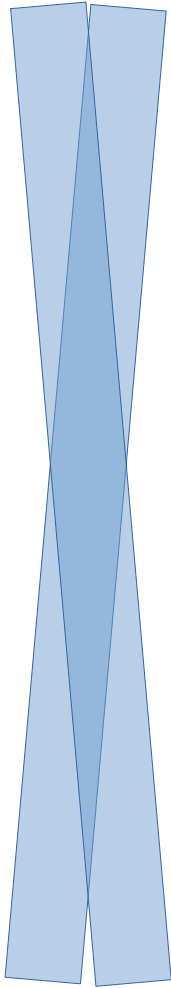

TMS orthogonal counters

Andrew Furmanski
TMS meeting, 31st Jan 2024



Y-resolution of stereo view

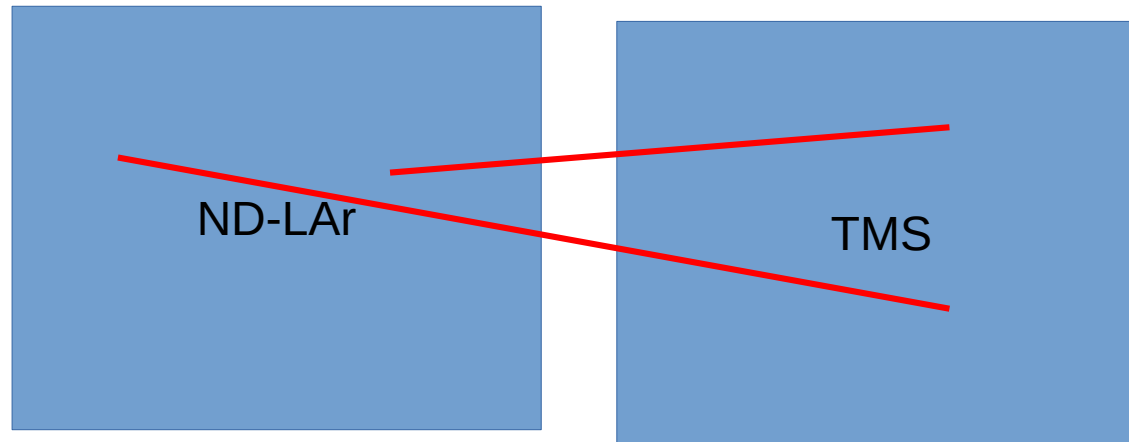


Rotation
exaggerated for
comic effect

- Assume ± 3 degree tilt
- Assume 3.5cm wide bars
- Vertical “resolution” is the height of the rhombus of overlap
 - This at least sets the scale
- This is around 65cm
- ~20x worse than the horizontal position resolution
- Around 20% of the detector height



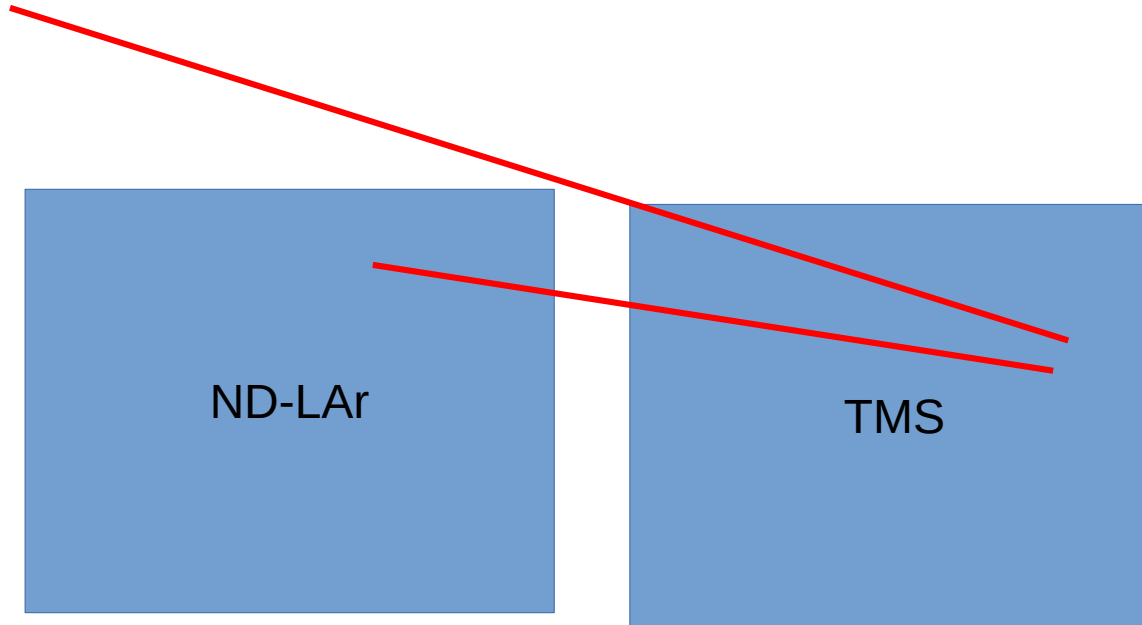
Potential confusion



We can throw away
these events easily



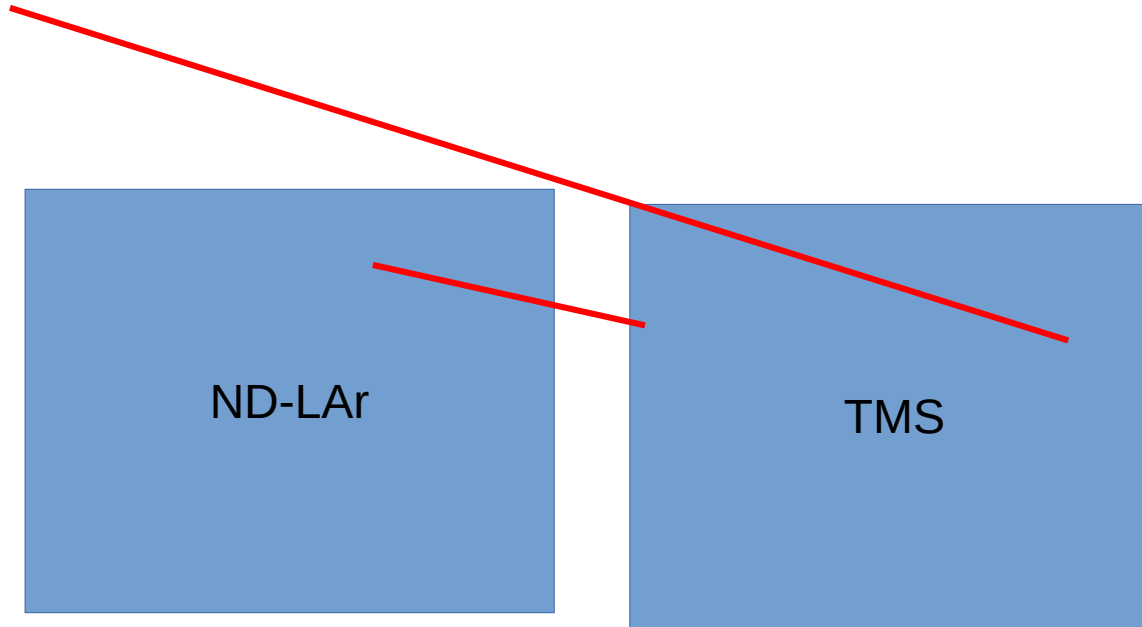
Potential confusion



This one is harder to throw away, but likely still possible



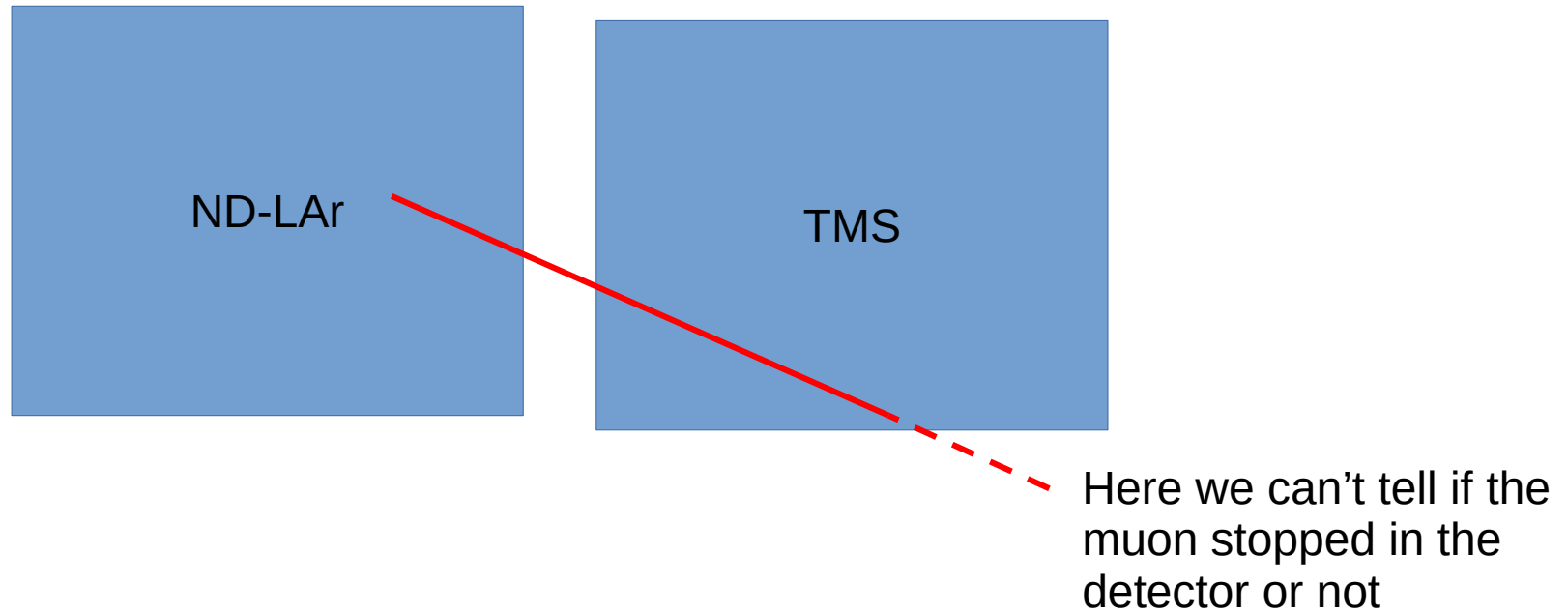
Potential confusion



This could lead to genuine confusion – artificially extending track with rock muon



Potential confusion



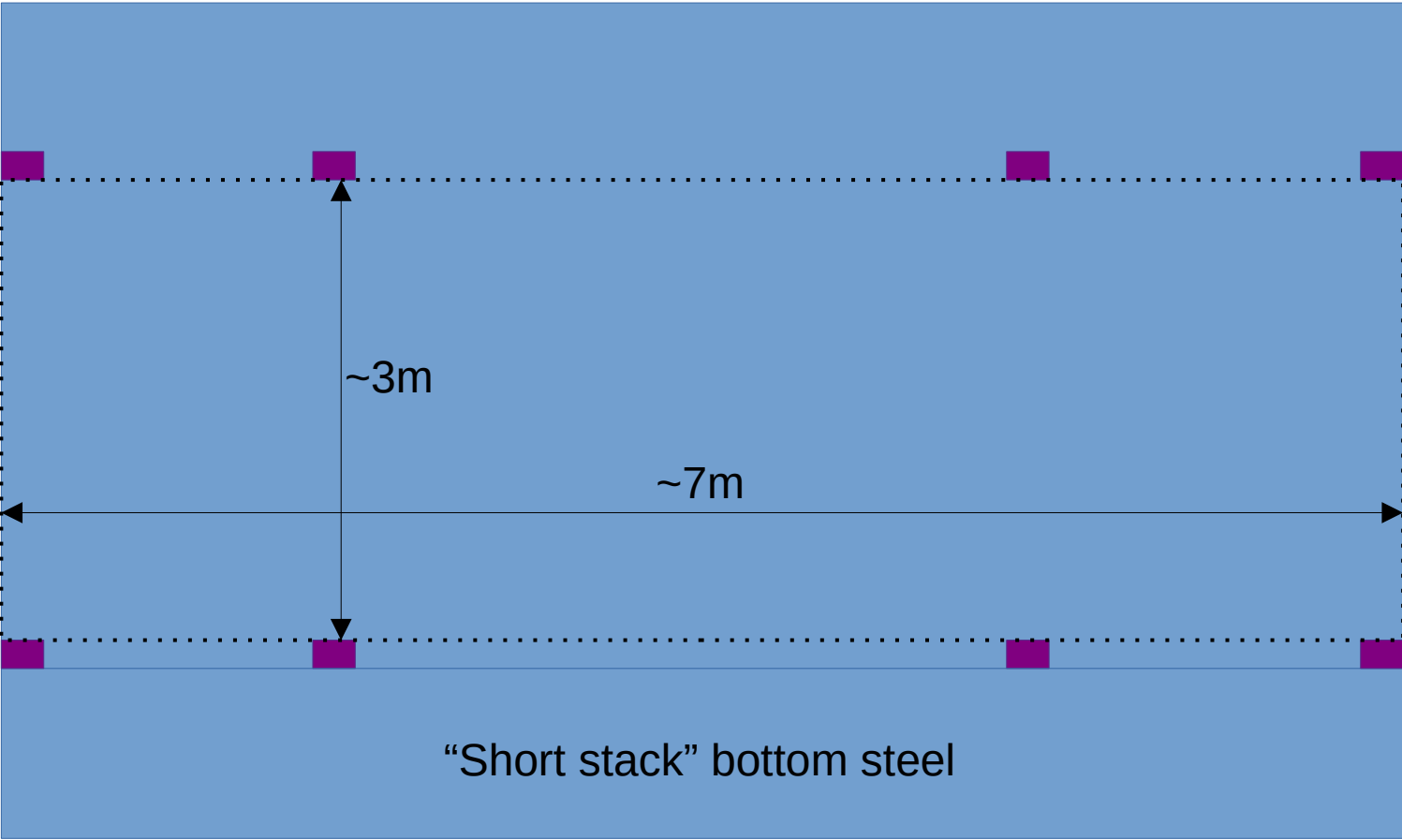
The meat of the talk

- If one of these problems is bad enough to need better y -resolution and/or degeneracy breaking, we might want some orthogonal counters
- I'm not answering *whether* we need them here
 - We've had the debate, and we need some more concrete studies
- I'm going to talk through some necessary differences w.r.t the existing counter design
- Potential options for counters that run \sim perpendicular to the existing design



TMS dimensions

Coils



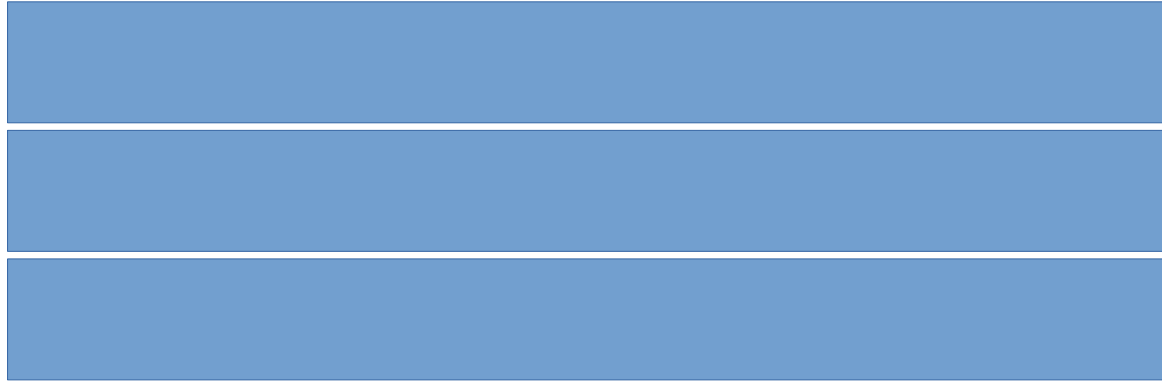
How many bars?

- Work under the assumption that one bar cross section would be used for all modules
 - This means 4cm x 1cm bars
- 3m of vertical space = 75 bars
- Call it 72 bars to leave some wiggle room (and have a number with many divisors)
 - Note – the coils place a *really* hard limit to the vertical size, and I don't have the exact size here
 - But this is conceptual



7-metre* modules?

3 x 24-channel
modules



Double-ended
readout is an
option here, if
desired

2 x 36-channel
modules



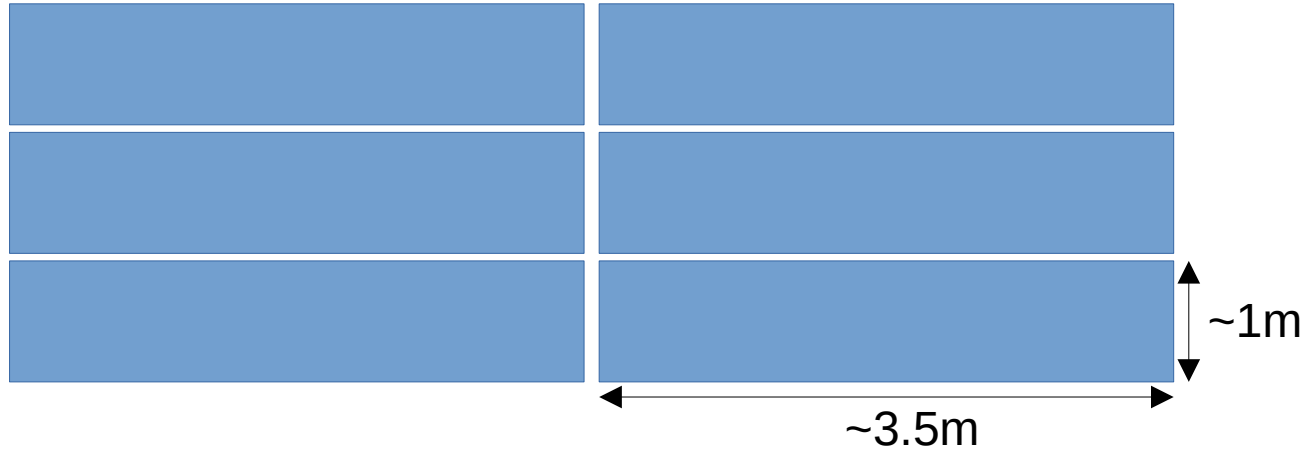
Note: MINOS used 8-metre
modules – this isn't that crazy

*I'm working to make UK spellings standard in TMS

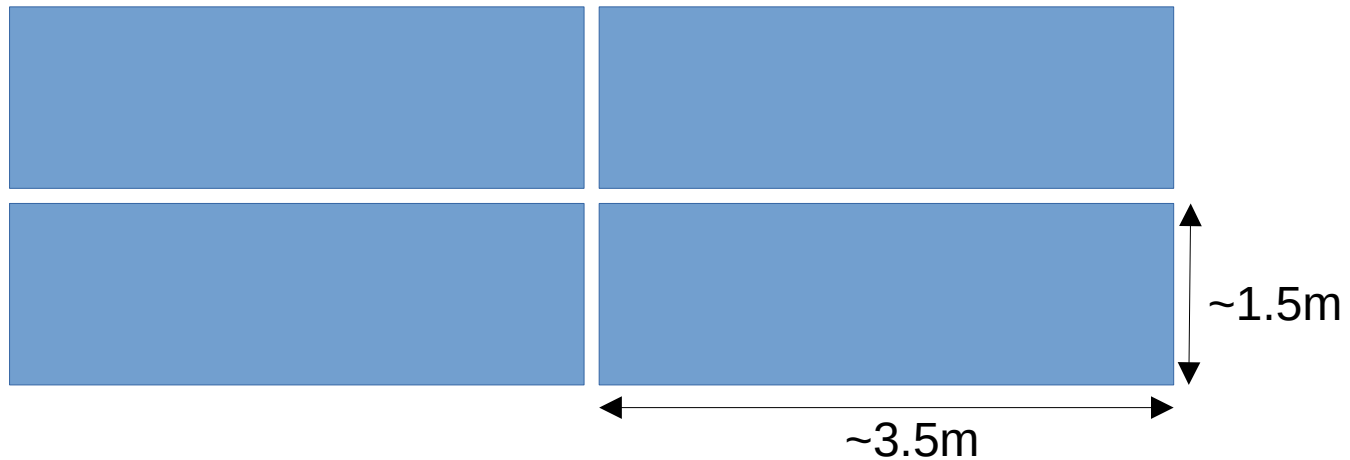


Cut them in half?

6 x 24-channel
modules



4 x 36-channel
modules



These would be fairly similar to the existing module design



Readout locations



- In the full-width case, we can do double-ended readout (1a)
 - Or we can mirror one end and use half the channel count (1b)
 - At the loss of light yield
- In all cases readout is at the side of the detector



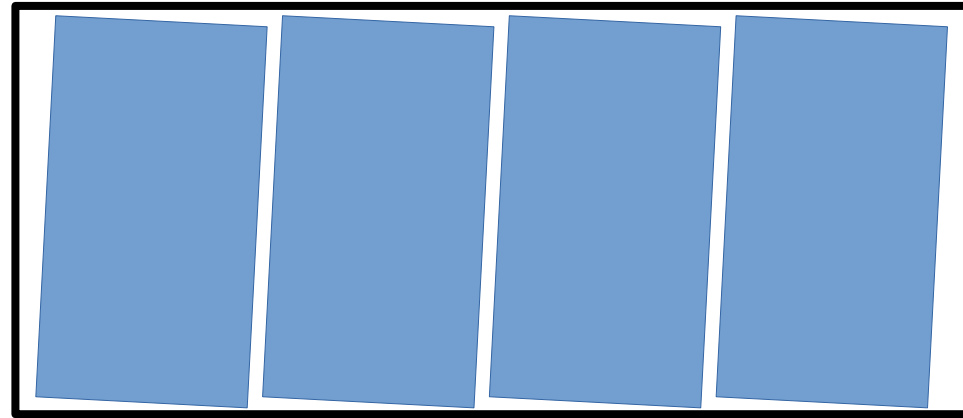
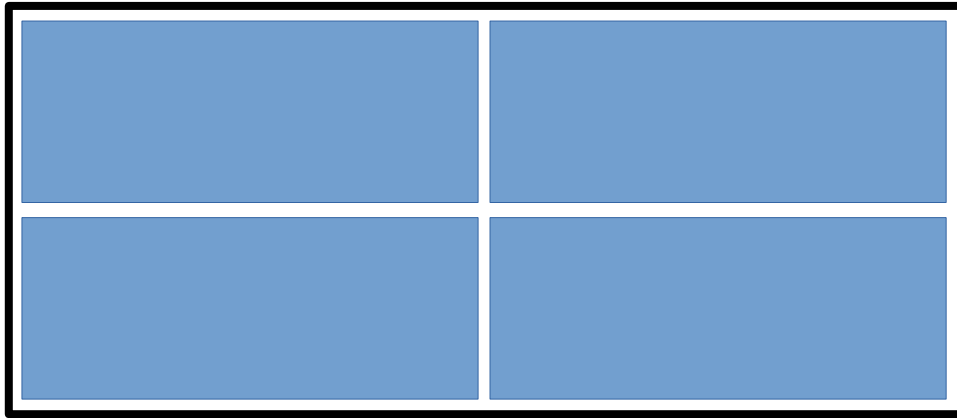
Baseline proposal

- Option 2 has a number of advantages:
 - Smaller modules are easier to handle
 - Less pileup (factor of 2)
 - ~Same number of channels per plane as existing stereo module design
 - Similar length bars as stereo modules, so expect response to be very similar
- I'm going to assume option 2 is what we'd go for
 - Disadvantages: “dead” region is bang in the middle of the active detector...
 - Also option 1 leads to fewer modules being needed



Using a cassette

- No reason we can't use the same/similar cassette design that has been proposed
- Final installation procedure can be identical for any of the module orientations
- Attachments to steel etc identical
- Cassette internals might need to be different, of course



Random thoughts

- My baseline proposal has readout on both sides
 - Is it easier to have it all on one side? Maybe?
 - Benefit is that the analogue signals don't need to go very far
- The cassette option actually makes it easier to decouple the module design/orientation from the steel etc. I like this

