



COMBILASER

COMbination of non-contact,
high speed monitoring and non-
destructive techniques
applicable to LASER Based
Manufacturing through a self-
learning system

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Fact sheet



Partners:

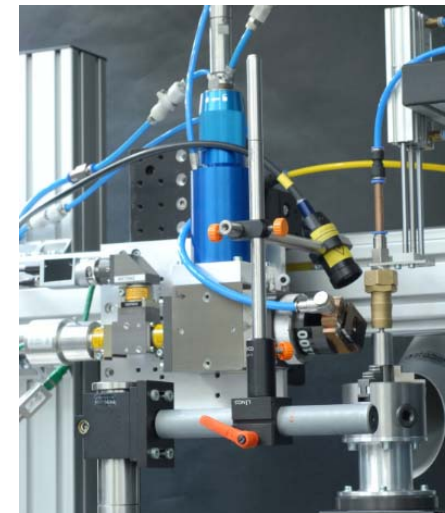
- **HIDRIA AET** (SLO, *coordinator*) LE - automotive
 - **IK4 LORTEK** (ESP) RTD
 - **LASER ZENTRUM HANNOVER** (GER) RTD
 - **RESEARCH CENTER FOR NON DESTRUCTIVE TESTING** (AUT) RTD
 - **UNIVERSITY OF SHEFFIELD** (UK) RTD
 - **LASERLINE** (GER) SME – laser supplier
 - **ORKLI** (ESP) LE – domestic appliances
 - **TALLERES MECÁNICOS COMAS** (ESP) SME – oil & gas industry
 - **MONDRAGON ASSEMBLY** (FRA) SME - automation
 - **4D** (GER) SME – laser sensors
 - **CAVITAR** (FIN) SME – illumination technology
 - **SIEVA** (SLO) SME – automotive
-
- **Total costs:** 3.439.420,00 EUR
 - **Duration:** 36 months (01.01.2015 – 31.12.2017)



Fact sheet



- **Main objective:**
To minimize defects appearing in laser based manufacturing to fulfil the zero-failure manufacturing approach
- **How to fulfill this approach?**
Combination of non-contact, high speed monitoring and non-destructive techniques and feed the generated and synchronized data through a self-learning system
- **Monitoring techniques:**
 - Laser ultrasonic
 - Temperature profile monitoring
 - Weld pool and spectral monitoring
 - Monitoring of laser power and process speed

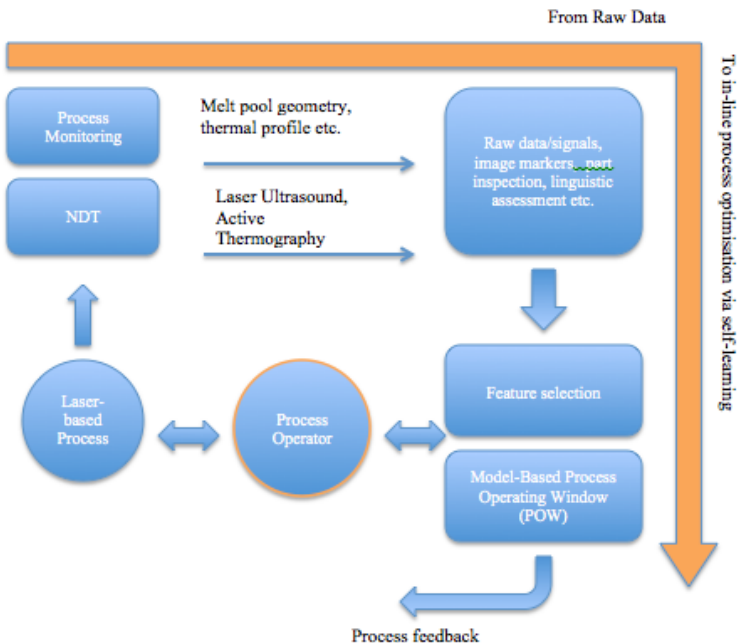


Fact sheet

- **Synchronization:**
Use of Position Synchronized Output (PSO)



- **Feed the data to self learning system**
- **Integration into three different processes**
- **Industrial demonstration and validation**



Fact sheet



- **Main objective:**

The minimization of defects appearing in laser based manufacturing fulfilling the **zero-failure manufacturing approach**. For that purpose, the combination of these two worlds (monitoring data vs. detected defects by NDT) through a **self-learning system (SLS)** -human-centric system- will be developed

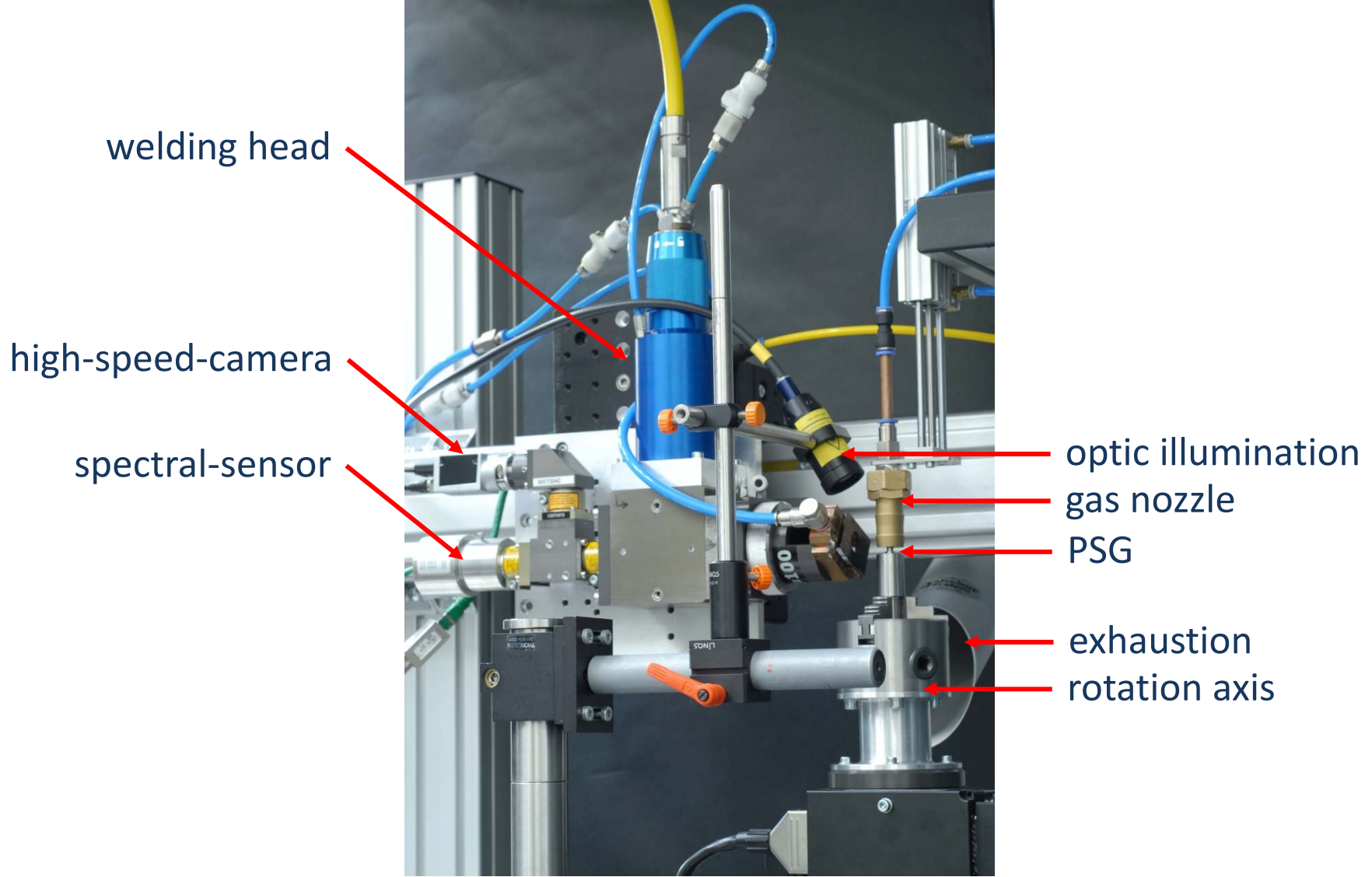
- **Sub-objectives:**

Productivity increase of about 35 % in **gas valves** repairing process due to required re-works reduction (cladding layer and base material cracking avoidance).

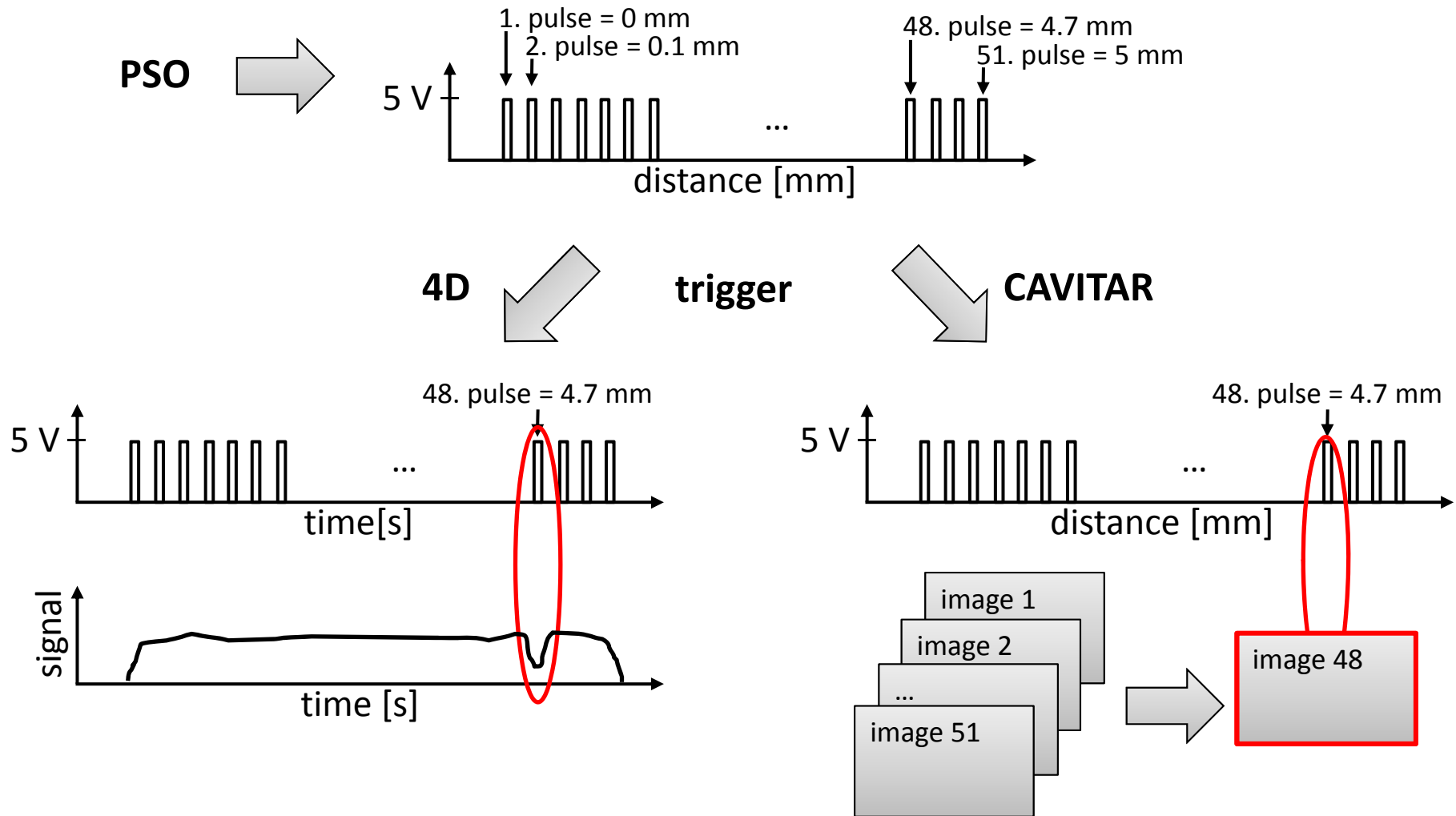
- Allow **to take to the market** new generation of **pressure sensor glow plug 45 % faster** thanks to the avoidance of cracking appearance using the developed SLS.
- **Reduce time-to-market of new flame device sensors by at least 45 %** thanks to acquired knowledge in previous products manufacturing thanks to SLS.
- **Reduction of scrap parts and wastes in new pressure sensors** (for glow plugs) manufacturing processes of **up to a 50 %** through laser welding monitoring and process parameters control.
- **Decrease the number of flame sensor defective parts up to 75 %** thanks to the continuous increase in LBW process knowledge.
- **Zero failure parts delivered to the customers** in all of the use cases making use of in-line advanced NDTs **to 100% of manufactured parts**.



Setup at the LZH



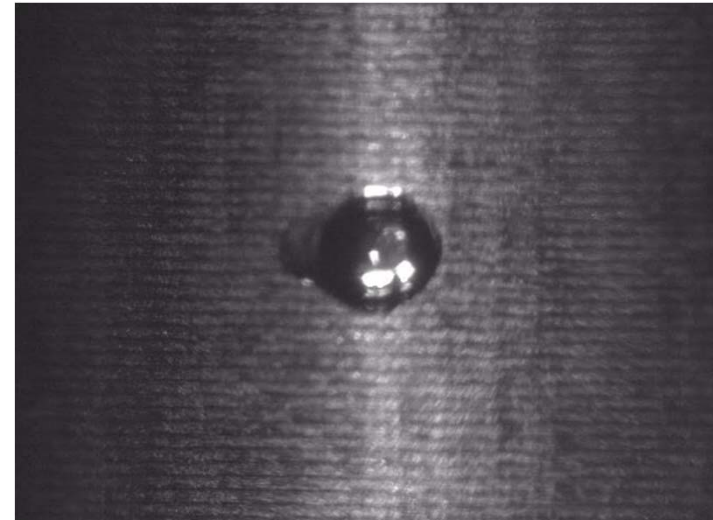
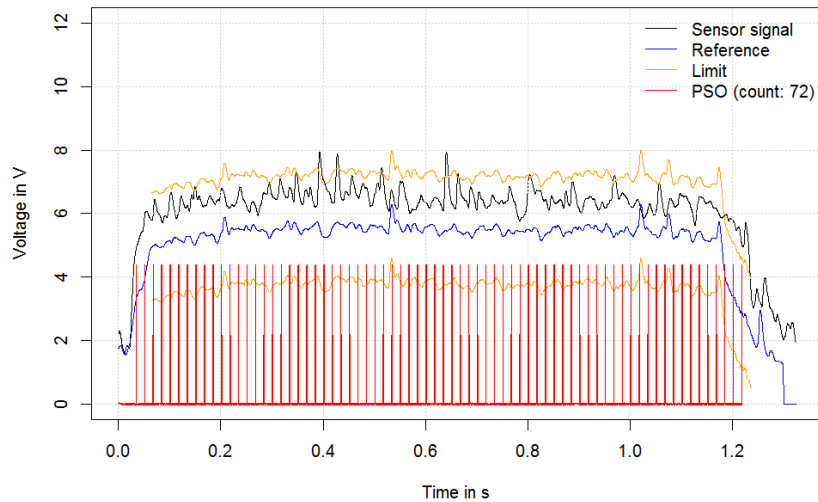
Synchronization with Position Synchronized Output



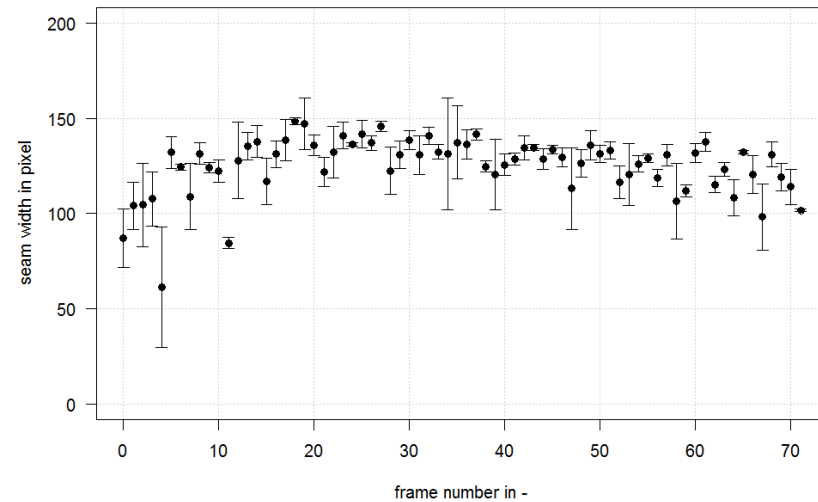
Example – I (good weld)



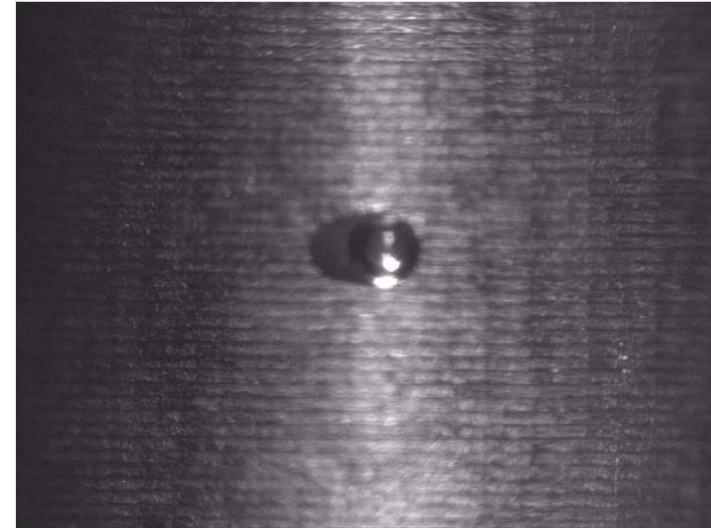
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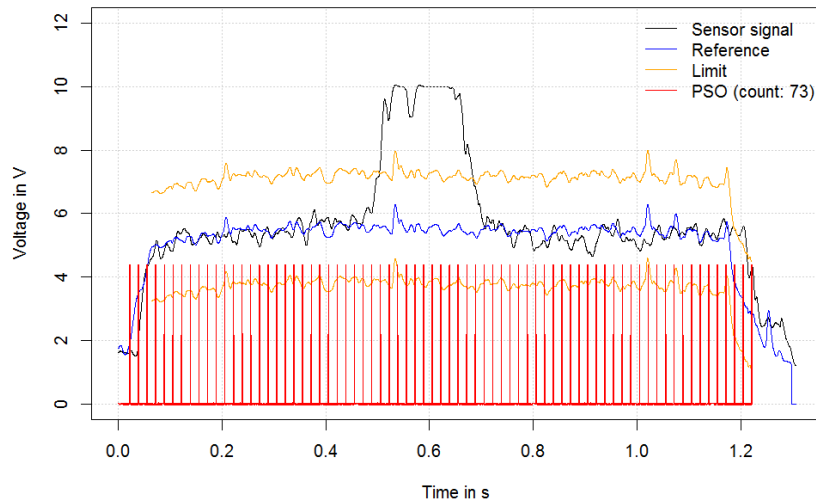
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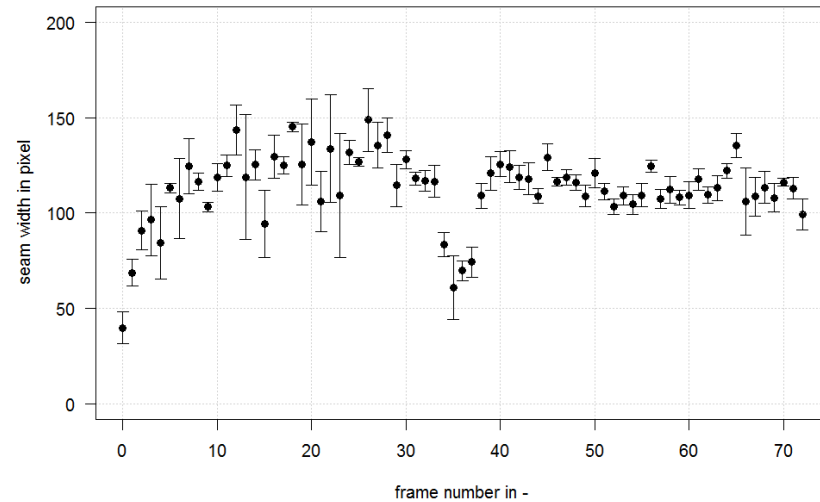
Example – II (bad weld)



Measurement: 166_1_1_NOK.txt



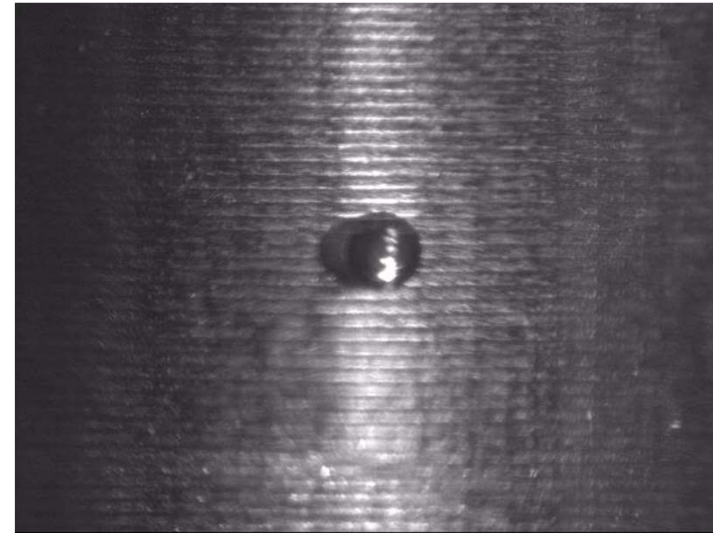
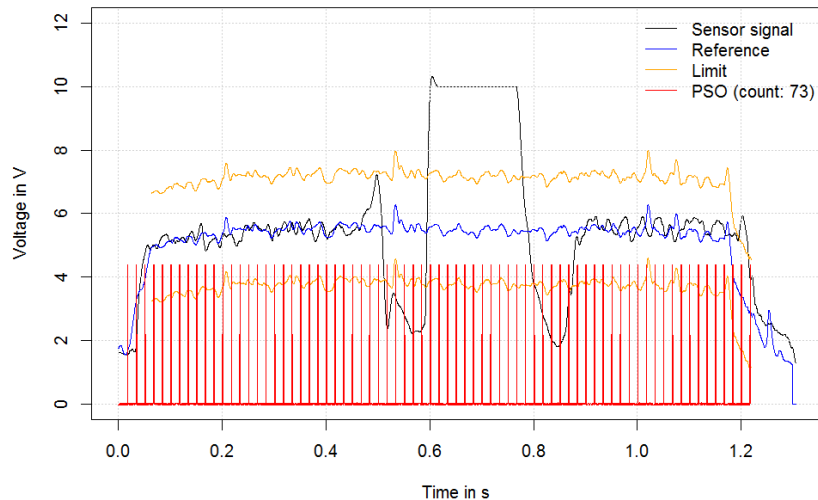
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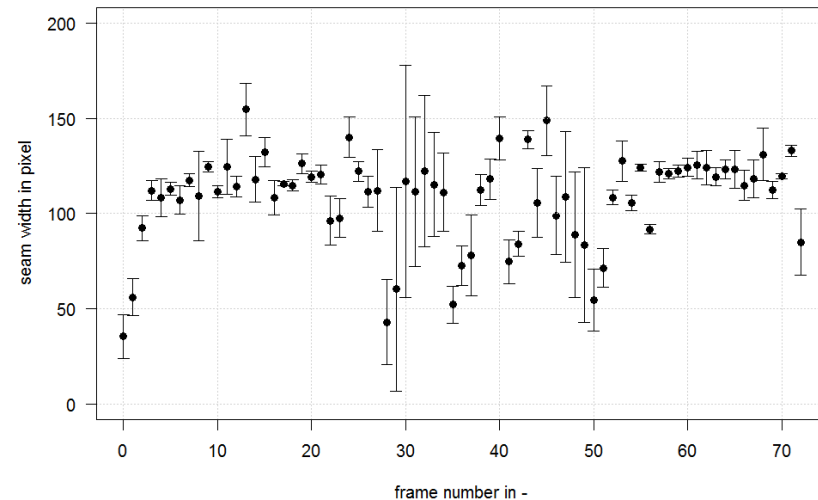
Example – III (bad weld)



Measurement: 169_1_1_NOK.txt



seam width as function of the frame number
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Expected outcomes



- The COMBILASER project assumes to obtain **three main results** :
 - 1) The obtained results in **processing algorithms** (WP2) as in the case of plasma, melt pool and thermal profiles monitoring, will represent an advance beyond the state of the art and will establish a first step for the definition of data reduction strategies in monitoring techniques. In the same manner, this will serve for gaining knowledge about laser based manufacturing processes.
 - 2) The development of **Novel non-contact NDT technique** (WP3) and its combination on a single quality assessment system will represent a clear advance in the NDT field and will open new horizons for the non-contact inspection techniques development. Specifically this will mean a basis for the study of IRT and LUS for new applications and systems.
 - 3) **Developed self-learning system** (WP4) that will be able to mimic human cognition in laser based manufacturing will go forward in the data-mining and data-driven modelling. Progress in this field will allow the study of novel strategies for self-learning systems development



Topics/issues for potential collaboration with other projects in the area



The results from COMBILASER can be useful for future projects in the **FoF work programme**, e.g.:

1. FoF10 – Manufacturing of custom made parts for personalized products
2. FoF12 – Industrial technologies for advanced joining and assembly processes for multi-materials

