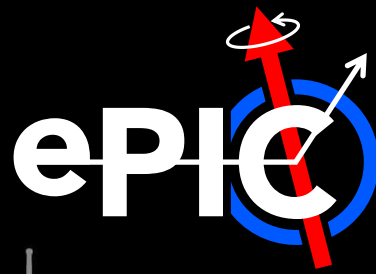




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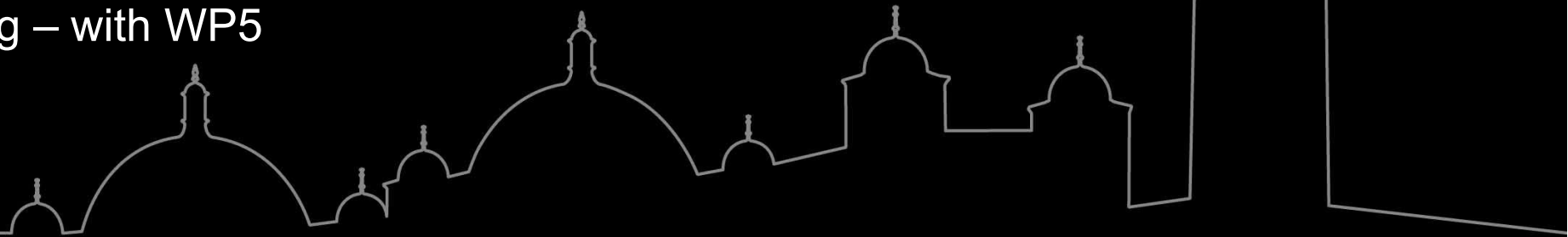


SVT Inner Barrel Readout Boards bPOL12V $\rightarrow$ LDO considerations

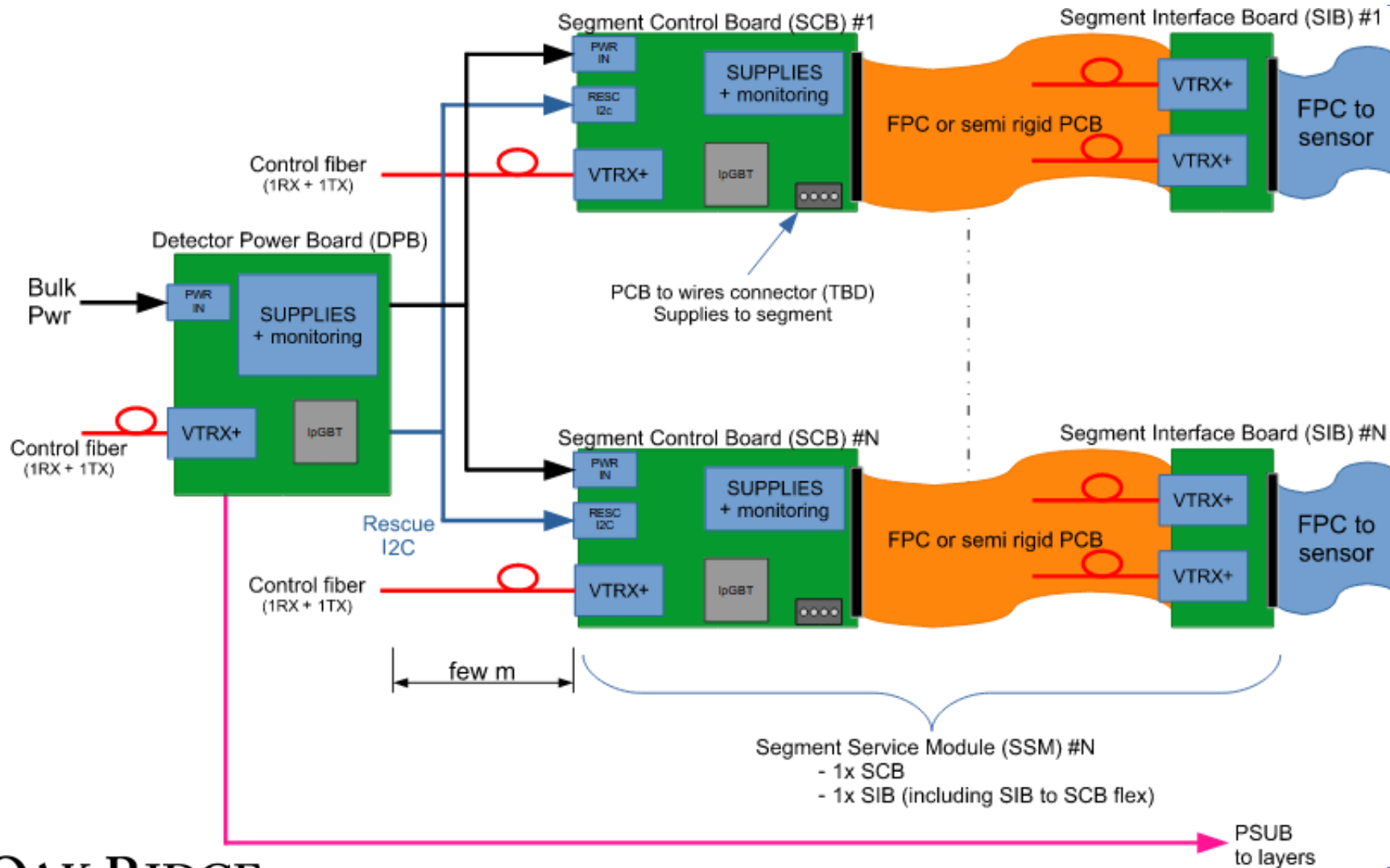
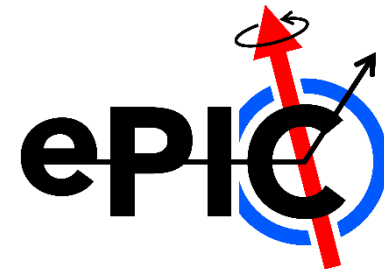
James Glover

ePIC SVT WP4&6 meeting – with WP5

Wed, 23rd Sept 2026



Reminder: IB Readout Architecture



Detector Service Electronics

1 set per sensor

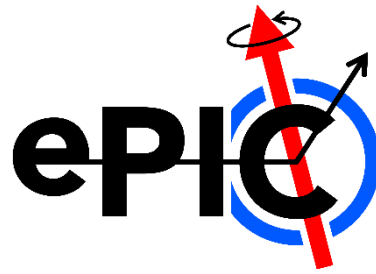
1 DPB

+

3 or 4 or 5 SSM

The scheme is a carbon copy of the ITS3 architecture, the boards will not be!

Previous information

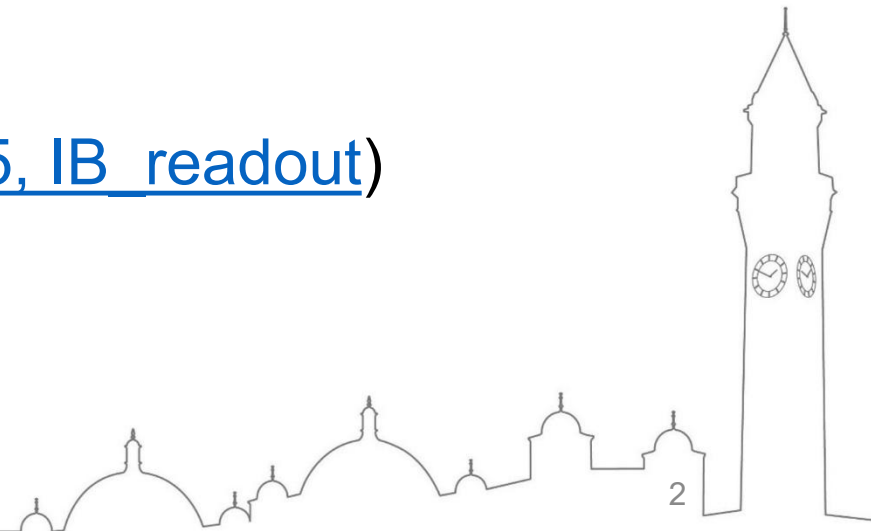


Last presented power estimates (for the IB) at the Stony Brook Working meeting: [J. Glover, Jul '25, RDO board cooling](#)

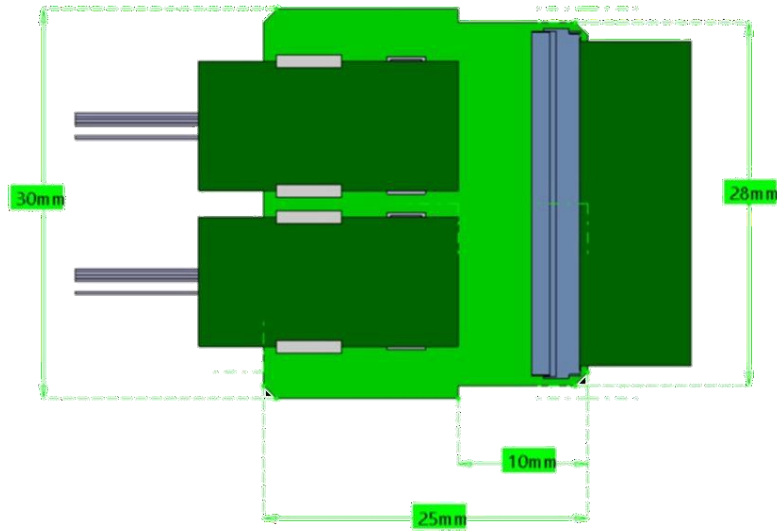
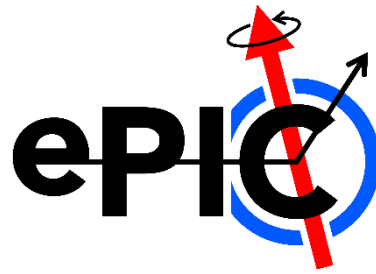
IB board numbers:

- 68 × Segment Interface Board (SIB)
- 68 × Segment Control Board (SCB)
- 16 × Detector Power Board (DPB)

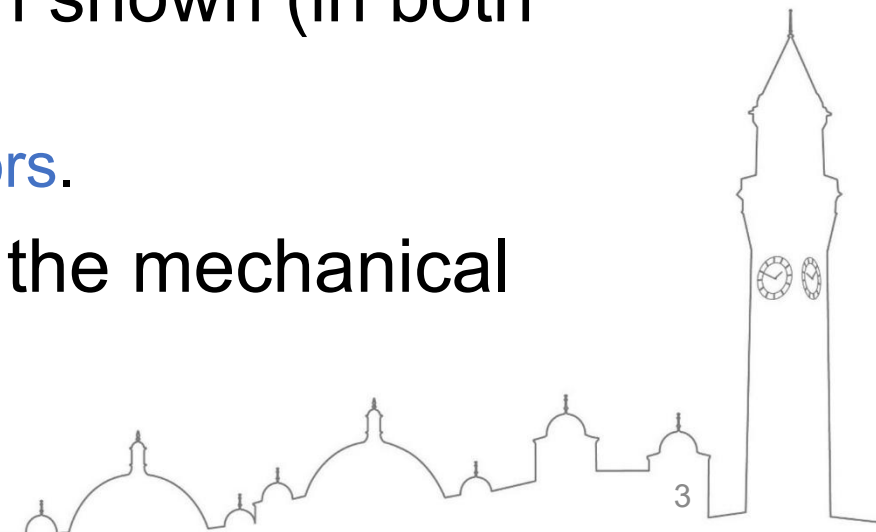
(Breakdown of this at: [J. Schambach, Jul '25, IB readout](#))



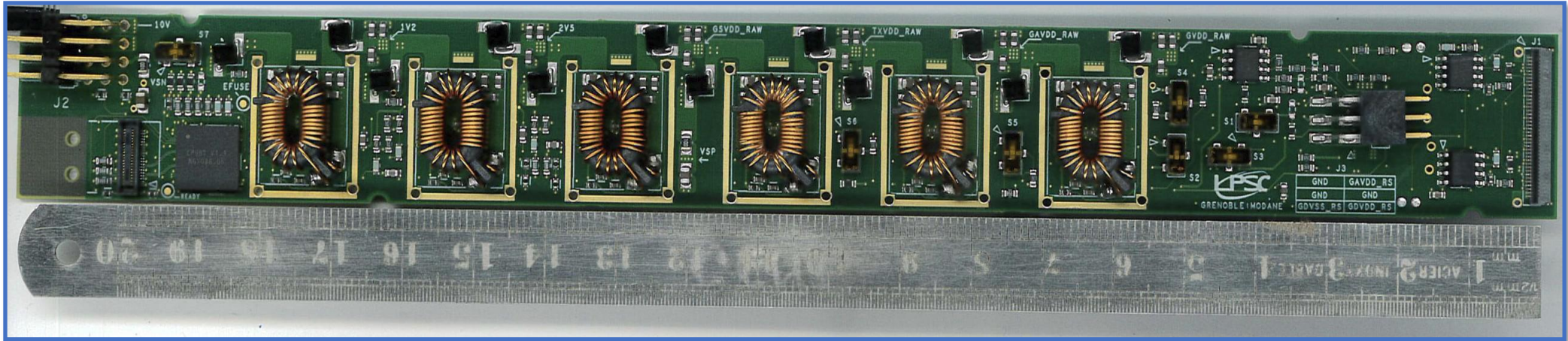
ITS3's SIB (option B)



- Two options for the SIB have previously been shown (in both ITS3 and SVT communities).
 - Options B is the planned version for **both detectors**.
- For SVT, **PCB is unlikely to vary** (much), but the mechanical support might.

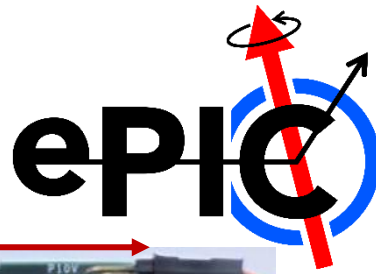


ITS3's SCB

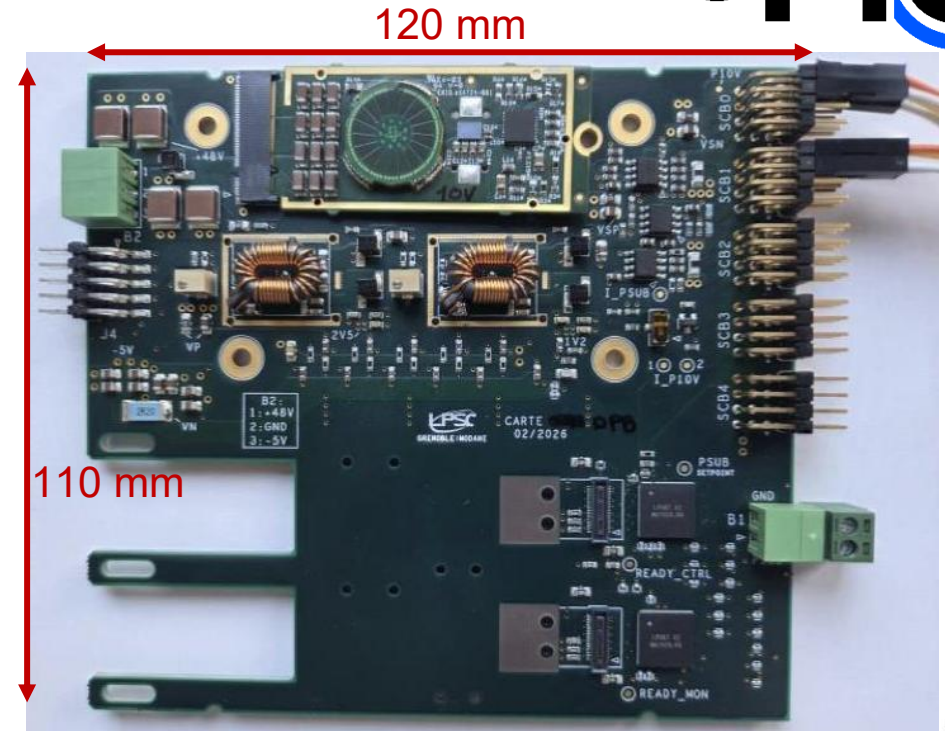


- Board is very long (~22 cm) due to the 6 × bPOL12Vs.
- What we are suggesting today is switching these bPOLs to LDOs.
 - Requires less V, but more I transmitted from DPB to SCB.
- Board length is the focus; width is dictated by the J1 connector (far right of image above).
 - Some package height should also be saved, but amount is TBD.

ITS3's DPB

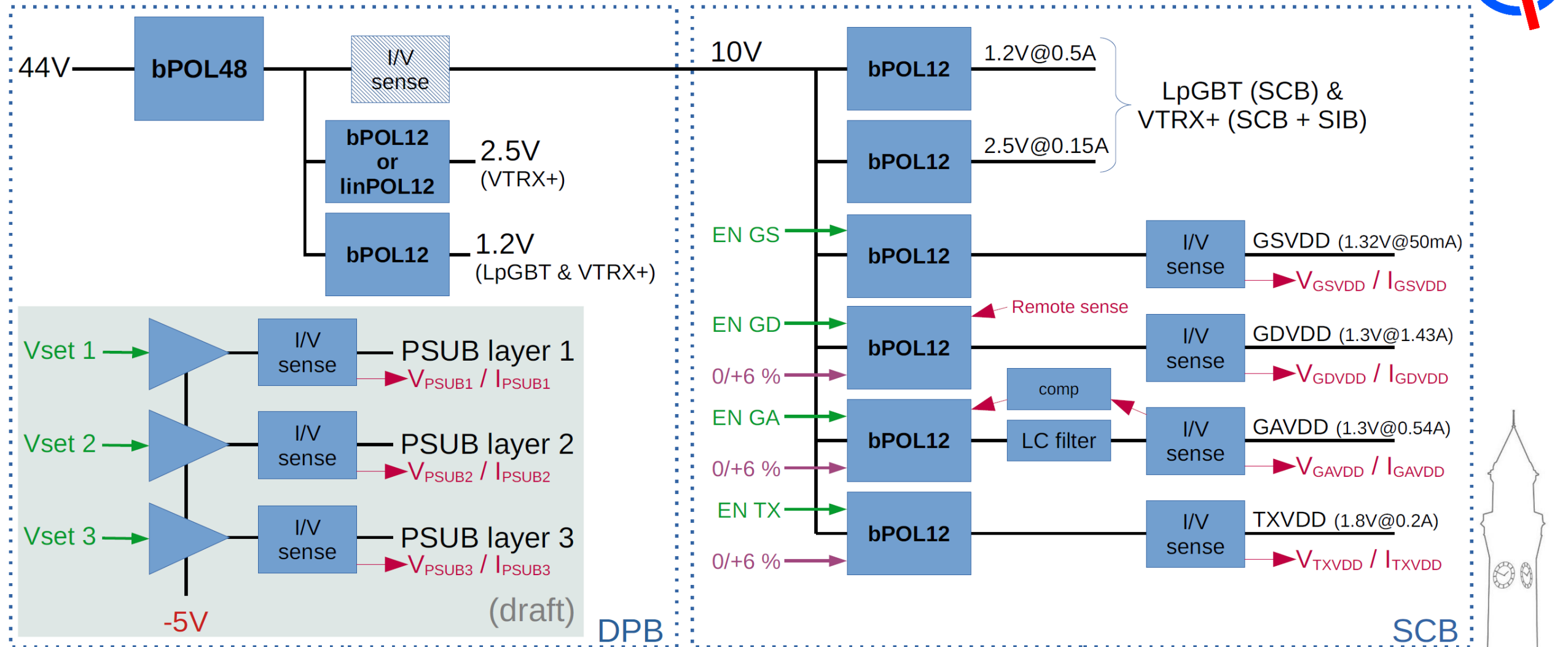
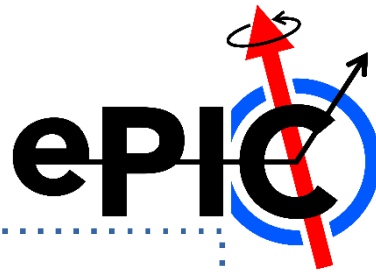


- ITS3's design utilises 1 × bPOL48V, 2 × bPOL12V, 2 × VTRx+.
 - Approx. 12 × 11 cm.
 - Similar dimensions to the last estimate of the FCB ([reported Dec '26](#)) at ~ 10 × 8 cm.
- SVT also looking to also switch out the bPOL12Vs for LDOs, however, may need 2 × bPOL48V.
 - Changing to 2 × bPOL48V and 2 × LDO is **unlikely to very dimensions significantly**.
 - 2nd VTRx+ is to add additional S/C recovery options for SCBs, TBD if this will be needed and whether it can be removed.

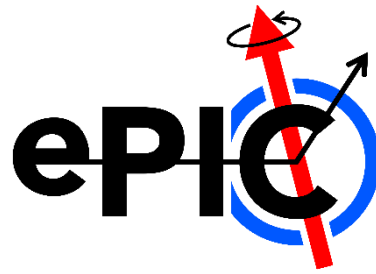


DPB without covers or bPOL48V.

ITS3's DPB – SCB power tree



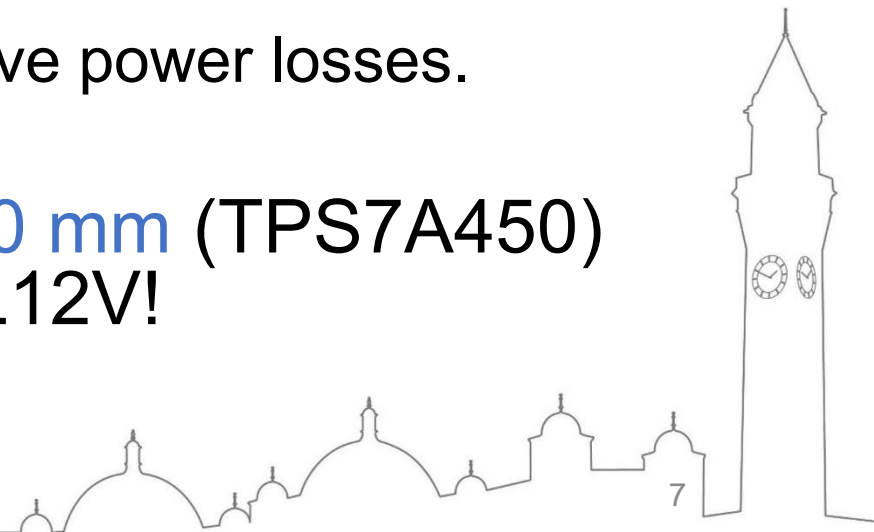
The changes to be considered



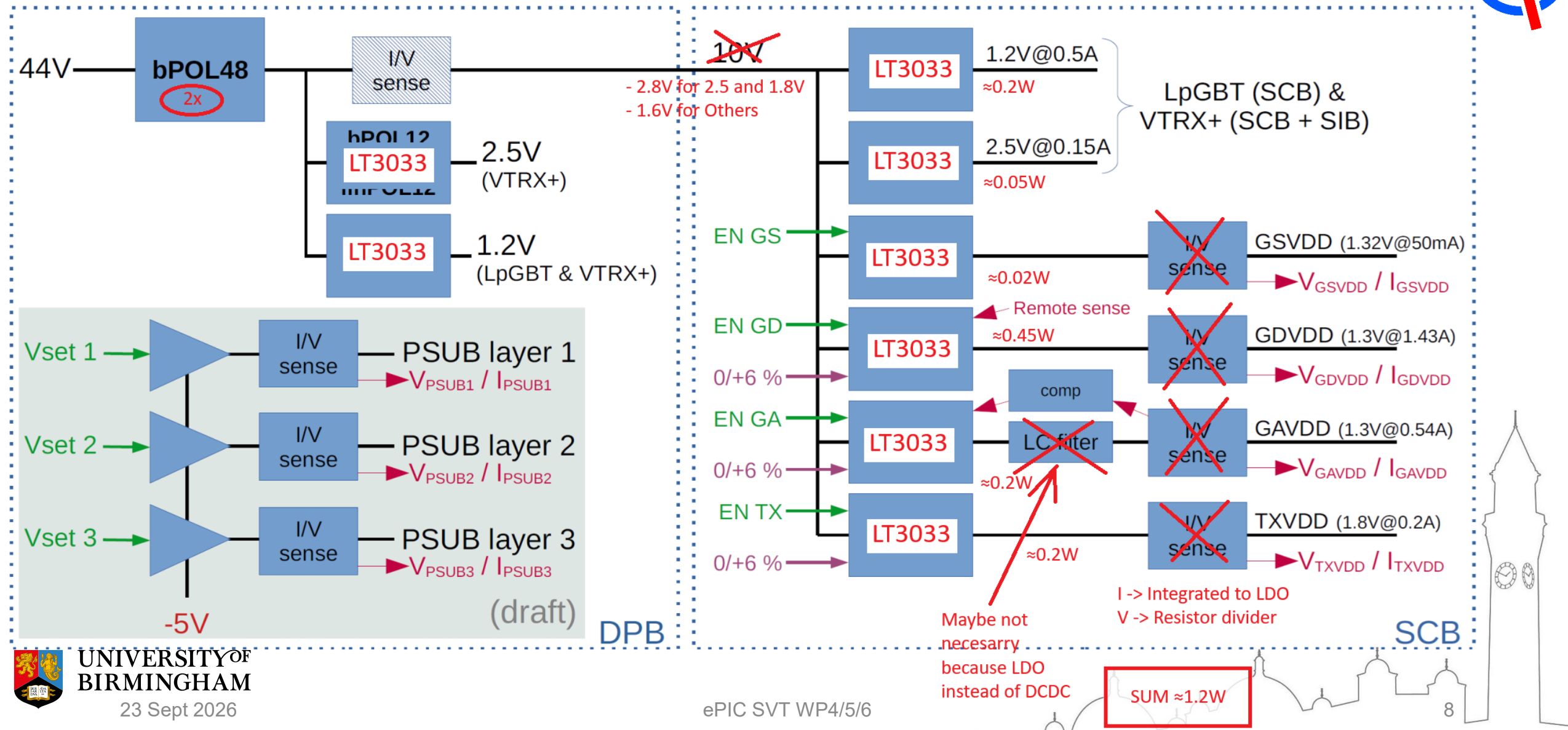
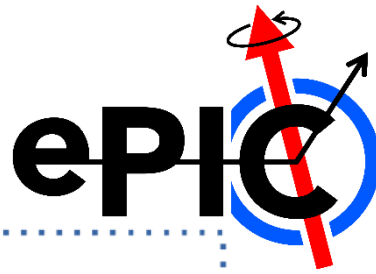
Switching from a DC/DC to an LDO will require adjustments:

- DC/DC: $\text{Power}_{\text{out}} = \text{Power}_{\text{in}} - \text{Conversion}_{\text{loss}}$
 - Converts $\uparrow V / \downarrow I$ to $\downarrow V / \uparrow I$ supply, thin wiring can be used to transmit the low input currents!
- LDO: $\text{Voltage}_{\text{out}} = \text{Voltage}_{\text{in}} - \text{Voltage}_{\text{DropOut}}$
 - Only drops voltage (and regulates, not power conversion).
 - $\text{Current}_{\text{in}} = \text{Current}_{\text{out}}$. Input wiring needs to transmit full current of the load, $\therefore$ **wider gauge wiring needed!**
 - $\text{Voltage}_{\text{in}}$ should be kept as low as possible to save power losses.

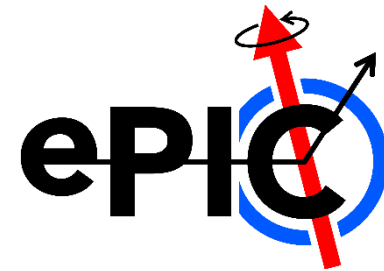
Miklos reported initial SCB board lengths of **130 mm** (TPS7A450) or **81 mm** (LT3033) with LDOs instead of bPOL12V!



SVT's DPB – SCB power tree



Powering take-homes



Detailed workings have been documented within the [SVT services & cooling Google sheet](#).

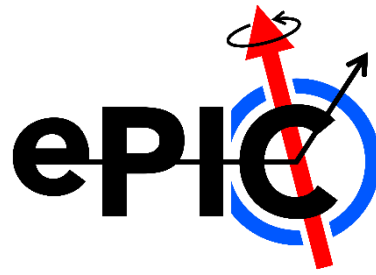
	bPOL12V (DC/DC)	TPS7A4501 (LDO)	LT3033 (LDO)
SCB V_{in}	10V	2.8 V & 1.62 V	2.6 V & 1.42 V
SCB (per board)	4.18 W	2.46 W	1.81 W
DPB (per board)	6.09 W	7.75 W	7.08 W
IB total	416.62 W	324.35 W	268.35 W

LDO caveats:

- TPS7A4501 needs at least a **300 mV dropout**.
- LT3033 needs at least **95 mV dropout** (assumed 100 in calcs).
- V_{in} was based on **1.32** and **2.5 V** output needs plus $V_{dropout}$ (these would be minimums and the most efficient).
- Same gauge wiring can be used for either LDO (same currents).
- **Confirming LT3033 is rad hard enough for our uses before committing to it!**



Summary



- Switching the bPOL12V to an LDO should be [possible](#).
 - Would save considerable SCB length.
- Power consumed in the Inner Barrel should also be reduced.
 - However, [more power would be dissipated within the DPB](#) (up to 8 W)!

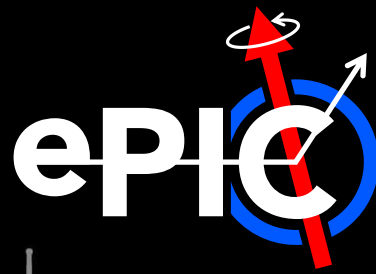
To Do

- Confirm radiation hardness of the LT3033 (the preferred LDO).
- Confirm efficiency of bPOL48V for regulating 48V to 1.42V (@1A).
 - Custom inductor may be needed!
 - Other ePIC DSCs are looking to be similar (reported in [Elec&DAQ meetings](#)).
- Reconsider the wire gauges and numbers between the DPB and SCB.



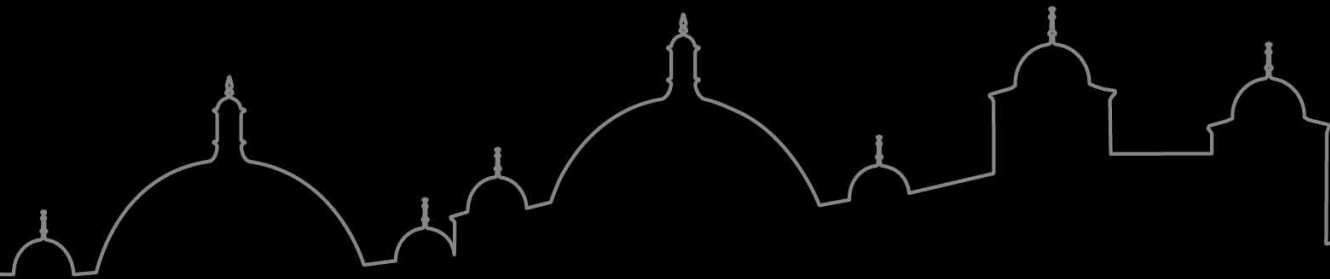


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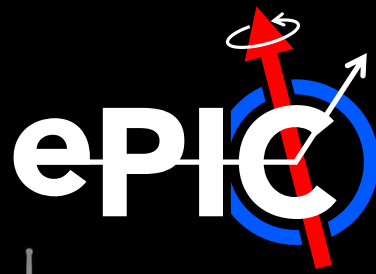
Thank you very much!

Any questions?

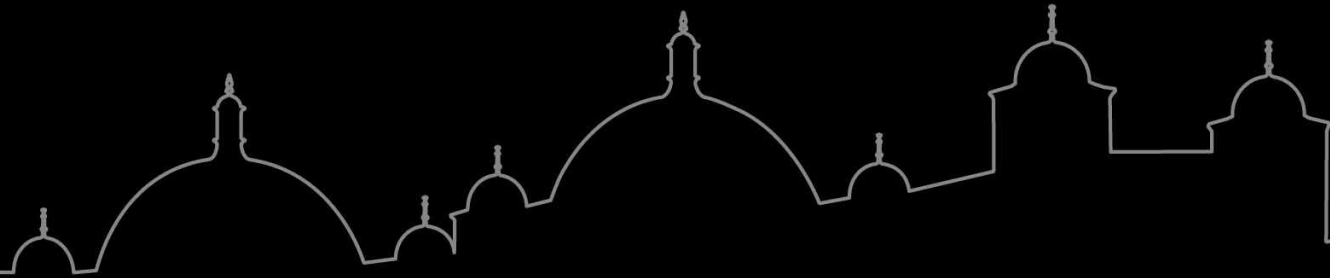




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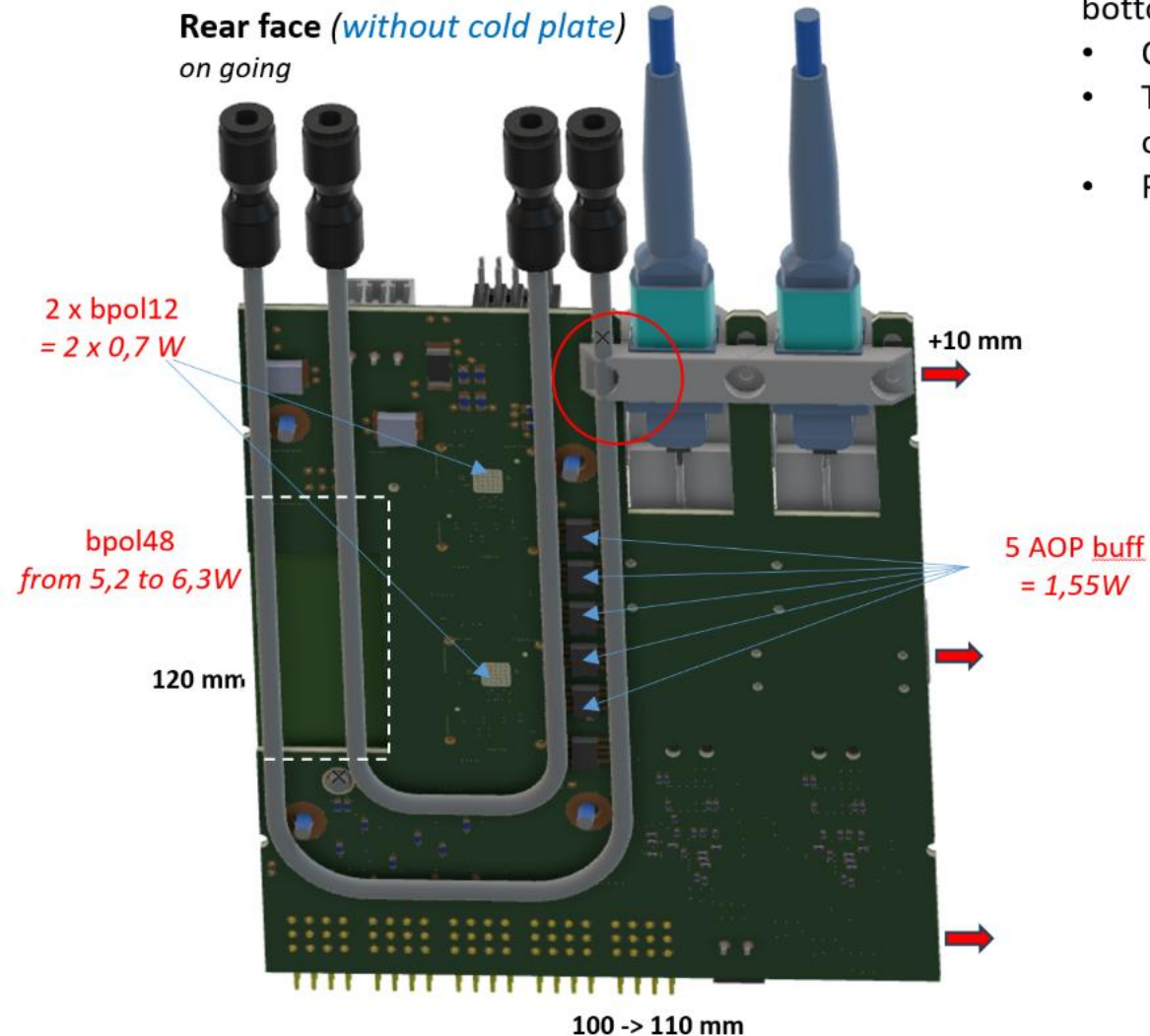
Additional (support) slides



Supports & cooling - DPB board

Dimensions (120 x 100) -> **120 x 110**

Rear face (*without cold plate*)
on going



bPOL48V : cooling of the converter performed from the bottom of the PCB (Maximum temperature allowed : 50°C)

- Cooling plate temperature between 20°C and 30°C
- Temperature gradient between cooling lines inlet and outlet -> 15°C IN – OUT free
- Flow rate per circuit -> 3,3 l/h to 6,7 l/h

