Experimental study of low-carbon fuel injection and combustion in marine engines

Introduction

Ambitious goals of the International Maritime Organization envision a decarbonization of the international shipping industry until 2050. New synthetic fuels such as Ammonia (NH_3) and Methanol (CH_3OH) are promising options to reduce green-house-gas emissions from marine internal combustion engines. Their thermophysical properties deviate strong from conventional compression ignition fuels resulting in slow reaction kinetics. These can be improved by dual fuel injection strategies, injecting small amounts of high reactive fuels as ignition and combustion promotion.

Primary objective

Identify and determine injection parameters supporting a retrofit of current marine engines with low-carbon NH_3 and CH_3OH.

Secondary objectives

- Characterize experimentally the dual fuel combustion of NH_3/CH_3OH (main injection) and various ignition promoters (pilot injections) in a constant volume combustion chamber.
- Identify the maximum practical NH_3 and CH_3OH energy share for various pilot fuels to reduce ignition time and increase reliability of combustion.
- Determine the best injection timings and spray interaction between main and pilot injections.

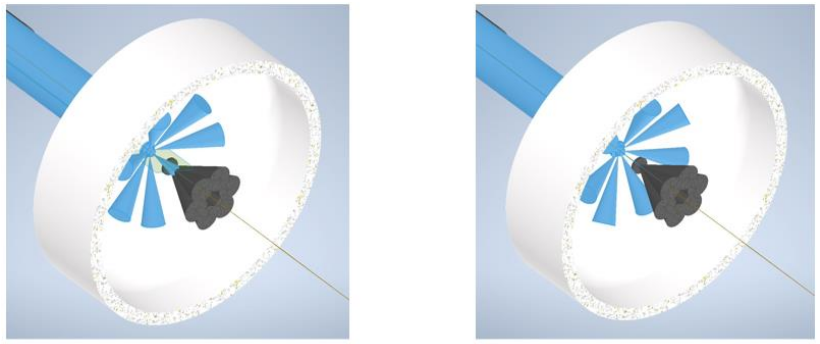

Fig.1: Spatial plume interaction of main and pilot

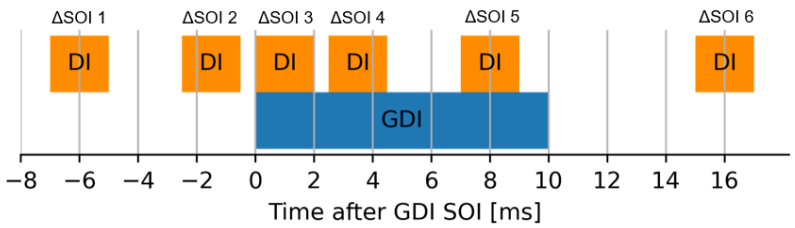

Fig.2: Temporal plume interaction of main and pilot

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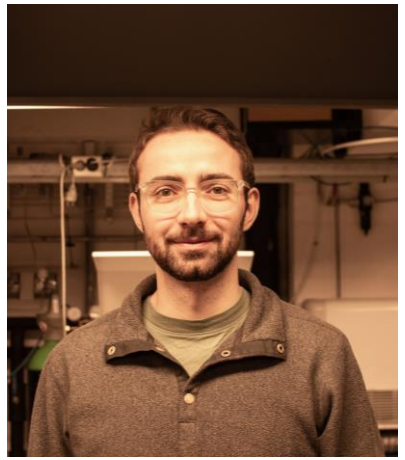

Estimated progress of the PhD project:

Just started ...	< 50 %	> 50 %	Almost done ☺

Publications

Oftedahl, Live; Zilles David. (2023) Flytende ammoniakk og methanol kan bli fremtidens drivstoff. (Blog entry)