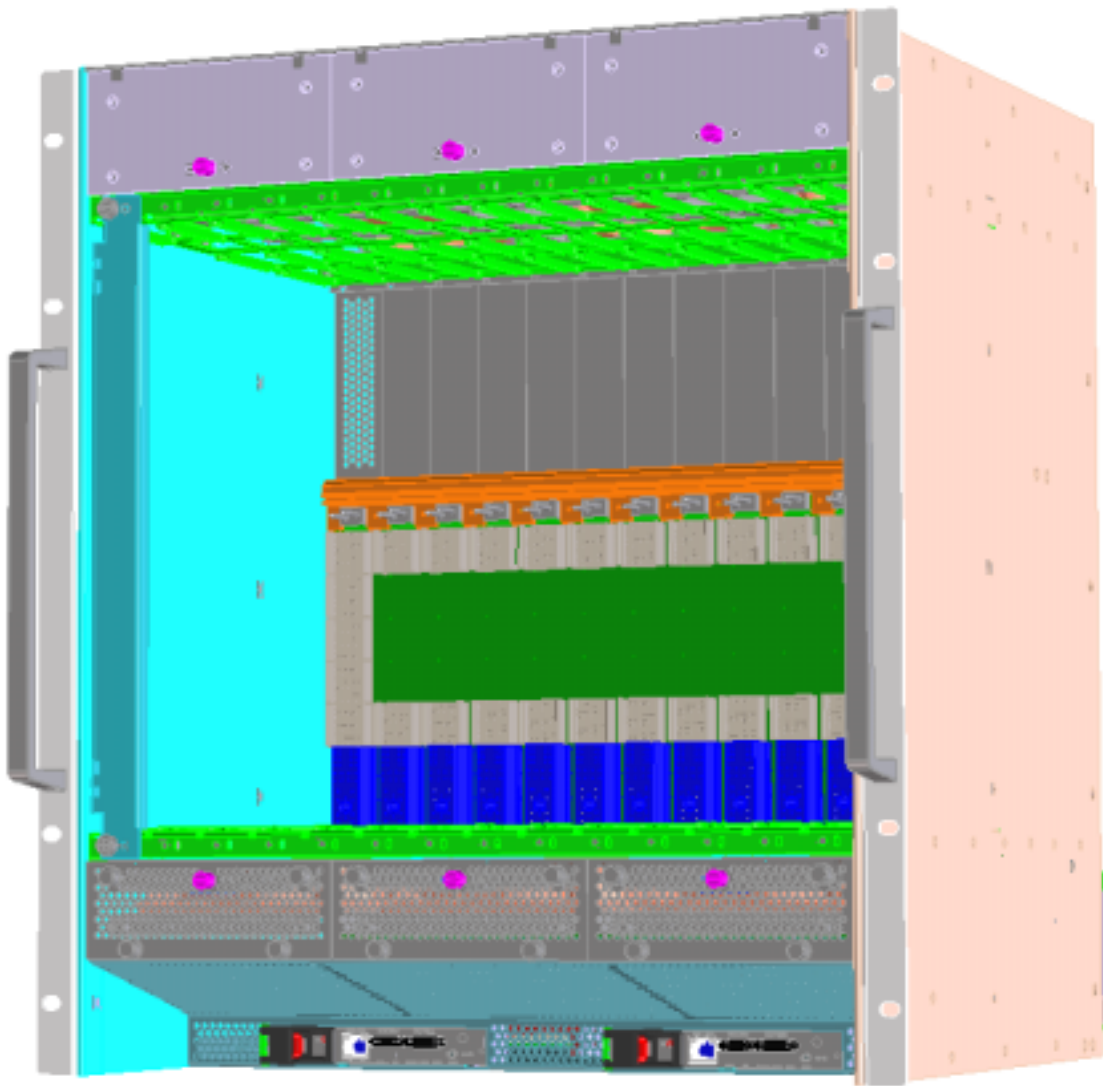




Temperature/Airflow CFM Simulation 12U ATCA Chassis with 6 Lower Fans and 3 Upper Fans



Simulation Software:
Flomerics Flotherm 4.2

System Simulated:

- 12U ATCA Chassis
- 14 ATCA Blades with 200W power source evenly distributed across the boards.
- The average height of the components on each blade is 12mm
- 14 ATCA RTM's with 30W power evenly distributed across the boards
- The average height of the components on each RTM is 12mm.
- Six 150 CFM Delta fans in three fan trays located below the card cage.
- 45 ppi Quadrafoam filters are located below the lower fans.
- Three 150 CFM Delta fans in three fan trays are located above the RTM at a 10° angle.
- The ambient temperature for the system is 25° C at 1 atmosphere
- The perforated panels for the intake and exhaust are 4mm diameter with a 70% open area ratio.
- Temperature monitor points were placed towards the top front and top rear of each slot.
- Temperature monitor points were placed at the top center of each RTM slot.
- Figure 1 below shows the grid summary for this model.

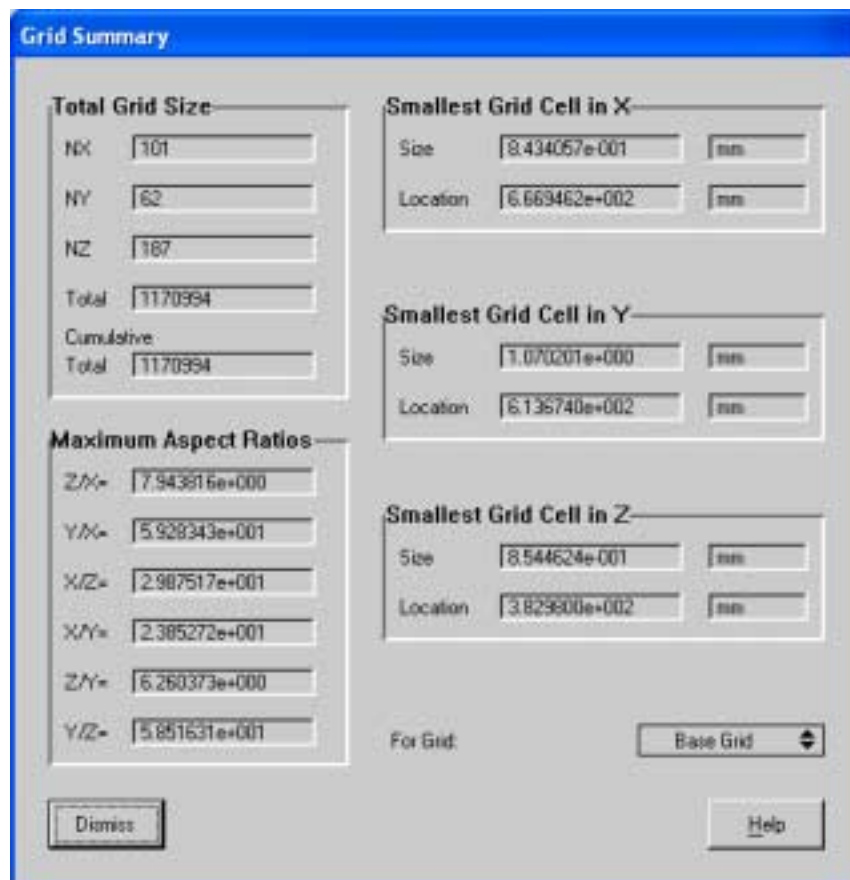


Fig. 1 Grid Summary

Temperature Solutions:

Figure 2 below shows the temperature rise at each monitor point. The maximum temperature rise was 15° C in the RTM and less than 14°C for the front card cage.

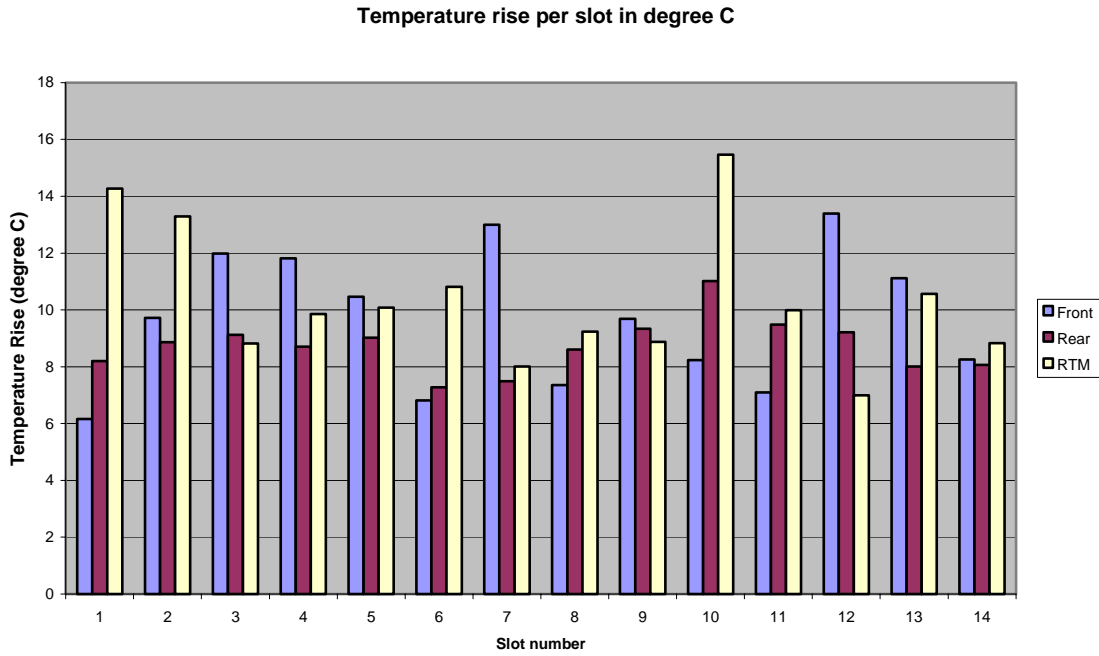


Fig. 2 Per slot temperature rise

Figure 3 below shows a snapshot of the temperature distribution for the front card cage.

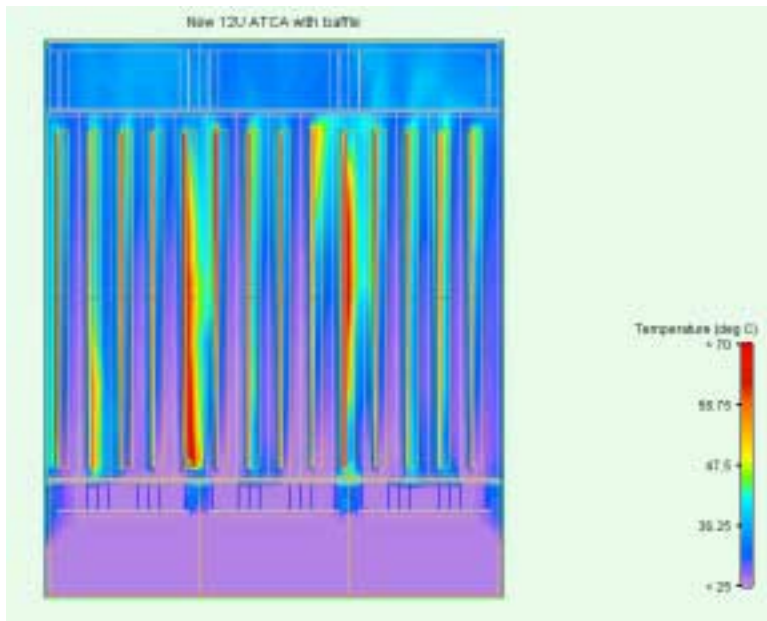


Fig. 3 Front card cage temperature distribution

Figure 4 below shows a snapshot of the temperature distribution for the RTM.

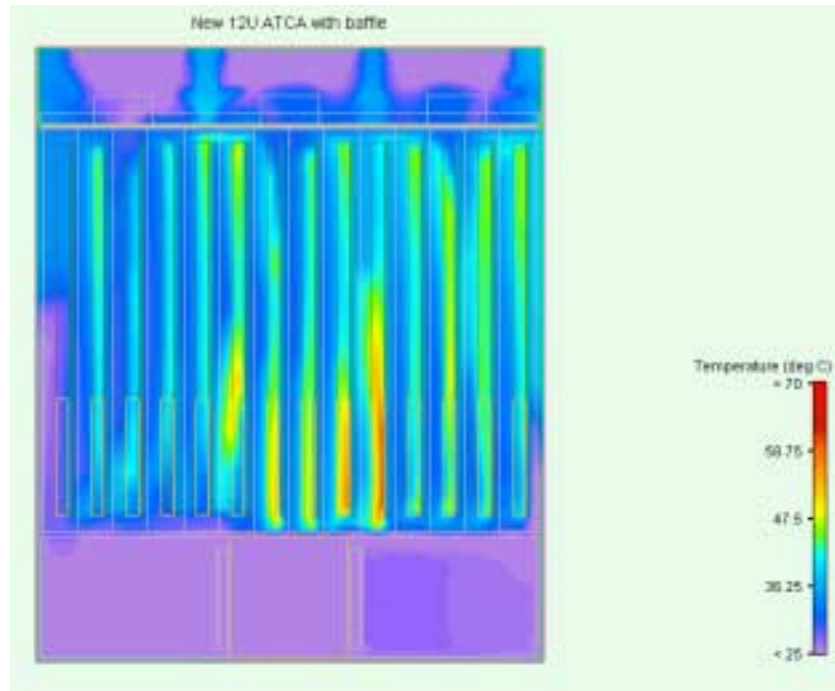


Fig. 4 RTM temperature distribution

Figure 5 below shows a snapshot of the temperature distribution across the front boards and the RTM's.

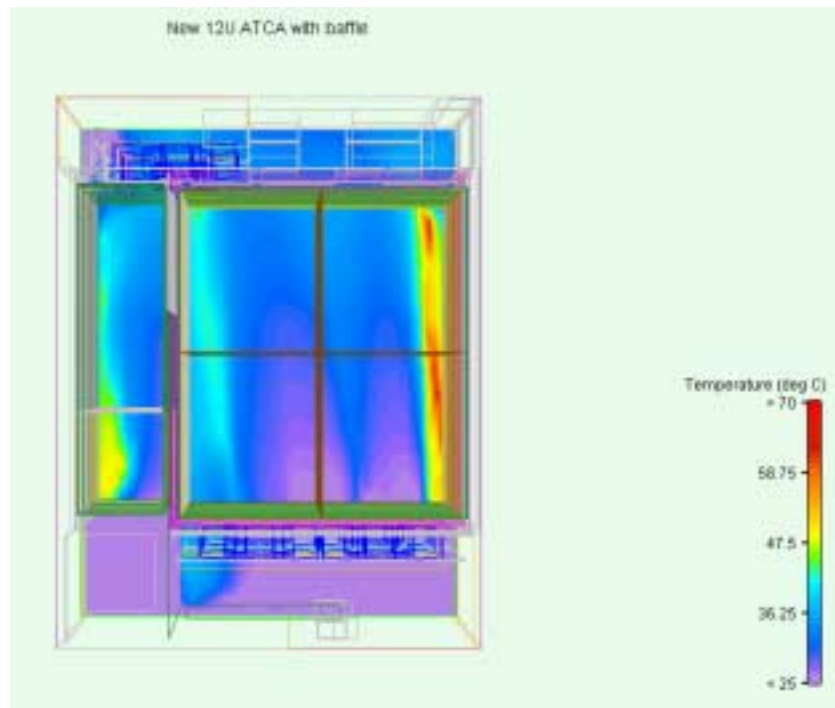


Fig. 5 Temperature distribution across front and RTM boards

Figure 6 below shows the minimum and maximum temperatures per slot as well as the minimum and maximum temperature for the entire chassis.

Region Name	Minimum(deg C)	Maximum(deg C)
Slot 1	25.20	56.75
Slot 2	25.01	58.57
Slot 3	25.00	69.85
Slot 4	25.00	72.07
Slot 5	25.30	78.62
Slot 6	25.00	67.97
Slot 7	25.00	68.82
Slot 8	25.00	72.67
Slot 9	25.03	65.39
Slot 10	25.16	71.22
Slot 11	25.01	68.97
Slot 12	25.01	68.14
Slot 13	25.01	56.00
Slot 14	25.73	78.10

Fig. 6 Minimum and Maximum Temperatures

Airflow Solutions:

Figure 7 below shows a snapshot of the airflow around the front boards.

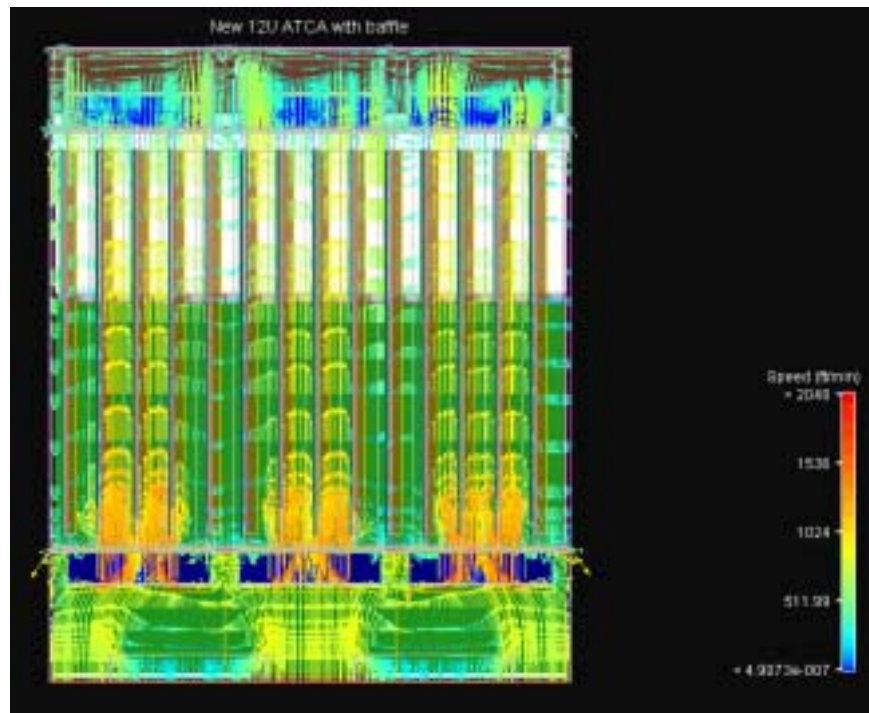


Fig. 7 Airflow for front card cage

Figure 8 below shows a snapshot of the airflow around the RTM's.

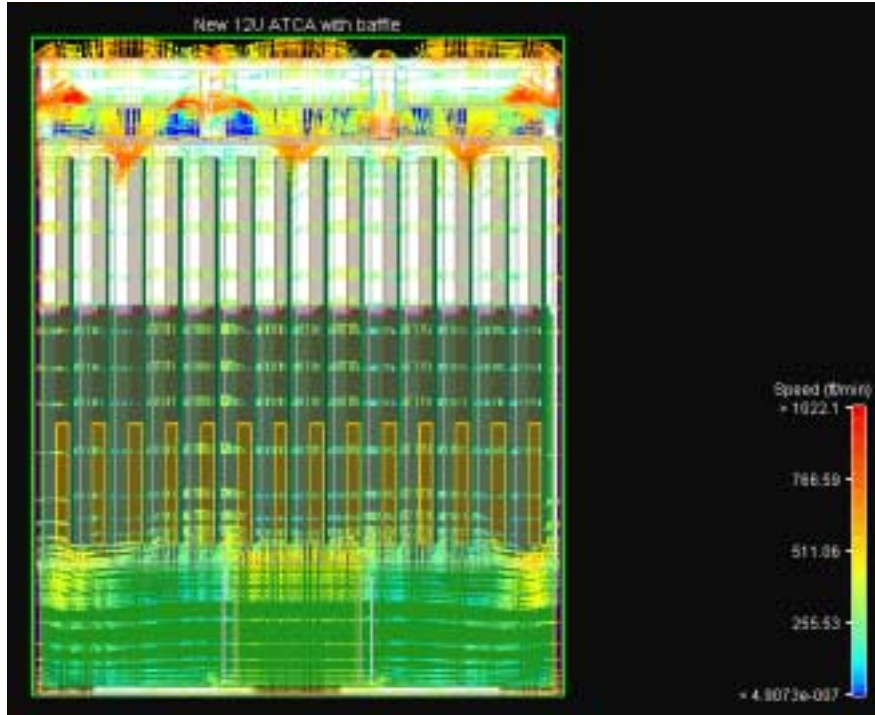


Figure 8 Airflow for RTM's

Figure 9 shows the airflow across both front and rear boards.

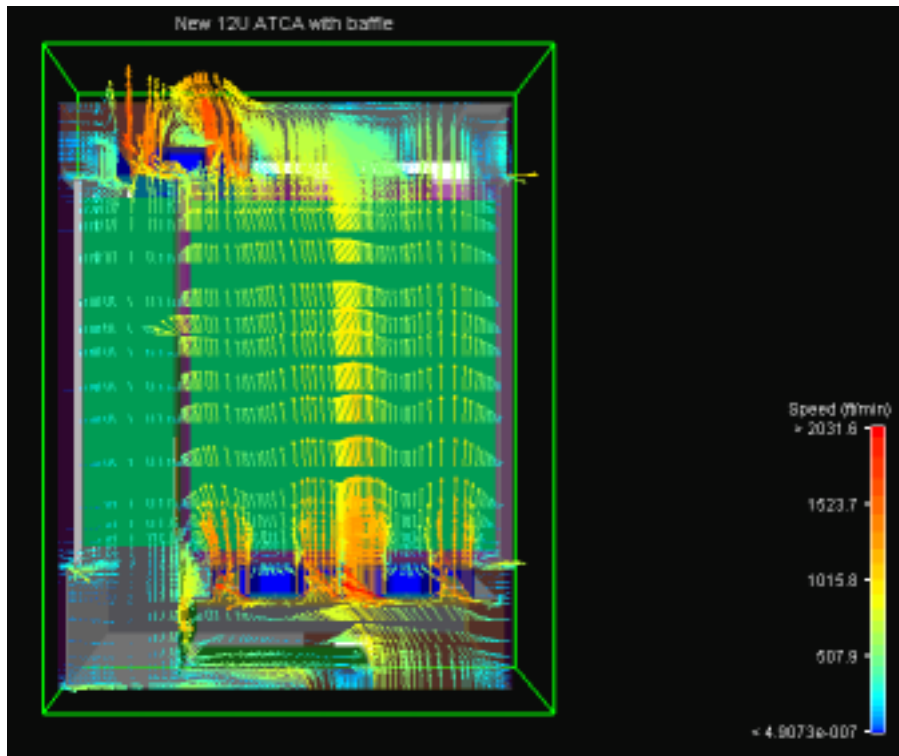


Fig. 9 Airflow across boards

Figure 10 below shows the Mean airflow distribution in lfm, and Figure 11 shows the bulk airflow distribution in cfm.

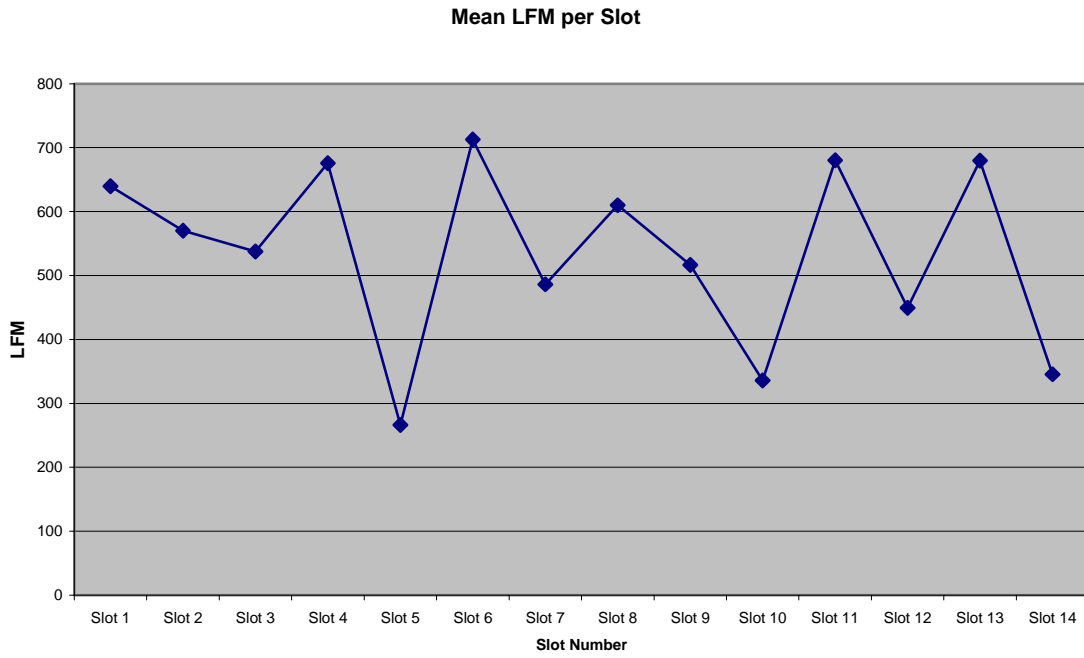


Fig. 10 Mean airflow per slot

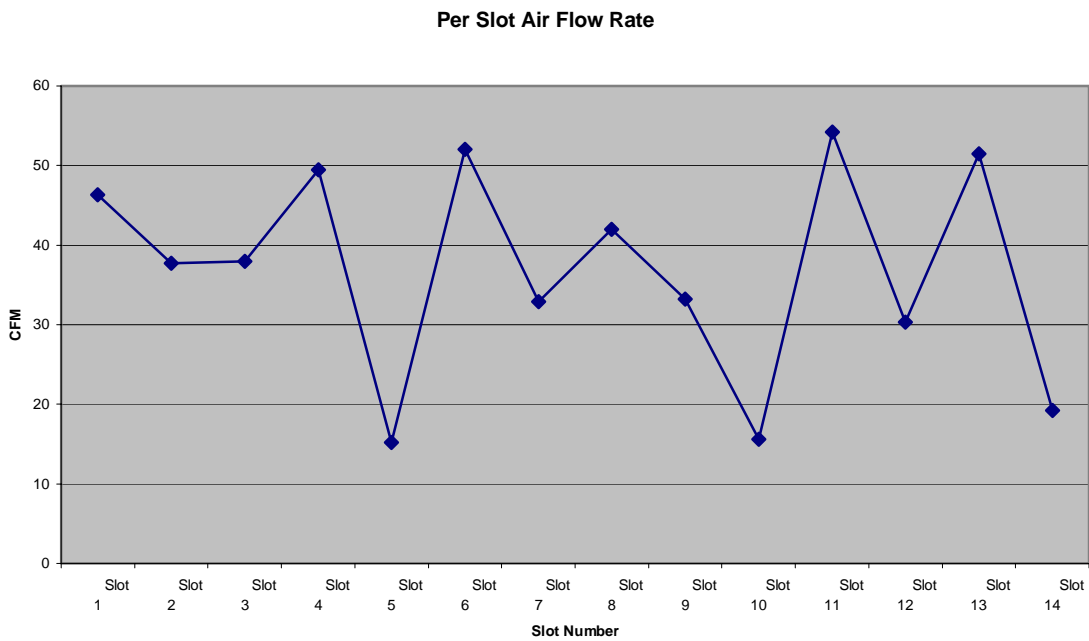


Fig. 11 Bulk airflow per slot

Figure 12 shows the system impedance curve, along with the operating point.

System Impedance Curve for CAP001800

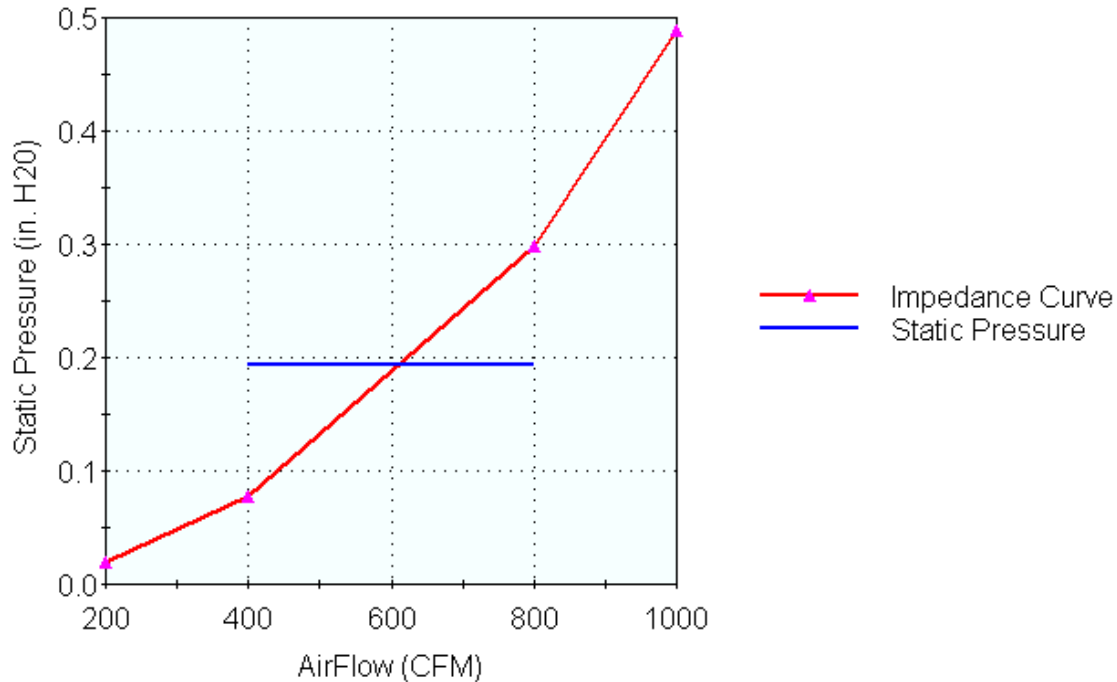


Fig. 12 System Impedance Curve

Conclusion:

- The temperature rise for the air as it exits the card cage area had a temperature rise of less than 15°C.
- The slots with the lowest airflow and highest temperature rise were slots 1, 5 and 10.
- The front edge of the front cards and the back edge of the RTM's had the least airflow and highest temperature rise for each slot.
- The operating point for this chassis when fully populated is 0.194 in of H²O.
- The average per slot temperature rise, including RTM's, is 9.58°C.
- The average per slot temperature rise, excluding RTM's, is 9.20°C.
- A thermal test was run on this chassis using load boards at 200W per slot to validate the simulation.
 - The standard deviation for chassis temperature was 4.6°C.
 - The average measured per slot temperature was 0.2°C below the per slot temperature results from the Flotherm simulation.