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LIN {E6POS: X 134.138, Y 1, Z 540, A 0, B 90, C 90, E1 0, E2 0, E3 0, E4 0} C_VEL
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```

ROBOT MOTION PLANNING

DIGITAL DESIGN

The Configurator is our online asset developed to assist our customer in the digital design of our sample products for robotic fabrication, such as cable chambers, beams, or manhole rings. It automatically generates a .json file which will be fed into our in-house trajectory generator. It is then interpreted by the Programmable Logic Controller (PLC) to control the robot and sprinting head movements. Motion planning for more complex geometries is available through local algorithm.

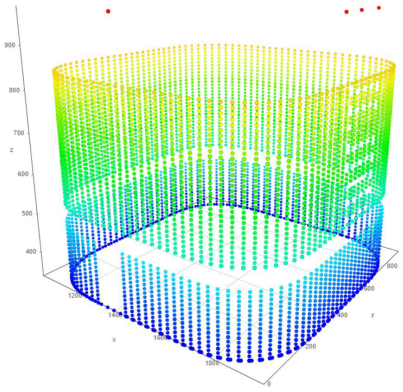

Image 1: trajectory generation

TRAJECTORY GENERATION

We utilize various advance frameworks and tools to develop a software which processes the design parameters and generates the printing trajectory. The dimensions are translated into a general path consisting of global coordinates where robot shall follow and rotation angles to which the head shall conform. Special features, such as rebars, slits or bottom, can be included but will impact on the whole trajectory sequence. In fact, each feature must be adjusted with each other in order to avoid incoherence. For example, a horizontal rebars could never pass through a rectangular slit.

Image 2: Kuka|prc simulator

SIMULATION

We use 3 approaches of testing the generated trajectory: 1. Kuka|prc to control the robot axis, 2. our simulator to analyze the elevation of the head and the commands given to the PLC, 3. a live simulation to validate the behavior of the robot and the rotational head axis. These simulations allows us to accelerate the test calculations, debug quickly and measure the feasibility of the system for complex elements.

SPRINTING = Mobbot spraying technique

The PLC reads the file sequentially. Initiation and termination of concrete sprinting during a session are conducted automatically through the PLC commanded by the trajectory file. In case of sprinting halts due to rebar or insert placement, the robot goes to the washing station and performs a washing cycle to clean the head from sprayed concrete residues. The messages area on the Human Machine Interface (HMI) informs the Operator about the actions to be carried out (placing reservation, reinforcement, etc.) and the status of the system. At the end, a knife trajectory evens the height of the chamber.

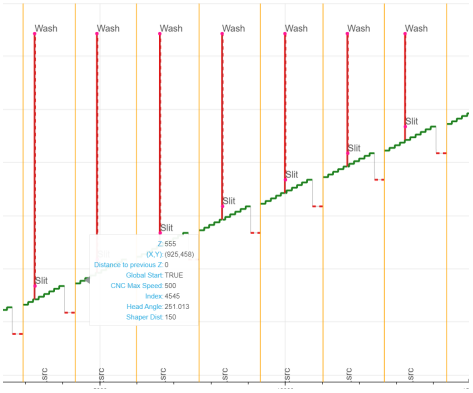

Image 3: extract of our simulator