

# Status of ARC in k4geo repo

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ARC detector implementation meeting

Oct. 24<sup>th</sup>, 2023

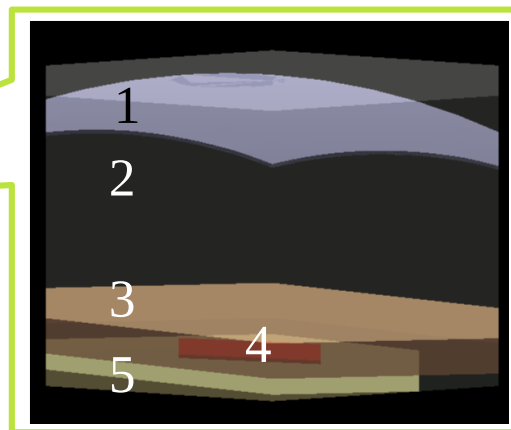
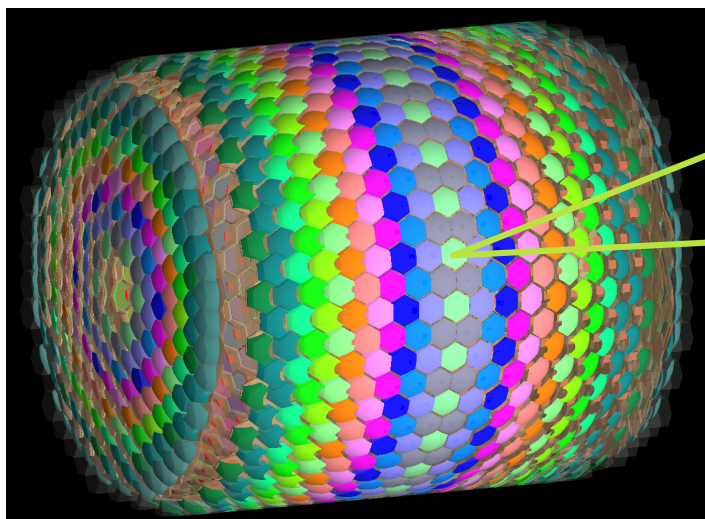


**FUTURE  
CIRCULAR  
COLLIDER**



# What was the status at FCC week 2023?

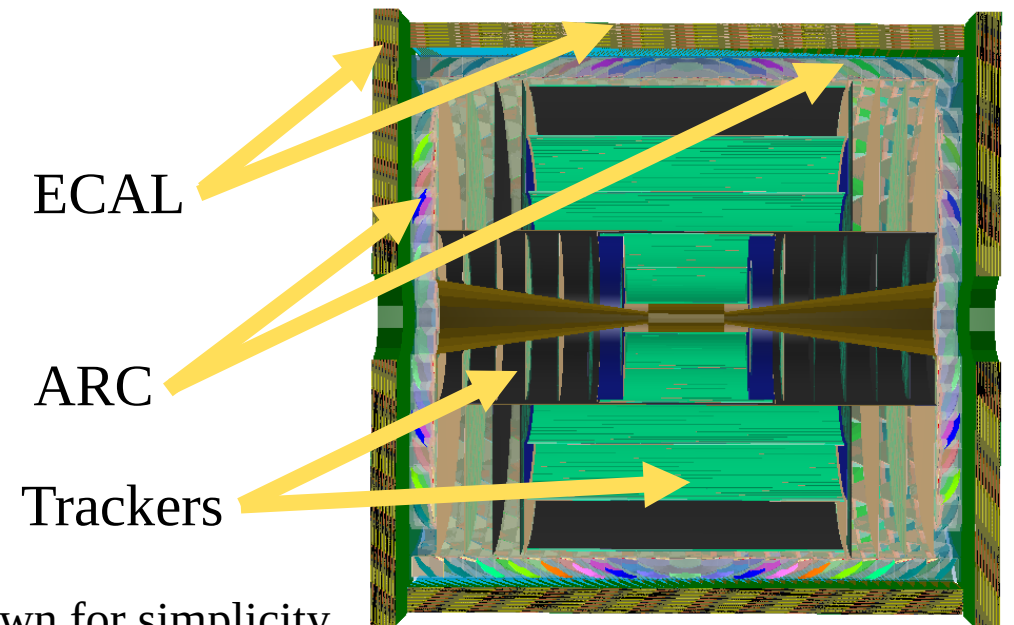
- CLD option for ARC did not exist
- Material budget was too high
- Geometry implementation was ready, but some tuning was needed



1. Spherical mirror
2. Radiator gas C<sub>4</sub>F<sub>10</sub>
3. Aerogel
4. Light sensor
5. Cooling plate

# CLD for ARC

- New CLD option (option 3) is ready to accommodate the ARC between the Trackers and the ECAL
- CLD option 3 evolves from option 2, version 5. Shrinking by 20 cm of the Trackers was needed to leave the required space by ARC
- Fullsim with ddsim is ready, to be checked within key4hep
- See [this talk](#) for further details
- The modified tracker requires a bit of redesign to keep the same angular coverage as the baseline



HCAL and yokes are not shown for simplicity

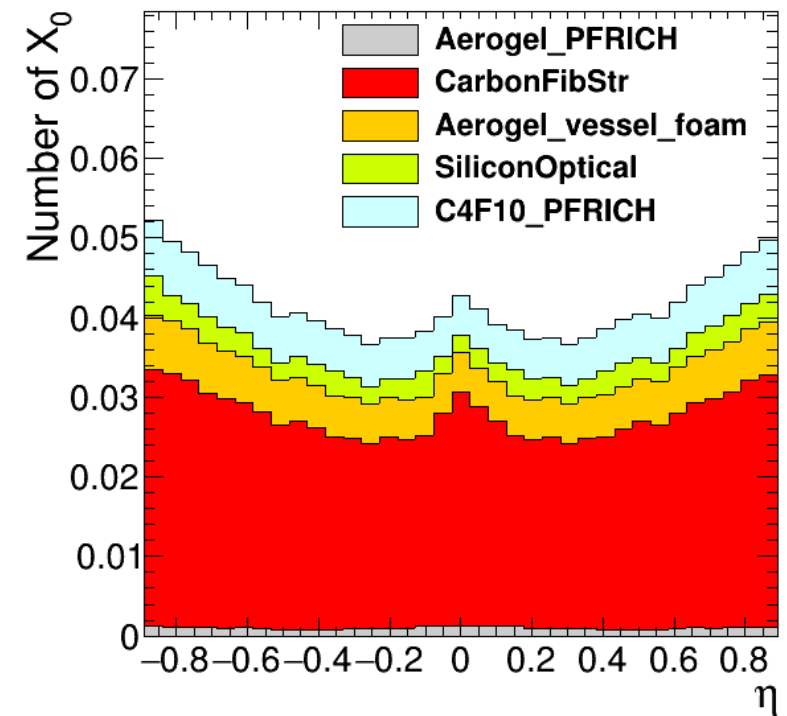
# Material budget



Replacement of Aluminum by Carbon fiber and enhancement of wall definition makes ARC  $0.04X_0$

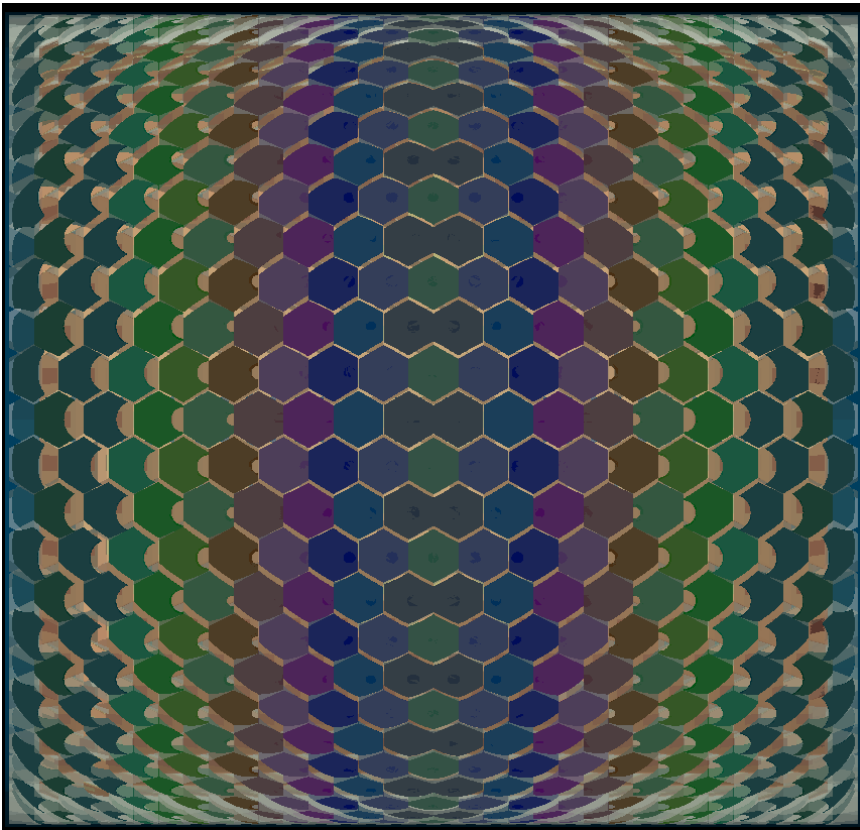
A list of ARC components and its material is shown below.

- Walls are now made up by
  - a bulk material (8 mm), at the moment a template material *Aerogel\_vessel\_foam*, to be replaced in the future
  - a thin skin (1+1 mm) of carbon fiber, *CarbonFibStr*
  - **The ratio skin/bulk thickness is a parameter**
- Mirror is made of *CarbonFibStr*
- Sensor is made of *SiliconOptical*
- Aerogel is made of *Aerogel\_PFRICH*
- Gas radiator is made of *C4F10\_PFRICH*

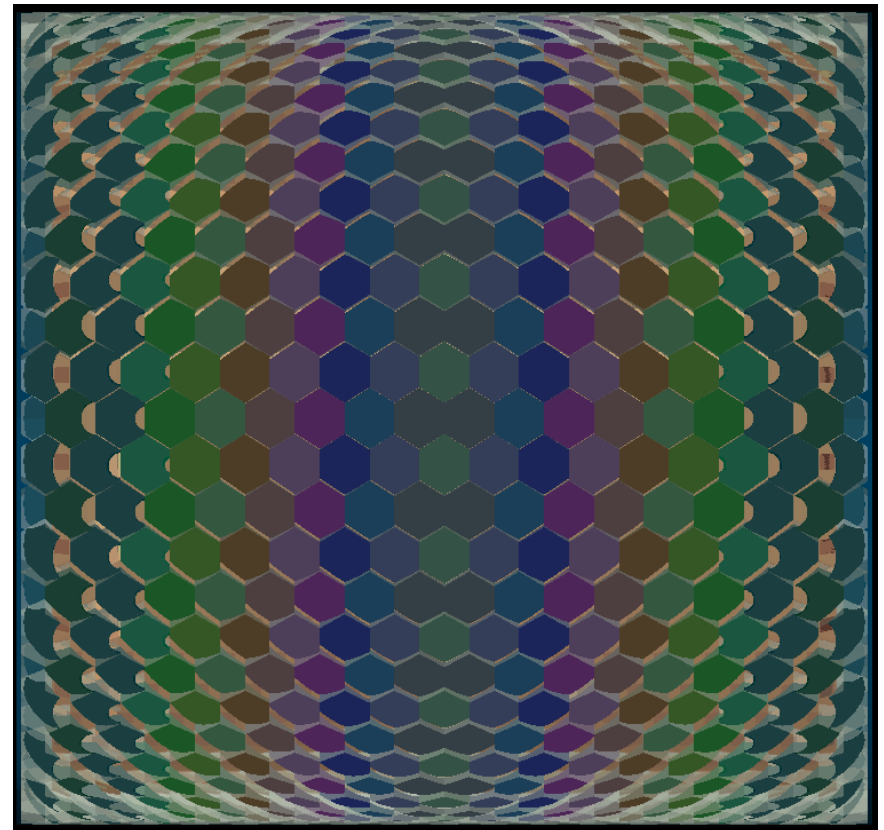


# Updates. Geometry of the barrel

- Geometry implementation was ready, but some tuning was needed
  - Thanks to Roger, a **new more compact unitary barrel cell** was implemented



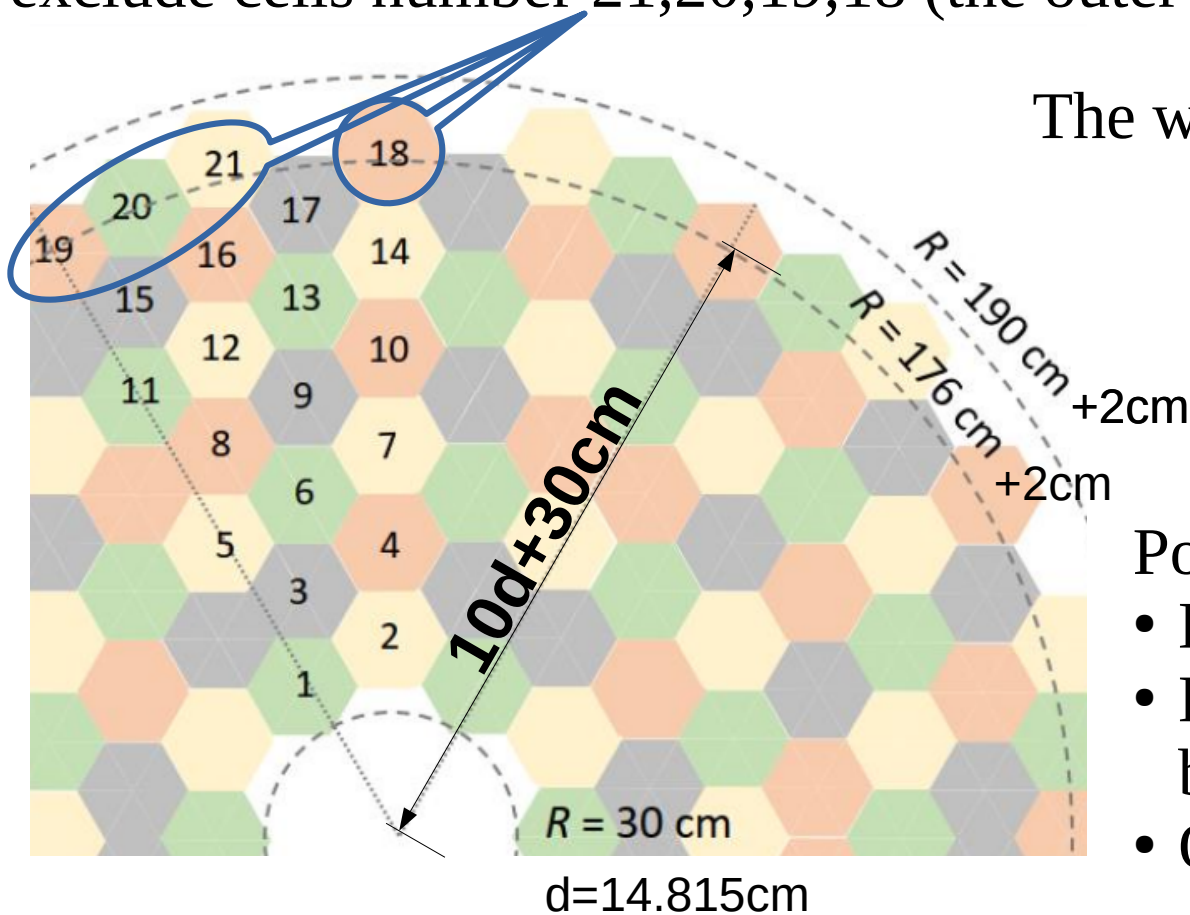
Before



After

# Updates. Geometry of the endcaps

- Geometry implementation was ready, but some tuning was needed
  - Endcap: the geometry details in the draft are not exactly realistic...  
I did not notice but the Geant4 overlap check did. The solution is to exclude cells number 21,20,19,18 (the outer ones)



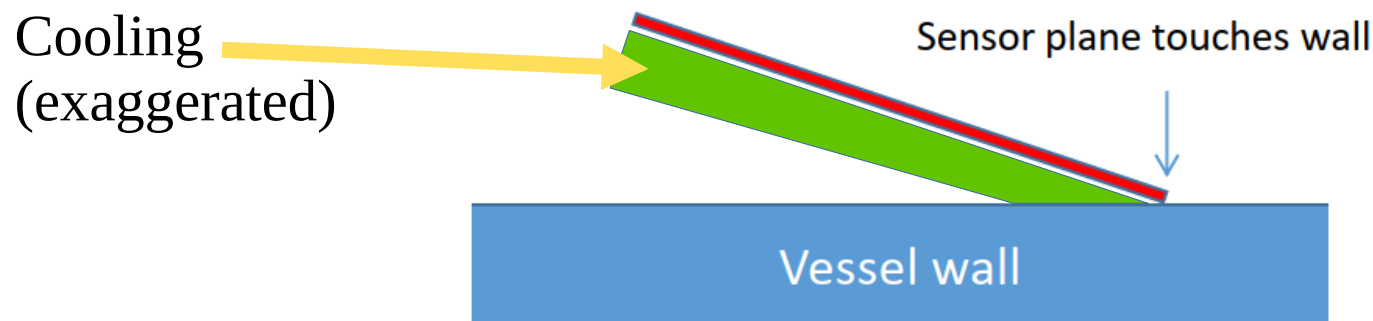
The wall starts at  $R = 189 \text{ cm}$

Possible solutions:

- Build these as partial cells
- Design a transition detector between endcap and barrel?
- Others...?

# Updates. Geometry of the sensors

- Geometry implementation was ready, but some tuning was needed
  - Elements defined as a sandwich aerogel/sensor/cooling
  - ✓ The aerogel and cooling plate shapes result from intersection of a disk of radius  $1.5*d$  ( $=22.2$  cm) and the cell shape
  - If a situation as in the image below happens, the intersection of the disk with the cell will lead to a partially cut cooling plate. Is it ok?



# Open tasks

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- Tackle partial cells for full angular coverage
- Optimization of parameters in case global geometry changes
- Run in key4hep
- I would like to add some test of the current implementation of ARC, to validate it and track changes, any idea how to test it?

