

## INSPECT *pro control* 3

### Video-based Analysis of Flame Fluctuation

Camera systems, in combination with an intelligent control system, offer a high optimization potential for thermal processes in general and technical combustion systems in particular. To describe the behavior of the flame or operation with various fuels, INSPECT flame fluctuation analysis with video-based image processing can be applied.

#### Introduction

Video systems are predestined for low-cost and efficient analysis of technical flames or the detection of wear and deposits on burners operating with various and alternating fuels.

Based on the results of flame fluctuation analysis, a strategy can be developed for real-time monitoring and optimization of the burner. INSPECT *pro control* is reliable in permanent operation, cost-efficient, and based on standard hardware.

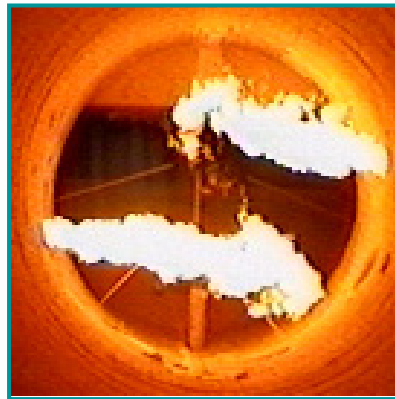


Figure 1: Monitoring of the shape, intensity, and fluctuation of a burner flame in real time

### Video-based Analysis of Flames

Increasing replacement of fossil fuels in power plants by alternatives like biomass or sewage sludge causes problems in burner stability and, hence, constant permanent operation. Deposits on the burner or wear may contribute to a strongly fluctuating combustion reflected by a fluctuation of the flame.

A frame grabber takes an image from the video signal every 500 milliseconds. Via a parameterization mask, the interesting region and intensity thresholds of the three color channels are defined.

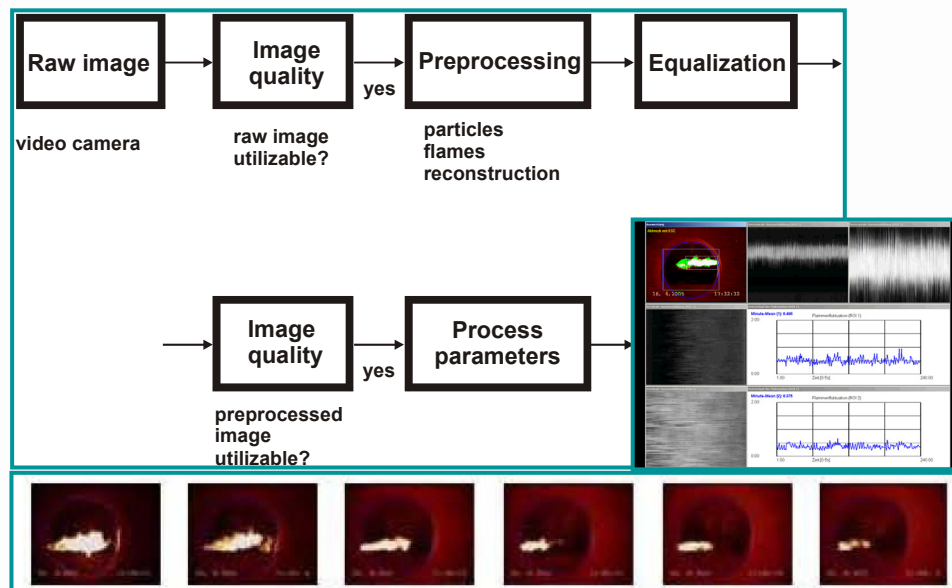


Figure 2: Information flow during image processing for the control of technical flames

### Flame Fluctuation Characteristics

More than ten characteristics can be calculated and archived. They describe the flame behavior in detail. The length and width of the flame are output relative to the defined region. The fluctuation is defined to be the flame zone that changes from one image to the next. It is calculated to be the ratio to the flame zone of the previous images.

The figure below shows the three characteristics of length, width, and fluctuation of the flame determined from the video images displayed above. During normal operation, both flames are long and extend up to the wall on the opposite side..

When burner parameters are changed, the flames become shorter and unstable. These parameters then serve as basis for the monitoring and optimization of the burner. The figure on the left shows the output for the operators.

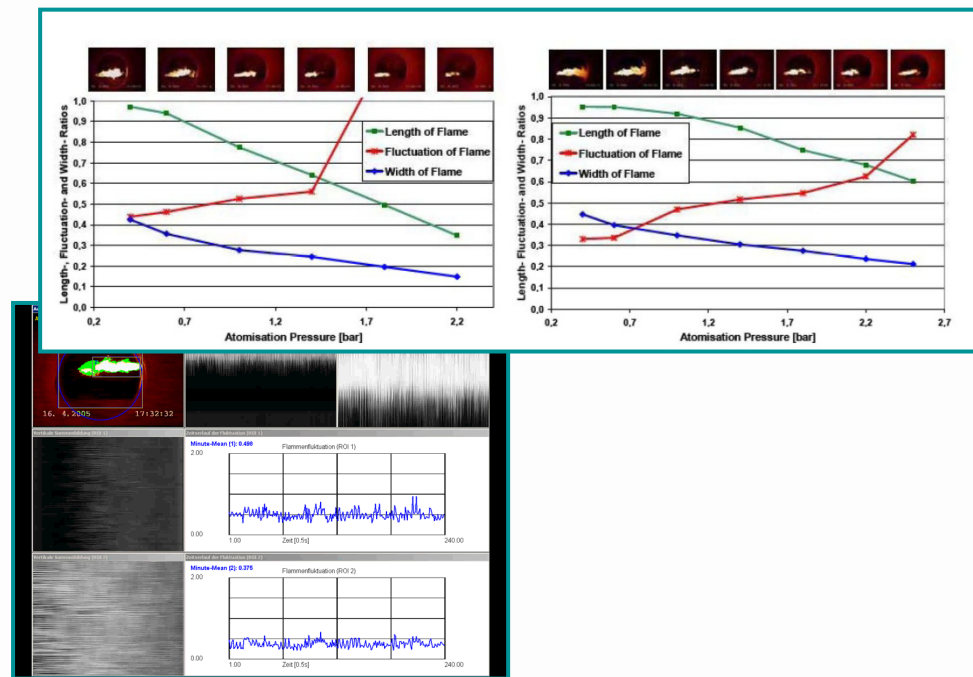


Figure 3: Relationship between length, width, and fluctuation of the flame (represented as normalized characteristics on the Y axis) and the atomization pressure

### The INSPECT pro control® Software Tool

The flame fluctuation analysis methods are integrated in the INSPECT pro control® software tool. INSPECT can be connected to any video camera. The results of the processing steps are transmitted cyclically to the process control system via pre-fabricated interfaces. INSPECT can also archive all process data in a database and visualize them via Ethernet-coupled graphical user interfaces (e.g. in the control room). Since 2000, INSPECT has already been in use at several industrial facilities worldwide.

If you wish to obtain further information or an offer, contact us directly.

**ci-Tec**

ci-Tec is an innovative enterprise that specialized in the optimization of thermal combustion processes. With its INSPECT product, the enterprise located in Karlsruhe offers an effective tool to improve highly sensitive process conducts. Close cooperation with the Institute for Applied Computer Science of Karlsruhe Institute of Technology (KIT) results in a rapid transfer of latest scientific research results to practical applications.

The expert team of ci-Tec provides assistance and support in the optimization of these high-tech processes based on its vast know-how and experience. ci-Tec solutions lead to measurable improvements that are of real benefit to your company.



Figure 4: ci-Tec office in Karlsruhe

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