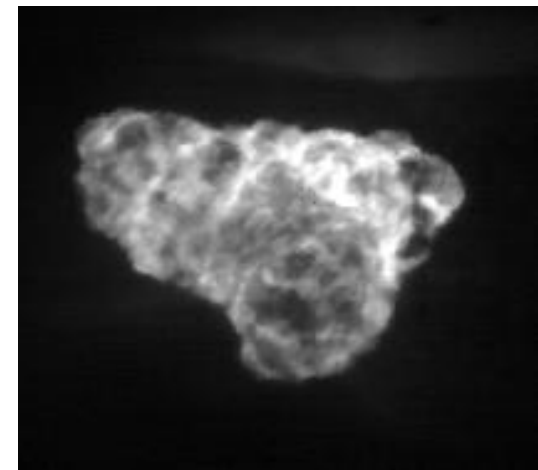
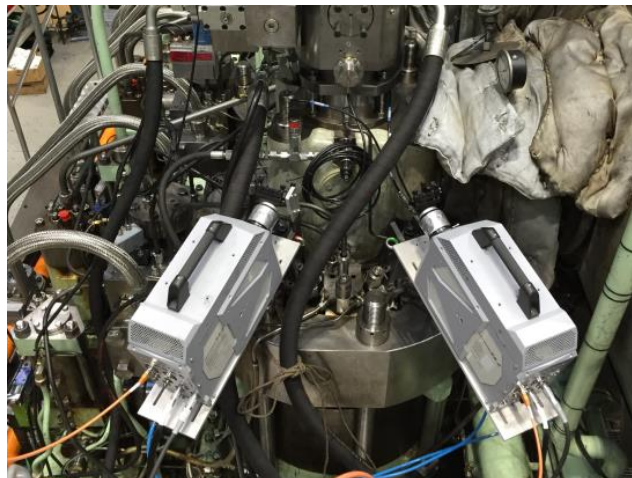
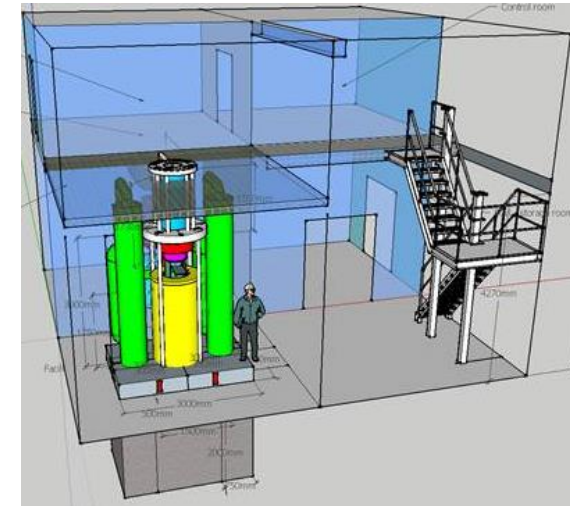


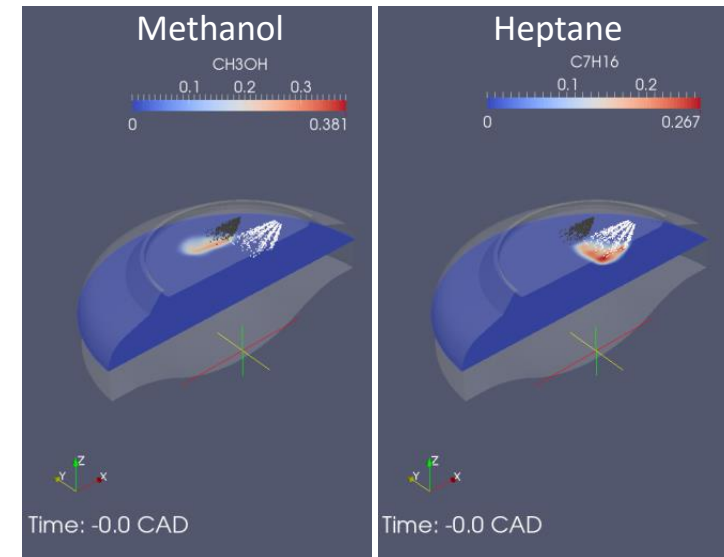
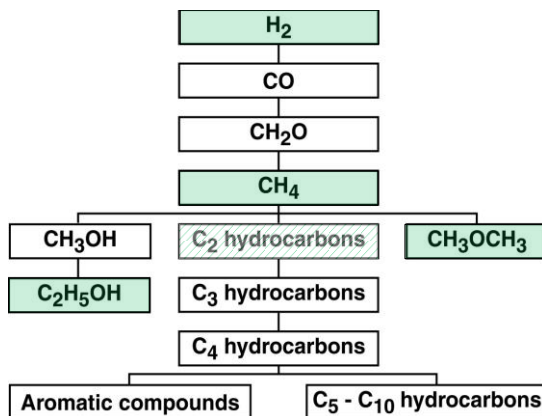
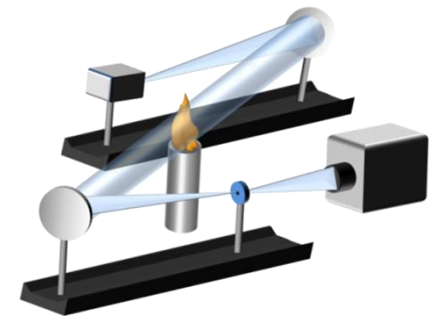
Main results achieved during 1st year

- Fuel flexible test facility concept study
 - Ø500 mm, optical access, expansion, $P_{\max} \sim 200$ bar
 - Building specifications, infrastructure requirements
 - Design work started
- Optical engine test: ME-GI operation on Ethane
 - 2×Photron SA-Z high-speed cameras (20000 fps)



Main results achieved during 1st year

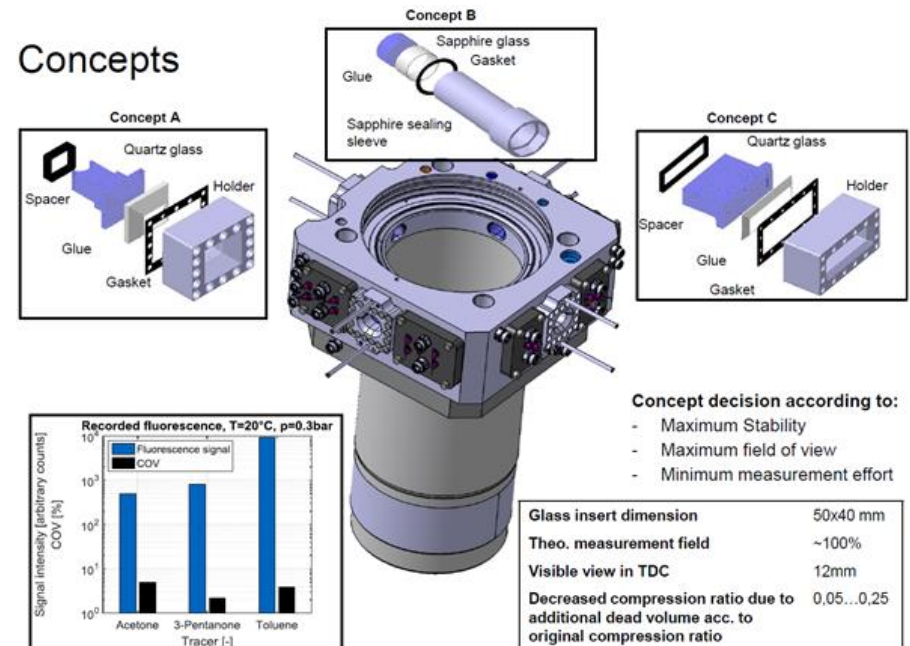
- High-speed Schlieren/shadowgraph system developed
- First test of multi-camera flame mapping
- Detailed chemical kinetic model developed and improved (methane, ethane, propane, methanol, ethanol)
- Experimental rig for high-pressure validation of propane and butane chemistry modified
- Porting to CFD, multi-fuel feasibility test



Main results achieved during 1st year

In-cylinder mixture formation

- Comparison of different possible optical accesses → finished
- Detailing of different concepts and decision → finished
- Procurement Process for necessary Engine Components and Measurement Equipment → started
- Integration of possible measurement techniques into optical engine concept → ongoing



Conceptual designs for an optical accessible engine

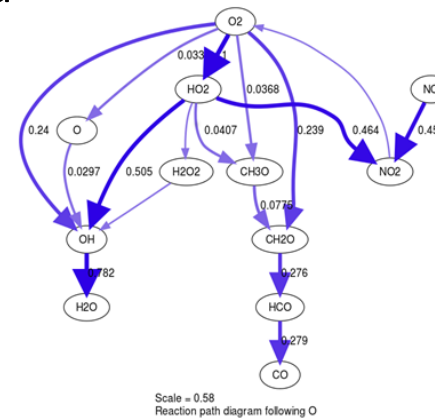
Main results achieved during 1st year

Fuel-specific engine-control strategies

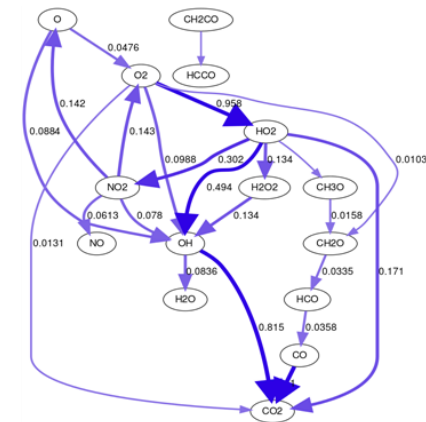
- First basic engine tests → finished
- Preparation of single cylinder parts and spray chamber measurements for investigation of different fuels → 3 Months Delay due to Single Cylinder Availability (can be recovered; no influence on Deliverable)

Low temperature NO_x formation

- Detailed Kinetics Simulation Parameter Studies were done based on Single Cylinder Engine Measurements → finished
- Build up of 3D CFD Model → ongoing



reaction path following O



NO₂ reaction path

Future Work (year 2)

MAN-CPH:

- Fuel-flexible test facility: Detailed design, building work, sub-system procurement
- Optical engine tests (LNG & LPG?)
- CFD: implementing chemical mechanisms, alternative fuel simulations

Lund:

- Test of high-speed Schlieren/shadowgraph for test engine and test facility
- Design and test of compact fuel jet visualisation units
- Multiple-camera flame volume mapping

DTU:

- Detailed chemical kinetic model extended to butane (LPG)
- Experimental validation of mechanism for propane and butane
- Reduced mechanisms for different ignition scenarios

Future Work (year 2)

MAN-AUG & TUM

- Procurement of the optical accessible single cylinder engine components and the necessary measurement technique
- Build up of optical accessible engine and measurement technique to evaluation in-cylinder fuel distribution
- Spray Chamber measurements for investigation of different fuels
- Single cylinder engine tests with different fuels
- Build up of 3D CFD model and link to detailed kinetics model