SVT Readout Boards Inspection and Test Plan

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Abstract

•*If you would like to include an abstract, provide a single paragraph that identifies the product that is being evaluated, and identifies each of the critical parameters and processes that are described in this plan. Additional text may describe how these processes will ensure that the product will meet quality and performance standards. But, hey, don't give away too much… you want them to read the document.*

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1. BOARD PROPERTIES

There are a number of readout boards needed for the ePIC SVT, the type of boards are dependent on sub-SVT area. Within the Inner Barrel (IB) there are three board types:

•Segment Interface Board (SIB)

•Segment Control Board (SCB)

•Detector Power Board (DPB)

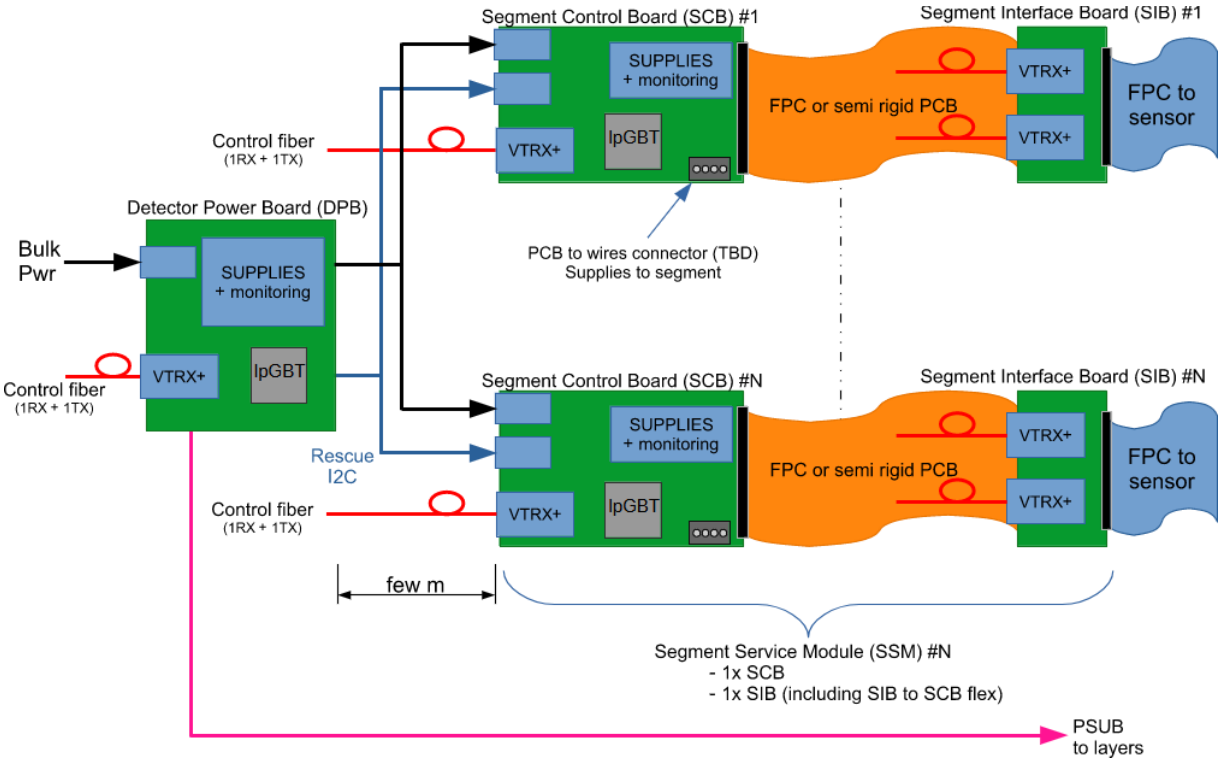

Figure 1. Diagram of the RDO scheme used within the ePIC SVT IB.

Within the Outer Barrel (OB) and Endcap Disks there are two board types (there may be minor differences between the boards in the OB layers and the Disks, but these will be cosmetic or relating to connectors only):

•FPC Interface Board (FIB)
FPC: Flexible Printed Circuit

•Control Board (CB)

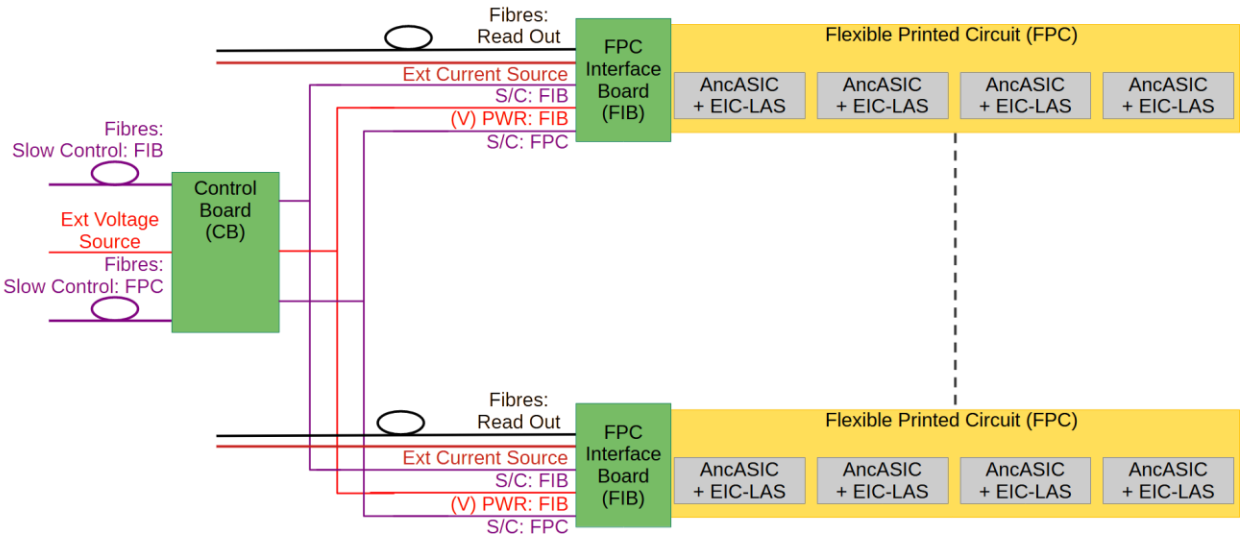

Figure 2. Diagram of the RDO scheme used within the ePIC SVT OB and endcap disks.

•All the boards are to be manufactured based on specifications defined in separate specification files [to be prepared and ref'd]. Both of the interface boards (SIB and FIB) are boards to interface between multiple connectors, with only passive components. The SCB, DPB and CBs all contain voltage conversion, power regulation and monitoring. For all boards, confirmation of manufacturing to the required specifications is required. For boards containing voltage regulators (SCB, DPB and CB), additional tests of the voltage regulation of stability.

2. PROCESSES AND PROCEDURES

The vendors are required to perform a series of tests during the production of the bare PCB boards and the PCB assemblies. On delivery of the assembled PCBs, acceptance testing will be performed at receiving sites.

2.1. Functional Testing

The functionality of all readout boards requires physical coherence of the PCBs at varying temperatures. Proper electrical connectivity is evaluated by flying probe tests dictated by the industrial standard IPC6012 (qualification and performance specification) certificate for bare PCBs, and IPC-A-610, class 2 for PCB assembly. The vendor should be ISO9001 certified (quality assurance and customer satisfaction).

Depending on when the product/material will be tested, one or more of the level 3 sub-sections below should be used. The final level 3 sub-section, Failures and Non-Conformances, should describe the action that will be taken if a product/material fails to meet the test standards.

2.1.1. In-Process Testing

The PCB manufacturer and PCB assembly vendor shall perform Factory Acceptance Tests (FAT) which shall include:

•Flying probe on the bare PCBs to verify the absence of shorts, the proper continuity, and different signals isolations.

- Visual inspection of the assembled PCBs, either automatically or manually.

2.1.2. Acceptance Testing

The Site Acceptance Test (SAT) will be performed by EIC Project personnel on all received PCBs. The SAT procedure includes:

- Visual inspection.

- Power delivering tree short check before powering up. Checking of voltage levels and current consumption after powering up will be performed (on boards performing power regulation).

2.1.3. Verification Testing

After a board has been accepted from the vendor, it will go through more detailed verification. This will involve confirming the regulated output voltages in accordance with the specification documentation.

2.1.4. Failures and Non-Conformances

If any problem (or error) is found during the acceptance testing, the defective PCBs will be diagnosed to pinpoint the problem, and the PCBs will be sent back to the manufacture to be repaired (as per warranty). In case of unrepairable cards because of incorrect assembly or poor bare PCB, a replacement will also be done at the vendor's expense (as per warranty).

Standard vendor warranties state the assembled PCBs shall be free from defects in workmanship for a period of one (1) year from the date of delivery. In the event of a failure due to defects in the bare PCB manufacturing or the assembly of the board within the warranty period, the contractor shall repair or replace the defective card, provided that the failure is determined to be a result of such defects in the bare PCB or the assembly. The warranty does not cover failures or malfunctions of individual components that were properly assembled, regardless of the cause of the component's failure. Additionally, the contractor shall not be liable for any damages arising from failures unrelated to defects in the assembly process. To claim under this warranty, the EIC project must document and provide evidence of the defect in the assembled PCBs and submit such evidence to the vendor within the warranty period.

3. EXPERIMENTAL/TEST SETUPS

- This section will have an individual sub-section for each of the experiments/tests that will be performed. If the same experimental process will be used for multiple properties, it does not need to be repeated. Each experimental section should provide a detailed description of the method, resource requirements, conditions, and equipment.

3.1. In-process tests by Contractors (FAT)

The contractors are required to provide the industry standard certifications for both the bare PCBs and the assemblies.

3.2. Acceptance test (SAT)

The acceptance tests will consist of visual inspections and verifying basic power delivery on the PCB in accordance with the design specification (on boards performing power regulation).

3.2.1. Resource Requirements

- Multi-meter and high-bandwidth oscilloscope.

3.3. Verification testing

The verification tests will confirm the regulated output voltages in accordance with the specification documentation.

3.3.1. Resource Requirements

- Multi-meter and high-bandwidth oscilloscope.

4. ENVIRONMENT, SAFETY & HEALTH CONSIDERATIONS

The procedures will be implemented in a way consistent with the environment, safety, and health policies of each of the facilities/institutions performing each and every step.
The PCBs can be powered up on a table-top for testing for all required testing. This requires a standard lab power supply able to supply DC voltages up to 50V and with a current up to 2A.

5. RECORDS AND DOCUMENTATION

- This section details all of the documentation that will be generated and exchanged during the manufacturing lifecycle. In all likelihood there will be many transient documents that are created that will not be collected or maintained as part of the project. This transient documentation need only be listed if it is pertinent to a specific experiment or test.

5.1. Manufacturer/Producer Records

- For every item that is manufactured, the manufacturer will be responsible for maintaining records (travelers) of all raw material that are used in the fabrication process, and document the processes and procedures that were used for production. The resultant documentation will be compiled into a report and will be provided to the project as part of the deliverable, which will be reviewed, validated, and then placed in the central data repository.

- List all pertinent manufacturer/producer records here.

5.2. Deliverable Documentation and Records

- This includes test results, tables of measurements, parameter lists or other records that must be provided to the project. All testing and inspection data that is collected as part of the validation, verification and testing plan will be provided to the project as part of the final report.

- List all deliverable documentation here.

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6. REFERENCES

EIC Systems Engineering Group. (2022). *Interface Management Plan.* Brookhaven, NY: Brookhaven National Laboratory.

EIC Systems Engineering Group. (2022). *Requirements Management Plan.* Brookhaven, NY: Brookhaven National Laboratory.

EIC Systems Engineering Group. (2022). *Systems Engineering Plan.* Brookhaven, NY: Brookhaven National Laboratory.