国家重点研发计划・项目实施方案汇报

R&D and Verification of Key Technologies for a High **Energy Circular Electron-Positron Collider**

2021 Annual Meeting

大科学装置前沿研究 所属专项: 项目负责人: João Guimarães da Costa 项目承担单位:中国科学院高能物理研究所

April 23, 2021





Institute of High Energy Physics Chinese Academy of Sciences





Main contents and objectives of the project

Advance research and validation on key technologies of accelerator and detector

Accelerator

Aim for high-luminosity, low cost



Build prototypes:

Detector

High-precision, high-resolution to insure physics goals



课题3: Hadronic calorimeter

Demonstrate technologies Meet possible technical limitations



任务分解和主要研究: Task Arrangement and Main Research

Task	Task Leader Institute	
Task 1: Accelerator	Yunlong Chi IHEP	Prototy vacu
Task 2: Silicon Detector	João Guimarães da Costa IHEP	Proto
Task 3: Hadronic Calorimeter	Jianbei Liu USTC	Protot scin



Total funding: 3145 万















Major Project Milestones:

- Official starting date: May 1, 2018
- Official kick-off meeting: November 28, 2018
- First Annual Meeting: April 2019
- Midterm review: August 2020
- Final report: April 2023





Agenda for meeting

Friday, April 23, 2021

08:00 - 18:00	Review 09:00	Meeting Project Overview (30' Speaker: Joao Guimaraes						
	09:40	Task 1 Progress report Speaker: Prof. 云龙池 (高能						
	10:30	Group photo and Coffee						
	11:00	Task 3 Progress Report						
		Speaker: Dr. Jianbei Liu (L						
	12:00	Lunch 1h30'						
	13:30	Task 2 Progress Report Speakers: Joao Guimaraes						
	14:20	Coffee Break 20'						
	14:40	Discussion (Project Tea						
	14:40	Discussion (Referees o						
	15:40	Close out session 总结 2						
18:00 - 20:00	Dinner							

Zoom room will be provided for referees discussion at 2:40 pm

General Overview: Today

▶10') 项目进展汇报 40'

Costa

: **课题一进展汇报:高能环形正负电子对撞机加速器关键技术验证 50'** 能所)

e break 30'

t 课题三进展汇报: 成像型强子量能器技术验证 50' University of Science and Technology of China)

t 课题二进展汇报:硅径迹探测器关键技术验证 50' s Costa, Prof. LIANG Zhijun

am Only) 1h0' (229)

nly) 评委内部讨论与撰写评审意见 1h0'

?h20'





Agenda for meeting

Detailed internal discussions happened in the last two days

Wednesday, April 21, 2021

09:30 - 12:00	Interna Locatior	al Meeting: HCAL n: Multi-subject Building (229)								
	09:30	Overview 20'								
		Speaker: Dr. Jianbei Liu (University of Science and Technology of China)								
		Material: Slides 📩								
	10:05	AHCAL design and optimization 20'								
		Speaker: 禹坤石 (中国科学技术大学)								
		Material: Slides								
	10:25	Status of production and quality control of scintillator tiles 20'								
		Speaker: Dr. Yanyun Duan (TDLI/SJTU)								
		Material: Slides 📩								
	10:45	Status of readout electronics and HBU development 20'								
		Speaker: 仲弢沈 (University of Science and Technology of China)								
		Material: Slides								
	11:05	Discussion 55'								

Lively discussions!

Dinner 2.5 hours later

Thursday, Ap	oril 22,	2021
09:00 - 12:00	Intern 09:15	nal Meeting: Accelerator Progress of Prototype Dipole Magnet for CEPC Booster (20'+5') 25 Speaker: Dr. Wen 康文 (Accelerator Centor, IHEP) Material: Slides
	09:40	R&D progress of CEPC vacuum system (20'+5') 25' Speaker: MA Yongsheng (高能所) Material: Slides
	10:05 10:25	Coffee break 20' CEPC MOST Project Midterm Review Meeting-separator (20'+5') 2 Speaker: Mr. bin 陈斌 (高能所) Material: Slides 到
	10:50	Polarization (20'+5') 25' Speaker: Dr. Zhe DUAN (高能所) Material: Slides 题
	11:15	Discussion 45'
12:00 - 14:00 14:00 - 17:30	Lunch Intern 14:00	Box al Meeting: Silicon Overview of Silicon Task 20' Speaker: Prof. LIANG Zhijun Material: Paper R Slides R R
	14:35	Status of the TaichuPix chip for the high-rate CEPC Vertex Detector 25' Speaker: Mr. Wei WEI (高能所) Material: Slides 教
	15:00	Detector optimization and software 15' Speaker: Hao Zeng (IHEP) Material: Slides
	15:15	Mechanical Design of Silicon Vertex Detector Prototype 25' Speaker: Jinyu (高能所) Material: Slides 教
	15:40 16:00	Coffee break 20' Vertex detector geometry implementation 15' Speaker: Kewei Wu Material: Slides
	16:15	Plan for flex PCB design 25' Speaker: Mr. 俊胡 (高能所) Material: Slides 對
	16:40	Plan for DAQ system development 25' Speaker: Hongyu ZHANG (EPC, IHEP, CAS, China) Material: Slides 🔂
	17:05	Discussion 25'
17:30 - 19:00	Dinne	r





第二年(2019.5-2020.4) — Up to midterm

Main Milestones

Task 1: Accelerator Manufacture the high-precision low-field dipole magnet small experimental prototype Finish engineering design of vacuum tube and bellows, and electrostatic separator Simulation program for storage ring polarization is developed **Task 2: Vertex Detector Engineering designs of mechanics structure** Second ASIC MPW submitted **Task 3: Calorimeter** Simulate whole HCAL prototype and develop software framework **Carry out production of scintillator units** Prototype absorber and supporting structure are designed

Outcome

Mid-term report

Delays in the implementation of the "tile production" due to re-optimization of the tile size, and COVID-19

Midterm indicators achieved for all tasks







第三年(2020.5-2021.4)

Main Milestones

- Task 1: Accelerator •
 - Small prototype of magnet fully tested
 - **Design of magnet complete** •
 - •
- Task 2: Vertex Detector
 - Mechanical structure completed
- Second ASIC MPW tested
- ASIC design optimized and completed
- **Task 3: Calorimeter**
 - Batch production of readout electronics, development of data acquisition system
 - Development of beam test platform and cosmic ray test platform

Outcome

Annual report



Processing of the vacuum tube, the coating experiment device and the shielding bellows are completed





Task 1 - Mission 1: High precision low-field dipole magnet

Two small low-field dipole magnet prototypes built and tested

Iron core



CT Coil — no iron core



Better performance in testing

Design full size prototype



Task 1 - Mission 1: High precision low-field dipole magnet

Full-scale prototype CT coil dipole magnet

Design complete







(ahead of schedule)

Task 1 - Mission 2: Main ring vacuum system

6-m long vacuum tubes



RF shielding bellows



(meets engineering requirements)

(finished - meets target

NEG Coating setup (6 m tubes)







Task 1 - Mission 3: Electrostatic separator Design was finished last year and prototype construction started ahead of schedule



Design improvements implemented this year

Separator to be shipped to IHEP soon

Testing platform built

第三年(2020.5-2021.4)

Main Milestones

- Task 1: Accelerator Small prototype of magnet fully tested Design of magnet complete Processing of the vacuum tube, the coating experiment device and the shielding bellows are completed
- **Task 2: Vertex Detector**
 - Mechanical structure completed •
 - Second ASIC MPW tested
 - ASIC design optimized and completed •
- **Task 3: Calorimeter**
- Batch production of readout electronics, development of data acquisition system
- Development of beam test platform and cosmic ray test platform

Outcome

Annual report

IHEP, SDU, NJU, NWPU, (IFAE & CCNU)

Task 2: Vertex Detector Highlights

- **Pixel array** 1024*512
- Periphery
- **DAC & Bias** generation
- Data interface
- 5. LDO (test blocks)
- 6. Chip interconnection features
- Scribe-able top power connection features

TaichuPix-2 irradiated at IHEP (6 keV X-ray)

Pitch: $25/24 \times 25 \,\mu m^2$ Power: 100-150 mW/cm² Size: $5 \times 5 \text{ mm}^2$

Good chip function and noise performance up to 30 Mrad TID

MOST project goals achieved

Full size chip ready to submit next month

Engineering run for Pixel Vertex detector prototype

(ahead of schedule)

Task 2: Vertex Detector Highlights

The design model of ladder support

Vertex Detector Structure

Assembling Tooling

Inner and middle barrels combination and customized tool

第三年(2020.5-2021.4)

Main Milestones

- Task 1:
 - Small prototype of magnet fully tested
 - Design of magnet complete
- Task 2:

Mechanical structure completed

Second ASIC MPW tested

ASIC design optimized and completed

Task 3:

- Batch production of readout electronics, development of data acquisition system •
- **Development of beam test platform and cosmic ray test platform** •

Outcome

Annual report

• Processing of the vacuum tube, the coating experiment device and the shielding bellows are completed

USTC, IHEP, SJTU

Task 3: Calorimeter Highlights

Resolution:

AHCAL **Scintillator and SiPM**

40 layers of 20 mm stainless steel + 3 mm scintillator + 2 mm PCB

Transverse size: 72 × 72 cm²

Length: 1.3 m

$\frac{60\%}{\sqrt{E(GeV)}} \oplus 3\%$

Single layer and detector part

Cell size: $4 \times 4 \text{ cm}^2$

Task 3: Calorimeter Highlights

10000 scintillators have been produced using the injection molding technique

Light yield of each scintillator is about 40 p.e., tested with NDL-22-1313-15S

Automatic wrapping and labelling

3 batch testing platforms built (USTC, SJTU, IHEP)

Mass production to start soon

Funding Allocation and Implementation

Project Funds Allocation

Bulk of expenses to build and test prototypes still in the future

Implementation:

Task 2	Task 3
60%	35%
34%	25%

Task 1: Funds allocation and implementation

序号	预算科目名称	Expense until 2021/4/14	Total budget	Rate of expense/total budget	Budget until 2021/4/30	Rate of expense/budg till 2021/4/14
2	direct fee	438.86	878.19	49.97%	659.29	66.56%
3	1、 device fee	377.00	456	82.68%	359.00	105.01%
4	(1) purchase device	122.35	140	87.39%	113.00	108.27%
5	(2) Trial device	256.10	296	86.52%	226.00	113.32%
6	(3) modifed device	0.00	20	0.00%	20.00	0.00%
7	2、material fee	7.98	116	6.88%	93.00	8.59%
8	3、testing fee	2.10	76.2	2.76%	63.20	3.32%
9	4、power fee	0.00	18	0.00%	10.00	0.00%
10	5 travel/conference/international communication	26.71	131.1	20.37%	84.40	31.64%
11	6、publication	2.60	20.29	12.81%	16.49	15.76%
12	7、labor	22.47	51	44.05%	27.20	82.60%
13	8、consult	0.00	9.6	0.00%	6.00	0.00%

Task 2: Funds allocation and implementation

序号	预算科目名称	Expense until 2021/4/14	Total budget	Rate of expense/ total budget	Budget until 2021/4/30	Rate of expense/ budget till 2021/4/14
2	direct fee	355.35	1047.71	33.92%	594.03	59.82%
3	1、device fee	76.99	196.30	39.22%	196.30	39.22%
4	(1) purchase device	76.99	196.30	39.22%	196.30	39.22%
5	(2) Trial device					
6	(3) modifed device					
7	2、material fee	109.33	235.66	46.39%	188.24	58.08%
8	3、testing fee	2.25	299.80	0.75%	27.60	8.15%
9	4、power fee	0.12	20.64	0.59%	12.39	0.98%
10	5、travel/conference/ international communication	52.99	123.81	42.80%	74.82	70.83%
11	6、publication	2.08	8.50	24.46%	5.10	40.77%
12	7、labor	109.54	157.00	69.77%	86.00	127.38%
13	8、consult	2.04	6.00	33.92%	3.60	56.53%

Task 3: Funds allocation and implementation

预算科目名称	Expense until 2021/4/14	Total budget	Rate of expense/total budget	Budget until 2021/4/30	Rate of expense/budge till 2021/4/14
direct fee	210.06	840.50	24.99%	592.56	35.45%
1、 device fee	51.53	135.60	38.01%	135.60	38.01%
(1) purchase device	51.53	135.60	38.01%	135.60	38.01%
(2) Trial device					
(3) modifed device					
2、material fee	72.95	379.46	19.22%	279.46	26.10%
3、testing fee	15.51	45.00	34.46%	27.00	57.44%
4、 power fee	0.00	4.60		3.00	
5、 travel/conference/international communication	24.42	128.34	19.03%	65.00	37.57%
6 publication	0.09	6.00	1.49%	3.00	2.98%
7、labor	45.35	137.50	32.98%	77.50	58.52%
8、consult	0.21	4.00	5.25%	2.00	10.50%
	対算科目名称	预算科目名称Expense until 2021/4/14direct fee210.061、device fee51.53(1) purchase device51.53(2) Trial device(2)(3) modifed device72.953、testing fee15.514、power fee0.005、 travel/conference/international communication24.426、publication0.097、labor45.358、consult0.21	预算科目名称Expense until 2021/4/14Total budgetdirect fee210.06840.501、device fee51.53135.60(1) purchase device51.53135.60(2) Trial device(3) modifed device2、material fee72.95379.463、testing fee15.5145.004、power fee0.004.605、travel/conference/international communication24.42128.346、publication0.096.007、labor45.35137.508、consult0.214.00	预算科目名称Expense until 2021/4/14Total budgetRate of expense/total budgetdirect fee210.06840.5024.99%1、device fee51.53135.6038.01%(1) purchase device51.53135.6038.01%(2) Trial device </td <td>预算科目名称Expense until 2021/4/14Total budgetRate of expense/total budgetBudget until 2021/4/30direct fee210.06840.5024.99%592.561、device fee51.53135.6038.01%135.60(1) purchase device51.53135.6038.01%135.60(2) Trial device(3) modifed device2、 material fee72.95379.4619.22%279.463、 testing fee15.5145.0034.46%27.004、 power fee0.004.603.003.00ftravel/conference/international communication24.42128.3419.03%65.005、 travel/conference/international communication0.096.001.49%3.007、 labor45.35137.5032.98%77.508、 consult0.214.005.25%2.00</br></td>	预算科目名称Expense until 2021/4/14Total budgetRate of expense/total

Impact due to Covid-19 pandemic

International collaboration diminished

- Travel to/from international partner institutions
 - Collaboration with BINP of Russia on Beam Polarization most affected
- Work at partner international institutions was reduced but has no critical impact
 - **Collaboration with Barcelona continued without interruption**

• Work in laboratories at universities and IHEP reduced -> delay still being recovered

- Main driver of delays in the calorimeter task
 - e.g. production of scintillator tiles, wrapping and testing

Other main tasks proceeded without major delays

- Personnel worked from home on most design activities •
 - 2nd version of vertex detector chip finalized at home and submitted to vendor in Israel with no impact on schedule

VBS	Chinese Name	Task Name	Duration	Start	Finish	2018 2019 2020 2021 H2 H1 H2 H1 H2 H1 H2 H1	2022 2023 2024 2025 2026 H2 H1 H2 H1 H2 H1 H2
مریک 1	高能环形取府电子对差机加速; CEPC高精度低场二极磁铁样 机	Key technology verification of accelerator CEPC high precision and low field dipole magnet prototype	1261 days 1111 days	18/5/1 18/5/1	23/3/1 22/8/2	an the second	Key technology verification of accelerator CEPC high precision and low field dipole magnet prototype
. 1.1 .1.1.1	小型实验样机 物理设计	Miniature experimental prototype Physical design	568 days 153 days	18/5/1 18/5/1	20/7/2 18/11/29	Physical design	tal prototype
.1.1.2	工程机械设计 加工制造 实验验证	Construction machinery design Processing and manufacturing	153 days 153 days	18/11/30 19/7/3 20/2/2	19/7/2 20/1/31 20/7/2	Construction machinery design Processing and manufact Experimental ver	g
.1.1.4 .1.1.5 . 1.2	英型型型型 样机改进及测试 正式磁铁样机	Prototype improvement and testing Formal magnet prototype	66 days 543 days	20/3/3 20/7/3	20/6/2 22/8/2	Frototype improve	t and testing Formal magnet prototype
.1.2.1	物理设计 工程机械设计	Physical design Construction machinery design	108 days 153 days	20/7/3 20/12/2	20/12/1 21/7/2	Physica	sign Construction machinery design
.1.2.3 .1.2.4 1.2.5	加工制造 实验研究	Experimental study	151 days 66 days 88 days	21/7/5 21/5/3 21/8/3	22/1/31 21/8/2 21/12/2		Experimental study
.1.2.6	 实验验证 测试验收 	Experimental verification Acceptance testing	107 days 66 days	21/12/3 22/5/3	22/5/2 22/8/2		Experimental verification
. 2 .2.1	真空系统 真空盒、RF屏蔽波纹管、镀	Vacuum system Preliminary design of vacuum box, RF	1217 days 220 days	18/5/1 18/5/1	22/12/28 19/3/4	Preliminary design of vacuum box, RF shielde	Vacuum system lows and coating device
.2.2	展表且初步以17 工程设计、招投标、签订技术 合同	Engineering design, bidding and signing of technical contracts	220 days	19/3/5	20/1/6	Engineering design, bidding	d signing of technical contracts
.2.3 .2.4	样机加工和制造 真空盒、RF屏蔽波纹管验收 直穴会由融煙間水路	Prototype processing and manufacturing Acceptance of vacuum box and RF shielder beliave costing experiment on inper well of	220 days d 220 days	20/1/7 20/11/10	20/11/9 21/9/13	Prototype	Acceptance of vacuum box and RF shielded bellows, coating experiment on inner wall of vacuum box
.2.5	, 兵工並內型破炭头型 破膜样品检测,抽迷测试	vacuum box Coating sample test, pumping speed test	220 days	21/9/14	22/7/18		Coating sample test, pumping speed test
.2.6 .3	评审验收,资料归档 静电分离器	Review and acceptance, document filing Electrostatic separator	117 days 1261 days	22/7/19 18/5/1	22/12/28 23/3/1		Review and acceptance, document filing
.3.1 .3.2	完成静电分离器参数计算 完成静电分离器束流阻抗分析	Complete the parameter calculation of electrostatic separator The beam impedance analysis of	200 days 240 days	18/5/1	19/2/4	Complete the parameter calculation of electros	tic separator
.3.3	完成静电分离器的整体方案设	electrostatic separator is completed Complete the overall scheme design of the electrostatic separator	190 days	19/6/11	20/3/2	Complete the overall sci	e design of the electrostatic separator
.3.4	完成绝缘支撑件、高压馈电穿 墙件设计	Complete the design of insulation support parts, high voltage feed through wall parts	220 days	19/4/30	20/3/2	Complete the design of	Ilation support parts, high voltage feed through wall parts
.3.5	完成静电分离器各关键部件的 机械设计及加工	Complete the mechanical design and processing of the key components of the electrostatic separator	140 days	20/5/4	20/11/13	Complete	e mechanical design and processing of the key components of the electrostatic separator
.3.6	完成静电分离器整体组装	Complete the assembly of the electrostatic separator	20 days	20/11/16	20/12/11	Comple	he assembly of the electrostatic separator
.3.8	指建網试干台, 近行靜电場初 步高压老练 完成高阶模吸收器的设计及加	preliminary high voltage sophistication Complete the design and manufacture of	280 days	20/12/14	21/6/25		-Complete the design and manufacture of high order mode absorber
.3.9	工 进行冷却系统和高阶模吸收器 的优化设计	high order mode absorber Optimize the design of cooling system and high order mode absorber	210 days	21/8/16	22/6/3		Optimize the design of cooling system and high order mode absorber
.3.10	完成静电分离器高压老练和测试	Complete electrostatic separator high voltage sophistication and testing	210 days	22/2/3	22/11/23		Complete electrostatic separator high voltage sophistication and testing
.3.11 .4	项目结题评审 Z能区极化束流的研究与设计	Final project review Study and Design of Z energy region polarized beam	0 days 1217 days	23/3/1 18/5/1	23/3/1 22/12/28		3/1 • Final project review Study and Design of Z energy region polarized beam
.4.1	基于共振进极化的精确能量 满量	Accurate energy measurement based on resonance depolarization	1050 days	18/5/1	22/5/9		Accurate energy measurement based on resonance depolarization
.4.1.1	极化扭摆器的参数选择 精确能量测量的工作模式	Parameter selection of polarized torsional pendulum A mode of operation for accurate energy	150 days	18/5/1	18/11/26	Parameter selection of polarized torsional pendulur -A mode of operation for accurate ene	r measurement
.4.1.3	精确能量测量的误差分析	measurement Error analysis for accurate energy	500 days	20/6/9	22/5/9		Error analysis for accurate energy measurements
.4.2	极化束流对撞 极化束流的产生和保持	Polarized beam collisions Generation and retention of polarized	1108 days 1108 days	18/5/1	22/7/28		Polarized beam collisions Generation and retention of polarized beams
.4.2.1.1	注入器设计	beams Injector design	861 days	18/5/1	21/8/17		njector design
.4.2.1.2 . 4.2.2	来调妆化度保持数值模拟 纵向极化束流对撞	Beam polarization is simulated numerically Longitudinally polarized beam collision	247 days	21/8/18 18/5/1	22/7/28 22/7/18		Beam porarization is simulated numerically Longitudinally jolarized beam collisions
4.2.2.1	自旋旋转器参数选择与设计	Selection and design of spin rotator parameters	400 days	18/5/1	19/11/11	Selection and design of spin ro	Decion and optimization of storage size meanable families also
.4.2.2.2 . 4.3	叫1747和米馬前列双计与优化 项目总结	Pesign and optimization of storage ring magnetic focusing structure Project summary	117 days	19/11/12 22/7/19	22/12/28		Project summary
.4.3.1	撰写极化束流运行的物理设计 报告	Write the physical design report of the polarized beam operation	117 days	22/7/19	22/12/28		Write the physical design report of the polarized beam operation (12/25 @ Peer writew and targing acceptance)
2000	验法运家需要关键技术验证	Key technology verification of silicon track detector	1261 days	18/5/1	23/2/28		Kyy technology verification of silicon track detector
.1 .1.1	力学支撑结构 探测器模块几何排布优化	Mechanical support structure Layout Optimization Proliminary design of ladder supporting	934 days 436 days	18/5/1 18/5/1	21/11/26 19/12/31 18/10/20	Layout Optimization	Mechanical support structure
.1.3	探测器整机结构初步设计	Structure Preliminary design of detector supporting	260 days	18/10/30	19/10/28	Preliminary design of detector	porting structure
.1.4	支撑结构的工程图设计	Engineering plot design of supporting struct production of prototype of ladder support	u 523 days	19/5/1	21/4/30		gineering plot design of supporting structures
.1.6	探测器模块的结构最终设计 探测器整机的结构最终设计	Final design of ladder supporting structure Final design of detector supporting structure	43 days e 416 days	21/5/3 19/10/29	21/6/30 21/6/1		Final design of detector supporting structure Final design of detector supporting structure
.1.8 .1.9	制造探测器整机支撑结构 完成所有力学支撑结构的研制	Manufacture supporting structure of detecto Complete the Manufacture of all mechanica	r 128 days I 0 days	21/6/2 21/11/26	21/11/26 21/11/26		Manufacture supporting structure of detector 11/26 Complete the Manufacture of all mechanical support structures
. 2 .2.1	传感器 传感器像素内的电子学设计	The sensor Electronics design in sensor pixel, design of	919 days f 170 days	18/5/1 18/5/1	21/11/5 18/12/24	-Electronics design in sensor pixel, design of anti	The sensor
.2.2	,抗辐照元件设计 外围数字电路、触发、时钟与 由预算维持设计 与艾兰拉和	anti - irradiation element Peripheral digital circuit, trigger, clock and power supply ladder design, and chip	261 days	18/5/1	19/4/30	Peripheral digital circuit, trigger, clock and	wer supply ladder design, and chip anti-radiation performance simulation
.2.3	电波导接灰度1, 马 5 月 5 福 照性能模拟 第一次多项目晶圆	anti-radiation performance simulation 1st MPW	100 days	19/6/17	19/11/1	1st MPW	
.2.4	 (MPW) 流片 第二次多項目晶間 (MPW) 流片 	2nd MPW	90 days	20/2/18	20/6/22	2nd MPW	
.2.5	整合全功能的小面积芯片设计	Integration of fully functional small area chip design	o 190 days	19/5/1	20/1/21	-Integration of fully-function	small area chip design
.2.6	第三次多项目晶圆 (MPW)流片 设计大面积,全功能的传感器	3rd MPW Design large area, full function sensor chip	108 days 328 days	21/1/1 20/5/13	21/6/1 21/8/13		pro MPW
.2.8	芯片 第一次工程批硅晶圆加工	First engineering batch silicon wafer proces	s 60 days	21/8/16	21/11/5		First engineering batch silicon wafer processing
.3.1	为初次MPW的芯片研制前端	system Development of the front end circuit board	261 days	18/5/1	19/4/30	-Development of the front end circuit board	the initial MPW chip
.3.2	电路板 研制单个传感器芯片的数据获 取系统	for the initial MPW chip Development of data acquisition system for a single sensor chip	220 days	19/5/1	20/3/3	Development of data acc	ition system for a single sensor chip
.3.3 .3.4	ladder的读出电子学 研制单个探测器模块的数据获	ladder readout electronic Development of data acquisition system for	218 days 472 days	20/8/31 20/3/12	21/6/30 21/12/31		tadder eacjout electronic Development of data acquisition system for a single detector ladder
.3.5	取系统 原型机的读出电子学 研制探测器原型机的数据非取	a single detector ladder Prototype readout electronic Development of data acquisition system for	132 days	21/7/1	21/12/31		Prototype readout electronic
.4	^{系统} 探测器原型机整体设计与组装	the prototype detector The overall design and assembly of the	1066 days	18/5/1	22/5/31		The overall design and assembly of the prototype
.4.1	制定探测器模块的组装流程	Develop the assembly process of detector ladder	260 days	18/5/1	19/4/29	Develop tile assembly process of detector	der
.4.2	制定探测器原型机的组装流程 , 开发自动组装系统	Develop the assembly process of detector prototype and develop the automatic assembly system	430 days	19/4/30	20/12/21	Develo	e assembly process of detector prototype and develop the automatic assembly system
.4.3 .4.4	探测模块模型试制 组装与调试首批探测器模块	detector ladder trail production Assemble and test the first detector ladder	66 days 38 days	21/4/30 21/11/24	21/7/30 22/1/14		detector ladder trail production
.4.5	组装与测试探测器模块 组装与调试探测器原型机	Assemble and test the rest of detector ladde Assemble and debug detector prototype	22 days	22/1/17 22/5/2	22/4/29 22/5/31		Assemble and test the rest of detector ladders
.4.7	元成探测器原型机时组装调试 测试与数据分析	Complete the assembly and debugging of detector prototype Test and data analysis	1086 days	19/1/1	23/2/28		Tist and data analysis
.5.1 .5.2	对第一次MPW芯片做测试 对第二次MPW的芯片做测试	Test 1st MPW chip Test the second MPW chip	157 days 93 days	19/11/4 20/8/4	20/6/9 20/12/10	Test 1st MPW chip Test 1st MPW chip	cond MPW chip
.5.3 .5.4	対第三次MPW的る片做測试 対工程批芯片做測试 音楽器は日新潟へ折	Test the third MPW chip Test engineering chip Beam testing and data analysis	12 days	21/6/2 21/11/8	21/8/13 21/11/23 23/2/28		Test engineering chip Beam testing and data analysis
.5.5.1	束流测试模拟、重建和分析教 件开发	development of the simulaiton, reconstruction and analysis software	784 days	19/1/1	21/12/31		development of the simulation, reconstruction and analysis software
.5.5.1.1 .5.5.1.2 .5.5.7	1% 拟软件开发 重建软件开发 分析软件开始	development of the reconstruction software development of the reconstruction software	201 days ar784 days 784 days	19/1/1 19/1/1 19/1/1	19/12/31 21/12/31 21/12/21	development of the simulait	development of the reconstruction software
.5.5.3 .5.5.4	來流測试实验 数据分析	Beam test experiment The data analysis	60 days 85 days	22/6/1 22/8/24	22/8/23 22/12/20		Beam test experiment The data analysis
.5.5.5 .5.6	发表测试结果,撰写终期报告 完成项目终期报告	Publish test results and write final report Complete the final project report	50 days	22/12/21 23/2/28	23/2/28		Publish test results and write final report 2/28.4 Complete the final project report
.1	州家里式丁里那群技不變從 量能響原型机物理设计	Physical design of the prototype of the quantizer	610 days	18/5/1	20/8/31	1 Physical des	of the prototype of the quantizer
.1.1	量能器关键参数的选取和优化	Selection and optimization of key parameters of the quantizer Performance simulation that a first	261 days	18/5/1	19/4/30	Selection and optimization of key paramet	of the quantizer
.1.2	■. III 单 III III III III III III III III	Quantizer Development of sensitive detectors	719 days	18/5/1	20/0/31	-Pertormance	xment of sensitive detectors
.2.1 .2.2	原材料、器件采购 灵敏单元结构的设计和优化	purchase of raw materials and devices Design and optimization of sensitive element structure	239 days 239 days	18/5/1 18/5/1	19/3/29 19/3/29	purchase of raw materials and devices Design and optimization of sensitive elemen	ructure
.2.3	闪烁单元生产工艺的研究	Research on the production technology of scintillation unit	393 days	19/4/1	20/9/30	Research o	ne production technology of scintillation unit
.2.4 .2.5	闪烁单元批量生产 闪烁单元包装工艺的研究	Batch production of scintillation unit Research on packaging technology of scintillation unit	66 days 436 days	20/10/1 18/5/1	20/12/31 19/12/31	Research on Packaging tec	auccion or senthilation unit
.2.6 .2.7	闪烁单元批量包装 7闪烁单元批量测试装置制作	Batch packaging of scintillation unit Manufacture of batch test device of	66 days 589 days	20/10/1 18/5/1	20/12/31 20/7/31	Manufacture of	ckaging of scintillation unit ch test device of scintillation unit
.2.8	闪烁单元批量测试 前目录: 新政副员工支持委	scintillation unit Batch test of flicker unit Process exploration of single-layer sensitive	44 days	20/12/1	21/1/29	Bat	et of flicker unit
.3	读出电子学和兼提获取系统	detector Readout electronics and data acquisition	959 days	18/5/1	21/12/31		Readout electronics and data acquisition system
.3.1	原材料、电子元器件的采购	Procurement of raw materials and electronic components	698 days	18/5/1	20/12/31	Proci	nent of raw materials and electronic components
.3.2	前端读出板和数据接口板的设 计和开发 SPIROC共出力的调动研究中	Design and development of front-end readout board and data interface board Functional test board development of	719 days	18/5/1	21/1/29	Functional test hours days	and development of front-end readout lioard and data interface board
.3.4	前编读出板和数据接口板的批	SPIROC chip Batch production and testing of front-end	130 days	21/2/1	21/7/30		Batch production and testing of front-end readout board and data interface board
.3.5	血町1F与潤式 測试用数据获取板的开发与制作	readout board and data interface board Development and production of test data acquisition board	436 days	18/5/1	19/12/31	- Development and production	f est data acquisition board
.3.6	数据获取板的开发与制作 SiPM 绘体数型空间中学生	Development and production of data acquisition board	415 days	20/6/1	21/12/31		Development and production of data acquisition board
.4.1	新完 基于LED的监测系统的开发	calibration system research Development of LED-based monitoring	479 days	19/5/1	21/3/1		orment of LED-based monitoring system
.4.2	基于光纤的监测刻度系统的研 究	system research on monitoring scale system based on optical fiber	479 days	19/5/1	21/3/1	ret	e) on monitoring scale system based on optical fiber
.5 .5.1	机械设计和制作 探测器灵敏层结构	Mechanical design and production Structure of detector sensitive layer	827 days 566 days	18/11/1 18/11/1	21/12/31 20/12/31		Mechanical design and production o detector sensitive layer
.5.2	除型机吸收体和支撑结构 束流测试平台	Absorber and support structure of the prototype Beam test platform	501 days 436 davs	19/5/1 20/5/1	21/3/31 21/12/31		Beam test platform
.5.4 .6	宇宙线测试平台 量能攝原型机系统集成	Cosmic ray test platform Integration of the prototype system of the	262 days 195 days	20/11/2 21/8/2	21/11/2 22/4/29		Chemic cay test platform Integration of the plototype system of the quantizer
.6.1	探测器灵敏层的组装和测试	quantizer Assembly and testing of detector sensitive layer	111 days	21/8/2	22/1/3		Assembly and testing of detector sensitive layer
.6.2 .7	整体样机的集成 量能器原型机测试和性能研究	Integration of the overall prototype Prototype testing and performance	84 days 325 days	22/1/4 22/1/3	22/4/29 23/3/31		Integration of the overall prototype Prototype testing and performance research of the quantizer
.7.1		Jouron or me quantizer	174 down	22/1/3	22/9/1		Development and preparation of data analysis software
	数据分析软件的开发和准备	Development and preparation of data analysis software	174 days				
.7.2	数据分析软件的开发和准备 原型机字宙线测试及质量检验 原型机束流测试查 如本 2 40 12	Development and preparation of data analysis software Cosmic ray testing and quality inspection of the prototype Preliminary preparation and tracesortetion	f 88 days	22/5/2	22/8/31		Cosmic ray festing and quality inspection of the prototype
.7.2 .7.3 .7.4	数据分析软件的开发和准备 原型机字宙线测试及质量检验 原型机束流测试筋期准备和运 输 原型机束流测试及样机运回	Development and preparation of data analysis software Cosmic ray testing and quality inspection of the prototype Preliminary preparation and transportation of prototype beam test Prototype beam test and prototype transpo	f 88 days 22 days rt43 days	22/5/2 22/9/1 22/10/3	22/8/31 22/9/30 22/11/30		Codmic ray (esting and quality inspection of the prototype Peliminary preparation and transportation of prototype beam test Prototype beam test and prototype transport back
.7.2 .7.3 .7.4 .7.5	数据分析软件的开发和准备 原型机宁宙线测试及质量检验 原型机束流测试前期准备和运 输型机束流测试及样机运回 测试数据分析及原型机性能研究	Development and preparation of data analysis software Cosmic ray testing and quality inspection o the prototype beam test Prototype beam test Prototype beam test and prototype transpo back Test data analysis and prototype performance research	f 88 days 22 days rt43 days 87 days	22/5/2 22/9/1 22/10/3 22/12/1	22/8/31 22/9/30 22/11/30 23/3/31		Cocmic ray (esting and quality inspection of the prototype Poliminary preparation and transportation of prototype beam test Prototype beam test and prototype transport back Test data analysis and prototype performance research

Task 1: ccelerator

ask 2: /ertex

Task 3: alorimeter early 2022, complete:

Future Integrated Plan (Microsoft Project)

by end 2021, complete:

- dipole magnet prototype
- vacuum tubes and RF bellows

by end 2022, complete:

- electrostatic separator
- polarization studies

by end 2021, complete:

- first chip engineering run produced
- manufacturing of detector support structure finished
- single ladder DAQ ready

early 2022, complete:

- prototype

by end 2022, complete:

- prototype test beam

by end 2021, complete:

- batch production and wrapping of scintillator tiles
- batch production of front end electronics

- prototype
- by end 2022, complete:
 - prototype test beam

Task 1: Accelerator Plan

WBS	Chinese Name	Task Name	Duration	Start	Finish	2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 H2 H1 H2 </th
1 1.1	高能环形政府电子对撞机加速 CEPC高精度低场二极磁铁 样机	Key technology verification of accelerator CEPC high precision and low field dipole magnet	1261 days 1111 days	18/5/1 18/5/1	23/3/1 22/8/2	Key technology verification of accelerator CEPC high precision and low field dipole magnet prototype
1.1.1	小型实验样机	Miniature experimental prototype	568 days	18/5/1	20/7/2	Miniature experimental prototype
1.1.1.1	物理设计	Physical design	153 days	18/5/1	18/11/29	Physical design
1.1.1.2	2 工程机械设计	Construction machinery design	153 days	18/11/30	19/7/2	Construction machinery design
1.1.1.3	加工制造	Processing and manufacturing	153 days	19/7/3	20/1/31	Processing and manufacturing
1.1.1.4	实验验证	Experimental verification	109 days	20/2/3	20/7/2	Experimental verification
1.1.1.8	▶ 样机改进及测试	Prototype improvement and testing	66 days	20/3/3	20/6/2	Prototype improvement and testing
1.1.2	此政國代件化	Formal magnet prototype	543 days	20/7/3	22/8/2	Physical design
1.1.2.	初理反计 工程机械设计	Construction machinery design	100 days	20/12/2	20/12/1	Construction machinery design
1123	加丁制造	Processing and manufacturing	151 days	21/7/5	22/1/2	Processing and manufacturing
1.1.2.4	实验研究	Experimental study	66 days	21/5/3	21/8/2	Experimental study
1.1.2.5	5 样机改进	improve the prototype	88 days	21/8/3	21/12/2	improve the prototype
1.1.2.6	实验验证	Experimental verification	107 days	21/12/3	22/5/2	Experimental verification
1.1.2.7	/ 测试验收	Acceptance testing	66 days	22/5/3	22/8/2	La Acceptance testing
1.2	真空系统	Vacuum system	1217 days	18/5/1	22/12/28	ı Vacuum system
1.2.1	真空盒、RF屏蔽波纹管、镀 膜装置初步设计	Preliminary design of vacuum box, RF shielded bellows and coating device	220 days	18/5/1	19/3/4	Preliminary design of vacuum box, RF shielded bellows and coating device
1.2.2	工程设计、招投标、签订技术合同	Engineering design, bidding and signing of technical contracts	220 days	19/3/5	20/1/6	Engineering design, bidding and signing of technical contracts
1.2.3 1.2.4	样机加工和制造 真空盒、RF屏蔽波纹管验收 ,真空盒内壁镀膜实验	Prototype processing and manufacturing Acceptance of vacuum box and RF shielded bellows, coating experiment on inner wall of vacuum box	220 days 220 days	20/1/7 20/11/10	20/11/9 21/9/13	Acceptance of vacuum box and RF shielded bellows, coating experiment on inner wall of vacuum box
1.2.5	镀膜样品检测,抽速测试	Coating sample test, pumping speed test	220 days	21/9/14	22/7/18	Coating sample test, pumping speed test
1.2.6	评审验收,资料归档	Review and acceptance, document filing	117 days	22/7/19	22/12/28	Review and acceptance, document filing
1.3	静电分离器	Electrostatic separator	1261 days	18/5/1	23/3/1	Electrostatic separator
1.3.1	完成静电分离器参数计算	Complete the parameter calculation of electrostatic separator	200 days	18/5/1	19/2/4	Complete the parameter calculation of electrostatic separator
1.3.2	完成静电分离器束流阻抗分析	The beam impedance analysis of electrostatic separator is completed	240 days	18/7/10	19/6/10	The beam impedance analysis of electrostatic separator is completed
1.3.3	完成静电分离器的整体方案 设计	Complete the overall scheme design of the electrostatic separator	190 days	19/6/11	20/3/2	Complete the overall scheme design of the electrostatic separator
1.3.4	完成绝缘支撑件、高压馈电 穿墙件设计	Complete the design of insulation support parts, high voltage feed through wall parts	220 days	19/4/30	20/3/2	Complete the design of insulation support parts, high voltage feed through wall parts
1.3.5	完成静电分离器各关键部件的机械设计及加工	Complete the mechanical design and processing of the key components of the electrostatic separator	140 days	20/5/4	20/11/13	Complete the mechanical design and processing of the key components of the electrostatic separator
1.3.6	完成静电分离器整体组装	Complete the assembly of the electrostatic separator	20 days	20/11/16	20/12/11	Complete the assembly of the electrostatic separator
1.3.7	搭建测试平台,进行静电场 初步高压老练	Build test platform for electrostatic field preliminary high voltage sophistication	140 days	20/12/14	21/6/25	Build test platform for electrostatic field preliminary high voltage sophistication
1.3.8	完成高阶模吸收器的设计及加工	Complete the design and manufacture of high order mode absorber	280 days	20/6/1	21/6/25	Complete the design and manufacture of high order mode absorber
1.3.9	进行冷却系统和高阶模吸收 器的优化设计	Optimize the design of cooling system and high order mode absorber	210 days	21/8/16	22/6/3	Optimize the design of cooling system and high order mode absorber
1.3.10	元成醇电分离器高压老珠和 測试 而且结顯速度	sophistication and testing	210 days	22/2/3	22/11/23	3/1 + Final project review
1.4	Z能区极化束流的研究与设	Study and Design of Z energy region polarized	1217 dave	18/5/1	22/12/28	Study and Design of Z energy region polarized beam
1.4.1	计基于共振退极化的精确能量	beam Accurate energy measurement based on	1050 days	18/5/1	22/5/9	Accurate energy measurement based on resonance depolarization
1.4.1.1	测量 极化扭摆器的参数选择	resonance depolarization Parameter selection of polarized torsional pendulum	150 days	18/5/1	18/11/26	Parameter selection of polarized torsional pendulum
1.4.1.2	2 精确能量测量的工作模式	A mode of operation for accurate energy	178 days	18/11/27	19/8/1	A mode of operation for accurate energy measurement
1.4.1.3	诸 确能量测量的误差分析	Error analysis for accurate energy measurements	500 days	20/6/9	22/5/9	Error analysis for accurate energy measurements
142	极化束流对槽	Polarized beam collisions	1108 days	18/5/1	22/7/28	Polarized beam collisions
1.4.2.1	极化束流的产生和保持	Generation and retention of polarized beams	1108 days	18/5/1	22/7/28	Generation and retention of polarized beams
1.4.2.1	 .1 注入器设计 .2 東流极化度保持数值模拟 	Injector design Beam polarization is simulated numerically	861 days 247 days	18/5/1 21/8/18	21/8/17 22/7/28	Injector design Beam polarization is simulated numerically
1421	如向您心古这时候	Longitudinally polarized beam collicions	1100 days	18/5/4	22/7/19	Longitudinally polarized beam collisions
1.4.2.2	2.1 自旋旋转器参数选择与设计	Selection and design of spin rotator parameters	400 days	18/5/1	19/11/11	Selection and design of spin rotator parameters
1.4.2.2	2.2 储存环磁聚焦结构设计与优化	Design and optimization of storage ring magnetic focusing structure	700 days	19/11/12	22/7/18	Design and optimization of storage ring magnetic focusing structure
1.4.3 1.4.3.1	项目总结 撰写极化東流运行的物理设	Project summary Write the physical design report of the polarized	117 days 117 days	22/7/19 22/7/19	22/12/28 22/12/28	Write the physical design report of the polarized beam operation
1.4.3.2	2 同行评议和项目验收	Peer review and project acceptance	0 days	22/12/28	22/12/28	12/28 * Peer review and project acceptance

Task 2: Vertex Detector Prototype Plan

WBS	Chinese Name	Task Name	Duration	Start	Finish	Н2	2018 H1	2019 H2 H1	H2	2020 H1	1	н2	2021 H1		H2	2022 H1	H2	2023 H	; 1 ∣ н2	2024 H1	H2 2	2025 H1	H2	2026 H1	H2
2	硅径迹探测器关键技术验证	Key technology verification of silicon track detector	1261 days	18/5/1	23/2/28	112		112 111	112			112			112		112		Key technol	logy verificat	ion of sil	ilicon tr	ack deteo	tor	112
2.1	力学支撑结构	Mechanical support structure	934 days	18/5/1	21/11/26		-									Mechan	ical supp	ort str	ucture						
2.1.1	探测器模块几何排布优化	Layout Optimization	436 days	18/5/1	19/12/31	1				Layou	it Opti	imizati	ion												
2.1.2	探测器模块支撑结构初步设计	Preliminary design of ladder supporting	130 days	18/5/1	18/10/29		-	Prelimin	hary desig	n of ladde	er sup	oportin	ng str	uctur	e										
2.1.3	探测器整机支撑结构初步设计	Preliminary design of detector supporting structure	260 days	18/10/30	19/10/28			+		Prelimina	ary de	esign o	of dete	ector	suppo	rting str	ucture								
2.1.4	制造模块支撑结构样品	Production of prototype of ladder support	87 days	20/12/31	21/4/30							1		Pro	duction	n of prot	otype of l	adder	support						
2.1.5	探测器模块支撑结构最终设计	Final design of ladder supporting structure	43 days	21/5/3	21/6/30								1	1 F	Final de	esign of	ladder su	ipporti	ng structure	e					
2.1.6	探测器整机支撑结构最终设计 和工程图	Final design of detector supporting structure and engineering plot drawing	416 days	19/10/29	21/6/1				*	,				Fi	nal des	sign of d	etector su	upport	ing structur	re and engine	ering pl	olot drav	wing		
2.1.7	制造探测器整机支撑结构	Manufacture supporting structure of detector	128 days	21/6/2	21/11/26									*	٦ ا	Manufac	cture supp	porting	g structure o	of detector					
2.1.8	完成所有力学支撑结构的研制	Complete the Manufacture of all mechanical support structures	0 days	21/11/26	21/11/26									1'	1/26 💰	Comple	te the Ma	nufact	ure of all m	echanical su	pport st	tructure	es		
2.2	传感器	The sensor	919 days	18/5/1	21/11/5		r-								1 1	The sens	sor								
2.2.1	传感器像素内的电子学设计	Electronics design in sensor pixel, design of	170 days	18/5/1	18/12/24			Elect	ronics des	sign in se	ensor	pixel, (desig	n of a	anti - ir	radiation	n element								
2.2.2	,抗辐照元件设计 外围数字电路、触发、时钟与	anti - irradiation element Peripheral digital circuit, trigger, clock and	261 davs	18/5/1	19/4/30				Periphera	al digital	circui	it, trigg	ger, cl	lock a	and pov	wer sup	ply ladder	r desig	In, and chip	anti-radiatio	n perfor	rmance	simulatio	on	
	电源等模块设计,与芯片抗辐 照性能模拟	power supply ladder design, and chip anti-radiation performance simulation	100.1	10/0/17	10/11/1										•										
2.2.3	第一次多项目晶圆 (MPW)流片	1st MPW	100 days	19/6/17	19/11/1					1st MPW															
2.2.4	第二次多项目晶圆 (MPW)流片	2nd MPW	90 days	20/2/18	20/6/22					*	2n	d MPV	v												
2.2.5	整合全功能的小面积芯片设计	Integration of fully functional small area chip design	190 days	19/5/1	20/1/21			ì	*	Integ	ratior	n of fu	lly fur	nctior	nal sma	all area o	hip desig	jn							
2.2.6	第三次多项目晶圆 (MPW)流片	3rd MPW	108 days	21/1/1	21/6/1							1		3r	d MPW	I									
2.2.7	设计大面积,全功能的传感器 芯片	Design large area, full function sensor chip	328 days	20/5/13	21/8/13					1					Desig	gn large	area, full f	function	on sensor c	hip					
2.2.8	第一次工程批硅晶圆加工	First engineering batch silicon wafer process	60 days	21/8/16	21/11/5										F 🛌 🖡	irst eng	ineering b	batch s	silicon wafe	r processing					
2.3	读出电子学与数据获取系统	Readout electronix and data acquisition	1066 days	18/5/1	22/5/31	1	-										Readout	t elect	ronix and da	ata acquisitio	on syste	em			
		system																							
2.3.1	为初次MPW的芯片研制前端 电路板	Development of the front end circuit board for the initial MPW chip	261 days	18/5/1	19/4/30				Develop	ment of th	ne froi	nt end	circu	uit boa	ard for	the initi	al MPW cl	hip							
2.3.2	研制单个传感器芯片的数据获 取系统	Development of data acquisition system for a single sensor chip	220 days	19/5/1	20/3/3			1	*	De	velop	ment	of dat	ta acq	quisitio	on syster	n for a sin	ngle se	ensor chip						
2.3.3	ladder的读出电子学	ladder readout electronic	218 days	20/8/31	21/6/30										adder i	readout	electronic	6							
2.3.4	研制单个探测器模块的数据获 取系统	Development of data acquisition system for a single detector ladder	472 days	20/3/12	21/12/31											Develo	opment of	f data a	acquisition	system for a	single d	detecto	r ladder		
2.3.5	原型机的读出电子学	Prototype readout electronic	132 days	21/7/1	21/12/31									1	+ +	Protot	ype reado	out ele	ctronic						
2.3.6	研制探测器原型机的数据获取 系统	Development of data acquisition system for the prototype detector	107 days	22/1/3	22/5/31											*	Develop	ment	of data acqu	uisition syste	m for the	ne proto	otype dete	ctor	
2.4	探测器原型机整体设计与组装	The overall design and assembly of the prototype	1066 days	18/5/1	22/5/31		l-										The ove	erall de	sign and as	ssembly of th	e protot	type			
2.4.1	制定探测器模块的组装流程	Develop the assembly process of detector ladder	260 days	18/5/1	19/4/29		-		Develop	the asser	mbly p	proces	s of c	detect	tor lado	der									
2.4.2	制定探测器原型机的组装流程 ,开发自动组装系统	Develop the assembly process of detector prototype and develop the automatic assembly system	430 days	19/4/30	20/12/21			I	-				Deve	lop th	he asse	embly pr	ocess of (detect	or prototype	e and develo	p the au	utomati	c assemb	ly systen	n
2.4.3	探测模块模型试制	detector ladder trail production	66 days	21/4/30	21/7/30								}}		detect	tor ladde	er trail pro	oductio	on						
2.4.4	组装与调试首批探测器模块	Assemble and test the first detector ladder	38 days	21/11/24	22/1/14								Į			Asser	nble and t	test th	e first detec	ctor ladder					
2.4.5	组装与测试探测器模块	Assemble and test the rest of detector ladder	75 days	22/1/17	22/4/29								ł				Assemble	and to	est the rest	of detector la	adders				
2.4.6	组装与调试探测器原型机	Assemble and debug detector prototype	22 days	22/5/2	22/5/31												Assemb	le and	debug dete	ector prototy	pe				
2.4.7	完成探测器原型机的组装调试	Complete the assembly and debugging of detector prototype	0 days	22/5/31	22/5/31											5/31 🤞	Complet	te the	assembly a	nd debuggin	g of dete	tector p	rototype		
2.5	测试与数据分析	Test and data analysis	1086 days	19/1/1	23/2/28			· · · · ·										_ .	Test and dat	ta analysis					
2.5.1	对第一次MPW芯片做测试	Test 1st MPW chip	157 days	19/11/4	20/6/9	1			*	,	Tes	st 1st N	MPW	chip											
2.5.2	对第二次MPW的芯片做测试	Test the second MPW chip	93 days	20/8/4	20/12/10	1					- +	J	Test t	the se	econd M	MPW chi	ip								
2.5.3	对第三次MPW的芯片做测试	Test the third MPW chip	53 days	21/6/2	21/8/13									*	Test	the third	MPW chi	ip							
2.5.4	对工程批芯片做测试	Test engineering chip	12 days	21/11/8	21/11/23										¥).	Test eng	gineering	chip							
2.5.5	東流测试与数据分析	Beam testing and data analysis	1086 days	19/1/1	23/2/28	1		·											Beam testin	ig and data a	nalysis				
2.5.5.1	束流测试模拟、重建和分析软 件开发	development of the simulaiton, reconstruction and analysis software	784 days	19/1/1	21/12/31											develo	opment of	f the s	imulaiton, re	econstructio	n and an	nalysis	software		
2.5.5.1.1	模拟软件开发	development of the simulaiton software	261 days	19/1/1	19/12/31					devel	opme	nt of th	he sin	nulait	ton sof	tware									
2.5.5.1.2	重建软件开发	development of the reconstruction softwa	784 davs	19/1/1	21/12/31						-					develo	pment of	the re	constructio	on software					
2.5.5.2	分析软件开发	development of the analysis software	784 days	19/1/1	21/12/31											develo	pment of	the ar	alysis softw	ware					
2.5.5.3	束流测试实验	Beam test experiment	60 days	22/6/1	22/8/23								t				Bear	m test	experiment	t					
2.5.5.4	数据分析	The data analysis	85 days	22/8/24	22/12/20												+	The	data analys	is					
2.5.5.5	发表测试结果, 撰写终期报告	Publish test results and write final report	50 days	22/12/21	23/2/28								Į					F	ublish test	results and	write fina	al repo	rt		
2.5.6	完成项目终期报告	Complete the final project report	0 davs	23/2/28	23/2/28								2				2/	28 🗸	Complete th	e final proied	ct report	t	Ŧ		
	PARCA H S MUS H	semplete the mar project oport	2 4470	23/2/20	20,2,20	I														a series project		~			

Task 3: Calorimeter Prototype Plan

WBS	Chinese Name	Task Name	Duration	Start	Finish	2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 H2 H1 H2 H1
3	成像型强子量能器技术验证	Technical verification of imaging hadrons	1304 days	18/5/1	23/4/28	Technical verification of imaging hadrons
3.1	量能器原型机物理设计	Physical design of the prototype of the quantizer	610 days	18/5/1	20/8/31	Physical design of the prototype of the quantizer
3.1.1	量能器关键参数的选取和优 化	Selection and optimization of key parameters of the quantizer	261 days	18/5/1	19/4/30	Selection and optimization of key parameters of the quantizer
3.1.2	量能器性能模拟研究	Performance simulation study of the quantizer	349 days	19/5/1	20/8/31	Performance simulation study of the quantizer
3.2	灵敏探测器的研制	Development of sensitive detectors	719 days	18/5/1	21/1/29	Development of sensitive detectors
3.2.1	原材料、器件采购	purchase of raw materials and devices	239 days	18/5/1	19/3/29	purchase of raw materials and devices
3.2.2	灵敏单元结构的设计和优化	Design and optimization of sensitive element structure	239 days	18/5/1	19/3/29	Design and optimization of sensitive element structure
3.2.3	闪烁单元生产工艺的研究	Research on the production technology of scintillation unit	393 days	19/4/1	20/9/30	Research on the production technology of scintillation unit
3.2.4	闪烁单元批量生产	Batch production of scintillation unit	66 days	20/10/1	20/12/31	Batch production of scintillation unit
3.2.5	闪烁单元包装工艺的研究	Research on packaging technology of scintillation unit	436 days	18/5/1	19/12/31	Research on packaging technology of scintillation unit
3.2.6	闪烁单元批量包装	Batch packaging of scintillation unit	66 days	20/10/1	20/12/31	Bate h packaging of scintillation unit
3.2.7	7闪烁单元批量测试装置制作	Manufacture of batch test device of scintillation unit	589 days	18/5/1	20/7/31	Manufacture of batch test device of scintillation unit
3.2.8	闪烁单元批量测试	Batch test of flicker unit	44 days	20/12/1	21/1/29	───Batch test of flicker unit
3.2.9	单层灵敏探测器工艺摸索	Process exploration of single-layer sensitive detector	262 days	19/12/2	20/12/1	Process exploration of single-layer sensitive detector
3.3	读出电子学和数据获取系统	Readout electronics and data acquisition system	959 days	18/5/1	21/12/31	Readout electronics and data acquisition system
3.3.1	原材料、电子元器件的采购	Procurement of raw materials and electronic components	698 days	18/5/1	20/12/31	Procurement of raw materials and electronic components
3.3.2	前端读出板和数据接口板的 设计和开发	Design and development of front-end readout board and data interface board	719 days	18/5/1	21/1/29	Design and development of front-end readout board and data interface board
3.3.3	SPIROC芯片功能测试板开 发	Functional test board development of SPIROC chip	370 days	18/5/1	19/9/30	Functional test board development of SPIROC chip
3.3.4	前端读出板和数据接口板的 批量制作与测试	Batch production and testing of front-end readout board and data interface board	130 days	21/2/1	21/7/30	Batch production and testing of front-end readout board and data interface board
3.3.5	测试用数据获取板的开发与制作	Development and production of test data acquisition board	436 days	18/5/1	19/12/31	Development and production of test data acquisition board
3.3.6	数据获取板的开发与制作	Development and production of data acquisition board	415 days	20/6/1	21/12/31	Development and production of data acquisition board
3.4	SiPM性能监测和刻度系统的 研究	SiPM performance monitoring and calibration system research	479 days	19/5/1	21/3/1	SiPM performance monitoring and calibration system research
3.4.1	基于LED的监测系统的开发	Development of LED-based monitoring system	479 days	19/5/1	21/3/1	Development of LED-based monitoring system
3.4.2	基于光纤的监测刻度系统的 研究	research on monitoring scale system based on optical fiber	479 days	19/5/1	21/3/1	research on monitoring scale system based on optical fiber
3.5	机械设计和制作	Mechanical design and production	827 days	18/11/1	21/12/31	Mechanical design and production
3.5.1	探测器灵敏层结构	Structure of detector sensitive layer	566 days	18/11/1	20/12/31	Structure of detector sensitive layer
3.5.2	原型机吸收体和支撑结构	Absorber and support structure of the prototype	501 days	19/5/1	21/3/31	Absorber and support structure of the prototype
3.5.3	束流测试平台	Beam test platform	436 days	20/5/1	21/12/31	Beam test platform
3.5.4	宇宙线测试平台	Cosmic ray test platform	262 days	20/11/2	21/11/2	Cesmic ray test platform
3.6	量能器原型机系统集成	Integration of the prototype system of the quantizer	195 days	21/8/2	22/4/29	Integration of the prototype system of the quantizer
3.6.1	探测器灵敏层的组装和测试	Assembly and testing of detector sensitive layer	111 days	21/8/2	22/1/3	Assembly and testing of detector sensitive layer
3.6.2	整体样机的集成	Integration of the overall prototype	84 days	22/1/4	22/4/29	Integration of the overall prototype
3.7	量能器原型机测试和性能研 究	Prototype testing and performance research of the quantizer	325 days	22/1/3	23/3/31	Prototype testing and performance research of the quantizer
3.7.1	数据分析软件的开发和准备	Development and preparation of data analysis software	174 days	22/1/3	22/9/1	Development and preparation of data analysis software
3.7.2	原型机宇宙线测试及质量检 验	Cosmic ray testing and quality inspection of the prototype	88 days	22/5/2	22/8/31	Cosmic ray testing and quality inspection of the prototype
3.7.3	原型机束流测试前期准备和 运输	Preliminary preparation and transportation of prototype beam test	22 days	22/9/1	22/9/30	Preliminary preparation and transportation of prototype beam test
3.7.4	原型机束流测试及样机运回	Prototype beam test and prototype transport back	43 days	22/10/3	22/11/30	Prototype beam test and prototype transport back
3.7.5	测试数据分析及原型机性能研究	Test data analysis and prototype performance research	87 days	22/12/1	23/3/31	Test data analysis and prototype performance research
3.8	项目总结	Project summary	20 days	23/4/3	23/4/28	Project summary

Problems and Main Risks

- time.
- **Continuation of travel restrictions due to COVID-19 could impact tasks long term:**
- CEPC Beam Polarization design. Trying to implement video-based collaboration. •
- Longer timescale, beam testing of vertex and calorimeter prototypes •
- assembly.
 - MPW, hoping that 1st engineering run chip works
- **Access to international test beam facility**

COVID-19 had significant impact on the calorimeter task schedule. Still trying to recover the lost

 Trade conflict with USA affected purchase of gantry for precision assembly of silicon vertex detector. Purchase of gantry from chinese vendor completed but cause delays in preparation for

Funding for 2nd engineering run of vertex chip not available, and schedule very tight. Skipped 3rd

Summary

- The project is progressing well towards completion
 - Accelerator and Vertex tasks meeting or exceeding expectations of work package • Calorimeter task still needs to accelerate production and design of prototype
- Impact due to COVID-19 partially recovered, but some delays persist.
- Possible impact on the availability of beam test time
- Expenses are not uniform and are expected to ramp up when final prototypes are produced and paid for

More details next

Agenda for meeting

Friday, April 23, 2021

08:00 - 18:00	Review 09:00	Meeting Project Overview (30'+ Speaker: Joao Guimaraes
	09:40	Task 1 Progress report Speaker: Prof. 云龙池 (高能
	10:30	Group photo and Coffee
	11:00	Task 3 Progress Report
		Speaker: Dr. Jianbei Liu (L
	12:00	Lunch 1h30'
	13:30	Task 2 Progress Report Speakers: Joao Guimaraes
	14:20	Coffee Break 20'
	14:40	Discussion (Project Tea
	14:40	Discussion (Referees o
	15:40	Close out session 总结 2
18:00 - 20:00	Dinner	

Zoom room will be provided for referees discussion at 2:40 pm

General Overview: Today

▶10') 项目进展汇报 40'

Costa

: **课题一进展汇报:高能环形正负电子对撞机加速器关键技术验证 50'** 能所)

e break 30'

t 课题三进展汇报: 成像型强子量能器技术验证 50' University of Science and Technology of China)

t 课题二进展汇报:硅径迹探测器关键技术验证 50' s Costa, Prof. LIANG Zhijun

am Only) 1h0' (229)

nly) 评委内部讨论与撰写评审意见 1h0'

?h20'

Extra Slides

Task 1: Funds allocation and implementation by Midterm

预算科目名称	Total	Budget until Midterm	Implementation until 2020/6/30	Rate of expense/ total budget	Rate of expense/ midterm budget
(—) direct fee	878.19	430.49	379.5	43.21%	88.16%
1、device fee	456	261	333.2	73.07%	127.66%
(1) purchase device	140	75	105.9	75.64%	141.20%
(2) trial device	296	166	227.3	76.79%	136.93%
(3) modifed device	20	20	0.00	0.00%	0.00%
2、material fee	116	56	2.9	2.50%	5.18%
3、testing fee	76.2	24.7	2	2.62%	8.10%
4、power fee	18	4	0	0.00%	0.00%
5、travel/conference/ international communication	131.1	53.2	21.9	16.70%	41.17%
6、publication	20.29	15.19	1.6	7.89%	10.53%
7、labor	51	13.6	17.9	35.10%	131.62%
8、consult	9.6	2.8	0	0.00%	0.00%

Task 2: Funds allocation and implementation by Midterm

预算科目名称	Total	Budget until Midterm	Implementation until 2020/6/30	Rate of expense/total budget	Rate of expense/ midterm budget
(—) direct fee	1047.700	402.583	234.84	22.41%	58.33%
1、device fee	196.300	176.2	53.11	27.06%	30.14%
2、material fee	235.66	112.49	52.01	22.07%	46.24%
3、testing fee	299.8	9.45	2.20	0.73%	23.28%
4、power fee	20.64	8.26	0.00	0.00%	0.00%
5、travel/conference/ international communication	123.81	39.9	44.80	36.18%	112.28%
6、publication	8.5	3.4	1.90	22.35%	55.88%
7、labor	157	50.5	81.27	51.76%	160.93%
8、consult	6	2.4	1.56	26.00%	65.00%

Task 3: Funds allocation and implementation by Midterm

预算科目名称	Total	Budget until Midterm	Implementation until 2020/6/30	Rate of expense/total budget	Rate of expense/ midterm budget
(—) direct fee	840.5	385.56	111.01	13.21%	28.79%
1、device fee	135.6	105.6	39.88	29.41%	37.77%
2、material fee	379.46	179.46	28.05	7.39%	15.63%
3、testing fee	45	18	5	11.11%	27.78%
4、power fee	4.6	2	0	0.00%	0.00%
5、travel/conference/ international communication	128.34	30	16.67	12.99%	55.57%
6、publication	6	2	0.07	1.17%	3.50%
7、labor	137.5	47.5	20.13	14.64%	42.38%
8、consult	4	1	0.21	5.25%	21.00%

"大科学装置前沿研究"重点专项2018年度项目申报指南

3. 新一代粒子加速器和探测器关键技术预研

3.1 高能环形正负电子对撞机关键技术验证

Research content: Prototype Verification of Key Technologies and High Resolution Detection Technologies for Electron Positron Colliders

Assessment indicators:

Validation of key technologies for high energy circular electron positron accelerators. Complete the prototype of the enhancer alternating two-pole low-field magnet. The magnetic field is from 31-620 Gs, the field uniformity is 5 x 10⁻⁴; Complete the prototype of bending vacuum chamber and RF shielded bellows, the total leakage rate is less than 2 × 10⁻¹⁰ Torr • L/s; Complete the prototype of electron and positron beam electrostatic separator, the maximum working field strength is 2MV/m, field uniformity is (1‰) 10×10 mm²; Complete the design of polarized beam collision in the Z energy region, beam polarization degree is larger than 50%, life time is larger than 60 minutes; Complete the prototype of polarization beam core device, spiral superconducting undulator.

Verification of High Resolution Detecting Technology on High Energy Accelerator. Complete the prototype of inner silicon track detector, verify the main design indicators through beam test, spatial resolution is 3-5 microns (um); Design a silicon detector with 1MRad Total ionization dose; Complete the original prototype of high granulated imaging type of HCAL, solving the key issues for process and test. Doing beam test to certify the main design conclusion.

3. 项目实施关键节点和具体实施计划: Key Points and Project Implementation Plans

第三年(2020.5-2021.4)

Main Milestones

- Task 1:
- Smal prototype of magnet fully tested •
- **Design of magnet complete** •
- Processing of the vacuum tube, the coating experiment device and the shielding bellows are completed •
- Task 2:
- Mechanical structure completed ٠
- Second ASIC MPW tested •
- ASIC design optimized and completed •
- Task 3:
- Batch production of readout electronics, development of data acquisition system ٠
- **Development of beam test platform and cosmic ray test platform** •

Outcome

Annual report

第四年(2021.5-2022.4)

Main Milestones

- Task 1:
 - Completed the formal prototype of the dipole magnet and measurement system •
 - Prototypes of vacuum tube and RF bellows completed •
- High pressure experiment was carried out on the electrostatic separator •
- Task 2:
- Silicon wafer processing of large area sensor submitted •
- Assembling and installing the prototype •
- Task 3:
- Integrated calorimeter prototype. •
- Carry out the cosmic ray test of the prototype •

Outcome

Annual report

第五年 (2022.5-2023.4)

Main Milestones

- Task 1:
- Complete the performance test of dipole prototype •
- Complete tests of prototypes of vacuum tube, RF bellows and electrostatic separator •
- High pressure experiment was carried out on the electrostatic separator •
- Task 2:
- Test beam and data analysis •
- Finish assembling of prototype •
- Task 3:
- Test beam and data analysis •
- Finish assembling of prototype ٠

Outcome

Final report, paper and experimental equipment •

4. 项目组织管理机制: **Project Management Organization**

Project management organization

- **MOST Project Responsibility Expert**
- Zhao Hongwei (Institute of Modern Physics, CAS)
- Wang Qiuliang (Institute of Electrical Engineering, CAS)
- Xu HongJie (Shanghai Institute of Application Physics, CAS)
- **Expert Team (8 people)**
- Xu Nu (Institute of Modern Physics, CAS)
- Tang Chuanxiang (Tsinghua University)
- Lv Junguang (Institute of High Energy Physics, CAS)
- Li Jin (Institute of High Energy Physics, CAS)
- Gao Yuanning (Peking University)
- Youjin Yuan (Institute of Modern Physics, CAS)
- Hu Guo Chaoying (IN2P3-CNRS-University of Strasbourg, IPHC)
- **Zhentang Zhao (Shanghai Institute of Applied Physics, CAS)**

Project leader — Management responsibilities

- Edit and sign project task book, review project task book;
- Establish a project management office and a project expert group based on the project leading institute; •
- Formulate the project research plan, make sure the academic direction and research focus of the project; •
- Carry out academic and technical communication and integration among tasks, and promote data sharing;
- Review the annual summary, technical report and other materials, compile and report project information, \bullet achievements and other progress reports;
- Develop project publicity plans and programs to enhance the impact of the project; •
- Formulate the project (task) implementation management system, formulate the approval system of funding allocation process;
- Propose major adjustment suggestions for projects (tasks), including adjustment or change of research objectives, contents, personnel and funding;
- Compile the mid-term assessment and annual report of the project, and cooperate with the completion of the midterm assessment and acceptance of the tasks;
- **Cooperate with MOST to complete the project assessment and acceptance;**
- **Complete other tasks entrusted by MOST**.

5. 成果呈现形式及测试方法: Achievement Presentation and Assessment Methods

				考核指标3				考核方式 (方
项目目标1	成果名 成果 称 类型	成果 类型	对应的课题 (任务) ²	指标 名称	立项时已有 指标值/状 态	中期指标值 /状态 ⁴	完成时指标 值/状态	法)及评价手段
1. 开 增强 CEPC 增强 器有设备 方程度低。 系 有一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个	高低 数 の す の し の し の し	□新理论 □新原理 □新产品 □新技 术 □新方法 ■关 键部件 □数据库 □ 软件 □应用解决方 案 □实验装置/系统 ■工程工艺 □标准 □专利 ■论文 □ 其他	课题1:加 速器关键技 术的研发和 验证	高精度低 场二极磁 均匀性	最低工作磁 场 127Gs, 磁场均匀度 5×10 ⁻⁴	最低工作磁 场 60Gs, 磁 场均匀度 5×10 ⁻⁴	最低工作磁 场 31Gs, 磁 场均匀度 5×10 ⁻⁴	同行专家组现 场测试,测试报 告将写入高能 环型正负电子 对撞机加速器 关键技术设计 和测试报告
吸气剂膜、高 能正负电子 束静电分离 器的研制;开 展 CEPC 在 Z 能区极化 束流的加速	研制弯葉真空の一方である。	□新理论 □新原理 □新产品 □新技 术 □新方法 ■关 键部件 □数据库 □ 软件 □应用解决方 案 □实验装置/系统 ■工程工艺 □标准	课题 1: 加 速器关键技 术的研发和 验证	真空盒极 限真空	5×10 ⁻¹⁰ Torr	3×10 ⁻¹⁰ Torr	2×10 ⁻¹⁰ Torr	同行专家组现 场测试,测试报 告将写入高能 环型正负电子 对撞机加速器 关键技术设计 和测试报告

Assessment method and means of evaluation: Expert review in the visit to prototype Test report will be included in "CEPC accelerator key technology design report and testing report"

器物理研究 与设计。 2.研制出硅 径迹探测器 原型机,并验 证其空间分 轴 案达到 3-5	御 の で し し し し し し し し し し し し し	□专利 ■论文 □ 其他	
 (前) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1	BellowS		
为灵敏层的成像型强子量能器技术方案的验证	Electrostatic 影子的意志的	□新理论 □新原理 □新产品 □新技 术 □新方法 □关 键部件 □数据库 □ 软件 □应用解决方 案 ■实验装置/系统 ■工程工艺 □标准	课题 1: 加 速器关键技 术的研发和 验证

Assessment method and means of evaluation: Expert review in the visit to prototype Test report will be included in "CEPC accelerator key technology design and test report"

真空盒总 漏率	5×10 ⁻¹⁰ Torr•L/s	3×10 ⁻¹⁰ Torr•L/s	2×10 ⁻¹⁰ Torr•L/s	同行专家组现 场测试,测试报 告将写入高能 环型正负电子 对撞机加速器 关键技术设计 和测试报告
RF屏蔽波 纹管接触 力	125±50g	125±30g	125±25g	同行专家组现 场测试,测试报 告将写入高能 环型正负电子 对撞机加速器 关键技术设计 和测试报告
静电分离 器电场强 度	1.8MV/m@ ±60kV 工作 电压	完成静电分 离器的初步 设计,以实 现: 2MV/m@±1 10kV工作 电压的电场 强度要求	2MV/m@±1 10kV 工作 电压	同行专家组现 场测试,测试报 告将写入高能 环型正负电子 对撞机加速器 关键技术设计 和测试报告

etrostatic arator	□专利 ■论文 □ 其他		静电分离 器电场均 匀性	无	完成静电分 离器初步设 计,以实现 (1‰)10×10 mm ² 的场均 匀性	(1‰)10×10 mm ²	同行专家评议, 静电分离器设 计报告将写入 高能环型正负 电子对撞机加 速器关键技术 设计和测试报 告
Sep6 Sep6			静电分离 器腔体真 空度	6×10 ⁻¹⁰ Torr	完成静电分 离器初步设 计,以实现 2×10 ⁻¹⁰ Torr 的腔体真空 度要求	2×10 ⁻¹⁰ Torr	同行专家组现 场测试,测试报 告将写入高能 环型正负电子 对撞机加速器 关键技术设计 和测试报告
の変化するのの方法であった。	□新理论 □新原理 □新产品 □新技 术 ■新方法 □关 键部件 □数据库 □ 软件 □应用解决方 案 □实验装置/系统 □工程工艺 □标准 □专利 ■论文 □ 其他	课题 1: 加 速器关键技 术的研发和 验证	在Z能区 极化束流 的加速器 物理研究 与设计	已有不含极 化插入件的 lattice 设计	明确极化插 入件的基 本参数选择 和精确能 量测量的工 作模式;模 拟研究束流 极化度大于 50%的实现 条件	束流极化度 大于 50%, 束流 寿命 大于 60 分 钟	同行专家评审, 東流极化物理 设计报告报告 将写入高能环 型正负电子对 撞机加速器关 键技术设计和 测试报告

(1) Final report: "CEPC accelerator key technology design and test report"

Assessment method and means of evaluation:

- Expert review in the visit to prototype - Test report will be included in final report (1)

- Peer expert review - Design report will be included in final report (1)

(2) Final report: "CEPC Detectors Test Report"

出小型 器芯 象素单 十小于 子 25 ×25 长。	3-5 微米	同行专家评审。 (通过束流实 验,离线分析数 据获得空间分 辨率。该测试结 果写入原型机 设计与测试报 告,以供同行专 家评审)	 Peer expert review Beam test and offline analysis; report to be included in final report (2)
专感器 步设 通过仿 正 服性	1 MRad	同行专家评审 (提供传感器的 设计与测试报 告供专家评审)	 Peer expert review Provide sensor design test report for expert evaluation

Assessment method and means of evaluation:

可知な する 定 の お が よ の の の に の の の に の し の に の し の に の し の た ろ た ろ た の た う た う た う た う た う た う た う た う た う た う た う た う た う た う た う た う た う た た た た た た た た た た た た た	□新理论 □新原理 □新产品 □新技术 □新方法 □关键部 件 □数据库 □软 件 □应用解决方案 ■实验装置/系统 □临床指南/规范 □工程工艺 □标准	课题 3:成 像型强子量 能器技术验 证	量能器能 量分辨	无	完成原型机 物理设计, 模拟得到原 型机能量分 辨达到 60%/√(E/G eV)⊕3%(10 GeV <e<80 GeV)</e<80 	60%/√(E/G eV)⊕3%(10 GeV <e<80 GeV)</e<80 	利用高能粒子 束对原型机进 行测试,离线分 析测试数据获 得性能指标。同 行专家评审测 试报告。	 Peer expert review Beam test and offline analysis; report to be included in final report (2)
Calorimeter	■论文 □发明专 利 □其他		量能器能 量线性	无	完成原型机 物理设计, 模拟得到原 型机能量线 性达到 3%(10GeV <e<80gev)< th=""><th>3%(10GeV <e<80gev)< th=""><th>利用高能粒子 束对原型机进 行测试,离线分 析测试数据获 得性能指标。同 行专家评审测 试报告。</th><th> Peer expert review Beam test and offline analysis; report to be included in final report (2) </th></e<80gev)<></th></e<80gev)<>	3%(10GeV <e<80gev)< th=""><th>利用高能粒子 束对原型机进 行测试,离线分 析测试数据获 得性能指标。同 行专家评审测 试报告。</th><th> Peer expert review Beam test and offline analysis; report to be included in final report (2) </th></e<80gev)<>	利用高能粒子 束对原型机进 行测试,离线分 析测试数据获 得性能指标。同 行专家评审测 试报告。	 Peer expert review Beam test and offline analysis; report to be included in final report (2)

* Final report: "CEPC Detectors Test Report"

Project Organization Issues: Communication Issues

- Meetings:
 - Schedule monthly short videoconference meetings on the global project
 - Weekly or biweekly video conference meetings on various research topics •
 - (e.g. international meeting on ASIC design every monday)
 - Satellite Meetings with CEPC International Workshops (e.g. Hong Kong, Oxford,)
 - Next Annual Meeting (with reviewers) in November suggest immediately after CEPC • workshop — Options: Nov 23-24 (weekend) or Nov 25-26 (M-T)
- **Documentation archiving:**
- Indico: Meetings and minutes •
- **DocDB:** Internal reports and technical reports archiving ullet
- Need new project webpage •
- **Project management:**
 - **Common gantt software**

Task 1: Beam Polarization at Z-pole

facilitate polarized e⁺/e⁻ colliding beams

To maintain beam polarization during acceleration in the booster, we found that at least one Siberian snake is required, an idea of using fixed field solenoids as a partial snake is being investigated.

To address the great challenges in polarized e⁺ source, propose to convert the e⁺ damping ring into a e⁺ polarizing ring, by introducing asymmetric wigglers to boost self-polarization build-up down to ~20 second, this novel idea looks promising to

A tentative parameter table of e+ polarizin					
Parameter	value				
Beam energy (GeV)	2.5				
Circumference (m)	200				
Wiggler total length (m)	22				
B+/B- (Tesla)	15 ^[3]				
U0 (MeV)	4				
Polarization build-up time (s)	17				
rms energy spread	~0.39				
Natural emittance (nm)	~10				
Radiation damping time (ms)	~1				

