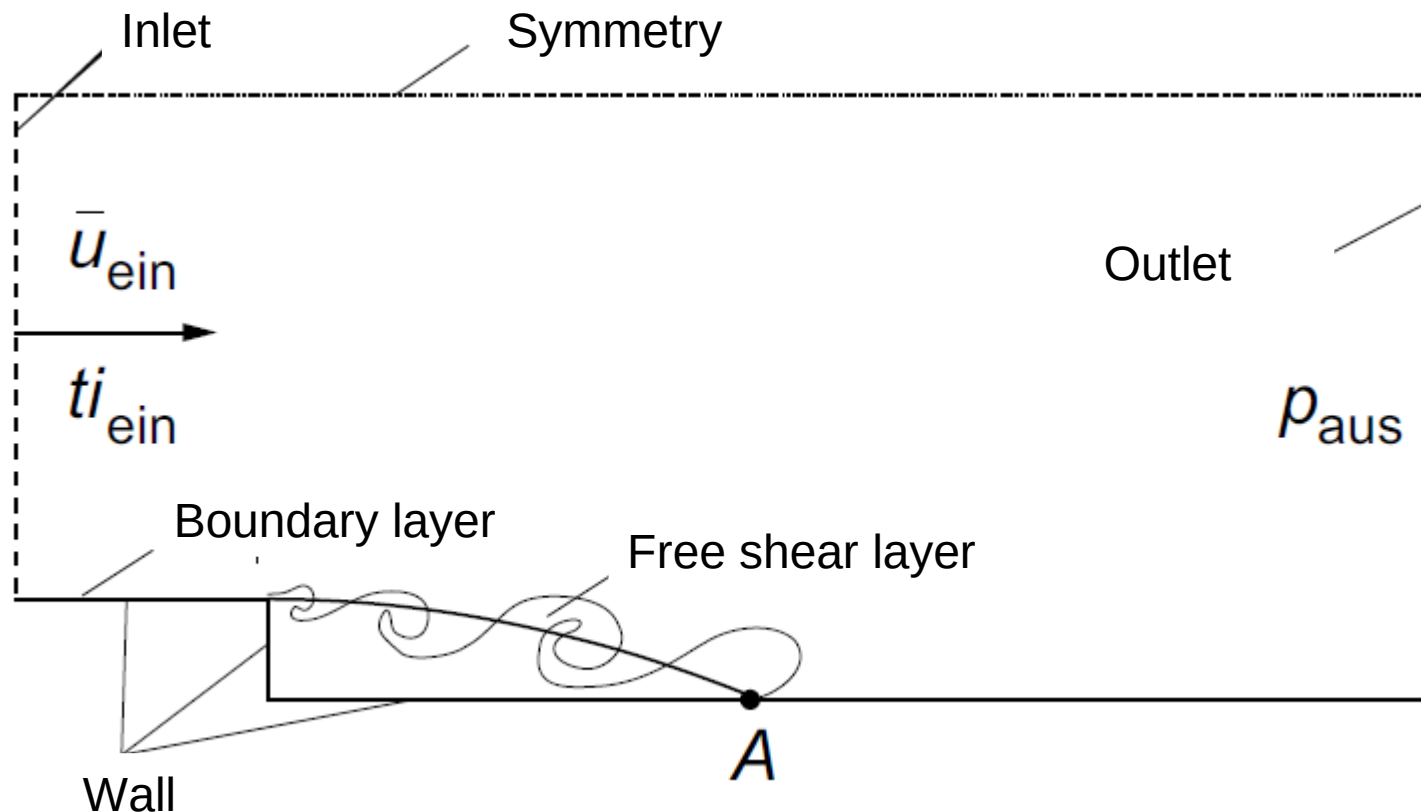
3D-Simulations of engine-related fluid mechanics / combustion using the software OpenFOAM®

- Turbulence Modeling
- Combustion Modeling
- Spray Modeling
- Engine Simulation

Dr. Dietmar Schmidt
IVK

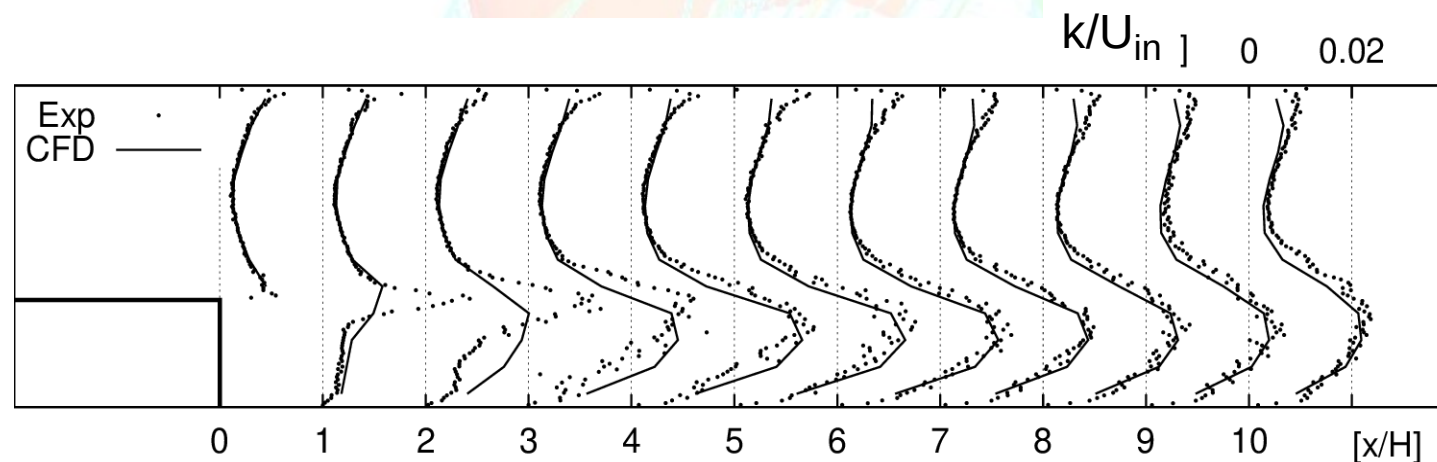
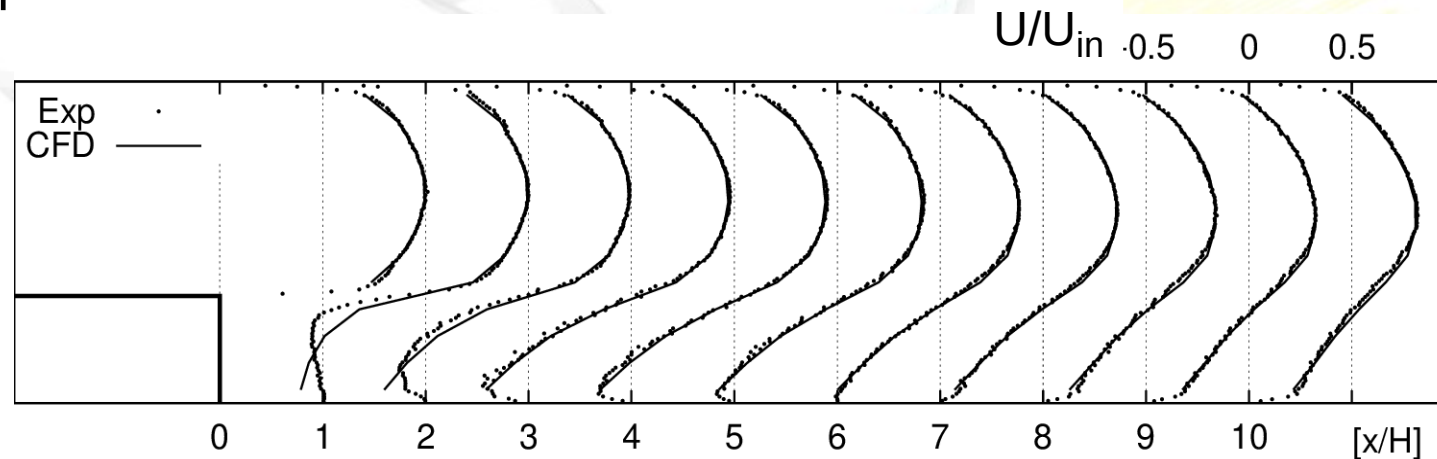
Turbulence Modeling

- Simulations of turbulent flows over backsteps, curved pipes, etc.
 - Boundary layers, Turbulent shearflows, ...



Turbulence Modeling

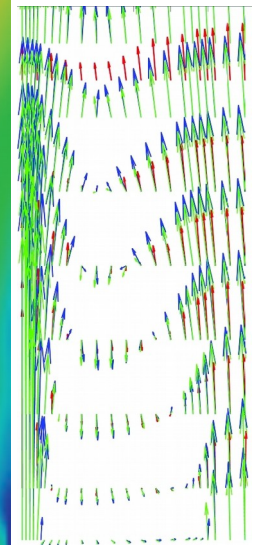
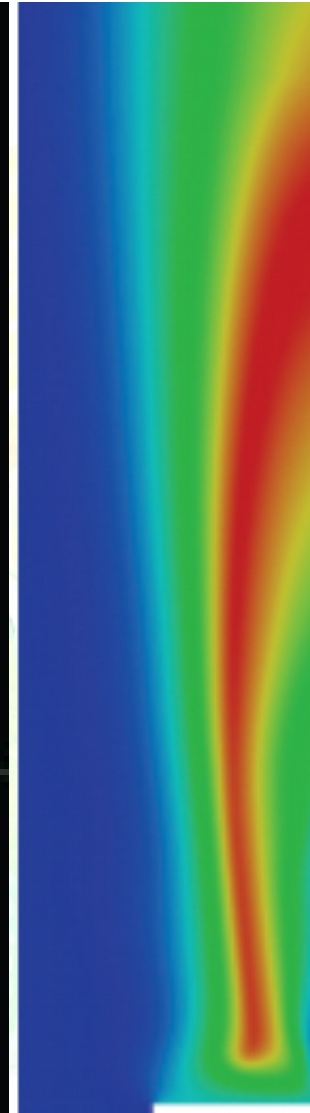
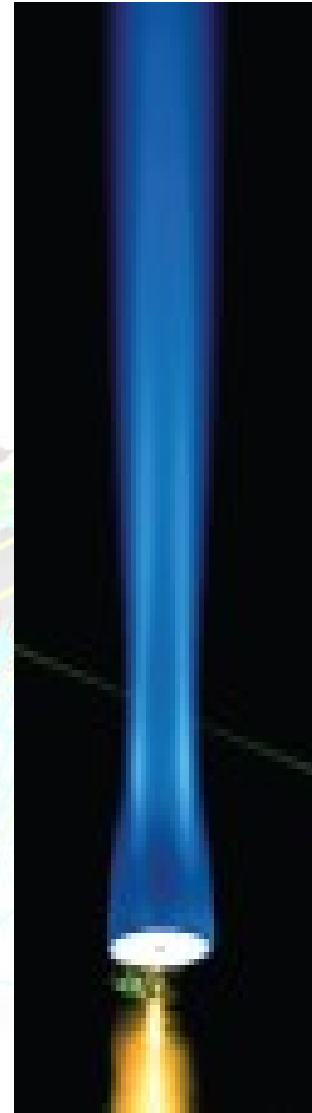
- Validation of flow field data and turbulence properties against experimental measurements



Combustion

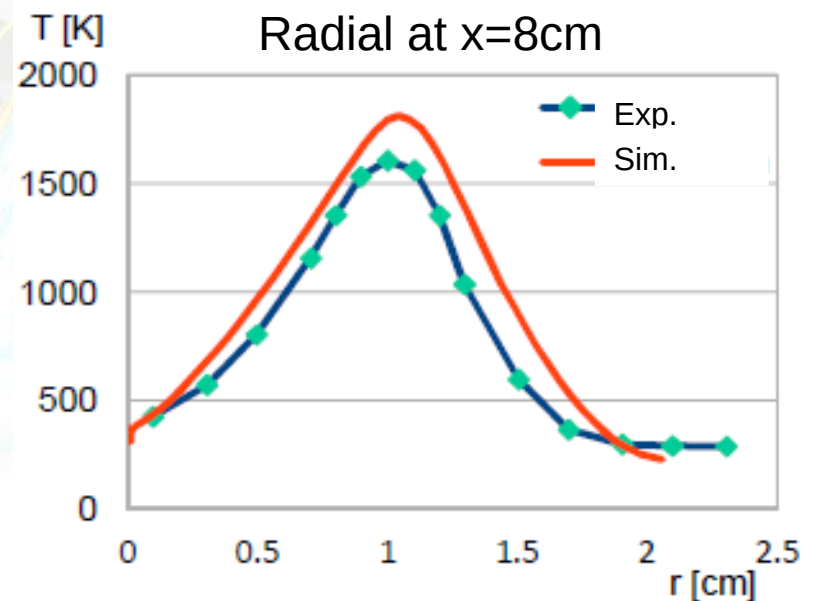
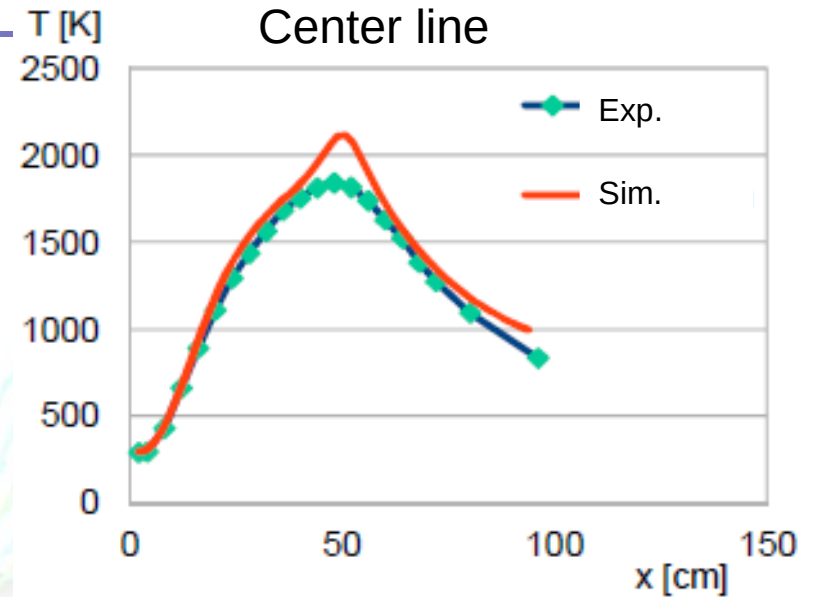
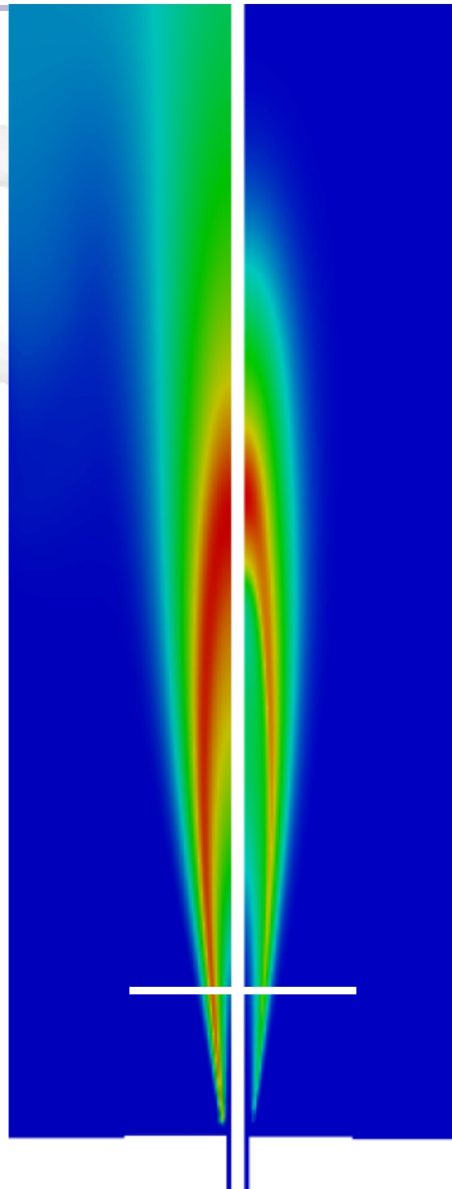
➤ Simulations of Jetflames

- Kinetic schemes
- Coupling of chemistry and turbulence

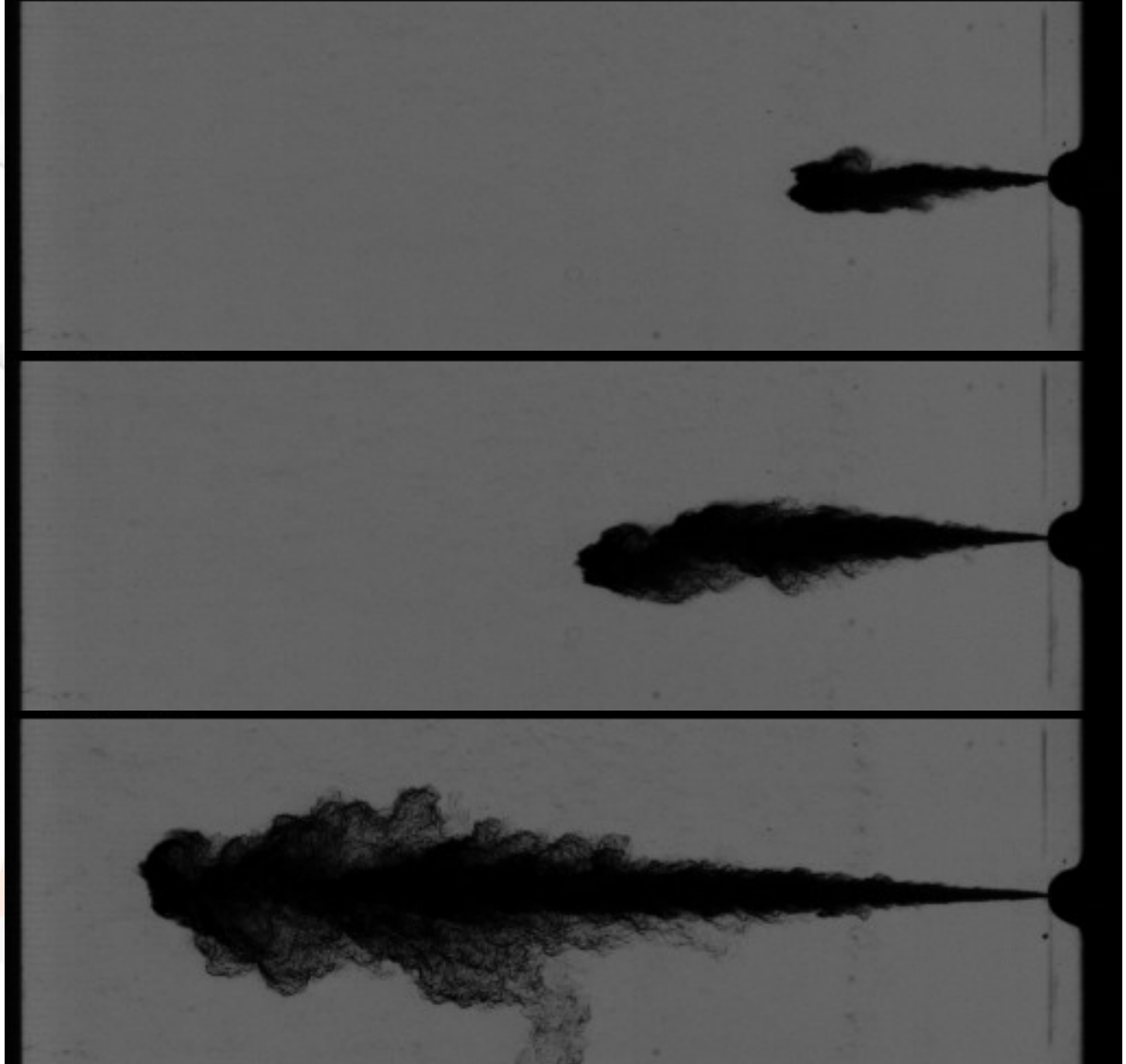


Combustion

- Simulations of jetflames
- ... and validation based on experimental data



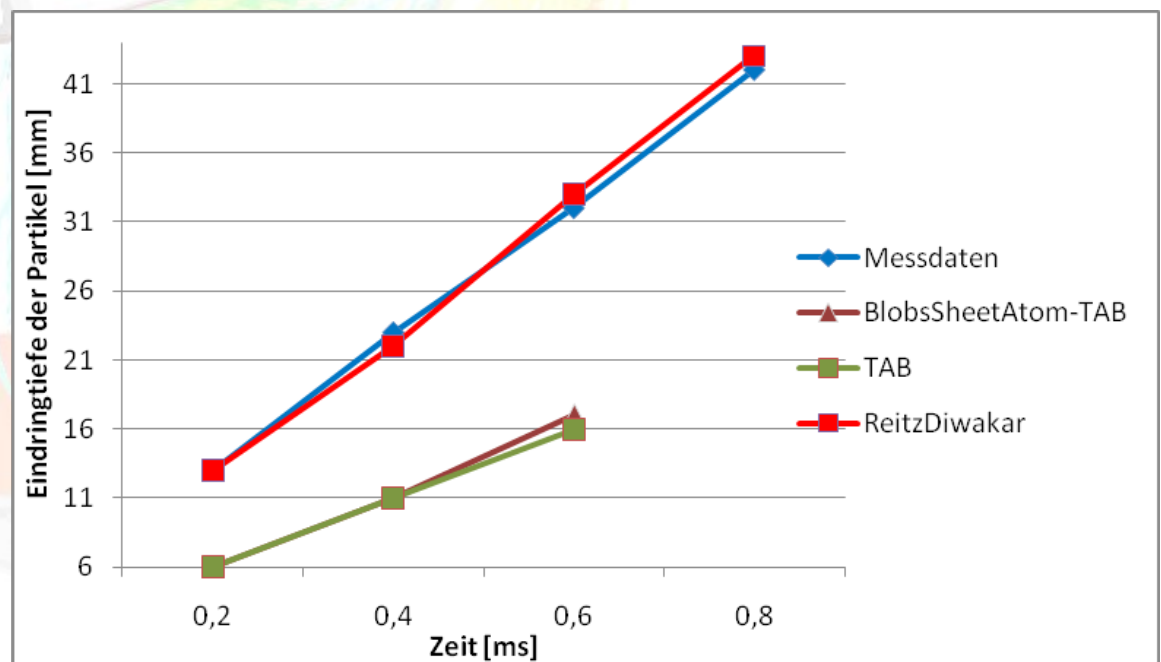
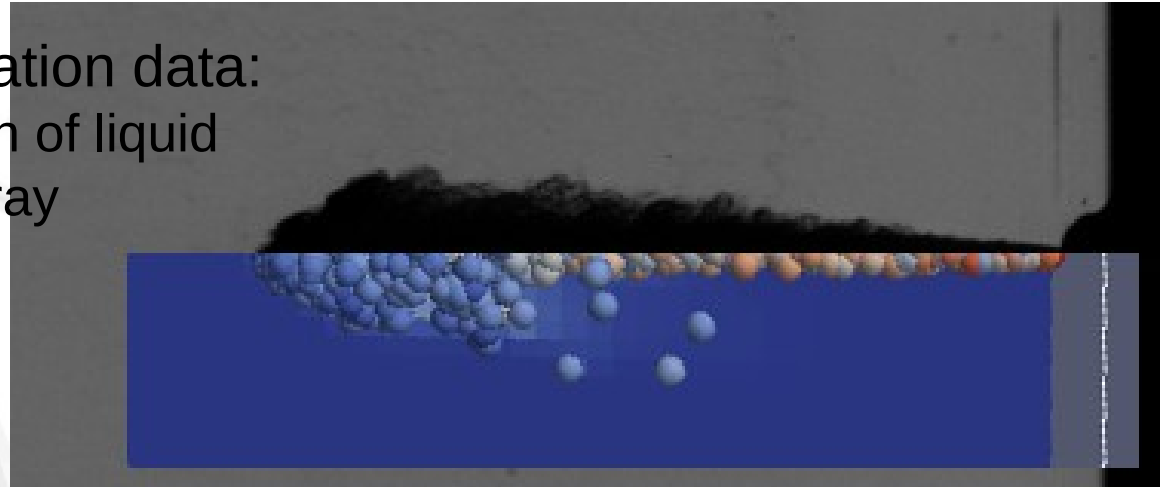
Injection of a liquid spray into a combustion cell
[Source: Stotz, Univ. Stuttgart, ITLR, 2008]



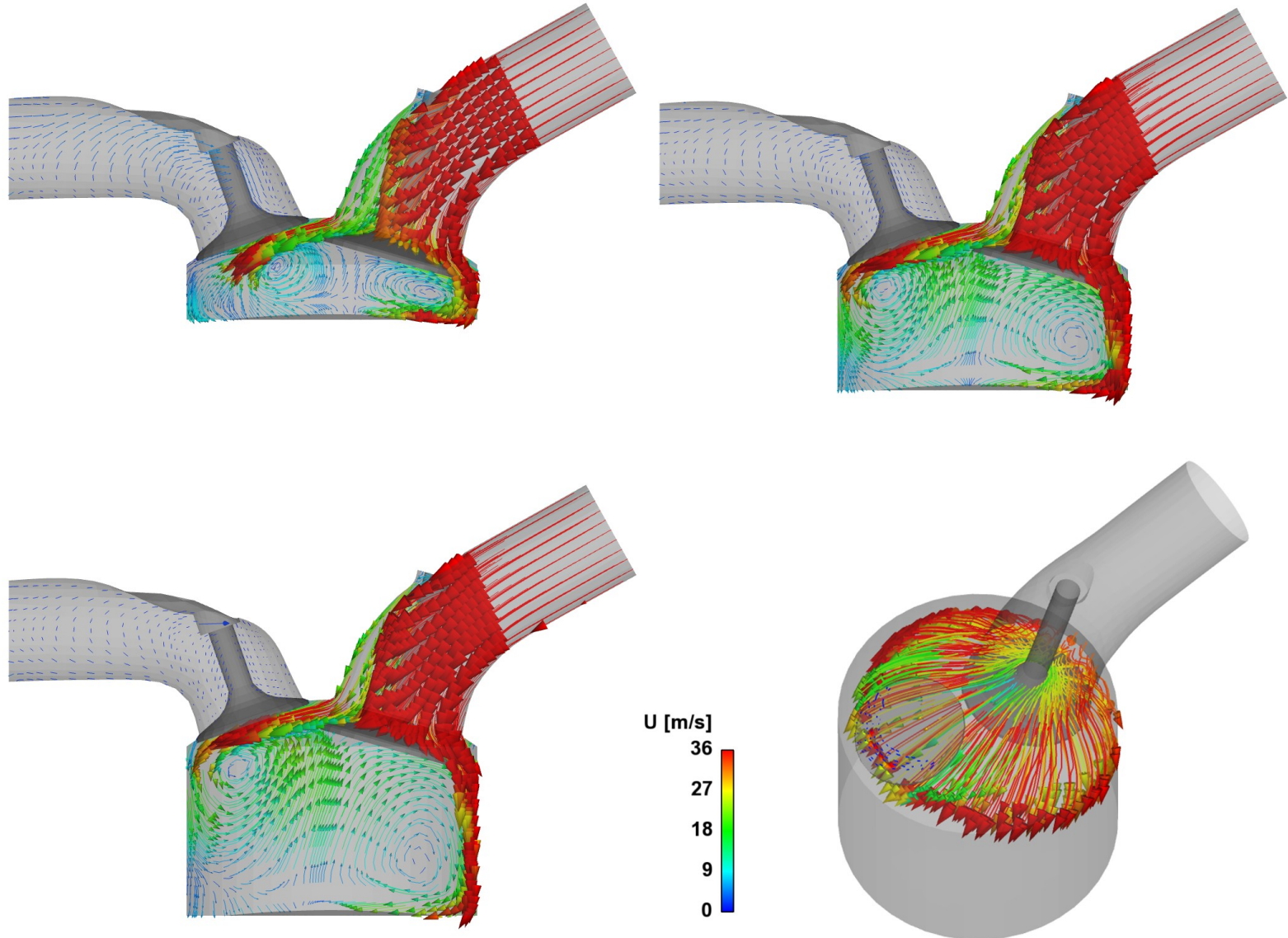
Injection (2)

➤ Validation of simulation data:

- penetration length of liquid
- cone angle of spray
- ignition delay

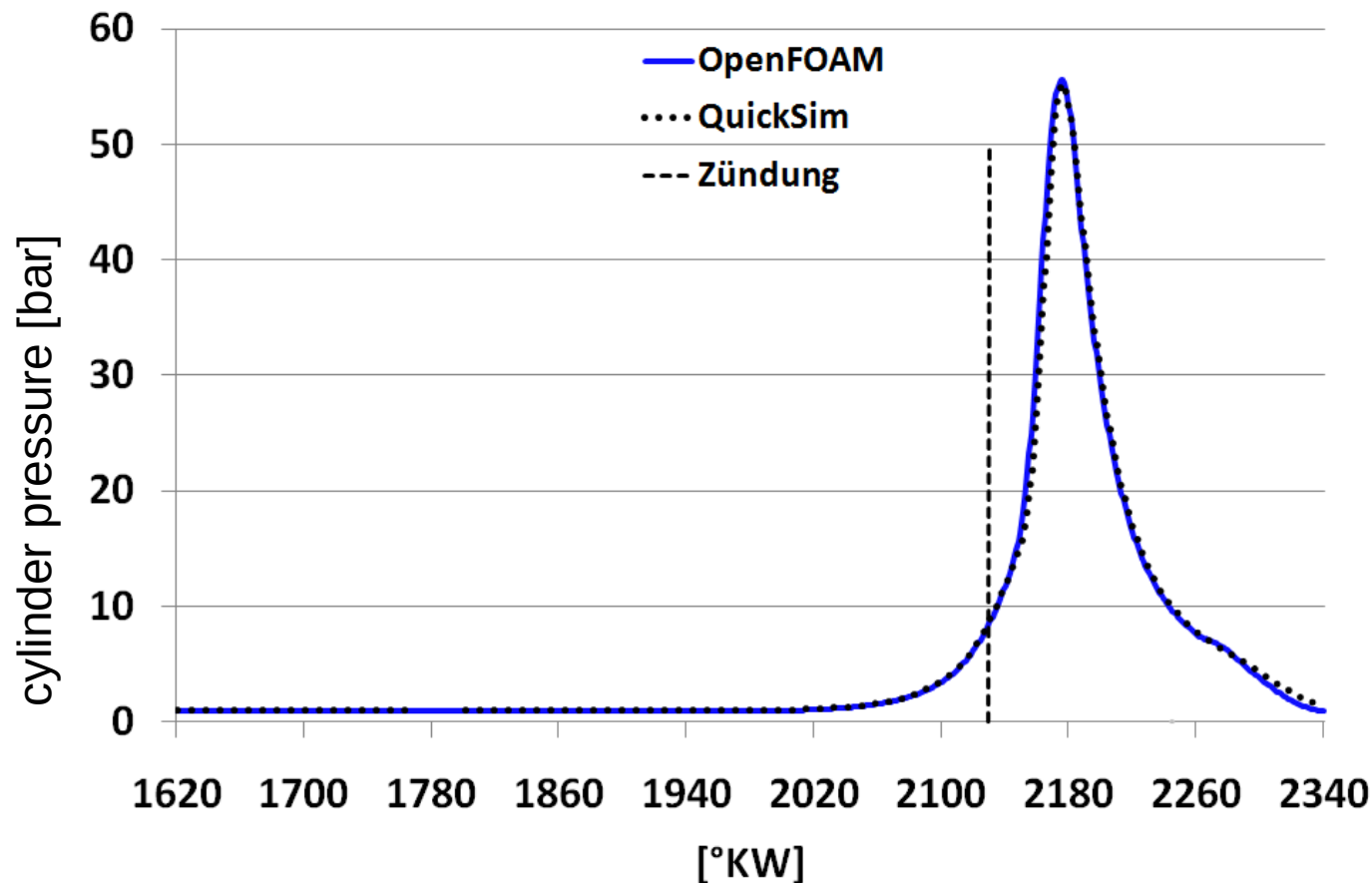


Engine Combustion



Engine Combustion

- Validation of simulation data:
- pressure trace from test bench
 - and other simulation data

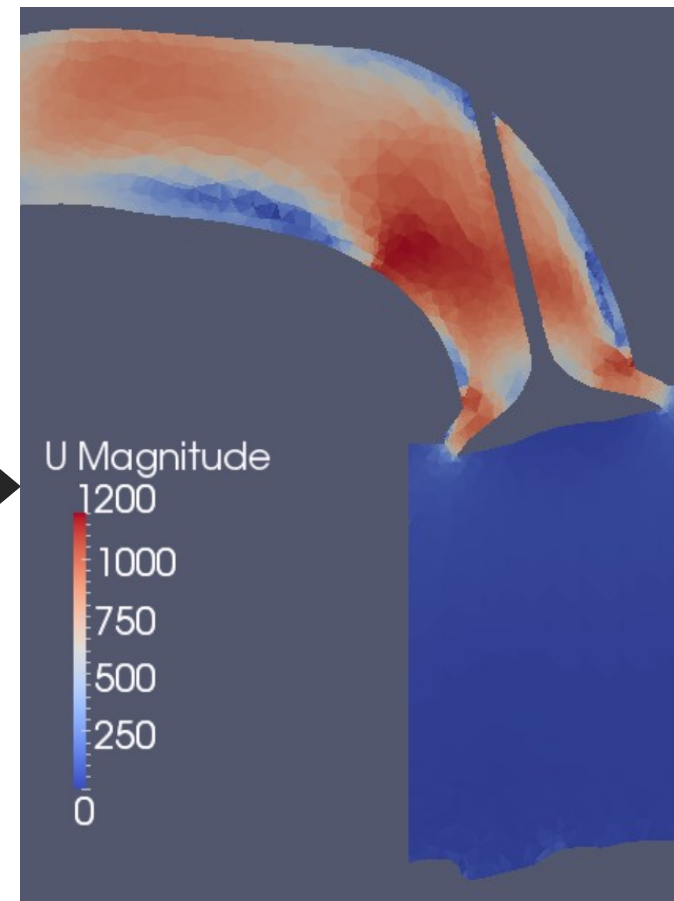
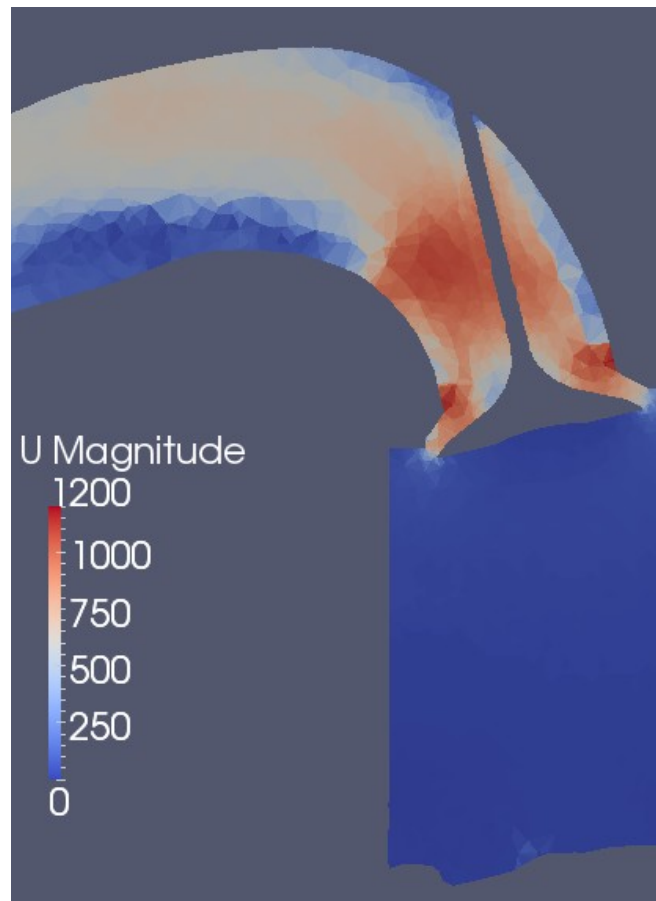


Formula Student

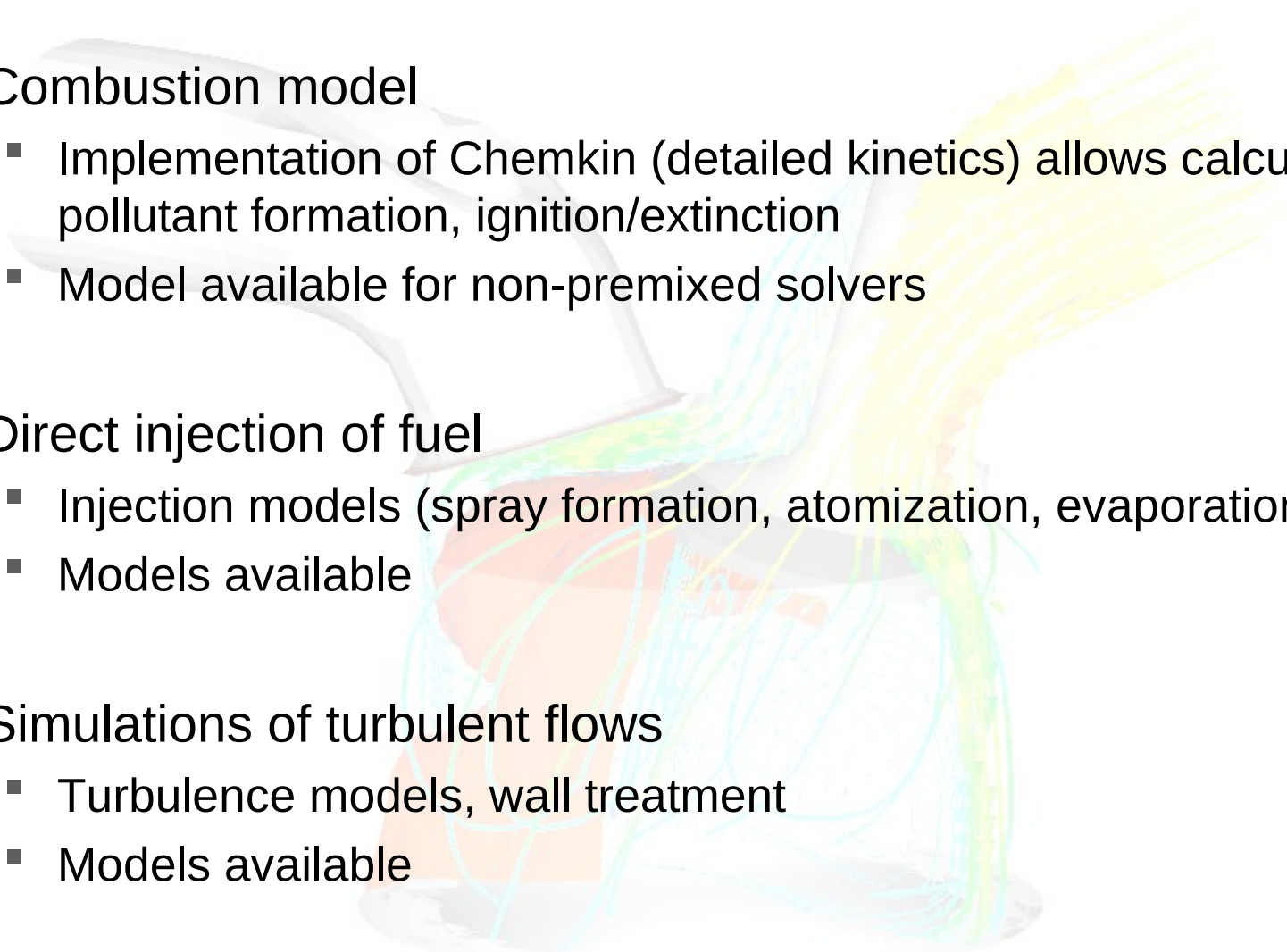


Quelle: FSG Zenker

Optimization of the Exhaust Pipe



Work to be done ?

- 
- Combustion model
 - Implementation of Chemkin (detailed kinetics) allows calculation of pollutant formation, ignition/extinction
 - Model available for non-premixed solvers
 - Direct injection of fuel
 - Injection models (spray formation, atomization, evaporation)
 - Models available
 - Simulations of turbulent flows
 - Turbulence models, wall treatment
 - Models available
 - ...

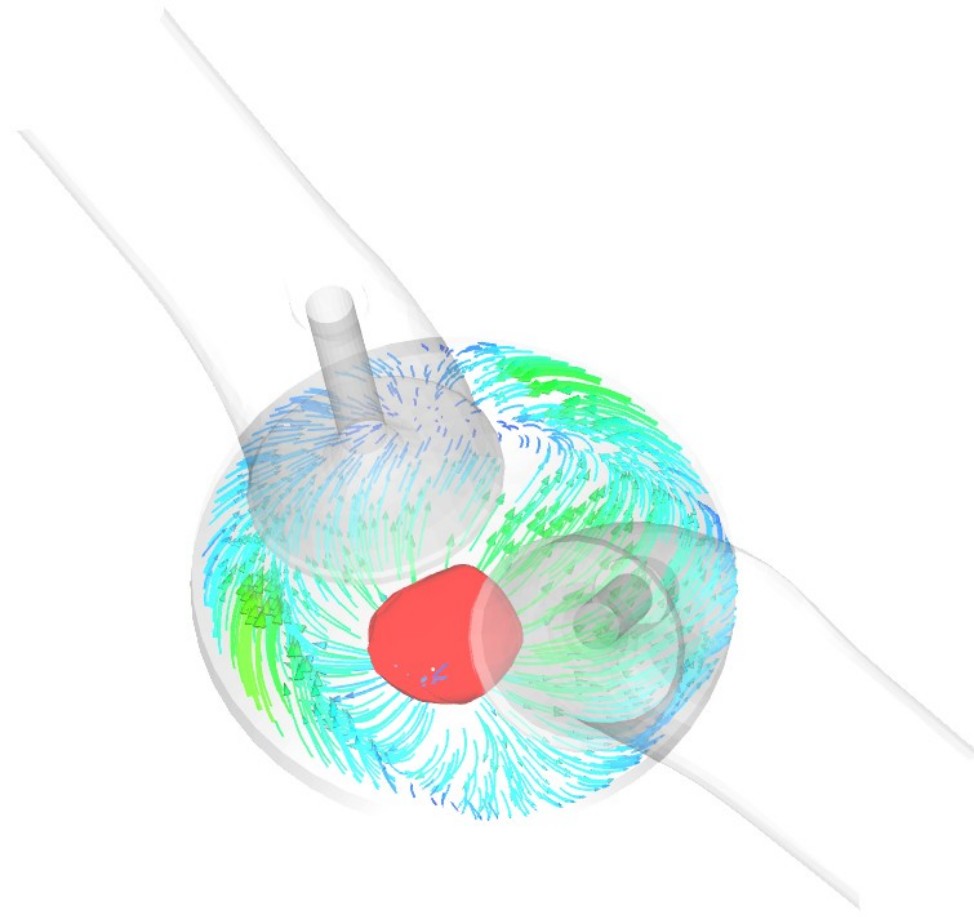
Prerequisites

- Have fun on computer work
- Don't fear on programming languages (preferably C++), but not needed!!!
- Work self-consistently

Goal

- Learn something new !
 - ✓ Fluidynamics
 - ✓ Numerical fluidynamics
 - ✓ Operating system (Linux)
and CFD software (OpenFOAM)
 - ✓ ...

Thank's for your attention



Questions?

Interest? Then: dietmar.schmidt@ivk.uni-stuttgart.de