TDR Editing

Tuesday CEPC TDR Meeting
July 15, 2025

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Outline

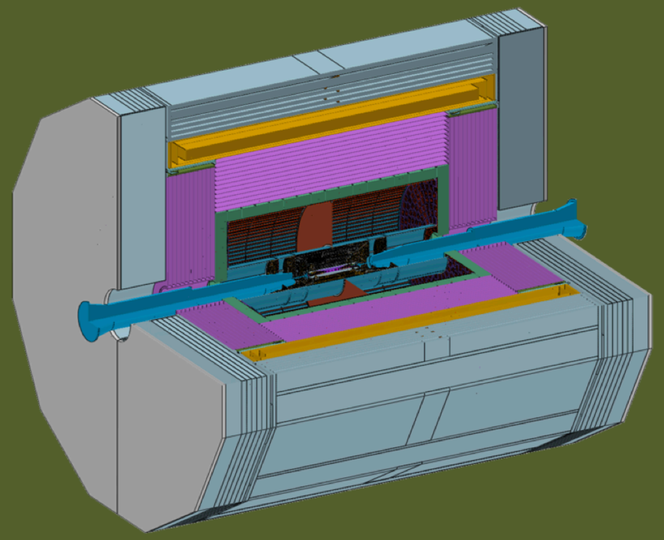
- News from IDRC
- Keeping track of modifications — overall situation
  - Today using version 0.5.0 available this morning
  - Update your private sections to use this version or higher
- Editing Instructions

Draft v0.5.0

CEPC Reference Detector

Technical Design Report

Version: v0.5.0 build: 2025-07-15 07:37:45+08:00



News from IDRC

- Comments from IDRC expected last week
  - So far, only got comments from Paul Collas on TPC

- Feedback from Daniela:
  - She has collected comments for a few chapters but there were delays due to EPS
  - Expect input very soon (I assume this week)

- Meeting date to be defined after comments are received

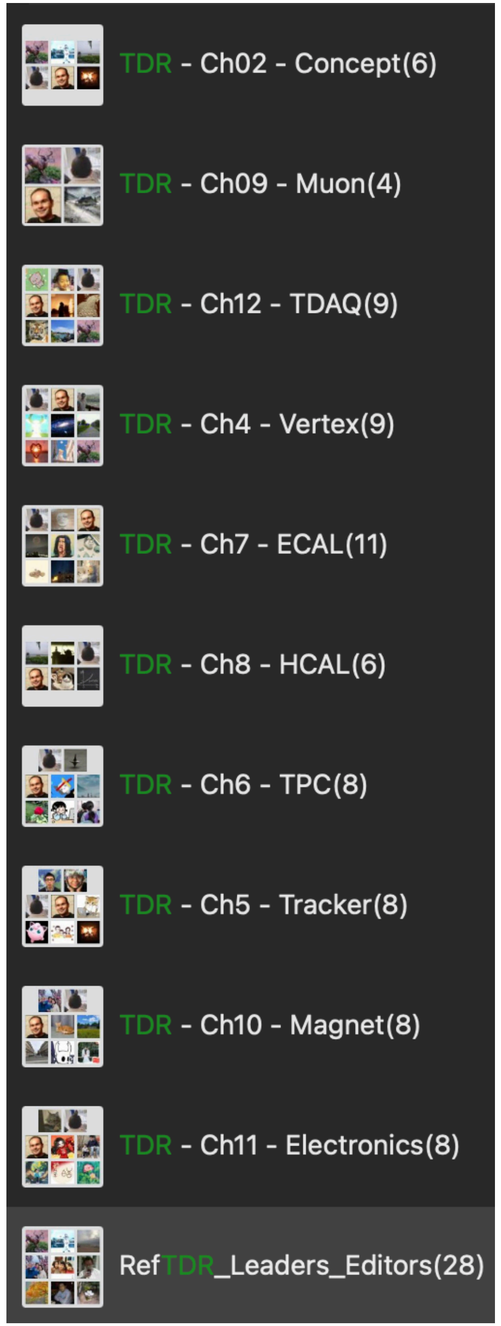
Keeping track of modifications

- **Spreadsheet monitoring the status in IHEP docs:**
  - https://docs.ihep.ac.cn/link/ARF4C648FCA57D4CF281A8E821A110229E
  - 文件名：Status of TDR.xlsx
  - 文件路径：AnyShare://ZHANG Zhaoru(zhangzr)/CEPC Det TDR/Status of TDR.xlsx

- Please fill in your input now, and **keep it updated** as we move along

- We will try to do the same!

- Provide feedback for improvements



Keeping track of modifications

Blue section of the spreadsheet is for chapter leaders

Chapter	Overall Complete	Chapter structure	Updated date	Tables		Figures			Text	
			Ready for check	Unified format	Significant digits	Change to pdf	Unified Macro	Enlarge the font size	Symbols	Glossary
Executive summary	100%	100%		100%	100%		100%	100%	100%	
1 Introduction	100%	100%		100%	100%		100%	100%	100%	
2 Concept of CEPC Reference Detector	90%	100%		90%	90%	90%		90%		
3 MDI and Luminosity Measurement	90%	100%		100%	100%	100%	80%	70%	80%	
4 Vertex Detector	90%	100%		90%	95%	50%		70%	80%	
5 Silicon Trackers	100%	100%		100%		80%			90%	
6 Pixelated Time Projection Chamber	95%	100%	Jun. 25th	100%	100%	100%		80%	95%	95%
7 Electromagnetic calorimeter	90%	90%		90%	90%	50%		80%		
8 Hadronic calorimeter	100%	100%	4-Jul	100%	100%	100%	100%	100%	90%	
9 Muon Detector	95%	100%	2-Jul	100%		75%		80%		
10 Detector magnet system	95%	100%		100%	100%	100%	100%	100%	100%	100%
11 Readout Electronics	95%	100%		100%	100%	100%		95%	100%	95%
12 Trigger and Data Acquisition	95%	100%	Jun. 5th	100%	100%	100%	100%	100%	100%	95%
13 Offline software and computing	97%	100%	Jun. 5th	100%	100%	100%	100%	100%	95%	95%
14 Mechanics and integration	80%	80%		100%	80%	100%		70%	90%	
15 Detector and physics performance	80%	100%		100%	90%	100%		90%	100%	
16 Timeline and Future Plans										
17 Reference detector costing										
18 Summary/Glossary										

Update status using “blue” color so that we can know it is up to date

Reminder of updated editors

	Chapter	Primary Contact	Next Editors
1	Introduction	Joao Costa, Gang Li	-
2	Concept of Ref-Detector	Haijun Yang, Mingyi Dong	-
3	MDI and Luminosity Measurements	Haoyu Shi	Hongbo Zhu
4	Vertex Detector	Zhijun Liang	Meng Wang
5	Silicon Trackers	Qi Yan	Yanyan Gao
6	Gaseous Tracker	Huirong Qi	Tianchi Zhao
7	Electromagnetic Calorimeter	Yong Liu	Yifang Wang
8	Hadron Calorimeter	Sen Qian	Xinchou Lou
9	Muon Detector	Xiaolong Wang	Jianchun Wang
10	Superconducting Solenoid Magnet	Feipeng Ning	Qingjin Xu
11	Readout Electronics	Wei Wei	Jingbo Ye
12	Trigger and Data Acquisition	Fei Li	Zhenan Liu
13	Software and Computing	Weidong Li	Xingtao Huang
14	Mechanics and Integration	Quan Ji	Xiaoyan Ma
15	Detector and Physics Performance	Mingshui Chen	Hideki Okawa
16	Construction Cost	Miao He	-
17	Future Plan	Gang Li, Miao He, JCW	-

- People with editing token
  - Others certainly needed to help

- **Other people providing key input recently:**
  - Imad (ECAL and HCAL)
    - Meeting a few days ago
  - Paul Collas (TPC)
  - Jianming (Performance)

Document with editing and formatting instructions

- **Location:**
  - https://docs.ihep.ac.cn/link/AR2BD148C9193F430BBD59C8324A1A827D
  - 文件名：TDR format instruction.docx
  - 文件路径：AnyShare://ZHANG Zhaoru(zhangzr)/CEPC Det TDR/TDR format instruction.docx
- Please check it and follow its instructions
  - Includes rules about english
  - Specially important for new editors
- Provide feedback

TDR Format Instruction

1 Chapter structure

Chapter X:	
X.1 Overview	
	Expected performance/requirements, Design overview
X.2 Detailed Design	
X.2.1 Detailed design	
X.2.2 Challenges and critical R&D	
X.3 Key Technologies to address challenges	
X.4 R&D and prototypes	
X.5 Simulation and Performance	
X.6 Alternative Solutions	
	Can be either backup or more advanced solution
	(demonstrate backup solutions are in hand and that their possible selection still meet the requirements)
X.7 Summary and Future Plan	
(X.8 Cost table and justification)	
	eventually to be moved to a common chapter

Requirement:
- Sections should not have more than 4 numbered subsection levels x.y.z.w
- If using AI, editors need to read the AI output and finalize the text themselves. Do not use AI output blindly. Also, AI usage should be focused on correcting English, do NOT write full sections using AI
- Figures and Table captions should be long and describe the figure/table, as needed. They should not be just a title. Reader should be able to understand content from the figure/table and caption.
- The document should be written in American English, not British English.
More instructions are given below.

Format for multiple Figures

Figures numbering should have (a), (b), (c), (d) for multiple figures

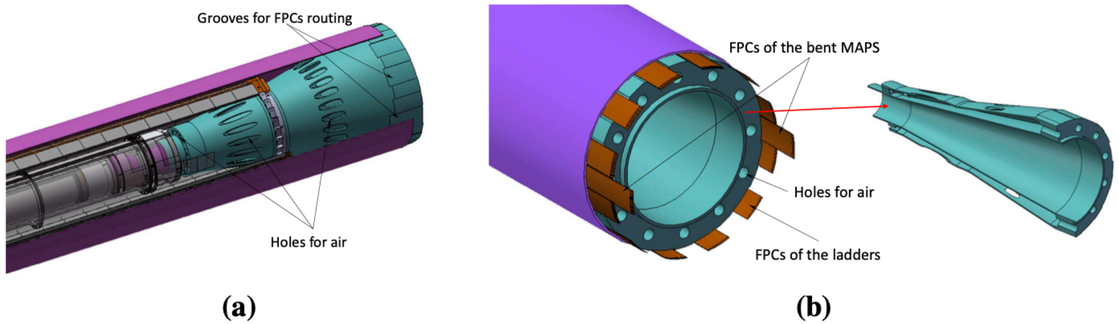


Figure 4.18: Air ventilation and cable routing of the VTX. (a)Air channel design with holes on global support structure for air distribution. Grooves on support structure is designed for FPCs routing. (b) the FPCs of the vertex detector routed out of the side of the beam pipe assembly, along with a cut view of the conical part.

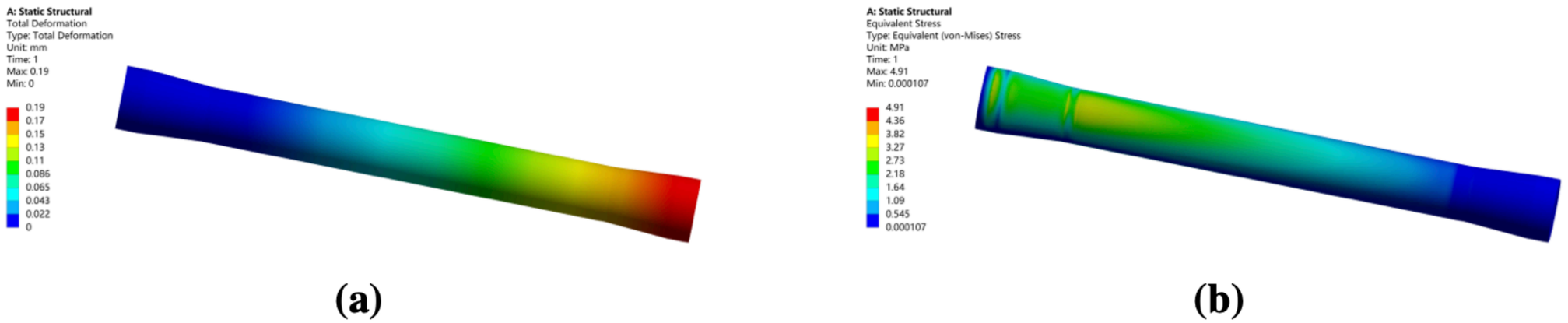
Caption should mention it (a), (b)

Use capital letters after "." and small letters if using ","

Sample Latex to implement this

- Here is a Latex example of defining multi-plots with (a)(b) labels:
- \begin{figure}[H]
- \begin{center}
- \subfloat[][]{\includegraphics[width=.4\linewidth]{ *a*.pdf}\label{fig:TESTa} }
- \hspace{.015\linewidth}
- \subfloat[][]{\includegraphics[width=.4\linewidth]{ *b*.pdf}\label{fig:TESTb} }
- \caption{.....}
- \label{fig:TEST}
- \end{center}
- \end{figure}

Example Pictures in need of improvements



(a) **(b)**

Figure 3.5: Stress analysis of the beam pipe when one end is fixed and the other end is cantilevered, the maximum deformation of the beam pipe is at the end flange, which is 0.36 mm, and the maximum stress at the outer beryllium pipe is 13.77 MPa.

- Numbering is correct (a) and (b), but it is **not used** in the **caption**. It should, in particular in such complex picture.
- Font still too small, legend is not readable

Example Pictures in need of improvements

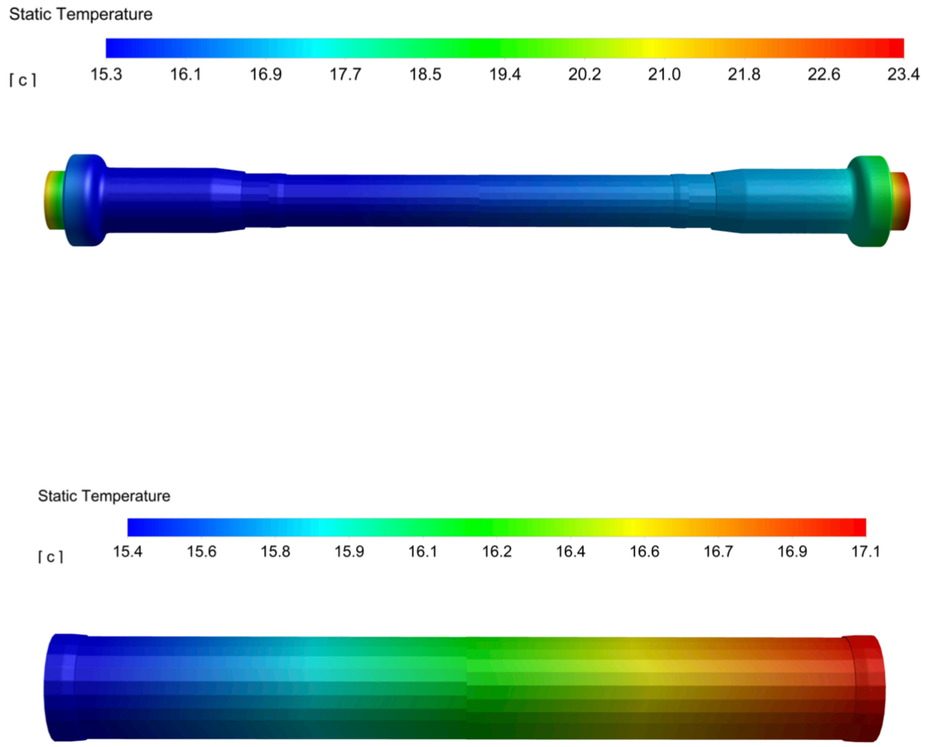


Figure 3.7: Temperature distribution of the central beryllium pipe, the left is the inner Be pipe while the maximum temperature of the central beryllium pipe is 23.4 °C, and the right is the outer Be pipe while the maximum temperature of the outer beryllium pipe is 17.1 °C. The unit in figure is °C.

- Numbering with (a) and (b) is missing all together

Example Pictures in need of improvements

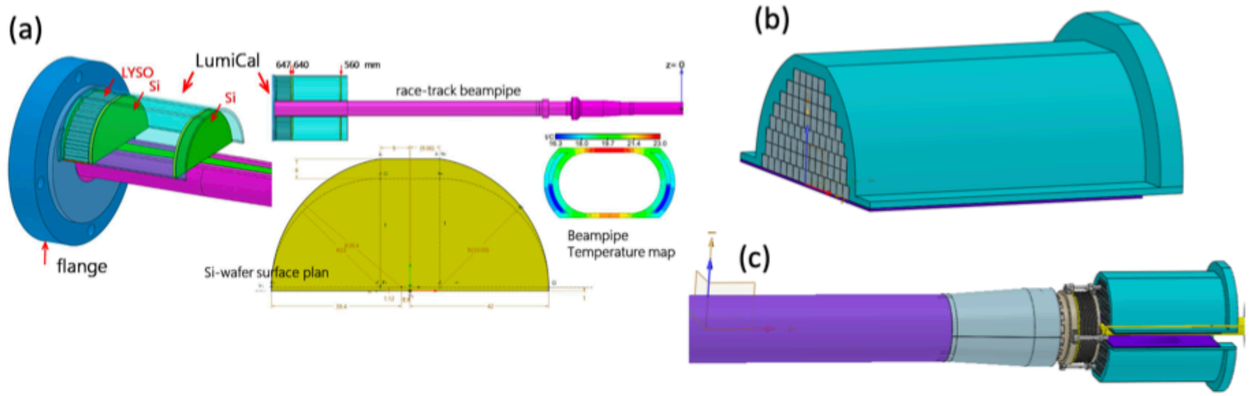


Figure 3.24: a) Mechanical drawings of the LumiCal modules before the flange of race-track beam-pipe. The two Si-wafers and $2X_0$ LYSO crystal bars are contained in half circular tubes above and below the pipe. The cooling of beam pipe has the water injected from the flange toward IP within the double Aluminum layers on the sides with the temperature map illustrated, b) Mechanical drawings of the LumiCal module beyond the flange, the $13X_0$ LYSO crystal bars covered by tungsten shell, and c) The LumiCal LYSO modules are contained in half circular tubes above and below the pipe.

- Proper number with (a) and (b) but font still too small. Can you read it?

Example Pictures in need of improvements

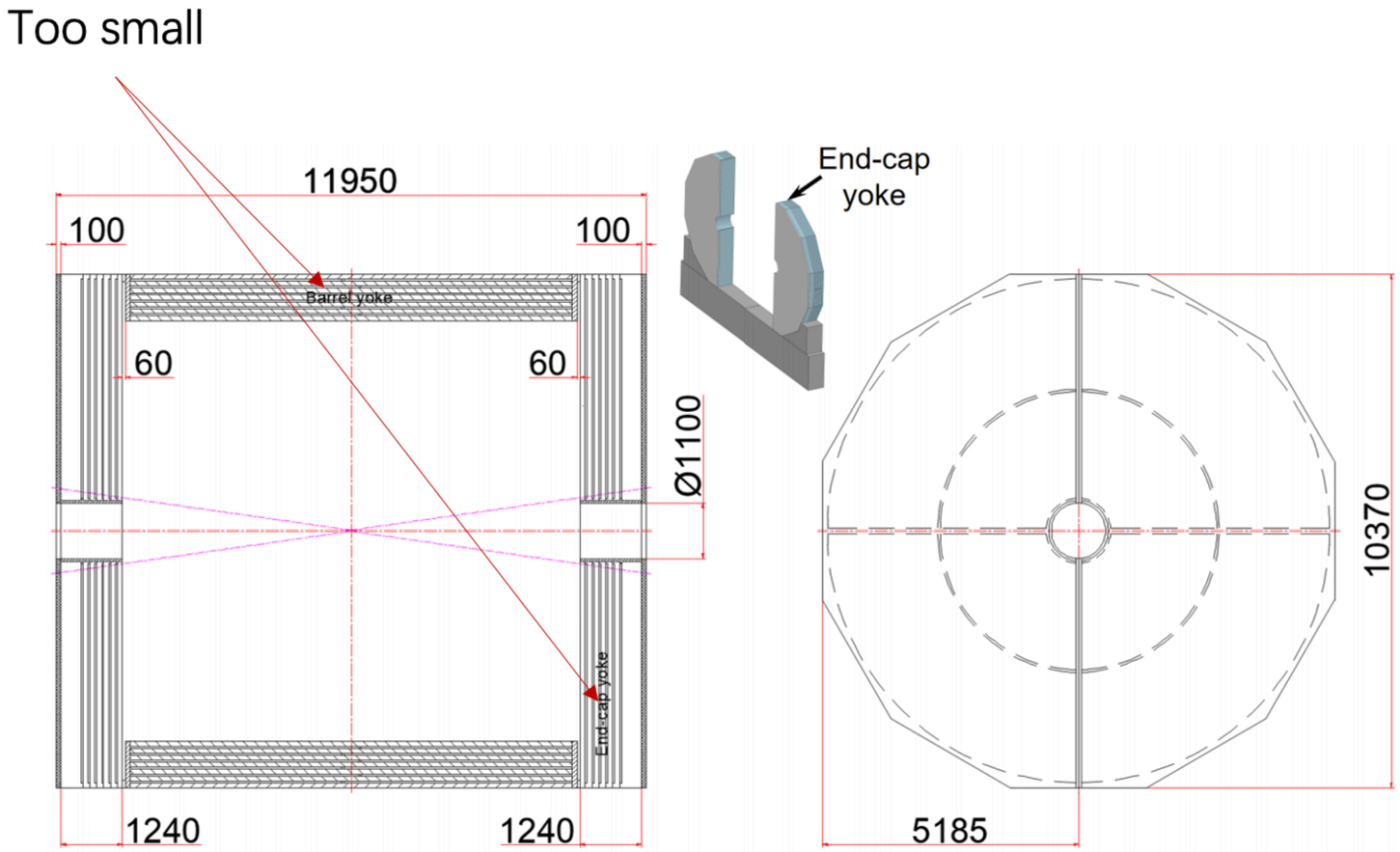


Figure 14.7: End-cap yoke dimension and location. (unit:mm)

- Text still too small
- When we fix one plot, we should fix all the similar plots (this was fixed in other plots)

Example Pictures in need of improvements

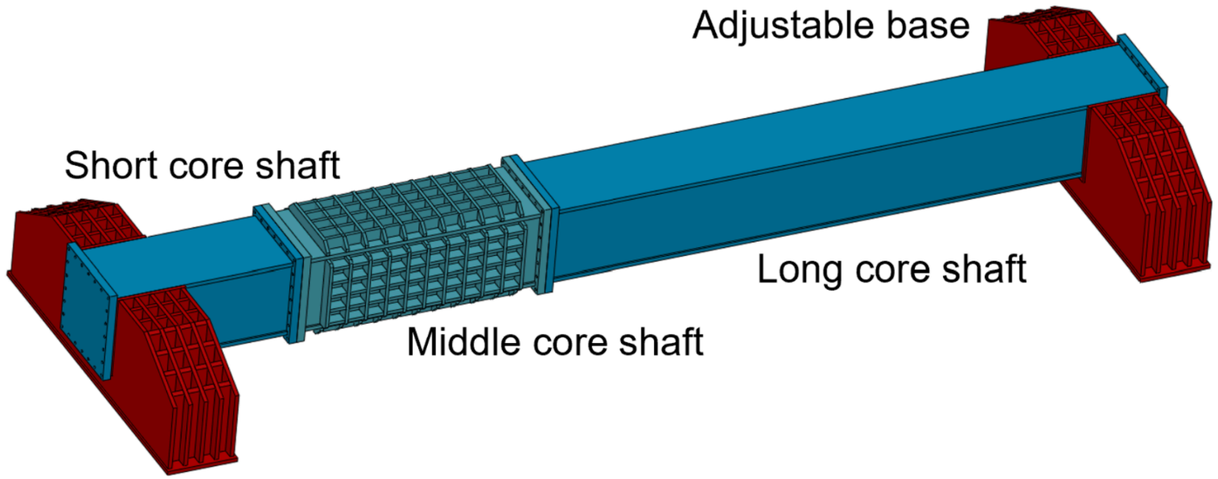


Figure 14.33: Three-section modular structure of the core shaft.

- Labels are ambiguous
- Add arrows to indicate what the labels correspond to

Example Pictures in need of improvements

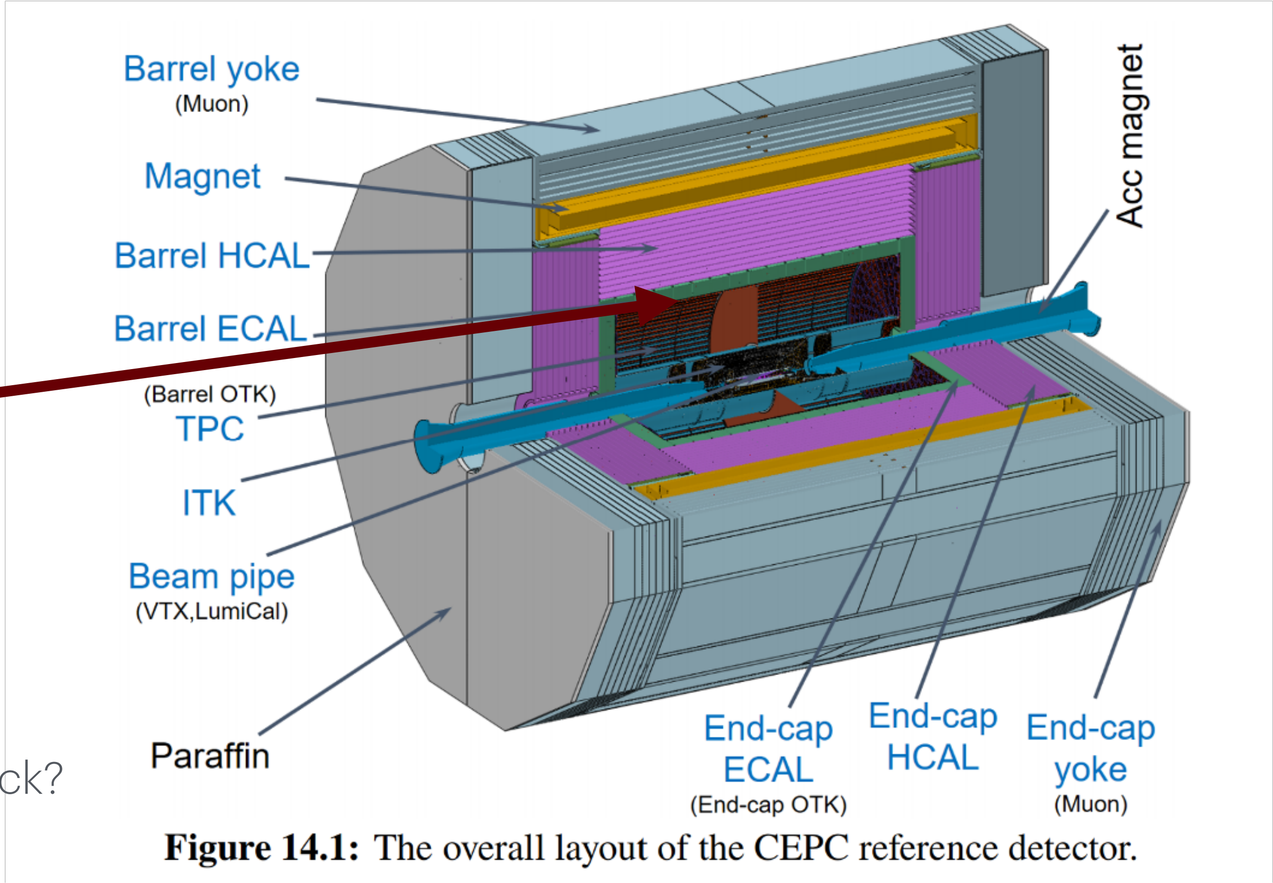


Figure 14.1: The overall layout of the CEPC reference detector.

Why Paraffin label is black?

- Text needs to be made uniform
  - OTK is a proper detector with a proper location, it should show up as such
  - Same for the VTX and LumiCal

Updates on ITK/OTK chapter

From Yanyan Gao

Previous outline

New outline

- Added an overview section with high level layout common to both ITk and OTk. Moved the hits information here as the specification
- Removed the previous section 5.4 on background (this was repeated from Chapter 3)
  - Half into Section 5.1 and half will be added to the readout electronics section when each detector is introduced
- Removing duplication
- Plan is to go through the rest of the chapter this week to further consolidate and streamline the sections

Updates on ITK/OTK chapter

From Yanyan Gao

Table 5.1: Parameters and layout of the Silicon Tracker. Silicon pixel sensors (HV-CMOS) and Low Gain Avalanche Detector (LGAD) technologies are planned for the ITK and OTK baseline, respectively. The column labelled $\pm z$ shows the half-length of the barrel layers, and the z position of the end-cap disks. The column labelled σ_ϕ and σ_t represent the spatial resolution in the bending direction and time resolution, respectively. The main parameters of the VTX and the TPC are also listed here for completeness.

Detector		Radius R [mm]		$\pm z$ [mm]	Material budget [% X_0]	σ_ϕ [μm]	σ_t [ns]
VTX	Layer 1	11.06		80.7	0.06	3	100
	Layer 2	16.56		121.1	0.06	3	100
	Layer 3	22.06		161.5	0.06	3	100
	Layer 4	27.56		201.9	0.06	3	100
	Layer 5	39.32		341.0	0.32	3	100
	Layer 6	39.69		341.0	0.32	3	100
ITK Barrel	Layer 1 (ITKB1)	235.0		493.3	0.68	8	3-5
	Layer 2 (ITKB2)	345.0		704.8	0.68	8	3-5
	Layer 3 (ITKB3)	555.6		986.6	0.68	8	3-5
OTK Barrel	Layer 4 (OTKB)	1,800		2,840	1.6	10	0.05
TPC	Inner wall	600		2900	0.16	—	
	Gas	625-1775		2761	~ 1	110-144 (220 hits)	
	Outter wall	1800		2900	0.16	—	
		R_{in}	R_{out}				
ITK Endcap	Disk 1 (ITKE1)	82.5	244.7	505.0	0.76	8	3-5
	Disk 2 (ITKE2)	110.5	353.7	718.5	0.76	8	3-5
	Disk 3 (ITKE3)	160.5	564.0	1,000	0.76	8	3-5
	Disk 4 (ITKE4)	220.3	564.0	1,489	0.76	8	3-5
OTK Endcap	Disk 5 (OTKE)	406.0	1,816	2,910	1.4	10	0.05

Simplify

No need to talk about other chapters

The end

Chapter Structure

Chapter X:				
X.	**1**	**Overview**		What are we going to build? **Design**, expected performance (“requirements”)
X.	**2**	**Detailed Design**		
X.	**2.**	**1**	**Detailed design**	
X.	**2.**	**2**	**Challenges and critical R&D**	
X.	**3**	**Key Technologies to address challenges**		
X.	**4**	**R&D and prototypes**		
X.	**5**	**Simulation and Performance**		
X.	**6**	**Alternative Solutions**		Can be either backup or more advanced solution (demonstrate backup solutions are in hand and that their possible selection still meet the requirements)
X.	**7**	**Summary and Future Plan**		
X.	**8**	**(Cost table and justification)**		Eventually to be moved to a common chapter

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