

Unlocking the Cosmos with CoolIT: Cooling Durham University's COSMA-8 Supercomputer



The Customer

Hosted by the Institute for Computational Cosmology at Durham University on behalf of the DiRAC HPC facility, COSMA 8 is set to take center stage as part of the DiRAC Memory Intensive service (www.dirac.ac.uk). This powerful tool will empower scientists to further explore the realms of astronomy and particle physics through extensive simulations.

Customer Challenge

Researching the big cosmological questions, such as the origin of the Universe, takes massive amounts of computing power. As a top 100 world university, Durham in the UK is at the forefront of this science. The University faced challenges in achieving the necessary computational density due to the thermal limitations of each node. The growing computational demands highlighted an urgent need for efficient heat management solutions, like liquid cooling.

CoolIT Systems Solution

Using highly efficient Direct Liquid Cooling (DLC) technology, CoolIT Systems designed a DLC solution to meet DiRAC's and Durham University's needs.

COSMA- 8 contains 528 direct liquid cooled Dell Technologies PowerEdge C6525 servers across 10 racks. The liquid is managed by 2 CoolIT CHx750 coolant distribution units (CDU) which are connected to a custom CoolIT secondary fluid network installed under the floor including 13 Rear Door Heat Exchangers.

Customer Benefits

With a successfully installed CoolIT Systems Rack DLC solution, COSMA-8 draws on the power of over 1000 processors and 67,000 cores spread over 528 compute nodes to achieve a peak performance of 2 PetaFLOPS with 0.5PB RAM. According to Durham University, COSMA-8 is a testament to their dedication to unraveling the mysteries of our universe.

This peak performance will help researchers in simulating the Big Bang to understanding the intricacies of black holes, dark matter, dark energy and how the universe was formed.



"CoolIT's DLC technology has helped us revolutionize our approach to scientific computing. It allows us to maintain elevated cooling water temperatures and achieve unparalleled computational density.."

*Dr. Alastair Basden,
Head of the DiRAC Memory Intensive HPC Service at Durham University and co-chair of the DiRAC Technical Directorate*

HPC Setup

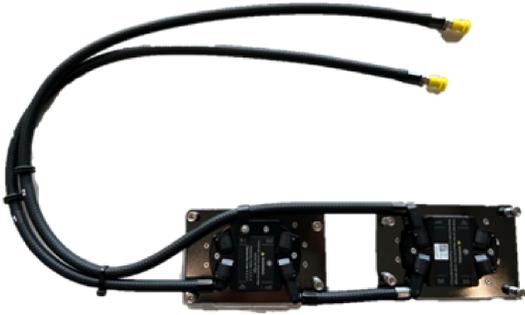
- 528 direct liquid cooled Dell Technologies PowerEdge C6525 servers across 10 racks
- 2 CoolIT Systems Rack DLC CHx750 CDUs
- 20 stainless steel 42U Vertical Rack Manifolds featuring dry-break quick disconnect technology
- 13 Rear Door Heat Exchangers
- 1 subfloor Secondary Fluid Network

Results

- More than 2PF of Peak Performance
- Heterogenic infrastructure, consisting of different CPU and GPU families working together.
- Combination of Direct Liquid Cooling and Air Assisted (Indirect) Liquid Cooling for the best efficiency
- Investment Protection by modernization of existing Data Center
- Significant Reduction of Operational Costs
- Lower noise emission to the building and surroundings



Passive Coldplate Loops



The Dell PowerEdge C6525 server CPUs are cooled by CoolIT Passive Coldplate Loops. Each Passive Coldplate Loop terminates in a Stäubli dry-break quick disconnect, allowing for safe and simple removal of servers from the cabinet during server maintenance.

Rack Manifolds



20 stainless steel 42U Vertical Rack Manifolds featuring dry-break quick disconnect technology were used to interface between the Passive Coldplate Loops and the Secondary Fluid Network under the sub-floor. This allows simple decoupling of a single server without the need to remove a neighboring system by way of the quick disconnects

Coolant Distribution Units (CDU)



The CoolIT liquid cooling system inside COSMA-8 is managed by 2 row-based CHx750 CDU which circulate coolant through the Secondary Fluid Network, racks and servers and rejects this energy to a facility water feed connected to the facilities water treatment center.

Rear Door Heat Exchangers (RDHx)



With DLC components managing the server heat through liquid cooling, 13 RDHx provide air cooling for the remaining heat. These RDHx operate in parallel to the DLC components utilizing the same liquid supply for efficient cooling.

Secondary Fluid Network (SFN)



COSMA-8 is separated into 2 rows of 13 data center racks, with each row being coupled to 2 CHx750 CDUs via a secondary fluid network. This network of CoolIT Systems installed sub-floor pipes connects the CDUs directly to the RDHx and Rack manifolds to provide constant supply of treated PG25 coolant.