The Forward Silicon Tracker at STAR

2019/05/16

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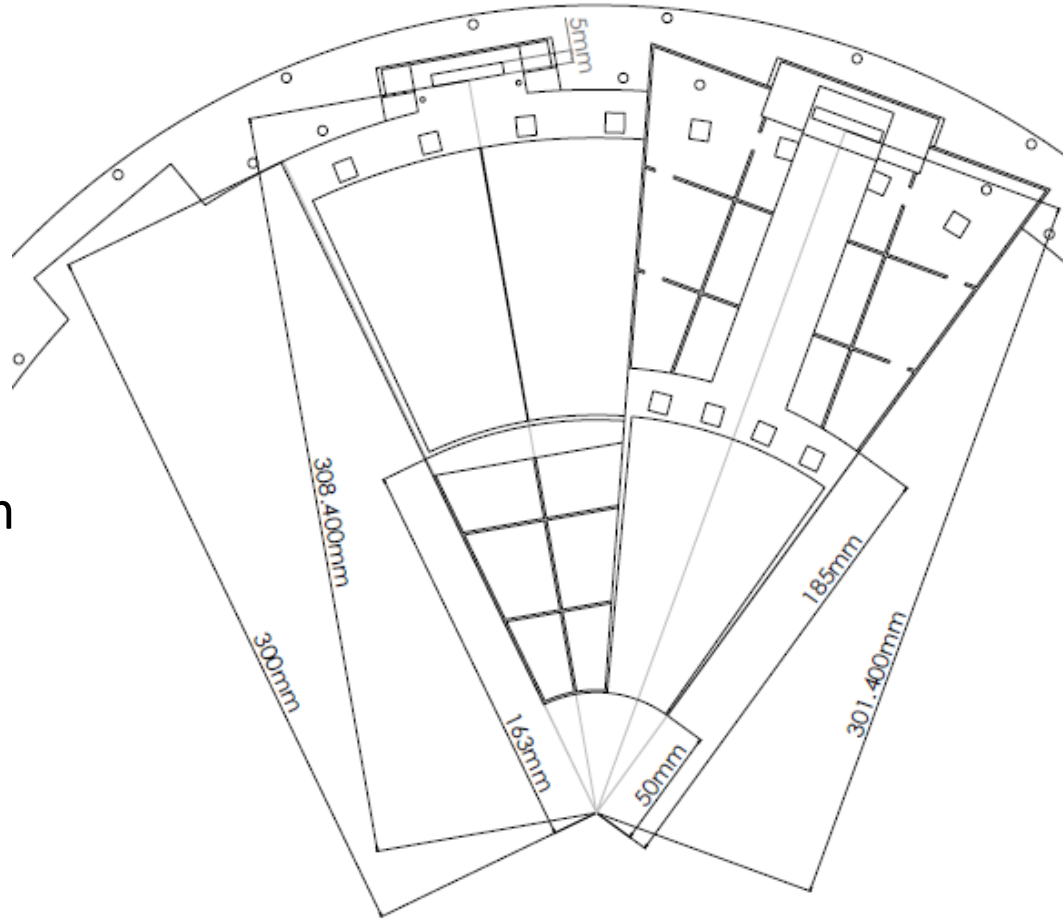
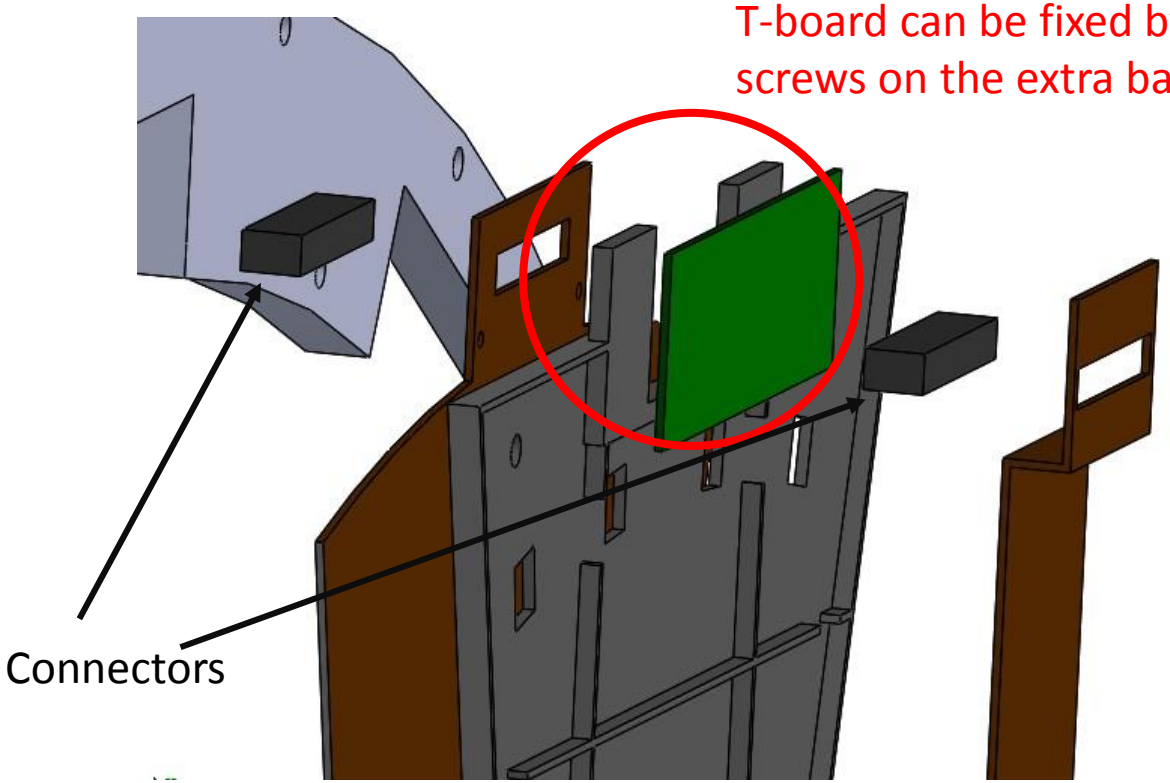
Design of mechanical structure

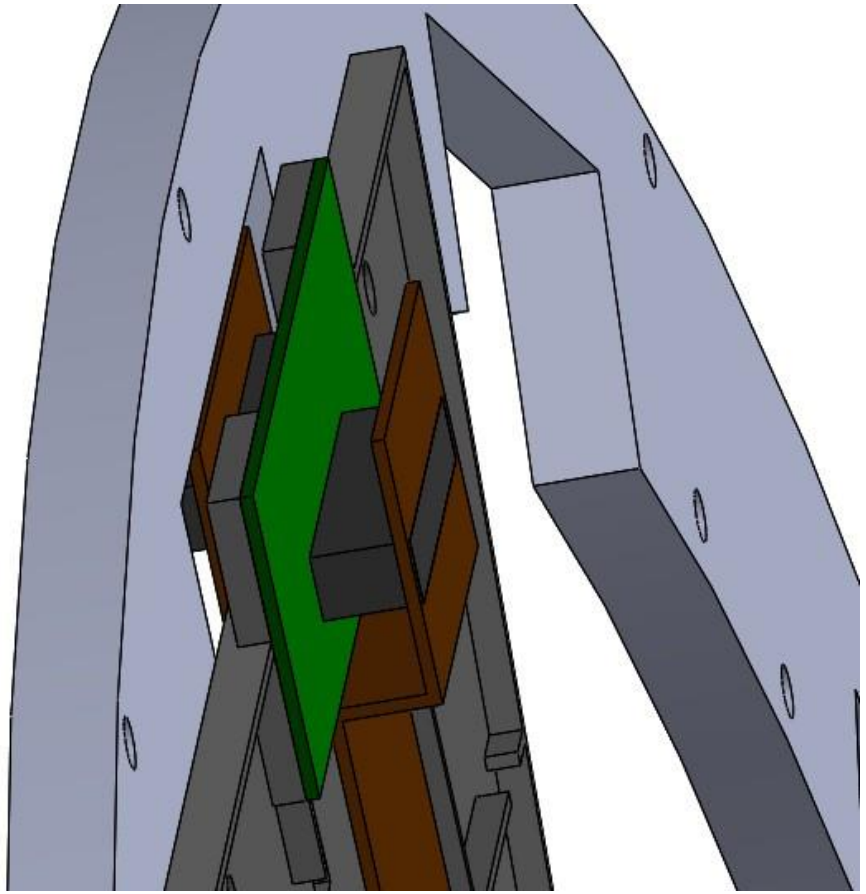
- Check list
  - ✓ Design of extra base for the T-board
  - ✓ Dimensions of supporting structure
    - Opening angle for the wedge: 32^0
    - Inner radius: 50 mm
    - Other dimensions are suitable for current design of hybrids
  - ☐ Adjust the sensor inner radius from 50 mm to 49 mm
  - ☐ Adjust the positions of heat sink, which depends on the new design of hybrids



Design of mechanical structure

- Current design with the extra base for T-board

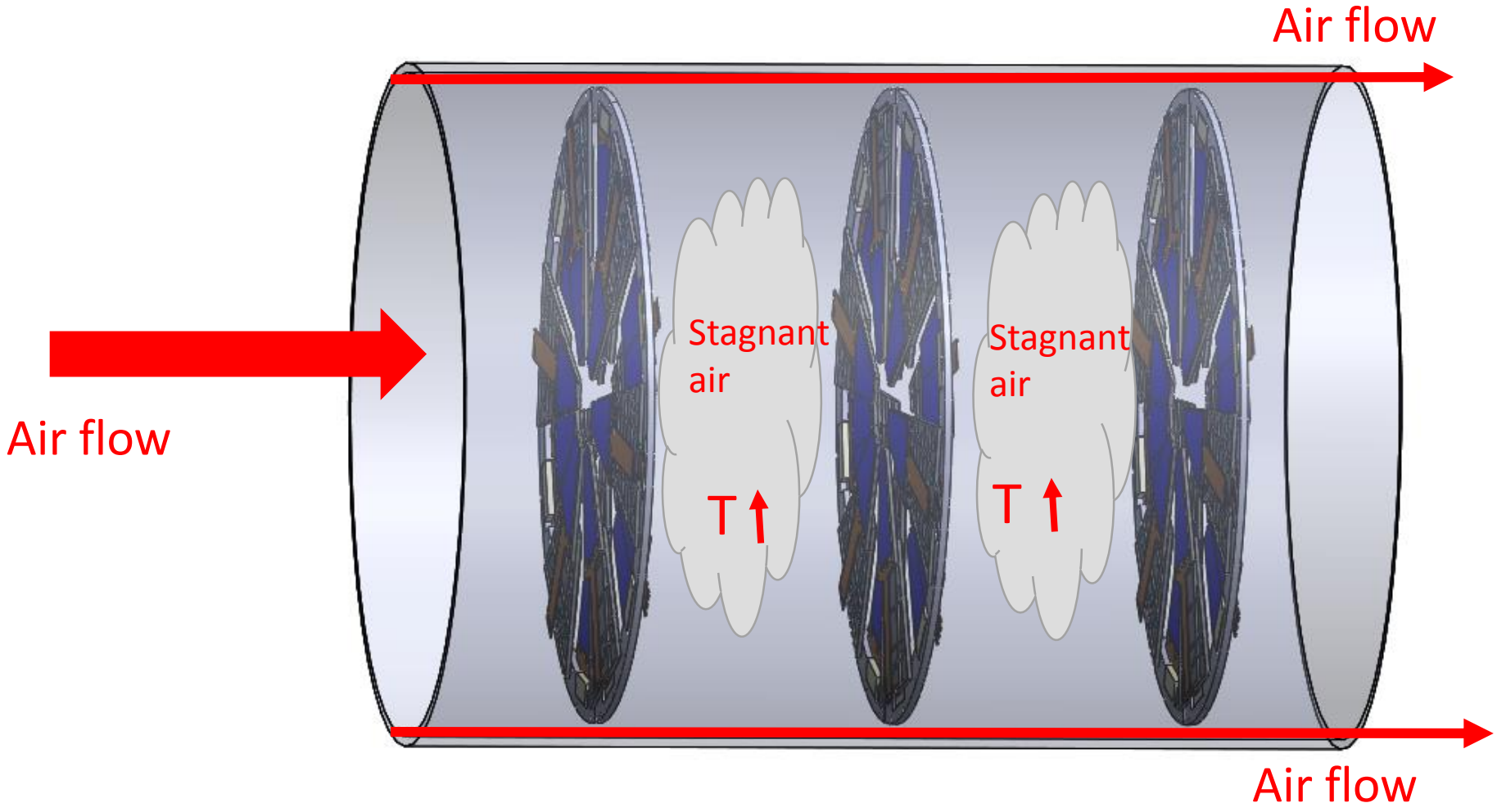




Air flow

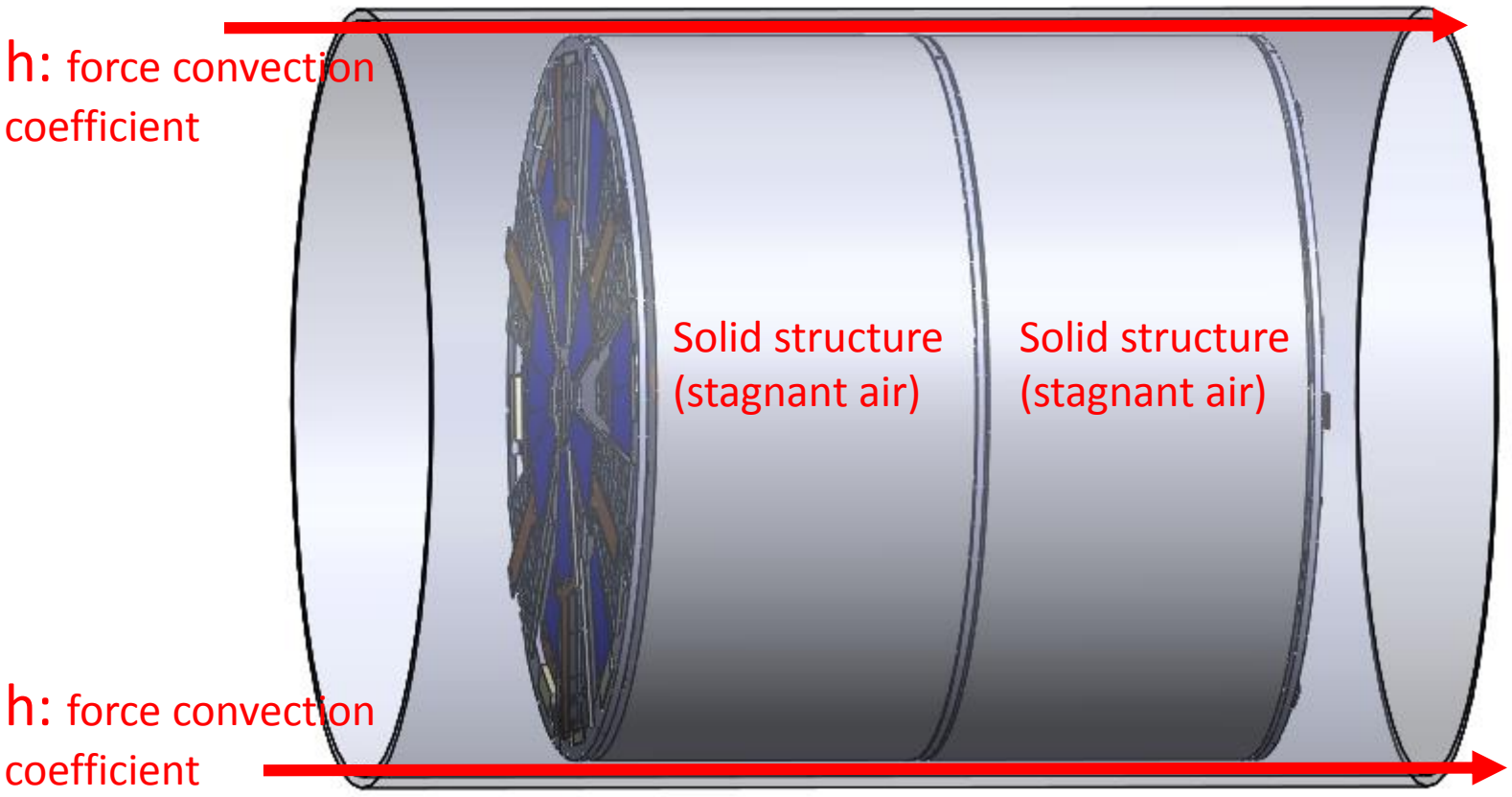
- Question

The trapped stagnant air will be heated, if the air flow do not involve in the inside space



Air flow

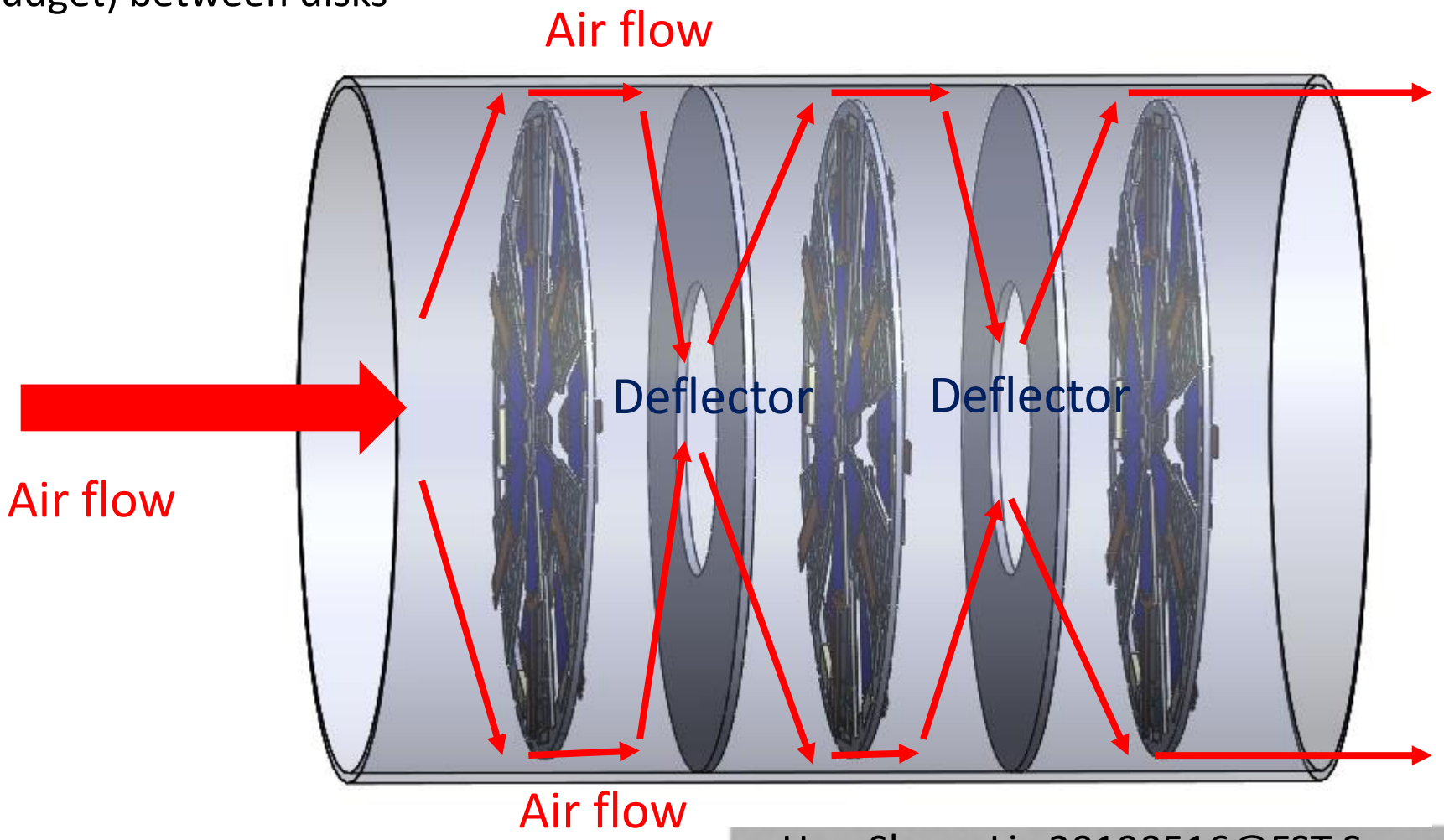
- Worse case estimation
  - In the simulation, we put solid structures assigned with air thermal conductivity as the stagnant air, and set up the force convection coefficient inside the cylinder.
  - The first result will be presented next week and confirmed with experts at Department of ME



Air flow

- One proposal

  To facilitate air flow covering surface of disks, we can mount deflectors (very thin and low material budget) between disks

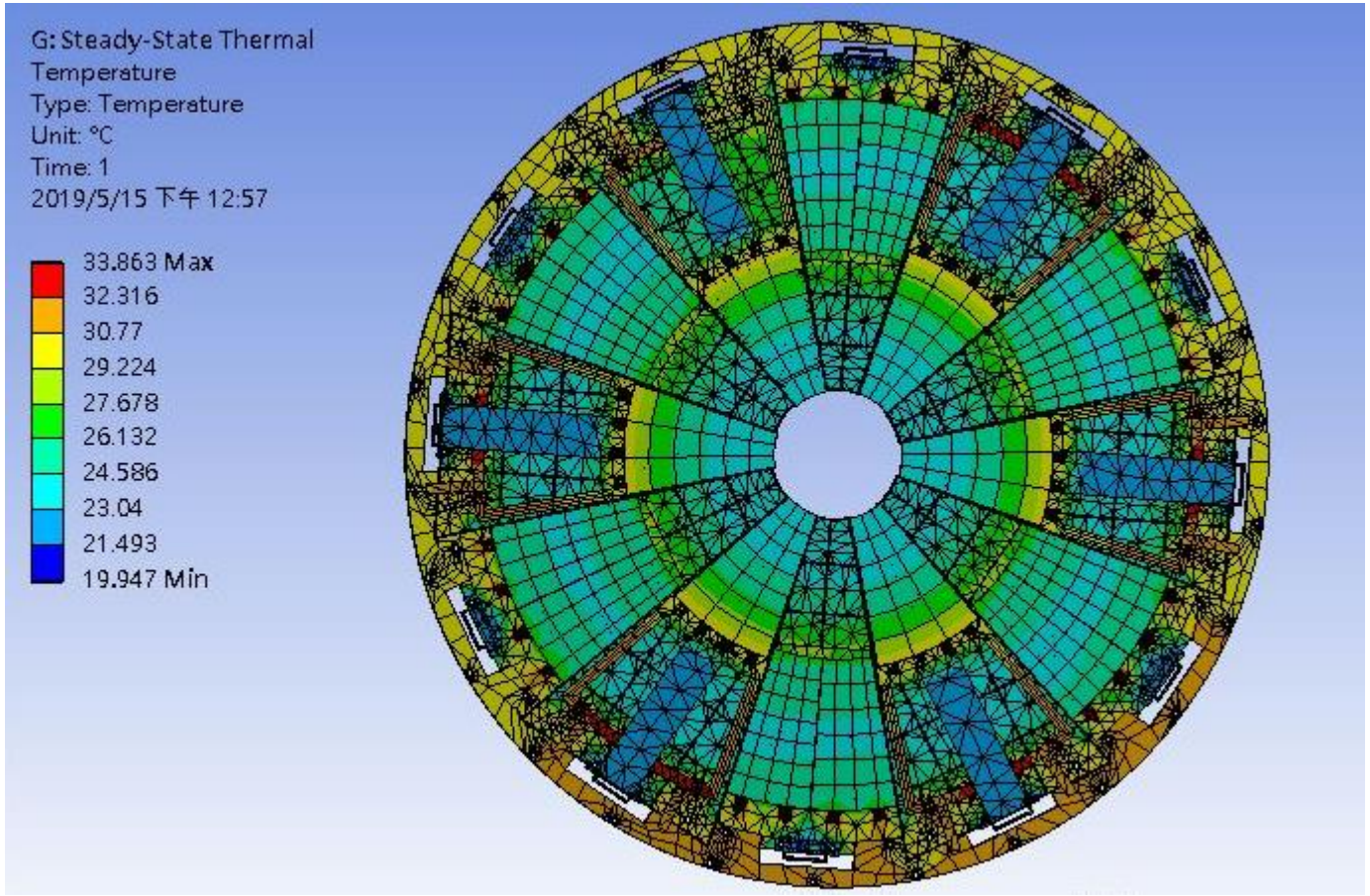


Temperature profile for full disk

- Setup
  - Ambience temperature: $22℃$
  - Heat generation
    - The power consumption (per chip): $300\,\frac{\text{mw}}{\text{per chip}} = 0.01524\ \frac{w}{mm^3}$
    - The power consumption (per sensor): $1\,\frac{\text{mw}}{\text{per } sensor}$
  - Convection
    - The nature convection coefficient to stagnant air: $3 \times 10^{-6}\,\frac{w}{mm^{2}\cdot℃}$ (a lower, but less precise, value calculated from text book)
    - We have checked the thermal simulation result with our calculations from text book, and applied a thermal model to obtain more precise convection coefficient, but it is still in the process. The specific calculation and model will be presented next week.

Temperature profile for full disk

- The temperature profile of full disk is consistent with previous result in the single wedge
- The power consumptions from sensors are negligible



Next Steps

- Finalize the design of mechanical structure
- Provide specific thermal coefficients
- Conduct the thermal experiment (ME department)
- Compare the simulation result with the thermal experiment