

Smart processes and materials for sustainable and human-centric manufacturing /TRACER

CASCADE FUNDING PROJECT | N°4

Spoke 5

Capofila

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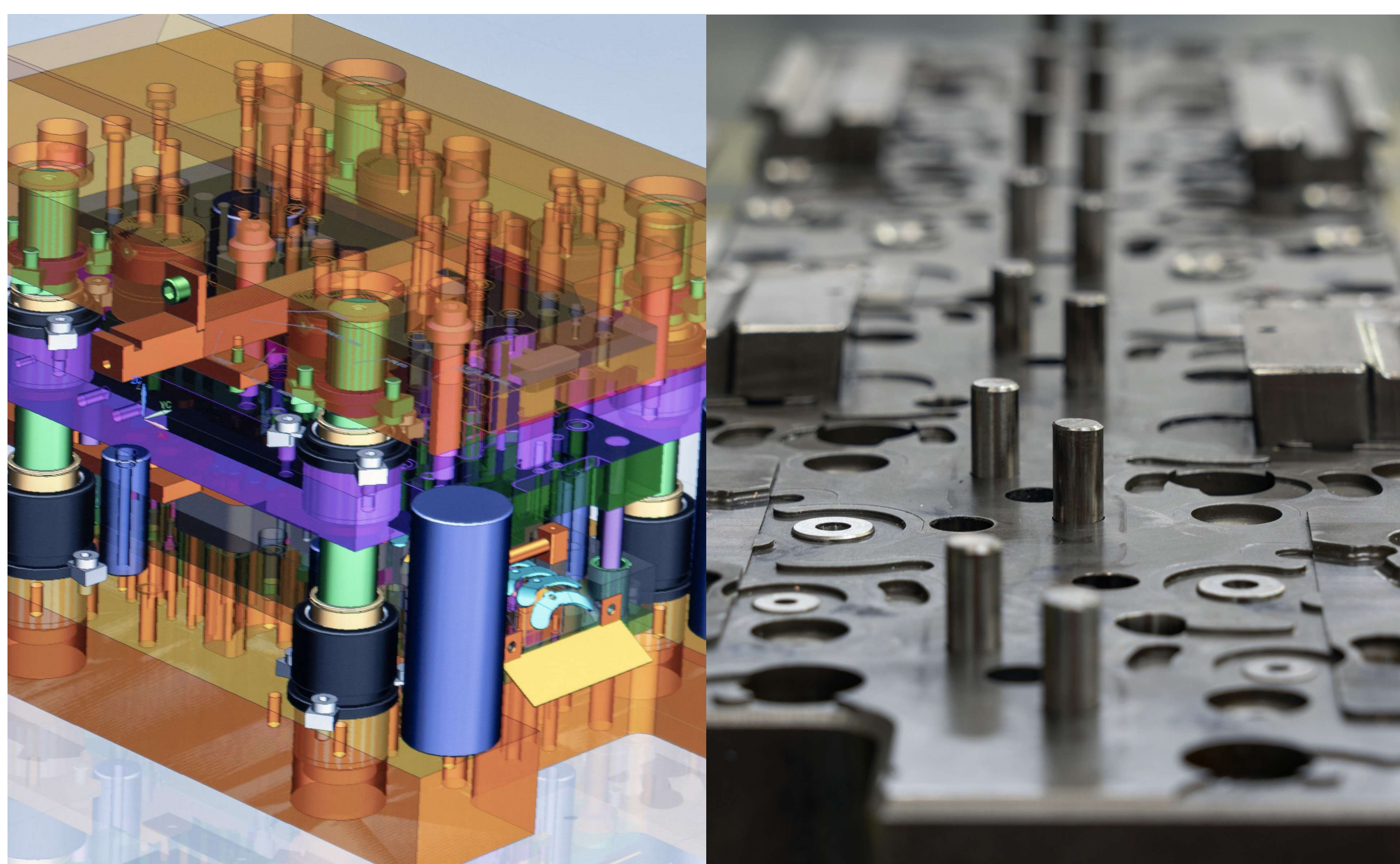
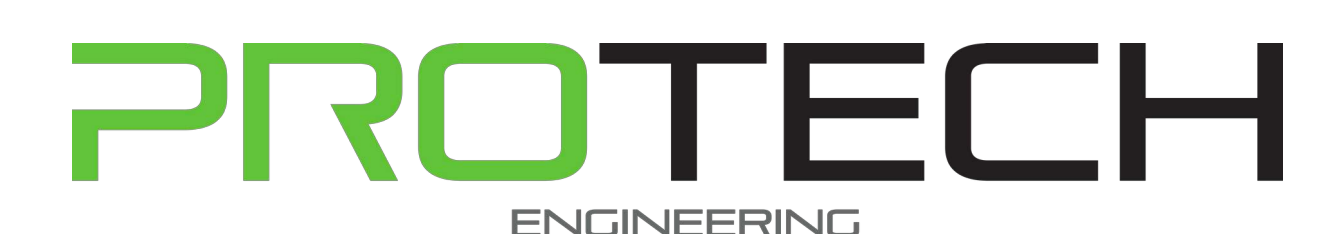


Fig. 1

Obiettivi

The ability to functionalize and control material properties in real-time during processes is enabling new scenarios in the control and management of manufacturing processes. The project TRACER aims to implement and prototype new technologies in an industrial context, with the goal of promoting intelligent, sustainable manufacturing paradigms with enhanced human-machine interaction in line with the requirements of the latest Industry 5.0 models. To achieve these objectives, the project will consist of two research lines: (i) the development of intelligent control systems or smart molds based on magneto-rheological fluid technology to enable interactive control of material flow in molds by operators, and (ii) the use of atmospheric plasma jet devices with nano-pulses to enhance the mechanical properties of metal surfaces. Within the scope of the project, experimental prototypes equipped with appropriate sensors will be developed to facilitate process digitalization, and real case studies will be made available for their validation.

Sheet metal forming

The project is organized into three Work Packages (WPs), guiding the development of new solutions through an initial design phase, followed by prototype creation, and culminating in a final phase of validation and testing. Within each WP, there are three parallel tasks addressing three case studies: two focused on sheet metal stamping and one on the development of the plasma device. Each task is led by a company within the consortium.

The objective of the research line applicability of the latest and most innovative paradigms in new materials research, with the following objectives:

- Improving process control capabilities and the quality of stamped products,
- Enabling the retrofitting of existing equipment to achieve at least a 30% reduction in process forces compared to existing systems
- Reducing the environmental impact of processes by lowering energy consumption
- Increasing operator safety

Atmospheric pressure plasma jet

The project aims to develop an atmospheric pressure plasma torch operating in the nanopulse domain to facilitate cold and efficient processes. The primary focus is on developing the nanopulse generator, which will be delivered as a prototype to the Atmospheric Pressure Plasma Lab of the Department of Physics and Astronomy.

Additionally, the project emphasizes implementing plasma process monitoring. The effects of plasma on surfaces are not visible to the naked eye, and plasma processes are highly sensitive to changes in impedance and gas composition. Factors such as substrate distance, surface cleanliness, and precursor flux stability can significantly impact the process. These variations are often undetectable by operators.

The plasma jets are intended also for applications requiring manual operation, such as cultural heritage restoration and clinical purposes. Effective monitoring is crucial to provide a clear interface for operators. To address this, the torch will be equipped with a Rogowski coil to provide direct feedback on the plasma, independent of the substrate. The University will develop the monitoring mechanism.



Obiettivo generale

Sviluppo di tecnologie innovative per abilitare il paradigma Industria 5.0

