# SVT Disks

Nikki Apadula, Eric Anderssen, Bobby Besuner, Elaine Buron, Ernst Sichtermann, Joe Silber

SVT DSC Meeting

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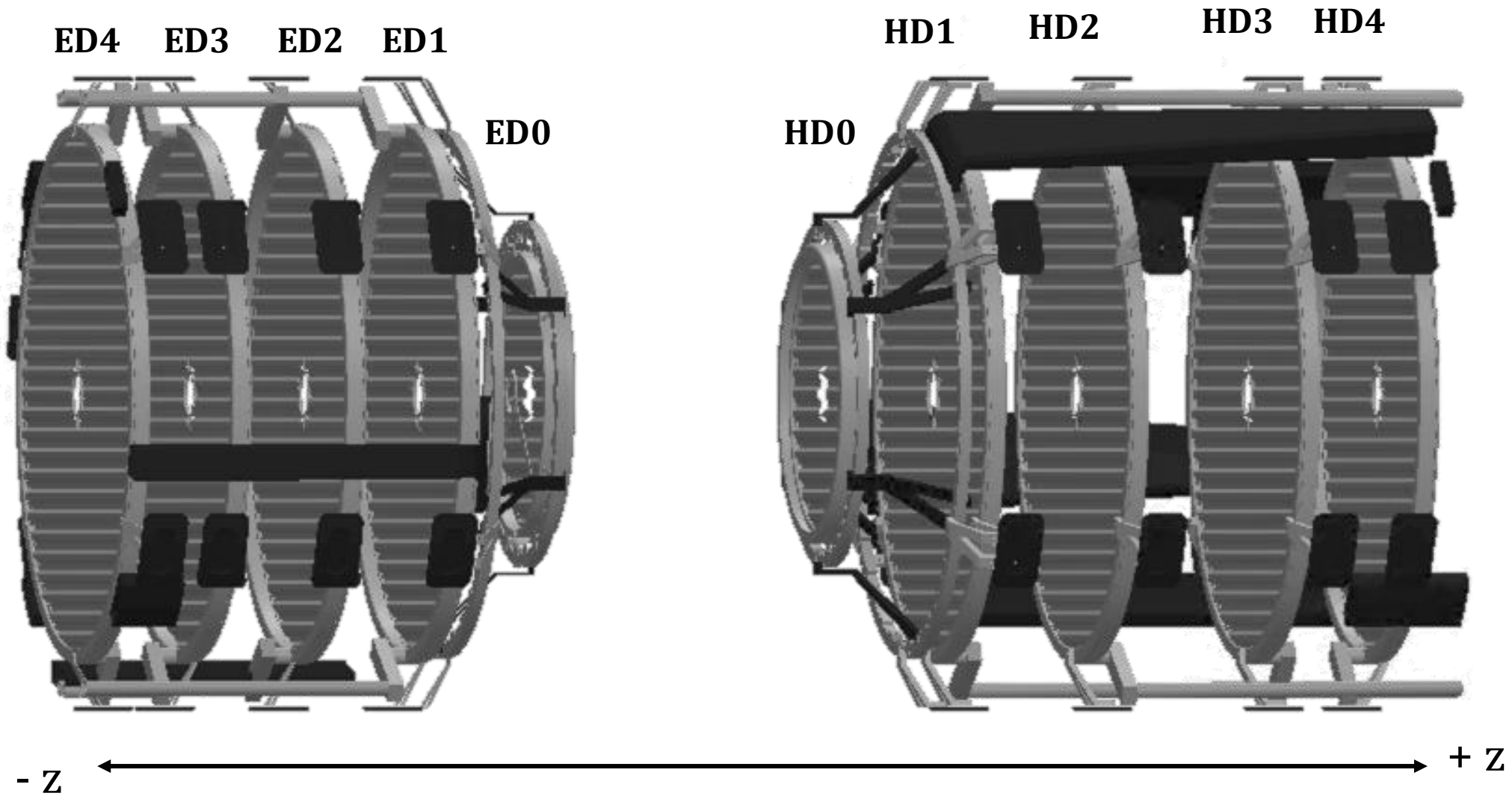
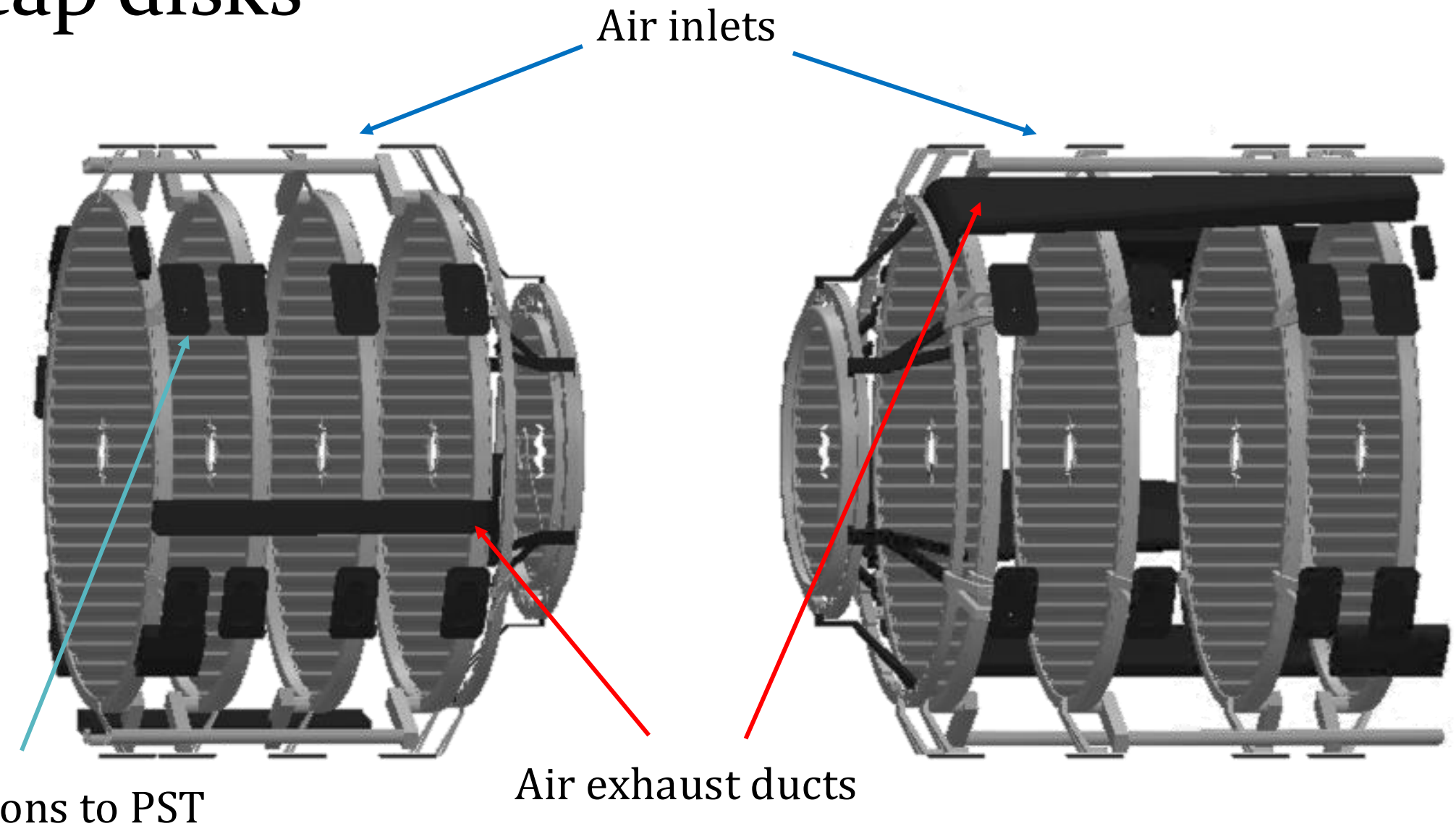
# Endcap disks

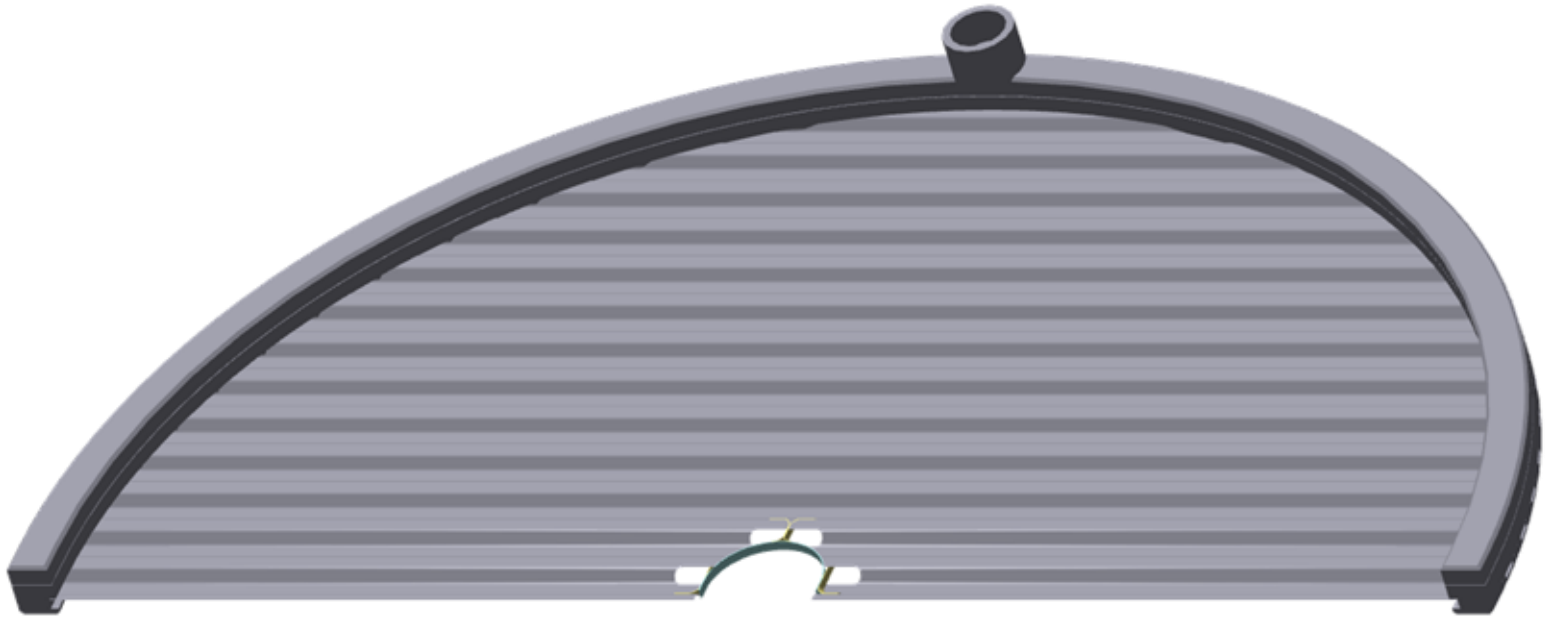


# Endcap disks



# Disk mechanical design

Back side of disk (pointing away from IP)

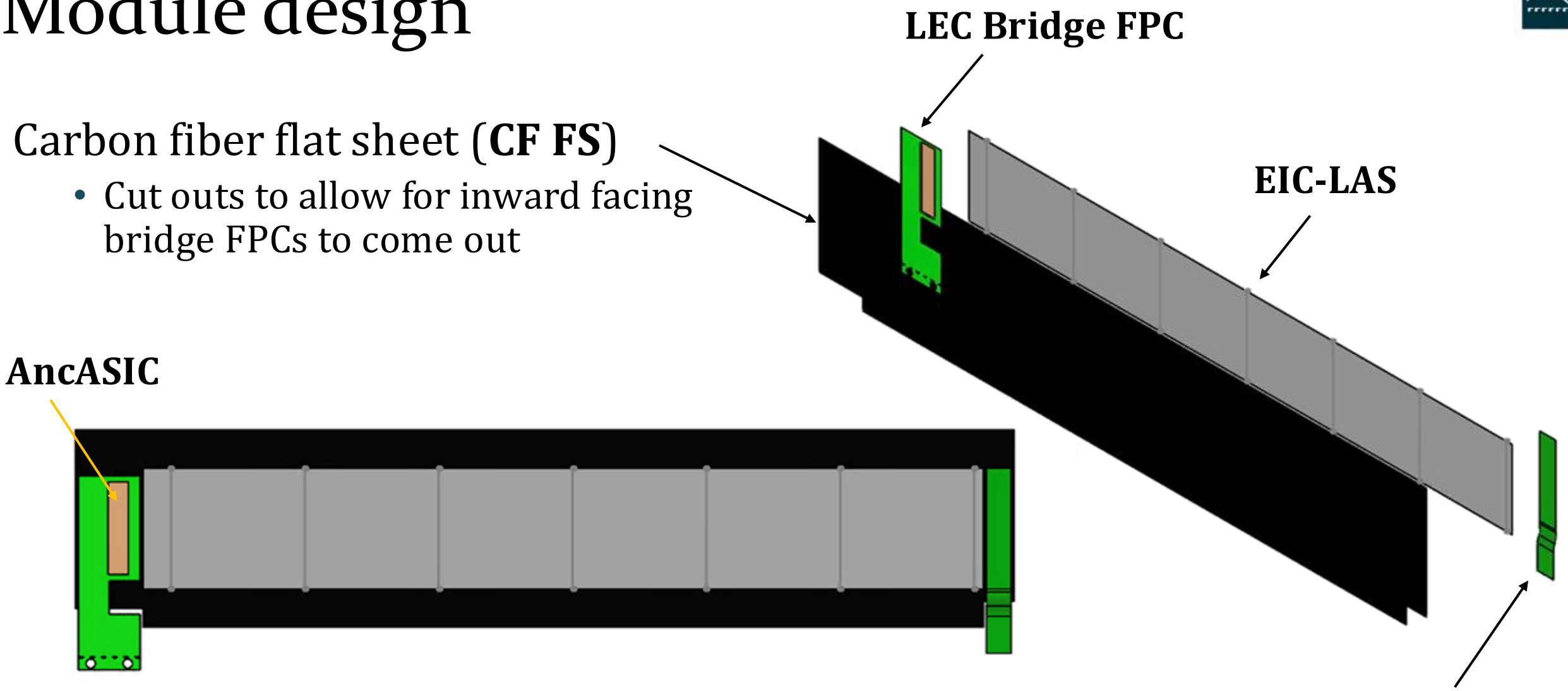


Air manifold incorporated into disk rim design

# Module design

Carbon fiber flat sheet (**CF FS**)

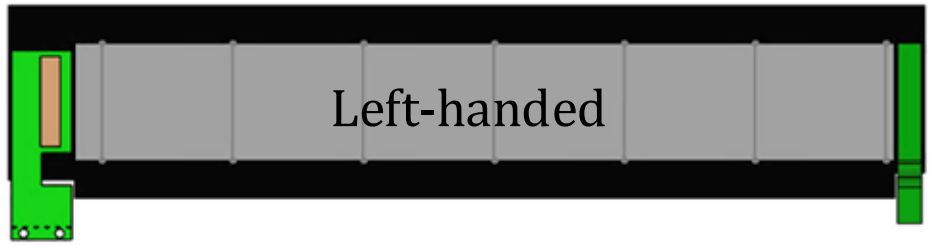
- Cut outs to allow for inward facing bridge FPCs to come out



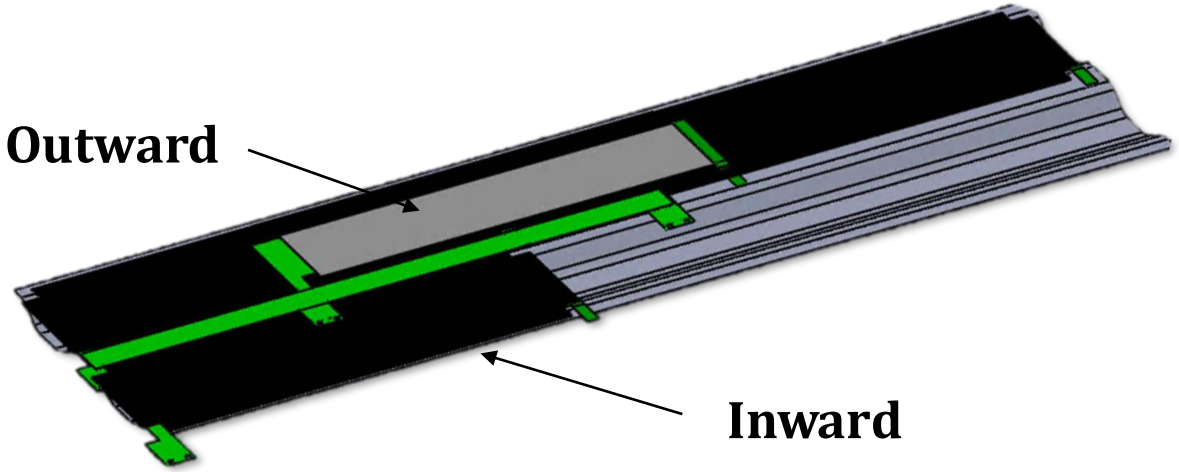

**FPCs are a general representation – updated version in development & coming soon**
**Holes are for alignment and will be cut off**

# Module types

- 8 total variations
  - **5** or **6** RSUs
  - **Inward** or **Outward** facing
  - **Left** or **Right** handed
    - Direction of bridge FPCs
- 4 different bridge FPCs
  - IN/Right
  - IN/Left
  - OUT/Right
  - OUT/Left

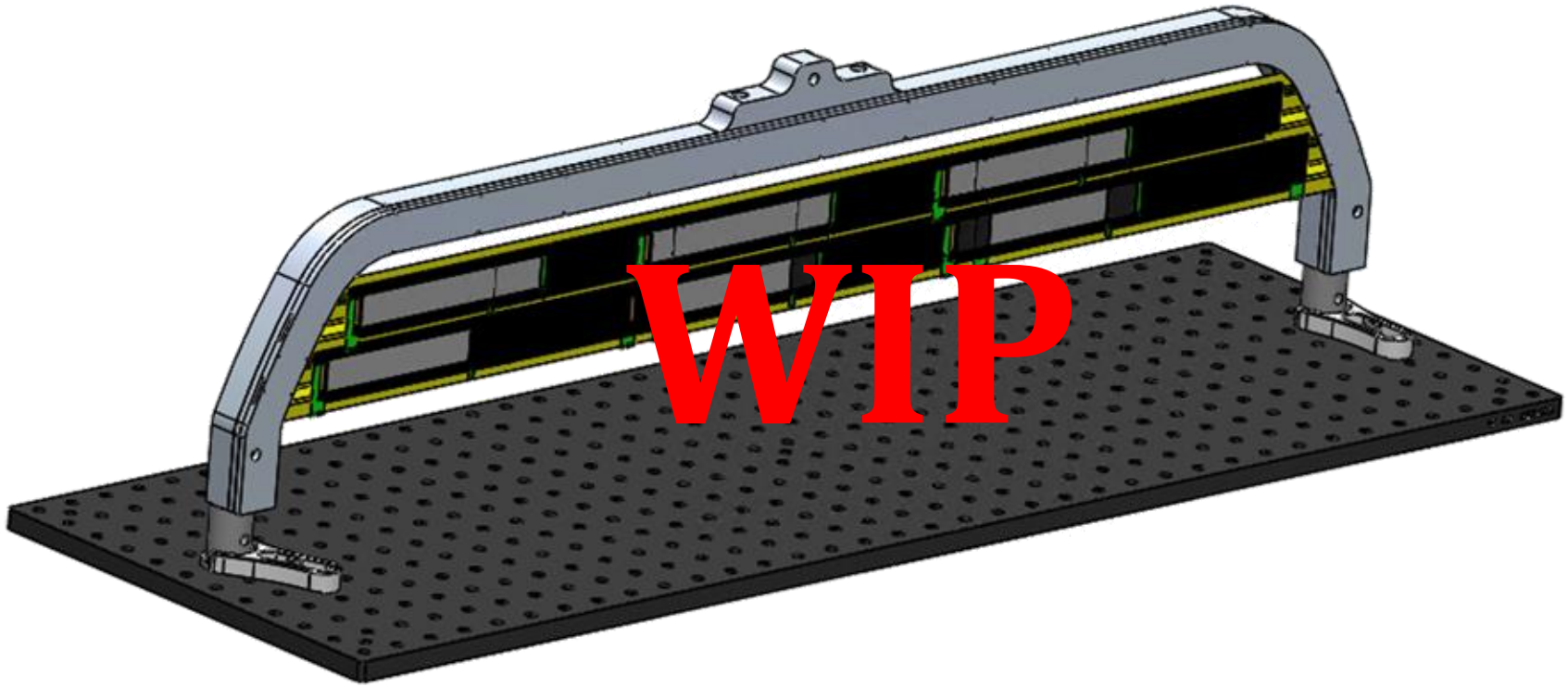






# Partial disk test piece

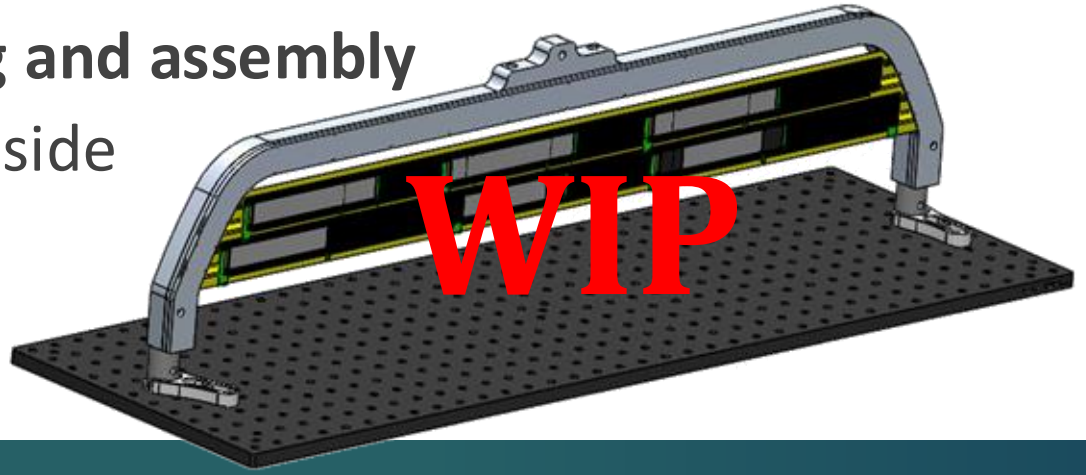
3 corrugation sections (2 front, 1 back)
Chosen right above the beam pipe (longest)




Adjustable → can stand upright (testing) or lay flat (assembly)

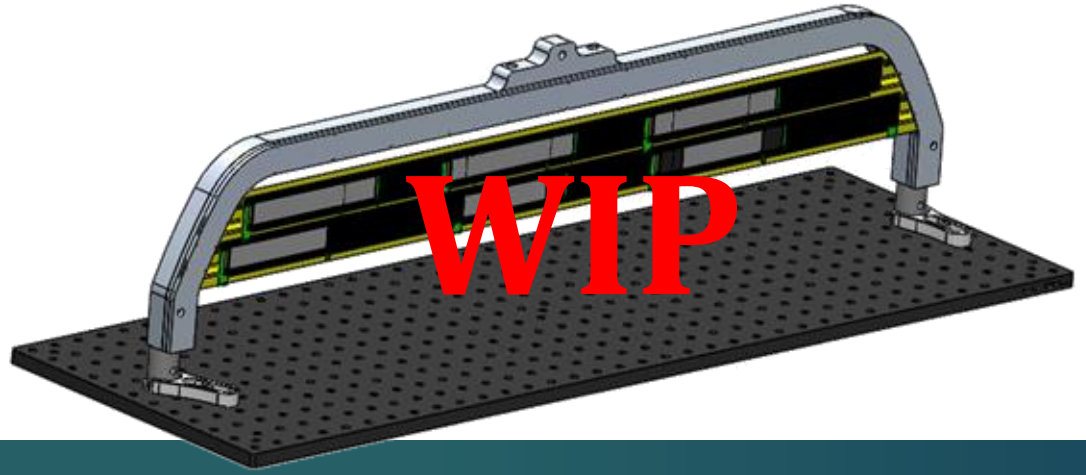
# Partial disk test piece: structural & assembly

- Inspect the manufactured rim for any **structural or fabrication issues**, and develop and evaluate the **bonding process** between the rim and corrugation structure
- Develop procedures for **module mounting**, including adhesive placement, alignment, and positioning repeatability
- **Rework evaluation**: module removal methods, damage risk assessment, and feasibility of sensor replacement
- Track what works and what doesn't for **handling and assembly** throughout whole process, particularly for back side



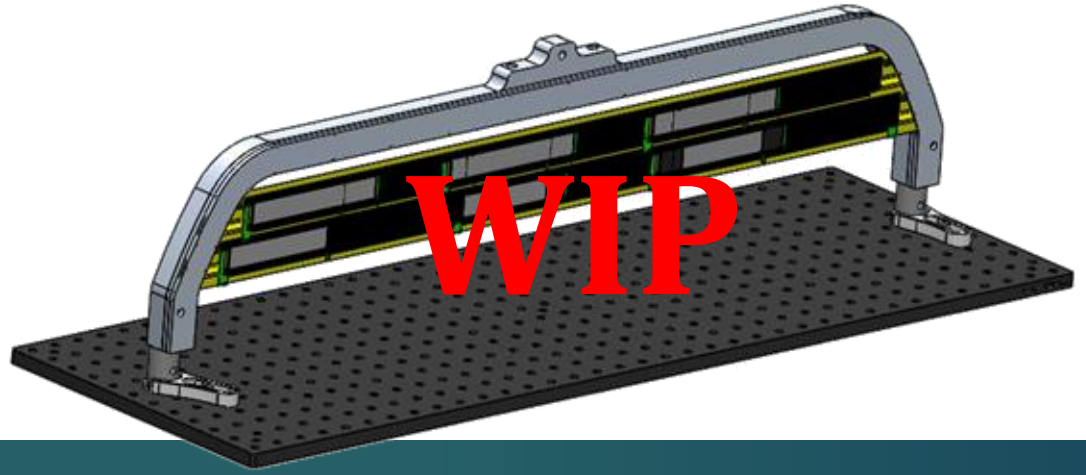
# Partial disk test piece: airflow & thermal

- Run airflow tests first without heaters to understand **baseline flow, pressure drop, distribution, and any leakage** — then check against predictions
- Add heaters to simulate **real module loads** and see how well cooling actually performs across the full channel
- Install FPC mockups near the outlets to check if airflow causes any unwanted **deflection, vibration, or fatigue** concerns
- Explore fixes like deflectors or outlet tweaks if anything looks problematic



# Partial disk test piece: vibration

- Use airflow to shake the structure and **measure vibrations** with accelerometers and non-contact probes
- Support the test piece the **same way the full disk would be supported** to get realistic results
- Compare measurements directly to **FEA model predictions**
- If the numbers line up, we can trust the models to predict full-disk vibration behavior



# Environmental testing:  approach

- Goal is to **identify a possible adhesive** for bonding sensors to carbon fiber and to understand how it holds up **during operation** and where its limits are — including during **beam-pipe bake-out**
- Two parallel tracks: **matched-material samples** (e.g. ceramic-to-ceramic) to measure adhesive strength and **silicon-on-carbon fiber assemblies** to catch real-world problems
- Module mockups will be mounted **vertically** so we can see if sensors slowly slide under their own weight at high temperature
- All tests happen after cooldown to room temperature, so every result reflects both **heat exposure and the stress of cooling back down**

# Environmental testing:  tests

- **Thermal cycling** (-5°C to 50°C, ~4 cycles) — quick screen for cracking or delamination
- **Extended high-temperature hold** (50°C for 2–4 days) — looking for creep, drift, and long-term stability
- **Over-temperature test** — step above 50°C until it breaks, so we know how much headroom we actually have
- **Thermal gradient test** — locally heat the silicon while running cooling air, simulating real non-uniform operating conditions

# Summary/upcoming

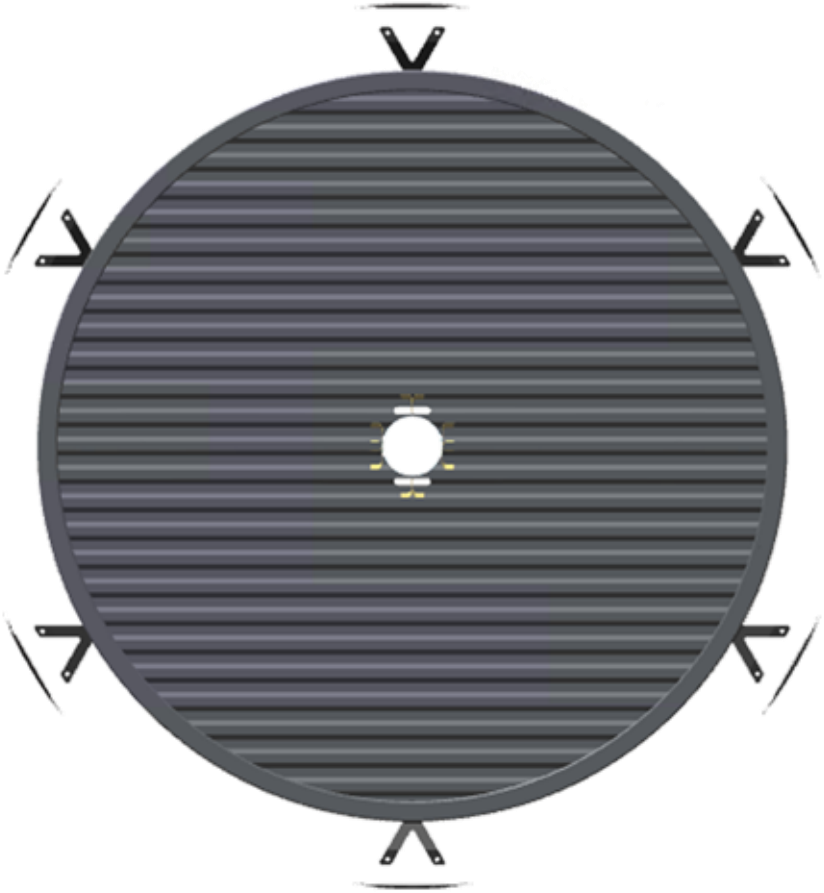
- Disk CAD model is progressing — iterating on the rim design, to be validated with the partial disk prototype
- Working on incorporating the FIBs and services into the model, routing them through the SVT space
- Module tooling development underway in parallel, with new FPC prototypes for checking fit and routing
- Environmental testing to test adhesives and understand real-world limits — including under operating conditions and bake out

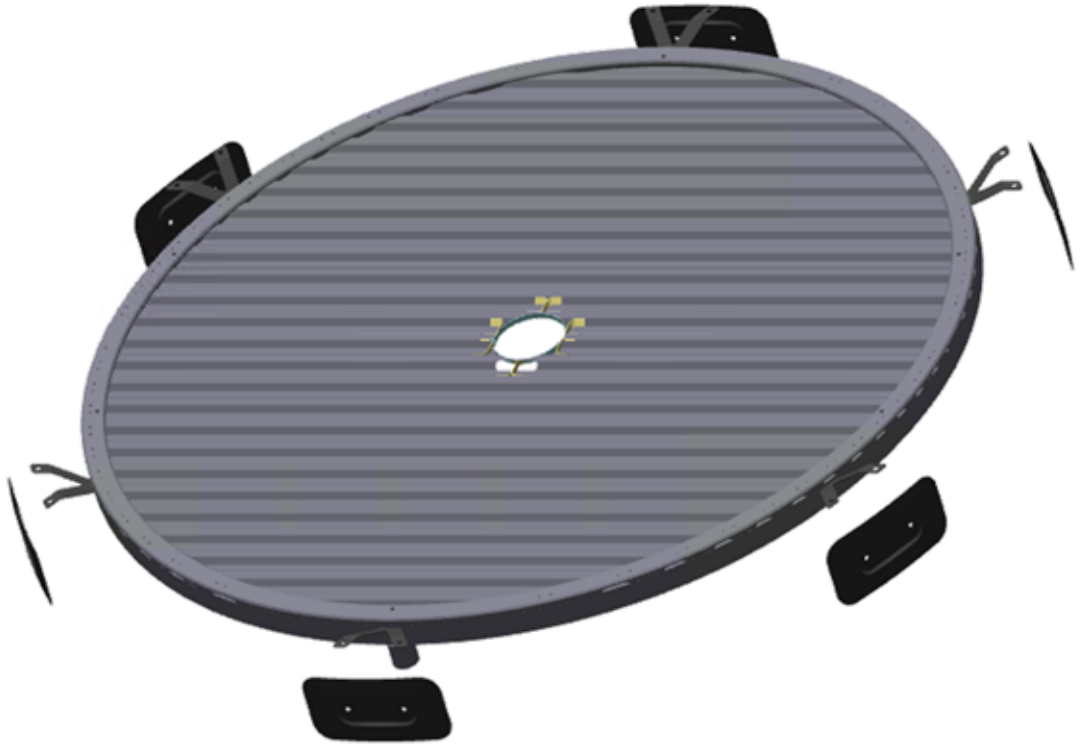
*Partial Disk Test Piece*

- Rim fabrication and bonding, module mounting, alignment, and rework procedures worked out
- Cooling and airflow performance validated against predictions; FPC routing near outlets checked for deflection or vibration concerns
- Vibration measurements compared against FEA model predictions, building confidence for the full disk design

# Disk mechanical design

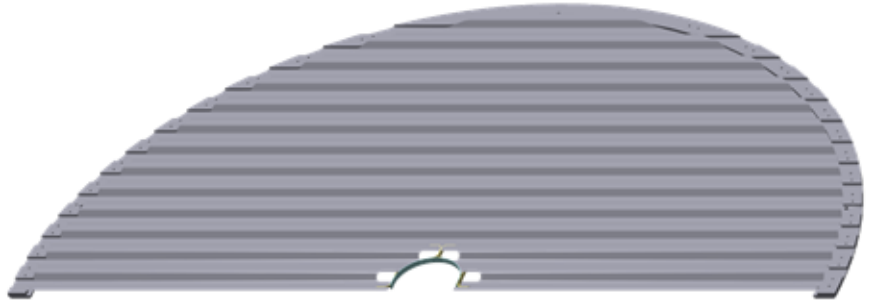
- Attachment points glued to Pixel Support Tube (PST)
- Disks then connect via bipods



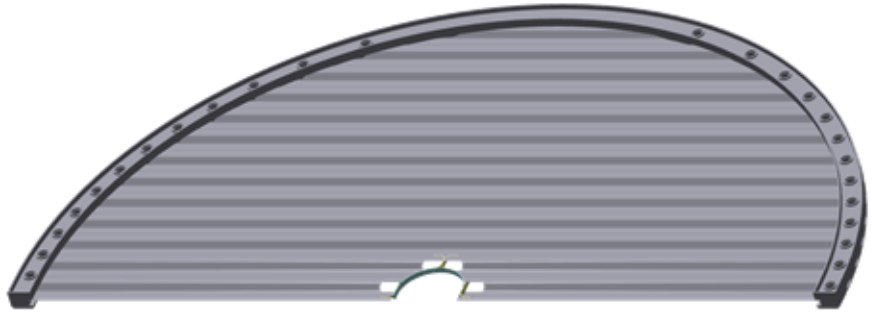


# Disk mechanical design

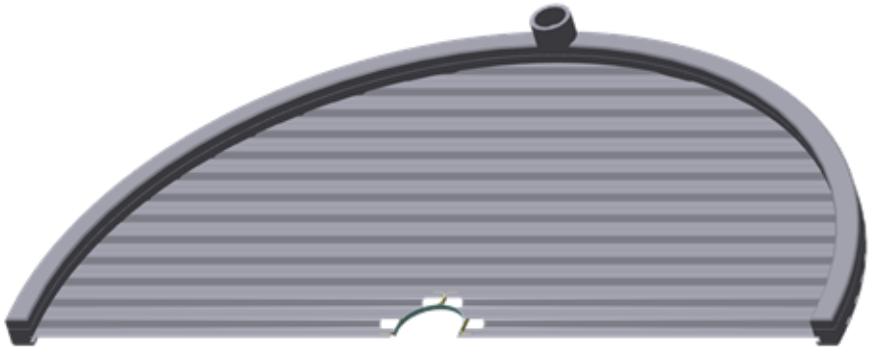
Back side of rim shaped to corrugation



Corrugation glued onto shaped rim

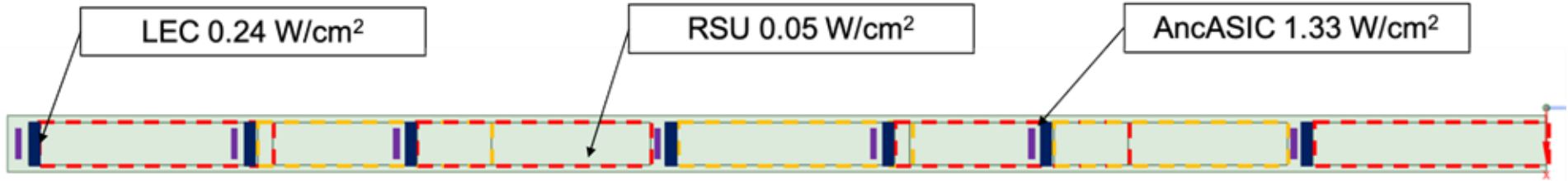


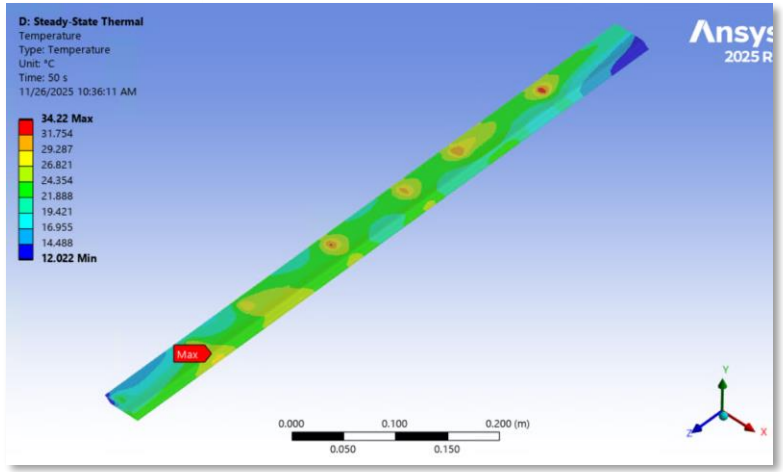
Holes for air flow through corrugation

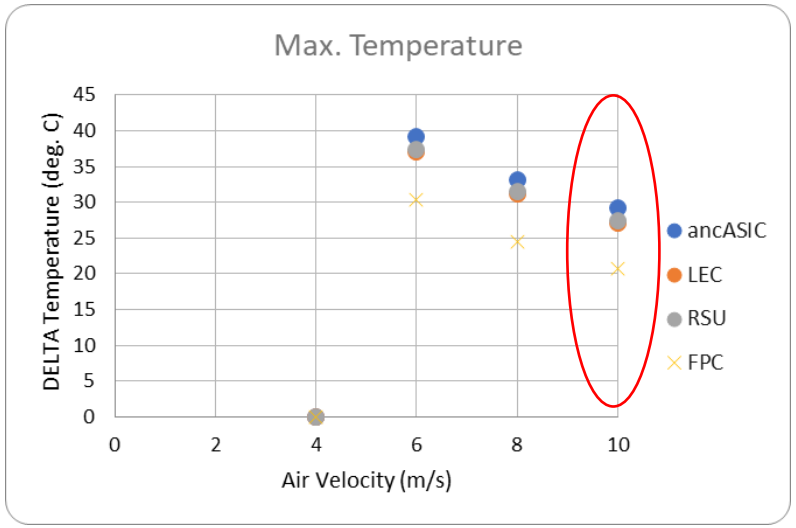


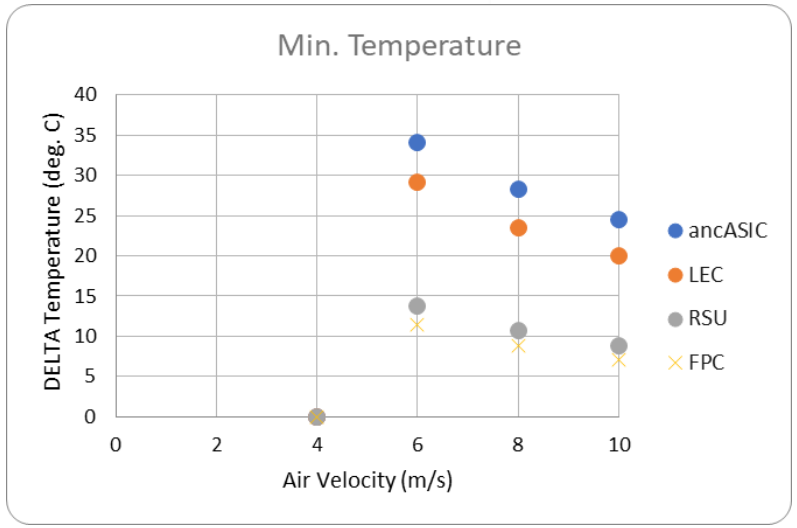
Top part of manifold with air tube

# Thermal FEA




- Testing 7 modules → the longest # of modules in a row on a disk

| Results: Component Temperatures. DELTA Temp | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ancASIC | | | LEC | | | RSU | | | FPC | | |
| v (m/s) | T min. | T max. | T avg. | T min. | T max. | T avg. | T min. | T max. | T avg. | T min. | T max. | T avg. |
| 4 | | | | | | | | | | | | |
| 6 | 34.027 | 39.236 | 37.31 | 29.092 | 37.099 | 33.792 | 13.831 | 37.441 | 26.391 | 11.4 | 30.401 | 25.463 |
| 8 | 28.271 | 33.202 | 31.361 | 23.557 | 31.111 | 27.969 | 10.777 | 31.422 | 21.14 | 8.81 | 24.528 | 20.197 |
| 10 | 24.518 | 29.221 | 27.446 | 19.966 | 27.137 | 24.114 | 8.825 | 27.471 | 17.745 | 7.137 | 20.633 | 16.771 |