Mechanical design of the VTX prototype

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The Mechanical Support of VTX Prototype



- Extend the inner layer to the same length as the other two layers based on the optimized layout.
- Refine:

the connecting flange and it's joint with detector. the secondary assembly of the inner layer and middle layer. the joint between the overall support and connecting flange

- materials and manufacturers were investigated.
- Plan to fabricate some trail parts (e.g. the side ring) which are tentatively made of composite.



Tooling Design for Barrels Assembling

- 3 sets of tooling for barrel assembling.
- tooling and customized tool for inner and middle barrels assembling.



New VTX Support Design

A split type support of the VTX integral structure (based on CEPC IP environment).

- > The overall VTX assembled by two halves which consist of main supports and half barrels.
 - Each barrel has two halves.
 - Inner and middle barrels share side flange.
- The claw shaped main supports connect and fix 3 half barrels from two ends to form a half of the overall VTX.
- The claw shaped main supports :
 - take less space, good for material budget and cable routing
 - locate and install the VTX on beam pipe and realize the deformation adjustment in axial direction along beam pipe.





At IP region the VTX is within a very compact space with beam pipe at the center, the challenge: to realize the installation and cable routing, cooling ventilation.



New VTX Support Design





Ladder Support Prototype

The trail production of the ladder support prototype are being conducted for process validation :



Section 16.8x2 mm, about 180 mm long (not full length), thickness 0.12 mm.

So far the full length main body of the ladder support has been fabricated. The design has been validated to be feasible.

Besides, we also plan to produce samples of the optional scheme with foam inside for comparison and test. Also the trial fabrication for process validation has been done.



Ladder Support Prototype

We already have 2 informal samples of the full length ladder support prototype.



Fabrication of the ladder support prototype with different design specific will start soon.

Test Platforms of Ladder and Ladder support

Most of the ladder prototype (and VTX) test related items have been considered.

- Design of platforms and tooling for different test.
 - Static (different support and load cases)
 - Vibration and cooling + pressed air (different cases)
 - Vacuum test for surface check of ladder support and ladder and procedure training (i.g. module fixation).
- Auxiliary tools and instruments for test have been investigated and purchased. To measure or control :

Deformation, temperature, air speed, flow rate, etc.







Test Platforms of Ladder and Ladder support

All the platforms have been fabricated and assembled and are basically ready for test.





Positioning and vacuum fixation bench



This bench allows positioning and fixation of the ladder-spt even if the ladder-spt is turned over for loading detector on the other side. It can works as a trail fixture of our "gantry".







Preliminary Test of the Informal Ladder Support

Very preliminary test of the informal ladder support samples has been done, which is mainly for verifying the function of the test platforms and the measuring instrument.







Lesson learned:

- Need more stable flow control
- More verification test combined with temperature measurement.
- Further familiar with the measuring instruments and interpret the data reasonably.



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Tooling Design for Ladder Assembling

Ladder assembling will be conducted on a gantry automatic system. The gantry only provide a 500x500 mm platform and a 3-way movable+1 axial rotatable spindle which we can use directly.





Based on the automatic system, the tooling should have the functions of positioning, moving and assembling parts, as well as the function of gluing (glue dispending).

Tooling Design for Ladder Assembling

Designed the preliminary assembling scheme, the main process:

- positioning of parts
- glue dispending on flex
- sensor picking
- sensor positioning and bonding in flex (module assembling)
- module (after wire bonding) shifting
- ladder semi assembling
 (module loading and gluing)
- Iadder full assembling, etc.



Tooling Design for Ladder Assembling

According to the ladder assembling scheme and procedure, carried out the following preliminary tooling design:

- Assembly of Vacuum fixation table -4 types (two of them have secondary vacuum fixation capability)
- Transition positioning table(with secondary fixation capability)
- Pickup tool-3 types
- A rack for repeated positioning of the pickup tool
- The tooling for holding the dispending syringe is being conducted
- The components and part for providing and controlling vacuum and compressed air and also the vacuum suckers are under investigation.

Optimizing of the VTX Prototype Beam Test Box

The test box is used to support and fix the VTX detector and provide air-cooled and light tight environment.

Updated the VTX integral structure

Add a transparent channel assembly outside the VTX detector

Refined the detailed joint structure between VTX and bracket inside the box(surface mating in axial direction and locating flange in radius direction).



Two cooling test schemes, compressed air and fan, related designs are on going:

- Precooling box embedded in the air duct(applicable to two cases respectively), this can also be used on the cooling test platform of ladder.
- Gas distributary (applicable to compressed air) .

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Next in the near future

- Fabricate the Ladder support prototype.
- Test the bare ladder support:

(Besides that, more test of the "ladder" with dummy flex and dummy sensor can also be done once they are ready)

• Finalize the design of overall support and tooling.