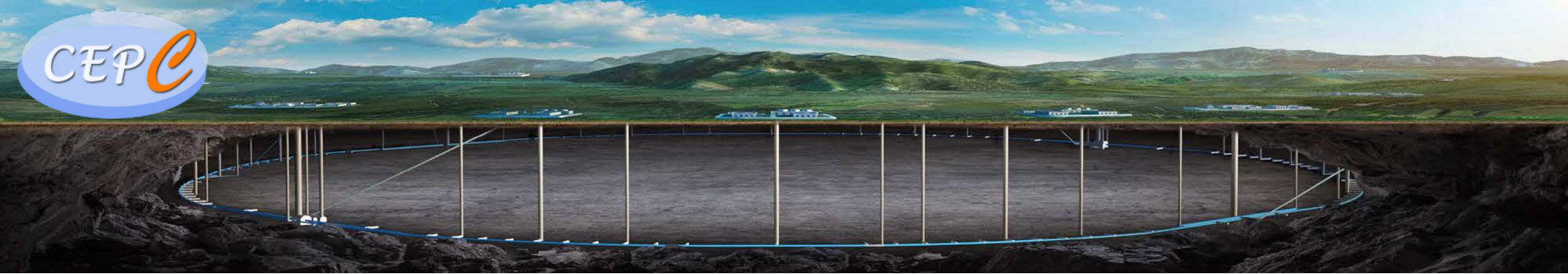

CEPC Gaseous Track Detector

Huirong Qi and Linghui Wu
On behalf the gaseous track group

中国科学院高能物理研究所
Institute of High Energy Physics
Chinese Academy of Sciences

Ch06: Revised Content Following IDRC Review

- CEPC Physics and Detector Ref-TDR.

Chapter 6 Gaseous Tracker

64 pages

Completed before May 6th.

Chapter 6 Pixelated Time Projection Chamber

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/Ind	labor (FTE.year)	total labor cost	TOTAL COST	update Ties
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-channe	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		
					Electronics				9,470,000					16,260,000
			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%.

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

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）< +-2.5%
- |cos(theta)|<0.93（Barrel and endplate） < +-6.8%

- **The software can be used to perform track corrections.**