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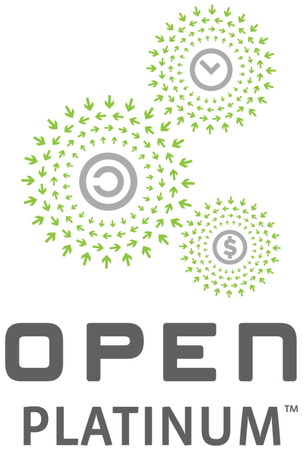
OCP
REGIONAL
SUMMIT

OAM Reference Systems
Design Joint Review

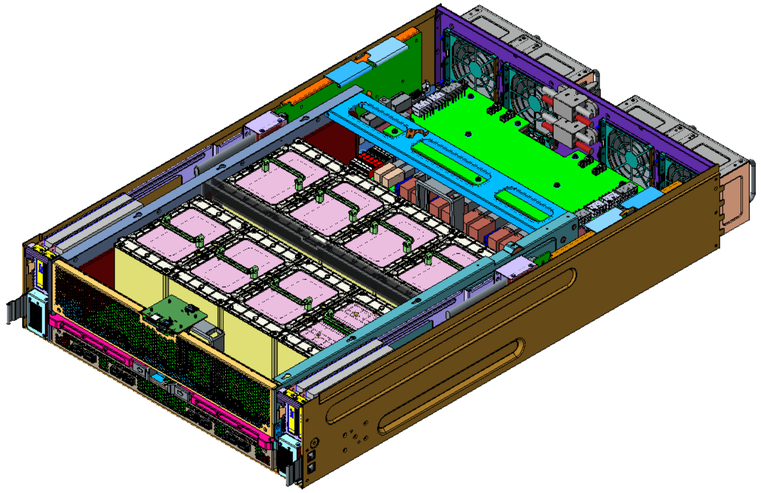
OAM Reference System Overview

Adam Ting, System Engineer, Inspur
Emilie Yang, Technical Program Manager, Hyve Design Solutions
Mark D. Chubb, Director of Architecture, ZT Systems



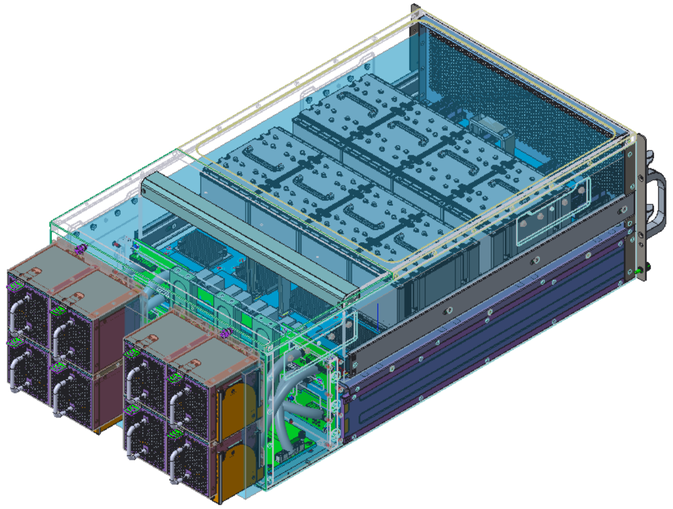
OAM Reference System Overview

Inspur 21 inch Co-Planar system



- 21 inch 3OU, 34.6” (800mm) depth
- 8*OAMs
- UBB: Combined FC+ 6 port HCM Topology
- 4*PCIE Gen4 x16 Link to connect Hosts
- 4*PCIE Gen4 x16 Slots support 100G Infiniband or Ethernet for expansion

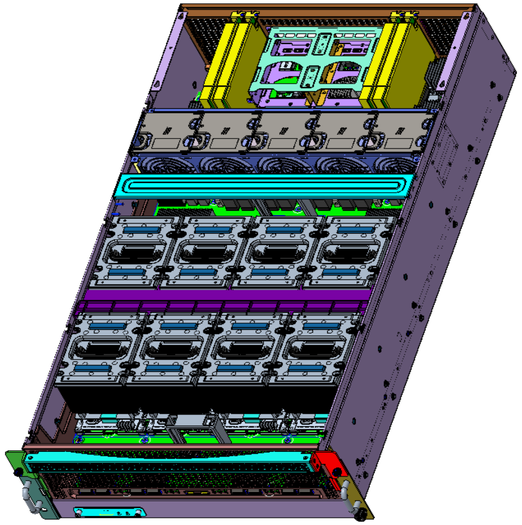
Hyve Design Solutions 19 inch Stack System



- 19 inch 6RU, 30 inch (762mm) depth
- 8*OAMs
- UBB: Combined FC+ 6 port HCM Topology
- 4*PCIE Gen3x16 slots for host uplink
- 12*PCIE Gen3 x16 slots for flexible IO expansion

(PCIE interface will be revised to Gen4 in next release.)

ZT Systems 19 inch Co-Planar System

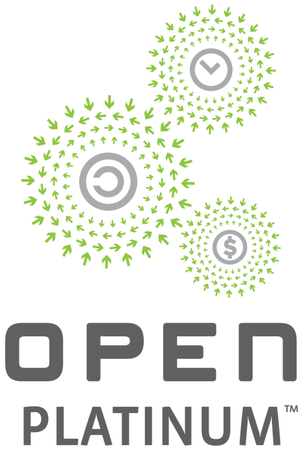


- 19 inch 4RU, 34.6” (880mm) depth
- 8*OAMs
- UBB: 8-port HCM topology
- 2*PCIE Gen4 x16 Uplinks for Multi-Host
- 4*PCIE Gen4 x16 Slots
- 4*2.5” NVME hot plug drives in front

OAM Reference Systems
Design Joint Review

Inspur
OAI Reference System

Adam Ting
System Engineer
Inspur



Content

- System Feature List
- System Architecture
- Board List
- Power Distribution
- Host Connectivity
- Thermals simulation
- Power simulation
- Sample schedule

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System spec

	Design spec 21”
Chassis	3OU W/H/D =537mm x 141mm x 800mm
PCIE	PCIE Gen4
OAM	8 x OAM TDP： 300W – 450W
Power	54V to 12V PDB
HIB	Support PCIE Gen4 switch 4 x PM42100 single layer.
FAN	4 x 9256 FAN
Extension	4 x PCIEx16 Slot; 2 x PCIE x 32 whisper; 8 x QSFP-DD
BMC	AST2520 with RJ45 management port

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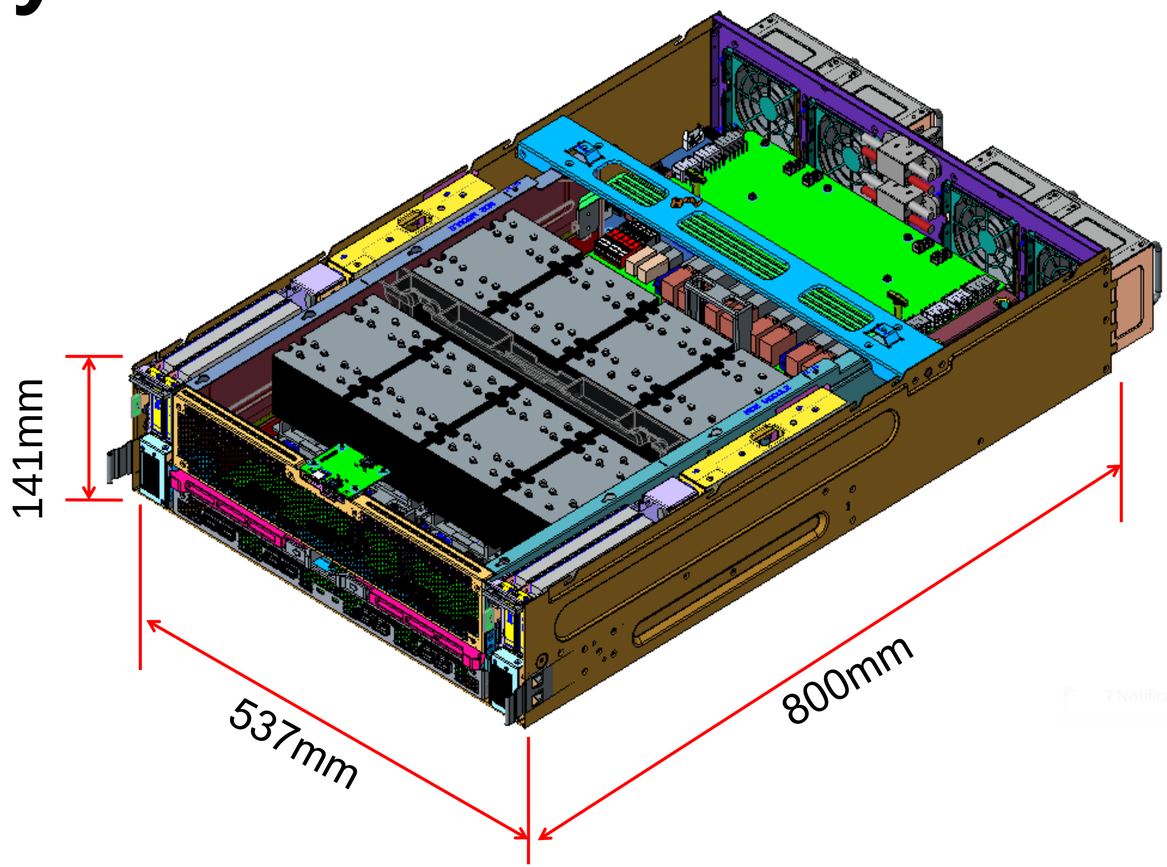
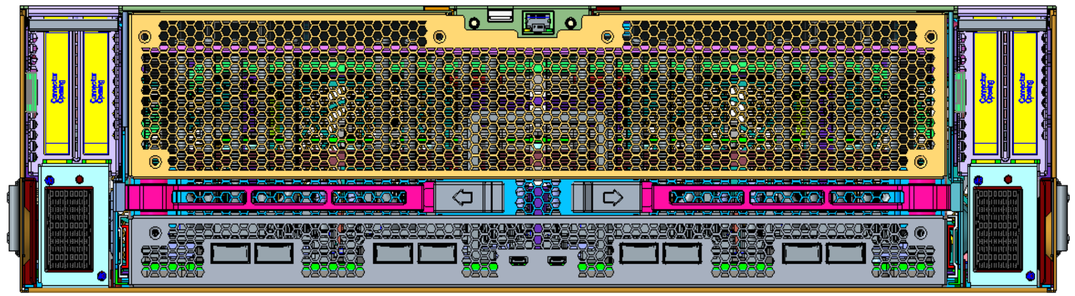
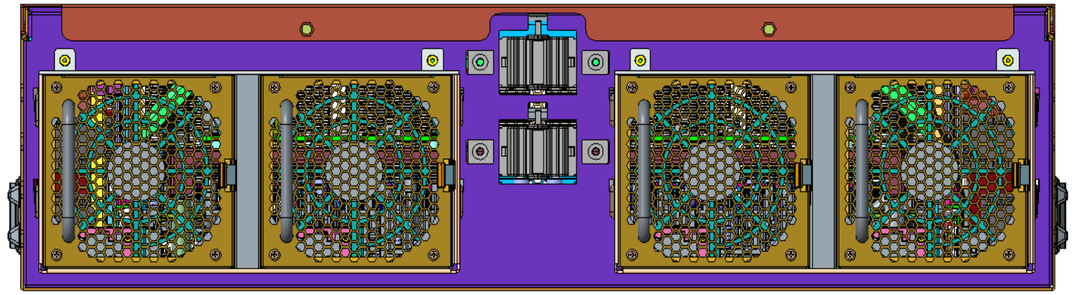
Specifications

System ISO View



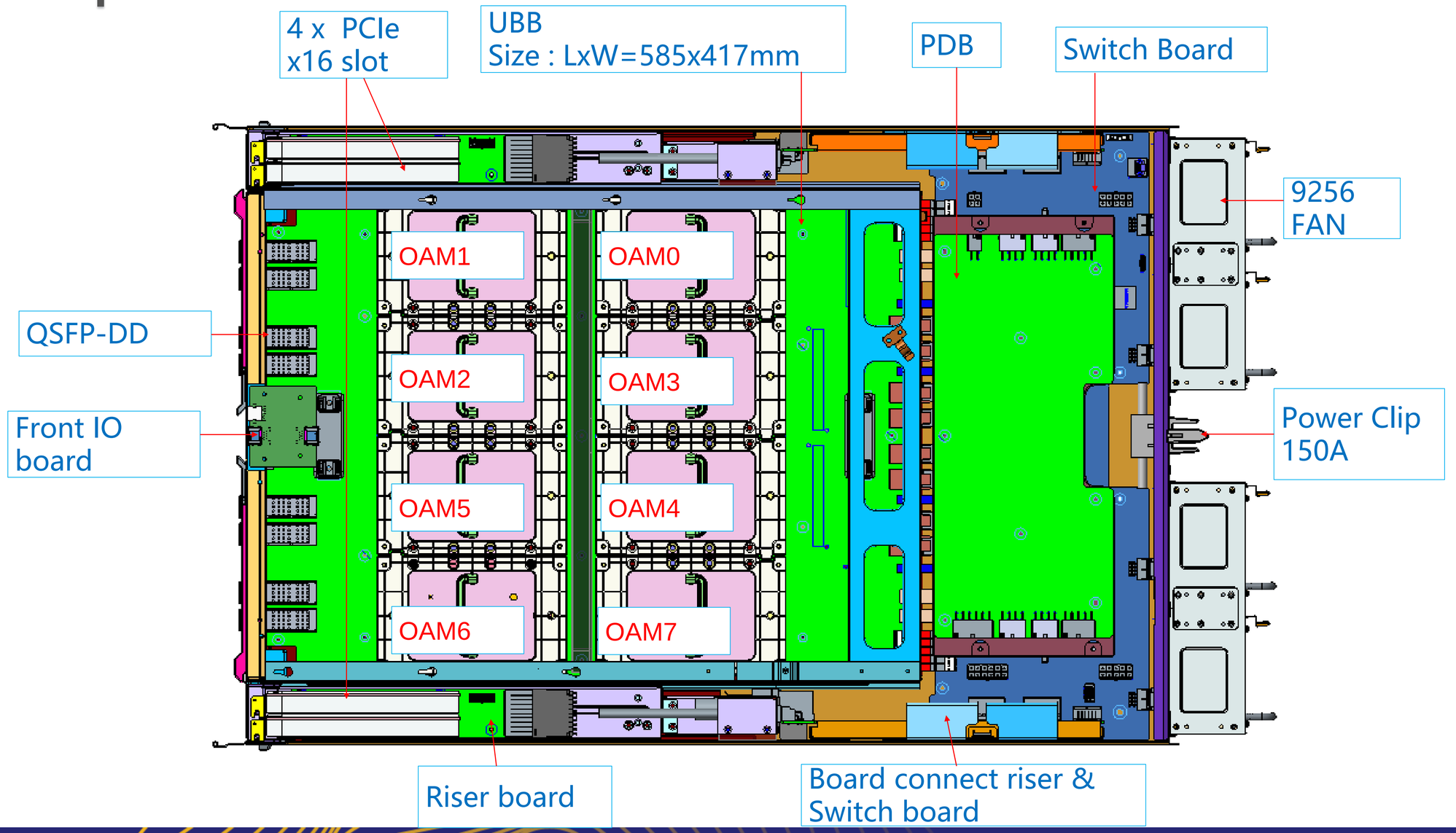


Front View

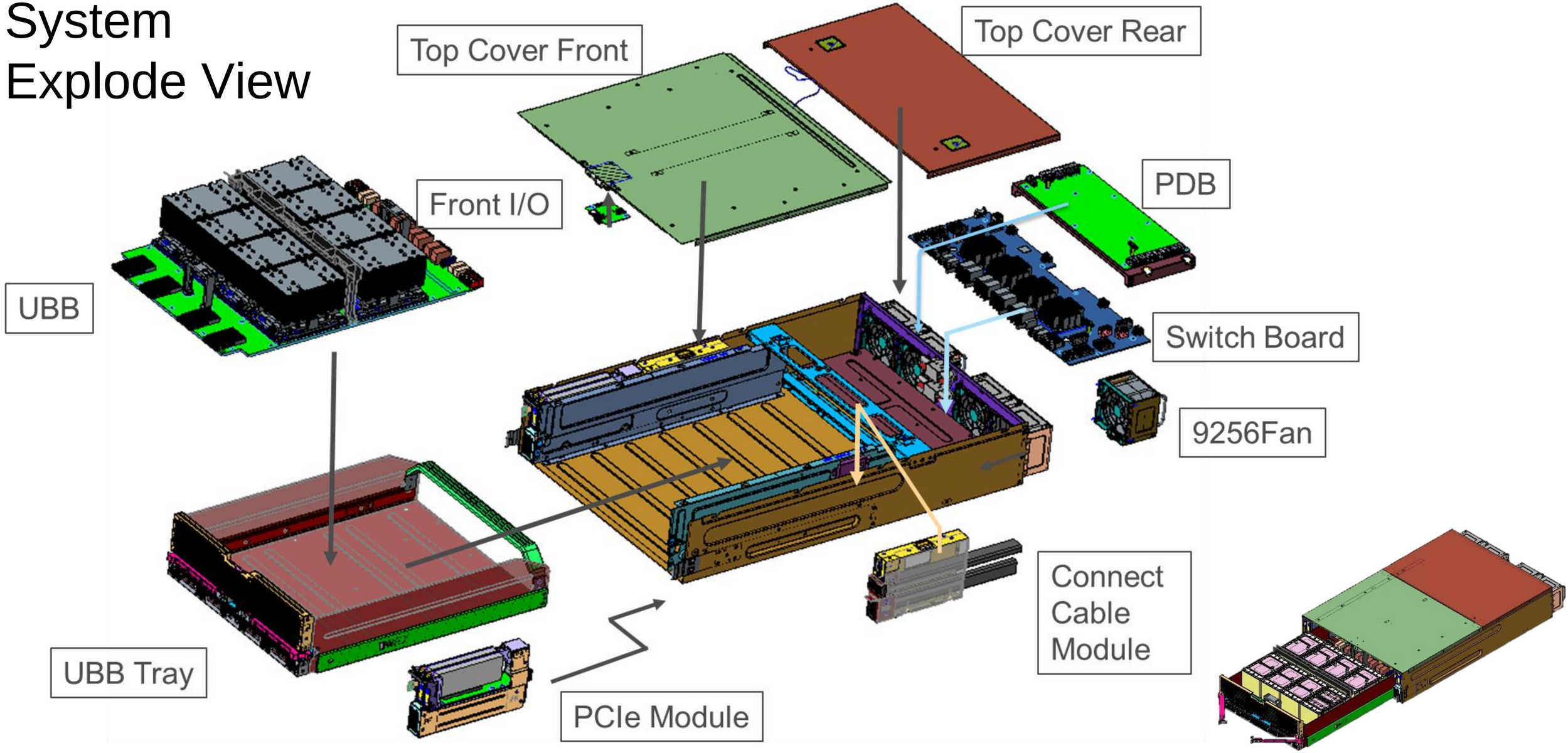


Rear View

System placement overview

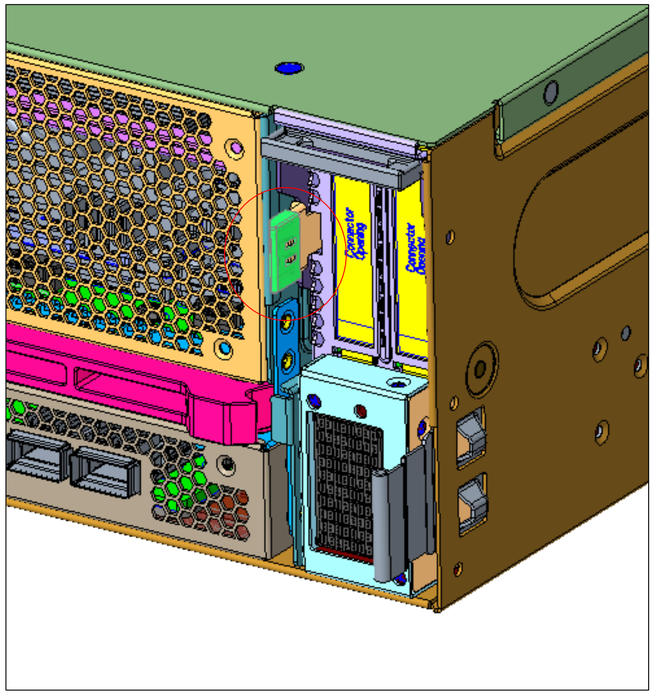


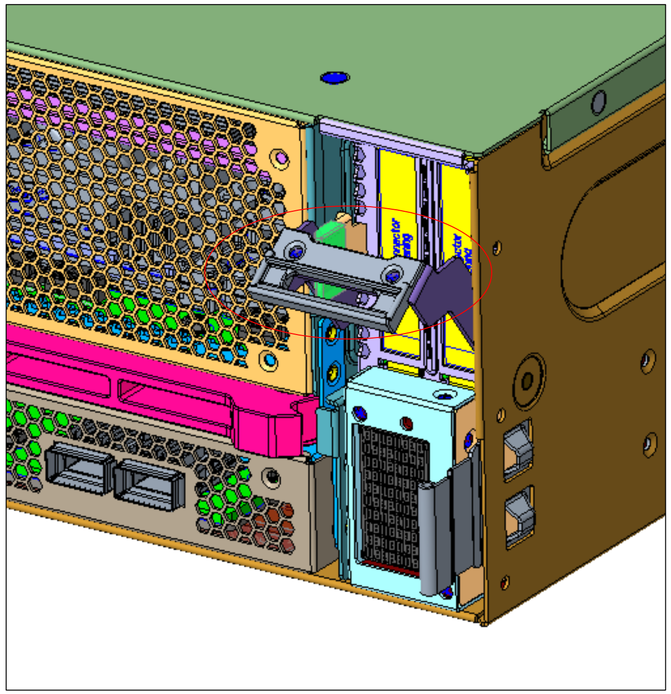
System Explode View

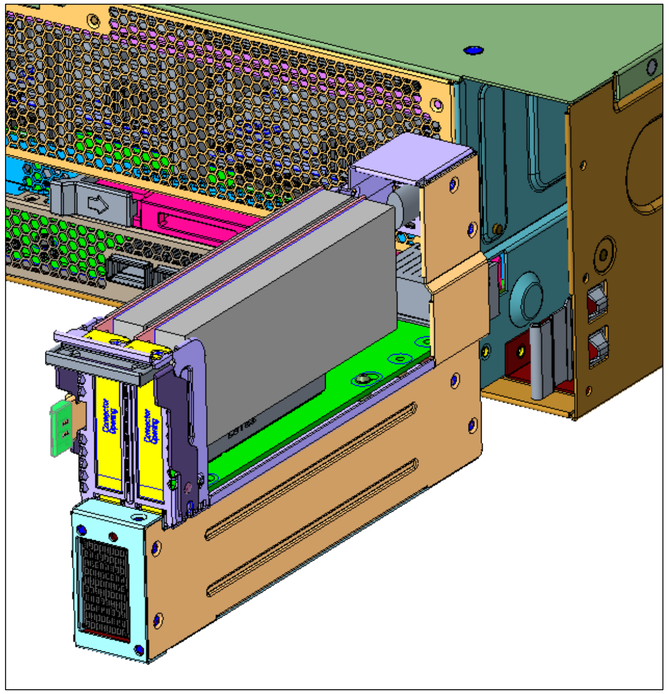


I/O Module Operating

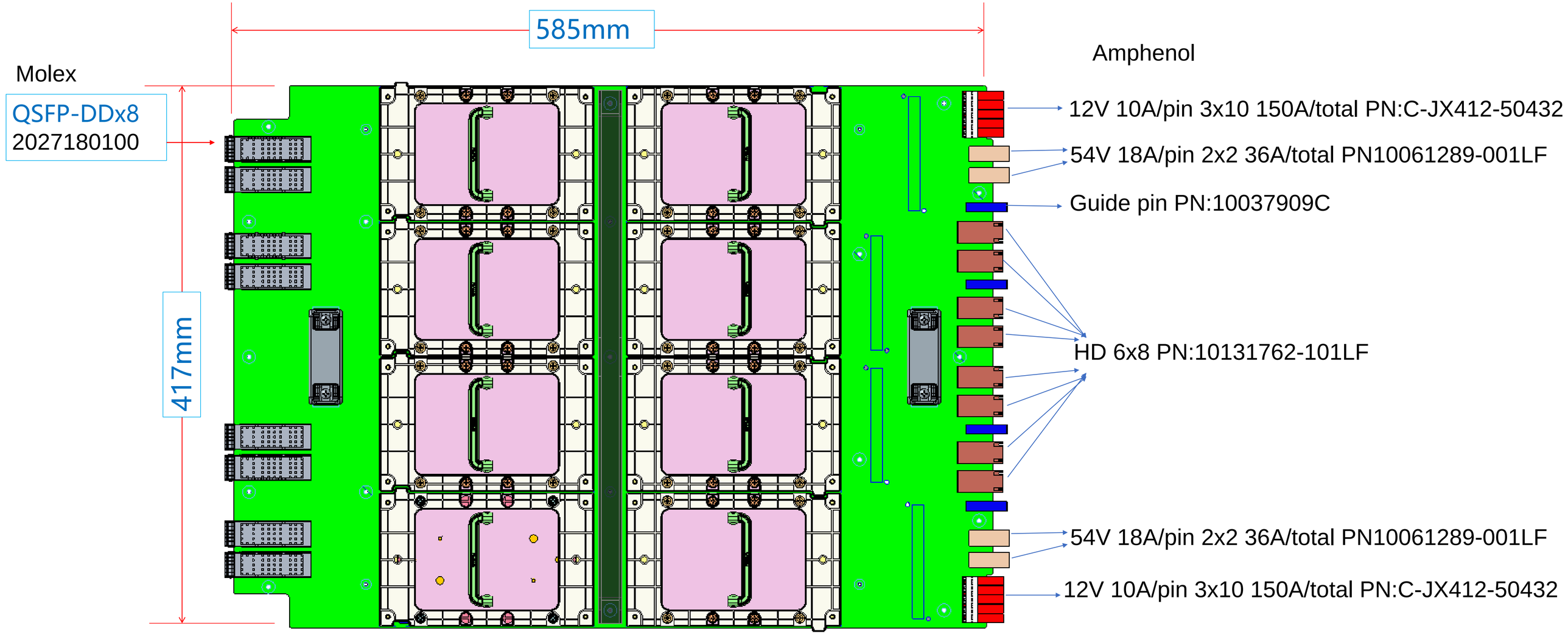
- The I/O module be lock by toolless latch.
- After release latch, the labor-saving lever can help to release module.
- The lever can help to pull whole I/O module out.



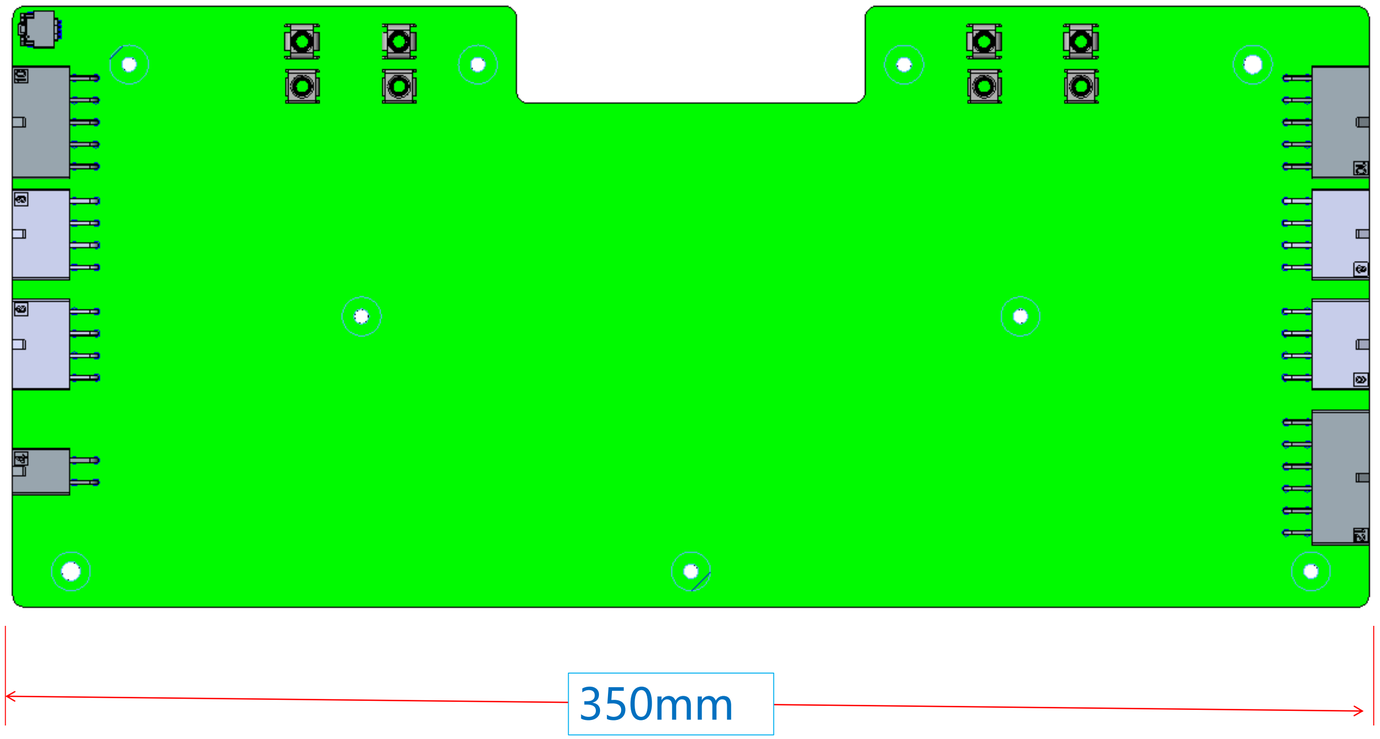


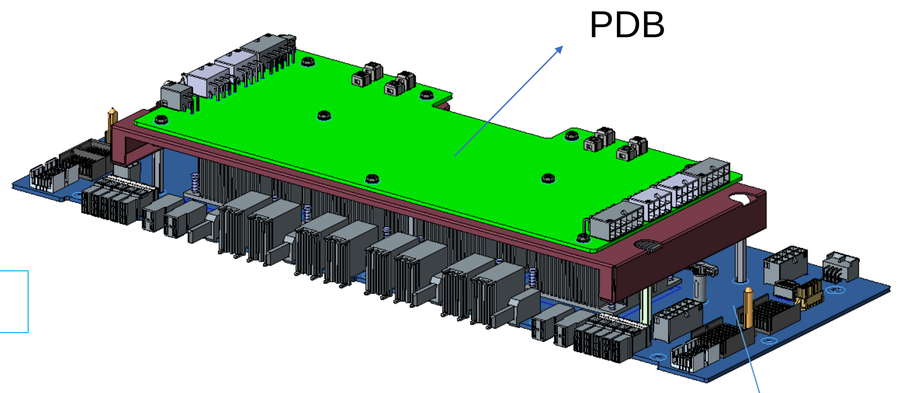


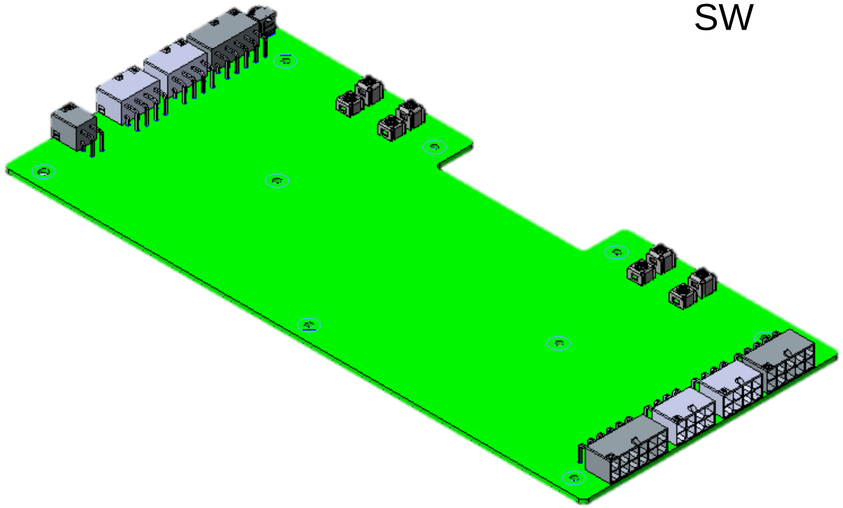
UBB Dimension and connector



PDB - 54V to 12V

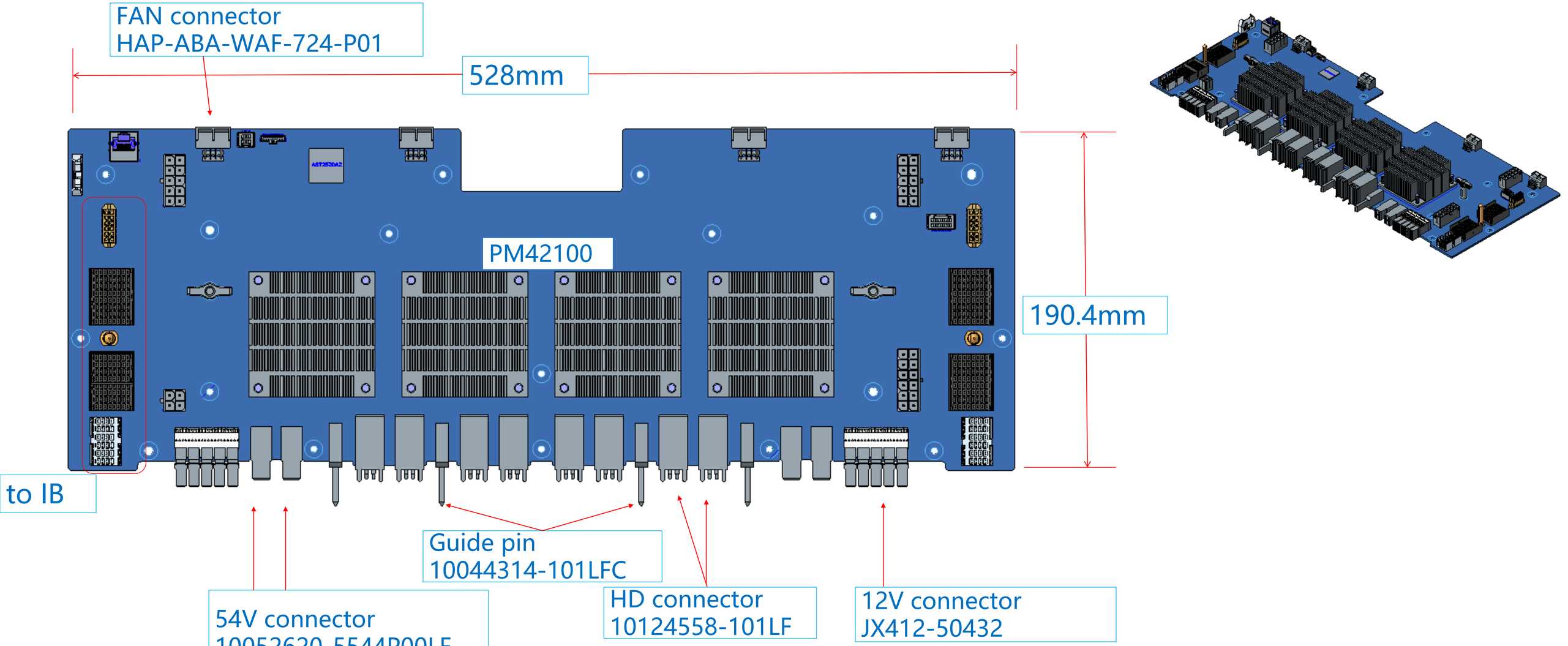






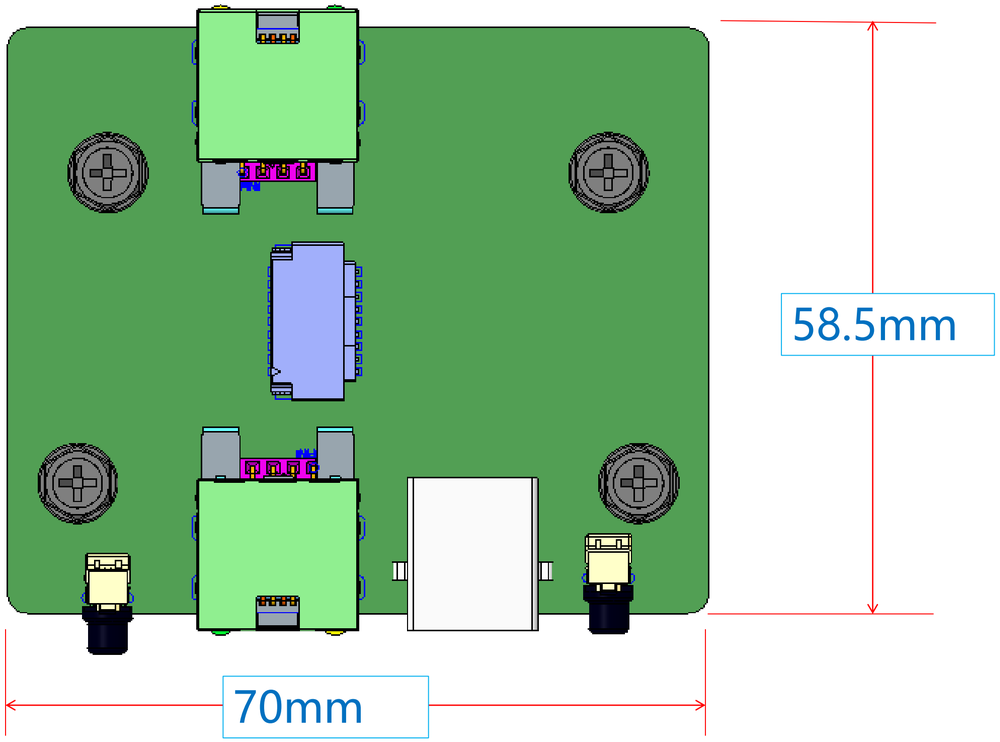
- ✓ 6 x 54V to 12V module to support about 4000W for SW and UBB
- ✓ Two clipper to deliver 300A/54V.
- ✓ Size change to Width 350mm , Length 155mm.

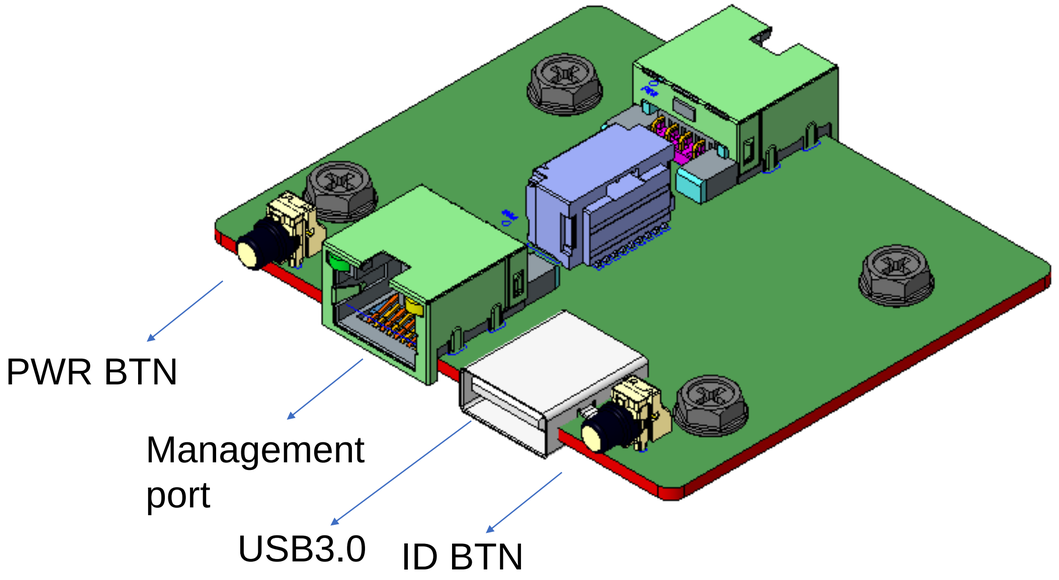
Host Interface Board



- ✓ Update length to 190.4mm

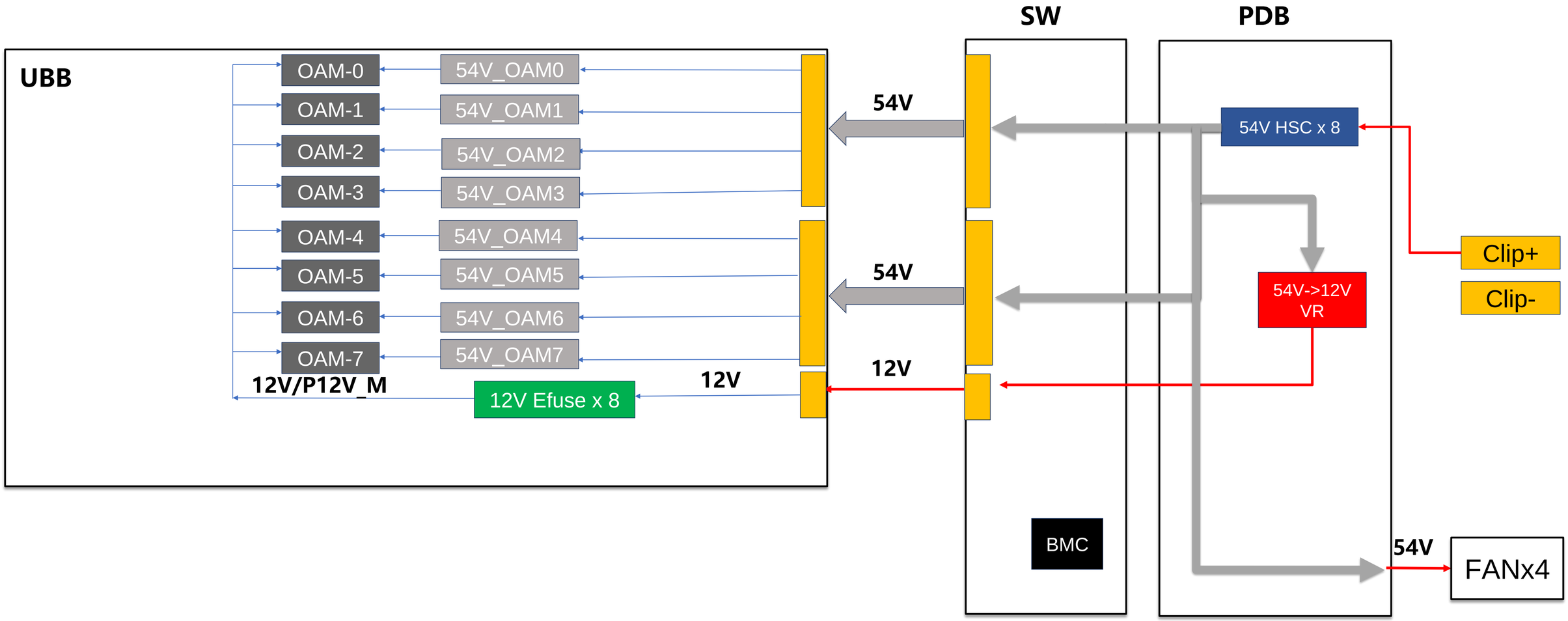
Front IO





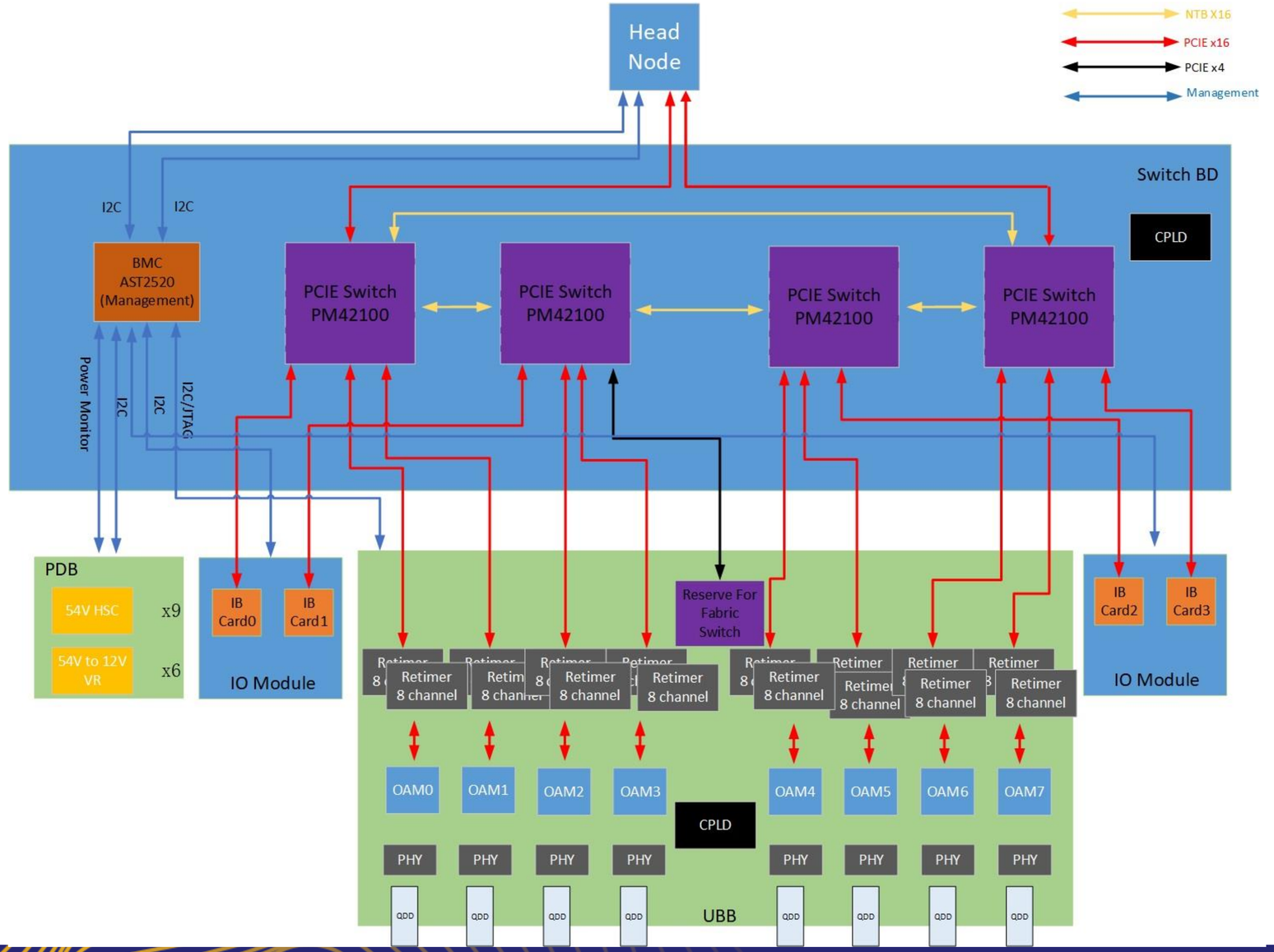
- ✓ Size change to Width 70mm , Length 58.5mm.
- ✓ Add USB3.0 port.

DC topology – 54V HSC in PDB,12V E-fuse in UBB



54V to 12V: DCM3717
54V HSC: ADM1272
12V E-fuse: MP5023

System Topology : Single Node connect 8*OAMs



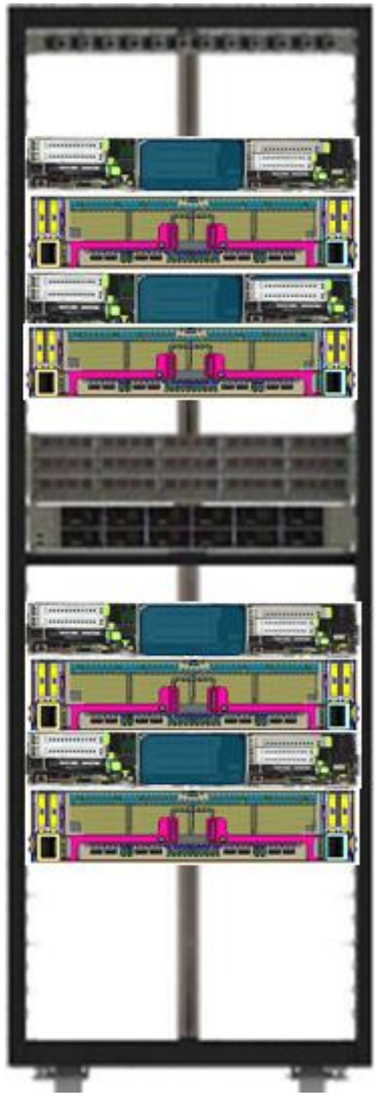
48V V2 Open Rack OAM Solution

48VDC V2 Open Rack

- 1 pairs 48V Bus Bar
- 1 shelf per Rack
- 15 PCS 2.7KW BBU and back up time 2 Minutes

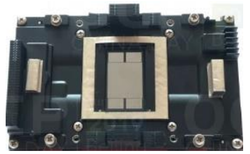
Power Shelf

- 33KW(12xPSU)
- 40V-58V
- 93mm x 534mm x 594mm



OAM Vendor

- Intel Nervana NNP-T
- Habana Gaudi
- Nvidia
- AMD

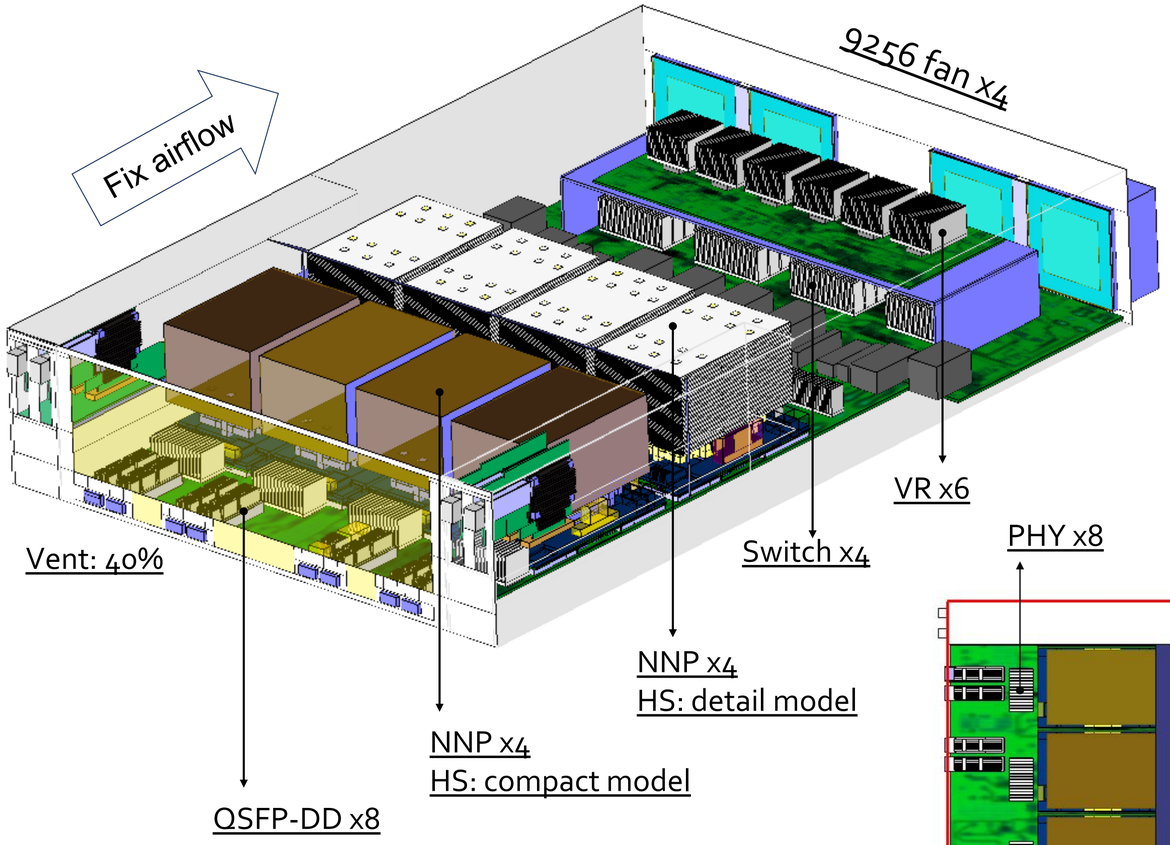


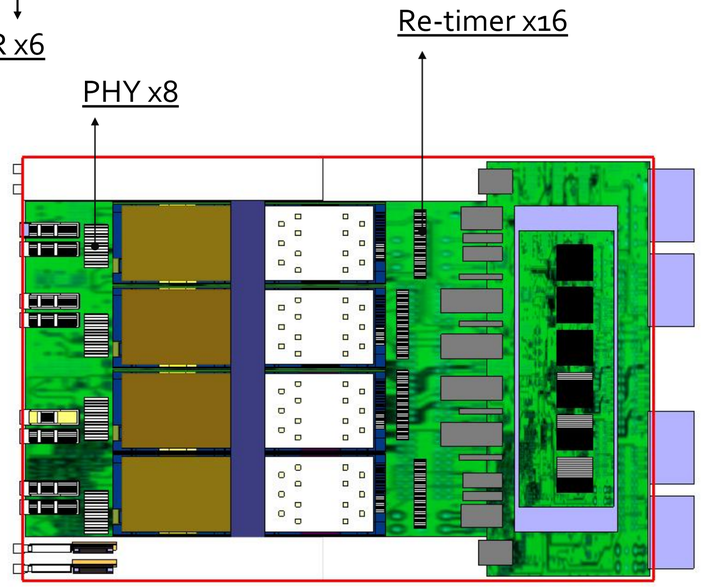
System Devices

- 4x Inspur 3OU OAM systems
- 8x Nodes

System	Power	Subtotal
Inspur 3OU OAM System	**20KW** (4x ~5000W)	**25.6KW**
Head node	**5.6KW** (8x700W)	
Total Power/Rack		**33KW**

System Configuration & Thermal Design Power





Top view

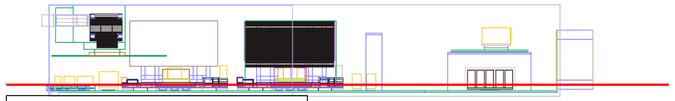
Thermal Design Power			
Component	Unit Power	Q'ty	Power
OAM	450	8	3600
Re-timer	5	16	80
Switch	60	4	240
PHY	12	8	96
QSFP-DD	12.5	8	100
CX5	18.1	4	72.4
VR	25	6	150
9256 Fan	140	4	560
Total Power (watt)			4898.4

*TDP in this table will modify when data update

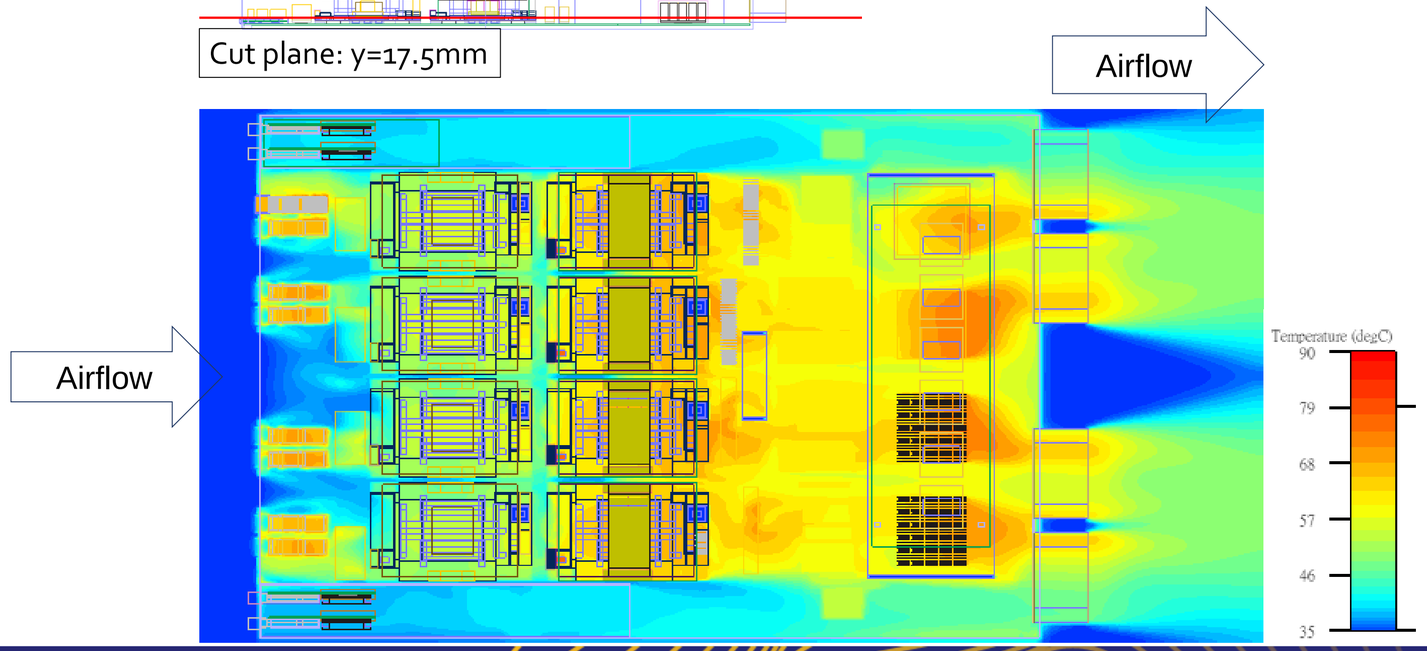
Simulation Results (Temperature Field)

Simulation Boundary Condition Setup

- TDP at 35C ambient
- Fan normal
- Sea-level
- Compact model for upper stream NNP HS
- Compact model HS for VR
- Symmetric placement for switch HS
  two for detail model; two for compact model



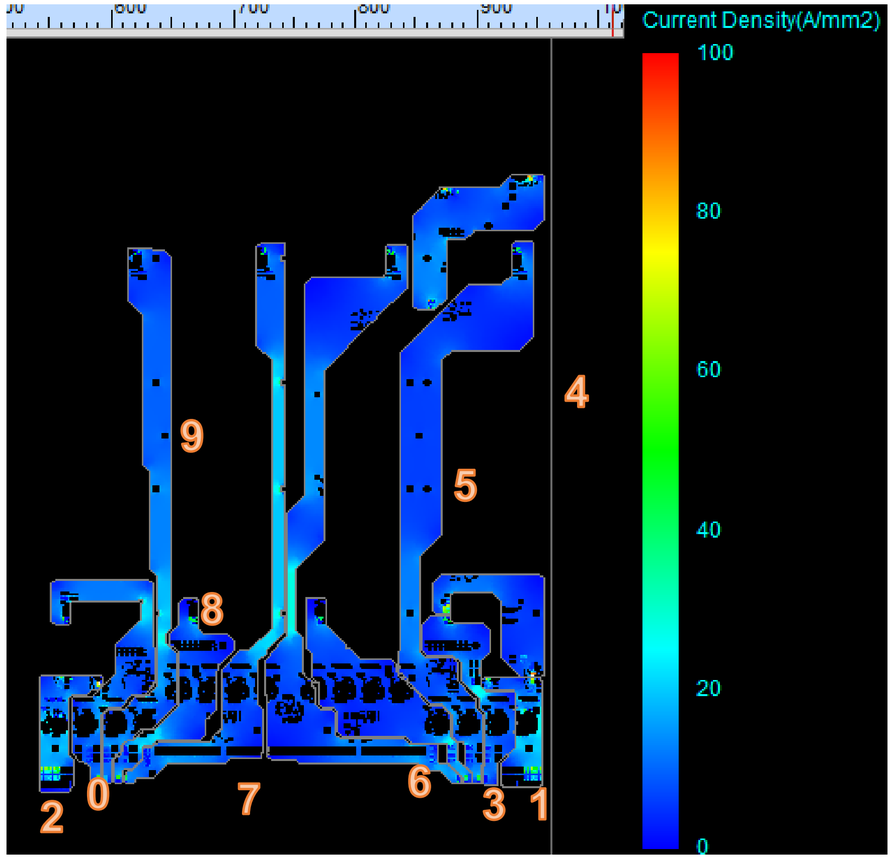
Cut plane: y=17.5mm



Temperature Results			
Location		Spec (C)	Temp.
NNP	**ASIC**	115.0	76.5
	HBM	95.0	93.3
Re-timer		85.0	82.8
Switch		115.0	90.8
PHY		110.0	72.7
QSFP-DD		70.0	66.9
CX5		105.0	94.1
VR		125.0	108.7

Current Density Plot L11

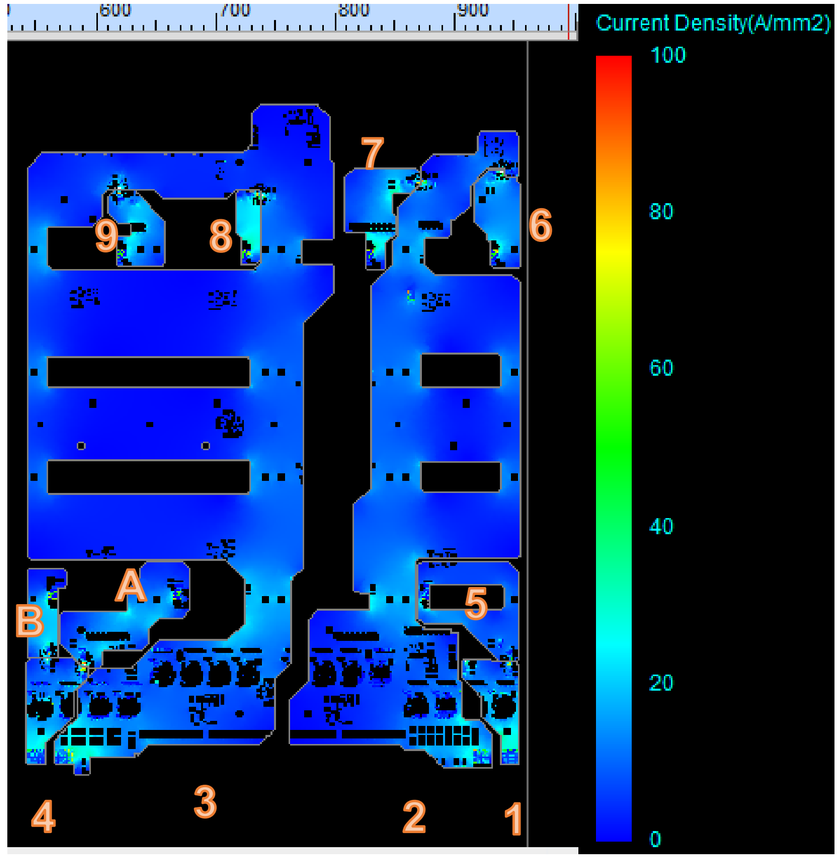
Number	Power rail
1	**P12V_VR0**
2	**P12V_VR2**
3	**P54V_0**
4	**P54V_1**
5	**P54V_3**
6	**P54V_2**
7	**P54V_5**
8	**P54V_4**
9	**P54V_6**
0	**P54V_7**



The higher current density is around 35A/mm2

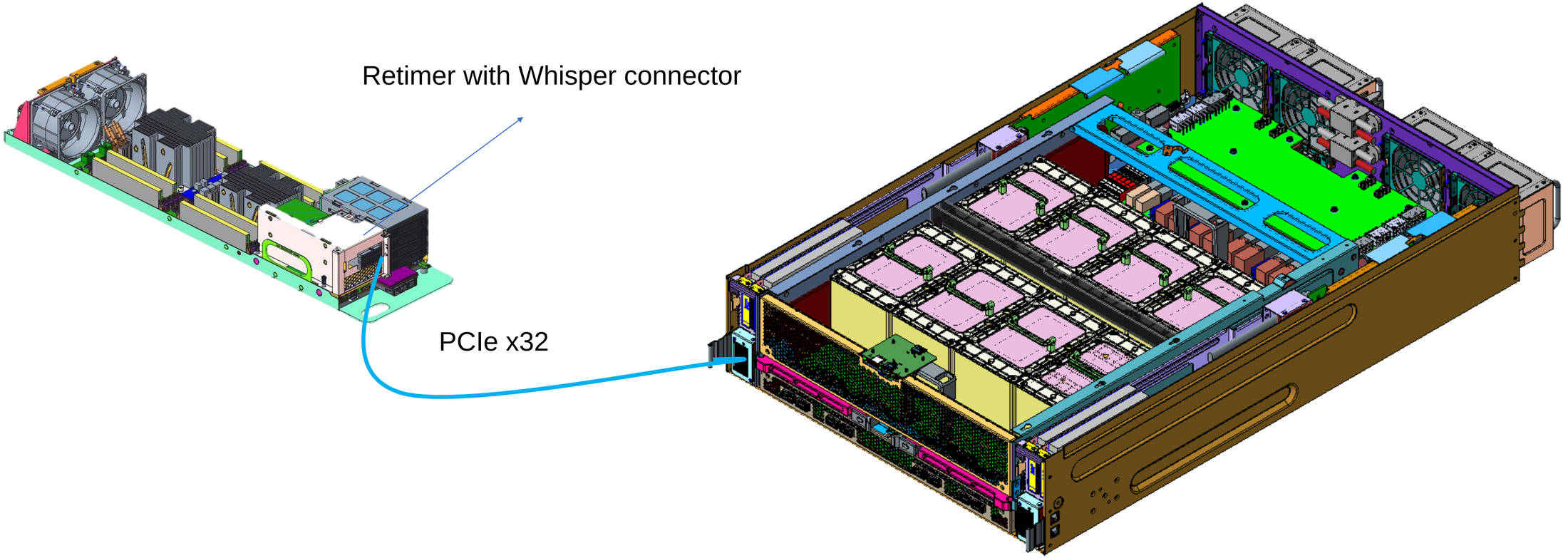
Current Density Plot L12

Number	Power rail
1	P12V_VR0
2	P12V_VR1
3	P12V_VR3
4	P12V_VR2
5	P12V_0
6	P12V_1
7	P12V_2
8	P12V_5
9	P12V_6
A	P12V_4
B	P12V_7

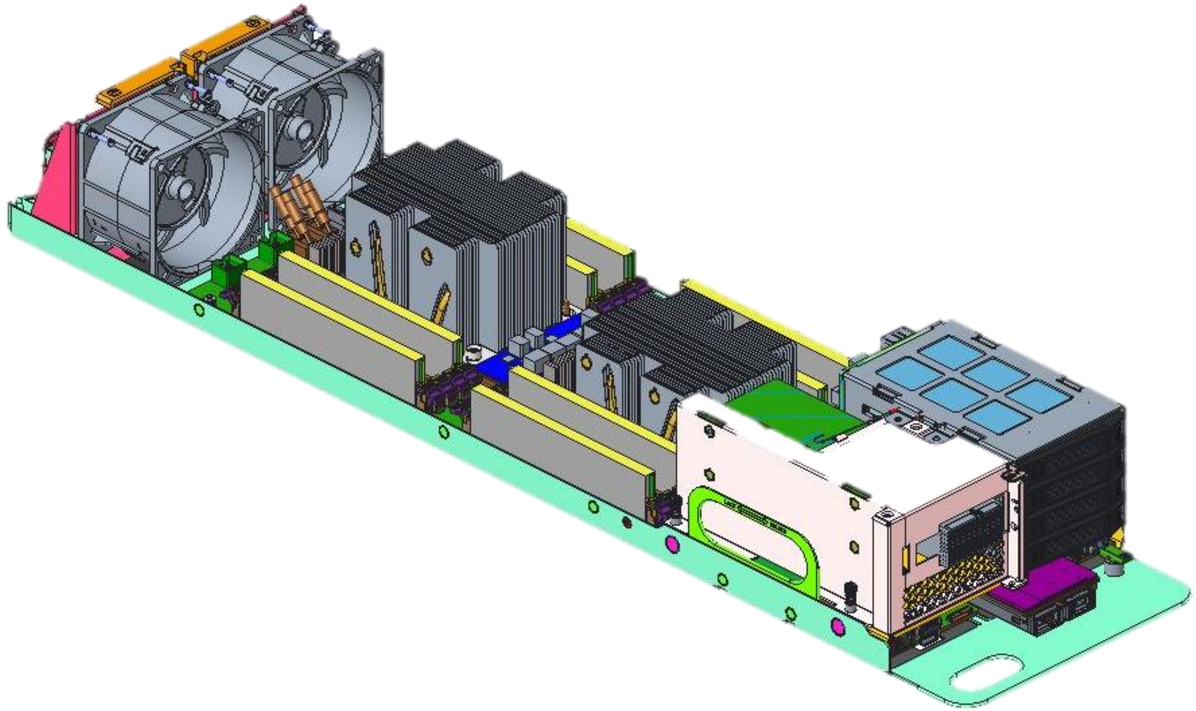


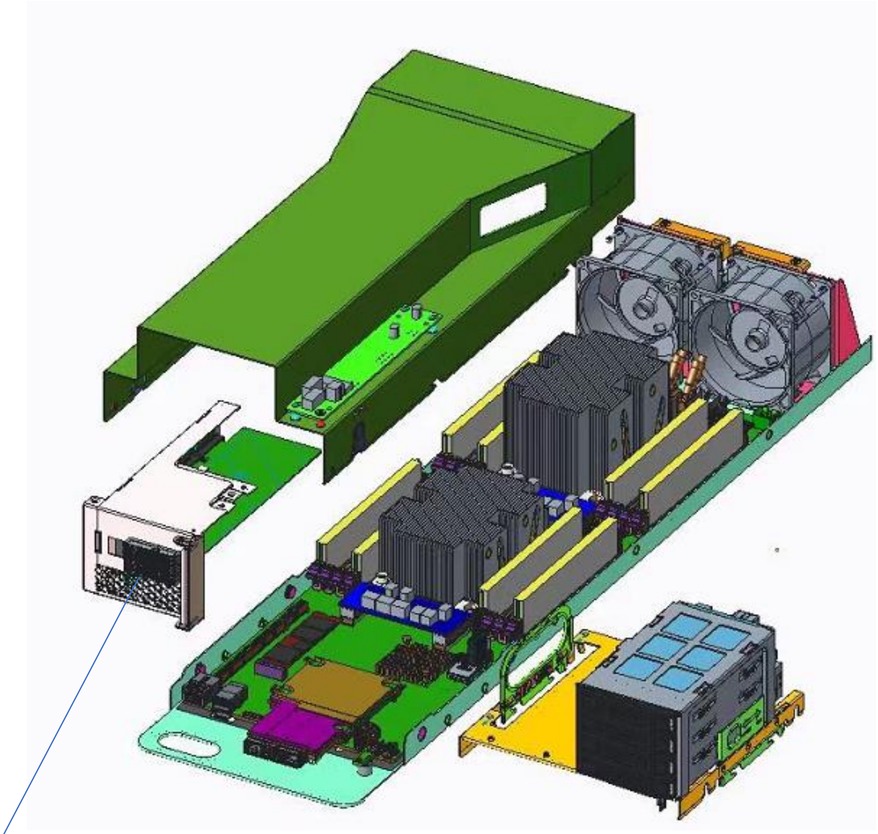
The higher current density is around 35A/mm2

Head node connection – whisper to whisper



Inspur Head node with Whisper GEN4 retimer card

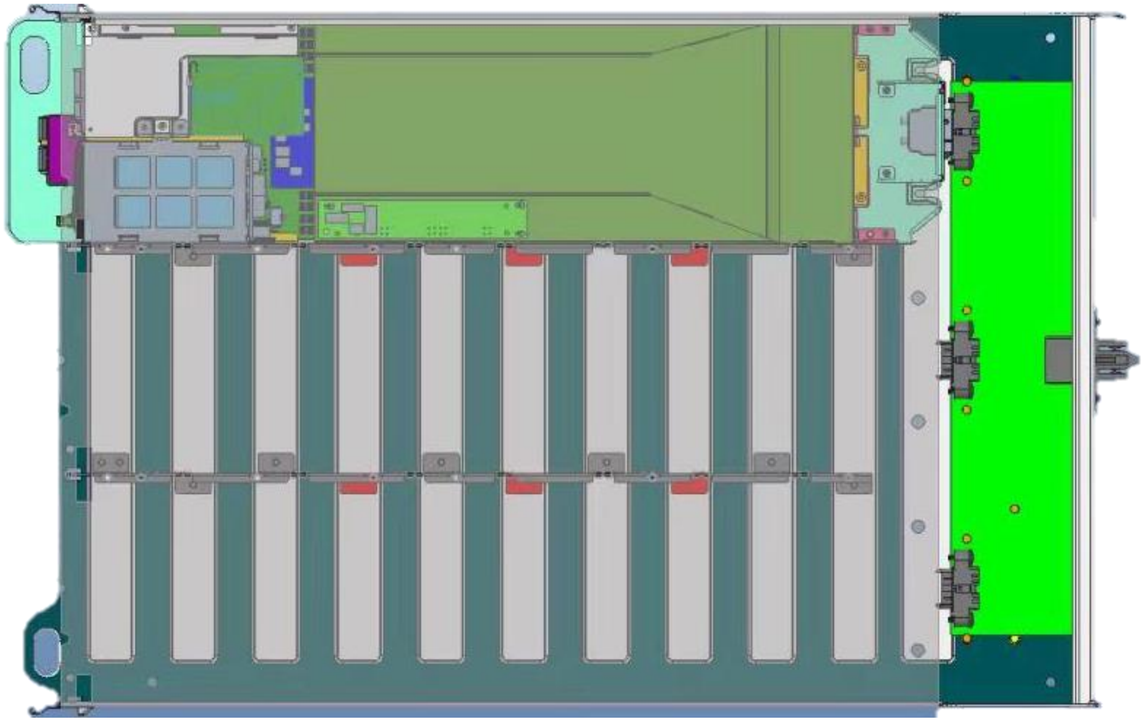


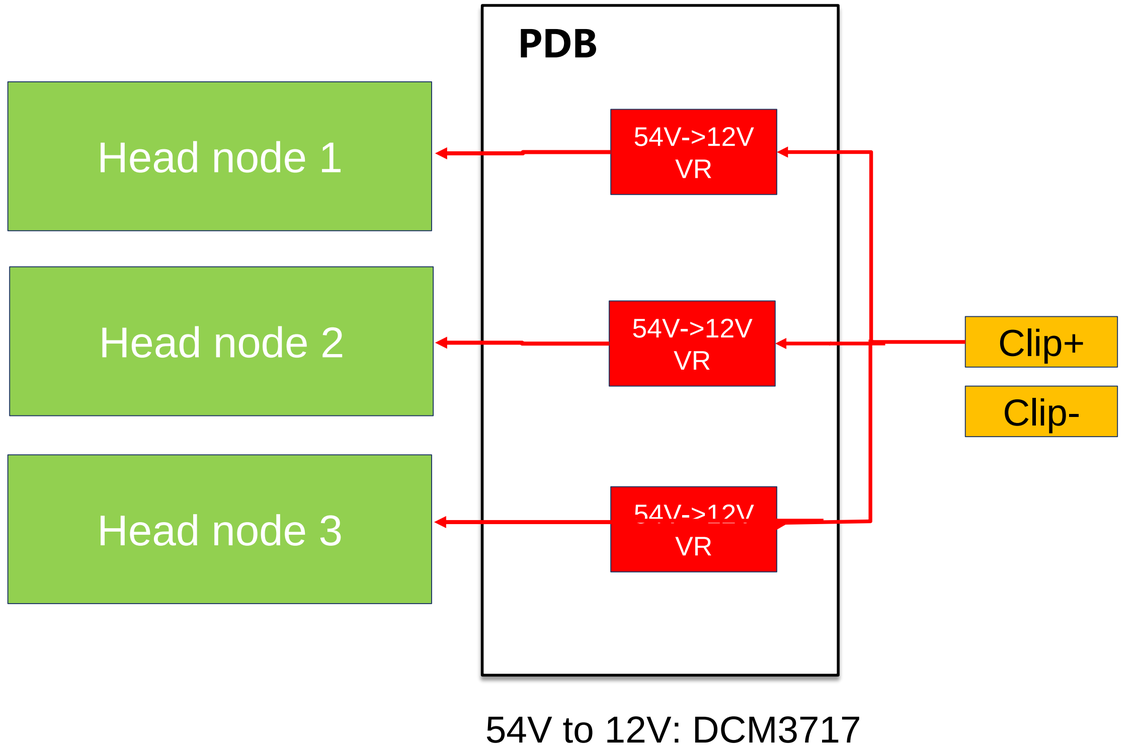


Gen4 Re-timer card

4x2.5”HDD
Expansion Slot:
1x HHFL(x32) : CPU0

Head node support 48V Rack





54V to 12V: DCM3717

Call to Action

- Power on Sample availability: Q4 2019
- Visit Inspur demo System at OAI Experience Lab and Inspur Booth
- Provide feed back to OAI group
- Project Wiki with latest specification : https://www.opencompute.org/wiki/Server/OAI
- Mailing list: https://ocp-all.groups.io/g/OCP-OAI

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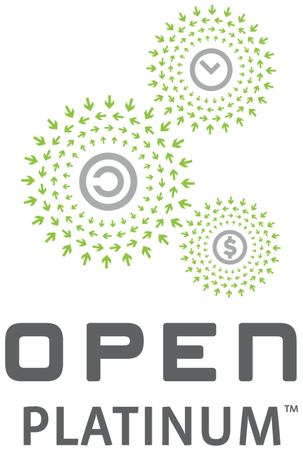
Emilie Yang
Technical Program Manager
Hyve Design Solutions



Outline

- System Feature List
- System Architecture
- Board List
- Power Distribution
- Host Connectivity
- Thermals

SERVER

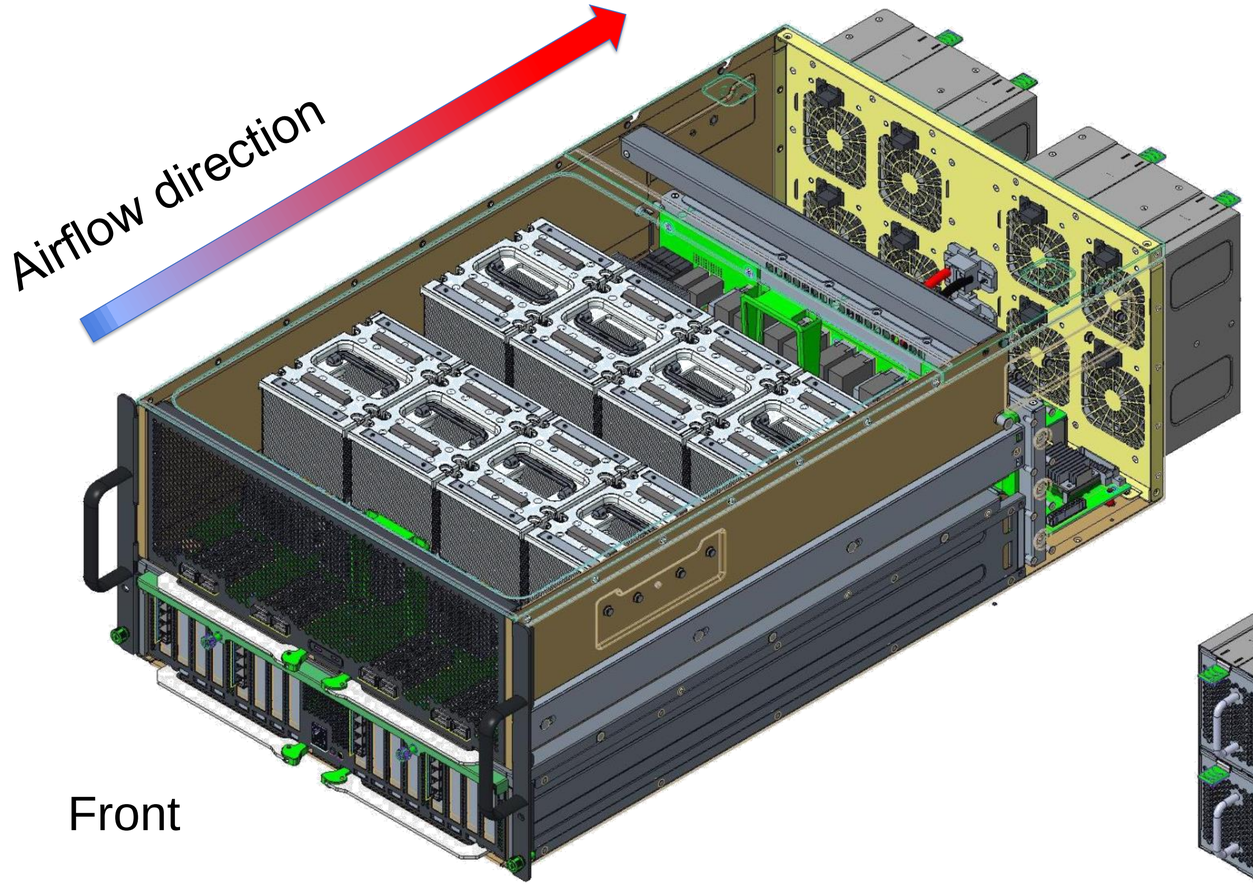
Workshops
Summits

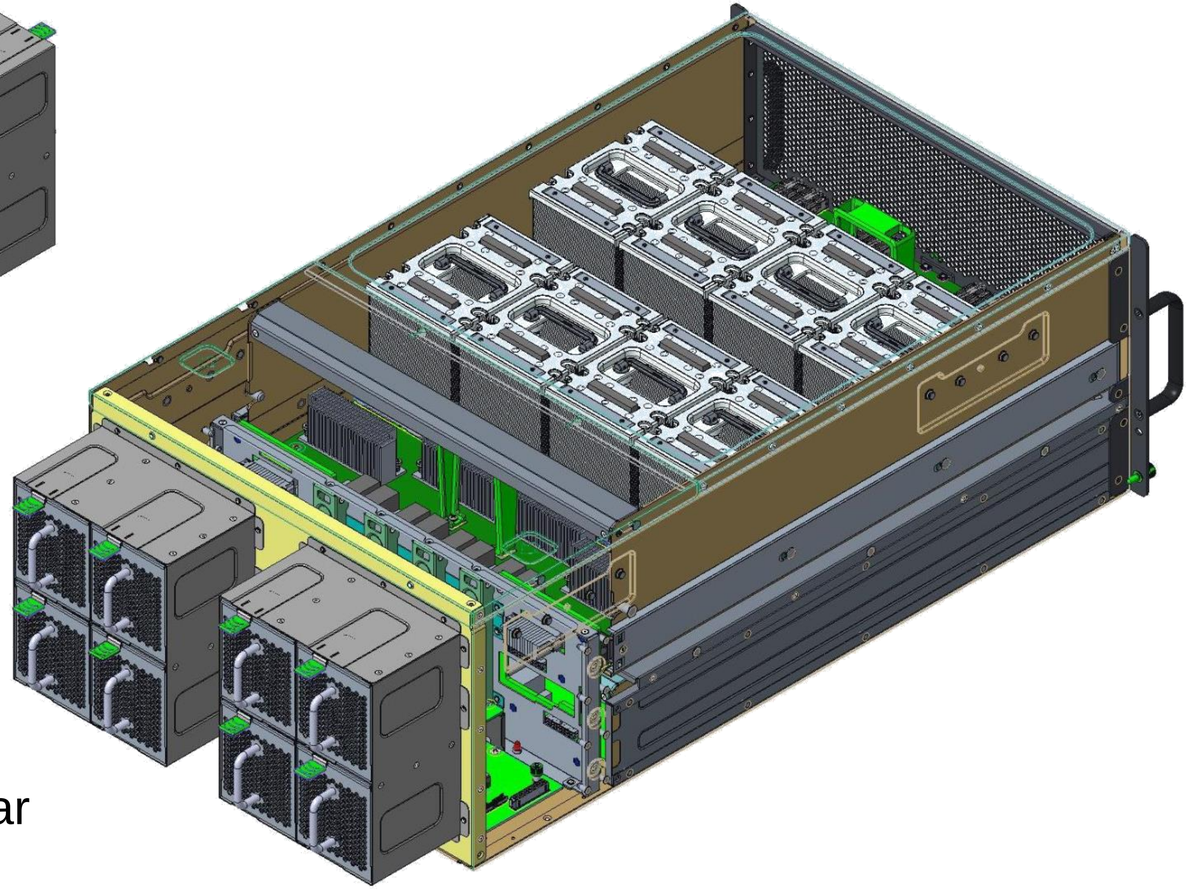
Feature List

Item	Features
Form Factor	• 19” rack mountable. • Total 6RU. • 30” depth sys with fan outside of support shelf
Dimension	L 762mm(30”) x W 447mm(17.6”) x H 261mm(10.27”)
Board List	• Universal BaseBoard (UBB) • HIB: PCIE Switch Board (PSB) • Midplane • PDB_Top, PDB_btm
UBB OAM Interconnection Topology	Combined FC+ 6 port HCM Topology
Host Connectivity	Up to 4 PCIE x16 slots on the HIB
UBB Scale Out	Up to 8x QSFP-DD (28Gbps NRZ or 56Gbps PAM4 Serdes interface)
PCIE Expansions	Up to 12 PCIE x16 slots on HIB
Debug Ports	• 1x USB3.0 form factor debug port to support OCP debug card for BMC error message display. • 2x MicroUSB OAM UART ports on UBB
BMC	AST2520, supports IPMI2.0
Management IO	1GbE RJ45 dedicated BMC LAN port
Cooling	Eight 8080 dual rotor fans, support up to 8x 450W OAM, air-cooling @35C
Power Delivery	54V input from rack bus bar through two power clips
Miscellaneous	UID. Power button

SERVER

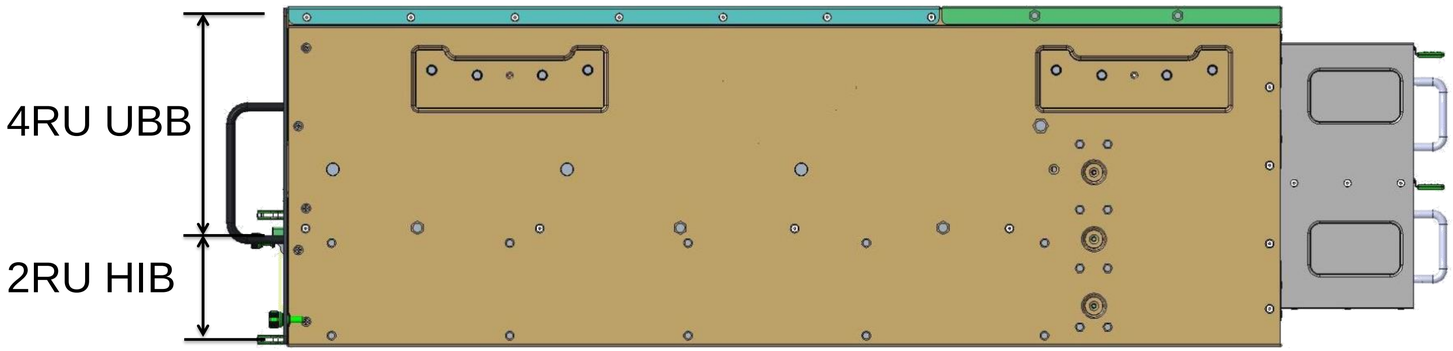
System ISO View

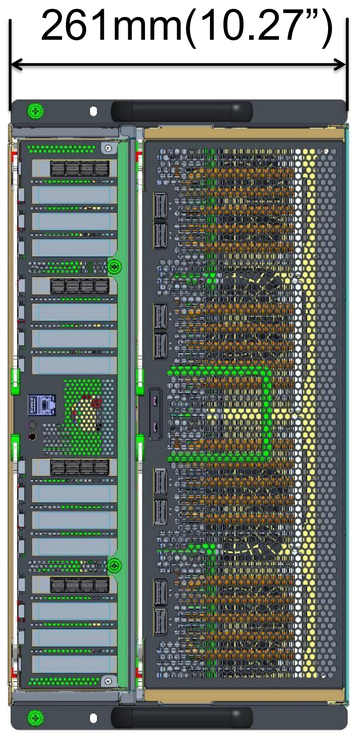


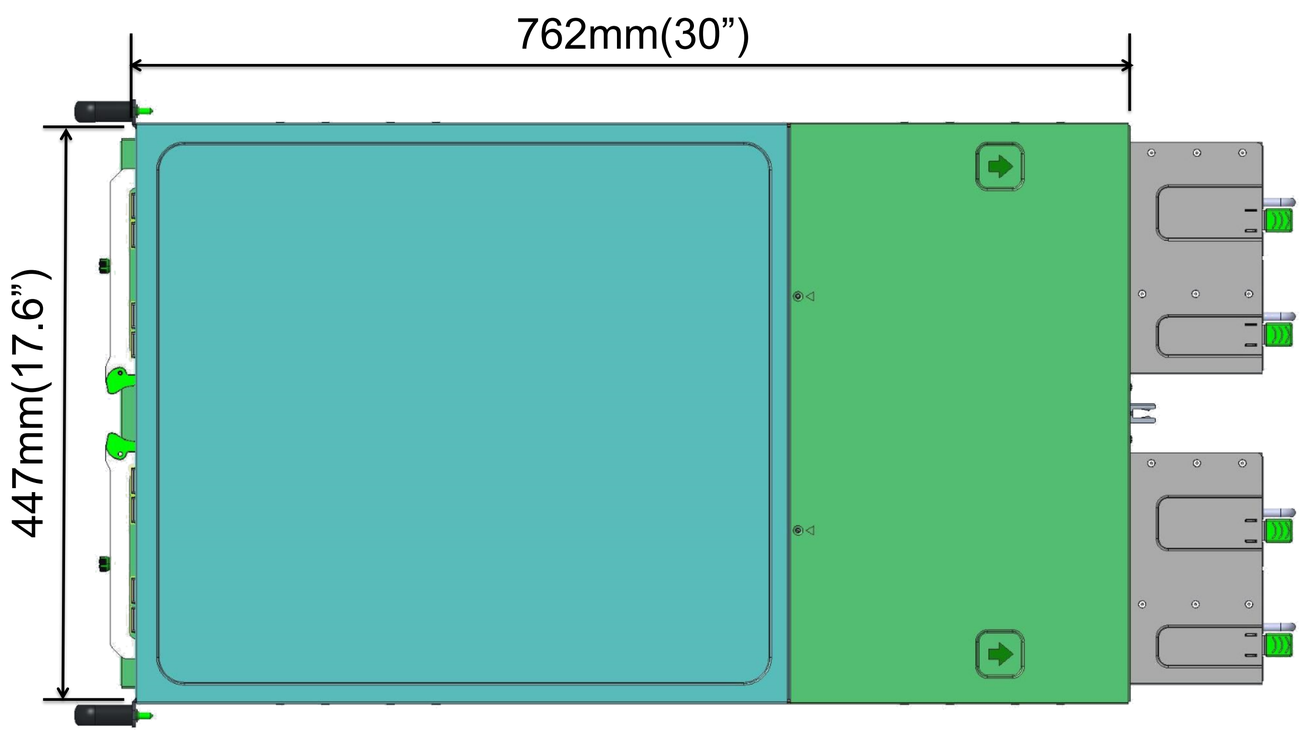


Outline Dimension

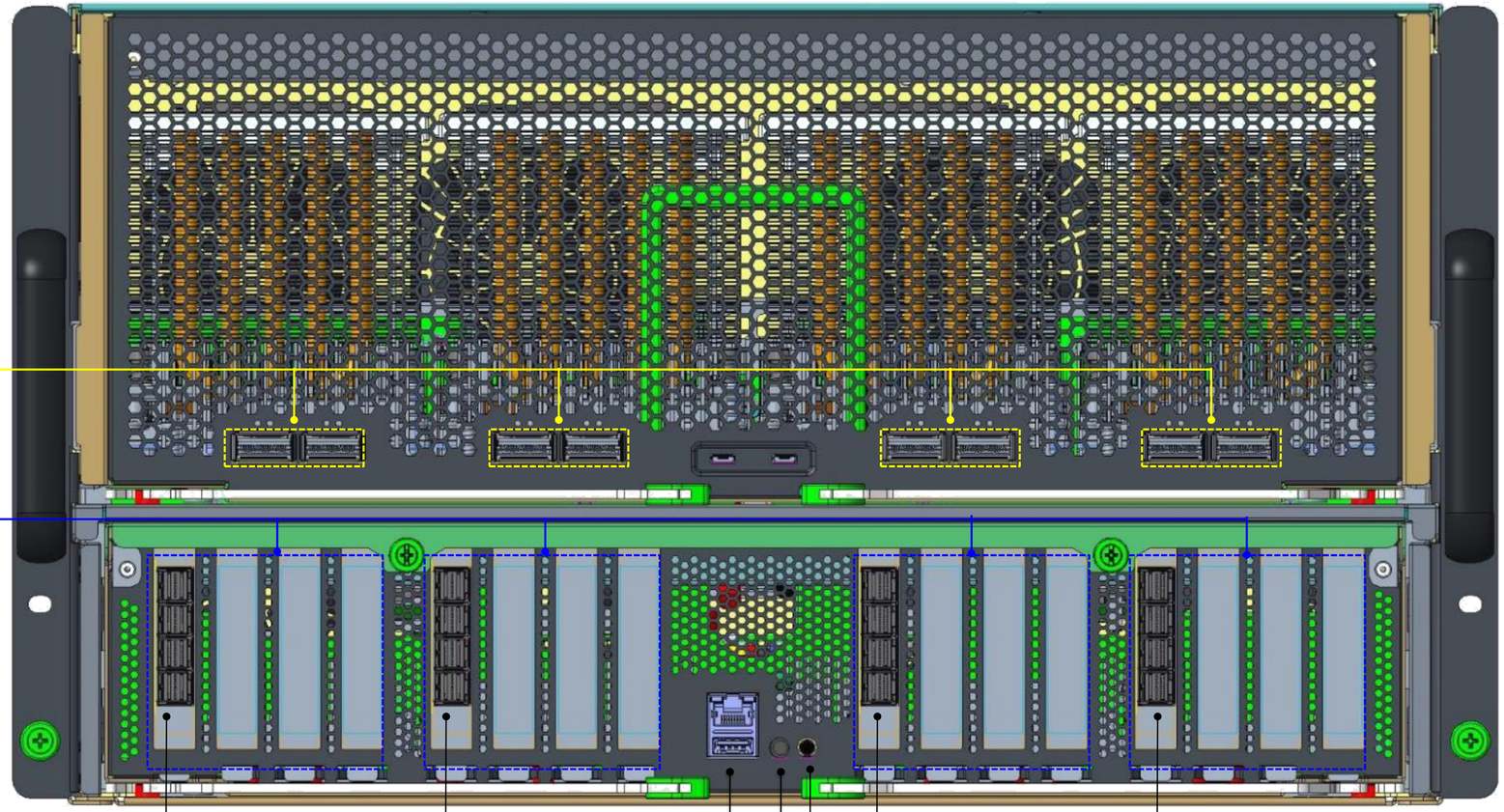
- Sys depth 30” with sys fan outside of support shelf
- 6RU in Height
- 19” rack form factor



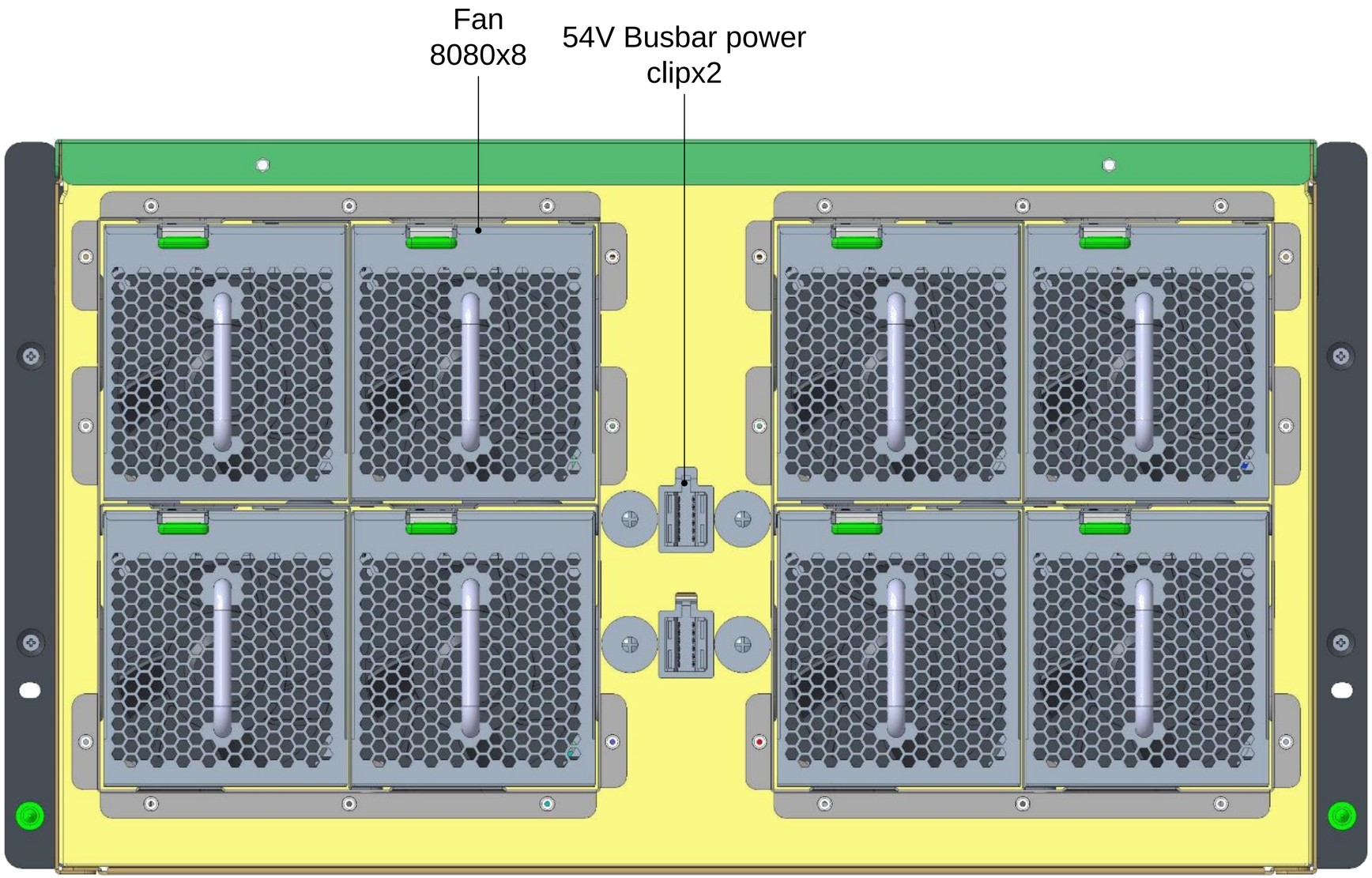




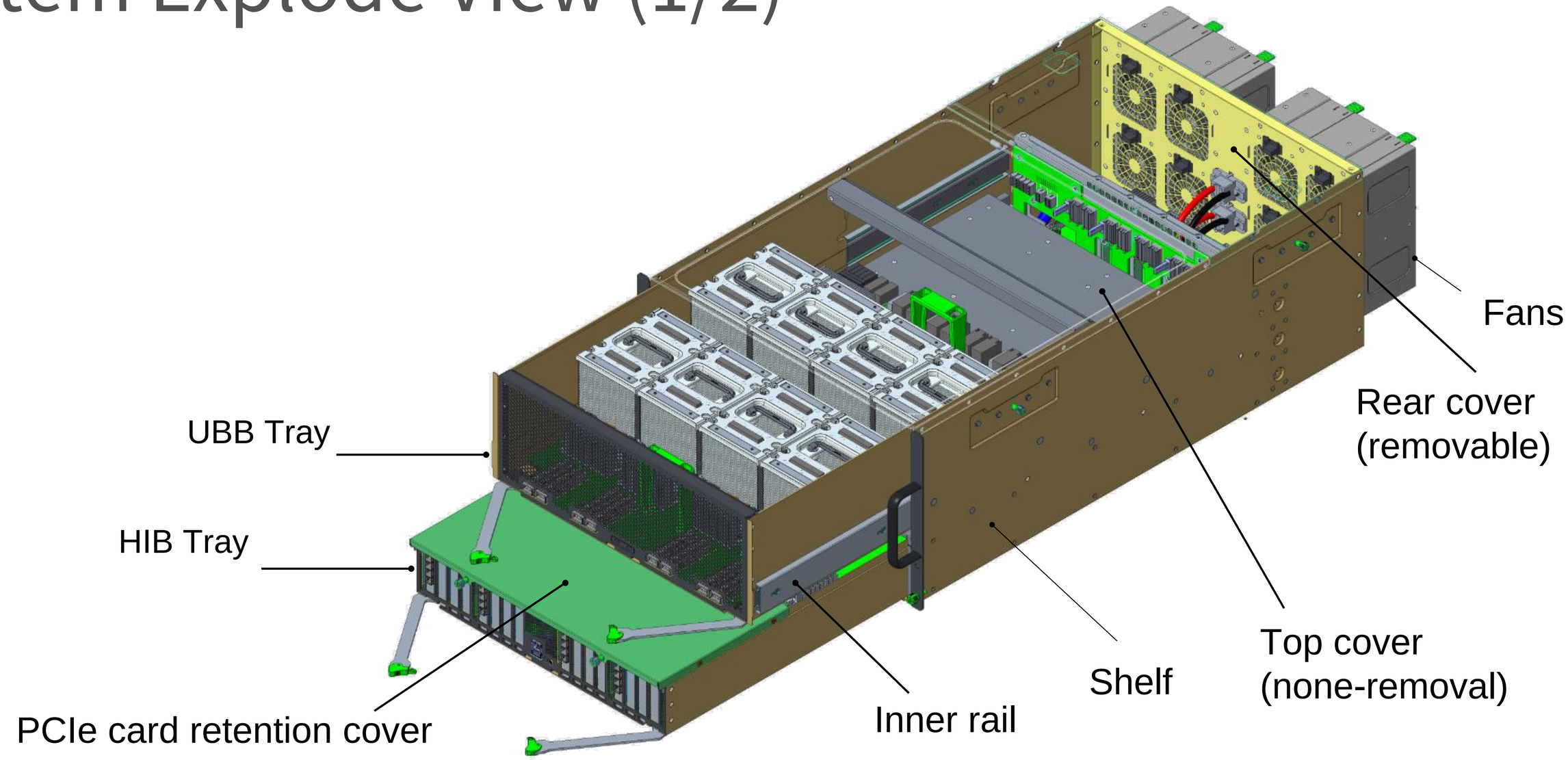
Front View


QSFP-DD*8(UBB)
PCIe slot X16*16pcs(HIB)
upstream 0
upstream 1
RJ45&
USB 3.0
debug port
UID
Power
bottom
upstream 2
upstream 3

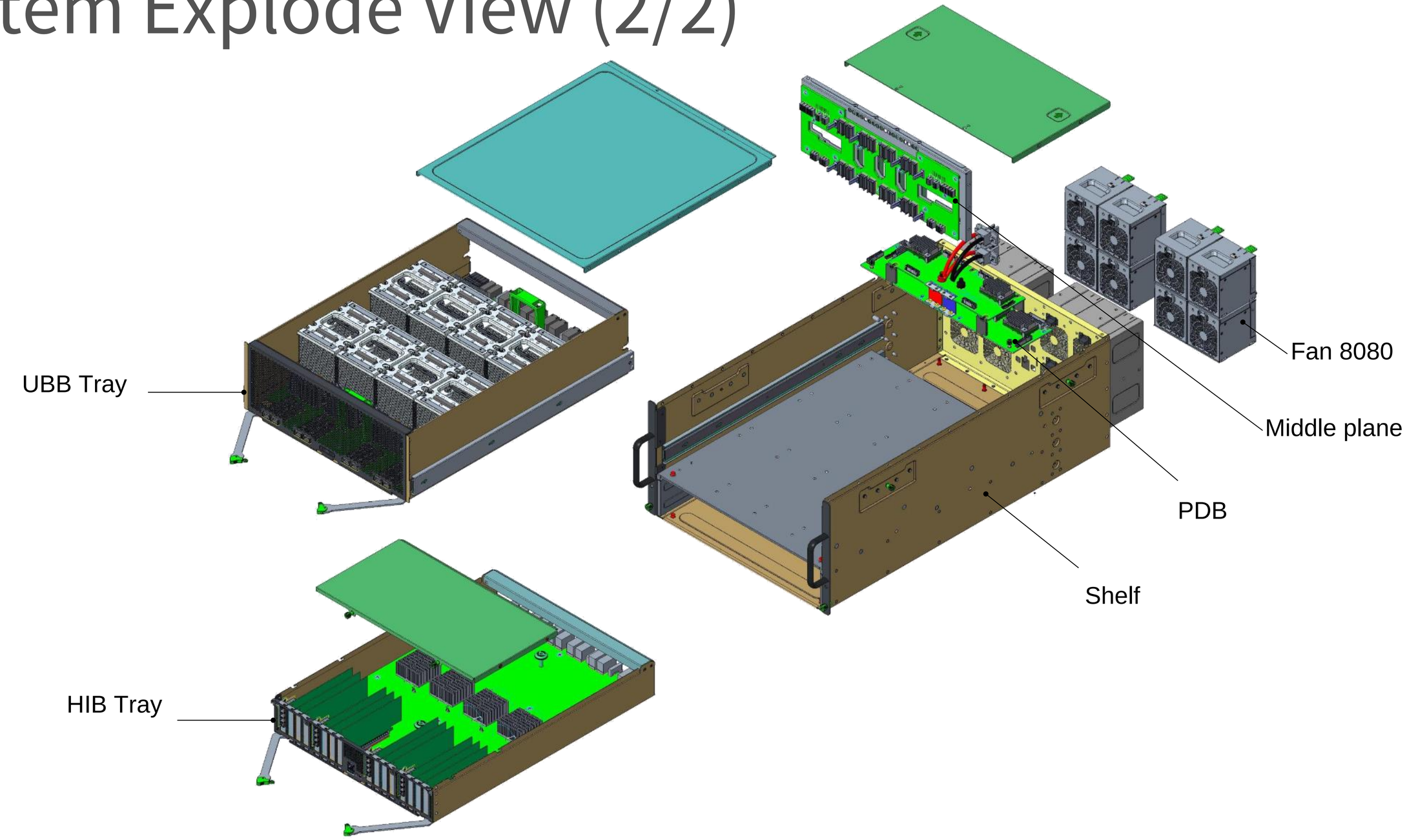
Rear View



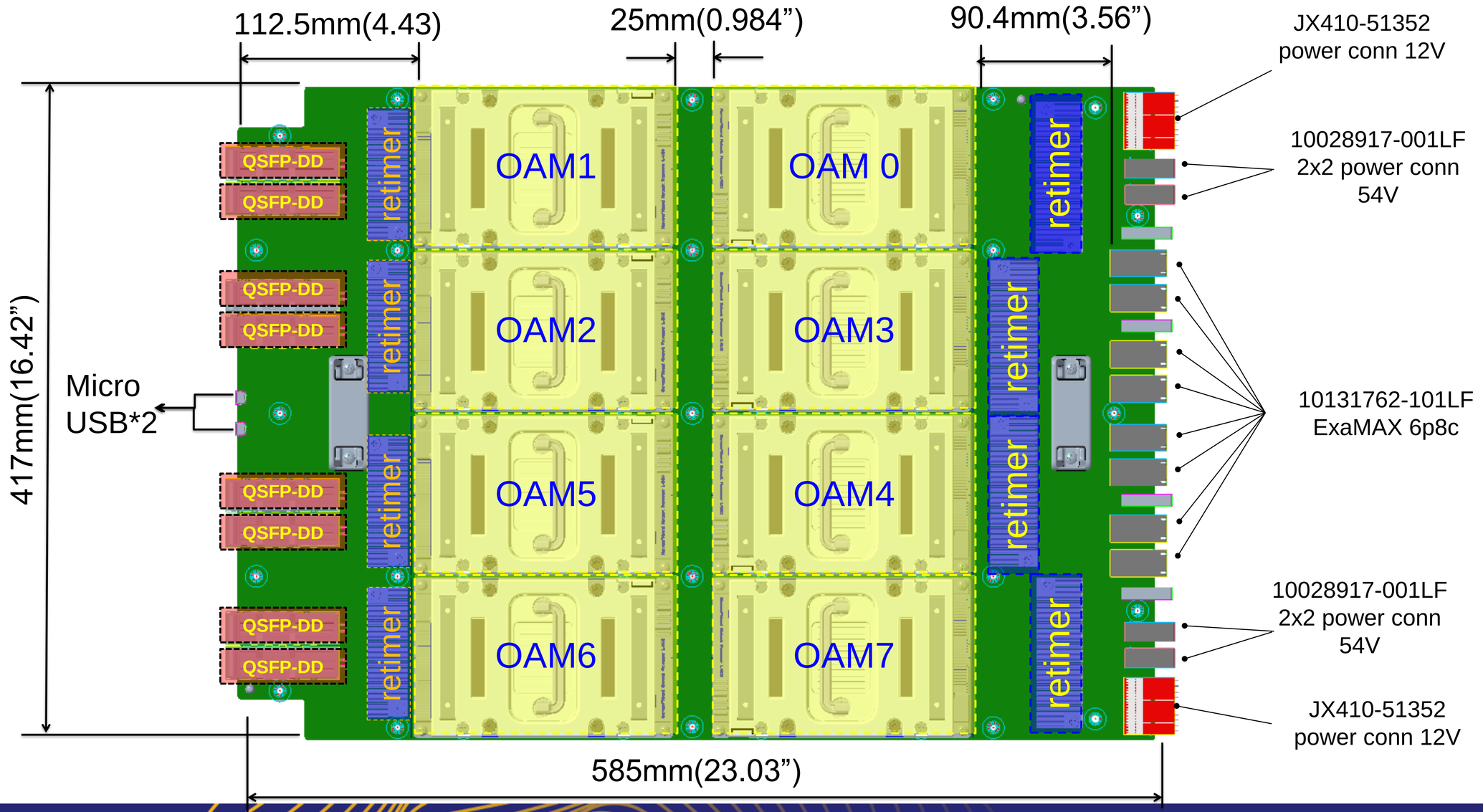
System Explode View (1/2)



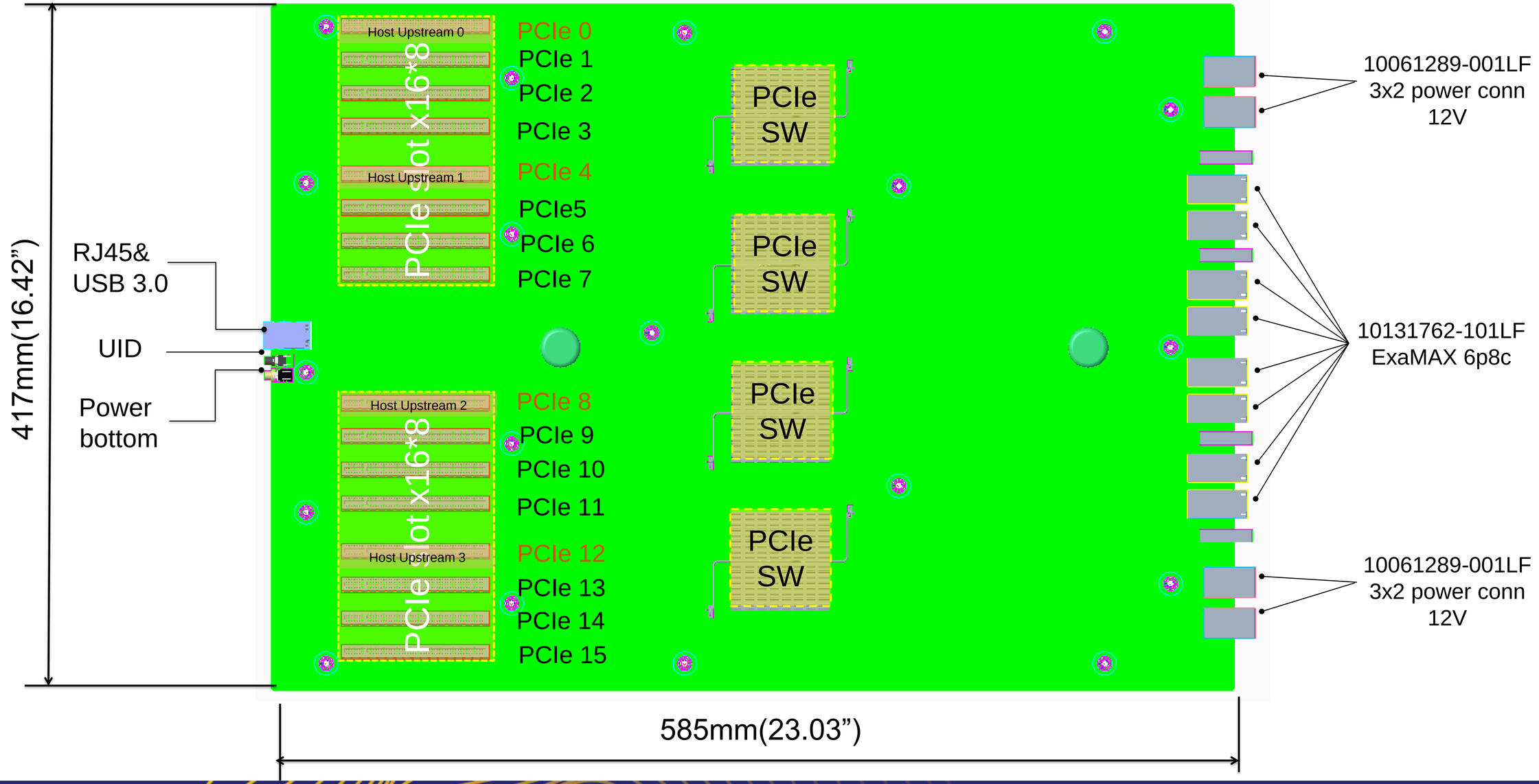
System Explode View (2/2)



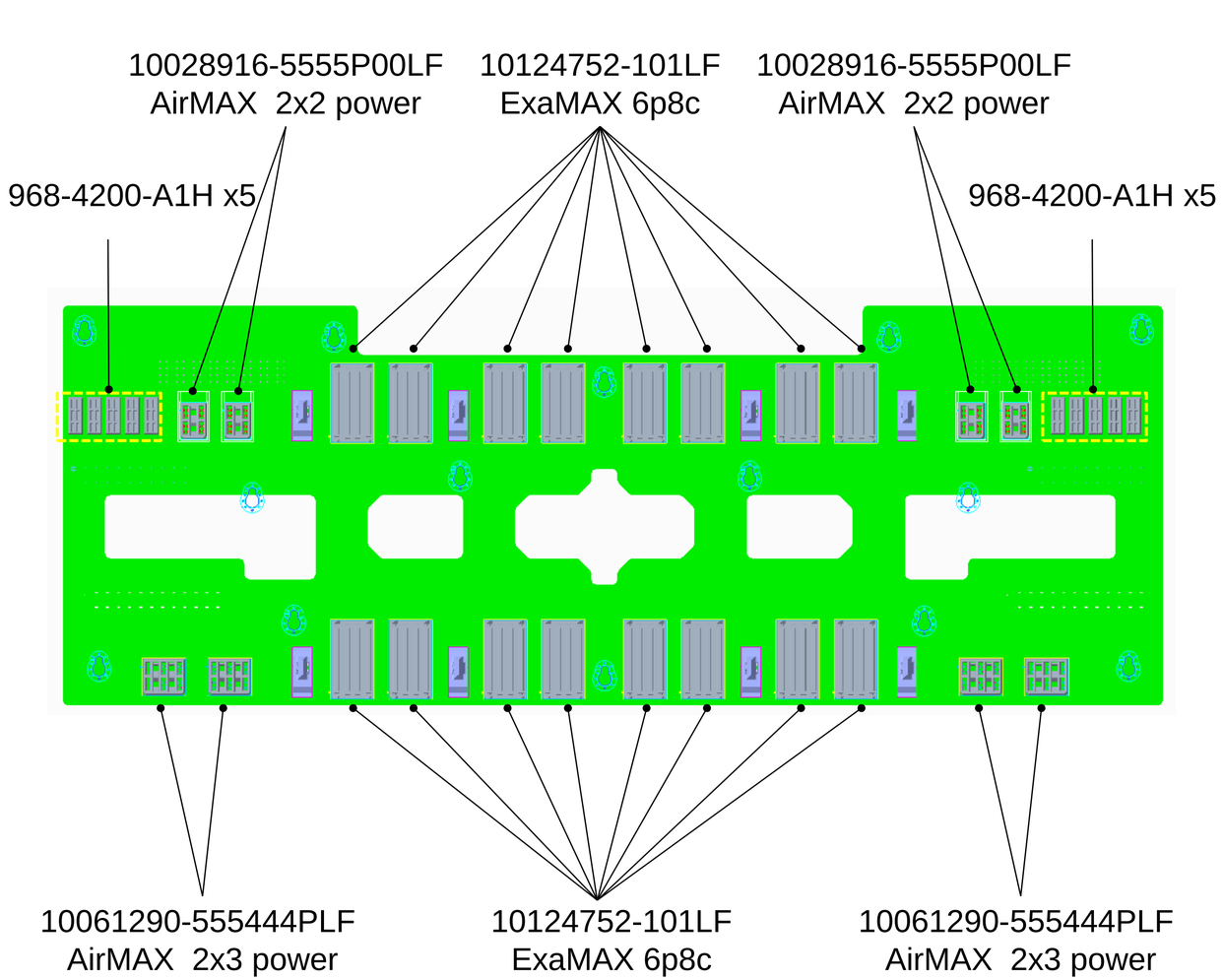
UBB Board Placement

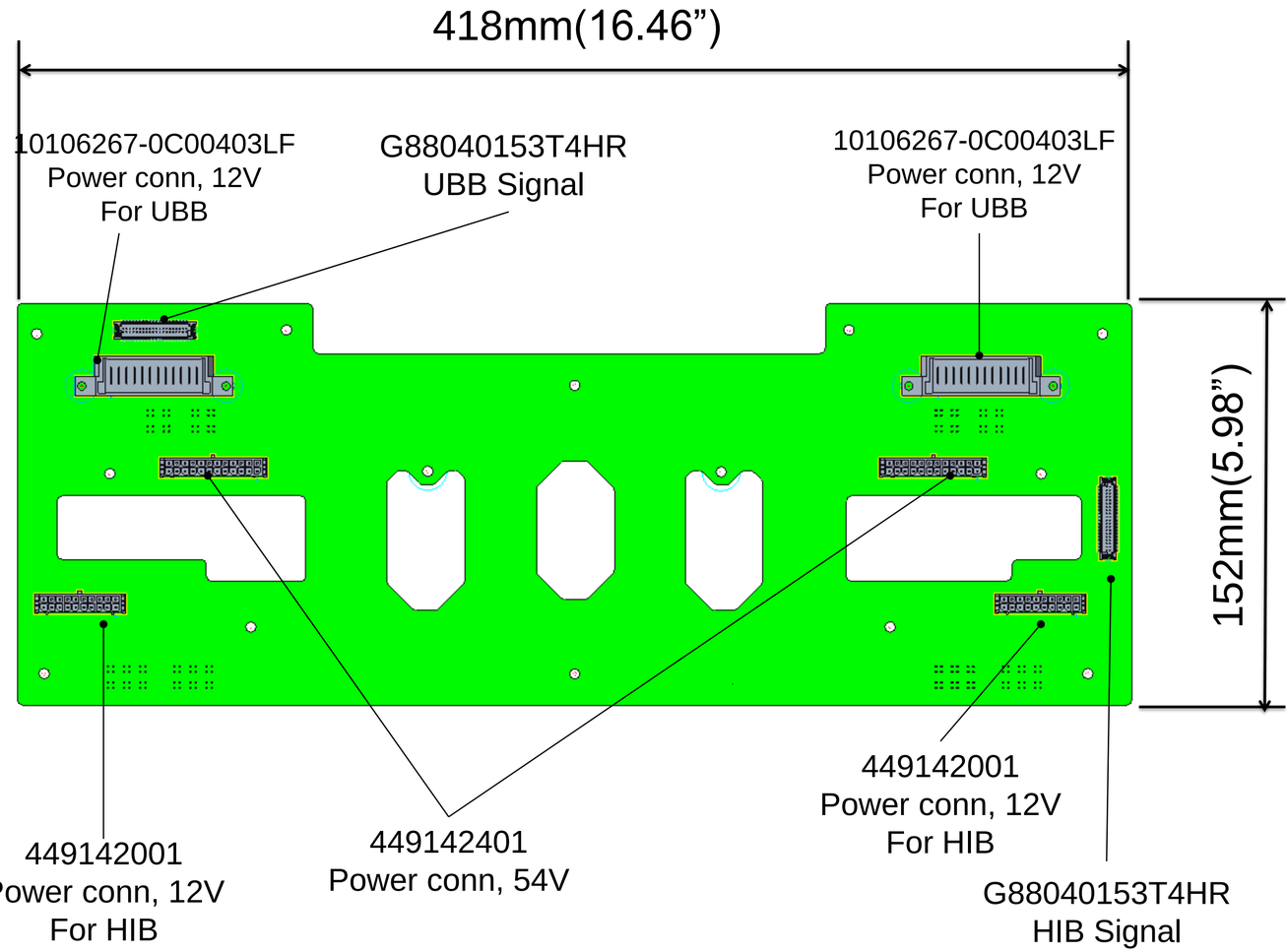


HIB Board

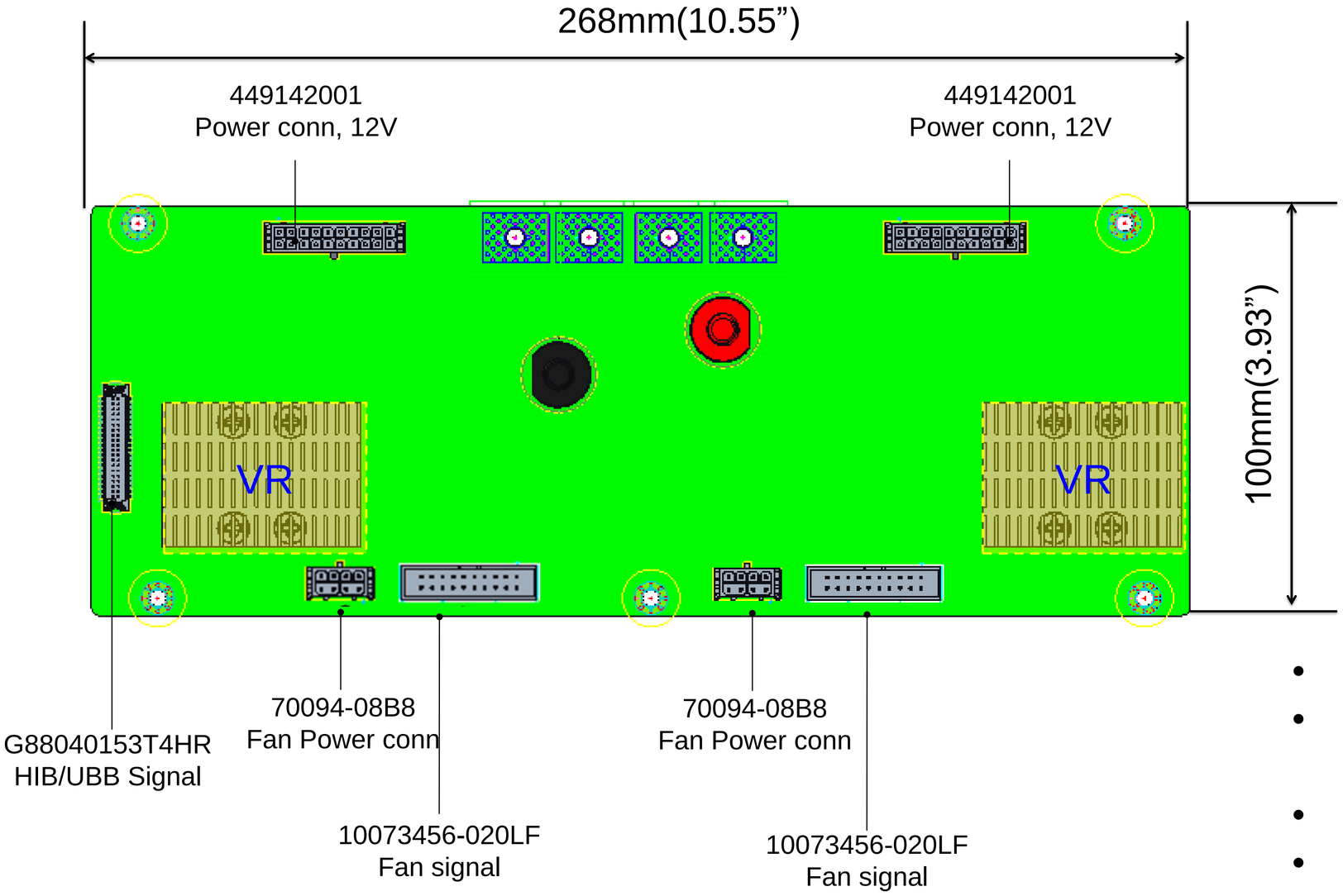

Host Upstream 0
PCIe Slot x16*8
PCIe 0
PCIe 1
PCIe 2
PCIe 3
Host Upstream 1
PCIe 4
PCIe5
PCIe 6
PCIe 7
Host Upstream 2
PCIe Slot x16*8
PCIe 8
PCIe 9
PCIe 10
PCIe 11
Host Upstream 3
PCIe 12
PCIe 13
PCIe 14
PCIe 15
PCIe SW
PCIe SW
PCIe SW
PCIe SW
RJ45&
USB 3.0
UID
Power
bottom
417mm(16.42”)
585mm(23.03”)
10061289-001LF
3x2 power conn
12V
10131762-101LF
ExaMAX 6p8c
10061289-001LF
3x2 power conn
12V

Middle Plane Board





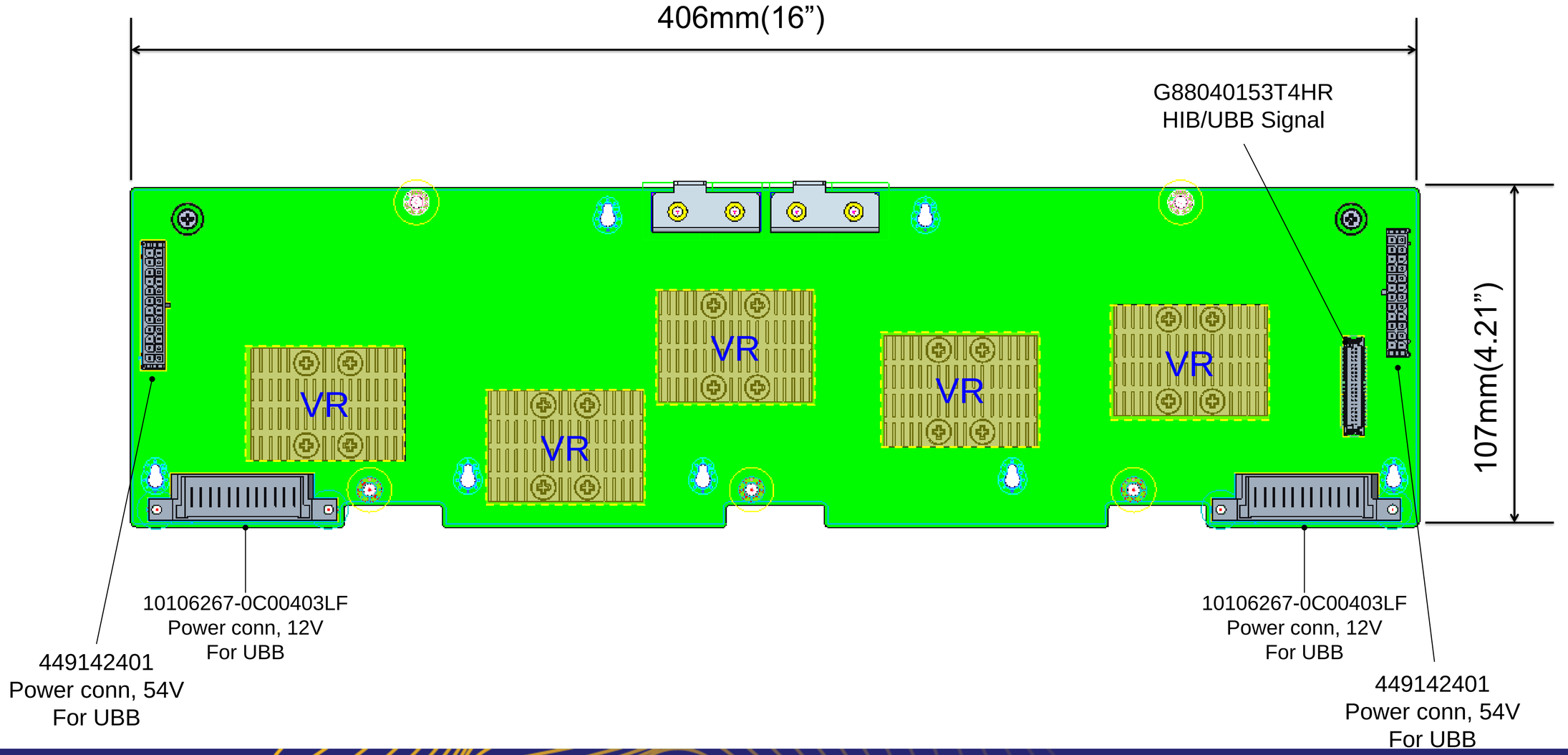
PDB_top Board



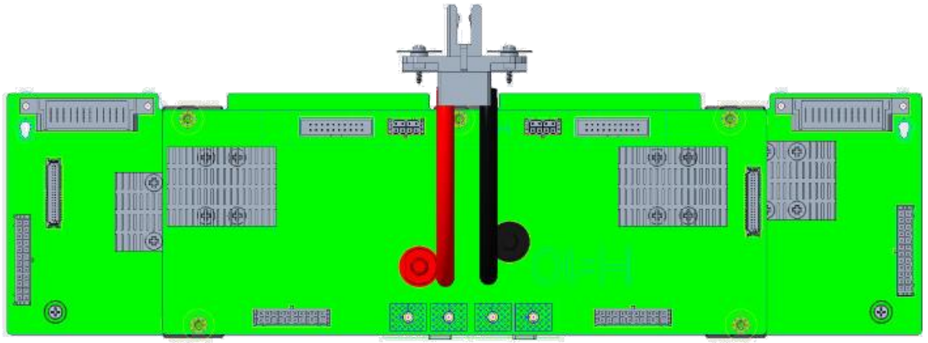
- PDB_top: 54V input from rack bus bar
- 54V delivered to PDB_btm through PDB bus bars
- supplies 12V to HIB
- Supplies 54V to fans

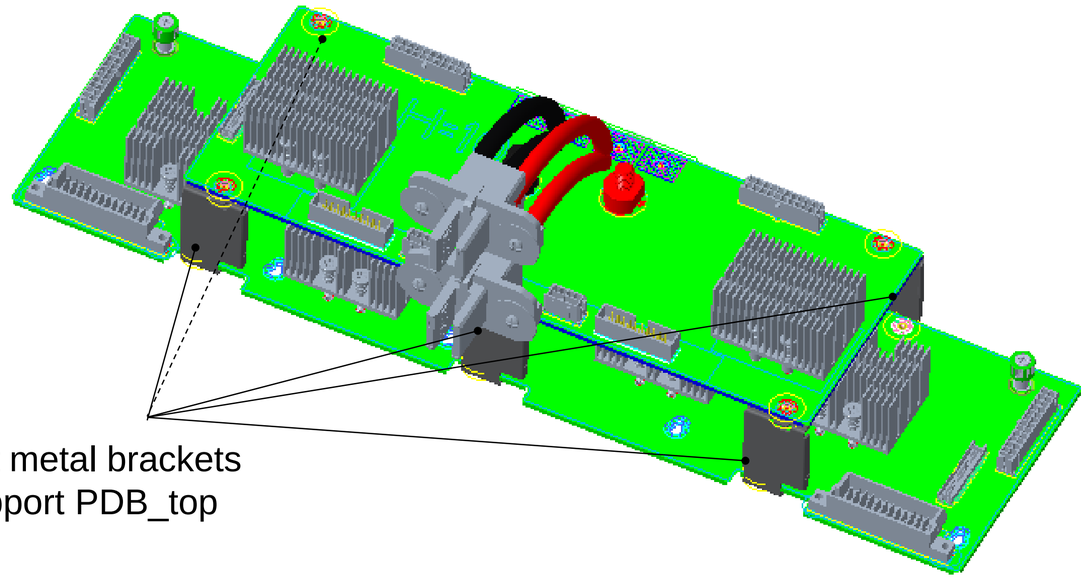
PDB_btm Board

- PDB_btm supplies 54V and 12V to UBB.

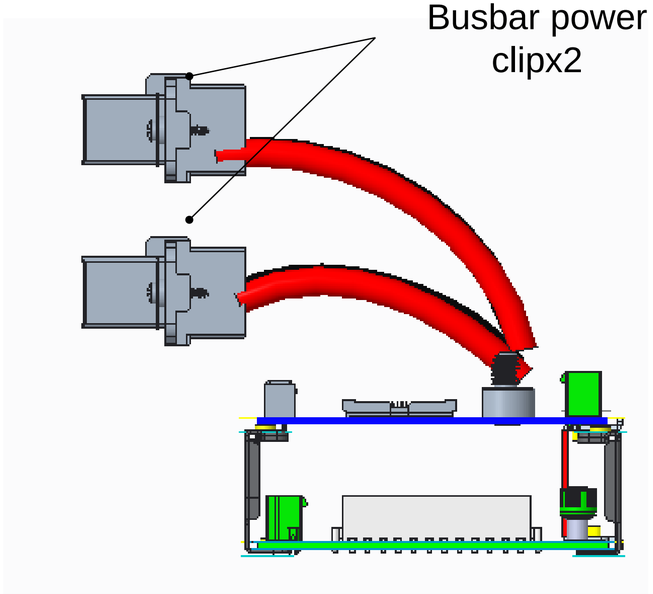


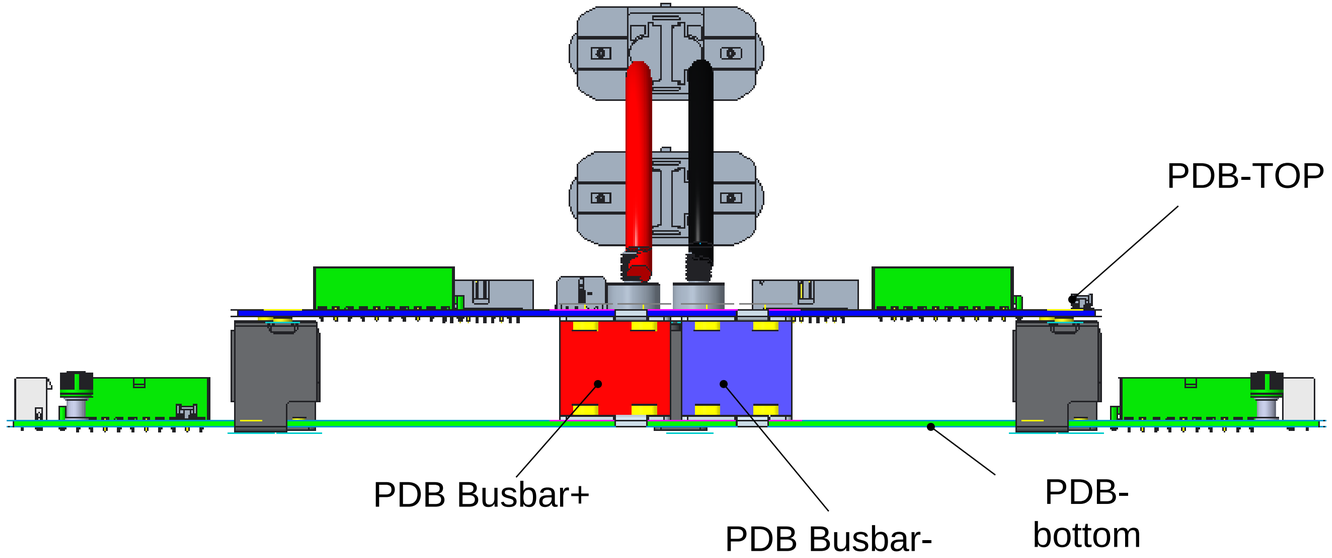
PDB Assembly



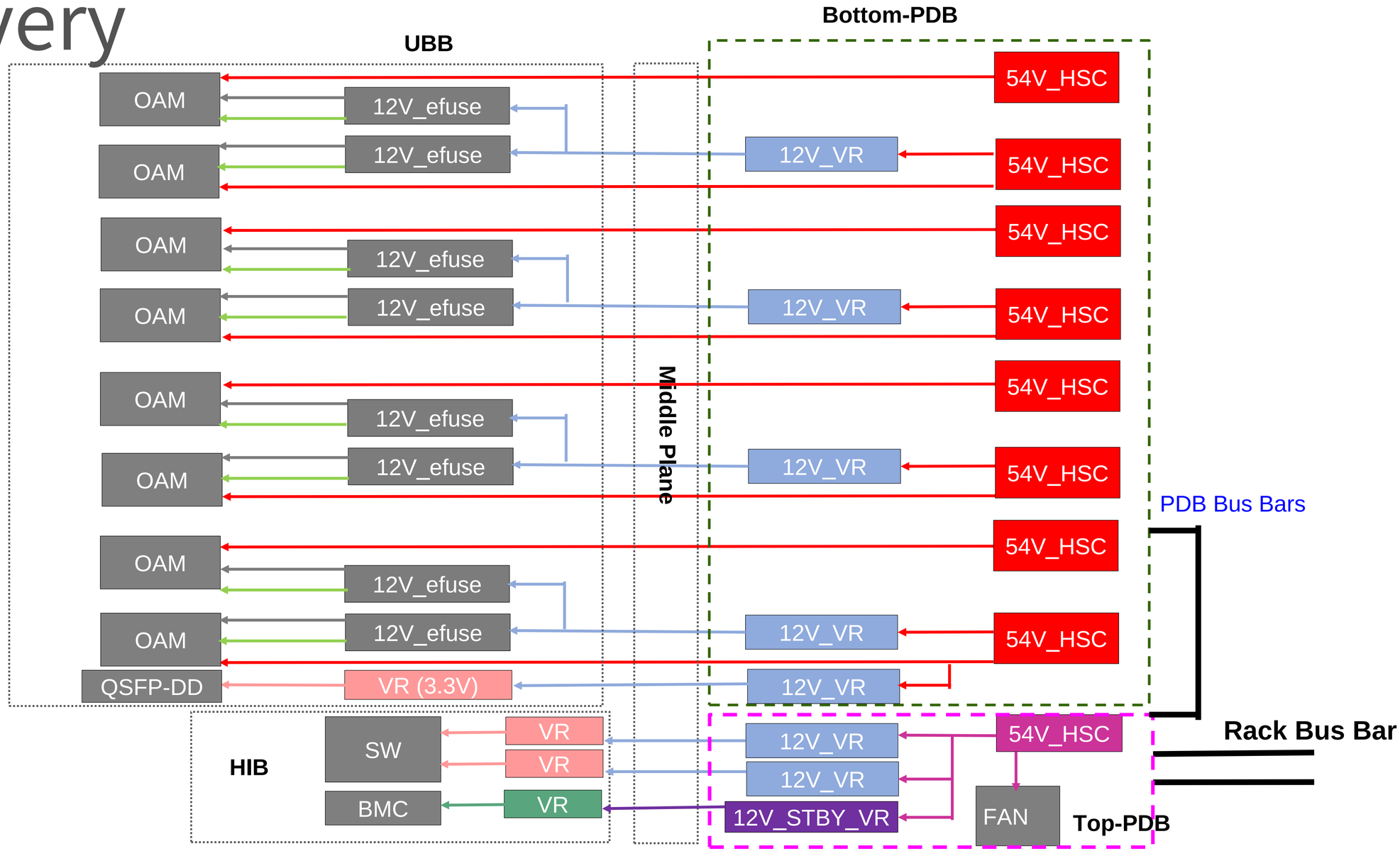


5 sheet metal brackets
to support PDB_top

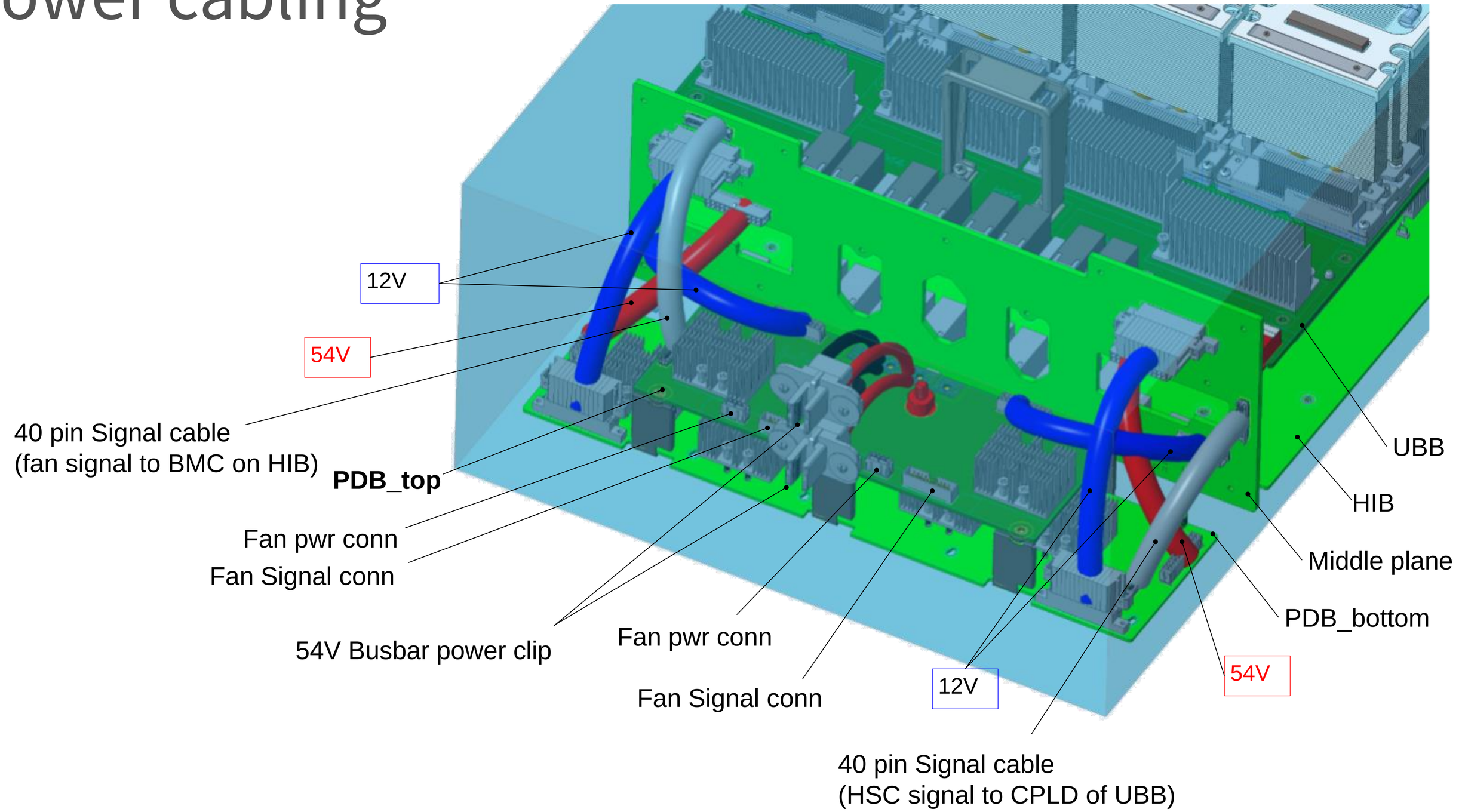




Power Delivery

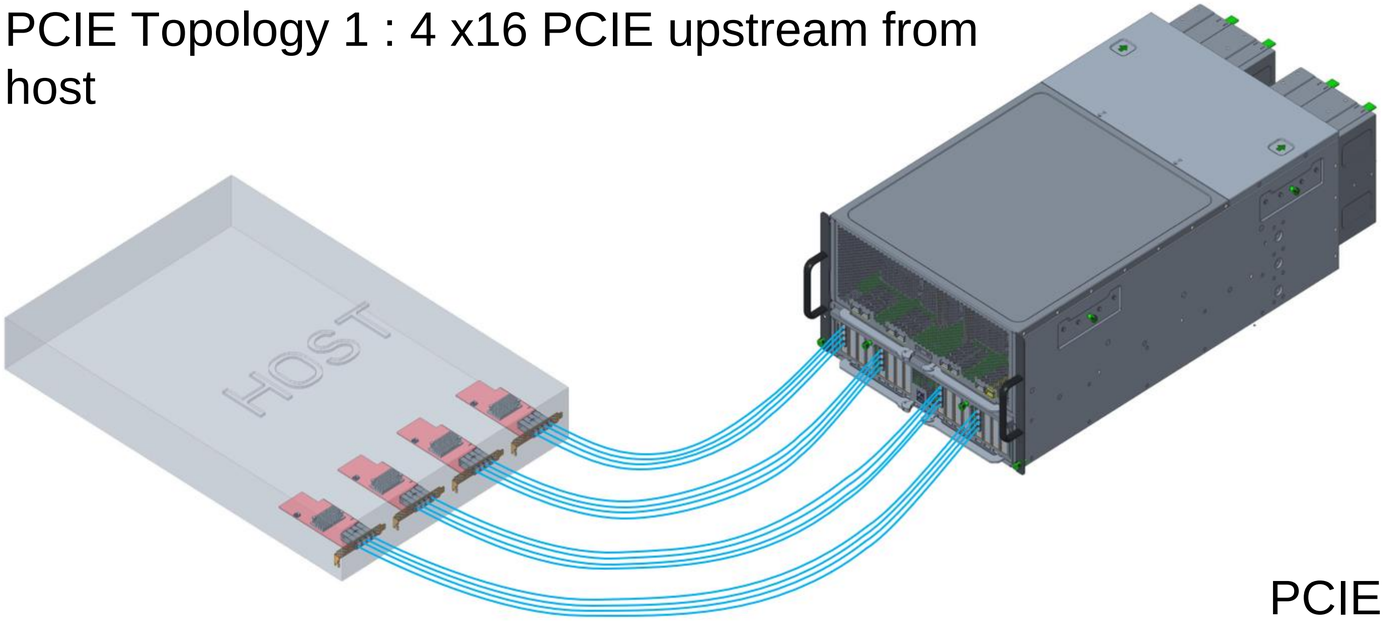


Power cabling



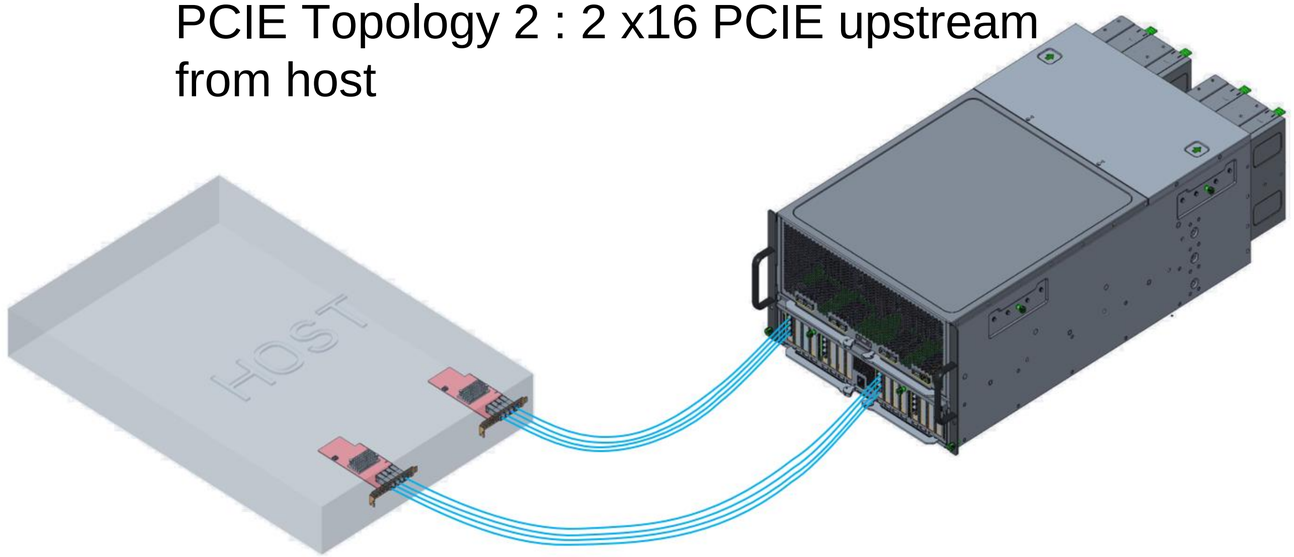
Host Connectivity

PCIE Topology 1 : 4 x16 PCIE upstream from host

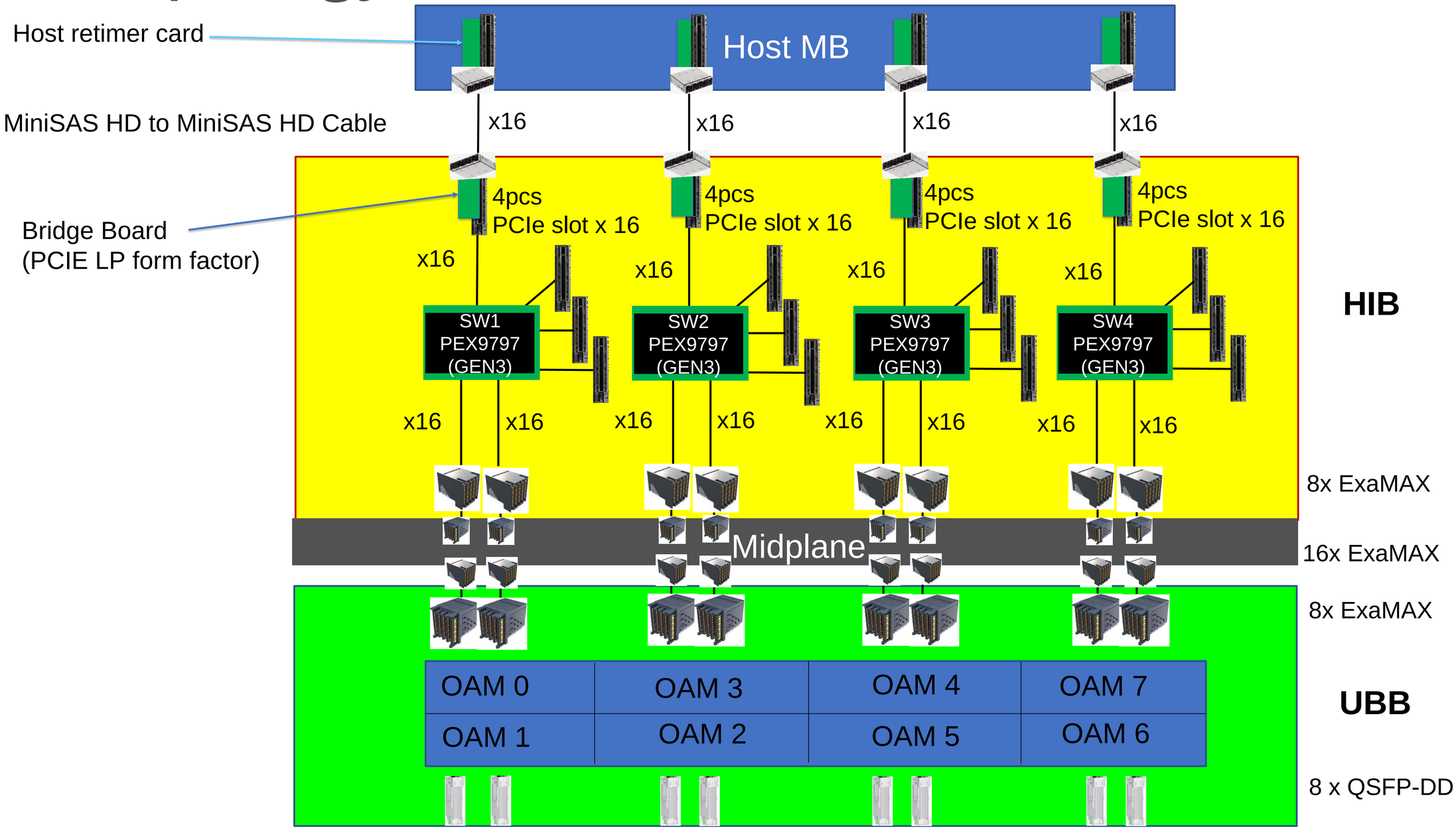


MiniSAS HD to MiniSAS HD Cable

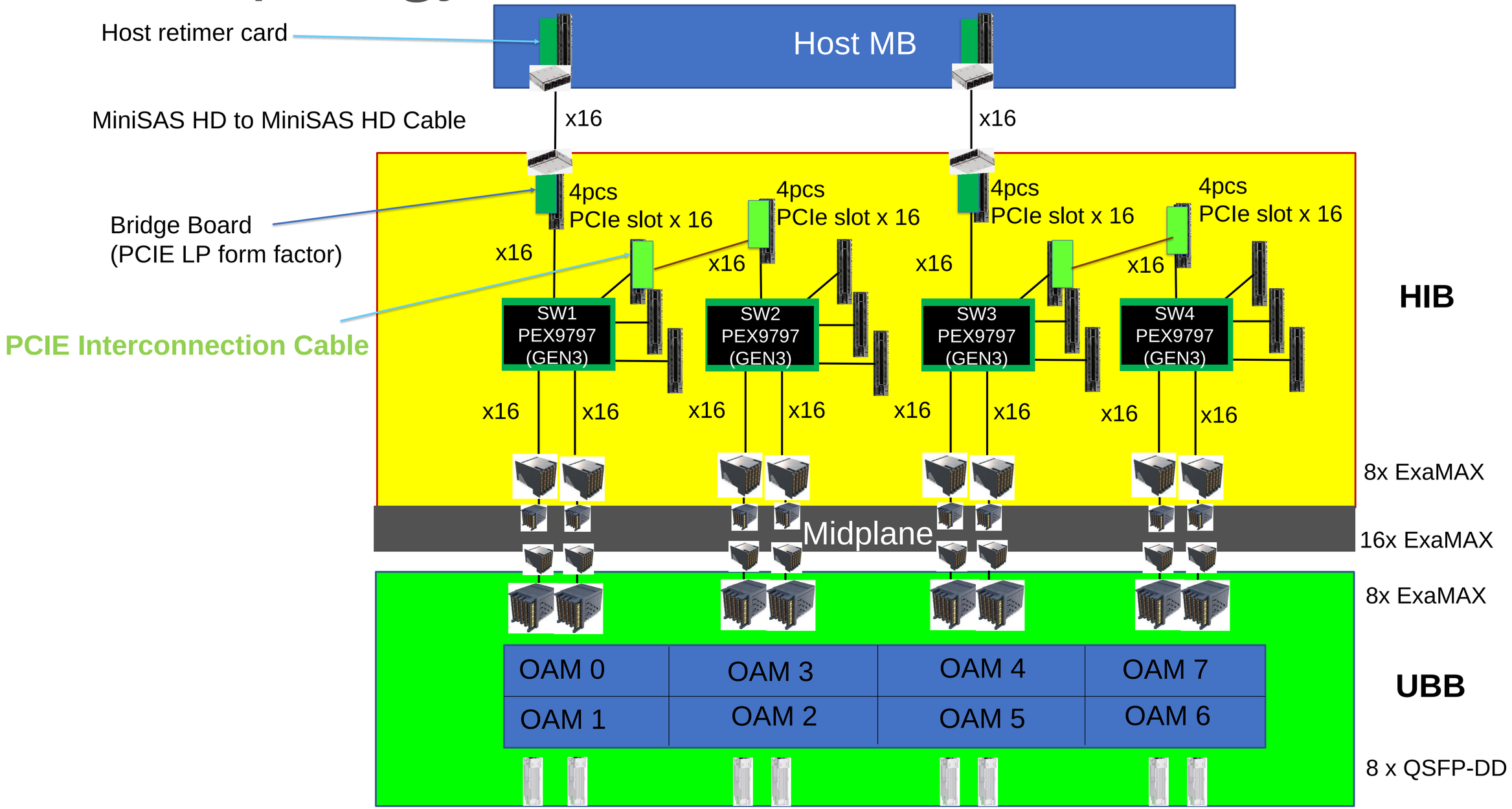
PCIE Topology 2 : 2 x16 PCIE upstream from host



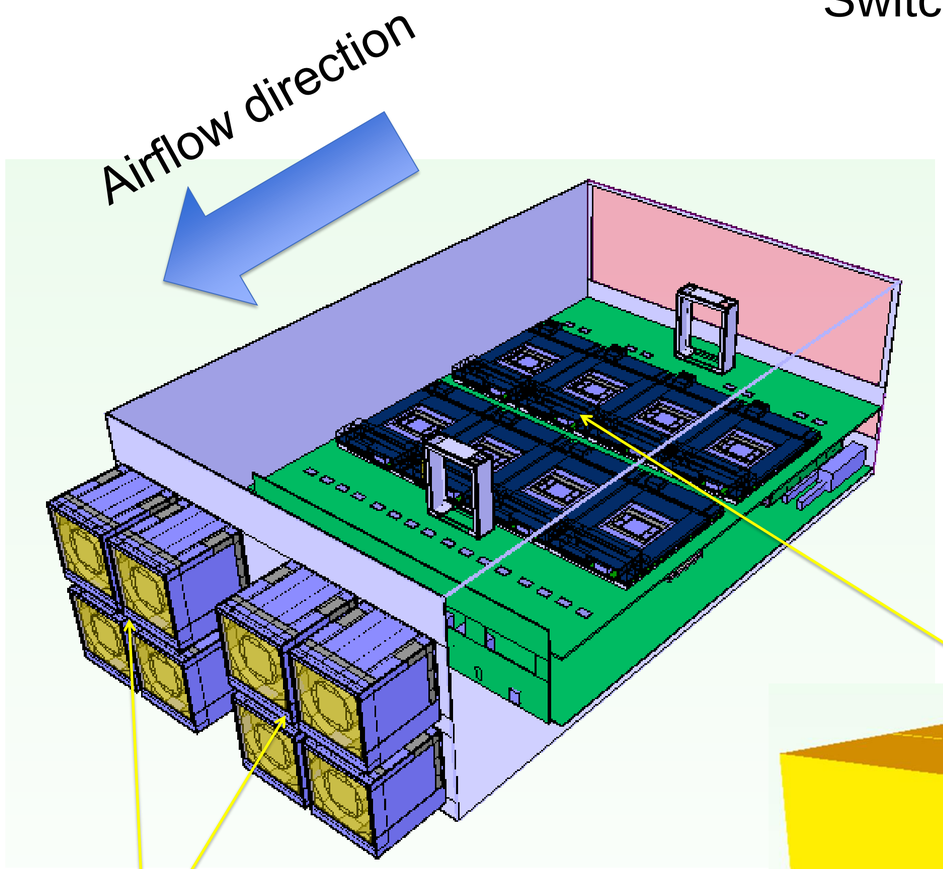
PCIE Topology 1

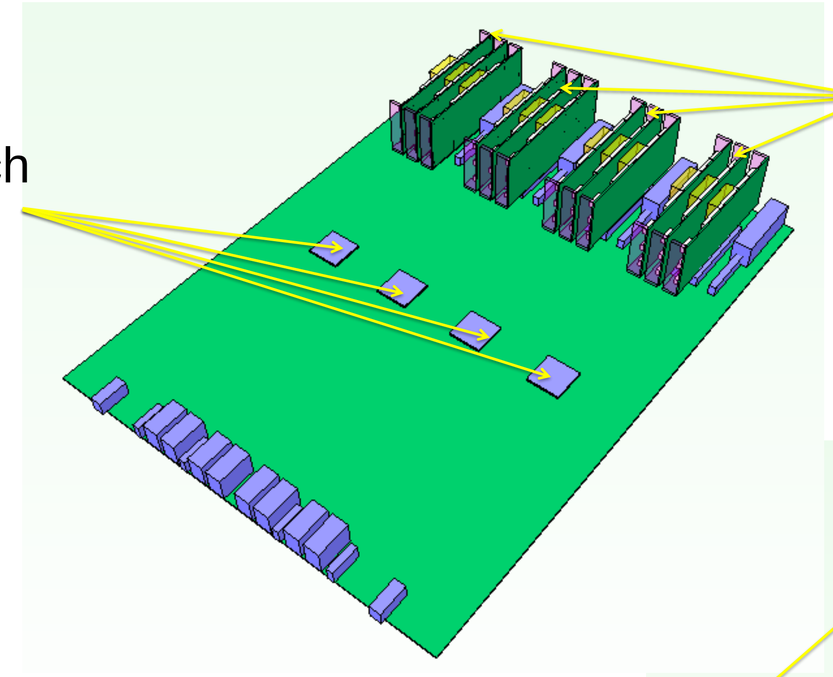


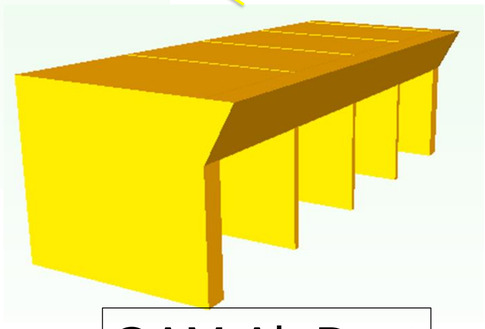
PCIE Topology 2

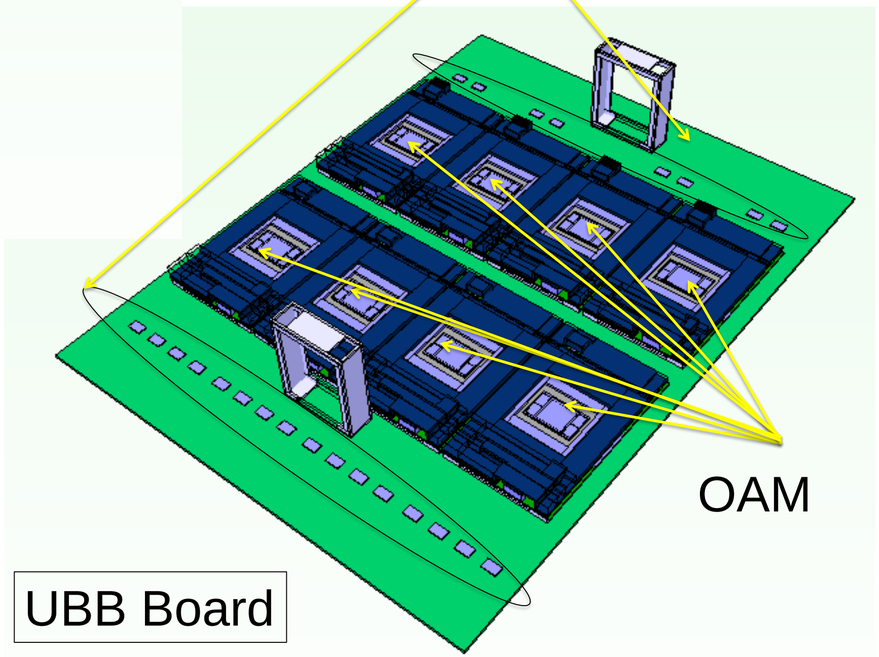


Thermal Modeling









Thermal Power Budget and Simulation Result

Component	TDP, W	Qty	Total TDP, W	Thermal Spec, C	Worst Result , C
OAM ASIC	450	8	3600	Tj=115	104
OAM HBM				Tj=95	93
Gen3 Switch	58.3	4	233.2	Tj=110	98
PHY Re-timer	7	8	56	Tj=105	68
Retimer	7	16	112	Tj=105	99
PCIe card(LP)	25	12	300	55C/200LFM	35C/300LFM
Total TDP, W			4301.2		

Call to Action

- Power on evaluation sample availability: Q4 2019
- Visit Hyve Design Solution demo System at OAI Experience Lab and Hyve Solution Booth
- Provide feed back to OAI group
- Project Wiki with latest specification : https://www.opencompute.org/wiki/Server/OAI
- Mailing list: https://ocp-all.groups.io/g/OCP-OAI

ZT Systems
OAI Reference Design

Mark D. Chubb, Director of Architecture, ZT Systems
(In partnership with Inventec)

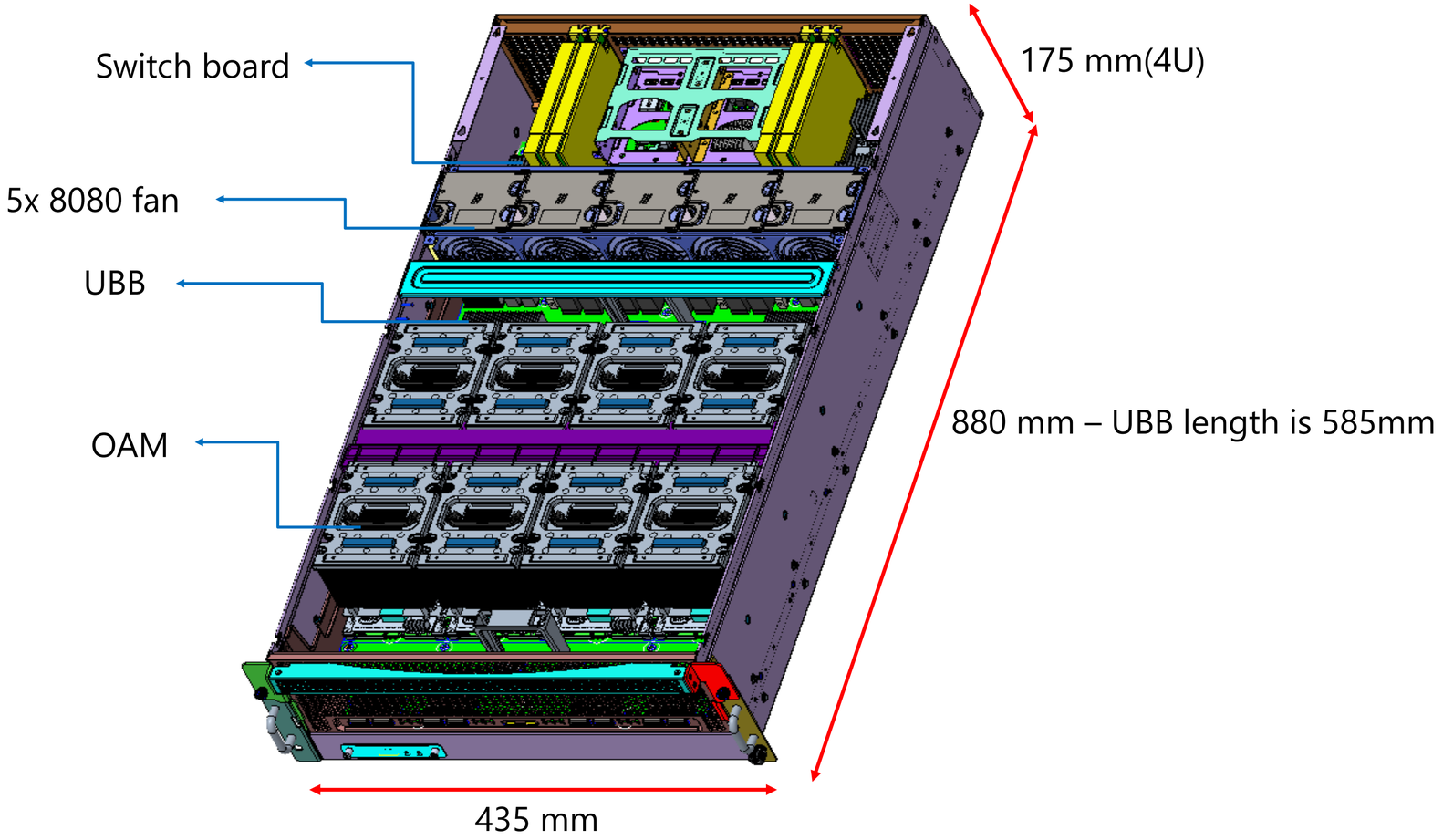
Agenda

- System Features
- Mechanical Overview
- System Architecture
- Board List
- Power Distribution
- Thermals

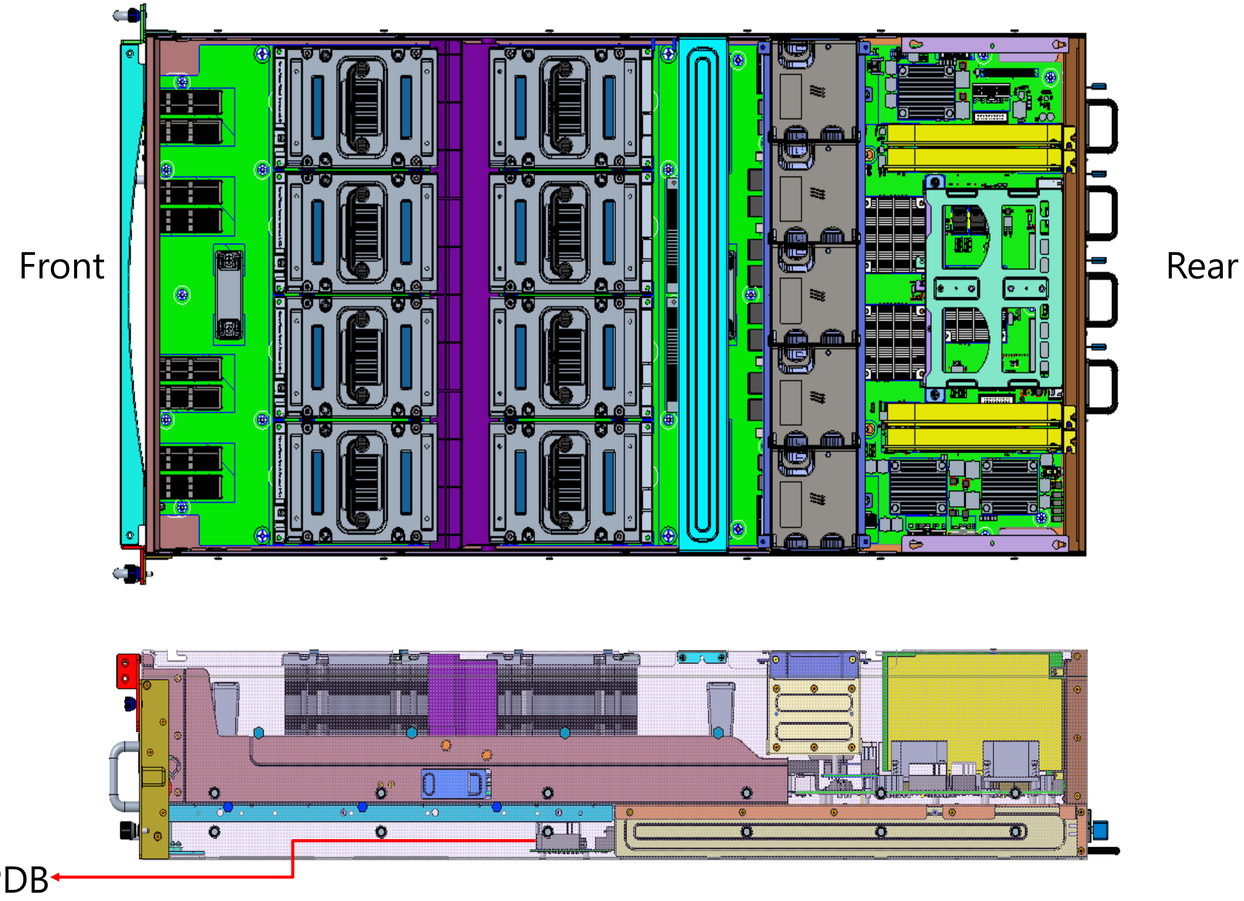
System Features

	OAI
Chassis Dimensions	435mm width x 880mm length x 175mm height (4U)
Rack Infrastructure	19” Rack
Host Node Connectivity	Non-Integrated External Host
Universal Baseboard	Supports 8x OAM modules in a 8-port Hybrid Cube Mesh (HCM) topology
Host Interface Board	Co-planar connectivity to UBB, hosts BMC, 3 Broadcom Gen4 Switches, and PCIe expansion slots
Expansion Slots	Support 4* PCIe Gen4 x16 Single width including 2 * PCIe Gen4 x16 Uplinks for multi-host
Storage	Front: 4* 2.5” NVME hot plug drive (Option)
Power	3000W Platinum PSU 54V for 2+2
System Management	Aspeed 2520, IPMI v2.0 Compliant
System Fans	5x 8080(80mmx80mmx80mm) dual rotor fans
IO Rear	PWR button, RST button, UID button, System Health LED, 8x OAM Health LED MGMT (RJ45), Com port, USB 3.0 (USB 2.0/UART/I2C)
IO Front (Optional)	PWR button, RST button, USB 3.0 (USB/UART/I2C)

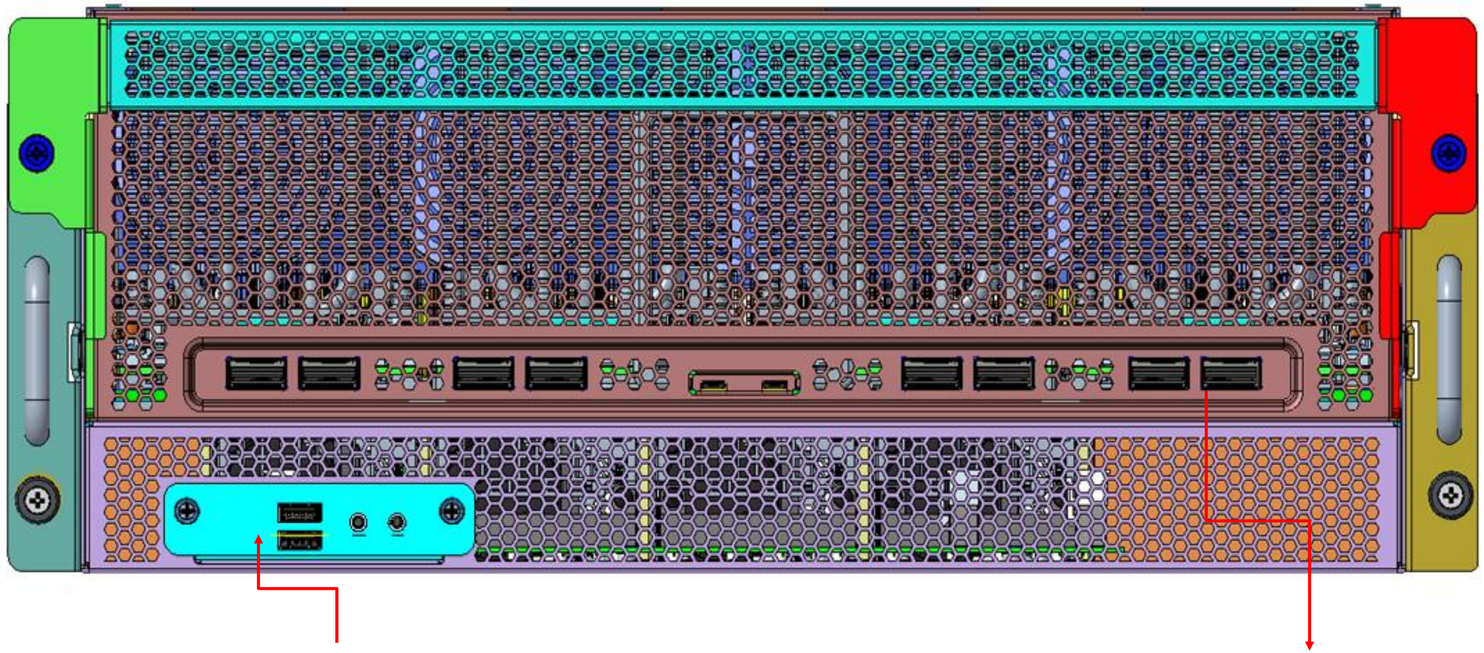
System 3D View



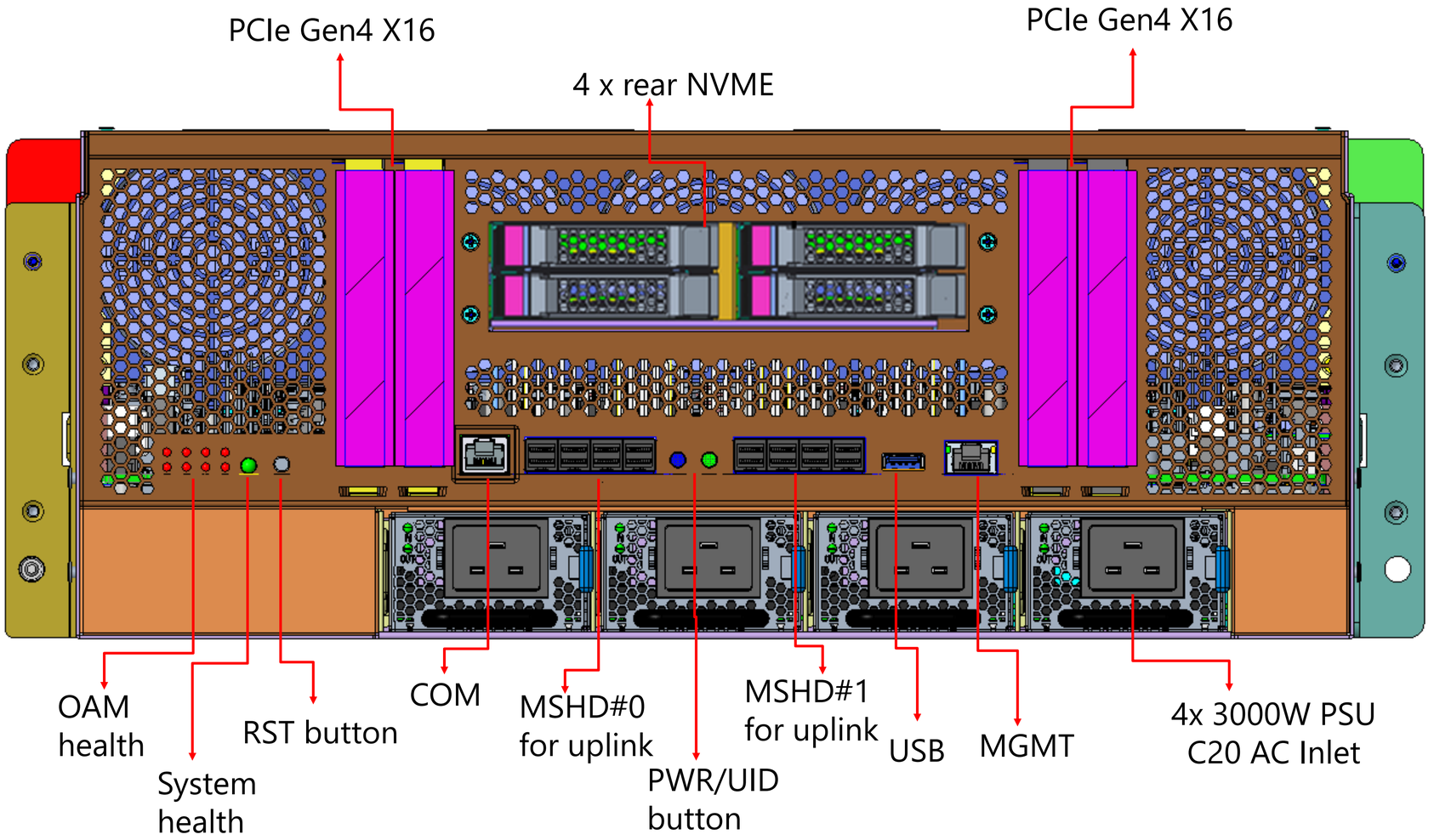
Top and Side View



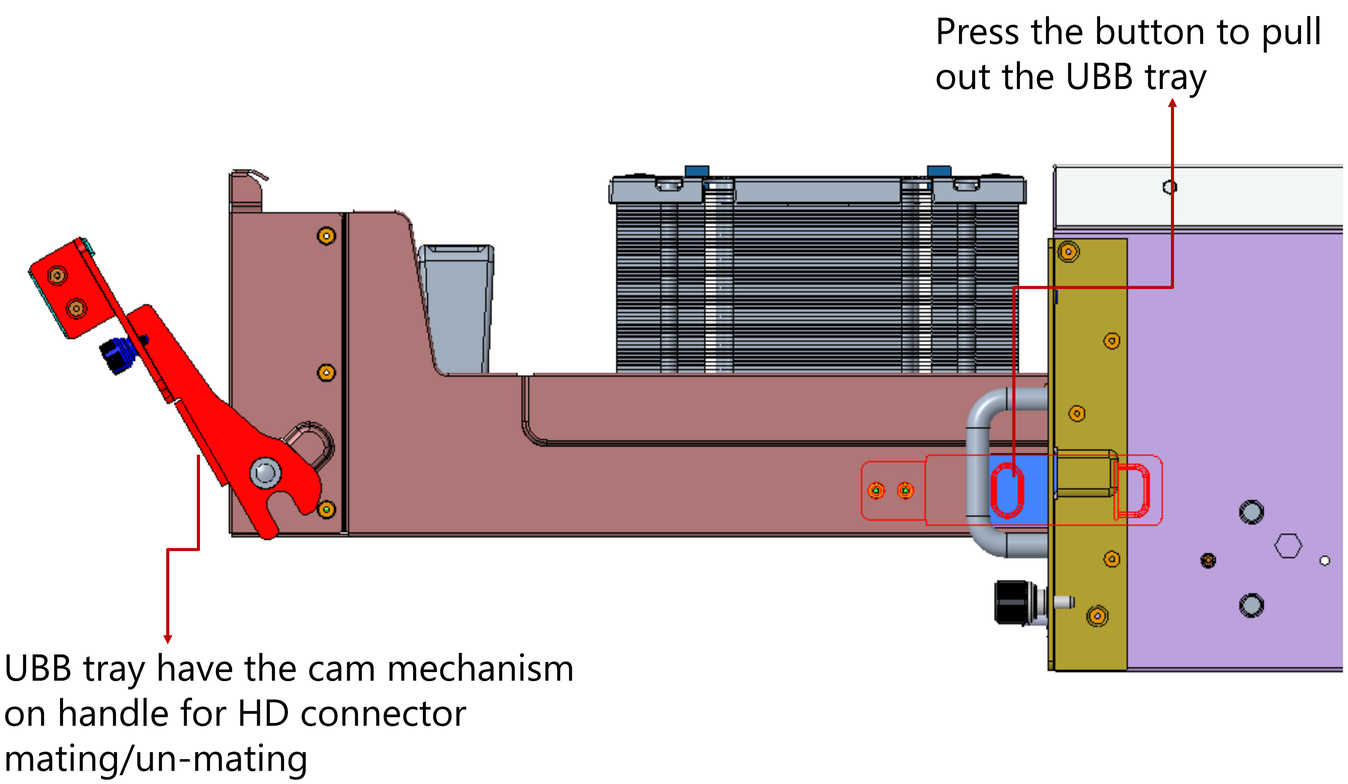
Front View

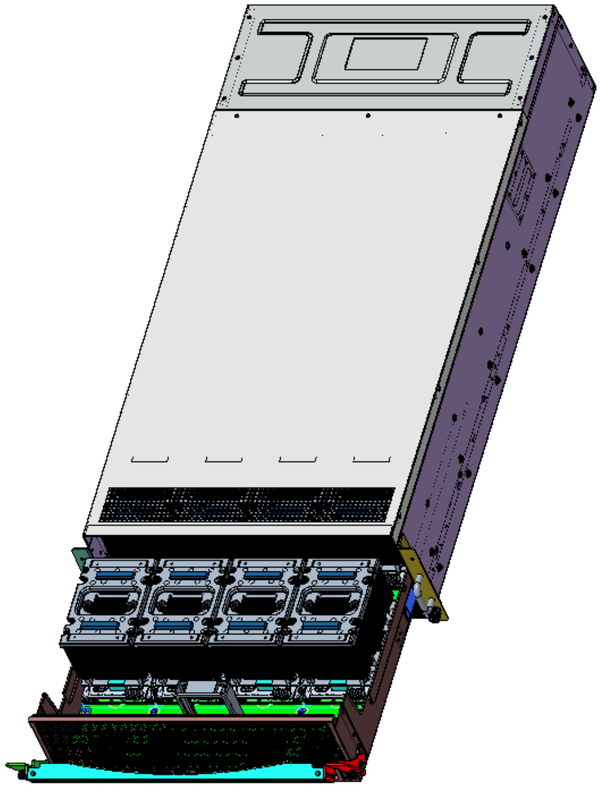


Rear View


PCIe Gen4 X16
4 x rear NVME
PCIe Gen4 X16
OAM health
System health
RST button
COM
MSHD#0 for uplink
PWR/UID button
MSHD#1 for uplink
USB
MGMT
4x 3000W PSU C20 AC Inlet

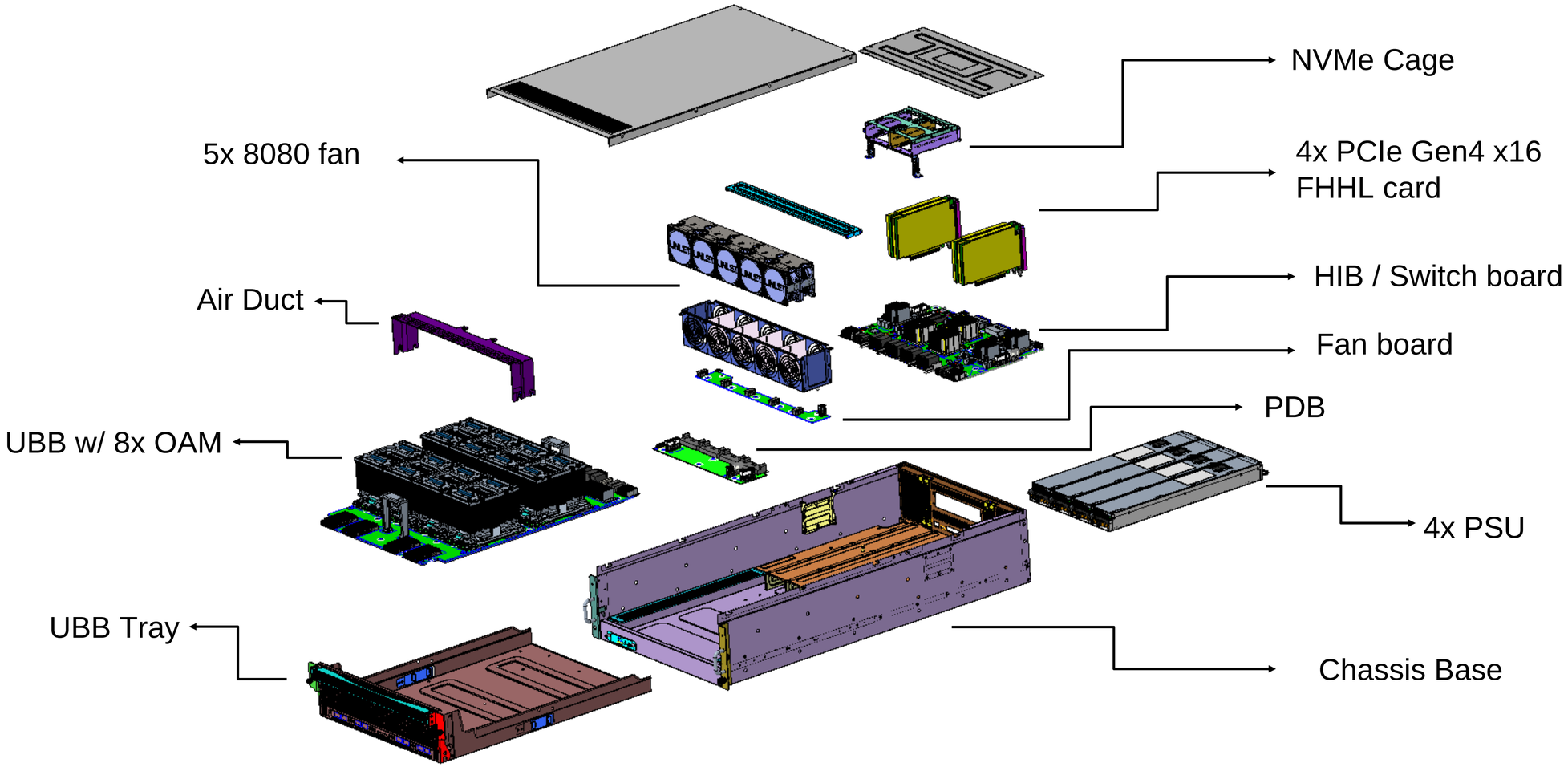
UBB Tray Serviceability



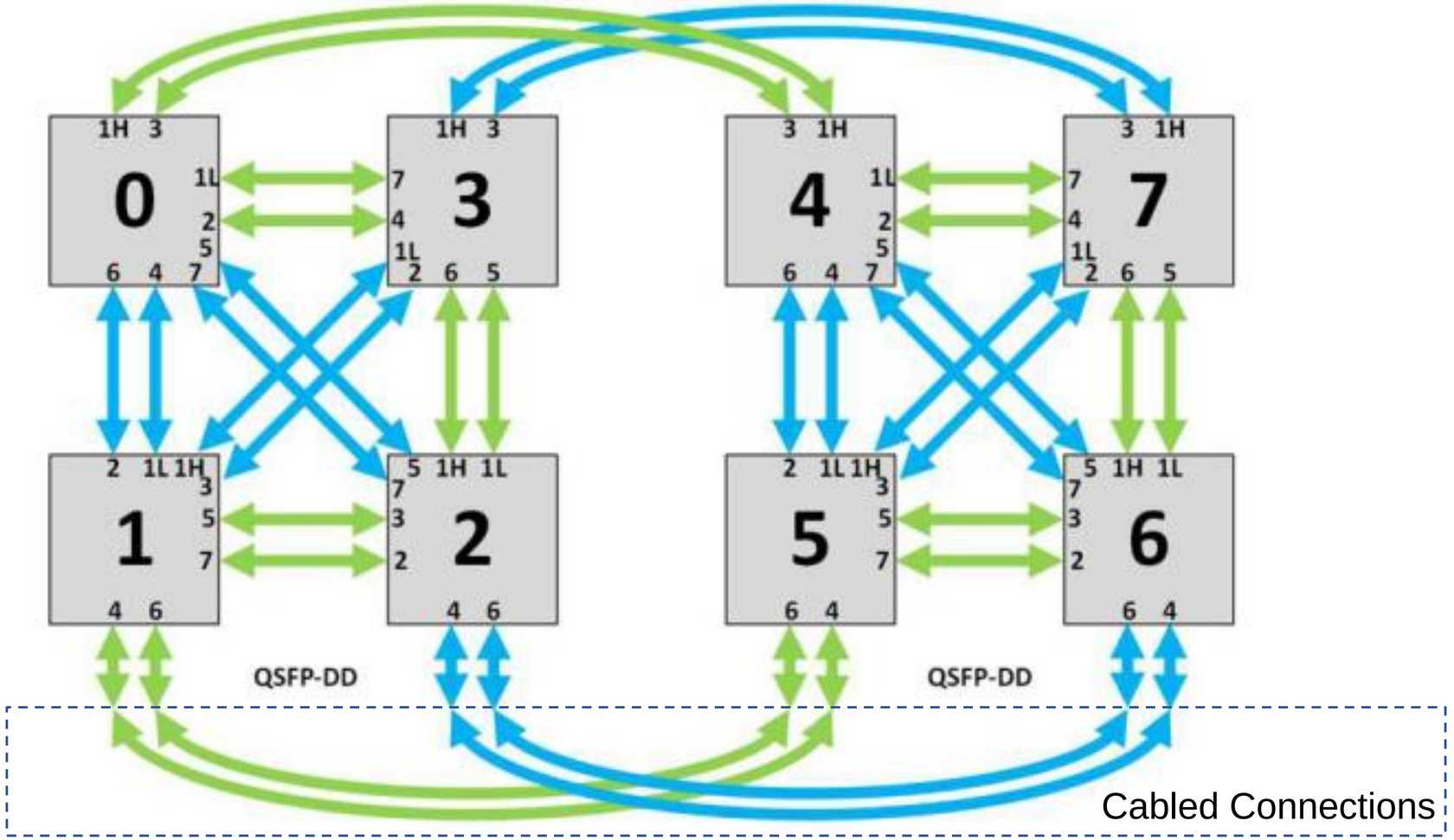


Note: The working group is studying common tray compatibility across the different reference systems

System: Exploded View

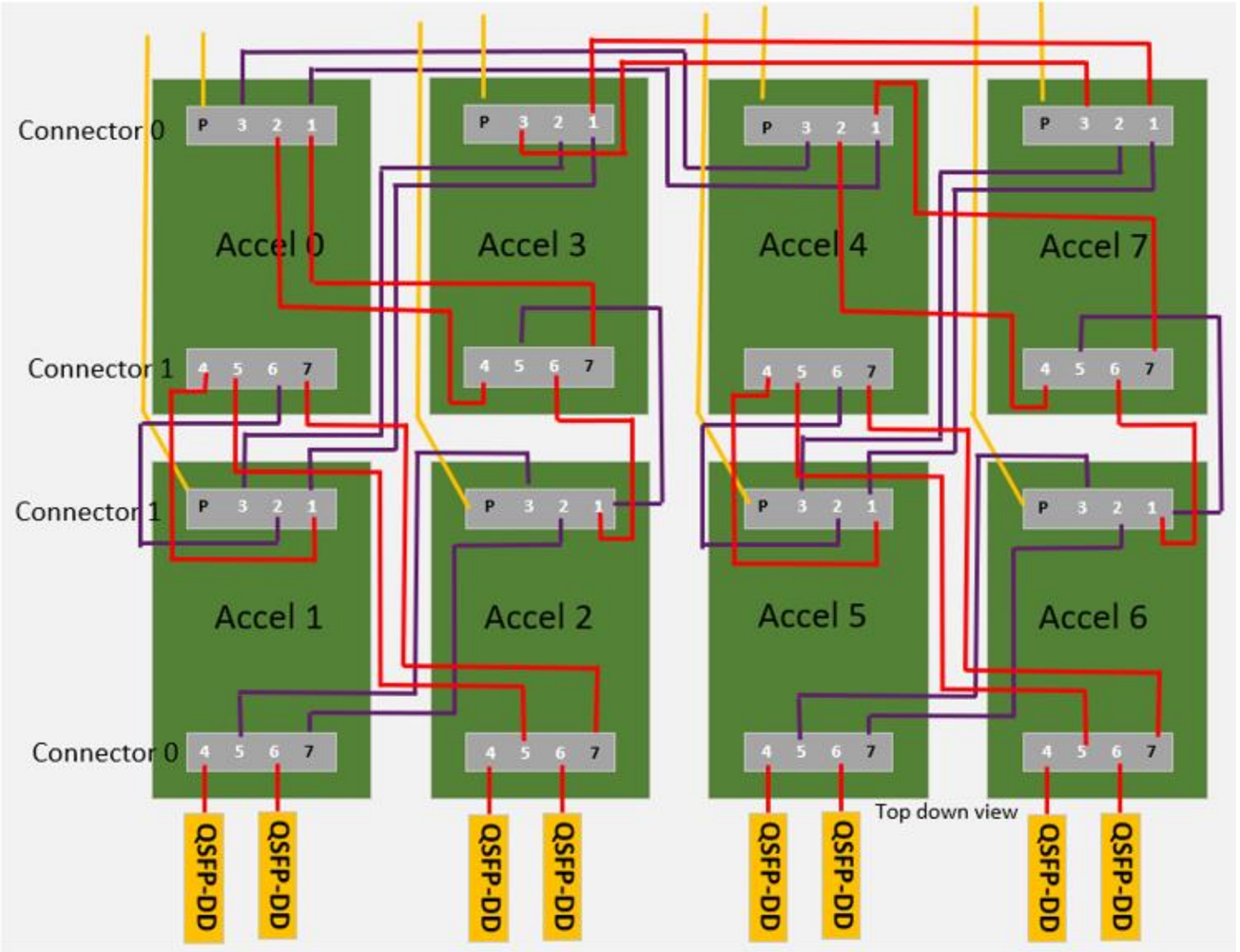


UBB 8-port HCM topology

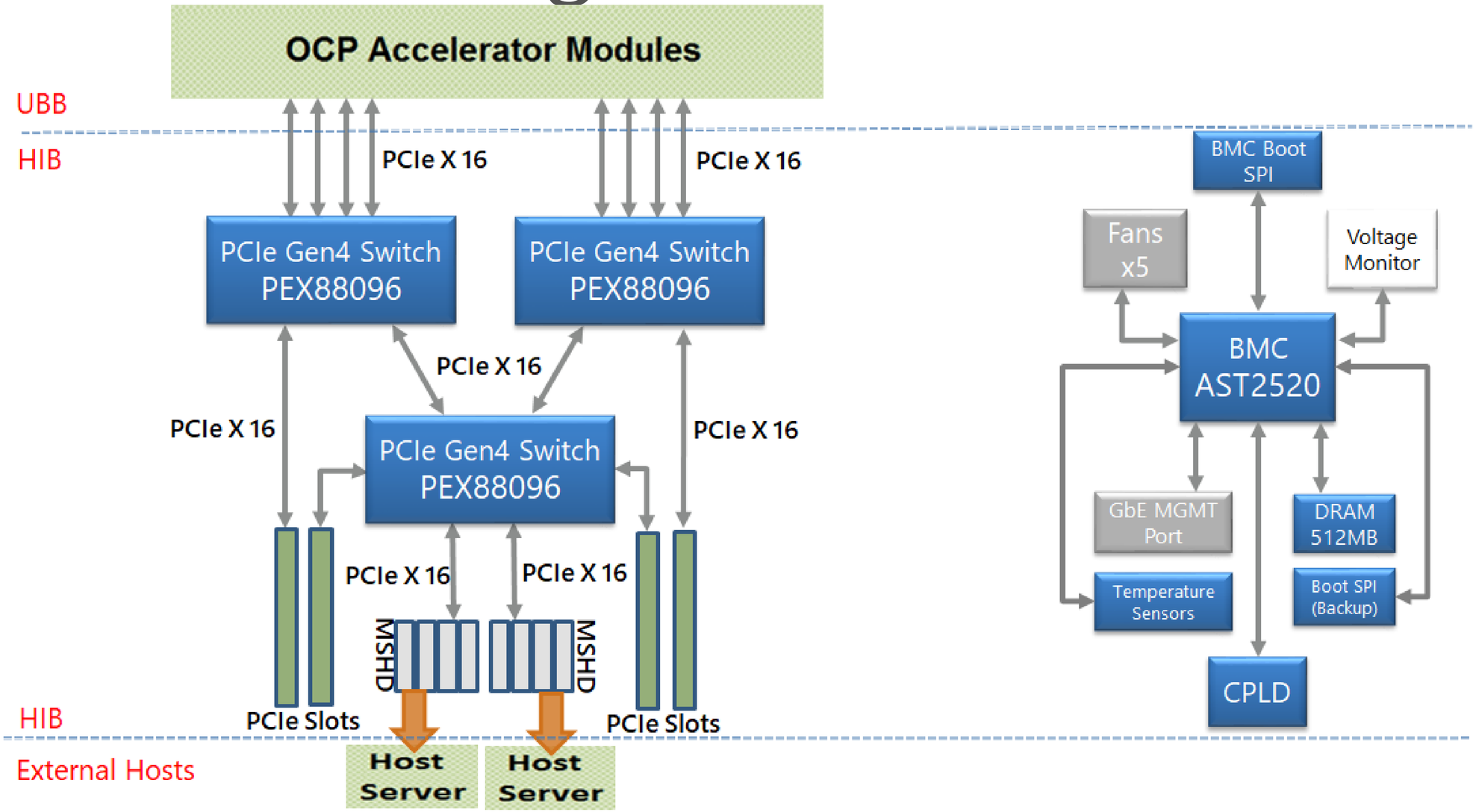


UBB 8 Port HCM topology

- **HCM using 8 ports: 1L, 1H, 2, 3, 4, 5, 6, 7**
- **SerDes Port 2, 3, 4, 5, 6, 7 are x8 lanes**
- **SerDes Port 1 is x16 (2 x8) lanes**
  - **1L – SerDes 1 Lower 8-bit**
  - **1H – SerDes 2 Upper 8-bit**
- **Ports 4 and 6 (OAM #1, #2, #5 and #6)**
  - **Ports 4 and 6 on the bottom row are cabled connections to support full 8 port HCM.**
  - **Alternatively, Ports 4 and 6 can be used for OAI expansion (scale out) via QSFP-DD cables to another UBB board.**



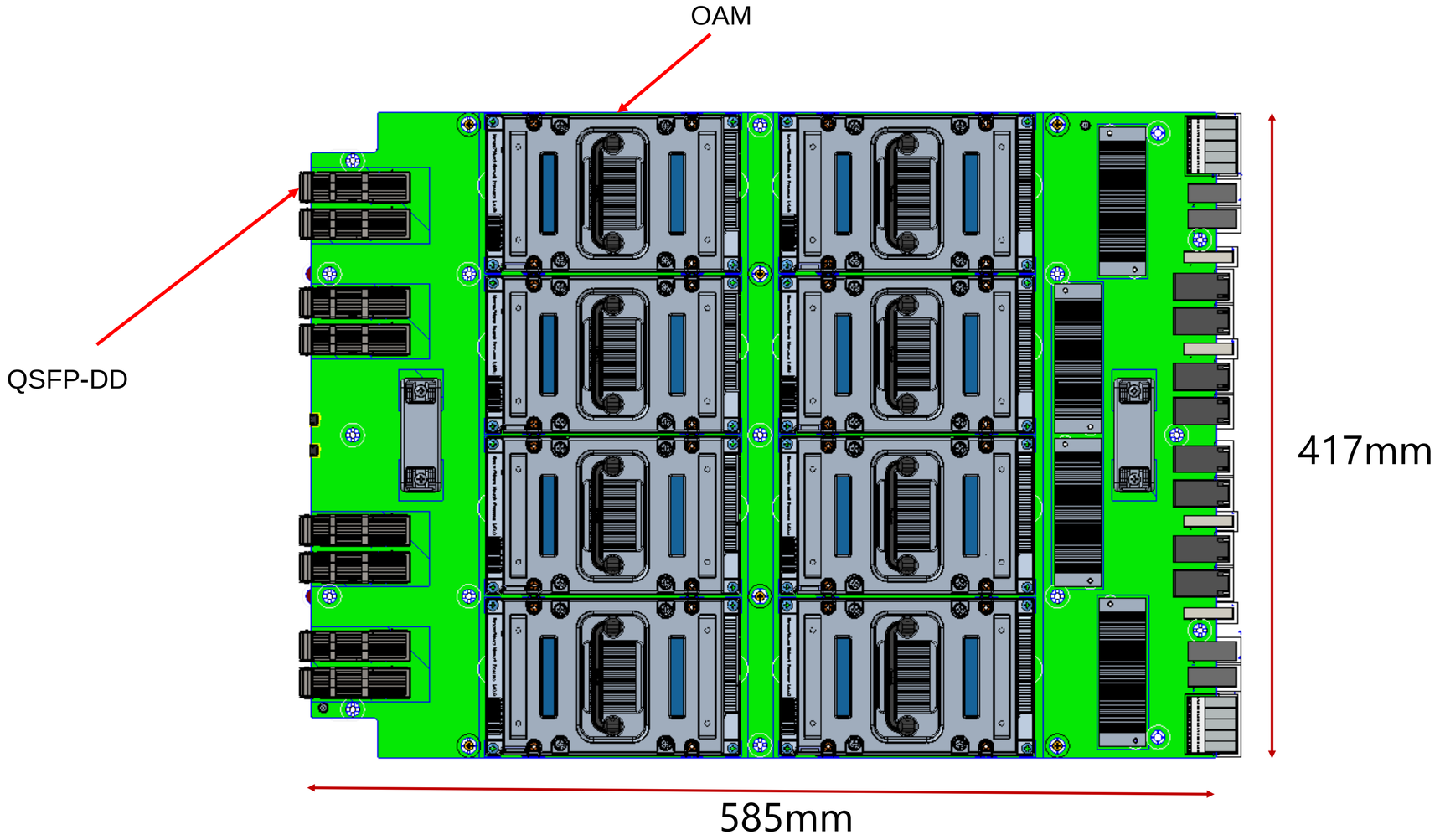
System Block Diagram



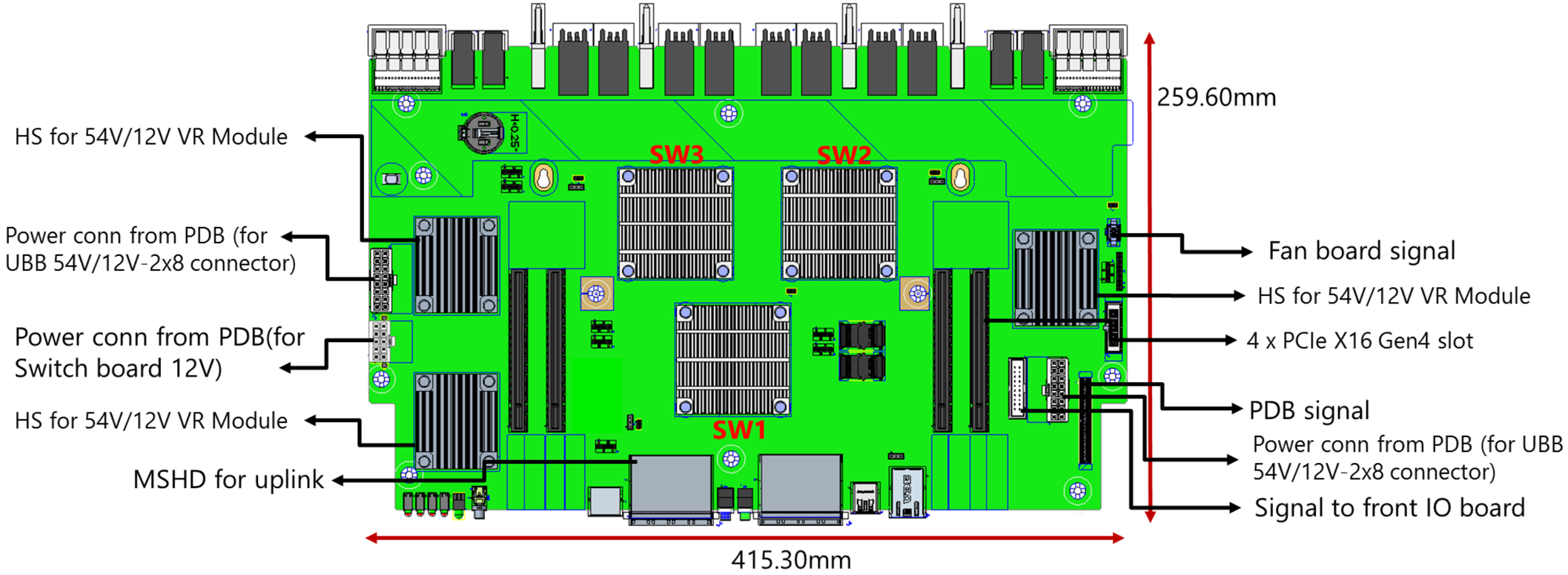
Board List

PCB#	Description	Dimension WxL (mm)	PCB Layer	PCB Materials	PCB Thickness (mm)
1	Universal Baseboard (UBB)	417.00 x 585.00mm	22L	Hyper Low Loss	3.26mm
2	Host Interface Board (HIB)	415.30 x 259.60 mm	16L	Ultra Low Loss	2.49mm
3	Fan board	407.42 x 52.83 mm	6L	Normal	1.60mm
4	Power Distribution Board (PDB)	314.96 x 75.44 mm	10L	Normal	1.60mm

Universal Baseboard

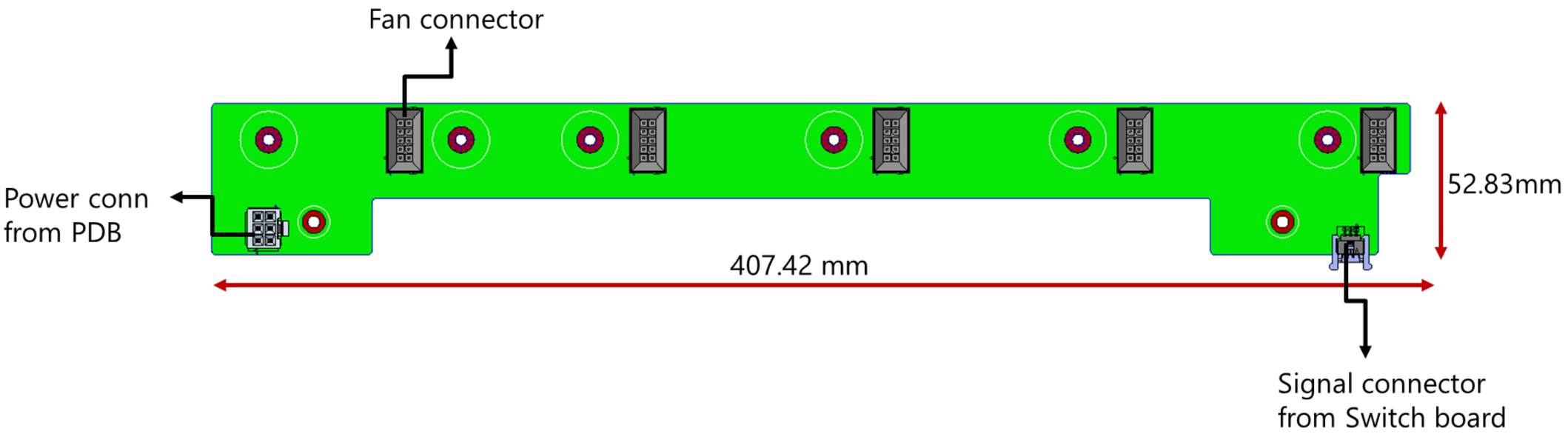


HIB Switch Board

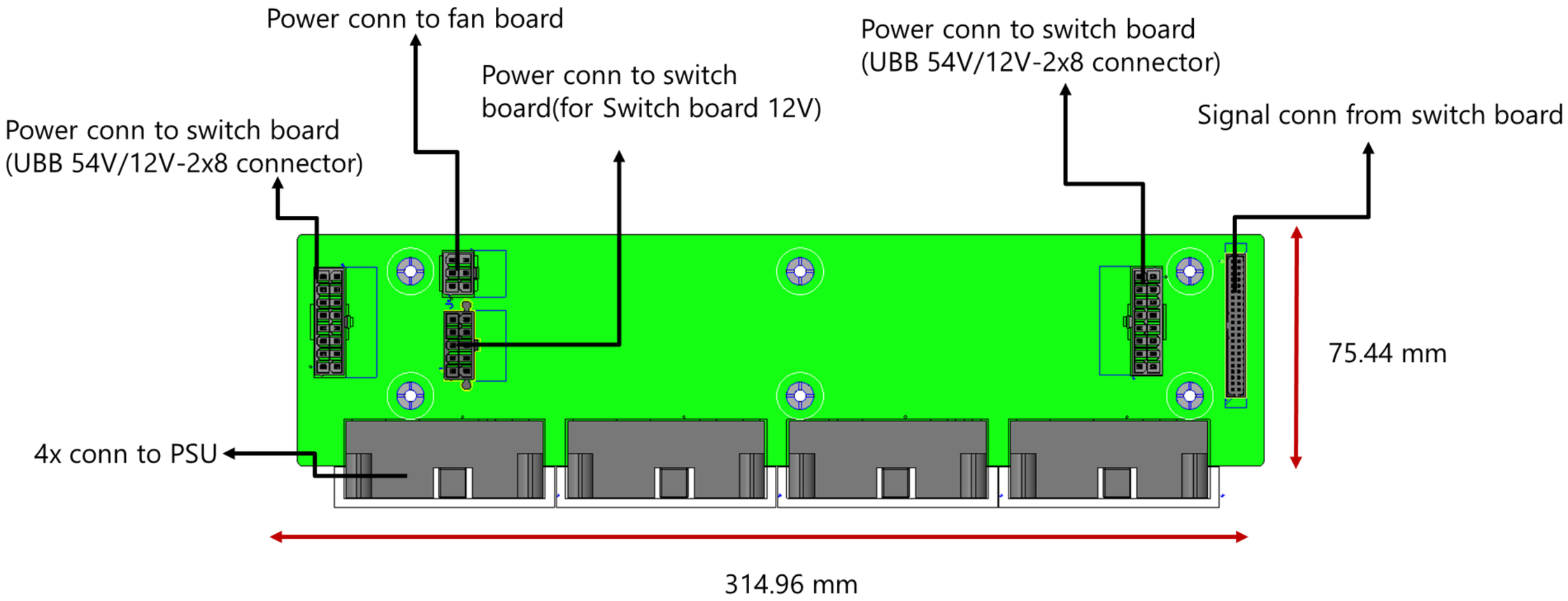


*P12V VR: Vicor 3717(54V to 12V VR solution)

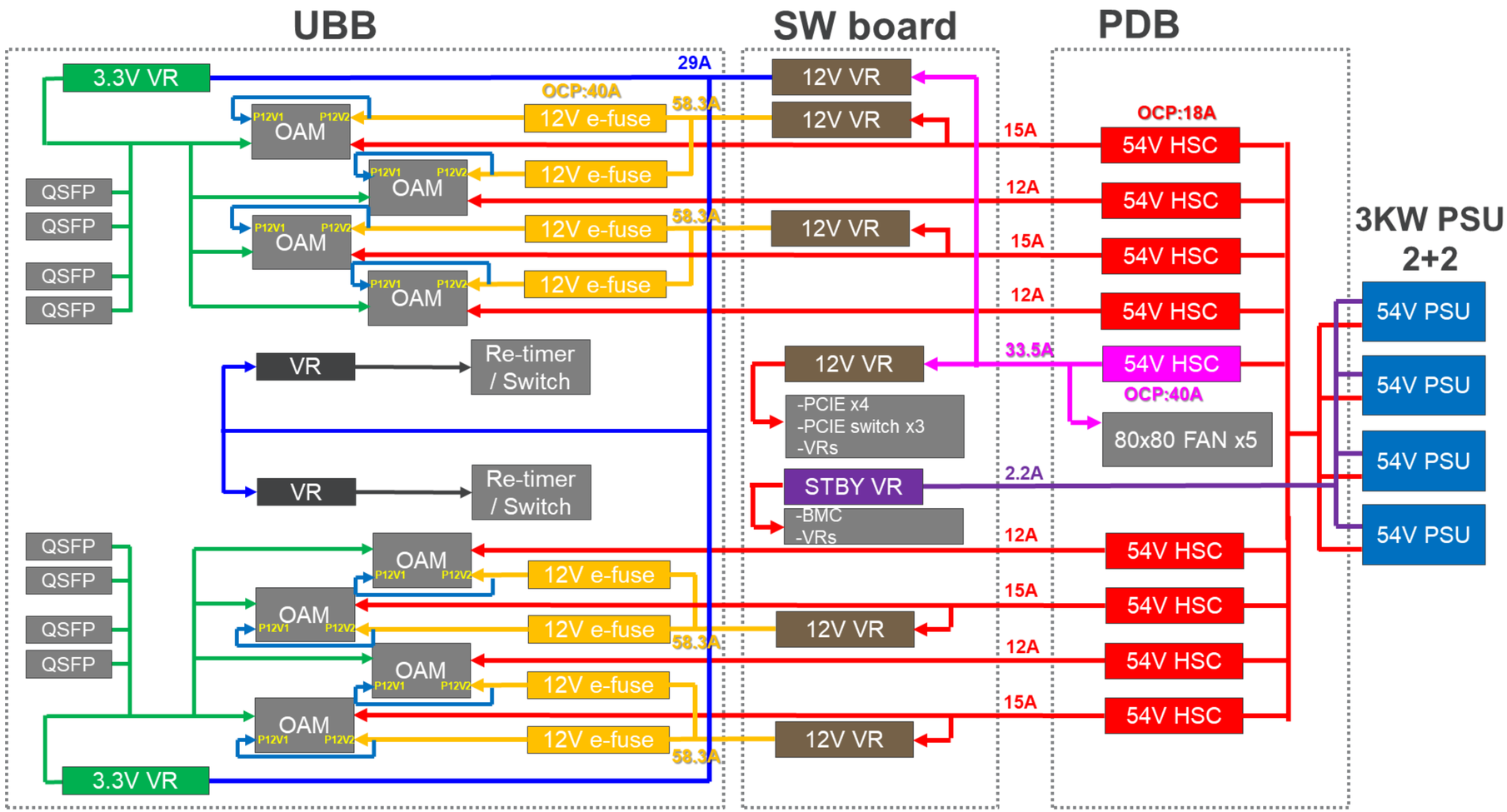
Fan Board


Fan connector
Power conn
from PDB
52.83mm
407.42 mm
Signal connector
from Switch board

PDB Placement



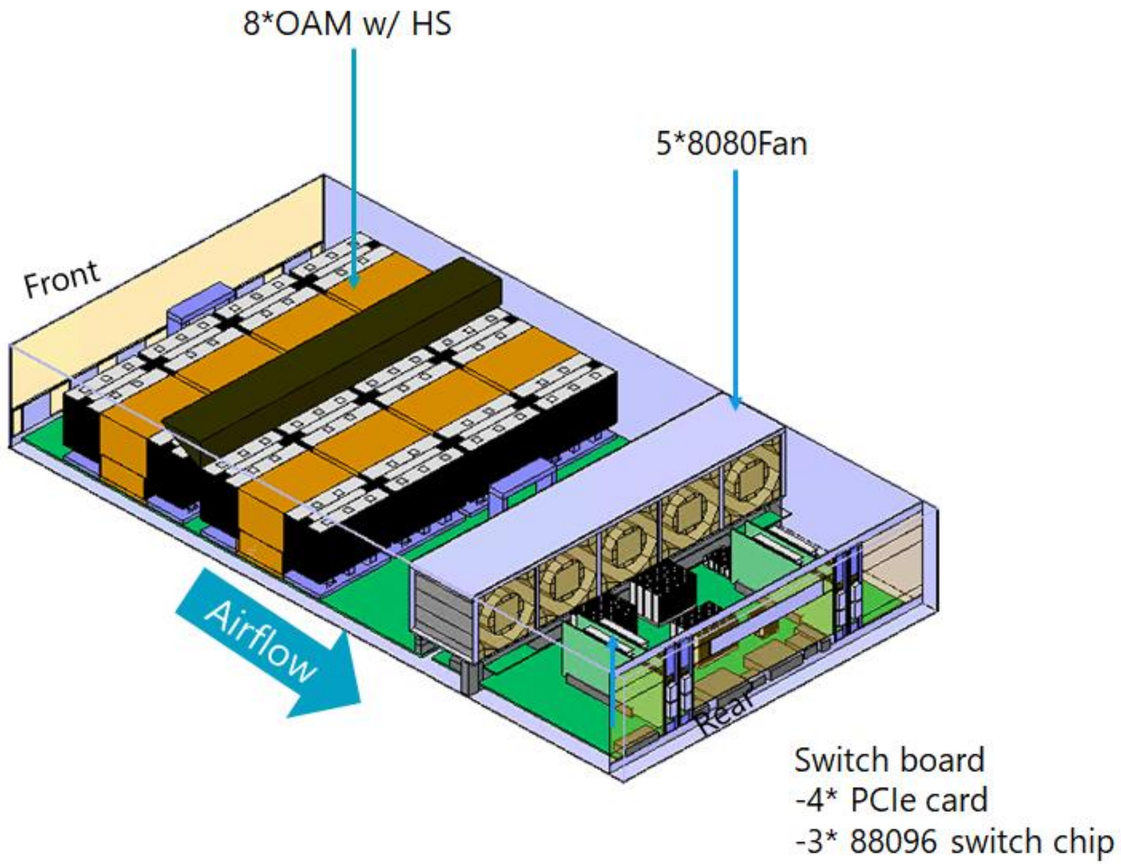
Power Delivery



Thermal Design

Thermal System Model

- 8* OAM module(up to 410W)
- 5* 8080 Fan
- 1* Switch board
- 4* PCIe card



CFD Results

System passes

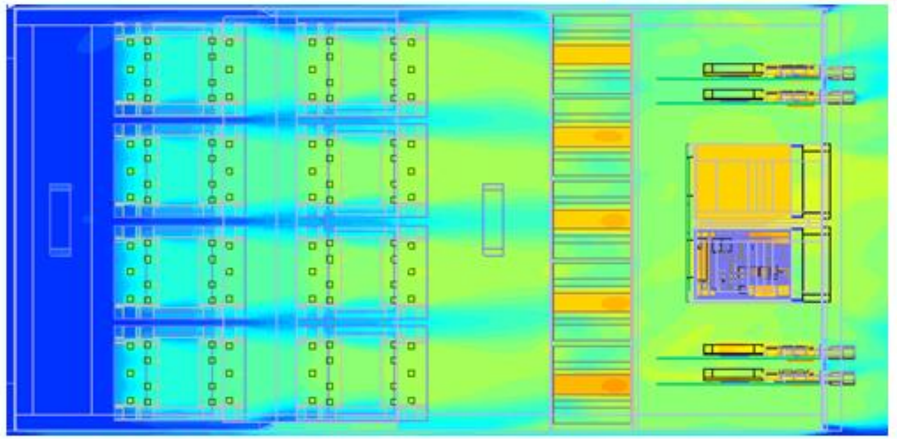
- System Airflow 477 CFM
- HBM memory is close to spec

Next Steps

- Simulate up to 450W TDP
- Fine tune the air duct to improve margins by increasing air flow to the down stream OAMs
- Simulate fan fail conditions

All fans run at full speed 35'C Ambient

35'C 100'C



Spec.	Components	Temperature('C)
	Condition	900m Altitude
105	OAM ASIC Die	99.5
95	OAM HBM	94.5
70.0	Front QSFP-DD Tc	65.6
110	Switch 88096	89.1
105	PCIe NIC	94.1

Call to Action

- Visit the ZT / IEC demo System at the OAI Experience Lab
- Provide feed back to OAI group
- Project Wiki with latest specification : https://www.opencompute.org/wiki/Server/OAI
- Mailing list: https://ocp-all.groups.io/g/OCP-OAI

Speakers' Profile

Adam Tin
System Engineer at Inspur based in Taiwan. Over 16 years of server hardware design and architecture. As system leader to provide various form factor of server solution for target customer in US and Europe.

Emilie Yang
Emilie is a senior Technical Program Manager at Hyve Design Solutions in Taiwan. She contributed several OCP hardware and cooling designs in past decade. Now, she continuously delivers various products through program management and technical expertise to OCP community and customers.

Mark D. Chubb
Mark is the Director of Architecture at ZT Systems. Mark is based in Seattle, WA and works closely with key Cloud Customers to conceptualize and develop Server and Rack solutions for Hyperscale computing needs. Mark has over 20 years of experience in HW Design and Architecture of Server class boards and systems. Mark is an active participant in various OCP Forums and has provided talks at prior OCP Summits about ZT Systems design contributions to OCP.

OCP REGIONAL SUMMIT

Open. Together.

OCP Regional Summit

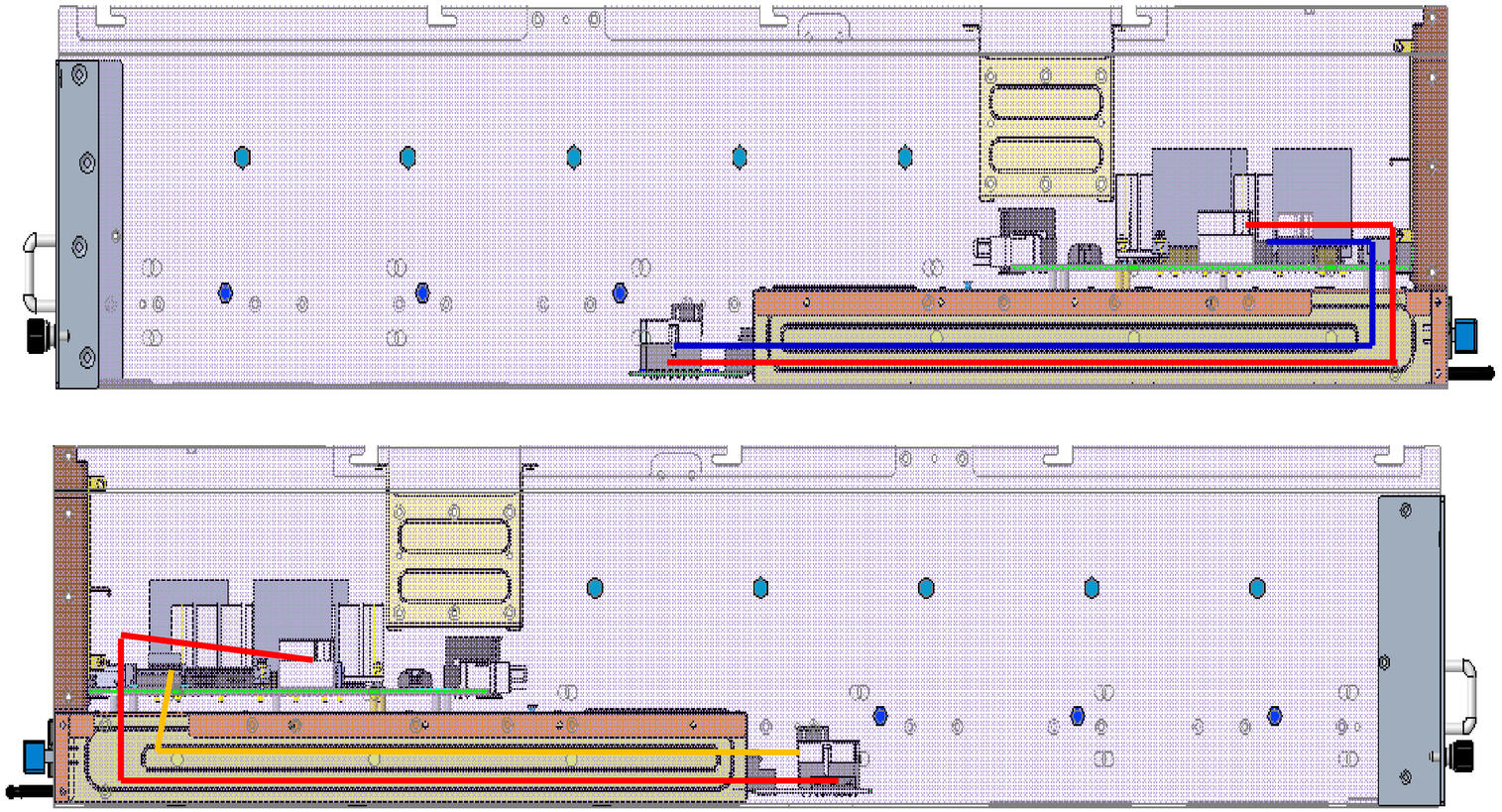
26–27, September, 2019

ZT Systems BACK UP SLIDES

Mechanical Design

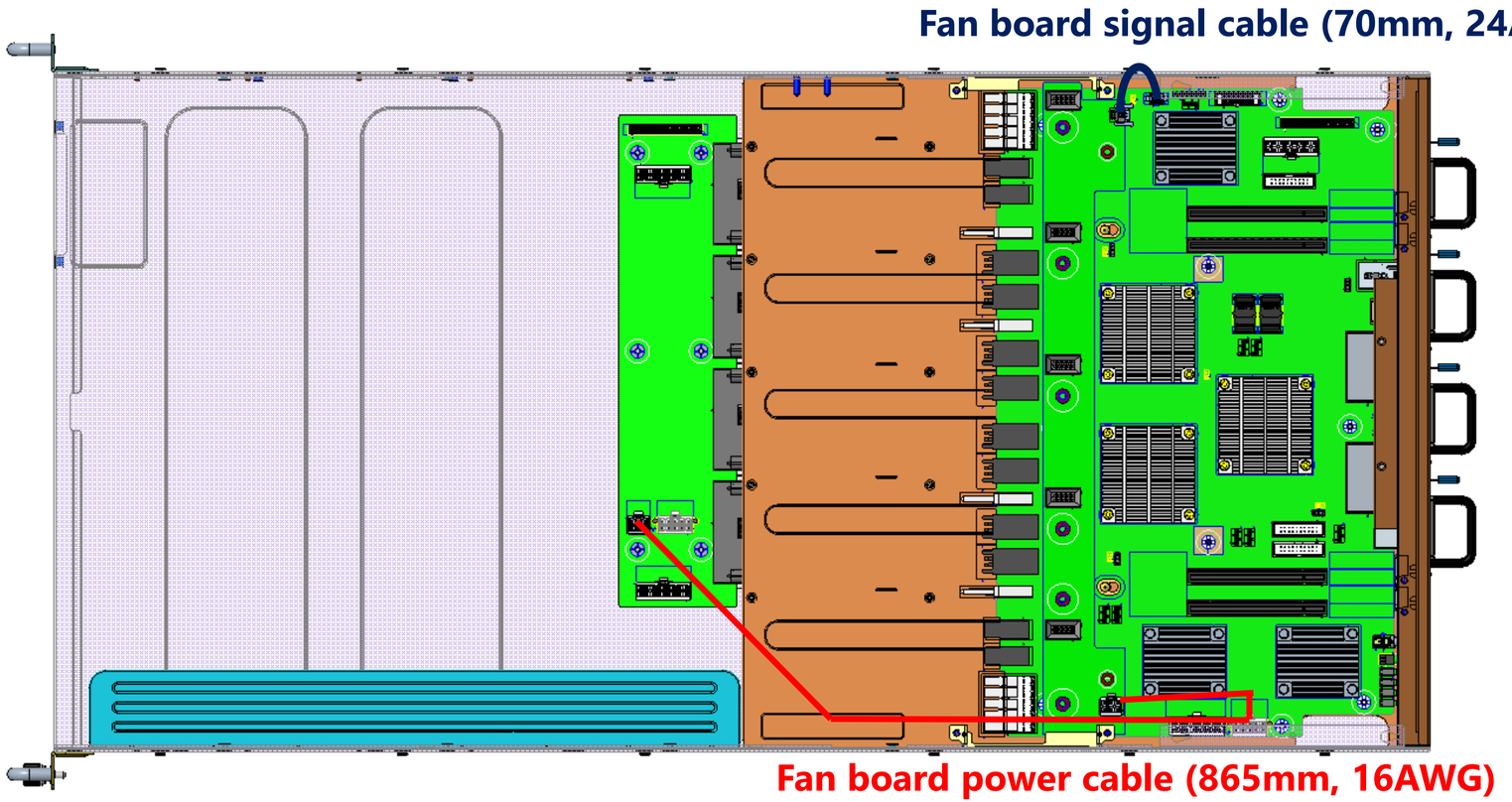
2X8 power cable (660mm, 16AWG)
2X5 power cable (670mm, 16AWG)
PWR Signal cable (630mm, 24AWG)

Cable routing – PDB power and signal cable to Switch board



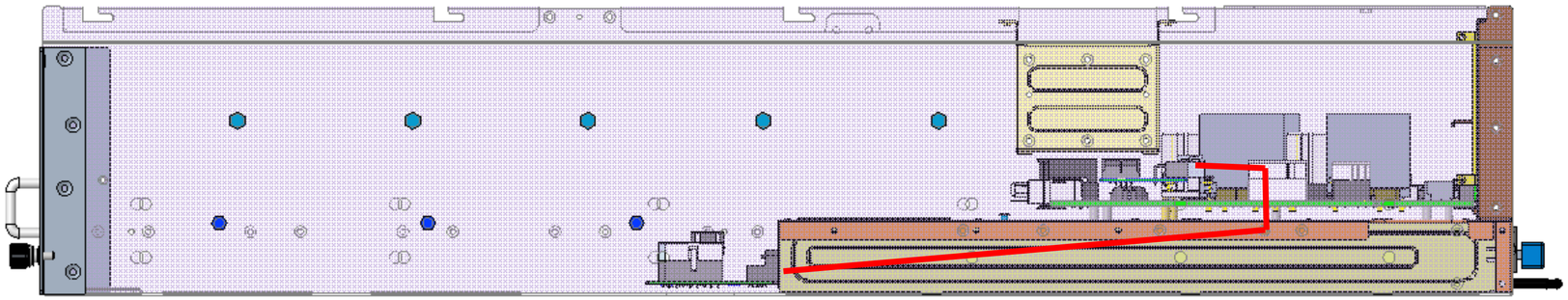
Mechanical Design

Cable routing – fan board signal to Switch board ; PDB power to switch board

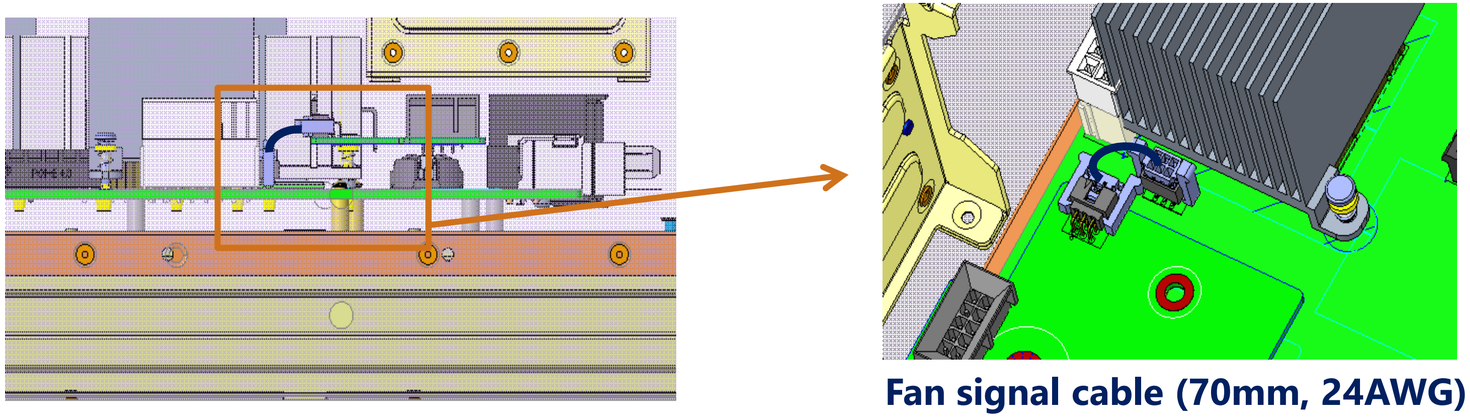


Mechanical Design

Cable routing – fan board signal to Switch board ; PDB power to switch board



Power cable (865mm, 16AWG)



Fan signal cable (70mm, 24AWG)

Mechanical Design

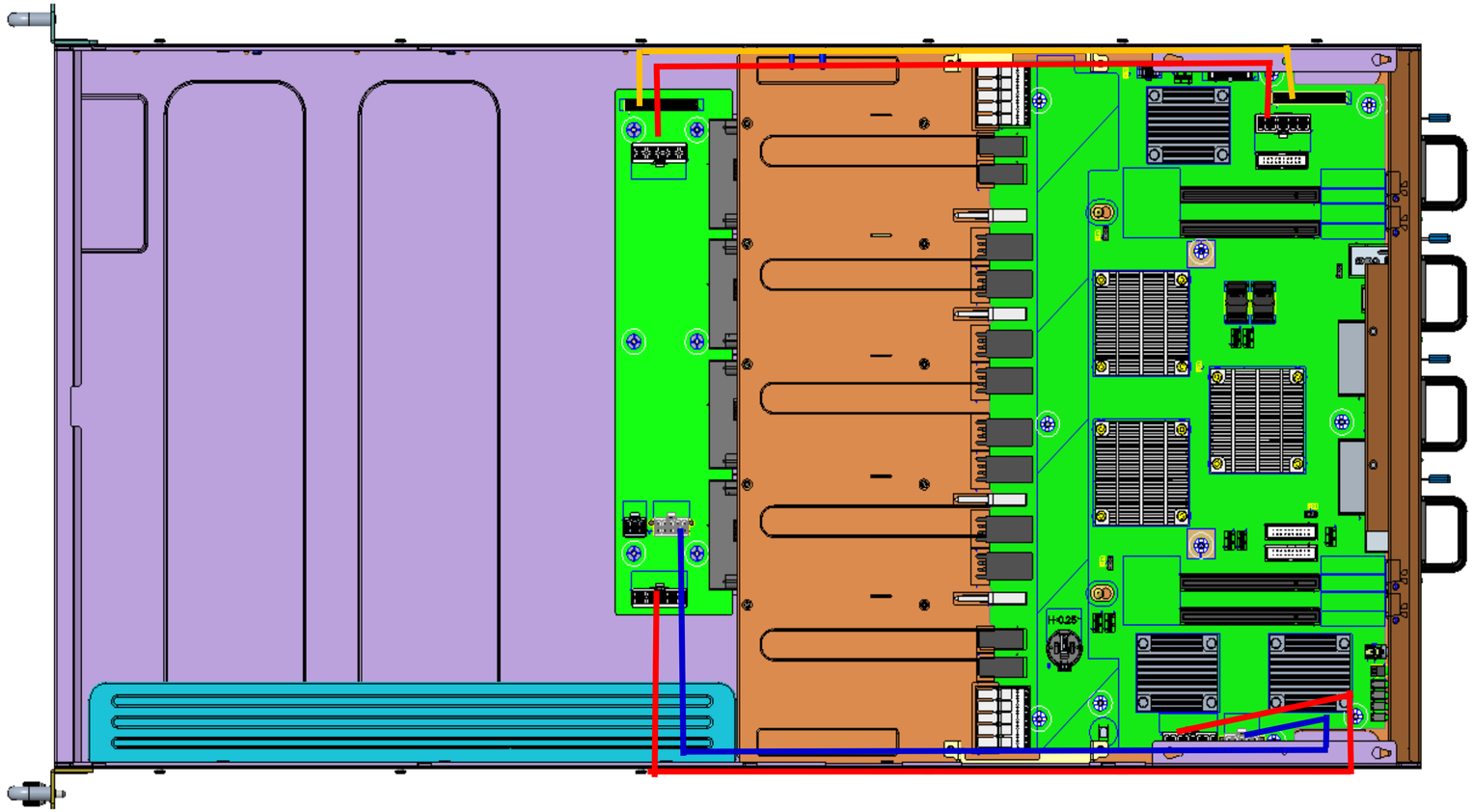
Internal Cable List

Item	Description	Quantity	AWG	Length	Note
1	PDB to Switch board power cable (for UBB 48V/12V-2x8 connector)	2	16	660mm	
2	PDB to Switch board power cable (for Switch board and UBB 12V_M-2x5 connector)	1	16	670mm	
3	PDB to Switch board signal cable	1	24	630mm	
4	Fan board power to PDB power cable	1	16	865mm	
5	Fan board to Switch board signal cable	1	24	70mm	
6	Silmlinex8 cable from switch board to NVMe BP	2			Option
7	NVMe BP power from PDB	1			Option
8	NVMe BP signal from Switch board	1			Option

Mechanical Design

2X8 power cable (660mm, 16AWG)
2X5 power cable (670mm, 16AWG)
PWR Signal cable (630mm, 24AWG)

Cable routing – PDB power and signal cable to Switch board



PCBA Design

UBB Stackup

- PCB layer: 22L
- PCB material: Hyper low Loss
- PCB thickness: 128 mil (3.25mm)

For 22-Layer Stack-up H=3.7/4(MS/SL) (if there is a "Space" existed in the below two columns, the cell will be highlighted in dark red and please remove it)		Impedance (Ω)	Breakout (mils)		
			Width (W)	Spacing (S)	Maximal length
PCIE	Diff	85	4	4	TBD
PCIE	Diff	85	4	4	TBD
ICL	Diff	90	4	4	TBD
CLK	Diff	85	4	4	TBD

Dielectric and Copper Prope				
	Layer		Copper	
Name	Description	Type	Weight	Type
Top_SM	Top Soldermask	Soldermask		
L1top	Signal_L1top	Signal	0.5 oz. plated	HTE
PP_L1top_L2	Preprog	PP		
L2	GND_L2	GND	1.0 oz.	HVLP
Core_L2_L3	Core	Core		
L3	Signal_L3	Signal	1.0 oz.	HVLP
PP_L3_L4	Preprog	PP		
L4	GND_L4	GND	1.0 oz.	HVLP
Core_L4_L5	Core	Core		
L5	Signal_L5	Signal	1.0 oz.	HVLP
PP_L5_L6	Preprog	PP		
L6	GND_L6	GND	1.0 oz.	HVLP
Core_L6_L7	Core	Core		
L7	Signal_L7	Signal	1.0 oz.	HVLP
PP_L7_L8	Preprog	PP		
L8	GND_L8	GND	1.0 oz.	HVLP
Core_L8_L9	Core	Core		
L9	Signal_L9	Signal	1.0 oz.	HVLP
PP_L9_L10	Preprog	PP		
L10	GND_L10	GND	1.0 oz.	HVLP
Core_L9_L10	Core	Core		
L11	PWR_L11	PWR	2.0 oz.	
PP_L9_L10	Preprog	PP		
L12	PWR_L12	PWR	2.0 oz.	
Core_L12_L13	Core	Core		
L13	GND_L13	GND	1.0 oz.	HVLP
PP_L13_L14	Preprog	PP		
L14	Signal_L14	Signal	1.0 oz.	HVLP
Core_L14_L15	Core	Core		
L15	GND_L15	GND	1.0 oz.	HVLP
PP_L15_L16	Preprog	PP		
L16	Signal_L16	Signal	1.0 oz.	HVLP
Core_L16_L17	Core	Core		
L17	GND_L17	GND	1.0 oz.	HVLP
PP_L17_L18	Preprog	PP		
L18	Signal_L18	Signal	1.0 oz.	HVLP
Core_L18_L19	Core	Core		
L19	GND_L19	GND	1.0 oz.	HVLP
PP_L19_L20	Preprog	PP		
L20	Signal_L20	Signal	1.0 oz.	HVLP
Core_L20_L21	Core	Core		
L21	GND_L21	GND	1.0 oz.	HVLP
PP_L21_L22bot	Preprog	PP		
L22bot	Signal_L22bot	Signal	0.5 oz. plated	HTE
Bot_SM	Bot Soldermask	Soldermask		

PCBA Design

HIB Switch Board Stackup

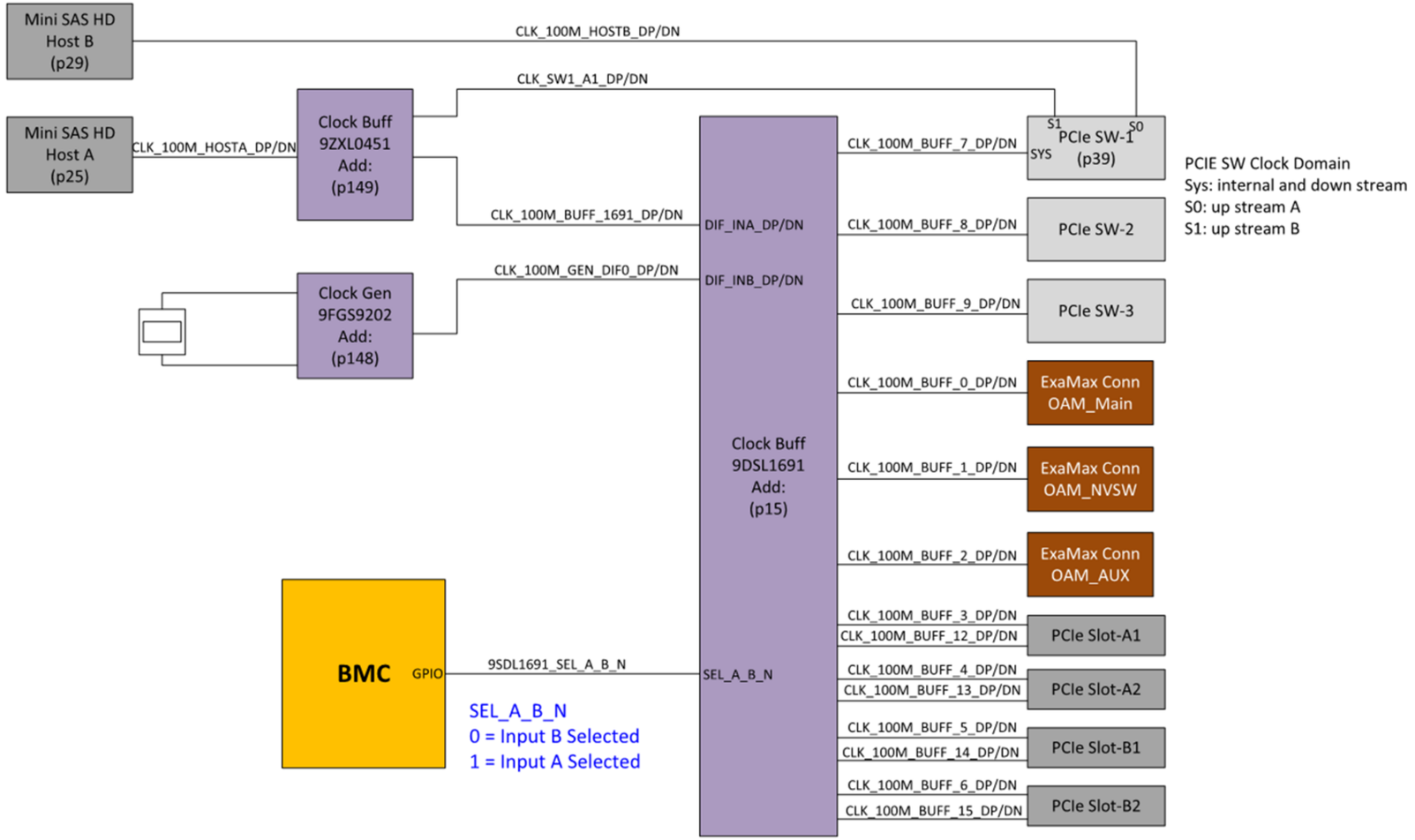
- PCB layer: 16L
- PCB material: Ultra Low Loss
- PCB thickness: 97.6 mil (2.48mm)

For 16-Layer Stack-up H=3.7/4(MS/SL) (if there is a "Space" existed in the below two columns, the cell will be highlighted in dark red and please remove it)		Impedance (Ω)	Breakout (mils)			Remark
			Width (W)	Spacing (S)	Maximal length	
PCIE	Diff	85	4	4	TBD	TBD
PCIE	Diff	85	4	4	TBD	TBD
CLK	Diff	85	4	4	TBD	TBD
I2C	SE	50	4	4	TBD	TBD
MISC	SE	50	4	4	TBD	TBD
CLK	SE	50	4	4	TBD	TBD
Power enable	SE	50	4	4	TBD	TBD
JTAG	SE	50	4	4	TBD	TBD
SPI	SE	50	4	4	TBD	TBD
UART	SE	50	4	4	TBD	TBD
USB	usb	85	4	4	TBD	TBD
BCM54612	diff_MDI	100	4	4	TBD	TBD
BCM54612	Single-End	50	TBD	TBD	TBD	GTXCLK;

Layer	Nominal Board thickness 97.6 MIL	Thickness (MIL)	Type
	Solder Mask	0.5	Solder mask
L1	0.5oz+platting	2	Signal
	PP	2.7	
L2	1oz	1.2	GND
	Core(1/1)	4	
L3	1oz	1.2	Signal
	PP	4.5	
L4	1oz	1.2	GND
	Core(1/1)	4	
L5	1oz	1.2	Signal
	PP	4.5	
L6	1oz	1.2	GND
	Core(1/1)	3	
L7	1oz	1.2	Signal
	PP	12	
L8	2oz	2.4	PWR
	Core(1/1)	4	
L9	2oz	2.4	PWR
	PP	12	
L10	1oz	1.2	Signal
	Core(1/1)	3	
L11	1oz	1.2	GND
	PP	4.5	
L12	1oz	1.2	Signal
	Core(1/1)	4	
L13	1oz	1.2	GND
	PP	4.5	
L14	1oz	1.2	Signal
	Core(1/1)	4	
L15	1oz	1.2	GND
	PP	2.7	
L16	0.5oz+platting	2	Signal/PWR
	Solder Mask	0.5	Solder mask

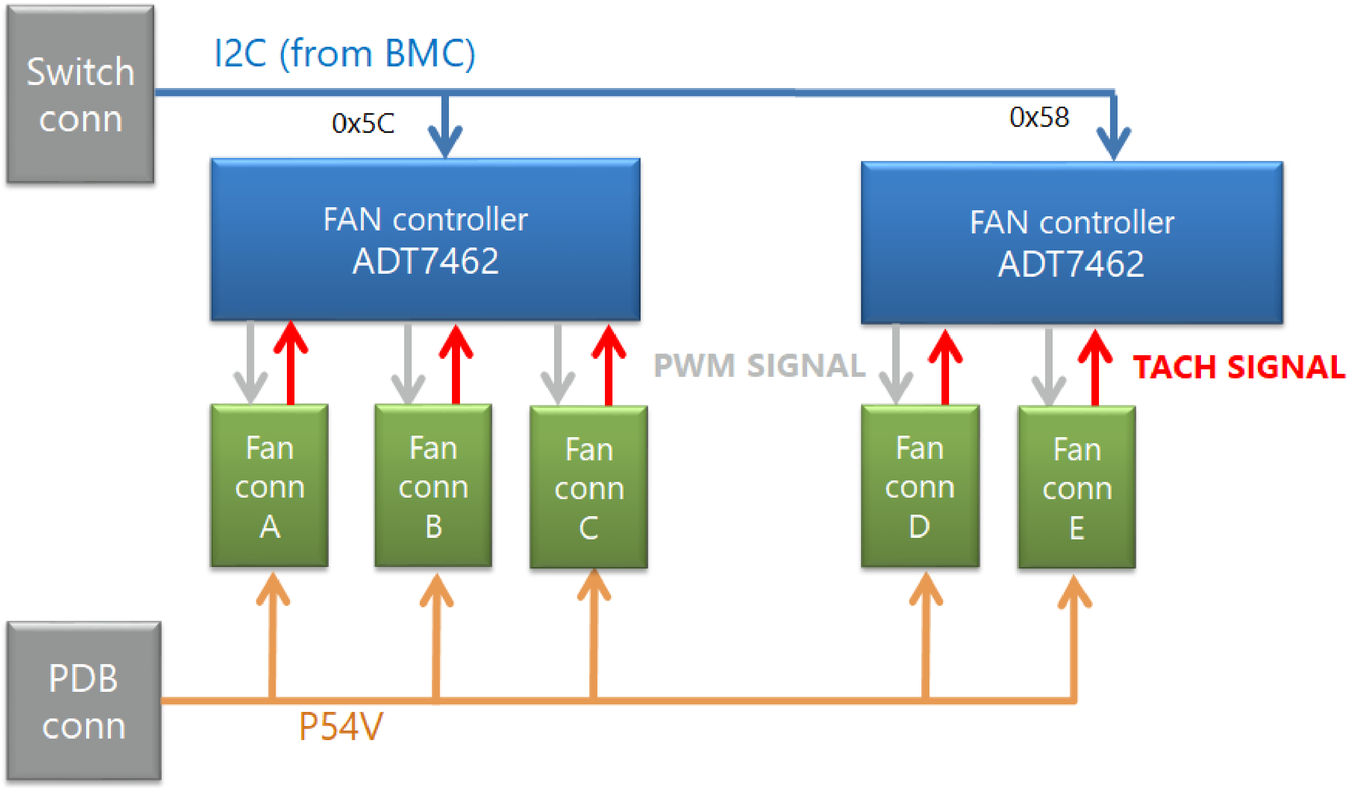
PCBA Design

HIB Switch Board CLK Block Diagram

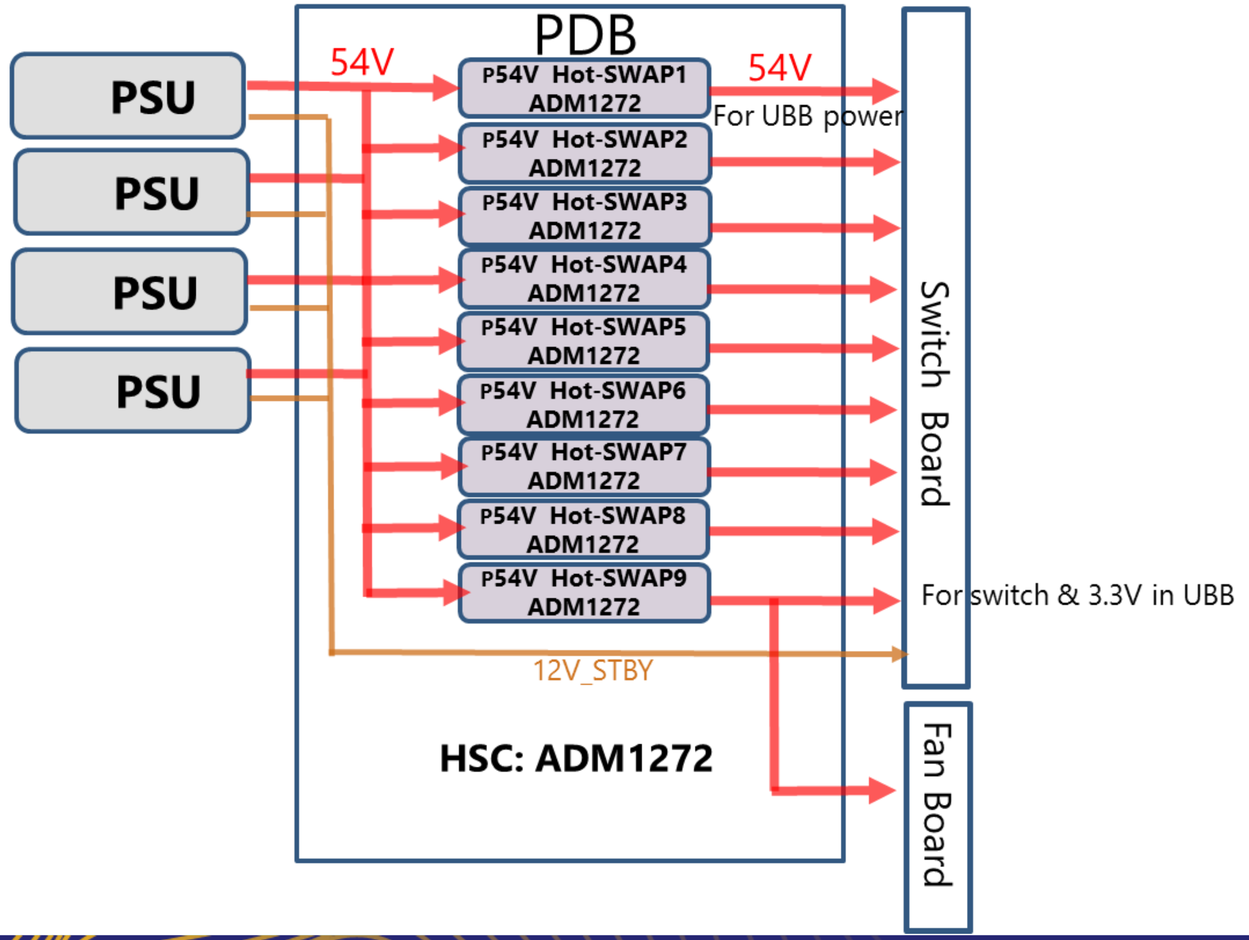


Fan Board Block Diagram

Block diagram

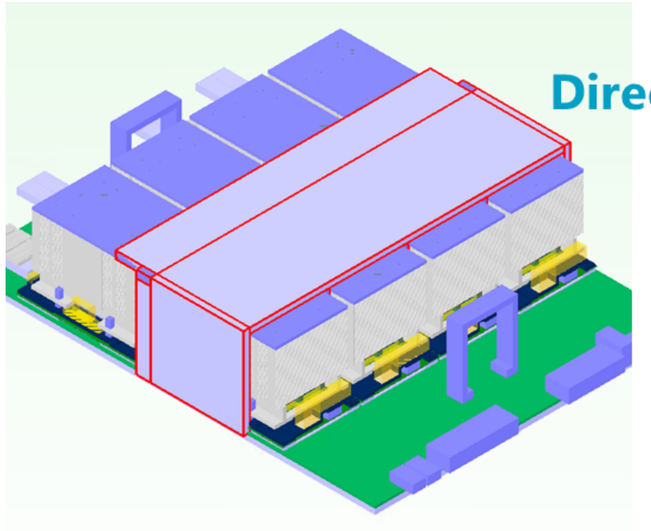


PDB Block Diagram

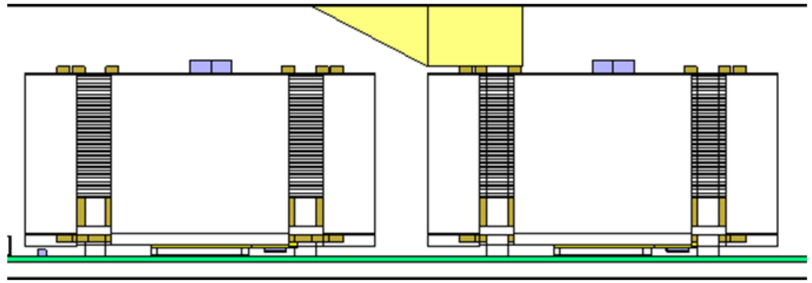


Thermal Design

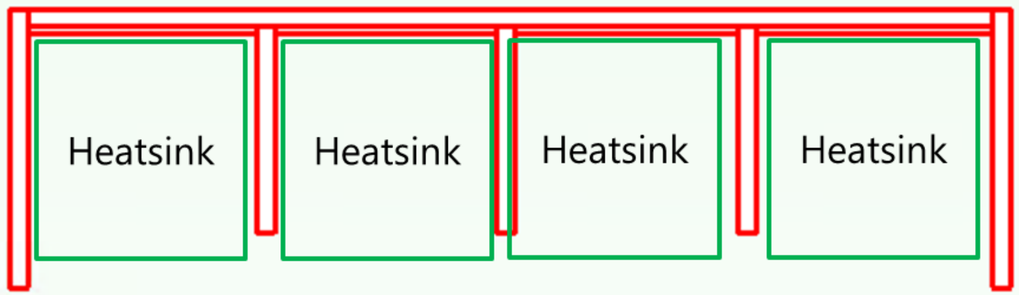
Air Duct



Direct cool air to downstream heatsink (Side view)

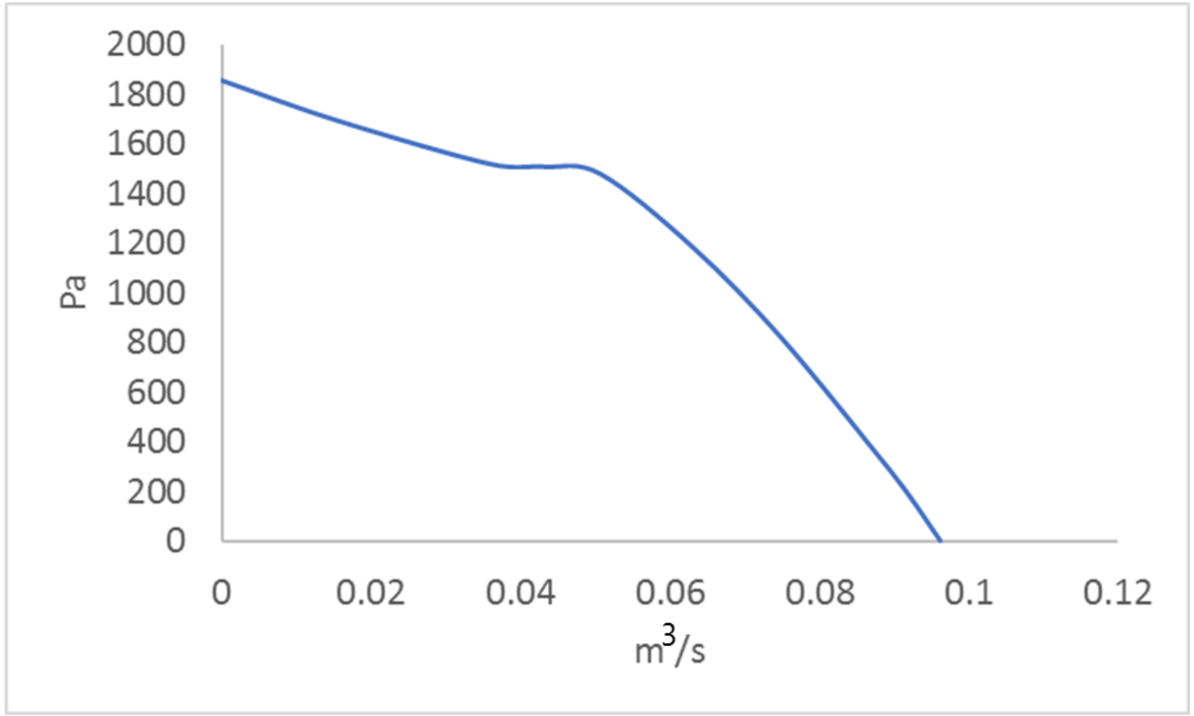


Block the bypass flow (Front view)



Thermal Design (BU)

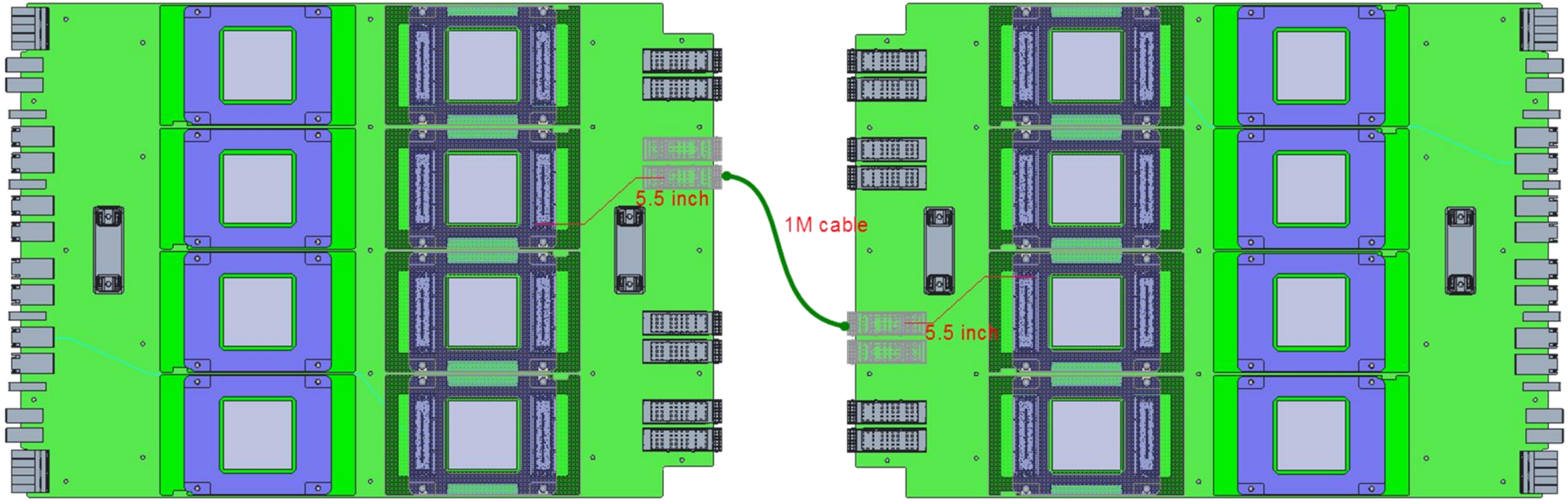
- **System Fan**
  - **8080 Fan (48V~60V)**
  - **Fan speed: F17000/R13000rpm**
  - **Max power:~177 Watts**



SI Evaluation

OAM on system1 to OAM on system2 Topology

- Length evaluation

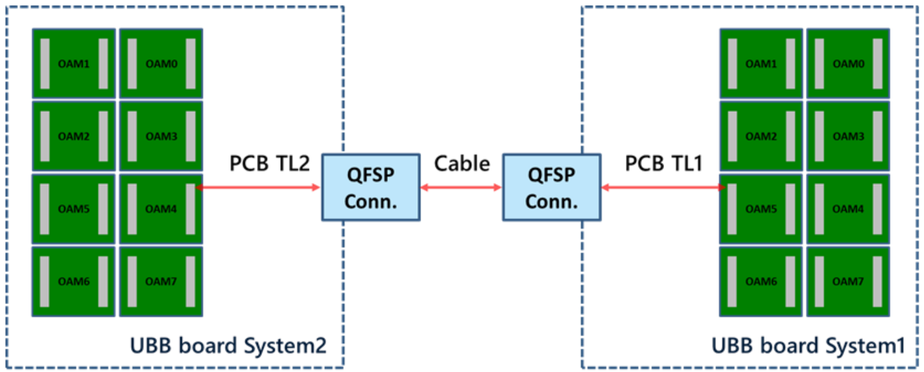


SI Evaluation

OAM on system1 to OAM on system2 Topology

- Loss table

Total loss @ 14GHz	Hyper Ultra Low loss (dB)	Ultra Low loss (dB)	Low loss (dB)
OAM on System1	8	8	8
Via 1	0.5	0.5	0.5
PCB TL1 estimation (5.5”)	4.356	5.269	6.248
Via 2	0.5	0.5	0.5
QFSP-DD Conn. (worst case)	1.5	1.5	1.5
QFSP-DD Cable	0.288	-1.538	-3.496
QFSP-DD Conn. (worst case)	1.5	1.5	1.5
Via 3	0.5	0.5	0.5
PCB TL2 estimation (5.5”)	4.356	5.269	6.248
Via 4	0.5	0.5	0.5
OAM on System2	8	8	8

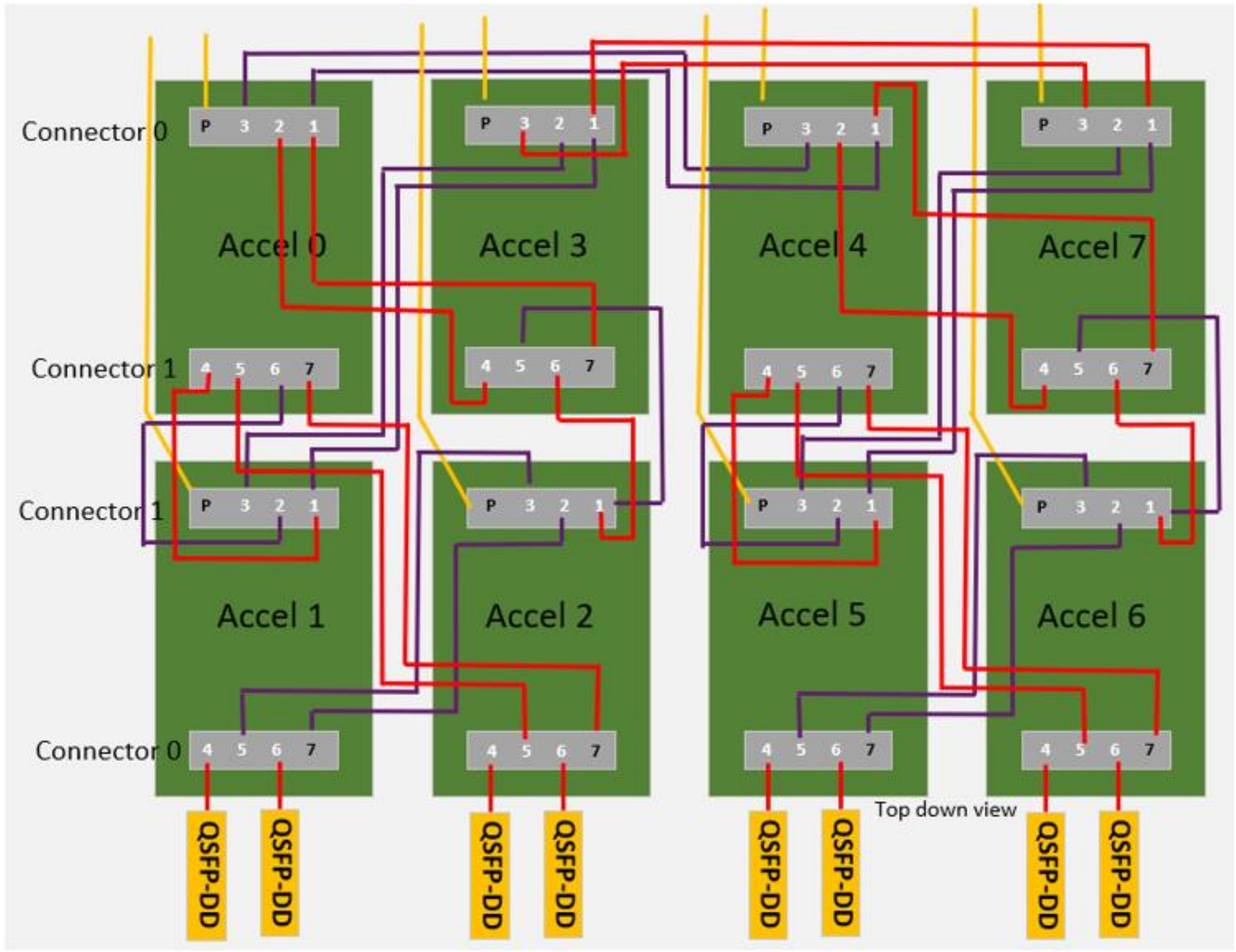


*We only have **0.288 dB** loss margin for cable even we use hyper ultra low loss material.**
We have to use active cable or have re-timers on the UBB.

PS. By JDA decision, will use re-timers on the UBB

SI Evaluation

OAM to OAM (28G SerDes) Topology

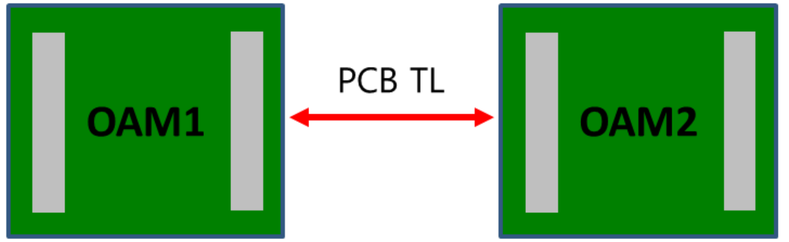


SI Evaluation

OAM to OAM (28G SerDes) Topology

- Loss table

Total loss @ 14GHz	Hyper Ultra Low loss (dB)	Ultra Low loss (dB)	Low loss (dB)
OAM Module 1	8	8	8
Via 1	0.5	0.5	0.5
PCB TL estimation (10.3")	**8.16**	**9.87**	**11.7**
Via 2	0.5	0.5	0.5
OAM Module 2	8	8	8
Total Channel Loss	25.16	26.87	28.7
Spec	30	30	30
Evaluation Result	Low Risk	Low Risk	Margin



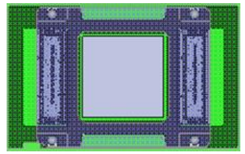
**The estimated PCB TL is ~10.3".
Based on the SI evaluation on the topology (OAM System1 to OAM System2), UBB will use Hyper Low Loss materials PCB.

We only have 13 dB loss margin for routing on PCB.

Acceptable length	Hyper Ultra Low loss (inch)	Ultra Low loss (inch)	Low loss (inch)
PCB TL	16.41	13.57	11.44

SI Evaluation

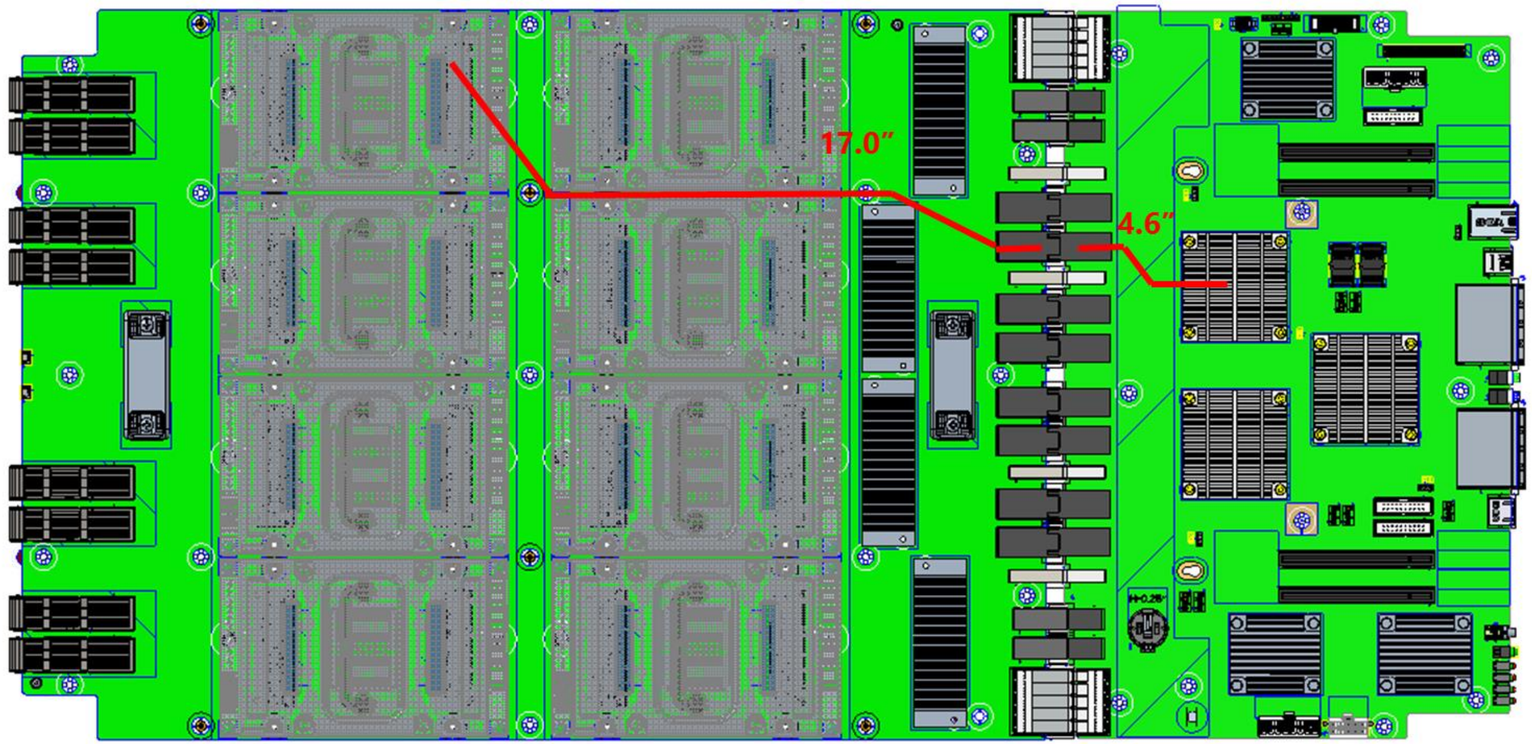
Switch to UBB (OAM) PCIe Gen4 Topology



OAM

Switch

- The worst case length evaluation

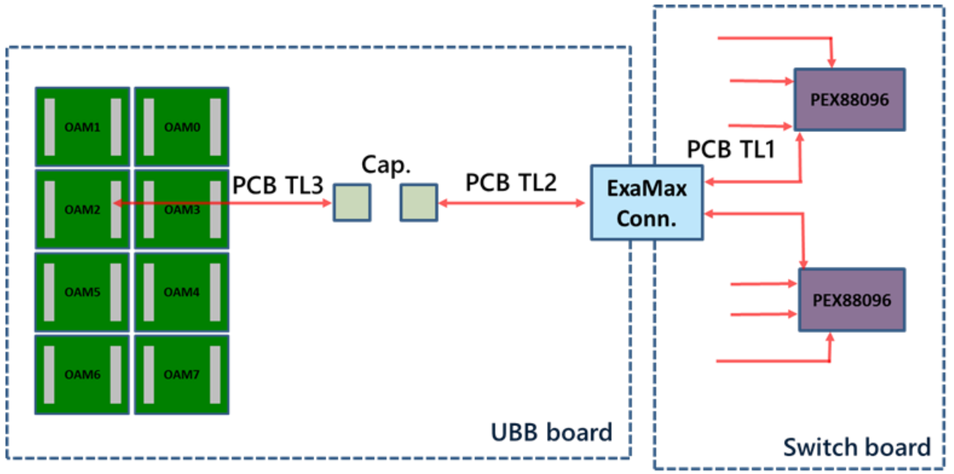


SI Evaluation

Switch to UBB (OAM) PCIe Gen4 Topology

- **Loss table**

Total loss @ 8GHz	Hyper Ultra Low loss (dB)	Ultra Low loss (dB)	Low loss (dB)
PCIe Gen4 Switch (PEX88096)	3	3	3
PCB TL1 estimation (4.6”)	*0.524=2.4104	*0.621=2.8566	*0.741=3.4086
ExaMax Conn.	1	1	1
PCB TL2+TL3 estimation (17”)	*0.516=8.772	*0.607=10.319	*0.725=12.325
Cap. loss	0.5	0.5	0.5
Total Via loss (<25mils stub)	6*0.27=1.62	6*0.27=1.62	6*0.27=1.62
OAM	5	5	5
Total Topology loss	22.3024	24.2956	26.8536
PEX88096 Spec.	28	28	28
Evaluation Result	Low risk	Low risk	Mid. risk



It is Low risk for this topology, if we use Ultra Low Loss Materials for Switch PCB.

PS. UBB will use Hyper Low Loss materials PCB.