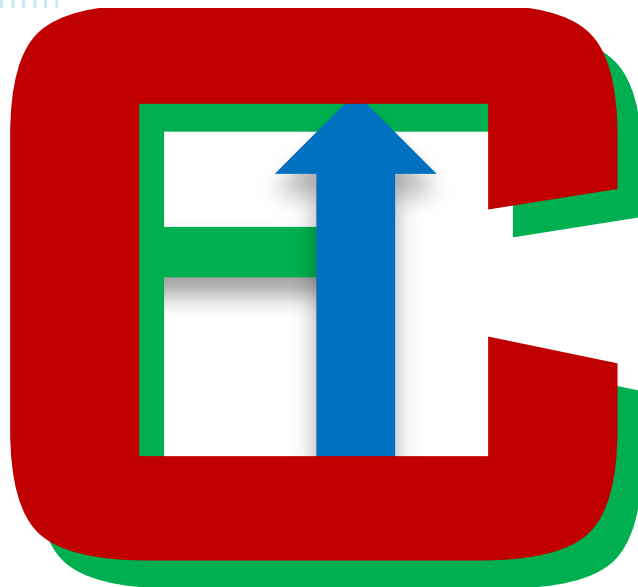


# *EicC*

(Electron-Ion Collider at China)

Nu Xu

Center China Normal University  
Institute of Modern Physics





# Outline

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- 1) Background Information
- 2) Conceptual Design of EicC
- 3) Science Cases for EicC
- 4) Summary



# High Intensity Heavy-ion Accelerator Facility



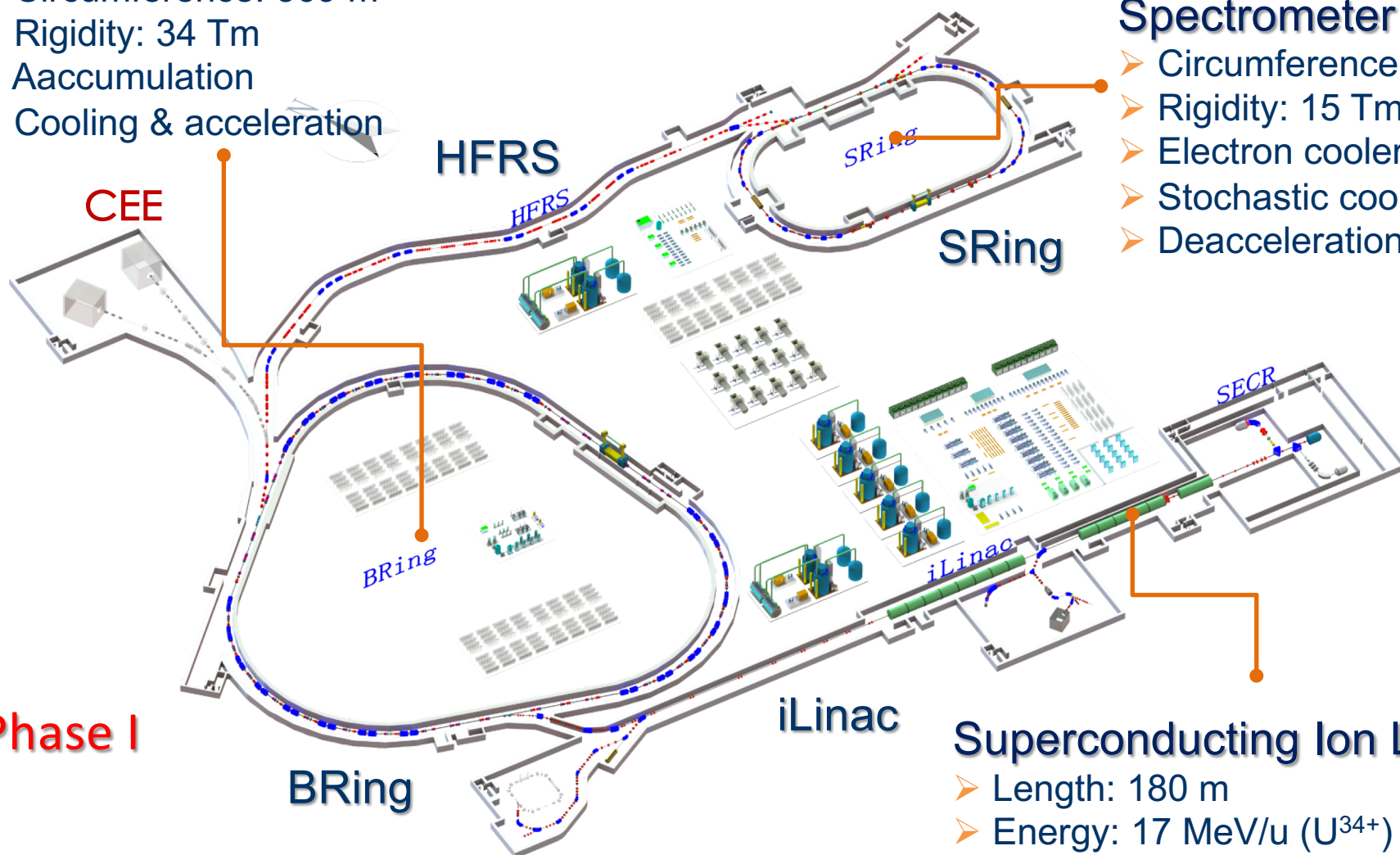
## HIAF

### Booster Ring:

- Circumference: 569 m
- Rigidity: 34 Tm
- Accumulation
- Cooling & acceleration

### Spectrometer Ring:

- Circumference: 270.5 m
- Rigidity: 15 Tm
- Electron cooler
- Stochastic cooler
- Deacceleration



### Phase I

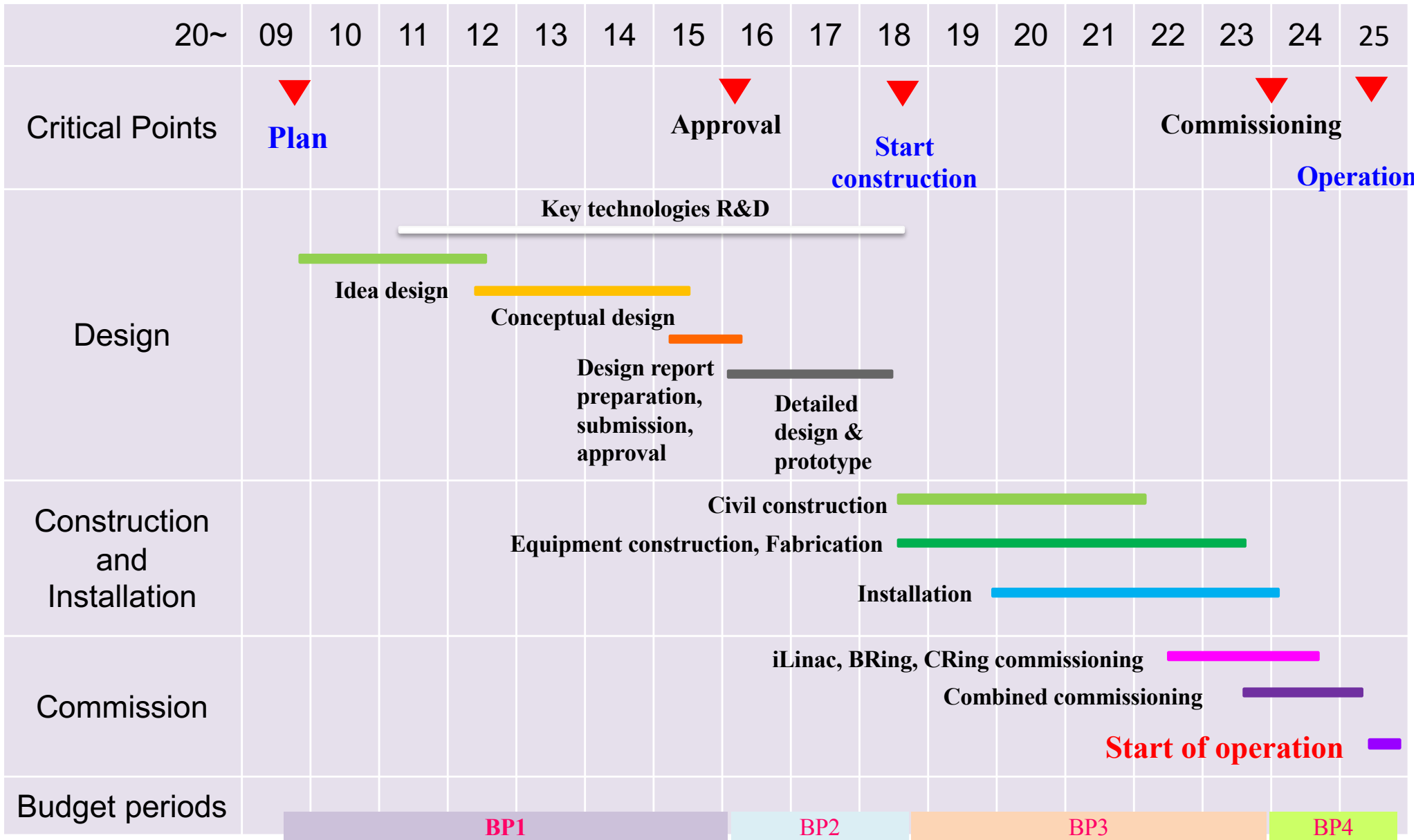
- Two-plane painting injection scheme
- Fast ramping rate operation

### Superconducting Ion Linac:

- Length: 180 m
- Energy: 17 MeV/u (U<sup>34+</sup>)
- CW and pulse modes

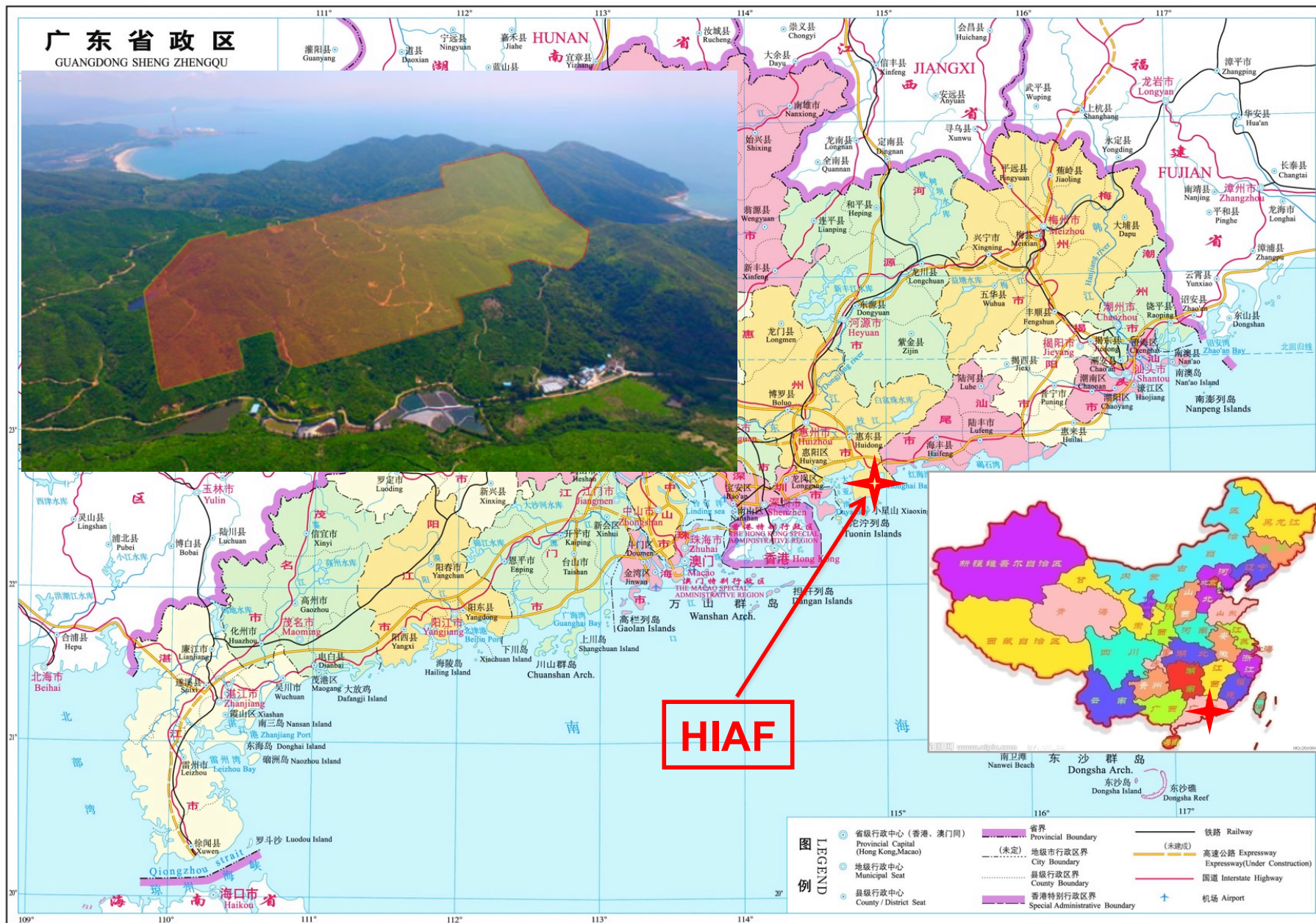


# Schedule for HIAF



From J.C. Yang





广东省国土资源厅、广东省地图出版社编制 审图号：粤S(2004)048号

比例尺 1 : 2500000

2004年11月





# Location



Huizhou city and Guangdong province will cover the expenses for buying land, preparing land, building roads, building electricity and water supply stations, ...





# New Branch of IMP

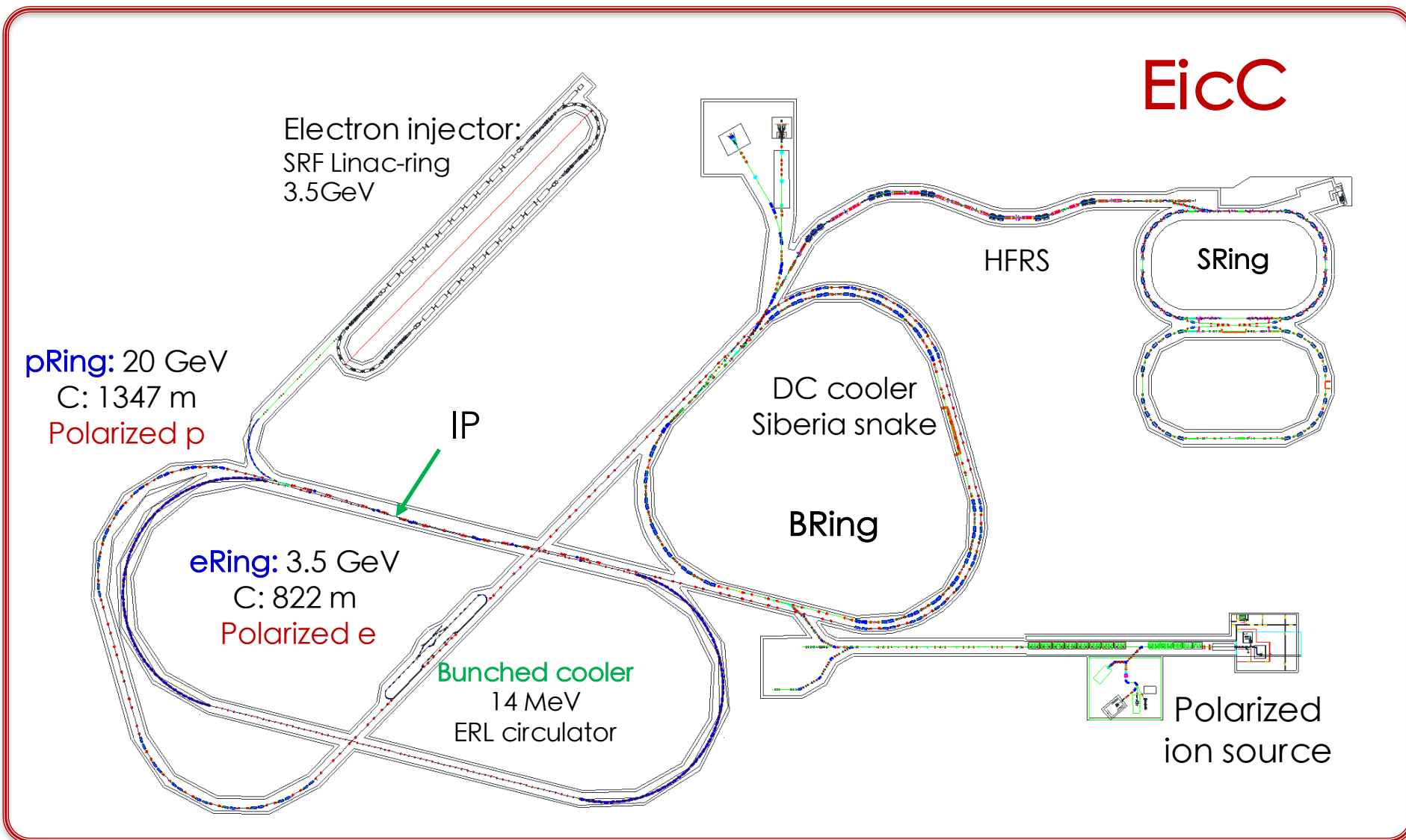


About 5 km to downtown of Huizhou City  
Construction will start soon

# Layout of EicC

## EicC construction

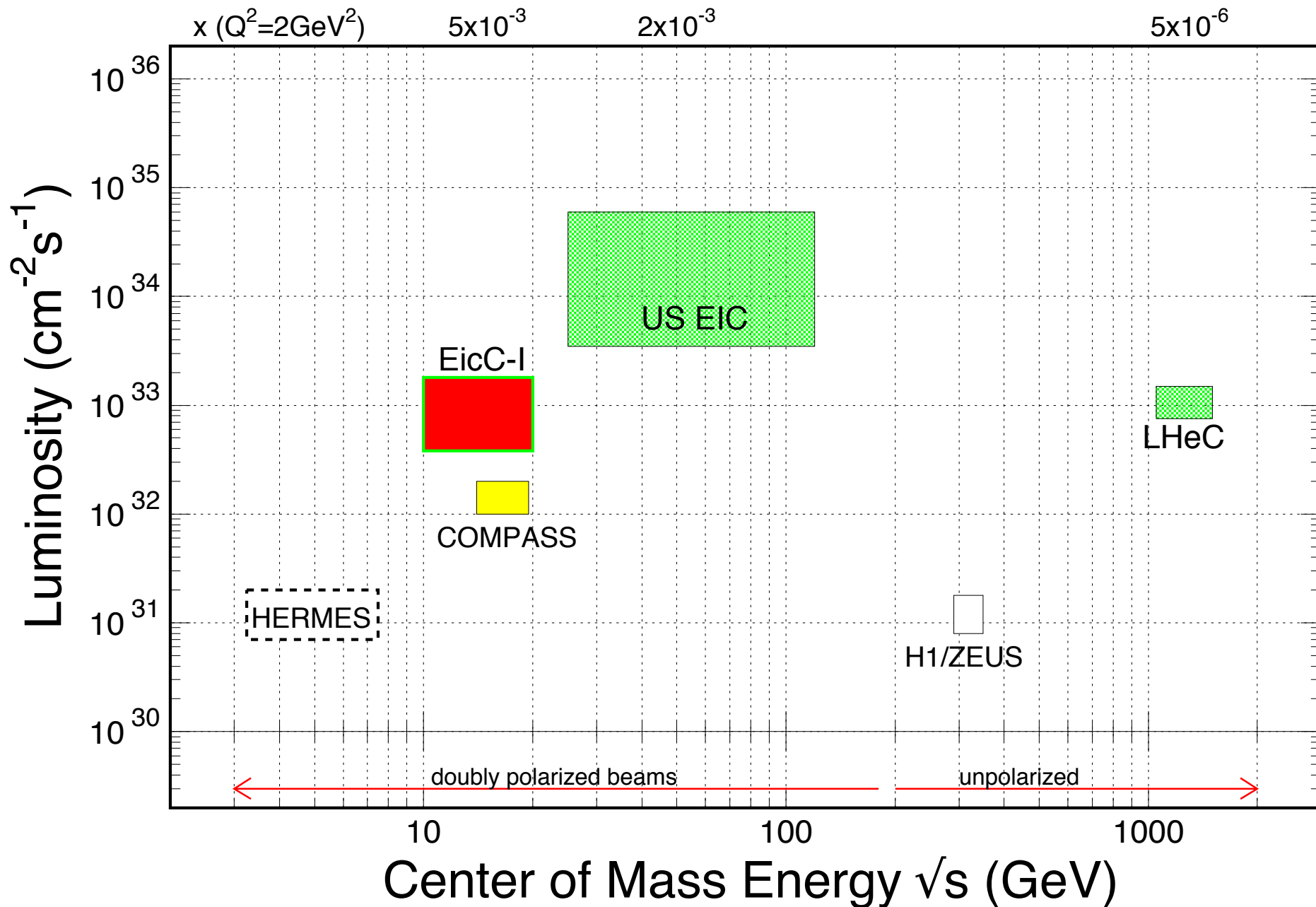
- polarized ion source
- Siberia snake/DC cooler for BRing
- pRing: Superconducting, 4T  
Partial sharing with BRing
- eRing, Racetrack shape
- e injector, SRF Linac-ring

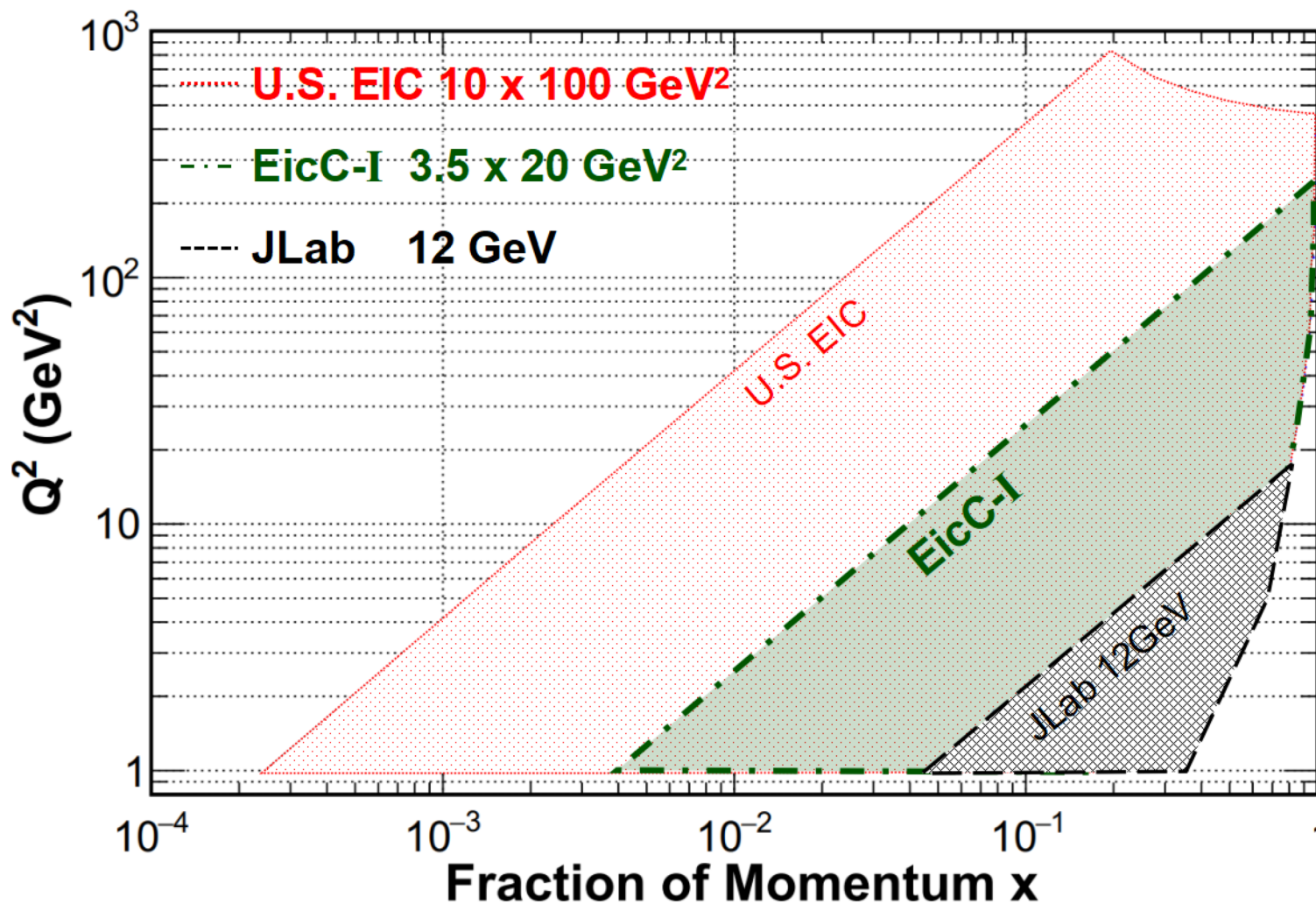






# Designed Energy and Luminosity



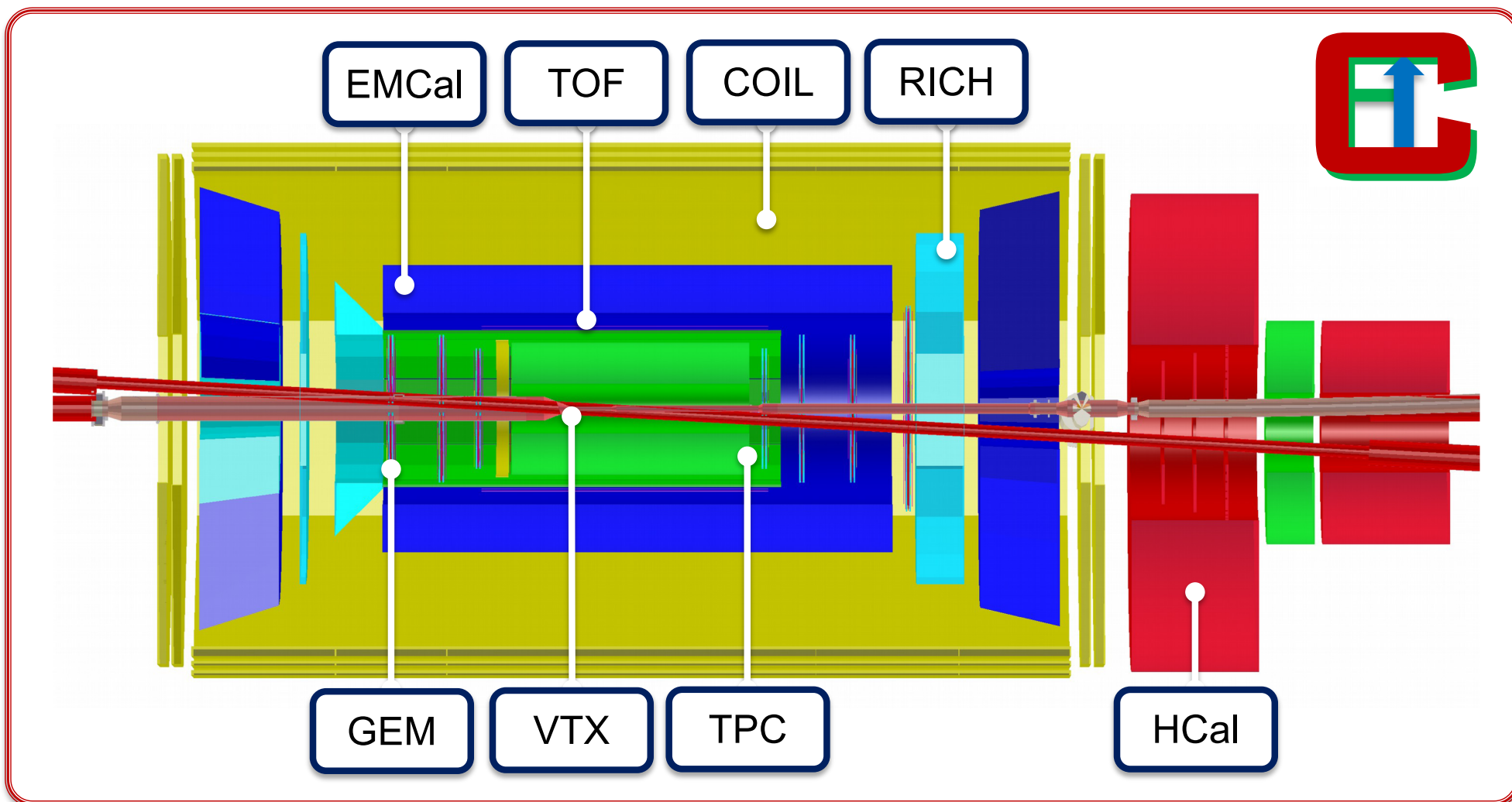


EicC-I:  $x \sim 4 \times 10^{-2}$  region

Valance- and sea-quark



# EicC Concept Detector





# EicC Discussion Meetings



***EicC*** ( $\sqrt{s} \sim 15$  GeV) programs focus on sea-quark and nuclear physics issues, complements to the world EIC physics programs

- (1) Define the design of the accelerator and science cases for ***EicC***
- (2) Three working groups:
  - Accelerator working group (AWG)
  - Detector/Physics working group (DWG)
  - Physics/Theory working group (PWG)

**At the end of 2019, EicC whitepaper**





# EicC Working Groups



WGs	People	Topics
Accelerator Group (AWG)	M. Bai, L.J. Mao, G.D. Shen, <b>Y.C. Yang</b> , H.Y. Zhang, H.W. Zhao, ...	1) Conceptual design ( $\geq 10^{33}/s \text{ cm}^2$ ) 2) Cooling 3) IR design
Detector Group (DWG)	<b>J.P. Chen</b> , <b>X.R. Chen</b> , H.Y. Gao, F. Liu, A. Deshpande, N. Xu, Z.H. Ye, L. Zhang, Z.W. Zhao	1) Conceptual design 2) Observables
Physics Group (PWG)	<b>Z.T. Liang</b> , B.Q. Ma, <b>J.P. Ma</b> , Q. Wang, <b>J.J. Xie</b> , B.W. Xiao, F. Yuan, J. Zhou, Q. Zhao, B.S. Zou	1) Science cases 2) Observables

## - Local Contact

- Monthly working group meeting (video meeting)
- General meeting every three-month (video meetings + annual IMP meeting)

**Goals: first draft of EicC Whitepaper by the end of 2019**

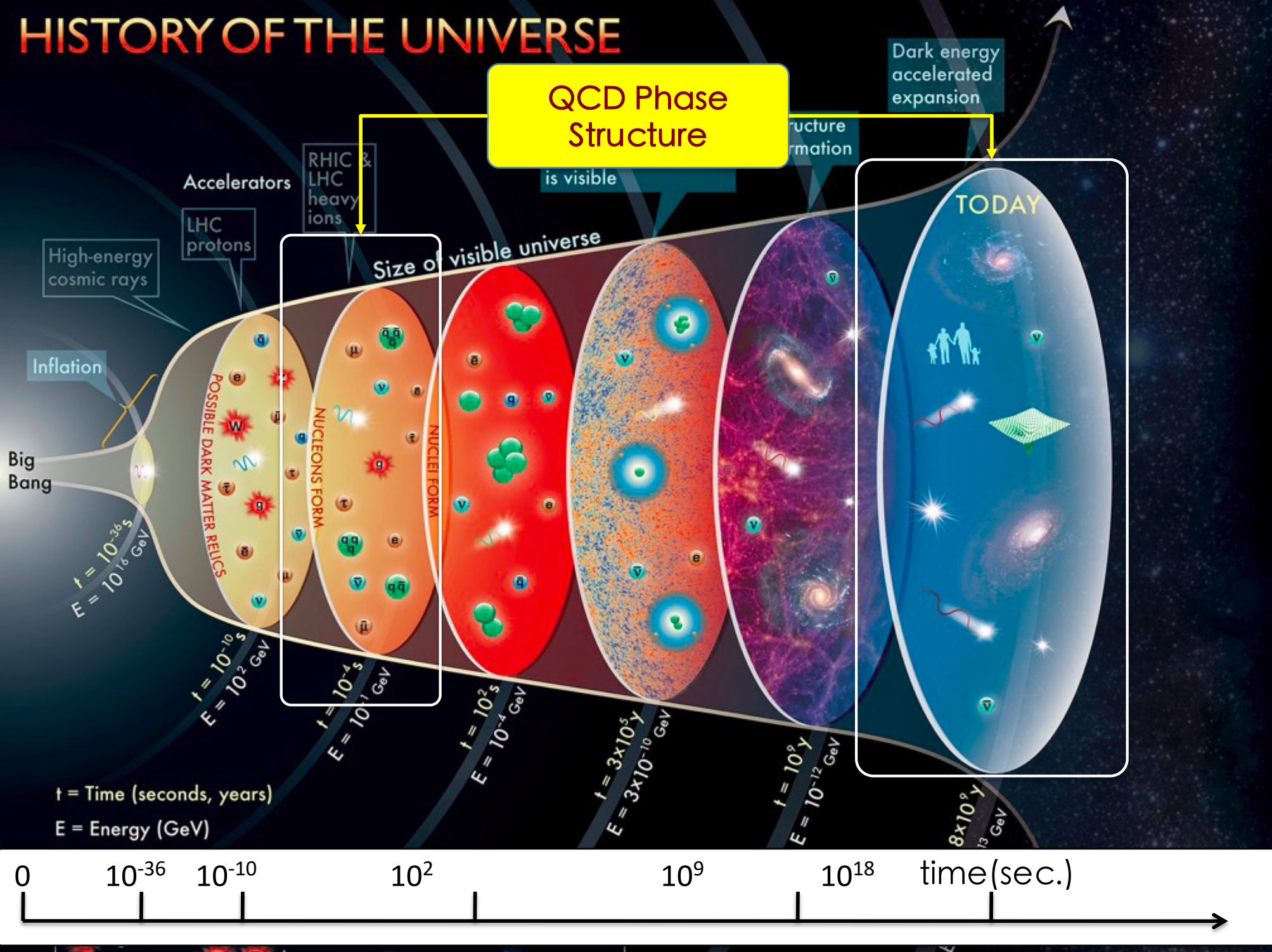


# EicC Timetable

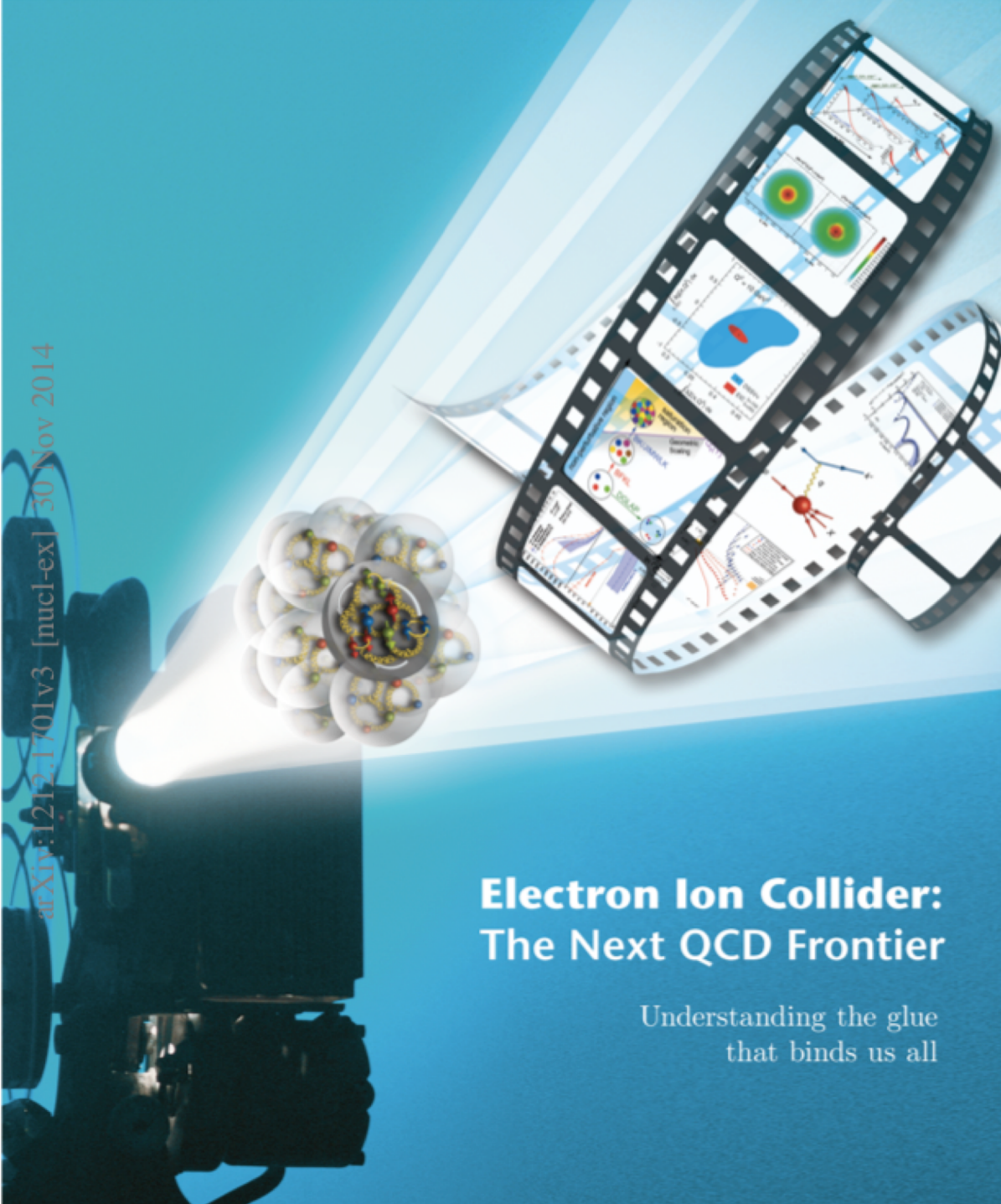


	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	十三五			十四五					十五五					十六五						
	HIAF																			
EicC	R&D																			
									$\sqrt{s} \sim 15\text{GeV}, 4 \times 10^{33}/\text{sec cm}^2$											
			R&D and construction																	
			In operation																	

# HISTORY OF THE UNIVERSE







## Electron Ion Collider: The Next QCD Frontier

Understanding the glue  
that binds us all

EIC: next frontier for  
strong interaction

### Nucleon Structure:

- spin of nucleon
- mass of nucleon
- role of gluons
- confinement
- exotic states
- ...

**CERN:** LHeC

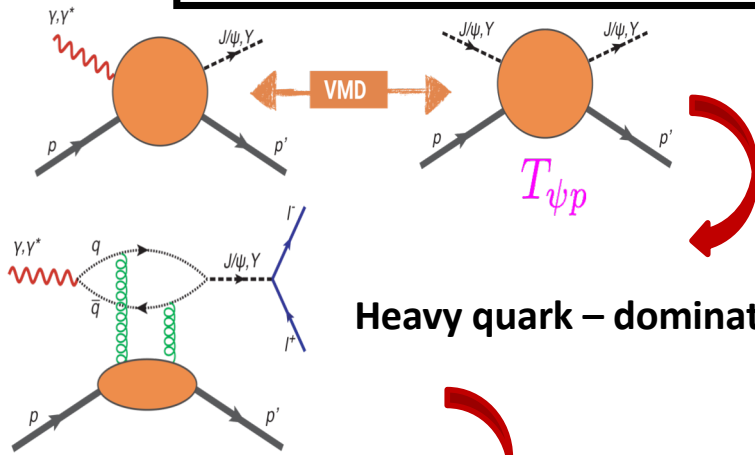
**USA:** eRHIC, JLEIC

**China:** EicC



# (1) Charm @ SoLID and Beauty @ EicC

$$\gamma^* + N \rightarrow N + J / \psi$$



Heavy quark – dominated by two gluons

Proton Mass:

$$\langle P | T_\alpha^\alpha | P \rangle = 2P^\alpha P_\alpha = 2M_p^2$$

Covariant Decomposition of the Energy Momentum Tensor

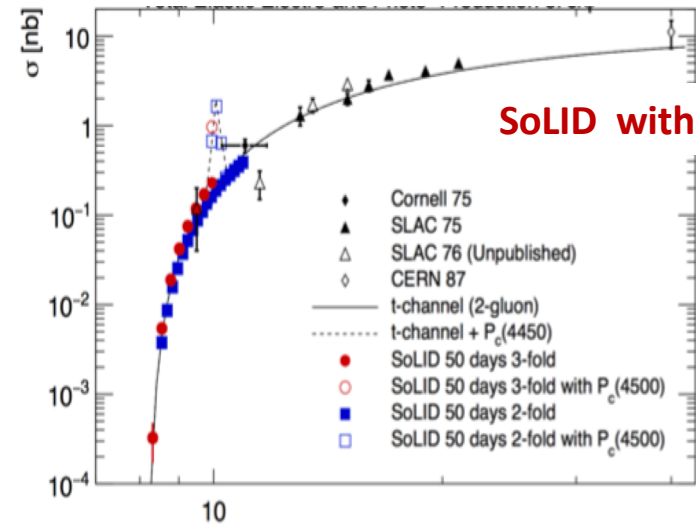
$$T_\alpha^\alpha = \frac{\tilde{\beta}(g)}{2g} F^{\mu\nu,a} F_{\mu\nu}^a + \sum_{q=u,d,s} m_q (1 + \gamma_m) \bar{\psi}_q \psi_q$$

QCD trace anomaly      Light quark mass

$T_{\psi p}$

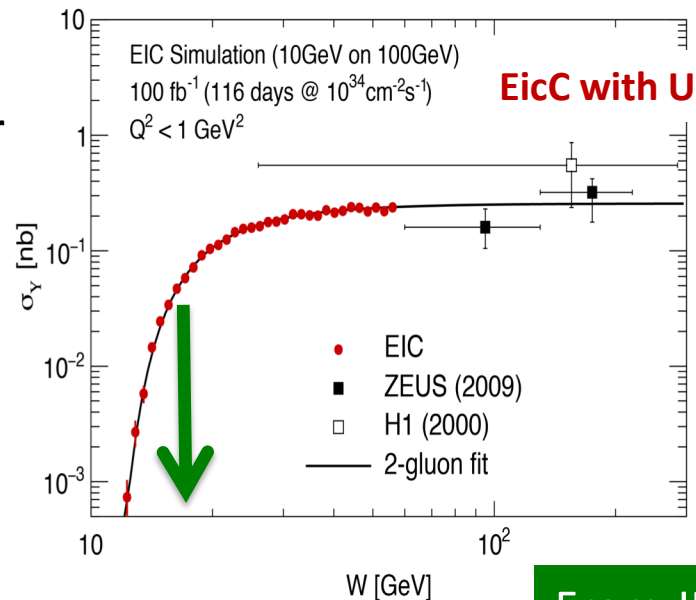
Trace of EMT proportional to Quarkonium  
-proton scattering amplitude to be  
measured at JLab with J/psi at SoLID and  
Upsilon at EicC

Total elastic Electro and photo-Production of J/psi



SoLID with J/psi

Total elastic Electro and photo-Production of Upsilon

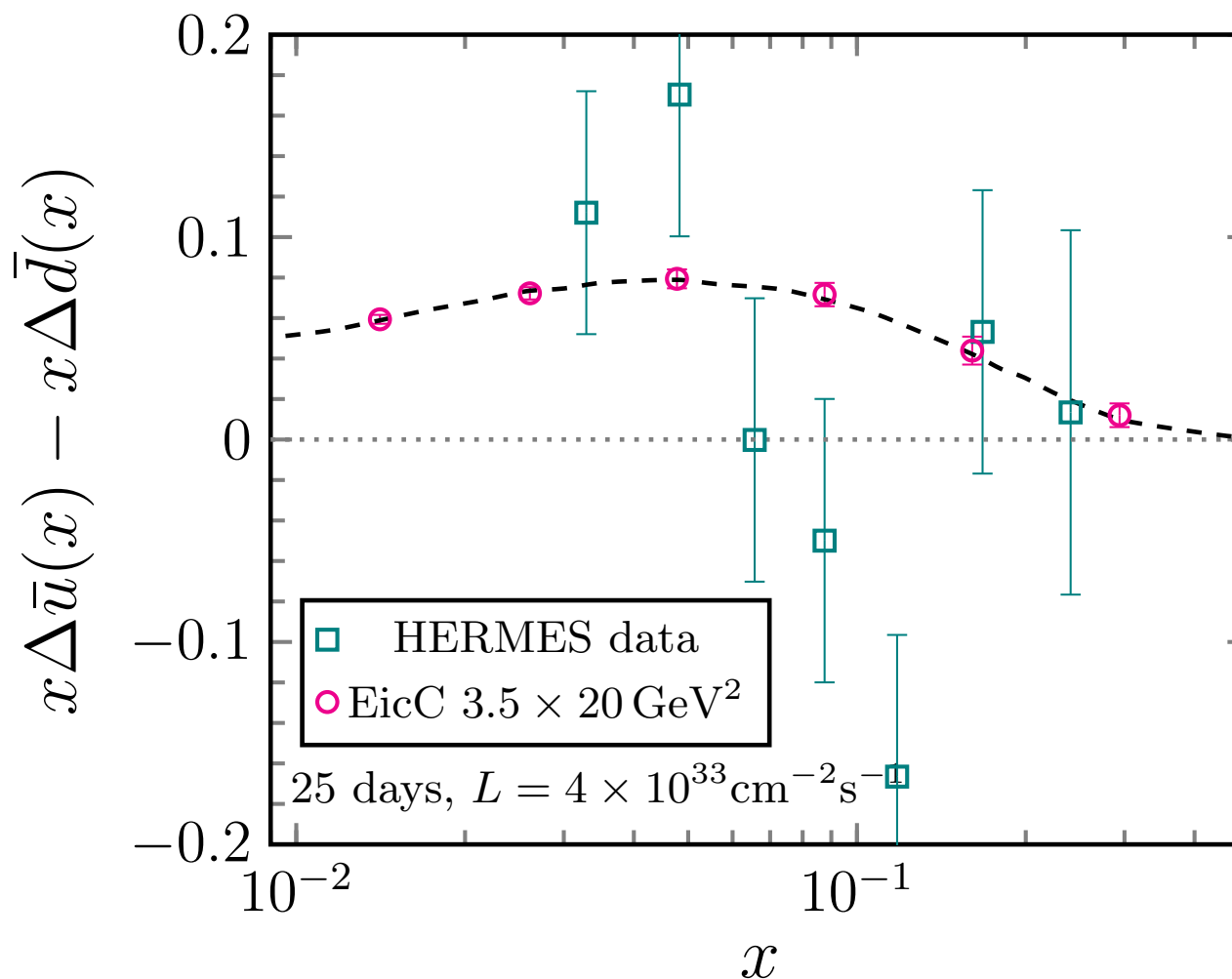


EicC with Upsilon

From JP Chen



## (2) Sea-quark Distributions

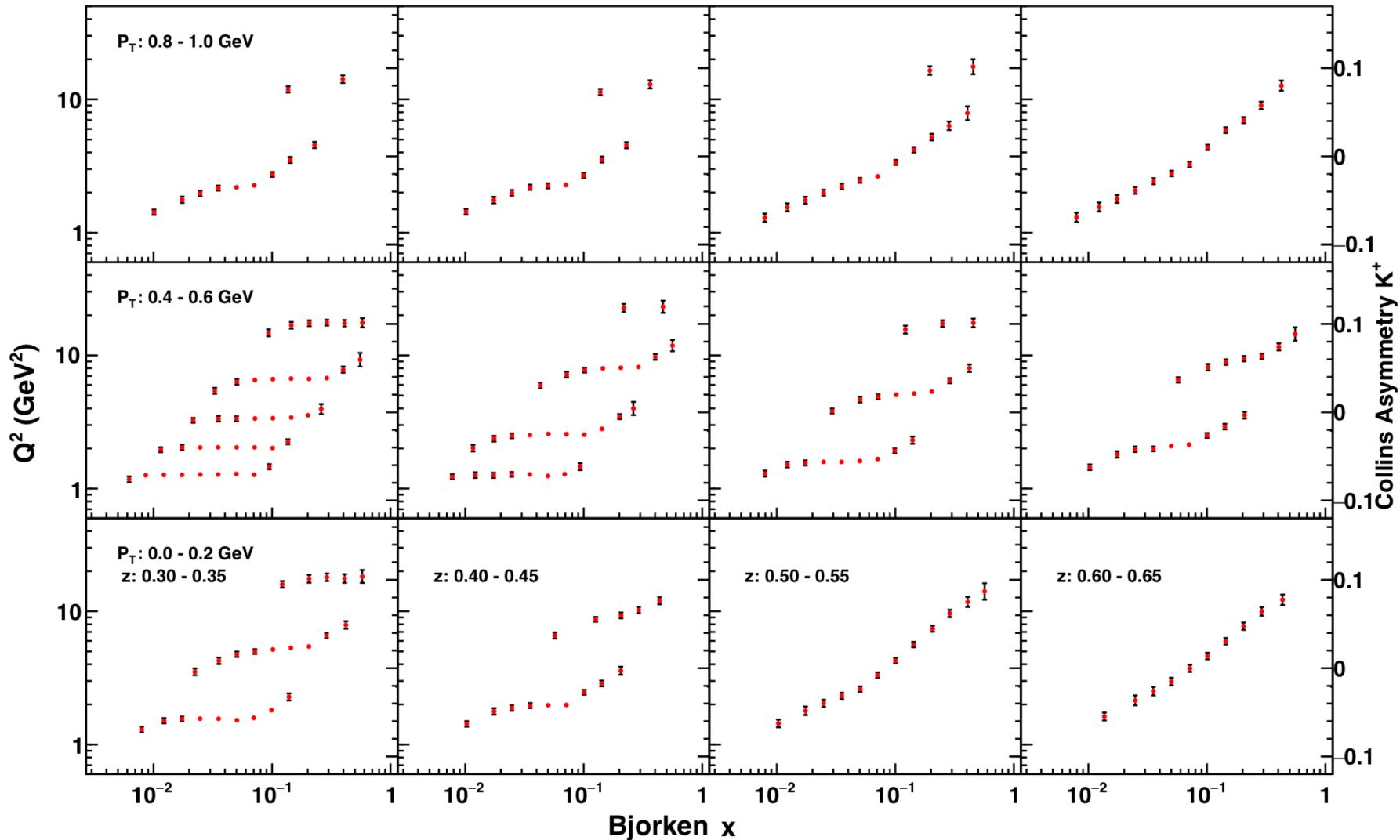


~ 4 weeks running at EicC

From B.W. Xiao



# (3) TMD Collins asymmetry uncertainty for Kaons



Kaon is one of key measurements at EicC

From Z. Yang



# Summary

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- 1) EicC focuses on valence- and sea-quark region ( $x \sim 10^{-2}$ ), addresses nuclear physics problem, complements to the world EIC physics programs
- 2) End of 2019: EicC Whitepaper draft
- 3) Worldwide efforts, both theoretical and experimental, are needed

**You are ALL invited to join the scientific endeavor: EicC**



热烈祝贺  
‘量子物质研究院’  
成立！

