DUNE FD2 Vertical Drift

Cathode X-Arapuca
SiPM to WLS Spring Coupling
Faraday shielding of SiPM and Cabling

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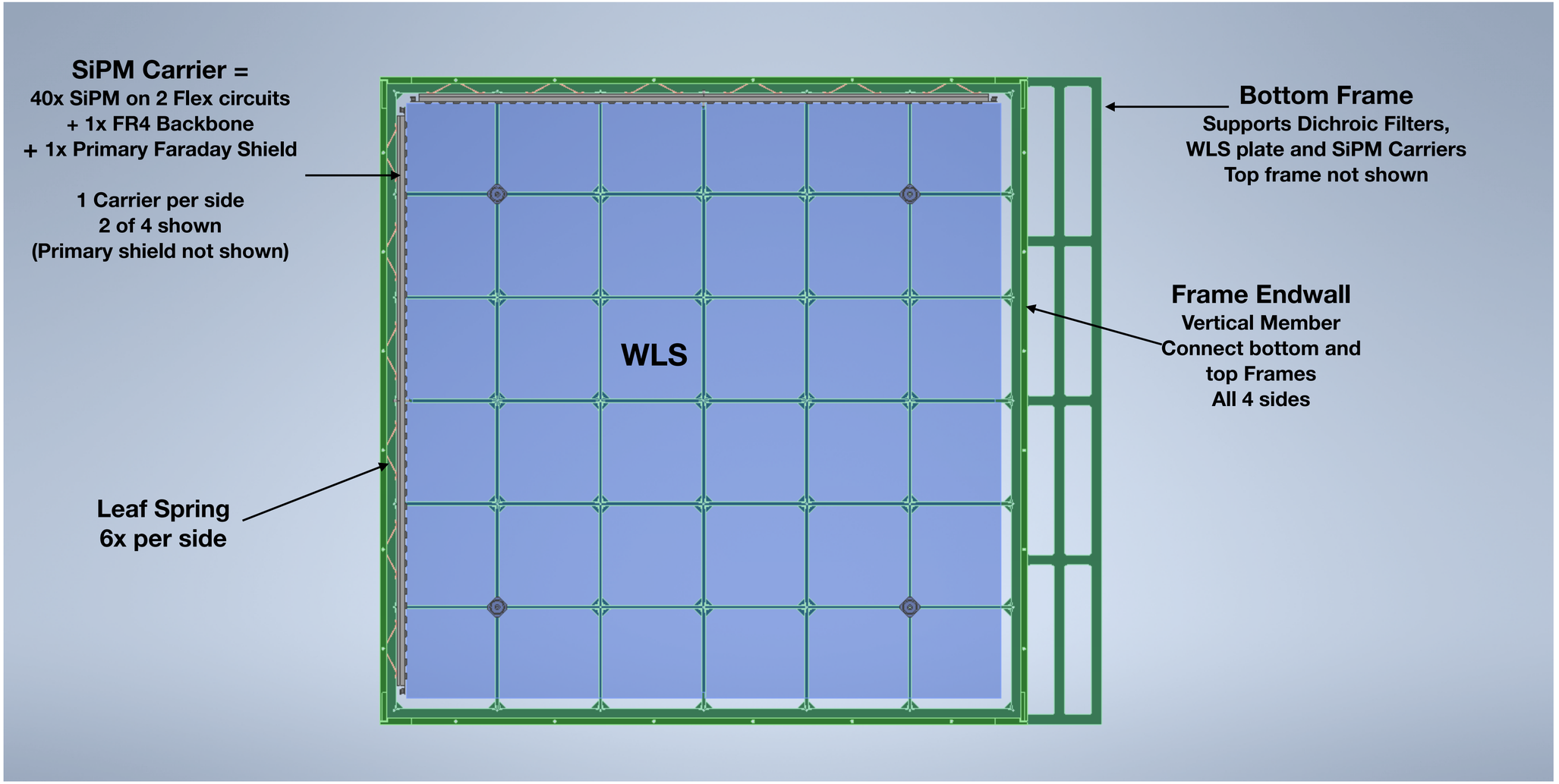
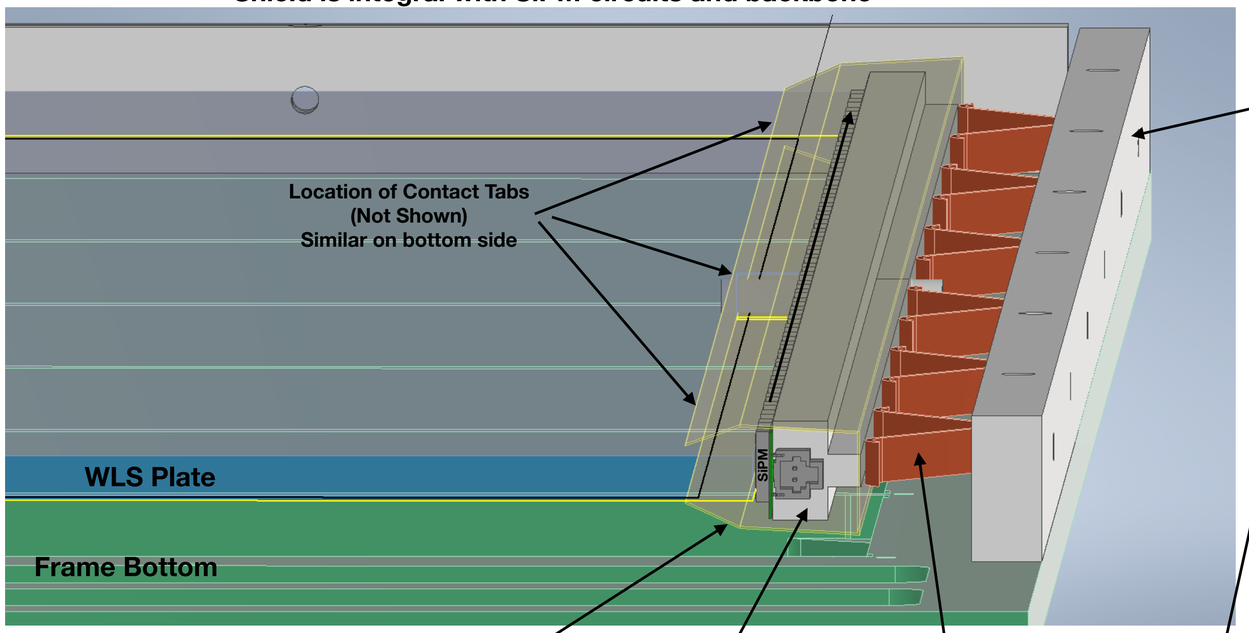
OVERVIEW


SiPM Carrier =
40x SiPM on 2 Flex circuits
+ 1x FR4 Backbone
+ 1x Primary Faraday Shield
1 Carrier per side
2 of 4 shown
(Primary shield not shown)
Leaf Spring
6x per side
WLS
Bottom Frame
Supports Dichroic Filters,
WLS plate and SiPM Carriers
Top frame not shown
Frame Endwall
Vertical Member
Connect bottom and
top Frames
All 4 sides

Perspective View - Single side

Primary SiPM shield shown

Shield is integral with SiPM circuits and backbone



Primary Shield

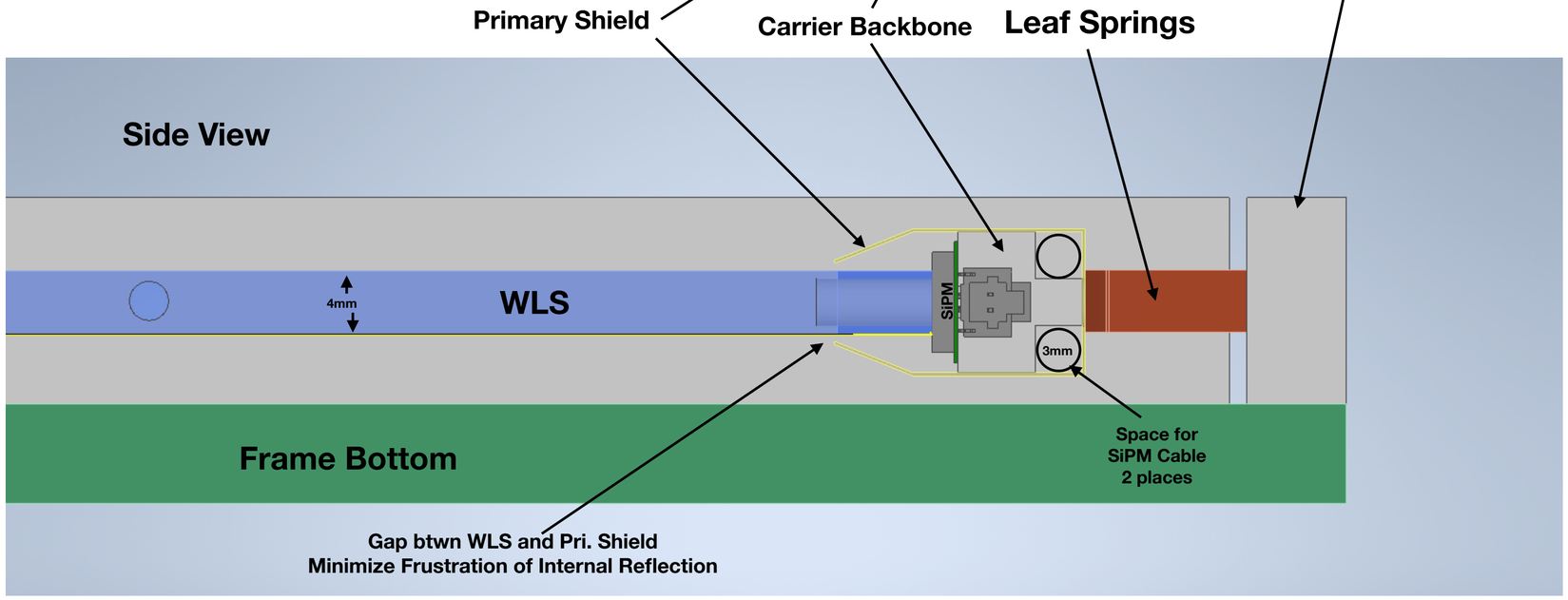
BeCu or Phosphor Bronze

~ 0,1mm thick

Does not make contact with WLS except for small tabs near ends and in center.

Contact Tabs 'clip' onto the WLS and make the entire SiPM Carrier align with WLS and 'float' relative to the rest of the frame (leaf springs only push forward, and do not constrain in other dimensions.

Primary Shield acts a mechanical element between WLS and SiPM carrier as well as a Faraday shield.



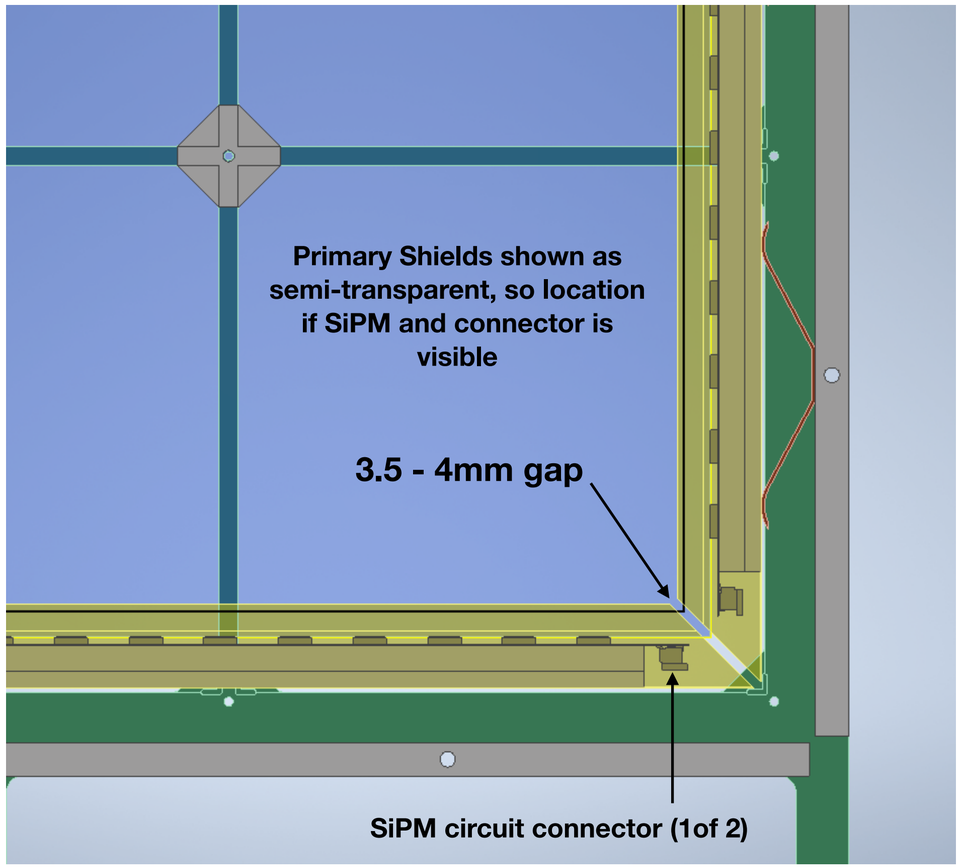
Top View of 1 Corner

Shows junction of 2 SiPM Carriers

Each of the 4 carriers are mechanically independent from each other and the frame structure - avoid contention between pieces in cooldown.

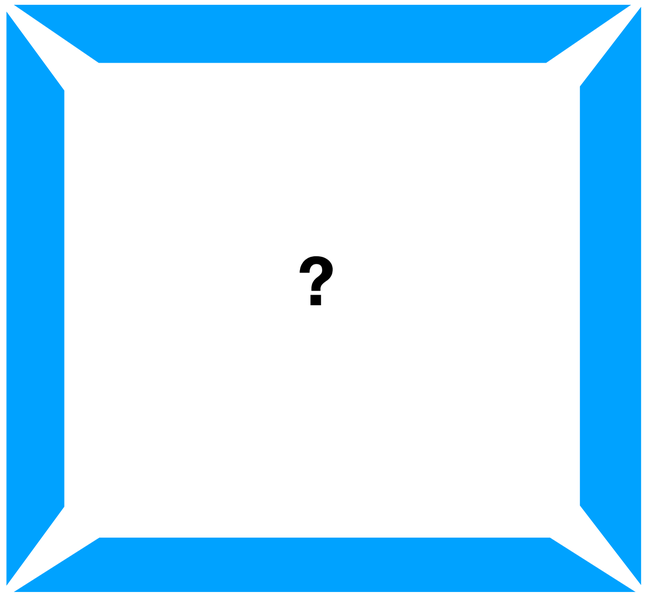
Estimate 3.5 - 4mm gap between neighbouring primary shields after cooldown

What is acceptable for gap?
Can be bridged with a flexible mesh -
What mesh size is ok?



How to electrically interconnect the individual segments of the shield?

Tie them together and share a common reference point, or independently connect each to the reference? Or something else?

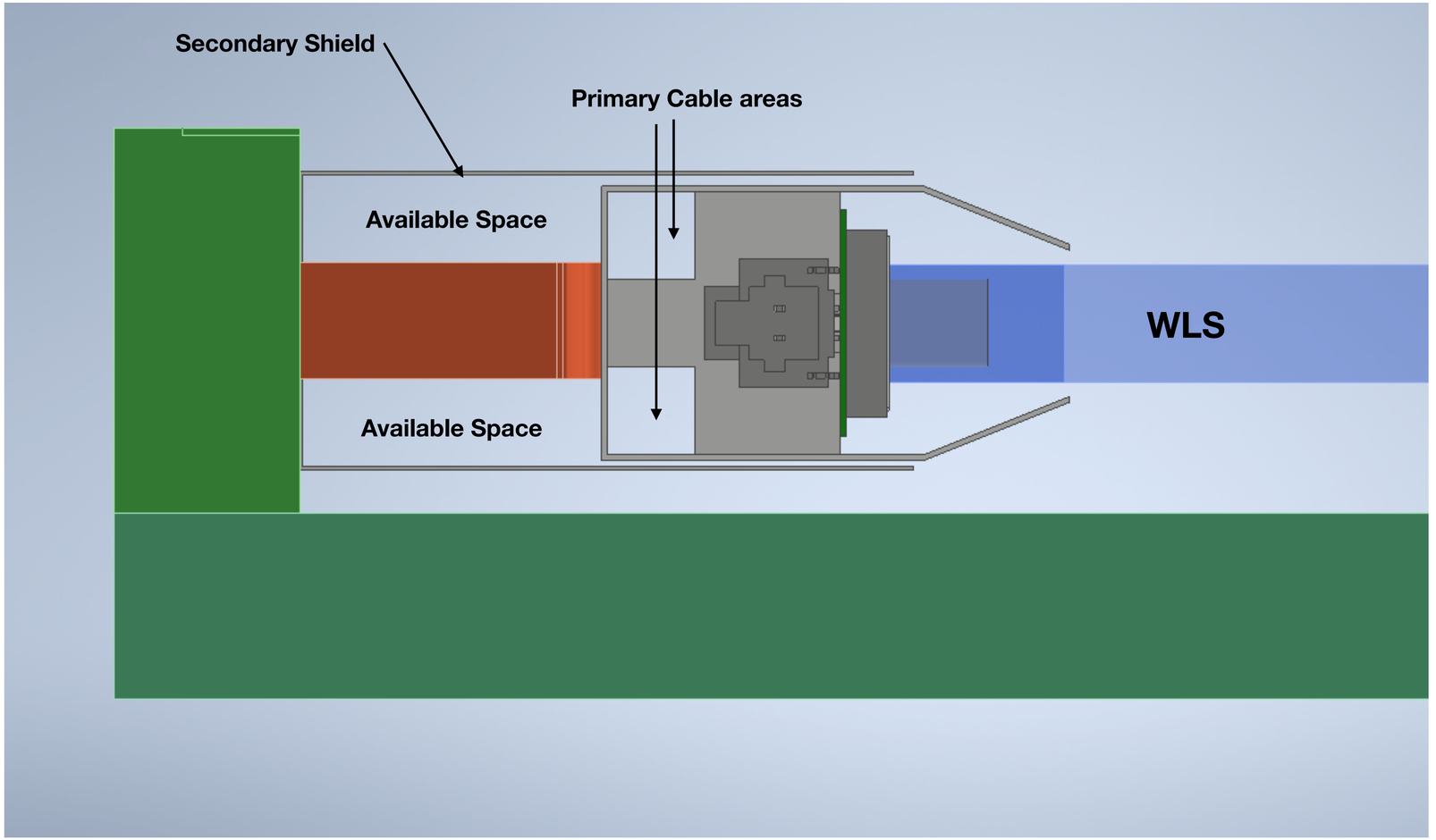


Secondary Shielding Possibility

Preferred to run cables in primary areas, but space is available in the leaf spring area between leaf springs and outer sidewall if needed.

This space can be shielded with a secondary shield.

Would be extra parts and assembly complexity.

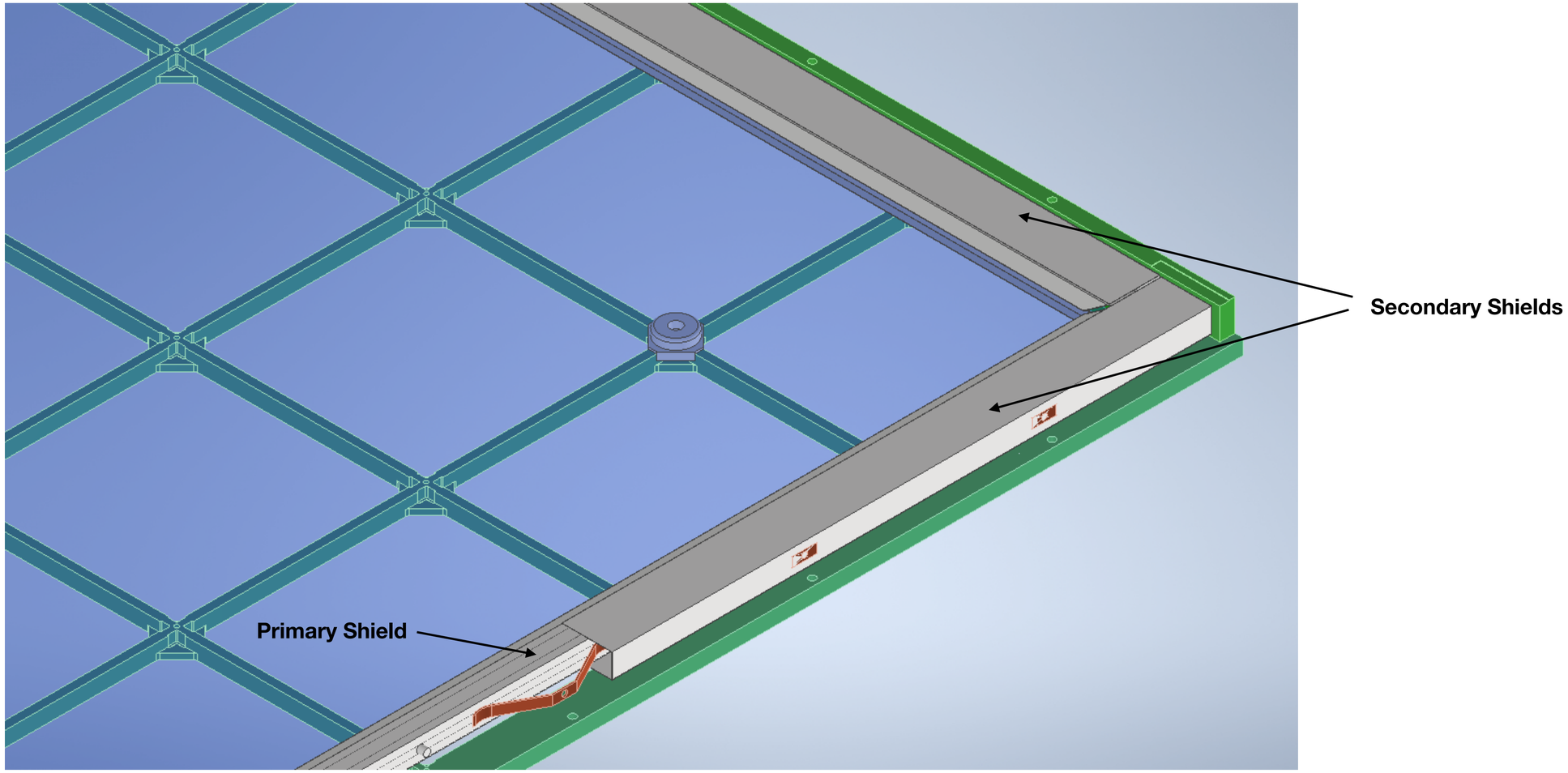


Isometric View of Secondary Shield

Shown partially cut away for detail.

This also affords the possibility to bring SiPM signals out through the back of the circuit, rather on the ends.

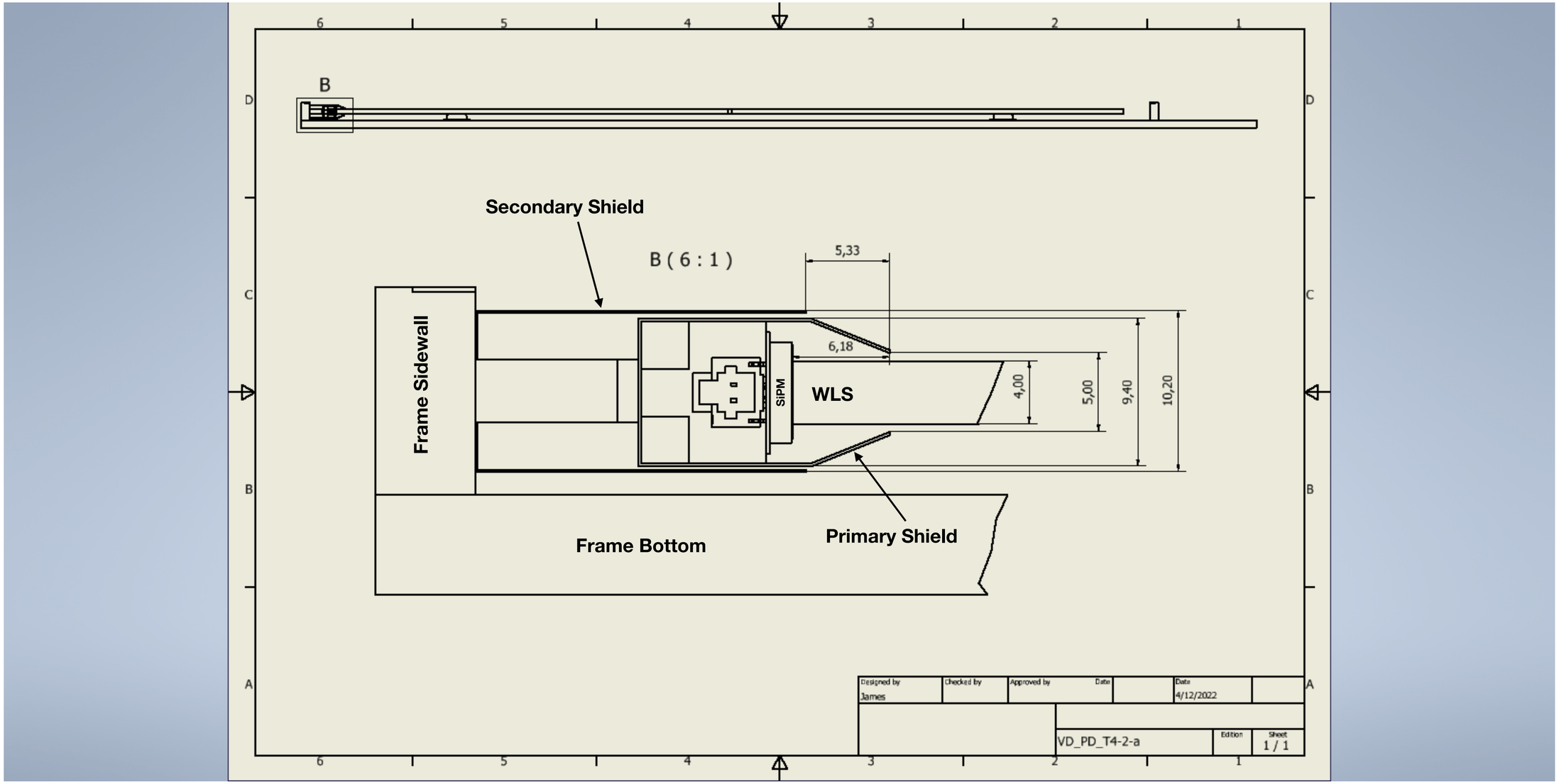
No mechanical demands on the shield, so could be thinner than primary shield.



Current Dimensions of Shielding in 3D Model

Input needed as to what dimensions are required for shielding

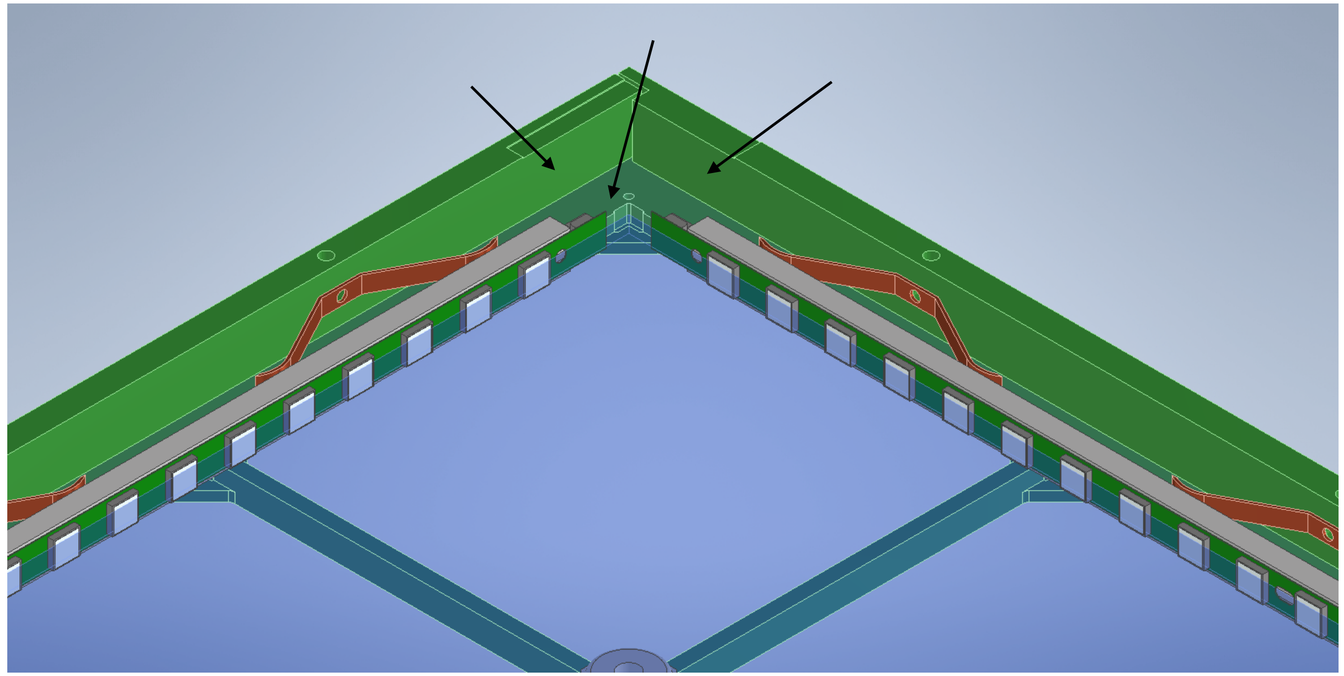
Shields shadow the WLS and reduce light collection -



Perimeter of FR4 Frame could be coated with conductive epoxy to provide Secondary Shielding.

Unclear if this is viable:
- **withstand the energy of discharge**
- **stable bond with FR4 through cooldown**
- **LAr purity issues**

If possible then it opens up some interesting options for shielding.



Testing sample for MG834

Acrylic Lacquer, 50-65 micron nom thickness
0.08 ohm/sq

Bonded to 1" x 1/4" thick FR4

Preliminary testing only - 2 part epoxy conductive paint on order for evaluation.