Service Oriented Immersion Cooling with 48V Power Solution

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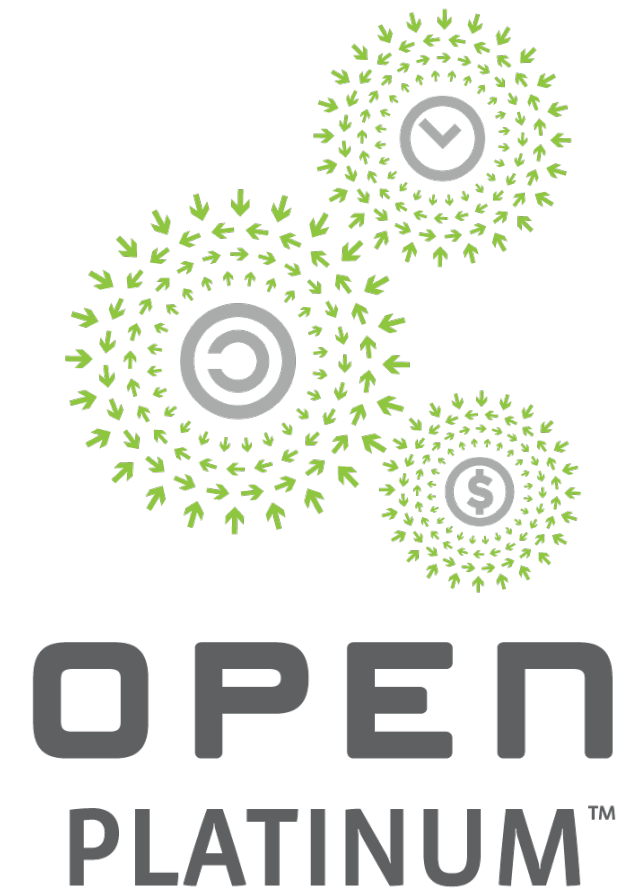
Purpose

- In order to meet the demand of the fast-growing power consumption with energy saving

- Contribute the specifications and send a message to the ecosystem vendors to increase the interest to develop the commodities and components together for immersion cooling, such as redefine life/reliability, specific components…etc
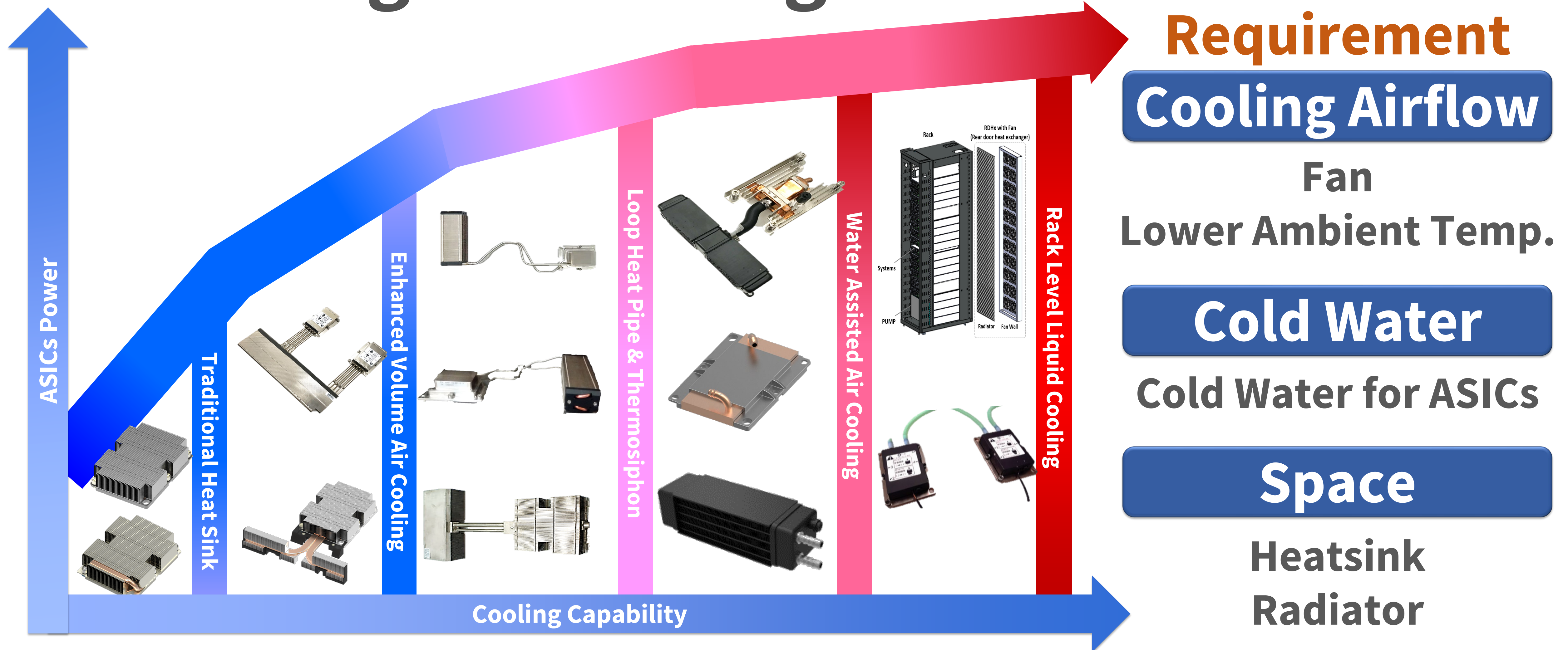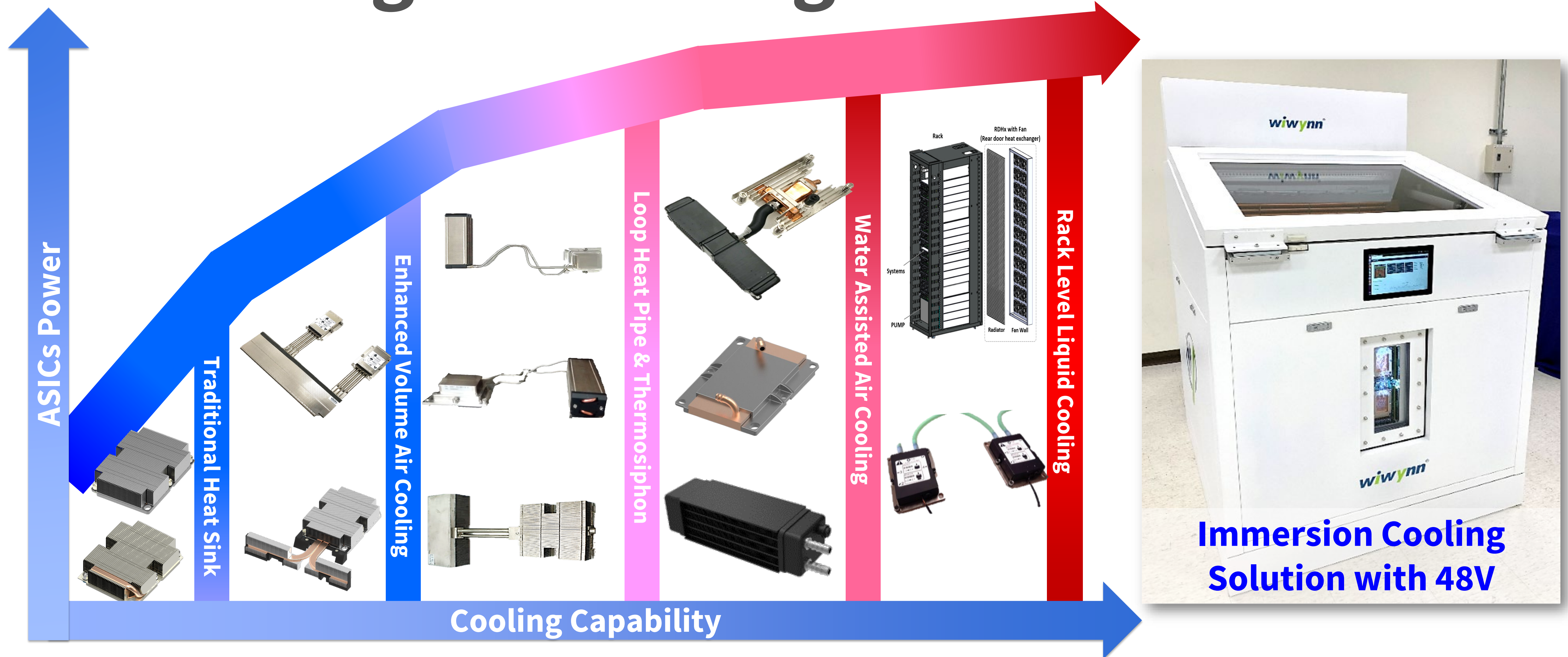
Contents

- Existing Air Cooling Solution
- Immersion Cooling Solution
- Immersion Cooling Development
- Wiwynn 48V Immersion Cooling Solution
- Tank Management
- Investigation

Existing Air Cooling Solutions

Requirement

Cooling Airflow

Fan
Lower Ambient Temp.

Cold Water

Cold Water for ASICs

Space

Heatsink
Radiator

ASICs Power

Cooling Capability

Traditional Heat Sink

Enhanced Volume Air Cooling

Loop Heat Pipe & Thermosiphon

Water Assisted Air Cooling

Rack Level Liquid Cooling

Rack
Systems
PUMP
RDHx with Fan
(Rear door heat exchanger)
Radiator   Fan Wall

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Existing Air Cooling Solutions

ASICs Power

Cooling Capability

Traditional Heat Sink

Enhanced Volume Air Cooling

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Water Assisted Air Cooling

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Rack

RDHx with Fan
(Rear door heat exchanger)

Systems

PUMP

Radiator   Fan Wall

Immersion Cooling Solution with 48V

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Immersion Cooling

Low Airflow Requirement

Higher Ambient Temp.

Higher Density

Warm Water Cooling

PUE 1.2~2

Air

PUE 1.02~1.08

Immersion

Energy Saving

35ºC

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Design Goal

Serviceability
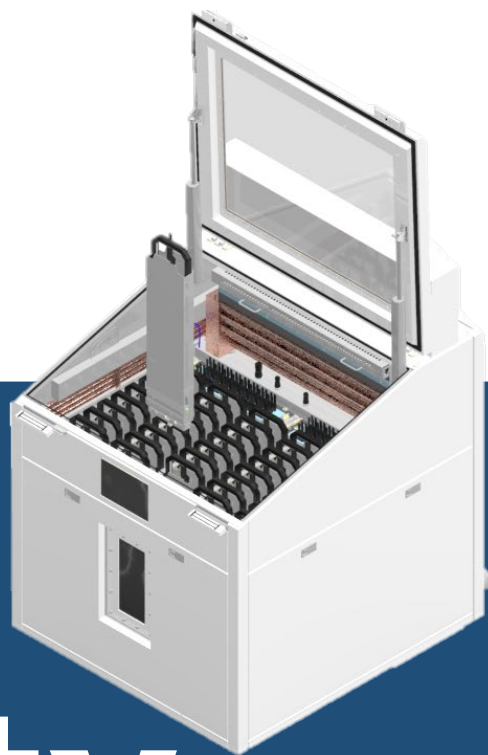
Efficiency

48V Power Delivery

Seawolf Tank

Safety

Safety
- Monitoring
- Reporting
- Warning
- Critical
- Control

Low Leakage

Advanced Condenser

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Immersion Cooling Development

~2017 **Prove Immersion Cooling**   2018   2019   **Optimize Tank for Immersion Cooling**   2020   2021~

POC with Existing Board

High Power Tank for Existing Board

Tank Next Gen

Tank with Optimized Board

Q2, 2018   Q4, 2018   Q2, 2019   Q2 2020

POC
Tioga Pass

Benchmarking
Olympus

48V Tank
Tioga Pass
60 kW

White Papers

Q3, 2019

Specifications

Q4, 2019

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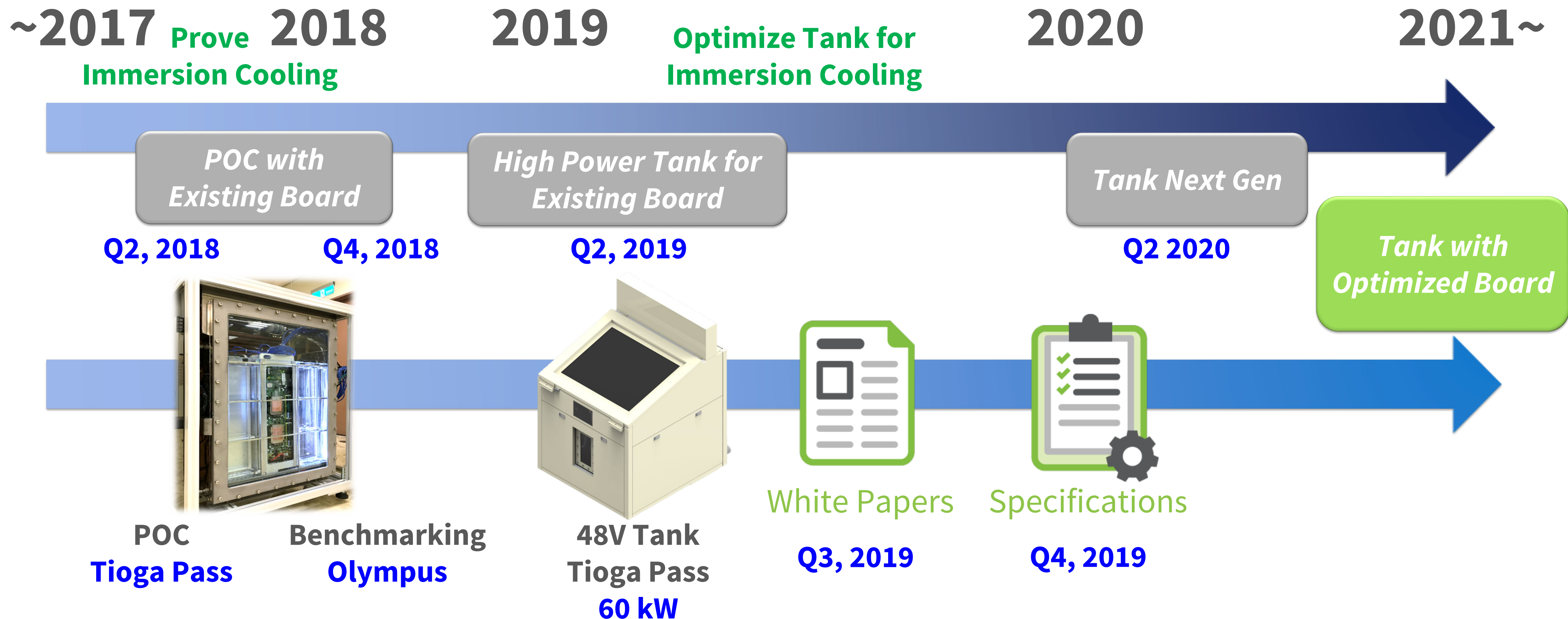
Service Oriented Immersion Cooling with 48V Power Solution
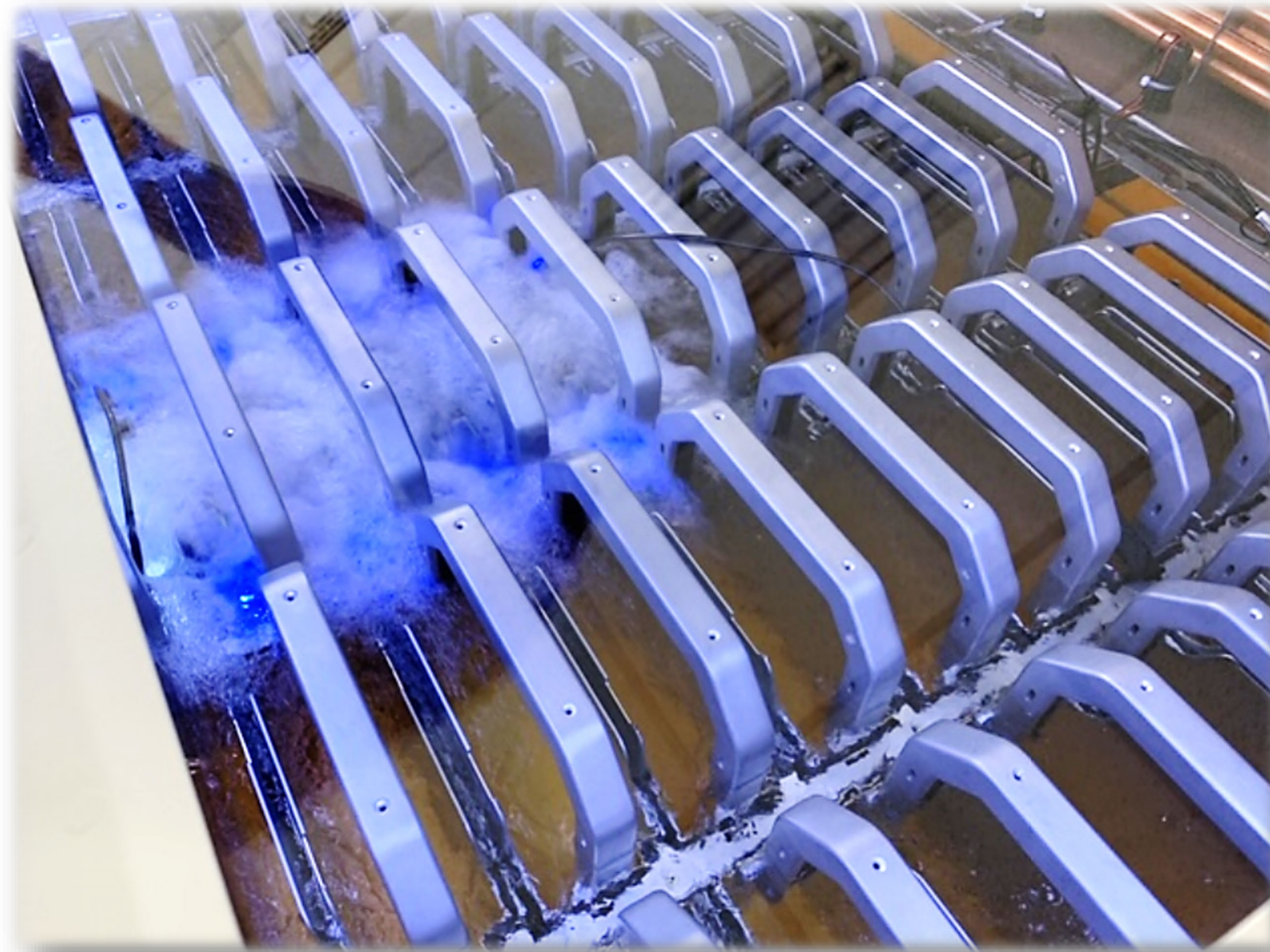
Wiwynn Seawolf Tank

48V Immersion Cooling Solution

A Service Oriented Immersion Cooling Tank with 48V Power Solution

Solution Features

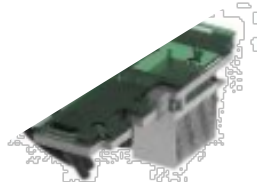|	
Dimension	1200mm(L) x 1200mm(W) x 1250mm(H)
Cooling Capability	60kW
Server Quantity	100 Nodes
Mother Board	OCP Server Board (Tioga Pass)
Power Input for Server	48 VDC by Bus Bar
Switch	4 Switches

Seawolf

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Cartridge Design

Bus Bar Clip

48V PTB

Top Cover

OCP MB

Upper Board

OCP MB

Lower Board

Handle

Bottom Cover

196

Cartridge

800

64.5
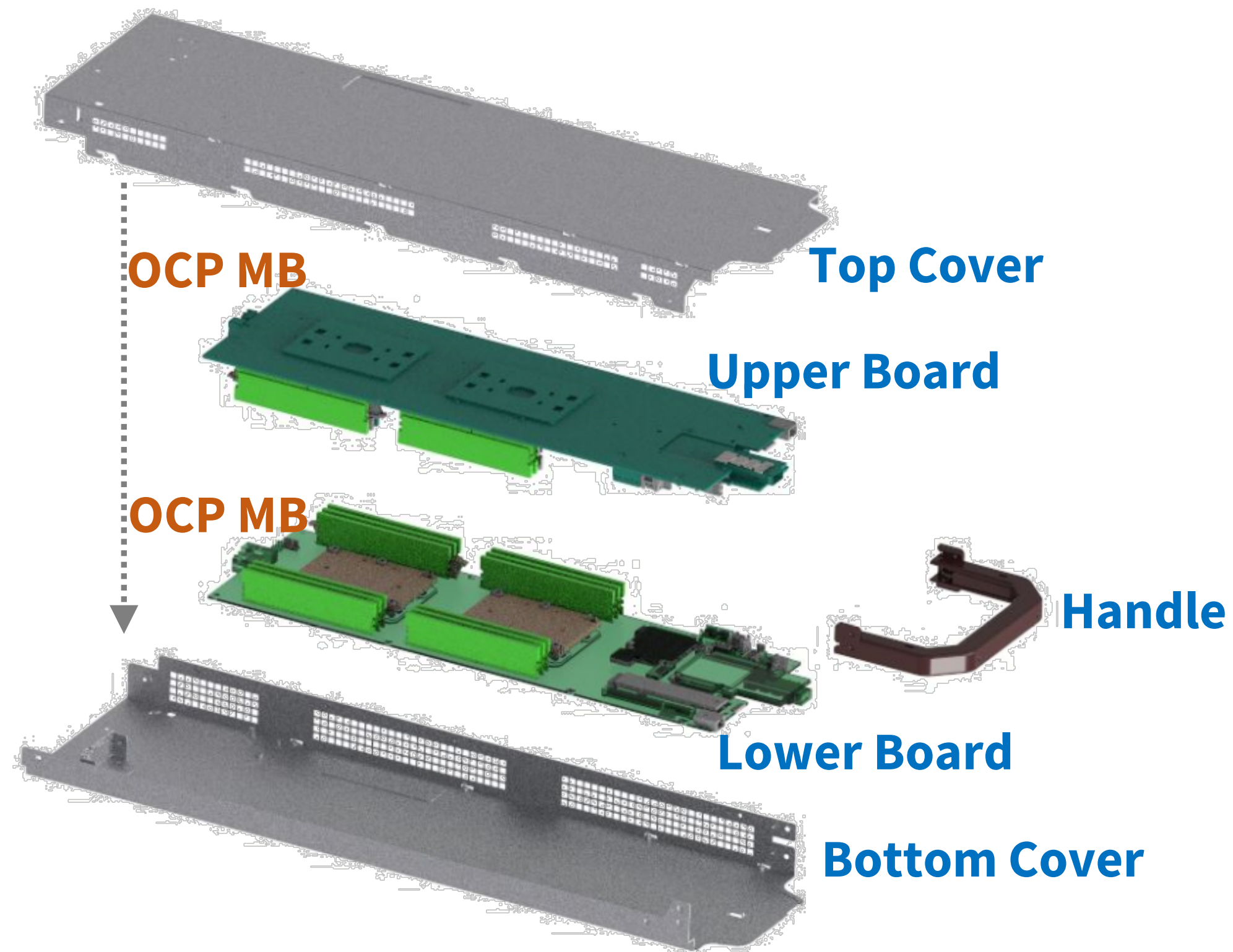
- **Two boards face to face in one cartridge < 1.5U**
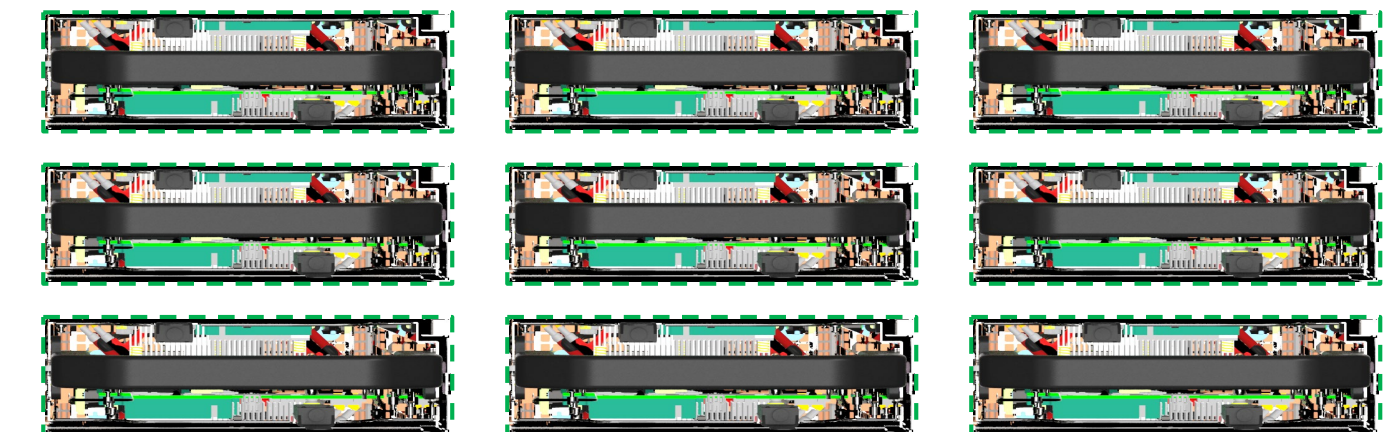- **No modification for MB**
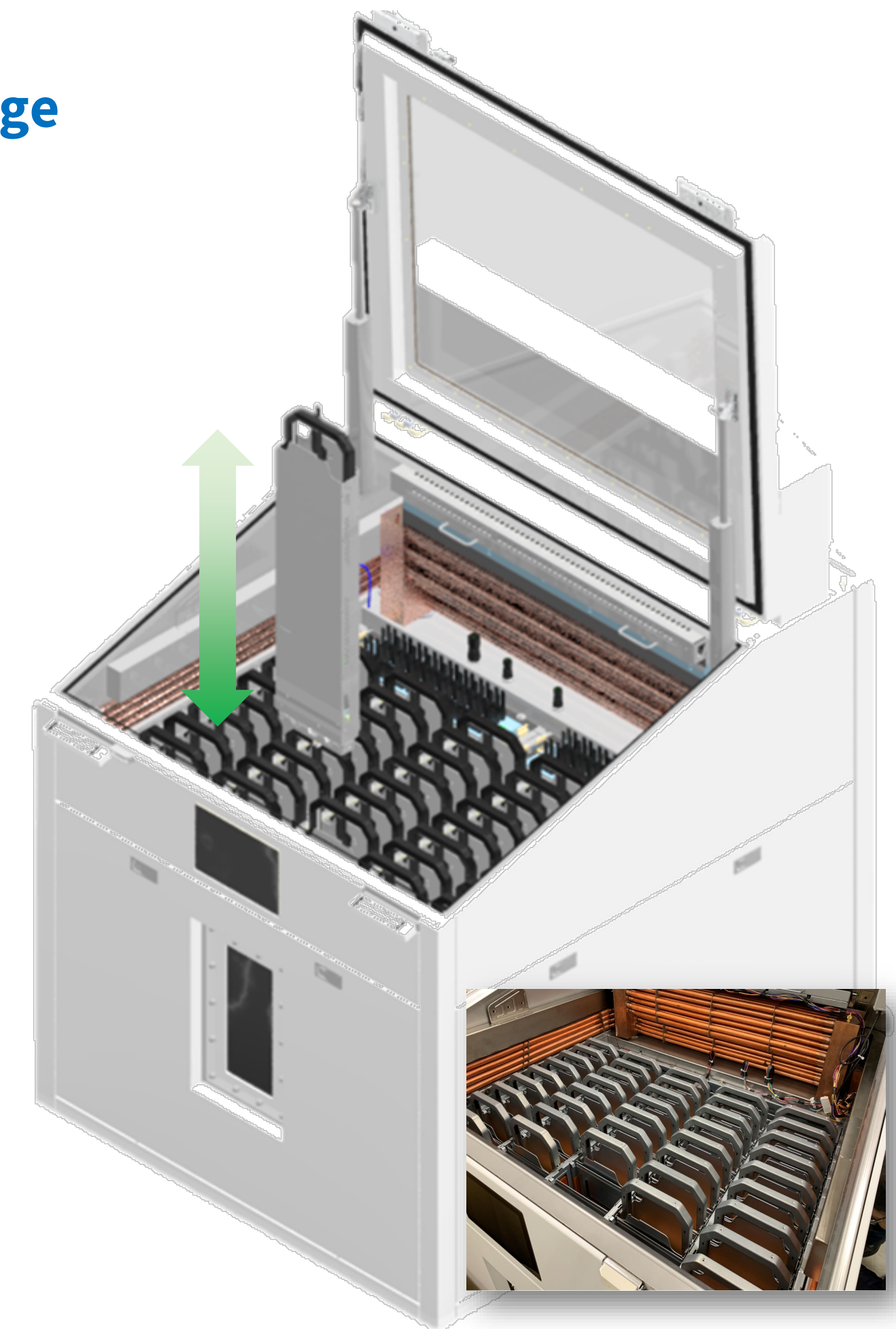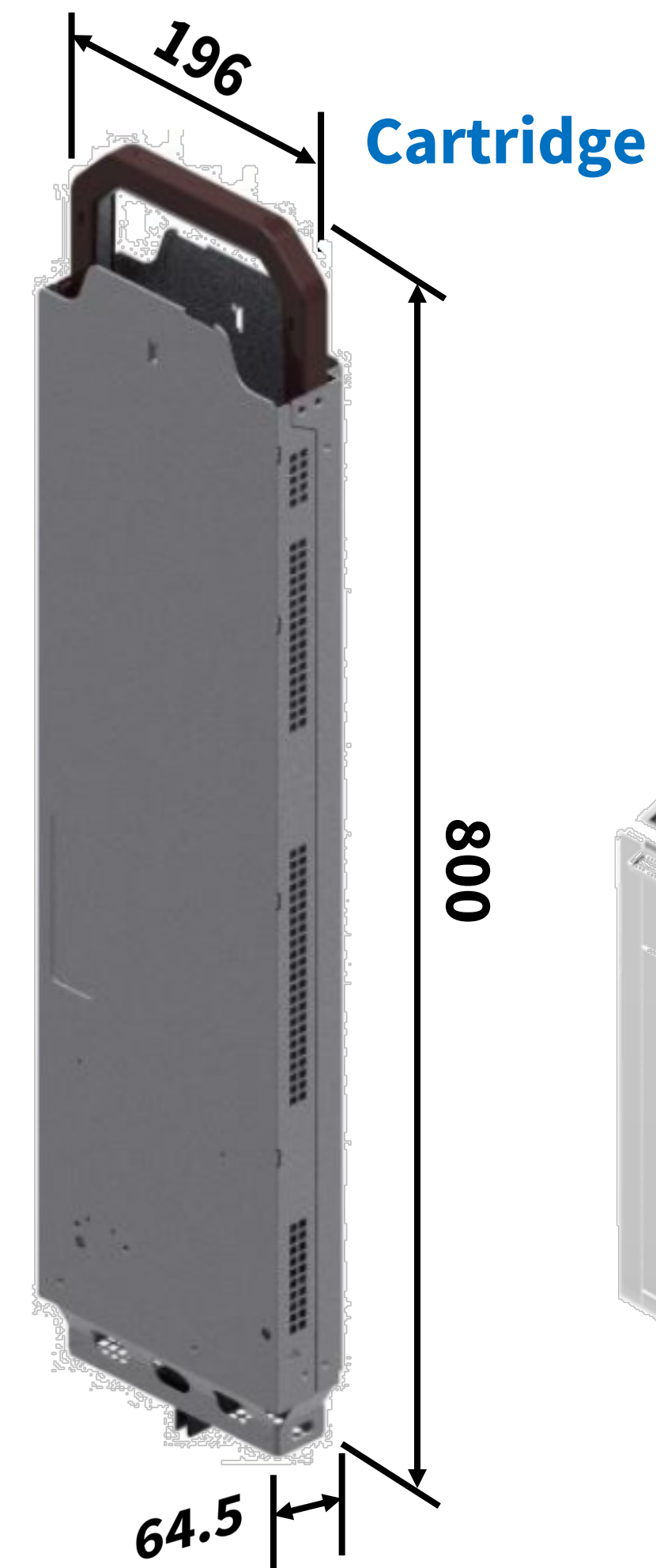
Board and Switch Matrix

Tank Top View
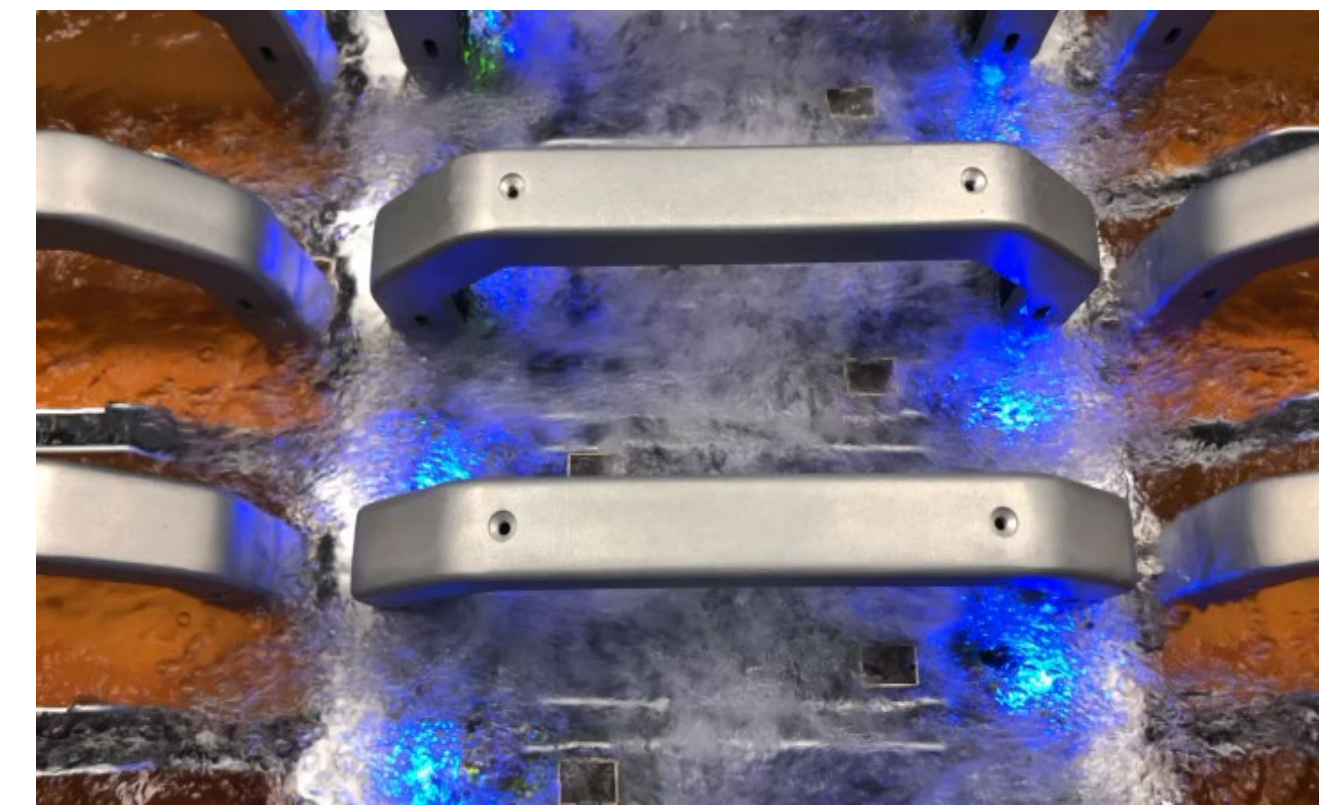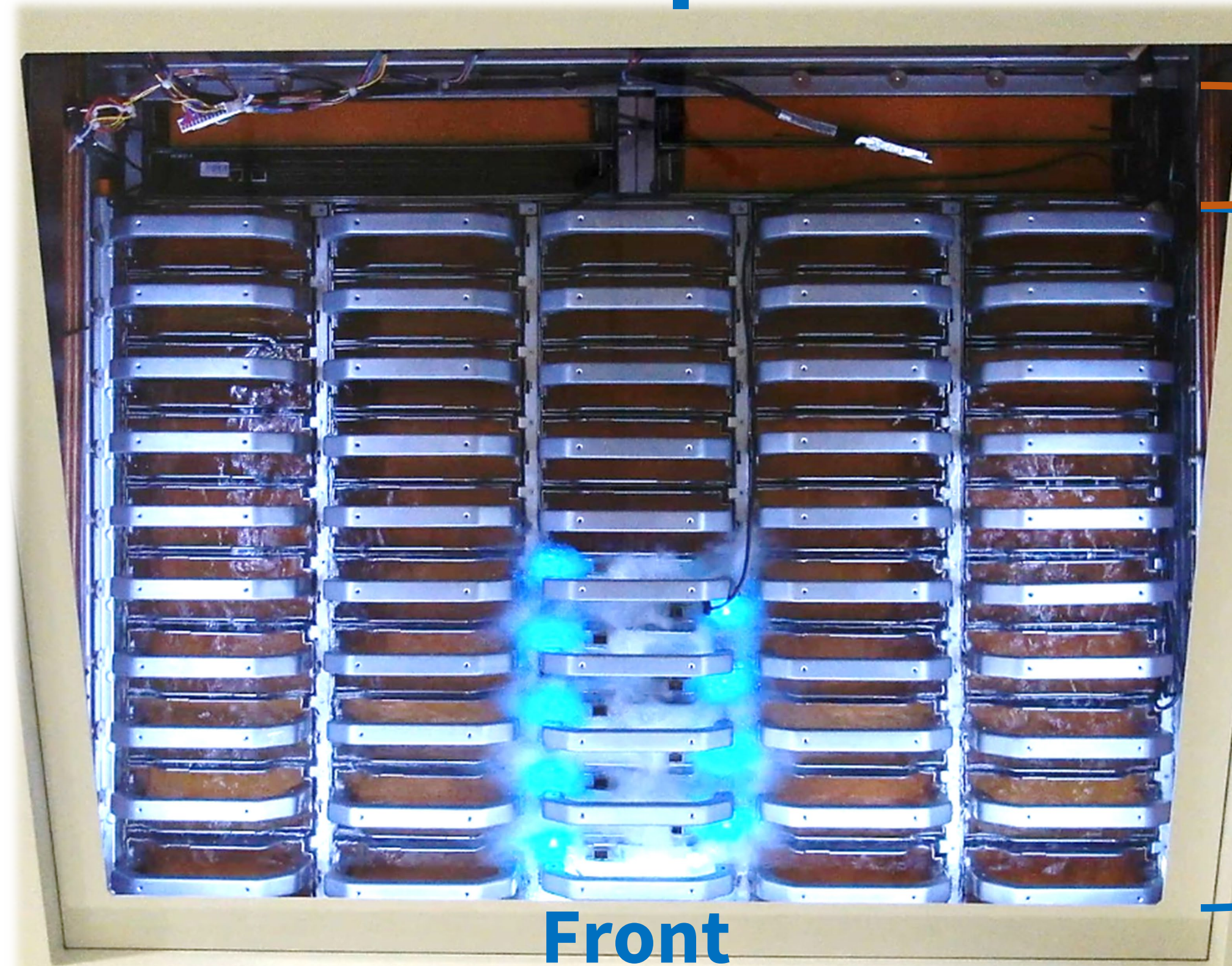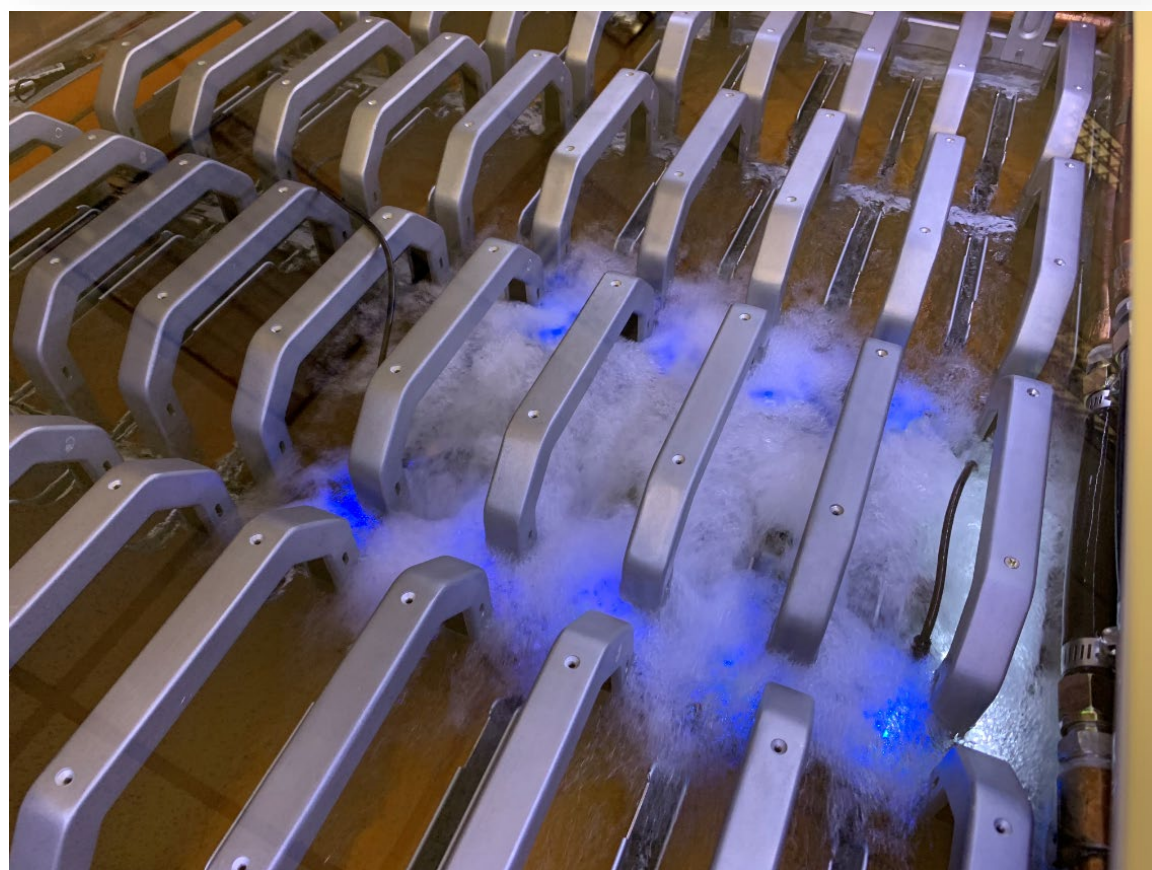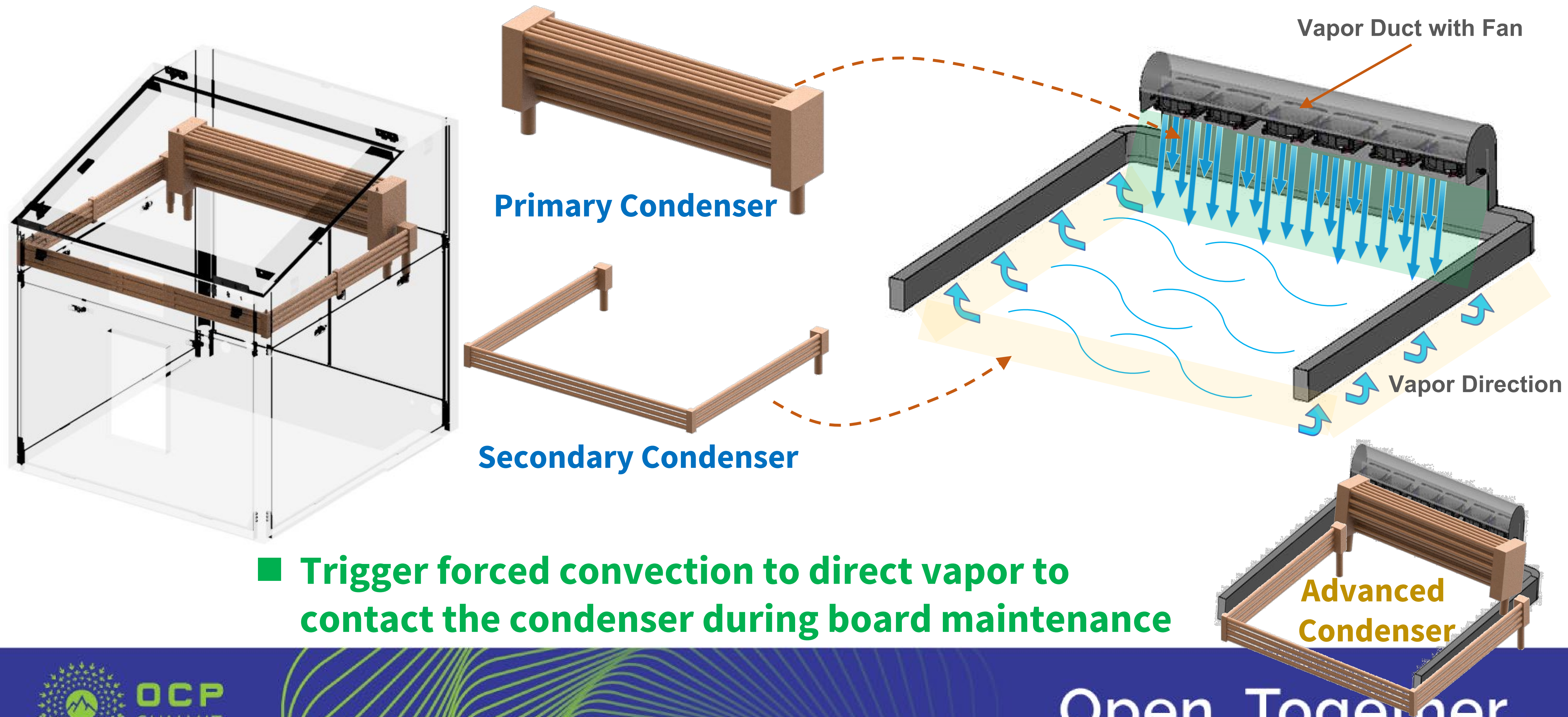
4 Switches

10 Cartridges * 5 Column

100 Boards

Front

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Power Solution

Two 48V power shelves to support 60 kW (Optional)

Rear Side

Cartridge

Bus Bar Clip

Power Bus Bar

Power bus bar for power delivery
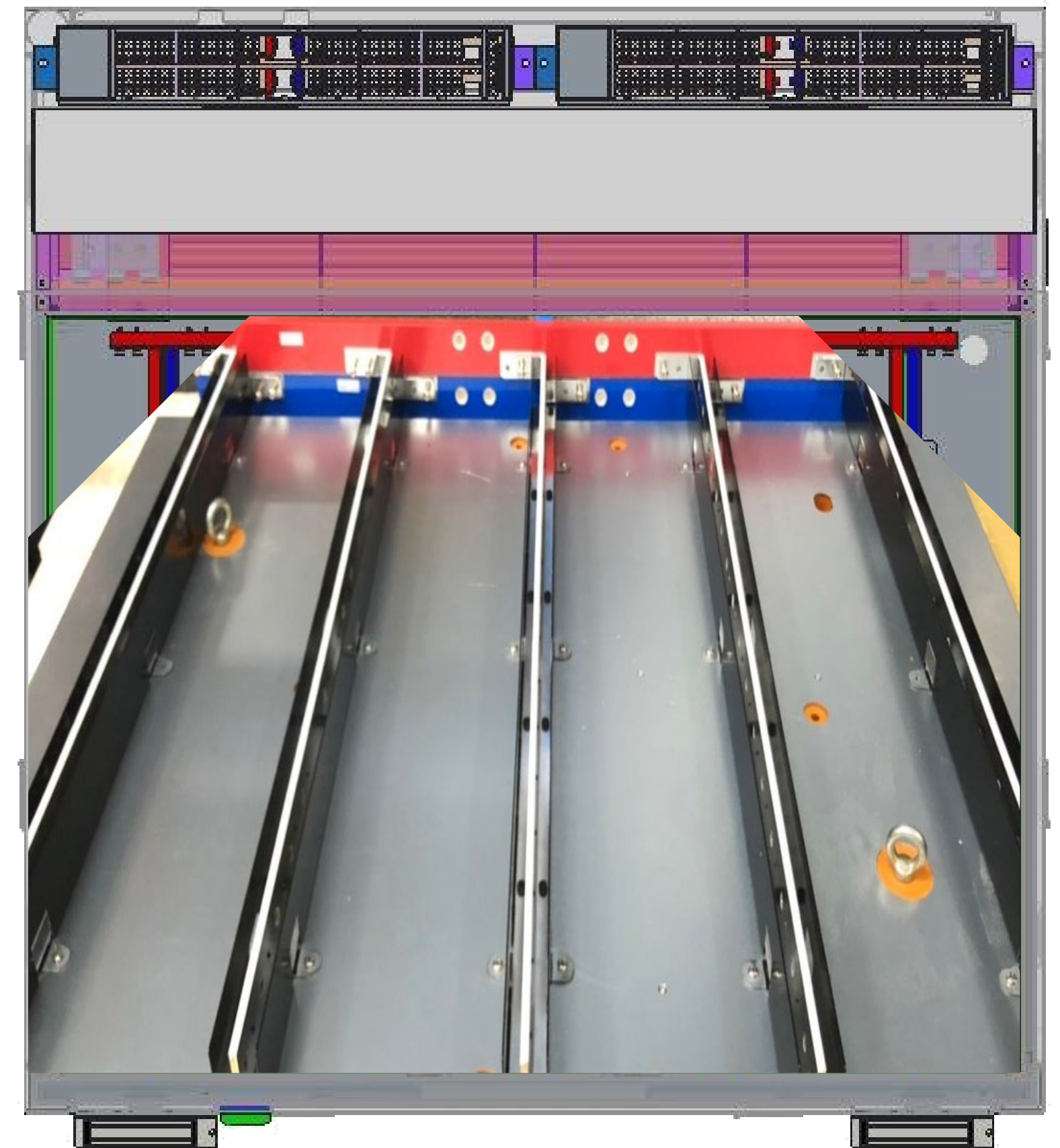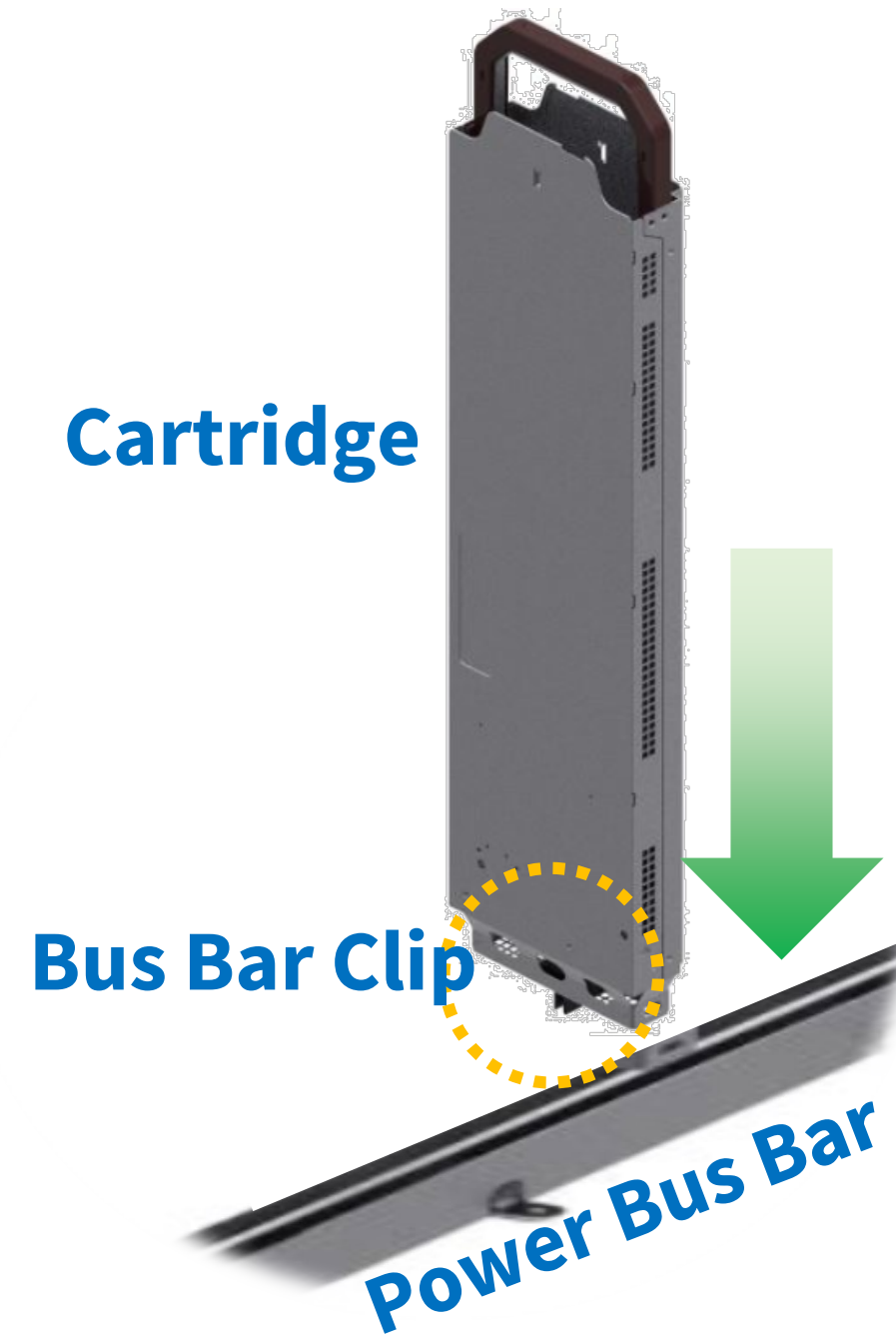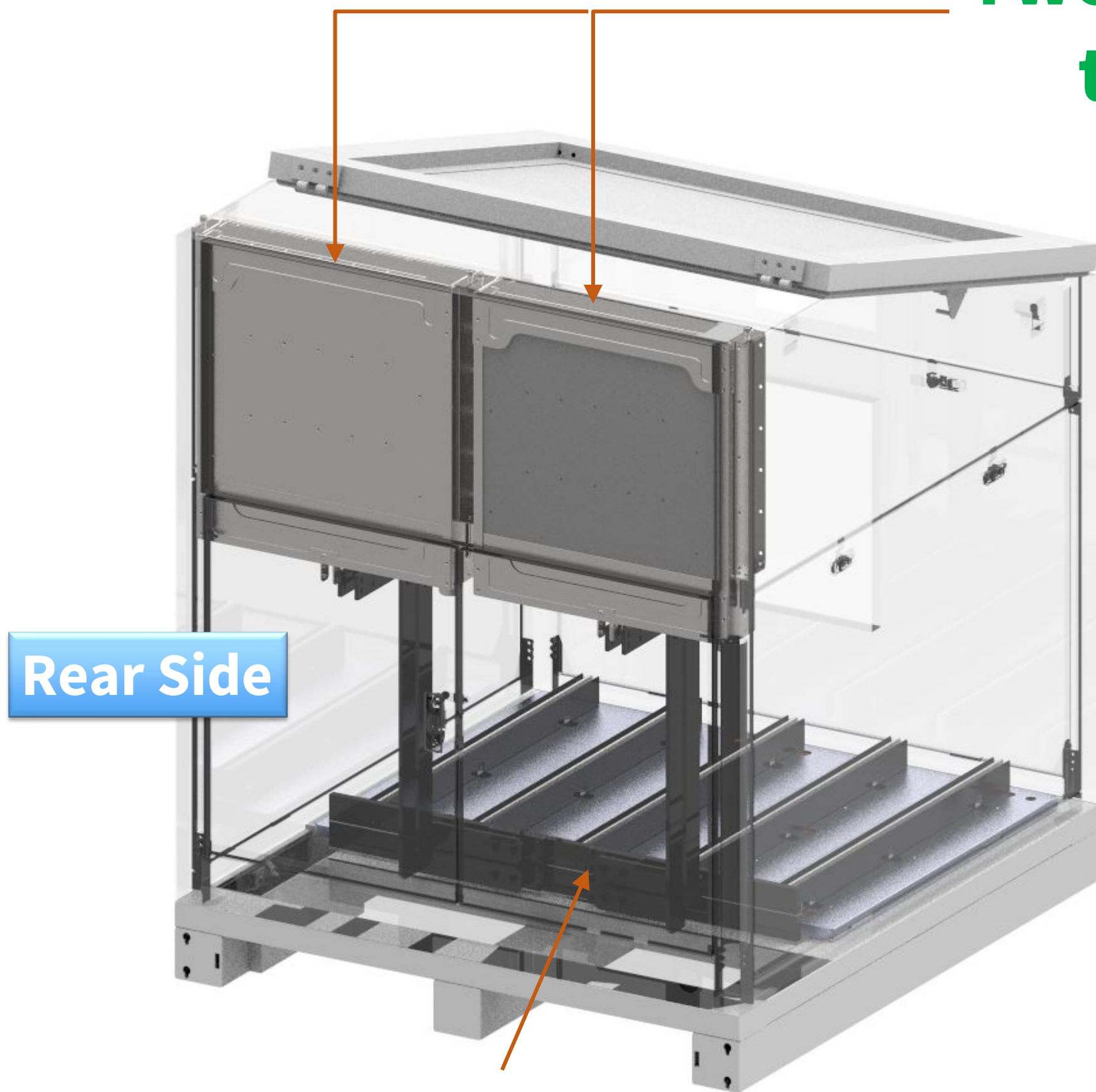
Separated power deliver by 5 branches for each cartridge column

Active Condenser

Primary Condenser

Secondary Condenser

Vapor Duct with Fan

Vapor Direction

Advanced Condenser

■ **Trigger forced convection to direct vapor to contact the condenser during board maintenance**

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Monitoring and Safety
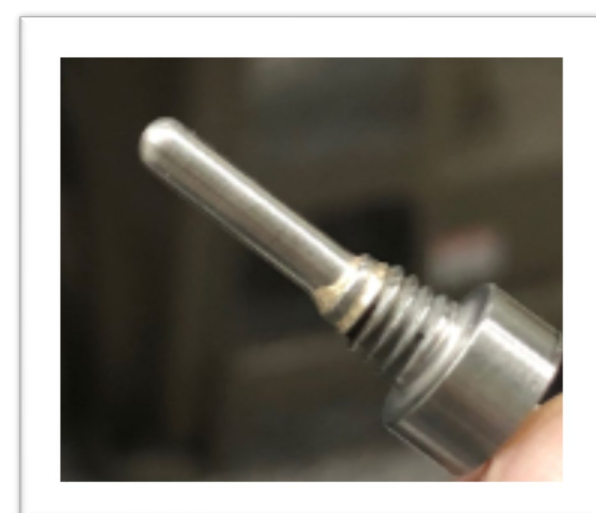
Temperature Sensors
Fluid/Vapor/Water

Moisture Sensors
Dehumidification

Liquid Lever Sensor

Pressure Sensor
Bellows System

Filter System & Pump

Power Shelf & Power Meter

Monitoring
Reporting
Warning
Critical
Control

Monitoring

Reporting

Safety

Warning

Control

Critical

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Tank Management

Tank Controller

Water Valve	Relief Valve	Active Condenser	Power Shelf
Water Temperature		Water Temperature	
Liquid Temperature		Liquid Temperature	Liquid Level
Tank Pressure	Tank Pressure	Tank Pressure	Tank Pressure
System Power			
Top Lid Detector	Top Lid Detector	Top Lid Detector	

Tank Management

Redfish-based API

Web-based GUI

- **Tank Cooling Control**
- **Power Management**
- **Node Management**
- **Interfaces**

Goal:
Compatible with OCP Profiles
Friendly to the Existing Data Center

Tank Management Board

Tank Controller

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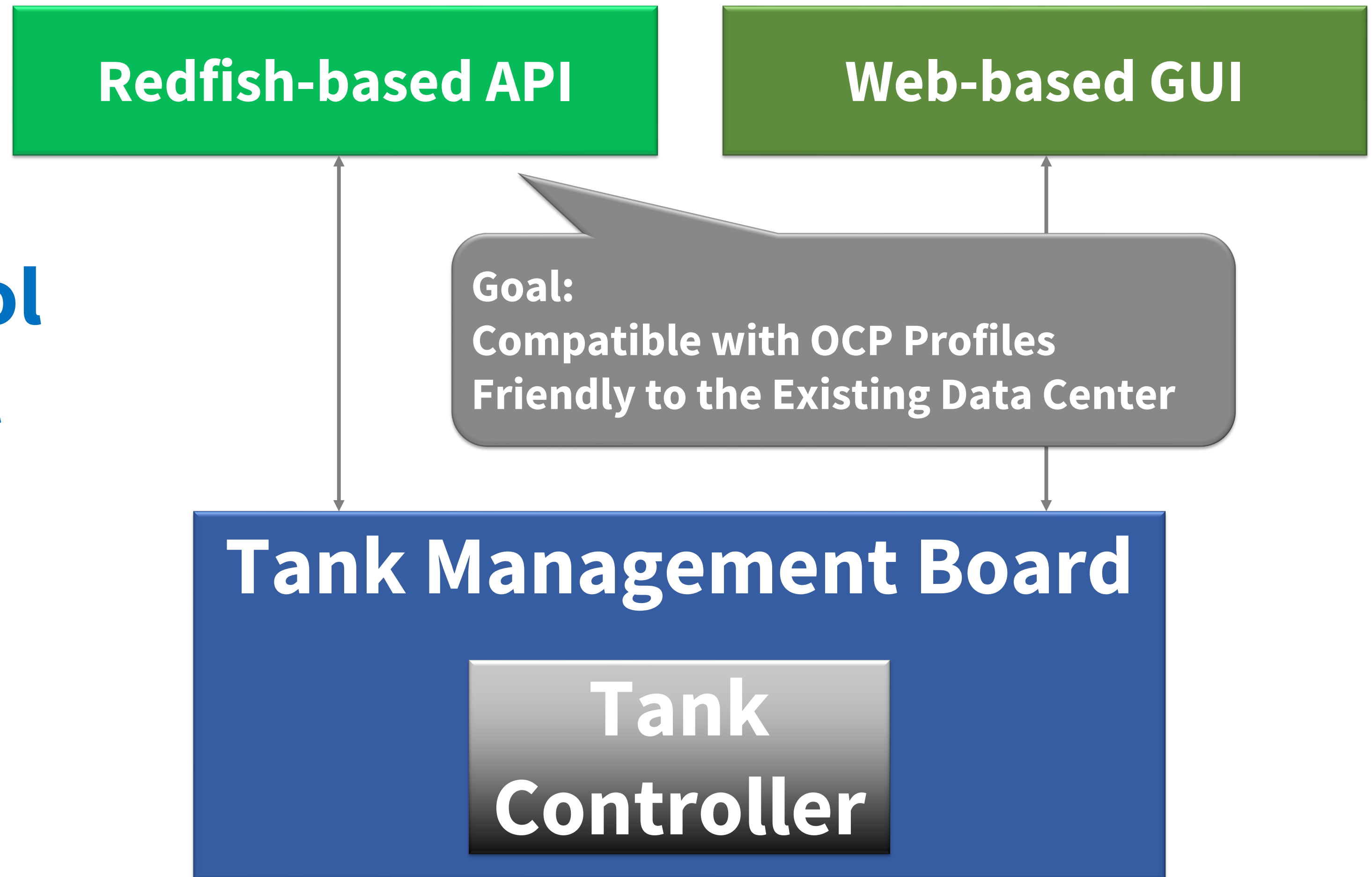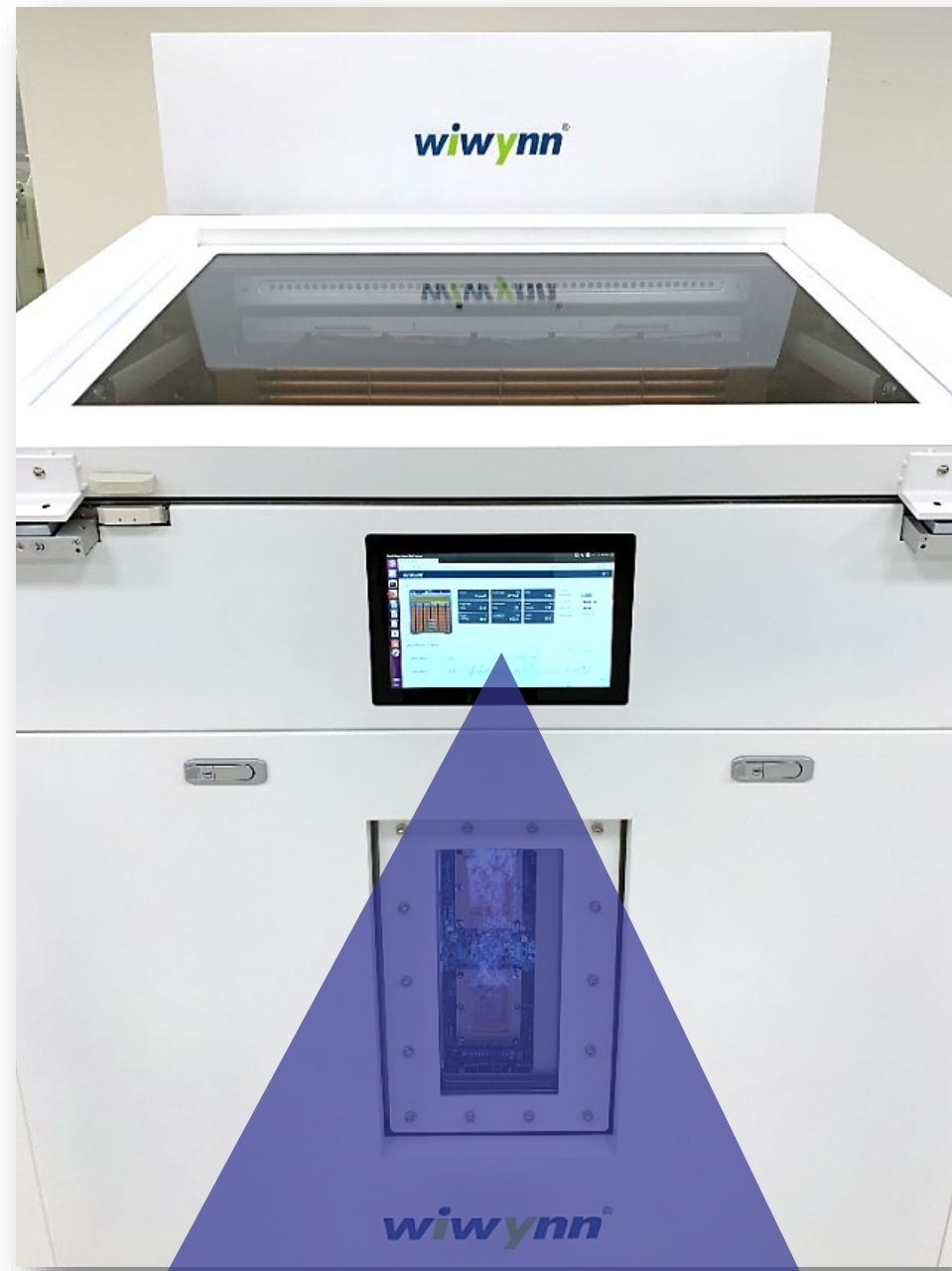
Tank Management

Tank Management

- **Touch Panel**
- **Friendly User Interface**
- **Wireless Remote Control**

- ✓ **Monitoring**
- ✓ **Reporting**
- ✓ **Warning**
- ✓ **Critical**
- ✓ **Control**

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Serviceability

Swipe the touch panel

To open lid automatically

Door Status Open
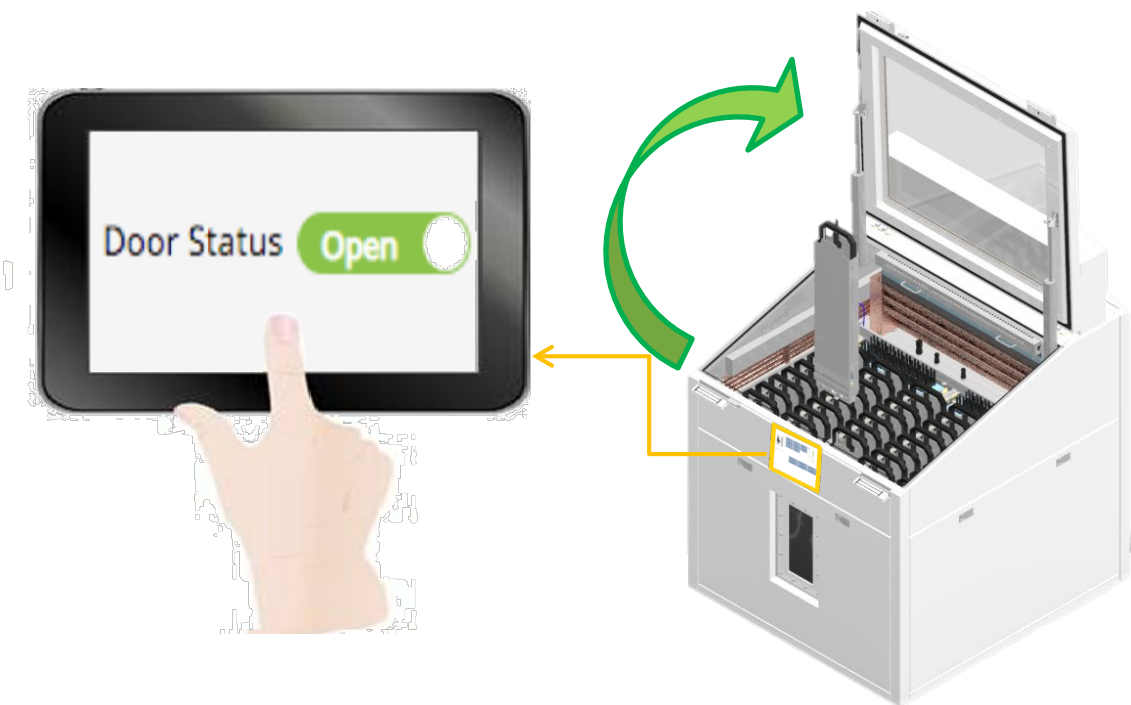
Swipe the touch panel

To Close lid automatically

Door Status Close

Open Lid

Activate Condenser System

1 2
4 3

Close Lid
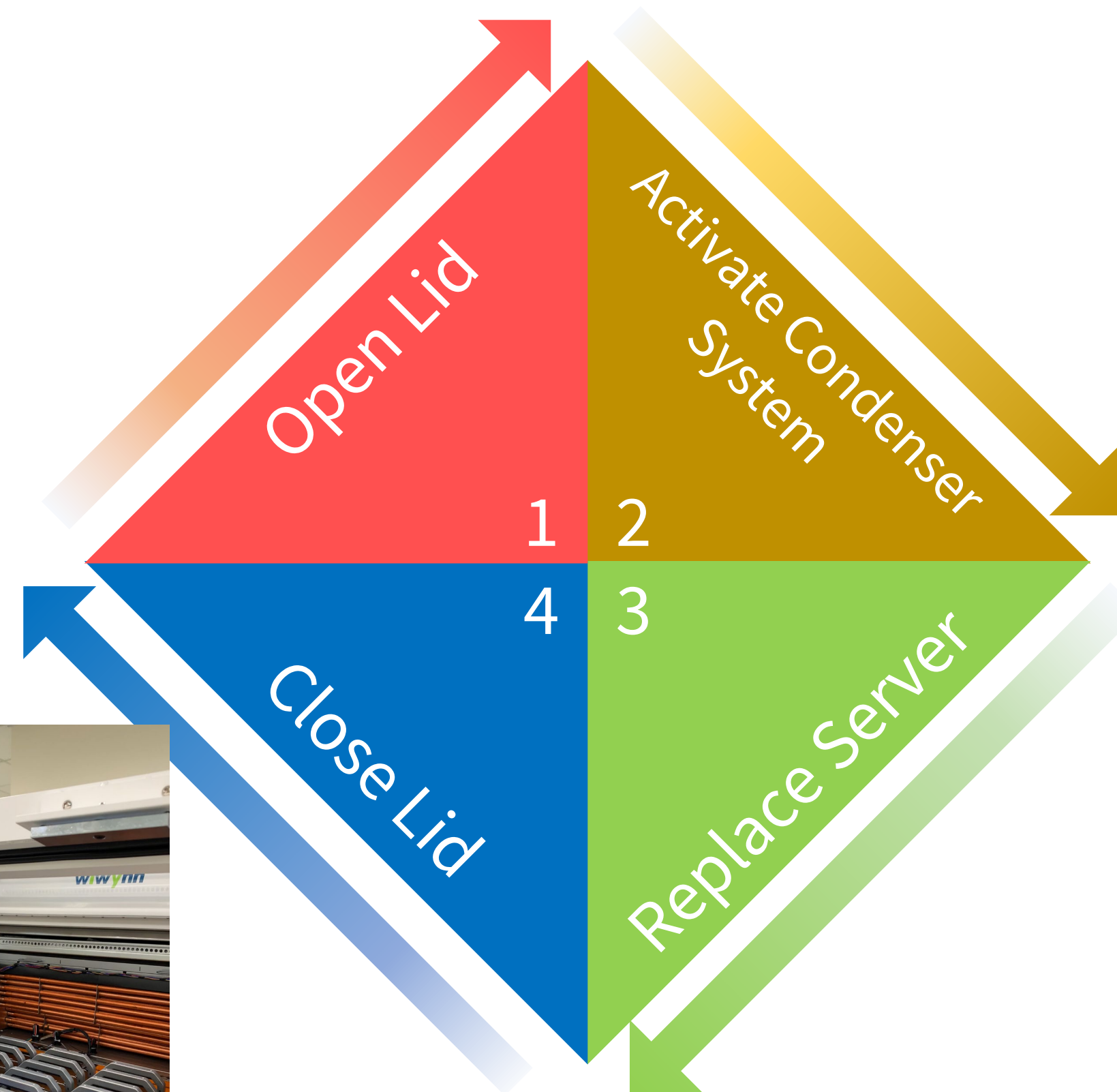
Replace Server

Activate Condenser System

**Proprietary condenser system**

Replace sever

Pull up to replace server

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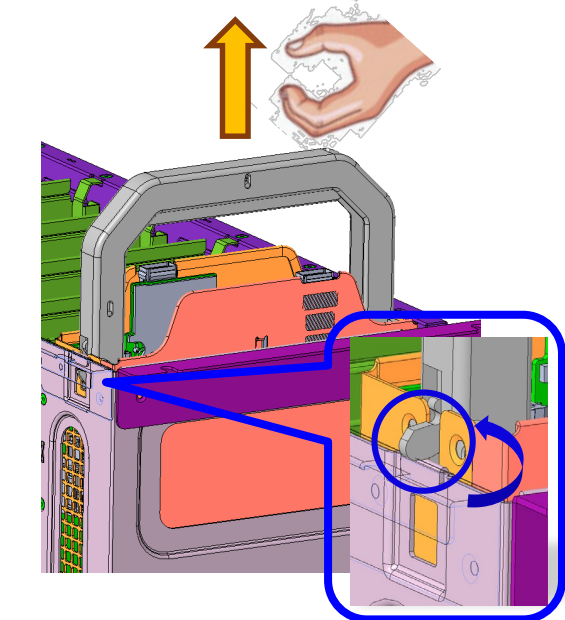
48V Immersion Cooling Solution

- **Two Phase Immersion Cooling for Excellent PUE**

- **High Efficiency DC 48V Power Delivery System**

- **Advanced Condenser System for Low Vapor Leakage**

- **Tool-less Design, Automation, and Friendly UI with Easy Serviceability**

- **Tank Management for Safety**

- **Leverage Large Scale Deployed and Field Proven OCP Server Board**

Boiling

100 Nodes

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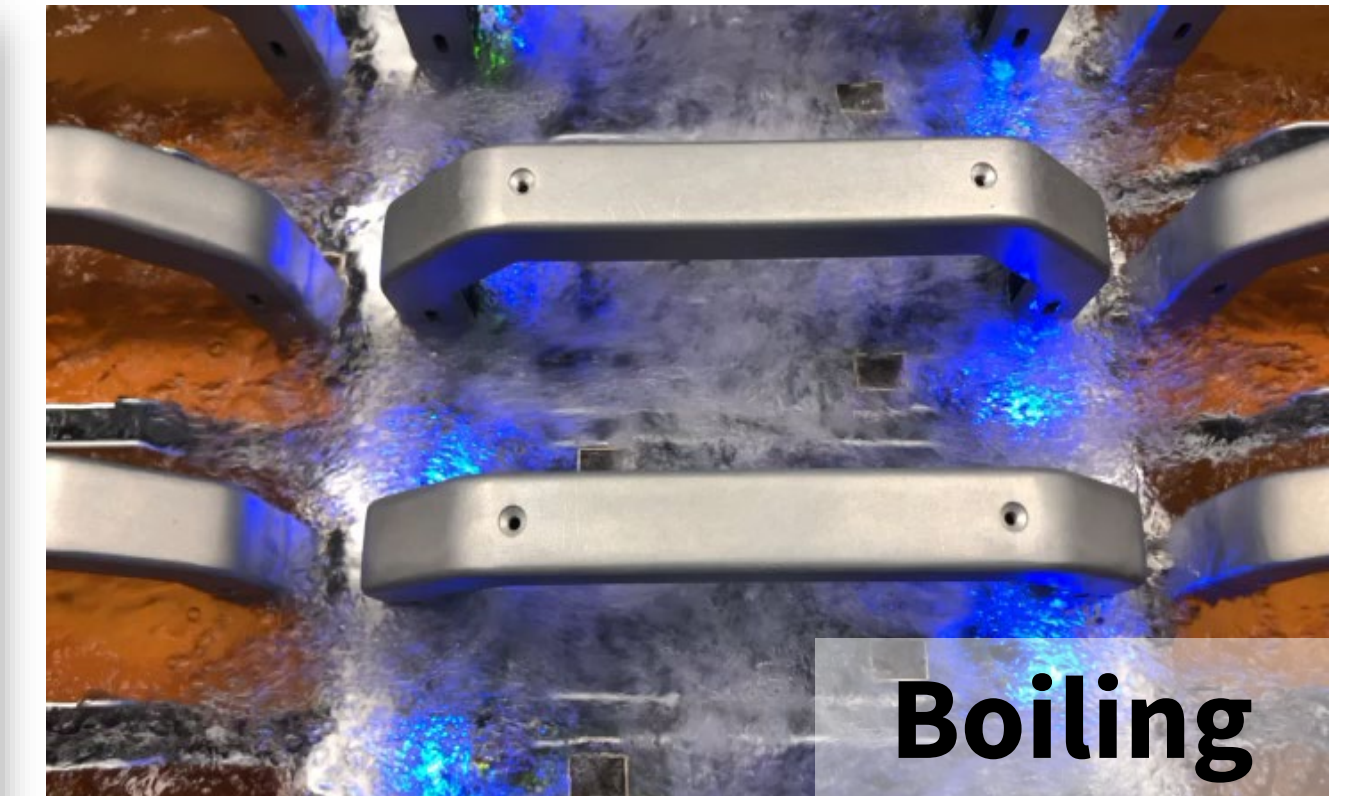
Design and Investigation

Tank Management Board

Lower Emission Rate

Cost Reduction

Serviceability

Optimized Server Board

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Tank Specification

Density	
Compute density	42 kW/m^2, 35°C
Solution density	42 kW/m^2, 35°C
Solution footprint	21 kW/m^2, 35°C
ASHRAE density (W3)	24 kW/m^2, 32°C
Density per fluorocarbon volume	120 kW/m^3
Construction	
Static load (Bare solution)	5,9 kN/m^2
Static load (Full solution)	11,8 kN/m^2
Static load (IT solution, Max)	14.8 kN/m^2
Height clearance	2530 mm
Efficiency	
Non-IT power/kW	0 W
Non-IT power overhead	70W
Thermal loss to air	TBU
Temperature delta (Min/max)	TBU
Highest cooling temp	60°C
IT	
IT chassis type	Immersion-optimized
Max chassis size	7.7"
Chassis capacity	0.75 U
IT brand compatibility	OCP/Wiwynn

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OCP Global Summit | March 14–15, 2019

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