

# Participation of The Russian Scientists in The CEPC Detector and Physics R&D

Jianchun Wang

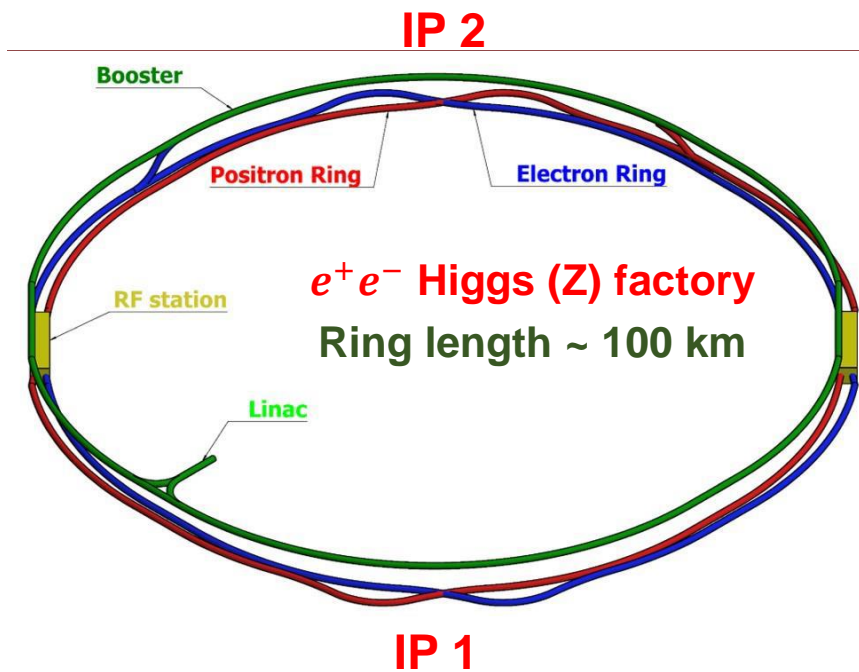
April 16, 2024



- ❖ Lebedev Physics Institute, RAS, Moscow (LPI)
  - Mikhail Danilov (Belle, CALICE, CMS, ILD)
  - Marina Chadeeva (CALICE, CMS, ILD) **Calorimetry for lepton colliders**
  - Alexey Drutskoy (Belle, ILD) **Physics case of ILC**
- ❖ Budker Institute of Nuclear Physics, RAS, Novosibirsk (BINP)
  - Alexander Bondar (Belle, CMD, LHCb)
  - Ivan Logashenko (CMD)
- ❖ Institute of High Energy Physics, CAS, Beijing (IHEP/CAS)
  - Jianchun Wang (CEPC, LHCb, AMS) CEPC PhysDet co-convener, **CEPC Introduction**
  - Manqi Ruan (CEPC, BES) **CEPC physics study**
  - Zhijun Liang (CEPC, ATLAS) **CEPC vertex and tracking**
  - Yong Liu (CEPC, CALICE) **CEPC calorimetry**
  - Gang Li (CEPC, BES) **CEPC software environment**
  - Zhaoru Zhang (CEPC, ATLAS) Organizing
- ❖ University of Science and Technology of China, Hefei (USTC)
  - Jianbei Liu (CEPC, STCF, CALICE, ATLAS, BES) CEPC PhysDet co-convener



- ❑ The CEPC was proposed in 2012 right after the Higgs discovery. It aims to start operation in 2030s, as an  $e^+e^-$  Higgs / Z factory.
- ❑ To produce Higgs / W / Z / top for high precision Higgs, EW measurements, studies of flavor physics & QCD, and probes of physics BSM.
- ❑ It is possible to upgrade to a  $pp$  collider (SppC) of  $\sqrt{s} \sim 100$  TeV in the future.

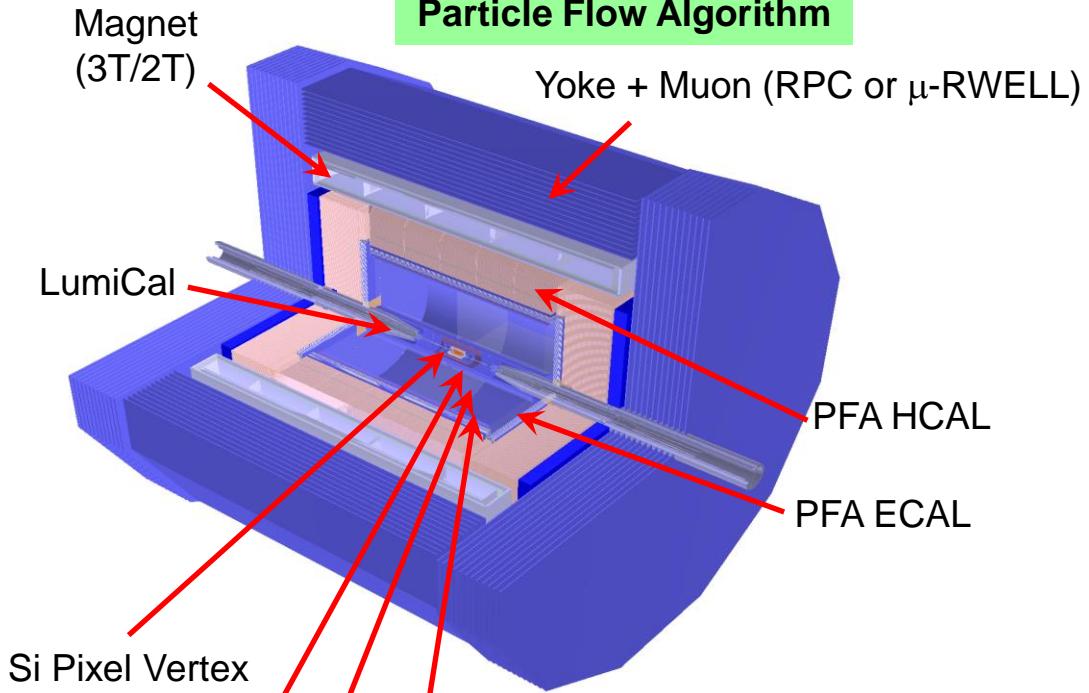


Operation mode		ZH	Z	W+W-	$t\bar{t}$
$\sqrt{s}$ [GeV]		~240	~91.2	~160	~360
Run Time [years]		10	2	1	~5
<b>30 MW</b>	$L / IP$ [ $\times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$ ]	<b>5.0</b>	<b>115</b>	<b>16</b>	<b>0.5</b>
<b>50 MW</b>	$L / IP$ [ $\times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$ ]	<b>8.3</b>	<b>192</b>	<b>26.7</b>	<b>0.8</b>
	$\int L dt$ [ $\text{ab}^{-1}$ , 2 IPs]	21.6	100	6.9	1
	Event yields [2 IPs]	$4.3 \times 10^6$	$4.1 \times 10^{12}$	$2.1 \times 10^8$	$0.6 \times 10^6$

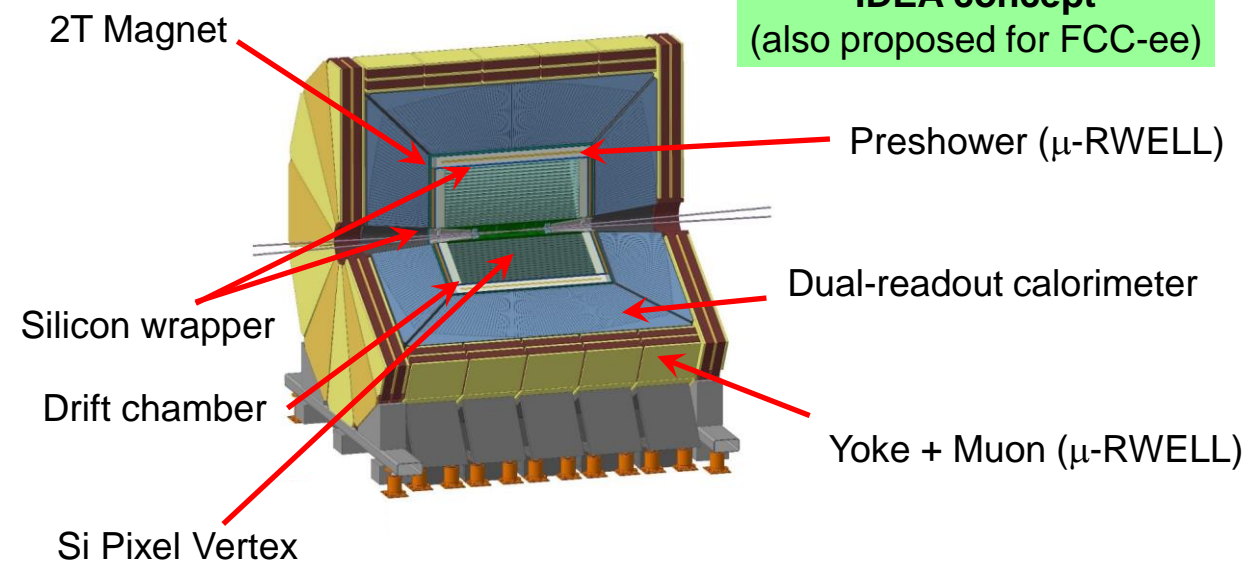
Both **50 MW** and  $t\bar{t}$  modes are considered as upgrades



## (Baseline Design) Particle Flow Algorithm

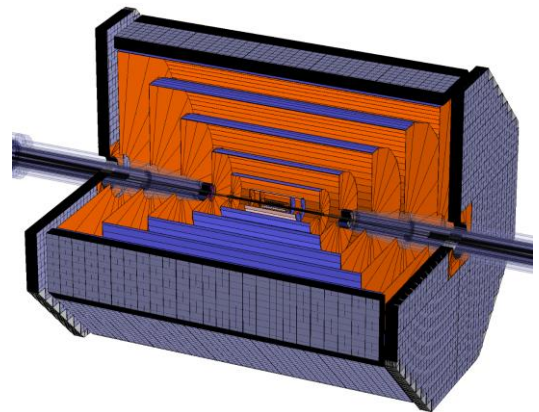


## IDEA concept (also proposed for FCC-ee)

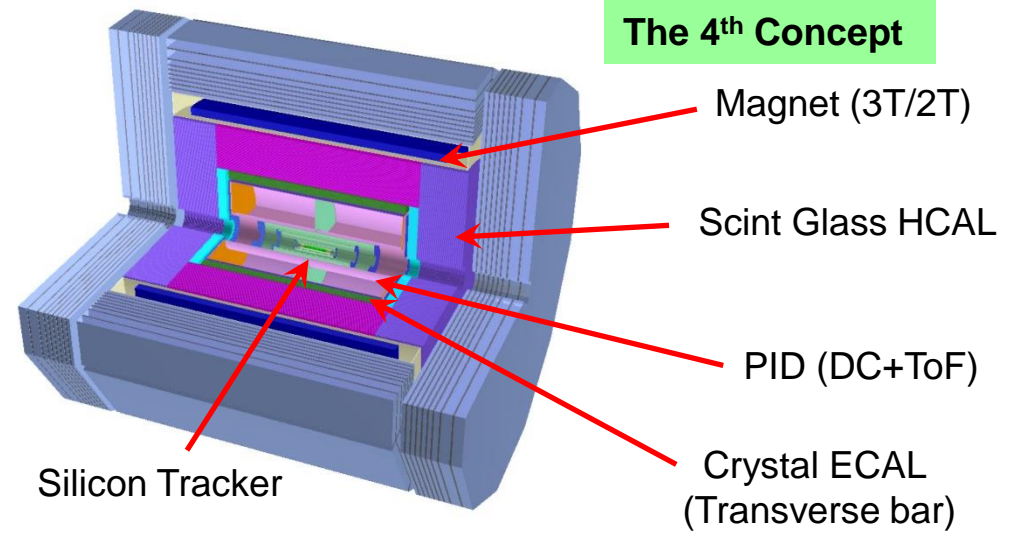


- SIT
- TPC
- SET
- FTD
- ETD

## FST concept (Full Silicon Tracker)



## The 4<sup>th</sup> Concept







Det	Technology	Det	Technology
Pixel Vertex	JadePix	Calorimeter	Crystal ECAL
	TaichuPix		Stereo Crystal ECAL
	CPV(SOI)		Scint+W ECAL
	Stitching		Si+W ECAL
	Arcadia		Scint+Fe AHCAL
Tracker & PID	CEPCPix		ScintGlass AHCAL
	Silicon Strip		RPC SDHCAL
	TPC		MPGD SDHCAL
	Drift chamber		DR Calorimeter
	PID DC		Muon
	AC-LGAD ToF	RPC	
	$\mu$ -Rwell		
Lumi	SiTrk+Crystal ECAL	Misc	HTS / LTS Magnet
	SiTrk+SiW ECAL		MDI & Integration
	Fast LumMoni		TDAQ scheme
	CEPC SW		

- ❖ We will never stop seeking for better technologies till the starting point of construction.
- ❖ However, we need to converge for the TDR of a reference detector (Ref-TDR)
  - Start preparation Jan 2024
  - Converge and start writing Jun 2024
  - A draft version by Dec 2024
  - Official release by Jun 2025



Legend	Baseline	Comparison	To-be-decided
System	Technologies		
Beam pipe	Φ20 mm		
Vertex	CMOS Pixel	SOI	CMOS+Stitching
Tracker & PID	SPD ITrk		
	Pixelated TPC	PID Drift Chamber	
	SSD OTrk	SPD OTrk	AC-LGAD OTrk
	LGAD ToF		
ECAL	4D Crystal Bar	PS+SiPM+W	Stereo Crystal Bar
	SiDet+W	GS+SiPM	
Magnet	HTS	LTS	
HCAL	GS+SiPM+Fe	PS+SiPM+Fe	RPC+Fe
Muon	PS Bar+SiPM	RPC	
LumiCal	SiTrk+Crystal		
TDAQ	Conventional	Software Trigger	
BE electr.	Common	Independent	



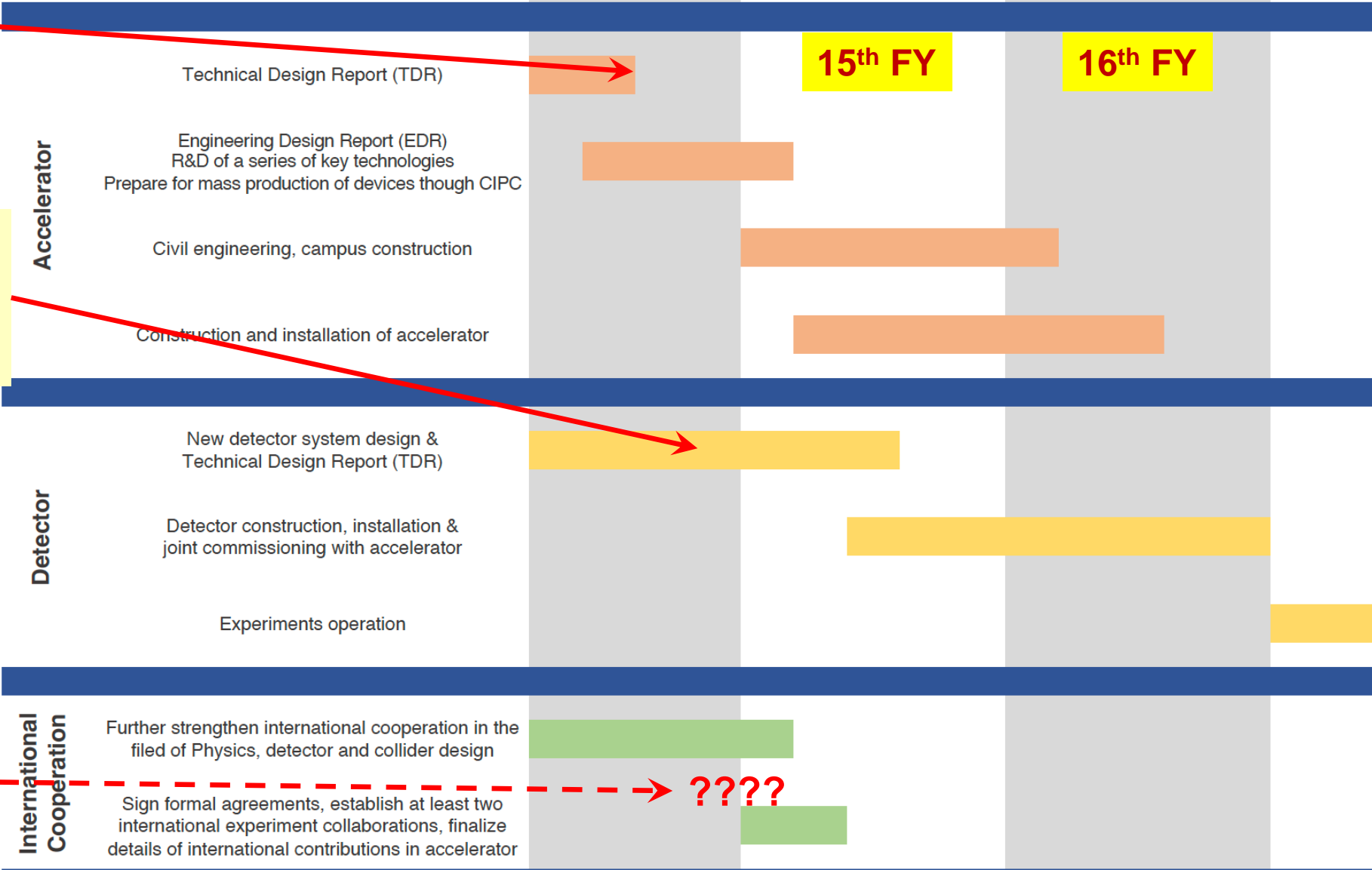
## CEPC Project Timeline

2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037

Completion of Accelerator TDR

**Goal**  
TDR of a Reference Detector @ June 30, 2025

International Collaborations



15<sup>th</sup> FY

16<sup>th</sup> FY

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- ❖ CEPC webpage <http://cepc.ihep.ac.cn/>
- ❖ CEPC documents
  - CEPC Accelerator TDR: [http://cepc.ihep.ac.cn/CEPC\\_tdr.pdf](http://cepc.ihep.ac.cn/CEPC_tdr.pdf)
  - CEPC CDR Volume I (Accelerator): [http://cepc.ihep.ac.cn/CEPC\\_CDR\\_Vol1\\_Accelerator.pdf](http://cepc.ihep.ac.cn/CEPC_CDR_Vol1_Accelerator.pdf)
  - CEPC CDR Volume II (Detector and Physics): [http://cepc.ihep.ac.cn/CEPC\\_CDR\\_Vol2\\_Physics-Detector.pdf](http://cepc.ihep.ac.cn/CEPC_CDR_Vol2_Physics-Detector.pdf)
- ❖ Major mailing lists:
  - CEPC-General [cepc-general@maillist.ihep.ac.cn](mailto:cepc-general@maillist.ihep.ac.cn)
  - CEPC-PhysDet [cepc-physdet@maillist.ihep.ac.cn](mailto:cepc-physdet@maillist.ihep.ac.cn)
- ❖ Regular meetings
  - The CEPC Day, <https://indico.ihep.ac.cn/category/215/> monthly meeting announced via the CEPC-General mail list. It normally has 3 sessions: accelerator, physics/detector/software, steering committee.
  - The PhysDet plenary meeting, <https://indico.ihep.ac.cn/category/324/> biweekly meeting announced via the CEPC-PhysDet mail list. It is arranged in the afternoon.
  - Subsystem meetings, organized weekly, in sub-category of <https://indico.ihep.ac.cn/category/214/> and <https://indico.ihep.ac.cn/category/1041/> Please let the leaders know to include in the mailing list.
- ❖ Workshops and conferences
  - The general ones are announced through the CEPC-General mail list. Topic specific workshops may be announced through different channels. They are normally in <https://indico.ihep.ac.cn/category/1004/>
  - The upcoming CEPC workshop at Hangzhou, Oct 23-27, 2024, <https://indico.ihep.ac.cn/event/22089/>