Observations and recommendations from ePIC-UK SVT OB Review, 1st August 2024

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Link to review: https://indico.bnl.gov/event/24313/

Production considerations

1. The yield model was incomplete and, based on experience within other similar thin silicon projects, likely underestimated. 50% unthinned yield was mentioned but then further (significant?) losses from thinning, tab bonding, module assembly, stave assembly, integration, transport etc. must be expected. There was no estimate of how many missing/disabled pixel blocks were acceptable - this needs to be understood urgently. It was not clear where this leaves the overall yield and affects the silicon cost which is a substantial fraction of the budget Iain
2. How easy it will be to transport the modules around the country should be thought about and the impact this could have on the production model should be considered (eg. whether a less distributed production model would be advantageous given the fragility of the modules). Planning for a dedicated transport option ("man with a van") should be included early in the project. Georg
3. Given the designs shown, it was noted that the tooling needs were very high, potentially needing as much as one assembly/transport jig per module. The thinned silicon design will also require highly polished/cleaned jigs which will likely be challenging and costly. Coupling the number of jigs and the precision manufacture this could well end up costing more than the silicon. Having said that, assembly jigs doubling for transport jigs is a nice concept if it can be made to work. Georg, Marcello

Design and prototyping considerations

4. The stave design shown is very complex with many parts to be made and assembled for each stave. There were a number of questions raised about the design (cooling channels in the foam, adhesive to be used, yield of handling thin silicon modules, tab bonding of modules on stave). We would recommend honestly asking whether this level of complexity is necessary, the current prototyping plan foresees 18 months, given the complexity we would expect far longer will be needed. Georg, Adam
5. Prototyping and pre-production planning was not clear and needs further planning, especially in light of the highly complex design mentioned above. Part numbers shown did not include prototyping or pre-production which should be included in planning. Georg, all
6. In addition to prototyping, no plan was shown towards a system test with final (or close-to-final) parts and where this fits into the project timeline. This is an important milestone which must be included and understood with the wider international project. International project (Georg, Peter to raise)
7. Pre-production and site qualification for stave loading was missing in the Gantt chart shown Peter

Project/schedule considerations

8. There is clearly a significant potential impact of delays in receiving access to the chip library and/or the coupling of the schedule to ITS3/ALICE/LHC. Any possible mitigations for the problems this could cause should be considered, including looking at possible fallback options in the case that the MOSAIX chip fails. International project (Georg, Peter to raise)
9. There are significant uncertainties regarding the off-detector cooling and powering services. Work needs to urgently go into these areas and this appears symptomatic of a lack of engineering support within the wider project. The challenges of the air cooling plant and service routing should not be underestimated, along with their potential impacts on stave design and interfaces. Of particular concern was the lack of international effort on the cooling system which has significant potential to impact the stave design. International project (Georg, Peter to raise)
10. Within the planning the UK project appears to require a lot from external entities that we have little or no control over (eg. cooling, power and readout). The UK project needs to ensure that the requirements of these parts are understood along with required timelines. Failing this, the UK project should consider increasing involvement in these areas, within the envelope of the available resources, even if not nominally a UK deliverable. all
11. The project planning seemingly includes an expectation that the timelines of LHC Phase-II Upgrades and ePIC align such that some of the production resources currently tied up in LHC Upgrades can seamlessly transition to ePIC. How this balance of resources works in the event of a change in the Run-4 schedule should be considered early. Georg
12. Additional institutes were mentioned throughout the presentations but it was not clear what they are or will be doing within the project. Will this additional effort materialise and where will it be deployed? Peter

Technical considerations

13. An I2C bus is needed to turn on additional VCSELs in VTRx (default power up only has one VCSEL enabled). All VTRx have same address but slow control lpGBT only has three buses. This needs a solution. In addition, the powering of the VTRx and lpGBT is currently unknown James
14. The current FPC data transfer requirements seem aggressive and challenging. Work should be done to understand exactly what is needed, the expected data rates and understand the required specification on the FPC. Marcello, Todd
15. We did not understand the slow control daisy chaining given the offsets of the daisy chained chips. As presented it was not clear how this worked or why simpler AC coupling was rejected. ?
16. Having a VTRx dedicated to the slow control signals seems overkill given the bandwidth already available on 4 VTRx's - should consider whether slow control links could be included within the main data pathways to reduce the number of VTRx needed per stave. ?