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## 3D PRINTER PLATFORM HEATERS DIAGNOSTIC THROUGH THERMOCAMERA SENSOR

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## **3D printer platform heaters diagnostic through ThermoCamera sensor**

### ABSTRACT

In some 3D printers or other Additive Manufacturing technologies, parts are built by adding successive layers of powder (plastic, metal or other composite materials) from a series of cross sections (slices), which stick to each other creating the final part's body.

In some printing solutions these layers are formed on top of a moving platform, in vertical axis. There is also a scan axis which drops some agents to fuse and define (fusing and detailing agent or binder) the parts printed through this printing process involving powder, agents and temperature.

All related to keep temperature uniform in X,Y and Z is extremely critical to get good part quality on the parts printed.

This invention disclosure proposes a method to check the performance of Build Unit heaters as a diagnostic through Thermocamera sensor.

Finally, we would like to highlight the fact there is no current solution to check the performance of Build Unit heaters system from thermal point of view except the diagnostic we currently have but focused on PWM sanity check. This diagnostic may not be robust enough the guarantee right performance of this subsystem, then may not guarantee good part quality .

### PROBLEMS SOLVED & ADVANTAGES

- 1) After any degradation, reparation or intervention in the customer side focused on any thermal heater in the Build Unit (BU), this method improves the accuracy of the performance check whose main root causes may be:
  - Reliability issues: the performance of some thermal blankets might be worse, then the PQ outputs may be not the same as before.
  - Part Quality Issues: the new thermal blanket installed by the service engineer is not performing as expected despite we have a robust QaP from vendor side.
  - WMS issues: the installation from service engineer is not done well.
- 2) The consequences of these risks/issues could directly impact to PQ expectations:
  - In case of plastics, the dimensional attribute is the one that could be more affected as a malfunctioning could increase dimensional part deviations.
  - In metals case, as the thermal blankets are used to remove the solvent during the curing, green part mechanical properties could be drastically reduced if this solvent is not completely removed
- 3) This diagnostic allows to do a periodic and rapid double check if needed just to verify everything is within specs related to BU Thermal subsystem performance.
- 4) No special tooling is needed to be used from HP technical engineers in the field. Also, all the workflow could be embedded in the printer as a service/user diagnostic.

### CONCEPT PROPOSED

The following concept tries to summarize which subsystems are relevant for this invention disclosure. This is the concept proposed:

- 1) Define a control loop which main inputs and subsystems involved are:
  - Thermal Blankets
  - Thermo camera sensor
- 2) With that, we can heat up the different thermal blankets and read the heat trend from thermo camera sensor to advance abnormalities during transient or permanent period.
- 3) No material is used in this concept. It is not really needed to check the scope we noted above

Example concept:

- The current 3D Build Units have different thermal blankets: Platform & lateral.
- All of them can be read by thermocamera sensor while switch them on. Platform:

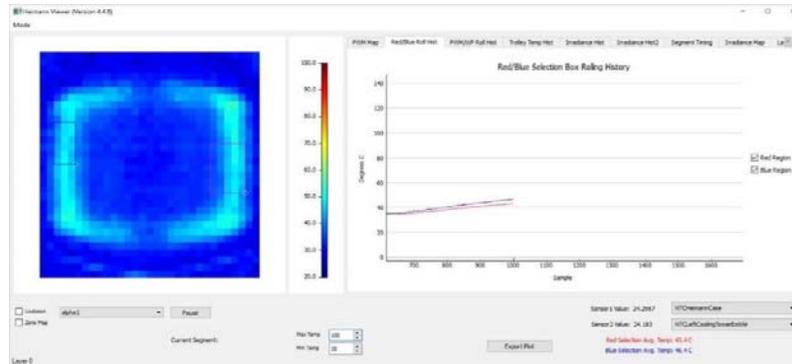


Figure 1. Experiment in which platform heater was activated at medium PWM to understand the trend on the thermos camera readings just to advance abnormalities.

- Lateral: different captures while we can see the trend once the thermal blankets are enabled. Right:

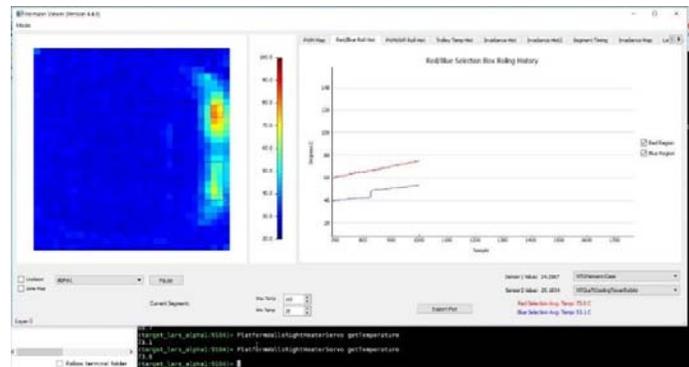


Figure 2. Experiment in which right heater was activated at medium PWM to understand the trend on the thermos camera readings just to advance abnormalities.

- Corner:

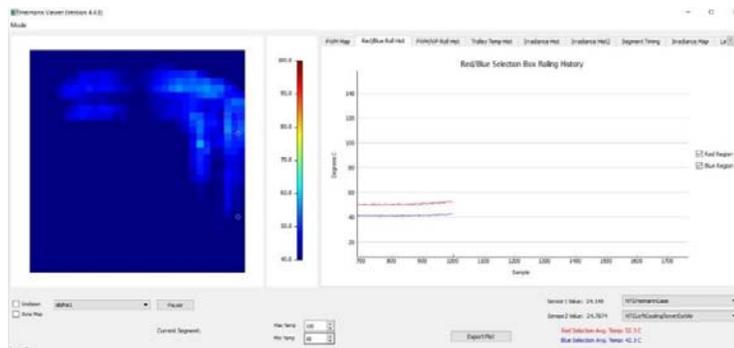


Figure 3. Experiment in which the corners heaters were activated at medium PWM to understand the trend on the thermos camera readings just to advance abnormalities.

ADVANTAGES

1. Availability: Using this diagnostic, Customer Service will be able to run diagnostics for that assembly (Thermal Blankets): Execute sanity checks involving different thermal blankets (platform and lateral ones).
2. Economy: no special tooling needed. Also, no material needed.
3. Quick workflow. All process may be embedded within the FW of the printer and executed through user/service menu.

*Disclosed by Reig, Jordi, Garcia Grau, Marc and Salas Roura and Francesc, HP Inc.*