PN 297 ‘

EMCal group
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EMCal Integration Test

Cooling test

EMCal Sector frame was assembled in the building 902. Part of this frame (1/6) was insulated to simulate the heating conditions inside electronics enclosure (Fig 1). The heater with maximum 530W power was attached to aluminum tube (3” diameter, 72” length) to provide uniform heating. Two heat-sensing devices (top and bottom) were used to measure the temperature.

Heat load:

Under normal operating conditions the heat on 1/6 part of the sector dissipated by 432 PMT bases(~ 200W total power at 2 kV HV) and 3 motherboards (~ 300W total power).

Cooling:

The cooling was provided by water heat exchanger (24”L x 4”Sq, 1/2” cooper tubing) and 4 fans (15W, 30 CFM each). Temperature of the water at the inlet was 80°F (26.7°C) to avoid condensation. Water flow varied from 0 to 1.85 GPM (controlled by plastic flow meter).

Summary of the test results:

The temperature raised by 17°C (Fig 7) without water flow and by 8°C (Fig 8) at the water flow 1GPM with 530W heater (Fig 2, average top and bottom). The upper limit of temperature was 42°C (Fig 7) and 33.5°C (Fig 8) accordingly. Measurings was made also with 350W heater (Fig 4,5,6) and without heater (Fig 3) The difference temperature between top end bottom was 4°C. Increasing water flow above 1GPM was non-effective (Fig 9).

Conclusion:

Cooling system, as it designed for EMCal, will operate successfully and will stabilize the temperature inside EMCal electronic enclosure at a value ~ 8°C above the room temperature.