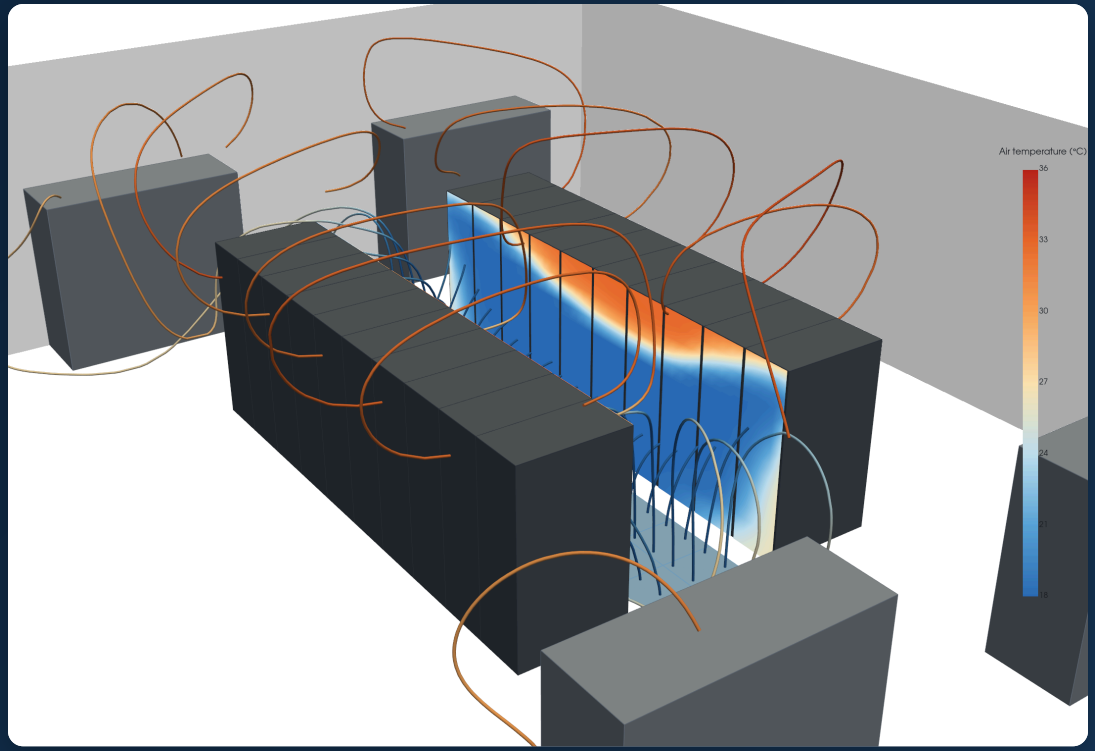
Thermal Simulation & CFD

From your 3D model to a verified temperature field — modelling and thermal simulation for data centres, liquid cooling and heat-rejection equipment.

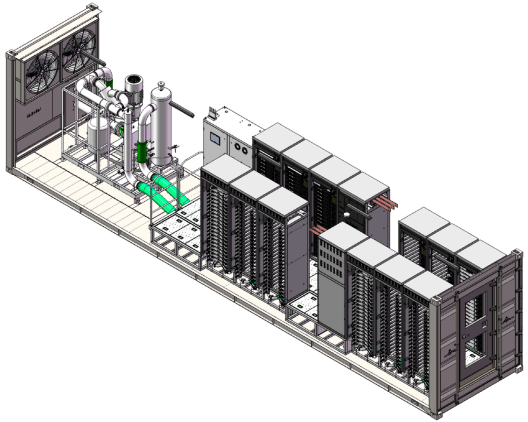
- CAD clean-up & simplification
- Meshing & solving
- Conjugate heat transfer
- Data-hall airflow
- Cold plates
- Hot-air recirculation
- Container cooling
- EN / CN reports

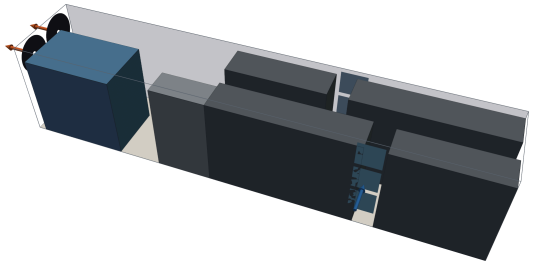


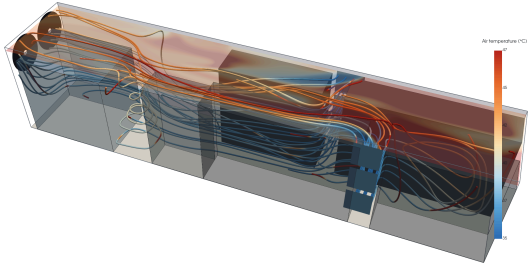
All contour images in this portfolio are my own ANSYS Fluent 2026 R1 results, post-processed in Python. Sample studies are labelled as such.

Phone +86 151 6711 6563

From CAD Model to CFD







① Your 3D model

SolidWorks / STEP assemblies with thousands of parts, opened read-only.

② CFD model

Equipment reduced to heat sources, fans and openings at their true size and position; bolts, cables and other flow-irrelevant detail removed.

③ Results

Temperature field, air paths, local hot spots and the inlet temperature of every unit.

Modelling rule: geometry that drives flow and heat transfer (openings, ducts, heat sources, obstructions) keeps its real dimensions; the rest is simplified — controlled mesh size, trustworthy results.

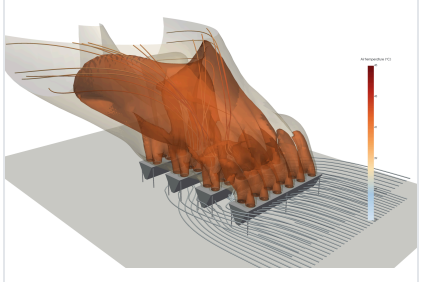
What I Simulate

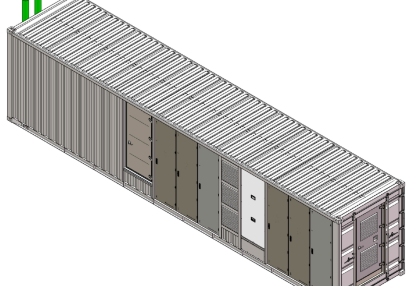


Illustrative photo, not my project · Carl Lender, CC BY 2.0, Wikimedia Commons



Illustrative photo, not my project · Phiarc, CC BY-SA 4.0, Wikimedia Commons





Data halls

- Hot / cold aisles, raised-floor supply
- Rack inlet temperatures vs. ASHRAE
- Cooling-unit failure (N+1), growth

Liquid cooling

- Cold plates and heat exchangers (CHT)
- Chip temperature, channel pressure drop
- Manifold flow distribution

Heat-rejection yards

- Dry-cooler / tower recirculation
- Wind, spacing, screen walls
- Layout comparison

Containers / modular

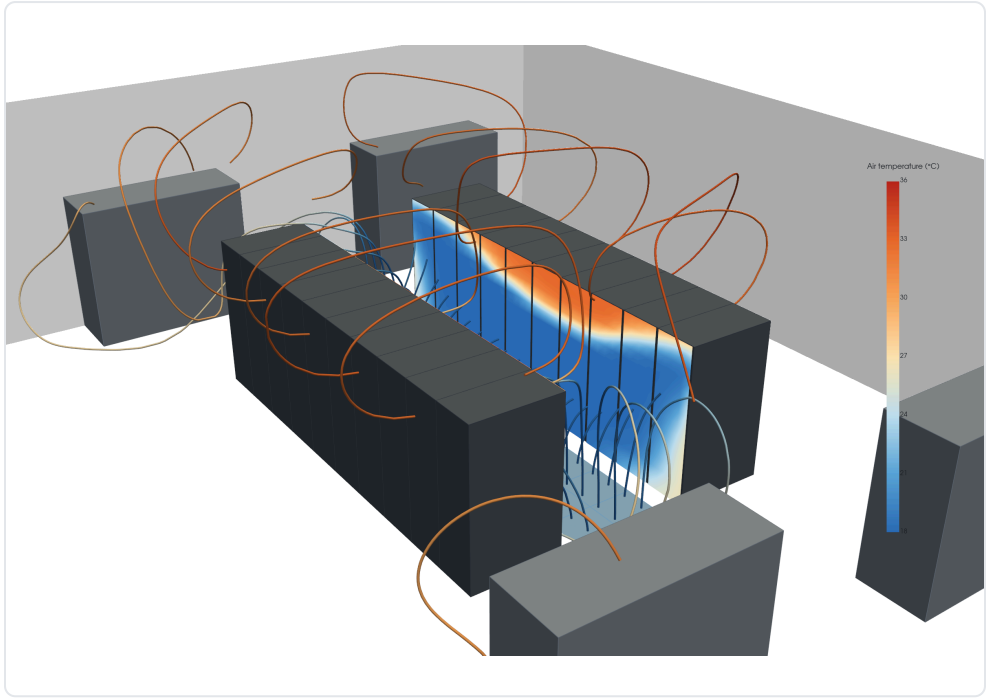
- Air flow and equipment cooling inside
- Inlet / exhaust arrangement
- Extreme-ambient checks

Typical physics: turbulence (k-ε / SST k-ω) · buoyancy · conjugate heat transfer · fans & porous media · steady / transient

Data-Hall Airflow

Sample study

Two rows, 20 racks (159 kW), raised-floor supply into the cold aisle at 90% of rack airflow. Open vs. contained cold aisle.



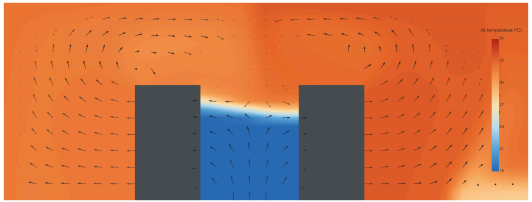
Open aisle: cold air rises from the perforated tiles (blue); hot exhaust wraps over the rack tops into the cold aisle (orange) and heats the upper fronts of row B.

33.0 °C
Open aisle: max. rack inlet

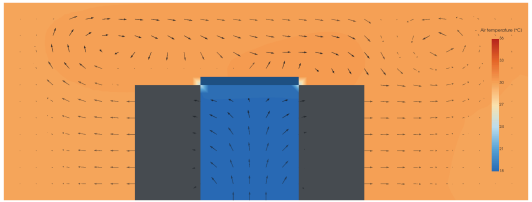
28.9 °C
Contained aisle: max. rack inlet

109 k
Hex cells

0.015%
Energy balance error



Section across the cold aisle: hot recirculation over the racks pushes the upper inlets above the ASHRAE 27 °C recommended limit.

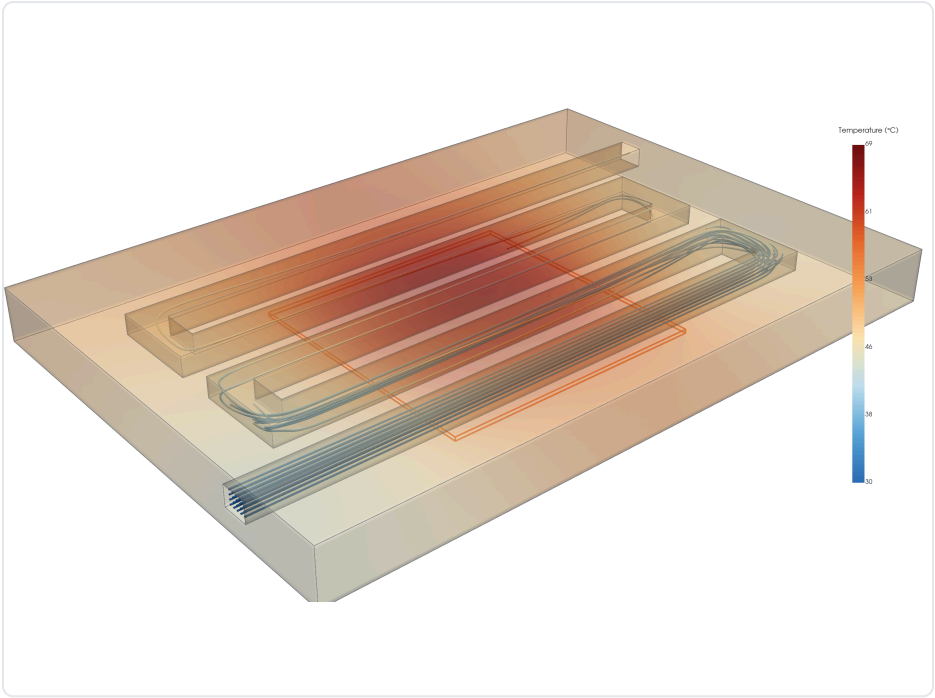


Contained aisle (0.15 m leakage gaps at both roof ends): the middle racks see near-supply air; the 28.9 °C peak sits at the row-end racks next to the gaps — supply still needs to reach full rack airflow.

Liquid Cold Plate — Conjugate Heat Transfer

Sample study

Copper plate with a 5-pass serpentine channel, 40 × 40 mm chip at 600 W, water 30 °C at 0.6 L/min. Water and copper solved together (CHT).



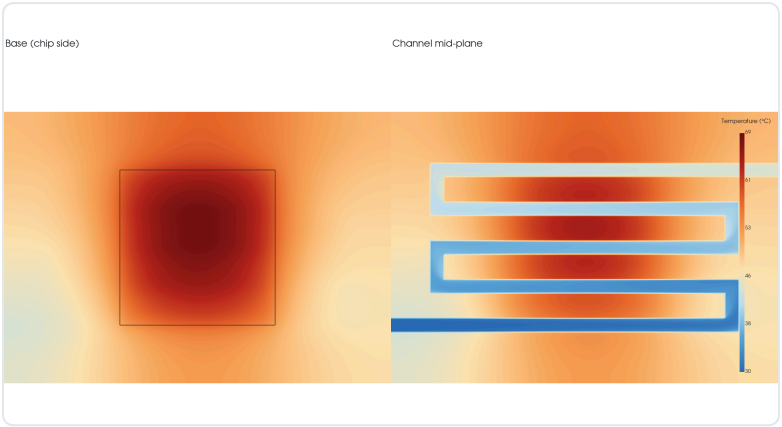
Copper shown transparent; streamlines follow the water and are coloured by temperature, warming pass by pass.

68.6 °C
Max. chip-face temperature

14.4 K
Water temperature rise

4.4 kPa
Plate pressure drop

< 0.001%
Heat balance error



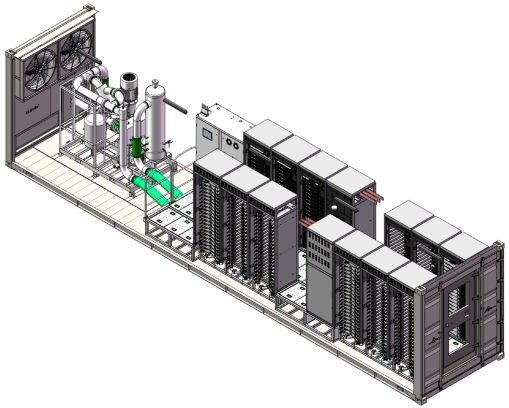
Left: base temperature on the chip side. Right: channel mid-plane — hot spot and channel layout at a glance, ready for channel optimisation.

40 ft Liquid-Cooled Container — Internal Cooling

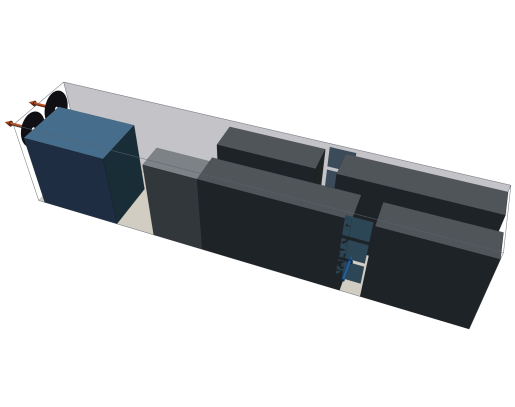
Engineering model

Simplified from the real 3D model: liquid-cooled racks, power cabinets and CDU as heat sources; side louvres in, two end fans out.

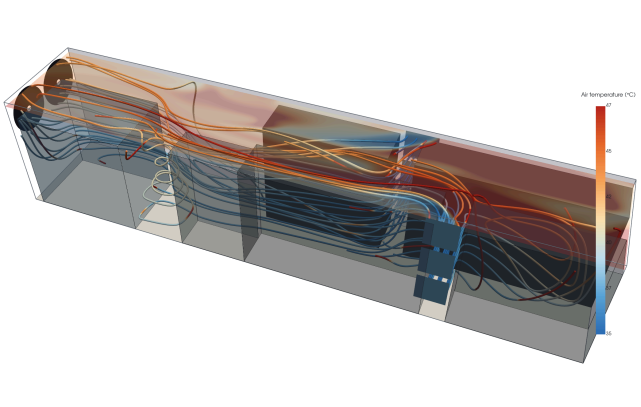
7,542 m³/h	42.0 °C	1.3 m/s	0.006%
Intake through 6 louvres	Exhaust air (35 °C ambient)	Effective louvre face velocity	Energy balance error



Real 3D model (≈ 5,000 parts)



CFD model: equipment at true size and position



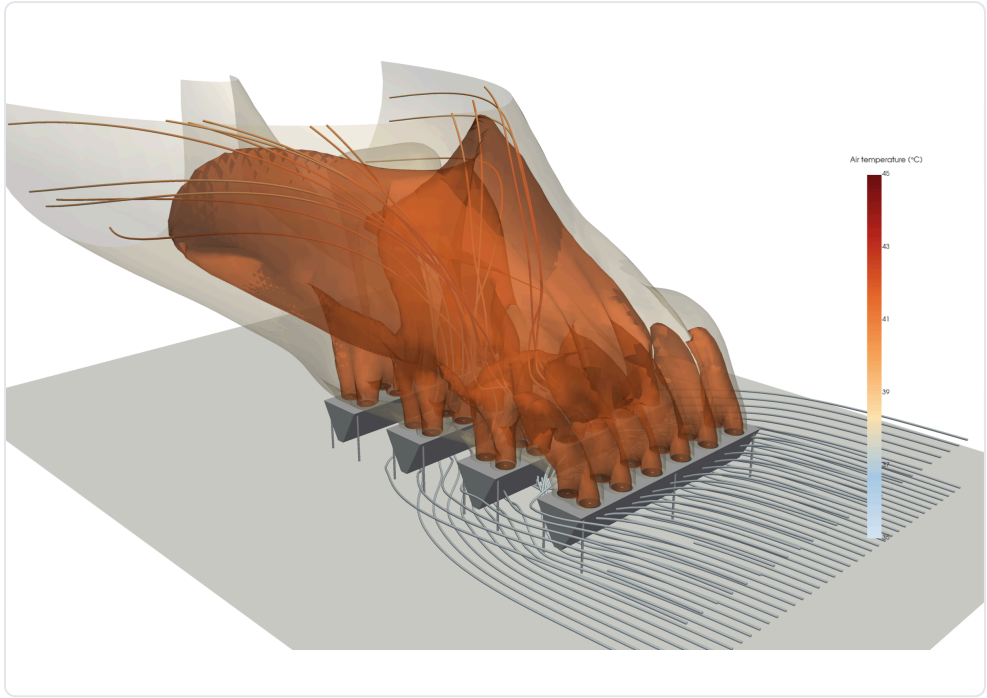
Air flow and temperature inside

Finding: intake is concentrated mid-container; the far end opposite the fans (right) sees weak, recirculating, warming air — the hottest zone. Adding louvres or baffles at that end is the obvious fix. Heat loads (17 kW total) and fan flow are assumed; equipment modelled as surface heat sources, to demonstrate the workflow.

Dry-Cooler Cluster Recirculation

Sample study

Four 1000 kW V-type dry coolers side by side, 35 °C ambient: calm vs. 3 m/s cross-wind.



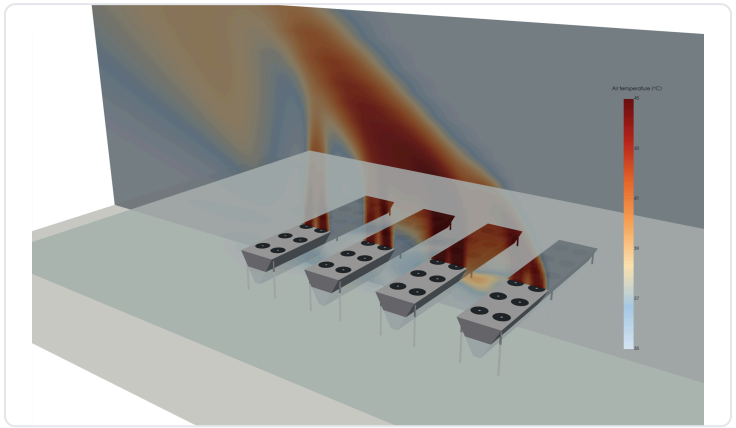
Cross-wind plume (iso-surfaces 38 / 41.5 °C) with upwind streamlines: the plume is pushed onto the downstream units.

0.14 K
Calm: max. intake rise

0.96 K
Cross-wind: worst unit

41.0 °C
Cross-wind: local max. intake

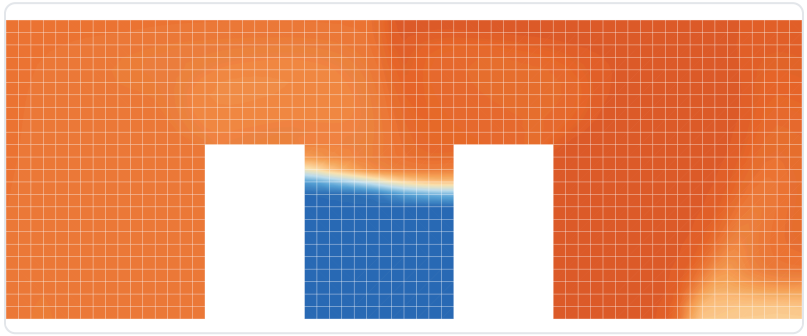
< 0.001%
Energy balance error



Vertical temperature section through the fan centres.

Checked Before Delivery

Case	Mesh	Iterations	Energy balance
Data hall (open / contained)	109 k	1200 / 1500	0.015% / 0.21%
Cold plate CHT	448 k	600	< 0.001%
Container cooling	241 k	500	0.006%
Dry-cooler cluster (wind)	553 k	500	< 0.001%



Hex mesh (0.15 m) and temperature on a data-hall section: every equipment edge lies on a grid line.

Energy balance

Heat in vs. heat out for every case — see the table.

Mesh sensitivity

Key results re-run on a refined mesh; the change is reported.

Correlation check

Tube heat transfer and pressure drop vs. Gnielinski / Darcy; tube-in-tube case within 7.6% of Gnielinski.

Near-wall mesh

y^+ checked for CHT; first cell down to 30 μm ($y^+ \approx 0.5$) when needed.

Assumption list

Every assumption (loads, flows, ambient) listed for your confirmation.

How It Works

1

Send your data

3D model or drawings, equipment data, your questions.

2

Scope

I reply with the model scope, cases and assumptions to confirm.

3

Model & solve

Interim results shared; key assumptions confirmed first.

4

Delivery

Report in English or Chinese, contours and data; revisions included.

You receive

- Simulation report (PDF / Word, EN or CN)
- 3D contours, sections, streamlines (PNG)
- Key results table (Excel)
- Case files on request

Good to know

- Sample studies show capability and contain no client data.
- Your models and data stay confidential and are never used as samples.

→ Send your model and scope for a free effort estimate

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