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FOR
BUSINESS.



OCP
SUMMIT



HPC/Advanced Cooling Track

Advanced Cooling

Optimising for immersion

Rolf Brink/CEO/Asperitas
Rolf.Brink@ocproject.net

OPEN. FOR BUSINESS



Asperitas

IMMERSED COMPUTING

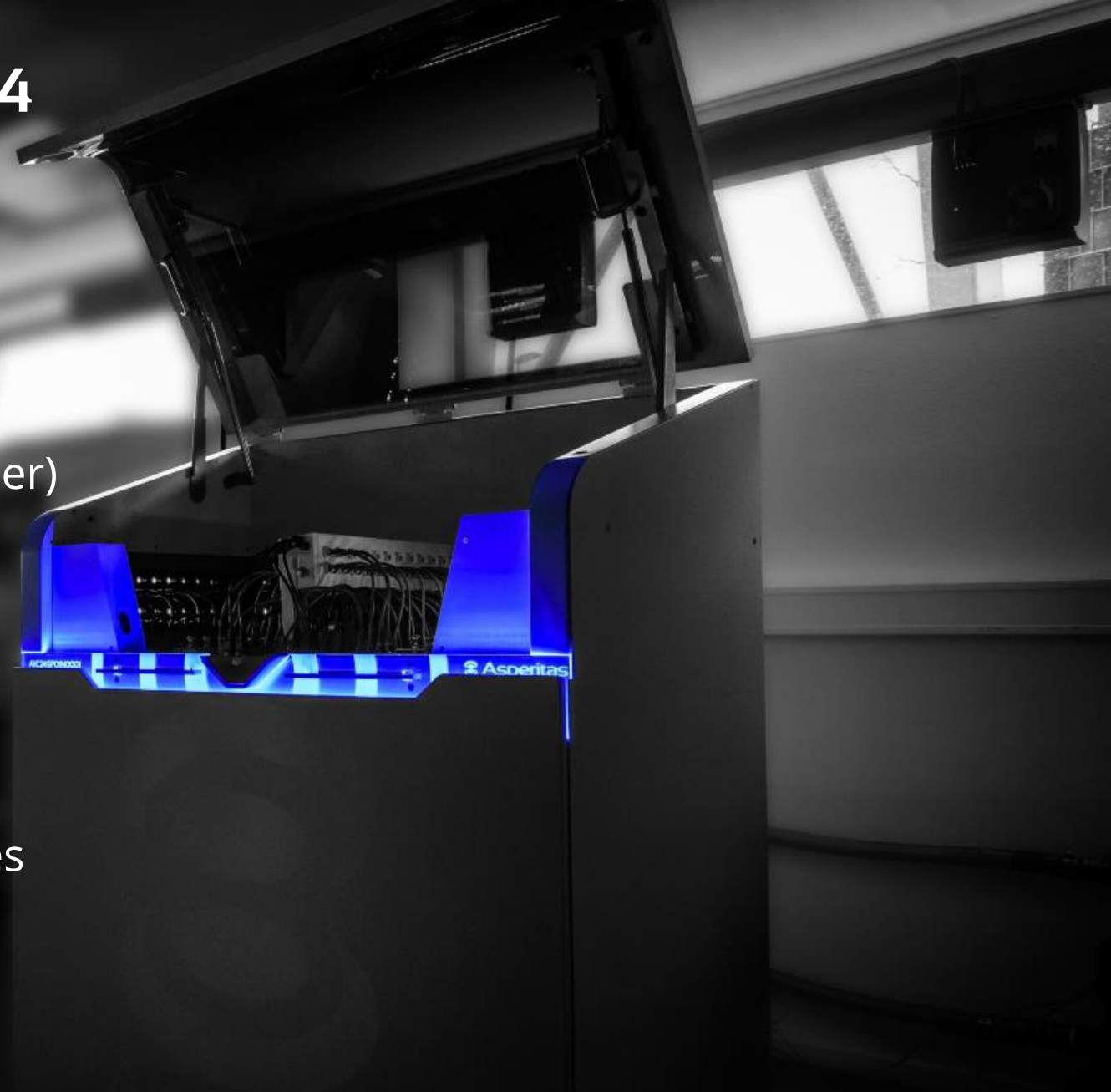


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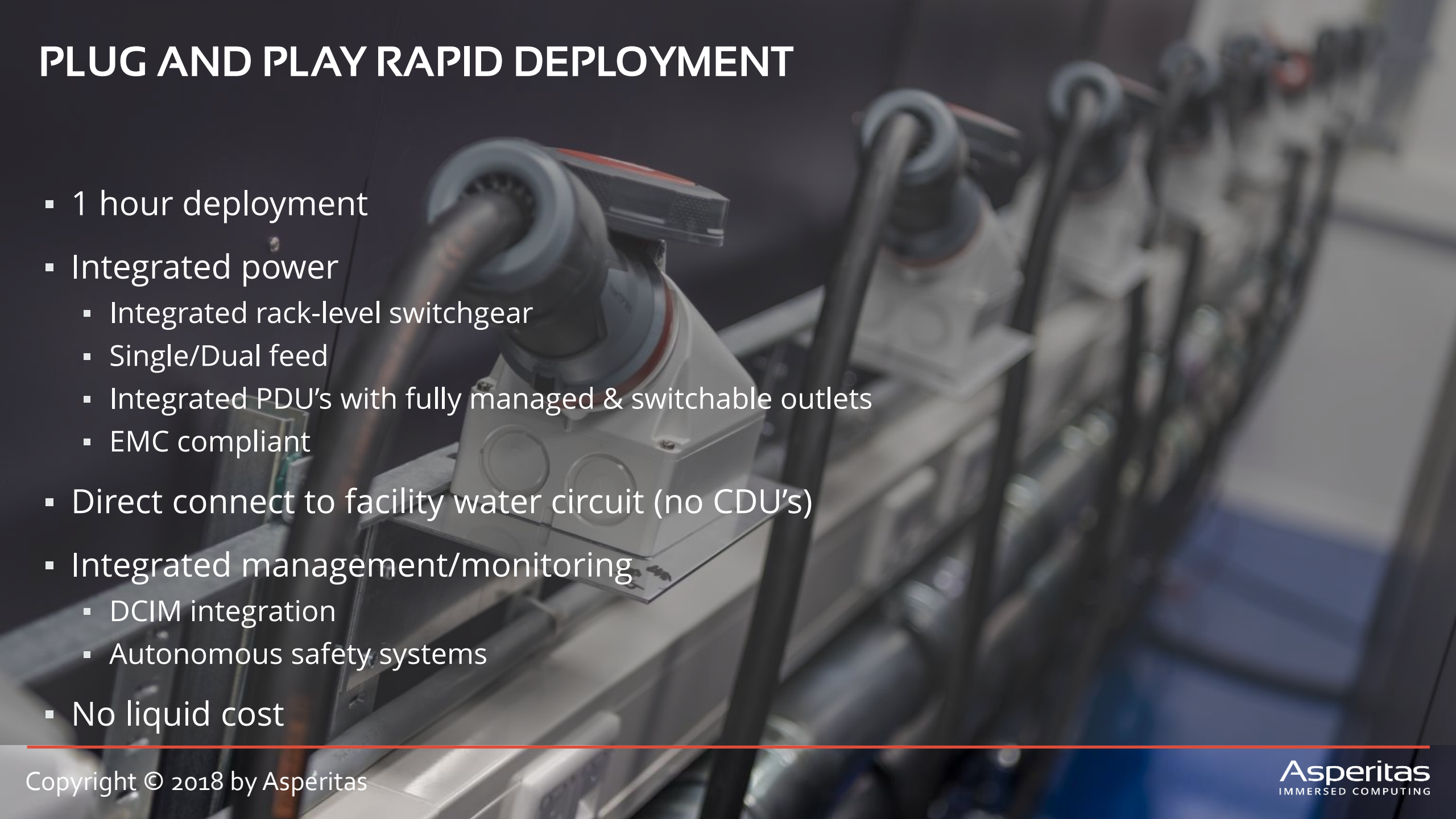
www.asperitas.com

IMMERSED COMPUTING®: AIC24

- 100% Removal of heat from the IT
- Tier 3-4 focus - fully redundant
- 22/36 kW or 31-50 kW/m² (free cooling/chiller)
- No airflow, Passive liquid circulation
- Intelligence system (demo at booth)
 - Management control and insight
 - Automatic hydraulic optimisation
- Optimised for high density cloud/HPC nodes
 - Varying servers
 - Flexible IT hardware
- Feed: 12-40°C, up to 55°C / ΔT 2-16°C



PLUG AND PLAY RAPID DEPLOYMENT

The background of the slide is a blurred photograph of industrial equipment. It shows several large, grey, cylindrical connectors or ports mounted on a metal frame. Black cables are plugged into these ports. The scene is dimly lit, with some highlights on the metal surfaces and the cables.

- 1 hour deployment
- Integrated power
 - Integrated rack-level switchgear
 - Single/Dual feed
 - Integrated PDU's with fully managed & switchable outlets
 - EMC compliant
- Direct connect to facility water circuit (no CDU's)
- Integrated management/monitoring
 - DCIM integration
 - Autonomous safety systems
- No liquid cost

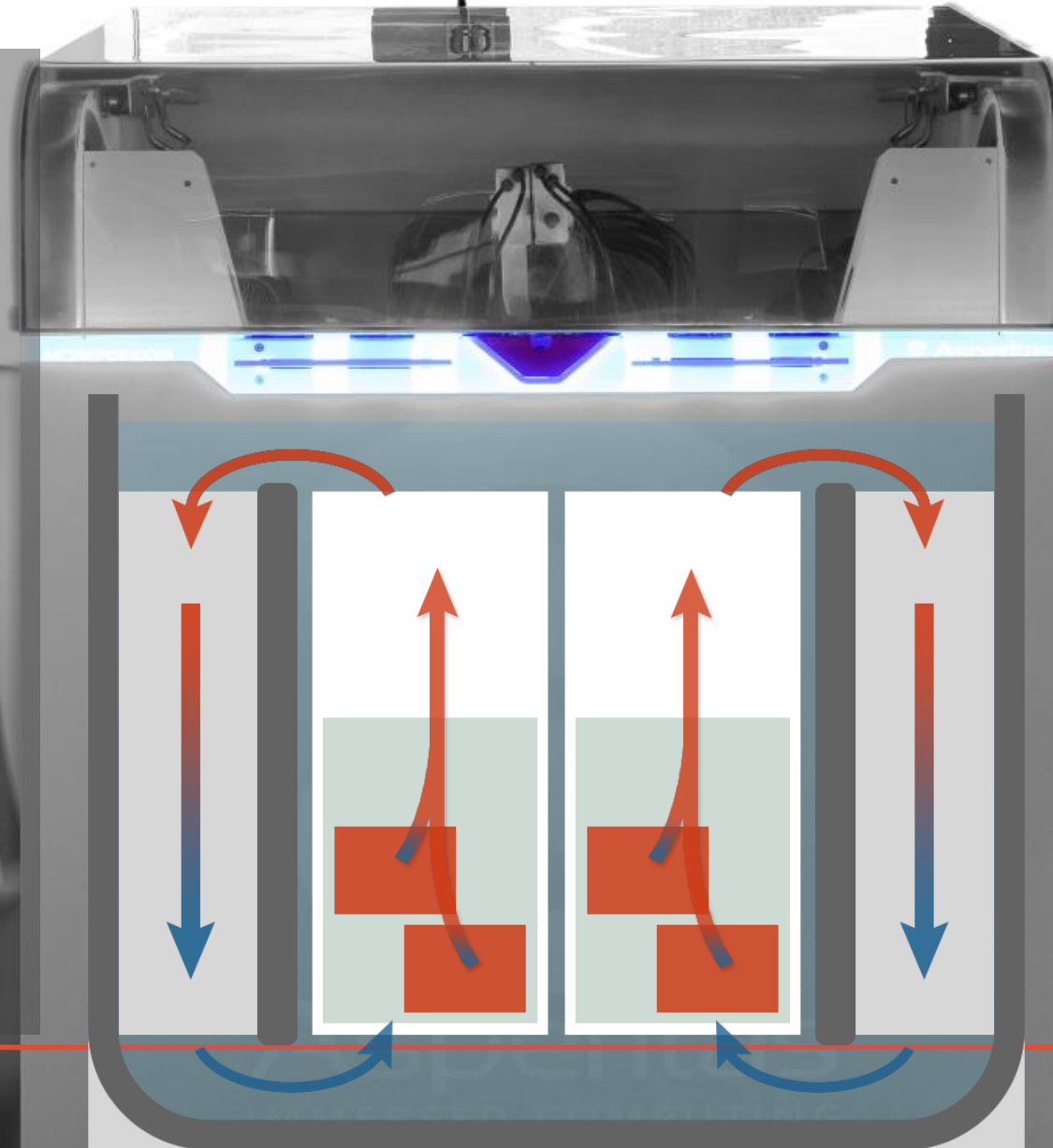
ENCLOSED IMMERSION TECHNOLOGY

Self Sustained by Convection drives®

- Driven by gravity
- Self regulating

Reliable

- No moving parts
- No oxygen
- High heat capacity
- Reduced thermal shock



Efficient

- IT energy reduction
- No chiller requirements
- No circulation pumps

Specialised servers

- Optimised for liquid
- Liquid certified
- Brand agnostic

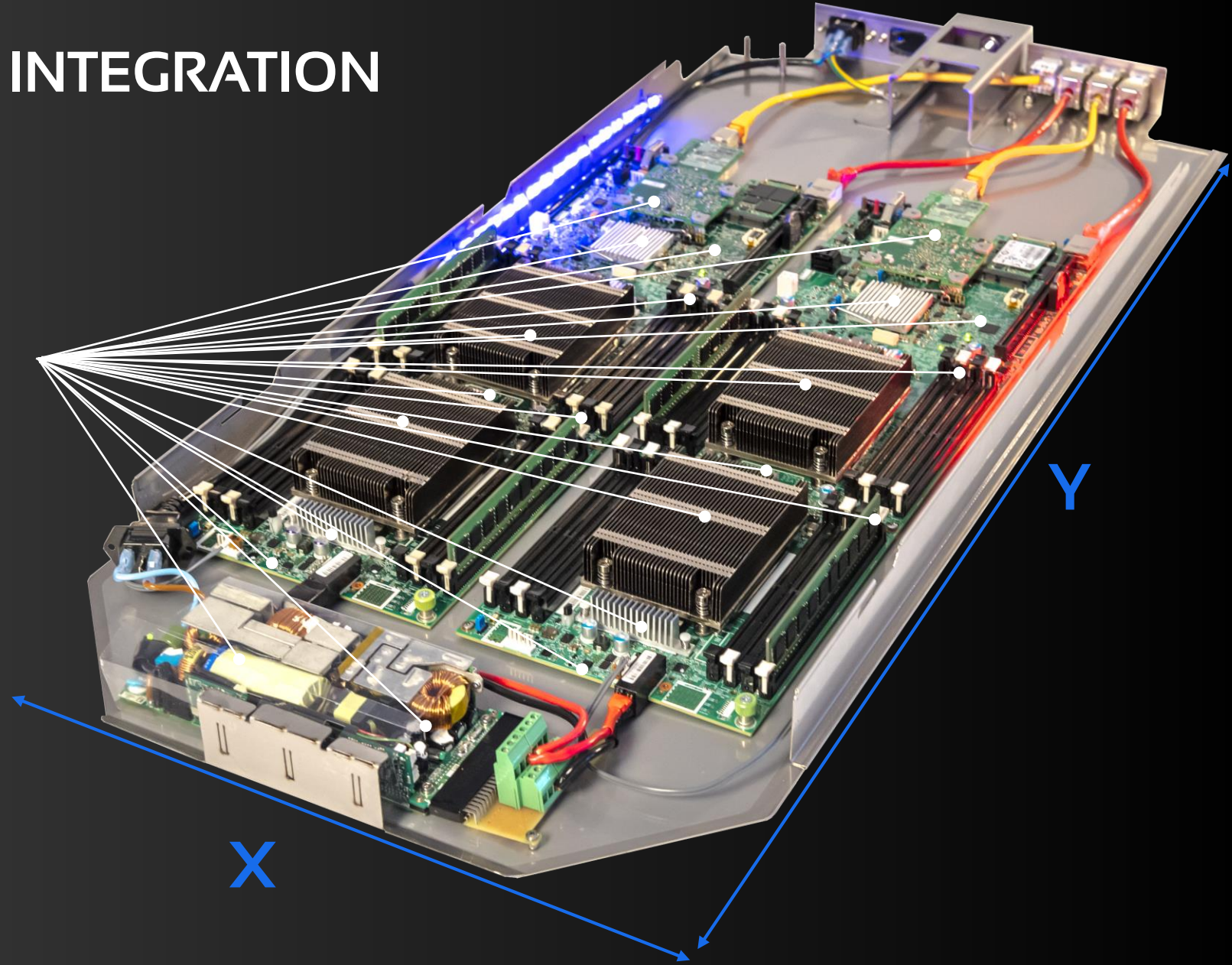
ASPERITAS INTELLIGENCE OVERVIEW

AIC24 INTEGRATED SAFETY

	SENSORS	CONTROL	FAILSAFE
			Cloud/HPC
POWER	Input total per outlet	On Off	On/off
WATER	Temperature in/out Flow & Pressure	Electric Valves	Open/close
OIL	Temperature Level		

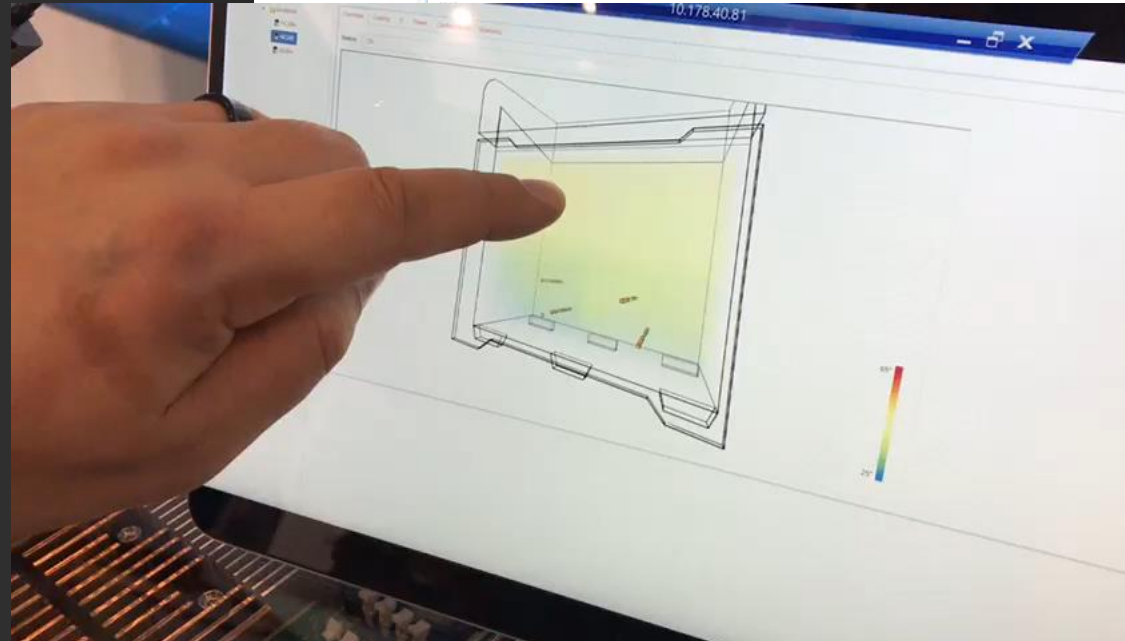
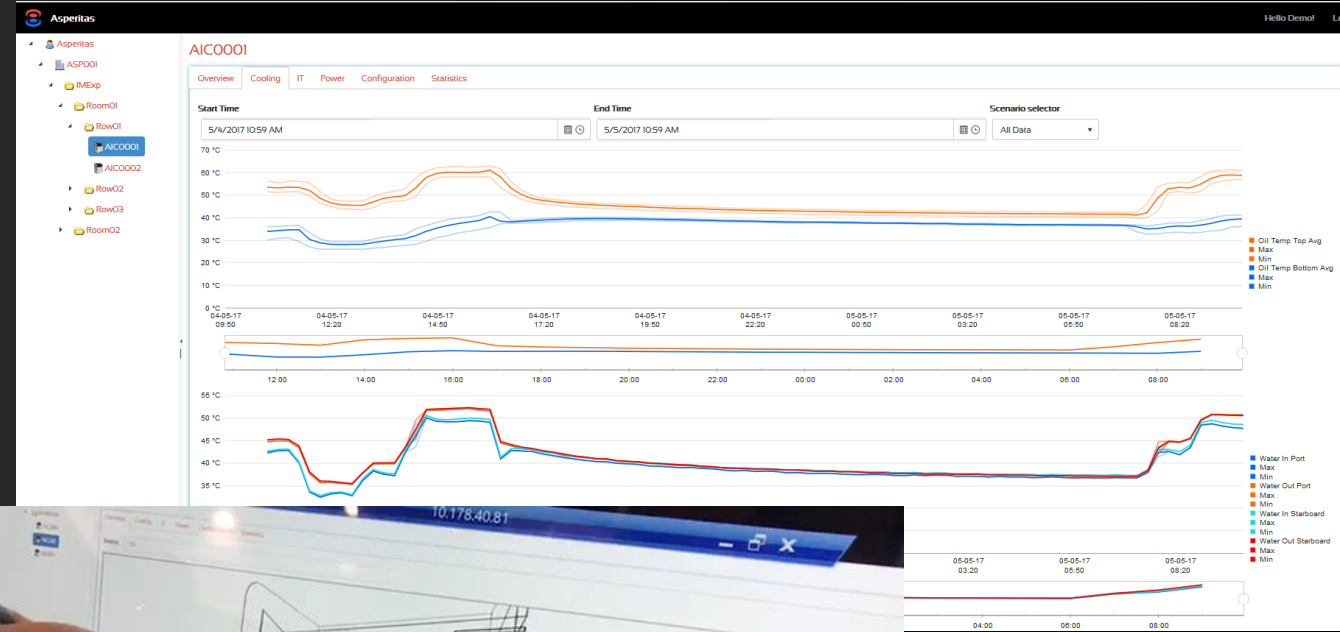
SERVER MANAGEMENT INTEGRATION

- Server mainboards
 - Built-in Temperature sensors
 - Mapped X/Y coordinates
 - Temperature map template
- Data extraction with IPMI
- Management integration
 - Cassette location awareness
 - Z-coordinate
 - 3D location of sensors



REAL-TIME 3D THERMAL ANALYSIS

- 1000+ sensors
 - Integrated temperature
 - IT temperature readings
- Temperature logging
 - Trend analysis
 - Fault analysis
- Optimisation water circuit
 - Real-time IT health
 - Water input control



DESIGN, ENGINEERING AND PRODUCTION OF
PRODUCTS FOR THE CIRCULAR ECONOMY

BRINK
solutions in metal engineering

PRODUCTION FROM
NEW AND REUSED PARTS

NEW PARTS FROM
RECYCLED STEEL

Asperitas
IMMERSED COMPUTING

ADAPTIVE TO FUTURE
NEW CONFIGURATIONS

REUSE HEAT IN
OTHER APPLICATIONS

TOTAL
REWORK OIL

REWORK POWER
CONTROLS

2E interCONNECTION
REUSE NETWORK
CABLING

Mink Kunststoffen
REWORK, RECYCLE
PMMA PANELS

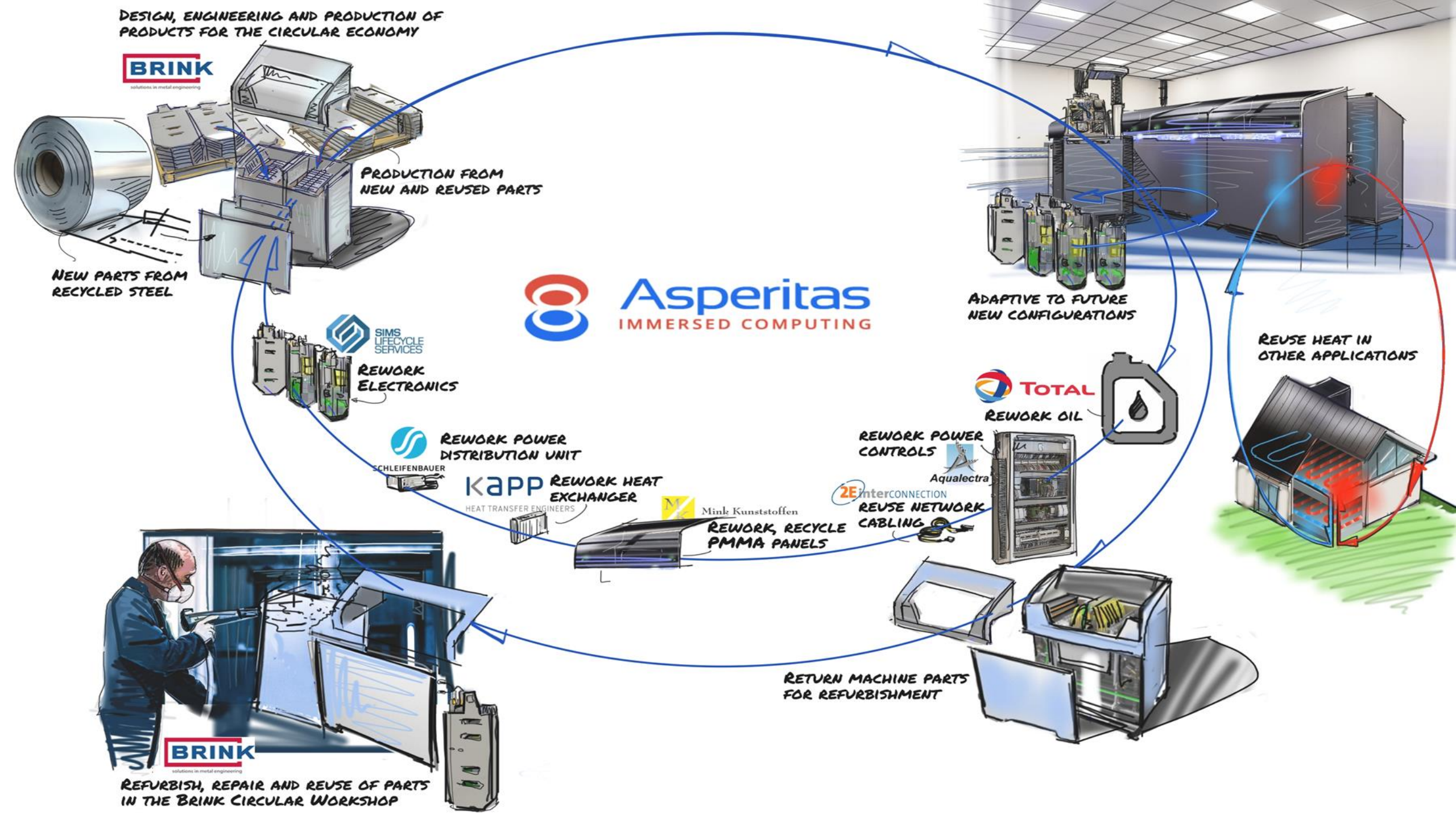
KAPP REWORK HEAT
EXCHANGER
HEAT TRANSFER ENGINEERS

SCHLEIFENBAUER
REWORK POWER
DISTRIBUTION UNIT

SIMS
LIFECYCLE
SERVICES
REWORK
ELECTRONICS

RETURN MACHINE PARTS
FOR REFURBISHMENT

BRINK
solutions in metal engineering
REFURBISH, REPAIR AND REUSE OF PARTS
IN THE BRINK CIRCULAR WORKSHOP



ACS- IMMERSION OCP ENGAGEMENT

AIR VS LIQUID DESIGN ASPECTS

THERMAL DESIGN GUIDELINES

MATERIAL COMPATIBILITY

CHIP DESIGN ASPECTS

ASPERITAS CERTIFICATION

AIR VS LIQUID DESIGN

- Air based Open Cloud servers
 - 1 kW/U
- Liquid optimised servers (passive)
 - Upto 1,5 kW/U

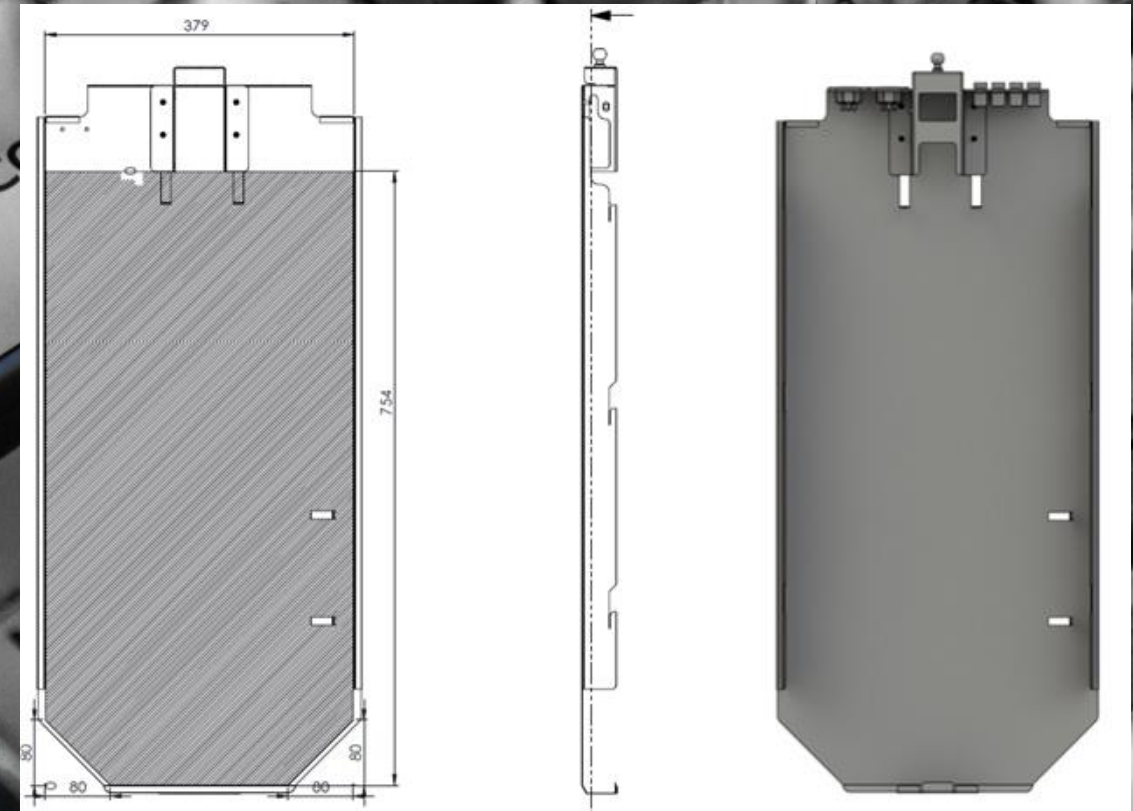
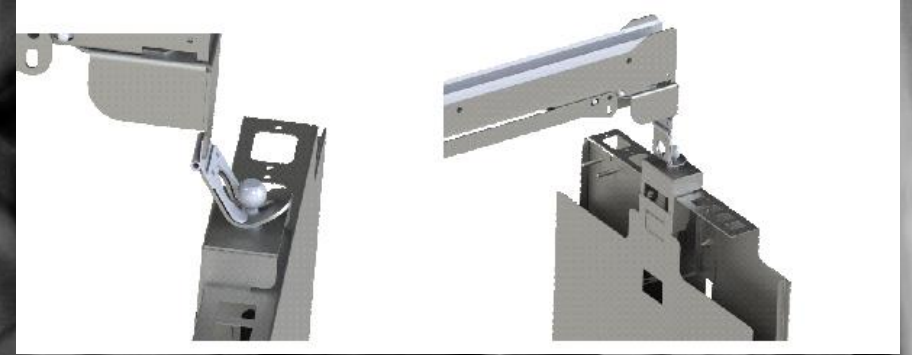


AIR DESIGN VS LIQUID DESIGN

- Chassis design for stability, strength and closed structure
- Design for forced airflow
- High flowrate, large pressure drop
- Preventing thermal shadow
- Thermal shock managed by fans
- Reliance on continuous cooling
- Temp sensors for component health
- Chassis design for low resistance and open structure
- Design for natural flow (most effective for any circulation)
- Low flowrate, minimal pressure drop (high flow may damage components)
- Using thermal shadow
- Thermal shock dampened by liquid
- Design for thermal buffer
- Temp sensors for thermal environment

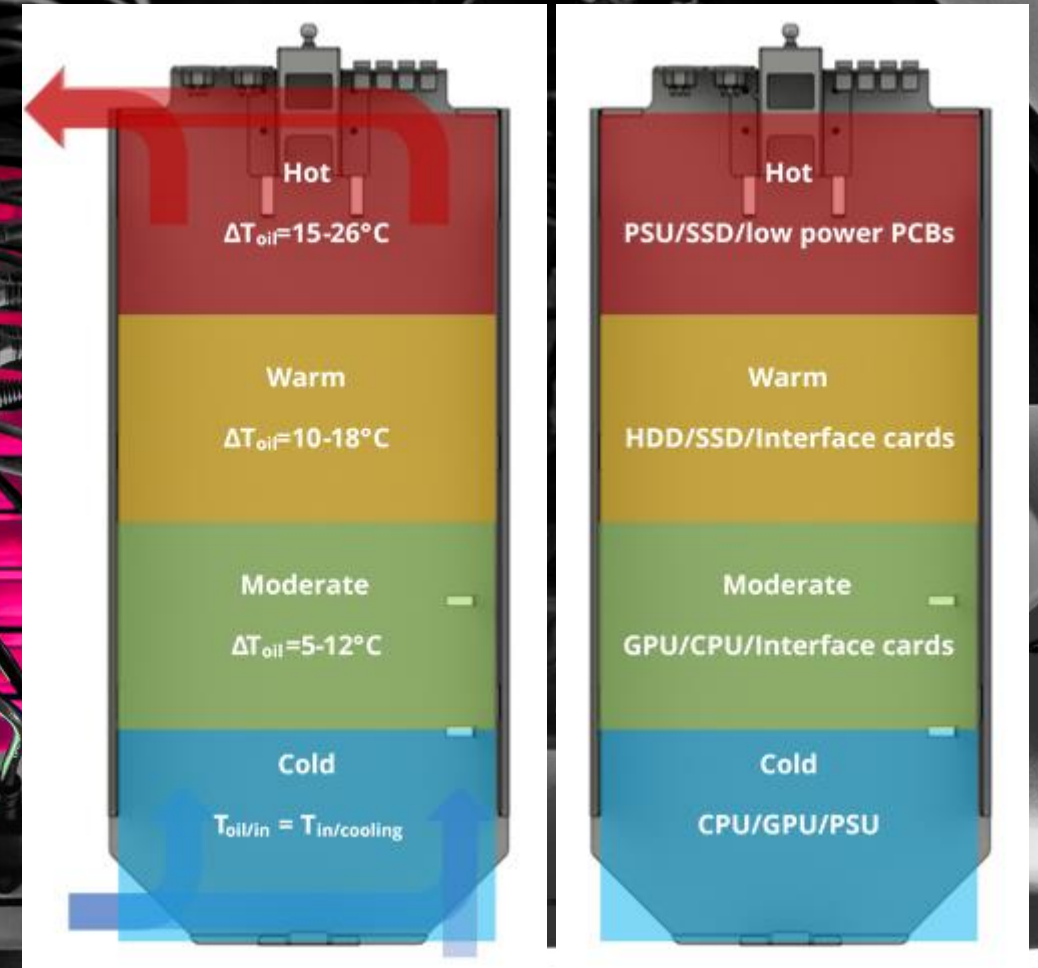
CASSETTE CONSIDERATIONS

- Vertical orientation!!!
 - Fixation in rack (prevent movement/floatation)
 - Gravity
 - Serviceability, dry interfaces
 - Extraction
- Chassis dimensions
 - 19" sub-optimal (fluid dynamics/density combo)
 - Narrow(er) form factor for dual-board
- Unobstructed liquid flow
 - Sideways outflow on surface
 - Cooled liquid distribution/levelling on bottom



THERMAL DESIGN GUIDELINES

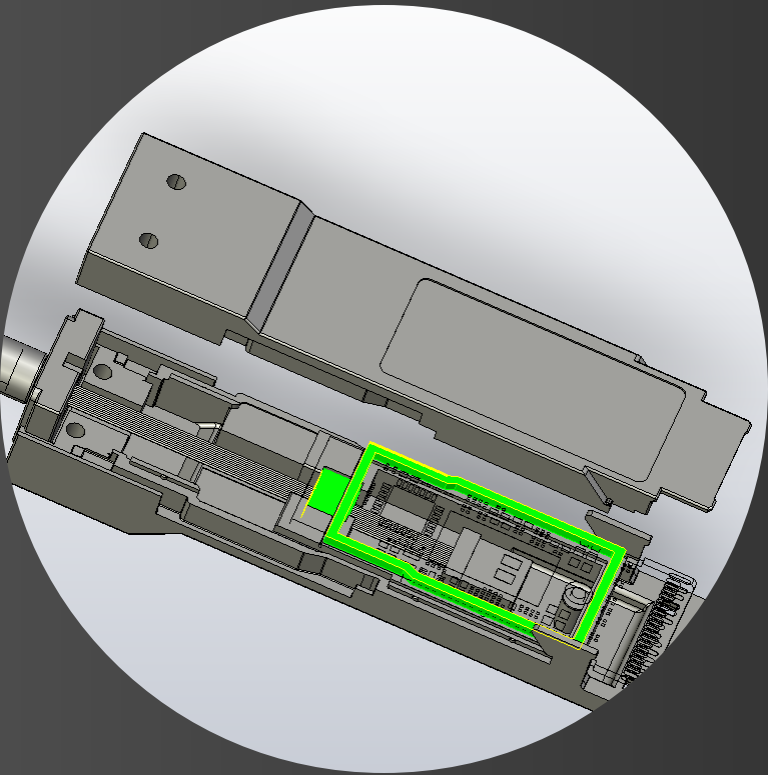
- Cooling input at bottom (coolest liquid)
- Cooling output on top (hottest liquid)
- Component placement considerations
 1. Thermal tolerance
 2. Thermal load (rate of heating)
 3. Thermal buffering
 4. Fluid dynamics



IMMERSION READY ACTIVE OPTICAL CABLES

LEONI

Inspired by ASPERITAS - developed by LEONI



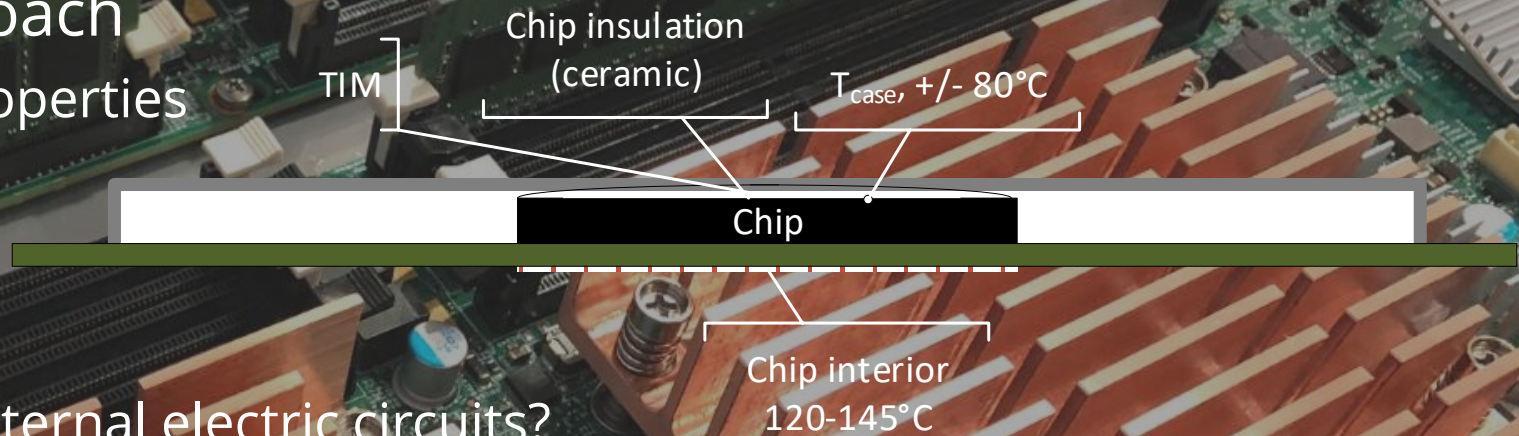
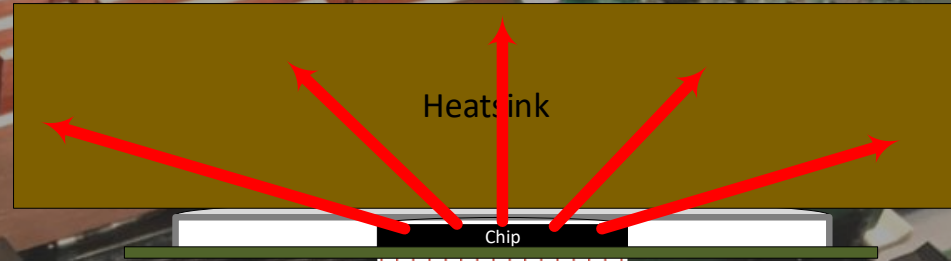
- LEONI group, 86.000 employees in 31 countries
- Development partnership with ASPERITAS for Immersed Computing® cables
- Together we develop **immersion ready Active Optical Cables**
 - QSFP+/28 interface for 40G and 100G transmission
 - Long-term oil/immersion resistant cable and components
 - Hermetical protection of the optics

Mechanical prototype for display at the ASPERITAS booth

*Functional samples by **November 2018***

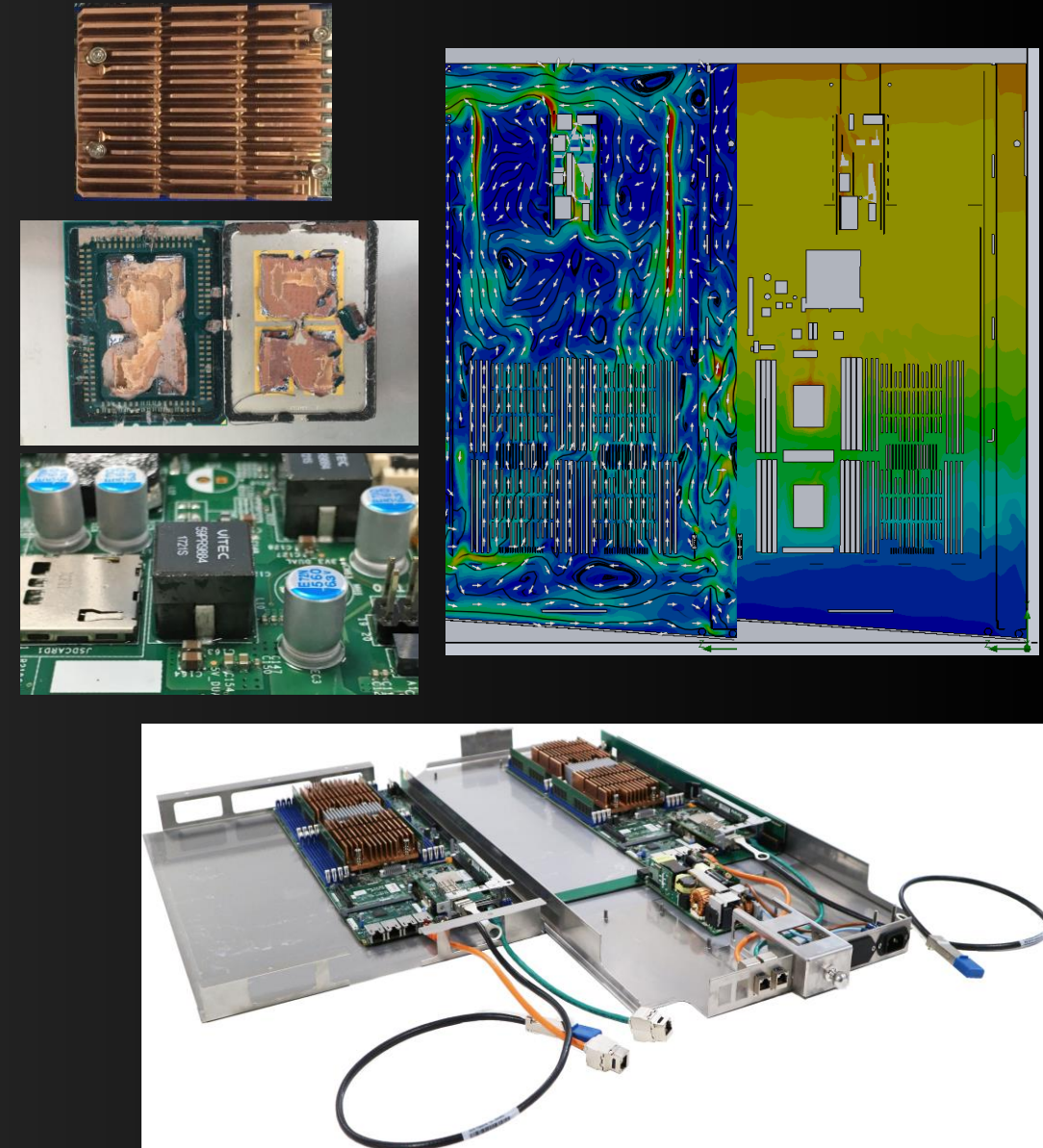
CHIP DESIGN FOR LIQUID

- Current chip designs
- 2-dimensional problem approach
 - Chip packaging poor thermal properties
 - Electrical insulation = thermal insulation
- Liquid optimisation
 - Could dielectric liquid insulate internal electric circuits?
 - Cooling rear-side of chips?
 - Cooling interior of chips directly?
 - 3D “open” chip design?
- Result: Higher (valuable!) temperatures accessible => Reusable heat



ASPERITAS CERTIFICATION

- Asperitas is NOT manufacturer/(re)seller
- Focused on oil immersion (limited chemical)
- Asperitas OPEN certification process
 - Focus on material compatibility R&D
 - Driven by CFD analysis
 - Aimed at long term risk assessment
 - Potentially destructive
 - 3 certification levels
 - Level 1, feasibility
 - Level 2, prototyping & benchmark test
 - Level 3, 10-week duration and operation test
 - Level 4, 24 systems production for 3 months





JOIN THE IMMERSION ACS TRACK

Send email to rolf.brink@ocproject.net

https://www.opencompute.org/wiki/Rack_%26_Power/Advanced_Cooling_Solutions

Looking for manufacturers and (future) end-users



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