

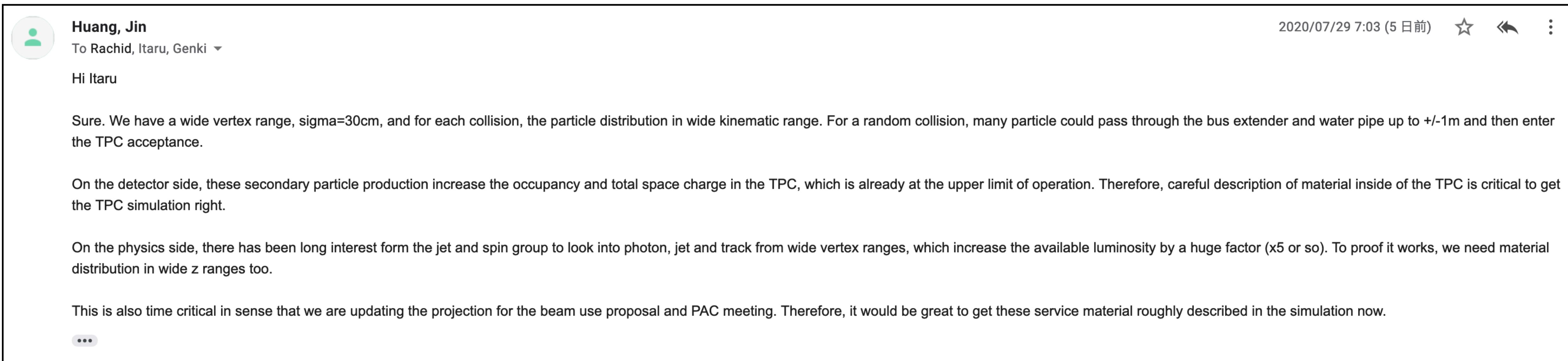
03/Aug/2020

# **Quick Implementation of the Bus Extenders & Report About my Talk at Simulation Meeting**

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# Motivation

A request from Tracking group:



The screenshot shows an email exchange in a dark-themed interface. The message is from Huang, Jin, dated 2020/07/29 7:03 (5日前). The recipient is Itaru. The message content is as follows:

Hi Itaru

Sure. We have a wide vertex range, sigma=30cm, and for each collision, the particle distribution is in a wide kinematic range. For a random collision, many particles could pass through the bus extender and water pipe up to +/-1m and then enter the TPC acceptance.

On the detector side, these secondary particle production increase the occupancy and total space charge in the TPC, which is already at the upper limit of operation. Therefore, careful description of material inside of the TPC is critical to get the TPC simulation right.

On the physics side, there has been long interest from the jet and spin group to look into photon, jet and track from wide vertex ranges, which increase the available luminosity by a huge factor (x5 or so). To prove it works, we need material distribution in wide z ranges too.

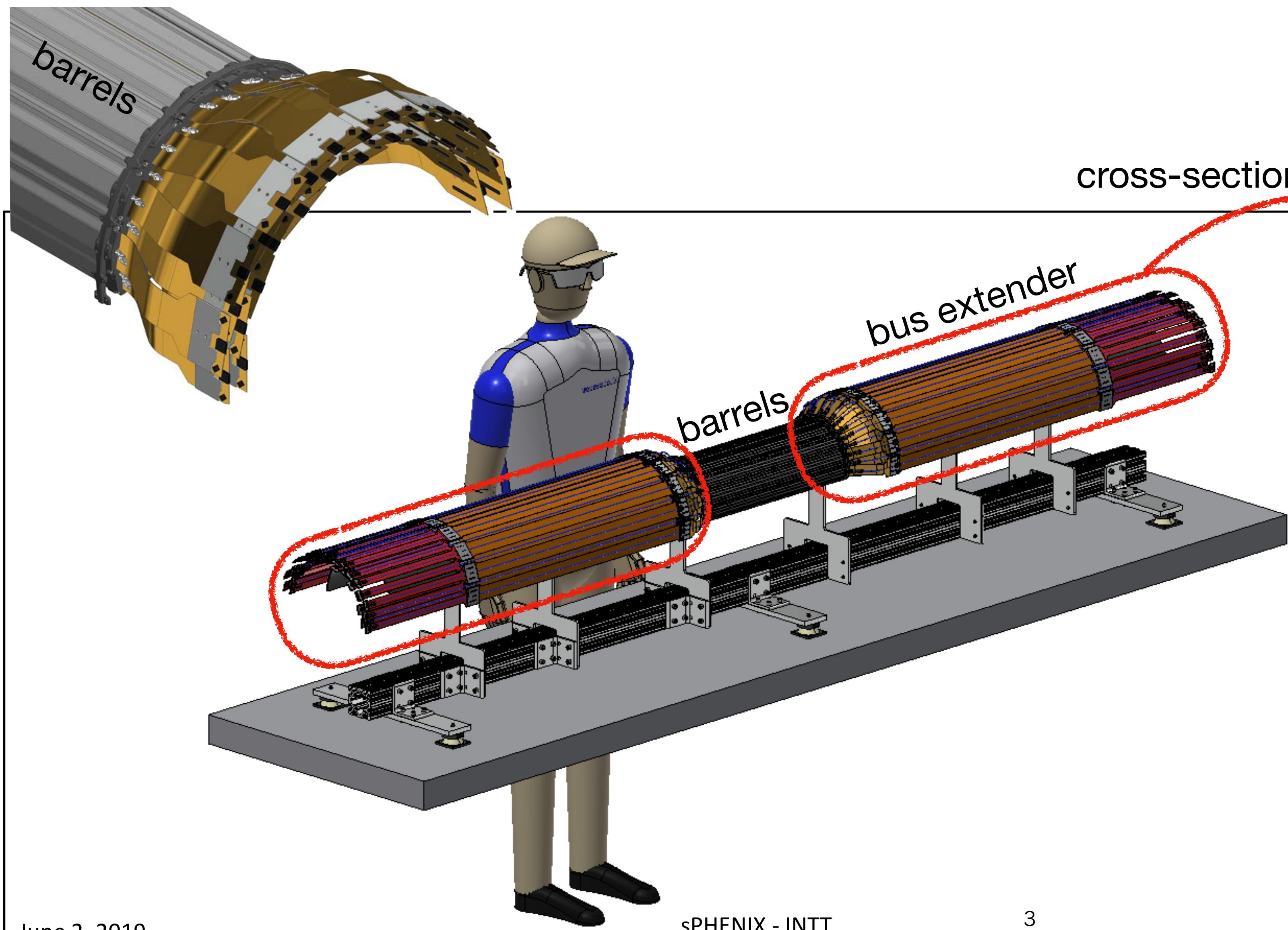
This is also time critical in sense that we are updating the projection for the beam use proposal and PAC meeting. Therefore, it would be great to get these service material roughly described in the simulation now.

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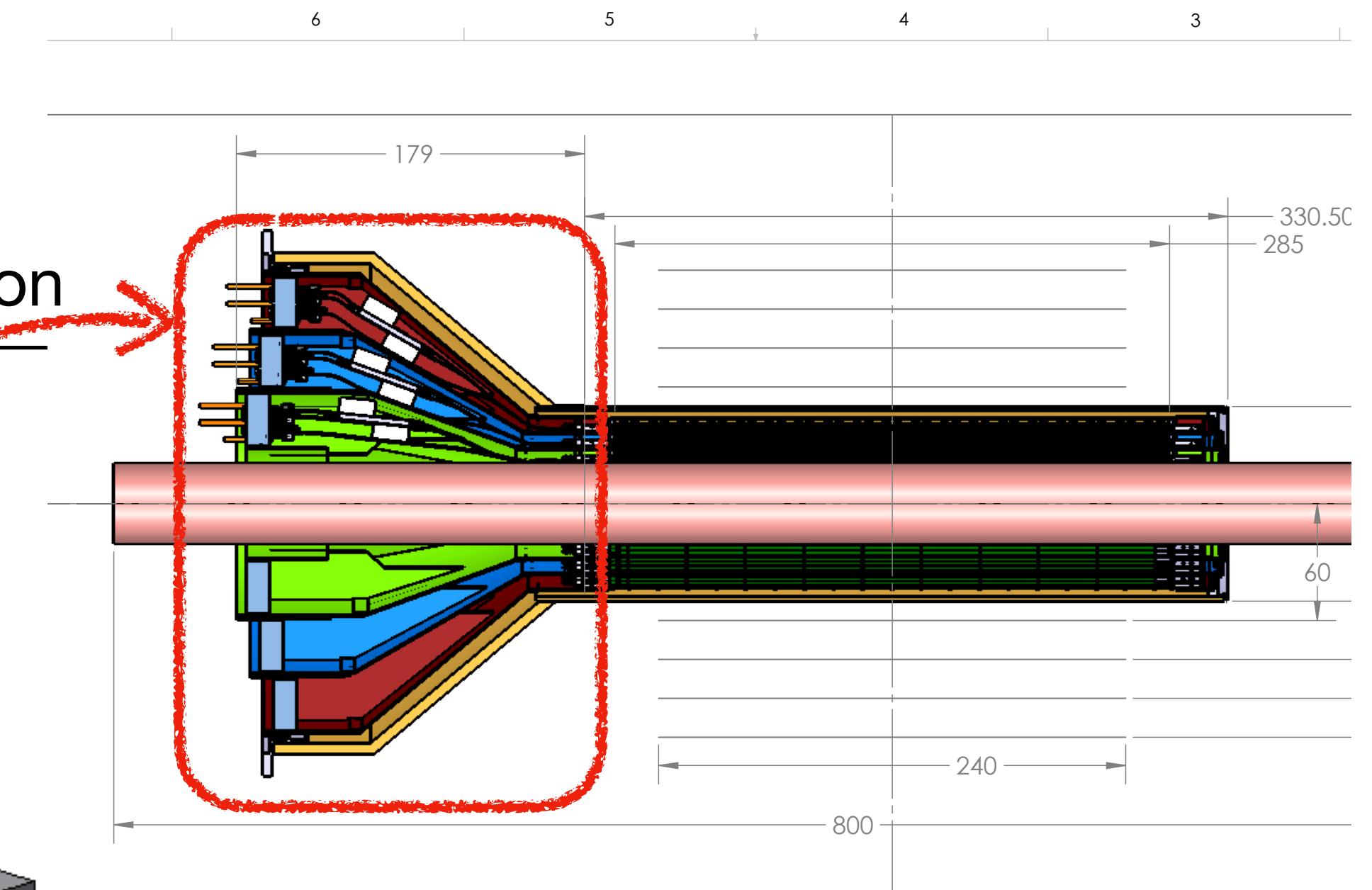
Summary: Description of materials in  $-1 \text{ m} < z < 1 \text{ m}$  is needed for

- better estimation of TPC occupancy
- jet and track from wide vertex range to prove a big gain on luminosity thanks to that
- updates for the beam use proposal and PAC meeting

# Things to be implemented



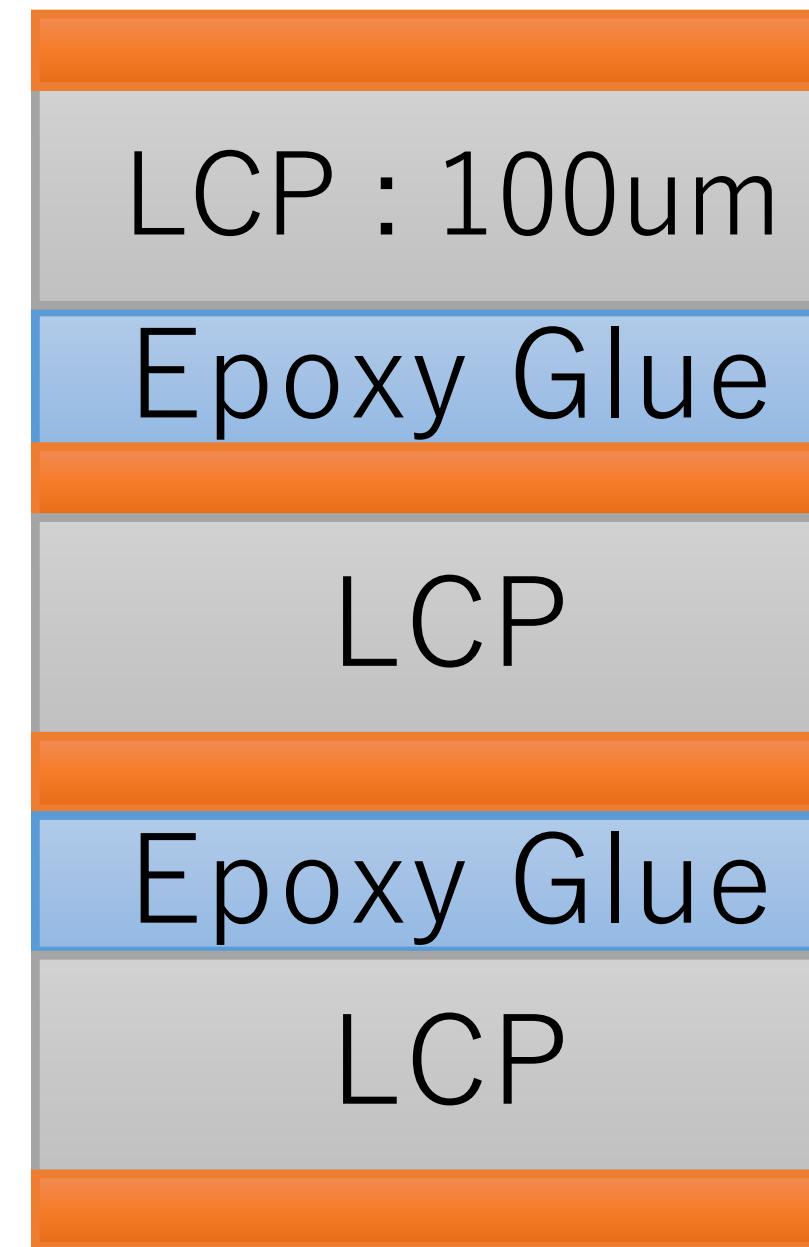
cross-section



Bus extenders should be implemented.

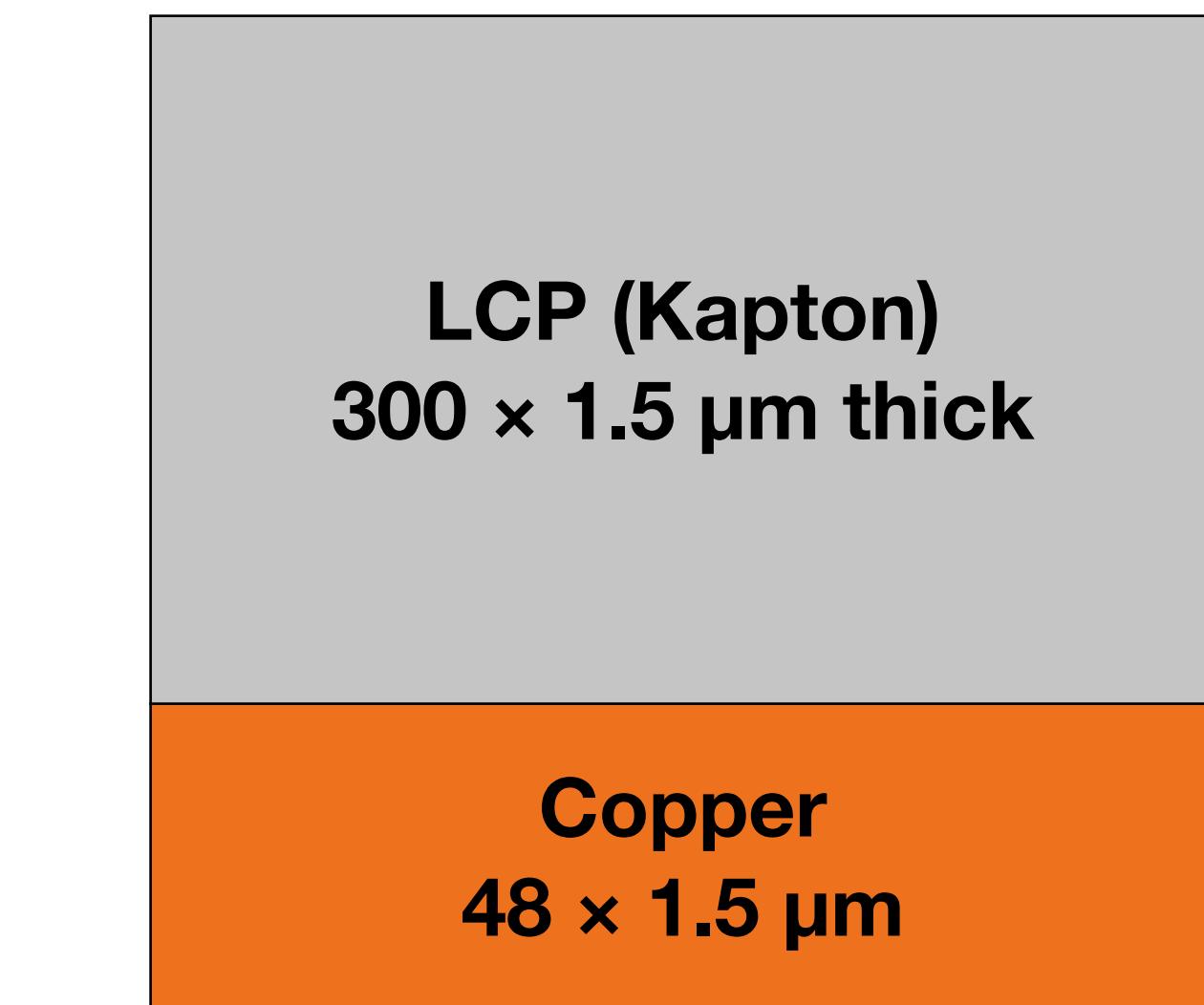
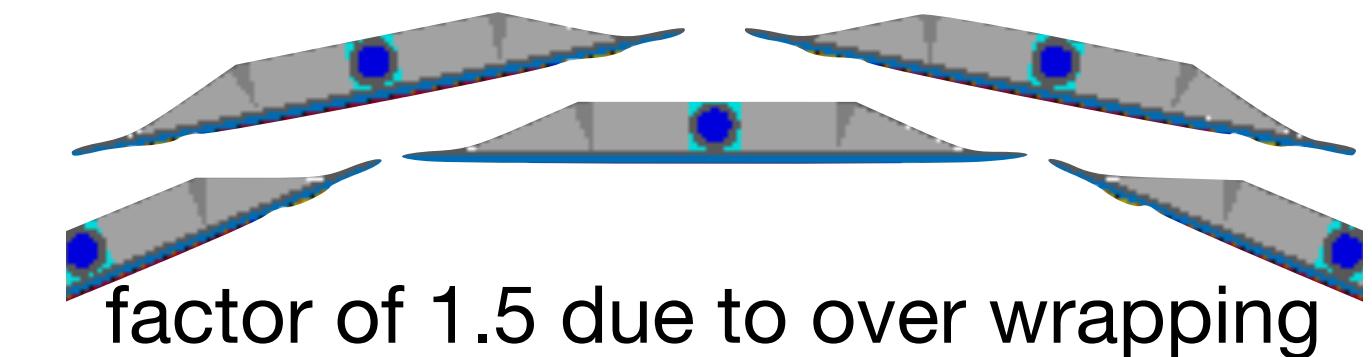
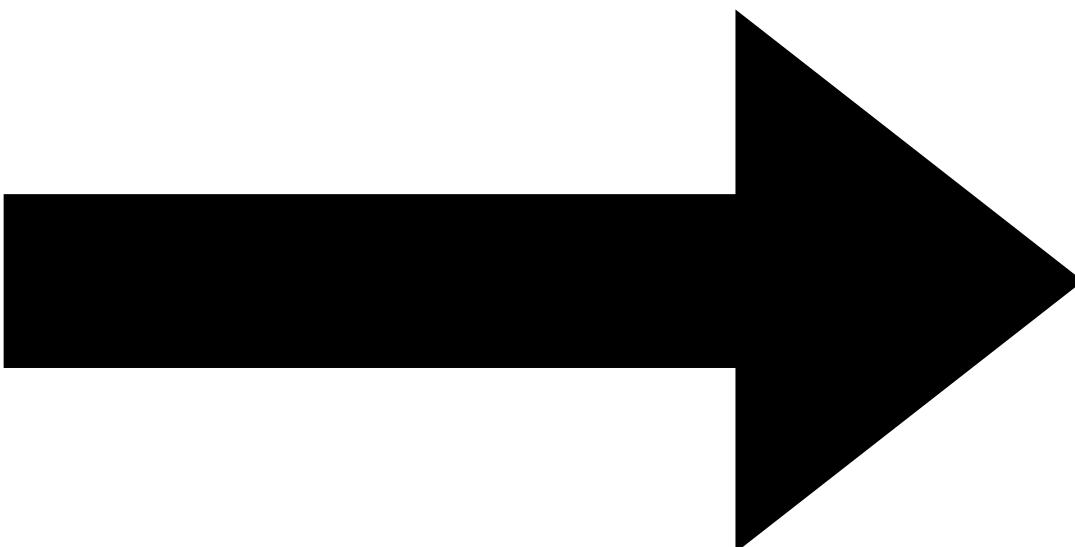
# Simplified model for a quick commit, layers

Cross Section



Cross-section of a bus extender

Copper : 12um



Cross-section of the simplified model

A bus extender consists of

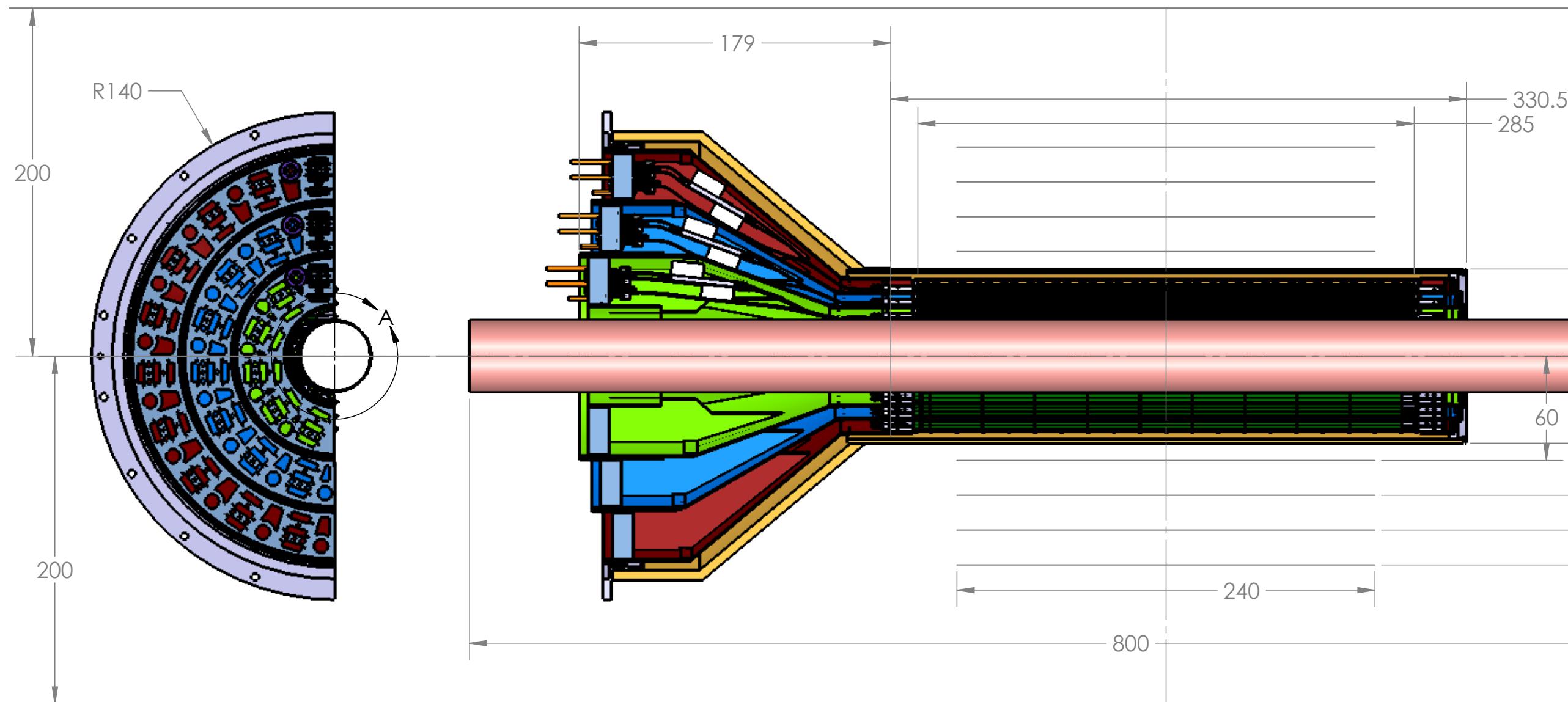
- 3 LCP layers, 100  $\mu\text{m}$  each
- 4 copper layers, 12  $\mu\text{m}$  each
- 2 epoxy glue layers, 25  $\mu\text{m}$  each

The structure is simplified to

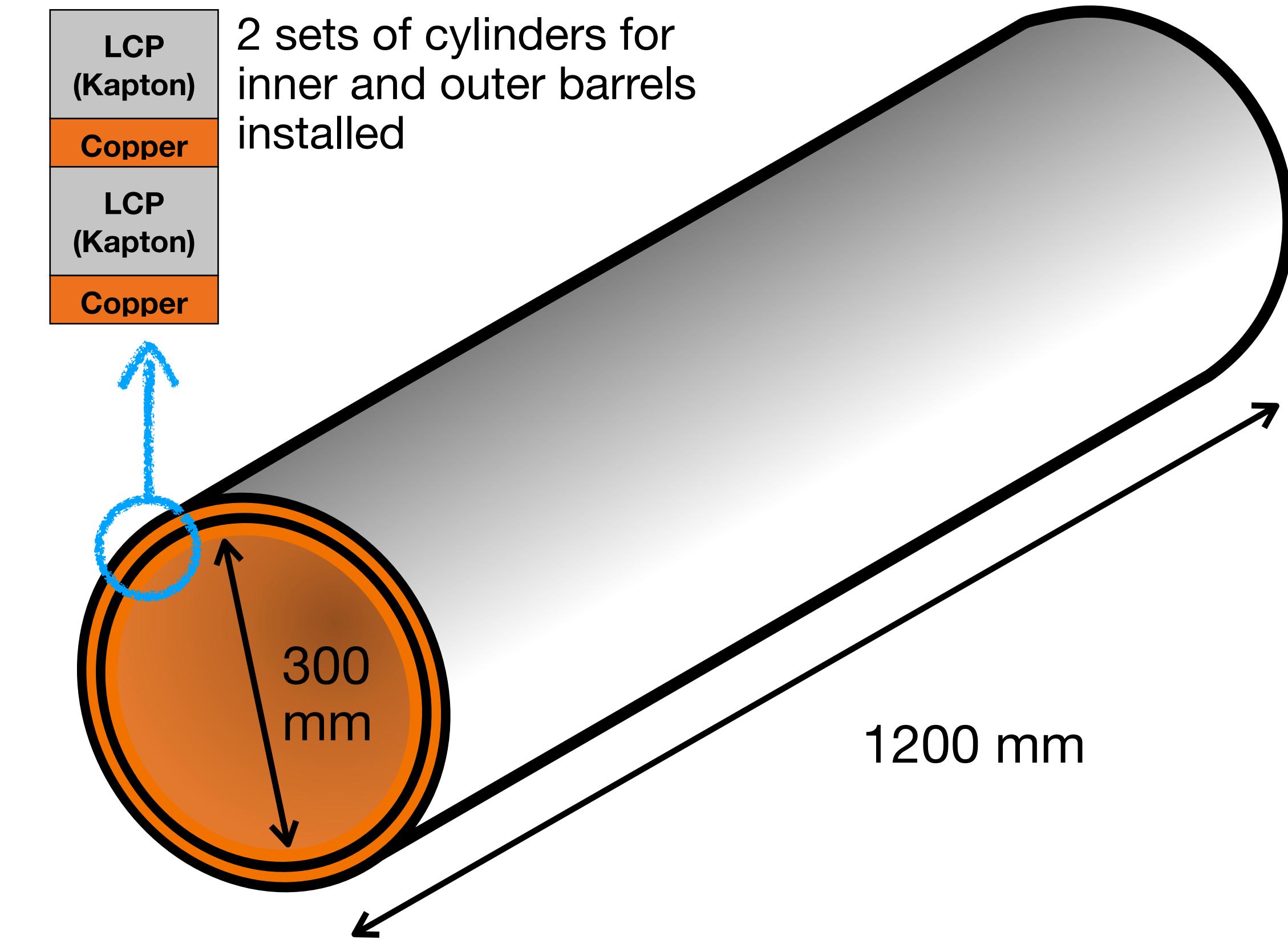
- 1 kapton layer, 300  $\mu\text{m}$
- 1 copper layer, 48  $\mu\text{m}$

The epoxy glue layers are omitted while the others are merged into a layer.

# Simplified model for a quick commit, shape

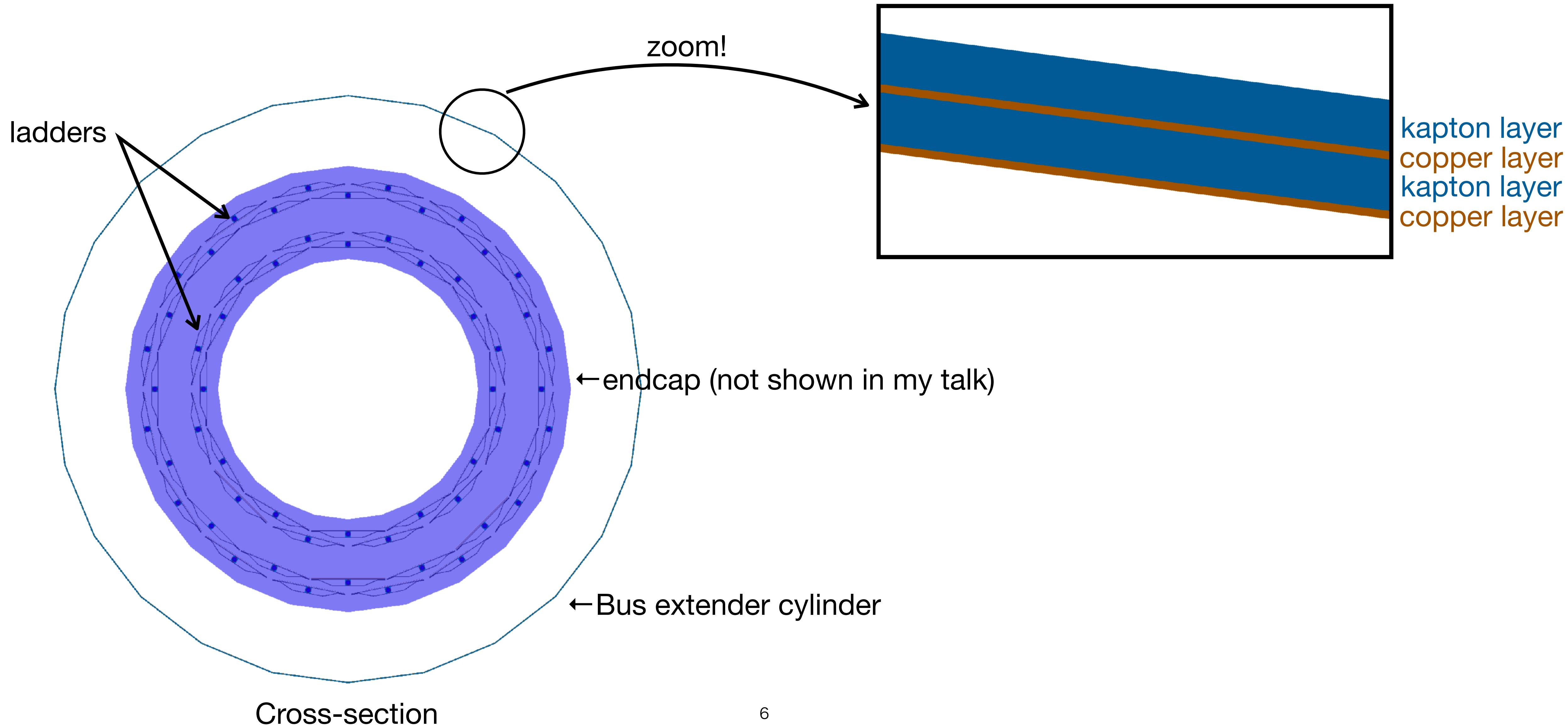


Bus extenders run from ladders to ROC in a winding way... Detailed description in few days are extremely hard.

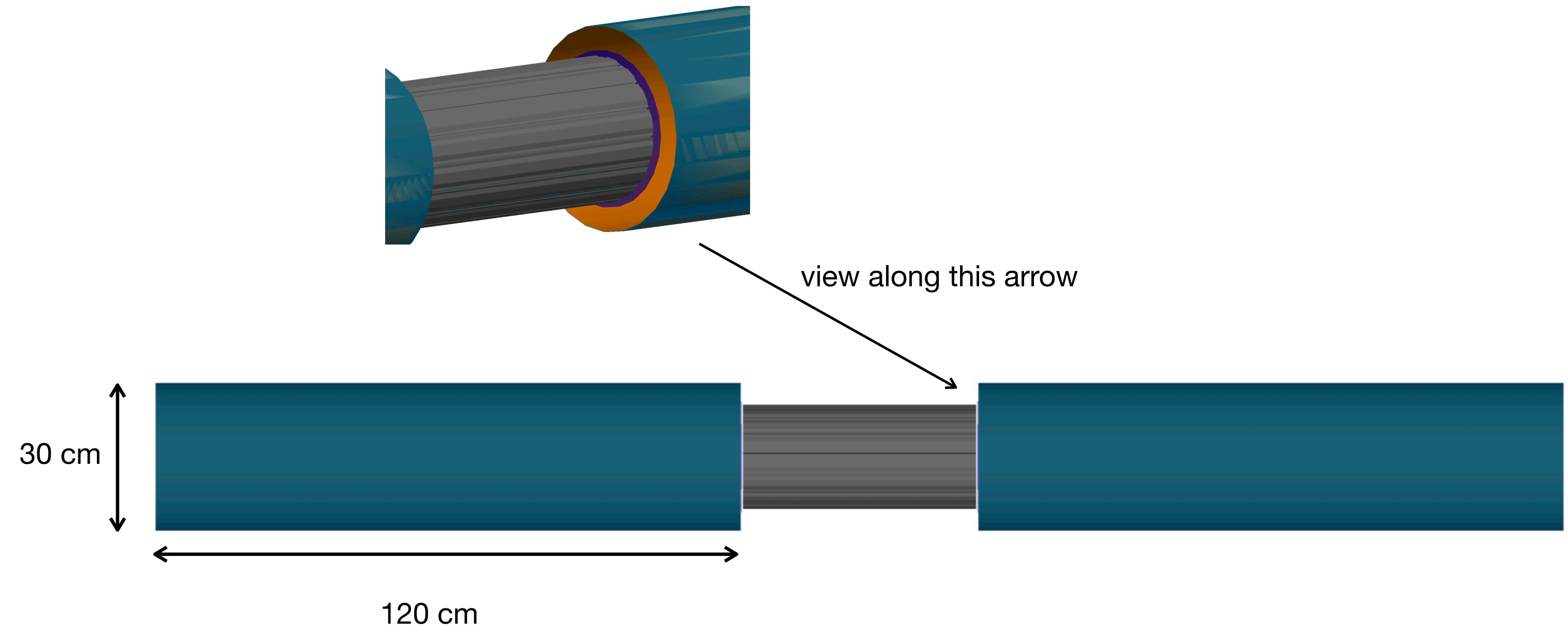


Approximation of the structure to cylindrical shape is not so bad and can be done in a day.  
Diameter: intermediate value should be used → 300 mm  
Length: same as bus extender's to keep the same material budget → 1200 mm  
2 sets of cylinders are installed for inner and outer barrels.

# Implemented model

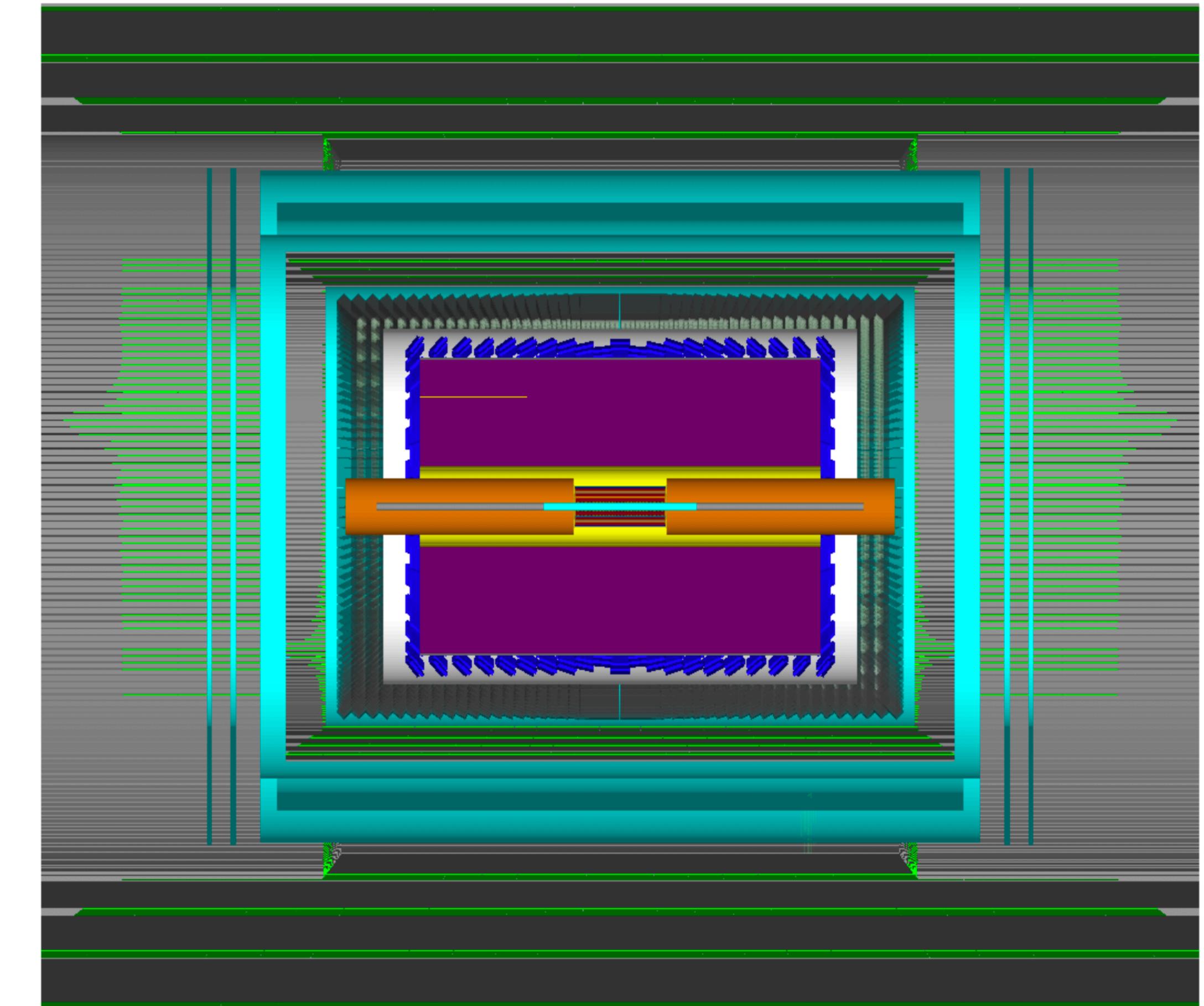
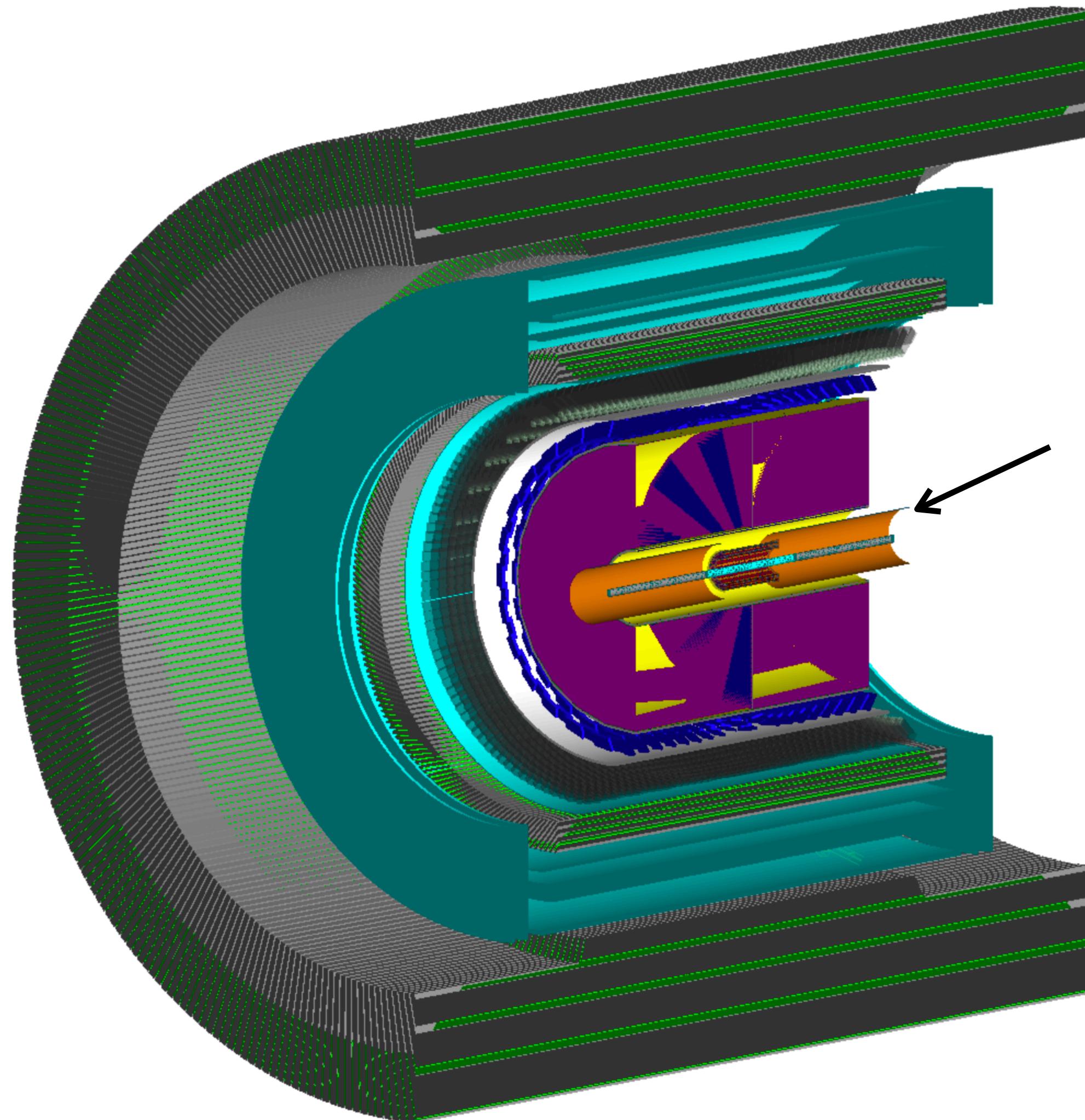


# Implemented model



Side view of INTT outer barrel and bus extender cylinders

# Implemented model



Cross-section of sPHENIX detector complex.

# Report at sPHENIX Software and Simulations Meeting Yesterday

<https://indico.bnl.gov/event/7426/>

They warmly welcomed me and the updates 😊

Questions and comments:

- **Change of barrel diameter:** How much is acceptance changed?
- **Bus extender:** Connecting material for the ladders and bus extender might give effect.
- **Bus extender:** Cone shape can be implemented in the next step.
- **Bus extender:** MVTX group is introduce a service barrel on one side. Let's work not to make overwrap.

## Service Barrel Geometry

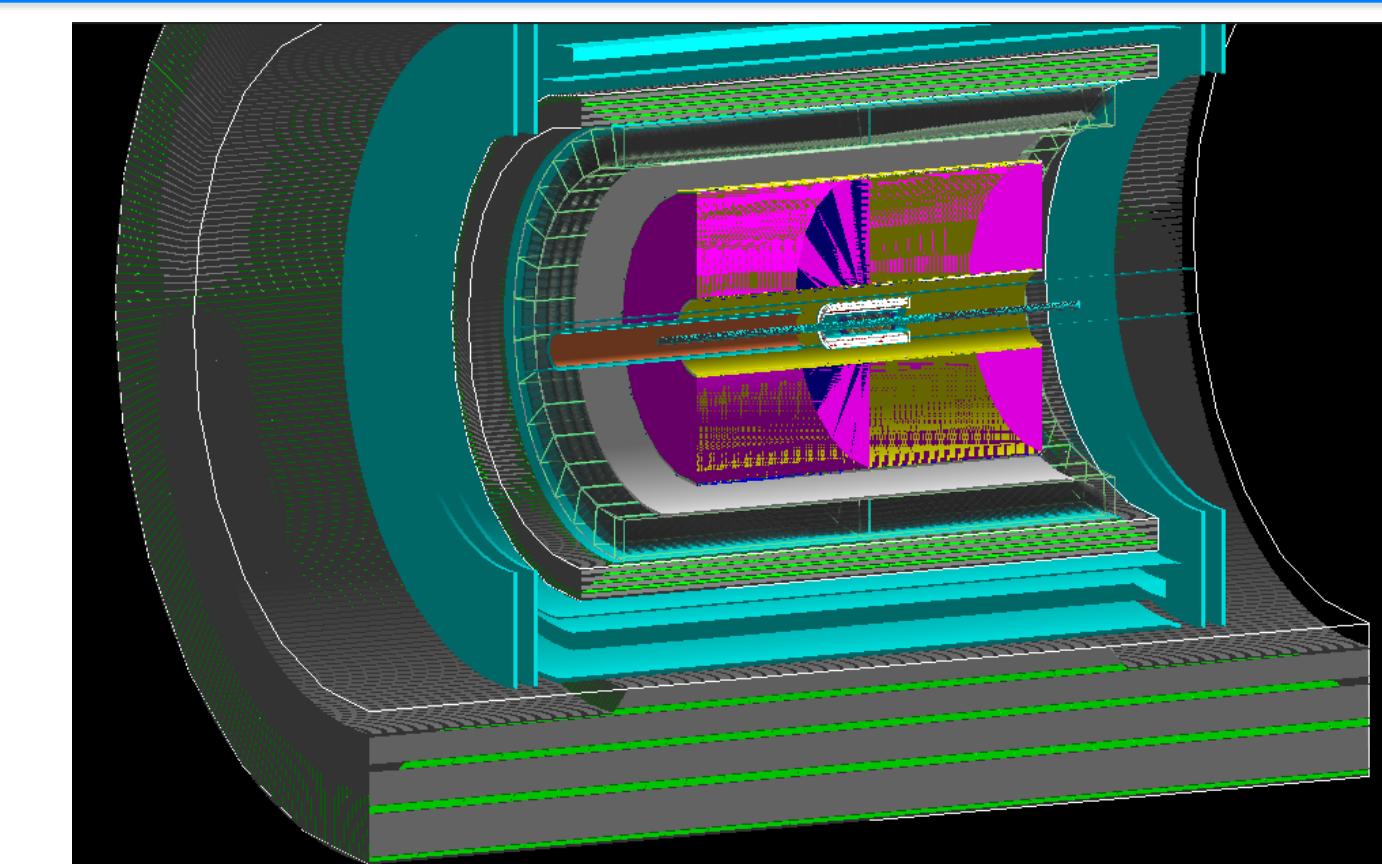
SPHENIX

- The service barrel consists of:
  1. Carbon fibre shell
  2. Water cooling pipes
  3. Copper power and signal cables
- The current simulation:
  1. 1mm thick carbon peek for shell at 10.75cm radially
  2. Cylinders of copper, water and polyethylene starting at 8.5cm radially
  3. Each stave contributes:  $0.0677 \text{ cm}^2$  copper,  $0.0098 \text{ cm}^2$  water,  $0.4303 \text{ cm}^2$  of polyethylene
  4. SB starts at 35 cm
  5. SB length is 1.5 m

8/4/20 MVTX Service Barrel 4

## SPHENIX with SB

SPHENIX



8/4/20 MVTX Service Barrel 8