

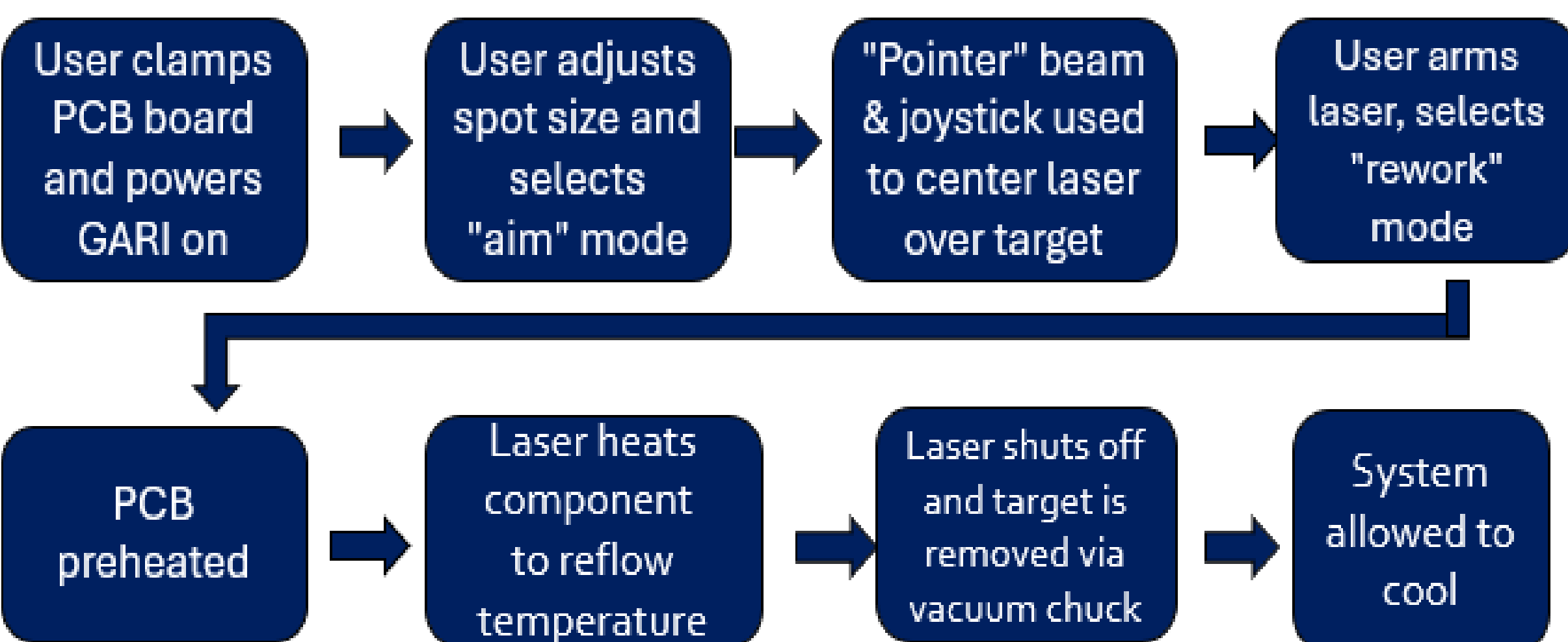
## Background

Northrop Grumman utilizes many low volume electronic components. Due to the nature of low volume components, it is labor intensive and expensive to rework such components. Gantry automated rework interface cuts out years of experience and skill needed to perform such tasks with the ease of clicking a button.

## Overview / Design Specs

- Remove components of edge length 1mm x 1mm
- 0.01" Gantry Motion Resolution
- Solder Reflow 200°C
- Max adjacent component temperature of 170 °C
- Temperature ramp of 1.5 °C /s
- Closed loop heating control

## Process



## G.A.R.I.

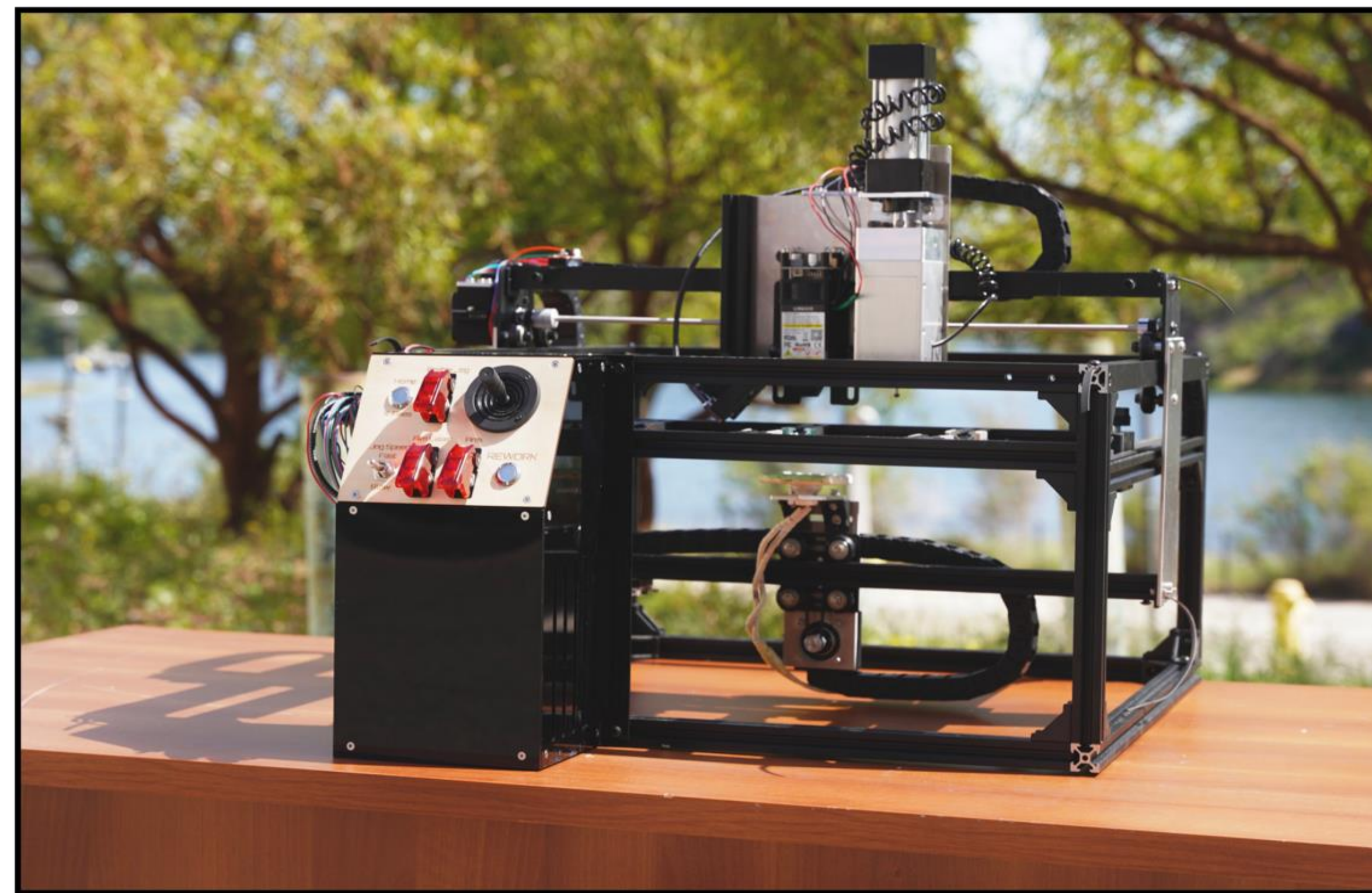
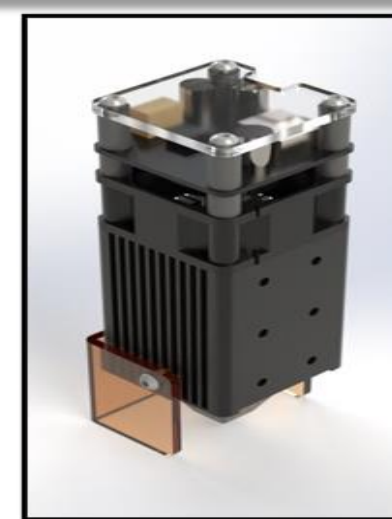


Figure 1: Full assembly of machine

## Hardware / Key Components



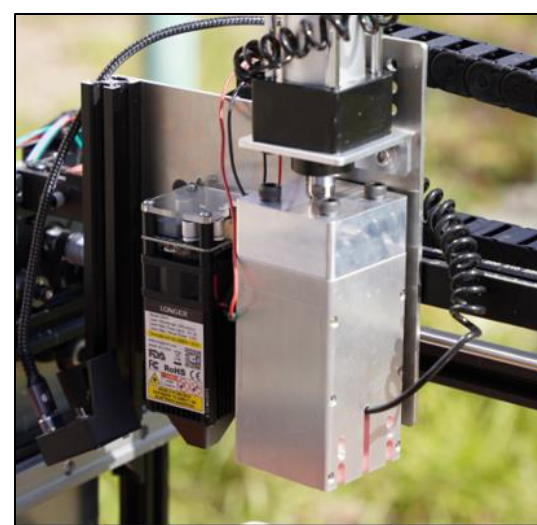
### Laser Module

Precise heating to achieve reflow at 200 °C at a controlled temperature ramp of 1.5 °C/s avoiding damage to nearby components



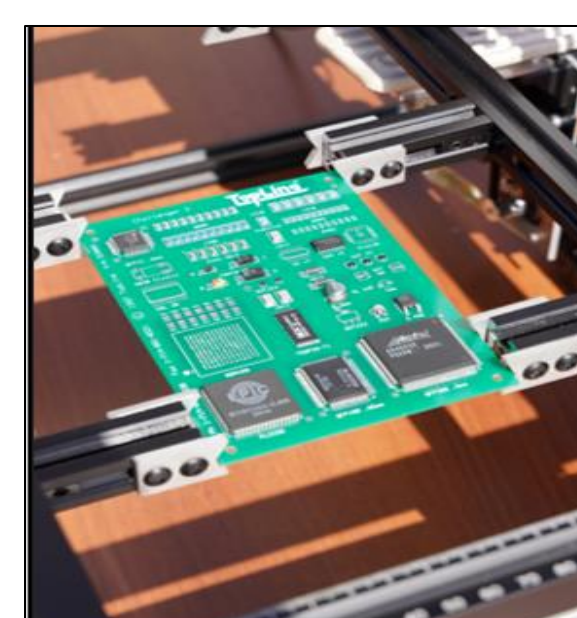
### Thermal Camera

Accurate thermal sensing from a thermal camera to allow for closed loop temperature control.



### Vacuum Chuck

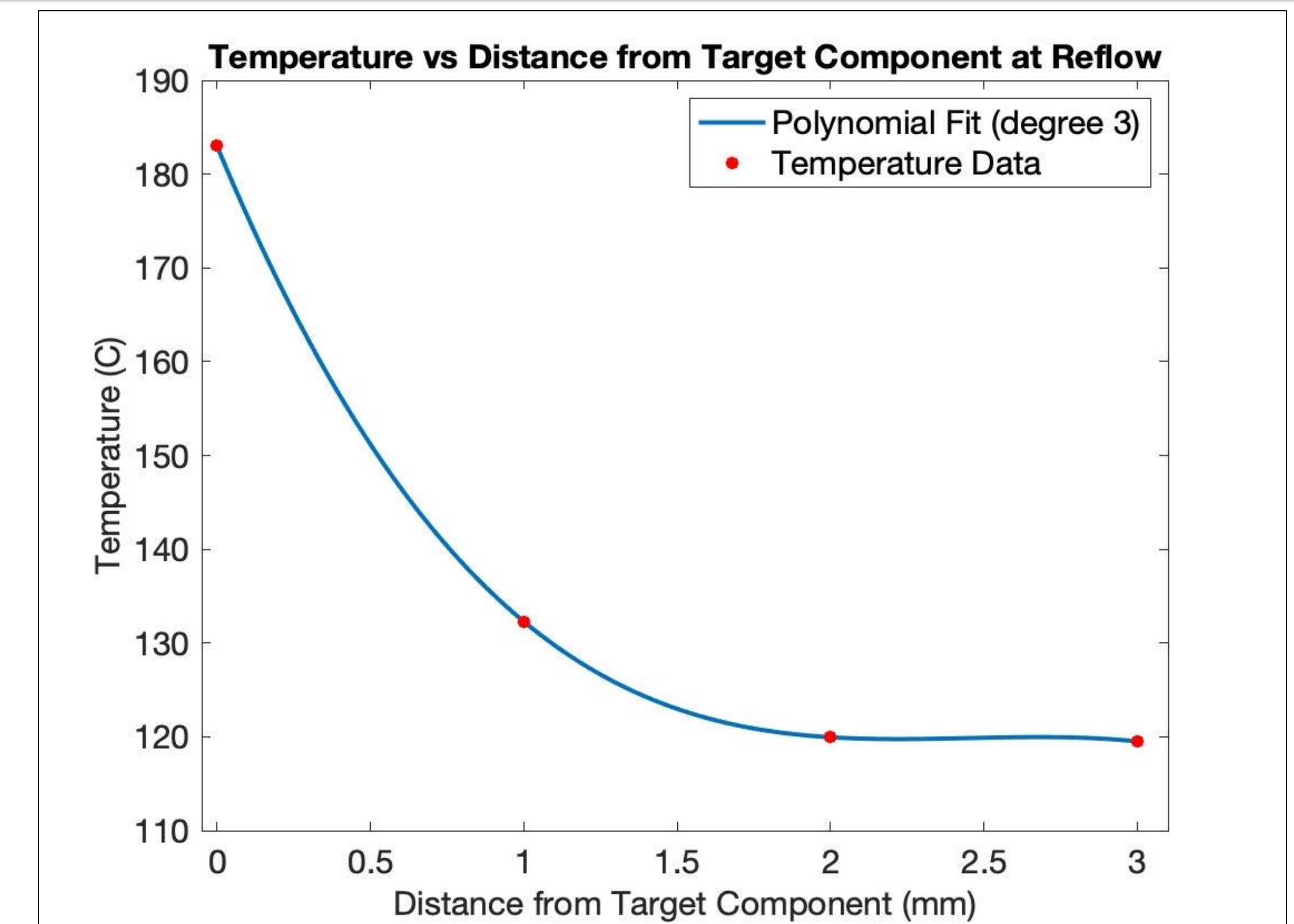
Pneumatically activated vacuum pen allows for precise removal of 1mm x 1mm PCB components



### Adjustable Board Clamp

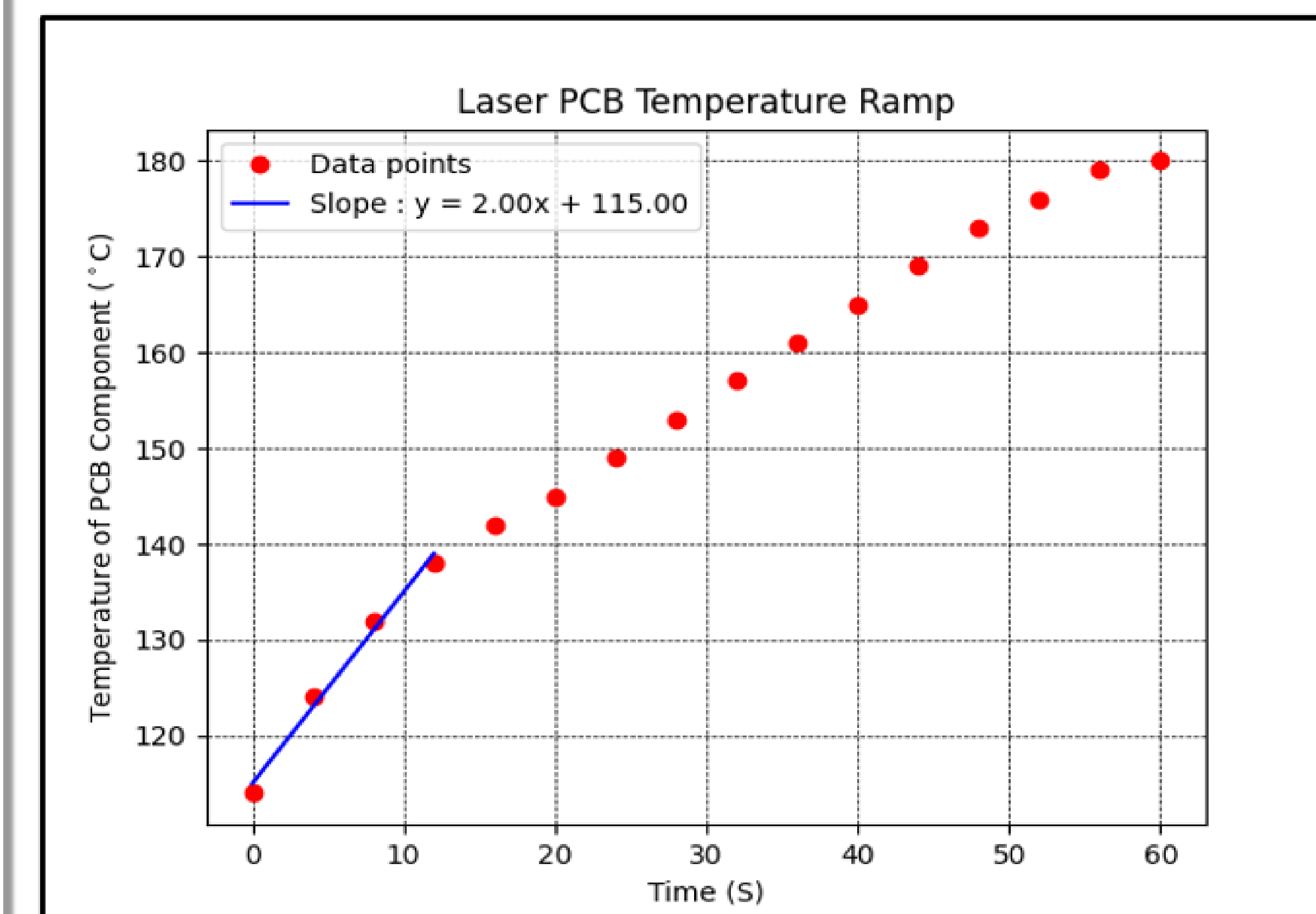
Allows for clamping of boards of various sizes

## Thermal Gradient Test



The temperature of adjacent components drops rapidly beyond 1mm, allowing safe part removal without damaging nearby components.

## Thermal Ramp Test



Precise laser heating follows a thermal temperature ramp of 1.5 °C /s