

CEPC ITK cost estimation

Yiming

ITK module meeting, 19 Feb 2025

CEPC Work Breakdown Structure (WBS)												
black	red	blue	brown	purple	pink	green	WBS Element Title	Type	Unit	Number	price (10,000 Y	Total Price (10,000 Yuan)
Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7						
							TOTAL					
1							Project Management					
2							Accelerator Physics					
3							Collider (Ch 4)					
4							Booster (Ch 5)					
5							Linac, Damping Ring and Sources (Ch 6)					
6							Transport Lines					
7							Systems Common to Accelerators (Ch 7)					
8							Conventional Facilities (Ch 9)					
9							Gamma Ray Source (Appendix 5)					
10							Experiments					
10	1						Detector 1 (baseline option only)					
10	1	1					Machine Detector Interface and Luminosity Measurement					
10	1	1	1				Subsystem 1					
10	1	1	1	1			Sub-Subsystem 1					
10	1	1	1	1	2		Sub-Subsystem 1					
10	1	1	2				Subsystem 2					
10	1	1	2	1			Sub-Subsystem 1					
10	1	1	2	2			Sub-Subsystem 1					
10	1	1	3				Subsystem 3					
10	1	1	4				Subsystem 4					
10	1	2					Vertex detector					
10	1	2	1				Subsystem 1					
10	1	2	2				Subsystem 2					
10	1	2	3				Subsystem 3					
10	1	2	4				Subsystem 4					
10	1	3					Silicon trackers					
10	1	3	1				Inner silicon tracker					
10	1	3	2				Outer silicon tracker					
10	1	3	3				Subsystem 3					
10	1	3	4				Subsystem 4					

ITK cost breakup

- CMOS sensor
- Module (excluding common electronics)
 - Raw material: PCB, flex, support, glue, ...
 - Fabrication: bonding, assembly, ...
- Electronics & DAQ (mass procurement by electronics/DAQ group)
 - Chitu, Taotie, Kinwoo, ...
 - Optical cables
 - Power supply (HV, LV)
 - DAQ & control board
- Mechanics and cooling
 - Carbon fibre support, carbon foam
 - Cooling pipe (polymide, titanium...)
 - Truss material and fabrication
 - Connectors, flanges, ...
 - Cooling plan??
- Other
 - Detector safety (sensors, interlock...)

Sensor cost

■ Key inputs

- Unit price [in 10kCNY]: 350 NTO + 2.87/wafer (12 minimum)
- Number of chips: 33,264 (barrel) + 14,112 (endcap) = 47,376
- Assume 150 chips/wafer, at least 316 wafers needed
- Assume yield of 50%, spares 10%, 696 wafers needed

■ Total sensor cost in 10k CNY: 2348

- NB: from experience of other experiments, sensor (+FE ASIC) usually consists of 1/3 ~ 1/2 of total cost, so **total ITK cost likely range [10k CNY]: 5000~7000**