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New 63U ATCA rack: thermal performances and integration challenge

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In order to save the space in the underground counting rooms during the ATLAS phase II upgrades, a project dedicated to the study of the impact of taller rack integration in the actual counting rooms was launched analyzing its cooling performance and the impact on the cooling infrastructures.

A new 63U prototype rack equipped with three ATCA shelves with open bottom to top airflow, high power dissipating load blades, three new prototype 2U heat exchangers and various sensors was installed in a lab. Impact of stocking three ATCA crates on the cooling performance was checked alongside with other critical aspects.

Summary

The most valuable aspect in the underground areas is space –which due to the nature of the location is limited and its expansion is expensive. Thus, investigation of integrating the taller racks being able to house more equipment, in the underground counting rooms - was in need. In order to do that a 63U prototype rack was ordered and installed in a lab, it was equipped with three ATCA shelves –each of the shelves can house up to 14 blades. The target max power dissipation foreseen is 450W per blade, thus the total power dissipated by the rack, including the required internal fan power, can easily exceed 20 kW. This high power dissipation called for assessment of the new taller rack equipped with three stocked open bottom to top airflow ATCA crates cooling capabilities. To be able to provide the rack with enough cooling power, a chiller with maximal cooling capacity of 25kW was ordered and installed –supplying the rack with cooled water.

Currently in many of the racks in the ATLAS underground areas, standard 1U 19” air/water heat exchangers are installed. To increase cooling efficiency and use the maximal cooling capacity, a new prototype 2U HX was ordered with reduced heat exchange area, decreasing the necessary water connections in the rack by half. These prototypes will be evaluated in the test rack before installation in the ATLAS counting rooms, the results will be presented.

As was already measured, a standard 52U LHC rack equipped with two ATCA shelves can create noise up to 102 dB(A), equipping the rack with additional shelf can only increase the generated noise. Thus the thorough studies regarding soundproofing of these taller racks were also a part of this test campaign. During previous thermal management studies of the 52U LHC rack, a soundproofing material was chosen in consultation with CERN HSE group and preliminary tested. Same material was installed in the new rack, its efficiency and the impact on the cooling capacity of the crates were evaluated.

Since the 63U rack is a prototype, also its mechanical aspects have to be evaluated, that is why the part of these studies is dedicated to investigate possible improvements which can be introduced to the rack structure increasing not only its cooling capabilities but also its integration capabilities.

Number of tests were carried out investigating many different aspects of the rack cooling such as, establishing optimal cooling water conditions to maximize heat removal from the rack, finding best power distribution across the shelves to increase power supplies sustainability, evaluation of the new 2U heat exchangers to assess its cooling capacity, and many more. The relevant results will be presented.

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