Disk QC Plan Outline

Overview & Document Structure

The disk QC may draw from several component-level QC documents rather than replicating their requirements. The following documents are possible, though some are still under discussion:

- **Mechanics QC?** – corrugated core and outer rim; may be a separate document or handled entirely within the Disk QC as component acceptance plus the mechanics assembly section
- **FIB/CB QC** – likely a dedicated document; main & edge FPCs may be included here if their QC needs are sufficiently detailed, or they may instead be handled as a component acceptance within the Disk QC
- **Module QC** – already exists
- **Disk QC** – the primary document discussed here, with acceptance sections referencing each of the above

A key open question on document structure is how detailed the QC needs to be for the main & edge FPCs and for the mechanical components. If the FPC QC is detailed enough to warrant inclusion in the FIB/CB document, then the disk QC simply performs a reception test against that document. If not, FPC acceptance can live entirely within the disk QC. The same logic applies to the mechanics: if no separate mechanics QC document is created, then the disk QC picks up from component acceptance through the full mechanics assembly.

Disk QC Document Structure

1. Component Acceptance

This section covers the incoming inspection of all components before disk assembly begins. It references external QC documents where they exist.

- **Modules** are fully tested per their existing QC document; acceptance here is confirmation that the module QC has been completed and documented.

- **Main & edge FPCs** will either be electrically tested at reception (if their QC is handled in the FIB/CB document or a standalone FPC document) or will be more fully characterized within this section if no external QC document exists. The depth of electrical testing here depends on the outcome of the document structure discussion above.
- **Mechanical components** (corrugated core, outer rim, and associated disk parts) will have key dimensions and tolerances verified at reception. If a separate mechanics QC document exists, this is a confirmation check against that document. If not, this section carries the full dimensional requirements. In either case, all components should be weighed at reception as a baseline for later mass tracking.

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2. Mechanics Assembly

- **Weigh all components** - record mass of each piece before assembly begins; continue to record mass at defined points during and after assembly to track glue usage and catch anomalies
- **Rim-to-corrugation bonding** - glue the outer rim to the corrugated core per the bonding procedure; verify cure (*note: may move to a separate Mechanics QC document depending on document structure decision)*
- **CMM survey of key dimensions** - survey the assembly mechanics at defined hold points to verify geometry and tolerances
- **Air channel integrity verification** - attach a temporary test structure to close off the corrugated channels; use flow meters at input and output to verify airflow through the channels and confirm the rim sealing is sound; acceptance criteria for flow rate and allowable leakage TBD

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3. Module Gluing & Electrical Integration

The following sequence is repeated row by row, first for all front-side rows and then, after flipping the disk, for all back-side rows.

- **Glue module row to corrugation** - glue modules for one row to the corrugated core; verify placement and cure

- **Positional survey of glued row** *(if CMM is available during assembly)* - survey module positions after each row; if CMM access is limited, surveys should occur at minimum before flipping to the back side and again after back-side assembly is complete
- **Glue main & edge FPC for assembled row** - position and glue main & edge FPC to the corrugation; verify placement and cure
- **Connect main & edge FPCs** - make electrical connections between bridge & main/edge FPCs for the glued row
- **Connect FIB/CB** - complete the electrical connection of the FPCs into the FIB/CB (up to 4 modules per FIB)
- **Quick electrical acceptance test** - perform a quick acceptance test each time a FIB's electrical connection are completed; criteria TBD
- **Full electrical test** (*at defined cadence, TBD)* - perform a more comprehensive test at a frequency determined by the group, sufficient to catch issues that can still be reworked before more modules are added

Repeat the above for each row until all front-side rows are complete.

- **End-of-front-side positional survey** - survey all front-side module positions before flipping; this is the last practical opportunity to identify and correct placement issues
- **End-of-front-side full electrical test** - perform a comprehensive test of all front-side modules as a hold point before flipping; last practical opportunity to rework front-side connections (*whether this is required or is covered by the per-FIB full test cadence is TBD)*
- **Flip disk to back side**
- **Repeat row-by-row gluing and electrical sequence for back side**
- **Periodic quick tests on front-side modules** *(cadence TBD)* - check that front-side modules are not being damaged during back-side assembly and handling
- **End-of-back-side positional survey** - survey all back-side module positions upon completion

- **End-of-back-side full electrical test** - comprehensive test of all modules on both sides upon completion of back-side assembly (*whether this is required or is covered by the per-FIB full test cadence is TBD)*

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4. Cooling During Testing

Running a system close to detector operating conditions (cold, very dry air) is likely not feasible in an assembly environment. A practical alternative being considered is a two-part approach: blowing air directly onto the sensors, combined with flowing air (at slightly sub-room temperature) through the cooling channels. The specifics of this system need to be developed, but the QC document should define whatever temperature and flow conditions are achievable and required for each test type.

Summary of Open Items

The following items need to be resolved with the broader group and/or engineers before the plan can be finalized:

1. Whether the main & edge FPCs get their own QC document, are included in the FIB/CB QC document, or are handled entirely as component acceptance within the Disk QC
2. Whether the mechanical components get a separate Mechanics QC document or are handled through component acceptance plus the mechanics assembly section of the Disk QC
3. Definition of “quick” vs. “full” electrical tests and the criteria or cadence that triggers each
4. Whether a comprehensive test of all front-side modules is required as a hold point before flipping to the back side, or whether this is covered by the per-FIB full test cadence
5. Whether and how often front-side modules are spot-checked during back-side assembly
6. Use of CMM during assembly
7. Cooling system specification for assembly-environment testing