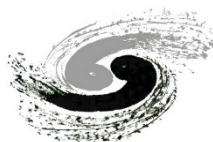




CEPC Gaseous Track Detector

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Ch06: Revised Content Following IDRC Review

■ CEPC Physics and Detector Ref-TDR.

Chapter 6 Gaseous Tracker

6.1	Physics requirements
6.2	Overview and technology choices
6.2.1	Technology comparison
6.2.2	Baseline gaseous tracker
6.2.3	R&D efforts and results
6.3	Pixelated readout Time Projection Chamber
6.3.1	Time Projection Chamber detector
6.3.2	Design of the pixelated readout TPC
6.3.3	Simulation of the pixelated readout TPC
6.3.4	Beam background estimation and calibration
6.3.5	Challenges and critical R&D
6.4	Performance
6.4.1	Overview of TPC simulation study
6.4.2	Spatial resolution
6.4.3	Tracker reconstruction
6.4.4	Particle identification
6.5	Costs
6.6	Prospects and outlook

64 pages



Completed before
May 6th.

Chapter 6 Pixelated Time Projection Chamber

6.1	Overview
6.2	Detailed Design
6.2.1	Chamber and field-cage
6.2.2	Endplate and readout modules
6.2.3	Pixelated readout electronics
6.2.3.1	Low power consumption FEE
6.2.3.2	Front electronics R&D
6.2.3.3	Multi-chips interposer
6.2.3.4	Radiation hardness
6.2.4	Design of the operation gases inlets and outlets
6.2.5	Design of mechanics and cooling
6.2.6	R&D efforts and results
6.2.6.1	Study on TPC module and prototype
6.2.6.2	Front electronics R&D
6.3	Key Technologies to address challenges
6.3.1	Challenges and critical R&D
6.3.1.1	Material budget
6.3.1.2	Hit density and occupancy
6.3.1.3	Ion back flow suppression
6.3.2	Beam background estimation
6.3.2.1	Simulation flow of beam induced backgrounds in TPC
6.3.2.2	Pixelated readout TPC occupancy
6.3.2.3	Main energy deposit contribution in TPC
6.3.2.4	TPC space distortions estimation
6.3.3	Calibration and alignment
6.4	Alternative Solutions
6.4.1	Alternative DC for particle identification
6.4.2	Particle identification performances
6.5	Simulation and Performance
6.5.1	TPC simulation framework
6.5.2	Simulation and digitization of TPC
6.5.2.1	Ionization
6.5.2.2	Drift and diffusion
6.5.2.3	Amplification
6.5.2.4	Electronic Noise
6.5.3	Data and processing
6.5.4	Spatial resolution and momentum resolution
6.5.5	Particle identification
6.5.5.1	Reconstruction Algorithms
6.5.5.2	Particle identification performance of TPC
6.6	Summary and Future Plan
6.7	Costs

54 pages

Cost recommendation from Paul and Maxim

- WBS used for the latest update of the TPC cost (updated after estimates for T2K) in 2019
- Recommendation of TPC detector cost**
 - GEM option**

2019 cost (GEM option)										person.y 80,000.00						
Colonne1	Colonne2	Colonne3	Colonne4	Colonne5	Detector concept / detector items	Unit	Unit cost	Quantity	total m&s	Home/Indr	labor (FTE,year)	total labor cost	TOTAL COST	update	Ties	ur
WBS Number					ILD											
1.2					Time projection Chamber				*****			*****	25,348,020		25,211,620	
	1.2.1				Field cages				5,890,000			0			1,930,000.00	
		1.2.1.1			inner fieldcage		860000	1	860,000						300000	
		1.2.1.2			outer fieldcage		4300000	1	4,300,000						820000	
		1.2.1.3			central membrane		300000	1	300,000						300000	
		1.2.1.4			hanging and damping				120,000						200000	
		1.2.1.5			HV test bef. Assembly				10,000						10000	
		1.2.1.6			shipping				300,000						300000	
	1.2.2				Endplates			2	540,000			64000			540,000	
		1.2.2.1			base material (Al)		10000	2	20,000							
		1.2.2.2			machining		40000	2	80,000							
		1.2.2.3			Fixtures		10000	2	20,000							
		1.2.2.4			Module jigs		500	120	60,000							
		1.2.2.5			shipping				300,000							
		1.2.2.6			assembly				60,000		0.8	64000				
	1.2.3				Modules (20 spares)			140	2,042,800			520000			4,064,400	
		1.2.3.1			back-frames	frame	1000	140	140,000						280000	
		1.2.3.2			PCBs	PCB	2000	140	280,000						840000	
		1.2.3.3			mesh and DLC	detector	4000	140	560,000						1400000	
		1.2.3.3.1			structural material	Ceramics									397600	
		1.2.3.4			connectors	connector	45	13440	604,800						604800	
		1.2.3.5			storage boxes	box	200	140	28,000						112000	
		1.2.3.6			shipping		70000		70,000						70000	
	1.2.4	1.2.3.7			Mounting and test				360,000		6.5	520000			360000	
					Ancillaries				2,307,680			400000			2,307,680	
		1.2.4.1			CO2 compressor	compress	65000	14	910,000		2	160000				
		1.2.4.2			CO2 comp. Shipping	compress	7000	14	98,000							
		1.2.4.3			Gas mixer				400,000		1.3	104000				
		1.2.4.4			Gas analyser				100,000		0.5	40000				
		1.2.4.5			laser system				540,000							
		1.2.4.6			HV power supplies	supply	6000	12	72,000		0.3	24000				
		1.2.4.7			HV racks	rack	5000	2	10,000		0.5	40000				
		1.2.4.8			LV power supplies	8-channel	7900	16	126,400		0.3	24000				
		1.2.4.8			VHV power supply		50000	1	50,000		0.1	8000				
	1.2.5	1.2.4.9			Packing and shipping		80	16	1,280			0			0	
					Cables and pipes				49,540			724000			49,540	
		1.2.5.1			HV cable (60m) x120	60m HV c	130	120	15,600		2	160000				
		1.2.5.2			LV cable	cable	25	120	3,000		2	160000				
		1.2.5.3			fibre optics	fibre	120	120	14,400		2	160000				
		1.2.5.4			CO2 hoses	m	70	50	3,500		0.5	40000				
		1.2.5.5			steel pipes for CO2	m	17	240	4,080		2	160000				
		1.2.5.6			VHV cable 60 kV	cable			800		0.05	4000				
	1.2.6	1.2.5.7			steel pipes for gas	m	17	480	8,160		0.5	40000			16,260,000	
					Electronics				9,470,000							
		1.2.6.1			Front End cards	card	3000	2880	8,640,000							
		1.2.6.2			Module cards	card	4000	140	560,000							
		1.2.6.3			Backend	backend	5000	14	70,000						0	
	1.2.7	1.2.6.4			Slow Control				200,000						200,000	
					Assembly on site				0			*****			0	
		1.2.7.1			Mounting in surface						2	160000				
		1.2.7.2			test in surface						8	640000				
		1.2.7.3			installation in racks						9	720000				
	1.2.8	1.2.7.4			final test						8	640000				
					Management				60,000			*****			60,000	
		1.2.8.1			follow-up						14	1120000				
		1.2.8.2			documentation				60,000							

Discussion of Magnetic field

Feipeng:

The CEPC detector needs a 3 Tesla superconducting solenoid followed by a muon detector embedded in a flux return yoke. The magnet system uses a solenoid that is supported by an aluminum alloy cylinder and cooled indirectly by liquid helium to an operating temperature of 4.5 K. A room temperature bore is required with 7.07 m in diameter and 9.05 m in length. The requirement for the uniformity of the magnetic field in the TPC region is less than 7%.

$$\frac{B_{\max} - B_{\text{ave}}}{B_{\text{ave}}} < 0.07 \quad (10.1)$$

The magnet is located outside the hadronic calorimeter detector. This chapter describes the technology design of the magnet, including the overview, detailed design of the magnet, key technologies to address challenges, conductors and dummy coil development, simulation and performance, ancillary systems, High Temperature Superconducting (HTS) option for detector magnet, summary and future plan and cost.

Linghui:

- Magnetic field of BESIII MDC
- $|\cos(\theta)| < 0.83$ (Barrel) $< \pm 2.5\%$
- $|\cos(\theta)| < 0.93$ (Barrel and endplate) $< \pm 6.8\%$
- **The software can be used to perform track corrections.**