

VTRx+ needs for SVT

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VTRx+ needs for SVT

Brings together material from multiple previous meetings, in particular:

- August 8 SVT meeting - P. Jones, “Update on outer barrel and endcaps (disks) tiling study”, <https://indico.bnl.gov/event/20219/>
- August 22 SVT meeting - P. Jones, “ Update on outer barrel and endcaps (disks) tiling study”, <https://indico.bnl.gov/event/20336/>
- August 22 SVT meeting - E. Sichtermann, “Update on disks and tiling”, <https://indico.bnl.gov/event/20336/>
- November 14 SVT meeting - J. Schambach, “SVT Readout”, <https://indico.bnl.gov/event/21207/>
- November 28 SVT meeting - J. Glover, “Outer Barrel Layout Considerations”, <https://indico.bnl.gov/event/21355/>
- November 28 SVT meeting - E. Sichtermann, “Update on disks”, <https://indico.bnl.gov/event/21355/>

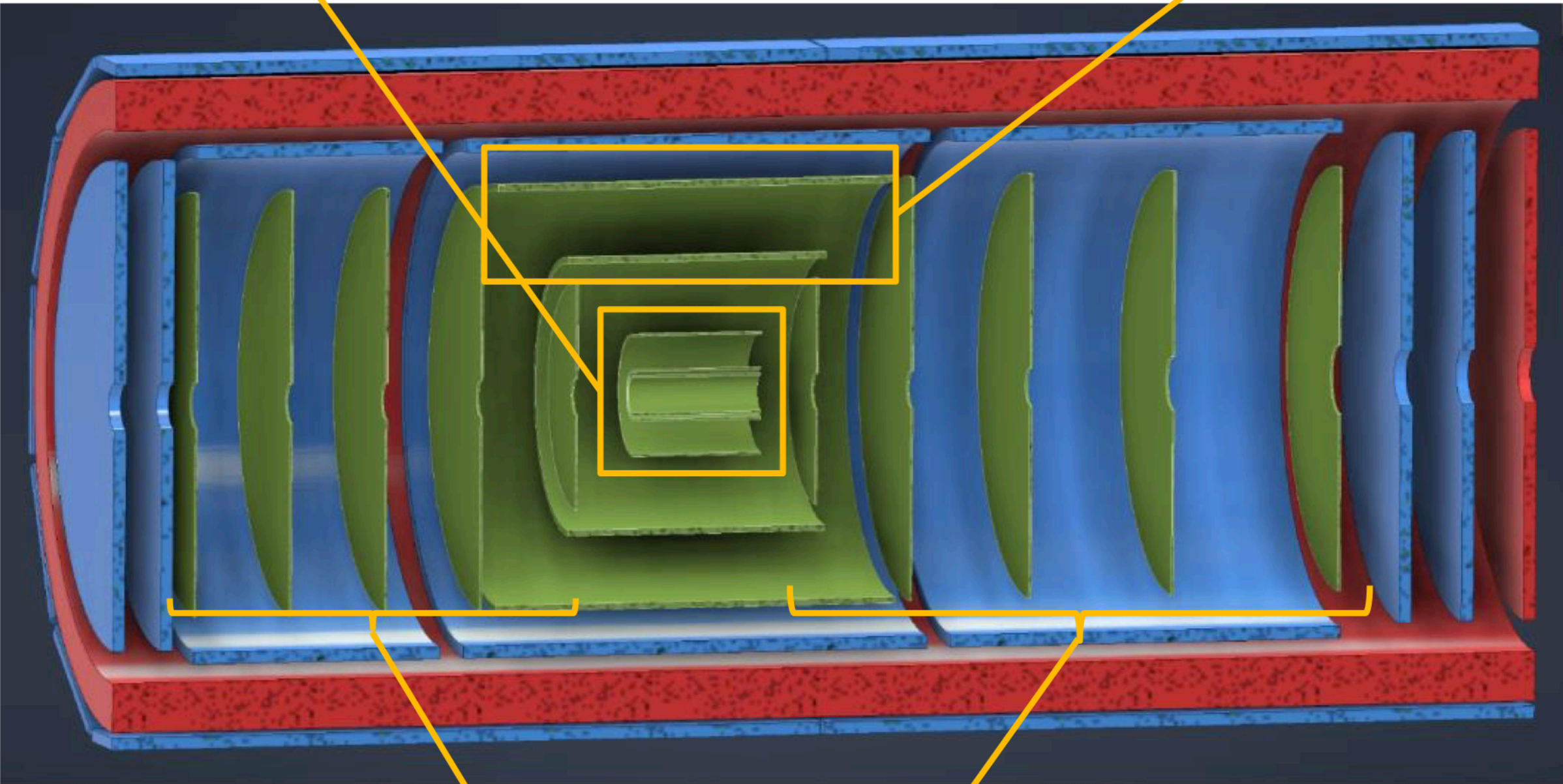
The short version:

- Readout VTRx+:
 - IB: $136 = 24 (L0) + 32 (L1) + 80 (L2)$
 - OB: $440 = 144 (L3) + 296 (L4)$
 - EE: $410 = 26 (EE0) + 4 \times 96 (EE1 - 4)$
 - HE: $410 = 26 (HE0) + 4 \times 96 (HE1 - 4)$
- Slow control IpGBT + VTRx+:
 - IB: $24 = 4 (L0) + 6 (L1) + 14 (L2)$
 - OB: $55 = 18 (L3) + 37 (L4)$
 - EE: $52 = 4 (EE0) + 4 \times 12 (EE1 - 4)$
 - HE: $52 = 4 (HE0) + 4 \times 12 (HE1 - 4)$

SVT Reminder

Inner Barrel (IB)
3 curved layers

Outer Barrel (OB)
2 stave-based layers



Inner Barrel (IB) will use ITS3 sensor

Outer Barrel (OB) will use EIC Large Area Sensor (LAS)

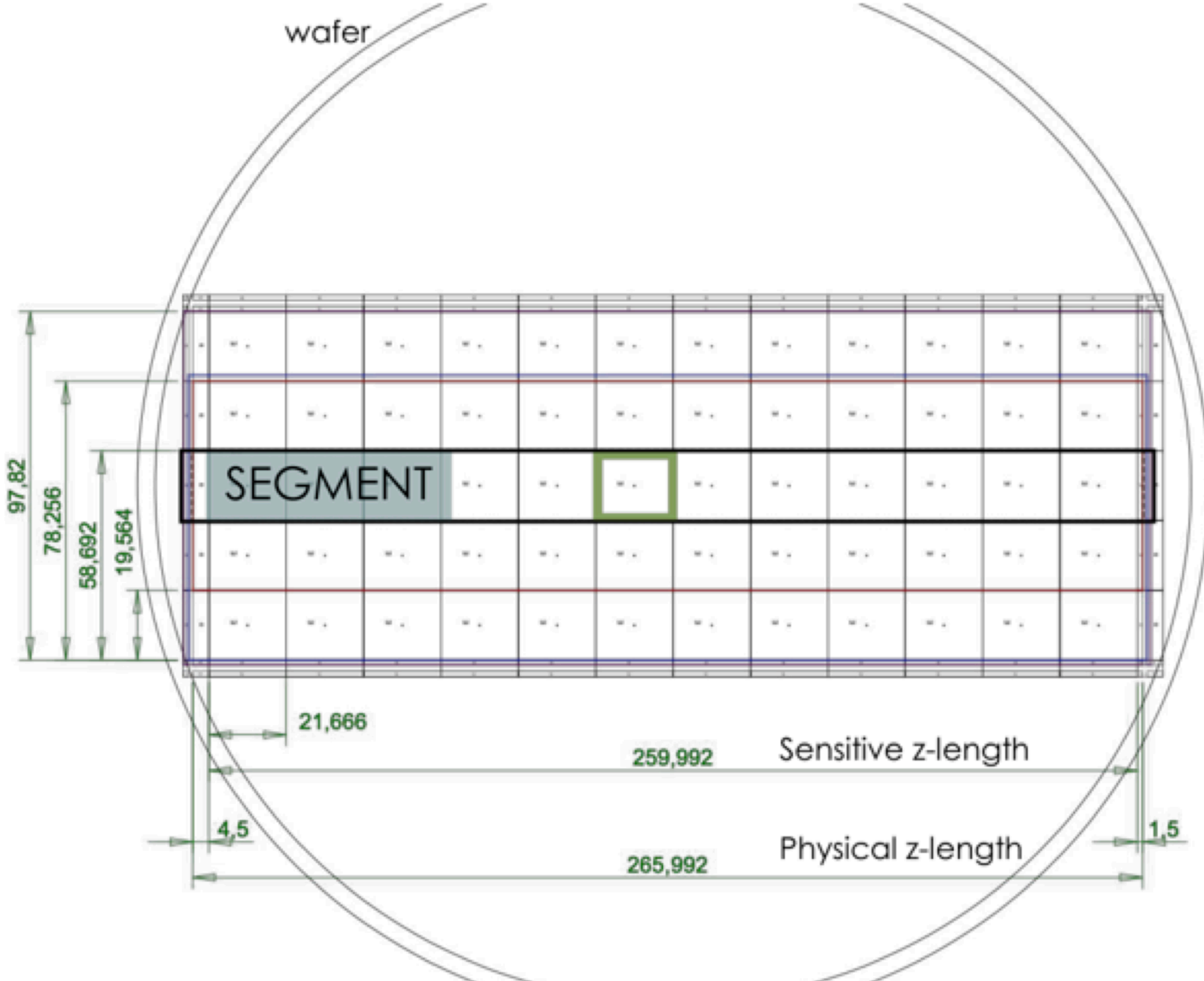
Disks (EE, HE) will use EIC LAS

SVT MPGDs ToF (fiducial volume)

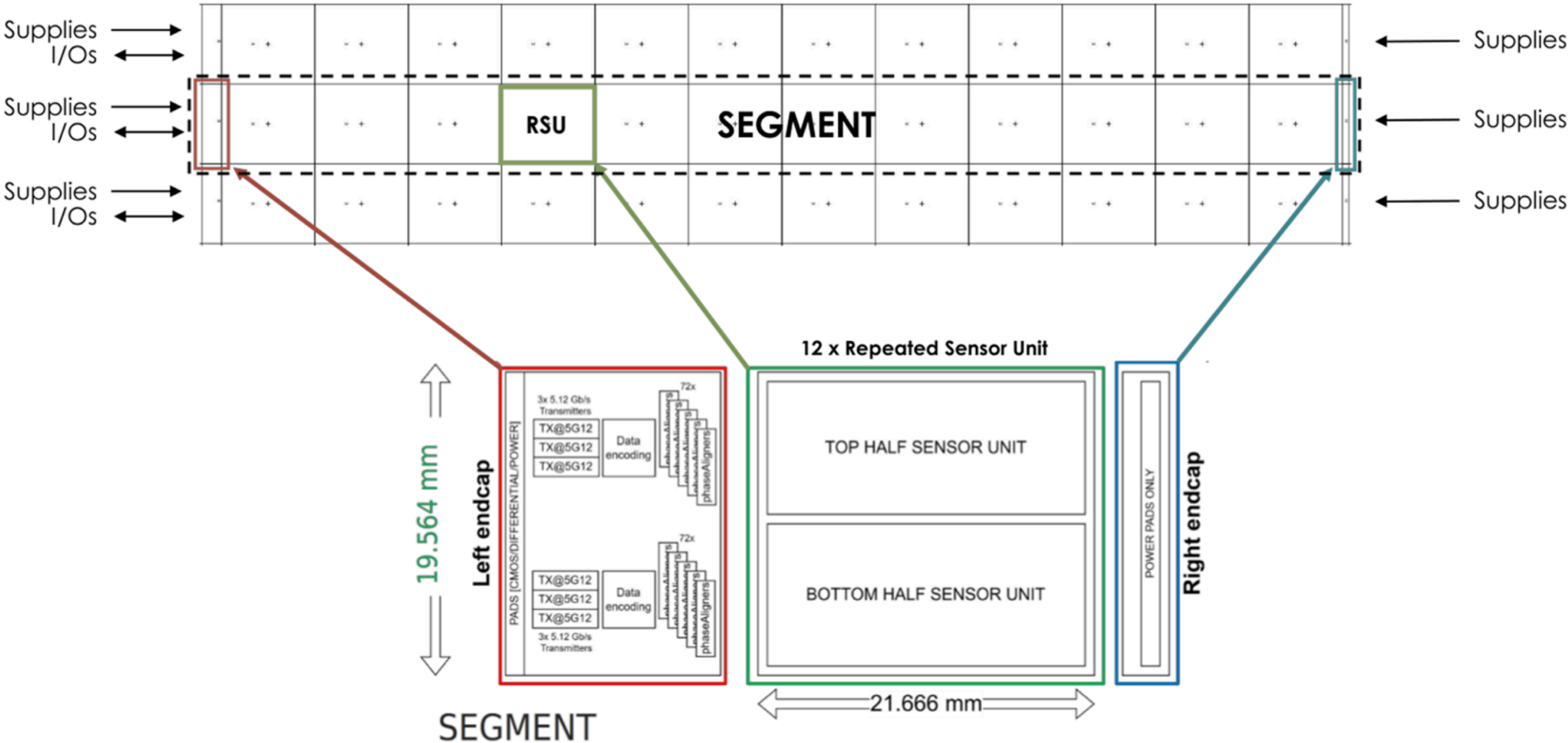
Electron/Hadron Endcaps (EE, HE)
5 disks on either side of the IP

SVT Sensor Reminder (IB)

- Layer 0: 12 x 3 repeated units+endcaps
- Layer 1: 12 x 4 repeated units+endcaps
- Layer 2: 12 x 5 repeated units+endcaps

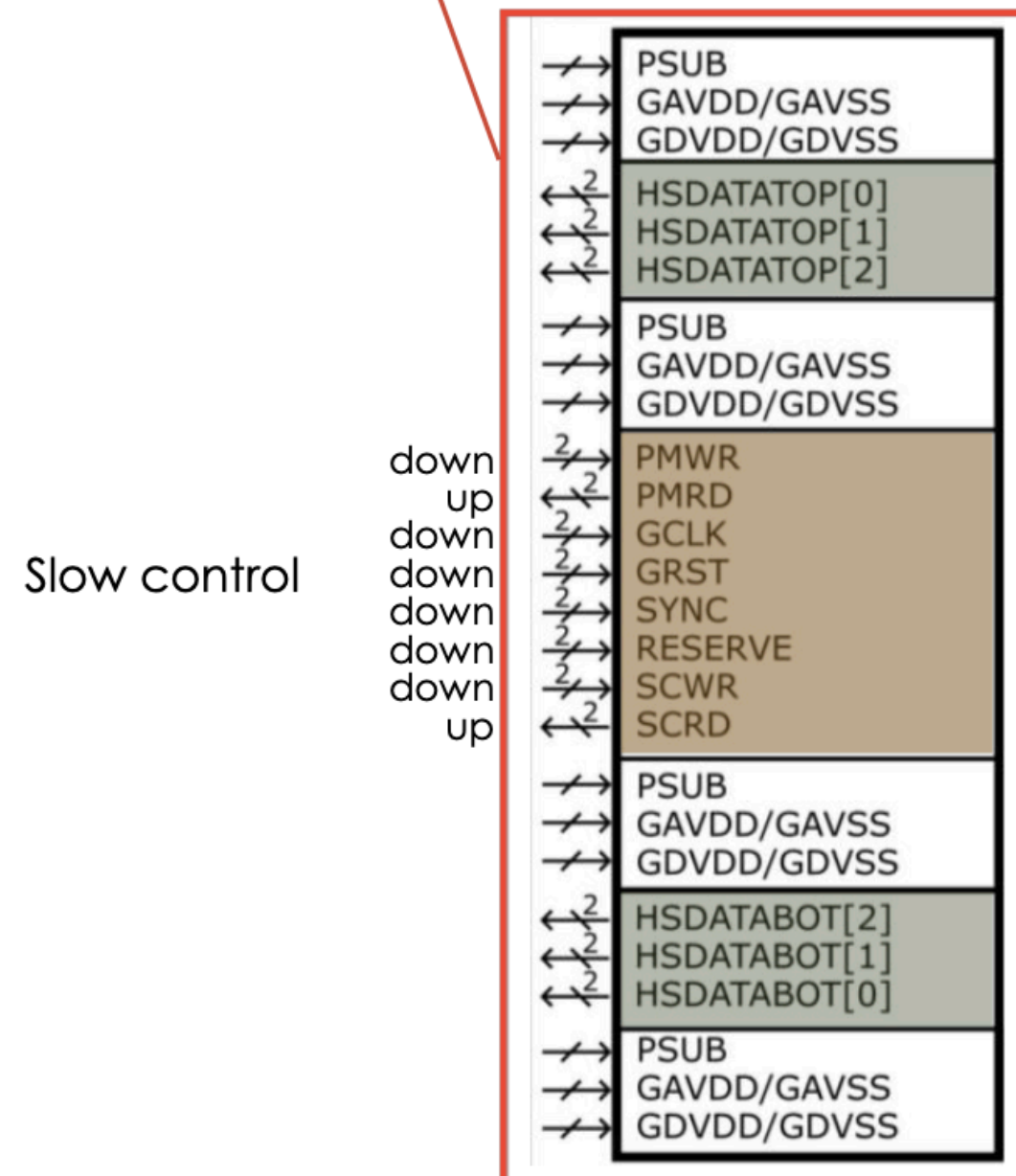
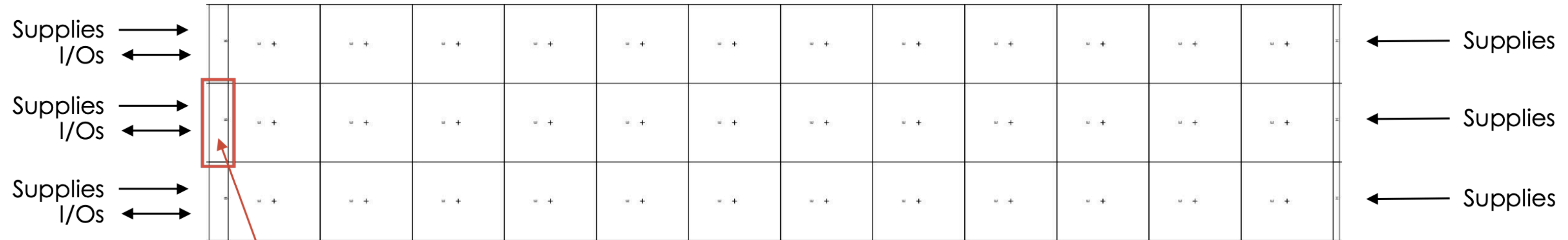


SVT Sensor Reminder (IB)



I/O is indeed uniquely about the “left endcap” (main periphery)

SVT Sensor Reminder (IB)



All I/Os are differential

6x 5.12 Gb/s **data** outputs

1x **clock** at 160 MHz (possibly 320 MHz?)

2x **slow control** at 5 Mbps (possibly 10 Mbps?)

(slow controls via IpGBT: 1 clk, 4 elink down, 2 elink up, 1 spare)

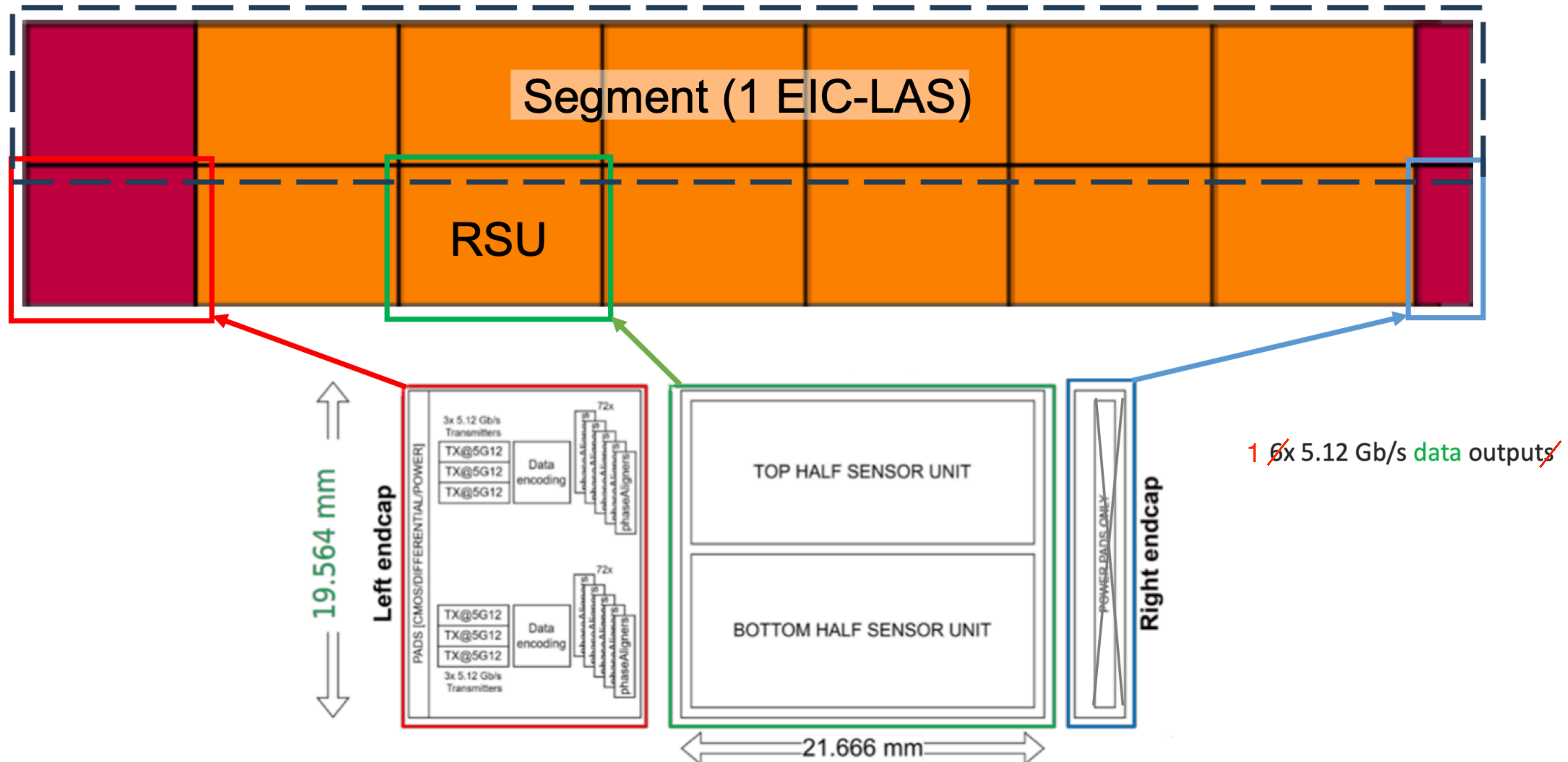
Global analog and digital supplies per *segment*

On-chip supply segmentation and control

Reverse biasing of substrate (PSUB)

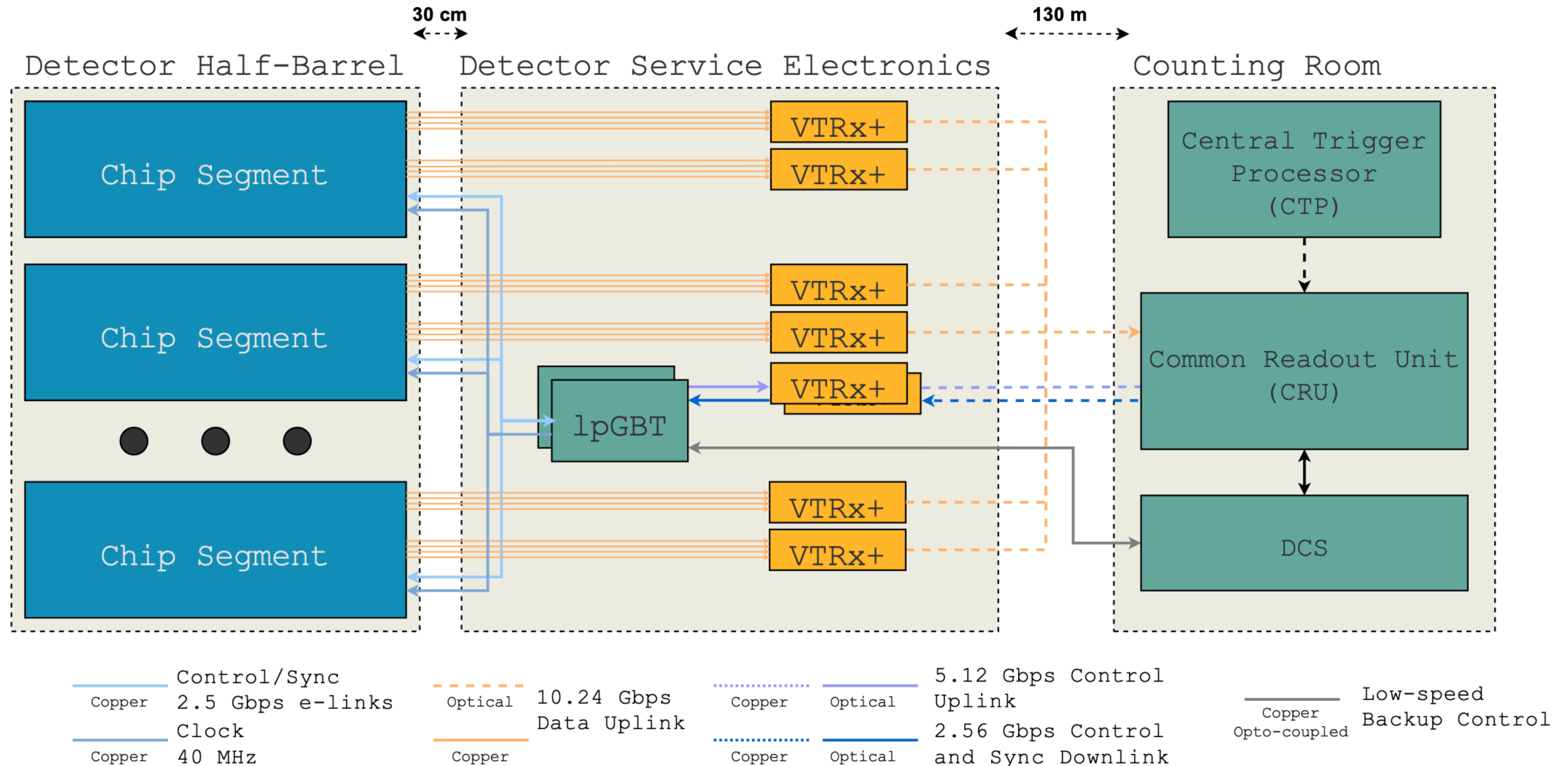
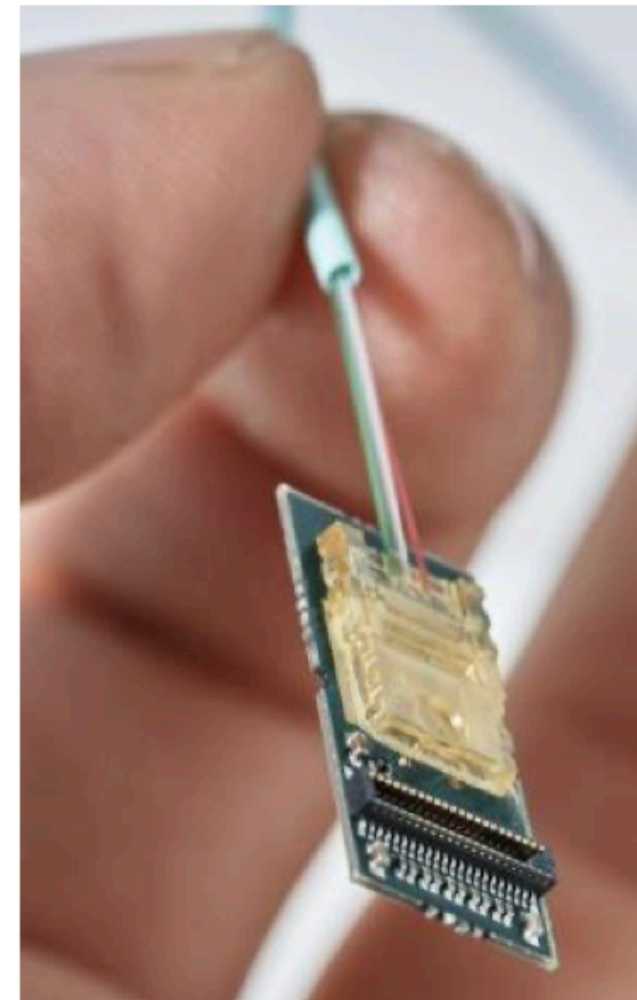
I/O is indeed uniquely about the “left endcap” (main periphery)

SVT Sensor Reminder (OB, EE, HE)



Studies so far point to optimal EIC-LAS having 5 or 6 RSUs

SVT Readout Reminder

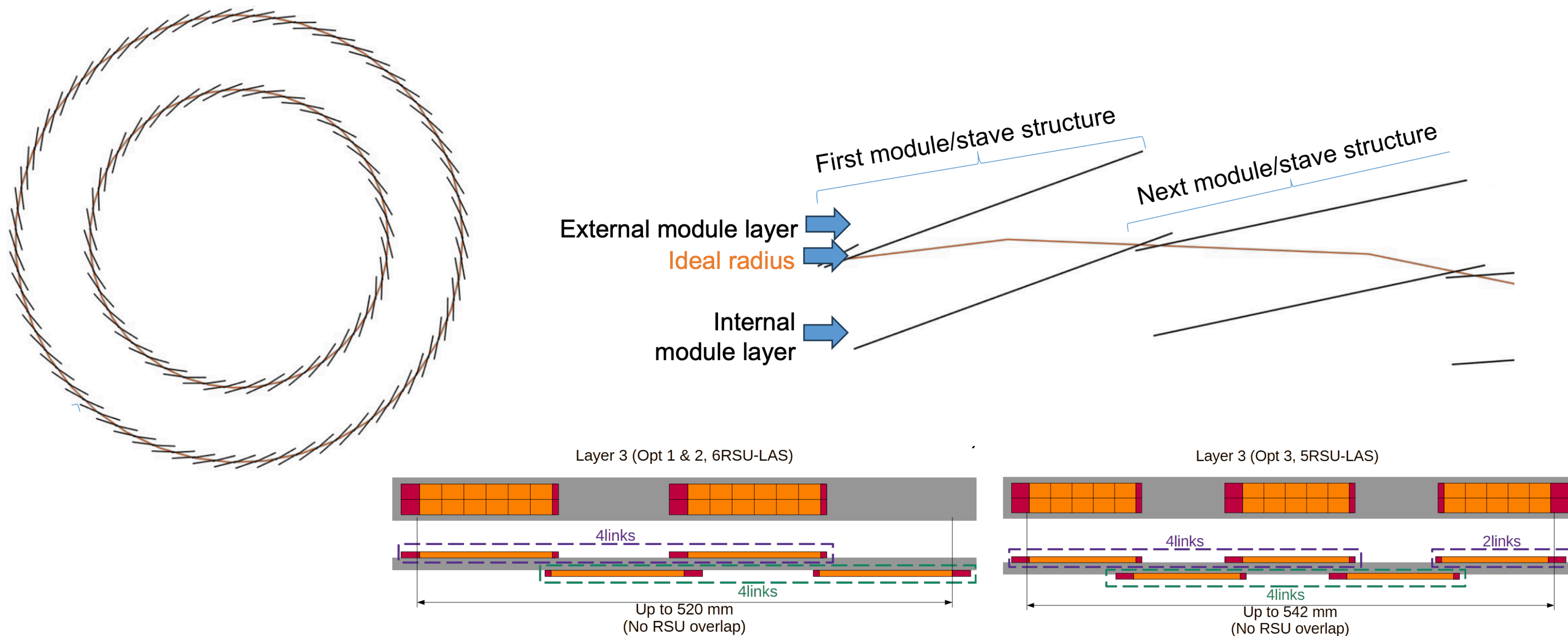


Note: this drawing is for the ITS3 – we plan to use a similar readout architecture adapted to the SVT

IB: 2 VTRx+ per segment for data – 136 = 24 (L0) + 32 (L1) + 80 (L2)

OB, EE, HE: 1 VTRx+ per *up to* 4 segments for data

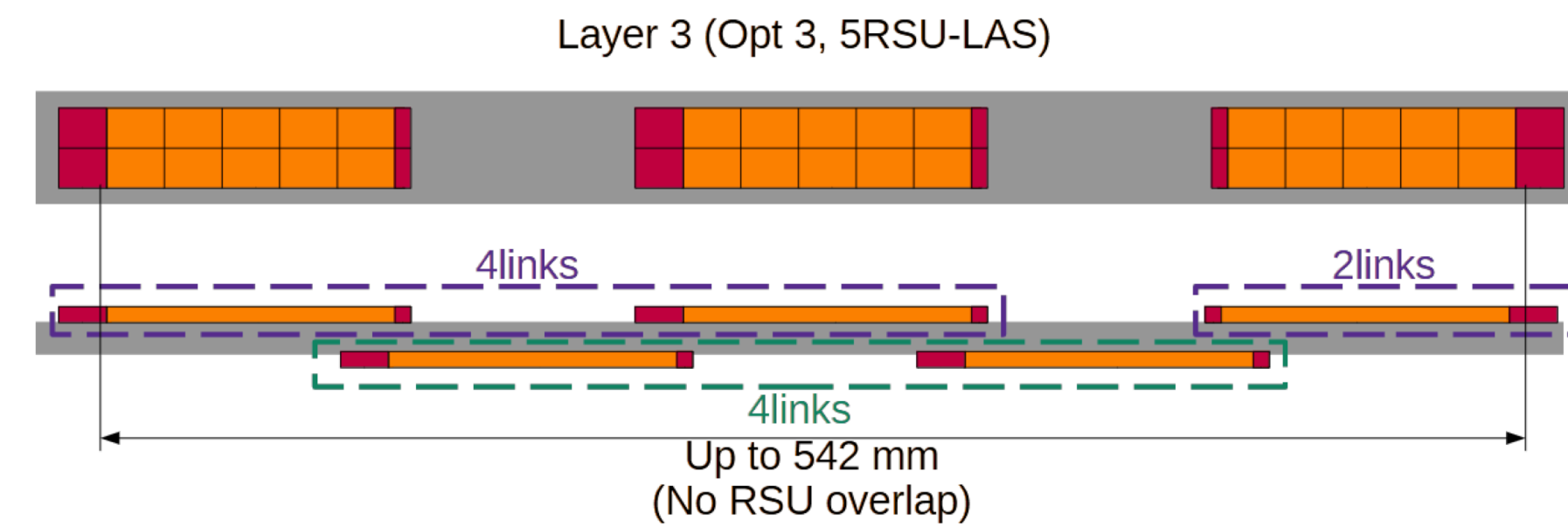
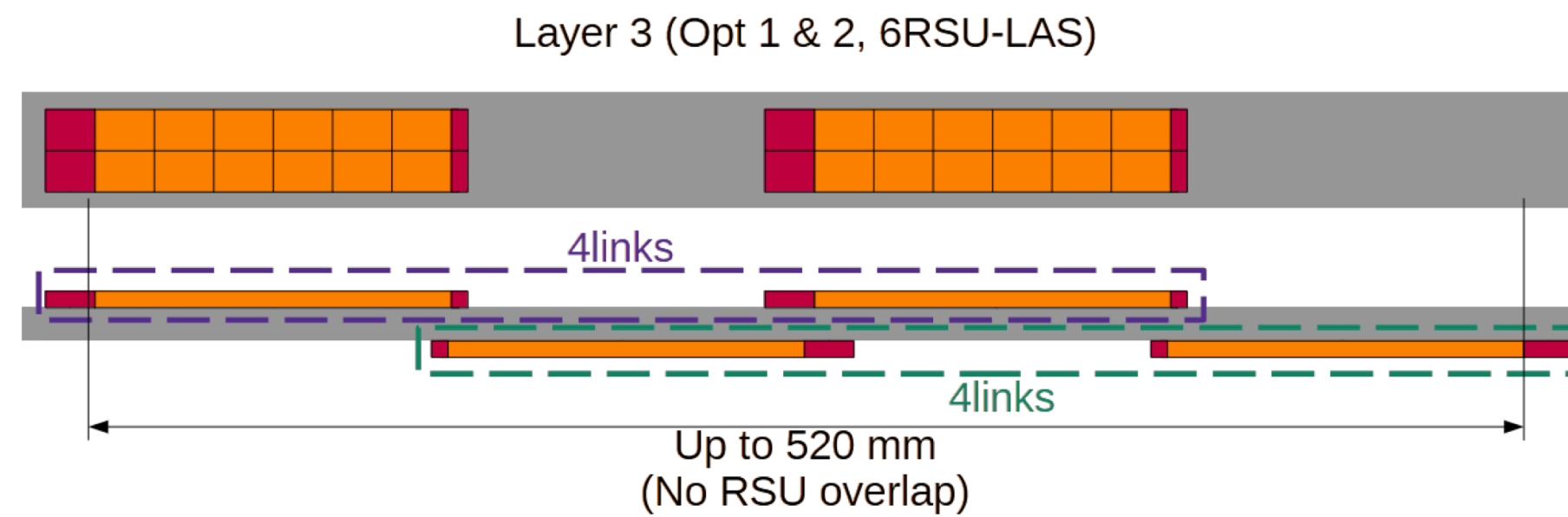
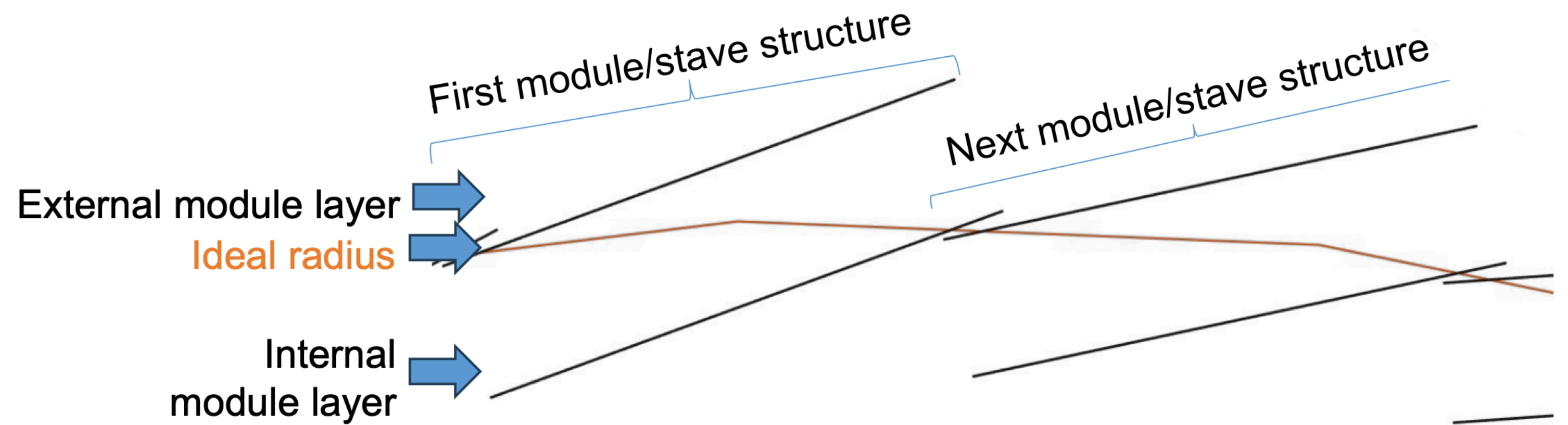
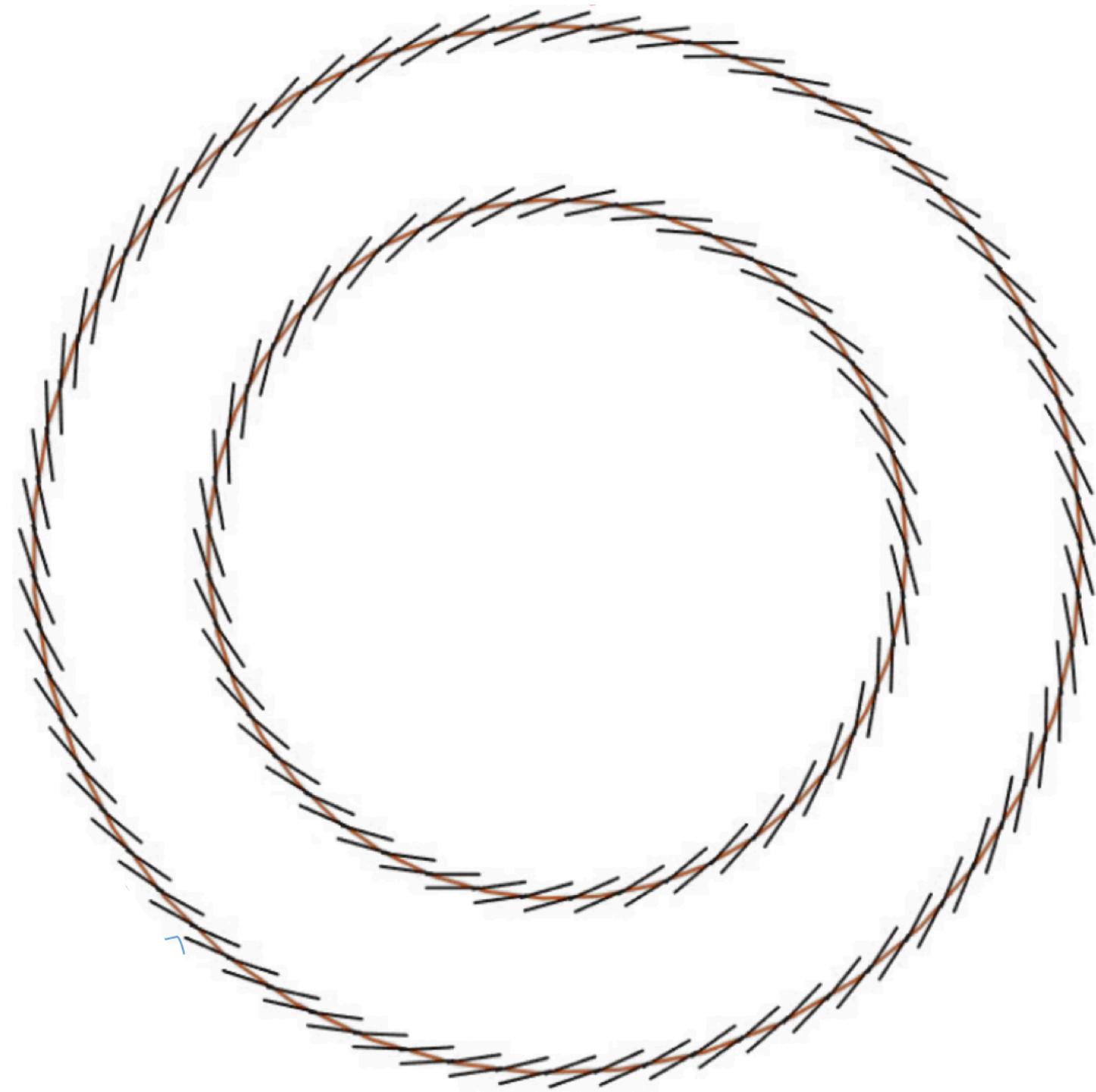
SVT OB Reminder



OB has a turbine-wheel structure with staves that are 2 segments wide and have sensors on both sides of the stave, 5 and 6 RSU variants of EIC LAS considered, as well as minor variants of overall geometry,

VTRx+ for data are then counted assuming they are associated with one and only one stave - use conservative value. 9

SVT OB Reminder

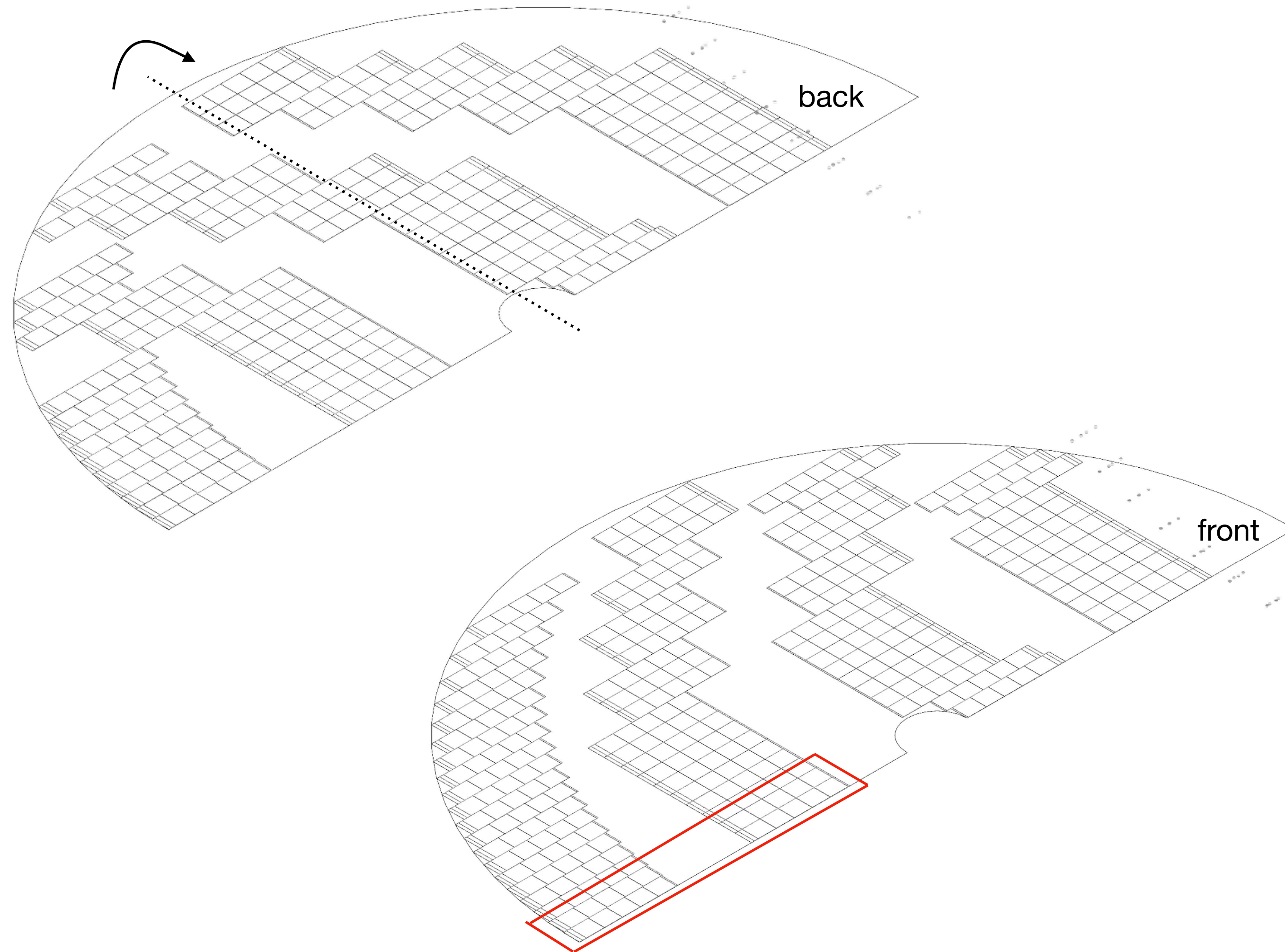


L3: 48 staves with 480 5-RSU EIC LAS — 144 VTRx+ needed for data

L4: 74 staves with 1184 5-RSU EIC LAS — 296 VTRx+ needed for data

SVT EE, HE Reminder

ED1, HD1 — “large disk”



**Tiling is intricate; simple model illustrated on the left,
Alternative(s) under consideration, allowing for better
sensor overlap (length axis)**

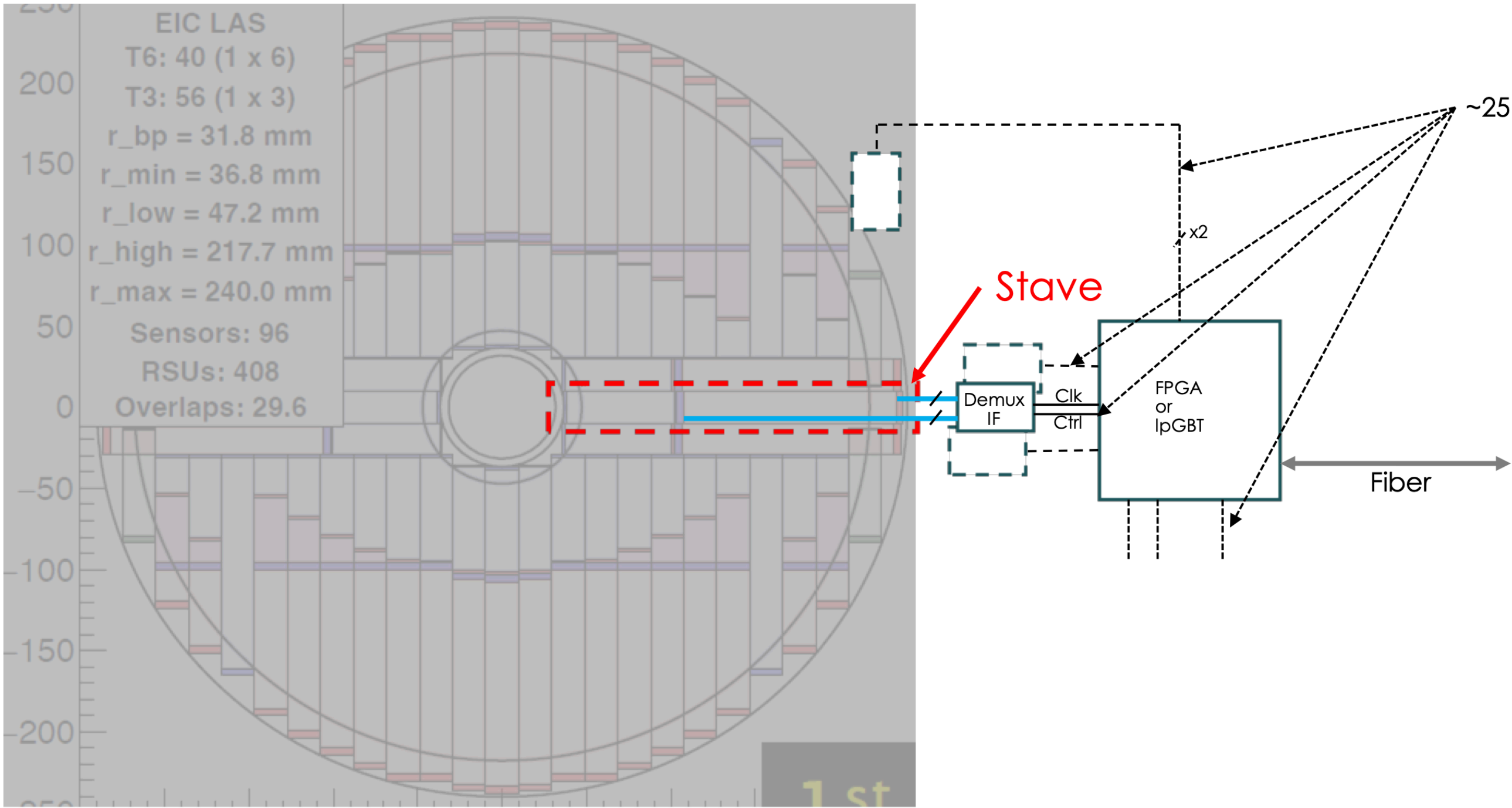
5 and 6 RSU variants of EIC LAS considered,

Stave-like structures apparent in most tiling variants,

**Up to 52 single-wide stavelets in the innermost disks,
26 VTRx+ for readout**

**Up to 192 single-wide stavelets in each of the large disks,
96 VTRx+ for readout**

SVT Slow Control Thoughts



Number of slow-control lines in ITS3 is quite sizable (slide 6) and does not scale well to SVT,

Consider a form of multiplexing; thoughts go to a solution where 1 IpGBT+VTRx+ handles (up to) 8 stave(-lets) in the OB, EE, HE,

The data rate of the slow-control lines is Mbps, so that the ~30 cm length constraint on Gbps data lines (slide 8) can be relaxed.

It may thus also be possible to drive out these lines to a low-radiation area and use commercial components.

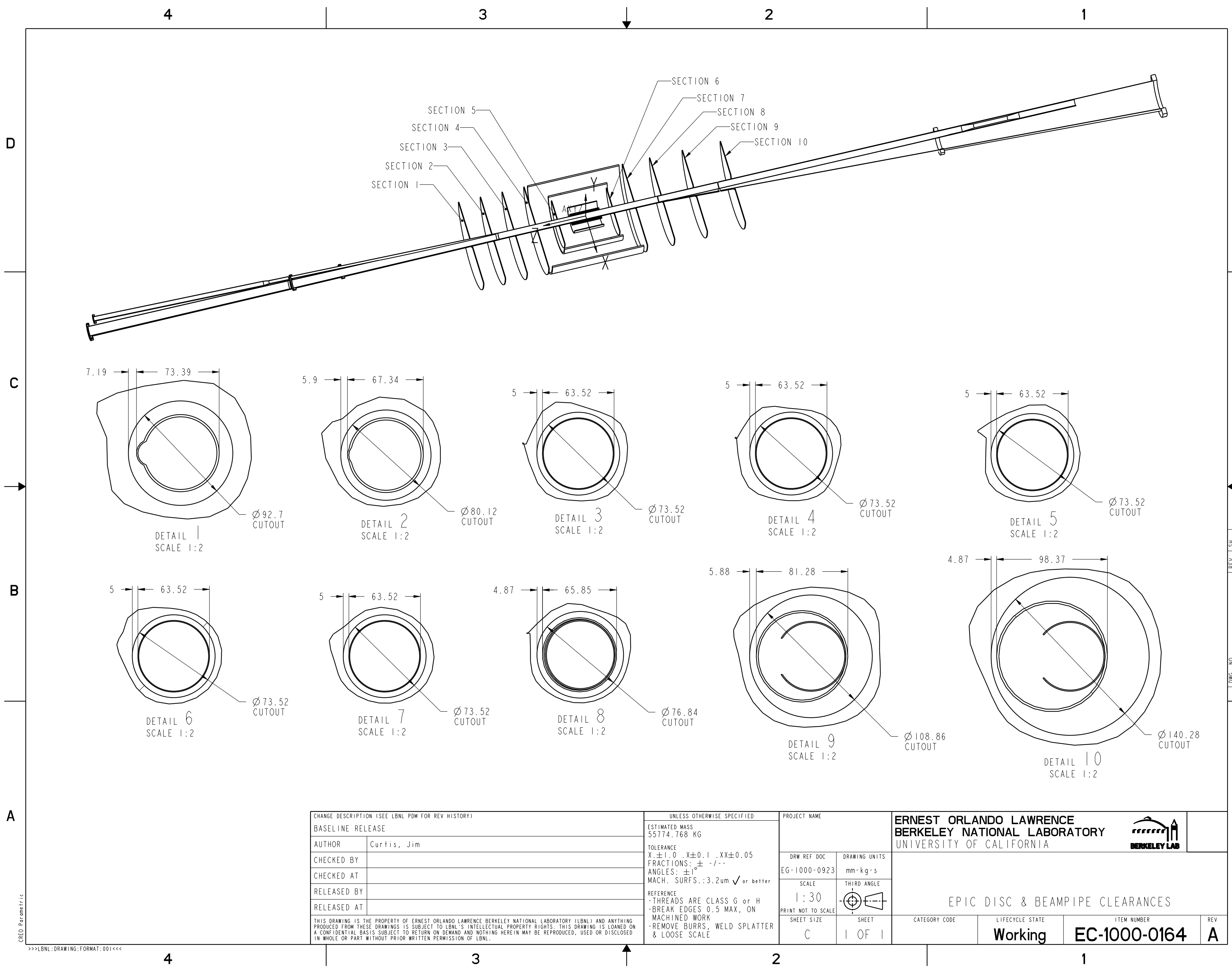
SVT VTRx+ and (external) IpGBT

Before spares and R&D needs, the estimated VTRx+ needs are thus:

- Readout VTRx+:
 - IB: $136 = 24 (L0) + 32 (L1) + 80 (L2)$
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 - HE: $52 = 4 (HE0) + 4 \times 12 (HE1 - 4)$
- Total VTRx+: 1579
- Total IpGBT: 183

With a 20—25% spares and a small number for R&D, this rounds to 2,000 VTRx+ and 230 IpGBT.

The readout VTRx+ will all be located close to the stave or disk ends; desired pig-tail lengths would derive from this and the desired transition point(s).



CREO Parametric

>>>LBNL: DRAWING: FORMAT: 001<<<

CHANGE DESCRIPTION (SEE LBNL PDM FOR REV HISTORY)	
BASELINE RELEASE	
AUTHOR	Curtis, Jim
CHECKED BY	
CHECKED AT	
RELEASED BY	
RELEASED AT	

UNLESS OTHERWISE SPECIFIED	
ESTIMATED MASS 55774.768 KG	
TOLERANCE X: ±1.0 .X±0.1 .XX±0.05	
FRACTIONS: ± -/ -	
ANGLES: ±1°	
MACH. SURFS.: 3.2um ✓ or better	
REFERENCE - THREADS ARE CLASS G or H - BREAK EDGES 0.5 MAX, ON MACHINED WORK - REMOVE BURRS, WELD SPLATTER & LOOSE SCALE	

PROJECT NAME	
ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY UNIVERSITY OF CALIFORNIA	
DRW REF DOC	DRAWING UNITS
EG-1000-0923	mm-kg-s
SCALE	THIRD ANGLE
1:30	
PRINT NOT TO SCALE	
SHEET SIZE	SHEET
C	1 OF 1

ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY
UNIVERSITY OF CALIFORNIA

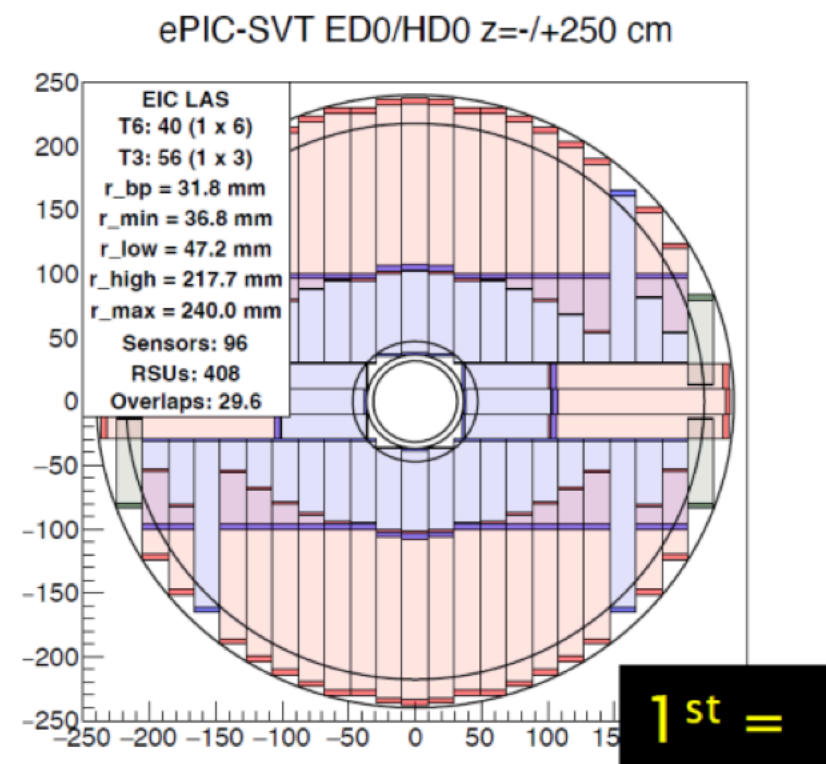


EPIC DISC & BEAMPIPE CLEARANCES

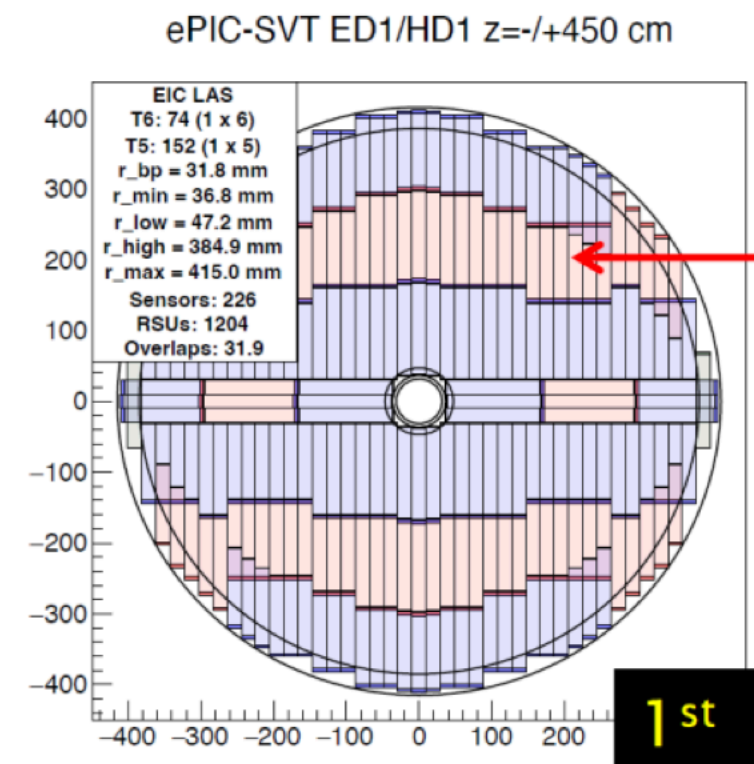
CATEGORY CODE	LIFECYCLE STATE	ITEM NUMBER	REV
	Working	EC-1000-0164	A

DWG. NO. EC-1000-0164 REV. 1 SH. A 1

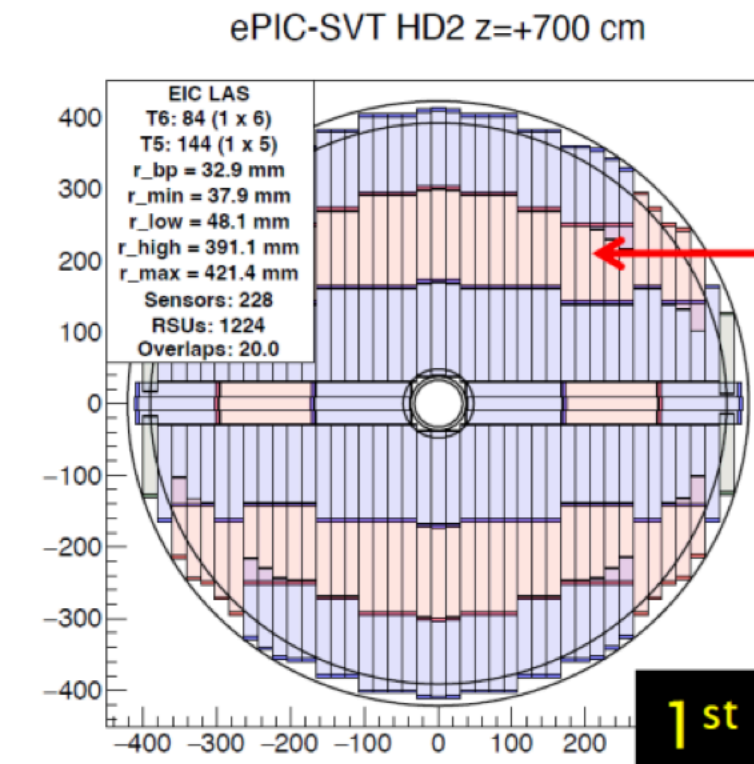
Disk staves



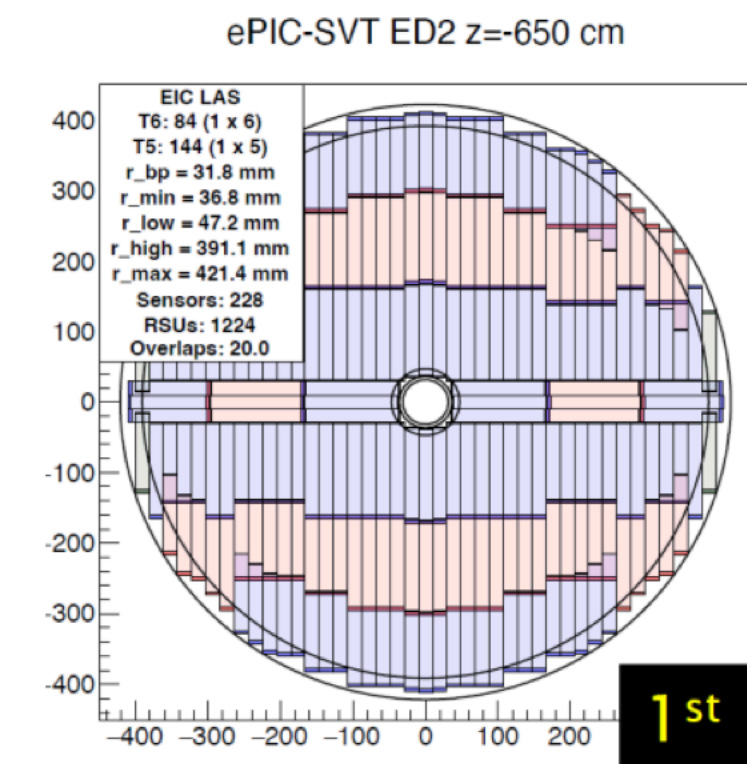
52 stave



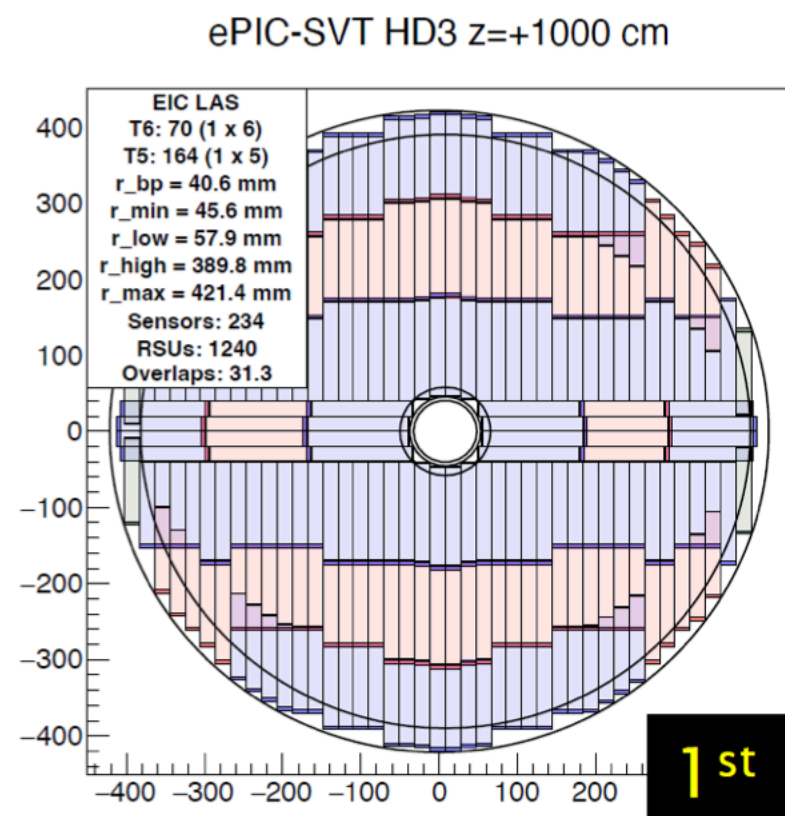
86 stave



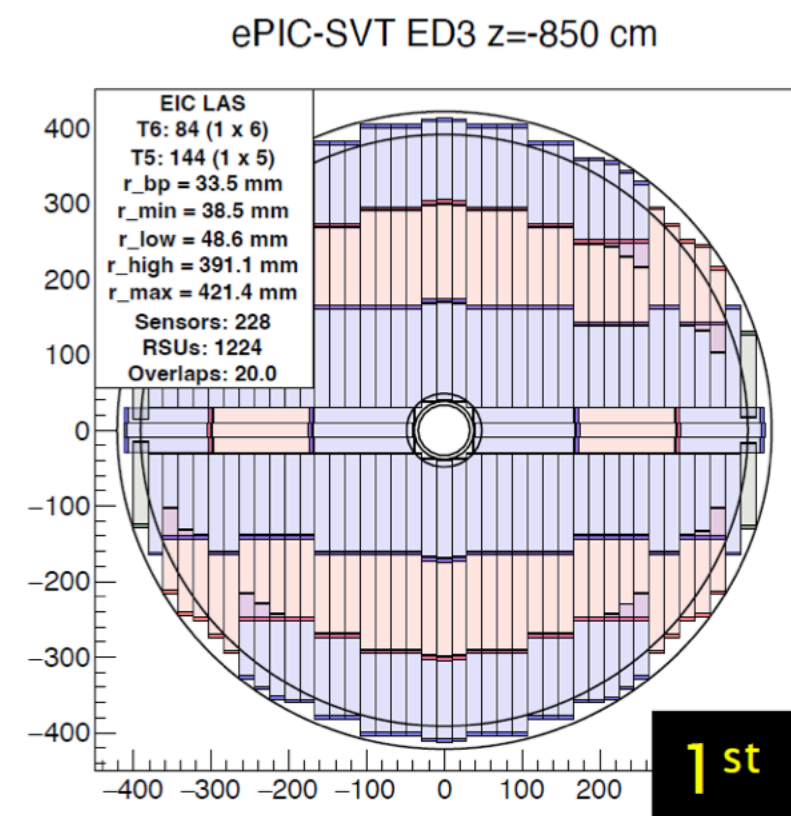
88 stave



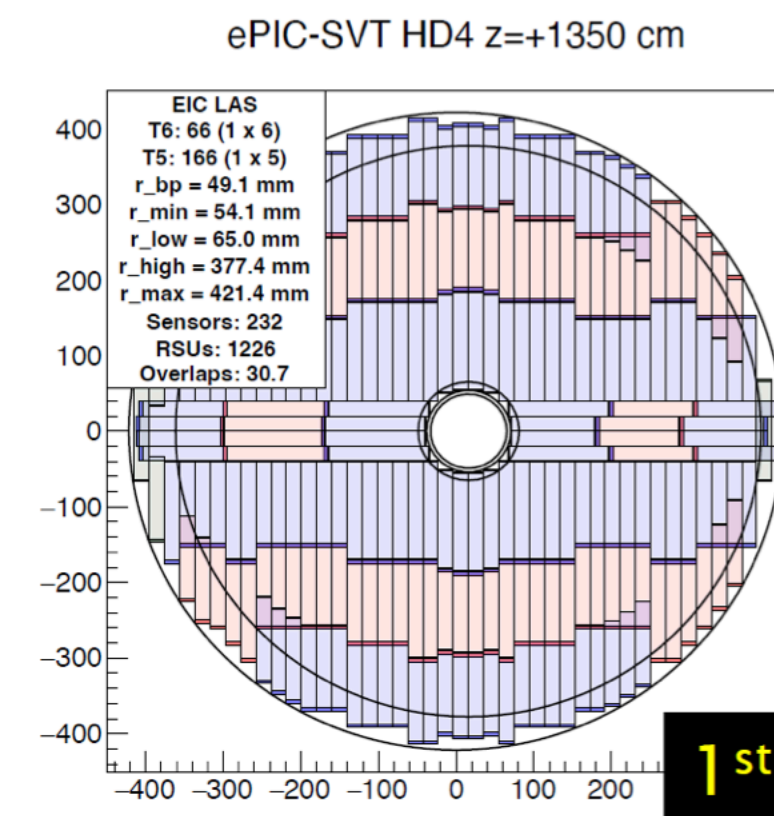
88 stave



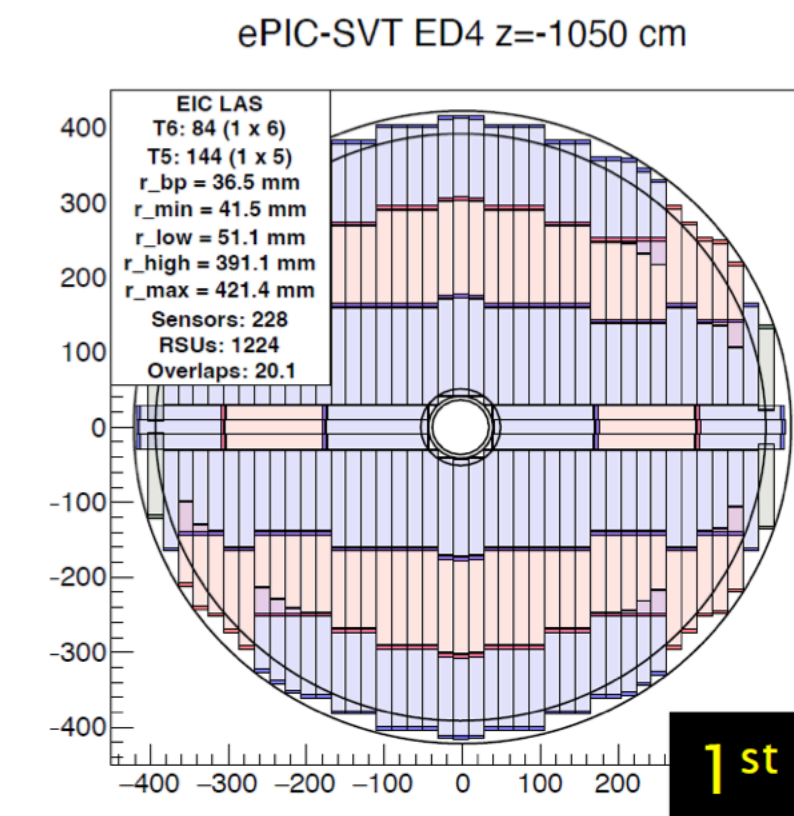
88 stave



88 stave



88 stave



88 stave

Integration of Readout

