# Update on vertex detector optimization

Zeng Hao 2021/01/29



# Updates

- New beam pipe radius=10mm
- New ladder arrangements for innermost layer
- Long barrel vertex design

# New beam pipe with diameter of 20 mm



Detailed structure of the central beryllium pipe



boundary line, which defines the vertex detector coverage. Shorter innermost layer is required

10 chips on both sides of the innermost ladder

20

0.99

1.00

COSE

350 z [mm]

300









- > Using 7 ladders for the innermost layer improves d0 resolution a lot at  $\cos\theta=0$ .
- For mechanical consideration, I prefer placing second layer in the middle.

















7 chips on both sides for innermost layer and second layer in the middle is better.

- 7-ladders arrangement is better than 8-ladders arrangement.
  - less material
  - ➢ 7 ladders are close to beam pipe.

Discussed with JI Quan, he has already adjusted the beam pipe design.

Best! Optimal vertex layout!

#### Realistic long barrel vertex





- ➢ Feasible solution for air cooling
- Simple structure
- Realistic long barrel vertex:
  - stiffer carbon fiber ladder support
  - $\succ$  more cable for read-out
  - vibration of long ladder

	Long barrel design	Length of ladder	Chips / ladder	Reado mode	ut	No. of flex Layers
	layer1	250	10	Single	end	2
	layer2	500	20	double	e ends	2
	layer3	750	30	double	e ends	4
					Thicknes	Optimization ss goal
		Polyimide			25um	12
		Adhesive			28um	15
£1.		Plating Al			17.8um	1 ?
	ex layers	Rapton			50um	50
		Adhesive			17.0um	1 ? 15
	_	Polyimide			25um	13
			i organide		thickness	Optimization s goal
		Polyimide			25um	12
		Adhesive			28um	15
		Plating Al			17.8um	?
		kapton			50um	50
fle	x lavers	Plating Al			17.8um	!
110		Rapton+adhesive			50um	50
		rialing Al			17.8um	50
		Plating Al			17 Sum	2
		Adhesiye			28um	15
$\mathbf{N}$		p	Polvimide		25um	12

#### Realistic long barrel vertex



- > The material budget of realistic long barrel vertex is about twice as much as the ideal long barrel vertex.
- > Much more material in the front region than optimal vertex layout.

The d0 resolution of realistic long barrel vertex is worse about 7% than ideal long

#### **Optimal vertex layout**





- $\succ$  more disks
- Ionger innermost layer

## Vertex design considering air cooling



## Plan



- Air cooling for this optimal vertex layout (CLIC spiral, multi-spiral)
  - thermal simulation,
  - vibration studies
- Implement this layout using Geant4 full simulation (WU Kewei)
  - CEPCSW: tracking
  - Mokka: tracking, flavor-tagging, tau identification
- Vertex layout optimization
  - MOST2
  - CEPC overall layout (JI Quan)