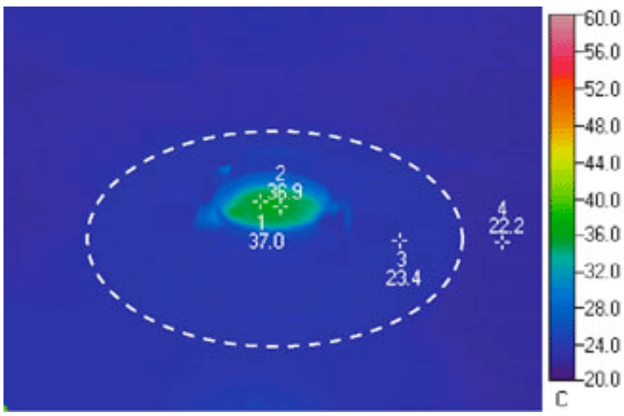
Thermal Reference Images

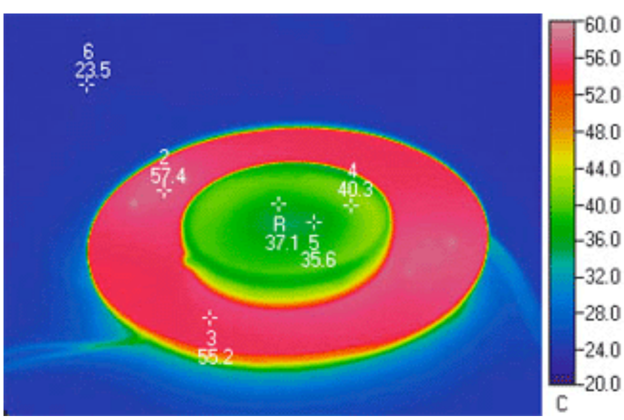
The thermopgraphic images on these pages represent the propagation of heat in micro-environmental systems. This enables you to visualize temperature distribution patterns normally not seen by the human eye. These images provide you with a far better understanding of what is happening on your stage than the limited information on the numerical displays of temperature controllers. The following thermographic images were acquired at the Bioptechs facility. They were made under laboratory conditions with the use of a calibrated thermographic camera. An infrared analysis program was used to extract the temperature data and annotate the images.



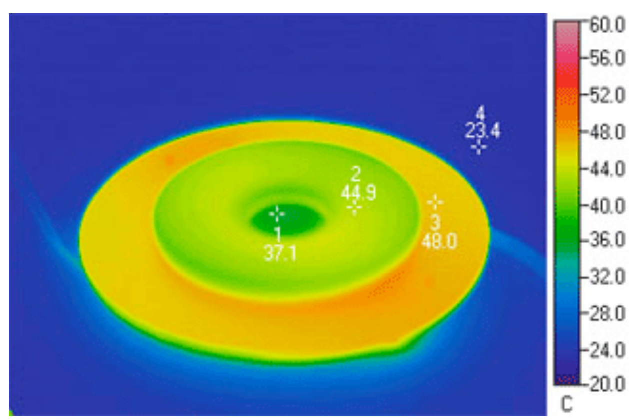
Thermal Profile of a Bioptechs Delta T4


Visible Light Image of a Bioptechs Delta T4

The first Thermograph shows the efficiency, accuracy and uniformity of the Delta T system. Notice the temperature of the stage adapter. It is nearly the same temperature as the room temperature background. Only the specimen and media are heated. Power consumption is 0.9 watts because heat is only applied to the specimen area. There is no heat transmitted to the stage. Therefore, it remains "Z" axis stabile. This is a sharp contrast to traditional peripheral heating methods (shown below), and clearly superior.



Thermal Profile of a Traditional Stage Heater

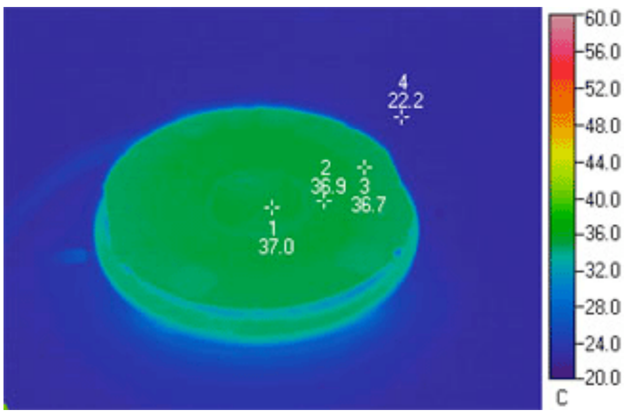


Thermal Profile of a Traditional Closed Chamber System

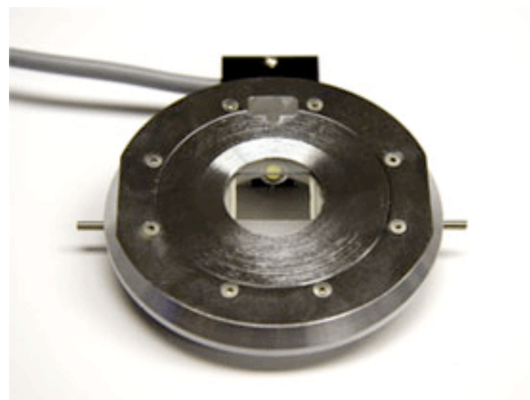
This thermograph indicates the disadvantage of peripheral heating. This is a thermal model of a 50mm culture dish in

This thermograph shows a traditional geometry for a closed system chamber on a peripherally heated plate equilibrated the center of a 100mm diameter uniformly heated, 3mm thick, aluminum plate with a 25 mm hole in the center. This image was acquired after 20 minutes of equilibration. Note the high temperatures of nearly 60 C, that it takes to reach 37 C in the specimen area. In this case heat that is not beneficial to the specimen is sunk into the stage causing Z-axis instability, not to mention the non-uniform temperature of the specimen area.

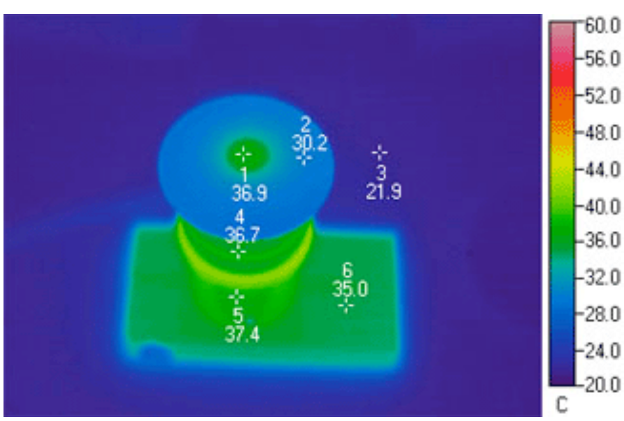
for 30 minutes. There are two 40mm coverslips separated by a 0.5mm gasket sandwiched between a 100 mm heated aluminum plate and an acrylic ring cover. Note the temperature of the heated plate required to warm the center of the field. There is a two-degree difference between the center of field and the acrylic plate, a nine-degree difference between the heated plate and the specimen area. This plate is resting in free air, not in contact with a stage plate that would sink much of the heat away through conductivity. This excess heat transmitted to the microscope results in “Z” axis variations. Also, due to the poor thermal conductivity you can see that it would take a long time to re-equilibrate after perfusion.



Thermal Profile of a Bioptechs FCS2


Visible Light Image of a Bioptechs FCS2

The thermograph above demonstrates the uniform temperature distribution of an FCS2. Notice that the coverslip temperature is so uniform that its location, in infrared, is indistinguishable from the base of the chamber. This demonstrates the effectiveness of the ITO heated Microaqueduct slide. It is capable of re-equilibrating cell temperature within seconds of perfusion and eliminates the typical thermal gradient that occurs with peripheral heating.



Thermal Profile of a Bioptechs Objective Heater


Visible Light Image of a Bioptechs Objective Heater

Notice the temperature distribution in the following locations: nosepiece, bottom of objective, region above heater band,

and top of objective. Power consumption after equilibration is 1.3 watts. The point is that, unless you warm the entire microscope, the microscope will always act as a heat sink with respect to warming the objective. You can expect a small thermal gradient. All objectives have different thermal profiles. Therefore, it is imperative to efficiently transfer heat to the core of the objective and prevent excess heat from radiating from the heater-band. This is exactly what the Bioptechs Objective Heater does! Check with Bioptechs for thermal information on your objective.

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