AKTION PROJECT 37p6

„Action monitoring methods in the combustion chamber of the spark ignition engine“

(October 2003 – December 2003)

FINAL REPORT

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Resume of research activities

In this project done in cooperation with TU Graz (Mr. Winkler) and AVL Graz (Mr. Werlberger) were using a PCO DICAM PRO camera with a higher sensitivity for the observation of the burning process of a homogenous mixture. This report presents the first view of the combustion process of homogenous mixture in the petrol engine and in the gas (natural gas) engine from the firing point of the air-fuel mixture until after the combustion process has finished. It draws upon previous research of the thermodynamic analyses of high-pressure indication in these engines about the important (positive) influence of the indirect ignition mode on the completion of the combustion process.

The laboratory of the department of transport machines is equipped with AVL Visioscope observation equipment, with which it is possible to observe the combustion process inside the cylinder of the engine. In its basic setup the AVL Visioscope works with a camera, this is able to make a first-rate recording and analysis of the combustion process in a diesel engine (heterogeneous mixture). This camera does not possess the sensitivity for the observation of the combustion process of a homogenous mixture in a spark-ignition engine. For the utilization of this camera, it was necessary to install a graphic instrument and evaluation

device system along with a new camera to the original AVL Visioscope device. After installation process it was necessary to verify the new camera's function with an observation of the combustion process in a petrol engine and a gas engine. A compliance test of the cameras was done on both engines with ignition of the mixture using a classic spark plug, and by means of indirect ignition of the mixture.

The results from the observation on both engines, were modified to enable the easy comparison of the development of the combustion process, with ignition of the mixture by a classic spark plug and also with indirect ignition of the mixture, which were compiled are presented on the following pages of this report (Figures 4,5): This demonstrates unambiguous evidence of the positive effect of indirect ignition (Both with the indirect ignition spark plug and with only the electrode protected - without enclosure of the bottom cell).
Effective measuring was realized with a higher sensitivity camera, which belongs to AVL.

1. AVL observation equipment creates a picture of the combustion process in a cylinder engine with a gradually built up picture record of the combustion process at a single crankshaft position in different cycles with the engine in a steady operating mode (the individual scan of picture is with a maximum frequency of 10 cps). That is how we created a picture of the combustion process, which is naturally affected by the variability of the combustion process between single cycles (especially with an SI engine). With a multiple record picture of the combustion process, it is possible to watch the variability at an identical crankshaft position in a different working cycle.
2. The PCO DICAM PRO Camera works in black and white mode. We can change the results with special software from black and white, to chromatic (Termovision).

Liberec, May 27, 2004

Eng. Josef Blažek

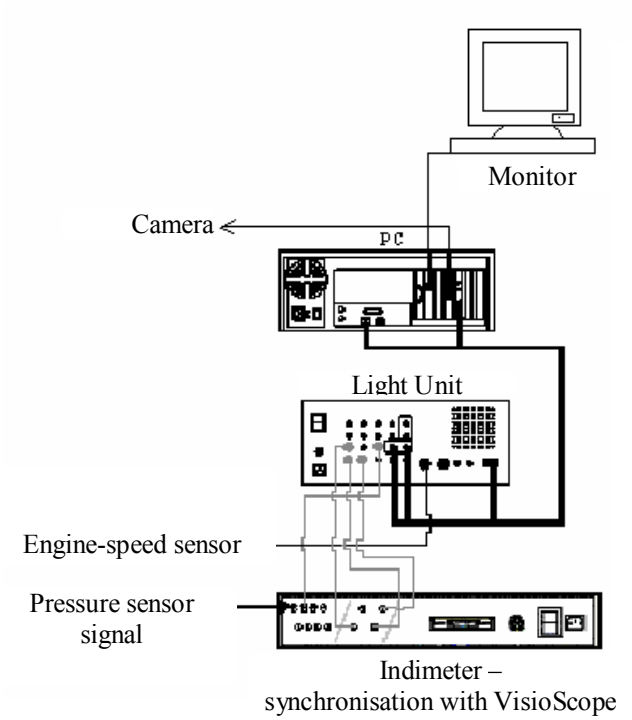

Fig.1: Measuring system for the observation of the combustion processes in the combustion chamber of the piston engine, including the connection to the indicating equipment

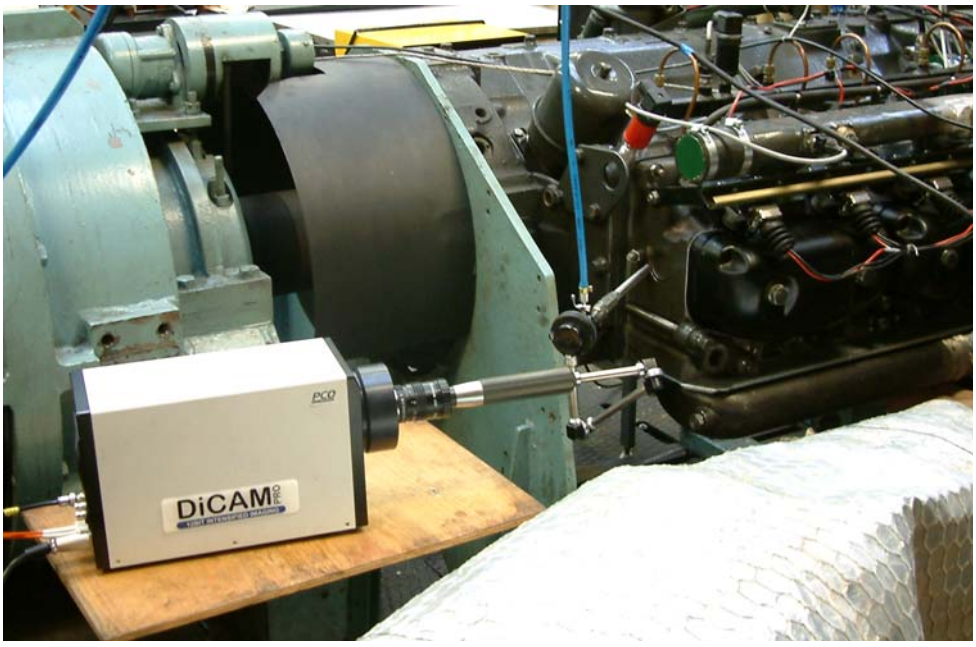

Fig.2: View of the cooled endoscope with camera connected by means of an optical link

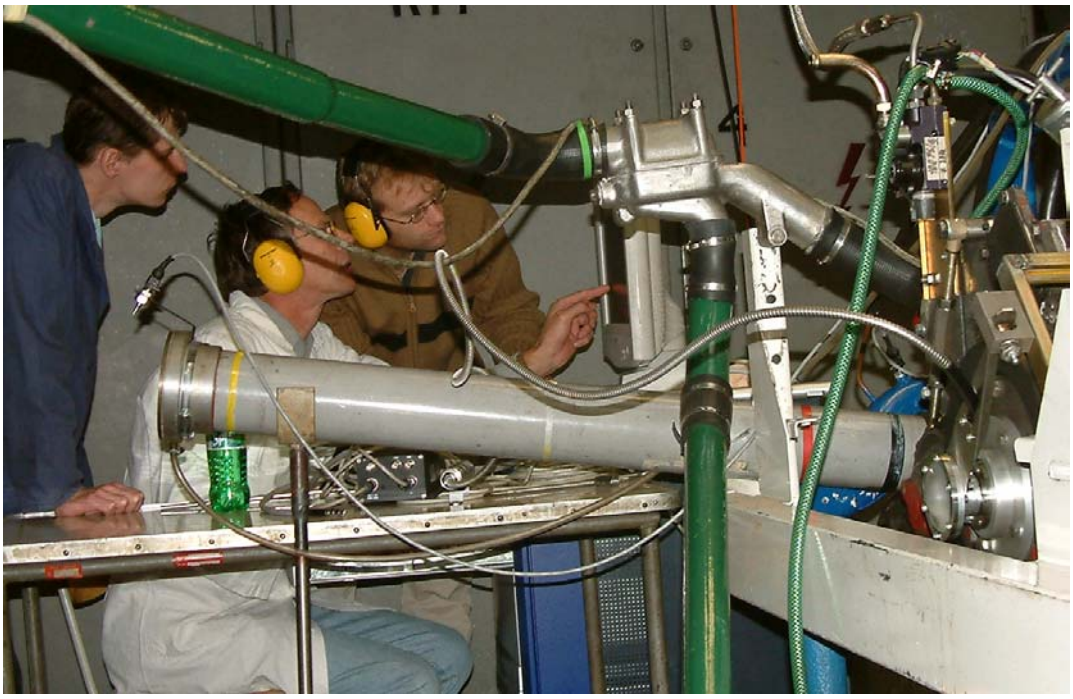

Fig.3: Discussion about the results of the combustion process in the gas engine

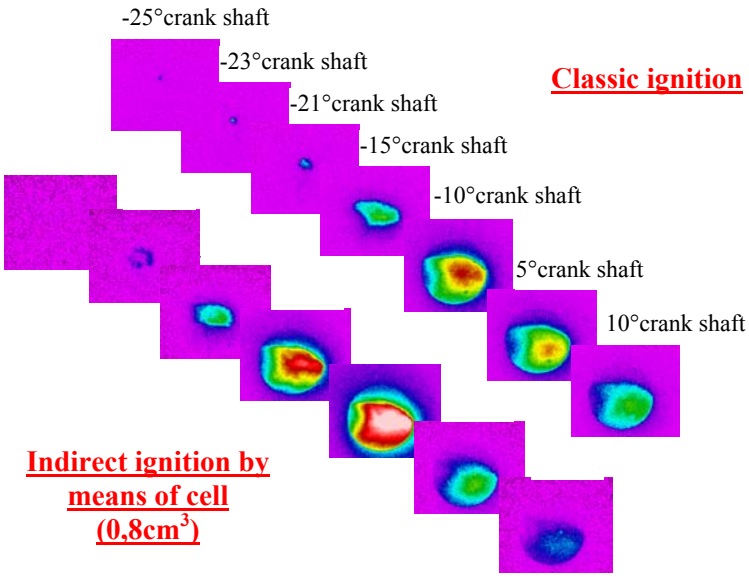

Fig.4: Petrol engine Škoda 1.4 MPI
n=2500 RPM, Mt = 60 Nm, α=29° crank shaft before TDC

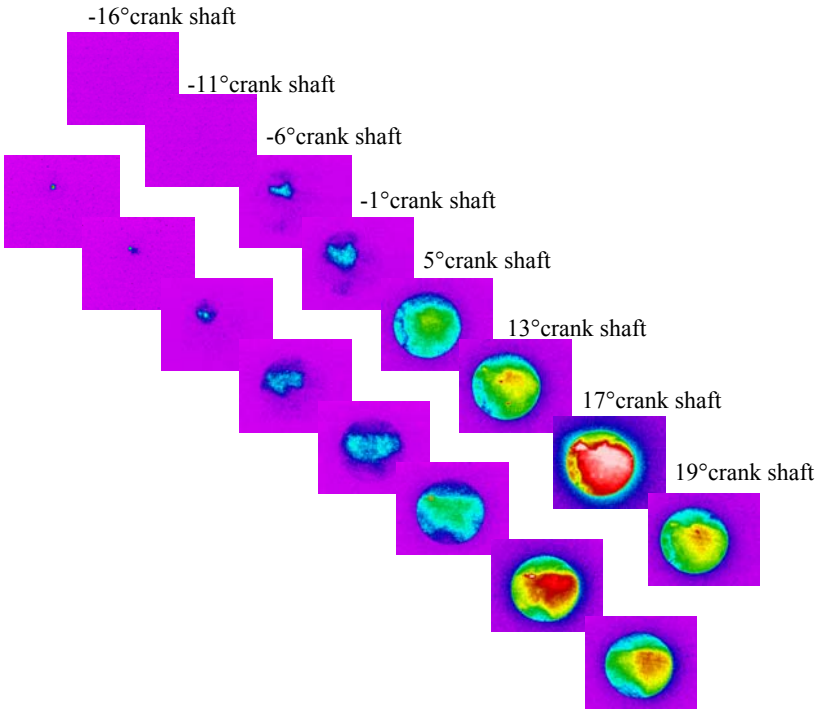

Fig. 5: Gas Engine Liaz at 1200 rpm, Mt = 400 Nm, α= 17° crank shaft before TDC, ($\lambda \cong 1,2$)

Expense Report

October – December, 2003

CZK account

	CZK
Income	
Budget	288000
Expenditure	
Services on the invoice	288000
Expenditure total	**288000**
Credit balance	0

Liberec, May 27, 2004

Doc. Celestýn Scholz, Ph.D.
Project coordinator