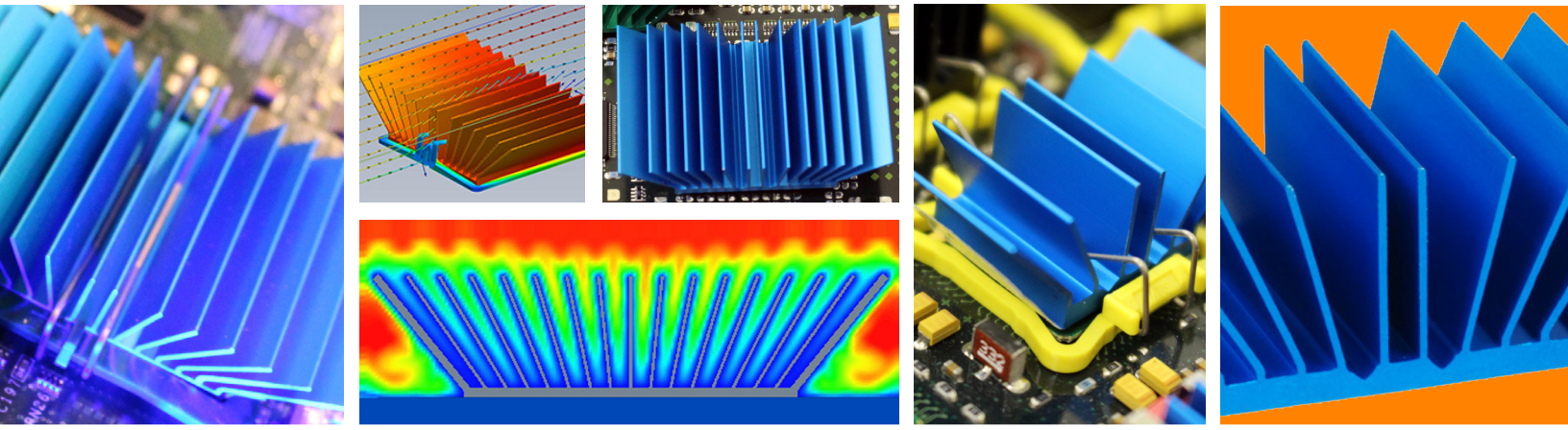


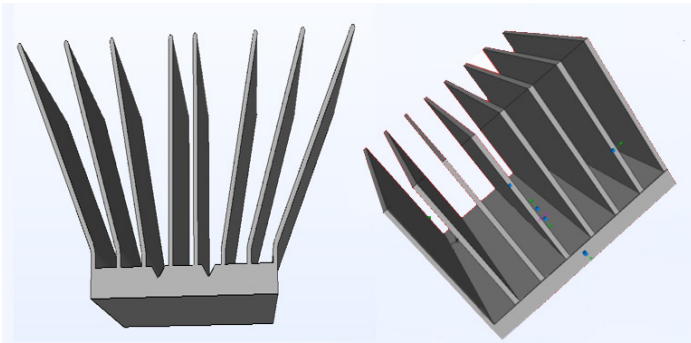
# ATS Case Study

Modeling maxiFLOW™ Heat Sinks with 6SigmaET

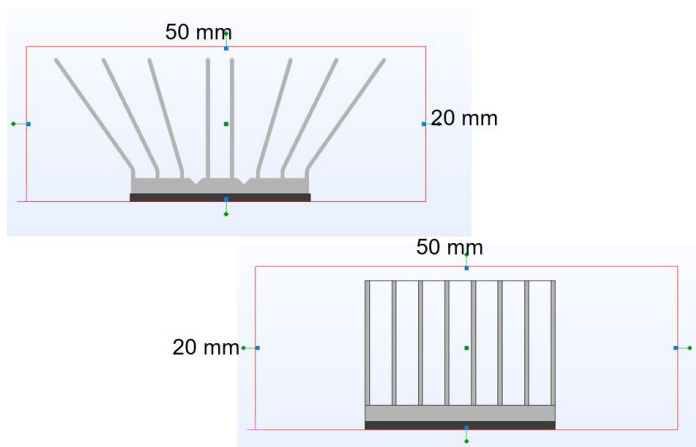


# Modeling maxiFLOW™ Heat Sinks with 6SigmaET

Advanced Thermal Solutions, Inc. (ATS), a leading-edge thermal engineering and manufacturing company focused on the thermal management of electronics, ran a case study to evaluate the capability of 6SigmaET to model maxiFLOW™ heat sinks. Previous attempts at modeling these slant-fin heat sinks with other CFD software had been unsuccessful due to the cartesian nature of the gridding system.



ATS engineers used an ATS-50230P-C1-R0 maxiFLOW™ heat sink, which had a base footprint of 22.25 mm x 22.25 mm, base thickness of 2.0 mm, fin thickness of 0.5 mm, fin height of 15.25 mm, max width at top of 32.0 mm, and eight fins. The thermal performance of this heat sink was compared to a standard straight-fin heat sink with the same base and fin dimensions, which could be easily modeled by CFD. A CAD file (STL format) of the maxiFLOW™ heat sink was imported into 6SigmaET for the test.



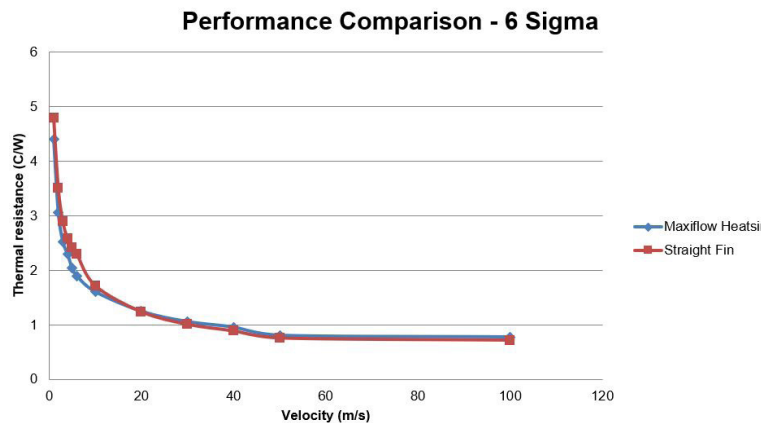
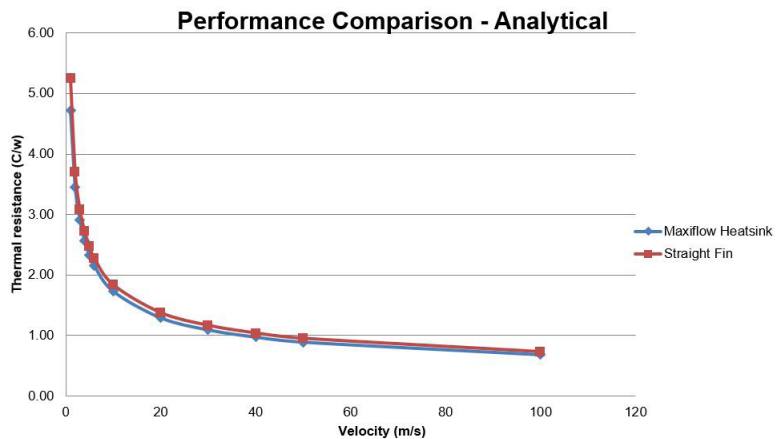
The length of the duct in the flow direction was 50 mm in both cases because some of the air that was flowing around the flared heat sink was captured by 6SigmaET.

Analytical models of thermal resistance and pressure drop were calculated for both heat sinks and then compared to the results of the CFD simulations. The performance curves of each heat sink were then compared to each other as well. Analytical and CFD models showed that as velocity

(m/s) increased, the difference in thermal performance between the maxiFLOW™ and straight-fin heat sinks decreases.

In analytical models, the maxiFLOW™ heat sink is 10% better than the straight-fin at 1.0 m/s and 6% better at airflows greater than 20.0 m/s. Performance remains constant from that point forward. By comparison, the thermal resistance of the maxiFLOW™ heat sink at 100 m/s was 0.73 °C/W, while the straight-fin was 0.68 °C/W.

In CFD simulations, the maxiFLOW™ heat sink is better than the straight-fin by 8% at 1.0 m/s, but the trend is not consistent with the analytical models. At around 20.0 m/s, with everything else remaining constant, 6SigmaET predicts that the straight-fin heat sink begins to outperform the maxiFLOW™ and at higher airflow the straight-fin heat sink outperforms maxiFLOW™ by about 8%.



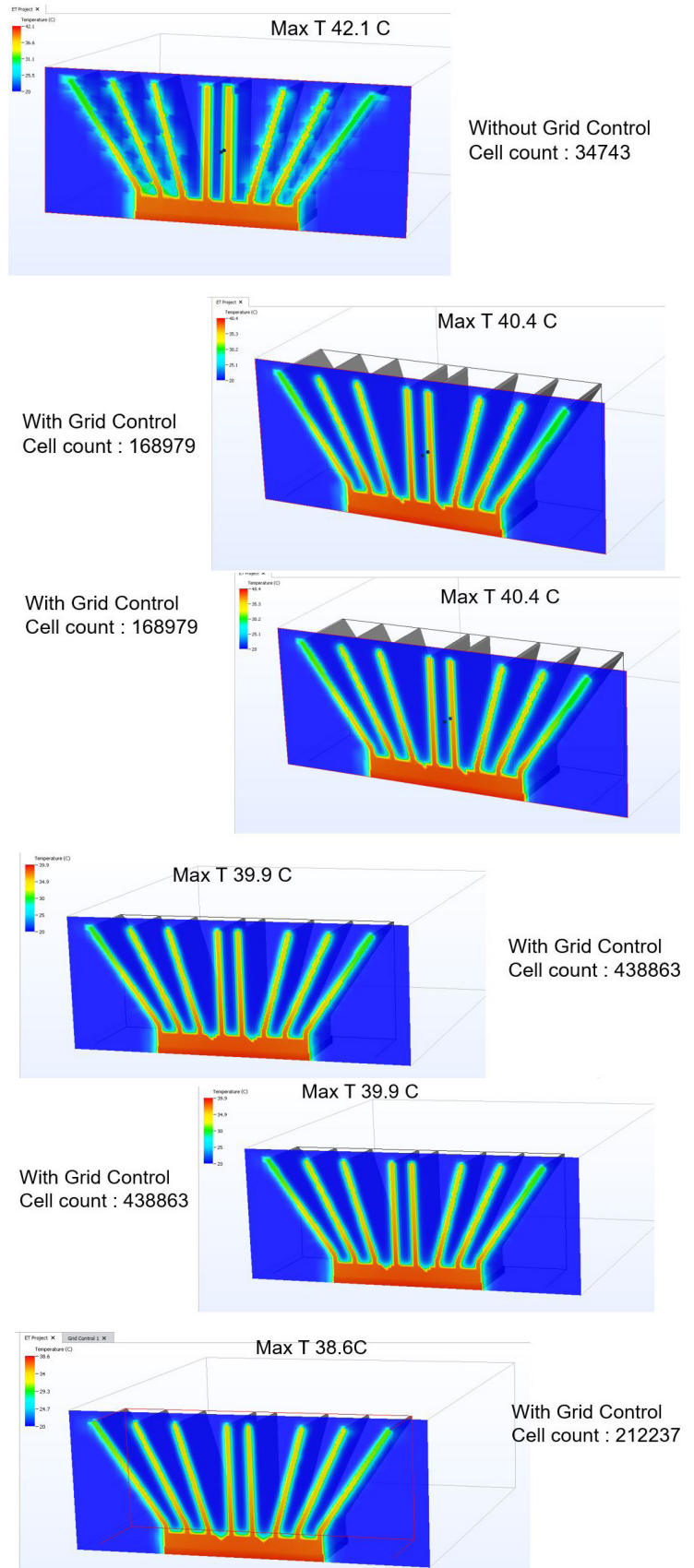
When modeling maxiFLOW™ heat sinks, grid control was necessary to adequately capture the physics due to their inclined fins. Without grid control, 36,410 cells were used and 6SigmaET took 28 seconds to solve the simulation. With grid control, 168,412 cells were used, and it took six minutes and 12 seconds to solve. As the cell count increased (with grid control), the model became increasingly clear and also reduced the max temperature from a high of 42.1°C (with 34,743 cells) to 38.6°C (with 2,122,372 cells). The challenge with other software tools was to get the mesh lines aligned with the angled block, but 6SigmaET made it easier to get finer and finer meshing until the results correlated with the analytical tools. (Images to the right demonstrate the enhancements from addition mesh control.)

ATS engineer Sridevi Iyengar ran the simulations using 6SigmaET. She explained, “It was very easy. It is a good tool to characterize maxiFLOW™ heat sinks for our datasheets using CFD because I can simply input the CAD file, run it, and see good correlation between the results of the CFD and the analytical calculator that we developed.”

### Conclusion

Using 6SigmaET, ATS engineers were able to model maxiFLOW™ heat sinks, with its slanted-fin array and achieved similar thermal performance results as those predicted by analytical models. The simulations were enhanced by implementing grid control and increasing the cell count in each mesh to get a finer image and results that were more consistent with the expected totals.

6SigmaET proved to be a faster modeling tool than other software options and enabled our engineers to easily model maxiFLOW™. Now our engineers can input maxiFLOW™ heat sinks into future projects for quicker turnaround for customers.



### About Advanced Thermal Solutions, Inc.

Advanced Thermal Solutions, Inc. (ATS) is a leading engineering and manufacturing company supplying complete thermal and mechanical packaging solutions, from analysis and testing to final production. ATS provides air and liquid cooling solutions and laboratory-quality thermal instrumentation, as well as thermal design consulting services and training. For more information about ATS, visit [www.qats.com](http://www.qats.com) or email [ats-hq@qats.com](mailto:ats-hq@qats.com).