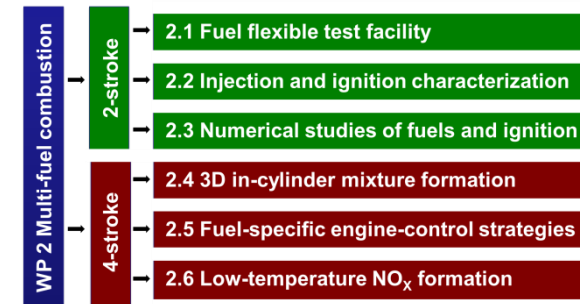


Objectives of Work Package

WP Leaders: Dr. Johan Hult
Christian Kunkel

- Further improve fuel flexibility of marine engines
- Increase understanding of injection, ignition, combustion and emissions formation for novel and mixed fuels → efficient operation
- Develop experimental and numerical tools required to exploit alternative fuels in marine engines:
 - Experimental facilities with optical access
 - Development of numerical tools
 - Development of novel control strategies



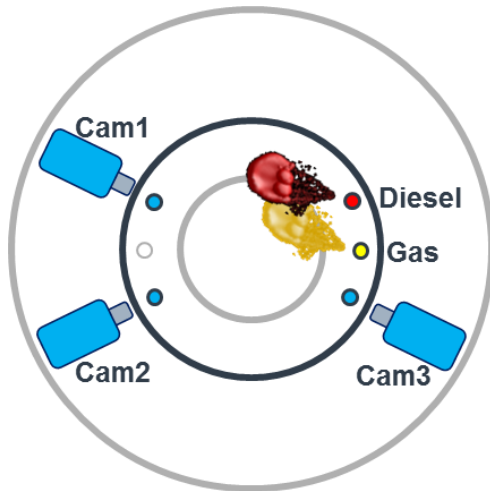
Partners:



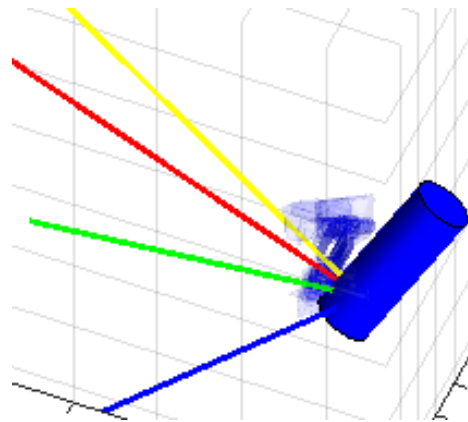
POLITECNICO
MILANO 1863

Progress M24-M30 (WP2.1 & WP2.2)

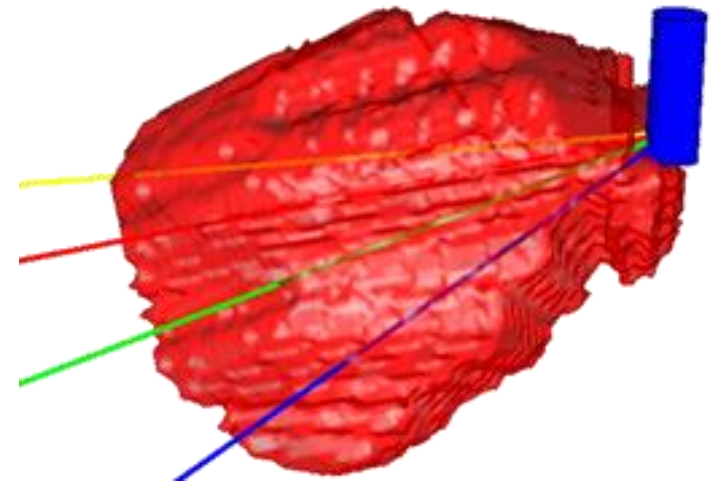
- Design of improved optical inserts for CPH test engine finished
- Preparations for next optical tests (MAN+LUND) in progress
- Data processing of tri-camera data for CFD validation



*3×High-speed camera
flame imaging*



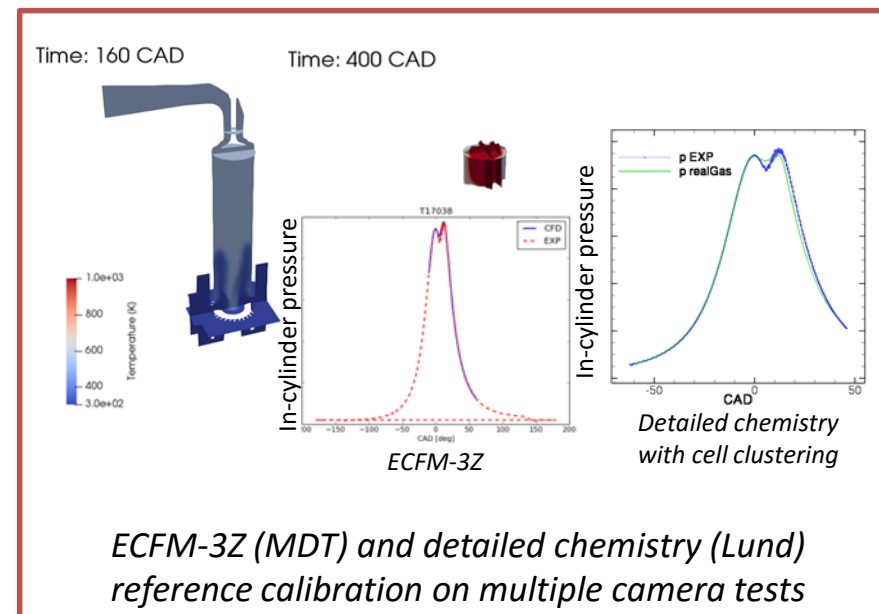
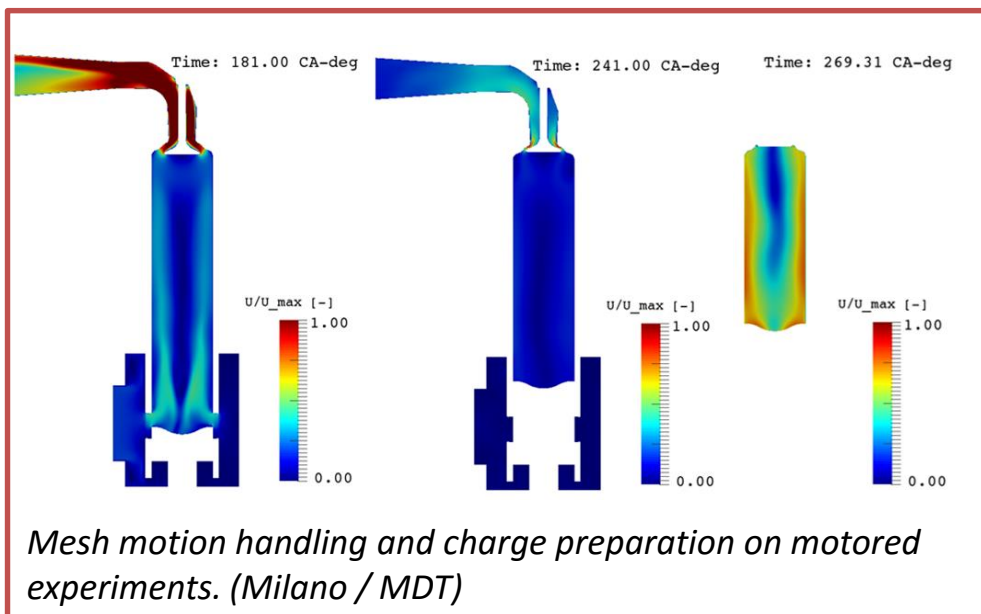
Ignition location statistics



Flame shape estimation

Progress M24-M30 (WP2.3)

- Validation of detailed chemical kinetic model for LPG (propane/butane)
- CFD is focusing on using detailed chemistry for LNG (from DTU). To boost progress new partner groups assist with:
 - *Mesh motion handling for fast and robust CFD simulations (Milano)*
 - *Turbulence/chemistry interactions and cell clustering for detailed chemistry (Lund)*
 - *Charge preparation & tabulated chemistry (Milano)*



Future Work

- Optical engine tests:
 - *high-speed Schlieren/shadowgraph (MDT&Lund)*
 - *LPG (MDT)*
 - *lubrication visualisation (MDT&Lund)*
- Data processing and CFD validation using Tri-camera data
 - *will form CFD validation cases for partners (MDT&Lund)*
- CFD:
 - *further work on mesh handling for speedup (Milano)*
 - *use of detailed chemistry using cell clustering (Lund)*
 - *test of tabulated chemistry approach (Milano)*

Progress update

2.4 In-cylinder mixture formation

lateral access:

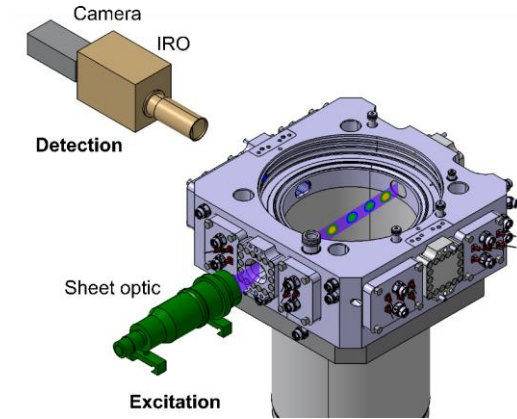
- Tested up to 100% → finished ✓
- Investigation of flame luminescence → finished ✓

vertical access:

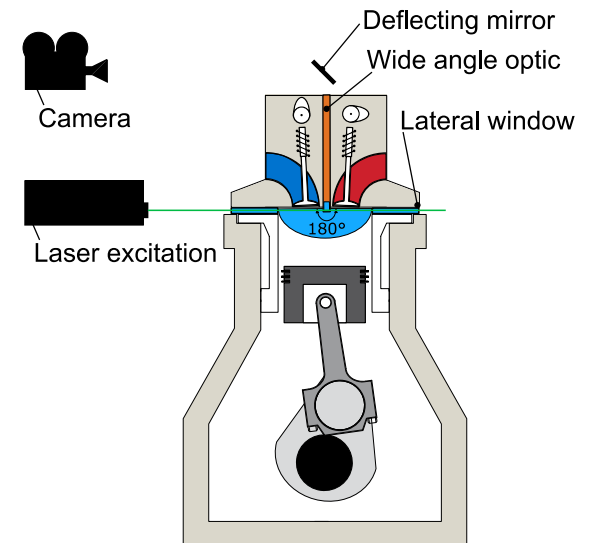
- Design and strength calculation → finished ✓
- Procurement and installation of parts → ongoing ⚠
- 3D CFD mixture formation → ongoing ⚠

Tracer devices:

- Design and calculation → finished ✓
- Procurement and installation → ongoing ⚠



Design for measuring mixture distribution



Vertical optical access

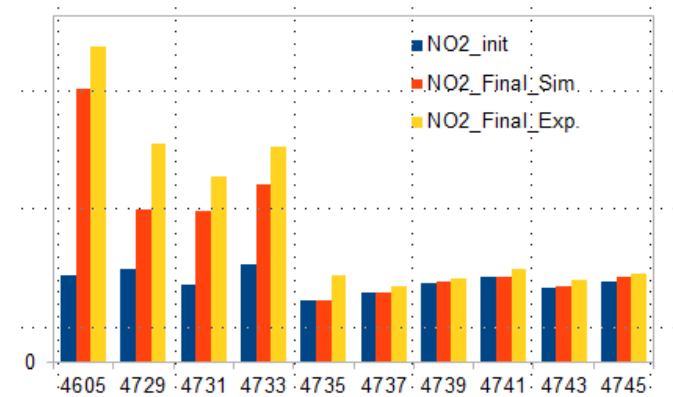
Progress update

2.5 Fuel-specific engine-control strategies

- Analyzation of base data (fuel1 and fuel2) → finished ✓
- Definition of strategy for adv. inj.-timing → finished ✓
- Validation strategy on full scale engine → open ⚠

2.6 Low temperature NO_x formation

- FTIR-measurements (diff. positions) → finished ✓
- Definition of appropriate kinetic mechanism → finished ✓
- Validation of model with engine data → finished ✓



Simulation (red) vs. experiment (yellow)

Future work

- Installation of 2nd optic release on the Single Cylinder Engine
- Initial Operation with 2nd optic release on Single Cylinder Engine
- Optical Investigations with 2nd optic release on Single Cylinder Engine
- Combination of 1st and 2nd optic release
- Further improvement of optical measurement techniques
- Installation of Tracer-Devices on test bench and engine tests

- Full Scale Engine tests with advanced injection timing with fuel 2

- Finalizing of report for NO/NO₂ model