

Development of a robotic cell capable of winding various types and sizes of stators in response to the growing need of having a higher productivity than manual winding and a high flexibility winding system for small to medium production numbers, as well as being easy reconfigurable for future stator designs such as segmented stators.

PROJECT, DESIGN, SOLUTION

Robotic cell for stator winding Project overview

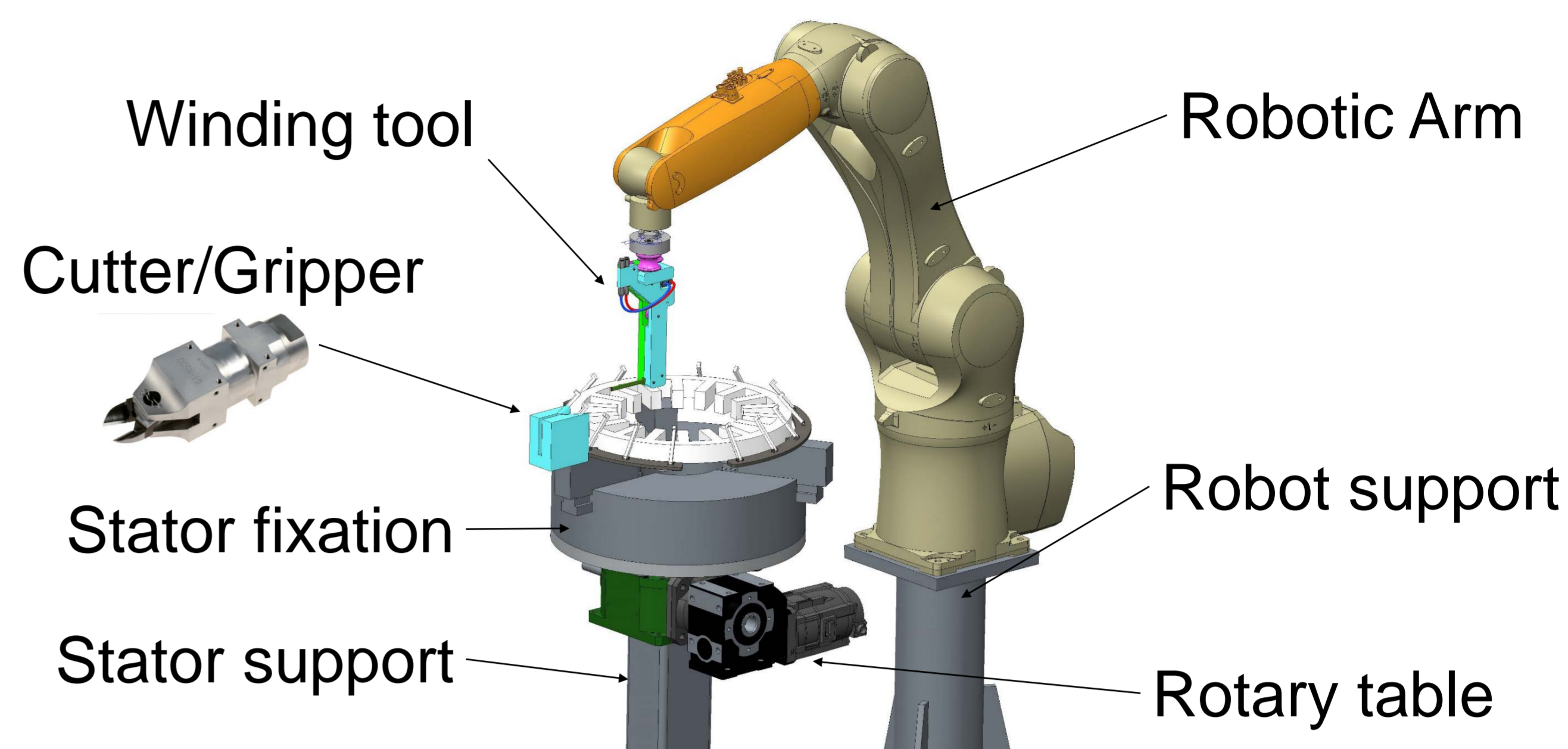
Project acronym: R4Win
 Project full title: Robotic Winding of Electrical Motors
 Topics: New manufacturing methods, components and systems
 Total project costs: 697.500,00 €
 Total requested funding: 364.000,00 €
 Project duration: 24 months
 Start date: April 2018
 Total Effort (Person Months): 103,00 PM



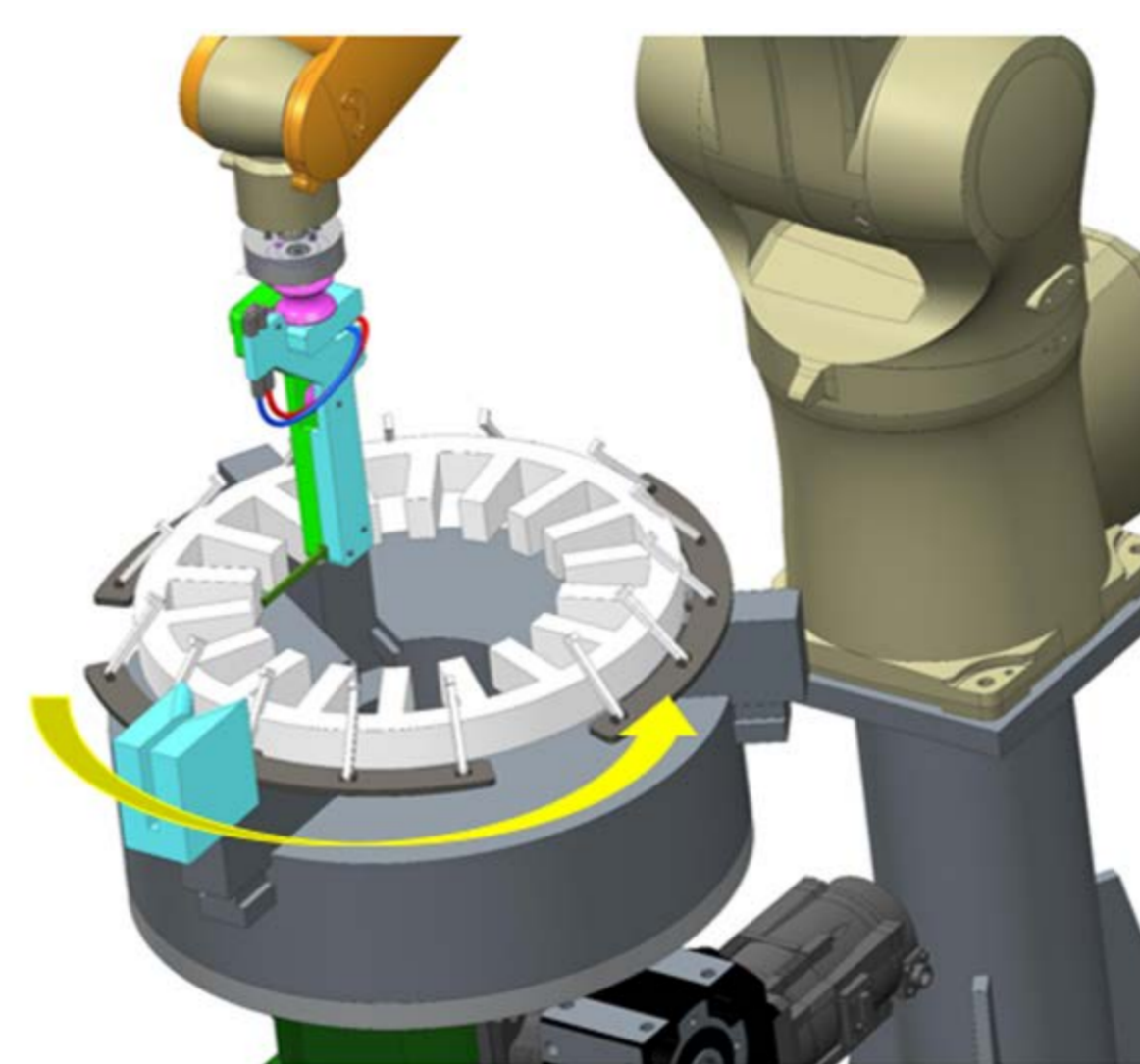
Objectives of the project:

- To develop a robotized coils winding system, to be used in the electric motor manufacturing industry.
- To design a reconfigurable interactive manufacturing cell, suitable to wind the coils of several kind of motors already on the market
- To present the user with a simple interface that can be easily used by operators without specific skills in robotics.
- To avoid the need of complex and time consuming robot programming each time a new product is set in the production line
- To reduce set up time and costs, thanks to the simplicity of system reconfiguration.

Robotic cell configuration Design overview



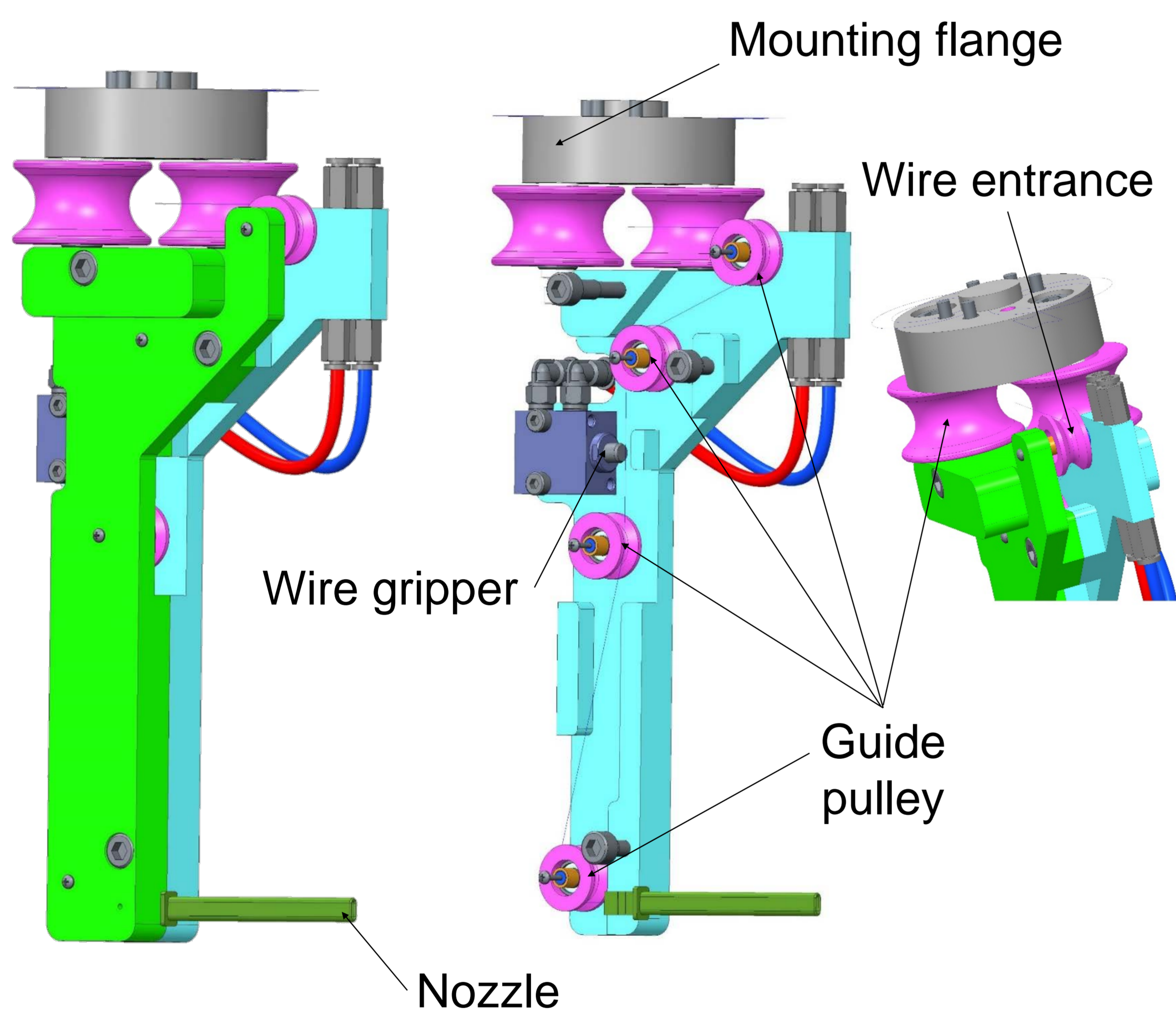
Winding



Winding is achieved by vertical and horizontal passes of the end effector/winding tool and rotation of the stator.

This setup is computationally more efficient, instead of generating a complex path for the winding tool and simplified the design of the end effector, as a full rotation of 360° would imply wire handling issues. Also, gripping and cutting the wire at the start and end of the winding process is done in only one place.

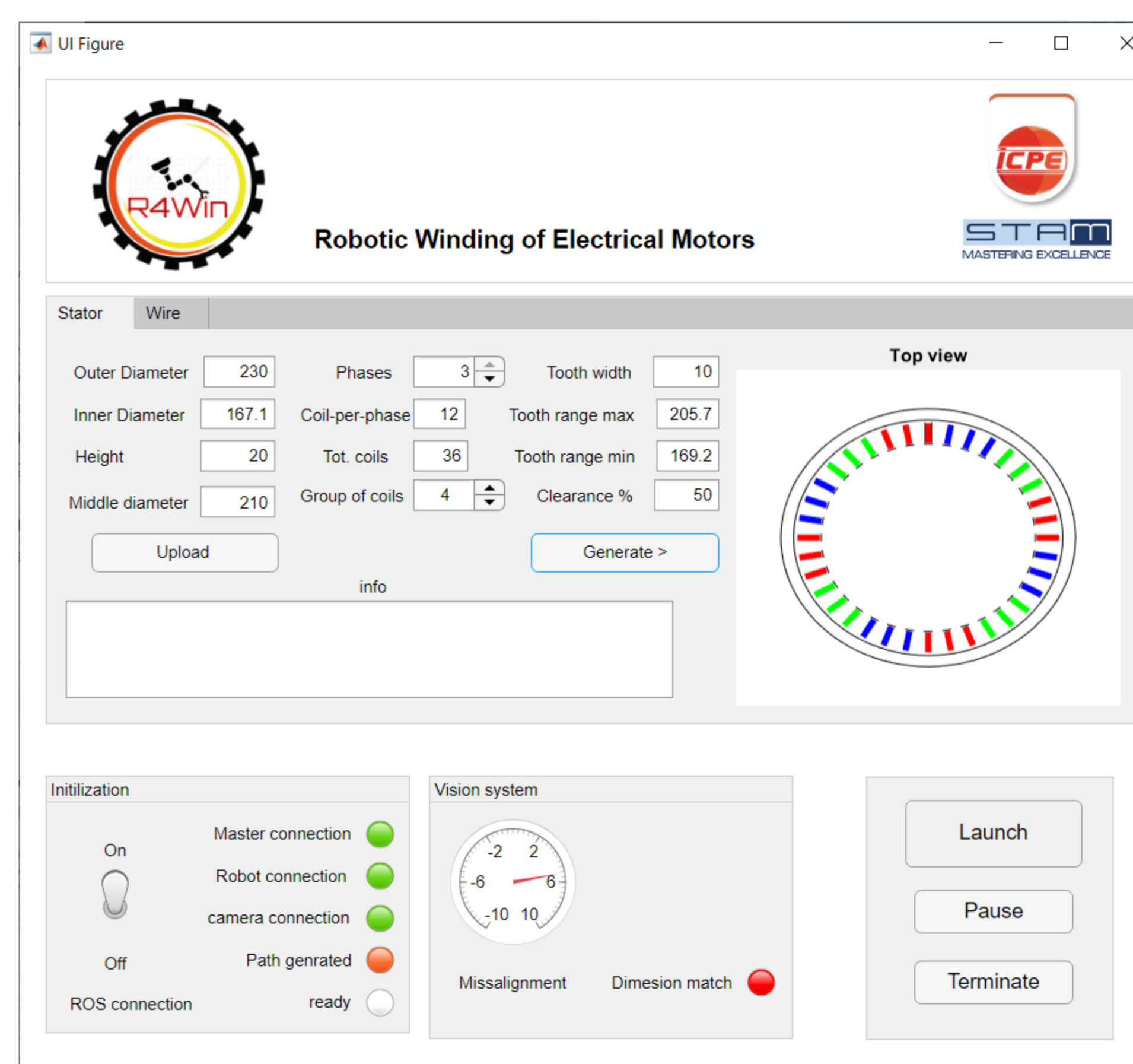
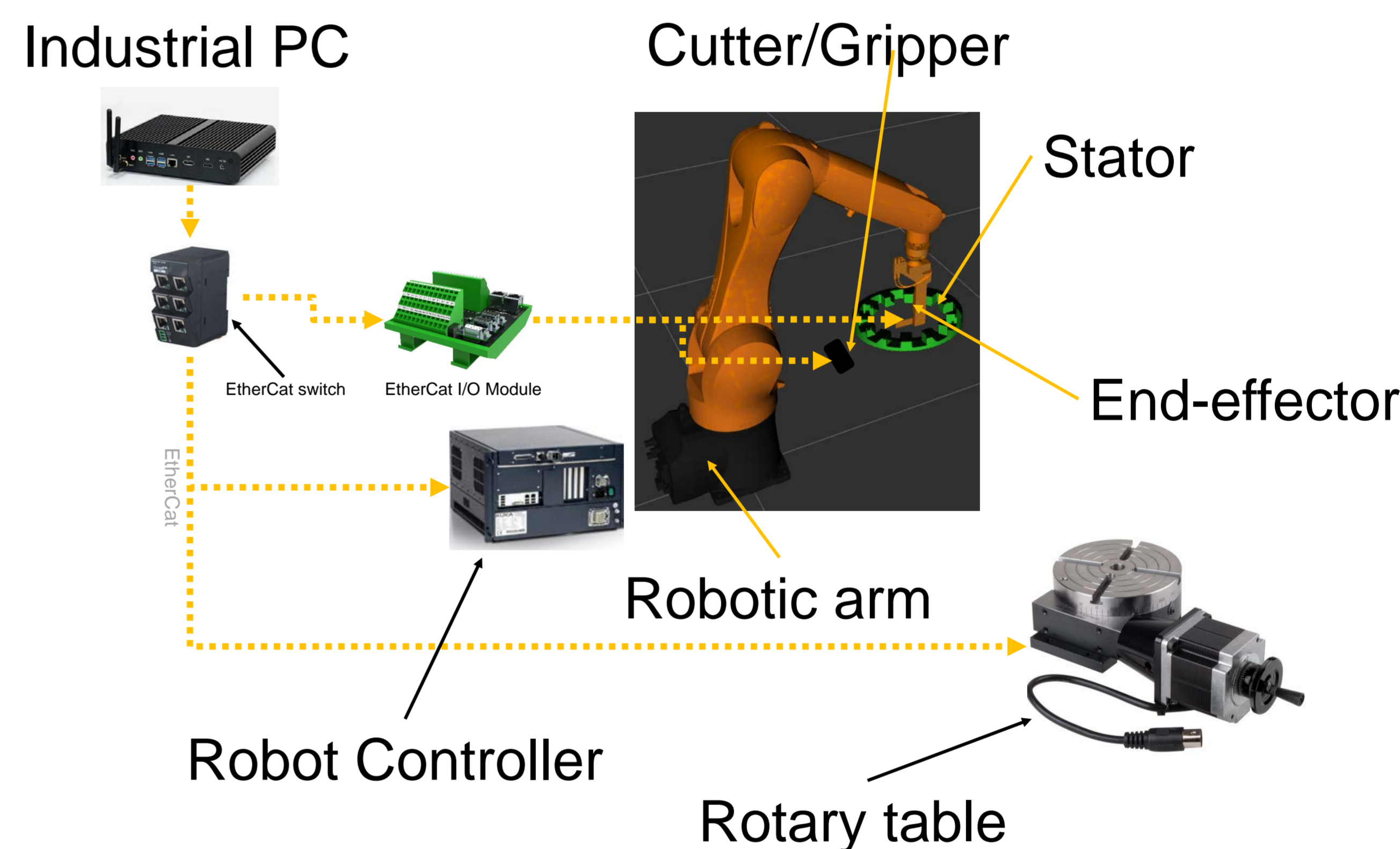
Winding tool



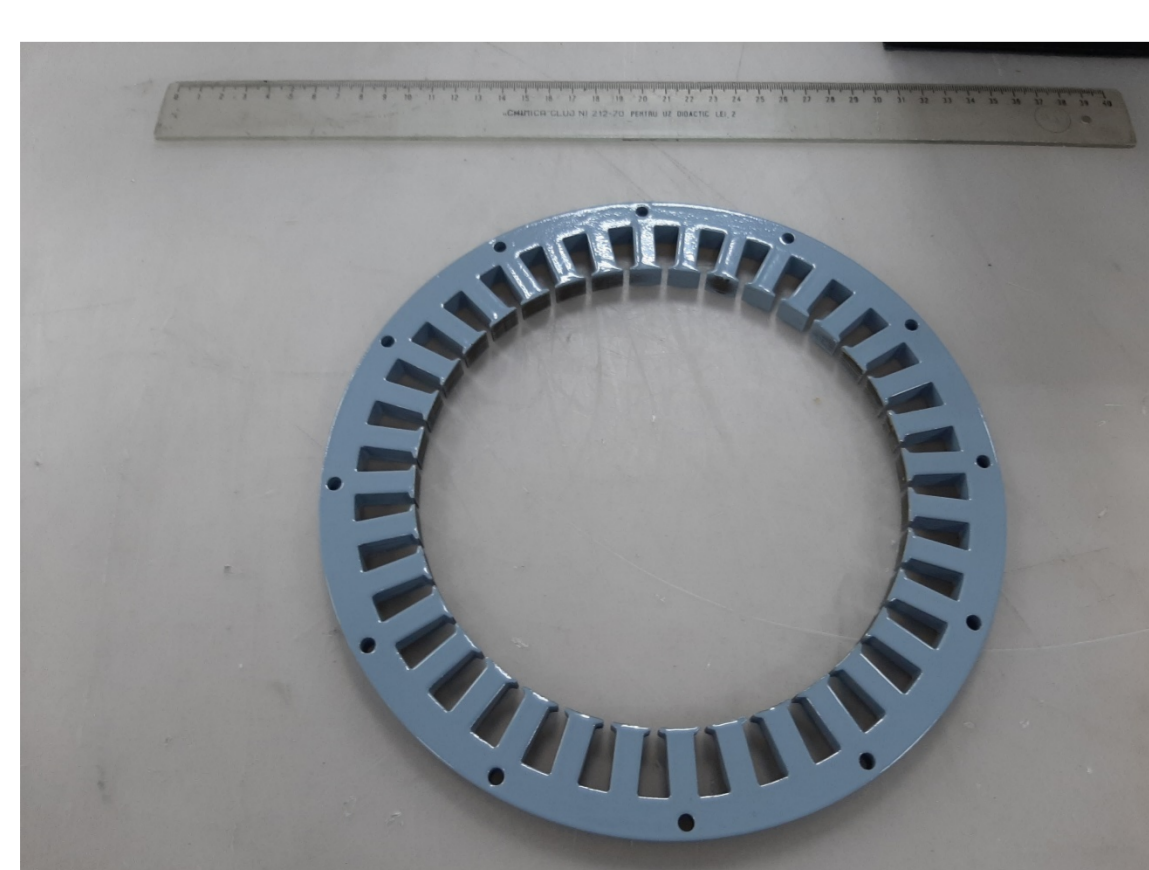
End effector main components:

- Dedicated nozzle** to precisely guide the wire between two adjacent teeth during winding, which can be easily replaced if dimension of the wire changes
- Wire guide pulleys** to precisely allow for the movement of the wire from the feeding line to the dedicated nozzle
- Gripper** to hold the wire during down time, such as stator replacement.

Cell control system and user interface



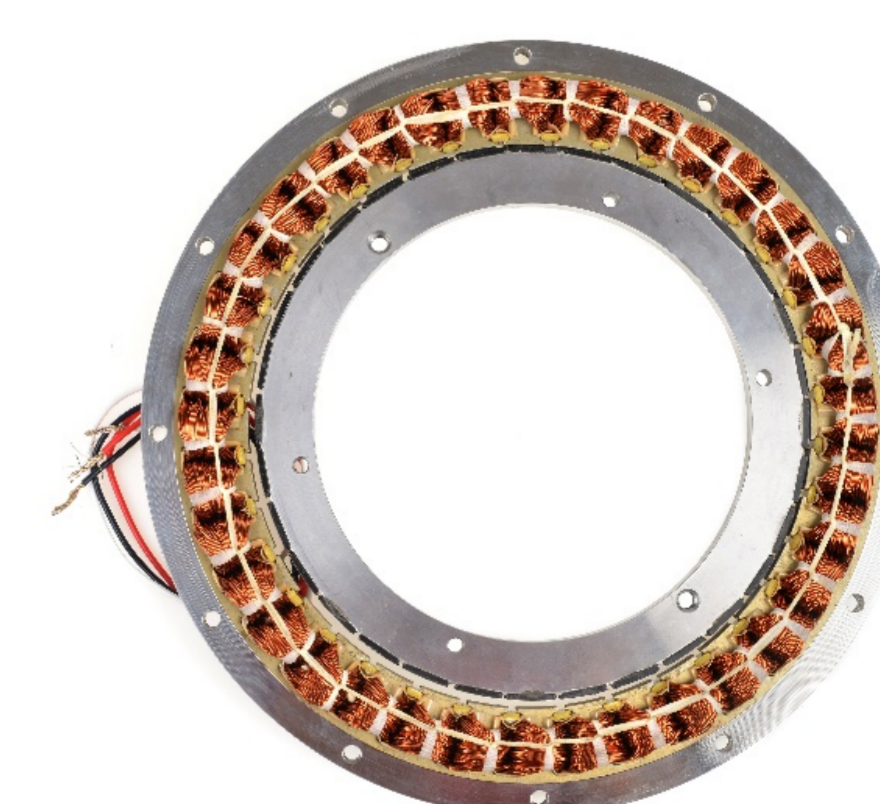
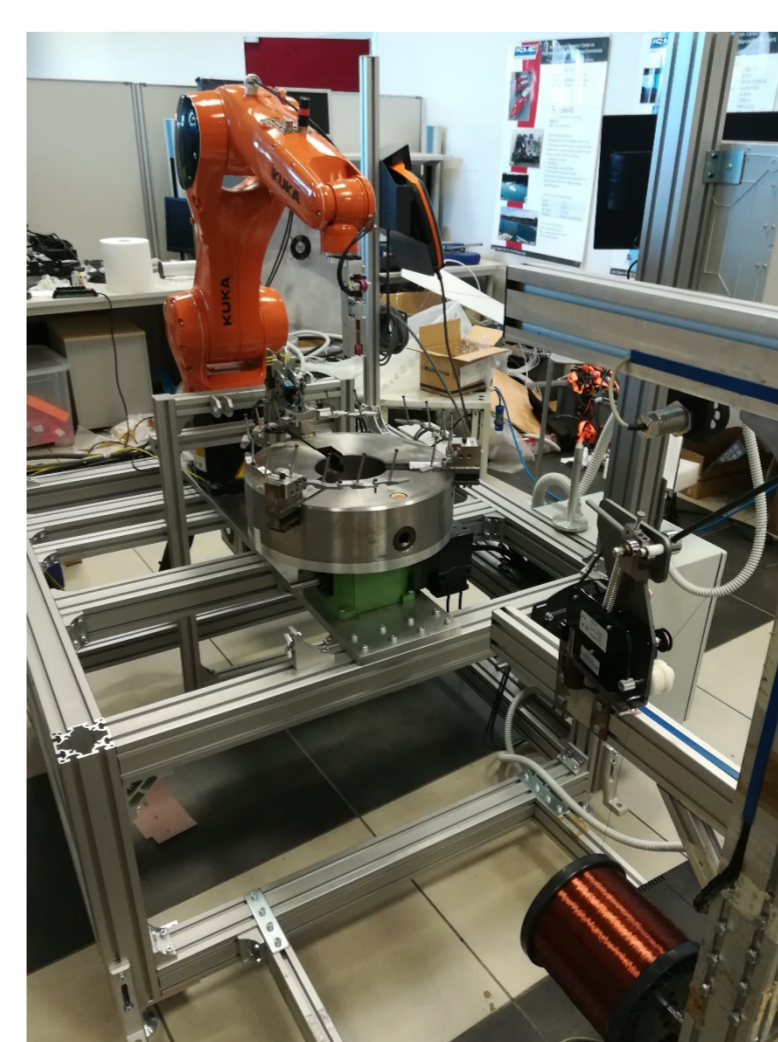
- Simple and intuitive user interface for inserting stator parameters
- Instructions to start the winding process
- Manual data insertion feature
- Automated data insertion feature – data file containing geometry and winding information
- Instruction list given to the operator
- Data is sent directly to the control system.



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Stator

Robot

Winded Stator