Introduction
Next to the use of fossil fuels, other fuels are increasingly becoming the focus of public discussion. Reasons for the search for alternatives are the limited crude oil reserves, but also the environmental pollution and emissions that occur during the combustion of mineral oil products and their additives. An alternative to diesel or gasoline offer bio-alcohols such as ethanol. Ethanol, such as other alcohols, absorbs water from the air contained moisture. To understand the impact of water content in ethanol, either due to long term storage or due to water injection strategies during combustion, extensive laminar flame velocity ($S_f$) experiments have been performed.

Experimental setup
The laminar burning velocity of ethanol-water-air flames at atmospheric pressure and initial gas temperatures of $T = 358$ K was measured with the heat flux method. The mixture of ethanol-water-air contained 0%, 10%, 20%, 30% and 40% water by mole and the equivalence ratio ($\phi$) range was varied from 0.7 to 1.4.

Modelling
The experimental data were simulated using three kinetic models of Maghreher et al. [1] based on a series of previous developments [2-4]. The model of Shrestha et al. [5] focused on the oxidation of methanol and ethanol and their fuel interaction with NOX chemistry. The modelling of both were performed with LOGEResearch [8]. The last model, a mechanism of Konov and coworkers [7] based on the Konov mechanism version 0.6.8 [8] and include extensive updates and validation for methanol. The numerical calculations for this model were performed with CHEMKIN-PRO software package.

Results and discussion
Figure 2 compares the present data including error bars with published data and shows good agreement. The overall accuracy for $S_f$ was around 1 cm/s. At lean and near stoichiometric conditions the obtained $S_f$ is slightly faster in comparison to other experiments.

The $S_f$ measured by Sileghem et al. [9] agrees very good for lean and rich mixtures with the present measurements. At $\phi = 1.3$ the present data found to be close to the data of Dirrenberger et al. [10] and Sileghem et al. [9] with a difference below 1 cm/s. The $S_f$ of Liao et al. [12] are generally 6 cm/s slower at all conditions than the presented results. It should be noted that Liao et al. [12] used a combustion bomb to determine the $S_f$.

The $S_f$ obtained along with their uncertainties are compared against the predictions of three models seen in Figure 3 to Figure 5. It is seen that the experimental $S_f$ for ethanol-water-air mixtures decrease with increasing the water content 10 - 40%.

Conclusions
The $S_f$ measured by Sileghem et al. [9] and Dirrenberger et al. [10] shows a close match with present experiments, which were obtained using the same method. The kinetic model of the group of Konov et al. [7] agrees best with present data. The model of Shrestha et al. [5] displays a good agreement at lean and rich conditions with an underprediction at stoichiometric mixtures.

References