

EPIC Endcap TOF Layout

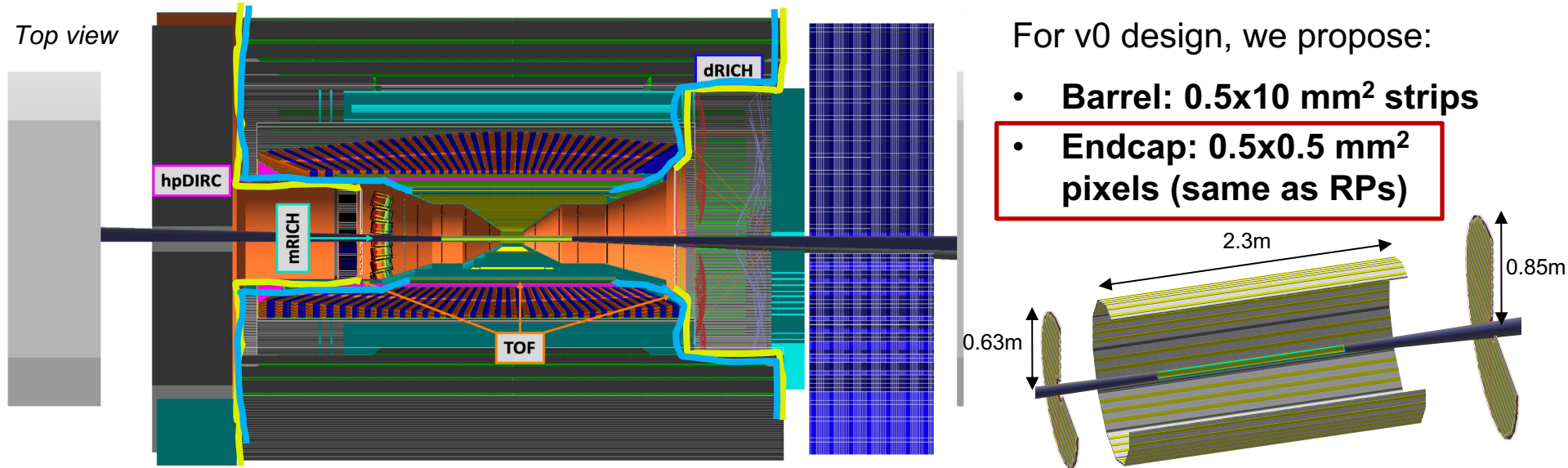
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EPIC TOF-PID WG meeting
August 29, 2022

Introduction

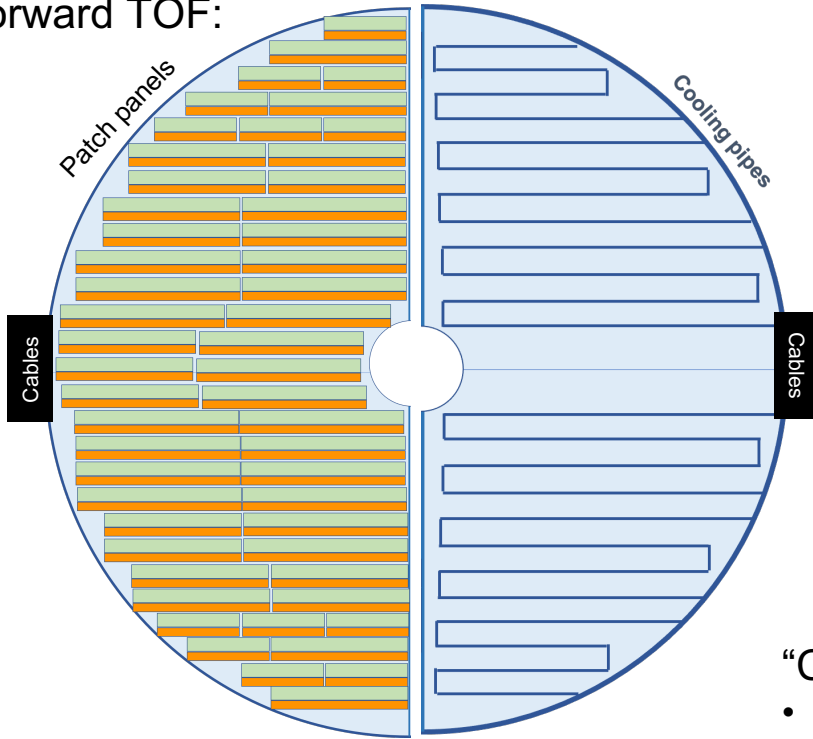
The goal is to conceive a reference layout and technical design (v0) as inputs to GD/I group to advance the detector integration (service routing etc.)

However, there are still going studies to investigate the optimal pixel granularity based on physics performance so by no means this is a proposal for final design

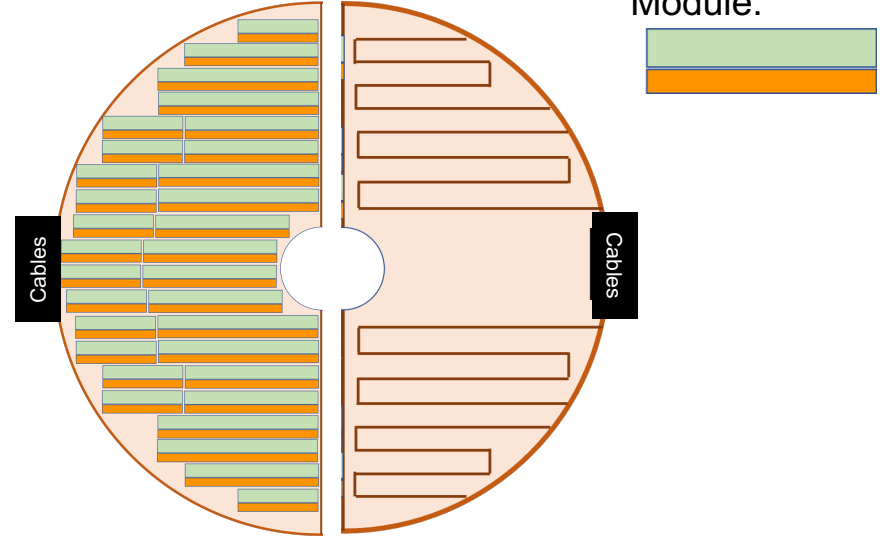


ETOF Layout

Forward TOF:



Backward TOF:



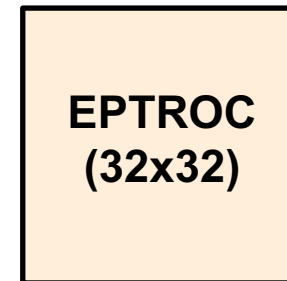
“Clam shells” or DEEs:

- Convenient for installation/maintenance
- Each is patched by TOF modules (one or more types) on both faces

Sensors, ASICs and Service Hybrids

Sensors:

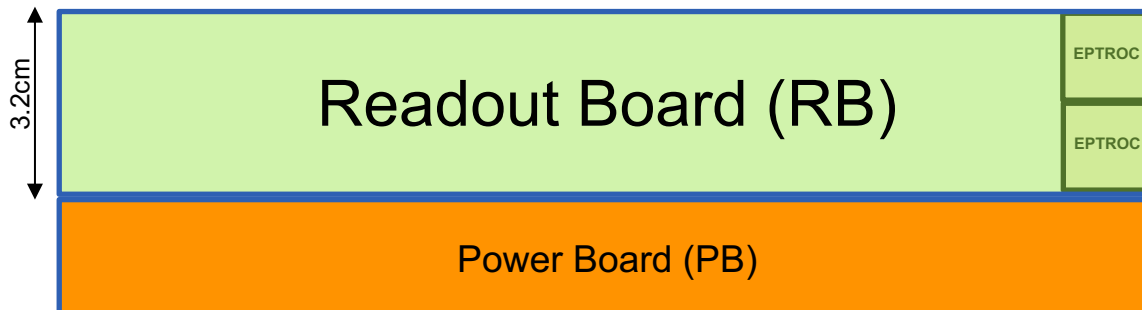
- Each sensor is a matrix of $0.5 \times 0.5 \text{ mm}^2$ pitch pixels
- In general, larger sensors are preferred to maximize active area but also have to consider yields etc. in fabrication
- **Each sensor is assumed to be 32x32 pixels or $1.6 \times 1.6 \text{ cm}^2$**



ASICs:

- Match the sensor pixelization and size and bump bonded to the sensor

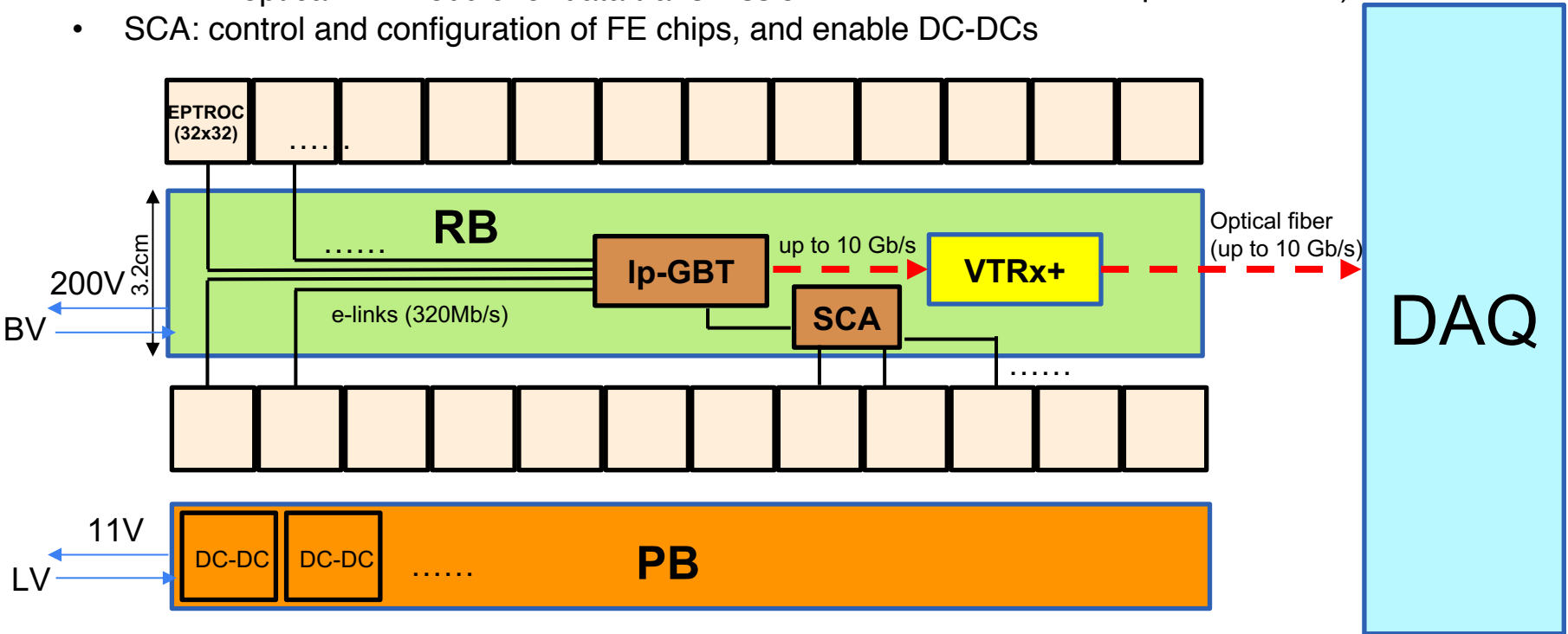
Service Hybrids: situated **on top of sensor+ASICs** provide power and readout services to the modules via flex circuit connectors



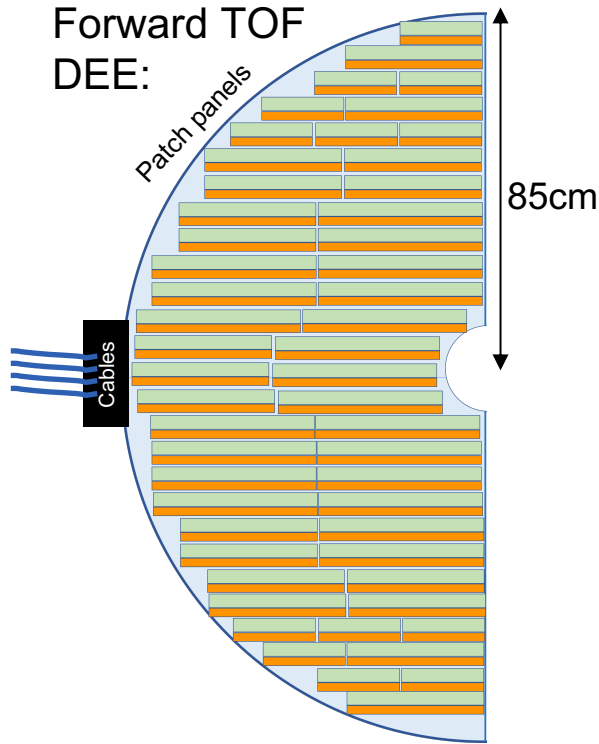
Service Hybrids

Each service hybrid will serve a number of EPTROCs

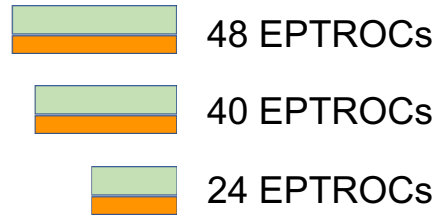
- Ip-GBT: low power gigabit transceiver (CERN chips or EIC equivalent ones)
- VTRx+: optical link module for data transmission (CERN chips or EIC equivalent ones)
- SCA: control and configuration of FE chips, and enable DC-DCs



ETOF Layout



3 types of modules to tile the full DEE:

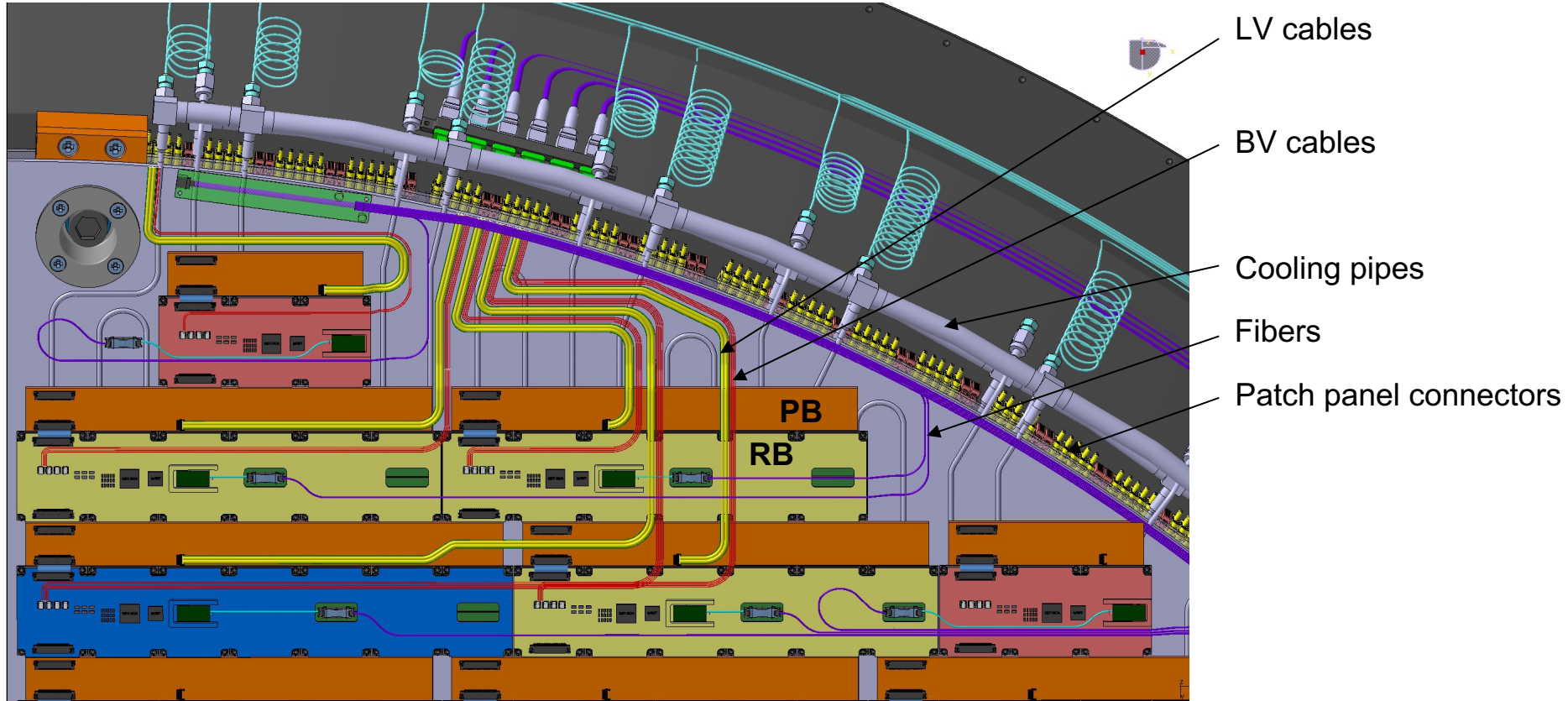


For each module:

- 1 fiber to DAQ
- 2 LV cables (1 supply, 1 return)
- 2 BV cables (1 supply, 1 return)

	Forward	Backward
Sensors/ASICs	4352	2304
LV cables	424	248
HV cables	424	248
Fibers	212	124

Service routing in CMS ETL

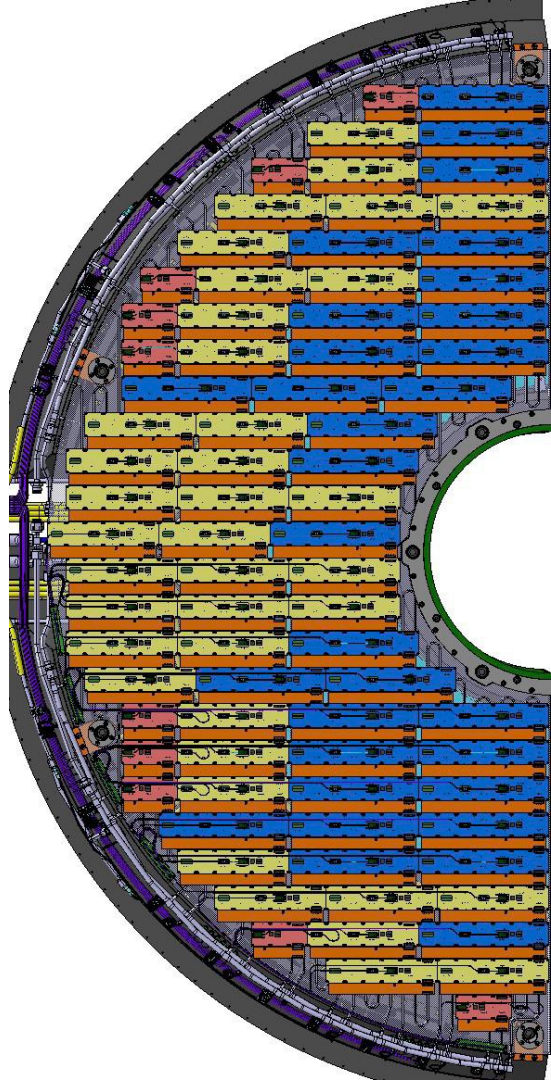


ETOOF Power budget

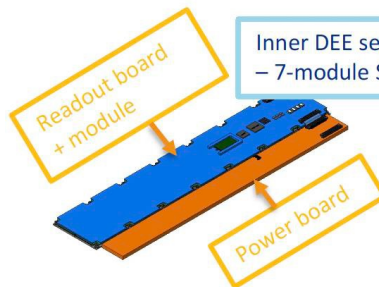
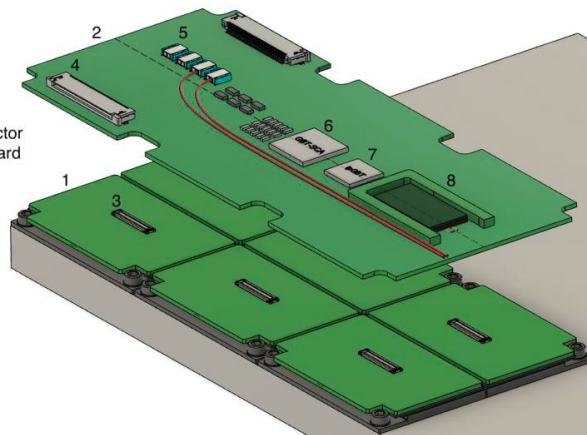
	Forward	Backward
Sensors	0.6kW	0.35kW
EPTROC	8.5kW (17kW)	4.8kW (9.6kW)
DC-DC	3.5kW	2kW
IpGBT, VTRx+, SCA	0.5kW	0.3kW
Power cables	0.5kW	0.3kW
Total	13.6kW (22.1kW)	7.75 (12.55kW)

Backups

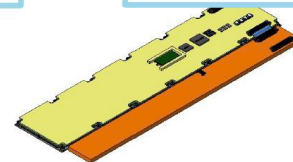
CMS ETL Layout



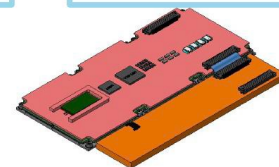
- 1: Flipped module
- 2: Readout board
- 3: Board-to-board connector
- 4: Connector to powerboard
- 5: BV connector
- 6: GBT-SCA
- 7: IpGBT
- 8: VTRx+



Inner DEE section
- 7-module SH



Middle DEE section
- 6-module SH



Outer DEE section
- 3-module SH

CMS ETL Layout

